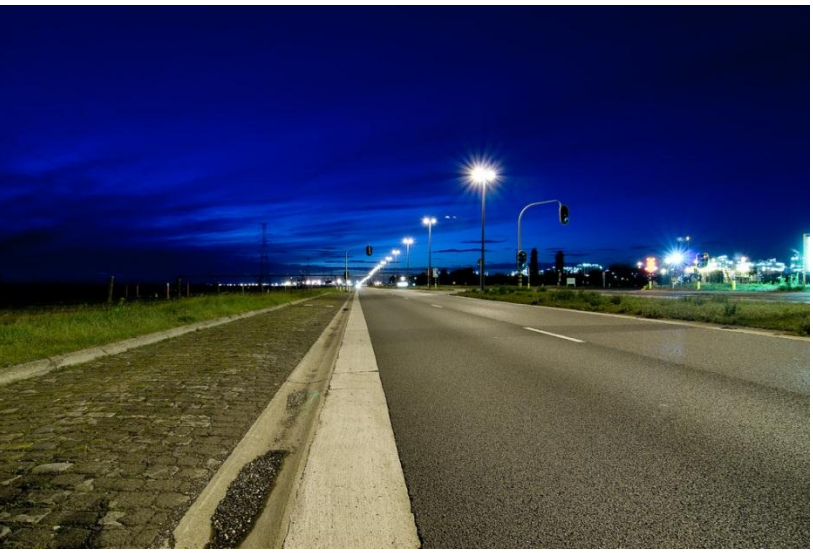
THE STATE OF ONTARIO'S ROADS AND BRIDGES

AN ANALYSIS OF 93 MUNICIPALITIES

2015

Prepared for the Association of Municipalities of Ontario



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Bringing aging capital infrastructure assets to a state of good repair in Ontario's 444 municipalities undoubtedly requires significant financial investments over the coming years and decades. Previous studies have attempted to outline the state of the infrastructure in Canada, regionally and nationally, primarily using survey methods and economic and/or financial modelling.

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 asses, 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.

3. The *2012 Canadian Infrastructure Report Card* surveyed 123 municipalities across Canada on the condition of four major asset classes: **water**, **waste water**, **storm**, and **roads**. The study suggested that $171.8 billion was needed to replace assets ranked as "fair" to "poor."[2]

This report seeks to add to the discussion by enumerating the state of **roads**, **bridges**, and **culverts** for 93 Ontario municipalities. The estimates in this report use best available information with regards to actual field condition assessments as available (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).

Since 2010, Ontario municipalities have spent nearly $6 billion from all sources on construction and additions & betterments for paved roads, bridges, and culverts.[3] In fact, 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 daunting.

Our study suggests that more than $5.1 billion is needed today, by the 93 municipalities in our sample alone, to replace assets which have reached the end of their lifecycle. Paved roads comprise more than 80% of this deficit.

In addition to the current deficit, the annual infrastructure investment gap for our sample of 93 municipalities totals nearly $462 million. This is the difference between annual lifecycle needs and the amount currently allocated for this purpose from all sources.

Eliminating both the infrastructure deficit and the annual investment gap is a commitment that will span decades and will require financial resources from all orders of government. We are confident that our analysis will further the discussion on this centrally important matter which is essential for the economic growth and prosperity of Ontario and Canada.

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[1] Saeed Mirza, *Danger Ahead: The Coming Collapse of Canada's Municipal Infrastructure (accessed June 20, 2014); available from http://www.fcm.ca.*

[2] *Canadian Infrastructure Report Card, Volume 1: 2012, Municipal Roads and Water Systems* (accessed May 15, 2014)*;* available from http://www.canadainfrastructure.ca/downloads/Canadian_Infrastructure_Report_Card_EN.pdf.

[3] Net Expenditures = [(Additions and Betterments) + (Expenditures)] - (Capitalized Assets). See FIR Provincial Summaries on http://csconramp.mah.gov.on.ca/fir/Welcome.htm

I. HIGHLIGHTS

1. Field level condition assessments are essential to accurately quantify the infrastructure deficit and annual investment gap. Condition ratings should be routinely gathered as part of effective asset management practices. Additional support is needed to do this and to advance asset management.

2. If field condition data is replaced with only PSAB 3150 data, the percentage of assets in poor condition increases and the percentage of assets in fair or better conditions decreases across each asset class in our sample.

3. Evidence indicates that assets with condition ratings are performing better than their age and expected useful life would suggest.

4. Assets which are in poor or very poor condition are more likely to be classified as such according to PSAB 3150, age-based data, whereas those which are rated as fair, good, or excellent generally have field condition assessments data available

5. Out of the $23 billion of paved roads analyzed in our sample, more than one third are in poor to very poor condition.

6. Bridges and culverts, valued at $5 billion based on 2013 replacement costs, fared similarly to paved roads, with 26% of bridges and 34% of culverts in poor condition with a Bridge Condition Index of less than 60.

7. The current **infrastructure deficit**, i.e., the investment needed today to replace assets which have already reached the end of their lifecycle, totals $5.1 billion for our sample of 93 municipalities. Paved roads make up more than $4 billion of this deficit.

8. The **annual investment gap**, i.e., the difference between average annual infrastructure requirements and actual funding available, totals $462 million for our sample.

9. On average, the federal Gas Tax Fund accounts for 29% of the annual funding allocated by municipalities for roads, bridges, and culverts.

10. The total reserves in our sample dedicated specifically to roads, bridges, and culverts are less than 7% of the $5 billion infrastructure deficit.

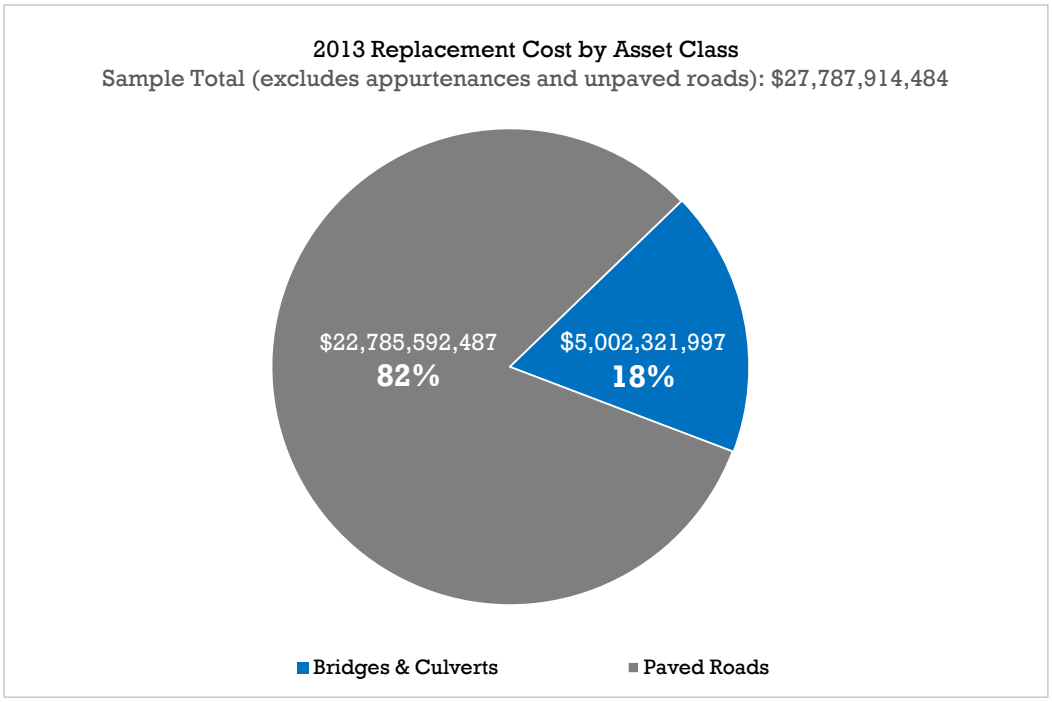
11. Additional studies are needed to evaluate the use of debt and reserves in municipalities.

II. SAMPLE AND 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 PSAB 3150 financial data, and field condition assessment data as available. We then aggregated this data to form strictly objective, quantitative conclusions about the sample.

Total Replacement Cost

The 2013 replacement cost of roads (including appurtenances such as sidewalks, curbs, lights, etc.), bridges, and culverts across 93 Ontario municipalities evaluated in this study equalled $32 billion, including unpaved roads.[4] We assessed 1.2 million m^2 of bridges and culverts, 54.4 thousand lane kilometers of paved roads, and 23 thousand lane kilometers of unpaved roads.[5] As unpaved roads require perpetual maintenance, they are excluded from the capital replacement analysis.



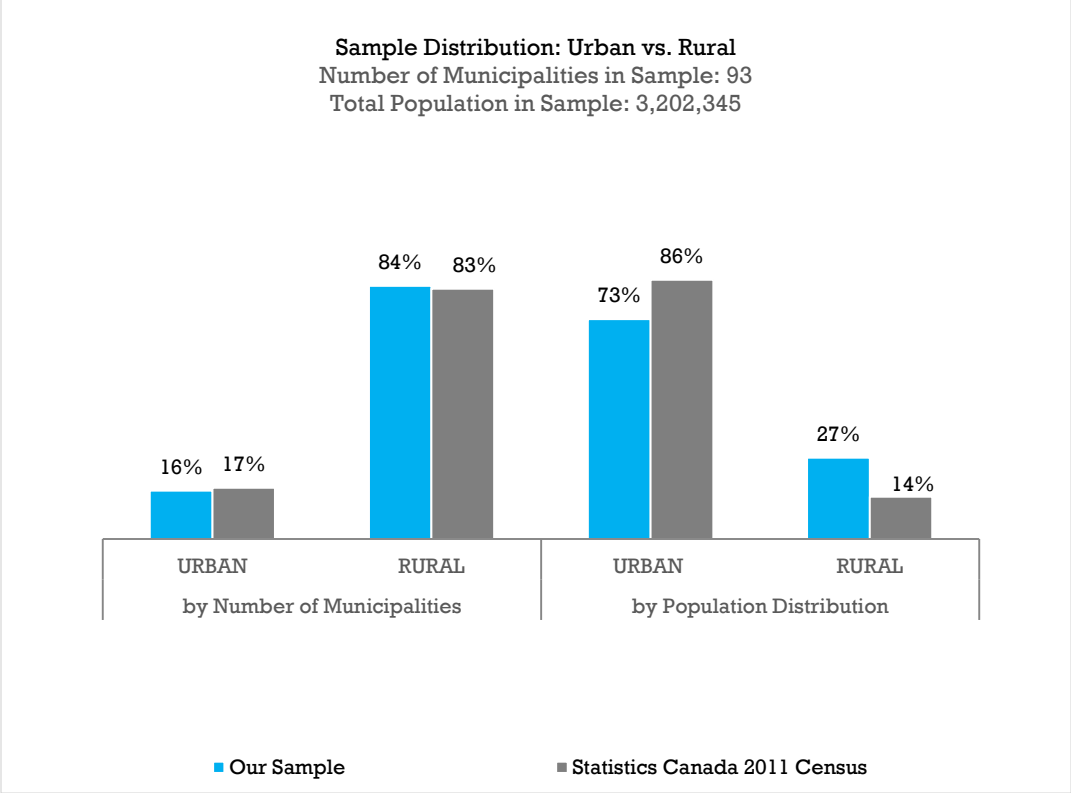
4 Appurtenances, e.g., guardrails, sidewalks, streetlights, comprise less than 5% of the assets studied in this report based on current replacement cost. Given the large number of different appurtenances, it would have been too cumbersome to include separate condition graphs for each group type. As such, they have been excluded from discussions of condition for simplicity. Appurtenances are included in the financial analysis.

