



**OFFICE OF
INSPECTOR GENERAL**
UNITED STATES POSTAL SERVICE

**The
Postal Service
and Cities:
A “Smart”
Partnership**

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OFFICE OF INSPECTOR GENERAL

UNITED STATES POSTAL SERVICE

Executive Summary

Urban populations in the United States are increasing. As a result, cities are turning to new technologies to better connect with and serve their citizens. These “smart” projects aim to, among other things, decrease traffic congestion, cut pollution, and improve infrastructure. Data and analytics are increasingly important tools to achieve these goals.

The U.S. Postal Service, with its ubiquitous physical network, could provide cities with an unparalleled means to collect the data that can be used for smart city initiatives. The U.S. Postal Service Office of Inspector General (OIG) described this concept in a 2015 white paper on the [Internet of Postal Things](#).

To explore this concept further, the OIG conducted interviews with city, university, and private-sector stakeholders involved in smart city projects. This paper presents the results of those interviews, and additional research, which identified five specific smart city projects where the Postal Service could collaborate on pilots to help accelerate their adoption. Our key findings are

- Cities large and small across the United States are undertaking smart initiatives in a variety of project categories, ranging from energy and infrastructure to healthcare and education.
- Barriers to furthering these initiatives include limited city budgets, cities’ relative lack of technical expertise, and difficulties in collecting, storing, and analyzing large amounts of data.

- The Postal Service has a vast infrastructure of carriers, vehicles, post offices, and mailboxes that, if equipped with sensors and other data collection devices, could facilitate the collection of multiple types of data for local governments.
- Interviews revealed great interest by city officials in collaborating with the Postal Service and identified specific pilot opportunities where the Postal Service could be a valuable partner. These opportunities include monitoring city

Highlights

City governments are turning to data, analytics, and digital technologies to better serve citizens.

These “smart city” efforts are hampered by tight budgets, lack of technical expertise, and inability to efficiently collect enough data.

The Postal Service’s physical network of vehicles, carriers, and mailboxes already blankets cities. Those assets could be used to also collect data for smart city projects.

City officials are eager to collaborate with the Postal Service on future initiatives.

The OIG identified five specific pilot opportunities that the Postal Service could consider in the near-term.

infrastructure, such as roads and bridges, monitoring air quality, and identifying vacant properties to help fight urban blight.

- Becoming involved in these projects could translate into cost savings for the Postal Service itself (e.g. better pavement conditions would reduce vehicle maintenance costs), help the Postal Service advance its sustainability plans, strengthen its role as a public service provider, and potentially generate new revenue.
- Before offering data collection services for cities, the Postal Service would need to address questions surrounding data ownership, privacy, and security as well as the admissibility of these services under the current regulatory framework. Furthermore, the Postal Service would need to select a suitable business model, determine the appropriate level of its involvement, and consult with unions especially if any work is required of the postal employees.

Smart cities are at a crucial moment of development. There is significant interest and some funding at the federal level for these local initiatives, and many cities already have projects underway or in the planning phase. Cities we spoke with think the Postal Service could be a very useful partner in carrying their projects out. This might be the right time for the Postal Service to explore the opportunity to extract new value from its infrastructure. It could start by getting involved in selected pilots, as well as participating in organizations that promote and develop smart cities projects, to become part of the national smart cities conversation.

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Observations

Introduction

A massive demographic shift is taking place around the world: people are leaving rural areas and moving to urban ones in substantial numbers.¹ Cities, already struggling to provide adequate services to residents, will be under more pressure as their populations balloon. Increasingly, city governments are turning to big data, analytics, and digital technologies to improve the management of their territory, and to solve age-old problems like traffic congestion, poor air quality, and infrastructure maintenance.

The U.S. Postal Service, with its vast network that blankets the United States, could deploy segments of that network to support cities' efforts to become "smarter."² The U.S. Postal Service Office of Inspector General (OIG) described this idea in a 2015 white paper that presented the concept of the Internet of Postal Things (IoPT) — the instrumentation of the physical postal infrastructure with sensors to collect, communicate, and act upon a broad variety of data.³ This earlier vision focused mostly on use of that data by the Postal Service itself, but the research also showed that the postal network could leverage the Internet of Things (IoT) to become a platform for the collection of valuable data needed by cities to enact their smart city plans.

This paper takes an in-depth look at how the Postal Service might collaborate with local governments on their smart city endeavors. Through interviews with city officials, private sector providers, and other experts in the field, the OIG has identified and examined possible collaboration opportunities, including five pilots that could be actionable in the short-term. This paper discusses the development of smart city projects in the United States, describes the opportunities for Postal Service involvement, considers possible business models, and addresses implementation issues.

The Rise of the Smart City in the United States

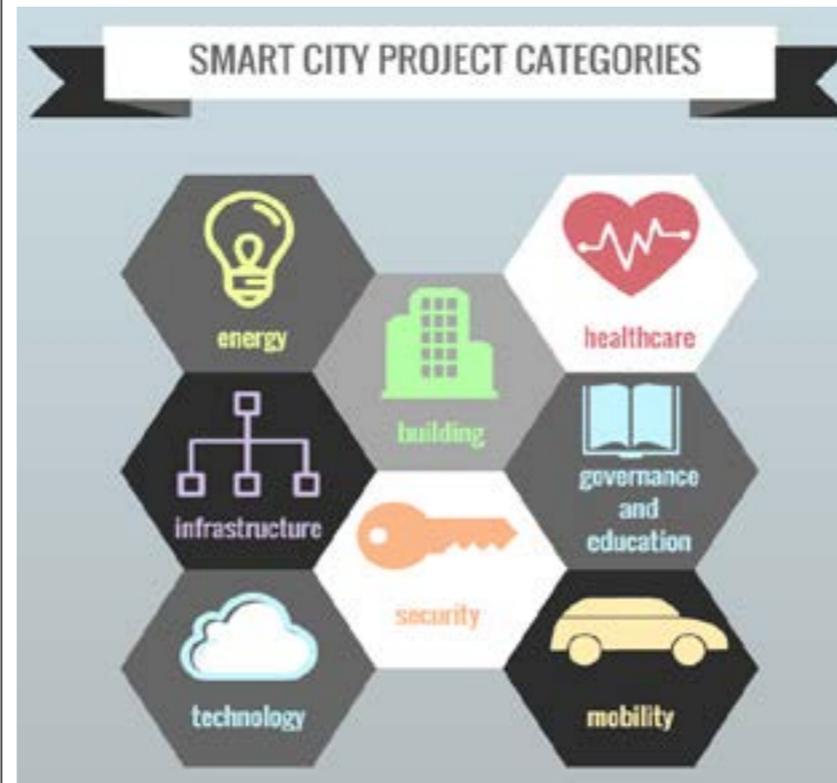
The United States, already a highly urbanized country with 81 percent of the population living in cities, will see that figure rise to 87 percent by 2050. By then there will be 350 million Americans living in cities — nearly 90 million more than there were in 2014.⁴ Managing these growing urban areas and ensuring that all citizens receive necessary services will be one of the major challenges of this century.⁵ Even cities with stable or shrinking populations, such as the former industrial centers of the upper Midwest, are looking to better serve remaining residents in order to prevent further erosion.

IoT technology and data analytics are enabling local governments to meet citizens' needs in new ways. This has led to the coinage of a new term — "smart cities." A prominent industry body defines a smart city as "one that has digital technology embedded across all city functions."⁶ The purpose of making a city smarter is not simply to use digital technology, but rather to leverage that technology and its benefits to improve governments' efficiency, transparency, and responsiveness.

Internet-connected devices can perform a number of functions. They can offer services to the public, as in the case of New York City's phone booths turned multi-purpose kiosks (a project called LinkNYC).⁷ They can use contextual information to alter the behavior of other electronic devices around them, as in Kansas City's streetlights that save energy by dimming unless they detect

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- 1 Already, more than half of the world's population (54 percent) lives in cities — the United Nations anticipates that that proportion will grow to 66 percent by 2050. That equates to an additional 2.5 billion people living in cities. United Nations, "World's Population Increasingly Urban with More than Half Living in Urban Areas," July 10, 2014, <http://www.un.org/en/development/desa/news/population/world-urbanization-prospects-2014.html>.
 - 2 U.S. Postal Service Office of Inspector General, *The Postal Service's Role as Infrastructure*, Report No. RARC-WP-15-003, December 15, 2014, https://www.uspsig.gov/sites/default/files/document-library-files/2015/rarc-wp-15-003_0.pdf.
 - 3 OIG, *The Internet of Postal Things*, Report No. RARC-WP-15-013, August 3, 2015, https://www.uspsig.gov/sites/default/files/document-library-files/2015/rarc-wp-15-013_0.pdf.
 - 4 United Nations, *World Urbanization Prospects: 2014 Revision*, <https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Highlights.pdf>, p. 24.
 - 5 United Nations, "World's Population Increasingly Urban with More than Half Living in Urban Areas."
 - 6 Smart Cities Council, "Definitions and Overviews," <http://smartcitiescouncil.com/smart-cities-information-center/definitions-and-overviews>.
 - 7 LinkNYC repurposes old phone booths to provide public Wi-Fi hotspots, device charging, and access to city services. For more information, see <https://www.link.nyc/>.

Figure 1: Categories of Smart City Projects



Source: Forbes.

Office of New Urban Mechanics has developed an app called “Street Bump” that citizen volunteers can download onto their smartphones. While users are driving, the app automatically records data about the smoothness of the ride and the location of problem areas, then sends that data to Boston’s transportation department.¹¹ The city uses it to help identify potholes, keep track of the maintenance of city roads, and plan for long-term infrastructure investment.

Until recently, cities largely had to undertake these efforts with little coordination from higher levels of government. This has just recently begun to change, with the federal government stepping in to play a role in coordination, knowledge-sharing, and funding. Even with this new layer of support, though, the implementation of smart city projects remains challenging.

Current Gaps in the Adoption of Smart City Initiatives

Although many cities are experimenting with smart city technologies, only some have advanced their projects into the prototype and development phases, while many initiatives remain in the ideation stage of the process.¹² This is due to a variety of factors that make it difficult for cities to get these initiatives off the ground.

motion nearby.⁸ They can gather data for long-term analysis by city officials, as in Portland’s sensors that measure air quality in various locations. Cities are brainstorming smart solutions to a list of challenges that includes transportation and traffic, public safety, waste management, energy, and more (Figure 1).

As there is no central database of smart cities, we relied on a variety of sources to map major smart city projects. We identified projects in 74 cities across 29 states and the District of Columbia (Figure 2).⁹

One of the most ambitious examples is the Array of Things (AoT) initiative. AoT aims to collect data on environmental factors such as climate, air quality, pedestrian and vehicle traffic, and noise through a variety of nodes to create “a fitness tracker for the city.” AoT began as a collaboration between Department of Energy research center Argonne National Laboratory and the city of Chicago and has since been extended to nine other cities around the world, including New York City, Seattle, Portland, and Atlanta.¹⁰ The first 50 nodes will be installed around Chicago in the summer of 2016; by 2018 there will be 500 of them in Chicago.

Another good example comes from Boston, where the Mayor’s

8 Andrew J. Hawkins, “Kansas City Just Installed Free Public Wi-Fi and Dozens of ‘Smart’ Streetlights,” *The Verge*, May 9, 2016, <http://www.theverge.com/2016/5/9/11640558/kansas-city-free-public-wifi-smart-streetlights-google-sprint-cisco>.

9 The projects displayed in the map are drawn from the list of finalists from the Department of Transportation Smart City Challenge, the 2016 participants in Envision: America, participants in the Metrolab Network (a partnership framework set forth in the White House’s Smart Cities Initiative), and cities with active Action Cluster projects with the Global City Team Challenge sponsored by the National Institute for Standards in Technology.

10 In addition to the cities in the United States mentioned in the paper, Mexico City, Mexico; Amsterdam, the Netherlands; Newcastle, United Kingdom; Glasgow, United Kingdom; and Bristol, United Kingdom will also be deploying AoT sensor nodes. For more information, see <https://arrayofthings.github.io/faq.html>. Generally speaking, there are more smart city projects internationally than there are in the United States, with these projects taking off particularly in Asia and Europe. For a thorough understanding of smart city activity in Europe, refer to the map of commitments, EU projects, and solution proposals at <https://eu-smartcities.eu/>. For the purposes of this paper, we elected to focus on projects in the United States only as that is where the U.S. Postal Service is active.

