

Effective Time for Application of Slurry Seal on Asphalt Pavements in the Truckee Meadows Region

**University of Nevada Reno (UNR)
Western Regional Superpave Center**

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Work Shop/Conference
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Problem Statement and Objective

- ▶ The time of Slurry Seal (SS) application is left to the Project Engineer judgment and practice.
 - ▶ SS right after construction
 - ▶ SS after 1, 3, 5 etc. years of service
 - ▶ ...
- ▶ **Objective:** Evaluate the field performance & effectiveness of SS on asphalt pavements in Truckee Meadows Region



Research Phases

- ▶ Phase I:
 - ▶ Evaluate *effectiveness* & *optimum time* for single application of slurry seal

- ▶ Phase II:
 - ▶ Evaluate *effectiveness* & *optimum time* for sequential application of slurry seal



Phase I: Research Approach

- ▶ Collect & evaluate performance data of asphalt pavements
 - ▶ *without* slurry seal
 - ▶ *receiving* single slurry seal at various times: 0, 1, 3, 5, 7, and 9.
- ▶ Identify *effectiveness* & *optimum time* for SS application.

Phase I: Evaluated Sections

- ▶ Asphalt pavement sections were identified within the jurisdictions of: WCED, COR and COS.

Initial Construction Pavement Type	Road Classification	ADT	Total number of sections
New Construction	Arterial	≥ 10,000	36
	Collector	< 10,000	33
	Residential	< 6,000*	525
Overlay	Arterial	≥ 10,000	34
	Collector	< 10,000	226
	Residential	< 6,000*	<u>1,848</u>

* With a high percentage of trucks (> 4%)

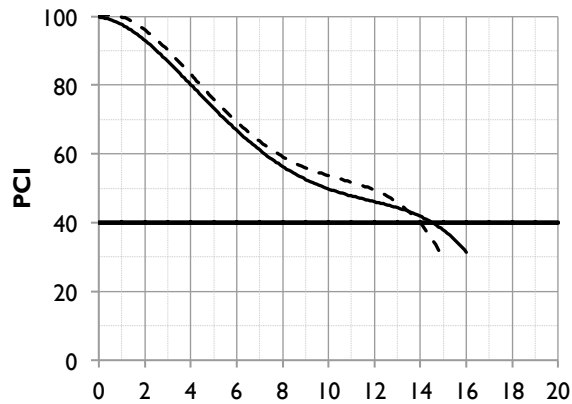


Phase I: Evaluated Sections (Cont'd)

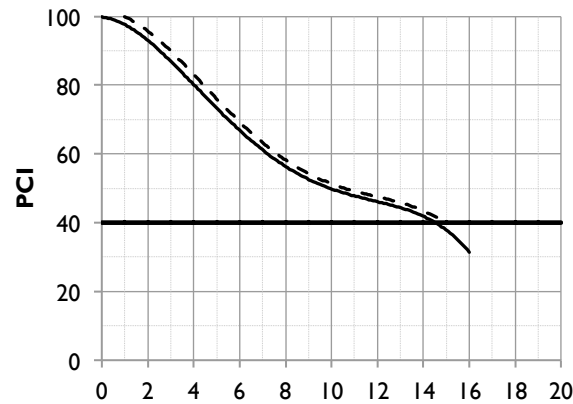
- ▶ Within each group (i.e. Road class), pavement sections were broken into three categories:
 - ▶ **Do –Nothing**: SS was not applied to the pavement
 - ▶ SS applied immediately after construction (referred to as **0**)
 - ▶ SS applied at: **1, 3, 5, 7, and 9** years after construction
- ▶ Performance was measured in terms of PCI.

Phase I: Prediction Performance Models

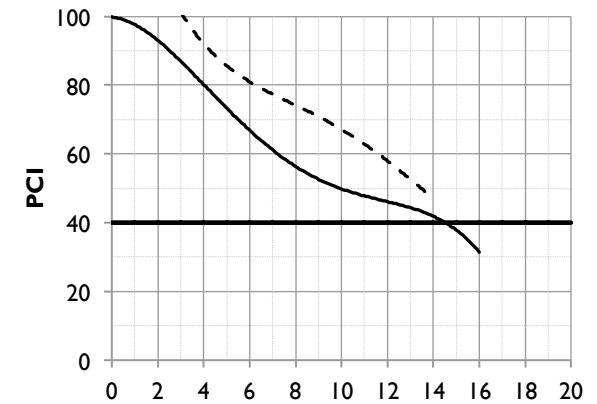
New Construction - Arterial



Age in Years



Age in Years

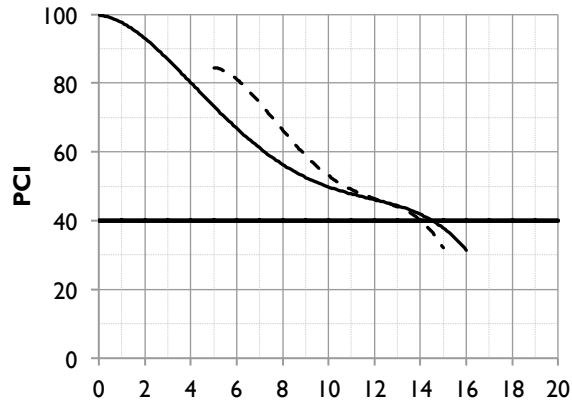


Age in Years

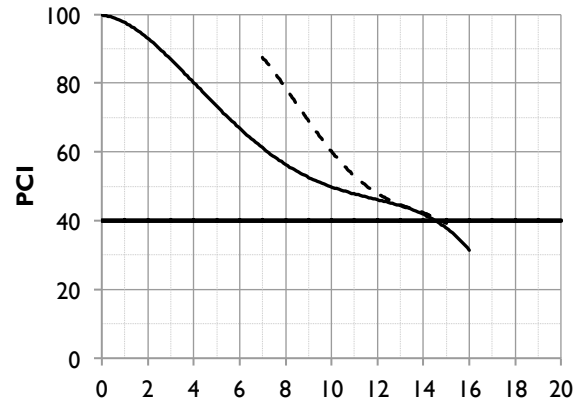
— New Construction - - - Slurry Seal at year 0

— New Construction - - - Slurry Seal at year 1

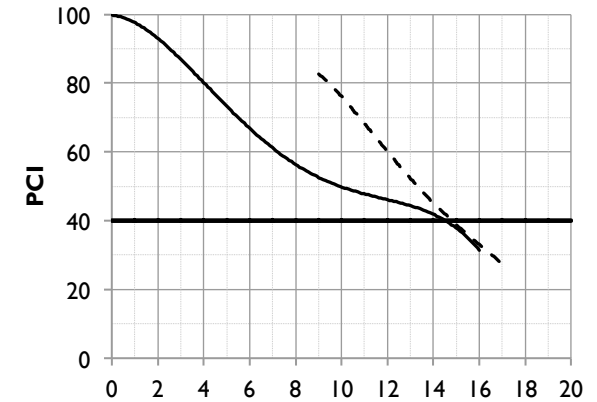
— New Construction - - - Slurry Seal at year 3



Age in Years



Age in Years



Age in Years

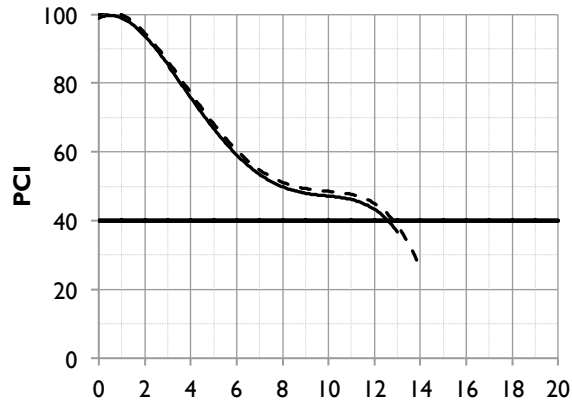
— New Construction - - - Slurry Seal at year 5