5 Paved roads include high class bituminous (HCB), low class bituminous (LCB), asphalt, concrete, surface treated, tar & chip, and brick. Bridges in our sample included concrete, wood, and steel structures.

Sample Selection & Description

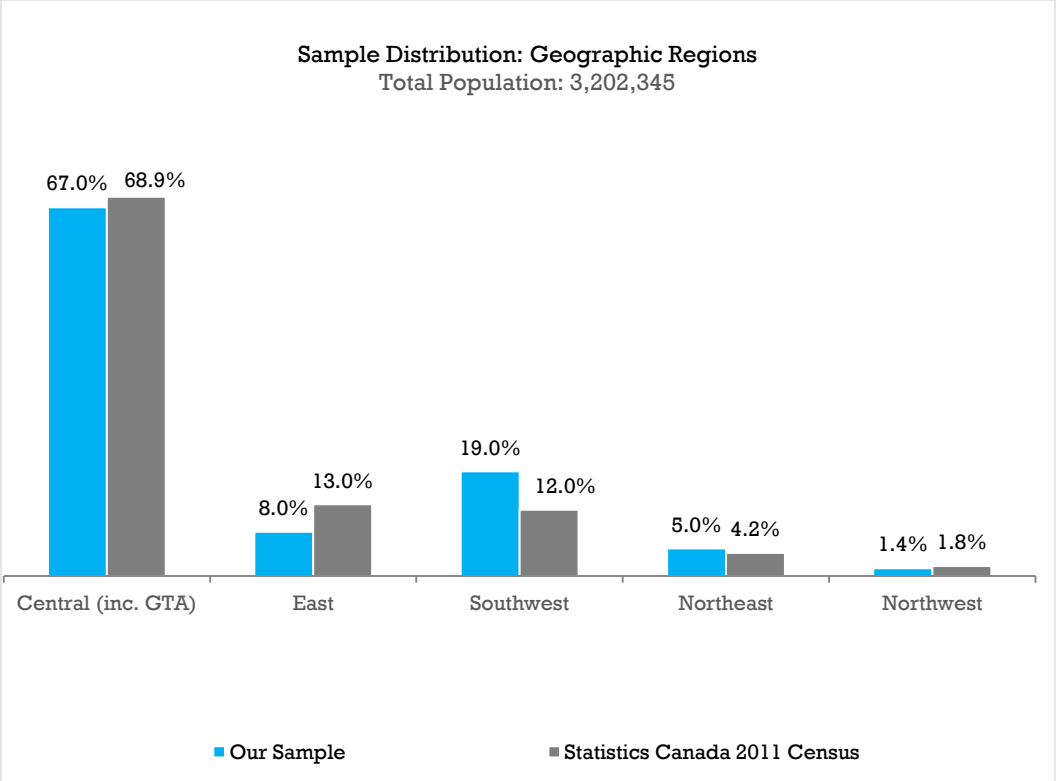
We selected our sample of 93 municipalities across Ontario based on only one, central criterion: completeness of infrastructure data. Municipalities with insufficient infrastructure data which would have undermined our estimates and conclusions were not included. As such, this approach unintentionally led to an underrepresentation of some geographic regions.

The sample in our study has a total population of 3.2 million, with 93 municipalities making up 21% of Ontario's 444 local governments and 24% of the provincial population. We classified each municipality as urban or rural based on the 2011 Rural and Small Communities Measure (RSCM), which measures the percentage of a municipality's population living in a rural area or small community.[6] Municipalities with an RSCM of 25% or greater are classified as rural. We also segmented municipalities into seven levels based on population.



[6] *Ontario Municipal Partnership Fund 2011 Technical Guide* (accessed June 1st, 2014); available from http://www.fin.gov.on.ca/en/budget/ompf/2011/techguide.html#rascome.

Our sample parallels official Statistics Canada measurements, both on an urban vs. rural comparison as well as geographic distribution. The geographic segmentation of our market is retrieved from the Financial Information Return (FIR) as completed by each municipality. The five major regions included in this report are: Northeastern Ontario; Northwestern Ontario; Eastern Ontario; Southwestern Ontario; and Central Ontario (including the Greater Toronto and Hamilton Area).



Condition Data

The findings on the state of infrastructure for our sample are derived from actual field condition assessments as provided by municipalities and detailed financial data that is in compliance with PSAB 3150 reporting standards. The following tables show condition descriptors and ranges we used to describe the state of the infrastructure throughout this report. To describe bridges and culverts, we used the guidelines outlined in the Ontario Ministry of Transportation's Bridge Condition Index (BCI).

Paved Roads
(CityWide® Software Solutions Methodology)

Condition	Scale (0-100)	Description
Good or Excellent	75-100	Minor deterioration
Fair	50-75	Noticeable deterioration; function is affected
Poor or Very Poor	0 – 50	Significant deterioration in asset function; assets may no longer be functional

Bridges and Culverts
(Ministry of Transportation Bridge Condition Index)

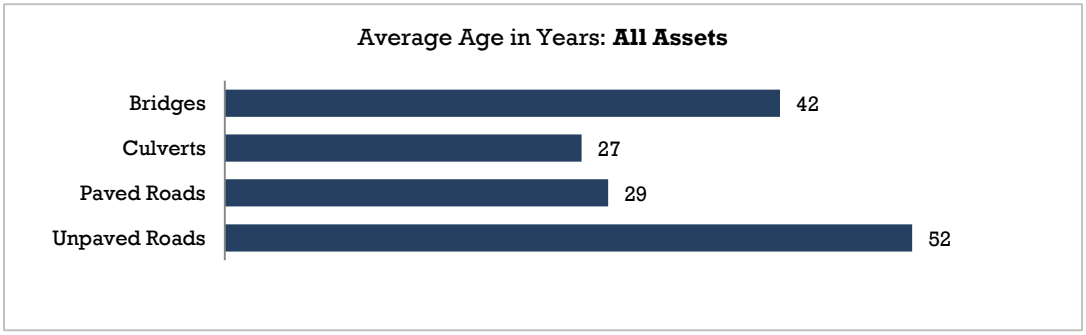
Condition	Scale (0-100)	Description
Good	70-100	Maintenance work not required within the next five years
Fair	60-70	Maintenance work likely required within the next five years
Poor	Less than 60	Maintenance work scheduled within the next year

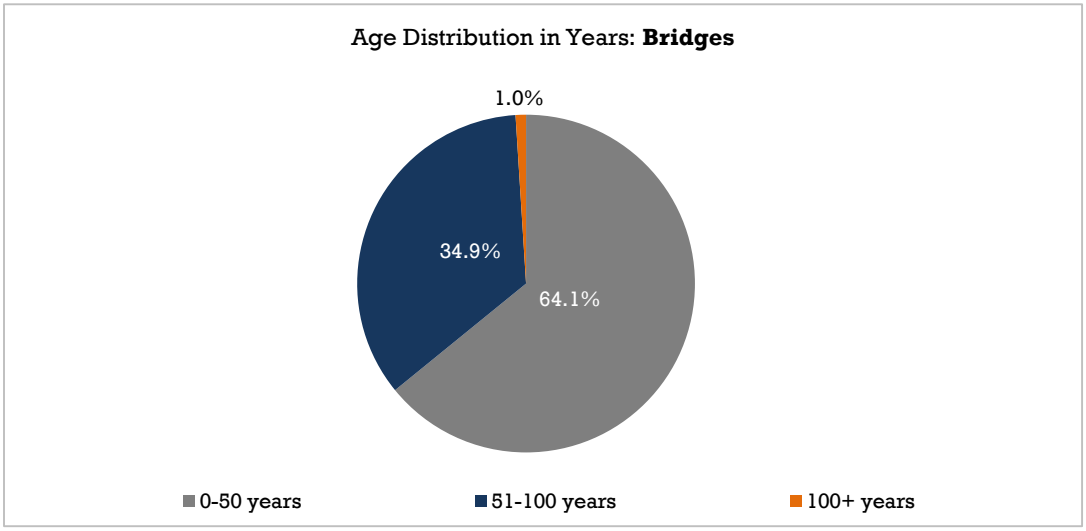
Municipalities are required to perform biennial inspections for bridges and culverts over 3m using the Ontario Structure Inspection Manual (OSIM). However, this data was not always readily available or provided. In the absence of condition data, we used PSAB 3150 data on age and expected useful life of an asset as a proxy.

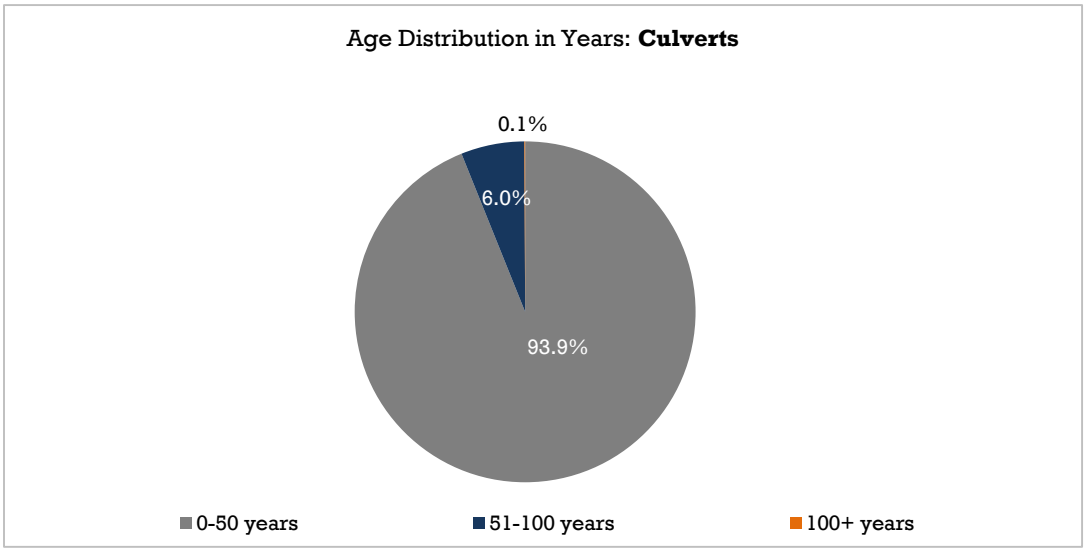
Out of 93 municipalities in our sample, 66 municipalities provided feedback regarding inspection histories for bridges, and 58 for paved roads. For bridges, 54 had conducted an assessment in the last two years. For roads, 37 municipalities out of 58 respondents had conducted an inspection in the last three years.