11 City of Boston, “Street Bump: Help Improve Your Streets,” <http://www.cityofboston.gov/doi/apps/streetbump.asp>.

12 For example, the Global City Team Challenge sponsored by the National Institute for Standards in Technology and US Ignite, <https://www.us-ignite.org/globalcityteams/>.

In particular, the following are the major obstacles:

- **Budget.** Cities often have strained budgets, and many of their ledgers are still recovering from the recent recession. Although revenues are increasing again, expenditures are growing at a slightly quicker pace.¹³ The willingness of city governments to put these limited discretionary funds toward unproven smart city initiatives varies from city to city. New York’s LinkNYC project is paid for by the private sector while its ShotSpotter project, which uses acoustic sensors to detect gunshots, is fully funded by the city. Across the Hudson River, Newark, New Jersey is interested in smart city initiatives but has not contributed funds to the projects underway there. Often, pilots are funded by a combination of city funds, private sector money, and federal grants such as those available from the National Science Foundation.¹⁴ However, money acquired for pilots and testing cannot sustain projects indefinitely; cities will need to figure out how to fund these activities for the long-term.
- **Technology expertise.** Given the relative novelty of the technology involved, local officials often lack the expertise to select, deploy, and manage that technology in-house — especially given the wide variety of tools employed across smart city initiatives. This is where the federal government can play a role. The National Institute of Standards and Technology can set standards for the technology’s use, and other agencies can facilitate knowledge-sharing between cities that may be trying to solve similar problems. Knowledge-sharing between the public and private sectors also plays an important role.¹⁵
- **Data collection, storage, and analytics.** In projects that require data intake, there are cases where cities are unable to collect certain types of data or the current method of data collection may be inadequate. For example, Boston’s Street Bump app for finding potholes is reliant on people downloading and activating the app, which will favor those who own smartphones and have higher levels of civic engagement. Furthermore, cities often lack the appropriate physical and digital infrastructure to handle large amounts of data. Even when cities are able to obtain and store it, they may have difficulty analyzing the data and creating actionable intelligence from it.¹⁶

Due to these challenges, the development of smart cities in the United States is still at a nascent stage. One of the ways that cities are addressing these gaps is through partnerships and collaborations. Many cities collaborate with state or federal government agencies, non-profit organizations, university research partners, and private-sector vendors to access new sources of funding, technology expertise, and data capabilities. However, identifying the right partners and determining their roles and responsibilities is its own challenge. Who will pay for what? Who will collect the data? Who will own it? Who will analyze it? Who can profit from the results? All of these questions must be answered in advance.

13 Revenues grew 1.3 percent and expenditures grew 1.5 percent in 2014. This does not equate to a deficit though. Expenditures are increasing relative to expenditures from previous years, but money spent still remains less than money earned. In addition, cities hold rainy day funds (called ending balances) which are currently at a 30 year high. National League of Cities, *City Fiscal Conditions 2015*, <http://www.nlc.org/Documents/Find%20City%20Solutions/Research%20Innovation/Finance/CSAR%20City%20Fiscal%20Conditions%202015%20FINAL.pdf>, p. 7.

14 In addition to direct funds, many cities have a Chief Innovation Officer or other innovation staff on their payroll. These include Austin, Boston, Chicago, Kansas City, New York, Pittsburgh, San Francisco, and Montgomery County. Jessica Mulholland and Noelle Knell, “Chief Innovation Officers in State and Local Government (Interactive Map),” *Government Technology*, March 28, 2014, <http://www.govtech.com/local/Whos-Making-Innovation-Official.html>.

15 President’s Council of Advisors on Science and Technology, *Report to the President: Technology and the Future of Cities*, February 2016, https://www.whitehouse.gov/sites/whitehouse.gov/files/images/Blog/PCAST%20Cities%20Report%20_%20FINAL.pdf.

16 The lack of analytics results in “dark” data — data that is collected but either only partially analyzed or not analyzed at all. For example, many cities, such as the city of Austin, use “loop detectors” on the street surface at some intersections that identify when a car is present and alter the traffic light in real time in order to improve the flow of traffic. However, this data is not stored or analyzed for other types of insight, such as overall traffic patterns across the city. Both business and cities struggle with unutilized and underutilized data — it has been estimated that over 80 percent of enterprise data is dark. Karen A. Frenkel, “Shedding Light on the Problem of Dark Data,” *CIO Insight*, May 13, 2016, <http://www.cioinsight.com/it-strategy/big-data/slideshows/shedding-light-on-the-problem-of-dark-data.html> and David Lumb, “How America’s Biggest Cities Make Sense of Their Data,” *Fast Company*, February 26, 2016, <http://www.fastcompany.com/3056842/startup-report/how-americas-biggest-cities-make-sense-of-their-data>.

One federal agency that has thus far not been involved in the smart city push is the Postal Service. But an opportunity exists. The following section explains possible roles that the Postal Service could play in helping cities address the aforementioned gaps and challenges, and provides further rationale for its involvement.

Rationale for Postal Involvement

There are many reasons why the Postal Service would be a valuable partner in smart city projects, having to do with both the characteristics of the postal network and the circumstances of this moment in time. The early phase of smart city development offers USPS the opportunity to get involved while these initiatives are on the ground floor. In addition, our interviews with city innovation staff and their partners showed that nearly all saw value in partnering with the Postal Service to turn existing postal assets into dual-purpose data collection points. The Postal Service itself would also stand to benefit from these efforts, as a way to potentially generate new revenue and strengthen its role as a national public infrastructure and service provider.

An Infrastructure Characterized by Ubiquity and Frequency

The first characteristic of the postal network valuable for smart city projects is its ubiquity. The Postal Service has a vast infrastructure that crisscrosses the country daily. Because of its mandate for universal service, the Postal Service is present in every community in the United States; post offices are in almost every town and its vehicles travel down almost every road, including roads that city or county vehicles and bus routes may not cover — a breadth of coverage that is particularly relevant for pavement monitoring projects. Such wide coverage by one organization allows smart city projects a degree of flexibility in setting their scope. Data could be collected and compared nationally, regionally, locally, or even just along a specific route, as needed.¹⁷

In addition to comprehensive coverage, the postal network also offers frequency and consistency. This is particularly important when it comes to its mobile assets. As indicated by Postmaster General Megan Brennan during her testimony before the Senate on January 21, 2016, sensor-enabled postal vehicles driving near-identical routes 6 days a week could represent an opportunity for the Postal Service to partner with local municipalities in the collection of data on road conditions and traffic patterns.¹⁸ The data collection potential of 215,000 vehicles traveling the same routes every day — over 1.2 billion miles annually — is enormous and could create a powerful information network.¹⁹ These mobile assets can collect a data snapshot from multiple locations once per day, which is cost-effective because one sensor is able to cover a wide geography. For the purposes of smart city data collection, this means data can be collected on a near-daily basis, allowing for changes in that data to be measured over time.

17 Michael J. Ravnitzky, “Offering Sensor Network Services Using the Postal Delivery Vehicle Fleet,” 2010, http://www.prc.gov/sites/default/files/papers/Ravnitzky%20Postal%20Sensors%20Paper%20070910-MJR-1_1191.pdf, p. 2.

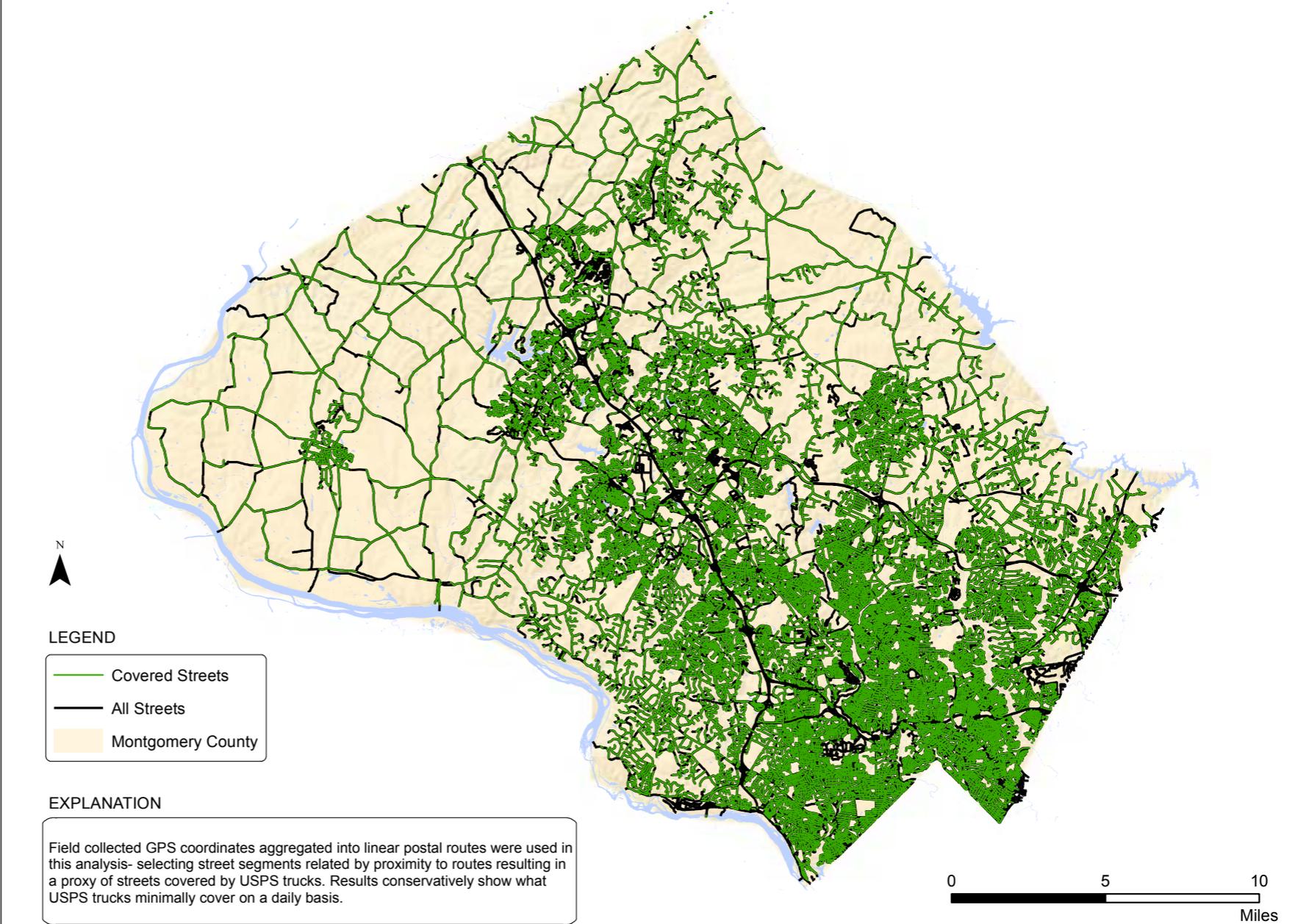
18 Nicole Ogrysko, “USPS: Time has long passed for postal reform,” *Federal News Radio*, January 21, 2016, <http://federalnewsradio.com/hearingsoversight/2016/01/usps-time-long-passed-postal-reform/>.

19 U.S. Postal Service, “Postal Facts: Facts and figures about your Postal Service – Size and scope”, <https://about.usps.com/who-we-are/postal-facts/size-scope.html> and U.S. Postal Service, “Postal Facts 2014,” <https://about.usps.com/who-we-are/postal-facts/postalfacts2014.pdf>.

Figure 3: Road Coverage of Postal Delivery Vehicles in Montgomery County, MD

POSTAL VEHICLES COVER GROUND

The map demonstrates the coverage of postal routes in Montgomery County, Maryland — a location of one of the pilots discussed later in the paper. Postal vehicles there drive along almost three-quarters of the county's roads 6 days a week.



