9th International Conference on MANAGING PAVEMENT ASSETS (ICMPA9)

Maximise levels of service using cross-asset portfolio renewals management

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Renewals Optimisation Model

- Renewals decision support tool
- Top-down long-term renewal needs analysis
- Whole of asset portfolio
- Identify optimum distribution of funds to maintain levels of service and minimise risk
- Provide decision makers with the long-term consequences of funding scenarios.

Looking after what we have

Looking after what we have

- $12.6 billion of assets
- 7,300kms of roads
- 100,000 street signs
- 536 signalised intersections
- 1,585 bus shelters
- 45 rail Stations
- 22 ferry wharves and terminals

Looking after what we have

Four stage intervention process

1. Look after what we have
2. Make better use of what we have
3. Encourage smarter travel choices
4. Build new assets

Looking after what we have

Four stage intervention process

1. Look after what we have

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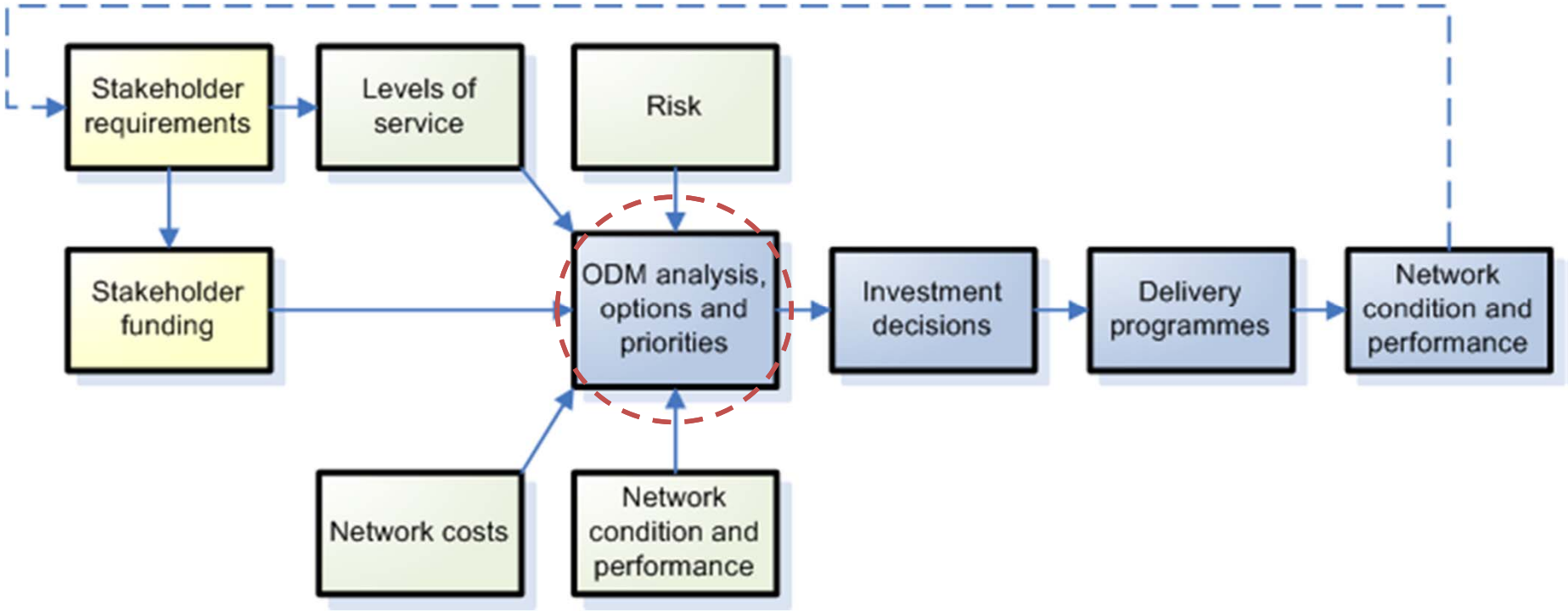
3. Encourage smarter travel choices