— New Construction - - - Slurry Seal at year 7

— New Construction - - - Slurry Seal at year 9

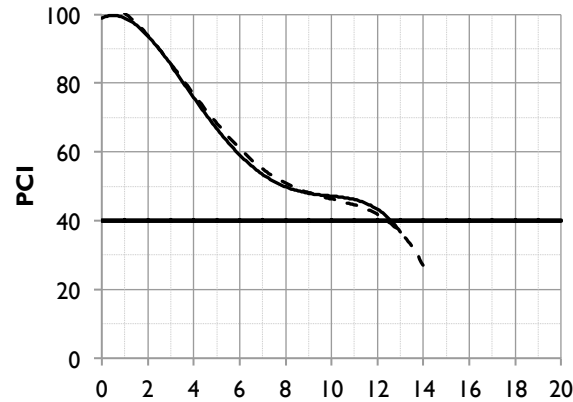
Phase I: Prediction Performance Models

Overlay - Arterial



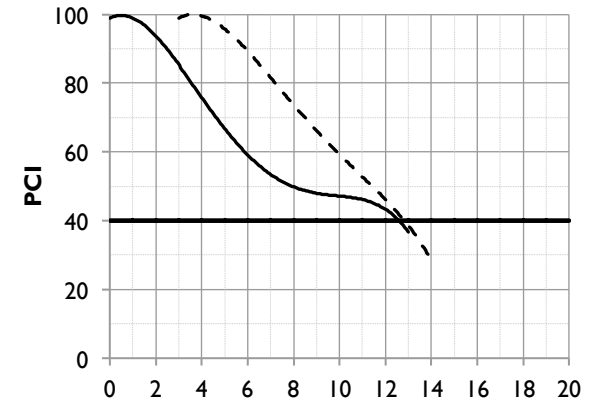
Age in Years

— Overlay - - - Slurry Seal at year 0



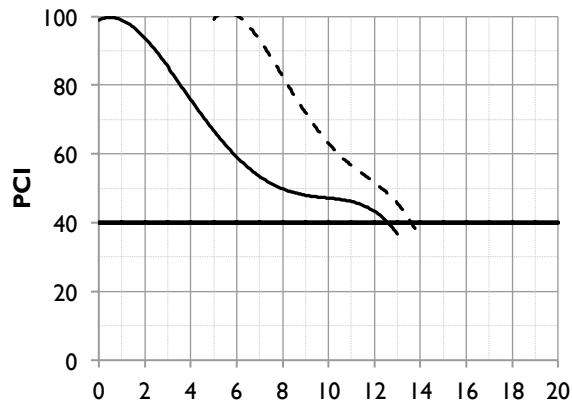
Age in Years

— Overlay - - - Slurry Seal at year 1



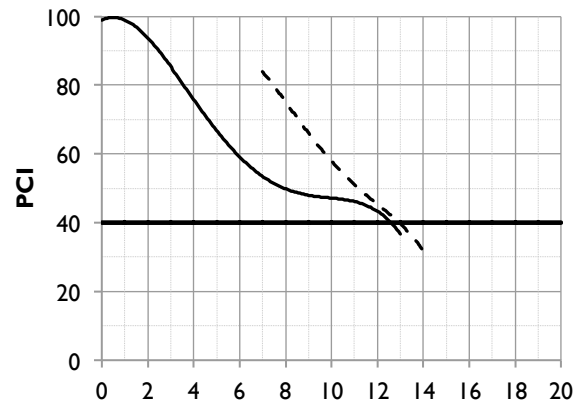
Age in Years

— Overlay - - - Slurry Seal at year 3



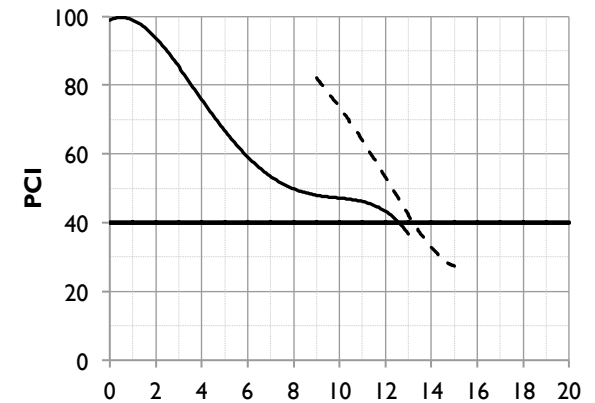
Age in Years

— Overlay - - - Slurry Seal at year 5



Age in Years

— Overlay - - - Slurry Seal at year 7

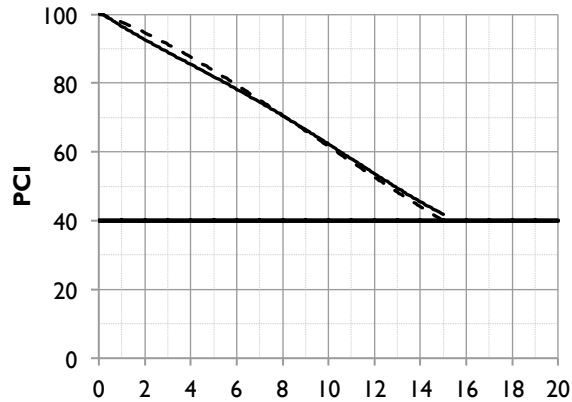


Age in Years

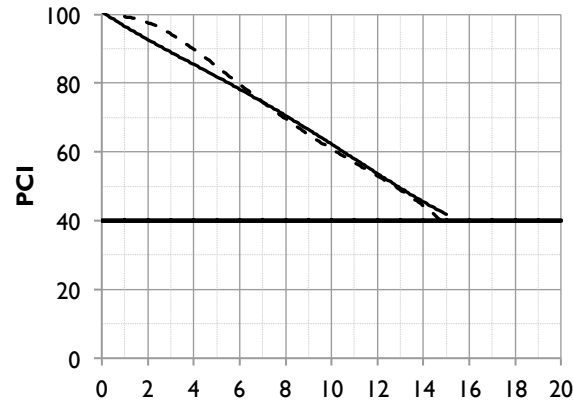
— Overlay - - - Slurry Seal at year 9

Phase I: Prediction Performance Models

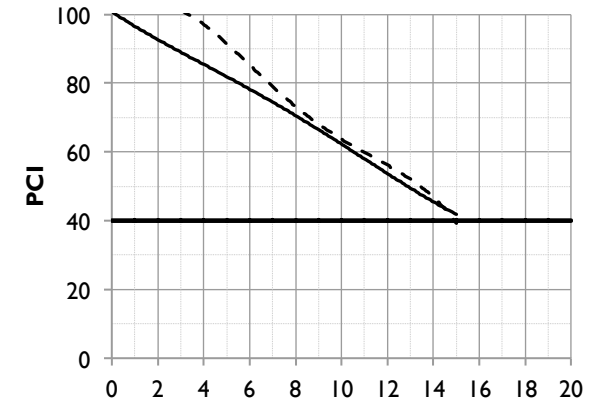
New Construction - Collectors



Age in Years



Age in Years

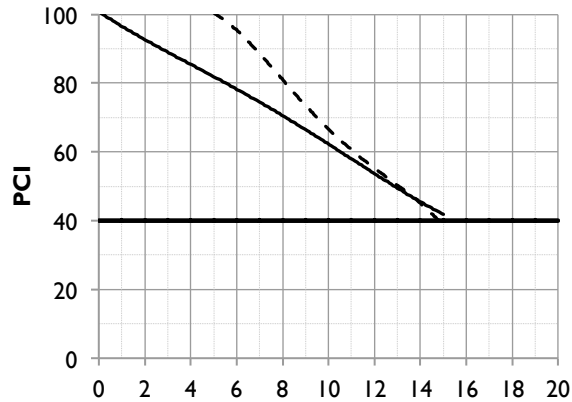


Age in Years

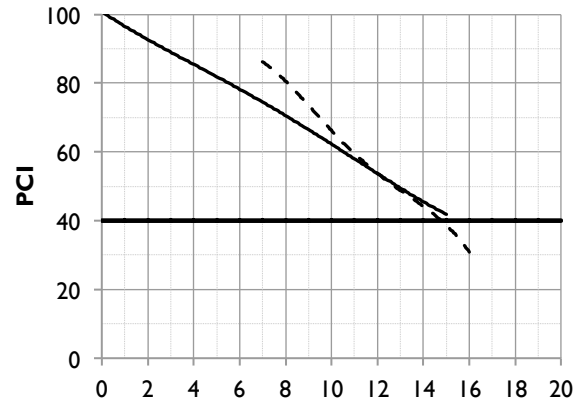
— New Construction - - - Slurry Seal at year 0

— New Construction - - - Slurry Seal at year 1

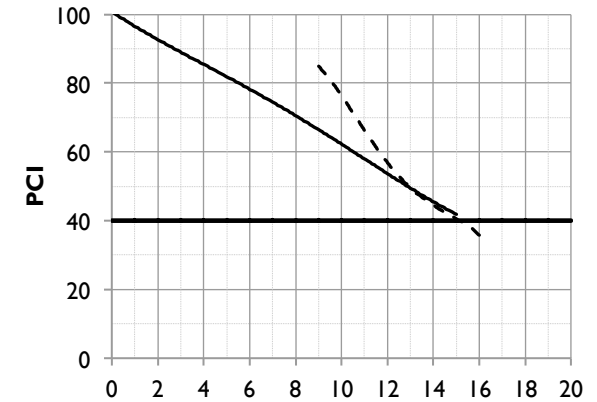
— New Construction - - - Slurry Seal at year 3



Age in Years



Age in Years



Age in Years

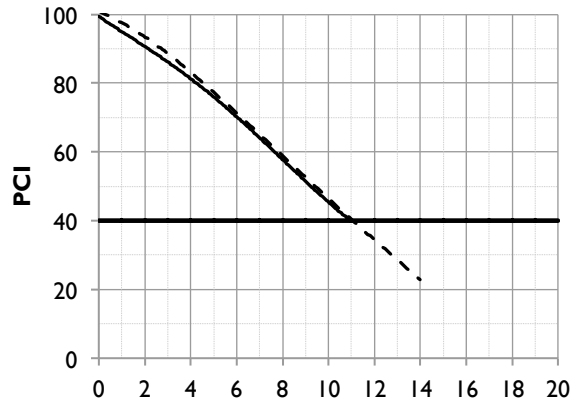
— New Construction - - - Slurry Seal at year 5