Source: OIG Analysis.

Postal vehicles are the asset most in demand by smart cities, but smart city projects could also leverage other postal assets, such as letter carriers and stationary assets: mailboxes, blue collection boxes, and post offices. Stationary objects can house sensors that continuously collect data from a single location, offering a level of granularity that may be important for some purposes. For example, a sensor-outfitted collection box on a busy street corner could measure how foot traffic changes over the course of a day.

The Postal Service Is Updating Its Infrastructure

Many components of the postal infrastructure are in the process of being overhauled by the Postal Service. Currently, their vast infrastructure is largely unconnected. The updating of the infrastructure represents an opportunity to install connectivity into these assets. Although these capabilities can be installed after-the-fact, embedding from the outset makes it easier to enable services based on IoT technology.

One asset in need of an update is the mailbox. In response to a changing mail mix and corresponding changes in customer needs, the Postal Service has released new guidelines about making future mailboxes larger to accommodate more parcels, as well as increasing their security.²⁰ Larger mailboxes have already been made available in stores. By going a step further and introducing connectivity to the box, USPS guidelines could enable new “smart” services — for example, alerting city health care workers if an elderly resident hasn’t picked up the mail in days.²¹

The biggest opportunity is in updating the over 20-year old fleet of delivery vehicles, which is becoming costly to maintain and out-of-date with current technology. The Postal Service has released a request for proposal for a Next Generation Delivery Vehicle prototype, which it will test over the next couple of years with the intention of eventually replacing the entire fleet.²² In this request, the Postal Service expressed interest in vehicle telematics, although it is not listed as a mandatory feature.²³ Connective technology in the vehicle would be valuable, particularly when it comes to road safety applications.²⁴ Connected postal vehicles would not only make city streets safer — a smart city goal in itself — but could support smart city projects that require information collection and transfer. As other logistics fleets move toward increased connection, such as UPS with their ORION project, the Postal Service cannot afford to miss the opportunity to add connectivity and digital capabilities to its assets.²⁵

Increase in Federal Funding and Support

In the past 2 years there have been substantial funding commitments from the federal government, which sees the potential of smart city initiatives to abate age-old urban problems like crime, traffic, and infrastructure maintenance. In September 2015, the White House announced its Smart Cities Initiative that includes over \$160 million in research grants from a variety of agencies, ranging from the National Science Foundation to the Department of Commerce.²⁶ The Department of Transportation (DOT) soon followed up with an announcement that it would be awarding a total of \$50 million dollars to a city that came up with the best plan to improve the movement of both people and goods.²⁷ Even those cities that did not win this Smart City Challenge are hopeful of

20 U.S. Postal Service, “Standards Governing the Design of Curbside Mailboxes,” *Federal Register*, Vol. 80, No. 157, August 14, 2015, https://www.federalregister.gov/articles/2015/08/14/2015-20033/standards-governing-the-design-of-curbside-mailboxes?utm_campaign=pi+subscription+mailing+list&utm_medium=email&utm_source=federalregister.gov#h-9.

21 For more on the concept, and benefits, of a connected mailbox, see OIG, *Internet of Postal Things*. Prototypes for connected mailboxes already exist, but have not been approved by the Postmaster General.

22 U.S. Postal Service, *Next Generation Delivery Vehicle (NGDV) Prototype: General Requirements, Section A*, October 8, 2015, https://www.fbo.gov/index?s=opportunity&mode=form&id=2288d69f0ca30e5bafa826e7d3e4fa9e&tab=core&_cview=1.

23 U.S. Postal Service, *Next Generation Delivery Vehicle (NGDV) Prototype Design: Statement of Objectives, Section B*, October 8, 2015, https://www.fbo.gov/index?s=opportunity&mode=form&id=2288d69f0ca30e5bafa826e7d3e4fa9e&tab=core&_cview=1, p. 24.

24 In 2014, the Department of Transportation’s National Highway Traffic Safety Administration issued advance notice of its proposal to mandate a vehicle to vehicle communications medium, such as Dedicated Short Range Communications (DSRC), in all new light vehicles in the near future. Department of Transportation, “Federal Motor Vehicle Safety Standards: Vehicle-to-Vehicle (V2V) Communications,” *Federal Register*, Vol. 79, No. 161, August 20, 2014, <http://regulations.justia.com/regulations/fedreg/2014/08/20/2014-19746.html>.

25 UPS’ On-Road Integrated Optimization and Navigation (ORION) software uses vehicle telematics, package information, and GIS data to maximize the optimization of its routes. UPS, *Orion Fact Sheet*, <https://www.pressroom.ups.com/pressroom/ContentDetailsViewer.page?ConceptType=FactSheets&id=1426321623549-553>.

26 The White House Office of the Press Secretary, *Fact Sheet: Administration Announces New “Smart Cities” Initiative to Help Communities Tackle Local Challenges and Improve City Services*, September 14, 2015, <https://www.whitehouse.gov/the-press-office/2015/09/14/fact-sheet-administration-announces-new-smart-cities-initiative-help>.

27 The \$50 million total came from \$40 million from the DOT itself and an additional \$10 million supplied by Vulcan, the Paul Allen-owned umbrella company. Six finalists received \$500,000 each while Columbus, Ohio, the winner announced in June 2016, gets the grand prize. U.S. Department of Transportation, *U.S. Department of Transportation Announces Columbus as Winner of Unprecedented \$40 Million Smart City Challenge*, June 23, 2016, <https://www.transportation.gov/briefing-room/us-department-transportation-announces-columbus-winner-unprecedented-40-million-smart>.

receiving other grants that will allow them to follow through on some of their plans. Denver is one such example; it plans on using a combination of funds from other sources to improve a major freight corridor that runs through the city.²⁸ (Incidentally, a USPS distribution center sits along this corridor.)

The federal government is also embracing its role as facilitator by helping to create common technology standards, coordinate research, and support knowledge sharing and collaborations.²⁹ The White House initiative mentioned above also established the MetroLab Network, a framework to promote collaboration between cities and universities.³⁰ Additionally, the National Institute for Standards and Technology in partnership with US Ignite has sponsored the Global City Teams Challenge, a platform to promote collaboration between local governments, nonprofits, universities, and private companies on specific IoT-based smart city projects (called “action clusters”).³¹

The growing level of interest and support from federal agencies is an opportunity for any entity that wants to get involved with smart cities. It provides a window for the Postal Service to get a pilot off the ground using federal funding and cooperation that may not be available forever. Private-sector support is available too. Columbus, OH, won the DOT Smart City Challenge in part because it received a pledge of \$90 million from local businesses; San Francisco, a finalist, got \$150 million in private pledges.³²

The Benefits of Participation

Smart cities projects exist to benefit cities and citizens; however the Postal Service would also benefit from many of them. Such benefits include:

- **Cost Savings and Efficiency Gains.** Some improvements within a city will directly benefit the Postal Service through efficiency gains and costs savings. For example, as a major user of our nation’s roads, the Postal Service would be materially benefitted by improved pavement conditions. TRIP, a national transportation research group, estimates that the poor condition of U.S. roads costs citizens \$109.3 billion per year (or \$516 per driver) due to accelerated vehicle deterioration, more frequent repairs, and increased fuel consumption.³³ This translates into a direct cost to the Postal Service of almost \$111 million per year in additional operating costs. In addition, many cities, particularly those that applied to the DOT Smart City Challenge, plan to use vehicle movement data to improve traffic flow. The Postal Service would certainly benefit from its drivers spending less time sitting in traffic and any other efforts to improve the movement of goods throughout cities and regional transportation corridors.
- **Brand Enhancement.** Promoting the public good through projects such as these generates goodwill among customers and stakeholders, including legislators. This is an intangible benefit, but intangible does not mean immeasurable. Belgium’s bpost has calculated that its acquisition of CityDepot, which uses collaborative logistics to cut down on traffic congestion and carbon dioxide emissions within cities, generated \$4.75 million of intangible value due to an increase in goodwill.³⁴

28 Fanganello, Crissy, Phone interview by author, July 25, 2016.

29 President’s Council of Advisors on Science and Technology, “Report to the President: Technology and the Future of Cities,” p. 34.

30 For more information on the MetroLab Network, visit the website at <http://metrolab.heinz.cmu.edu/>.

31 National Institute of Standards and Technology (NIST) and US Ignite, “About,” <https://www.us-ignite.org/globalcityteams/about/>.

32 These commitments were to take effect only if the city won the contest.

33 TRIP, “Bumpy Roads Ahead: America’s Roughest Rides and Strategies to Make our Roads Smoother,” July 2015, http://www.tripnet.org/docs/Urban_Roads_TRIP_Report_July_2015.pdf.

34 Collaborative logistics refers to companies working together to maximize efficiency along supply chains. It includes, for example, the coordination of deliveries across multiple logistics companies so that one full truck replaces multiple, less-full trucks traveling down the same road in order to cut down on both carbon emissions and congestion. Erica E. Phillips, “Collaborative Logistics Comes to the Warehouse,” *Wall Street Journal*, June 12, 2015, bpost, *With Confidence: bpost Annual Report 2015*, http://corporate.bpost.be/~media/Files/B/Bpost/annual-reports/bpost%20annual%20report%202015_EN.pdf, p. 16.

- **Supporting Other Postal Initiatives.** Some city goals align with postal goals, such as the goal to cut down on carbon emissions. For example, Norway’s Posten Norge has what it describes as an “aggressive focus on the environment.” In 2008, it set a goal to reduce carbon emissions by 30 percent. Posten Norge has already met this goal through the purchase of over 1,000 electric vehicles. In 2015 alone it purchased 241 — one of the largest single purchases of electric vehicles in the world — and is on its way to reducing carbon emissions by 40 percent in 2020.³⁵ The Postal Service likewise has a goal, put forward in its strategic sustainability plan, of reducing greenhouse gas emissions 20 percent by 2020.³⁶ Helping cities meet their emissions goals would help posts meet their own emissions goals.
- **Revenue Generation.** Smart city services could also represent a new source of revenue. Because these efforts are in the very early stages of development, it is too early to say whether these services will be a significant or even a consistent new line of business. Posts are looking at several business models for smart city participation, with different levels of involvement. As the level of effort and involvement by the post increases, the potential revenue opportunity also increases (as do the risks). More details on these different business models are in a following section.

Helping cities solve local problems is nothing new to postal operators around the world. Many foreign posts provide local government services through windows at the post office.³⁷ Poste Italiane offers its “Sportello Amico” window where residents can conduct a variety of transactions, including the payment of local taxes.³⁸ Likewise, many posts have been active in helping cities promote efficient transportation by using fuel-efficient vehicles, such as electric vehicles or bicycle couriers.³⁹ Swiss Post is directly involved in improving mobility in cities, and has been for a long time, through its PostBus service, which is now testing autonomous (driverless) buses.⁴⁰ Swiss Post also offers a bikeshare program called PubliBike.⁴¹

Other posts are already beginning to explore sensor-based data collection. As early as 2014, Spanish post Correos was involved in developing air quality monitoring sensors for placement on postal vehicles.⁴² Posti, in Finland, is beginning to conduct experiments on how sensor-based data it collects (for example, road conditions, traffic flow, and signal strength data) could be of use.⁴³ French postal operator La Poste, through its subsidiary Dicapost, is taking a different tack, aiming to be a platform where sensor-based data from a variety of sources can be housed together securely for easy access. Under this model, La Poste plays the role not of data collector but of data broker, offering storage and analytics services.⁴⁴

35 Posten Norge, *We Know Norway: Annual and Sustainability Report 2015*, <http://www.postennorge.com/annual-report-2015/>.

36 U.S. Postal Service, “Strategic Sustainability Plan,” 2015 https://about.usps.com/what-we-are-doing/green/pdf/2015_USPS_SSPP.pdf.

37 OIG, “e-Government and the Postal Service: A Conduit to Help Government Meet Citizens’ Needs,” RARC-WP-13-003, January 7, 2013, https://www.uspsaig.gov/sites/default/files/document-library-files/2015/rarc-wp-13-003_0.pdf.