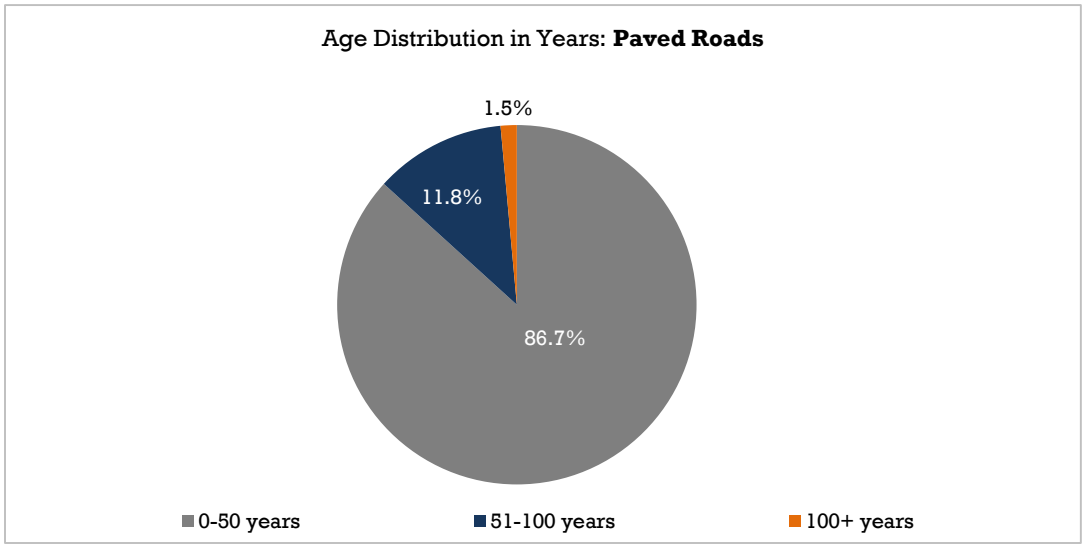
Age of Assets

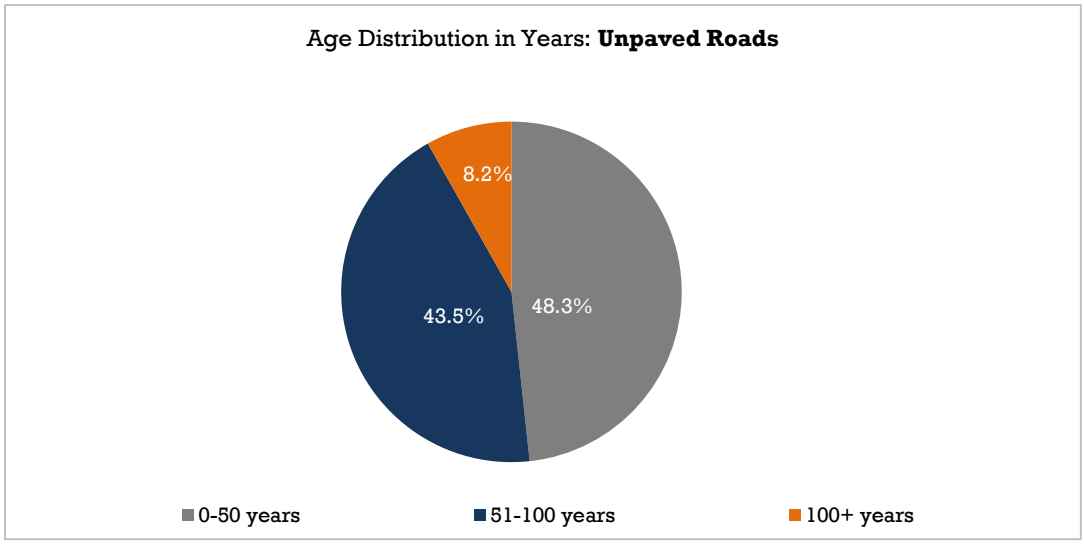
The sample of 93 Ontario municipalities in this report is assessed against two critical, broad criteria: condition of the infrastructure, and whether the municipalities are setting aside sufficient funds each year to meet their infrastructure replacement needs once assets reach the end of their lifecycle. After unpaved roads with an average age of 52 years, bridges were the second oldest asset group in our sample, with an average age of 42 years. The distribution of age within each asset class is also shown.





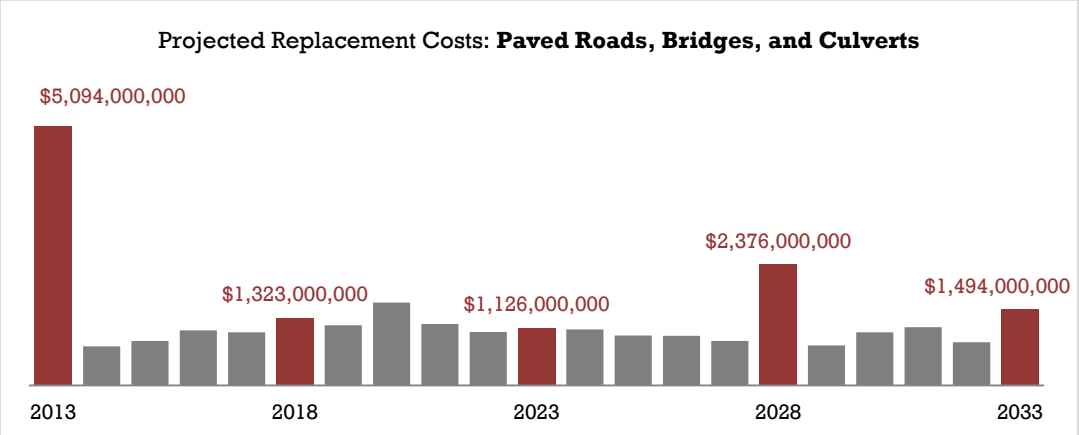



Age Distribution in Years: **Paved Roads**
1.5%
11.8%
86.7%
0-50 years
51-100 years
100+ years


Age Distribution in Years: **Unpaved Roads**
8.2%
43.5%
48.3%
0-50 years
51-100 years
100+ years

Projected Replacement Costs

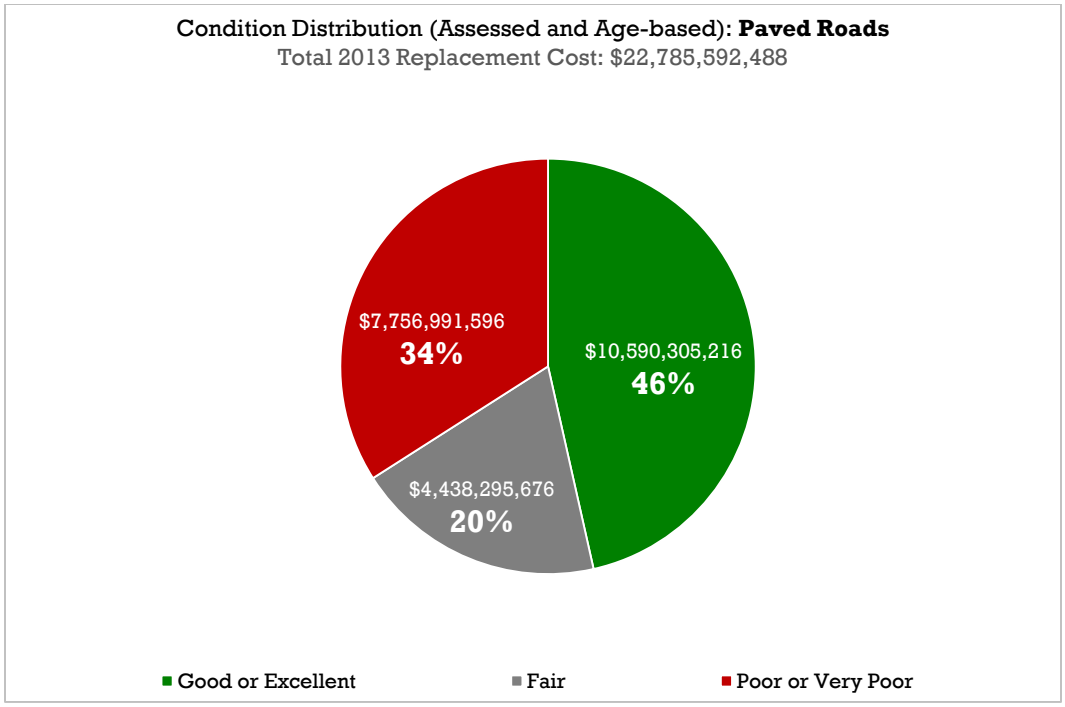
To determine projected replacement costs over the next 20 years, we conducted a lifecycle analysis for all paved roads, bridges, and culverts analysed in this group. The following graph shows the annual amount required by all municipalities in our sample to replace assets as they reach the end of their lifecycles each year.



The estimate in 2013 also represents the current infrastructure deficit of approximately $5.1 billion. This is the investment needed today to replace assets which had already reached the end of their lifecycles or had been fully amortized as of 2013. 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.