— New Construction - - - Slurry Seal at year 7

— New Construction - - - Slurry Seal at year 9

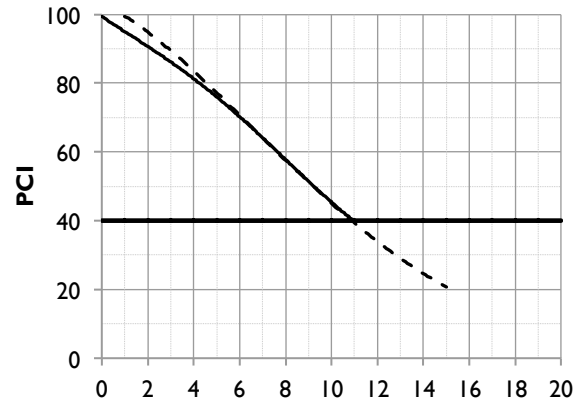
Phase I: Prediction Performance Models

Overlay - Collector



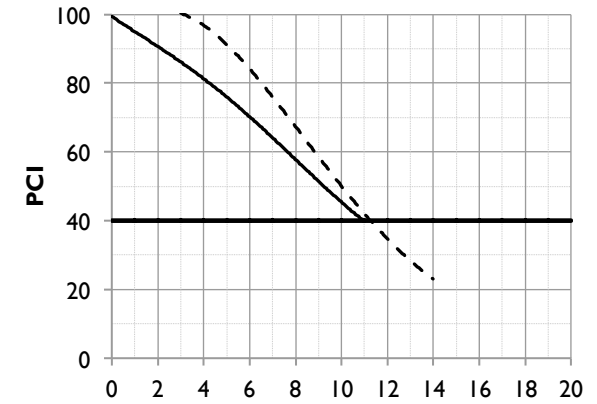
Age in Years

— Overlay - - - Slurry Seal at year 0



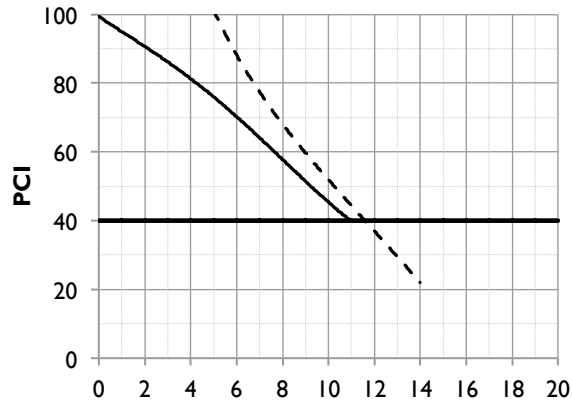
Age in Years

— Overlay - - - Slurry Seal at year 1



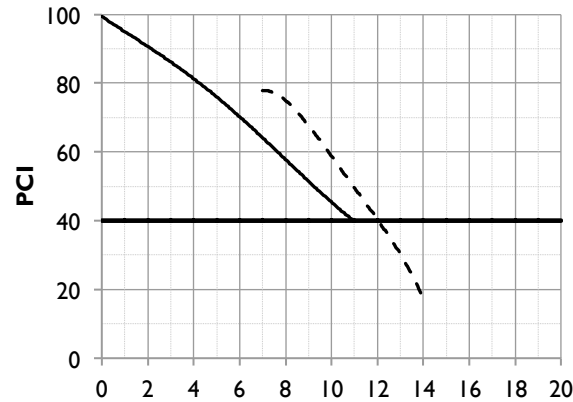
Age in Years

— Overlay - - - Slurry Seal at year 3



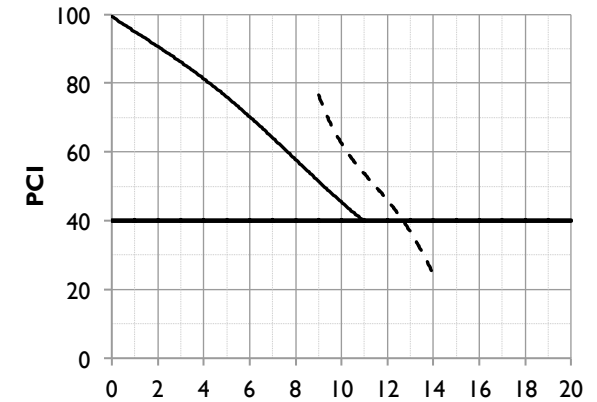
Age in Years

— Overlay - - - Slurry Seal at year 5



Age in Years

— Overlay - - - Slurry Seal at year 7

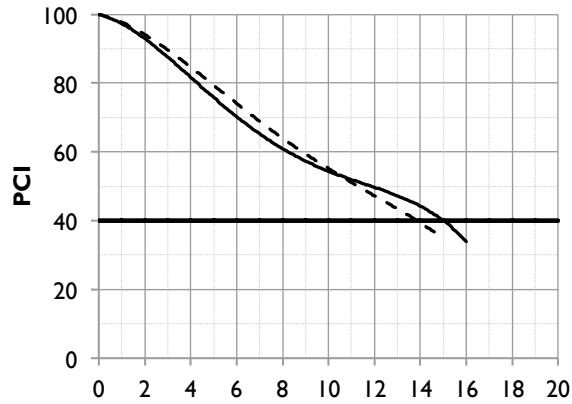


Age in Years

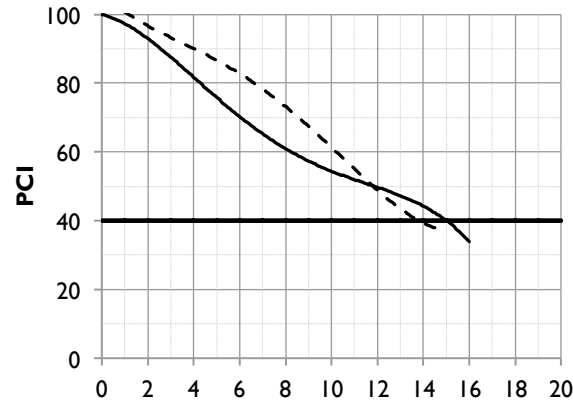
— Overlay - - - Slurry Seal at year 9

Phase I: Prediction Performance Models

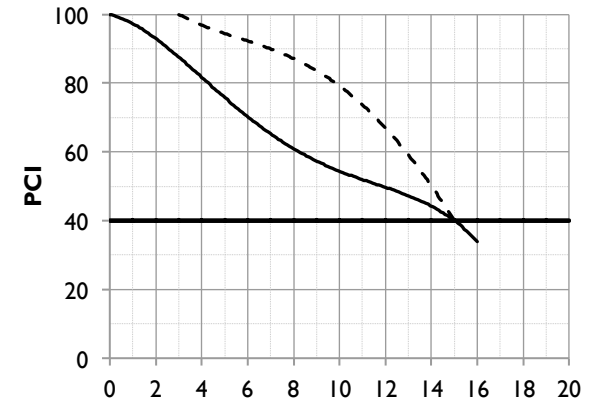
New Construction - Residential



Age in Years



Age in Years

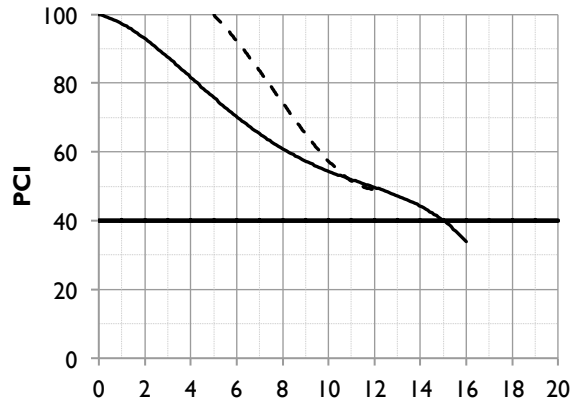


Age in Years

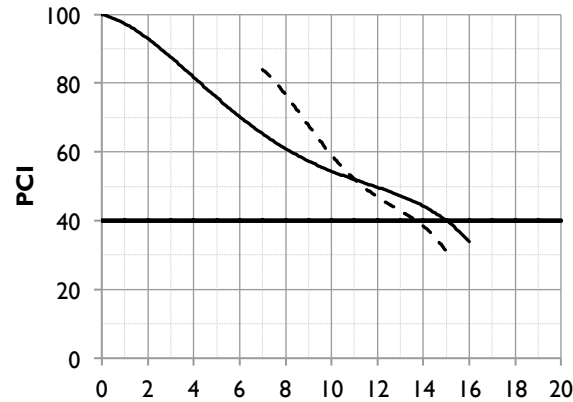
— New Construction - - - Slurry Seal at year 0

— New Construction - - - Slurry Seal at year 1

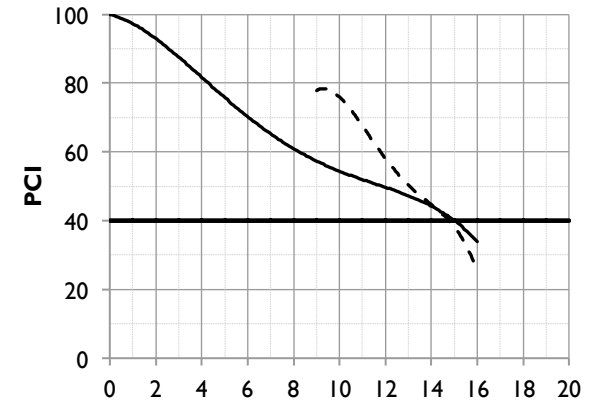
— New Construction - - - Slurry Seal at year 3



Age in Years



Age in Years



Age in Years

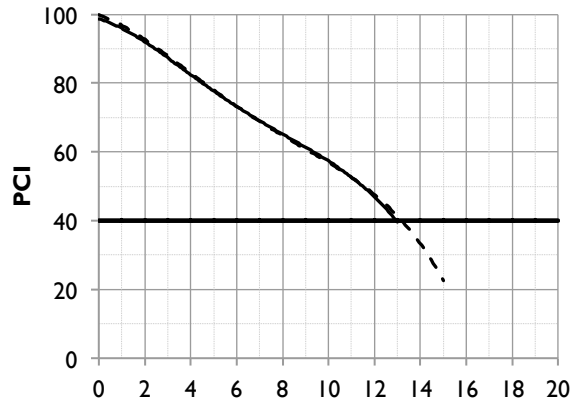
— New Construction - - - Slurry Seal at year 5