38 Poste Italiane, “Sportello Amico,” <http://www.poste.it/ufficio-postale/sportello-amico.shtml>.

39 For example, posts in Norway and Portugal have started “greening” their fleets with electric vehicles. “Norway Post to add 330 Electric Vehicles to Fleet,” *Post and Parcel*, June 18, 2015, <http://postandparcel.info/65771/news/environment-news-2/norway-post-to-add-330-electric-vehicles-to-fleet/> and “CTT Group Invests €5m in Green Fleet,” *Post and Parcel*, March 3, 2014, <http://postandparcel.info/60290/uncategorized/ctt-group-invests-e5m-in-green-fleet/>.

40 PostBus is a public transportation system provided by Swiss Post that uses buses to carry passengers to and from different cities in Switzerland, France, and Liechtenstein. Visit the Postbus website at <https://www.postauto.ch/en>.

41 Swiss Post, *The Pleasure of Simple Solutions: Annual Report 2015*, http://annualreport.swisspost.ch/15/ar/downloads/geschaeftsbericht_konzern/en/E_Post_GB15_Geschaeftsbericht_WEB.pdf.

42 Grupo Correos, “2014 Integrated Annual Report: Innovation and Technology, Our Present, Our Future,” http://www.correos.es/ss/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername0=content-type&blobheadername1=Content-Disposition&blobheadervalue0=application%2Fpdf&blobheadervalue1=filename%3DIntegrated_annual_report_2014_Correos.pdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1365523286344&ssbinary=true, p.36.

43 Posti, *Annual Report 2015*, http://annualreport2015.posti.com/filebank/1229-POSTI_Annual_Report_2015.pdf, p. 39.

44 Dicapost, “Digital Hub and IOT,” <http://en.docapost.com/solutions/digital-hub-iot>.

Smart City Opportunities for the Postal Service

To determine what types of projects smart cities are working on or are planning for the future, how these projects are or will be funded, and the partners needed by these cities in support of their smart city endeavors now and in the future, the OIG interviewed 21 smart city stakeholders. Of these, 15 provided written survey responses as displayed in Table 1. These cities were selected based on their participation in smart city development groups and available knowledge of their activities.⁴⁵

Table 1: Summary of Smart City Activities among Interviewed Cities

	Atlanta, GA	Boston, MA	Charlotte, NC	Columbus, OH	Denver, CO	Kansas City, MO	Montgomery County, MD	Newark, NJ	New York, NY	Pittsburgh, PA	Portland, OR	San Francisco, CA	Schenectady, NY	Seattle, WA	Washington, DC
Transportation Projects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Health Projects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Public Safety Projects	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Utilities Projects	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Federal Funding	No	Yes	Yes	Yes	No	Yes	No	No	Yes	No	Yes	Yes	No	No	No
City Funding	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Academic Partners	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Private Sector Partners	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Coordinating Office Established	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Interest in USPS	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

■ No ■ Yes

Source: OIG Interviews and survey responses from 15 cities.

Most city officials stated that some of their ongoing projects would benefit from Postal Service participation. Some of them also identified potential pilots specifically built around the Postal Service’s assets. The following section is a summary of the most noteworthy or most common suggestions of potential points of collaboration with the Postal Service, followed by the presentation of five concrete pilot opportunities.

⁴⁵ Please note that our interviews represent only a sample of the full list of smart cities in the U.S. For a list of people the OIG spoke to, please refer to [Appendix A](#).

Postal Assets That Cities Value Most

The postal assets of greatest interest to cities, according to our interviews, can be broadly divided into three categories: vehicle fleet, letter carriers, and stationary assets. Postal smart city projects would involve combining these assets with IoT technology to provide a service for city governments. In most cases, the combination consisted of using postal assets as tools for gathering data. The fleet was the most commonly suggested category by cities; this aligns with previous research on the topic, from 2010, highlighting the value of the postal fleet.⁴⁶

■ **Vehicles.** Different types of sensors, usually small and unobtrusive, would be attached to the interior or exterior of postal vehicles. They could, depending on the pilot, capture information about:

- air quality or other environmental measurements
- mobile, wireless, and radio signal strength
- gas leaks or biological and chemical agents
- traffic patterns
- road and bridge integrity.⁴⁷

These sensors or cameras would perform their function as the vehicle made its normal rounds in the neighborhood, giving the sensors mobility they would otherwise have trouble achieving. Placing sensors on a rooftop or other stationary spot would be of minor value for air quality readings and of no value for pothole detection. Having the sensors “ride along” on postal routes is an ideal solution since deliberately driving the sensors up and down every street in city or contractor vehicles would be time and cost-prohibitive. In addition, the coverage that postal vehicles offer is attractive; sensors placed on city vehicles to collect data would cover a more limited amount of ground.

■ **Carriers.** Some information about the surrounding environment cannot be collected passively because sensor technology is not sophisticated enough to identify the stimuli in question; instead data must be actively collected. In these instances, it was proposed that letter carriers could manually input data points into handheld devices through an app. Whenever they notice something amiss along their routes, they could pull out their handheld device or phone, open an app that contains a list of common problems, and push a button corresponding to that problem. A notification would be sent to the appropriate city agency along with the carrier’s GPS location. Problems would be caught quickly because of the daily presence of the carrier, and the tip would be reliable because it comes from a trusted source.

There are any number of things a carrier sees on his daily route that city governments would be interested in knowing about:

- fallen tree limbs
- damaged public property
- graffiti

⁴⁶ Ravnitzky, 2010, p. 1.

⁴⁷ Ibid.

- overflowing trash cans
- streets and sidewalks covered in snow (also hinders the carrier’s ability to perform his or her duties)
- vacant and abandoned property.

Chicago, Richmond, and Memphis all mentioned urban blight as a major issue where letter carriers could be of assistance. Cities are attempting to use predictive analytics to anticipate when properties will become vacant and cause local blight, but they are particularly interested in getting notifications from the Postal Service about when mail delivery ceases or other lack of activity at a residence.⁴⁸ With carriers’ unique knowledge of their routes and neighborhoods, they are perfectly positioned to know when a property has been abandoned. The type of app described above would be a way of capturing that knowledge.

- **Stationary objects.** This category includes blue collection boxes, home mailboxes, and post offices. Pittsburgh expressed an interest in using post offices in underprivileged parts of the city as outreach facilities for community engagement. They could also be Wi-Fi hotspot locations, bringing connectivity to otherwise unconnected citizens living in “tech deserts” in these underprivileged neighborhoods.

Many smart cities place sensors in streetlights because of the access to electricity as a power source for sensors, but sometimes the lights are owned by a utility company rather than the city, so permission to use them is not always forthcoming. In these cases, blue collection boxes could serve as possible substitutes. They are not wired, so sensors would have to be battery-powered or solar-powered, but they are often in prime locations on downtown street corners.

Boston took an interesting approach to the collection box, asking why a mailbox needs to be a box at all. Perhaps a mail-slot and collection box could be incorporated into the design of something utilitarian like a city bench. Boston is also interested in “tactical urbanism,” the incorporation of high-design and even whimsy to make the built environment more livable.⁴⁹ Under tactical urbanism, a collection box might have a layer of interaction built into it to make sending mail more fun and engaging, such as by lighting up or playing music when mail is deposited. While not designed to solve a problem in the way of most smart cities, this is a creative way to make a tiny improvement in people’s lives. And for the Postal Service, it would make depositing mail a “mail moment” in a similar way that receiving mail is now.

Five Pilot Opportunities

The OIG’s interviews resulted in a long list of possibilities for partnerships between the Postal Service and selected cities. Some were a casual exchange of ideas while others were well-defined opportunities for piloting a specific smart city solution using a postal asset. Nearly everyone was enthusiastic about the possibility.

From the list of possible pilot opportunities, we identified five specific pilots where the potential seems greatest and where the conditions (commitment from local players, funding, technology, and partnerships) are in place to make them actionable in the short term. These five are not meant to represent the only opportunities the Postal Service should consider, nor is it meant to represent the “best” opportunities under any single criteria. Additional details about these pilots and the criteria we used to select them can be found in [Appendix B](#). This selection criteria represents one framework that both the Postal Service and cities could use to evaluate pilot opportunities.

⁴⁸ Tom Schenk, Chief Data Officer for the City of Chicago, in discussion with the authors, June 23, 2016. Property tax payment records are not good sources of data because there are many reasons someone might not pay taxes other than abandoning the property. Foreclosure data would be useful, but that is a transaction between banks and that data is not readily available to the city.

⁴⁹ Nate Berg, “The Official Guide to Tactical Urbanism,” *CityLab*, March 2, 2012, <http://www.citylab.com/design/2012/03/guide-tactical-urbanism/1387/>.

Potential Pilot 1: Monitoring Pavement Conditions in Pittsburgh, PA

The problem: Potholes cost U.S. drivers \$3 billion annually. Catching cracks in the asphalt before they become potholes is the dream of transportation departments everywhere, but that kind of surveillance is easier said than done. Three means of monitoring pavement conditions are in common use today: citizen reports, city inspectors, and contractors. Citizen reports can be problematic because their accuracy cannot be verified, and citizens often wait until a crack becomes a pothole before reporting it. Sending out inspectors is time-consuming and inefficient, given the extent of the street grid. Contractors with laser-scanning devices are expensive.

The technology: A researcher at Carnegie Mellon University (CMU) has created software that analyzes digital images of a road, identifies cracks and potholes, and displays the results on an interactive map. Video images are collected through a simple digital camera mounted inside the windshield of a vehicle. The device is currently powered through the vehicle's 12V cigarette lighter electrical socket, but could leverage the engine's power in other ways.⁵⁰ Video is stored on the device's hard drive until the vehicle is parked near a Wi-Fi hotspot, at which point the driver can prompt the app to upload the data to a cloud. The data is then analyzed and the results presented through a color-coded dashboard.

The Postal Service's role: CMU has proposed installing the cameras in 10 postal vehicles in the city of Pittsburgh. Postal vehicles cover most streets in the city during their daily routes, thereby allowing the city to collect regular data without having to use special-purpose vehicles. Minimal to no deviation from normal behavior would be required of the postal vehicles. The cameras, which would be installed and maintained by CMU, could be programmed to turn on automatically when a carrier begins driving his or her postal route and off when the route is completed. Uploading data to the cloud could be automated as well, as long as the vehicle is parked within range of a Wi-Fi network in the postal lot where the vehicles are stored. Beyond alerting CMU if the device is malfunctioning, no intervention from USPS employees would be required at any stage. Nor would USPS be required to fund a small pilot.