4. Build new assets

Analysis, optimisation and options

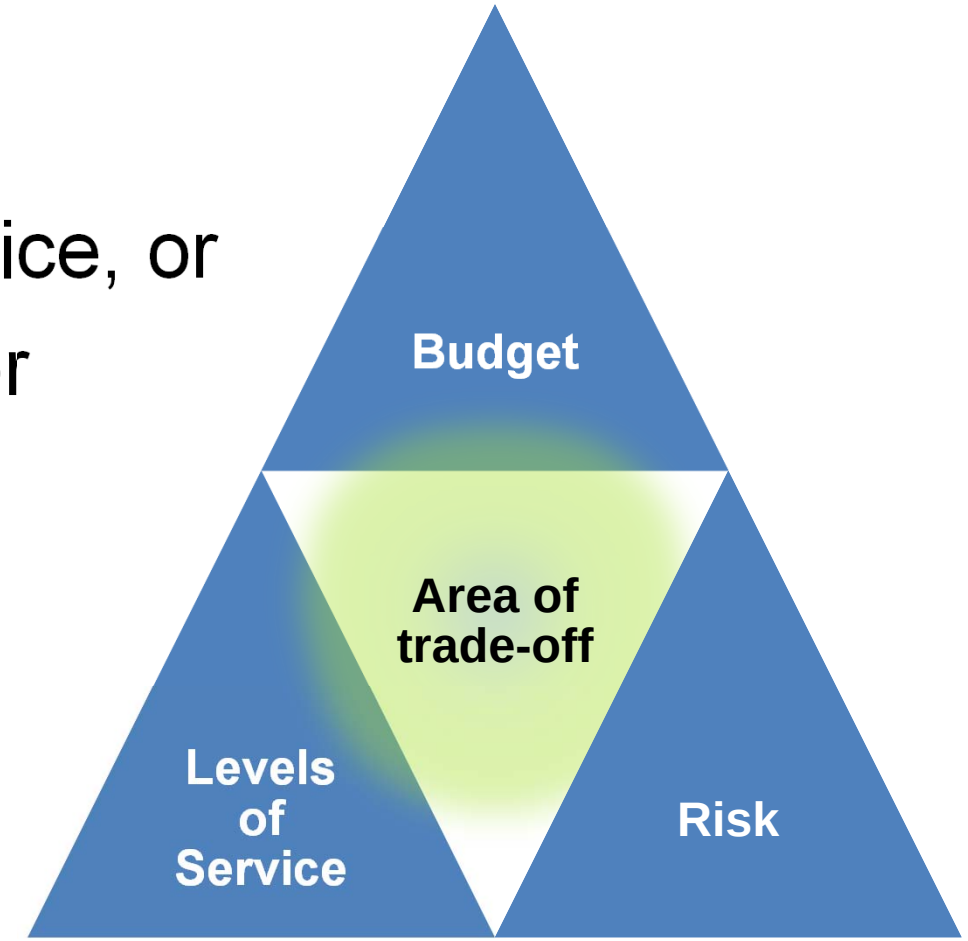


Finding the balance

For each asset

- Fully fund renewals, or
- Decrease levels of service, or
- Increase levels of risk or

- a measure of each . . .