— New Construction - - - Slurry Seal at year 7

— New Construction - - - Slurry Seal at year 9

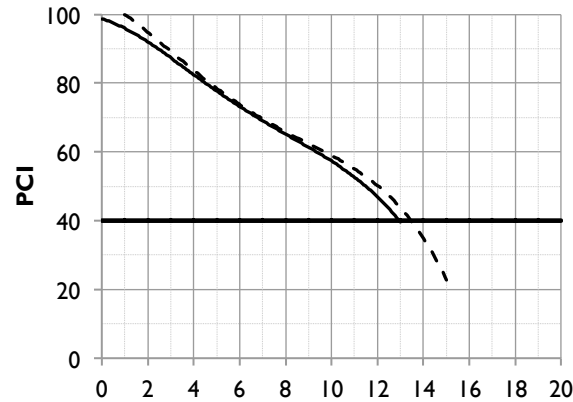
Phase I: Prediction Performance Models

Overlay - Residential



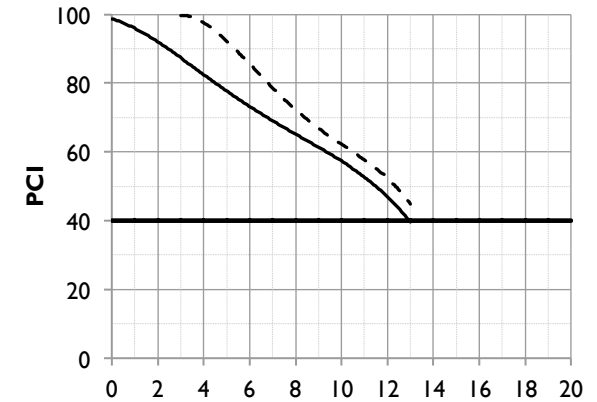
Age in Years

— Overlay - - - Slurry Seal at year 0



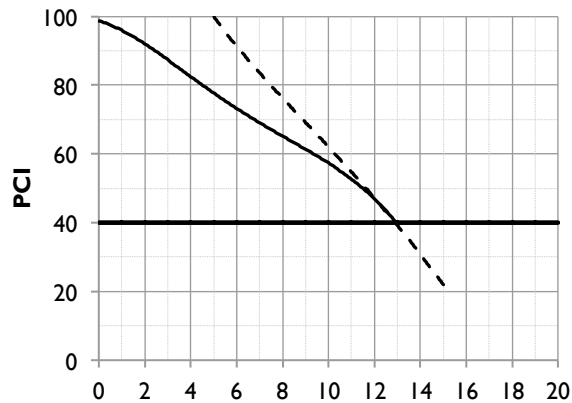
Age in Years

— Overlay - - - Slurry Seal at year 1



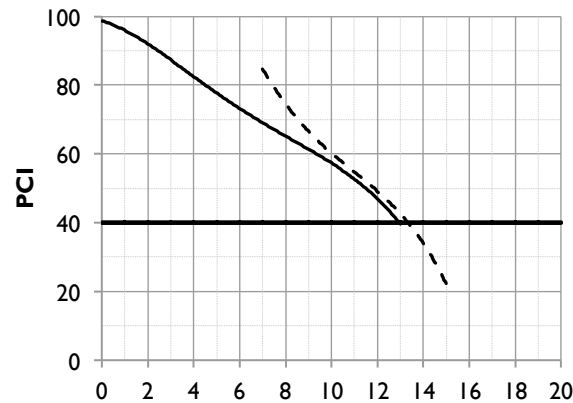
Age in Years

— Overlay - - - Slurry Seal at year 3



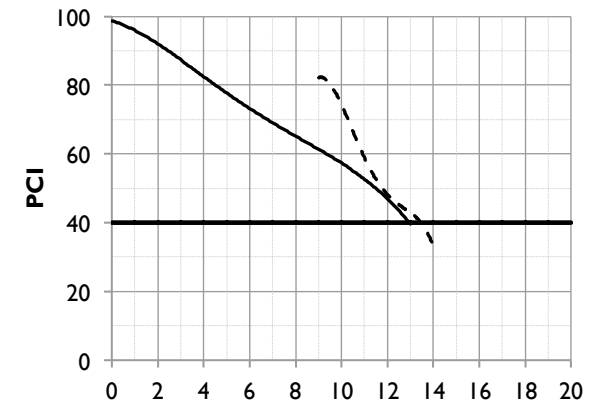
Age in Years

— Overlay - - - Slurry Seal at year 5



Age in Years

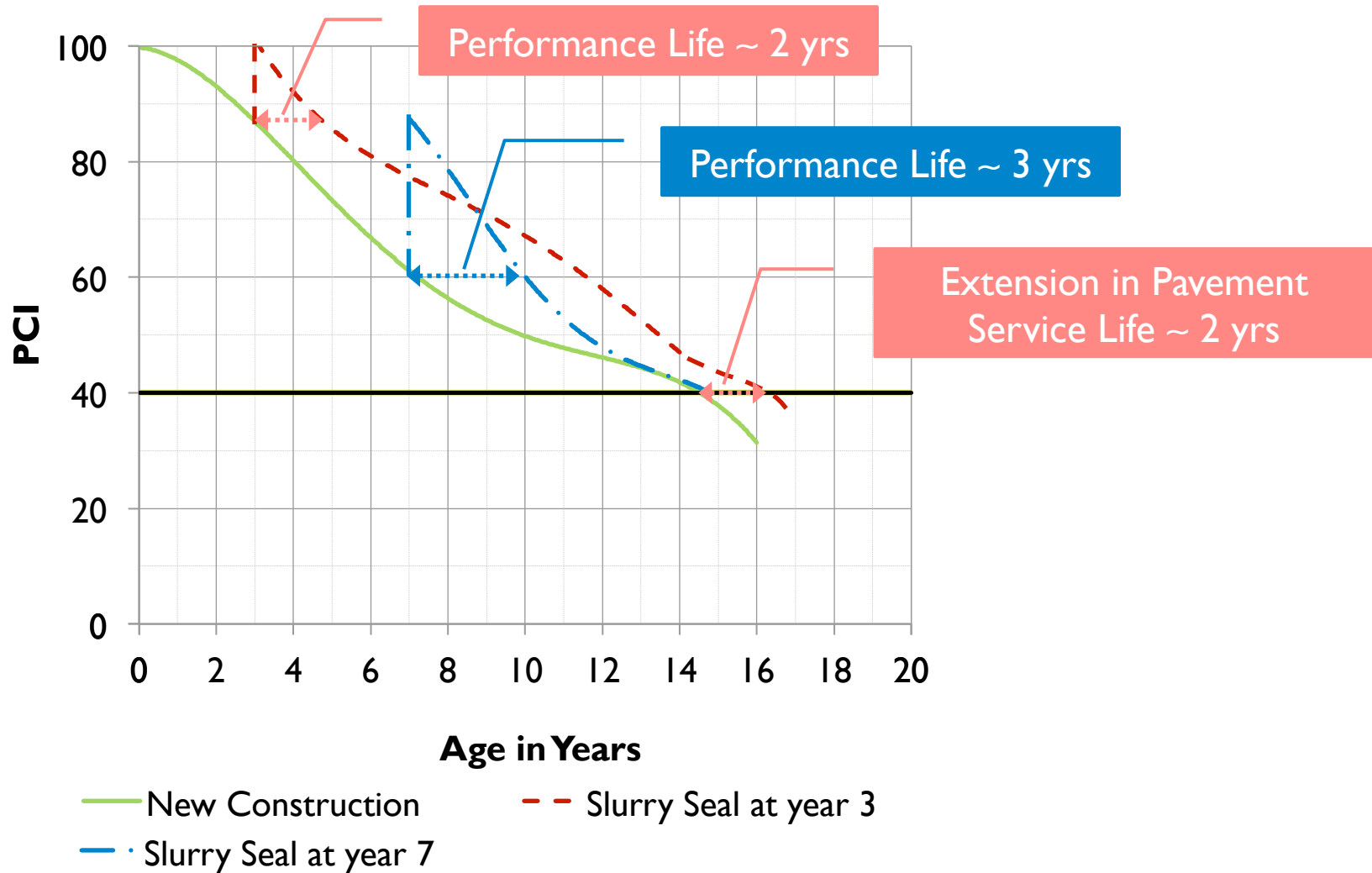
— Overlay - - - Slurry Seal at year 7



Age in Years

— Overlay - - - Slurry Seal at year 9

Phase I: Slurry Seal *Performance Life* & *Extension in Pavement Service Life*

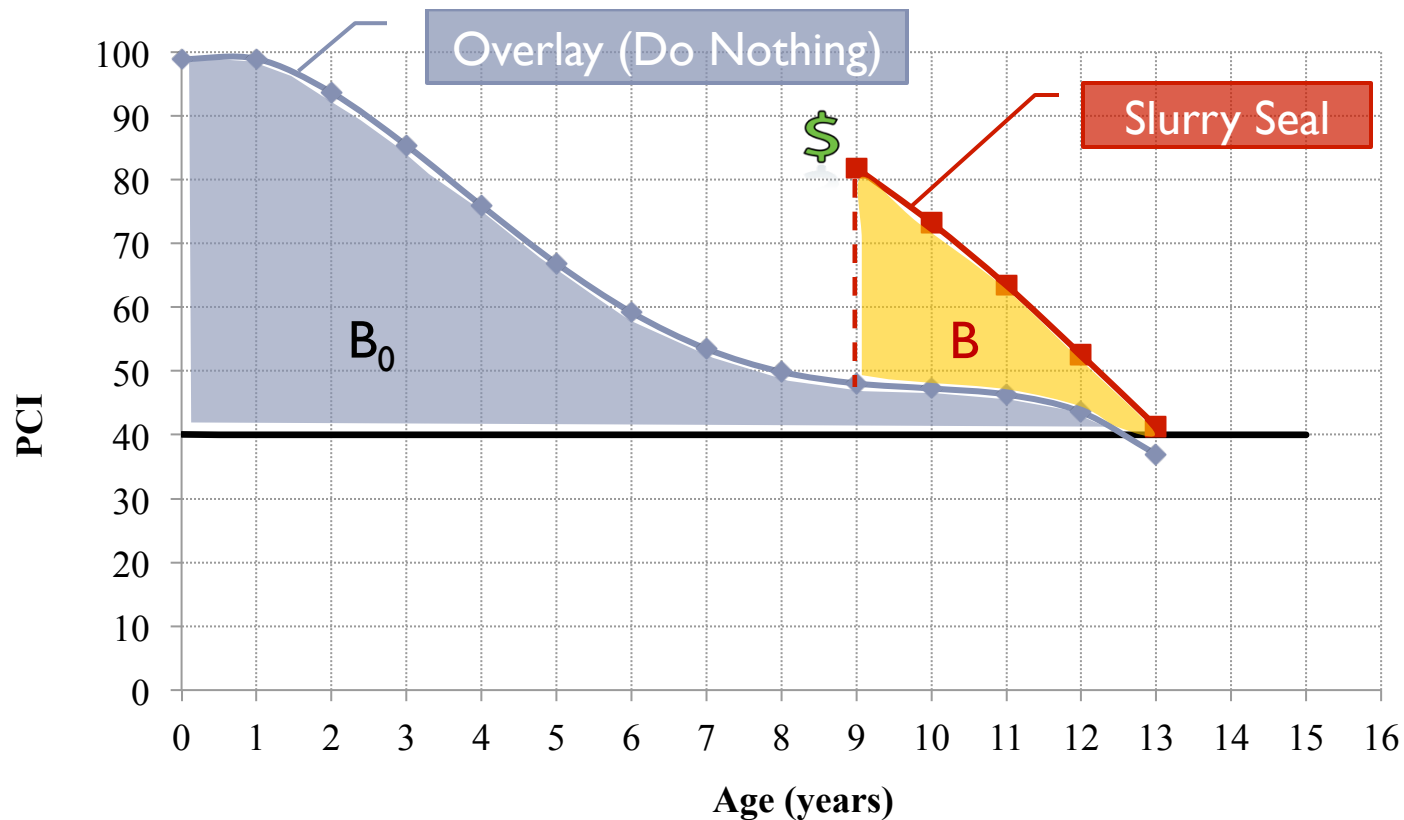


Phase I: SS Performance Life & Extension in Pavement Service Life



- ▶ In general, performance life ranged between 2 & 4 years.
 - ▶ Except when slurry seal was applied at year 0 and 1, performance life ranged from 0 to 1 year.