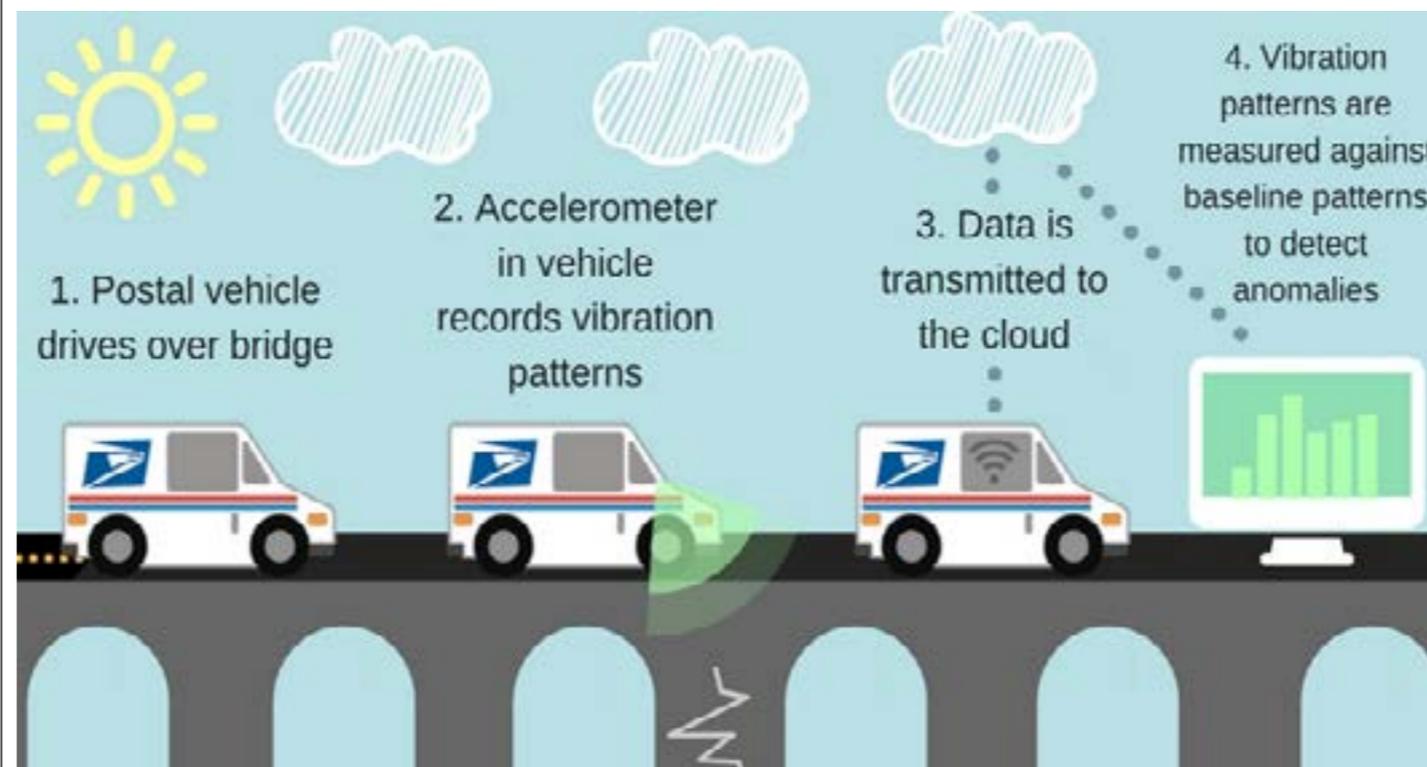
⁵⁰ The long-life vehicles used by city carriers are equipped with cigarette lighters. Grumman, "USPS Long Life Vehicle Operator's Manual," <https://www.nalc.org/workplace-issues/body/1990-LLV-Manual.pdf>. Rural carriers use their own vehicles; whether the vehicle has a lighter in it would depend on the specifications of that particular vehicle.

Potential Pilot 2: Monitoring Bridge Conditions in Pittsburgh, PA

The problem: Much like our nation's roads, our bridges are in poor shape too. In 2013, the American Society of Civil Engineers gave our bridge infrastructure an overall grade of C+, with over 65,000 bridges across the country categorized as “structurally deficient.” Municipalities are forced to either make costly repairs, which often means closing a bridge entirely and inconveniencing the public, or continue the status quo of hoping against a catastrophic collapse of the kind seen in Minneapolis in 2007. Regular updates about the integrity of bridges could help identify small structural problems when they are cheap and easy to fix. The current method of monitoring bridge conditions — sending engineers to visually inspect the bridges — is expensive and does not provide real-time information due to the time that passes between inspections, which are done every 2 years.

The technology: Researchers at Carnegie Mellon University (CMU) are testing the use of accelerometers to collect vibration data that they can analyze to gain intelligence about the structural condition of bridges. So far, this technology has been deployed in Pittsburgh's light rail in a pilot that measures the condition of train tracks. The next step is to use these sensors on cars and trucks to monitor the condition of road bridges. Accelerometers are often installed in vehicles when they are manufactured, so the data collection tool may already be in place. The next challenge is to fine-tune the analysis to filter out noise in the data so that vibration patterns can be trusted as a reliable detector of structural deficiencies.

The Postal Service's role: The CMU researchers propose that postal vehicles equipped with accelerometers could collect vibration data as they cross bridges along their routes. No deviation from normal routes would be required, and drivers of postal vehicles would not need to do any additional work. Provided adequate funding can be secured, the researchers from CMU would be responsible for: installing sensors in the vehicles in collaboration with postal employees, as well as a device to store the data for analysis; maintaining the equipment; and analyzing the data. Postal vehicles are of interest to the researchers due to their frequent travel over many of the bridges in Pittsburgh, which would ensure that data is collected on a predictable basis and as often as needed.

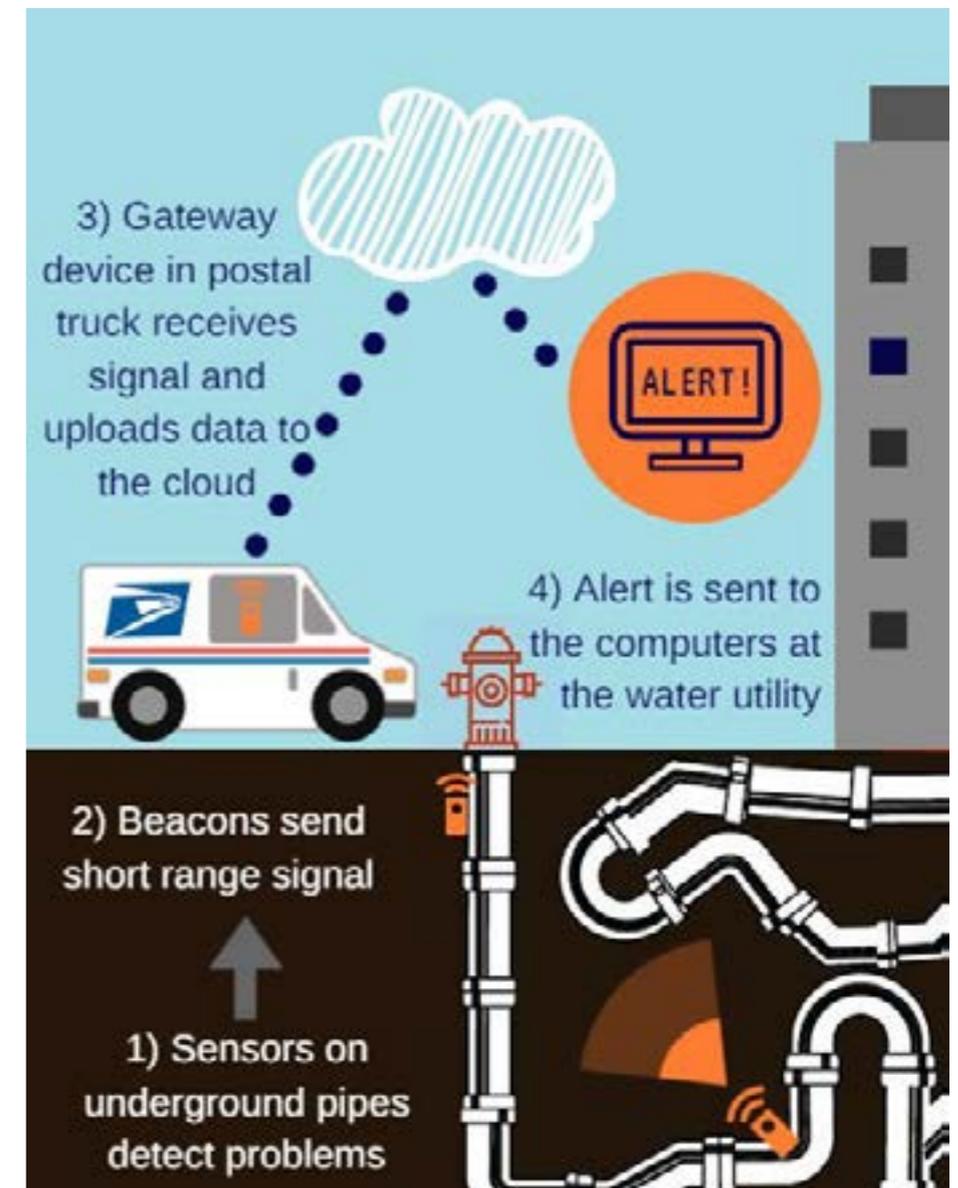


Potential Pilot 3: Managing Water Infrastructure in Montgomery County, MD

The problem: Two problems could be solved through this pilot. One is that fire hydrants sometimes lose pressure, preventing them from being used when a fire emergency strikes. The other is that underground water pipes wear out over time and can leak if enough deterioration occurs. Both of these are difficult to catch. Pressure sensors in fire hydrants and acoustic sensors on water pipes can detect a breakdown as soon as they happen (water mains are constructed out of woven coils that snap as they wear out, hence the acoustic sensors), but the signal beacons attached to these sensors must be battery-powered because they have no access to electricity. Batteries drain quickly unless the beacon uses a very short signal range, in which case they can last for years.

The technology: With a signal distance of only 20-30 yards, relaying the signals into the cloud is near impossible. It requires Internet gateways within range of each beacon, which must also be connected to a power source. The innovation office of Montgomery County, MD, an urban county adjacent to Washington, DC, with more than a million residents, has experimented with putting gateways in its county buses to transmit other kinds of data. It believes they could also be used to pick up these water-system beacon signals as the buses drive through their short range. The data would be relayed to the cloud and accessible to officials from the county and water utility. Any abnormality would create an automatic alert so that repairs could be made quickly.

The Postal Service's role: Buses, however, travel down less than 20 percent of the county's streets. Therefore the county has proposed a pilot to install the gateways in 10-20 postal vehicles, which achieve a much denser coverage of residential streets. About the size of a paperback book, the gateway could be attached to the vehicle's dashboard using Velcro and plugged into the 12V cigarette lighter. It would turn on and off automatically and perform its data transmission function with no prompting by the driver. As the vehicle drove past hydrants and over underground pipes, it would pick up the transmitter signals and upload the data to the cloud. Cooperation by the water utility, including the placement of beacons on the water infrastructure, would be required for this pilot. Beyond performing cursory checks on the gateways, the Postal Service would not need to take ownership of the hardware, the data, or most associated costs.



Potential Pilot 4: Identifying Warning Signs of Urban Blight in the New York Capital Region

The problem: Urban blight occurs when neighborhoods tip the balance between occupied, maintained structures and unoccupied, unmaintained structures. Many unoccupied properties decay, bringing on significant public safety and economic development challenges that affect both the city and the entire region. This “blight” has rippling effects that bring on many challenges for a city, such as a decrease in property values — which directly impacts city coffers since property taxes are a main source of city revenue. There are steps that governments, in conjunction with community partners, can take to prevent and mitigate the spread of blight. This requires early identification of newly vacant and mildly distressed properties. Accurate and timely data about properties is difficult to come by, but there are early warning signs that a property has recently become vacant. Cities are currently working across departments and bringing together data from a variety of sources (such as existing code violations, utility usage, property tax records, and foreclosure information) in order to assess the status of a property. However, this represents a reactive look at blighted properties; a more proactive approach would allow predictive analysis by integrating data collected daily with data from a range of internal and external sources.

The technology: The Center for Technology in Government (CTG) at the University at Albany is working with cities in New York’s Capital Region (Schenectady, Troy, Gloversville, and Amsterdam) to build each city’s capability to collect, manage, use, and share information to fight blight within their city and across the region.



So far this effort has focused on identifying and defining the critical data needed and developing the parameters of a shared platform that can help government leaders take proactive measures in addressing blight. In some of the smaller cities, collecting and recording the data is still done in a very low-tech way, for example, code inspectors filling out paper forms about code violations. Capturing this data electronically could enable predictive analysis in identifying blight. While code inspectors are trained to inspect and make judgments about code violations, because there are so many competing demands and responsibilities, they are not able to regularly observe the properties and are therefore unable to recognize when accumulated violations have tipped the balance to a blighted property. For these reasons, the CTG and the cities are interested in developing technologies and practices that offer a systematic way to collect data in at-risk neighborhoods, from a range of stakeholders, in order to take a proactive stance against blight.

The Postal Service’s role: The cities within this project are interested in leveraging both the daily presence of postal carriers in neighborhoods and their knowledge of the homes there. The carrier has first-hand, daily interactions with properties, owners, and inhabitants. An application could be created for the carrier’s device to capture this knowledge to allow more consistent input of information about properties in order to detect early signs of blight. For example, the carrier could report that a house is falling into disrepair or that a mailbox has not been emptied for a long time. Leveraging the postal carriers’ knowledge and presence in the community would allow a more holistic picture of the neighborhood but in order to achieve this, it would require a closer review and consideration of the operational implications for the Postal Service.

