

Bridge and Culvert Management

A nighttime photograph of a bridge with blue lighting. The bridge has several support pillars and is illuminated with bright blue lights. In the background, there are several tall buildings, including a prominent one with a pointed top, all lit up. The sky is dark, and the overall scene is a cityscape at night.

Budget Committee

December 7, 2009



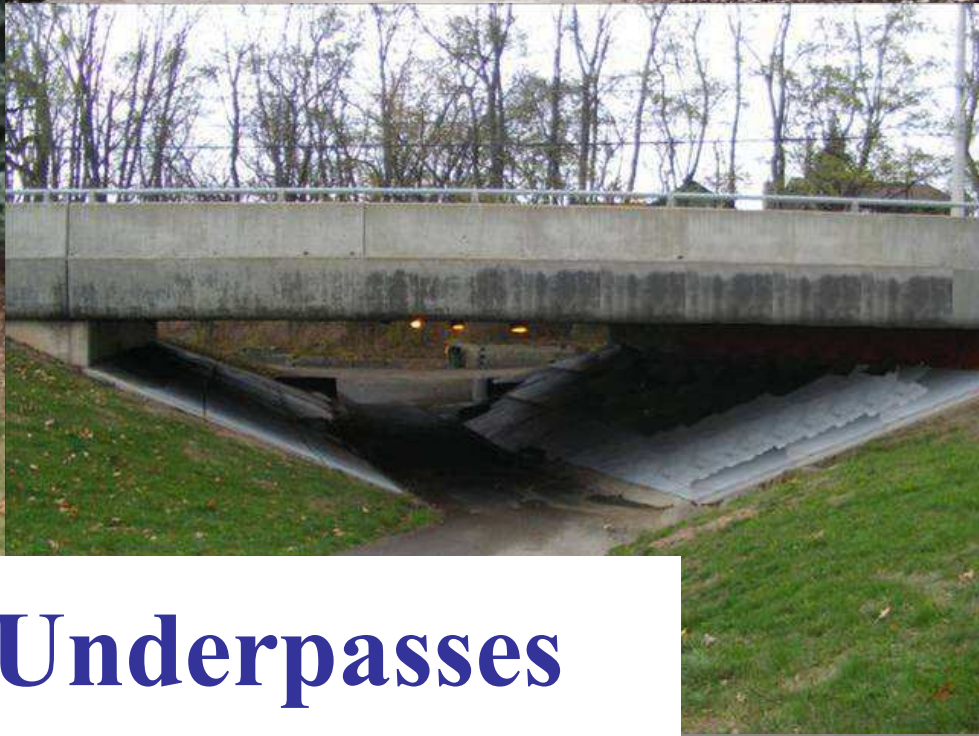
Over Water





Railway Bridges



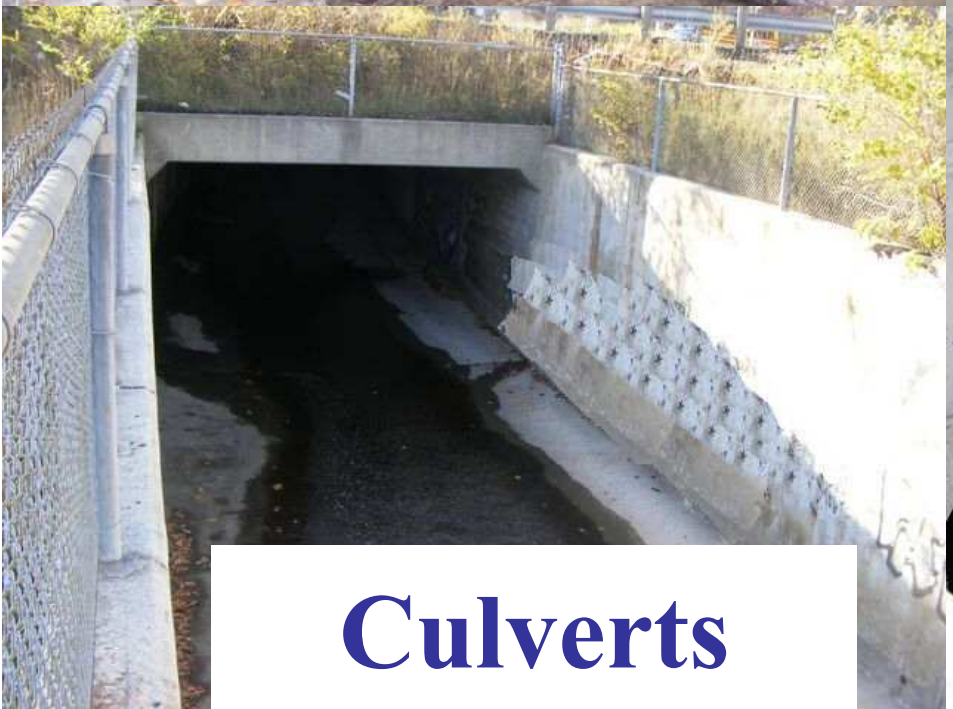


Pedestrian Underpasses

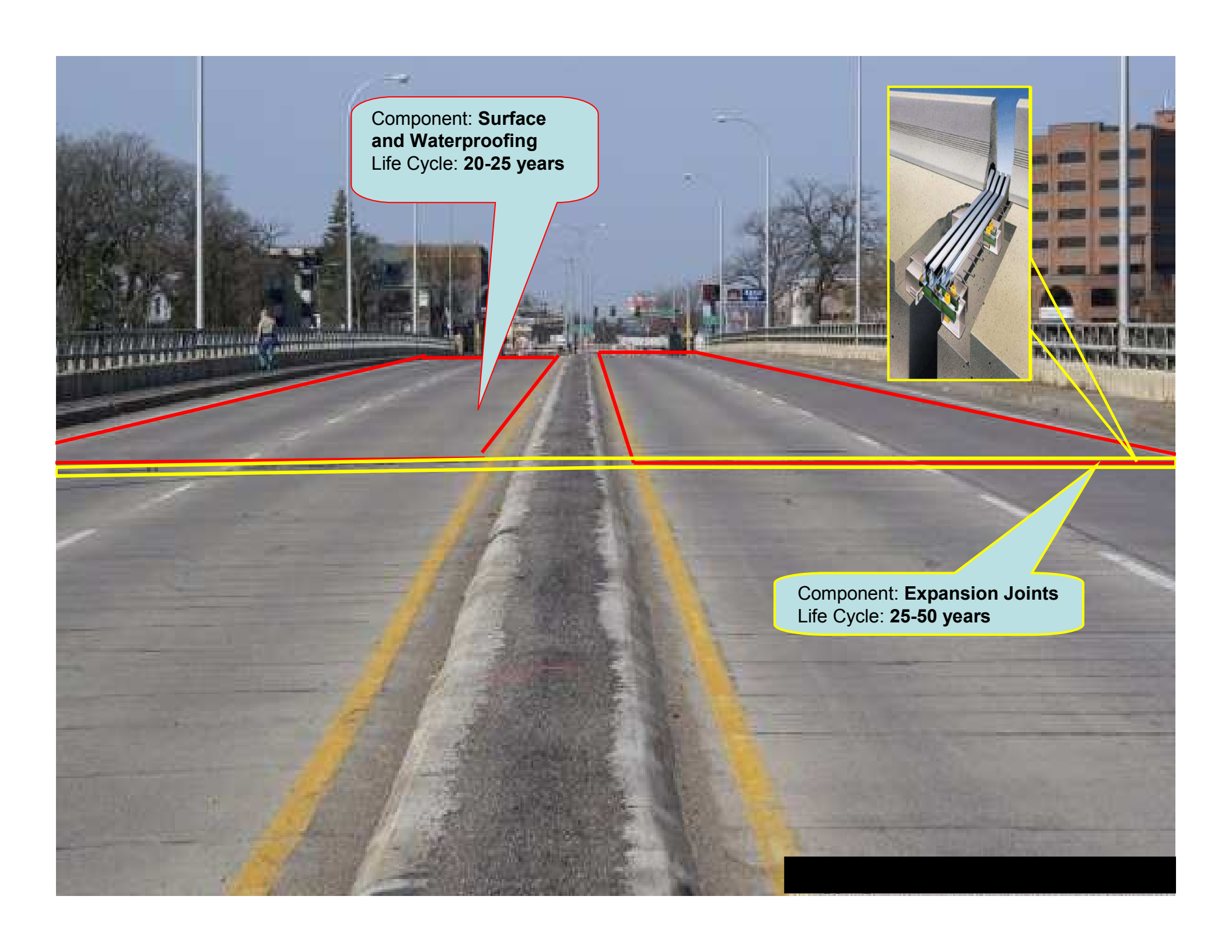


Pedestrian Overpasses





