



THE STATE OF GOOD REPAIR: MAINTENANCE & INNOVATION IN SMART CITY PROJECTS

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Executive Summary

This research brief confronts two challenges facing municipalities in a post-pandemic landscape: securing the funds to meet the State of Good Repair benchmark for infrastructure maintenance as well as rising to the promise of the open smart city by investing in innovative digital infrastructure. The State of Good Repair standard is framed against the backdrop of the massive hard infrastructure backlog facing Canadian municipalities, and the question of how to extend this standard to the implementation of smart city technologies. The brief canvasses physical infrastructure issues like sidewalk design and the manner in which urban technology impinges on the public realm. Complicating these issues is the nascent post-pandemic recovery and its attendant budgetary pressures, leaving municipalities with the difficult decision of whether to invest scarce funds in maintaining existing infrastructure or seeking out sustainable outcomes, as well as inclusive building practices in historically neglected and excluded communities.

A key discussion point is the nature of the State of Good Repair standard itself, and the manner in which it needs to evolve to encompass the planning, construction, and maintenance of new technologies and digital infrastructure. An expanded State of Good Repair standard would capture everything from the maintenance of new building technologies such as mass timber construction to the updating of legacy digital public services. This brief also addresses the overlooked question of why infrastructure investments favour some communities over others, and asks municipalities to think broadly about the impacts of their spending and to allocate funds more inclusively.

In light of the tension between maintenance and innovation, this brief considers the challenges and opportunities that present themselves in terms of policy considerations for municipal decision-makers. Municipal governments with limited capital budgets naturally lean toward State of Good Repair projects, but in order for long-term community benefits to be secured, such projects need to look beyond basic functioning to sustainability and inclusion. This paper also cautions municipalities from seeking out technological solutions that have no clear civic value, and instead plan for smart city infrastructure that embraces a full design-build-maintenance-decommissioning process that addresses existing community needs. Municipalities have the opportunity to look at integrating smart city projects with routine infrastructure planning, such as IoT applications for winter road maintenance, bridging the technology-urbanism divide. This paper also outlines the municipal governance implications of such integration, and the necessity of interdepartmental and inter-governmental collaboration on smart city and traditional infrastructure projects. The paper concludes by describing the unprecedented convergence of municipal infrastructure backlogs, limited capital budgets and the demands of post-pandemic recovery spending. In this challenging environment, municipal decision-makers and city-builders must seek to close gaps in governance structures and carefully consider the application of State of Good Repair thinking to both traditional infrastructure and smart city technology tools.

Foreword

by Open North

First defined in 2018 by Lauriault, Bloom and Landry, an Open Smart City is one where all actors, including residents, collaborate in mobilizing data and technologies to develop their community through fair, ethical, and transparent governance that balances economic development, social progress, and environmental responsibility.

As Canadian communities across the country explore smart city initiatives, there is a pressing need to better understand the opportunities and risks presented by data and emerging technologies and put open smart city principles into practice.

Open North has commissioned a series of research briefs for policymakers and practitioners to provide insight into how data and technology intersect with challenges local communities are grappling with, such as food security and shared transportation. The research briefs identify complex policy issues from an open smart city lens, describe their importance and provide key considerations for policymakers.

Using the State of Good Repair municipal standard as a starting point, this research brief highlights the infrastructure deficit in Canadian municipalities and frames the issue of infrastructure repair and planning in the context of investments in digital infrastructure. Smart city initiatives must be considered in tandem with existing and future planned infrastructure investments, especially as communities account for sustainability and historically exclusionary patterns of investment. The research brief poses a simple yet powerful question: What would a state of good repair look like in an open smart city?

Acknowledgements

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These research briefs are produced for the Community Solutions Network, a community-centric platform for communities to connect and build a national centre of excellence in open smart cities. As the project lead, Evergreen is working with lead technical partner Open North and other partners to provide valuable information, learning opportunities, advisory and capacity building services to Canadian communities in key areas of data and technology, helping to improve the lives of residents.

We offer—at no cost to communities—a comprehensive Advisory Service for Canadian communities interested in developing and implementing open smart cities projects. To learn more about the Advisory Service, please visit communitysolutionsnetwork.ca.