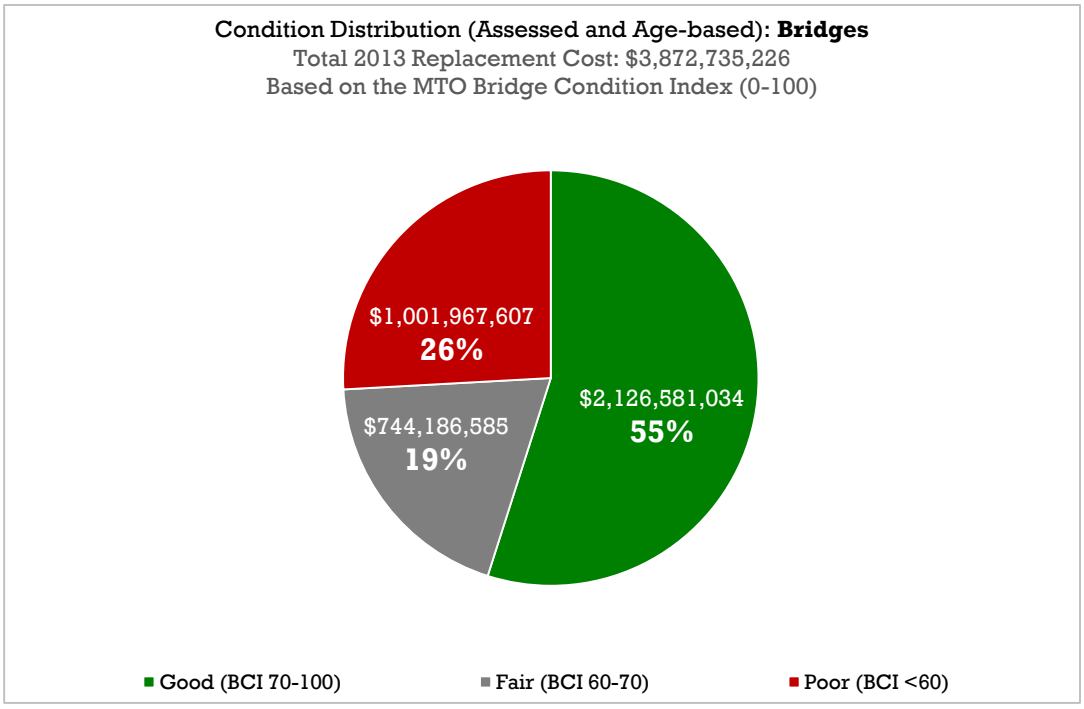
Condition

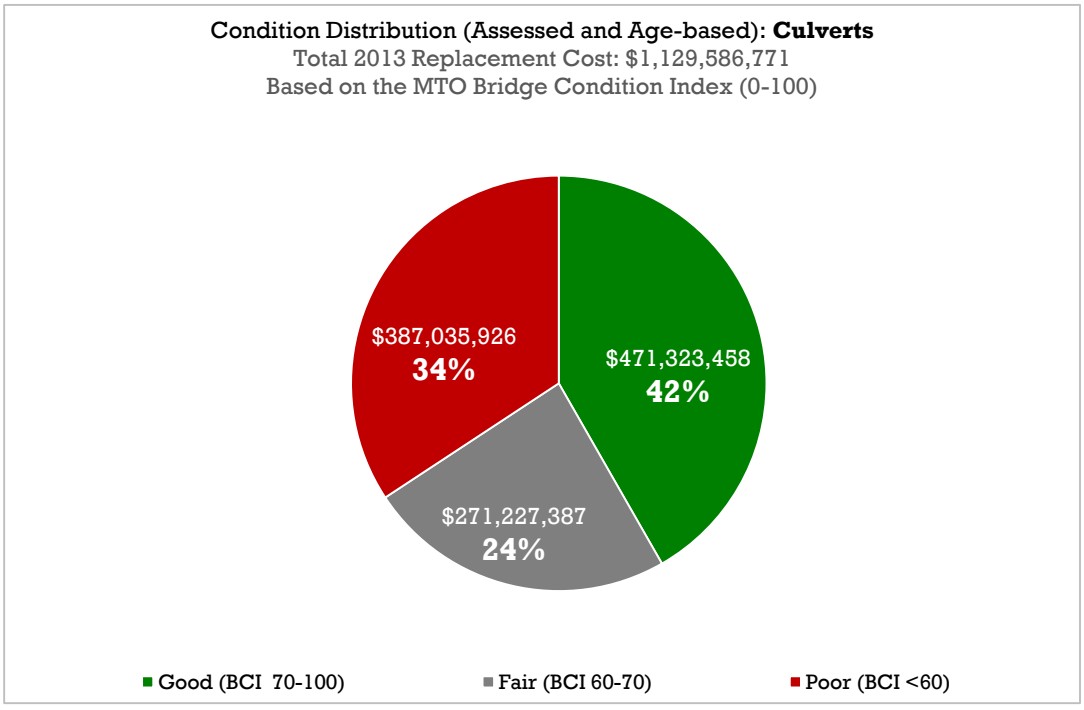
Using assessed condition data and PSAB 3150 age-based data, our analysis shows that out of a total 2013 replacement cost of nearly $23 billion[7], 34% of paved roads totalling nearly $8 billion are in poor to very poor condition, indicative of either a late lifecycle stage or significant defects.



For bridges and culverts, we referred to the Bridge Condition Index from the Ontario Ministry of Transportation (MTO) as a guideline for classifying asset health based on a numeric scale (See page 8 for full description). Once again, we used available condition assessment reports when they were provided by the municipalities, or PSAB 3150 data in the absence of such information. Our analysis shows that 26% of bridges and 34% of culverts in our sample are in poor condition, with a BCI of less than 60 out of 100.

[7] Excluding appurtenances.


Condition Distribution (Assessed and Age-based): **Bridges**
Total 2013 Replacement Cost: $3,872,735,226
Based on the MTO Bridge Condition Index (0-100)
$1,001,967,607
26%
$2,126,581,034
55%
$744,186,585
19%
Good (BCI 70-100)
Fair (BCI 60-70)
Poor (BCI <60)


Condition Distribution (Assessed and Age-based): **Culverts**
Total 2013 Replacement Cost: $1,129,586,771
Based on the MTO Bridge Condition Index (0-100)
$387,035,926
34%
$471,323,458
42%
$271,227,387
24%
Good (BCI 70-100)
Fair (BCI 60-70)
Poor (BCI <60)

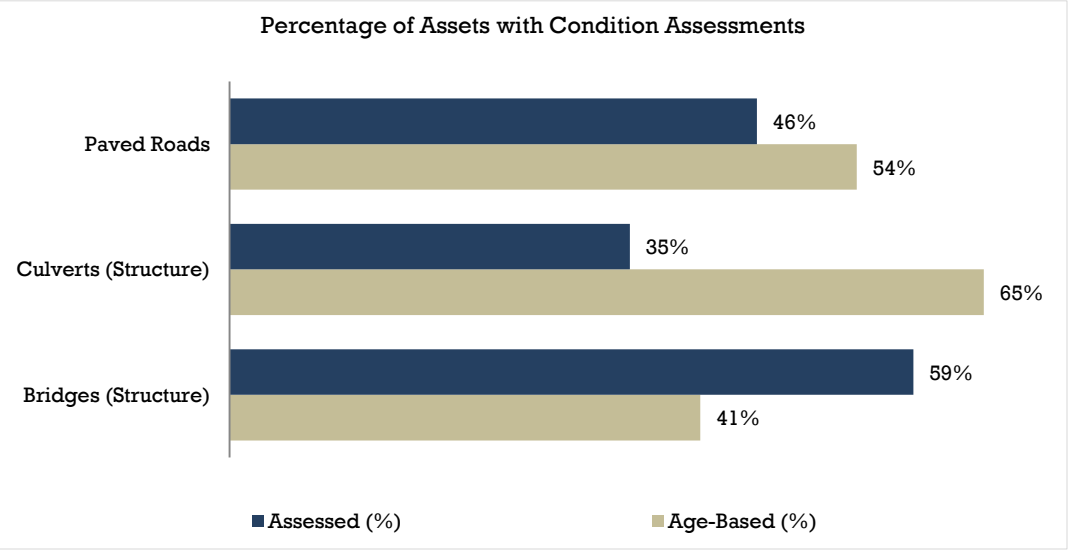
We also conducted condition analysis based on the Rural and Small Communities Measure (RSCM). Out of our sample of 93 municipalities, 78 were identified as rural and 15 as urban. Rural communities represent approximately 27% of the total population of our sample and own 35% of roads, bridges, and culverts analyzed in this report.

More than 40% of the paved roads in rural communities in our sample, with a 2013 replacement cost of nearly $3 billion, are in poor to very poor condition. Approximately 30% of bridges and nearly 40% of culverts in rural communities in our sample are in poor condition.

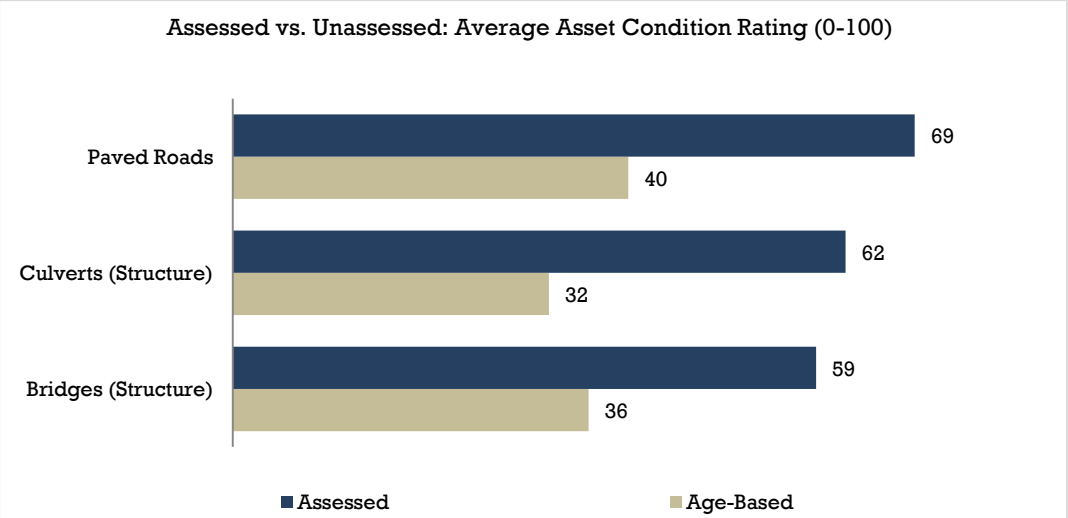
Roads, bridges, and culverts in urban municipalities make up 67%, or $18.5 billion, of our sample's total 2013 replacement cost. Nearly one third of the paved roads in urban communities in our sample are in poor to very poor condition. Bridges and culverts fared better, with less than 20% of bridges and approximately 33% of culverts in poor condition.

The Case for Condition Assessments

The use of field assessment data certainly provides a more accurate description of actual asset conditions. Our findings are based on both field condition assessments and age-based, PSAB 3150 financial data.

