

Edge Break Prediction Model for Low Volume Roads

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2007 Low Volume Road Workshop



RIMS NZ dTIMS & Low Volume Roads

- **NZ dTIMS predictions for low volume roads**
 - Fairly robust for resurfacing quantities
 - Not so accurate for rehabilitation needs particularly

AWPT

- **AWPT is mainly justified based on maintenance cost**



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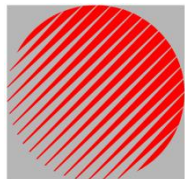
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RIMS NZ dTIMS & Low Volume Roads

- **Maintenance cost drivers are**
 - Heavy dig-outs
 - Potholes
 - Shoving
 - Edge Break
 - Flushing, etc.
- **Prediction models for many of these distress types are not available in HDM**



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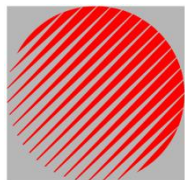
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RIMS NZ dTIMS & Low Volume Roads

- **LTPP study for improving current HDM models and/ or developing new models**
- **Interim arrangement – develop prediction models using available data**
- **Edge Break Prediction Model**



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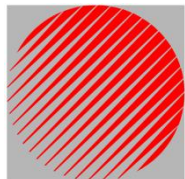
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Edge Break Model - Low Volume Roads

- **Local authorities (3100 KM of Local Authority Roads)**
 - **Central Hawkes Bay District Council**
 - **Wairoa District Council**
 - **Western Bay of Plenty District Council**
 - **Ashburton District Council**
 - **Southland District Council**
 - **Queenstown Lakes District Council**
- **Data comprised a total of 3762 treatment lengths out of which 1652 (44%) showed edge break or edge break patches**



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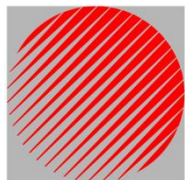
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Edge Break Model - Low Volume Roads (Based on Rating Data)


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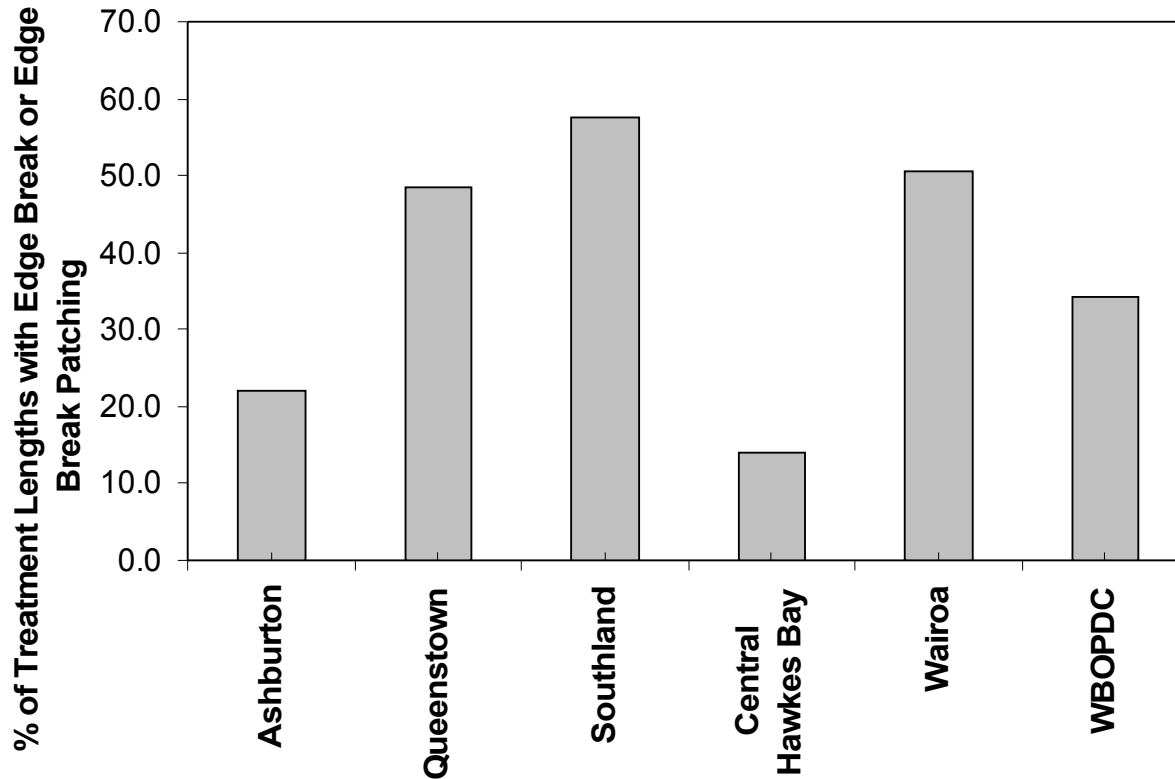