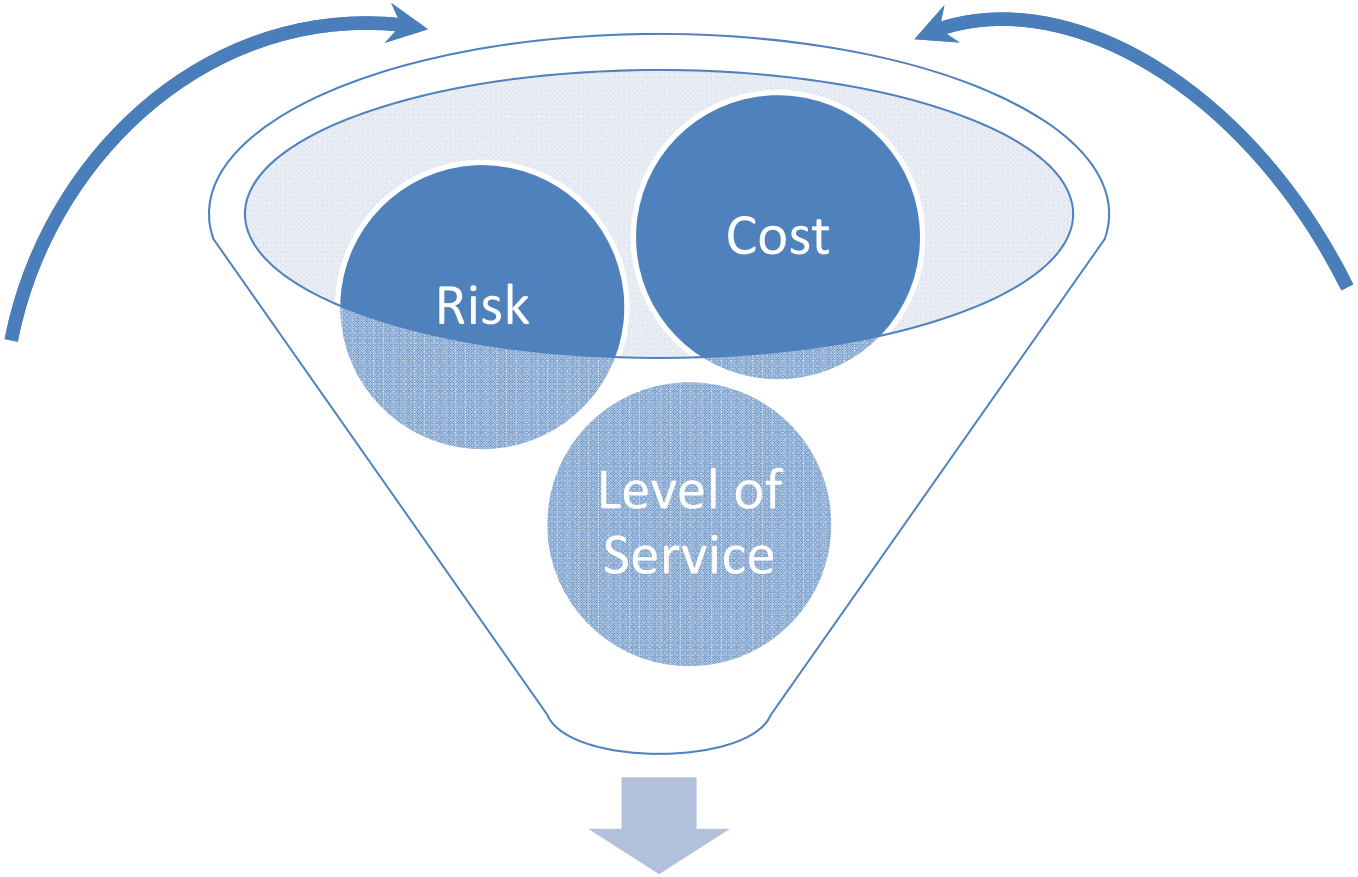


Renewals Optimisation Model

Benefits

- A robust and consistent basis for identifying long-term renewals impact of AM policy across the asset portfolio
- Identify the long-term renewals investment needs and trade-offs across the asset portfolio
- Help resolve inherited local variations in the levels of service across the region

How does it work?



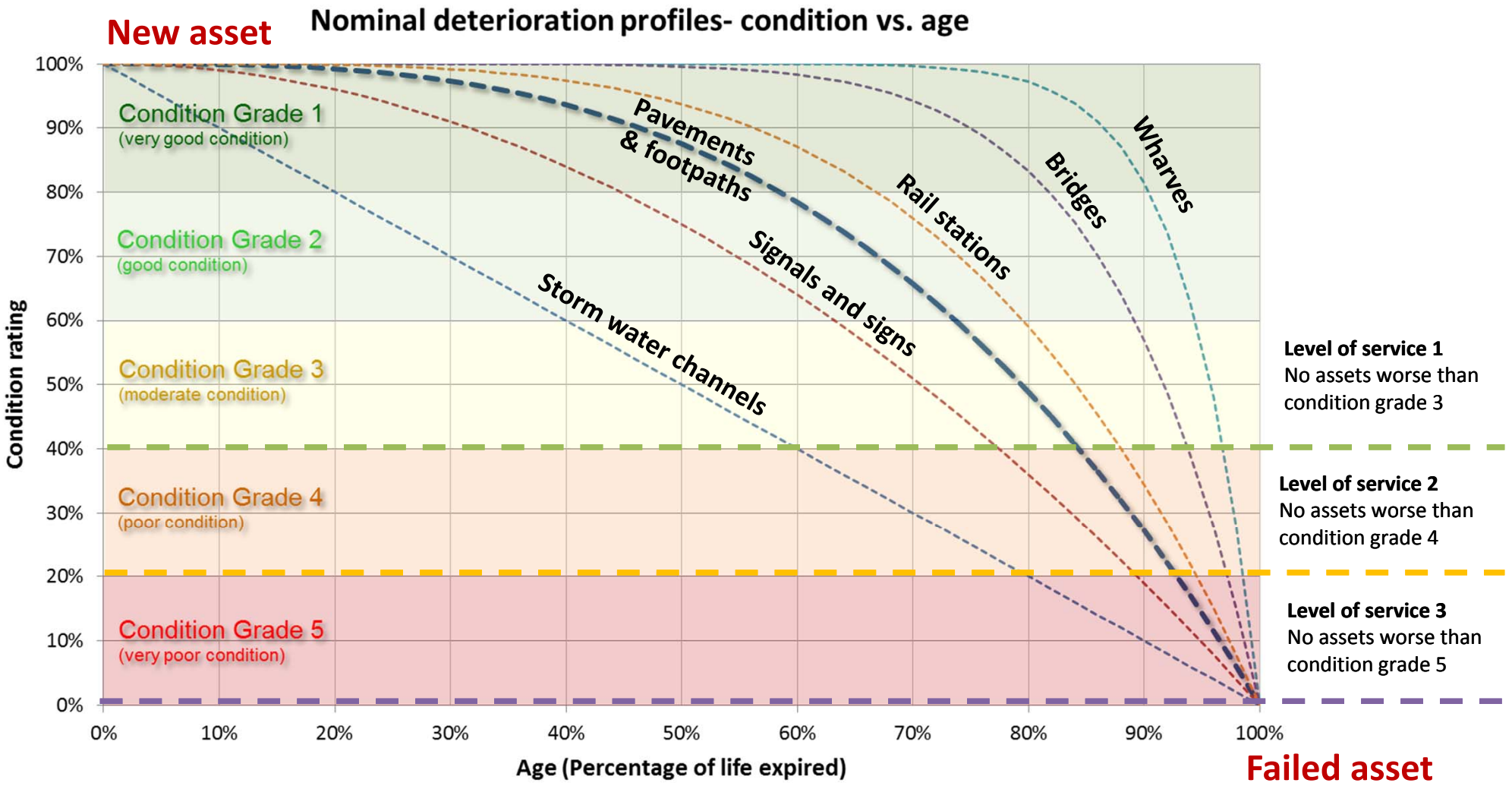
Renewals needs and investment consequences