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Introduction

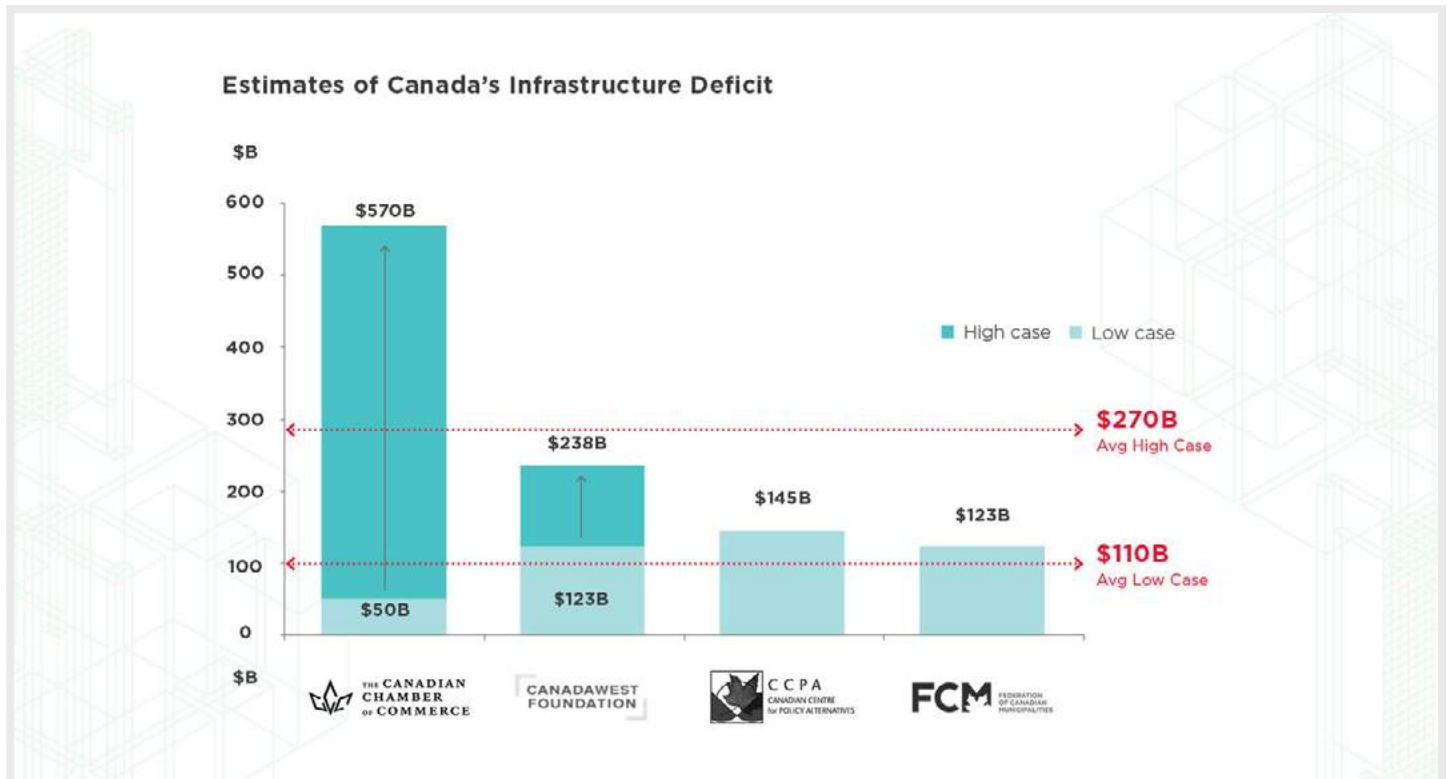
Defining the State of Good Repair

The State of Good Repair (SOGR) is a dominant infrastructure benchmark for North American infrastructure management. This maintenance standard is used to guide municipal capital budgeting investments so that infrastructure is: “able to perform its designed function; does not pose a known, unacceptable safety risk; and its lifecycle investments have been met or recovered (FTA 2016)”.

Its use as a standard is widespread in North American infrastructure planning organizations including Canadian local governments. The SOGR standard has long been applied to Toronto transit and other infrastructure projects with one of its originator’s, David Gunn, holding the Chief General Manager of the Toronto Transit Commission 1995-1999. The City of Toronto still uses this standard in its capital budget process and as a way of prioritizing which projects receive infrastructure funding, including during the COVID-19 pandemic. In May 2020, the City of Toronto announced that during the pandemic

shutdown in wave one, it was accelerating its state of good repair construction projects because the significant decreases in road traffic made it easier to complete surface and subterranean infrastructure works (City of Toronto, 2020).