Potential Pilot 5: Monitoring Air Quality in Portland, OR

The problem: Portland is reconfiguring its transportation infrastructure along a 12-mile commercial corridor and wants to ascertain what impact this will have on nearby air quality. Poor air quality is still a problem in this country. More than half the U.S. population — 166 million people — live in counties with unhealthy levels of ozone and particulate matter in the air, according to the American Lung Association.⁵¹ Long-term exposure to air pollutants can cause asthma, lung cancer, and cardiovascular problems, among other issues. Furthermore, air pollution has been shown to disproportionately impact people of lower socioeconomic status, who can least afford to see a doctor. Portland is particularly concerned about the many low-income neighborhoods that border this commercial corridor.

The technology: To measure changes in air quality along the 12-mile study corridor, Portland has designed and deployed two monitoring stations in strategic locations to measure pollutant concentrations. These stations are housed in traffic signal cabinets and are equipped with research grade instruments that measure nitrogen oxides, fine particulate matter, wind direction, temperature, humidity, and more. Each station costs more than \$50,000, and their range is not scalable. The City of Portland is actively participating in research to understand how smaller, but low-cost air quality sensors can be used to create a distributed network of air quality measurements. They will be deploying a pilot demonstration of up to 30 low-cost sensors along the road corridor. The smaller sensors measure gaseous and particulate pollutants but are sensitive to interferences from temperature, relative humidity, and other pollutants and are less accurate and precise than the larger instruments. The sensors like the larger cabinets, are stationary — they can only provide readings for a single location. City officials are working with Portland State University to determine how far apart they can be placed to still achieve adequate coverage of the area in question. They are also wrestling with the challenge of providing power to all of the sensors.

The Postal Service's role: The city could vastly increase the effectiveness of its sensors and expand the use cases of the air quality data by making them mobile, thereby expanding their coverage area. Attaching them to postal vehicles would be one way to accomplish this. The sensors would be affixed to the outside of the vehicles and collect data on air quality as they drive their normal routes. Geotagged data would be sent to the cloud automatically. The devices would be wired into the vehicle's electrical system for a steady supply of power. Similar mobile sensor deployments are currently being tested by other parties with Google Street View cars. City officials would be responsible for the devices and no participation by the driver would be required. By simply ferrying the sensors around the city, the Postal Service would be saving the government money and contributing to the health of its residents. Expanding the coverage area of measurements will also help the City of Portland better quantify impacts of their Climate Action plan and city goals to improve assessment of public health.



⁵¹ American Lung Association, *State of the Air 2016*, April 20, 2016, <http://www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2016-full.pdf>.

Implementation Considerations

Engaging in smart city pilots, including the pilots discussed above, would require addressing a series of implementation issues that emerged from our interviews with cities. These have to do with determining the specifics of the partnership, including what is the appropriate business model, how the data is to be protected, and whether the Postal Service would be allowed under current regulation to provide smart city services.

Selecting the Appropriate Business Models

Before involving itself in the world of smart cities, the Postal Service should make an organizational decision about how much responsibility it wants to take on. There are options for very low involvement or very high involvement, with some options in between. Determining which business model is appropriate depends on the Postal Service's business goals, its level of preparedness, and what it is legally allowed to do under current law and collective bargaining agreements with unions. The unions, for their part, tend to be supportive of employees engaging in more and different types of tasks. For example, the National Association of Letter Carriers (NALC), the union that represents city carriers, already actively participates in organized community events that generate more work for the carrier, including the Stamp Out Hunger food drive and the Carrier Alert program.⁵² Additional considerations about the regulatory framework are discussed in a following section.

The business model is something that can change over time as goals, market conditions, and regulations change. The business models range from the Postal Service acting as a passive data collector — by leasing out space for others to attach sensors — to taking on a role in data collection, storage, analysis, and presentation. Three business model options are discussed below.

- **Space leaser.** The lowest level of involvement from the Postal Service would be to simply rent out space on its infrastructure for others to attach sensors.⁵³ Another party — the city or affiliated partners — would be responsible for installing and maintaining the sensors, collecting the data, ensuring data security, and so forth. In this way, the Postal Service is only passively collecting data and is neither actively engaged in the pilot's design nor invested in its outcome, in the same way that a billboard owner is not involved in the marketing campaign that went into its hosted advertisement. Data collection would be a byproduct of regular postal activity, not an added value service. It would not add appreciable labor hours or result in changes to normal operations.⁵⁴ The partner city would work around the Postal Service's schedule and procedures, leaving as small a footprint as possible. USPS would collect rental fees but otherwise receive no service fees nor have any control or responsibility over the intelligence.
- **Data collector.** Any pilot that requires the Postal carrier to perform an action represents an increased commitment by the Postal Service. Such actions could range from powering a sensor device on and off, manually uploading data from the device

⁵² The Stamp Out Hunger food drive is the largest 1-day food drive in the country, where carriers collect donations of non-perishable food items put out by residents along their route. The Carrier Alert program encourages carriers to notify local points of contact when they observe something unusual concerning an elderly or disabled person along their route. National Association of Letter Carriers, "Community Service," <https://www.nalc.org/community-service>. In fact, all four major postal unions — NALC, The American Postal Workers Union (APWU), National Postal Mail Handlers Union (NPMHU), and the National Rural Letter Carriers' Association (NRLCA) — agree that the Postal Service should be permitted to offer certain non-postal services that expand the roles of postal employees. "Testimony of Fredric V. Rolando President, National Association of Letter Carriers to a Hearing on 'Reforming the Postal Service: Finding a Viable Solution' by the House Committee on Oversight and Government Reform," May 11, 2016, <https://oversight.house.gov/wp-content/uploads/2016/05/Rolando-NALC-Statement-5-11-Postal-Reform.pdf>. For example, the President of NRLCA has specifically mentioned offering services on behalf of state, local, and tribal agencies as a non-postal service of interest. "Written Statement of Jeanette Dwyer, President National Rural Letter Carriers' Association before the Senate Homeland Security and Governmental Affairs Committee," September 19, 2013, <https://www.nrlca.org/UploadedImages/ContentDocument/Dwyer%20HSGAC%209-17.pdf>. Furthermore, APWU is a supporting organization of the Campaign for Postal Banking and actively promotes allowing postal clerks to offer banking services. American Postal Workers Union, "Tell the Postmaster General: Make Postal Banking a Reality Now," November 19, 2015, <http://www.apwu.org/news/web-news-article/tell-postmaster-general-make-postal-banking-reality-now>.

⁵³ Ravnitzky, 2010.

⁵⁴ Ibid., p. 1.

to the cloud, or entering information manually into an app. In the case of the blight prevention pilot or other manual data entry, carriers would have to be trained in or provided guidance regarding what to observe and how to record it. Under this business model, the city could reimburse the Postal Service at a higher flat service fee, pay a variable fee based on the amount of data collected, or a combination of the two. Beyond these differences, this model is similar to the previous one in the sense that the Postal Service's infrastructure is only a mechanism of data collection, while data ownership, storage, and analysis is handled by the city or a different partner.

- **Full service provider.** If in the future the Postal Service chooses to embrace smart city projects as a serious line of business, it could offer a range of related services, from data storage to the creation of dashboards and analytics, in addition to the data collection activities. This would be similar to the path La Poste is venturing down with its Digital Hub. USPS could own the hardware and/or software, keep the data it collects on its own servers, then sell either the raw data or the dashboard results to the city governments. It could collect higher fees for this because it made all of the upfront investments in the technology. There is some precedent for this type of business model; the Postal Service is already in the business of selling operational data. Postal data, such as address files and route information, is licensed to software providers that then offer it to large mailers through their products.⁵⁵

Given the novelty of the endeavor, the Postal Service could start with a business model that has a low level of involvement, like the “space leaser.” In most of the pilots mentioned in this paper, the Postal Service would not be asked to take responsibility for the design, purchase, or maintenance of hardware or software; storage or protection of data; or converting raw data inputs into actionable outputs. USPS would merely allow other parties to use postal vehicles as a conveyance for their devices, for the purpose of making them mobile. If the pilots are not beneficial or unsuccessful, the Postal Service has made no investment and therefore lost almost nothing. If the pilots are a success, the Postal Service could consider advancing to the other business models, based on market conditions and its own strategic direction.

Data Questions

Data privacy and security are important considerations for IoT use cases, including IoPT applications for smart cities. Should the Postal Service ever decide to become a full service provider and own the data it collects, it will have to be diligent about designing an appropriate platform strategy to store, manage, and share data. It will need to build a platform that is open, scalable, and secure by creating a well-defined data model that clearly determines data flows, and establish policies to regulate and authorize access to each data point.

Best practices for privacy protection include collecting only the needed data, aggregating and anonymizing data that contains personally identifiable information, destroying data that is no longer needed, and creating transparent privacy policies that clearly state how data is collected and with whom it will be shared.⁵⁶

Even if the Postal Service never becomes a full service provider and never takes ownership of any data, it will not be absolved of all data responsibility in the eye of the public. Should there be a breach of city servers that compromises data security or privacy, USPS may face scrutiny merely for being a participant in the collection of the data. While enabling cities to get smarter should bolster the Postal Service's branding and perceived utility, it would not want to risk its reputation as a trusted identity protector. It should, therefore, inform itself about the data policies and protections of any city with which it contracts.

⁵⁵ For more information on Postal Service addressing services, see U.S. Postal Service, “Manage Address Quality,” June 23, 2014, https://ribbs.usps.gov/index.cfm?page=address_manage_quality.

⁵⁶ Ramirez, Edith, *IoT – Opportunities and Challenges*, Presentation at The 2nd Annual Internet of Things Global Summit: Realizing the Potential of the IoT, October 27, 2014.

Regulatory Framework

The Postal Accountability and Enhancement Act of 2006 (PAEA) prohibits the Postal Service from offering new non-postal services.⁵⁷ While the Postal Service generally has broad latitude to rent space to third parties who provide non-postal services, approval from the PRC or congressional action may be required if the Postal Service elects to become a full service provider as described above. The Postal Service is allowed under current law to provide services to federal agencies. For example, many post offices around the country process passport applications in conjunction with the U.S. Department of State. However, services provided to non-federal government agencies exist in a legal gray area at present — the law neither explicitly allows nor prohibits them.

The argument could be made that services to state and local governments are similar in nature to services offered to federal governments and thus allowable. In this perspective, smart city participation might be legal because it does not fit one of the legal definitions of a “service” — it is not provided directly to the public. Ultimately, though, this is a decision for either the PRC or Congress to make. If the latest proposed bills are any indication, there will be much more clarity about this service opportunity in the future.⁵⁸

Conclusion

The concept of the Internet of Postal Things has powerful use cases for both internal and external stakeholders. One of the most interesting is to use the vast and rich postal infrastructure to help cities and local governments collect valuable data for advancing their smart city projects. Smart cities are at a crucial moment of development right now — there is a lot of interest and funding at the federal level for these local initiatives, and many cities already have projects underway.

Through interviews with cities and other relevant stakeholders, the OIG identified five actionable pilot opportunities in which the Postal Service could participate in the short term: monitoring surface infrastructure, such as roads and bridges; monitoring air quality; monitoring water infrastructure, such as fire hydrants and underground pipes; and identifying vacant properties to help fight urban blight. A number of other projects that are in the ideation or development stages will be ripe for postal involvement in the future. Many questions regarding the appropriate business model, data governance, and regulatory issues remain. Nevertheless, the OIG believes that these projects represent a substantial opportunity for the Postal Service to better utilize its assets, promote the public good, generate goodwill, and possibly generate new revenue.

The Postal Service can also participate in and help shape the national smart cities conversation. Federal agencies that are already involved include: the National Science Foundation, National Institute of Standards and Technology, the Department of Homeland Security, Department of Transportation, Department of Energy, Department of Commerce, and the Environmental Protection Agency. Based on the reaction of city officials to our questions, many would relish the opportunity to work with the Postal Service. Smart cities offer the Postal Service an opportunity to play a collaborative role in the nation’s future.