Culverts



Component: **Surface and Waterproofing**
Life Cycle: **20-25 years**

Component: **Expansion Joints**
Life Cycle: **25-50 years**

Component: **Railings**
Life Cycle: **25-50 years**
depending on material

Component: **Decks**
Life Cycle: **50-75 years**

Component: **Girders**
Life Cycle: **50-75 years**

Component: **Abutment Wall**
Life Cycle: **50-75 years**



Component: **Parapet Wall and Barriers**
Life Cycle: **25-50 years**

Component: **Piers**
Life Cycle: **50-75 years**

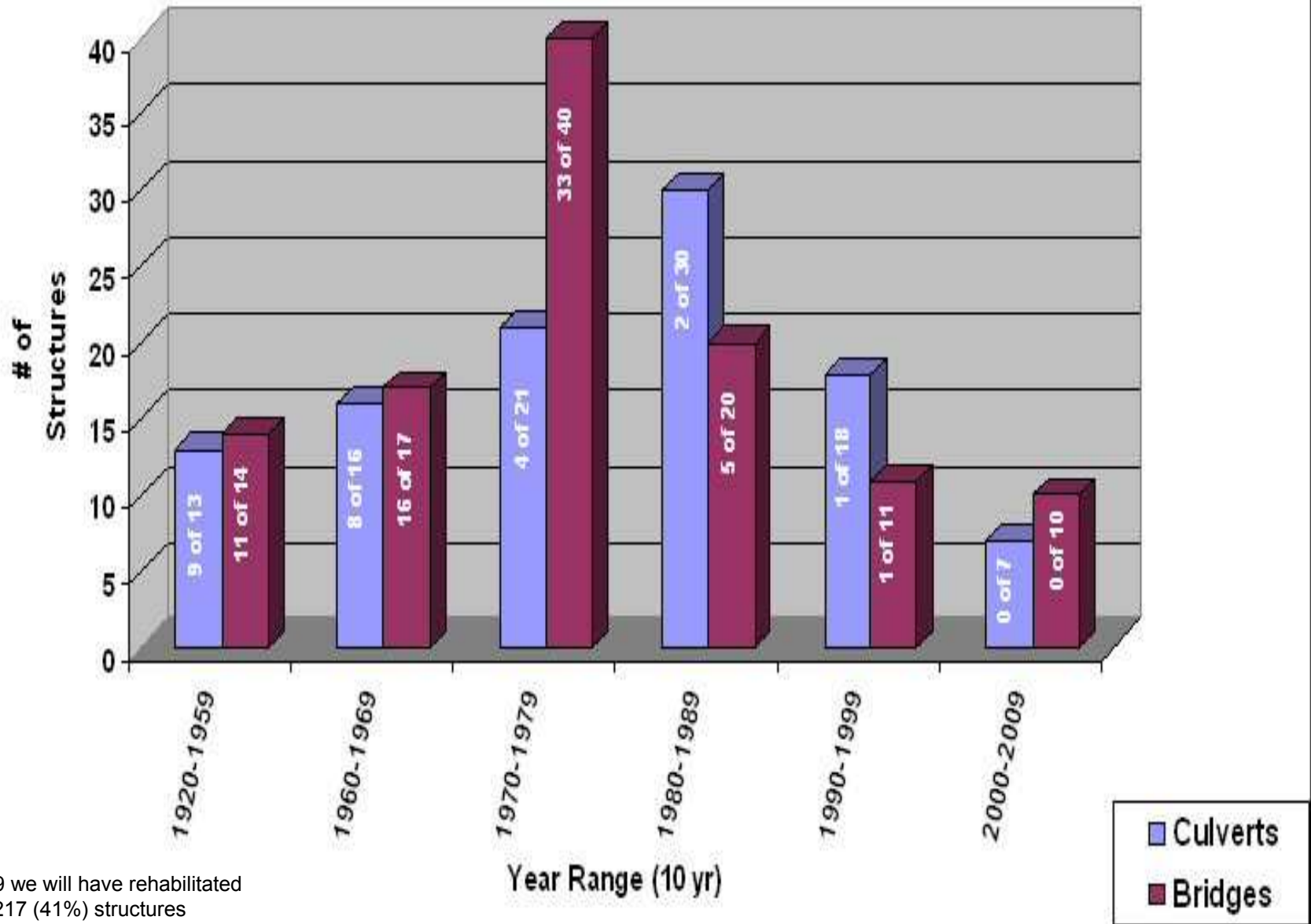
Component: **Wing Wall**
Life Cycle: **50-75 years**

