PSD RESEARCH CONSULTING SOFTWARE

THE STATE OF ONTARIO'S INFRASTRUCTURE

An Analysis of 60 Municipalities

RESEARCH CONSULTING SOFTWARE

For the Association of Municipalities of Ontario

Winter 2018

About PSD – Research Partner

PSD Inc. is a consulting firm specialized in enterprise asset management and budgeting for local governments. PSD's capabilities can be summarized in its three departments: research, consulting and software. PSD's research division produces a monthly digital and quarterly print publication – the Public Sector Digest – as well as a monthly webinar series, case studies, and applied research projects. PSD's research group also assists governments, non-profits, and the private sector with the completion of grant applications and other analytical research services, applying decades of experience in public sector management, grant writing, and policy analysis.

About AMO – Project Sponsor

The Association of Municipalities Ontario (AMO) is a non-profit organization representing Ontario municipalities that increases the effectiveness of local governments by bringing forward a common voice to municipal concerns. Through AMO, Ontario's 444 municipalities work together to achieve shared goals and meet common challenges. AMO's policy development initiatives, cost-saving programs, conferences and training courses provide municipal officials with the tools to succeed, and programs to help optimize value for taxpayer dollars.

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Summary of Literature Scan

Determining the current state of Ontario's municipal infrastructure is not a simple task. With non-standardized data collection processes at the local level and constrained municipal budgets for condition assessments and asset management, access to aggregated, up-to-date and accurate infrastructure data is limited. The following is a sample of previous studies that have attempted to identify the state of infrastructure in Canada or Ontario.

1. The 2007 FCM-McGill study *Danger Ahead: The Coming Collapse of Canada's Municipal Infrastructure*, surveyed 85 municipalities across Canada on the state of key municipal infrastructure assets, including roads, bridges, water, wastewater, transit, and facilities. The study estimated that **$125 billion** was needed "to repair and prevent deterioration in existing, municipally owned infrastructure assets."[1]
2. The 2008 *Provincial Municipal Fiscal and Service Delivery Review (PMFSDR)* determined that **$60 billion** over 10 years was needed to eliminate the infrastructure deficit in Ontario; roads and bridges comprised nearly half of this investment gap. The Review provided a thorough, quantifiable understanding of the needs in specific asset classes and was catalytic in the infrastructure debate.[2]
3. The 2016 *Canadian Infrastructure Report Card* surveyed 2,000 members of the Federation of Canadian Municipalities, which represent nearly 90% of the Canadian population, on the condition of the following major asset classes: water systems, roads and bridges, buildings, sport and recreation facilities and public transit. The study suggested that **$388 billion** was needed to replace assets ranked as "fair," "poor," and "very poor."[3]
4. The 2015 *AMO Roads & Bridges Study* provided an up-to-date understanding of the state of the core infrastructure assets in Ontario in 2013 by profiling the assets of 93 Ontario municipalities (representing 24% of Ontario's population). Roads and bridges were analyzed on an asset-by-asset basis using both lifecycle and condition. Key insights included the fact that the sample's infrastructure deficit totalled nearly **$5 billion** for roads and bridges alone, and that assets with condition data are found to be performing better than what PSAB 3150 data shows.[4]

With the exception of the 2015 Roads & Bridges Study, the research outlined above primarily utilized survey methods for data collection, rather than analyzing actual municipal asset inventory data. Most prior research in this area has also been limited by a lack of data across all assets categories – precluding the authors from producing a complete analysis of all municipal infrastructure. In order to develop an effective strategy for addressing the mounting infrastructure deficit facing Ontario's 444 municipalities, it is necessary to have a clear, comprehensive, and accurate picture of the state of Ontario's municipal infrastructure today. Before outlining how the purpose and methods of this study align with this goal, the following section describes the current state of asset management in Ontario.

[1] https://fcm.ca/Documents/reports/Danger_Ahead_The_coming_collapse_of_Canadas_municipal_infrastructure_EN.pdf
[2] http://www.mah.gov.on.ca/AssetFactory.aspx?did=6050
[3] http://www.canadainfrastructure.ca/downloads/Canadian_Infrastructure_Report_2016.pdf
[4] https://www.amo.on.ca/AMO-PDFs/Gas_Tax/Roads-and-Bridges/Roads-and-Bridges-Study-March-2015.aspx

The State of Asset Management in Ontario

With the launch of the *Municipal Infrastructure Investment Initiative (MIII)* in 2012, Ontario was the first province in Canada to require its municipalities to complete an Asset Management Plan (AMP) and to provide funding to assist with the process. AMPs were to be completed by December 31st 2013, and municipalities were required to include just core infrastructure categories within their AMP (roads, bridges & culverts, water and wastewater assets). In 2014, the province introduced the now permanent *Ontario Community Infrastructure Fund (OCIF)*, which provides small and northern communities with guaranteed annual formula-based funding for asset management capacity building activities and infrastructure projects. Another stream of funding – the OCIF Top-up Fund – provides small and northern communities with the opportunity to apply for a "top-up" to their formula-based funding for specific infrastructure projects.

In 2014, as a result of renewed Federal Gas Tax Agreements, Ontario's municipalities were required to develop and implement an Asset Management Plan by the end of 2016. While some communities are still working on completing their comprehensive AMPs, nearly every municipality in Ontario now has a plan with at least core assets included.[5]

Meanwhile, the Ontario Government passed the *Infrastructure for Jobs and Prosperity Act (Bill 6)* in 2015, launching the process of regulating asset management planning at the local level. Bill 6 consultations and draft regulation feedback periods took place throughout 2016 and 2017, with the final regulation being adopted at the end of 2017. As of January 1st 2018 Ontario municipalities became subject to *O. Reg. 588/17: Asset Management Planning for Municipal Infrastructure*. To remain compliant with O. Reg. 588/17, every municipality will be required to prepare a strategic asset management policy and a series of AMPs increasing in complexity, with deadlines starting July 1 2019 and ending July 1 2024. Moving forward, Ontario's municipalities must review and update their AMP at least every five years.

In addition to the OCIF and Gas Tax Funding available for asset management capacity building, Ontario's municipalities have also made use of the Federation of Canadian Municipalities' (FCM) new *Municipal Asset Management Program (MAMP)*. Funded by the federal government, MAMP will provide $50 million in asset management capacity building funds over five years to Canadian municipalities of all sizes.[6]

Although many of Ontario's municipalities have faced significant capacity challenges in meeting the above requirements – especially small and rural communities – grant funding, training, and the step-by-step approach to rolling out requirements has most certainly helped build the overall awareness and maturity of asset management practices in Ontario. As other provinces and territories introduce asset management requirements, along with several states south of the border[7], municipal practitioners continue to turn to Ontario for best practices and guidance. There is still work to be done – as the results of this study demonstrate – but Ontario's municipalities, along with the province, AMO, and industry partners, have a strong foundation to build upon.

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[5] Ontario's Ministry of Infrastructure reported that 95% of Ontario's municipalities had an AMP as of January 2018.
[6] Click here to find a breakdown of awarded MAMP funding by project type and by province.
[7] Learn more about emerging asset management requirements in the US here.

Introduction

There are two main objectives for this study. The first is to build on the 2015 Roads & Bridges Study by enumerating the state of roads, bridges, culverts, facilities, furniture and fixtures, information technology, land improvements, machinery and equipment, motor vehicles, sanitary sewer, storm water, and water systems in Ontario in 2016. The second is to demonstrate the progress made in asset management in Ontario, given the recent efforts of both the federal and provincial governments to improve asset management planning and build capacity at the local level.

The estimates in this report use best available information with regards to actual field condition assessments (i.e., actual performance), and financial data based on the Public Sector Accounting Board standard (PSAB 3150), which focuses on age and the amortization period (i.e., an asset's expected lifecycle). As outlined in the methodology section below, this study includes 60 Ontario municipalities that completed asset management plans in 2016. This sample should not be directly compared to the sample of 93 municipalities from the 2015 Roads & Bridges Study as the sample size and composition varies.

Our study suggests that more than **$1.4 billion** (**$3,545** per household[8]) is needed today (backlog), by the 60 municipalities in our sample alone, to replace assets which have reached the end of their lifecycle. Roads comprise more than 40% of this backlog. While federal and provincial infrastructure funding programs have been invested in critical municipal infrastructure and has raised overall capital spending, the scope of the need remains significant.

In addition to the current backlog, the annual infrastructure investment gap for our sample totals nearly **$317 million** (**$754** per household). This is the difference between annual lifecycle needs and the amount currently allocated for this purpose from all sources. Eliminating both the infrastructure backlog and the annual investment gap is a commitment that will span decades and will require financial resources from all orders of government. This study, while also demonstrating the progress made by Ontario municipalities in building asset management capacity, clearly elucidates the need for greater investment and planning in municipal infrastructure renewal across the province.

[8] Note: For the purposes of this report, households are considered "dwellings occupied by usual residents" as per the 2016 census. The number of assessed residential properties may be substantially higher than the number of households in some municipalities. This may be of particular importance in areas with a higher prevalence of cottages or seasonal homes, not considered to be occupied by usual residents.

Highlights

Part 1: Cross-sectional Analysis of 2016 AMPs

- Municipalities in our 2016 sample appear to be **confident in their asset management data**, with municipalities being most confident that their AMP data comes from an authoritative source, but slightly less confident that their data is error free
- The 2016 replacement cost of all assets owned by our sample municipalities is significant, equalling **$20.6 billion** or just over **$44,000** per household. The average replacement cost for all assets per municipality in our sample is **$343.3 million**
- The road network makes up the largest proportion (**39%**) of the total replacement cost of assets owned by our sample municipalities, valued at **$8 billion**
- Among our sample, prevalence of assessed condition data is limited across most asset classes. Only **29%** of asset condition data is assessed (versus age-based), with bridges & culverts having the highest prevalence of assessed condition data (**81%** of assets)
- Similar to the 2015 Roads & Bridges study, this study found that when using assessed condition data (where available) across our sample, the distribution of asset condition for roads and bridges changes significantly compared to using only age-based condition. The change is most pronounced for the road network, where the percentage of poor or very poor road assets drops by **38%** when incorporating assessed condition data and the percentage of good or excellent roads increases by **58%**. Although assessed condition data has a lesser impact on the distribution of asset condition for the remaining asset categories (facilities are an exception with a noted reduction in the percentage of poor or very poor assets using assessed condition), it is evident that a clearer picture of the true state of municipal assets has a significant impact on the quality of information available for proper asset management
- The amount of annual investment needed across our sample of Ontario municipalities to maintain their assets as of 2016 totaled nearly **$520 million**, or **$1,232** per household. By region, the per household annual requirement of our sampled communities was highest in North Eastern and North Western Ontario, and lowest in South Western Ontario
- Despite efforts by many municipalities across the province to increase investments in infrastructure – with some introducing a dedicated infrastructure tax levy – the annual infrastructure funding gap remains high at **$317 million** for this sample, or **$754** per household
- Of the funding that is available for infrastructure projects, government grants, such as the **Federal Gas Tax Fund** and the **Ontario Community Infrastructure Fund,** make up **25%** of the total funding for tax-based infrastructure across our sample. The Gas Tax is used most heavily to fund the road network and bridges and culverts, making up **33%** and **34%** of funding sources respectively for those asset categories
- Grants such as OCIF, Gas Tax and FCM MAMP have provided the resources to allow many small and medium sized municipalities to make significant strides in developing asset management capacity

Part II: Cohort Analysis of 2013 vs 2016 AMPs

- Asset management plans, on average, are becoming more comprehensive across Ontario's municipalities. In 2013, our sample of municipalities had less than **four** asset classes (categories of infrastructure types), on average, in their AMPs, rising substantially to **8.57** asset classes per municipality in 2016
- Many small and medium sized municipalities are making significant progress in their asset management plans and processes. When small municipalities decide to undertake an initiative, they can mobilize and make the initiative part of the internal culture far quicker than large municipalities (due to their large complex internal organizational structure)
- The total annual infrastructure deficit for this sample increased by more than **50%** from 2013 to 2016, with the road network seeing the greatest increase. The total annual deficit for water and sewer assets dropped slightly from **$24.5 million** in 2013 to **$18.5 million** in 2016
- While the deficit grew for roads and bridges, the infrastructure backlog diminished, dropping by **30%** from 2013 to 2016 in the case of the **road network** and by **20%** for **bridges & culverts**. Conversely, the backlog grew by **30%** for **water & sewer**. Overall, the backlog was reduced by **12%** for this sample
- For this sample of municipalities, **roads** are becoming much poorer in condition, bridges are slightly deteriorating, sanitary and sewer asset condition remains steady, and more water assets are becoming poor or very poor in condition. While the total replacement costs of "fair," "good," and "excellent" **road** assets remained relatively constant from 2013 to 2016, "poor" and "very poor" asset replacement costs increased by nearly **50%** for this sample. For **bridges & culverts**, the "good or excellent" rated assets remained relatively constant as a percentage, while assets rated as "poor" decreased and assets rated as "fair" increased. Both **sanitary sewer** and **storm water** assets have increased by total replacement cost across all tiers of condition ratings, while an increase was reported for the total replacement cost of **water** assets rated as "poor" and "very poor"

Methodology

Our analysis is not survey based. Rather, we gathered rigorous data at the individual asset level across each municipality and each asset class. This data included physical asset attributes, detailed financial data, and field condition assessment data as available. We then aggregated this data to form strictly objective, quantitative conclusions about the sample. With the exception of AMO's 2015 Roads & Bridges study, this detailed level of asset analysis has not been completed to our knowledge anywhere in Canada.

The lack of standardized asset inventories across municipalities limits the ability for most jurisdictions to conduct apples to apples comparisons of municipal assets. Furthermore, asset information available to municipalities is still largely based on less accurate age-based data, restricting the ability of researchers to develop a clearer picture of the true state of municipal assets across the province. Survey-based studies are limited by the challenges of respondent bias, incomplete information, and lack of capacity on the part of municipalities to complete comprehensive surveys. PSD, in working with nearly a quarter of Ontario's municipalities on their asset management plans (AMPs) and

roadmaps, was able to complete a unique analysis of the state of municipal assets and asset management capacity building in the province.

This study includes two primary research methods. The first research method is a cross-sectional study of 60 Ontario municipalities, using data from their most up-to-date 2016 AMPs. The second research method used in this study is a cohort analysis of 35 Ontario municipalities, measuring changes in asset management data and practices from 2013 to 2016.

The cross-section analysis provides a snapshot of 60 municipalities' AM practices in 2016, whereas the cohort study provides an indication of trends in AM. The purpose of both research methods is to gain a better understanding of the current state of assets and asset management planning in Ontario, while also demonstrating the progress made in the province since 2013. As Ontario's municipalities continue to develop in asset management maturity, the results of this study can serve as a benchmark to measure progress over time.

Part I: Cross-sectional Analysis of 2016 AMPs

Part I Sample

In this report, two distinct sections will demonstrate the growth of asset management in Ontario. In this first section, we have collected asset condition and financial data from 60 municipalities across the province that completed asset management plans in 2016.

The federal Gas Tax has been a major impetus in advancing sector progress in asset management. In Ontario, municipalities were required to develop and implement an asset management plan by the end of 2016. Since 2013, municipalities have made considerable progress in including more assets in their plan. Because of these requirements, the 2015 AMO study was limited to an assessment of just roads and bridges for the sample of 93 municipalities, while this study assesses all asset categories as defined by the 60 municipalities included in this sample. With Ontario communities still working towards updating their AMPs at the time of this study, the sample size was restricted to the 60 municipalities that did complete an updated AMP with PSD by the end of 2016.

Figures 1 to 4 below illustrate the composition of our first sample.[9] A significant proportion of municipalities included in this study have a population of less than 10,000 people, accurately reflecting the high proportion of small communities in Ontario. It is also evident that this sample is skewed towards South Western Ontario municipalities, making up 50% of the total. Regional comparisons throughout this study are limited to using per household assessments to account for the regional sample bias.

[9] Note: the total number of households included in this study varies between 398,097 and 421,896, as the count changes based on the data available. For example, only 58 of 60 communities have backlog information available. The same is true for the annual investment gap data – 2 of the 60 communities are missing this data. However, the two outlying communities from each sample are not the same across both samples. Therefore, the household count will be different based on the subset of data.