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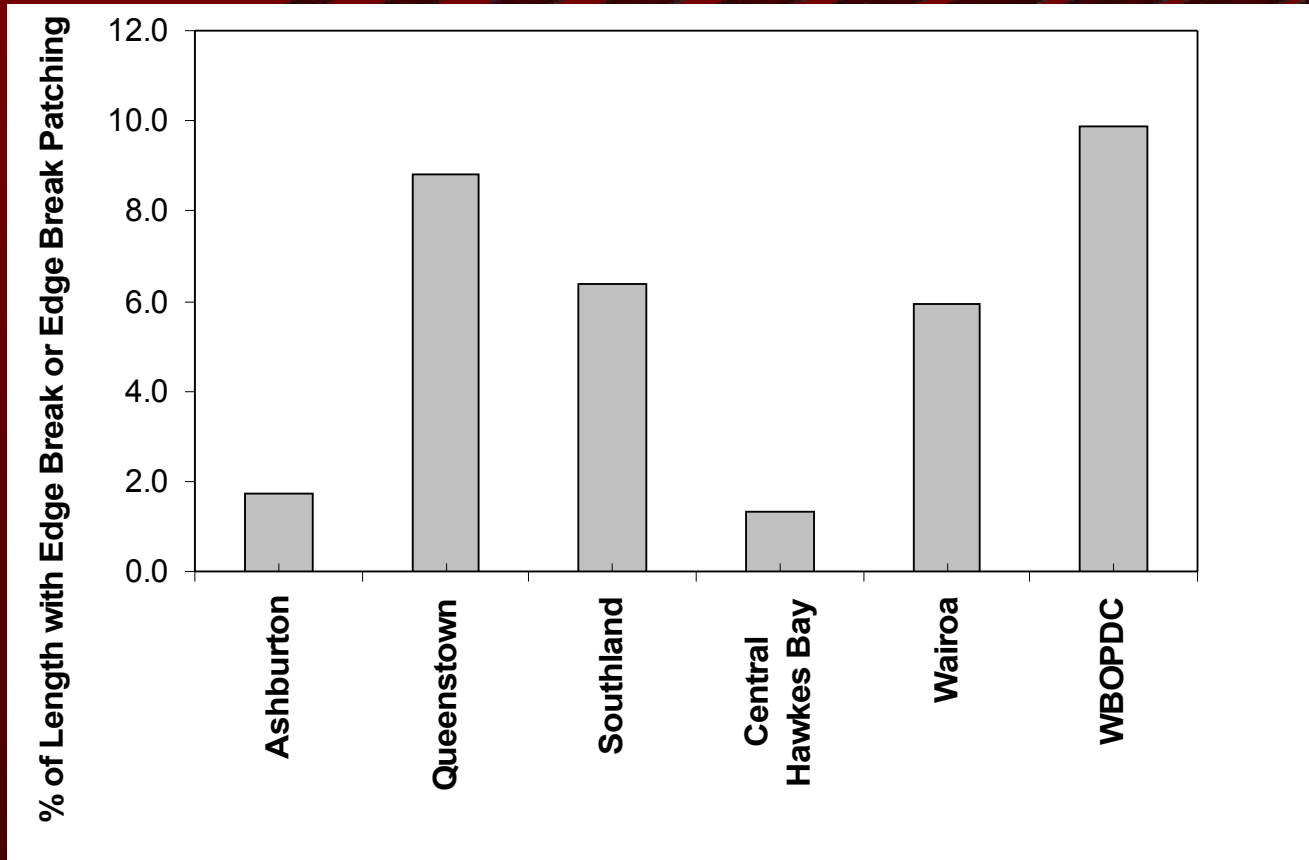

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Edge Break Model - Low Volume Roads (Based on Rating Data)



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Edge Break Models – Low Volume Roads

