Lifecycle Cost Analysis for Class 8 Snowplow Trucks at Utah DOT

TRB Session 818: Critical Issues in Snow Removal Equipment and Operations

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Client Overview

- Total fleet of more than 5,000 units
- Replacement value of 200 million dollars
- 500 Class 8 snow plow trucks
  - 2009 average age of 8.4 years
  - 2015 average age of 10.3
- Light duty fleet provided by General Services

Plow Fleet Budget History*

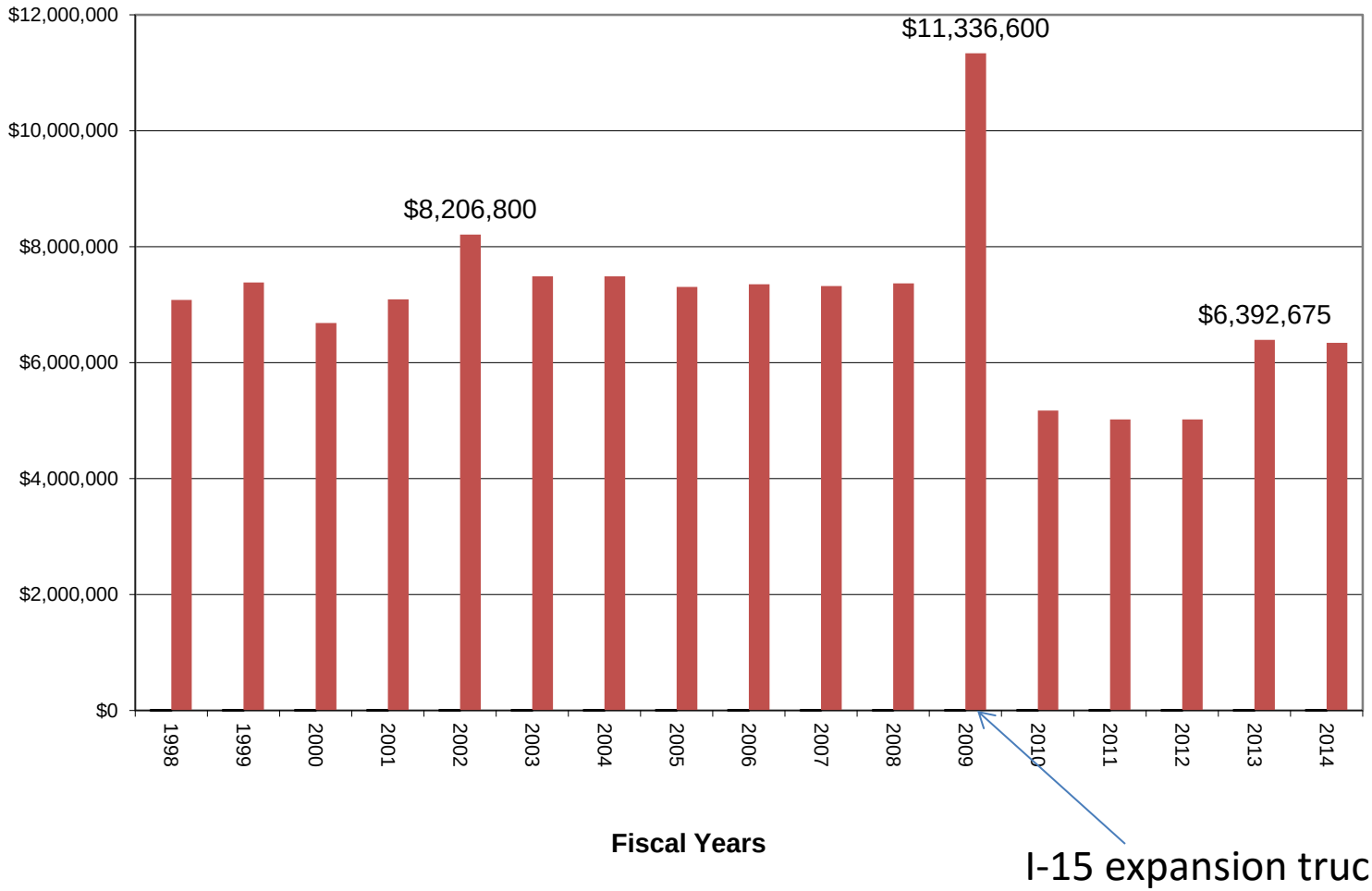


*Chart provided by UDOT

Plow Truck Repair Trends *

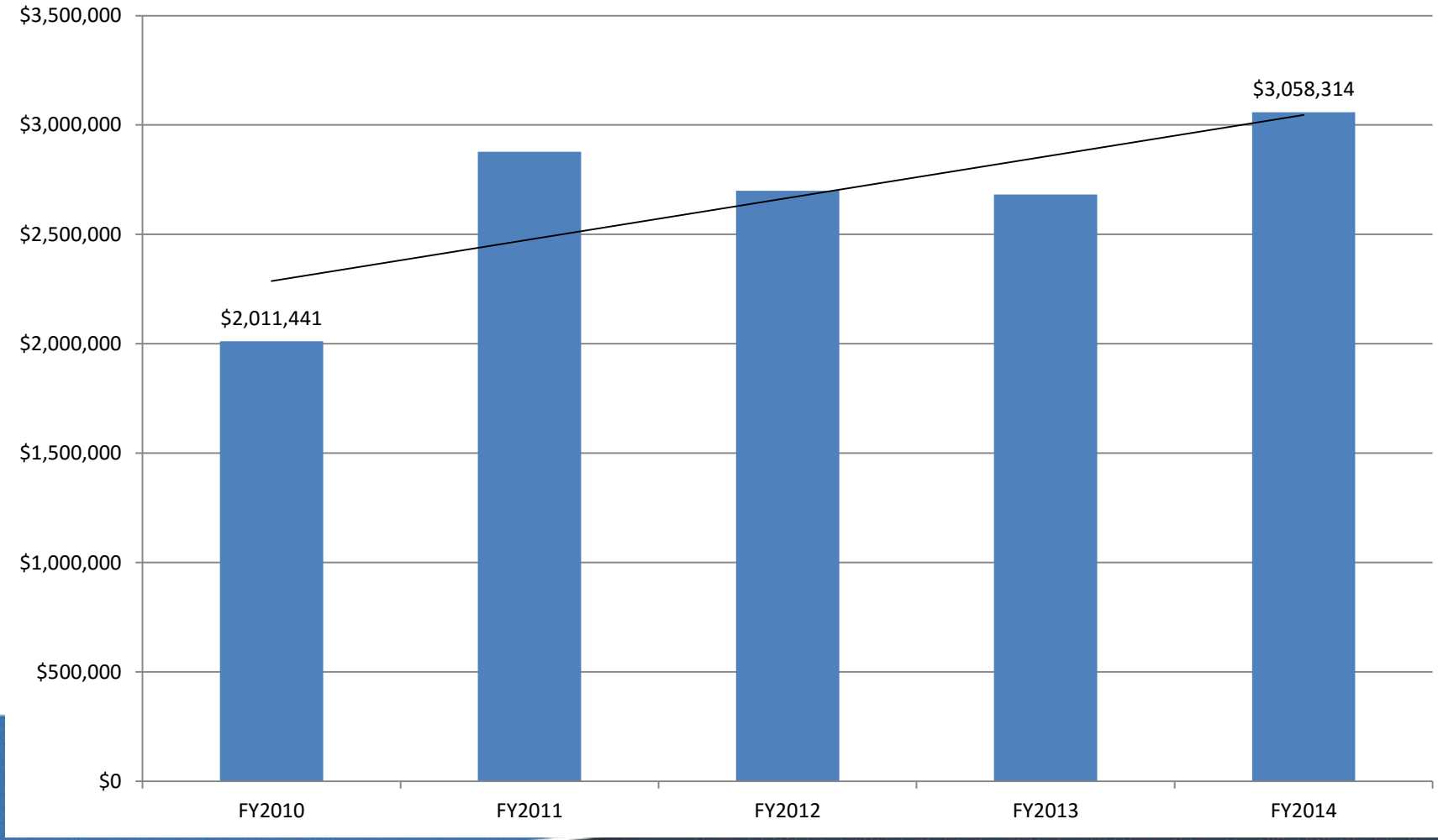


*Chart provided by UDOT

Project Objective

- Six tasks, three key questions:
  1. When should UDOT to replace its Class 8 snowplow trucks?
  2. What year-by-year funding is needed to achieve the target class age over 3, 4 or 5 years?
  3. How should UDOT address the units with cracked frames (or likely to develop such problems)?

Frame Cracking*

*Picture provided by UDOT

Cracked Frame – Side View*

*Picture provided by UDOT

Work Plan

- Literature review
- Develop lifecycle model
- Identify year-by-year funding needs
- Recommend strategy for units with current or potential frame cracking