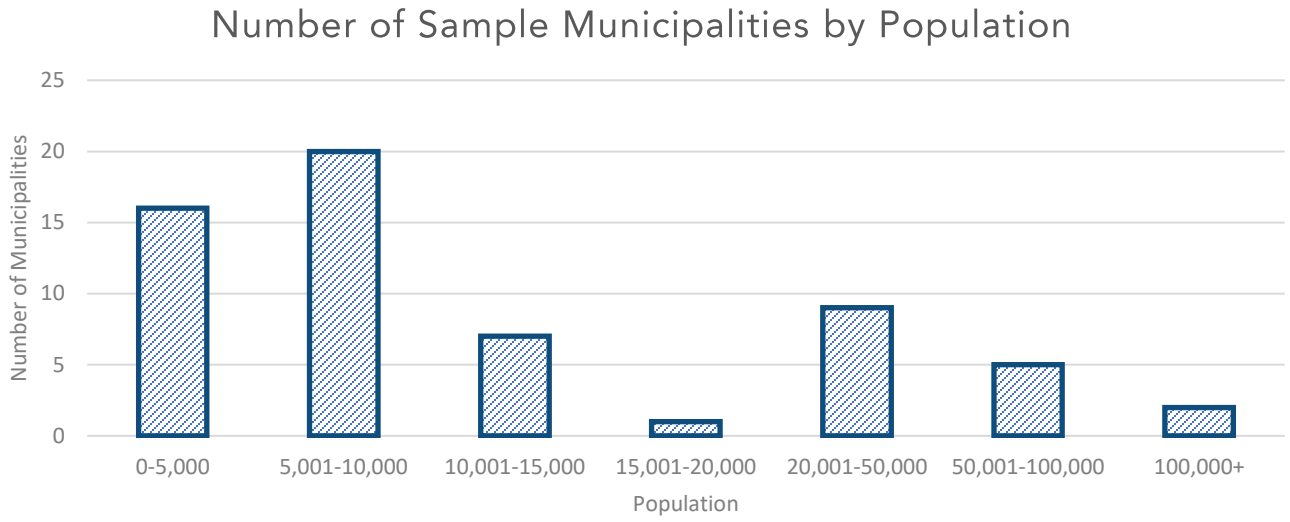


Figure 1

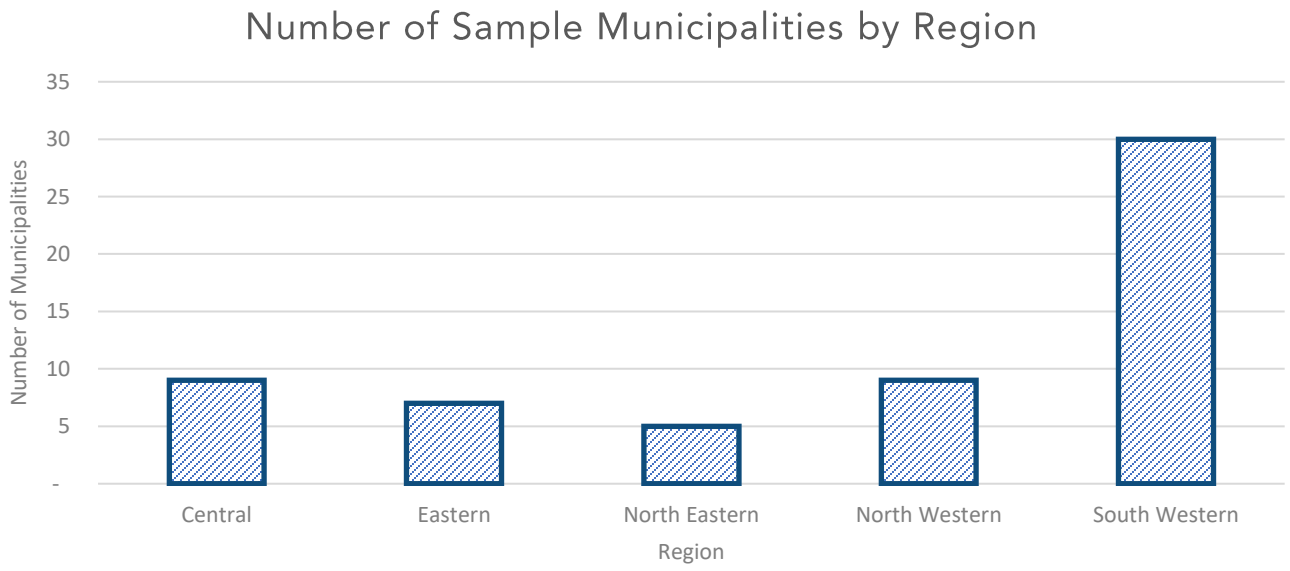


Figure 2

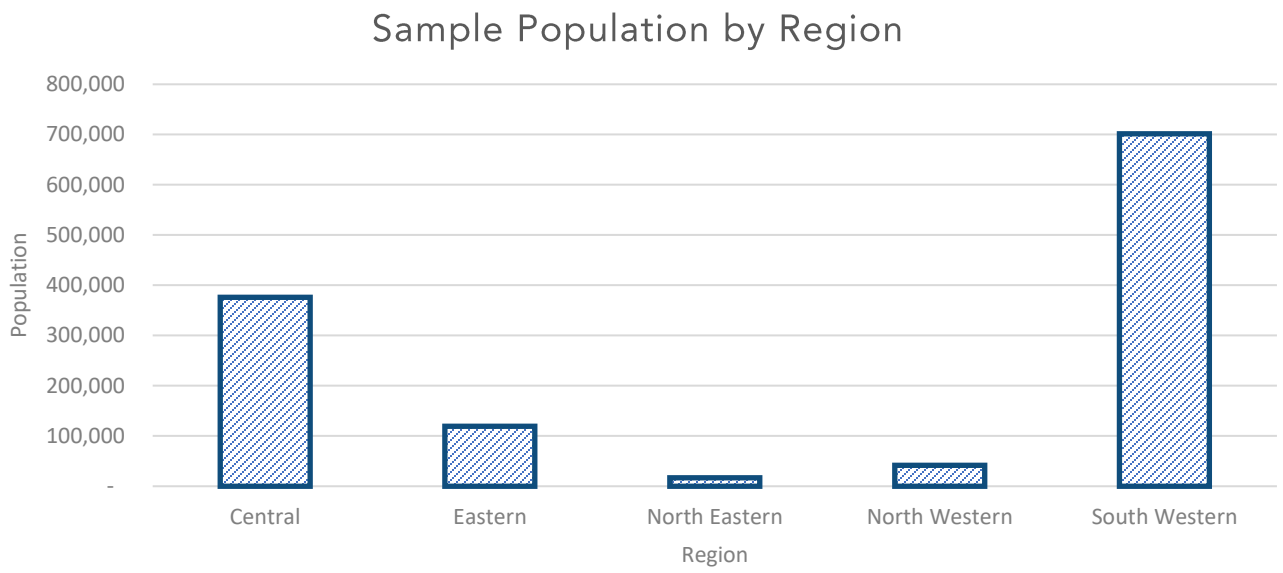


Figure 3

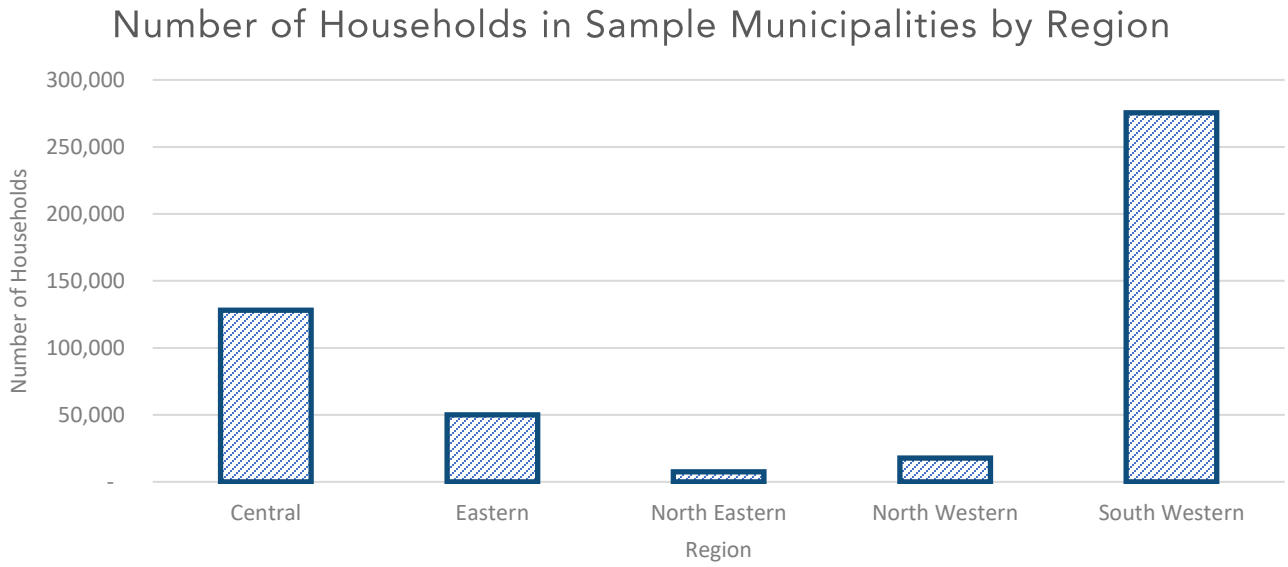


Figure 4

Maturity in Asset Management Planning

As municipalities across Ontario continue to build their knowledge and capacity in asset management, it is expected that the level of maturity in asset management planning will improve. One indicator of an organization's asset management maturity is the level of comprehensiveness of their asset management plan. Another indicator is the quality of the data being used by the municipality to inform the AMP. This section demonstrates some of the progress in asset management maturity development in Ontario as evidenced by our sample of municipalities.

Data Confidence

An AMP is only as accurate as the data that informs it. In order to measure the accuracy of AMP data, PSD asked municipalities to rate their own data confidence level based on several criteria. Data confidence was reported on a scale from 0-100%, with '0%' representing no confidence at all, and '100%' representing total data confidence. Figure 5 below shows the average data confidence across our 2016 sample for five categories. Municipalities in our sample generally rank the confidence in their data strongly: on average, confidence levels are between 80% and 90% for each category. Municipalities in our sample appear to be most confident that their AMP data comes from an authoritative source, whereas they are least confident that their data is error free. Important to note, among the 60 municipalities in our 2016 sample, only 16 organizations (27%) had completed the 'data confidence' section within their respective asset management plans, possibly resulting in a positive response bias for this small sample of 16 municipalities. There is likely some reluctance on the part of municipalities to share their data confidence assessment publicly if they are not confident in their information.

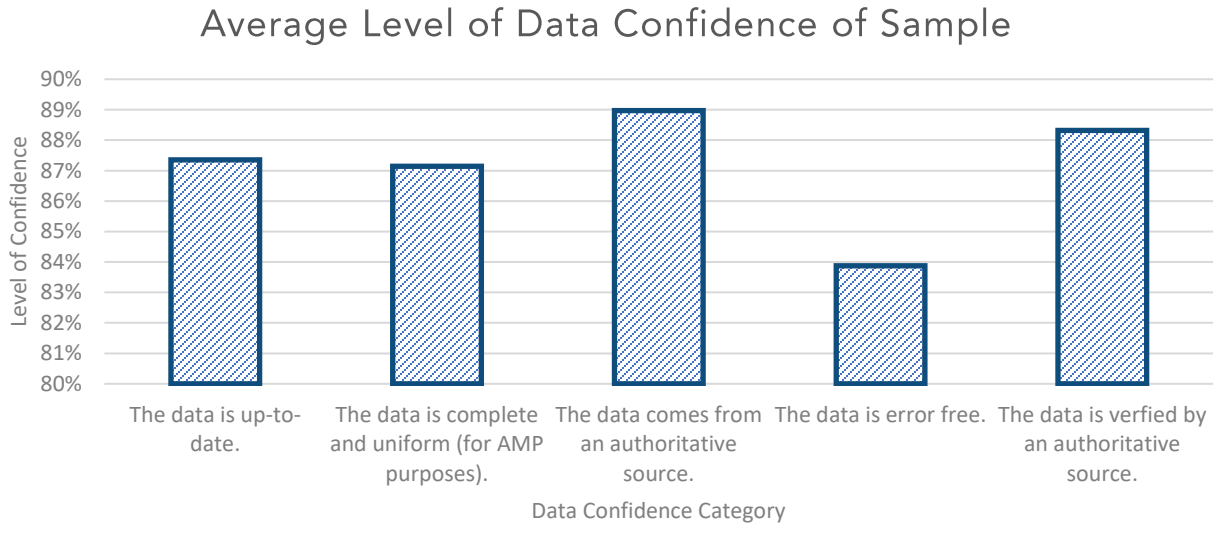


Figure 5

Total Replacement Cost

In order to understand the scale of the infrastructure challenge facing Ontario's municipalities, one of the first statistics to inspect is the replacement cost of existing municipally-owned assets. In line with provincial grant funding requirements in Ontario at the time, most municipal AMPs completed in 2013 included just core asset categories: roads, bridges, water, wastewater and stormwater assets. Under AMO's administration of the Federal Gas Tax Fund in Ontario, municipalities are required to develop and implement an AMP. Municipalities are expected to improve their AMPs on a continuing basis. This would include progress towards including all tangible capital assets reported in Schedule 51of the Financial Information Return (FIR). As a result, the 2016 cross-section of AMP data includes far more assets (and asset categories) than the cross-section of 2013 AMPs.

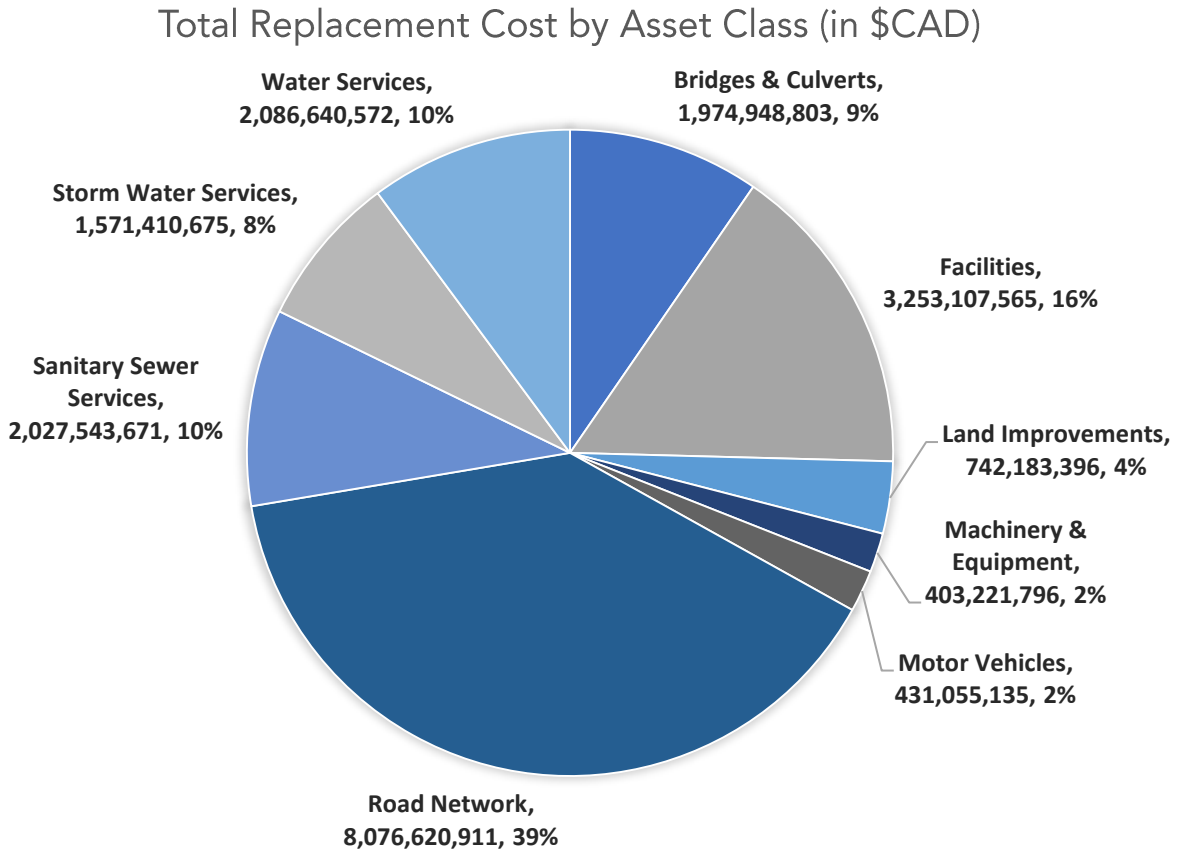


Figure 6

The 2016 replacement cost of roads, bridges & culverts, facilities, furniture & fixtures, information technology (IT), land improvements, machinery & equipment, motor vehicles, sanitary, sewer, and water services across 60 Ontario municipalities evaluated in this study equalled **$20.6 billion**. Per household, that number equals just over **$44,000.** The total replacement cost includes **$10.1 billion** worth of roads, bridges and culverts, **$5.7 billion** worth of water, sanitary, and storm services, and **$4 billion** worth of facilities and land improvements (see Figure 6). The average total replacement cost for all assets per municipality for the 2016 sample is **$343.3 million**. Please note that the IT and furniture & fixtures asset categories have been omitted from Figure 6 because the proportion of the total replacement cost of assets represents less than 1% for each category.