The need to maintain infrastructure in a “State of Good Repair” gets to the heart of a tremendous challenge in Canadian communities. Canadian municipalities are facing a profound infrastructure repair backlog. The economic estimates range from a low of \$50B to \$570B (Caninfra, 2020). The Government of Canada has a 2021 deadline to eliminate the conditions necessitating the boil water advisories in First Nations communities. At the time this briefing was written there were 63 long term advisories in effect (Stephanovich, 2020). And recently the Government of Ontario’s Financial Accountability Office reported that over half of Ontario’s hospitals are in “poor repair” positioning this situation as worse than the project infrastructure repair backlogs for roads, bridges and other infrastructure (Perkel, 2020). In October 2020, Guelph Mayor Cam Guthrie in his capacity as



Sources: The Canadian Chamber of Commerce, Canada West Foundation, Canadian Centre for Policy Alternatives, Federation of Canadian Municipalities, BCG Analysis

Chair of the Ontario Big City Mayors' group championed a call to the Province of Ontario and the Government of Canada to make immediate infrastructure investments to both address the State of Good Repair backlog with these funds serving as an economic stimulus for post-pandemic recovery (Chidley-Hill, 2020).

Pre-pandemic, Canadian municipalities were also wrestling with the challenges and opportunities of digital infrastructure. From November 2017 through May 2020, the world watched the ups and downs of the Quayside project in which Alphabet's (Google) Sidewalk Labs was exploring a \$50 million (CDN) investment in a 12-acre parcel of land on Toronto's waterfront. In the spring of 2018, the Government of Canada announced its Smart Cities Challenge with a \$300 million (CDN) budget to pay out over 11 years. The Challenge goal was to: "give communities a platform for implementing bold ideas to address priorities using innovation, data and connected technology" (Infrastructure Canada, 2017). The first round of this competition ran early winter 2018 through the spring of 2019 with a two stage process. First, in April 2018 130 applicants from 199 communities applied. Next a jury selected 20 finalists who each received \$200,000 to develop full proposals. In May 2019 the four winning projects were selected, receiving \$75 million (CDN) in prize money. These winning proposals focused on using digital technologies to: provide energy efficiency and security for low-income households (Bridgewater, NS, \$5 million), to build Canada's first digitally-enabled circular food economy (Guelph-Wellington County, ON, \$10 million), to create a new platform to help youth gain better access to mental health and wellness resources (Nunavut Communities, \$10 million) and build a new platform to improve mobility and food security options (City of Montreal, \$50 million). Initially there were plans for Round Two of the Challenge to begin in the spring of 2020 but with the onset of the COVID-19 pandemic, some of the funds (\$31 million) were redirected to the Canadian Healthy Communities Initiative which provides funding for both digital and hard infrastructure investments directly related to the pandemic (Infrastructure Canada, 2020).

Moving forward, Canadian municipal decision-makers with infrastructure responsibilities will need to confront the

infrastructure backlog and desires and pressures and demonstrate innovation. Kennedy (2019) frames the tension in smart city efforts between innovation and maintenance. While the desire to be innovative by embracing new technologies can be high, this desire can lead to vital maintenance considerations being overlooked with quite significant and persistent economic, social and ecological community impacts long after the private sector innovators have moved on.

Into 2021 and beyond, political and administrative decision-makers in Canadian municipalities will continue to face capital budget decision-making challenges that require them to confront the current and future implications of the enormous State of Good Repair backlog. These same decision-makers will also face the lure of new smart city opportunities that might bring private sector investments at a time when the enduring economic impacts of the COVID-19 pandemic will be generationally significant but are still yet emerging. These factors, when combined with the social and political imperatives to ensure that infrastructure investments address complex issues like sustainability, including the climate emergency, and historically exclusionary patterns of investment that further marginalize equity seeking communities, combine to recreate a complex yet potentially transformative juncture for Canadian municipal decision-makers.

The recent Infrastructure Canada contributions to the Canadian Healthy Communities initiatives demonstrate how physical and digital infrastructure decision-making can be considered together as playing a role in post-COVID recovery. At this significant community crossroads, Canadian municipal decision-makers have an opportunity to consider two important questions:

1. What would a state of good repair look like in an open smart city? and
2. How can we apply the SOGR standard to investments in public digital infrastructure?

This research brief will frame key policy considerations in terms of opportunities and constraints and will explore, at the end, how we might begin to bridge the hard and digital infrastructure divides in Canadian municipalities.

Maintaining Sidewalks for Present and Future Uses

By way of grounding these significant issues in everyday practice let's consider how State of Good Repair approaches could be applied to emerging smart city technologies. We'll focus on an example that is common across Canadian communities: sidewalk maintenance. The following maintenance standard from the City of Toronto illustrates the kinds of considerations that inform State of Good Repair standards for sidewalks:

"When inspectors are looking at the road conditions, they also inspect sidewalks and sidewalk bays. Inspectors will track the condition of the sidewalk and note which sections need repair or replacement. This means replacement only happens to the bays in the greatest need. Replacement will happen when road work is already planned or on an as-needed basis. (City of Toronto, n.d.)"