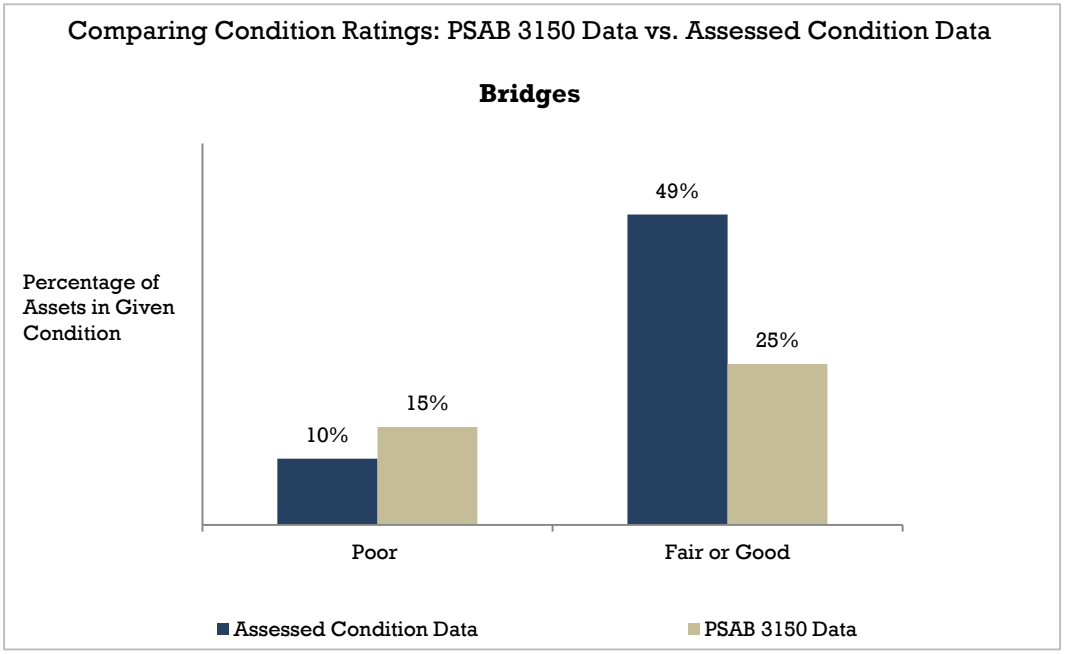


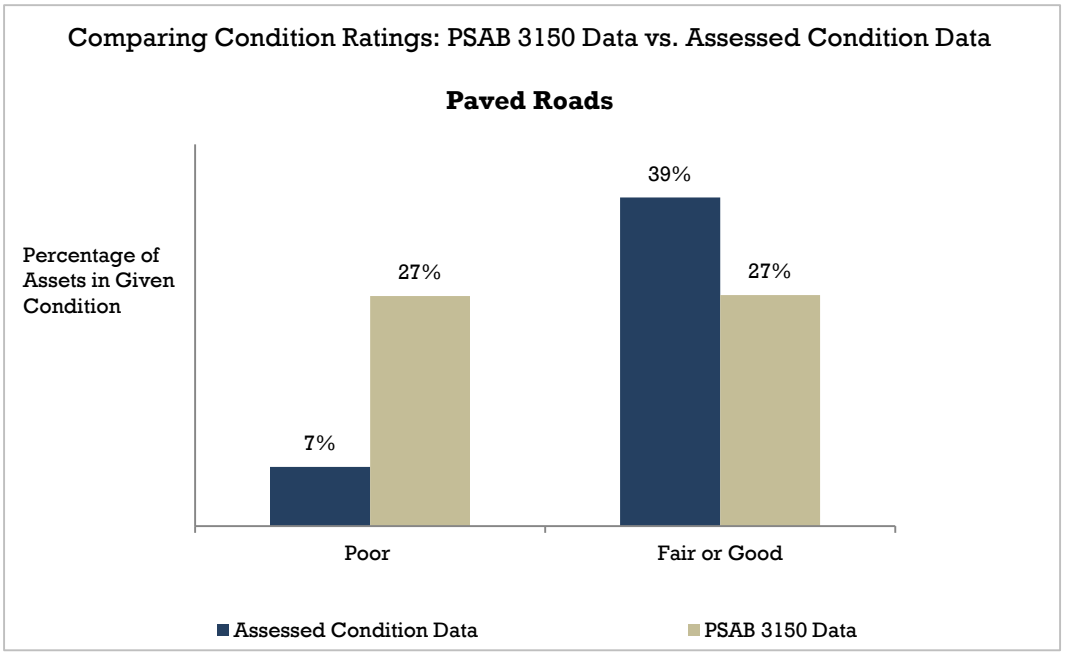
In our sample, we saw a noticeable, expected difference in condition when comparing assessed data with age-based data. In fact, for each asset group, field data based condition ratings were significantly higher than age-based condition ratings, with paved roads, culverts, and bridges showing an increase in score (0-100), of +29, +30, and +23 points, respectively. In other words, assets are performing better than age and expected useful life would suggest.



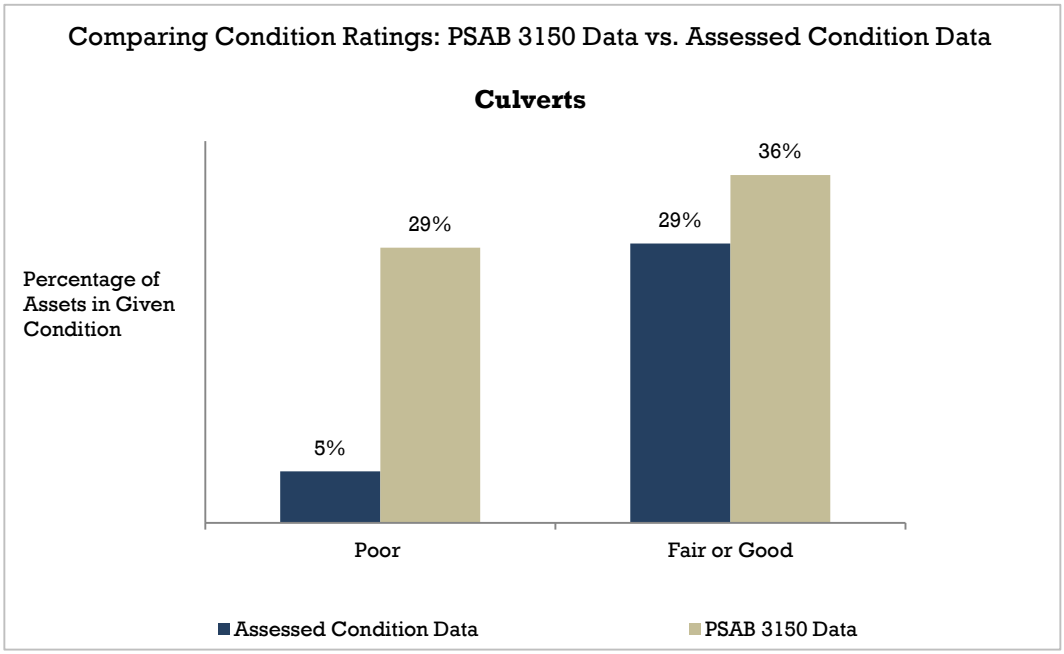
Our data suggests that assets which are classified as poor or very poor generally do not have field condition assessment data available. Rather, they're likely classified as such based only on PSAB 3150 data.

In the graphs below, we see that the majority of bridges and paved roads rated as poor or very poor are classified as such based on PSAB 3150 data. Conversely, the majority of assets in both classes rated as fair or better are classified as such based on field condition data.



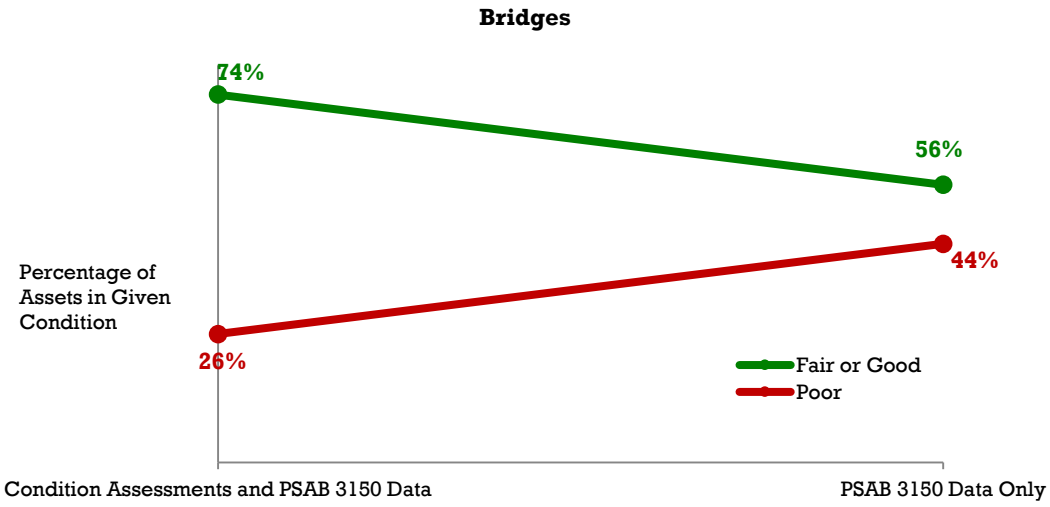


While this trend does not apply to culverts, the percentage of assets rated as poor based on field condition assessments is significantly smaller than those classified as such based only on PSAB 3150 data. There is also a much larger portion of assets with condition data available in the fair or better group.



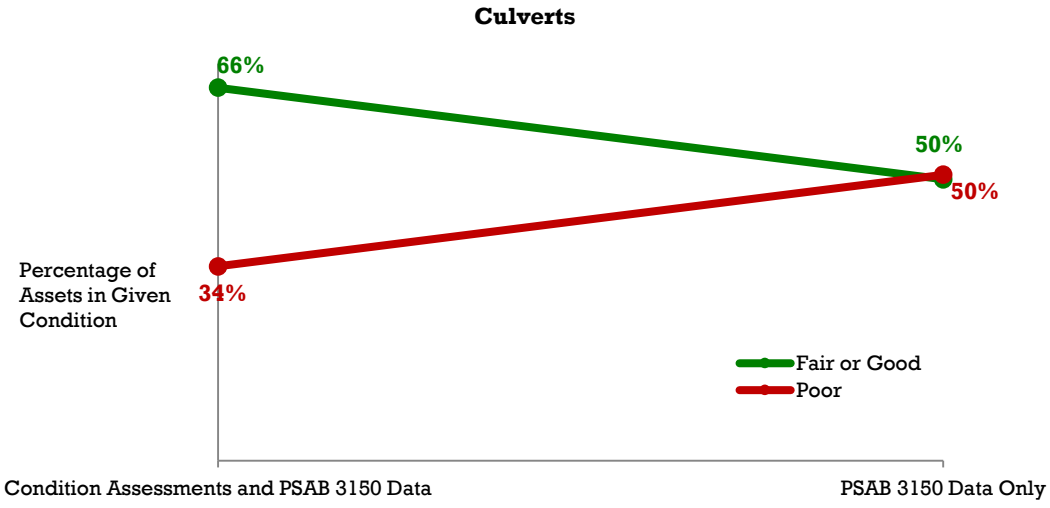
We also conducted a scenario analysis by temporarily excluding condition assessment data to generate hypothetical condition ratings using only age-based data. This experiment revealed that when only PSAB 3150 data is used, the overall asset condition rating for an asset group worsens, i.e., the portion of assets in fair, good, or excellent condition decreases while the portion of assets in poor or very poor conditions increases.

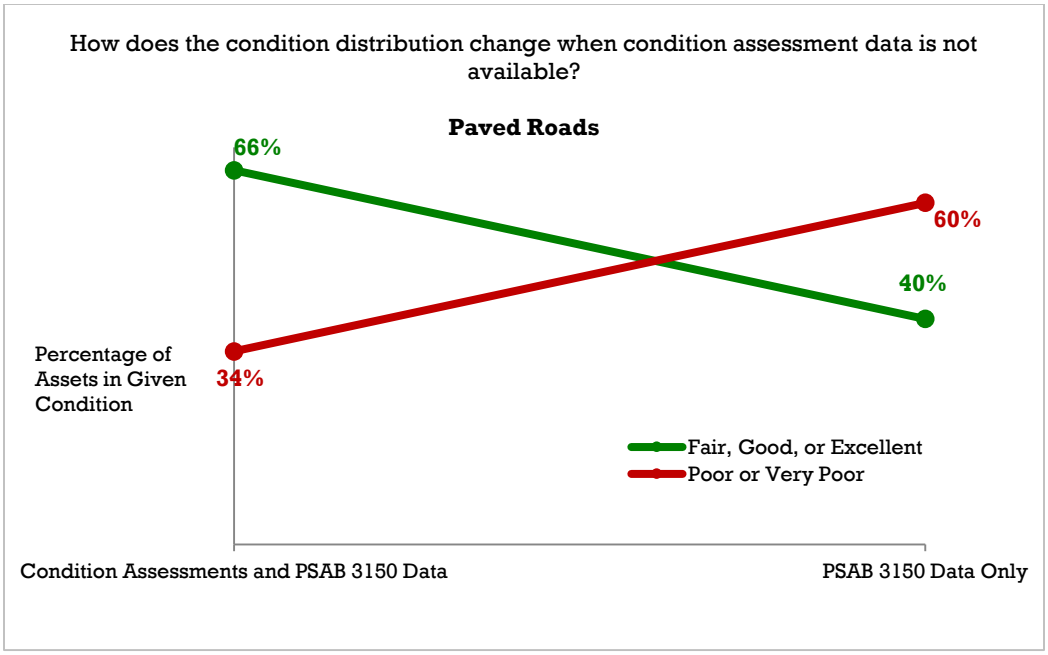
How does the condition distribution change when condition assessment data is not available?



For example, in the above graph, after removing all available condition data for bridges and replacing it with PSAB 3150 data, we observe that the percentage of bridges in fair or good condition dropped from 74% to 56% and those in poor condition increased from 26% to 44%. We see this pattern repeat for both culverts and paved roads in our sample.

How does the condition distribution change when condition assessment data is not available?