- ▶ Except few cases, the pavement service life was not extended by application of the single slurry seal.

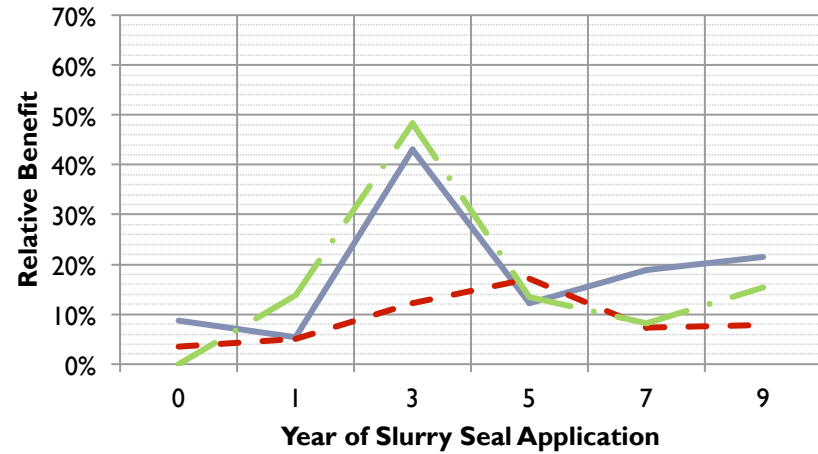
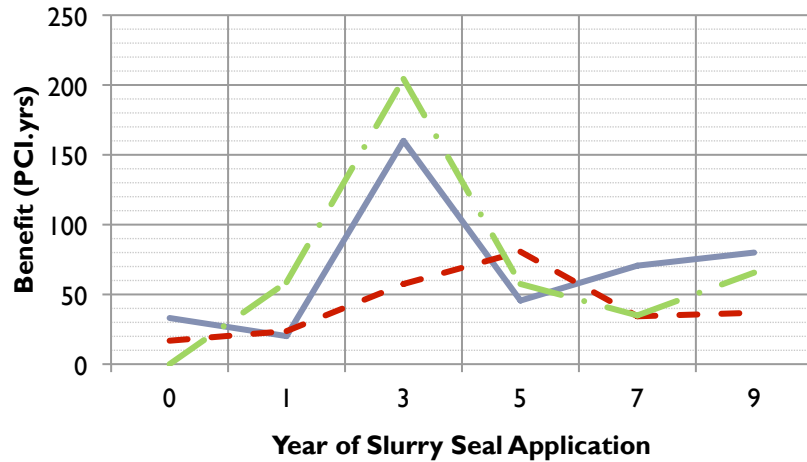
Phase I: Slurry Seal Effectiveness



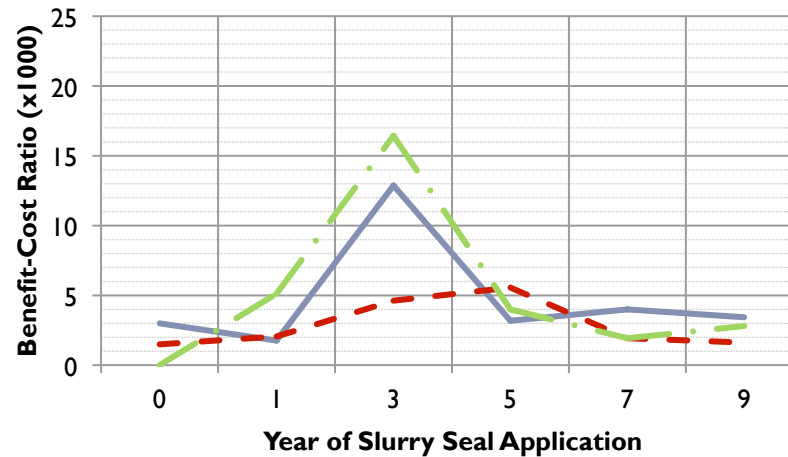
Relative Benefit = $100 \times B / B_0$

Benefit Cost Ratio = B / C

Phase I: Effectiveness Analysis – New Construction

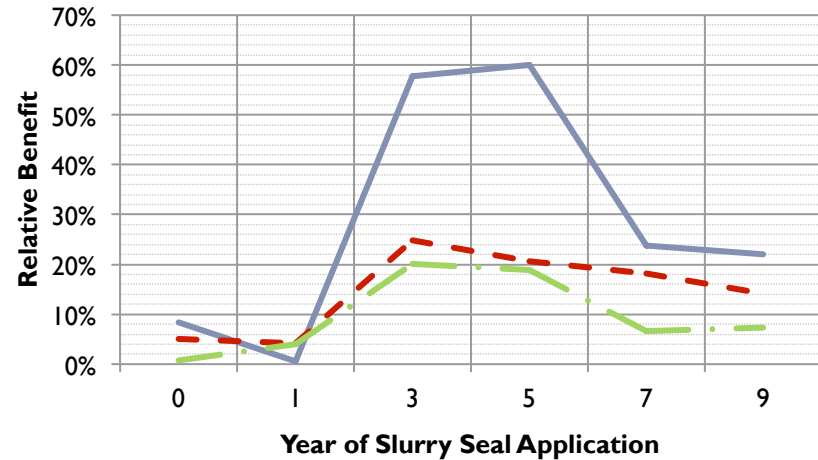
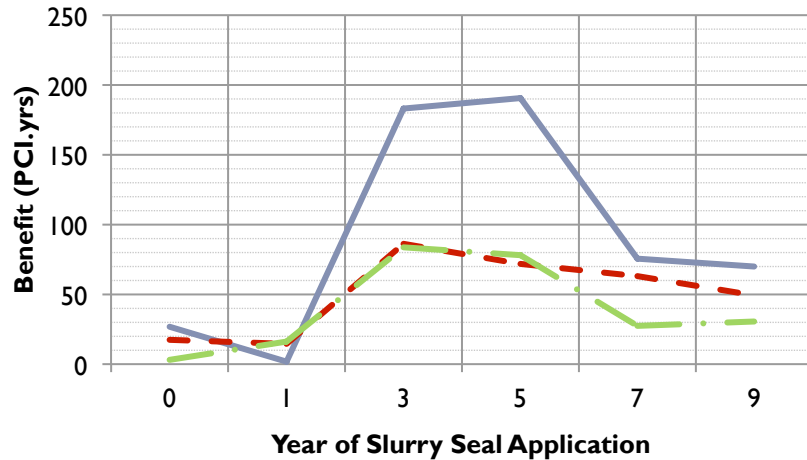


— NC-Arterial (A) - - NC-Collector (B) ··· NC-Residential (C) — NC-Arterial (A) - - NC-Collector (B) ··· NC-Residential (C)

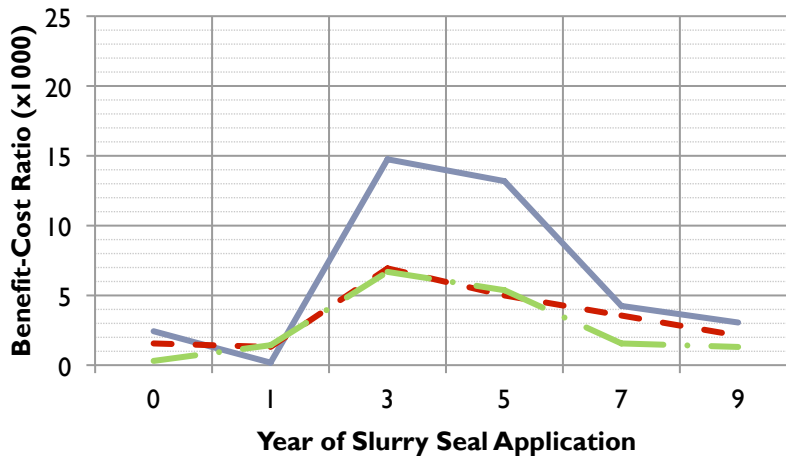


— NC-Arterial (A) - - NC-Collector (B) ··· NC-Residential (C)

Phase I: Effectiveness Analysis – Overlay



— OL-Arterial (A) - - OL-Collector (B) — OL-Residential (C) — OL-Arterial (A) - - OL-Collector (B) — OL-Residential (C)



— OL-Arterial (A) - - OL-Collector (B) — OL-Residential (C)

Phase I: Conclusion

- ▶ Application of SS *immediately* or *one year after* construction of asphalt layer is not effective in terms of:
 - ▶ the benefit to the users and
 - ▶ the benefit-cost ratio for the agency.