Currently, our thinking about sidewalk design focuses primarily on the movement of people, usually by foot, but sometimes using wheeled devices including wheelchairs and strollers. People needing mobility devices have been long underserved by the current design and state of our public realm. And as our populations age, the standards for design for sidewalks will need to further evolve (Biglieri, in press). We also know that the current road safety conditions lead people, including especially children, to ride bicycles and scooters on sidewalks as well whether they are permitted or not. So our current frame of reference for the State of Good Repair just barely effectively considers current conditions but does not anticipate future changes or needs.

Then we have the temporary changes to the public realm that the COVID-19 pandemic presented. Across Canada, in a matter of weeks we became acutely aware of how much more space we need on our sidewalks to allow people to socially

distance while walking. Suddenly, restaurants and small businesses had new lines of people waiting to enter stores or waiting for curbside pickups and a tremendous range of needs to create spaces for outdoor eating and drinking as well. Historic State of Good Repair thinking does not consider these kinds of emergent and episodic needs which have infrastructure design and investment implications.

Adding to these challenges, we also now have urban technology firms with significant interest in the real estate and activities that take place on public sidewalks. There has been a flurry of activity which seeks to add new technology products to the public realm. There are firms that seek to place new street furniture in the public realm to provide "free public wifi" broadcast through benches or wayfinding infrastructure (e.g. digital bulletin boards, such as those provided by Soofa Signs or LinkNYC). Other firms are experimenting with small delivery robots that help with last mile distribution but it is not at all clear where these robots will actually travel. Other firms seek to build utility poles for mounting smart city infrastructure (e.g. Koola). The poles and the technologies they house have implications for the State of Good Repair too. Whose job it is to remove legacy technology? Our sidewalks are littered with the street furniture of another era with empty newspaper boxes reminding us of a different time. The rapid state of change in urban technology development hints that the volume and nature of the technology junk will also be significant.

With the expansion of digital infrastructure options comes an opportunity to bridge the technology-urbanism divide by broadening the scope of infrastructure projects included in the State of Good Repair evaluation process. But this expansion brings challenges because the emergent nature of smart city technologies add complexity to our ability to benchmark what the actual SOGR is for these technologies.

Key Considerations From a Policy Perspective

In the next five years, Canadian municipal governments will find themselves at a juncture in which they will have increased pressure to address the municipal infrastructure repair backlog. Higher order governments will be confronting historically large debt and deficits exacerbated by the COVID-19 pandemic. And private sector smart city technology firms will continue to present new technology tools and solutions promoting efficiency, accountability and access to new sources of private sector capital. These issues mean that government infrastructure investments need to prioritize when to maintain existing infrastructure vs. when to make investments in new alternatives.

State of Good Repair of What?

The State of Good Repair standard focuses on keeping the existing infrastructure in working form. From a sustainability perspective, if we continue to only invest capital funds toward existing infrastructure, are we missing opportunities to make new infrastructure investments in projects that could deliver more sustainable outcomes including new green infrastructure, mobility and building systems with lower emissions, and alternative forms of transportation. This friction was flagged in a recent ReNew Canada commentary that focused on the need in Canada for a new approach to investing in aging infrastructure:

Because as assets are prioritized, depending on the limited funding available, the priority can be to do work that focuses solely on reaching a “state of good repair” in the short-term, even though long-term needs are visible. But getting to a state of good repair often misses the ability to factor the need to modernize the asset, structure the repair in a way that improves climate resilience, and in the case of buildings, improves energy efficiency (ReNew Canada, 2020)

When we consider the array of smart city technology tools that are infrastructure focused, there are many options for municipal governments. Autonomous connected buses, vacuum systems for waste management, sensor networks to inform traffic management, tall timber construction and new building heating, air conditioning and ventilation systems are among the many technologies that might be presented to

local governments as new options to replace aging infrastructure. But how does the consideration of new technologies fit into capital budget decision-making?

In scenarios when new technologies are adopted, then SOGR standards must evolve to apply as well. As municipal decision-makers are considering new smart city technologies, there is an important opportunity for sharing how the maintenance of these new technologies is factored into their operations budgets. The new momentum toward mass timber buildings is a good example. How does the maintenance of this wood technology vary from other more traditional building technologies? While the Quayside Sidewalk Labs project in Toronto is no longer being pursued, one of the innovations on the site was widespread use of mass timber buildings. Sidewalk Labs’ Director of Building Innovation, Karim Khalifa said “We’ve left the wood exposed where we can reach it [...] That’s important, because wood will probably need to be sanded and refinished every three to five years (Bozikovic, 2019) to which an architect, Russell Acton, with significant experience working with mass timber replied “If they get down to those tough decisions about detail and operations budgets, [...] they may find it doesn’t work so well.” This short exchange clearly highlights the importance of bringing SOGR thinking to smart city technology considerations. With new technologies, the innovations in infrastructure might have quite significant, and hard to predict, upstream operational (maintenance) budget implications.