Modelling inputs

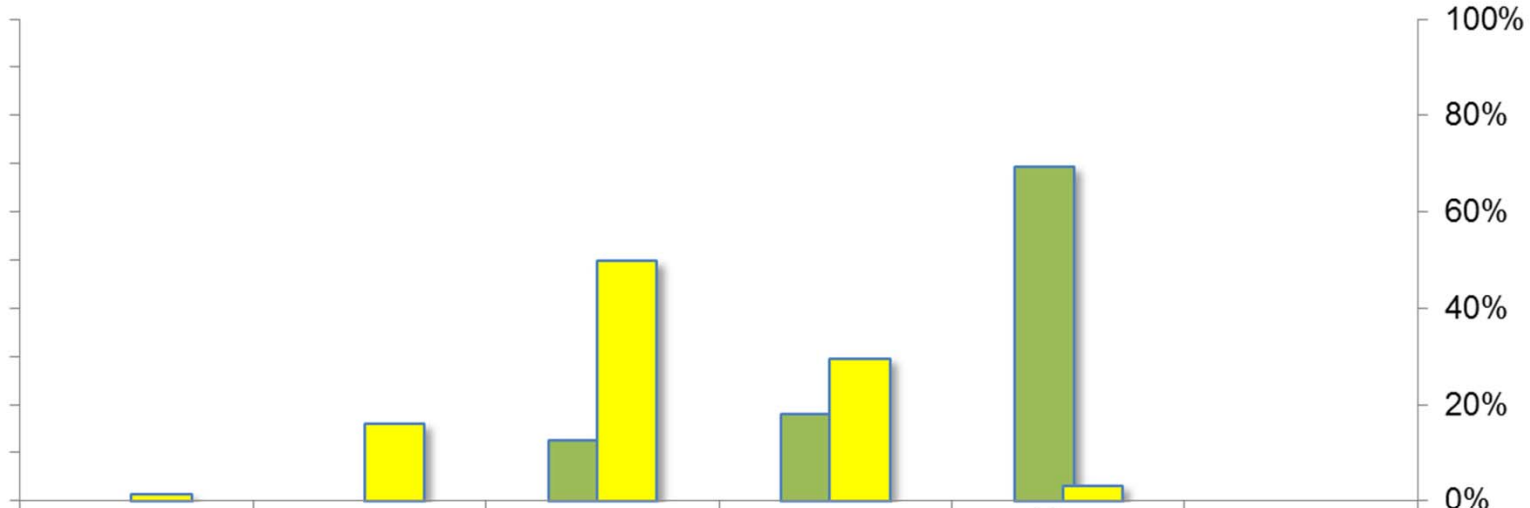
For each asset type:

- Current condition
- Level of service
- Deterioration profile
- Network growth
- Tolerance of backlog risk
- Base life
- Planning unit cost rate