Life Cycle Treatments

- **Preventative Maintenance** - Regular maintenance activity that prevents deterioration of bridge and culvert components
- **Repairs** - Minor fixes to secondary bridge and culvert components
- **Rehabilitation** - Major corrections to primary components and repair or replacement of secondary components
- **Replacement** - Complete removal and replacement of existing structure

Bridge and Culvert History

2009 Year End



By the end of 2009 we will have rehabilitated or replaced 89 of 217 (41%) structures

Bridge/Culvert Management Pre-2007

- Bridge/culvert network fairly young
- Number of engineering firms used to provide bi-annual visual inspection of bridge and culvert network
- Used “**worst first**” prioritization method
 - More detailed inspection and analysis for selected structures
- No formal preventative maintenance program
- Average annual budget \$2.0 million

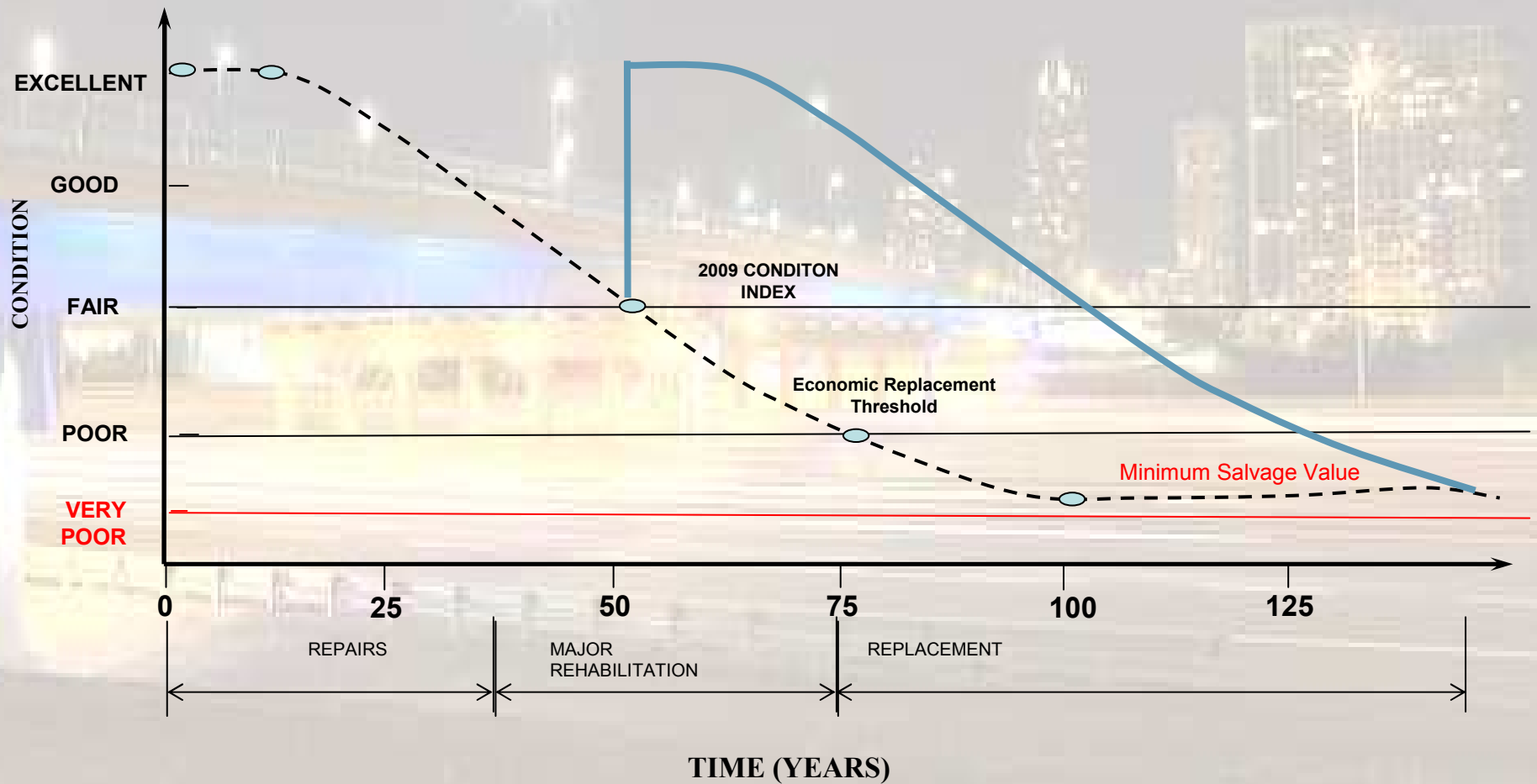
2007-2009 - Identified need for a bridge asset management system

- Bridge asset management system awarded to EMSi for a 4 year period
- Largest provider of bridge and culvert management services in Southern Ontario
- Developed software known as Bridge TMS (Total Management System)
- Bridge TMS looks at the lifecycle of individual structures and its components
- Includes detailed photos and inspection reports for each structure
- Allows City to manage the entire bridge and culvert network