Optimum time for application of a Single Slurry Seal:

- ▶ *Newly constructed pavements: 3 years after construction.*
- ▶ *Pavements subjected to overlays: 3-5 years after construction.*

Phase II:

Sequential Slurry Seal Applications



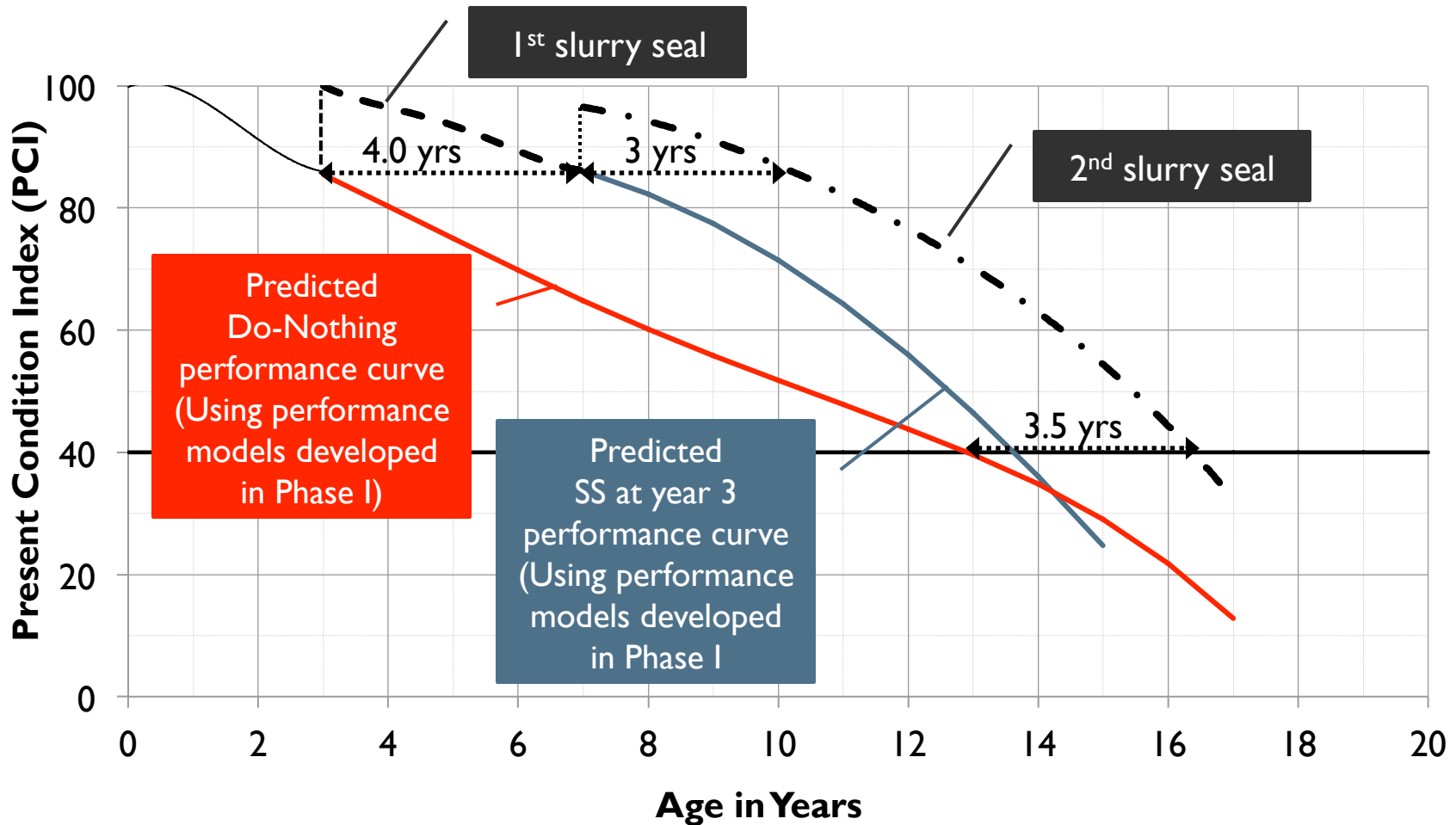
- ▶ Collect & evaluate performance data of asphalt pavements
 - ▶ With a *first* slurry seal application at: 0, 1, 3 and 5 years
 - ▶ receiving a *second* slurry seal at either: 7 or 9 years.
- ▶ Identify *effectiveness* & *optimum time* for sequential SS application.
- ▶ PMS data from WCED, COR and COS

Phase II: Sequential Slurry Seal Applications

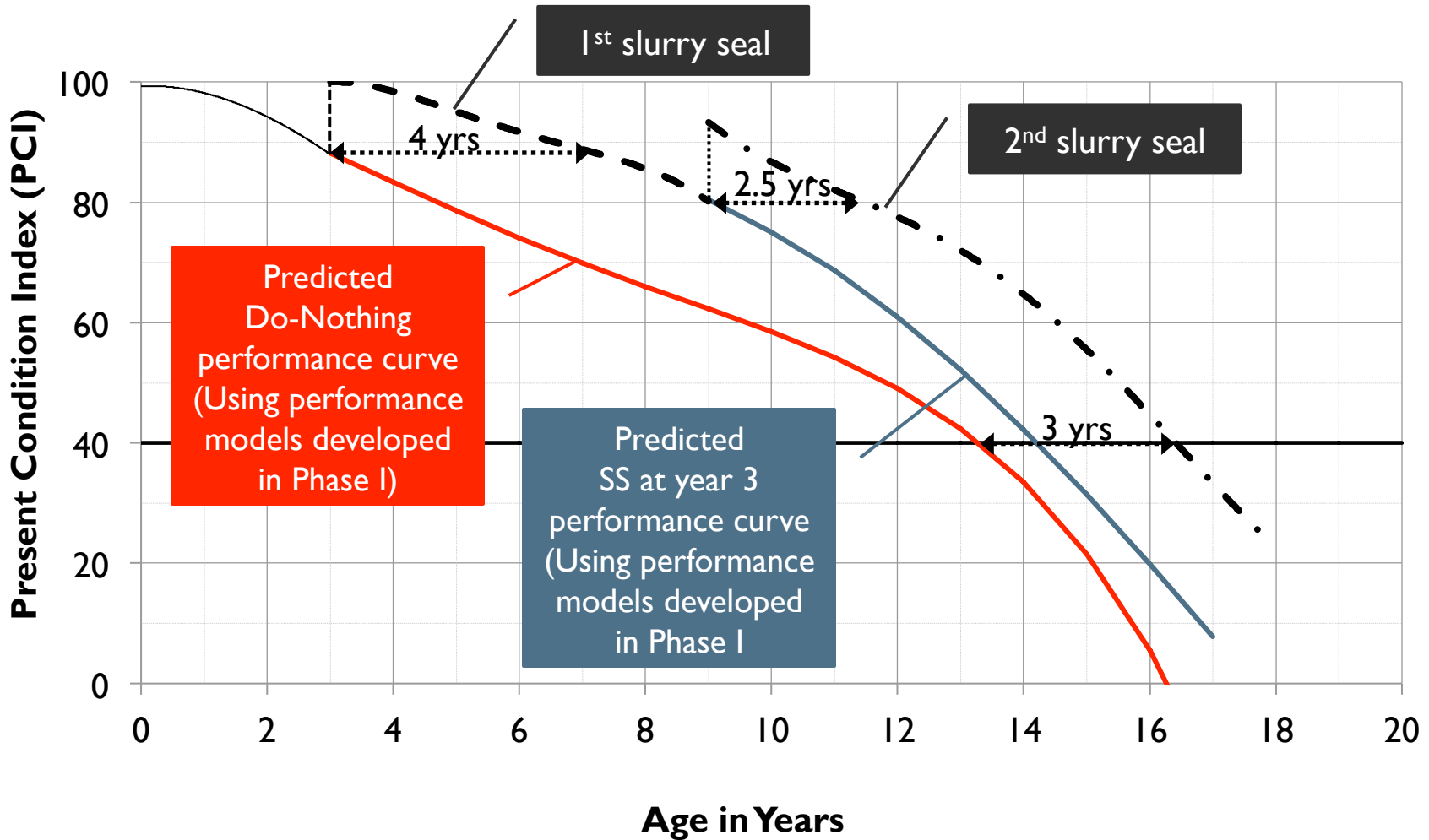


Initial Construction Pavement Type	Year of the 1 st Slurry Seal Application	Total Number of Sections	
		2 nd Slurry Seal Applied at year 7	2 nd Slurry Seal Applied at year 9
New Construction	0	10	12
	1	15	12
	3	15	11
	5	N/A	7
Overlay	0	15	17
	1	13	10
	3	17	12
	5	N/A	6
Total Number of Sections		85	87