- **Relevant Independent Variables**

- **Lane Width**
- **AADT**
- **Number of Heavies**
- **Surfacing Age**
- **Structural Number**
- **Construction Quality**
- **Terrain**
- **Presence or Absence of Shoulder (Sealed/ Unsealed Shoulder)**



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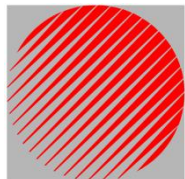
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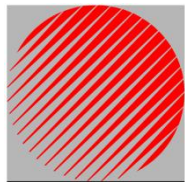
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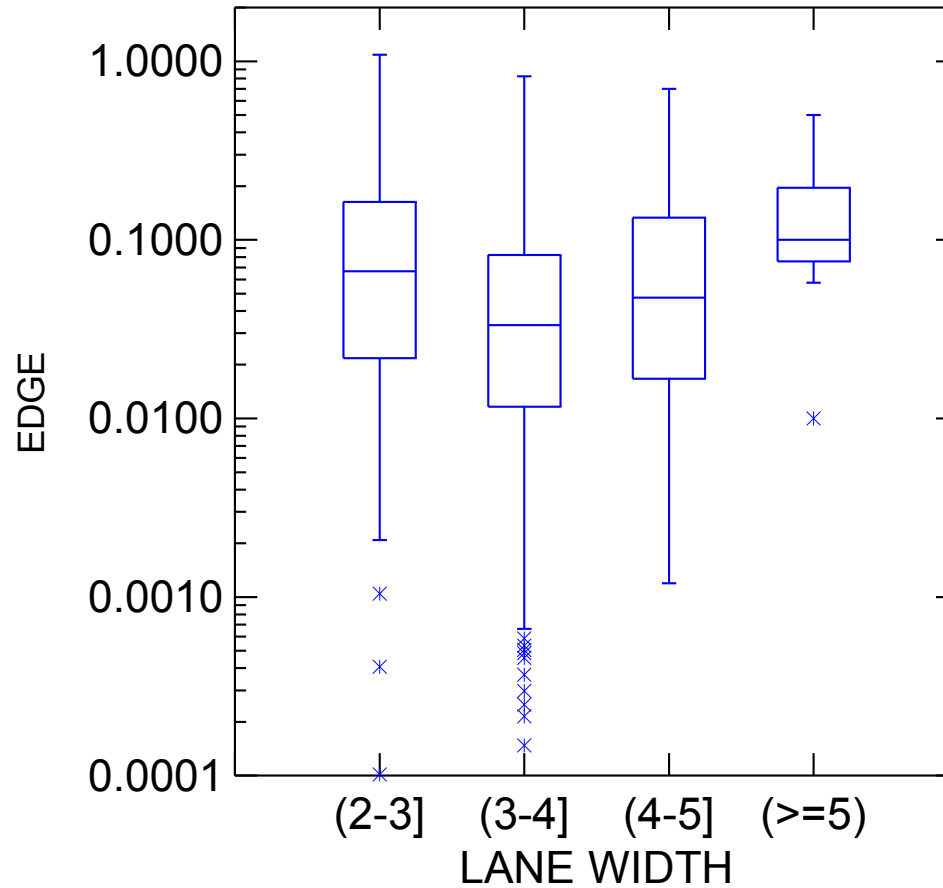