Deterioration profiles

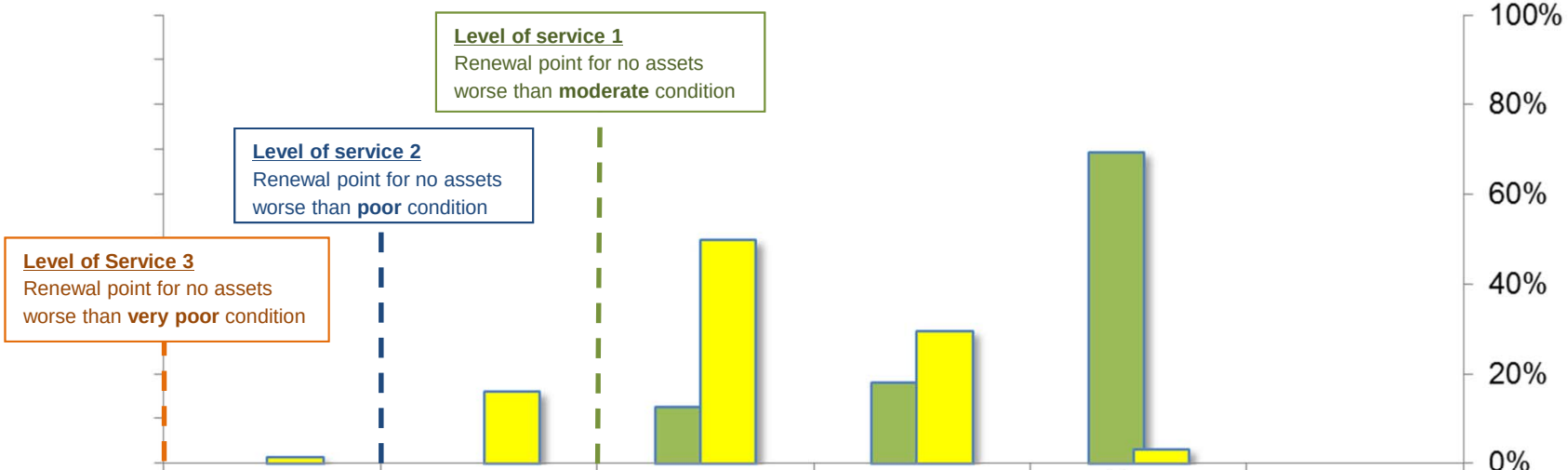


Asset condition profile



	Very poor condition	Poor condition	Moderate condition	Good condition	Very good condition	Total
Life (years) in each condition grade	7.1	8.4	10.6	15.0	57.9	99.0
LOS 1 distribution	0.0%	0.0%	12.6%	18.0%	69.3%	100.0%
Current condition distribution	1.3%	16.1%	49.8%	29.6%	3.2%	100.0%

Asset condition profile



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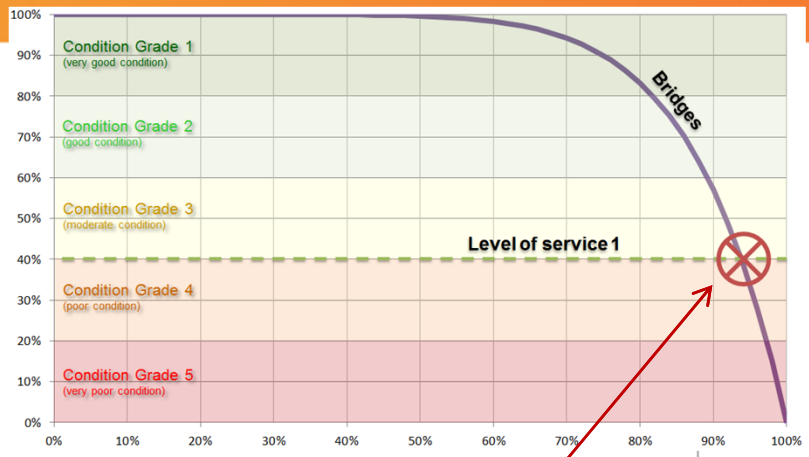
Asset condition profile