Age of Assets

Total replacement cost indicates the value of Ontario's municipal assets, but how old is the infrastructure in the province and when will it need to be replaced? To capture a snapshot of the age of assets in Ontario, we have drawn specific information from our sample of 60 municipalities. These include the average age of assets by asset class as well the distribution of asset age by replacement cost. After bridges and culverts with an average age of 37 years, storm water and sanitary sewer services were the second and third-oldest asset groups in our sample, with an average age of 34 and 33 years respectively (see Figure 7).

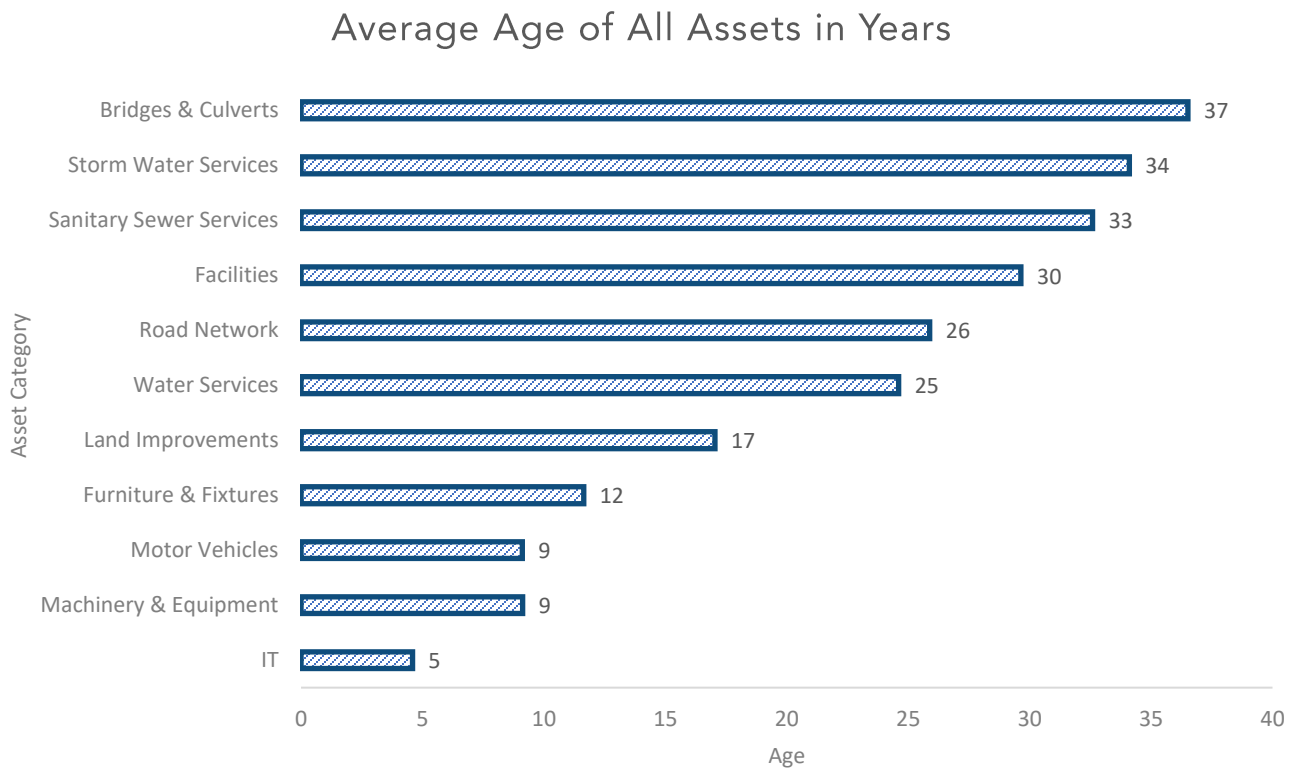


Figure 7

Figure 8 below depicts the age distribution of assets by replacement cost for each asset category. For the road network of our sample, 44% of the total replacement cost of the network can be attributed to assets between 11 and 30 years in age. 38% of the total replacement cost of the sample's bridges and culverts can be attributed to assets between 41 and 60 years old. With longer useful lives for bridges compared to roads, it is unsurprising that the sample's bridges and culverts trend older than its road network.

IT assets stand out with 95% of total replacement costs being attributed to assets of less than 10 years in age (unsurprising given the short useful life of IT equipment). Water, stormwater and sanitary sewer assets all have similar age distributions with the bulk of replacement costs falling between assets of 11 to 40 years in age. Storm water assets lean slightly older with another cluster of replacement costs being attributed to assets 51 to 60 years old.

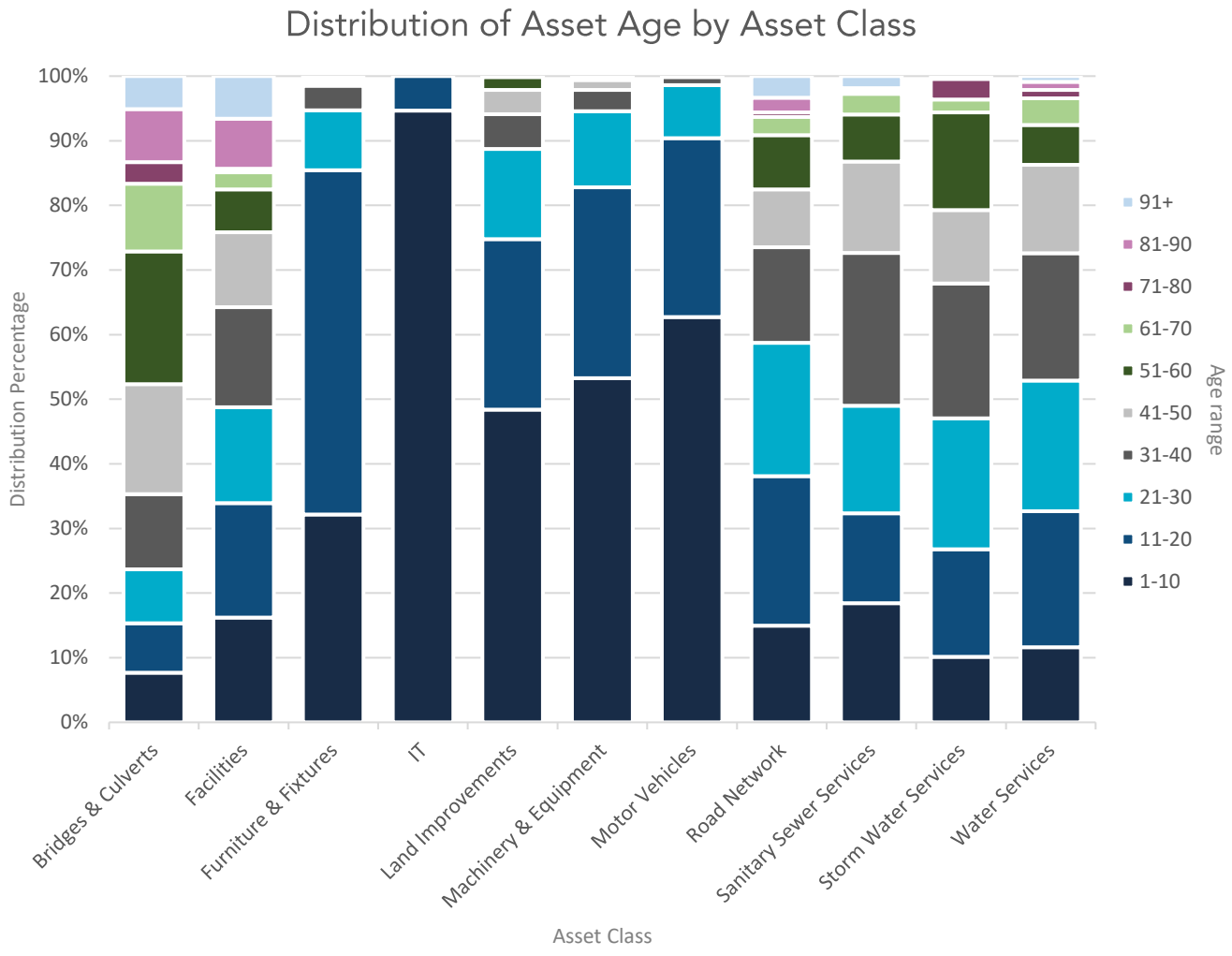


Figure 8

Condition Data

Asset age data helps asset managers plan for future needs, but age is not always an accurate predictor of asset condition, as evidenced in the 2015 Roads & Bridges Study. Temperature, environment and asset material type can all impact the rate in which an asset deteriorates, rendering an age-based assessment of condition far less accurate. The findings on the state of infrastructure for our 2016 sample are derived from actual field condition assessments, as provided by municipalities, and detailed financial information that is in compliance with requirements for both Gas Tax and OCIF funding.

Percentage of Assets with Condition Assessments

The following graph represents the percentage of all asset classes within our sample, by replacement cost, that have condition data based either on assessments or by age. Notably, a significant percentage (81%) of bridges and culverts among our sample have condition data derived from assessments (see Figure 9). Road networks and facilities have roughly 50% of assets (based on replacement cost) with assessed condition, while water system assets have between 23% and 14% of assets with assessed condition. Machinery and equipment assets have the lowest percentage of assets with accurate condition data (9%).

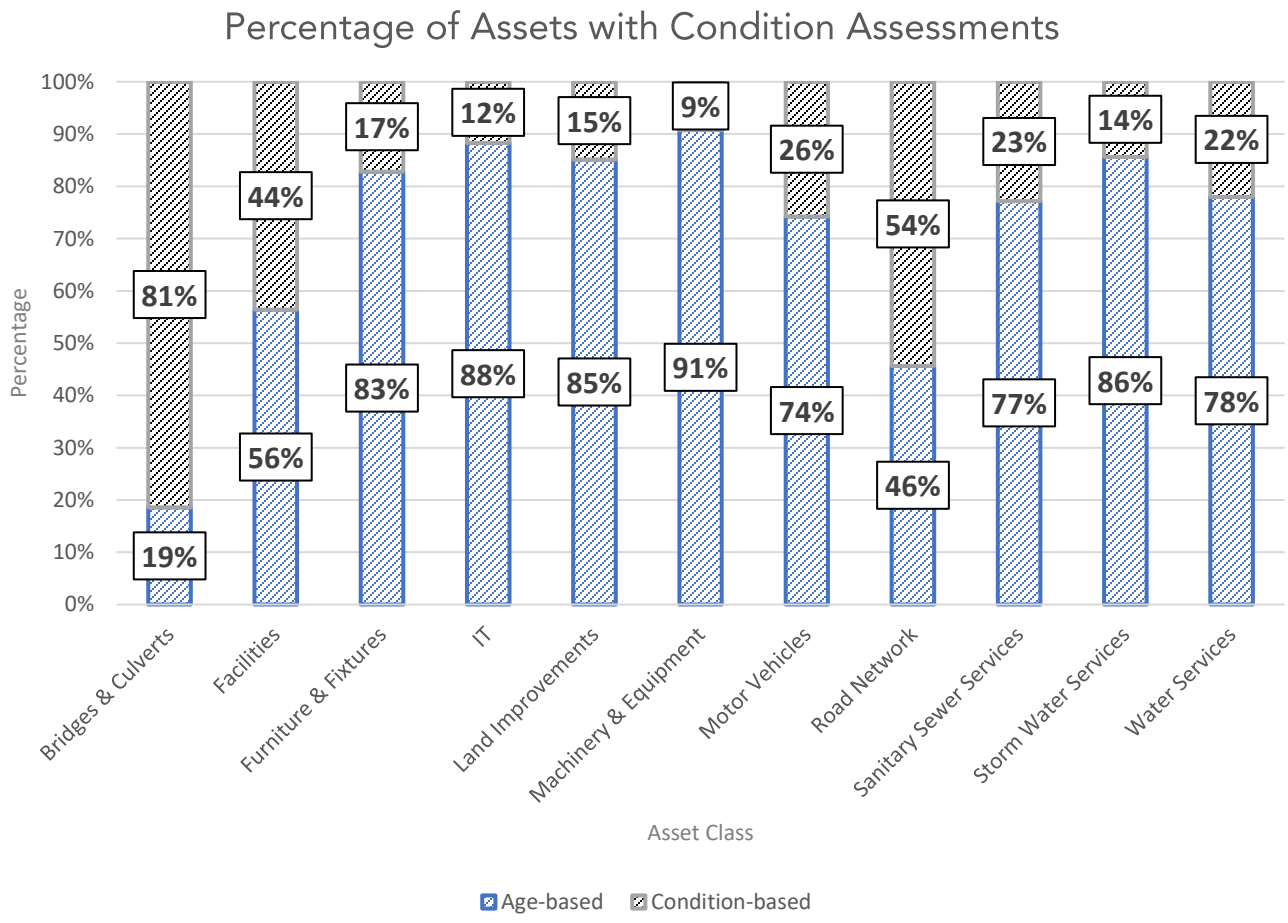


Figure 9

Assessed vs. Unassessed Assets Measured by Condition Rating

The use of field assessment data provides a more accurate description of actual asset condition. Our data suggests that, across all asset classes, 29% of all condition data is assessed. As a result, most assets are likely to be classified based on age-based data by default. As more assessments are performed, condition appears to improve. As per Figure 9, bridges, roads, and facilities show the largest proportion of assessed condition data among all assets classes. Notably, roads, bridges, and facilities also show the largest difference between age-based and assessed condition ratings in Figures 10 and 11 below.

For the road network (see Figures 10 and 11), when just considering age-based condition data, 56% of assets are deemed poor or very poor, while 31% are reportedly in good or excellent condition. Using available assessed condition, the percentage of road network assets in poor or very poor condition drops to 35% and the percentage of assets in good or excellent condition rises to 49%. With a 38% reduction in the percentage of poor or very poor road assets and a 58% increase in the percentage of good or excellent road assets as a result of incorporating condition assessment information, it is evident that a clearer picture of the state of municipal assets has a significant impact on the quality of information available for proper asset management.

Likewise, for bridges and culverts there is a sizable increase in the percentage of good or excellent assets when incorporating assessed condition data, however, with so few assets not having assessed condition data for bridges and culverts (only 19%), the comparison is less meaningful. The percentage of poor or very poor assets in the facilities category drops from approximately 62% using only age-based data to 52% using assessed condition, where available. This change can be attributed primarily to an increase in the percentage of fair assets, meaning that for this sample, condition assessments revealed that facilities were not as deteriorated as age-based data would indicate. For the remaining asset categories, the impact of available condition assessment data on the condition distribution of assets was far less significant.