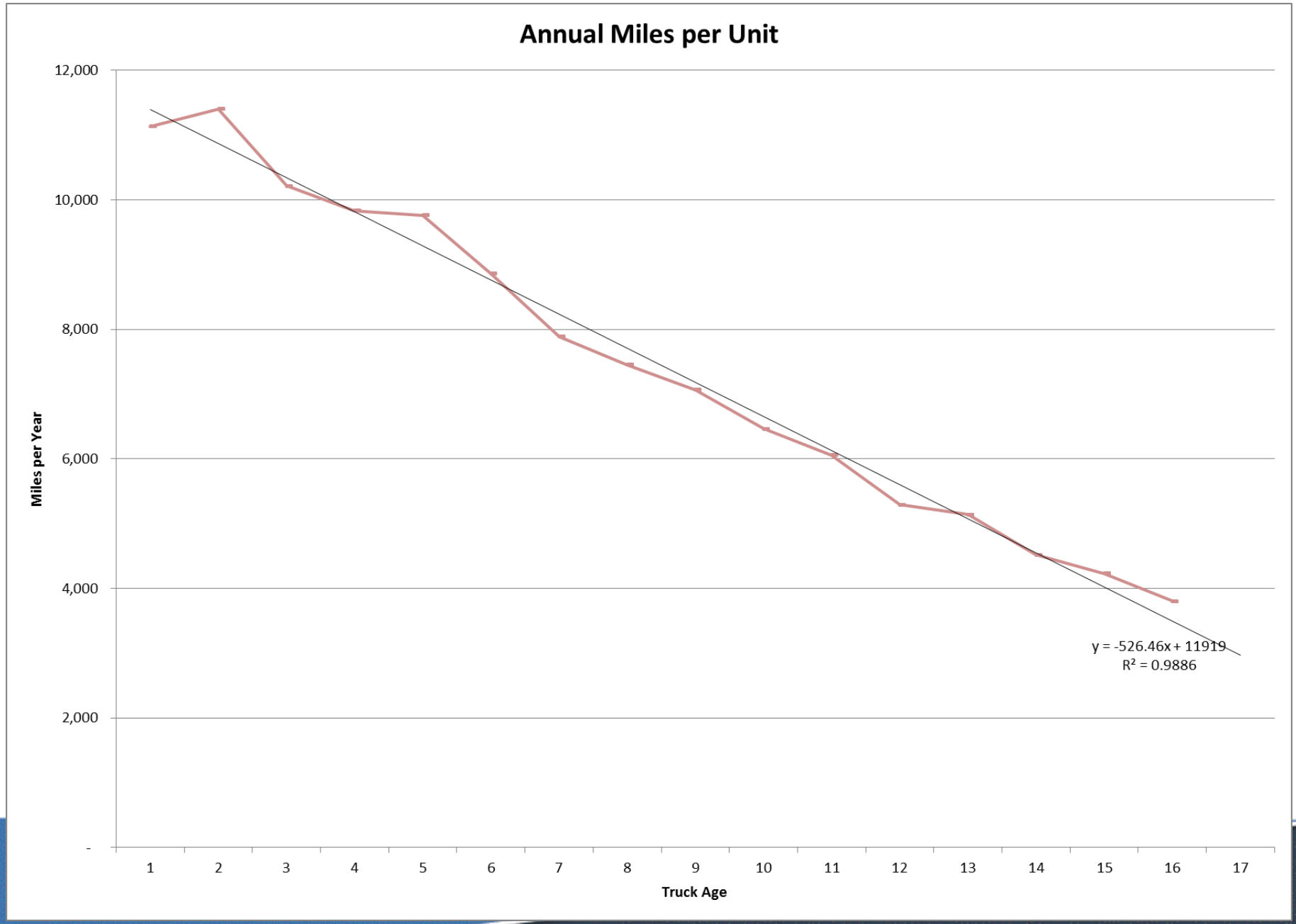
Key Recommendations

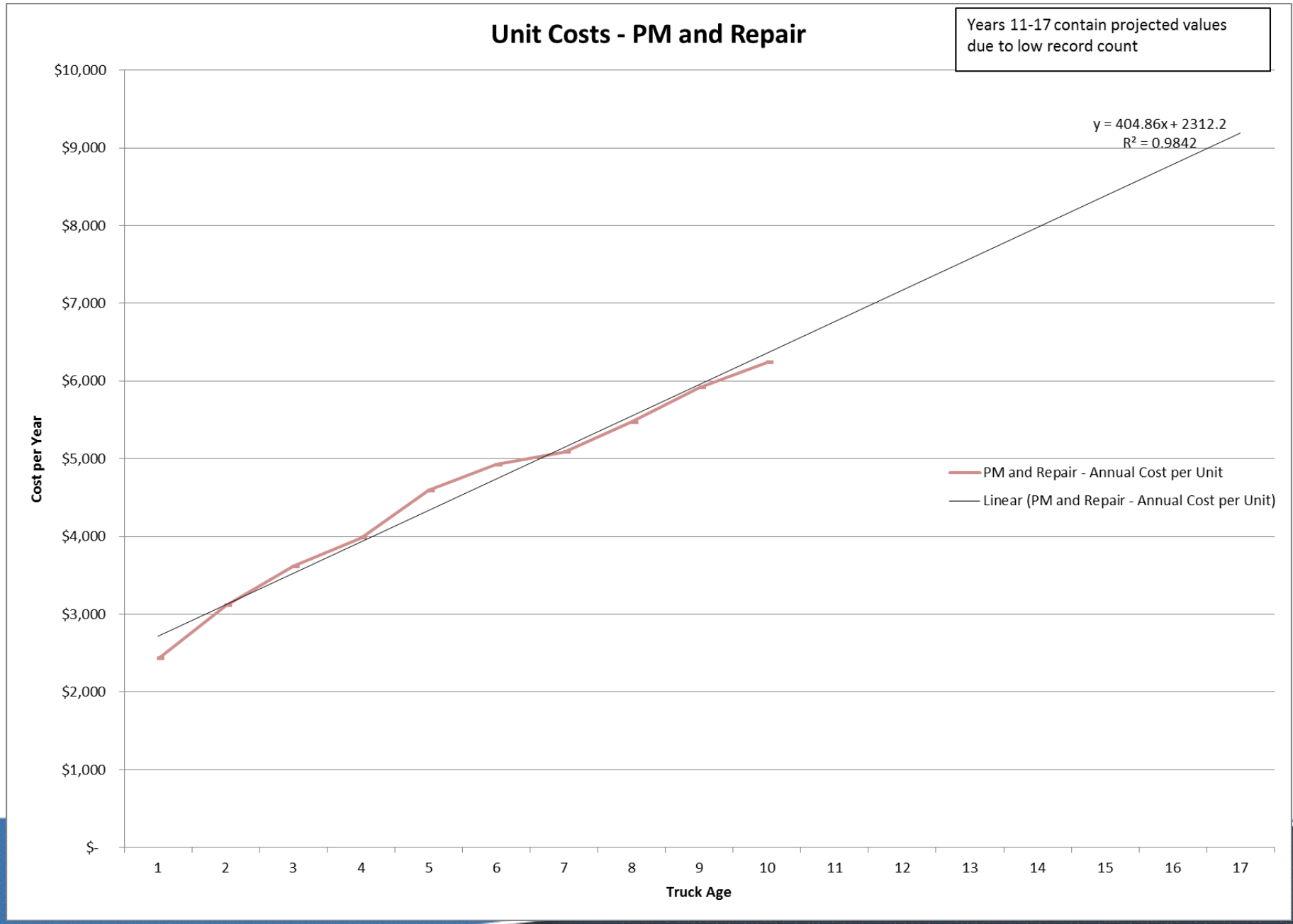
- Identified 9 years of age as the target for replacing UDOT Class 8 snowplows
- Add a points-based equipment condition evaluation system to age as replacement criteria
- Recommend a 5 year funding plan for achieving a target fleet age of 4.5 years
- Prioritize the replacement of trucks that have existing frame cracking issues

