COUNTY OF MIDDLESEX

ASSET MANAGEMENT PLAN

CORE ASSETS

Effective June 30, 2022

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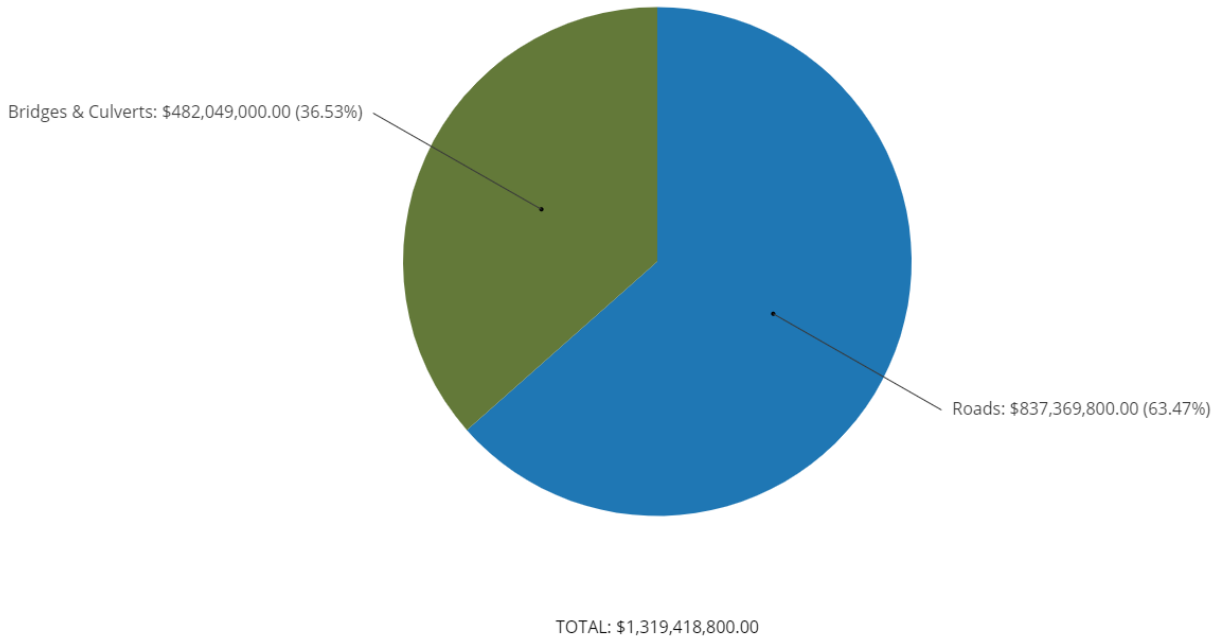

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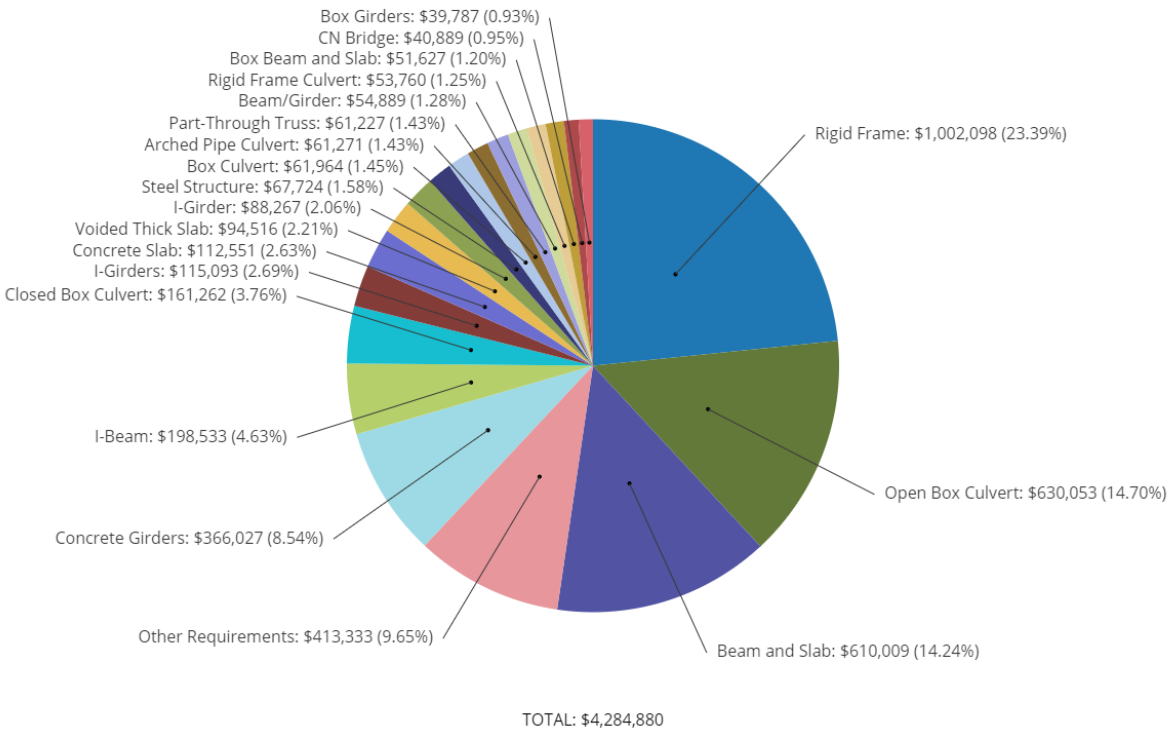
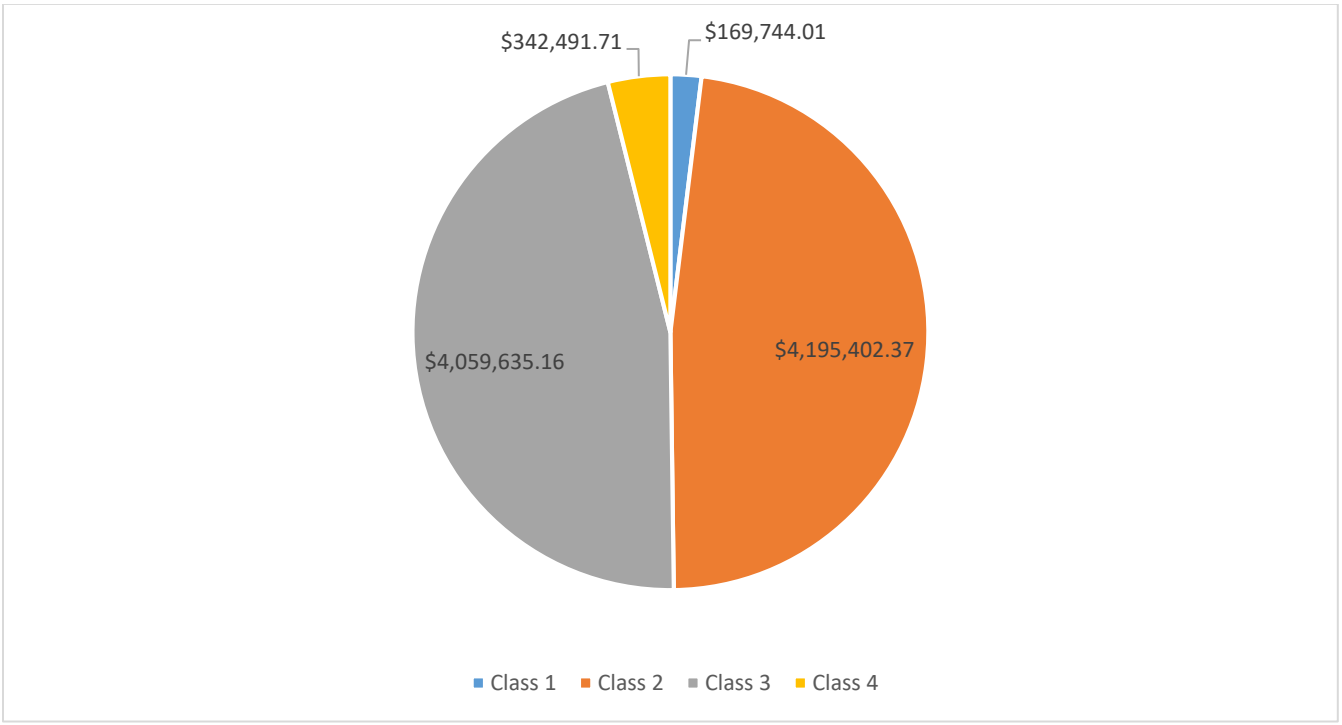