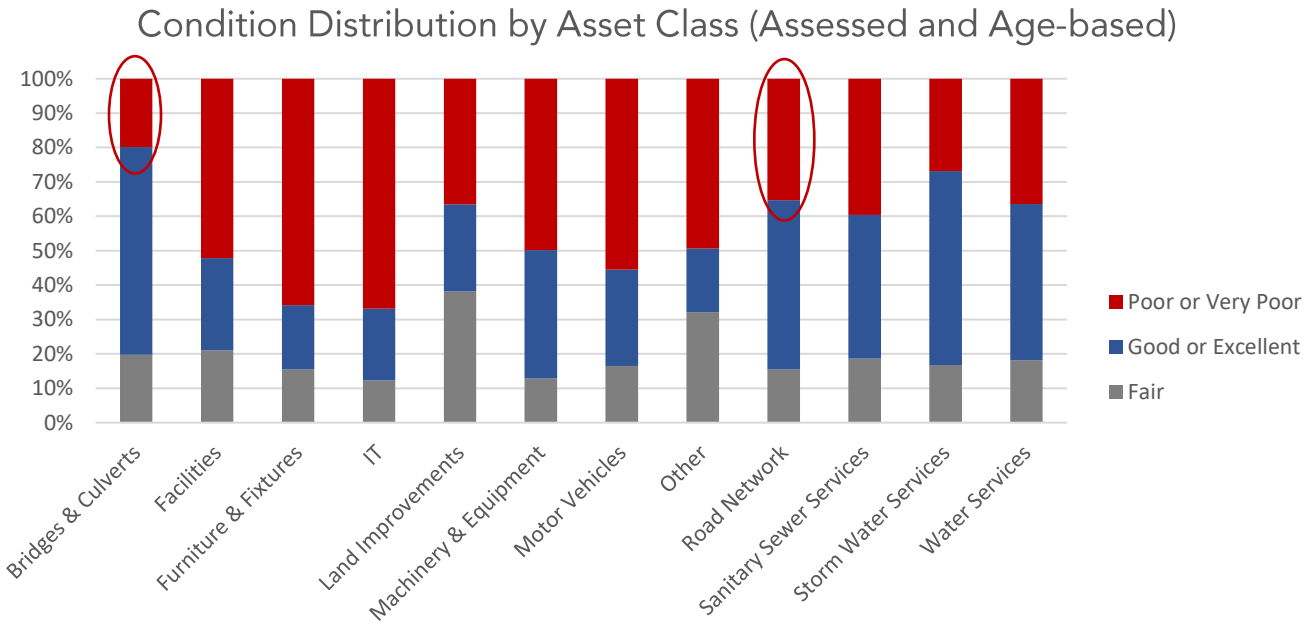


Figure 10

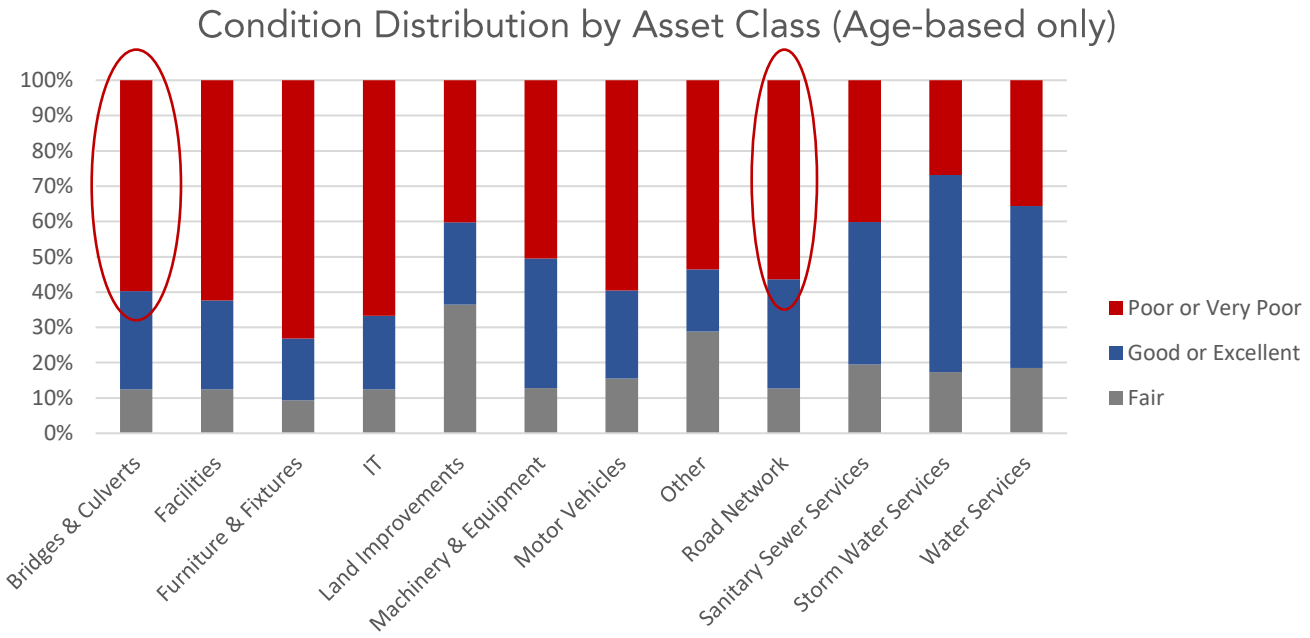


Figure 11

Annual Requirements

The amount of annual investment needed across our sample of Ontario municipalities to maintain their assets totals nearly **$520 million,** or **$1,232** per household. To calculate the annual requirement for an asset, the total replacement cost of the asset is divided by its useful life. The useful life can be based on either the amortization schedule (which is included in the calculation by default) or an asset profile. The annual requirement for each asset (including all assets that have reached the end of their life) is summed to produce the total annual infrastructure requirement for each municipality. Figure 12 depicts the average annual requirement per municipality for each region in Ontario, showing that Central Ontario municipalities, on average, require the greatest annual infrastructure investment ($14.7 million per community per year). North Eastern Ontario municipalities appear to have the lowest average annual infrastructure requirement at $4.7 million per community. Conversely, Figure 13 demonstrates that, per household, sampled communities from both North Eastern and North Western Ontario require the greatest annual requirements.

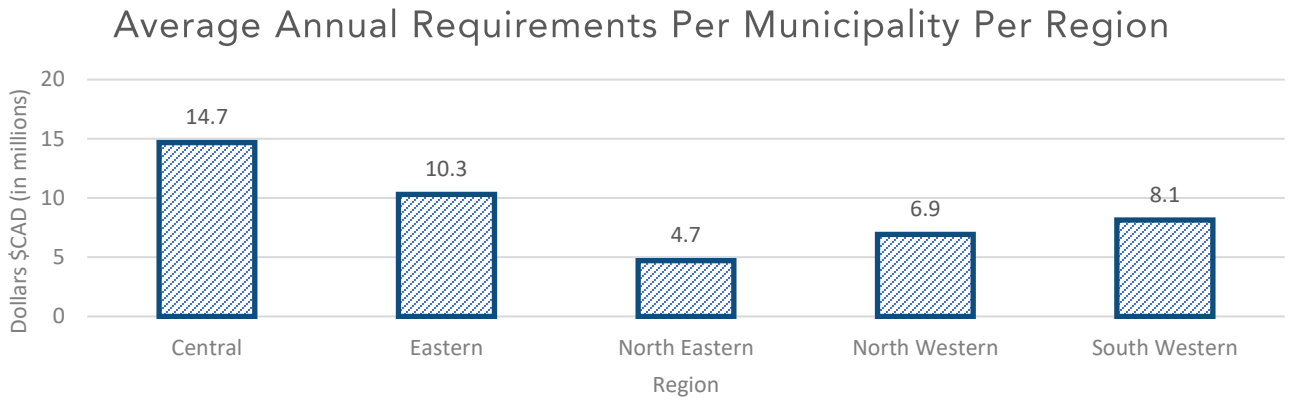


Figure 12

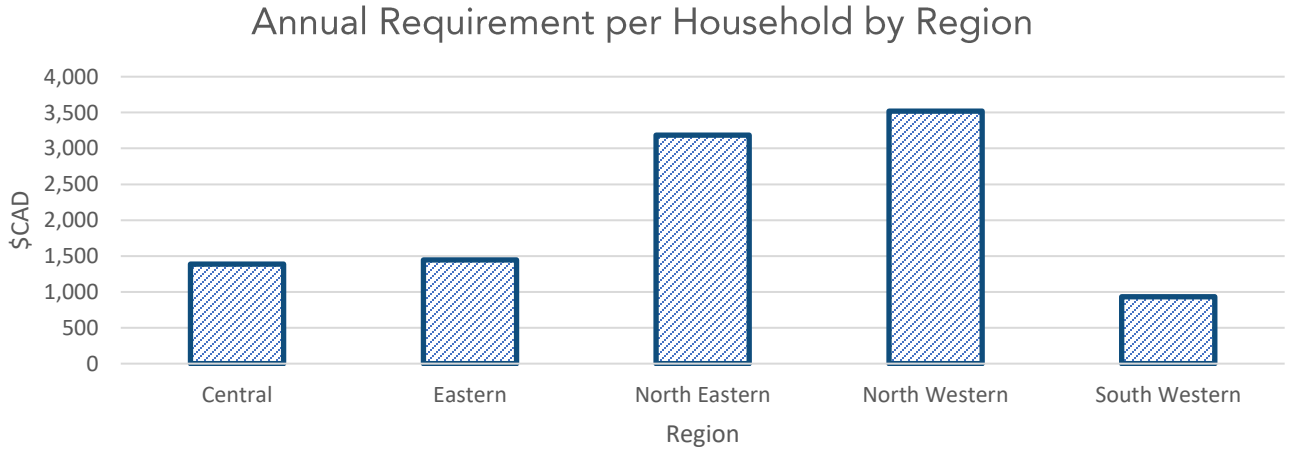


Figure 13

Projected Replacement Costs

To determine projected replacement costs over the next 20 years, a lifecycle analysis was conducted for all asset classes. The following graph shows the annual amount required by all municipalities to replace assets as they reach the end of their lifecycles each year.

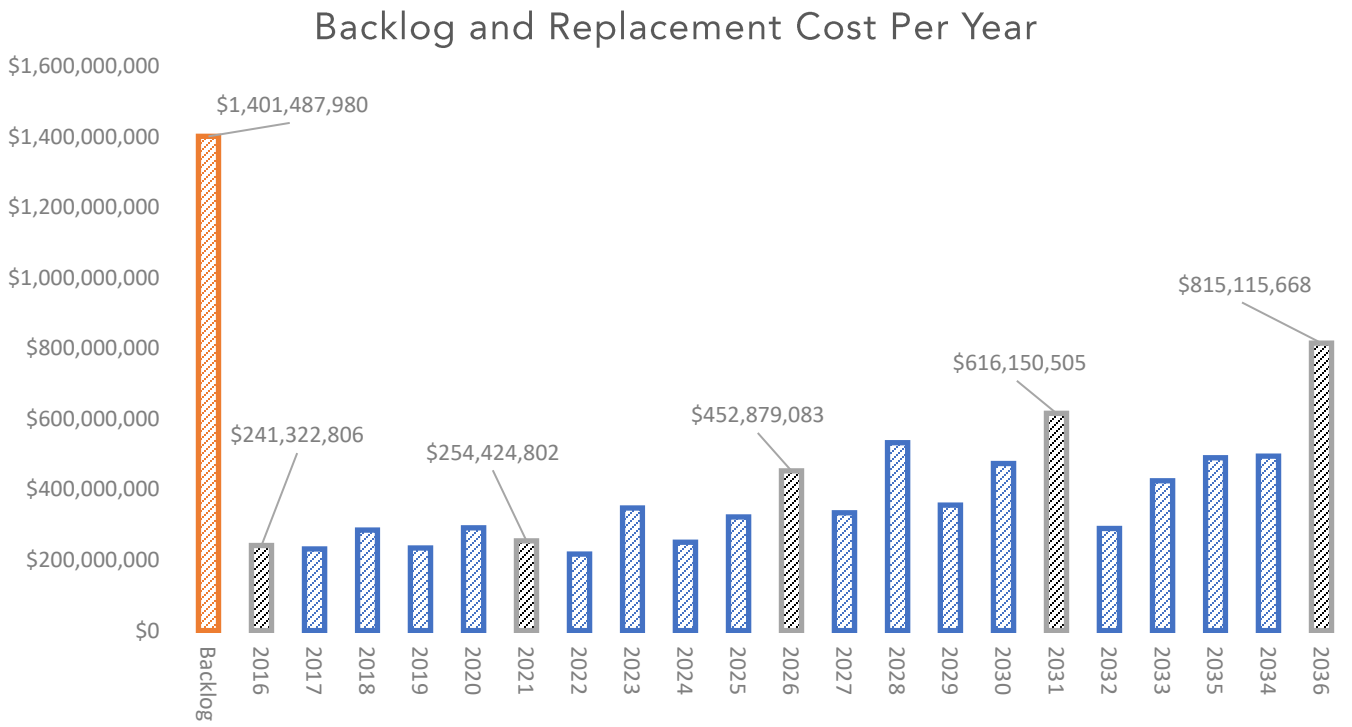


Figure 14

The backlog listed above **($1.4 billion**) represents the total investment needed today to replace assets which have already reached the end of their lifecycles or had been fully amortized as of 2016. The graph is not cumulative; that is, the projected replacement costs are calculated for each year. This assumes that annual replacement needs for each previous year are met as they arise. By 2036, the total replacement cost of assets per year for this sample of municipalities will reach more than **$815 million**.

Funding and Need

Annual Infrastructure Investment Gap

Once a municipality is able to project future replacement costs, it can plan to set aside sufficient funding to carry out those replacements as needed. Unfortunately, a number of political, organizational and fiscal pressures hamper the ability for most municipalities to adequately save for the future. As a result, an annual infrastructure investment gap appears, producing a significant cumulative investment gap across all municipalities in the sample.

To determine the annual investment gap (the difference between the amount of investment needed and the amount of funding available), we analyzed the funding municipalities in our sample set aside in 2014, 2015 and 2016. We excluded any one-time investments on projects, grants from senior governments, and any other outliers, to estimate a predictable level of funding. We then subtracted this available funding from the average annual requirements needed for sustainable infrastructure management, producing the annual investment gap. The total annual infrastructure investment gap for all asset categories in this sample is **$317 million**, or **$754** per household. This represents the difference between annual funding required for meeting infrastructure replacement needs, and the funding potentially available for this purpose.

When looking at the average annual infrastructure deficit per household, North Western Ontario's municipalities face the greatest burden with an average deficit of **$2,700**, compared to **$712** in Central Ontario (see Figure 15).

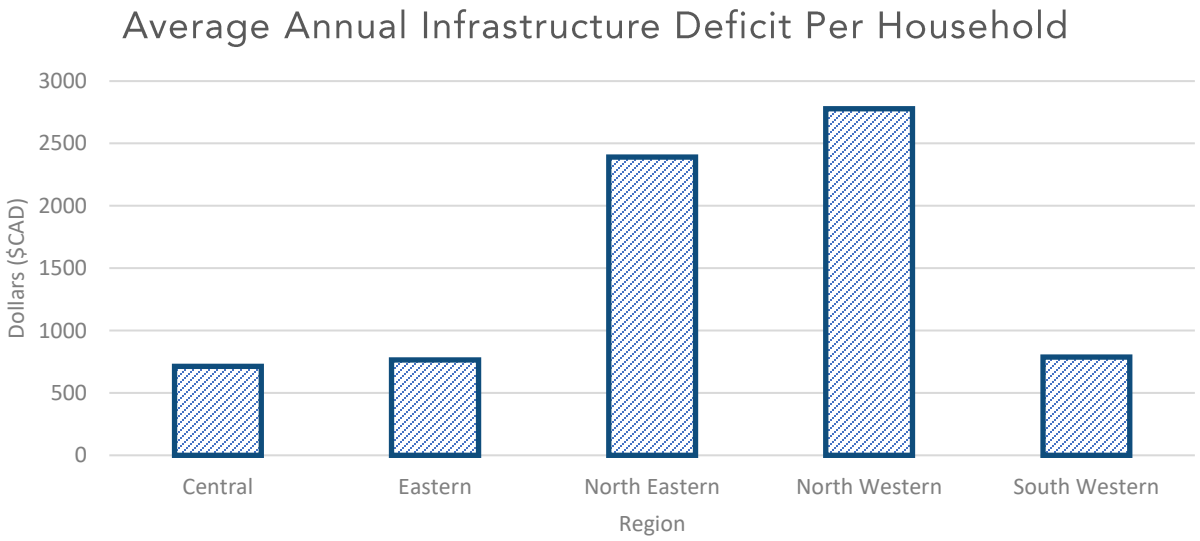


Figure 15

Infrastructure Backlog

The infrastructure backlog is the amount that municipalities require today to replace assets that have already reached the end of their lifecycle. In our 2016 sample, the current infrastructure backlog for all asset classes totals $1.4 billion. The two highest totals are for roads and facilities, which comprise 40.2% and 19.5% of the total backlog respectively (see Figure 16). Homes in North Eastern and North Western Ontario incur the highest burden with a per household infrastructure backlog of more than $16,000 (see Figure 17).