⁵⁷ The Postal Service can only provide non-postal services (including products) that were offered as of January 1, 2006. See 39 U.S.C. § 404(e)(1-3). The law defines “postal services” as “the delivery of letters, printed matter, or mailable packages, including acceptance, collection, sorting, transportation, or other functions ancillary thereto.” A postal “product” is defined as “a postal service with a distinct cost or market characteristic for which a rate or rates are, or may reasonably be, applied.” See 39 U.S.C. § 102(5), (6). See 39 U.S.C. § 411.

⁵⁸ The proposed iPost Senate bill as well as the June 2016 House discussion draft of postal reform specifically states that, under certain conditions, the Postal Service may enter into agreements with state and local governments. The conditions under which the Postal Service could offer services to state and local governments include: 1) that the service provides value to the public, 2) does not interfere with regular postal services, and 3) makes a financial contribution to the Postal Service’s institutional costs. H.R., § 3703, 114th Cong. (2016), <https://oversight.house.gov/wp-content/uploads/2016/06/Discussion-Draft-Postal-Service-Reform-Act.pdf> and S., 114th Cong., http://www.carper.senate.gov/public/_cache/files/8950b792-457b-4277-a508-16e93343f36a/postal-bill.pdf.

Appendices

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Appendix A: List of Interviews

As part of the research methodology for this paper, we reached out to a variety of stakeholders at cities, universities, and the private sector to discuss projects currently underway as well as plans for the future. We identified many of these stakeholders through their participation in the Global City Team Challenge or the Metrolab Network.

List of U.S. Municipal and University Contacts, by City

City	Name	Title	Affiliation
Atlanta, GA	Christopher Le Dantec	Assistant Professor of Digital Media, School of Literature, Media, and Communication	Georgia Institute of Technology
	Margaret Loper	Chief Technologist, Center for the Development and Application of Internet of Things Technologies	Georgia Tech Research Institute
Austin, TX	Brian Craig	Engineer	City of Austin
	David Carey	ITS Consulting Engineer	City of Austin
	Kenneth Perrine	Research Associate, Center for Transportation Research	The University of Texas at Austin
	Jen Duthie	Network Modeling Center Director, Center for Transportation Research	The University of Texas at Austin
Boston, MA	Kristopher Carter	Co-chair, Mayor's Office of New Urban Mechanics	City of Boston
	Nigel Jacob	Co-chair, Mayor's Office of New Urban Mechanics	City of Boston
Charlotte, NC	Darcy Everett	Former Sustainability Coordinator, Neighborhood and Business Services	City of Charlotte
	Robert Phocas	Energy and Sustainability Manager	City of Charlotte
Chicago, IL	Tom Schenk	Chief Data Officer	City of Chicago
Columbus, OH	Randall Bowman	Assistant Public Service Director	City of Columbus
Dallas, TX	Nicholas Gans	Assistant Professor, Department of Electrical Engineering	University of Texas at Dallas
	Khaled Abdelghany	Associate Professor and Chair, Department of Civil and Environmental Engineering	Southern Methodist University
D.C.	Mamta Sodikumar	Office of the Chief Technology Officer	City of Washington, DC
Denver, CO	Crissy Fanganello	Director of Transportation – Denver Public Works	City of Denver
Kansas City, MO	Bob Bennett	Chief Innovation Officer	City of Kansas City

City	Name	Title	Affiliation
Memphis, TN	Brent Nair	Chief Information Officer	City of Memphis
	Dr. Bonny Banerjee	Assistant Professor, Institute for Intelligent Systems and Electrical and Computer Engineering	University of Memphis
Montgomery County, MD	Daniel Hoffman	Chief Innovation Officer	Montgomery County, MD
Newark, NJ	Thomas Motyka	Director, New Jersey Innovation Institute	New Jersey Institute of Technology
	Seth Wainer	Chief Information Officer	City of Newark
New York, NY	Jeff Merritt	Director of Innovation	City of New York
Pittsburgh, PA	Debra Lam	Chief Innovation & Performance Officer	City of Pittsburgh
	Rick Stafford	Distinguished Service Professor of Public Policy; Executive Director of Metro 21	Carnegie Mellon University
	Christoph Mertz	Principal Project Scientist, The Robotics Institute	Carnegie Mellon University
	Jacobo Bielak	Hamerschlag University Professor, Civil and Environmental Engineering	Carnegie Mellon University
Portland, OR	Kevin Martin	Technical Services Manager	City of Portland
	Christine Kendrick	Air Quality Researcher	City of Portland
	Wilfred Pinfeld	CEO	Urban Systems
	Skip Newberry	President & CEO	Technology Association of Oregon
	Mike Reich	CEO	Sensamo
Richmond, VA	Andreas Addison	President, Founder	Civic Innovator, LLC
San Diego, CA	Sonia Martinez	Professor, Department of Mechanical and Aerospace Engineering	University of California at San Diego
	Daniel Tartakovsky	Professor, Department of Mechanical and Aerospace Engineering	University of California at San Diego
San Francisco, CA	Jay Nath	Chief Innovation Officer	City and County of San Francisco
Schenectady, NY	Meghan Cook	Program Director, Center for Technology in Government	State University of New York at Albany
Seattle, WA	Mark Schmidt	Engineering Manager	City of Seattle
	Bill Howe	Associate Director and Senior Data Science Fellow, eScience Institute	University of Washington

Private Sector and Other Stakeholders

Name	Title	Company/Affiliation
Andrew Wang	CEO	Prescient Designs
Yushi Akiyama	Director, Strategic Business Planning	Hitachi America
Steve Crout	Vice President, Government Affairs	Qualcomm
Riz Khaliq	CMO and Global Director, IBM Global Public Sector and Cognitive Cities	IBM
Naa-Oboshie Alexander-Reindorf	Government and Education Solutions Architect	Intel

Appendix B: Analysis of Potential Pilot Opportunities

Stakeholders presented many ideas for potential partnership with the Postal Service during the interviews. Of those ideas, the OIG identified five pilots that represented concrete opportunities for the Postal Service in the short-term. It is important to keep in mind that we are only discussing opportunities as it relates to *pilots*; whether these pilots can be fully scaled, and how difficult it would be to do so, is outside of the scope of this discussion.

Underlying the feasibility of all of these pilots is connectivity: the postal asset, be it the vehicle, post office, or carrier handheld device, will need to have a connectivity component to communicate data from the sensors. Likewise the city will need to have the underlying infrastructure necessary for communication to their data storage system, and a framework in place to analyze and create intelligence from the data.

Ultimately it will be up to the Postal Service itself to take this into consideration and evaluate these opportunities based on the criteria that it deems relevant. This assessment could include, but is not limited to, examining the following four factors:

- **Technological Feasibility.** Determining if the sensor technology exists, if it has been tested, and whether the data storage and analytics capabilities exist.
- **Operational Feasibility.** Examining the workload required of postal personnel (and possibly other partners to the project as well).
- **Economic Viability.** Discussing the costs associated with the project and whether funding has already been secured or would need to be sought.
- **Strategic Fit.** Identifying overlap between postal competencies and project needs, as well as the city's interest in partnering with the Postal Service.

In this section, we provide some additional information about the five pilots discussed in the paper regarding these four criteria.

Potential Pilot Opportunity 1: Pavement Condition Monitoring; Pittsburgh, PA

Technological Feasibility

Simple cameras, essentially smart phones, can be used to collect video footage of roadways.⁵⁹ The data that is collected is then transmitted to a cloud, such as the Amazon cloud, once a vehicle is in range of Wi-Fi, the data can be programmed to automatically upload. This would take place at the end of a postal route when a driver returns to the depot. Presently, researchers at Carnegie Mellon University (CMU) manually download the data and run the algorithm that analyzes the conditions of roads. However, the existing technology could be programmed to automatically perform the analysis. The result of the analysis is a color-coded map that indicates whether pavement is in good condition (green), moderate condition (yellow), or poor condition (red). Users can click on the map to see an image corresponding to a rating.

Because the technology already exists, this is a relatively feasible option. Although scaling the operation to be larger than the pilot conducted at CMU could prove to be a challenge, doing so should in theory be relatively straightforward. Because the data is uploaded to a cloud, there is no issue with storage. Additionally, programming the data to be automatically analyzed should theoretically not be problematic. While integrating the program into the City of Pittsburgh's system may require critical thinking, this too should not be incredibly difficult. Thus, although the technology must be scaled up to have the capacity for a whole city's data, this task is entirely realistic.

⁵⁹ The details of this pilot were developed in conjunction with Christoph Mertz, Principal Project Scientist, The Robotics Institute, Carnegie Mellon University.

Operational Feasibility

The monitoring of pavement would take place over normal postal routes, thus only minimal deviation would be necessary. The cameras could easily be installed, and they could be programmed to turn on when a carrier is on a postal route. Either city employees or researchers from CMU could perform maintenance if necessary, and the running of the app on the smartphone would take little to no intervention from the postal worker.

Economic Feasibility

Funding for the creation of the analytics program has been provided to CMU researchers by CMU's University Transportation Center (UTC, sponsored by U.S. DOT) and the National Science Foundation. The creator of the program believes that UTC would sponsor a small pilot with the Postal Service, though a larger one might need other funding sources. In the long term, this form of road monitoring is less expensive than what the city currently uses.

Strategic Fit

Due to the vast road coverage of postal vehicles, it is evident to both researchers and the city how useful this pavement monitoring program could be. Under a partnership between the U.S. Postal Service, CMU, and the City of Pittsburgh, this program could cover the entire city and provide data that benefits all parties involved.

Potential Pilot Opportunity 2: Bridge Monitoring; Pittsburgh, PA

Technological Feasibility

Accelerometers can be used to measure vibration; this data can be turned into intelligence about the structural condition of bridges.⁶⁰ Researchers at CMU have tested this technology in a lab environment and deployed it in a pilot on trains to measure conditions of rail tracks. The goal is to be able to use these sensors on cars and trucks to monitor the condition of road bridges; however use of these types of sensors on a vehicle in real world conditions is not yet in progress. The increase in the number of lanes of travel and vehicles on a road bridge creates more interference in the data. Filtering out this interference is a complicated task.

Accelerometers are often already present in vehicles, so this data can be readily collected. The required work to set up this pilot would be in capturing, storing, and analyzing this data. By comparing data from the train pilot against actual track repair work, researchers at CMU were able to determine what changes occurred in the data in the lead-up to needing a repair and create algorithms that are able to predict deterioration in track condition. It is not yet clear that this will translate to the more complicated road bridge application, and researchers are not quite at the point of being able to use data that could be collected by postal vehicles.

Operational Feasibility

Postal vehicles could be used as mobile sensors as they cross bridges along their normal routes — no deviation from normal routes would be required. The sensors required for this may already be in the postal vehicle, but researchers from CMU could install an accelerometer if needed. The researchers would also install in the vehicle a device to collect and transmit the recorded data for analysis. In the pilot using trains, the researchers partnered with the Port Authority of Allegheny County for permission to install the recording instruments. Port Authority personnel did the installation of the devices, and CMU researchers handled data collection. No action was needed from the train operators, and the drivers of postal vehicles would likewise not have to do any additional work.

⁶⁰ The details of this pilot were developed in conjunction with Jacobo Bielak, Hamerschlag University Professor, Civil and Environmental Engineering, Carnegie Mellon University.

Economic Feasibility

Researchers at CMU have obtained funding for earlier phases of their research from CMU's University Transportation Center (UTC, sponsored by U.S. DOT). The UTC has expressed interest in continuing this research, including the use of sensors on cars and trucks to monitor conditions of road bridges, but funding for this specific pilot has not yet been secured. The cost of equipping each vehicle with the necessary equipment would be very reasonable, approximately \$300 per vehicle.

Strategic Fit

Postal vehicles have coverage of the entire city, and likely most of the bridges in the city, which means that complete coverage of the city could occur through a partnership between the City of Pittsburgh, CMU, and the U.S. Postal Service. The regularity of the routes would also ensure that data is collected on a predictable basis, and as often as needed. For these reasons, the researchers at CMU expressed interest in working with the Postal Service on a pilot in the future.