TOTAL: $4,284,880

Annual Estimated Capital Expenditures Roads by Class



1.0 Introduction

1.1 What is asset management?

Asset management (AM) is an integrated approach to the maintenance, operation and ownership of assets, with an appropriate level of risk, and a commitment to delivery of services to an established level. The commitment to an organization wide asset management program (AMP) for the consideration of the increasing costs to provide a range of services to residents while being mindful of increasing development and population growth and the impacts of climate change within a complex municipal funding model.

AM planning is a mechanism by which municipalities can make sound investment in their assets by prioritizing investments, managing risks, improve financial performance, and strive for higher levels of efficiency and sustainability.

Five key elements of asset management include:

1. Provision of a defined level of service
2. Management of the impacts of demand (growth and/or decline)
3. Utilization of a life cycle approach to the long-term health of assets and for making sound capital budget decisions
4. Appropriate levels of control to minimize risk
5. Development of long-term capital planning including identification of required expenditures and maintaining of an appropriate level of funding

1.2 Middlesex County Assets

Middlesex County's main core assets include over 1,700 lane kilometers of roads and over 250 bridges. Road assets are inclusive of signage, roadside drainage, guiderails and other associated infrastructure. In urbanized areas assets are divided between the County and our local member municipalities, where the local municipalities have jurisdiction over water, sanitary sewers and sidewalks. Storm sewer infrastructure can be shared or under the jurisdiction of the County, however these assets are considered as part of the road system as a whole.

Other assets maintained by the County include municipal buildings including a long-term care facility and several operations garages, a fleet of approximately 50 pieces of equipment, and all associated furniture and hardware critical to the operation of these facilities.

This asset management plan meets the requirements of Ontario Regulation 588/14 for Core Assets including roads and bridges. Future versions of the plan will include additional asset classes including municipal buildings, vehicles and equipment.

1.3 Asset Management Program

A wholesome asset management plan should include the following:

1. A complete and accurate inventory of assets
2. A performance tracking system
3. A focus on levels of service
4. An optimized lifecycle events strategy
5. A demand management strategy
6. An integrated approach with capital and operational budgets

Middlesex County recently completed an asset management readiness scale assessment and rated on an average scale of 2.4 or at an intermediate level. Areas of focus and improvement around organizational commitment and planning will be positively affected by the completion of this core asset management plan.

The core of any plan is data and the quality and currency of that data. This is critical for sound decision making for optimal infrastructure investments. Specific data collected for each asset class includes:

1. Valuation data (for calculation of replacement costs)
2. Capital investment data (for estimation of lifecycle costs)
3. Condition data (for understanding rate of asset deterioration)
4. Performance data (for determination of level of service)
5. Risk data (for evaluation of consequences of asset failures)

The County strives to maintain complete and accurate data related to core assets. County staff have continually maintained a database of asset data through inspections and condition ratings of roads and bridges.

Two recent projects have reconfirmed the accuracy and detail of this data. The County-Wide Bridge Study Report and the StreetScan/StreetLogix Road analysis both returned data closely conforming to the data collected internally by County staff.

Ontario Regulations 588/17 Asset Management for Municipal Infrastructure provides guidance and timelines for the implementation of formal asset management practices for municipalities. On June 25, 2019 Middlesex County Council endorsed the Middlesex County Strategic Asset Management Policy which forms the basis for the remainder of the regulation. This plan conforms with the first benchmark of an asset management plan for core assets by July 1, 2022, and will be further developed to include all municipal assets by July 1, 2024.

Middlesex County updated and adopted a Strategic Plan for 2021 to 2024 including a strategic focus of ‘connecting through infrastructure’. This focus commits the County to a sound asset management strategy to maintain and fund critical infrastructure.

1.4 Collaboration and Coordination

Middlesex County is made up of eight local municipal governments. Much of our infrastructure shares space within common road right of ways and crosses bridge structures with shared jurisdictions. As such capital lifecycle events can and will impact other critical infrastructure, for example the replacement of a sanitary sewer located under the travelled portion of a road.

Staff from both levels of government communicate and interact on a regular basis and strive to coordinate projects in order to minimize impacts on shared infrastructure and to make smart and efficient budget decisions. Working together on shared projects maximizes the use of taxpayer funding such that these projects are coordinated and align with expected timelines for infrastructure renewal and sound asset management planning.