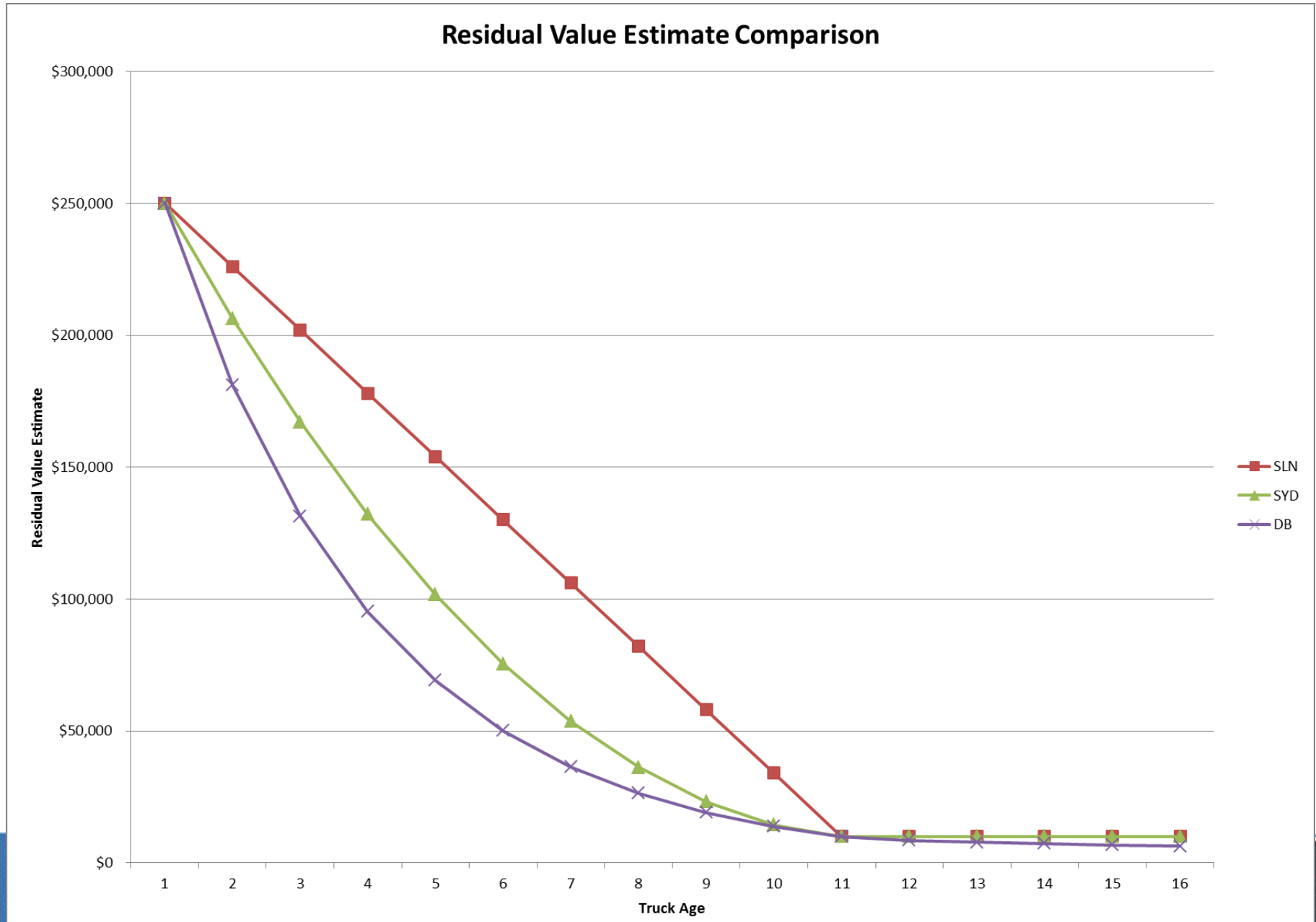
RECOMMENDATION DETAILS

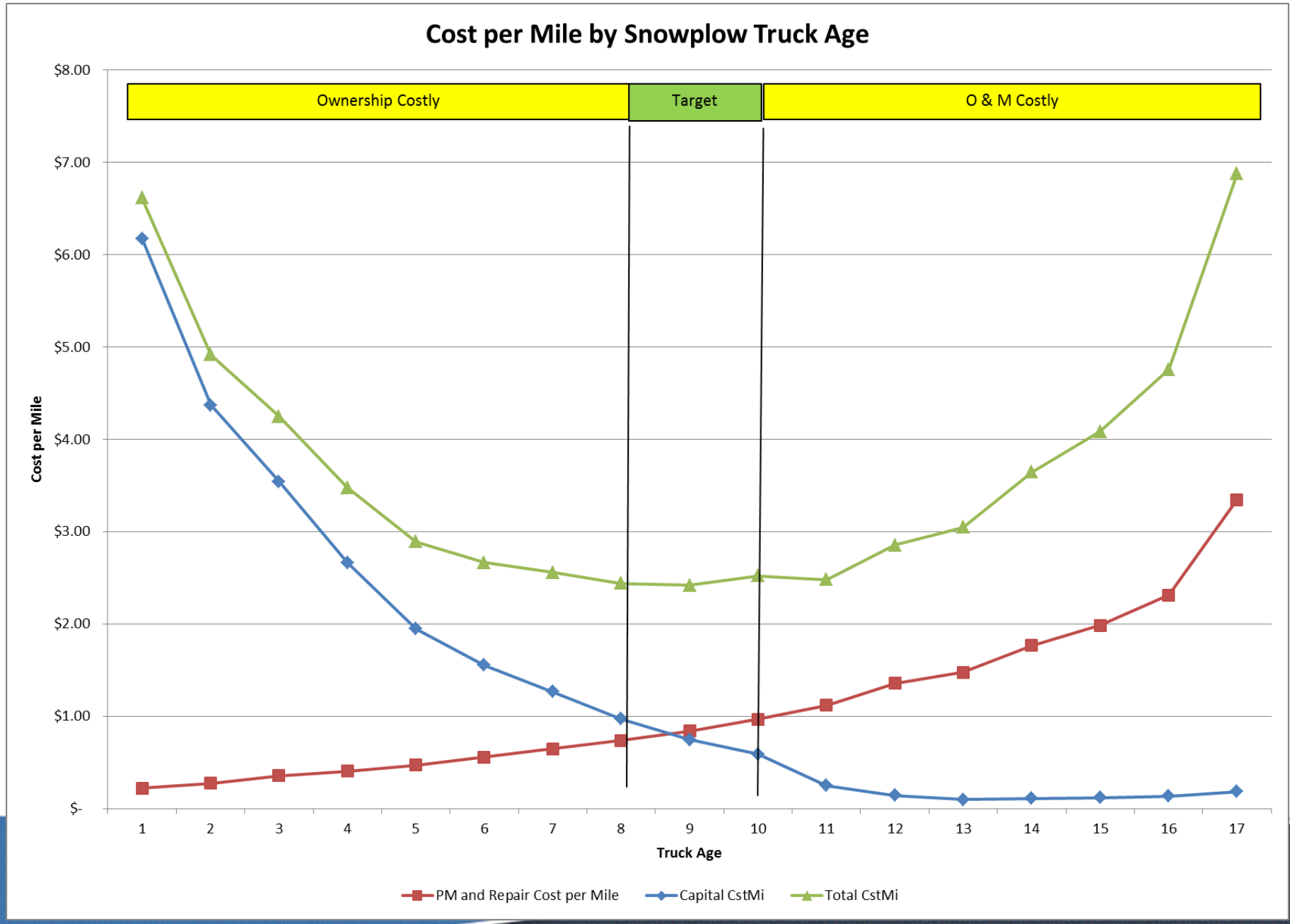
Lifecycle Model

- Consists of three curves:
  1. PM and repairs costs
  2. Capital costs
  3. Total Asset Cost curve (combination of above)


Annual Miles per Unit
12,000
10,000
8,000
6,000
4,000
2,000
-
Miles per Year
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Truck Age
y = -526.46x + 11919
R² = 0.9886


Unit Costs - PM and Repair
Years 11-17 contain projected values due to low record count
y = 404.86x + 2312.2
R² = 0.9842
PM and Repair - Annual Cost per Unit
Linear (PM and Repair - Annual Cost per Unit)
Cost per Year
$10,000
$9,000
$8,000
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$-
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Truck Age