Potential Pilot Opportunity 3: Monitoring Water Systems; Montgomery County, MD

Technological Feasibility

This pilot would monitor the water pressure to fire hydrants and damage to underground water pipes.⁶¹ Three pieces of hardware are required: a pressure sensor/transmitter affixed to selected fire hydrants, an acoustic sensor/transmitter placed underground near selected water pipes, and a relay gateway placed in postal vehicles. The gateways are already in use in Montgomery County buses, where they transmit geolocation data. Acoustic sensors are already in use on a few of the county's largest water mains. Though many of them are hardwired in order to communicate their data, it would not be difficult to attach wireless transmitters to new sensors. Pressure sensors for hydrants are not being used by the county currently but are commercially available.

Data collected by the sensors would be transmitted to the cloud by the gateways. Montgomery County has already built a dashboard to view and analyze the data it collects from buses. This dashboard could be modified to accommodate the new data without much difficulty. The water utility, the Washington Suburban Sanitary Commission (WSSC), also has existing software to process the information it receives from its few underground acoustic sensors.

Operational Feasibility

The gateway devices inside postal vehicles would pick up signals being broadcast by the transmitters on nearby pipes and hydrants. The vehicles would not be expected to deviate from their postal routes at all. All infrastructure transmitters would be placed along the routes of those 10-20 vehicles that are participating in the pilot. Simply by passing within 20-30 feet of the transmitters, the gateways will pick up the signals automatically.

Either the county or the utility, WSSC, will install the hardware to both the infrastructure and the postal vehicles. The gateways are approximately 2 inches by 4 inches by 6 inches, or about the size of a small paperback book. They can be attached with Velcro to the dashboard of the vehicle or stored in a more convenient location. They are powered by plugging into the vehicle's cigarette lighter or, if unavailable, can be wired directly into the vehicle's electrical system. Installation takes less than 1 hour in either case. The driver would not need to manipulate the gateway at all, even to power it on or off.

The pressure sensor/transmitting devices could likewise be installed easily on fire hydrants by WSSC. Installing the acoustic sensors/transmitters on underground pipes would be the biggest obstacle. This would require a significant amount of labor. It is likely that WSSC would need to see a proof of concept before agreeing to begin digging.

⁶¹ The details of this pilot were developed in conjunction with Dan Hoffman, Chief Innovation Officer, Montgomery County, MD.

Because the county and the utility already have systems in place to aggregate and analyze this type of data, the U.S. Postal Service would never need to handle the data directly. It would simply provide vehicle space for the gateways. This eliminates the need for designing software, buying new servers, or dealing with the legal challenges that come with data ownership.

Economic Feasibility

Montgomery County has a number of relationships with third parties that make this pilot less costly. It can get SIM cards free from AT&T, which also provides free access to its wireless network for transmitting the data. It would be able to involve the University of Maryland in some capacity, thereby granting it access to funds from the National Science Foundation (which only funds universities). It buys gateways from Machfu, a local startup, and might be able to buy more at a discount. In August it received a grant from NIST that could be used to fund the software side of the project. Dan Hoffman, the county's Chief Innovation Officer, believes it may be possible to raise the remaining funds through contributions from the county, the City of Rockville, and WSSC.

Strategic Fit

Although not technically a city, Montgomery County is highly urbanized, with a population of over 1 million, with a centralized county government. It is also a relatively wealthy county, giving it resources that many cities do not have. The county innovation office, nicknamed the "Things-titute," is a leader in exploring ways to improve citizen life through the Internet of Things.

The county considered a similar pilot using city buses. However, buses only cover 10-20 percent of county roads. Postal vehicles cover nearly all populated county roads, opening the possibility of a county-wide deployment should the pilot prove successful. This coverage would be extremely useful for monitoring fire hydrant pressure; Figure 4 shows the hydrants covered along just one postal delivery route.

Given the minimal requirements of the Postal Service, the high interest and access to resources by Montgomery County, and the county's proximity to postal headquarters in Washington, DC, this pilot seems to have great potential for all parties.

Potential Pilot Opportunity 4: Identifying Blight; Schenectady and the New York Capital Region, NY

Technological Feasibility

Blighted and vacant properties impact housing values, public safety, and economic development.⁶² Early identification of newly vacant and mildly distressed properties can impact whether properties become fully blighted and how long it takes to get the properties fully functioning again, but accurate and timely data is difficult to come by. Data about the condition of these properties could be collected by a camera on a smartphone and/or a series of questions to be filled in by the individual making the report through an app. The development of these types of tools, in general, would be simple enough; however, they do not yet exist. A

Figure 4: Example of Postal Delivery Route Coverage of Hydrants in Montgomery County, MD



Source: Montgomery County Analysis.

⁶² The details of this pilot were developed in conjunction with Meghan Cook, Program Director, Center for Technology in Government, State University of New York at Albany.

data storage and analytics platform to share this data across the region is currently being developed by the cities in conjunction with the Center for Technology in Government (CTG).

Operational Feasibility

The carrier is already in the neighborhood on a daily basis and is well-positioned to alert the city to the presence of a blighted or vacant property. However, the current handheld Mobile Delivery Device (MDD) is not set up to be able to make this kind of report. It lacks a camera feature, and no app has been developed that would integrate with the current unit. It is unclear whether the MDD would be able to be used at all, and equipping the carrier with a new device with the necessary capability would be a costly undertaking. Additionally, the carrier would need to pause his or her regular activities of delivering mail in order to make such a report.

Economic Feasibility

This project is currently underway with \$600,000 in funding through a grant from the New York Department of State. These funds will be used to help create policies surrounding the collection of data as well as to build the necessary data infrastructure to facilitate the sharing of data across the different local governments involved in this regional project. Funds for a specific program to equip the carriers with the necessary equipment and provide necessary training would need to be secured separately.

Strategic Fit

The CTG is interested in a partnership with the Postal Service because this project would take advantage of the carrier's presence in, and knowledge of, the streets he or she travels as part of the regular route. In order to collect data on blighted properties currently, the city has to send an employee out to identify buildings and collect data. Being able to gather data from someone who is already in the neighborhood anyway would be a cost savings for the city. In addition, the carrier is in the neighborhood daily and would be able to identify properties of interest right away, much earlier than when the next city employee comes by.

A final point of interest is that this project is all about collaboration between multiple cities and counties in the New York Capital Region. The fact that one entity could do data collection across the whole region, rather than a more disjointed effort by the different local governments involved, is attractive.

Potential Pilot Opportunity 5: Air Quality Monitoring; Portland, OR

Technological Feasibility

Air quality sensors are commonly used around the country by governments and private companies that sell the data.⁶³ However, there is a large disparity in reliability between small, off-the-shelf sensors and large monitoring stations equipped with federal reference method instruments. The latter collects a wide range of data, including information about nitrogen oxides, carbon monoxide, temperature, humidity, wind direction, and more, but are large and expensive. Readings from monitoring station instruments can be used to calibrate the readings of the smaller sensors, which are cheap but are sensitive to interferences from temperature, relative humidity, and other reactive pollutants. The City of Portland is using custom roadside monitoring cabinets, the state run Department of Environmental Quality background monitoring station, and low-cost sensors in a pilot to measure air pollutants along SE Powell Blvd/SE Division St, a 12-mile commercial corridor in which it is improving traffic and transportation conditions. Portland plans to add many of the smaller sensors soon.

63 The details of this pilot were developed in conjunction with Kevin Martin, Technical Services Manager, City of Portland and Christine Kendrick, Air Quality Researcher, City of Portland.

Data is sent automatically to the cloud via cellular signal. Portland State University is storing the collected data on Portland's behalf, as well as assisting with the analysis of it. Thus far the data has not been analyzed to the point of being actionable, but the city plans to build its analytics capabilities when it expands the pilot by adding up to 30 sensors plus the two existing monitoring cabinets.

Operational Feasibility

It is as yet unclear how close together sensors need to be placed to achieve comprehensive intelligence about this 12-mile corridor. If the city were able to make them mobile by attaching them to postal vehicles, it would enable a massive expansion of the coverage area in which they gather data. The sensors would be affixed to the exterior of the vehicles by bolting or epoxy. Aclima, a company that designs and deploys environmental sensors, has a similar partnership with Google to attach its products to Google Street View cars.

The city would do the device installation and provide maintenance and upkeep. Drivers would not be expected to deviate from their normal routes or interact with the devices.

Economic Feasibility

Because the large sensor cabinets cost \$50,000 and up, Portland's pilot expansion depends on improving the accuracy of its small sensors (which cost between \$2,000-5,000). This is true whether USPS participates or not. The city has already budgeted the purchase of more small sensors and has recently received grant funding from the National Institute for Standards and Technology (NIST) to help support their pilot deployment. Portland State University has a grant application pending with the National Science Foundation for expanding the data integration and management process associated with the air quality data. As for the Postal Service, its only economic commitment will be in allowing its vehicles to have the devices attached to them. Depending on the method of attachment, this may cause some small damage to the roof or siding.

Strategic Fit

The Postal Service has a stated goal of reducing its emissions by 20 percent by the year 2020. Clearly it counts environmental improvement and public health as a component of its public service mission. Partnering with the City of Portland would offer a chance to assist with an existing project that accomplishes both. For Portland, making its sensors mobile is an unexpected solution to its challenge of placement density and would expand the use cases of the air quality data to help achieve additional climate and public health goals. It would welcome USPS's assistance as a means of saving money on future sensor purchases and increasing the effectiveness of the sensors it does deploy.

Appendix C: Management's Comments

KERRY L. McADAMS
Vice President, DUMPHY GROUPONE



September 21, 2016

RENEE SHEEHY
DIRECTOR RARC CENTRAL
RISK ANALYSIS RESEARCH CENTER

SUBJECT: Final Review Draft – The Postal Service and Cities:
A “Smart” Partnership (Project Number 2016RARC002)

This is in response to the Office of Inspector General's (OIG) draft white paper titled “The Postal Service and Cities: A “Smart” Partnership dated September 8, 2016. The paper outlines potential opportunities for the U.S. Postal Service (USPS) to partner with local municipalities in various data collection efforts by leveraging new and existing technologies with the USPS footprint in cities across the country via our fleet, collection and mailboxes, and facilities.

Overall we find ourselves generally in agreement with the possibilities explored in the paper but would like to add some additional or more specific concerns to what the OIG has already expressed. While we do not believe that these concerns are beyond mitigation, it is important that they are addressed through either legislation, contract language with the municipality, or labor management agreements as appropriate.

1. USPS Fleet Modifications

- Installing equipment not owned by USPS such as cameras, air quality sensors, etc.
 - Performance of work and cost
 - Potential impact on fleet efficiencies
 - Fuel
 - Battery life
 - Additional service time for maintenance of equipment and impact on fleet availability
 - Liability for damage to equipment or fleet caused by equipment
 - Safety
 - Clearance
 - Stability

2. Data Collection

- Potential additional bandwidth requirements
 - Increased cellular charges
- Privacy
 - Ensure USPS understands nature of data being collected
 - USPS does not store/save data collected for any period of time
 - Direct transmission of data to client servers

3. USPS Workforce

- USPS prefers that the act of collection of any data be transparent to its workforce. While the items outlined below can seem trivial, their impact adds up over time due to the size and scope of the very footprint that makes USPS a logical choice for such

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efforts. These processes are often underestimated in terms of cost as the nature of these actions are difficult to quantify and to track the associated workhours. Rural carriers are particularly sensitive to additional workload as these employees pay structure is evaluated based on quantified elements of their job.

- Devices do not require any additional steps for employees to activate. These devices or the data transmission should start with the vehicle or carrier transmission device (currently/likely the Mobile Delivery Device or MDD)
- Does not require USPS workforce to carry an additional device on their person
- Devices requires no troubleshooting from USPS workforce
 - Rebooting, checking indicator gauges
 - Reporting of malfunctions

In conclusion we support opportunities for new potential sources of USPS revenue and the ability to co-partner with local government agencies which may earn "good will" for the Postal Service. However, it is important that any service we may end up providing is properly costed and that all potential liabilities are fully explored.

Sincerely,



Kevin L. McAdams

cc: Allison Glass, RARC, USPS OIG
CARM



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