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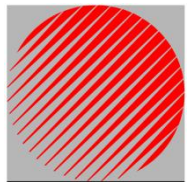
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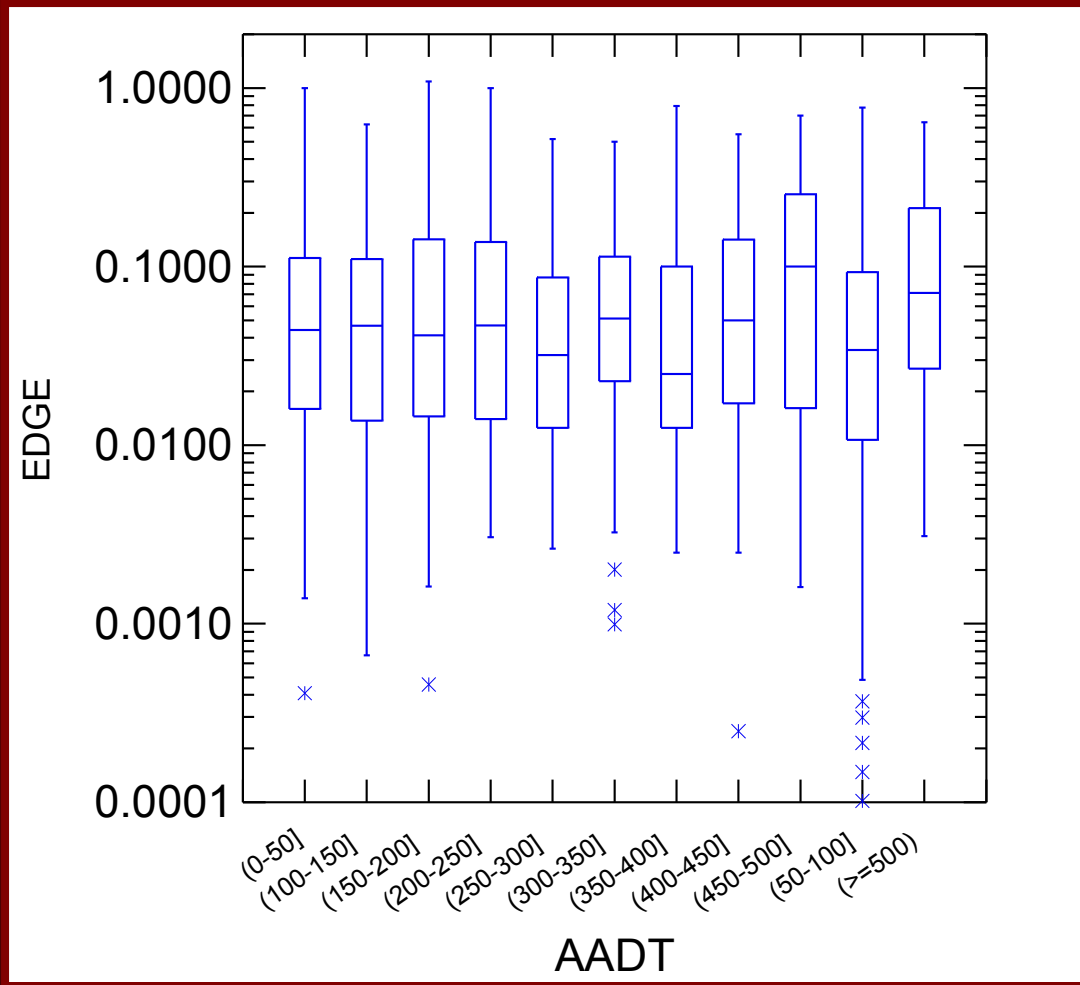
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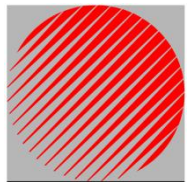
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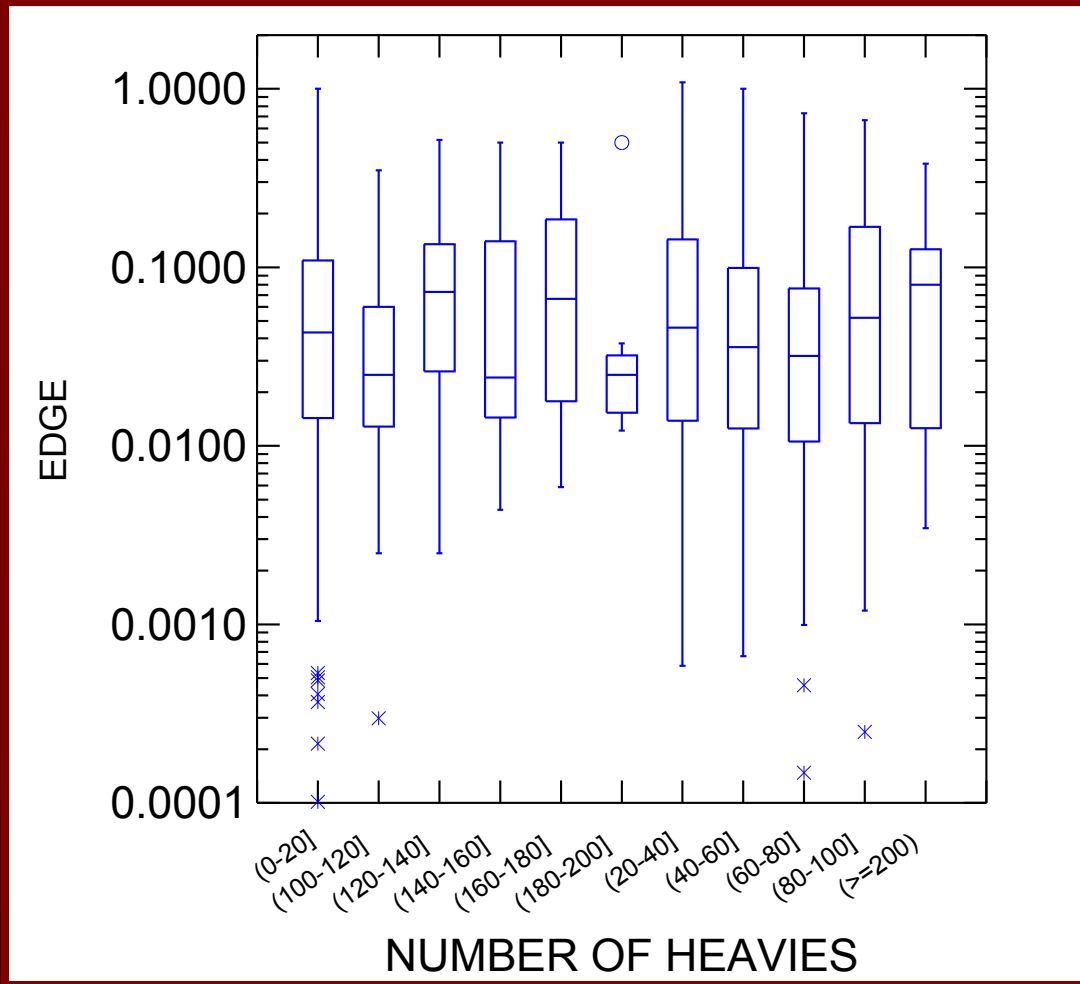
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Edge Break Model - Low Volume Roads

