Assessing Risk of Extreme Weather on Facilities Maintenance

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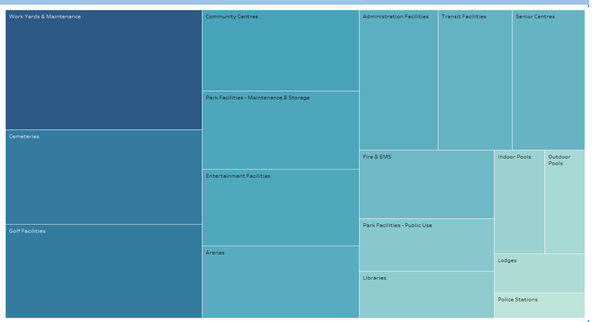
Problem Summary

This project seeks to revolutionize the City of Hamilton's facility maintenance strategies by incorporating a proactive assessment of climate change and extreme weather impacts. Traditionally reliant on routine intervals and historical data, the innovative approach aims to identify vulnerabilities to events like floods, storms, and heatwaves. By customizing strategies for each facility's unique needs, including building type and end-user vulnerabilities, the project aims to enhance overall resilience. The benefits include risk mitigation, cost efficiency, compliance with climate regulations, and improved public safety. By aligning maintenance plans with evolving environmental challenges, the city aims to optimize resource allocation, minimize downtime, and ensure its facilities remain robust and adaptable in the face of climate uncertainties.

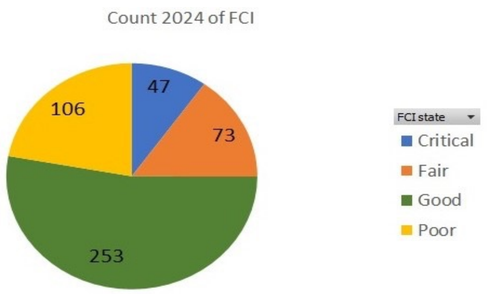
Goals

- Enhance Facility Resilience to develop strategies to assess and mitigate risks posed by extreme weather events on City of Hamilton on infrastructure.
- To identify cost-effective maintenance strategies
- Improve Infrastructure Prepare to strengthen the city's ability

Key Findings

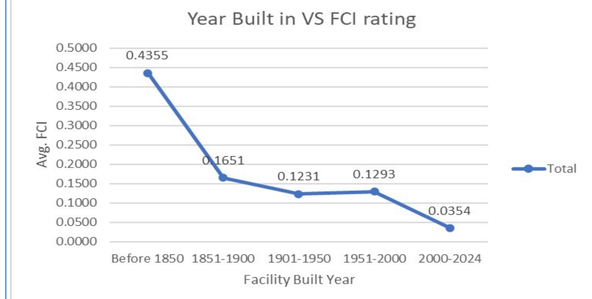


Based on the tree map asset type "work yards and maintenance" have the highest Avg. FCI rating. It depicts that the asset type that are outdoor/open facilities have higher FCI rating compared to the indoor/closed facilities. While the lowest is of Police Stations.

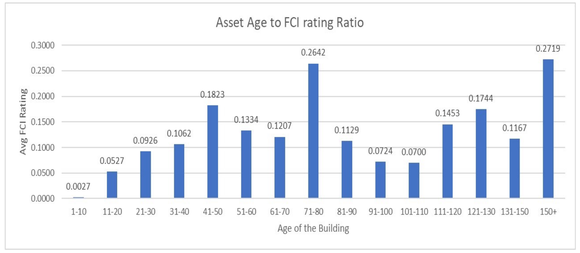


The pie chart provides an overview of the Facility Condition Index (FCI) ratings for facilities in Hamilton. It indicates that the majority of facilities have good FCI ratings, suggesting that they are in relatively good condition. However, there are also a considerable number of facilities with fair ratings, indicating some maintenance needs. Additionally, a smaller portion of facilities are classified as critical or poor, signifying urgent attention and investment requirements.

Results Based on the Age of the Facility



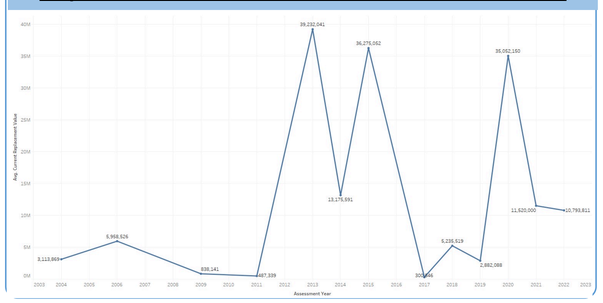
Based on the asset age the average FCI rating is higher for older buildings as compared to new built buildings. This states that the facilities that are built long time ago are more vulnerable to the climate change and need urgent attention on repair.