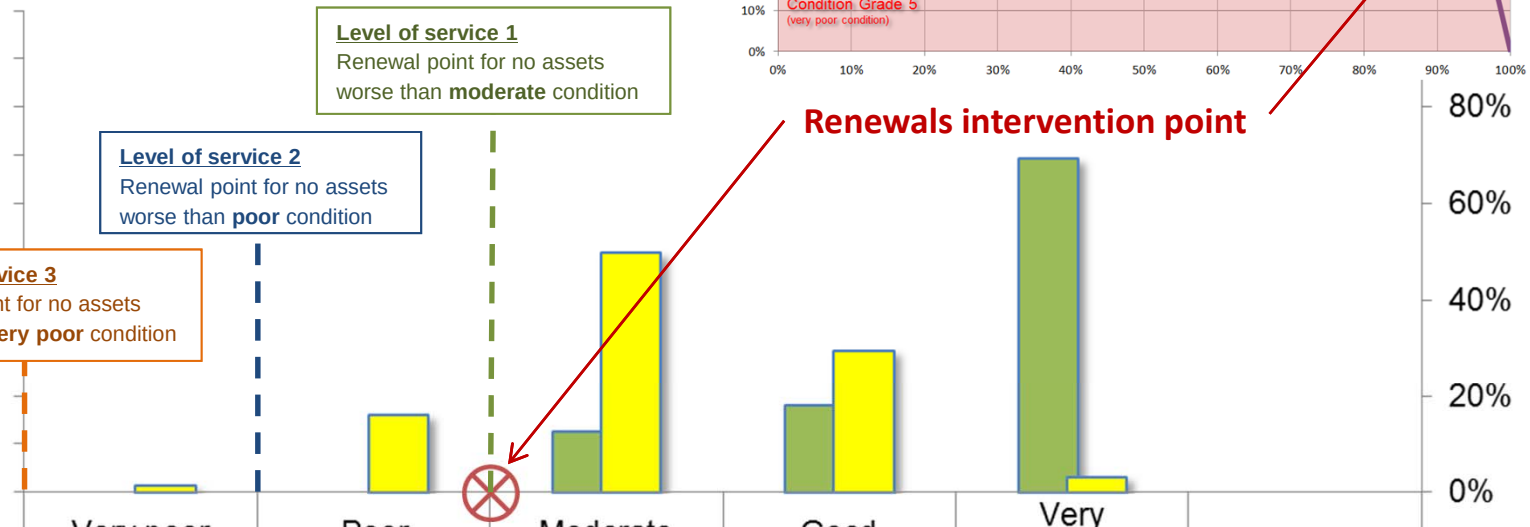


Renewals intervention point

Level of service 1
Renewal point for no assets worse than **moderate** condition

Level of service 2
Renewal point for no assets worse than **poor** condition

Level of Service 3
Renewal point for no assets worse than **very poor** condition



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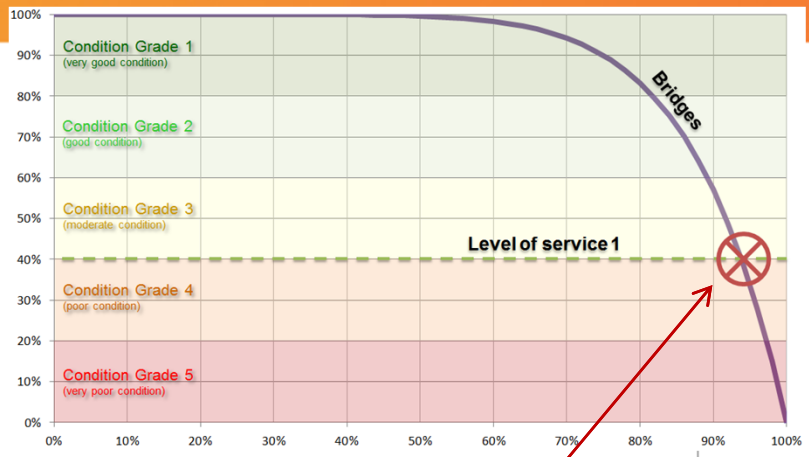
Asset condition profile