Newly Constructed Pavements: 1st SS at year 3, 2nd SS at year 7

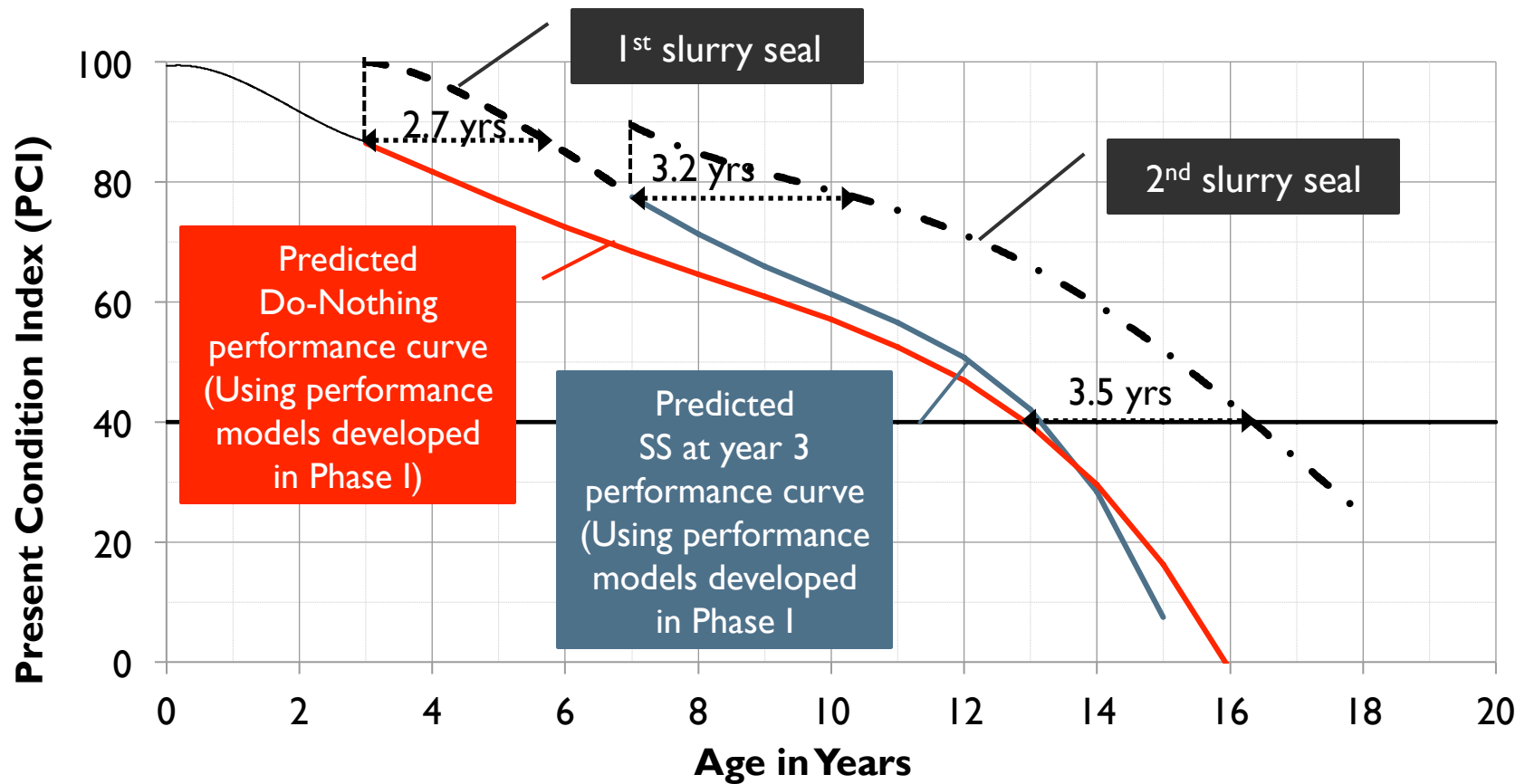


Newly Constructed Pavements: 1st SS at year 3, 2nd SS at year 9

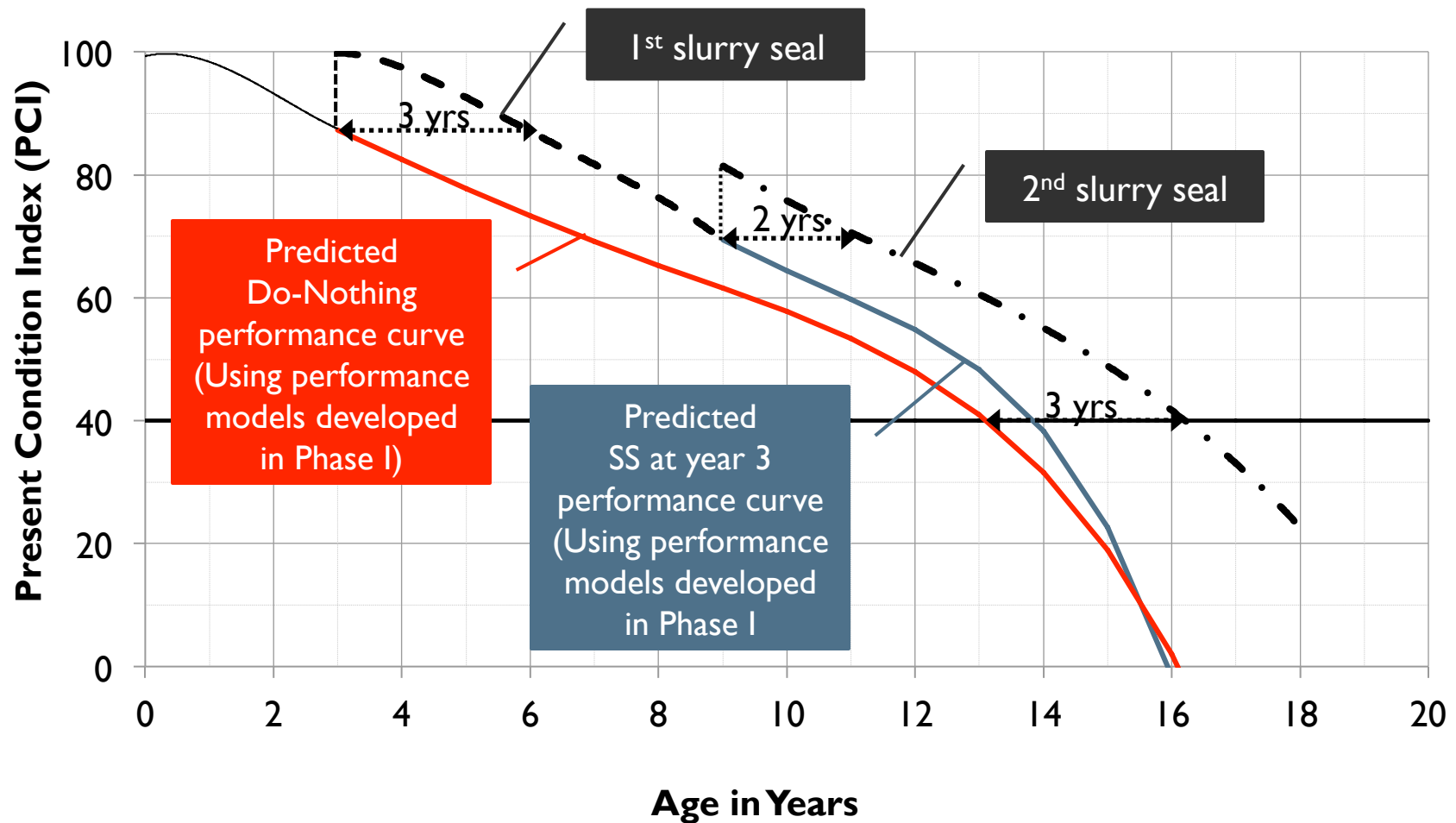


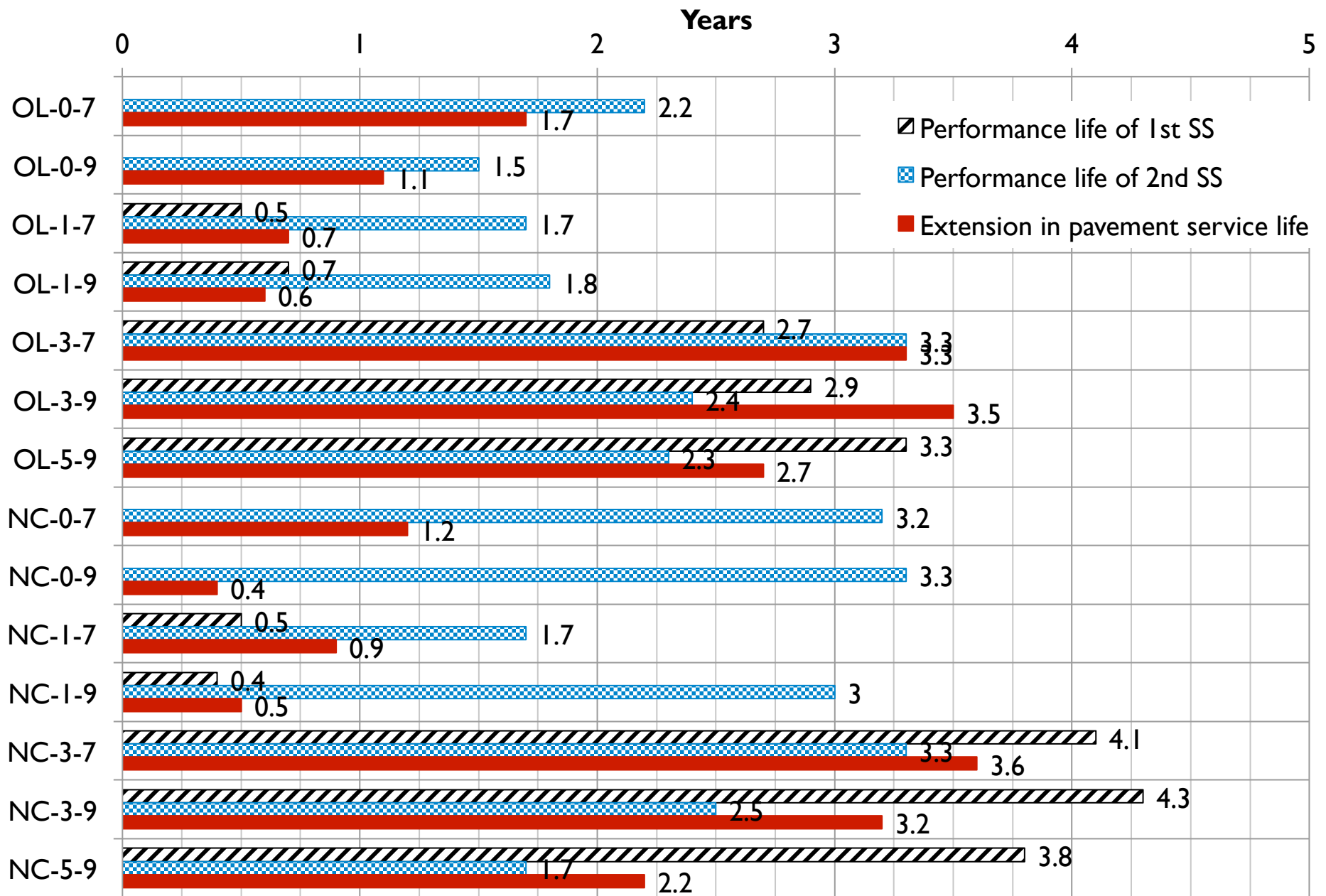
Overlay Pavements:

1st SS at year 3, 2nd SS at year 7

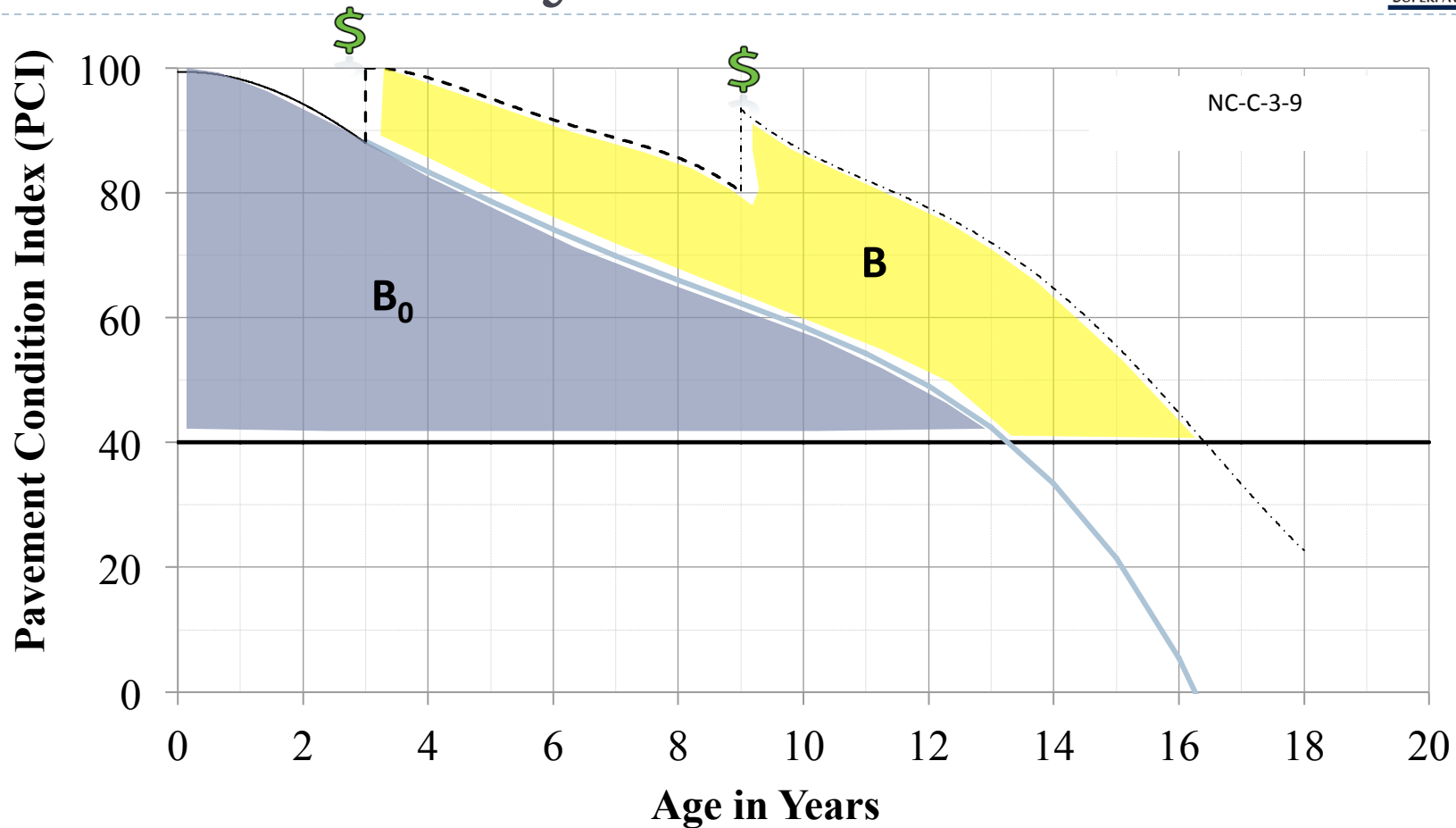


Overlay Pavements: 1st SS at year 3, 2nd SS at year 9





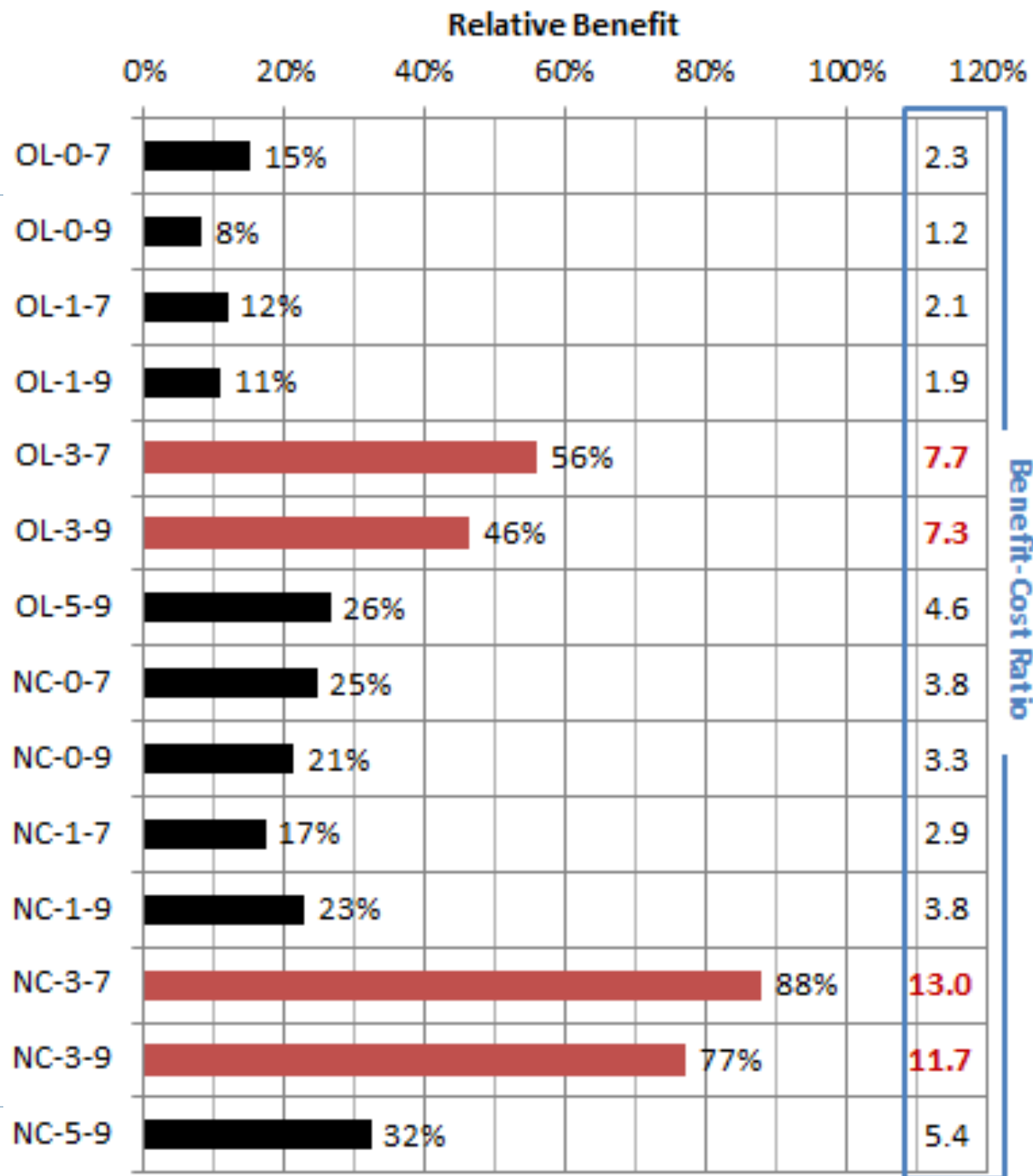
Phase II: Slurry Seal Effectiveness



$$\text{Relative Benefit} = 100 \times B / B_0$$

$$\text{Benefit-Cost Ratio} = B / C$$

Phase II: Effectiveness



PHASE II: Conclusions

- ▶ Application of first SS **immediately or one year after** construction is **not effective** in terms of both the benefit to users and benefit cost ratio for the agency.
- ▶ Regardless of construction activity, **optimum time** for a **sequential slurry seal** is when
 - first SS is applied in year 3**
 - &**
 - second SS is applied in year 7 (i.e. 4 years after the application of the first SS)**



PHASE II: Conclusions

- ▶ Pavement service life was extended by **2.0 to ~4.0 years** when first SS was applied in years, 3 or 5 and second SS in either year 7 or 9.
- ▶ For those application conditions, the sequential SS was effective in delaying the time for reconstruction.

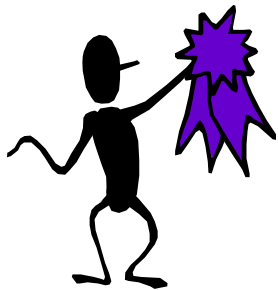


OVERALL RECOMMENDATION

- ▶ For both new and overlay constructions, it is recommended that the agency applies
 - ▶ First slurry seal 3 years after the construction of the asphalt layer and the second slurry seal 7 years after the construction.

Acknowledgment

- ▶ Financial Support of Washoe RTC
- ▶ City of Reno, City of Sparks and Washoe County, Nevada for providing access to their pavement management data.



THANK YOU FOR YOUR ATTENDANCE



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