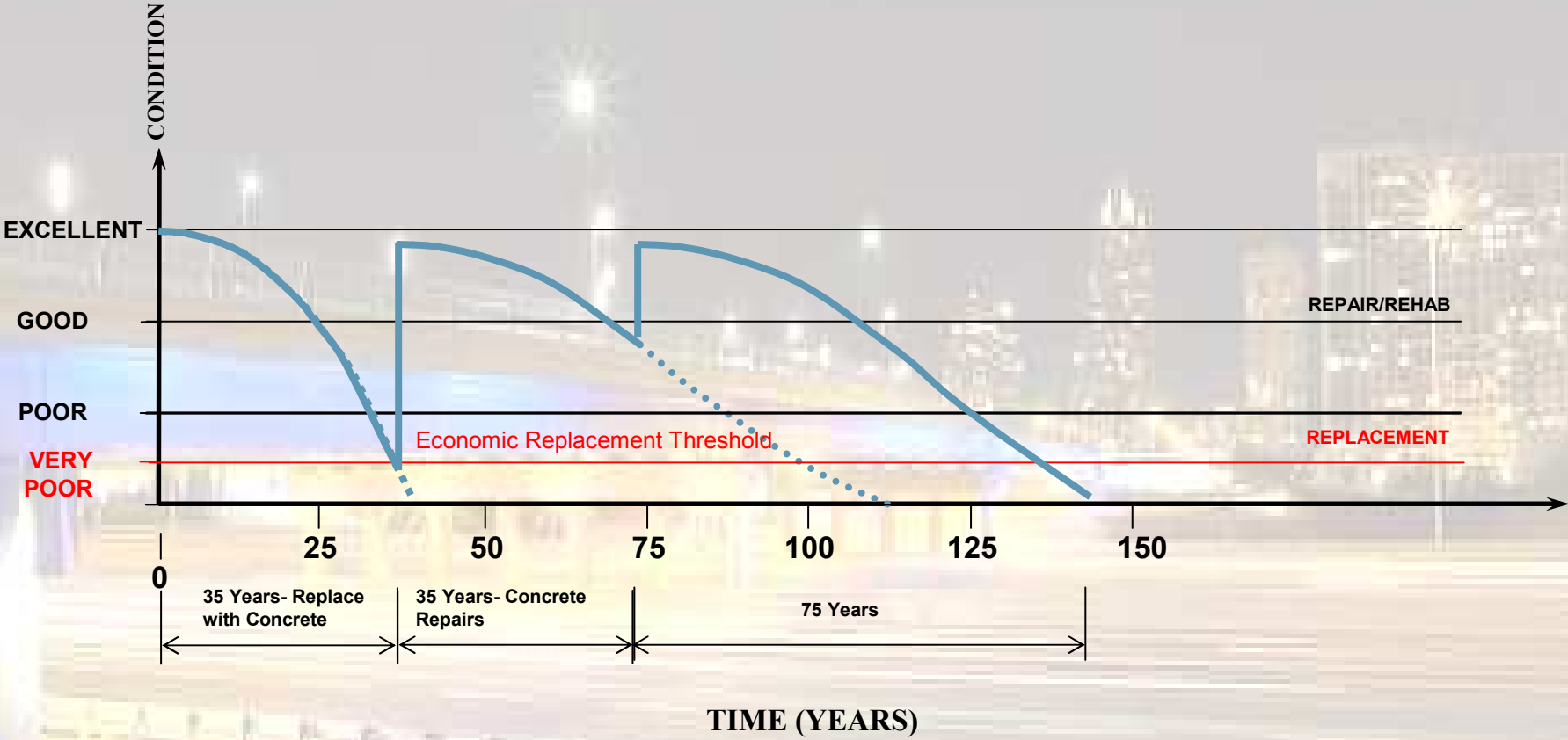
How does the Bridge Management System Work?

- Different from pavement management principles
- Based on the economic value of repair needs for each structure
- Looks at the Remaining Service Life (RSL) of each component
 - Safety items always have top priority (collision damage)
 - Safety items do not necessarily affect condition rating (barrier damage)
- 10 year deferral costs are considered to determine the right time to undertake work in conjunction with all other components
- Optimizes total lifecycle costs

Bridge Lifecycle Profile



Steel Culvert Lifecycle



Mississauga Analysis

- Network analysis identified needs of \$45M over ten years
- Average network level condition should remain around 90



Condition Index

Condition Index (CI) =

$$\frac{\text{Replacement Value of Bridge} - \text{Total Bridge Needs}}{\text{Replacement Value of Bridge}} \times 100$$

Example:

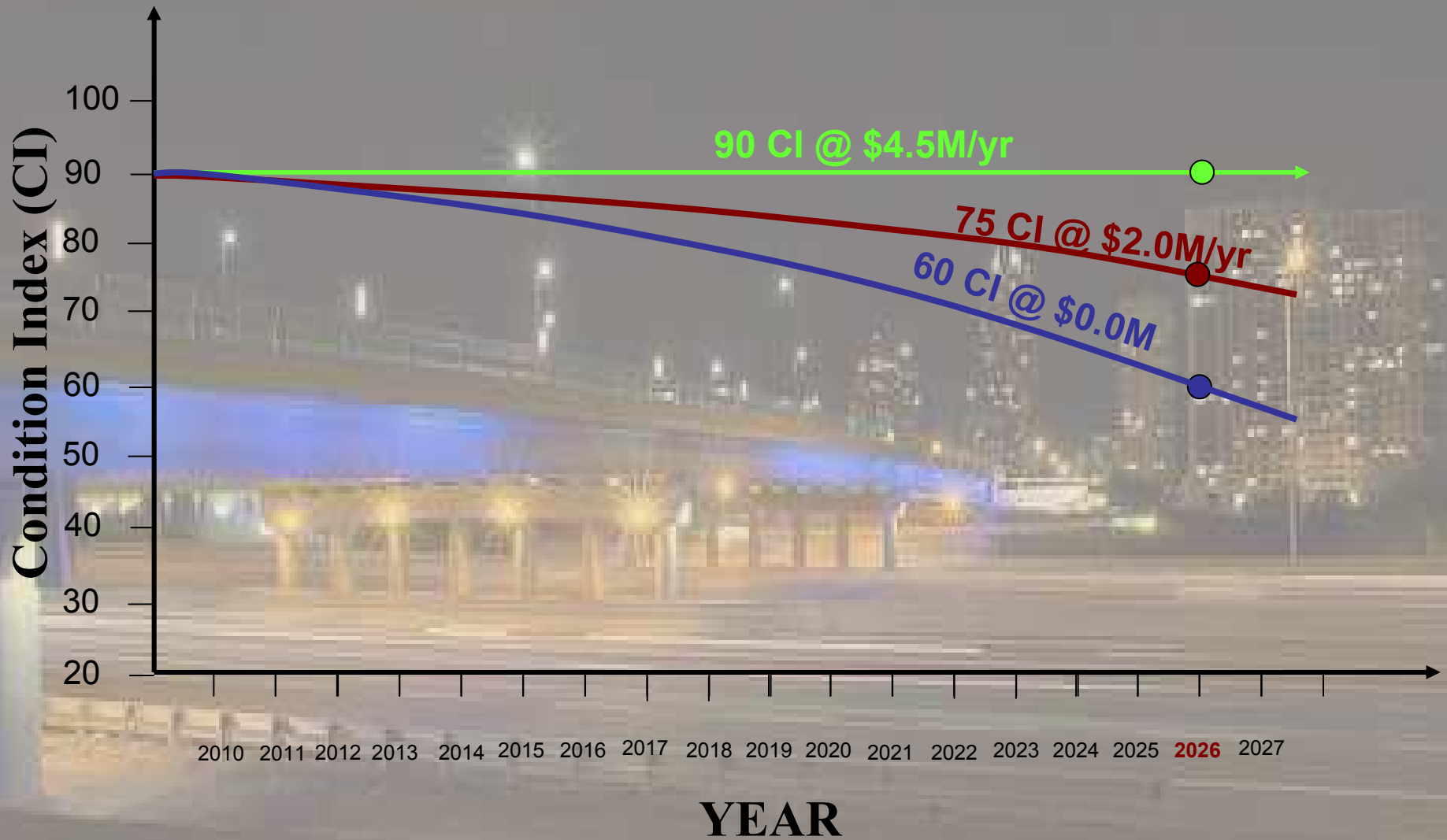
If Replacement Value of Bridge = \$500 M