When expanding State of Good Repair approaches to include digital infrastructure, it is important to recognize that decision-making is not always about maintenance investments vs. new technology adoption. Local infrastructure in a State of Good Repair is sometimes a necessary precondition for the adoption of new smart city technology. Take for example autonomous vehicles, which rely on clearly distinguishable road markings for image recognition (ForConstructionPros.com, 2019). Without adequate maintenance, the desired innovation may not be feasible. Government essential service provision can be hampered or compromised by outdated digital infrastructure too. The recent examples of the Governor of New Jersey asking for volunteers who can code in COBOL to help with their unemployment insurance

provision (Hicks, 2020) and the Canadian Auditor General's work being hindered by a technology system running DOS (Nardi, 2020) are two further examples of how bringing a maintenance perspective to digital infrastructure is vitally needed. Quite simply, there is no smartness without SOGR thinking. It is important, moving forward, that frameworks for informing State of Good Repair decision-making include digital infrastructure for consideration and they should also provide guidance as to how government decision-makers might navigate the relationship between maintenance and innovation to yield more sustainable outcomes.

State of Good Repair for Whom?

Robust sustainability decision-making processes reconcile economic, ecological and social issues to deliver better quality of life outcomes for current and future generations (Robinson & Dale, 2012). Oftentimes the social or the equity piece of sustainability is lost in the discussions about ecology and economy. At this juncture in Canadian community infrastructure investment decision-making, it is imperative we consider to what extent do our current decision-making processes ask challenging questions about how infrastructure investments for State of Good Repair maintenance or new digital infrastructure investments present or reinforce patterns of systematic exclusion?

Infrastructure investments tend to focus on the physical infrastructure items that are being installed. From pipes to power lines to fibre-optic cables, we tend to focus more on how much the investments will cost, where will the money come from and where will the infrastructure go? Moving forward, decision-makers need to think more broadly to more explicitly question the impacts of these infrastructure investments. We need to ask harder questions about why some projects, including those with technology, are funded over others (Valverde, 2020) and we need to "identify and actively work to reduce power imbalances when engaging communities—especially those with histories of exclusion and/or marginalization (Pitter, 2020)." The question of who does infrastructure

serve is fundamental and needs more attention in Canadian Communities. We must be more vigilant, moving forward, in evaluating the extents to which municipal infrastructure investments favour some communities over others. State of Good Repair decision making must evolve so that municipal decision-makers more actively consider whether those capital funds need to be spent differently and more inclusively.

The New York City "Community Parks Initiative" provides a good case for consideration here. Under the leadership of Parks Commissioner Mitchell Silver¹, the Commission conducted a review of its capital spending practices in parks by starting with the question: "Are we fair about how we distribute capital dollars?". Their review and analysis took twenty years of capital investment history. The Commission had spent \$6 billion (USD) on capital improvements, in the spirit of State of Good Repair investments, yet they found that approximately 215 parks received less than \$250,000 in spending. And these parks were "hiding in plain sight in neighborhoods that we all would expect to be neglected." Here was a case of State of Good Repair for some but not all. This analysis led to the creation of the Community Parks Initiative which now directs capital investments towards new parks and investments in existing parks.

As governments confront increasing needs with significantly reduced funding, the civic imperative to make government funds work harder to deliver more public good outcomes will be increased. New infrastructure investments shape the pattern, form and vitality of communities for tens of years to come. Government capital investments in infrastructure must not only meet State of Good Repair standards but they should also be positioned to deliver better social, environmental, and equity outcomes as well.

1 The author was first introduced to Commissioner Silver's leadership through a guest invitation to Jay Pitter's class ENV5 6120 Public Involvement in Planning: Engaging Black People and Power, Faculty of Environmental and Urban Change, at York University on November 17, 2020. For more information about Jay Pitter's significant contributions to equitable urbanism, please visit jaypitter.com.

Potential Challenges and Opportunities

The post-COVID landscape of government spending across Federal, Provincial and local governments is going to be challenging. Infrastructure investments and decision-making will require new forms of intergovernmental cooperation. Efforts to ignite the economic recovery are anticipated to include new infrastructure spending which could include funding for both State of Good Repair projects and new projects as well, including those with digital elements. Given the tremendous infrastructure backlog that already exists, these new funds are likely to be insufficient to cover the full range of needs. This gap creates an opportunity for private sector firms to pitch their projects with new public-private partnerships. And the private sector firms with some of the deepest pockets right now are technology firms. This confluence creates both challenges and opportunities for municipal decision makers.