Level of service 1
Renewal point for no assets worse than **moderate** condition

Renewals intervention point

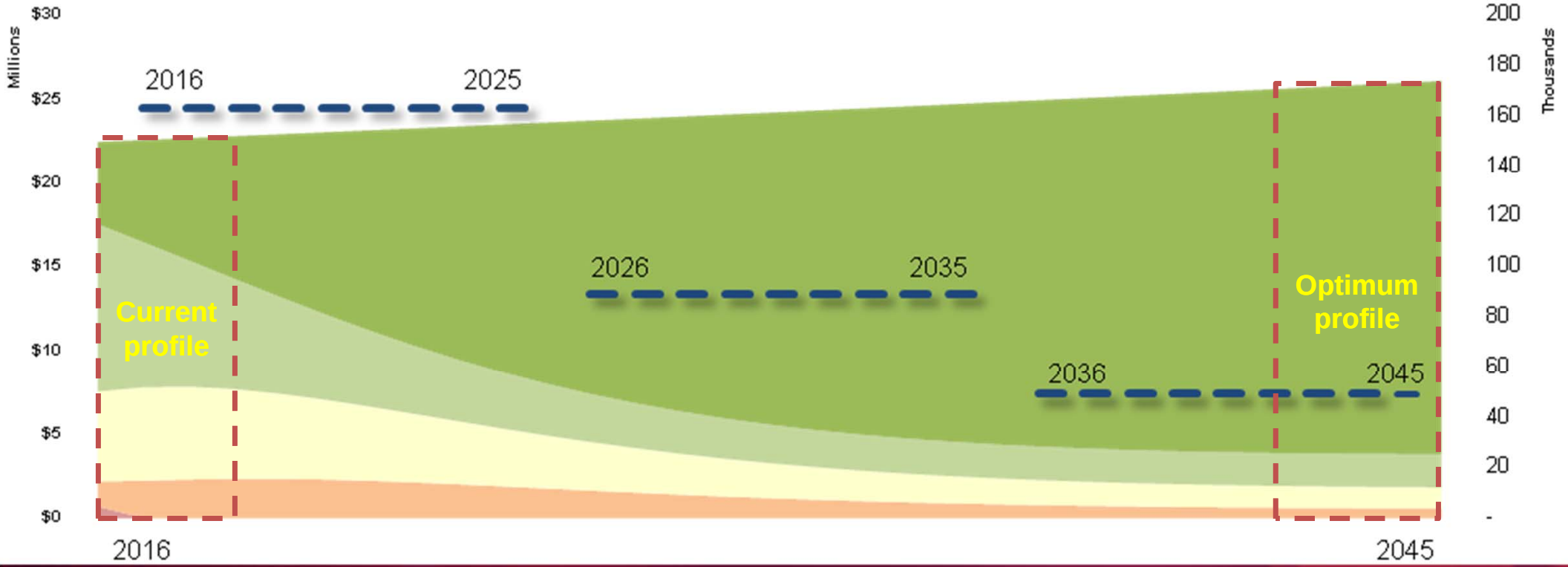
Area of backlog

80%
60%
40%
20%
0%

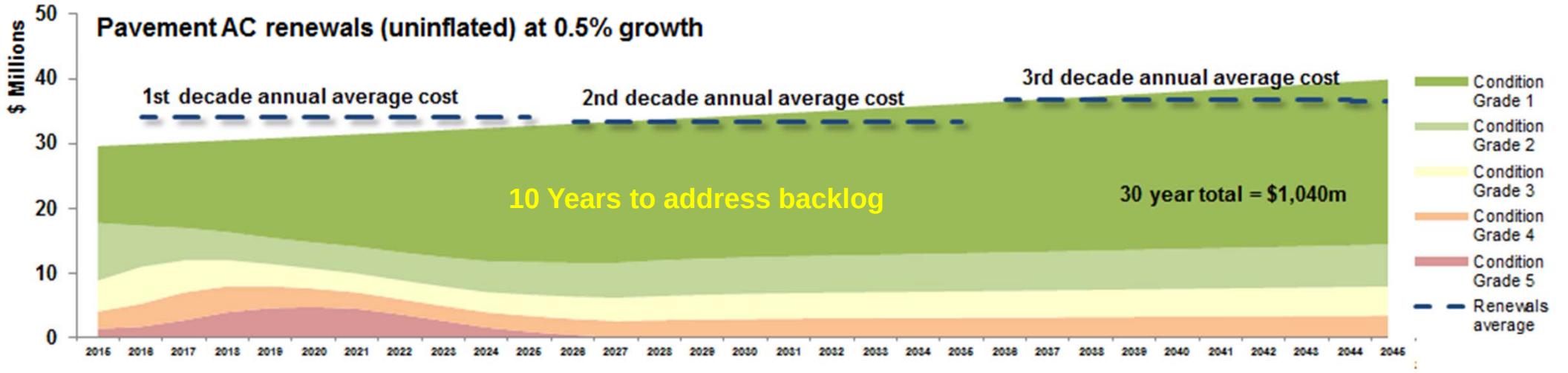
	Very poor condition	Poor condition	Moderate condition	Good condition	Very good condition	Total
Life (years) in each condition grade	7.1	8.4	10.6	15.0	57.9	99.0
LOS 1 distribution	0.0%	0.0%	12.6%	18.0%	69.3%	100.0%
Current condition distribution	1.3%	16.1%	49.8%	29.6%	3.2%	100.0%

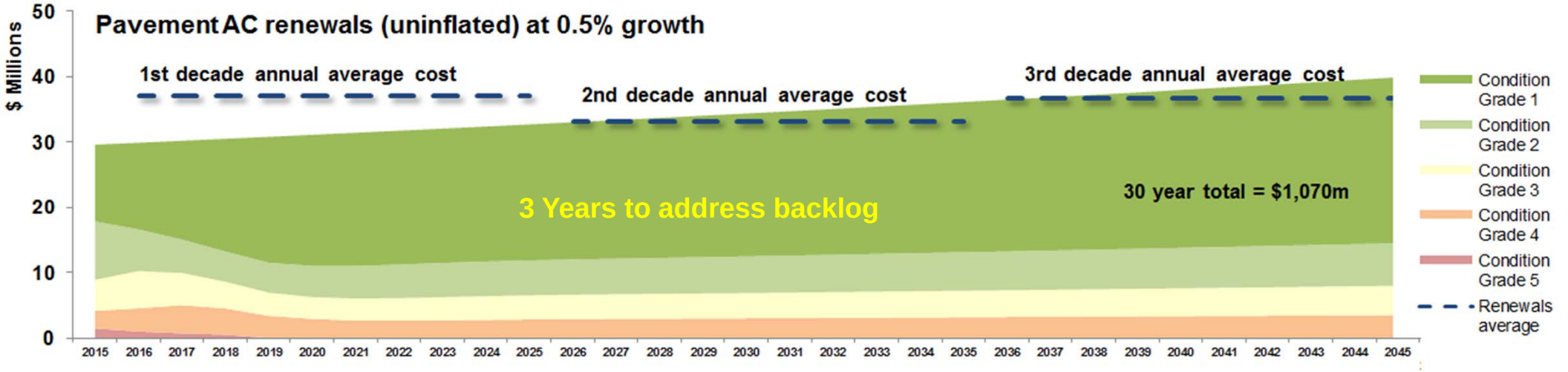
Optimising the condition profile

Long-term investment to change the current condition profile to a more cost-efficient condition profile