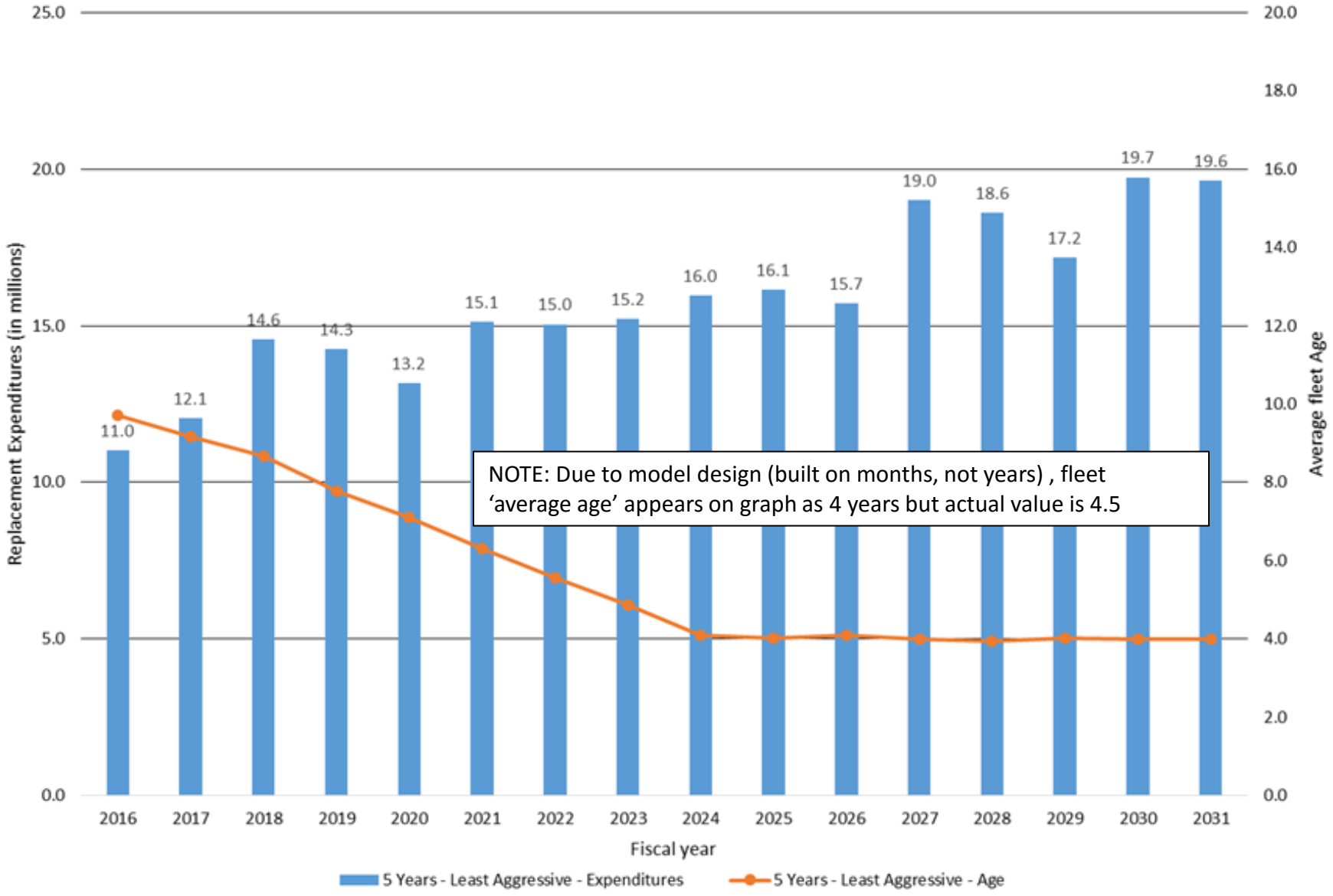

Residual Value Estimate Comparison
$300,000
$250,000
$200,000
$150,000
$100,000
$50,000
$0
Residual Value Estimate
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Truck Age
SLN
SYD
DB


Cost per Mile by Snowplow Truck Age
Ownership Costly
Target
O & M Costly
$8.00
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$-
Cost per Mile
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Truck Age
PM and Repair Cost per Mile
Capital CstMi
Total CstMi

Funding Comparison

- Based on Lifecycle Model recommendation of 9 years as target replacement age
- Assumes that corresponding fleet target age would be an average of 4.5 years
- Provided a year-by-year analysis of funding required to achieve goal in 3, 4 or 5 years
- Determined a 5-year target to be optimal

108 Month Replacement Plan 5 Year Age Target – Expenditures & Average Age



Frame Repairs Options

- Average residual value estimated < $8K
- Frame replacement
  - $47K per unit
  - Need to operate additional 7 years to recover costs
- Frame reinforcement
  - $10-15K per unit
  - Lasts only 2 years
  - OEMs do not recommend, increasing safety concerns
- No information to support any change in residual estimates with either approach

Other Comments

- Evolving emission regulations are changing equipment cost and service profiles
- Corrosion damage remains a significant, ongoing concern
- Existing fleet data includes a significant volume of unsegregated corrosion repairs

Other Comments (continued)

- Unclear as to whether changes in specifications or maintenance practices will alter cost and depreciation patterns
- Completing a snowplow route study to evaluate snowplow fleet size needs
- Revisit the equipment replacement criteria as additional data becomes available

Current Status

- Implementing the following recommendations
  - Segregating corrosion-related repair costs
  - Designing and implementing annual vehicle condition assessment system
- Legislature has stalled additional equipment funding authority

Thank You!

Provide questions / comments to:

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