Age of asset ↑ **Facility condition index** ↑

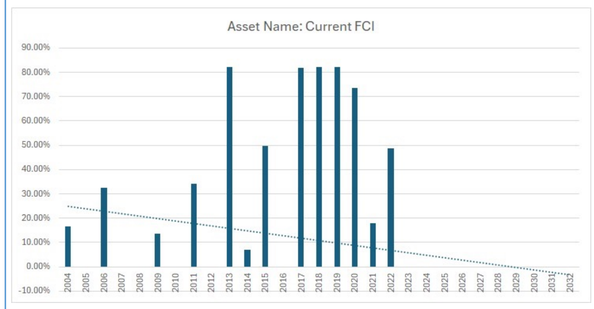
Overall, the graph illustrates a clear trend of increasing deterioration with the age of facilities, with older facilities generally exhibiting higher FCI ratios and indicating a greater need for maintenance and repair.
Facilities aged 150 and above have the highest average FCI ratio (0.2719), indicating the poorest condition among all age groups.
surprising trend in the graph is the relatively high Facility Condition Index (FCI) ratio for the 71-80 age group, which places it in the second position overall.
11-20 Age Group With the lowest FCI ratio of 0.0527, facilities show a moderate level of deterioration, suggesting that they might require attention but are generally in better condition compared to older age groups. It's important to note that while age is a significant factor, other factors such as maintenance practices, usage intensity, and environmental conditions may also influence facility condition.

Representation of Fluctuation of the Current Replacement Value based on Assessment Year

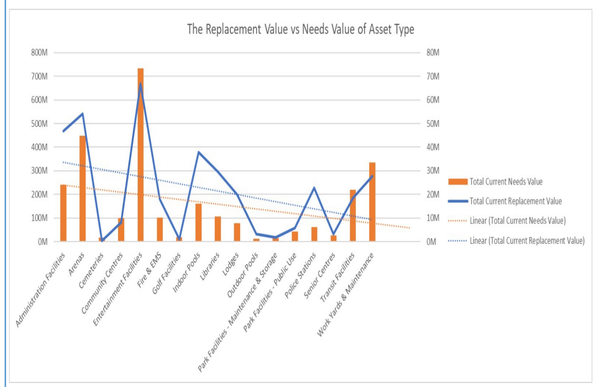


By observing the trend of the line connecting these points, one can discern patterns and fluctuations in the replacement values over time. A rising trend indicates an increase in asset values over the assessment years, suggesting potential appreciation or investment value. Conversely, a declining trend implies decreasing asset values, which might signal depreciation or changing market conditions affecting asset worth.
Moreover, fluctuations or spikes in the line graph can highlight anomalies or exceptional periods where asset values experienced significant changes. These fluctuations could result from various factors such as economic conditions, technological advancements, or specific events impacting asset values within the dataset. Overall, this graphical representation provides a visual narrative of how asset replacement values have evolved over time, offering valuable insights for strategic decision-making, financial planning, and asset management endeavors.

Predicted Trendline for the FCI Rating for upcoming Years



The line chart shows the Facility Condition Index (FCI) for City of Hamilton facilities over time, with two trendlines. The solid blue line represents the historical trend, where FCI generally increases as buildings age. The dashed green line is the projected trendline based on climate risks, showing a steeper decline in FCI. it would suggest that the rate of deterioration is slowing down or potentially even improving over time.



The combo chart illustrates the total replacement value compared to the total current needs value for various asset types in the City of Hamilton in 2024. The replacement value, represented by the blue bars, indicates the estimated cost to replace each asset category with a new one. In contrast, the total current needs value, shown by the orange bars, reflects the funding required to maintain these assets in good condition. Overall, the replacement value is significantly higher than the current needs value for most asset types. This suggests that while the current focus might be on maintenance, a significant investment would be required in the future to fully replace these assets.

Recommendations

- Utilize climate-resistant materials and technologies.
- Elevate structures in flood-prone areas to mitigate flood risks.

Elevated Structures ↑ **Flood Risks** ↓

- Employ landscaping strategies to alleviate heat island effects, such as planting shade-providing trees and using reflective materials.
- Incorporate energy-efficient technologies to reduce the overall environmental impact and enhance resilience during heatwaves.
- Install early warning systems for extreme weather events to provide advanced notice and facilitate proactive facility protection measures.

Early Warning Systems

- Install backup systems for critical operations, such as power generators and redundant communication systems, ensuring continuity during climate-related disruptions.
- Employ smart building technologies to monitor and control environmental conditions.
- Implement sensors for real-time data on climate variables like temperature, humidity, and water levels.
- Implement a robust preventative maintenance program to identify and address potential issues before they escalate into major problems due to climate change stresses.

Conclusions

- The data shows that the FCI rating of the building in Hamilton are affected by the climate change based on the asset type and asset age. It affects more on the buildings that are older and outdoor type.
- Also, the total replacement value is larger than the total needs value which indicates that the primary focus should be on the repair and maintenance, but the facility should be ready to bare the cost for replacement.
- The recommendations will help the facilities to incorporate safety measures to fight the climate change effects.
- Implementing the safety measures while repairing or replacing the facilities will ensure a way to mitigate the risks posed by the extreme weather events.
- The recommendations are based on the climatic conditions and other factors like the total replacement costs and total needs cost.

References

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