- **Half of the sites with edge break developed edge break within the first six years after surfacing**
- **Around 30% of sites with edge break, developed edge break within first two years after surfacing**
- **Around 64% of sites with lane width less than 2m showed edge break, whereas around 32% of sites with lane width between (3.75-4m) showed edge break**
- **More than 50% of all sites cater an AADT of less than 100vpd and 95% of all sites have less than 500vpd**



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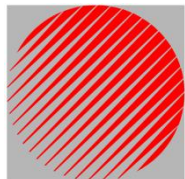
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Edge Break Models – Low Volume Roads

- **Probability Model to Predict Edge Break Initiation (Logit Model)**
- **Regression Model to Predict the Quantity of Edge Break**



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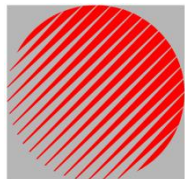
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Edge Break Models – Low Volume Roads



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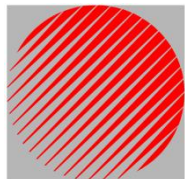
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$$\text{Probability of edgebreak} = \frac{1}{1 + \exp(0.962 + 0.14W - 0.859 \frac{\log_{10}(AADT)}{W} - 2.511 \frac{\log_{10}(Age)}{W})}$$

- **W** = lane width in meters (carriage way width/ number of lanes)
- **Age** = Surfacing age (in years)
- **AADT** = Estimated AADT



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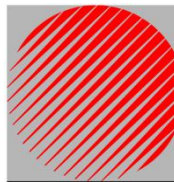
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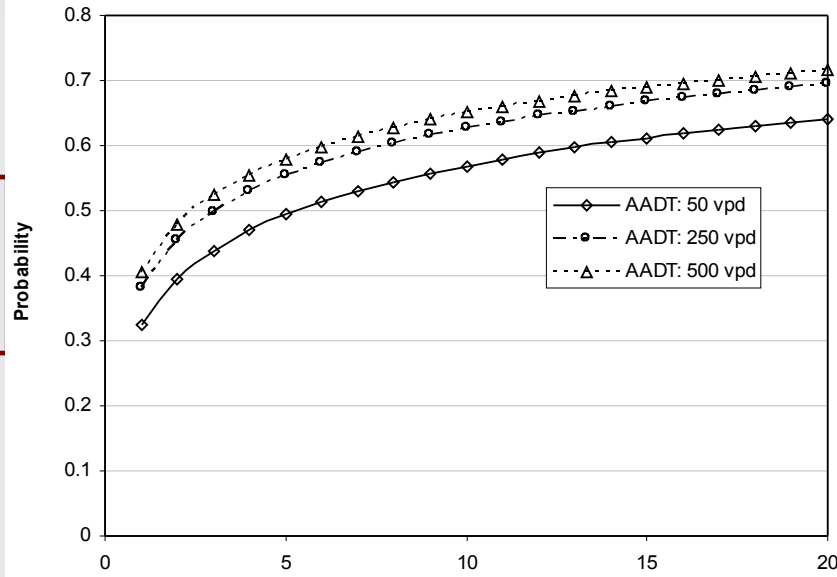