A similar analysis was conducted to determine the financial impact of condition assessments. After removing available condition assessments and replacing this data with PSAB 3150 data, our analysis suggests that the current deficit for our sample will increase by 40%, to over $7 billion. The lowest impact of this test was seen in bridges, for which the deficit increased by only 10%. Culverts experienced a 56% increase in the current deficit.

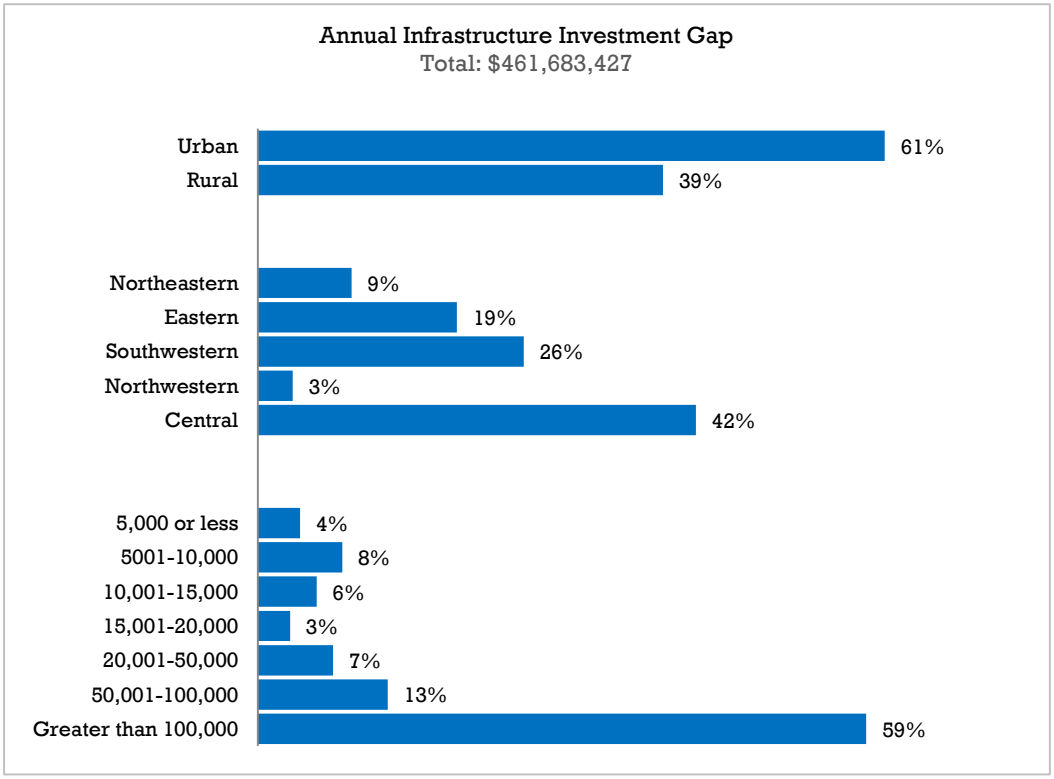
Funding and Need

A robust asset management plan (and accompanying long-term financial plan) sets aside sufficient funding to ensure that assets can be replaced when they are no longer functional. Considerable financial demands on local government budgets have made this difficult to achieve. This includes a variety of pressures, including fluctuations in provincial operating grants, increasing labour costs, and new or expanded mandates. It is also clear that solving the infrastructure deficit for roads, bridges, and culverts will require significant partnerships. No one order of government alone can provide the capital funding required on an annual basis to manage the significant gap.

Annual Investment Gap

To determine the annual investment gap (the difference between the amount of investments needed and the amount of funding available), we analyzed the funding municipalities in our sample had set aside in 2011, 2012, and 2013. 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. This produced the annual investment gap.

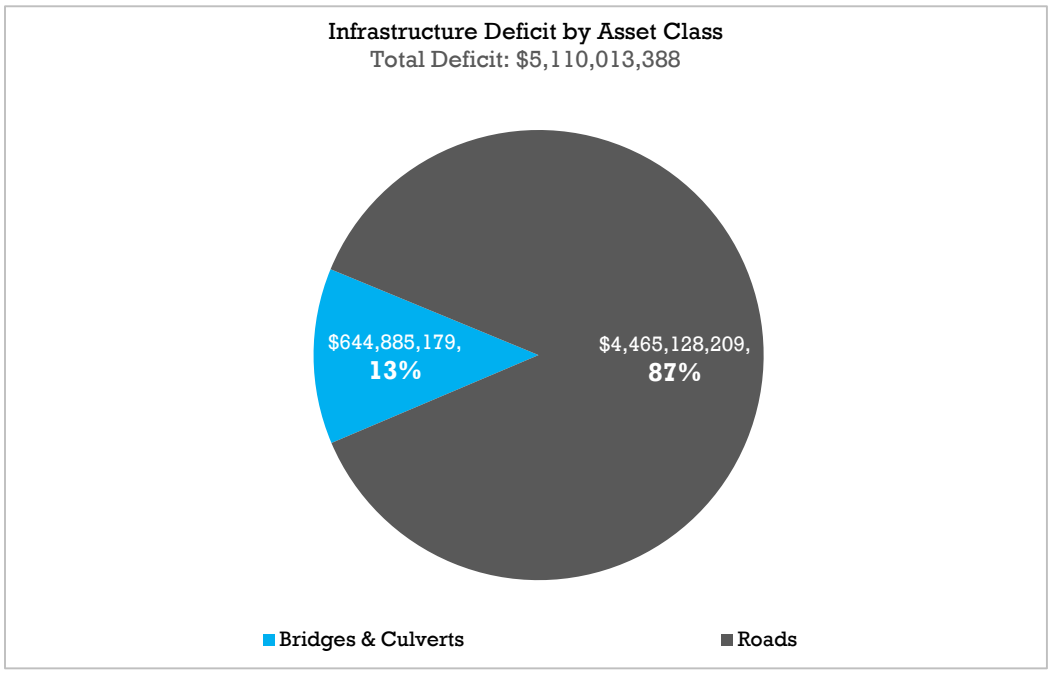
The total annual infrastructure investment gap for paved roads, bridges, and culverts for our sample is $462 million. This represents the difference between annual funding required for meeting infrastructure replacement needs, and the funding potentially available for this purpose. On a per capita basis, an individual's burden in our sample is $144, or $378 per household.

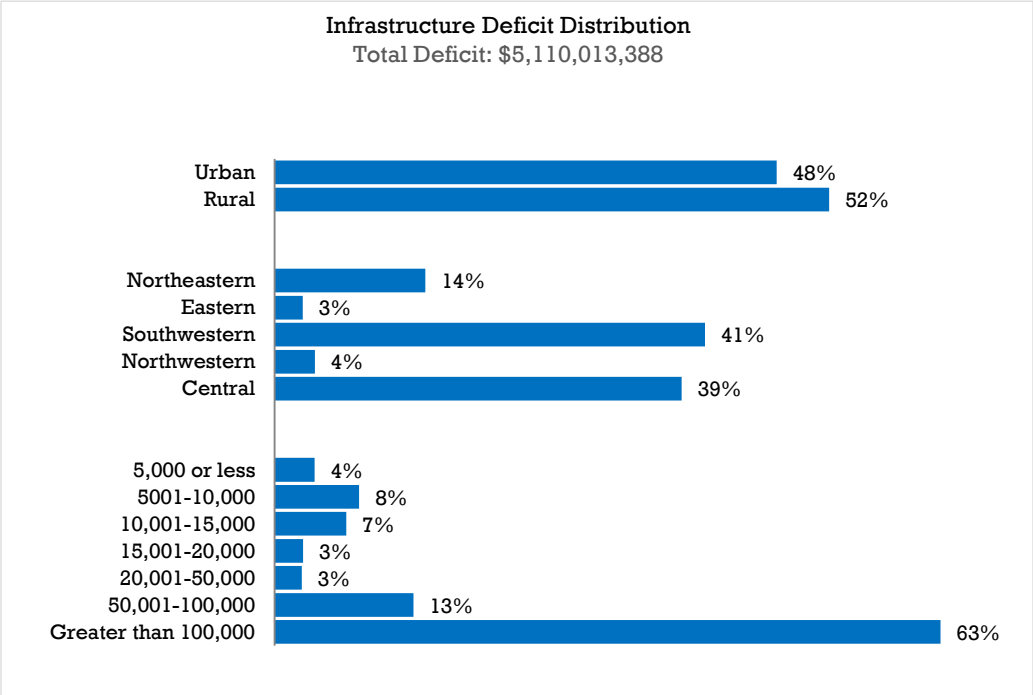


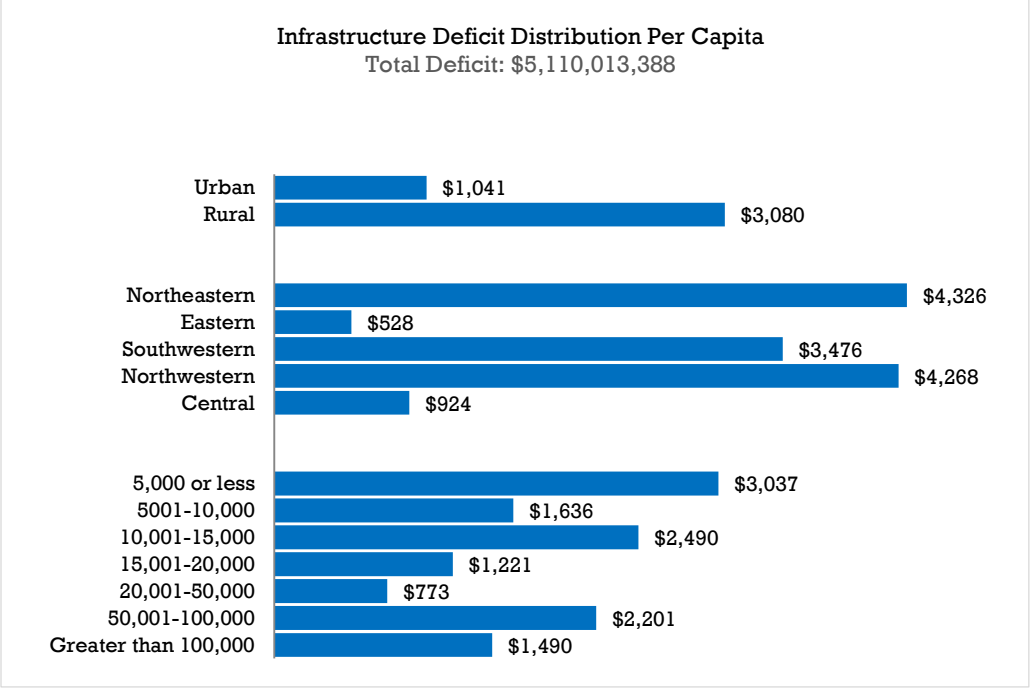
Urban municipalities and those with populations greater than 100,000 comprised 60% of this annual investment gap in our sample. On a per capita basis, however, these municipalities as well as those found in Central Ontario, place the lowest annual burden on individuals; Eastern and Northwestern rank highest in terms of an individual's share of the annual infrastructure investment gap.

Infrastructure Deficit

For our sample alone, representing 24% of Ontario's population, the current infrastructure deficit for roads, bridges, and culverts totals $5.1 billion dollars, or $4,180 per household and $1,596 per capita. Roads comprise more than 80% of this figure. Based on the Rural and Small Community Measure (RSCM), rural communities, with less than 30% of the sample population, make up more than 50% of the deficit.