Potential Challenges

As funding programs are opened up, municipal decision-makers will be confronted with the challenges of trying to sort which infrastructure projects should be prioritized to receive the money.

Leveraging Public Funding for Higher Impact

Given the infrastructure repair backlog and new government money available, there will be a strong temptation to prioritize SOGR projects. In these scenarios, decision-makers should be proactive to position their SOGR leanings in the contexts of broader sustainability and inclusion efforts. So SOGR investments paid for by recovery funding need to work harder to deliver a wider range of public good outcomes above and beyond functioning to acceptable standards.

There are precedents here to guide this thinking. The anchor institution movement first emerged from the American rustbelt communities (e.g. Cleveland OH, Detroit MI) where education and health-focused institutions were among the last remaining steady local employers (Community-wealth.org, n.d.). In Toronto, the leadership of Community Benefits Network guided the negotiations of the community benefits terms included in the Metrolinx Eglinton Crosstown LRT infrastructure project to create new apprenticeship positions, new jobs, workforce development, supplies from local businesses and opportunities for community engagement (Toronto Community Benefits Network, 2017). The Canadian Urban Institute's post-pandemic efforts to "bring back main street" include a toolkit for efforts to revive local economies which sets the following goal:

"To support a just pandemic recovery, create a better normal for those who need it most, and boost society-wide wellbeing, it is critical that a fixation on design outcomes be replaced with a focus on effective processes (CUI, 2020, p.2)"

Here again we see an appeal to begin to connect up the dots when putting new money into play to support community infrastructure. These three examples demonstrate how it is possible to build added benefits into the approach to infrastructure investments thus extending the State of Good Repair

investment decision-making process beyond the impacts of the infrastructure into the communities in which that infrastructure is laid.

Tight Alignment Between Technology Solutions and Community Needs

When government decision-makers lean toward new projects for infrastructure investments, then a subset here might include those with smart city technologies. The draw of the innovative technology solution is large because it can sometimes come with public praise for innovation and media attention for trying new things. News stories focus on ribbon cutting not filling potholes. In these scenarios government decision-makers should take heed to reflect upon whether there is a tight alignment between the technology tools available and the actual civic value the tool deployment offers in return. There are myriad smart city technology solutions that are forward-looking but the question must be asked: does this tool actually help solve a local infrastructure problem or challenge or need?

Luckily Canadian municipal governments have long histories of strategic planning for municipal growth and change. Municipal strategic plans for the corporation itself or for departments including parks and recreation, urban planning, social development and transportation and mobility (among others) all serve as democratically articulated priority lists against which the value of new technology solutions might be considered. This kind of priority-setting “pre-work” is especially vital during times in which the traditional ways of municipal governments consulting and engaging their community members are challenged both by the inability to meet in person and by the significant disruption the pandemic is presenting to people’s everyday lives. Given the pandemic’s inequitable landing in equity seeking communities, it is even more important than ever to ensure that whichever democratically established priorities are used, that the views and needs of these community members are informing the prioritization process itself.

If adopting new smart city technology tools is emerging as a possible option, then the complete life-cycle of design-

build-maintenance-decommissioning should be considered as an input into the decision-making process. Canadian municipalities have plenty of experience negotiating street furniture contracts with media companies and are aware of how much maintenance those physical elements of the public realm require. Street furniture has also, over the last 15 years, changed in response to technology advancements. It wasn’t that long ago that municipalities were trying to sort the conundrum of what to do about the many different newspaper distribution boxes that were common on mainstreets across the country. Private sector firms may offer loss-leader style smart city deployment opportunities which then come with rigid and/or expensive maintenance contracts and little attention paid to what happens to the obsolete technology at the end of its lifecycle. The staff managing the procurement of technology can learn from the staff who have responsibilities for street furniture procurement and maintenance. Bringing the State of Good Repair lens to building a more robustly informed view of what the maintenance costs will be for new smart city technology solutions deployed could be helpful.

Potential Opportunities of Taking Early Action

As efforts to integrate physical and digital infrastructure into State of Good Repair processes evolve, Canadian municipalities have a number of opportunities to build new governance processes and structures to enable this evolution. This integration can help shift away from the notion of smart cities as special innovation projects and help think about them in more familiar ways, such as implementations of data and technology in the routine work of running a city.