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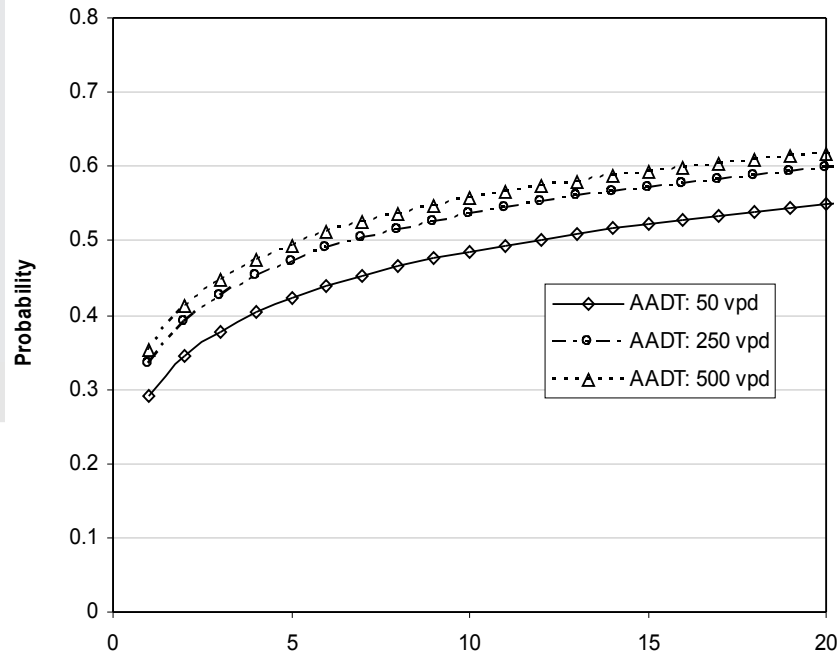
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Probability of Edge Break (Width: 2.5 m)

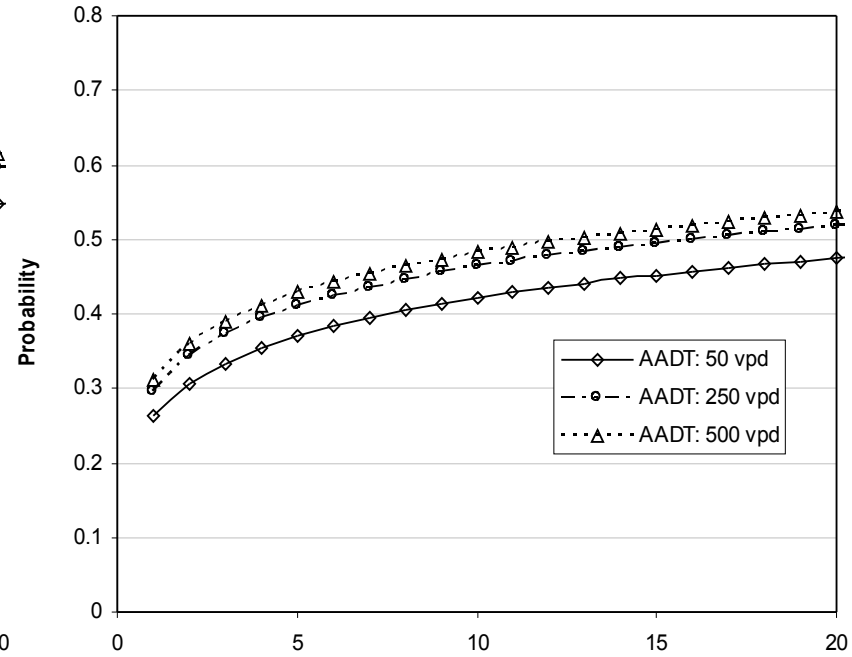


- **AAADT 250 vpd**
- **Probability = 0.5**
 - in 3 years (width= 2.5m)
 - in 7 years (width= 3m)
 - In 16 years (width=3.5m)