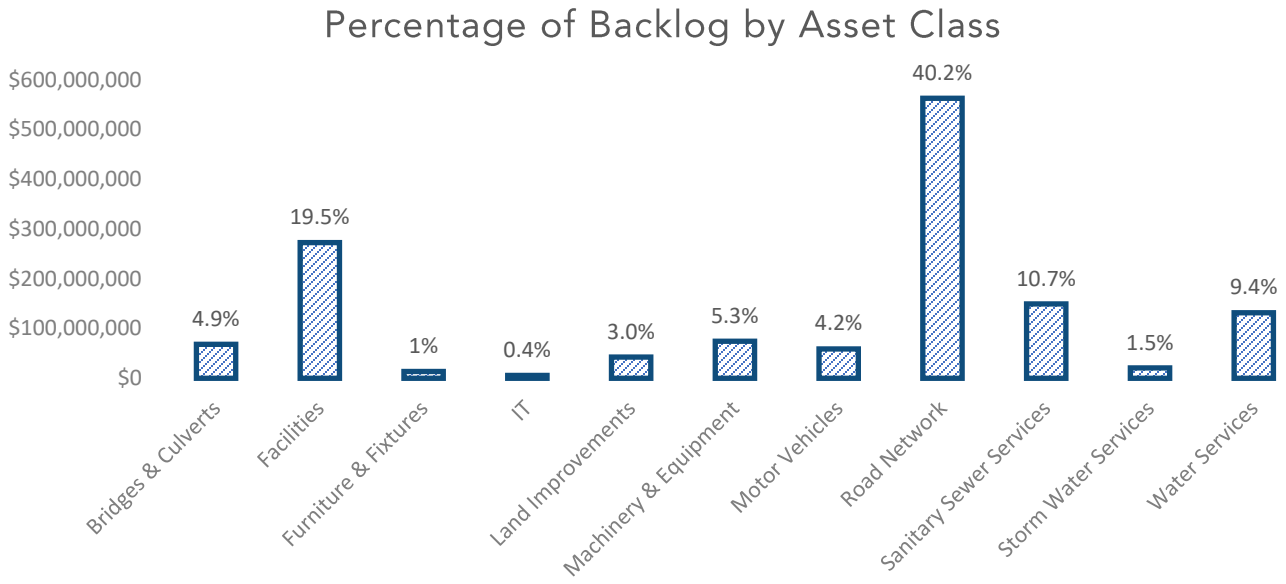


Figure 16

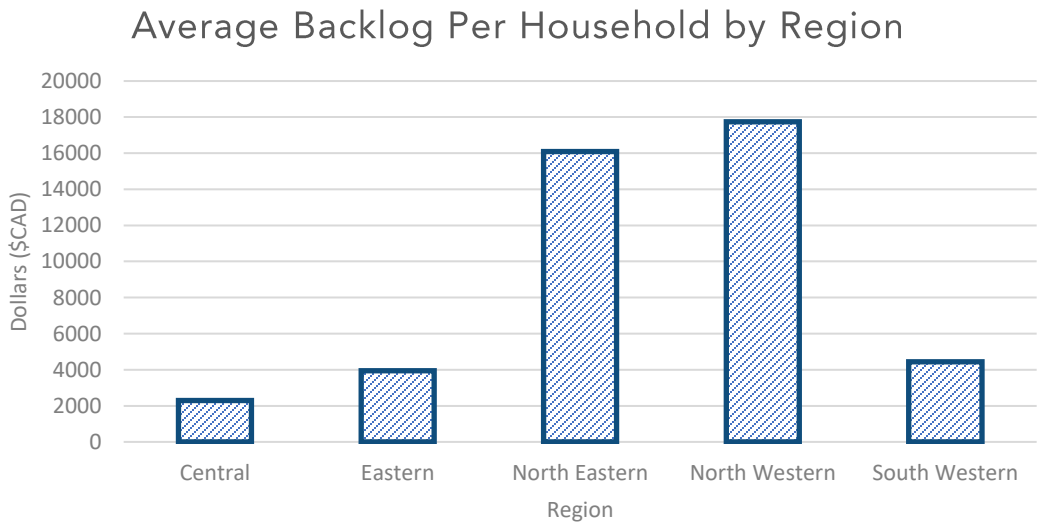


Figure 17

Part II: Cohort Analysis of 2013 vs 2016 AMPs

Part II Sample

In this section, changes in asset condition and replacement costs are analyzed for the 35 municipalities that completed an asset management plan with PSD for both 2013 and 2016, measuring changes in asset management data and practices. This allows us to directly compare condition and financial data between both years. Most of this sample is made up of small to mid-sized municipalities in South Western Ontario (see Figures 18-21), which closely reflects the composition of the sample in Part I.

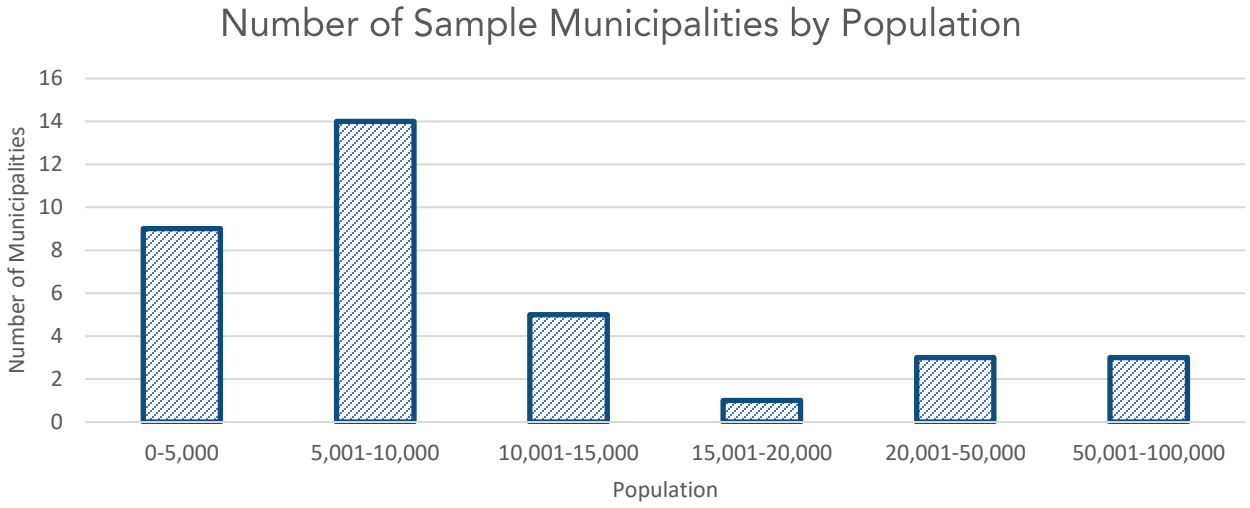


Figure 18

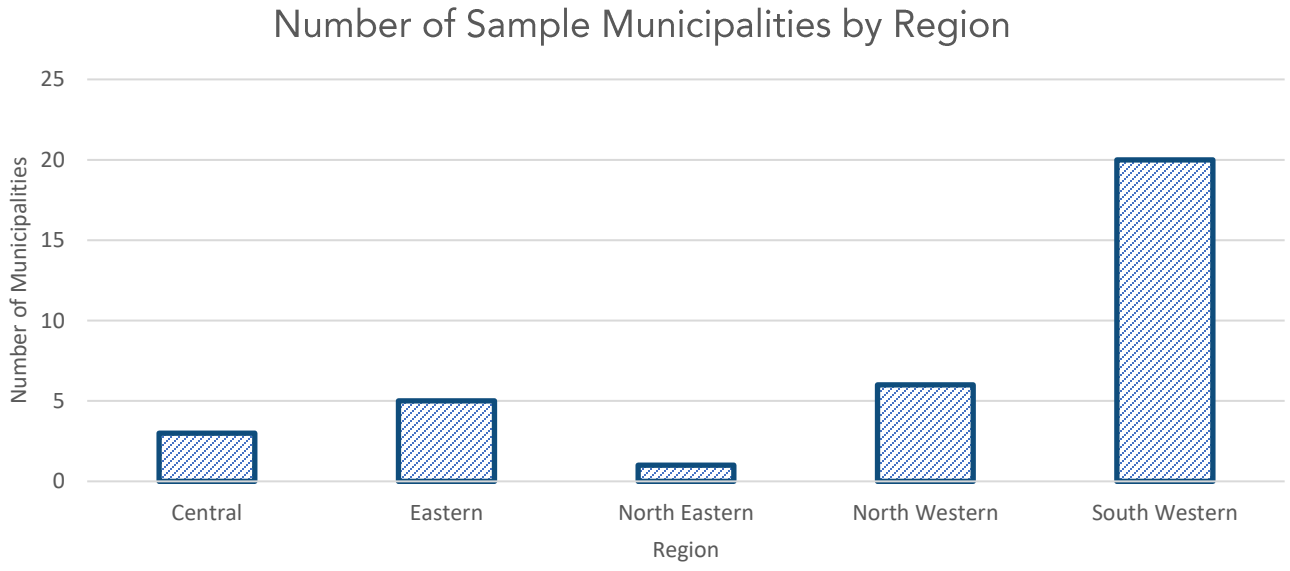


Figure 19

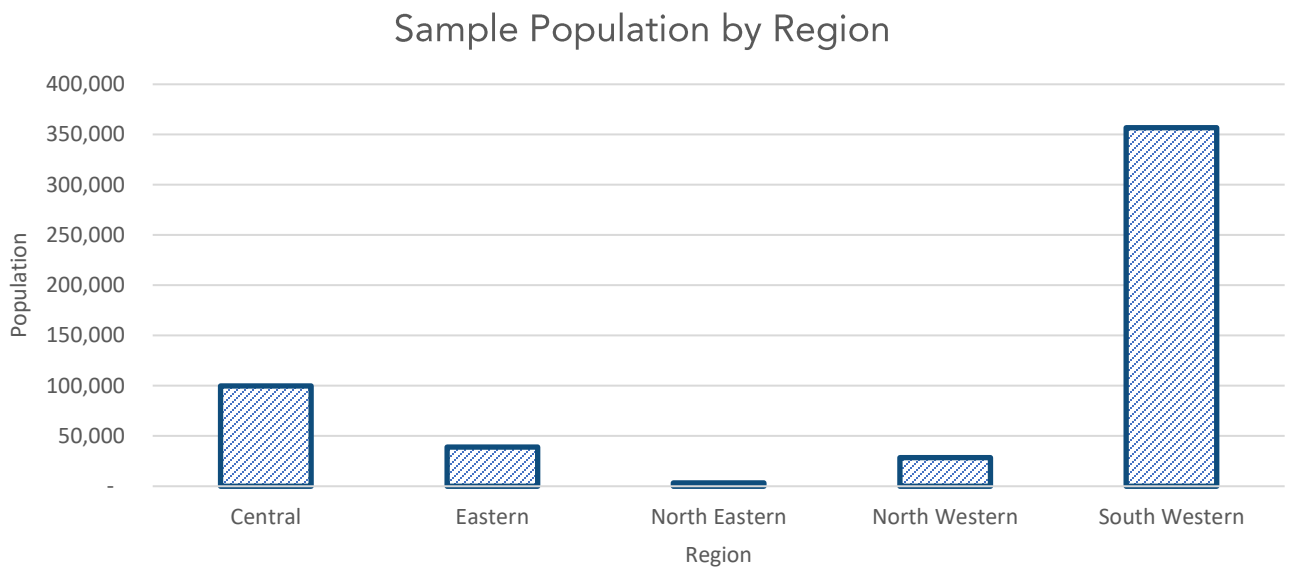


Figure 20

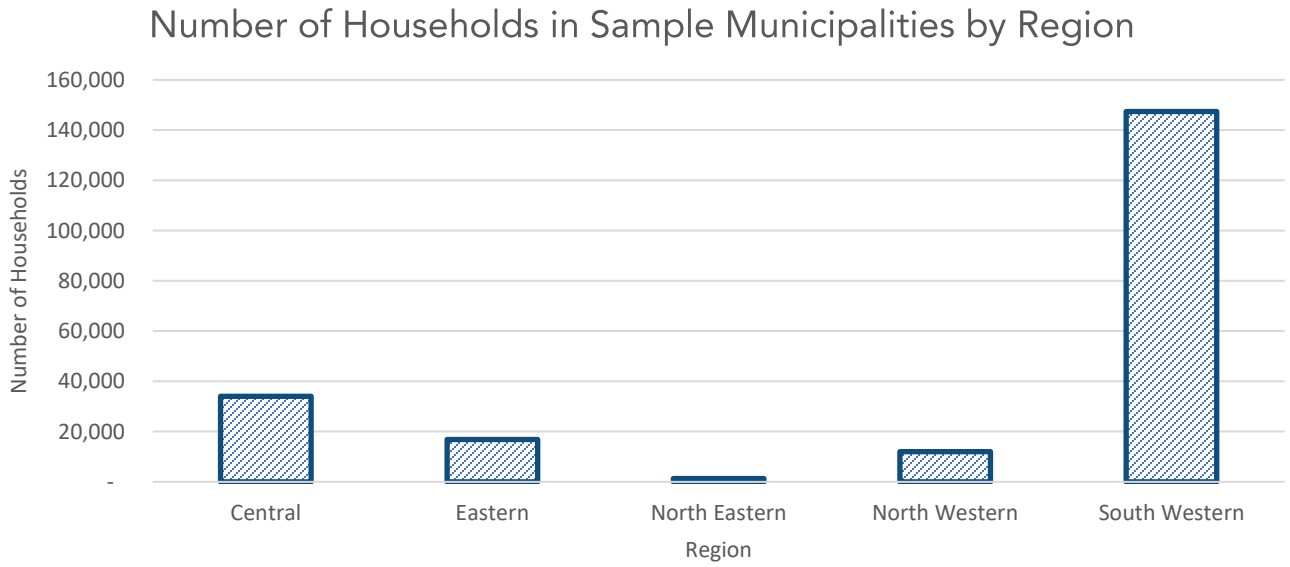


Figure 21

Asset Classes

In 2013, the 35 municipalities in our sample listed less than four asset classes, on average, in their asset management plans. In 2016, this number jumped substantially to **8.57** asset classes per community, including additional asset classes such as facilities, IT, and machinery and equipment (see Figure 22). Although much of this increase can be attributed to the Gas Tax Funding AMP requirement introduced in Ontario, many municipalities initiated the development of a more comprehensive AMP before the Gas Tax requirements were implemented. Through the completion of the first AMP in 2013, which only included core infrastructure assets, it was evident to municipalities that expanding the AMP to include all categories would produce a more meaningful document that would better inform long-term infrastructure planning. See Appendix on page **43** for full list of asset descriptions by category.

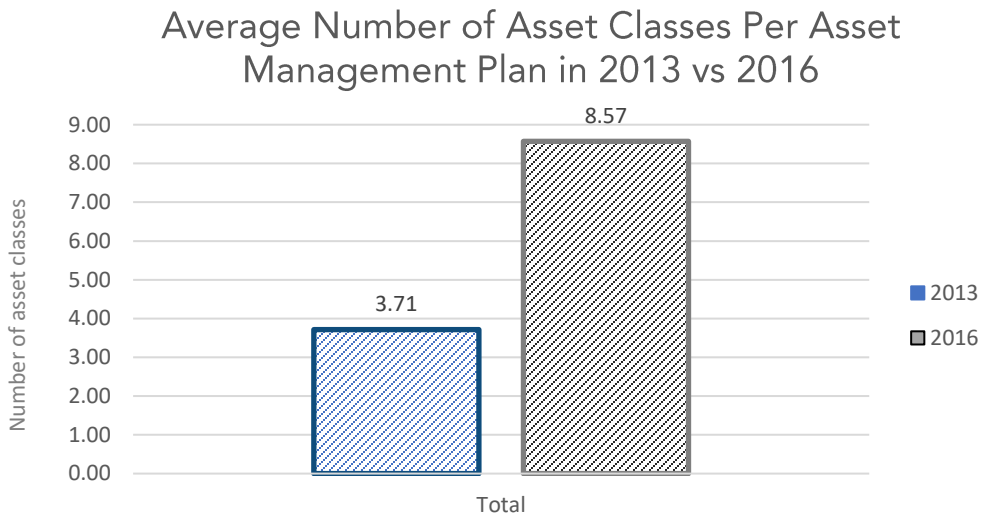


Figure 22

Annual Infrastructure Investment Gap

Figure 23 compares the total annual deficit for the same 35 municipalities in 2013 vs. 2016. Of note is that the overall deficit has increased from 2013 to 2016 by more than **50%**, despite the number of municipalities in our comparison remaining the same. One explanation for the significant increase is that the number of asset classes has approximately doubled on average for each municipality in the sample, adding to the overall infrastructure deficit. Figure 24 compares the change in the total annual infrastructure deficit for the same 35 municipalities by asset class. As the AMPs included in the 2013 sample did not include all asset categories, this comparison is restricted to bridges & culverts, road network, and water & sewer asset classes. It is apparent that the total annual infrastructure deficit has increased significantly for the road network, climbing from $50.9 million to $102 million. Meanwhile, the total annual deficit for water and sewer assets for these 35 communities dropped from $24.5 million in 2013 to $18.5 million in 2016.