Integrating Smart City Technology Decision-Making into Routine Infrastructure Planning

Canadian municipal government decision-makers might, moving forward, consider engaging with the “Maintainers” community (Maintainers, n.d.). This international gathering of people across disciplines, research and practice frames its mission as: *maintaining self and society through reflection,*

research, and advocacy in the hopes of achieving a more caring and well-maintained world. This Maintainers movement provides a bridge between technocratic and strategic approaches to infrastructure and provides a larger frame for considering issues of maintenance.

This corralling of smart city projects into routine infrastructure planning creates the possibility for synergies between physical and digital infrastructure to emerge. Could, for example, smart city technologies better enable preventative maintenance? Internet of things vendors pitch its applications for sewers and winter road maintenance. Municipalities already are experimenting with IoT management of waste with sensors indicating which garbage bins are full and optimizing removal truck routes. As municipal decision-makers begin to engage with more predictive maintenance efforts (Selcuk,

2017), taking a more holistic approach to defining State of Good Repair efforts is needed.

Is it also worth considering that perhaps the current concept of State of Good Repair could itself be adapted and updated to take into account the potential of “smart” technologies and infrastructure. For instance, the maintenance standard refers to a “desired function”, but does not accommodate the possibility of future desired functions. For example, a specific right of way may have one desired function during the summer and a different desired function in the winter. Or as efforts to experiment more with complete streets unfold, future public right of way use may include a wider range of desired functions than is currently needed. Here again we see the reciprocal benefits of extending State of Good Repair thinking to digital infrastructure projects.



Bridging the Technology-Urbanism Divide by Having the Right People at the Table

In these early days of smart city project selection, planning, design and implementation, there are myriad opportunities and also a number of constraints being realized on the ground by municipal government decision-makers. One common issue is that smart city technology projects are sometimes treated as entirely different projects than other capital infrastructure projects. Smart city units inside some municipal governments have technologists and data scientists but don't often have planners, landscape architects, and community development workers. While these technologies require a thorough review by government staff with technological expertise, they also need a thorough review by the teams inside city halls that focus on city-building efforts through sustainability and inclusion mandates.

The Sidewalk Labs Quayside project serves as an example of just how complex the planning and decision-making process can be when there is an integration of digital and physical infrastructures. If this project had proceeded, its focus on precinct level planning and an expansive range and variety of new technologies proposed would have presented real challenges for municipal decision-makers. Moving forward, there is a need to further develop the capacities of municipalities across Canada to thoroughly consider how new smart city technology projects impact the pattern, form, people and the social, economic and ecological futures of our communities. There is plenty of city-building talent inside municipalities from Canada's coast-to-coast-to-coast. And increasingly, a growing cadre of technology experts. Forward looking municipal governments will need to continue to find new ways to bridge the technology-city-building divide by bringing these kinds of expertises to the decision-making table together.

Remembering that smart city technology is actually infrastructure and that municipalities have long histories of building and maintaining infrastructure is a good start. The laying of some digital infrastructure could have similar impacts on communities as putting in new sewers or water lines.

Decision-making around regular infrastructure is embedded in a bureaucratic and political process that includes things like environmental impact assessments and State of Good Repair maintenance reviews. While these processes have not necessarily, in the past, included technology experts, they certainly could, moving forward. And while they may not entirely translate over to a thorough review of new smart city technologies, rather than local governments inventing, from scratch, the smart city planning process, in these challenging post-pandemic recovery times, we might start with the processes we have and extend them as far as possible. But this suggestion for new reach comes with a caveat: if the current municipal review processes have not effectively centred sustainability and inclusion lenses, then their extensions will continue to reinforce unsustainable and inequitable outcomes as a result of municipal capital infrastructure investments for decades to come.