Probability of Edge Break (Width: 3 m)



Probability of Edge Break (Width: 3.5 m)



Comparison with Earlier Study



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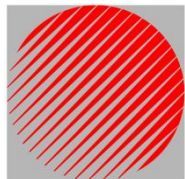
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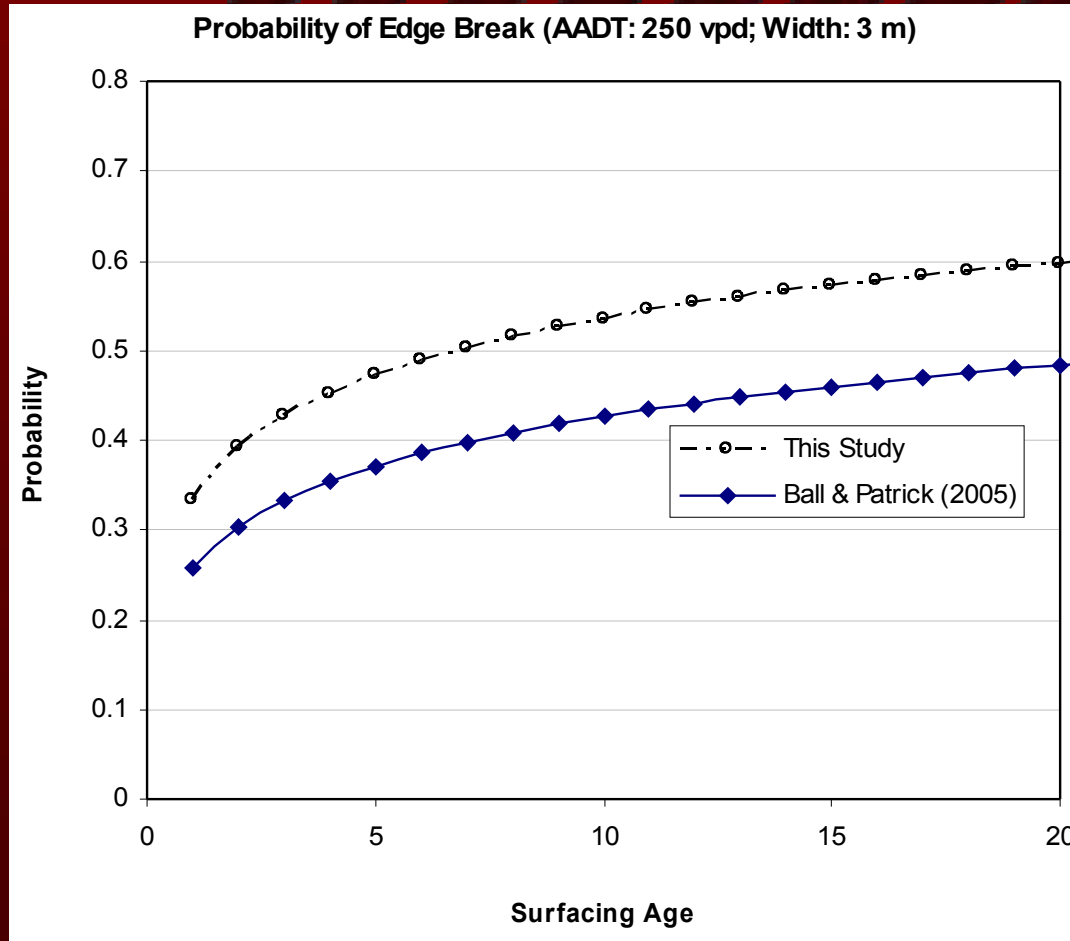
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Edge Break Models – Low Volume Roads

$$Y = 10^{(-0.537W + 0.018AGE + 0.001AADT)}$$

- **R-Square** = **0.862**
- **W** = **lane width in meters (carriage way width/
number of lanes)**
- **Age** = **Surfacing age in years**
- **AADT** = **Estimated AADT**



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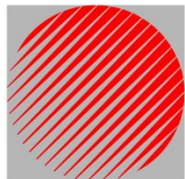
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Data and Model