2.0 Key Concepts

2.1 Condition

Middlesex County staff assess the condition of core assets on a regular basis in order to evaluate service level requirement and to inform short and long term capital budgeting decisions. These assessments are critical for long term planning processes as they provide a 'snapshot' of the current state of this infrastructure.

Condition assessments differ by asset class and are based on accepted engineering principles such that assets can be compared with similar assets within and across municipalities.

Assets are generally rated according to the following scale:

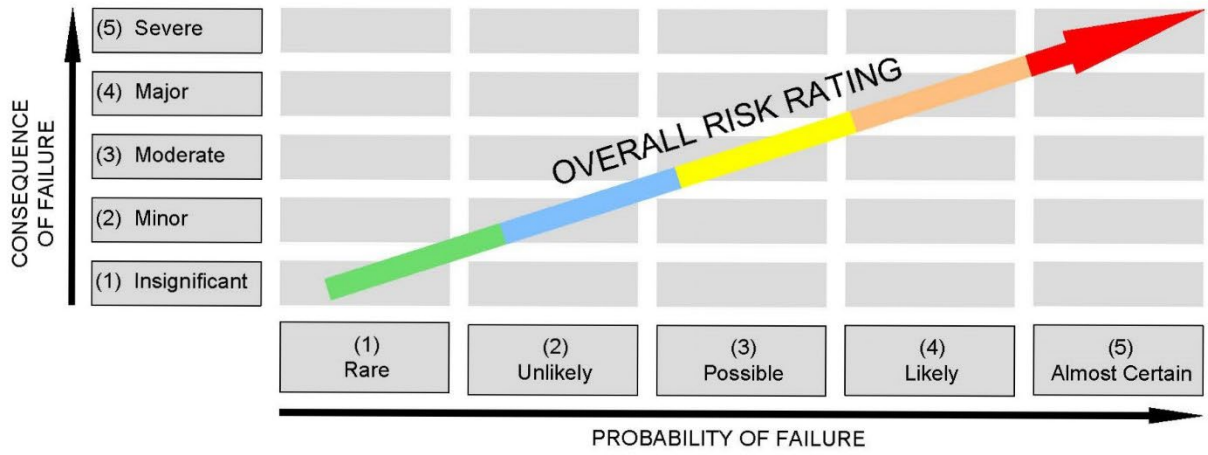
Scale	Definition
Very Good	**Fit for the future** Like new condition, generally either newly constructed or recently rehabilitated.
Good	**Adequate for now** Generally assets in the mid-stage of their expected life cycle showing some wear and may require additional maintenance.
Fair	**In need of attention** Asset is showing signs of deterioration and performance is being impacted and maintenance costs are increasing. Minor capital repair is likely required at this stage.
Poor	**At risk of failure** The asset is nearing the end of its useful life and shows signs of significant deterioration. Major repairs are required and asset should be monitored closely.
Very Poor	**Unfit for sustained service** Unacceptable condition with high probability of failure with risk of asset being out of service. Candidate for major rehabilitation or replacement.

2.2 Risk

The probability of failure is the likelihood that an asset will not meet the desired level of service or will not be able to fulfill its intended purpose. Generally as the condition of an asset decreases the potential for failure increases. However even assets with high condition scores can be at risk of failure.

Factors used to estimate the probability of failure vary by asset class but generally include items such as age, construction materials and asset condition. The consequence of failure varies by asset class and can impact health and safety, the environment, or the financial health of the County. The probability of failure multiplied by the overall consequence of failure results in an overall risk score which can be plotted on a risk matrix to provide a summary of critical assets.

Critical assets are those that would have a significant impact on County communities if they were to fail and include key infrastructure like heavily travelled bridges and roads connecting municipal population centers.



2.3 Lifecycle Events

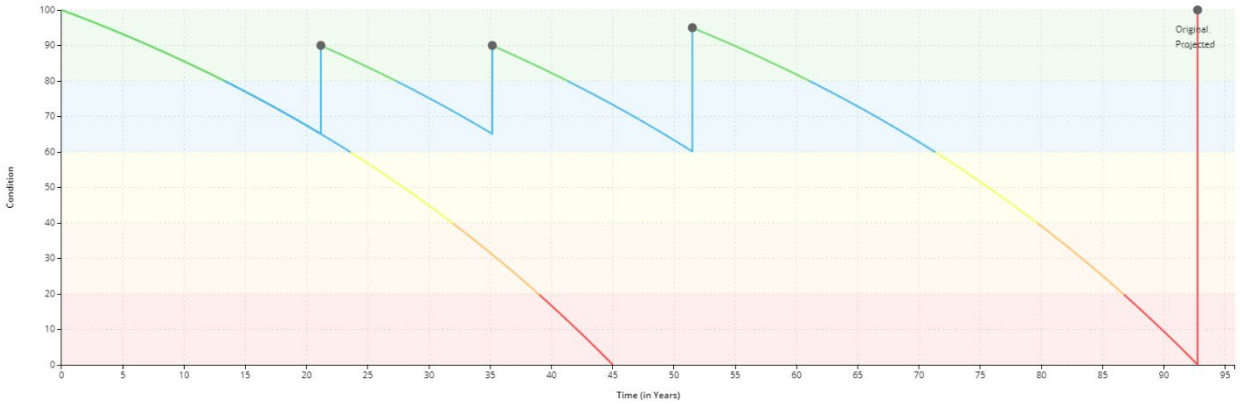
Asset ownership costs can be classified under procurement, operational or disposal costs. Once in service assets should be renewed or rehabilitated at regular intervals in order to extend their useful lives. These rehabilitation costs make up the bulk of expenditures for any core asset.

2.4 Estimated Useful Life

Estimated useful life is a term used to reflect the time the County expects for an asset to remain in service. This estimated useful life can be compared with the condition of an asset to better understand the performance of that asset over time.

One representation of estimated useful life is called a 'deterioration curve'. This curve represents the change in condition of an asset based on scheduled events over the asset's lifecycle. This curve typically includes event in the deterioration model which increase the estimated useful life of the asset over time.