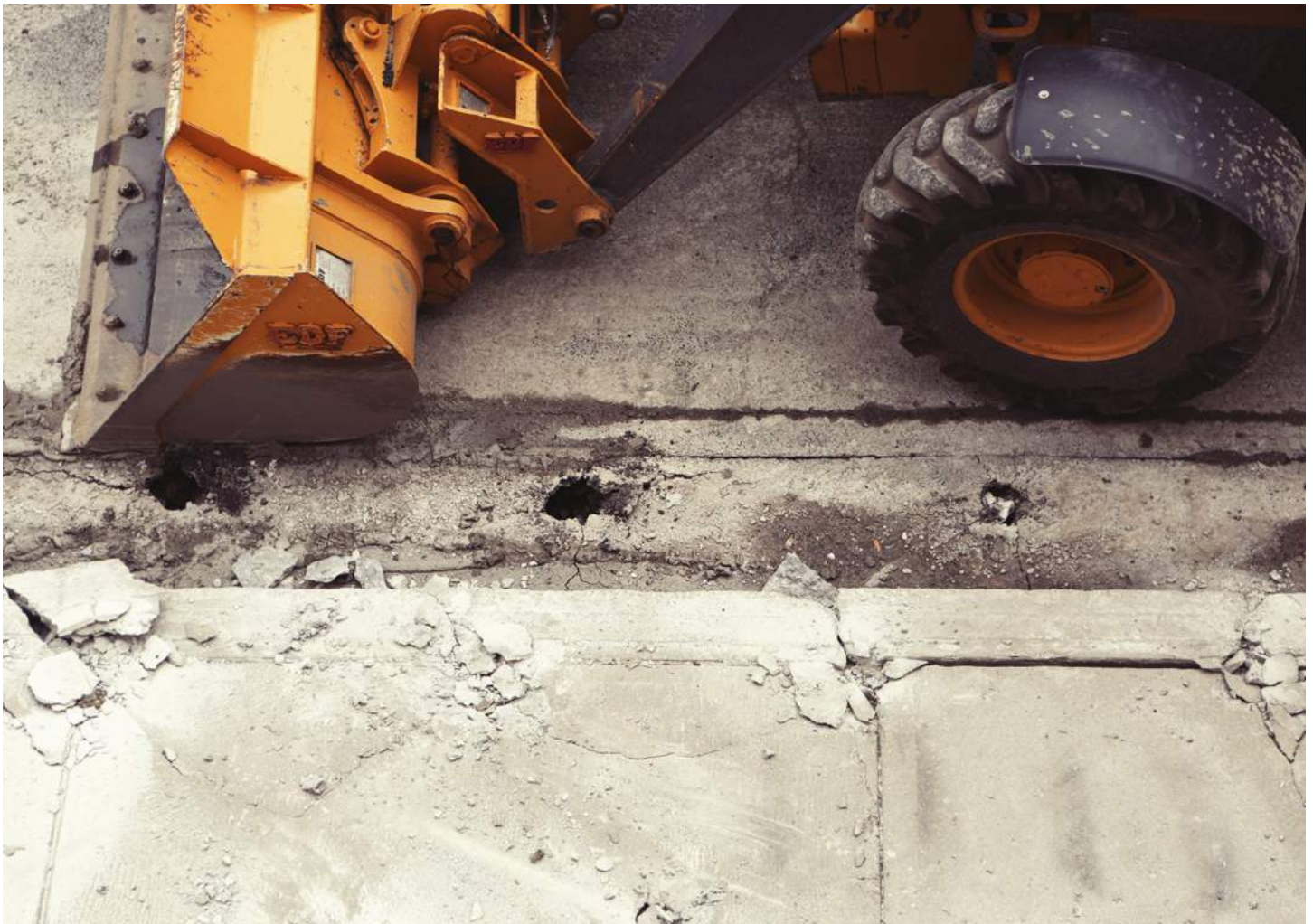
An additional policy consideration is that multiple levels of government and multiple departments will need to be engaged to plan for SOGR in smart city initiatives. Beyond governments needing to adopt new forecasting methods, modify procurement, and reconsider traditional budgeting and accounting practices, new forms of intergovernmental cooperation might be needed. In Canada where municipal governments take their direction from Provincial governments, smart city infrastructure planning spills over to include, potentially, new working relationships with the Federal government. Technology, privacy and data-management regulations are the domain of both Federal and Provincial governments in Canada and as such, considerations about what infrastructure elements require State of Good Repair benchmarks can include technology hardware and data-management systems. As municipal governments consider smart city technology adoption, not only will planners, urban designers, civil engineers, computer and data-scientists need to work together inside city halls, new government relations and legal experts across all three levels of governments might also need seats at the proverbial governance table.

Conclusion

Canadian municipalities find themselves at a critical juncture with staggeringly large infrastructure maintenance backlogs and insufficient capital budgets to cover costs, all converging at a time when all of our levels of government must confront how to recover from the COVID-19 pandemic. At this particular point in city-building processes, technology firms continue to invent and sell new smart city technology tools promising to deliver more efficient, sustainable and participatory outcomes for cities.

Municipal decision-makers will continue to confront the challenges of how to prioritize which projects for seeking funding from higher orders of government and potential

private sector partners. Our early Canadian community forays into smart city technology adoption signal that there are governance and decision-making gaps that need to be filled. Can previous strategic decision-making processes be brought forward into this new technology enabled infrastructure city? This paper has considered how the State of Good Repair infrastructure benchmark can both hinder and encourage new ways of thinking about which kinds of infrastructure projects to prioritize. Ultimately, through careful and forward-looking deployment of State of Good Repair thinking, municipal leaders can be wiser in their deliberations over new smart city technology adoption.



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