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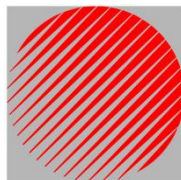
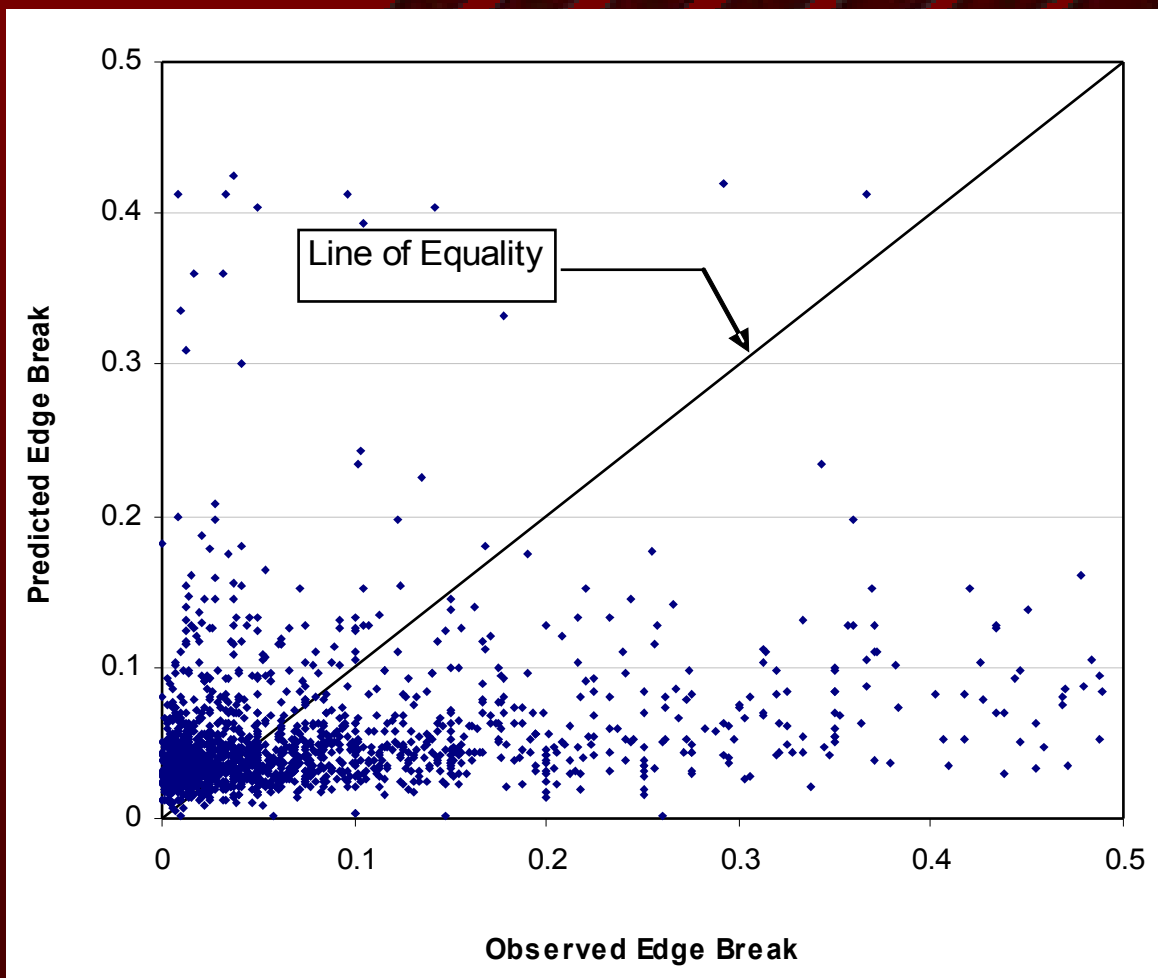
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Summary

- **Edge break initiation model seems reasonable given high randomness in data**
 - **The model is adopted in RIMS NZ dTIMS CT**
 - **Better model may be needed in the long term**
- (Based on LTPP data)**



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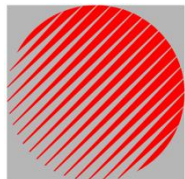
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Acknowledgements

- **RIMS Group**
- **dTIMS Development Consortium**



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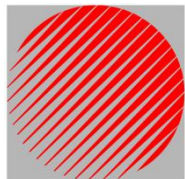
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