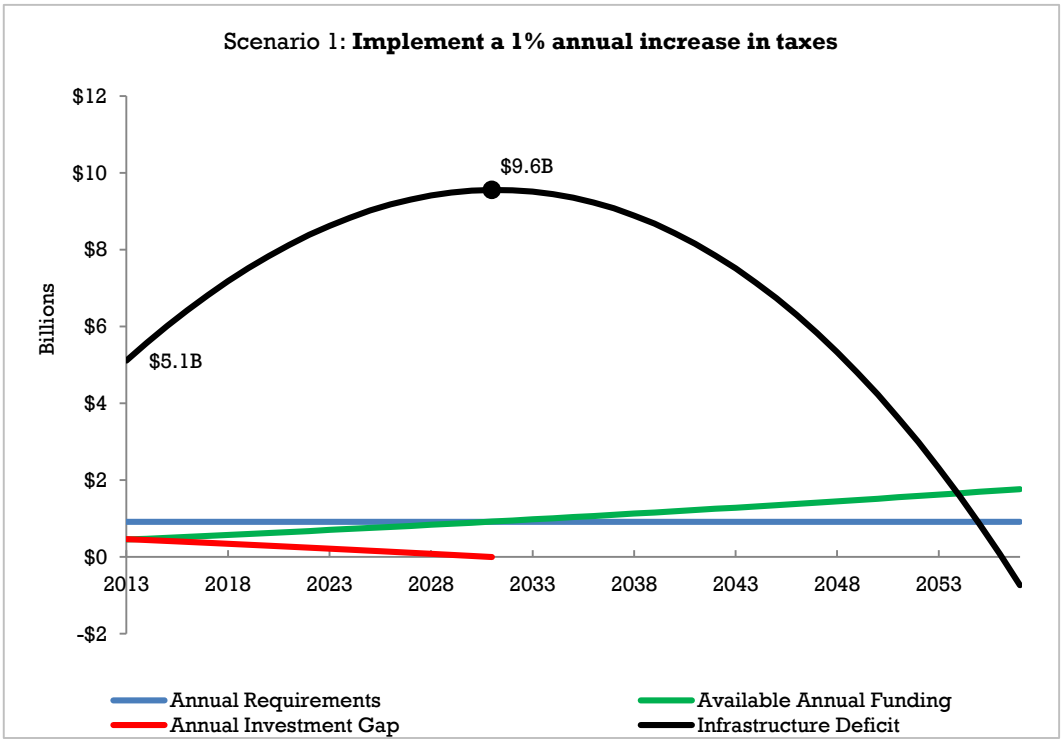




The infrastructure deficit is the investment needed today to replace assets which have either been fully amortized based on PSAB 3150 data, or have reached the end of their life cycles based on field condition assessments. Incorporating assets which are still operating in poor or very poor condition would amplify this deficit even further.

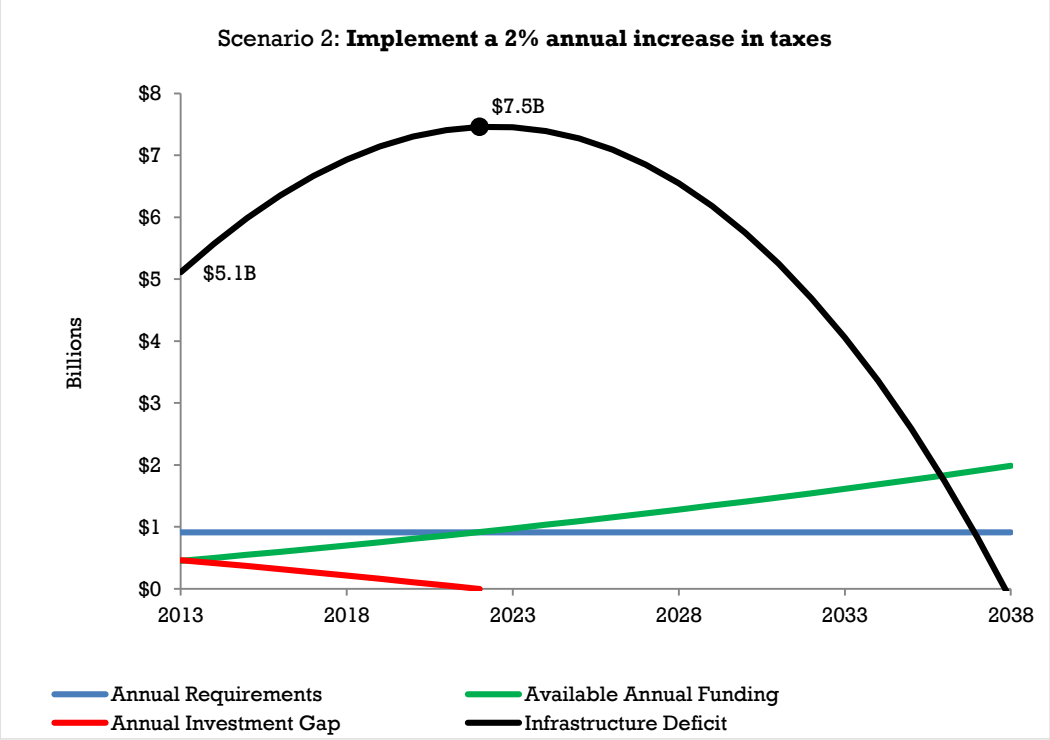
IV. ELIMINATING THE INFRASTRUCTURE DEFICIT

If current funding levels are maintained in our sample of 93 municipalities, annual investment gaps will persist and the $5.1 billion current infrastructure deficit will continue to climb indefinitely, reaching more than $14 billion by 2033.[8] Clearly, more funding and investment is needed. To determine the impact of additional resources on the annual investment gap and the infrastructure deficit, we developed two scenarios involving property tax increases on a sample wide basis. Of course, the impact of such increases will vary significantly across individual municipalities. Our modelling is presented at the aggregate level.

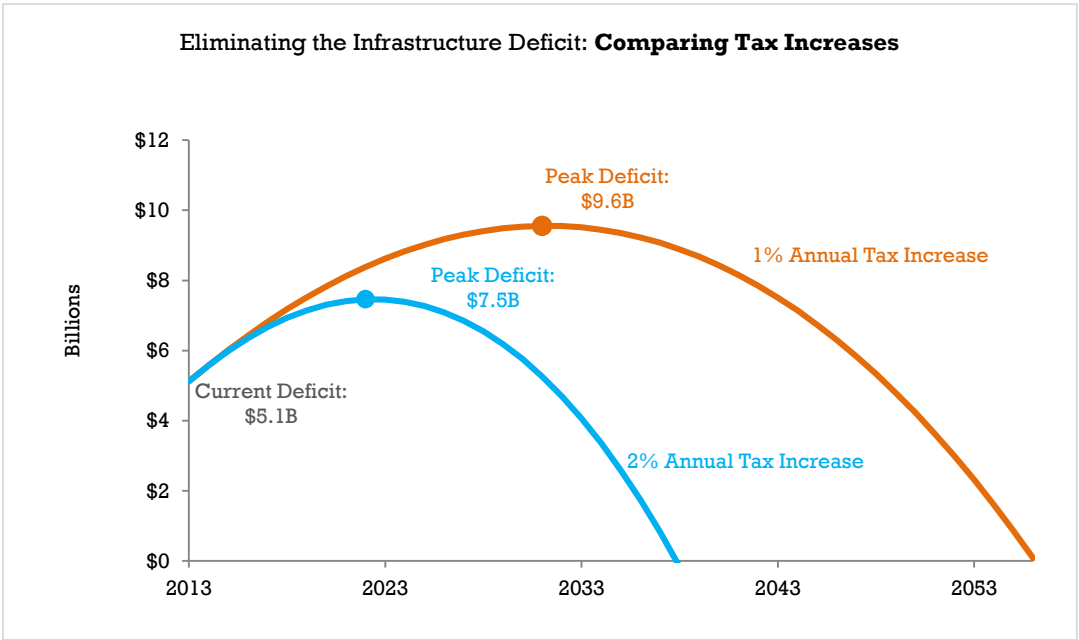


In the above graph, we implement a 1% increase in the aggregate annual property tax revenue for our sample. We allocate all of the additional revenue to existing annual funding for roads, bridges, and culverts. In this scenario, the infrastructure deficit peaks in 2031, reaching $9.6 billion. Additional funding each year means that the annual investment gap diminishes steadily until reaching $0 between the years 2030 and 2031. At this point, the infrastructure deficit begins to diminish precipitously, although it still persists for another two decades. After more than four decades following a 1% increase, the infrastructure deficit is fully addressed between the years 2056 and 2057.

[8] The deficit will grow each year by the annual investment gap of $462 million, which we hold constant for simplicity.



Following a procedure similar to Scenario 1, we implemented a 2% increase on the total property taxes collected by our sample. The annual investment gap is closed within 10 years following the annual tax increase. The infrastructure deficit peaks at $7.5 billion for our sample in the year 2022, and is fully addressed between 2037 and 2038, approximately 20 years before it is eliminated under a 1% increase. The graph below compares both scenarios and shows how the deficit is eliminated under a 1% and 2% increase in annual taxes.



V. THE FEDERAL GAS TAX

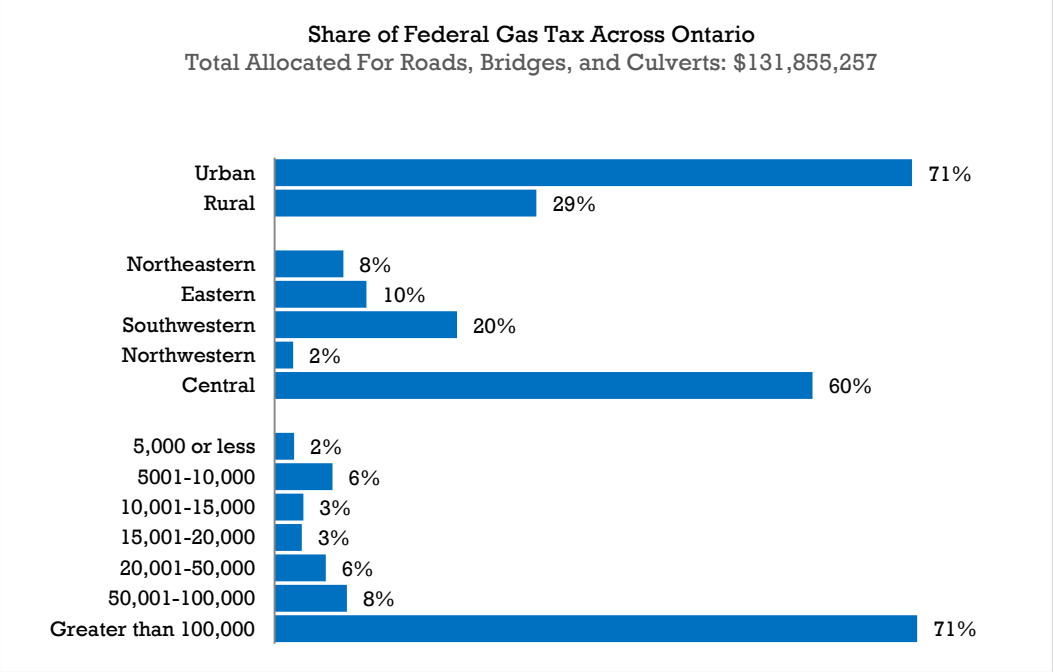
However imperious the challenge may appear today, governments across the globe are assigning greater resources to infrastructure sustainability. While the adequacy of their financial support can be duly contested, both the provincial and federal governments in Canada have made several significant commitments to supplement municipal infrastructure and asset management programs.