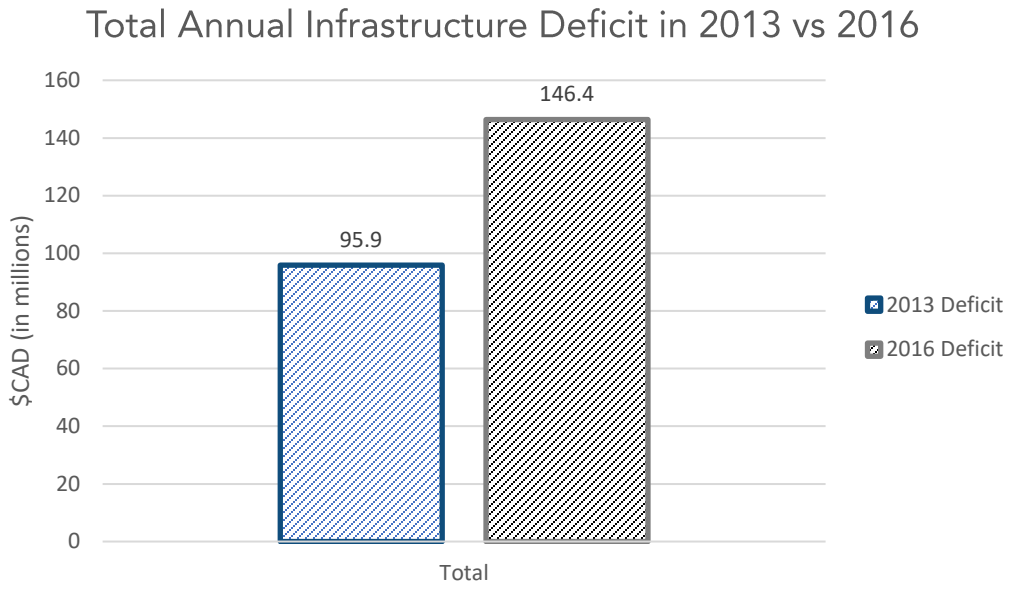


Figure 23

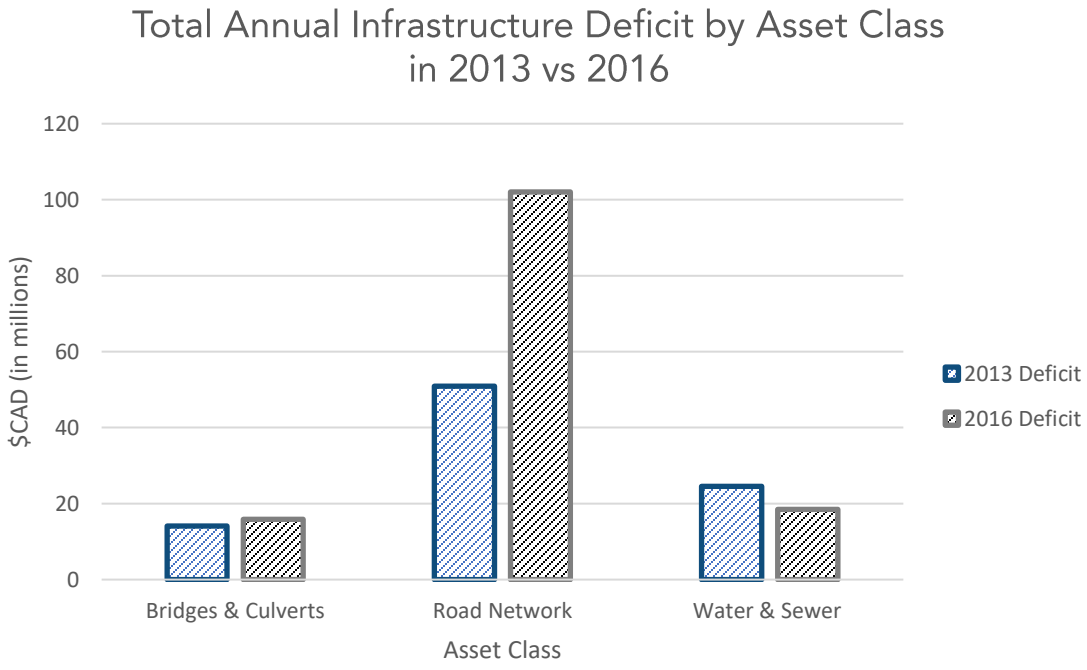


Figure 24

Change in Infrastructure Backlog

Again, the infrastructure backlog represents the total investment needed today to replace assets which have already reached the end of their lifecycles or have been fully amortized. For the cohort of 35 municipalities in this sample, the question is, has the infrastructure backlog grown from 2013 to 2016? Figure 25 below demonstrates that for bridges & culverts and the road network, the infrastructure backlog has actually shrunk. The infrastructure backlog was reduced by 30% from 2013 to 2016 in the case of the road network and by 20% for bridges & culverts. The backlog grew by 30% for water & sewer. Overall, our sample of 35 municipalities experienced a 12% reduction in the infrastructure backlog across these three asset categories. The change in backlog cannot be reported for the other asset categories as most municipalities did not include other categories in their 2013 AMPs.

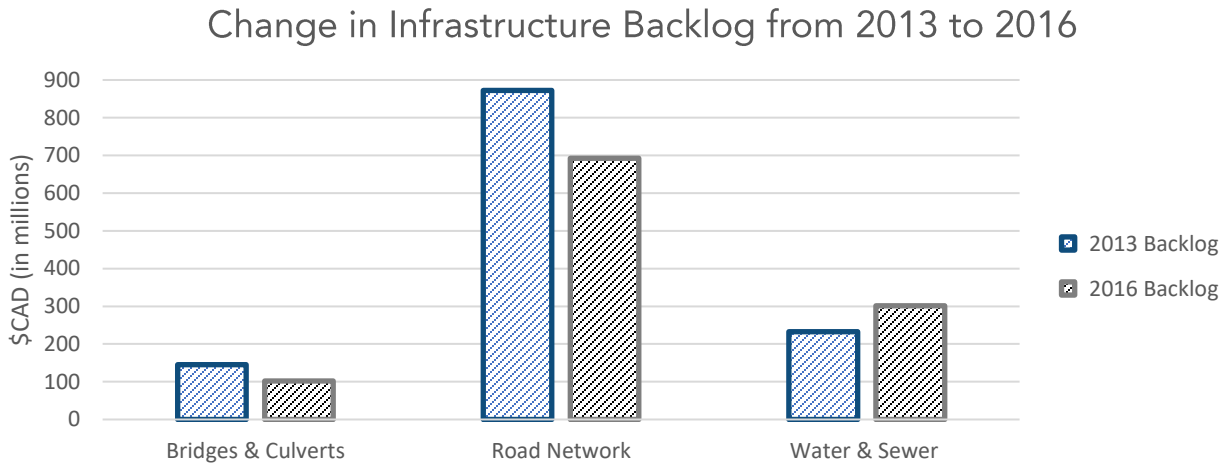


Figure 25

Road Network

Certain revealing trends emerge when comparing 2013 and 2016 road network condition data. While the total replacement costs of "fair," "good," and "excellent" assets remained relatively constant, "poor" and "very poor" asset replacement costs increased by nearly 50% (see Figure 26). However, the total sum of 2016 replacement costs exceed the total sum from 2013 (see Figure 29). Taken together, this information suggests that municipalities have incorporated additional roads assets as part of their asset management planning. Moreover, with respect to condition ratings, it is also likely that prominent, newer assets were included as part of 2013 asset management practices. In 2016, as the skills and capacity for asset management increased among Ontario municipalities, it is likely that other, older assets were incorporated into their asset management planning.

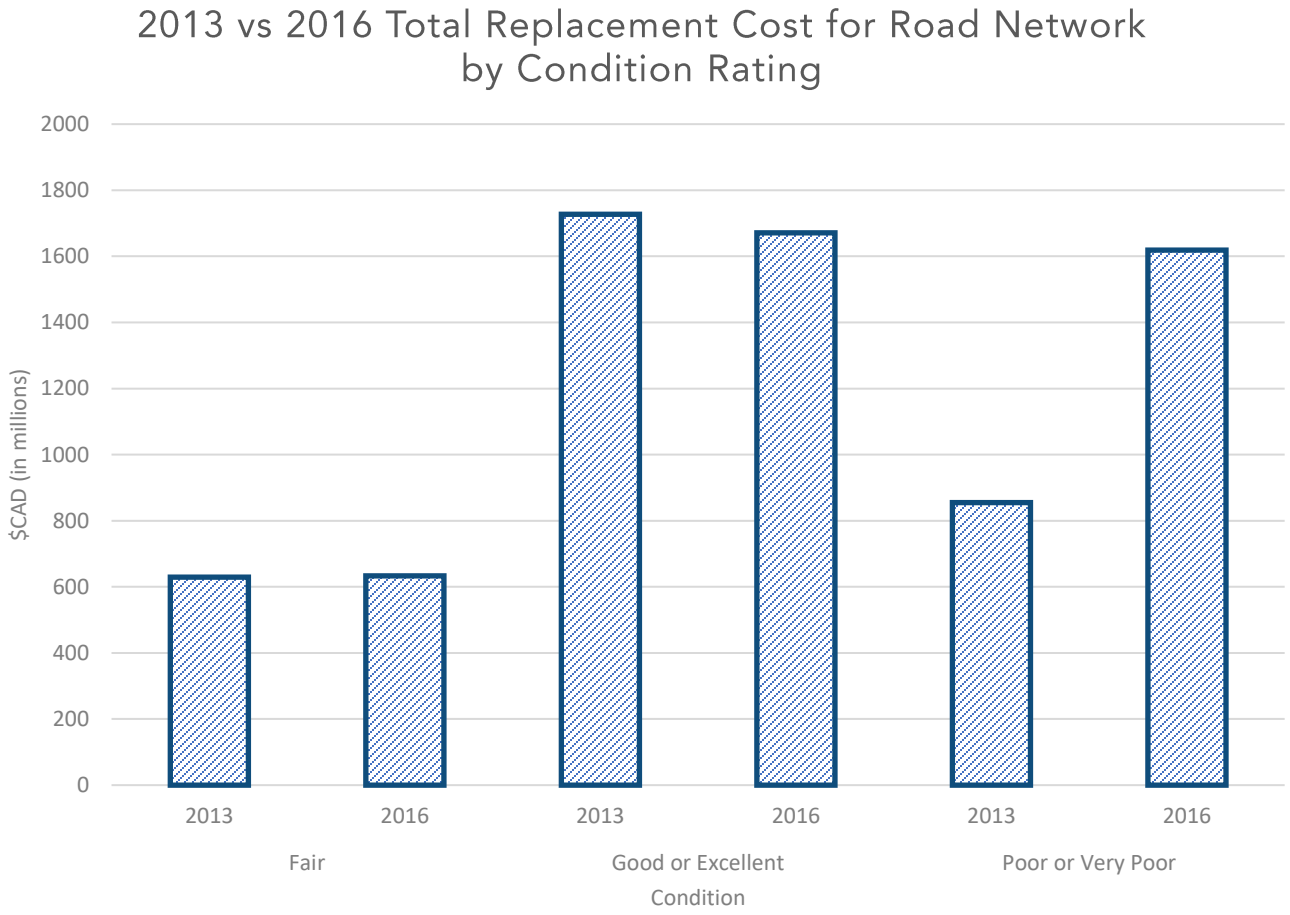
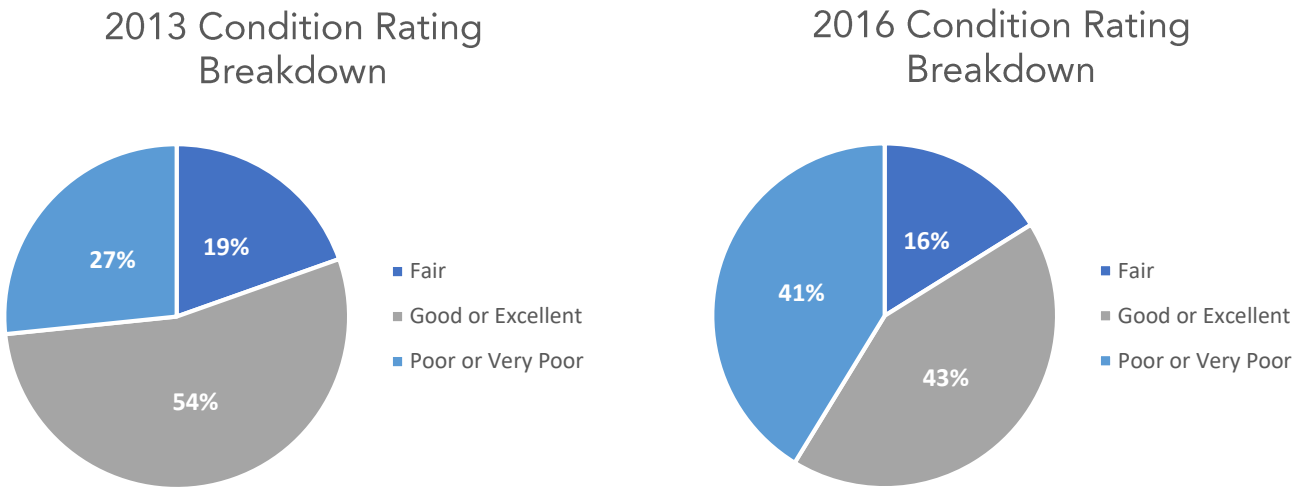


Figure 26



Figures 27, 28

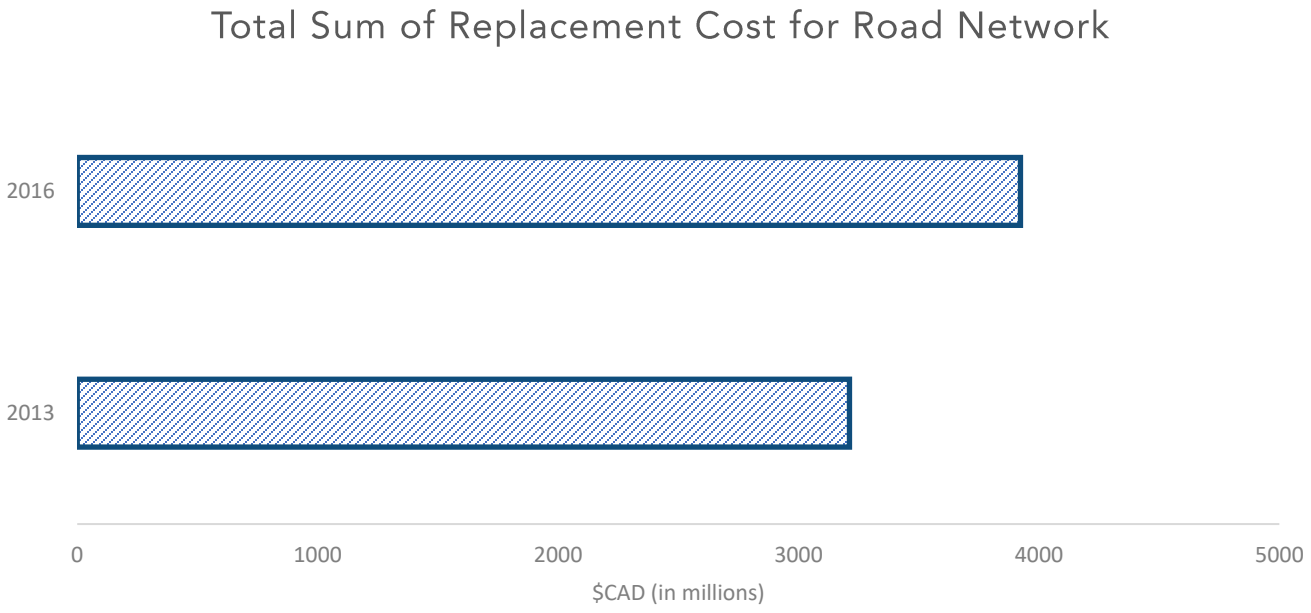


Figure 29

Bridges & Culverts

Compared to the road network data set above, the bridges and culverts data set shows improvement in overall condition rating from 2013 to 2016. As the total sum of replacement cost has risen since 2013, the percentage of overall condition ratings has improved. While the "good or excellent" rated group has remained relatively constant as a percentage, assets rated as "poor" have decreased as assets rated as "fair" have increased (see Figure 30).