An example of a deterioration curve:



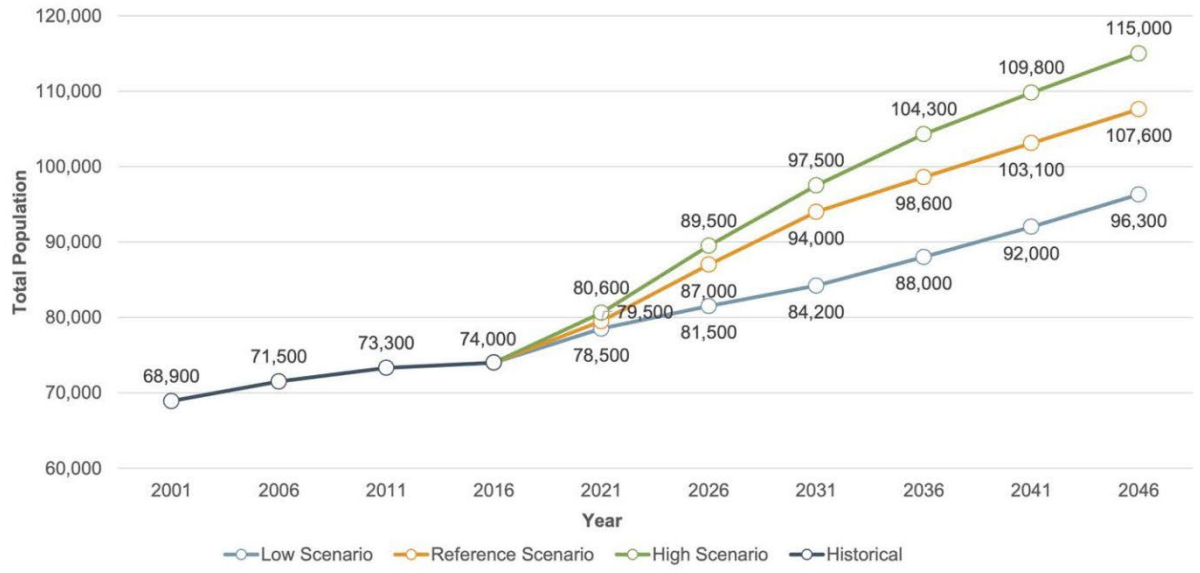
2.5 Demand Management

Demand is generally driven by factors including population growth, demographic shifts, land use changes, economic development and climate change. Anticipating these changes is critical for long term planning due to the impact on County infrastructure.

Infrastructure demand trends can occur over short or long time periods and can be cyclical in nature. Trends can depend on technological factors, for example the expansion of access to high speed rural broadband and the ability to work from home as established during the pandemic had a massive effect on travel patterns in the County.

Recent population forecasts are noted in the chart below:

Figure 2
Middlesex County
Population Forecast Scenarios, 2016 to 2046



2.6 Climate Change

Climate change is a global trend that is creating challenges for the management of assets in Middlesex County. Rising temperatures and increasing intensity of weather events will impact existing assets like bridges and storm sewers and is likely to increase the costs of replacement of such assets in order to accommodate larger volumes and more intense flows during these events.

2.7 Replacement Cost

Replacement cost is calculated as the capital budget required to replace an asset for an identical asset in today's dollars.

The costs for the replacement of core assets has been estimated using market rates for materials and unit prices in recent contracts. These costs are updated from time to time when staff assess shifts and changes in tender prices in our region and around Southwestern Ontario.

2.8 Funding Needs

Funding needs are classified under three general categories: capital needs; replacement needs; and annual funding needs.

Capital needs are calculated by using the estimated cost of completing the scheduled lifecycle events within a specific year. These costs also include any 'backlog' of life cycle projects from previous years that have yet to be completed.

Replacement needs are the costs of the scheduled (and potentially backlogged) asset replacements, typically bridge replacement and road reconstruction projects.

The annual funding requirement is the summation of the capital and replacement needs, essentially all the scheduled lifecycle events, of all assets in the County. This funding requirement is calculated with an estimated average life of each asset and does not account for any project backlogs as it should be an average annualized cost to maintain the asset system.

2.9 Financing Strategy

The financing of the management of the assets of Middlesex County is based on sound investment strategies and the utilization of a number of sources of revenue to support the capital program. Long term capital planning and sound asset management allow for a predictive level of investment with the goal of maintaining and improving the conditions and reliability of road and bridge assets.

Infrastructure renewal is currently funded using a variety of sources including general revenues, capital reserves, federal and provincial funding, and debt funding. Reliability of outside sources of funding (such as gas tax revenues) are always cautiously relied upon in the case those sources either are reduced or eliminated altogether.

Middlesex County does not currently rely on debt financing for asset management, and capital asset reserves are generally relied upon only for the emergency replacement of critical assets in the case of unexpected failure.

Development charges, user fees and other potential sources of revenue are not currently available for the funding of life cycle events for Middlesex County infrastructure.

INFRASTRUCTURE SUMMARY

ASSET DETAILS ROADS

Middlesex County maintains approximately 853 centerline km or roads, or 1,694 lane km of roads. All roads currently under the jurisdiction of the County are paved with hot mix asphalt.

A County Road and Bridge Assumption Study is conducted every five years to review and potentially assume road sections into the County road system from the local municipalities. These roads are evaluated at the request of local municipal officials, and are typically only assumed if they require a higher level of maintenance than can be provided under normal operating parameters, or if they create a geographical linkage, or are part of a system to address traffic demand needs. Middlesex County assumed approximately 26 centerline km/52 lane km of roads during the last study in 2020.

County roads are classified into maintenance classes as defined under the Minimum Maintenance Standards for Municipal Highways regulations under the Municipal Act.

Road Class	Patrol Frequency	Length (lane km)
Class 1	3 times every 7 days	31.4
Class 2	2 times every 7 days	728.6
Class 3	Once every 7 days	814.8
Class 4	Once every 14 days	119.6

The estimated useful life of any asphalt road surface is averaged at 18 years, with high posted speed limit rural roads with a slightly longer useful life and low posted speed limit urban roads with a slightly shorter useful life.