At the provincial level programs such as the Municipal Infrastructure Investment Initiative, Small, Rural and Northern Municipal Infrastructure Fund, Roads and Bridges Fund and Investing in Ontario funds have all supported municipal infrastructure. Recent commitments in the Ontario Budget to municipal infrastructure funding are also helpful.

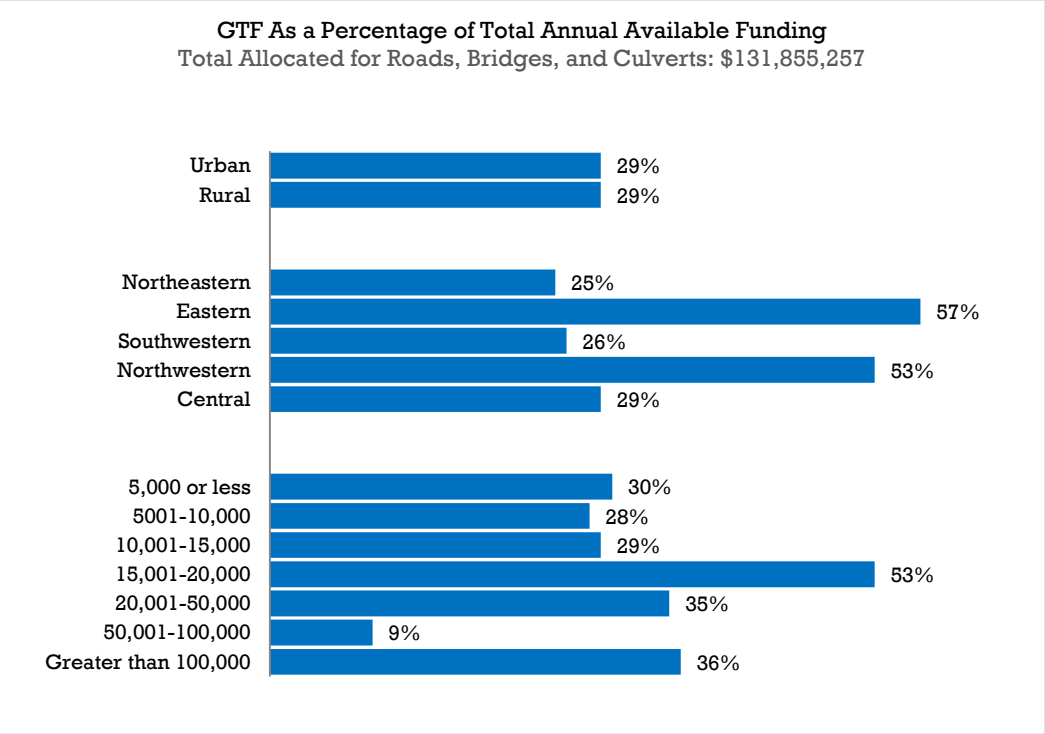
At the federal level, the 10-year, $53 billion New Building Canada Plan supports infrastructure advancement through two central mechanisms. The first, New Building Canada Fund (NBCF), worth $14 billion, will supplement the development of infrastructure projects deemed nationally, regionally, or locally significant. Secondly, the Community Improvement Fund avails over $32 billion to municipalities for capital projects, $22 billion ($2 billion per year over 10 years) of which will be administered through the renewed federal Gas Tax Fund (GTF). Between 2014 and 2019, Ontario's share of the GTF will total $3.874 billion, or $774 million per year. This is distributed on a per-capita basis, split 50/50 in Upper and Lower Tier municipalities.

The federal Gas Tax Fund can be invested in over seventeen eligible project categories; not just roads and bridges. Municipalities are required to demonstrate that asset management plans are being used to guide infrastructure planning and investment decisions made by local municipal councils. It is currently the only stable and predictable source of funding for municipal infrastructure.

In 2012, the sample of 93 municipalities in our study allocated approximately $132 million of federal Gas Tax funding towards roads, bridges, and culverts.



The federal Gas Tax Fund makes up, on average, 29% of the annual funding that municipalities in our sample set aside each year for investment in road, bridge and culvert infrastructure. The graph below shows how heavily or minimally municipalities in our sample rely on the GTF. For communities with a population between 15,001 and 20,000, the GTF comprises at least 50% of the annual funding allocated towards roads, bridges, and culverts. Both urban and rural communities rely equally on this source of funding.



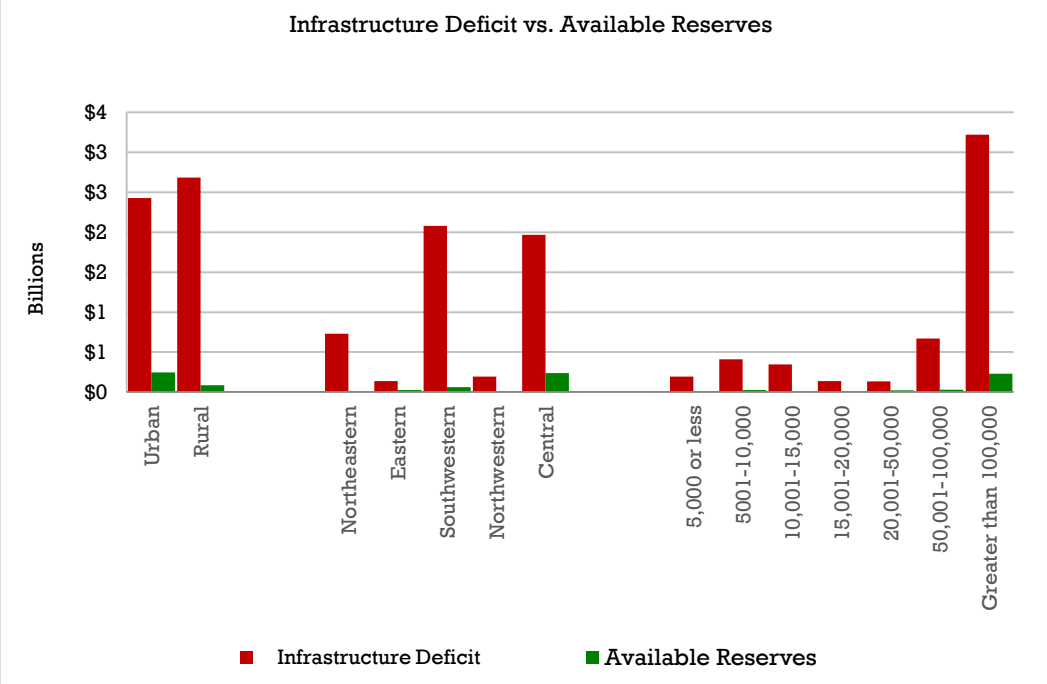
VI. USE OF RESERVES AND DEBT

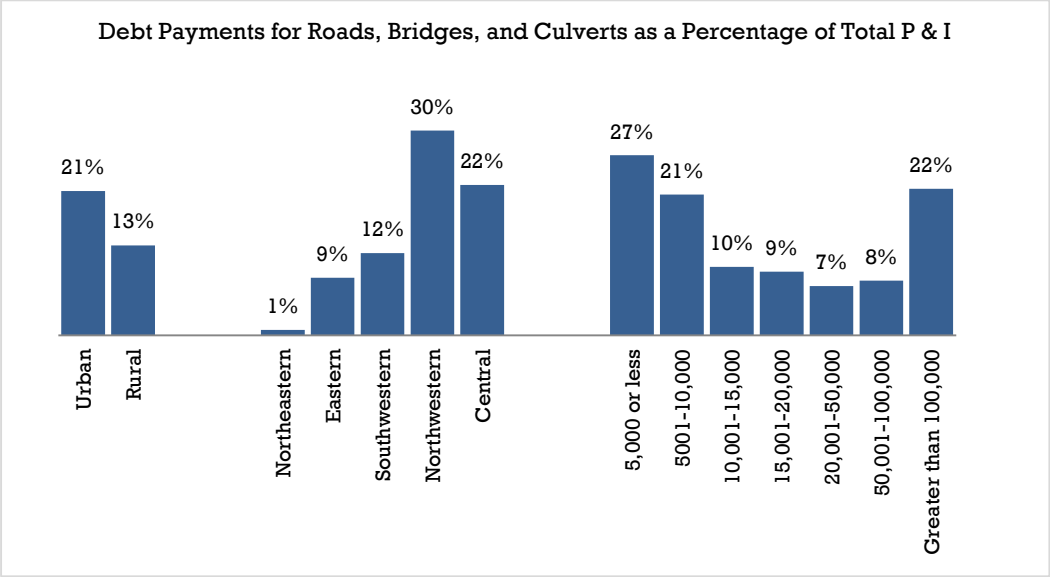
Reserves can play a critical role in long-term infrastructure planning. The benefits of having reserves available include:

1. the ability to stabilize tax rates when dealing with variable and uncontrollable factors
2. financing one-time or short-term investments
3. accumulating the funding for significant future infrastructure investments
4. managing the use of debt
5. normalizing infrastructure funding requirements

The reserves in our sample dedicated exclusively for roads, bridges, and culverts total approximately $329 million. However, this is less than 7% of the current infrastructure deficit of $5.1 billion.

As some asset classes have dedicated revenue streams (e.g., water), and some reserves are unrestricted, further study should be done on the availability and use of reserves with municipal governments in Ontario. While asset management is well underway, long-range financial planning is a best practice to be implemented over time.





As required, municipalities in our sample have remained within their provincially allowed debt limits. The principal and interest payments (P&I) for roads, bridges, and culverts related debt generally comprise, on average, less than 20% of the total municipal principal and interest payments. Further study should be done on the availability and use of debt with municipal governments in Ontario.

VII. LOOKING FORWARD

Our study relied on a comprehensive data set for paved roads, bridges, and culverts in 93 Ontario municipalities. We estimated that the infrastructure deficit for this sample alone reached over $5 billion, with an annual investment gap of $462 million, requiring decades of financial commitments.

An essential finding in our study was the value of condition assessments. Actual field condition assessments will provide more accurate data on the health of a municipality's infrastructure portfolio. This in turn will guide how funds are allocated for the life cycle requirements of capital assets. As such, their completion is an important element of any asset management plan. While more funding is needed to ultimately bring Ontario's infrastructure to a state of good repair, a strategic approach to asset management begins with better data.

The infrastructure challenge is all-consuming. It is evident that collaboration between governments, citizens, and other community partners is necessary to mitigate the infrastructure deficit.

VIII. GLOSSARY

Annual (infrastructure) investment gap
Each year, municipalities should set aside sufficient funding for infrastructure so that assets can be replaced upon reaching the end of their lifecycle. The annual investment gap is the annual shortfall in such funding.

Current Replacement Cost
The actual cost a municipality may incur to replace an asset in 2013 dollars.

Infrastructure deficit
The total financial investment needed today to replace those assets which have already reached the end of their useful life, based on either PSAB 3150 financial data or as determined by personnel through actual field condition assessments.

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