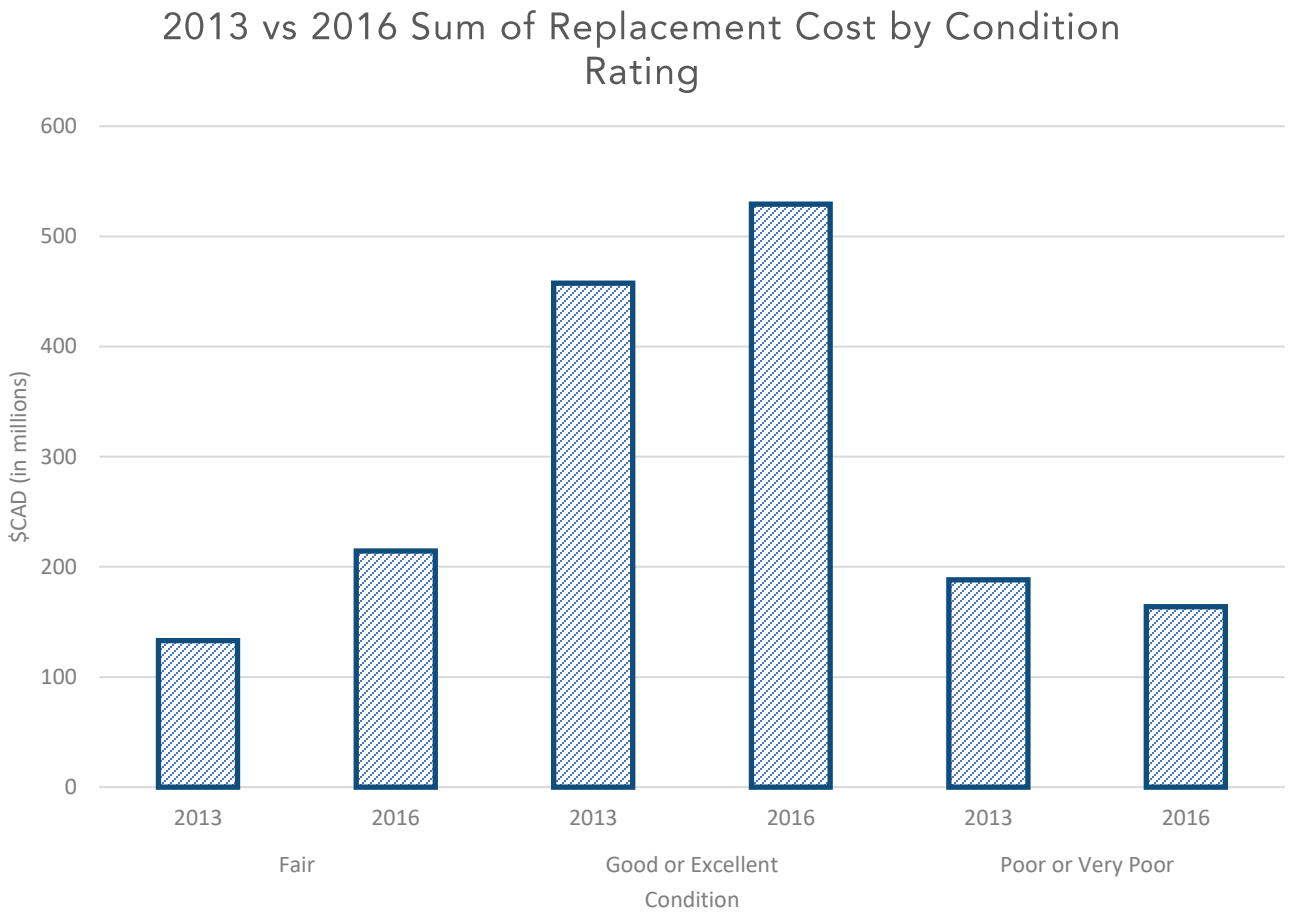
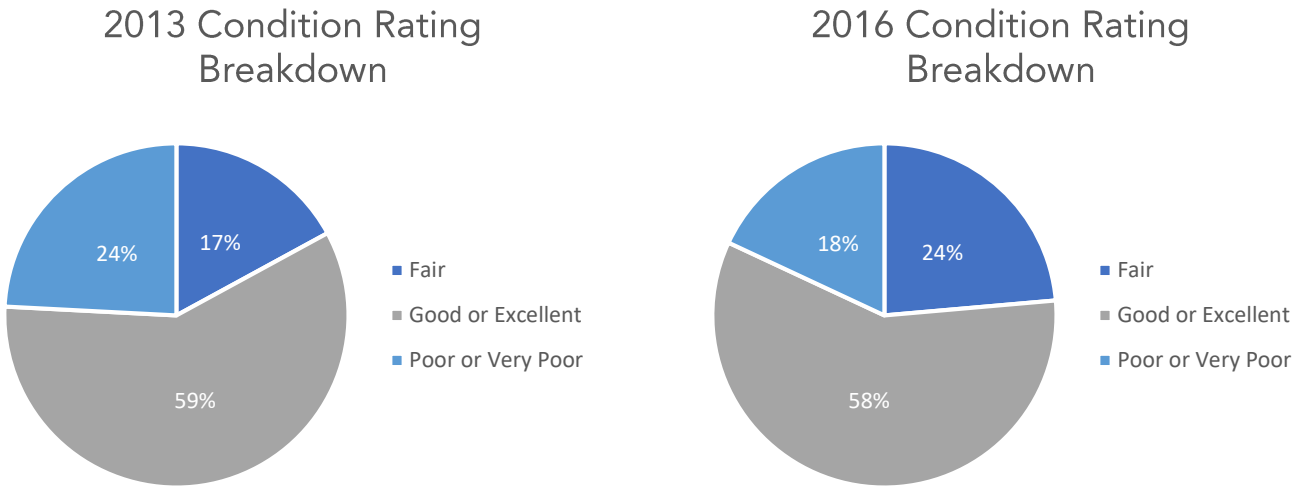


Figure 30



Figures 31, 32

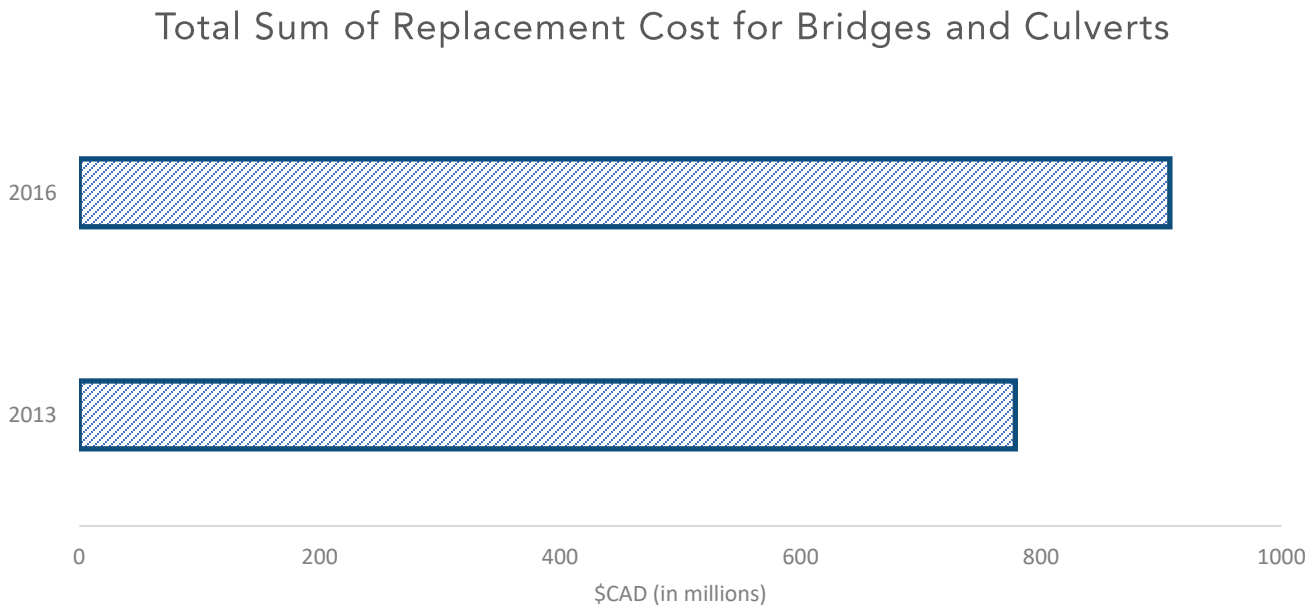


Figure 33

Sanitary Sewer Network

Both sanitary sewer and storm water assets have increased by total replacement cost across all tiers of condition ratings (see Figures 34 and 38), while the total replacement cost of water network assets have remained relatively constant, and have seen an increase in the number of assets rated as "poor" and "very poor" (see Figure 42).

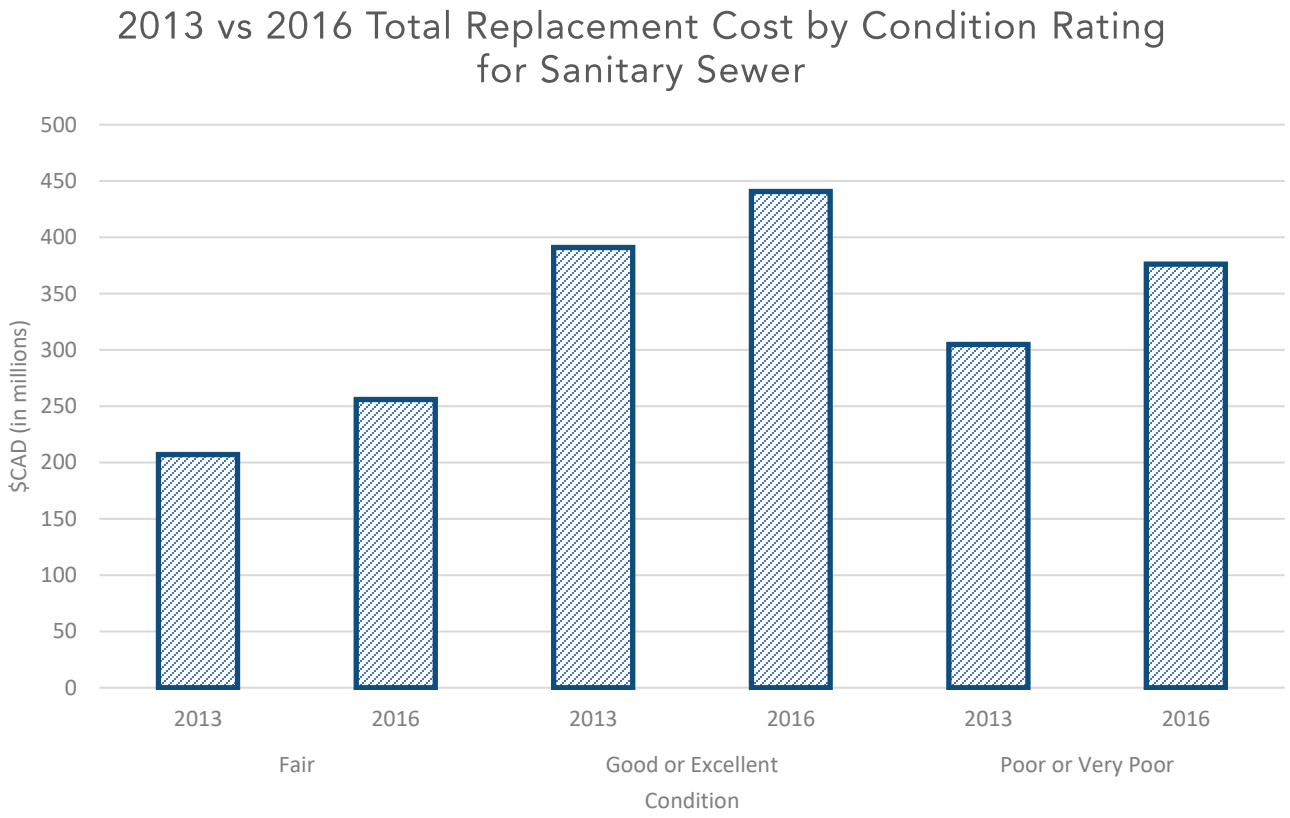
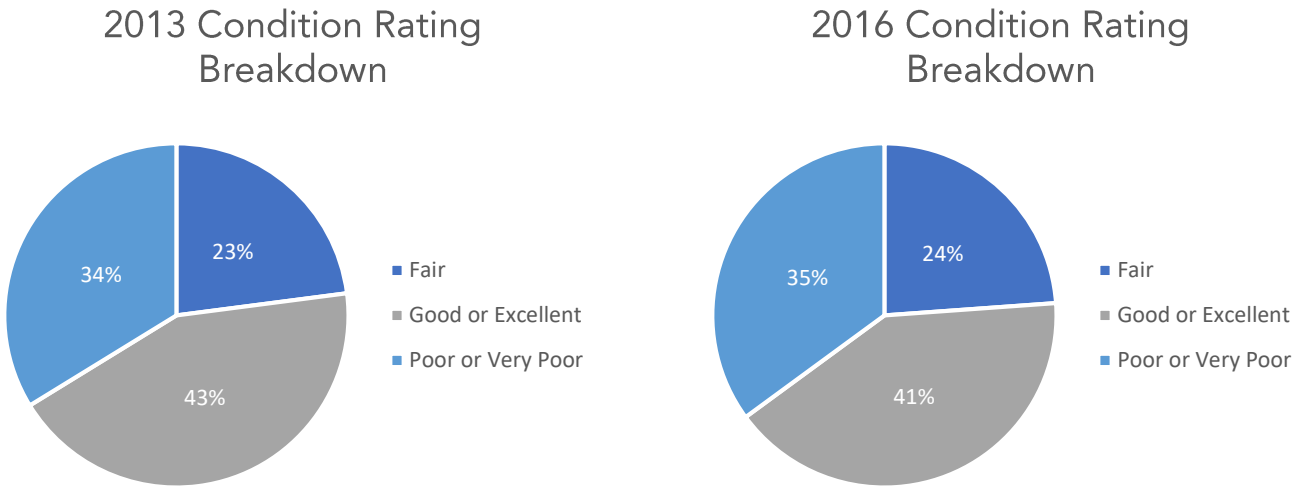