Staff determine the overall condition of the road surface by utilizing the Pavement Condition Index (PCI) rating. The PCI ranges from 0 to 100 with 100 being a road in perfect condition and 0 representing a road in the worst possible condition. PCI evaluations are performed for all County roads every three years. Ride Condition Rating (RCR) is a component of the PCI calculation with higher ratings representing more comfortable driving conditions due mainly to the smoothness of the road surface. PCI ratings are generally classified as per the following chart:

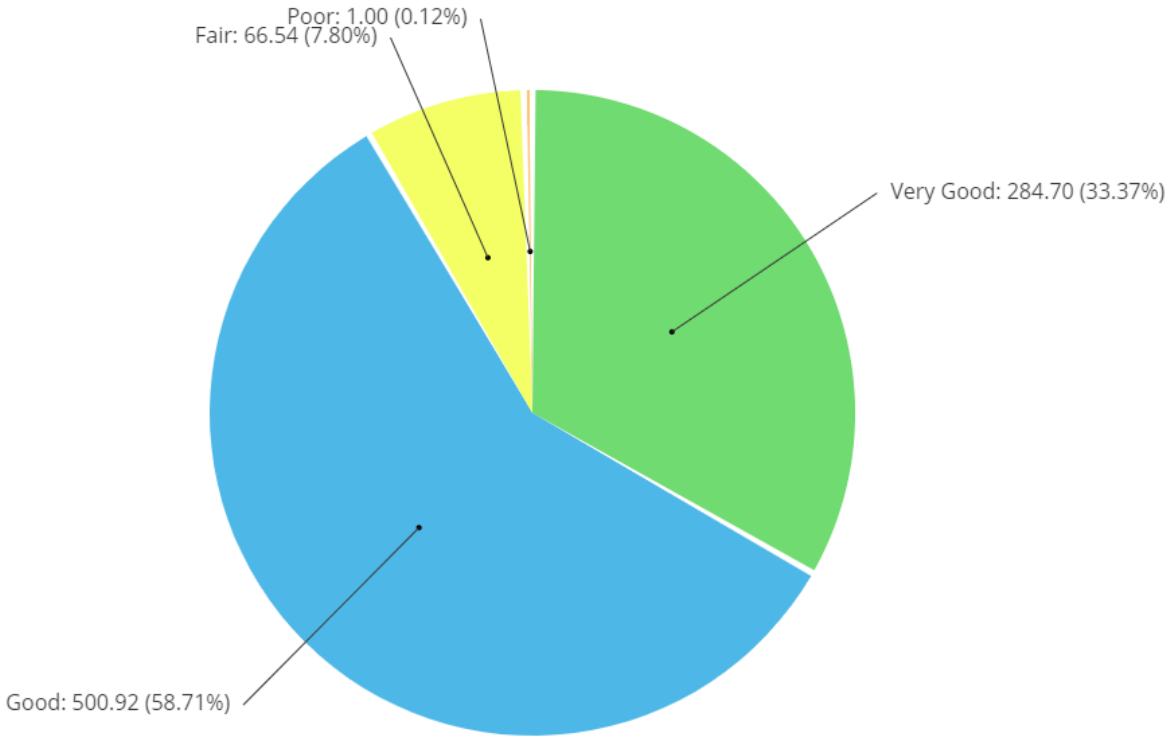
Scale	PCI	Service Level
Very Good	100 – 85	Relatively new or in newly constructed condition. No visible cracks or structural issues. Smooth ride.
Good	85 – 70	Road surface beginning to exhibit slight deficiencies including small cracks, rutting and/or surface deterioration. Relatively smooth ride.
Fair	70 – 55	Exhibiting signs of surface deterioration, random cracks, rutting and some patching of surface defects. Slightly rough ride.
Poor	55 – 40	Extensive deterioration, cracks, rutting and/or surface defects over 50 percent of the surface. Some structural issues are apparent. Rough ride.
Very Poor	< 40	Road is at the end of its useful life. Significant structural issues and large cracks, severe rutting over 75 percent of the road surface. Difficult to drive at the posted speed limit.

The entire County road system was last rated in 2020 with the resulting PCI analysis as follows:

Middlesex County Highway System Pavement Performance 2020

Weighted Average Pavement Condition	91.34
Lane Kilometres Rated Adequate	1344.4
% Road System Rated Adequate	79%
Lane km requiring improvement in next 5 years	59.2
% system requiring improvement in next 5 years	3%
Lane km requiring improvement in next 6-10 years	290.8
% system requiring improvement in next 6-10 years	17%

Road PCI Ratings (by km)



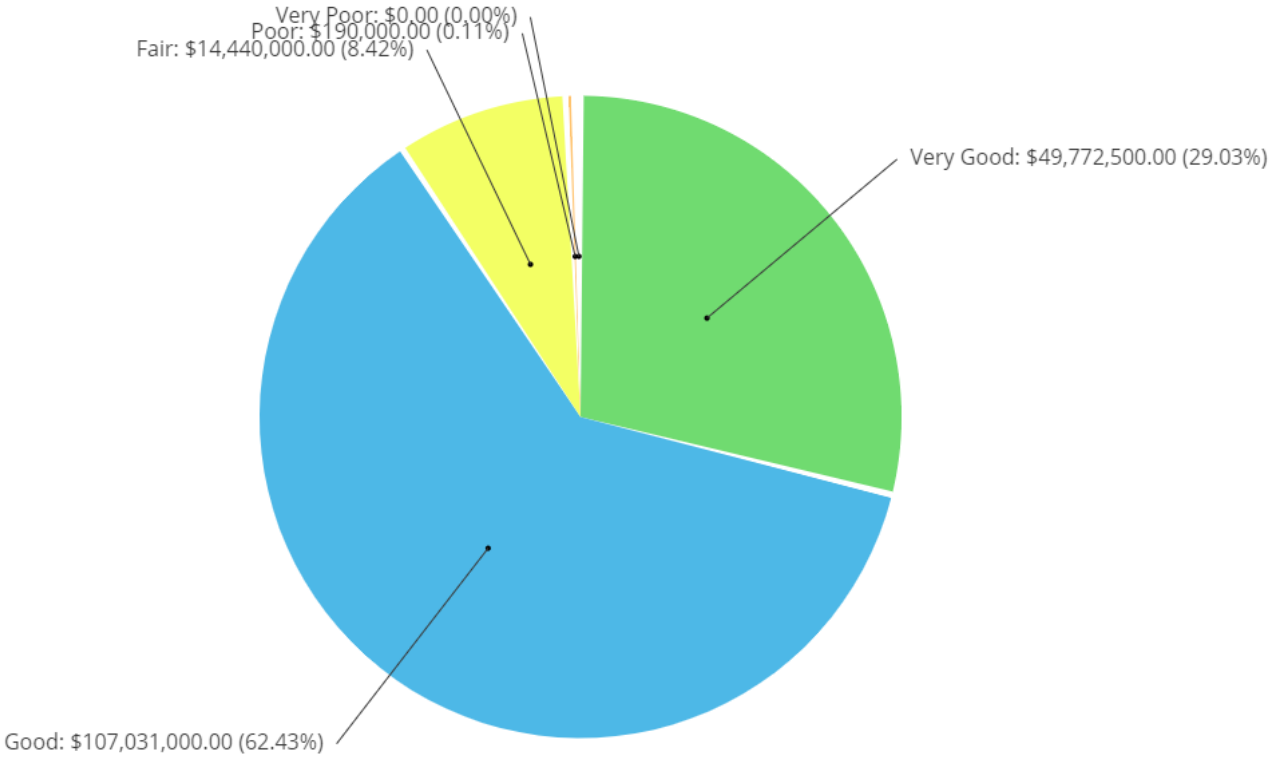
Middlesex County utilizes five general capital processes for the maintenance, rehabilitation and replacement of road assets:

1. Micro Surfacing: typically used as a holding method in urban areas to extend the useful life of the road to allow for alignment of capital budgets with local municipalities prior to road and utility replacement.
2. Mill and Pave: removal of the top layer of asphalt along urbanized road sections and replacement with new hot mix asphalt.
3. Asphalt overlay: addition of a new fresh lift of hot mix asphalt over an existing roadway. Similar performance to mill and pave and used in rural areas only.
4. Cold in place asphalt recycling: asphalt road surface is milled, mixed with new asphalt cement, and placed back onto the roadway. After a short curing period the cold in place recycled base is overlaid with hot mix asphalt.
5. Reconstruction: complete replacement of the entire road surface including but not limited to replacement of underground utilities, granular base, road drainage infrastructure (including storm sewers) and correction of horizontal and vertical alignment deficiencies.

These life cycle events are chosen based on the current condition of the roadway, the existing road composition, and the expected useful life extension period as per the chart below:

Treatment	Class	Budget	Timeline	Impact	Cost per lane km
Micro Surface	Maintenance	Capital	2-5 years	Hold condition	$2,500
Mill and Pave	Rehabilitation	Capital	12-15 years	Renewal of urban road section	$200,000
Asphalt overlay	Rehabilitation	Capital	15-18 years	Improve PCI to 90 or greater	$220,000
Cold in Place Asphalt Recycling	Rehabilitation	Capital	18-22 years	Improve PCI to 90 or greater	$270,000
Reconstruction	Replacement	Capital	15-18 years	Set PCI to 100	$500,000

Replacement value is calculated based on the current estimated costs of labour and materials and is estimated at approximately $171,433,500 as shown defined by class as shown in the graph below.



TOTAL: $171,433,500.00

Capital needs as calculated by class over the next ten year cycle:

10 Year Lifecyle by Class

	Back-log	2023	2024	2025	2026	2027	2028
Class 1 Total	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Class 2 Total	0	$3,028,200	$816,893	$4,665,944	$4,510,476	$1,907,005	$2,235,862
Class 3 Total	0	$4,245,660	$5,792,514	$2,015,534	$2,855,978	$4,341,481	$6,533,854
Class 4 Total	0	$0.00	$0.00	$2,332,972	$0.00	$0.00	$0.00
Total	**0**	**$7,273,860**	**$6,609,407**	**$9,014,451**	**$7,366,455**	**$6,248,487**	**$8,769,717**

	Back-log	2029	2030	2031	2032	Event Cost
Class 1 Total	0	$0.00	$0.00	$1,164,510	$0.00	$1,697,440
Class 2 Total	0	$4,399,258	$4,633,211	$3,904,533	$2,187,223	$41,954,023
Class 3 Total	0	$1,375,701	$2,505,037	$1,224,529	$6,039,224	$40,596,351
Class 4 Total	0	$430,455	$0.00	$0.00	$305,740	$3,424,917
Total	**0**	**$6,205,415**	**$7,138,249**	**$6,293,573**	**$8,532,189**	**$87,672,732**

Road risk analyis is based on a combination of the likelihood of failure and the volume of traffic that would be affected by a distruption in service. Green represents assets that are at a very low risk of failure and low consequence of failure, while red represents high risk of failure with high consequence of failure. Due to the realtively good condition of County of Middlesex road assets and generally good alternative routes most of our assets are considered to be low in consquence and low in probability of failure in the risk analysis exercise.

Road Assset Risk Analysis Matrix

Level of Service

The County road network is maintained to provide a safe and efficient means of transportation for all road users. The network is inspected and maintained in accordance with the County's maintenance standards which are based on the Minimum Maintenance Standards as prescribed under the Municipal Act. Based on the 2021 actual expenditures, the County budget for maintenance of the road network by centreline kilometer is estimated as follows:

County Road Annual Maintenance Expenditures

Activity	Per km	Total expenditure
General Maintenance	$2,875	$2,450,000
Winter Maintenance	$6,850	$5,835,000
Total	$9,725	$8,285,000

ASSET DETAILS BRIDGES

Middlesex County currently maintains 250 structures including 122 bridges, 127 large culverts and 1 earth dam. All structures are inspected by County staff bi-annually to evaluate their general condition and to monitor any deterioration. Bridges are generally estimated to have a useful life of 75 years, concrete culverts 75 years, and steel culverts 50 years.

Bridge structures widely differ in design, construction methods, materials, exposure to the environment and traffic loadings. However it is reasonably acceptable to assume lifecycle events approximately every 25 years, with minor rehabilitation 25 years after construction, major rehabilitation 50 years after construction, and replacement between 75 and 100 years of age.