and Total Bridge Needs = \$50M

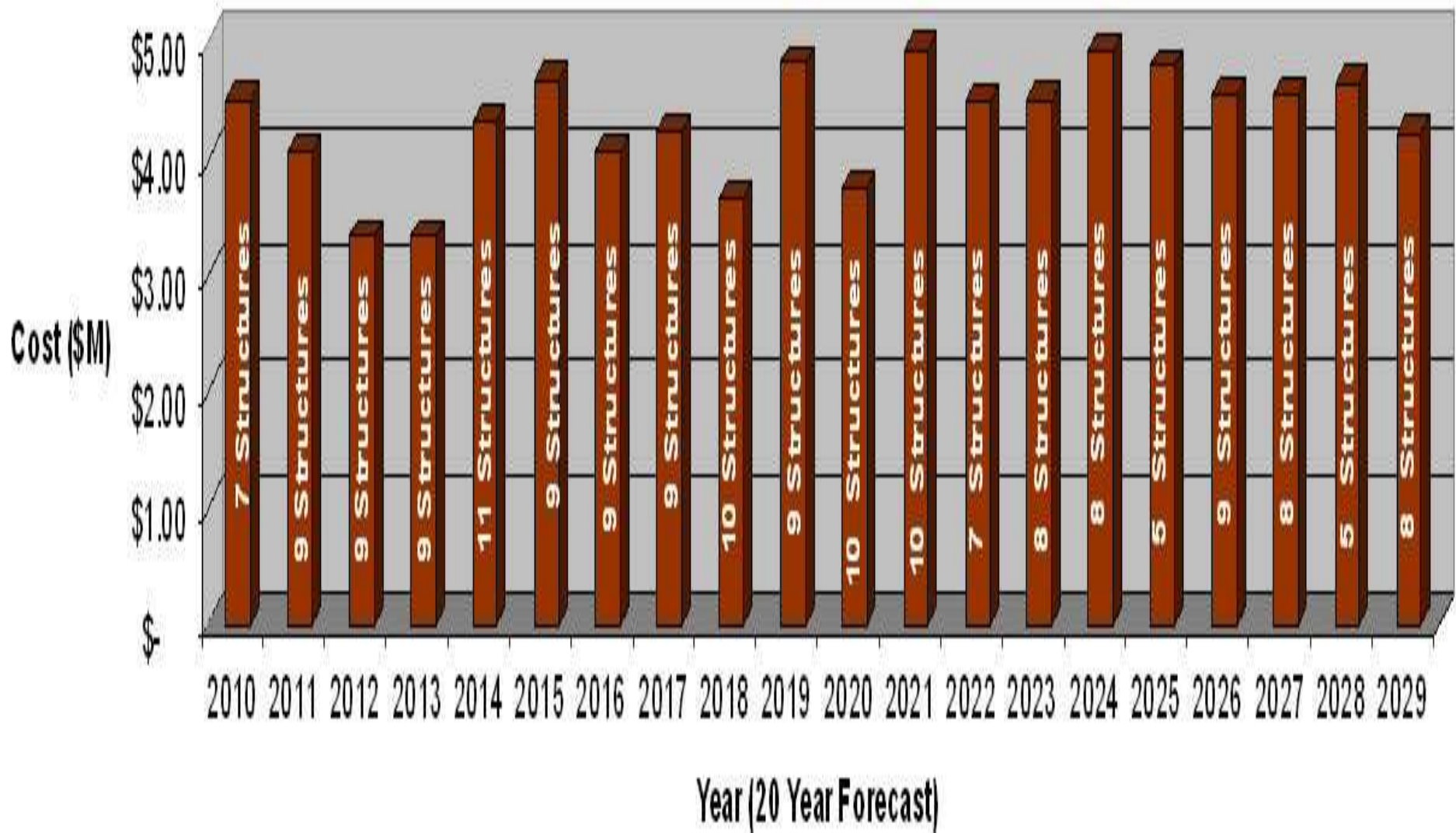
Then CI = 90

- **City-wide bridge network CI Average equals 90**

Network Average CI



Forecasted Bridge/Culvert Structure Program



Lakeshore Road Over Etobicoke Creek



Condition Index: 66

Year Built: 1945

Age: 64 years old

Replacement Value: \$3.9M



Birchwood Drive Over Birchwood Creek



Condition Index: 78

Year Built: 1963

Age: 46 years old

Replacement Value: \$421k



Brookhurst Road Over Sheridan Creek



Condition Index: 83

Year Built: 1970

Age: 39 years old

Replacement Value: \$1.2M



Glen Erin Drive Over Pedestrian Trail



Condition Index: 91

Year Built: 1978

Age: 31 years old

Replacement Value: \$1.46M



Recommendations

- Target 90 CI network wide to maximize lifecycle benefit
- **Increase average annual expenditure by \$2.5M**
- Apply appropriate rehab techniques on individual structures to maximize lifecycle of that structure
- Continue to address safety critical issues on individual structures
- Continue to upgrade components to new standards in conjunction with rehabilitation works (barriers and handrails)