Figure 34



Figures 35, 36

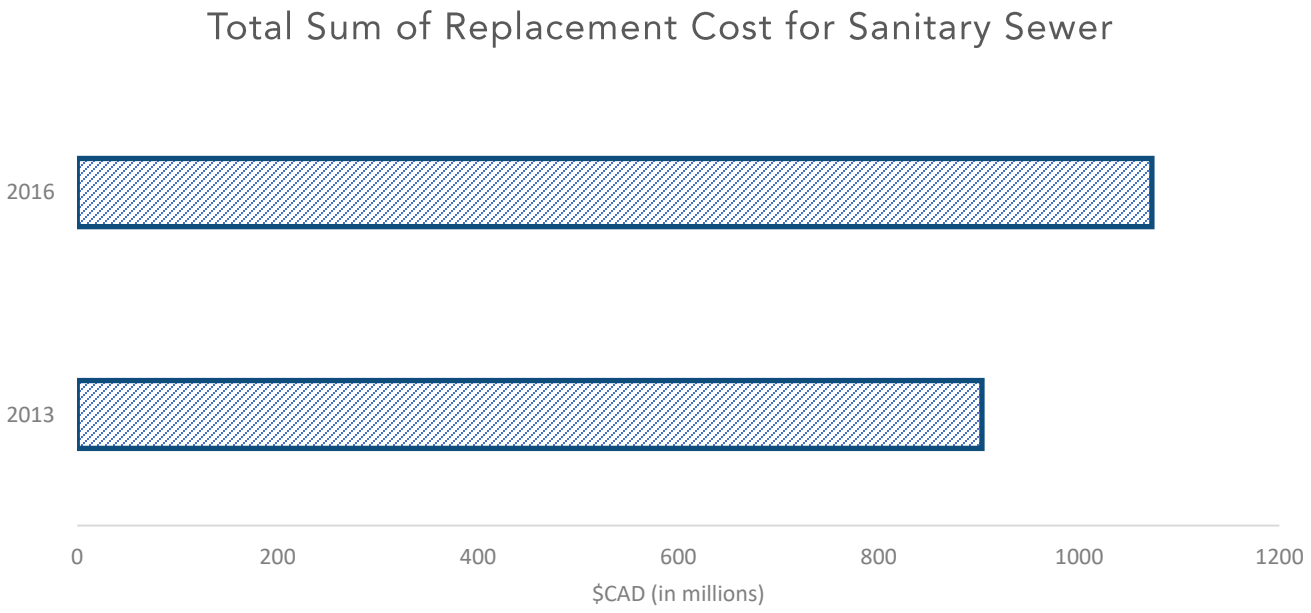


Figure 37

Storm Water Network

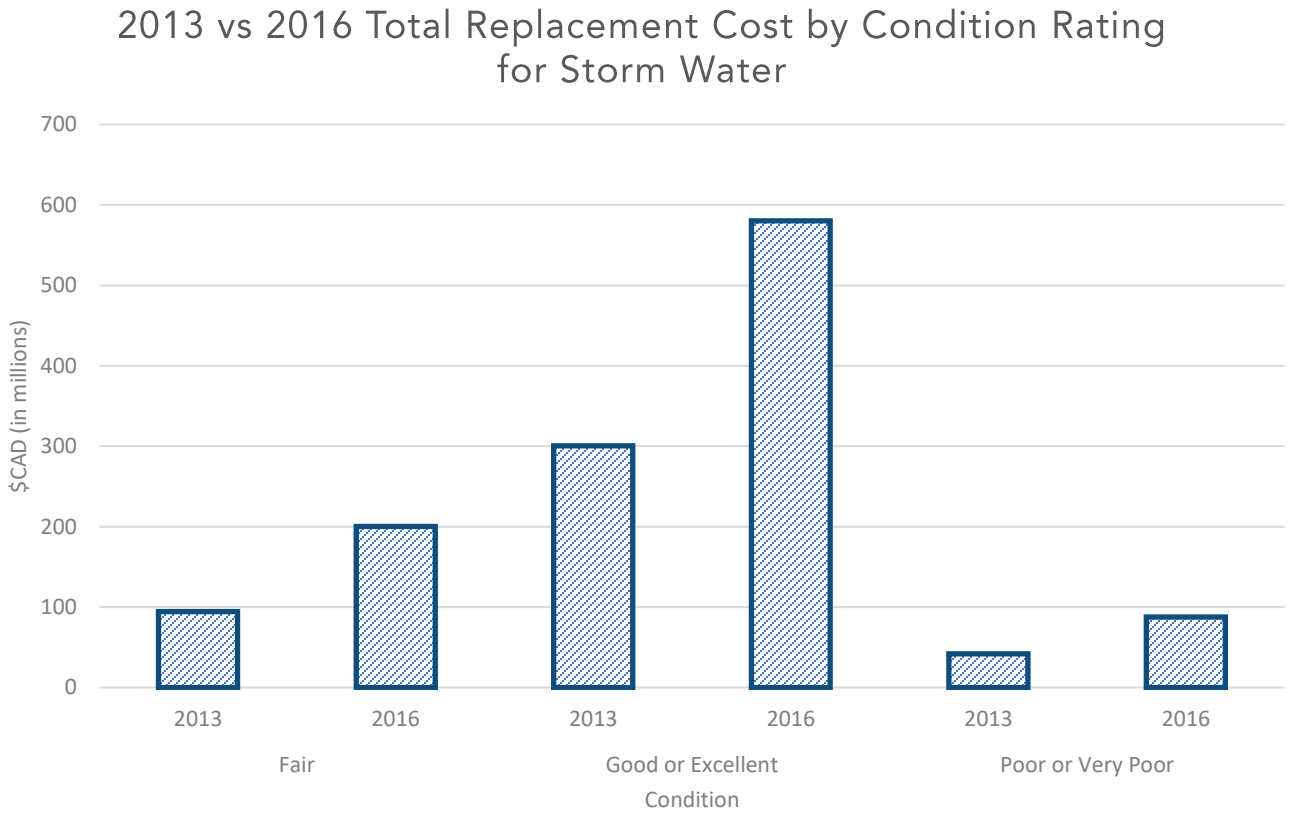
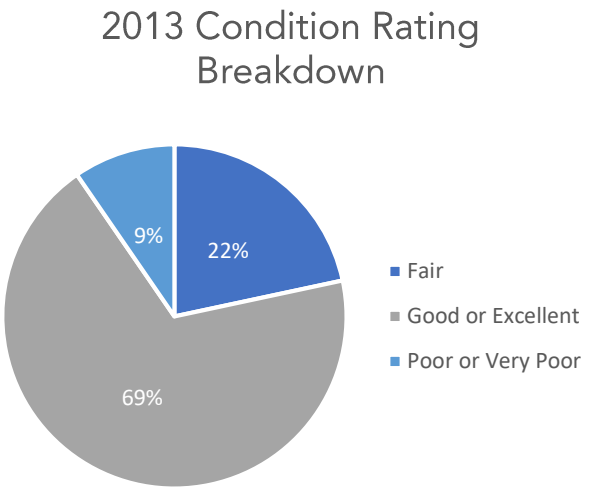
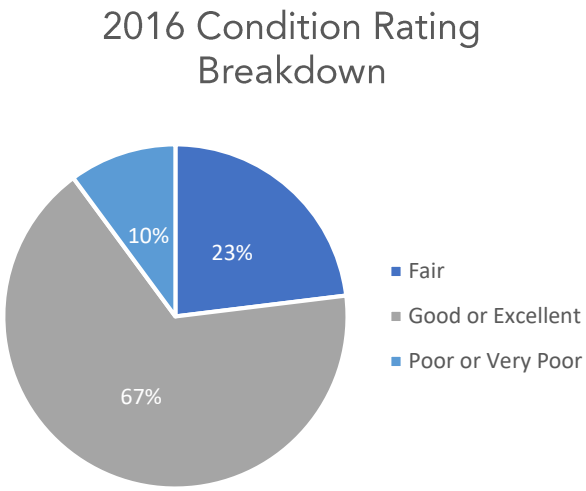


Figure 38





Figures 39, 40

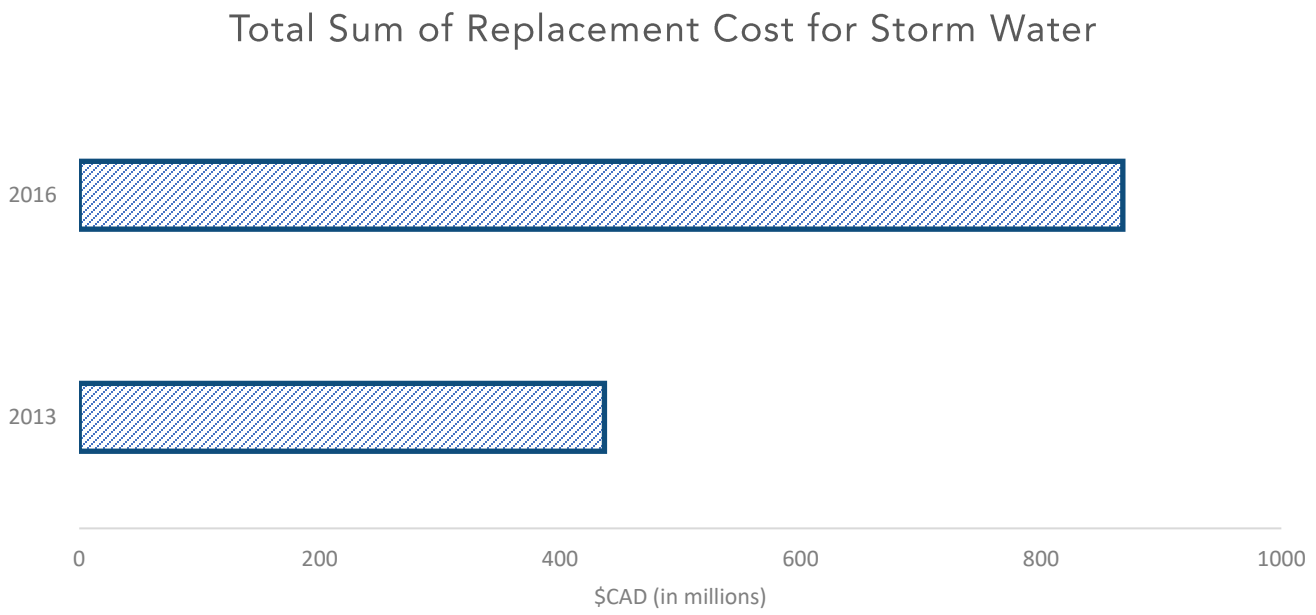


Figure 41

Water Network

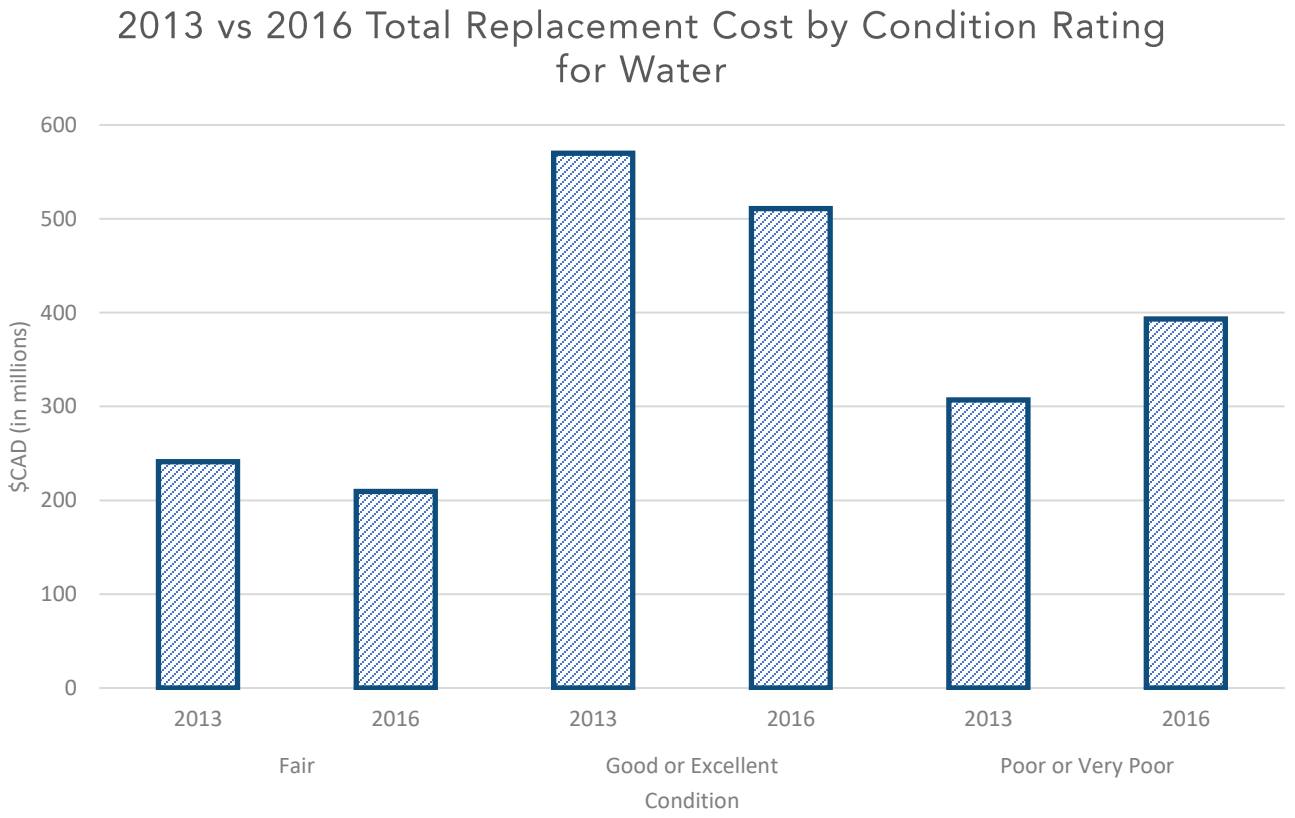
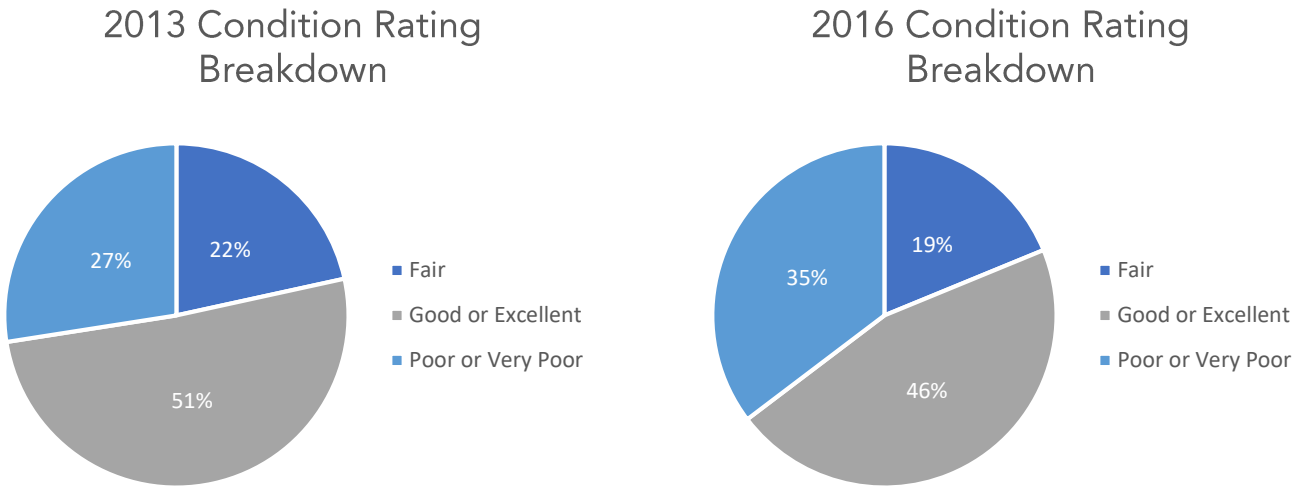


Figure 42



Figures 43, 44

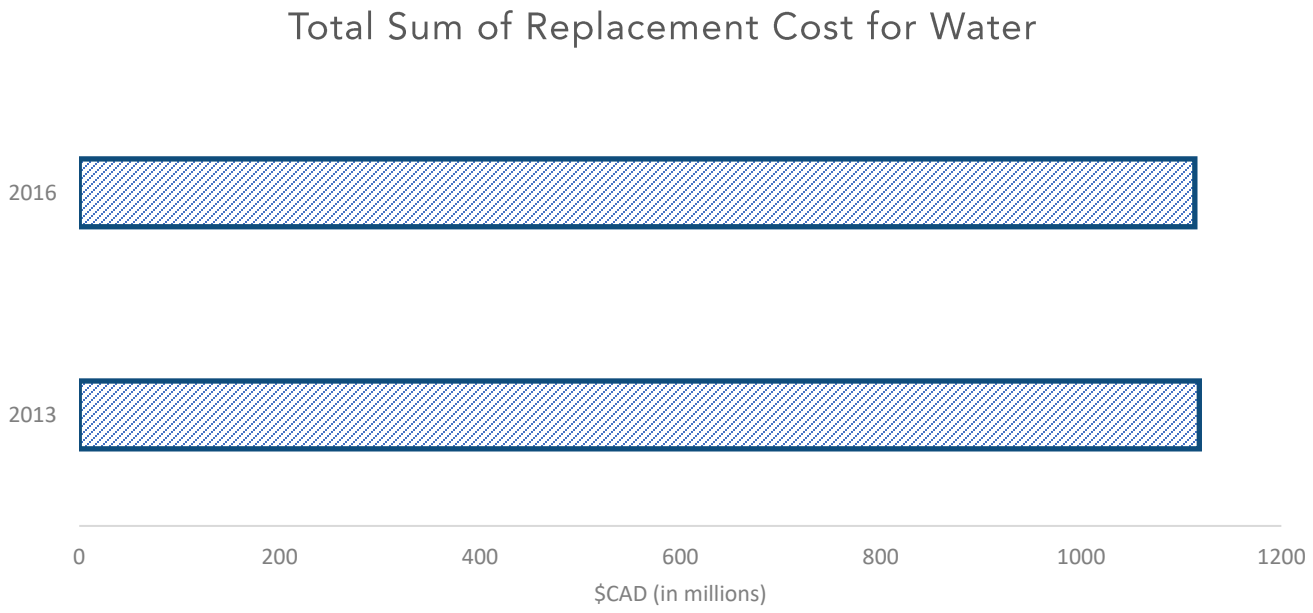


Figure 45

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