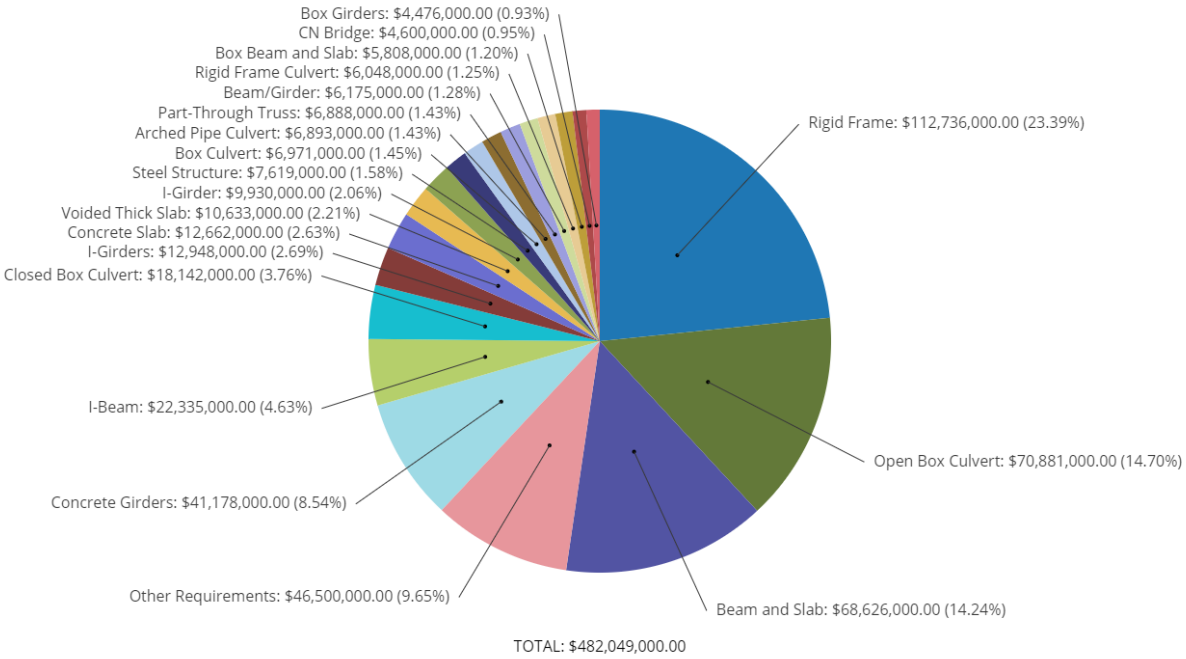
Large culverts are buried structures and as such are difficult or impossible to rehabilitate. Therefore typically only replacements are considered when culverts reach the end of their useful life.

A County Road and Bridge Assumption Study is conducted every five years to review and potentially assume road sections into the County road system from the local municipalities. These roads are evaluated at the request of local municipal officials, and are typically only assumed if they require a higher level of maintenance than can be provided under normal operating paramaters, or if they create a geographical linkage, or are part of a system to address traffic demand needs. Bridges located along roads assumed through this process are also uploaded to the County system. Middlesex County assumed one bridge during the last study in 2020.

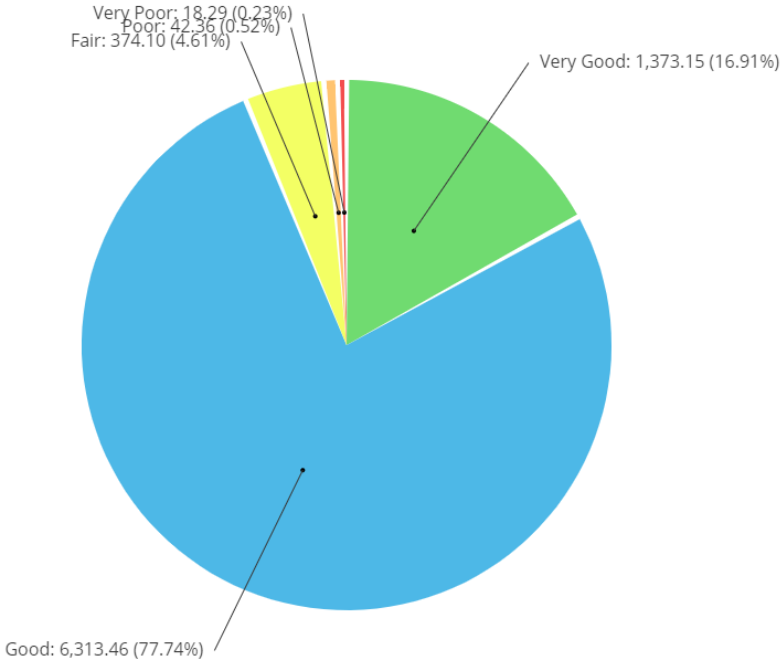
The construction of many of the bridge assets in Middlesex County, like much of Ontario and the rest of Canada, occurred during the 1950s and 1960s. Major infrastructure investments after World War II put many Canadians back to work and were fundamental to the bridge and highway systems we utilize today. However due to the estimated useful life of 75 years many of these structures will be reaching this critical age in the next 20 years.

Middlesex County engaged Dillon Consulting in 2017 to conduct an overall inventory and review of all County bridge and large culvert assets. This data was combined with in-house inspection reports and updated with recent capital construction cost estimates to provide the basis for this asset management plan.

Estimated Bridge Replacement Costs 2022



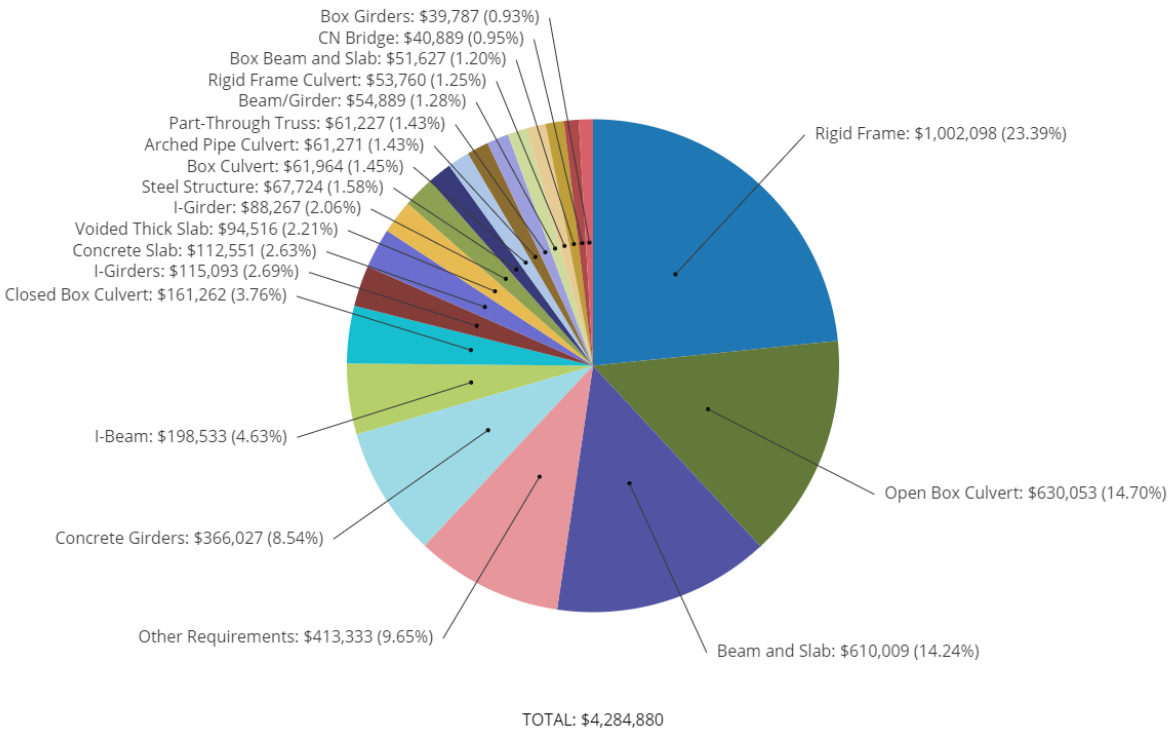
Bridge Asset Condition Ratings (by m^2 of deck area)



Bridge assets provide linkages along the road network, typically over watercourse or railways. As such the consequence of failure is typically higher. Probability of failure increases as a function of the age of the structure, the volume of daily traffic, the condition of the structure, and any regulated load restrictions. Most bridges in Middlesex County would be considered to have a medium level of risk, generally due to the higher consequence of a structure failure on the safety of the travelling public and the negative impact on the socio-economic viability of the community.

Bridge Asset Risk Analysis Matrix

Bridge Asset Annual Capital Needs 2022



Level of Service

Much of the maintenance required for bridges naturally aligns with the roads that traverse over the structures. As such the largest maintenance expenditures are allocated to the road assets, with small annual expenditures for minor repairs, small capital works (including rail system replacements and patching of concrete components) and annual bridge washing and debris removal. The County of Middlesex typically budgets around $250,000 or 5% of the annual capital expenditures recommended for bridge assets.

ASSET DETAILS STORM SEWERS

Middlesex County takes a collaborative approach to the management of storm sewer assets. Since all storm sewers are constructed under urbanized road segments along with other underground infrastructure managed by our local municipal governments, these assets are not typically replaced independently from those other utilities.

Storm sewer infrastructure is generally considered to be shared infrastructure, as the drainage of storm water includes areas outside of the County road allowance and may include side roads and other municipal drainage. Costs for the management of storm water infrastructure is typically shared on a pro-rated basis calculated on the volume of water flow contributed from the associated drainage areas.

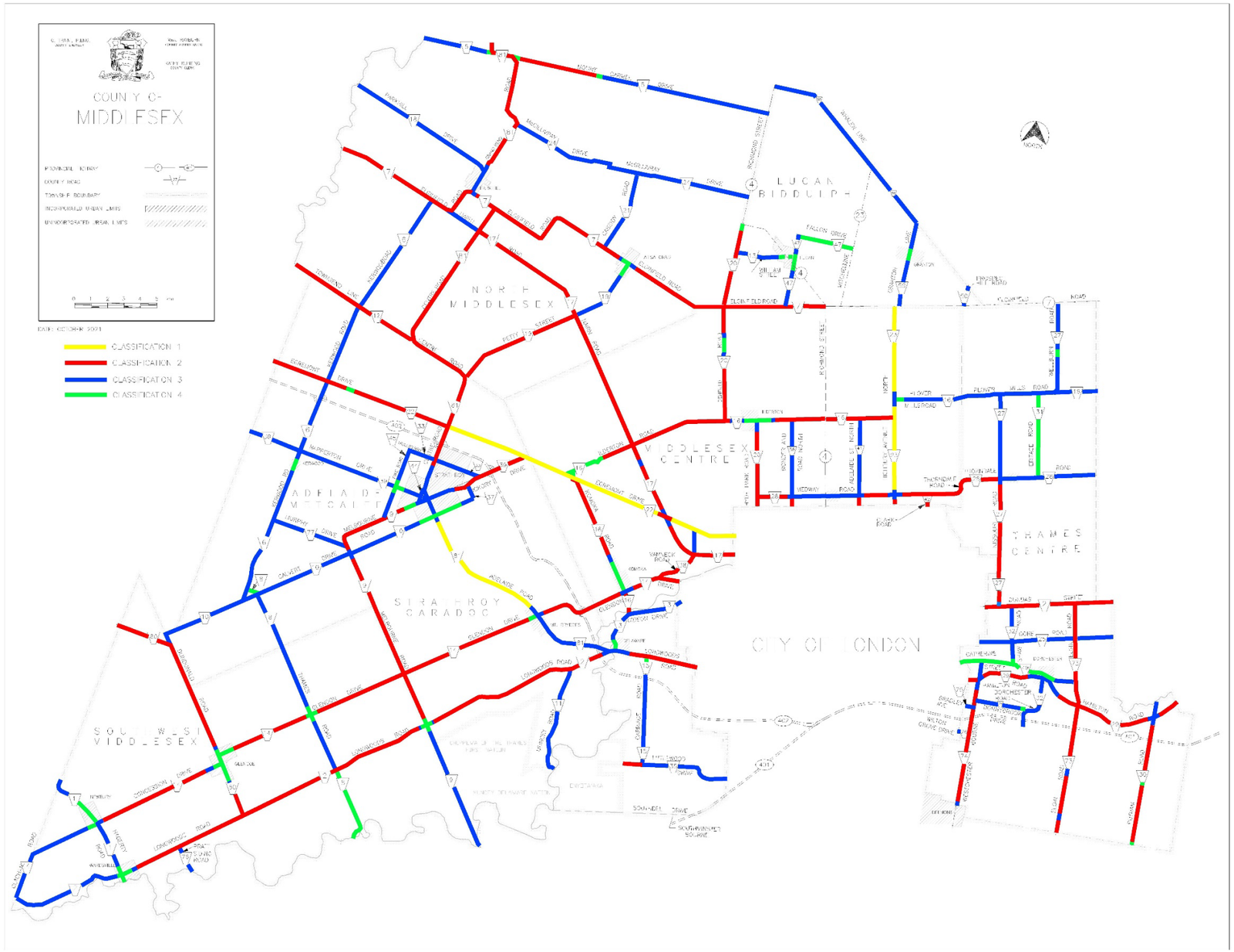
Analysis of condition of this infrastructure is conducted in cooperation with local municipal officials. Regular maintenance is conducted by County forces including annual catch basin clean outs and other minor repairs. Costs for this work is included in the annual maintenance budget.

Valuation of road assets are calculated including replacement values for storm sewers as noted in the asset details for roads constructed to an urban standard and as shown in that section of the asset management report.

Data quality for these assets will vary depending on the local municipal asset management plan, and the County plans to consolidate better centralized data as part of the ongoing evolution of the core asset management plan.

APPENDICIES

ROAD MAP w CLASSIFCATIONS



BRIDGE LOCATION MAP