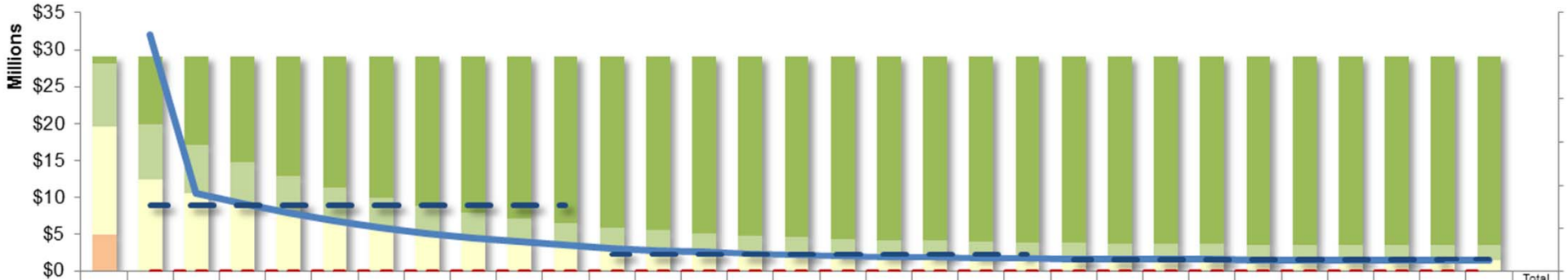


Backlog policy options





Years to address backlog = 1

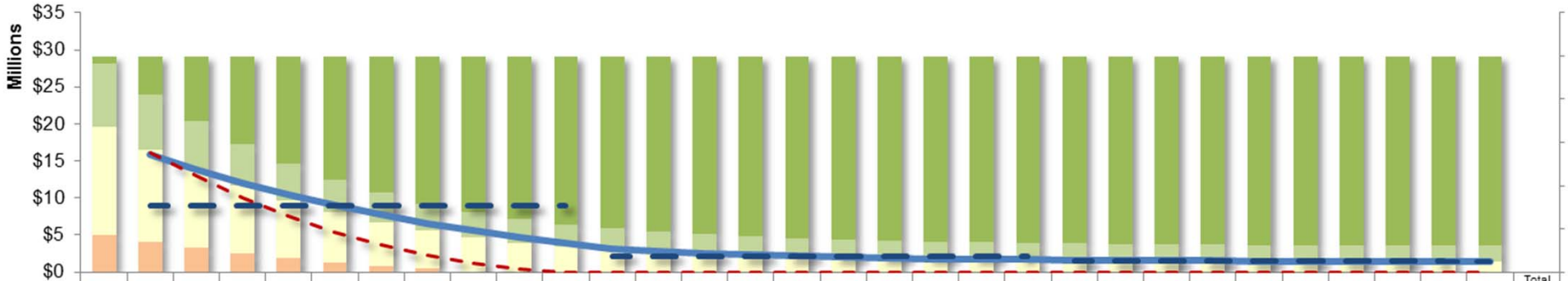


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	Total 2016-45
Condition Grade 1	3%	32%	41%	49%	56%	61%	66%	70%	73%	75%	78%	79%	81%	82%	83%	84%	85%	85%	86%	86%	86%	87%	87%	87%	87%	87%	87%	88%	88%	88%	88%	
Condition Grade 2	30%	25%	22%	20%	17%	16%	14%	13%	12%	11%	10%	10%	9%	9%	9%	9%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	
Condition Grade 3	50%	43%	37%	31%	27%	23%	20%	18%	15%	14%	12%	11%	10%	9%	8%	7%	7%	7%	6%	6%	6%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
Condition Grade 4	16%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Condition Grade 5	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Percentage backlog	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Renewals cost	4.6	32.0	10.6	9.1	7.9	6.9	6.0	5.2	4.6	4.0	3.6	3.2	2.9	2.6	2.4	2.2	2.1	1.9	1.8	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	127.3
Renewals average	.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	127.3
Backlog liability	19.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

30 Year renewal cost= $127m

1st 3 years average renewal cost= $17.2m annually

Years to address backlog = 10

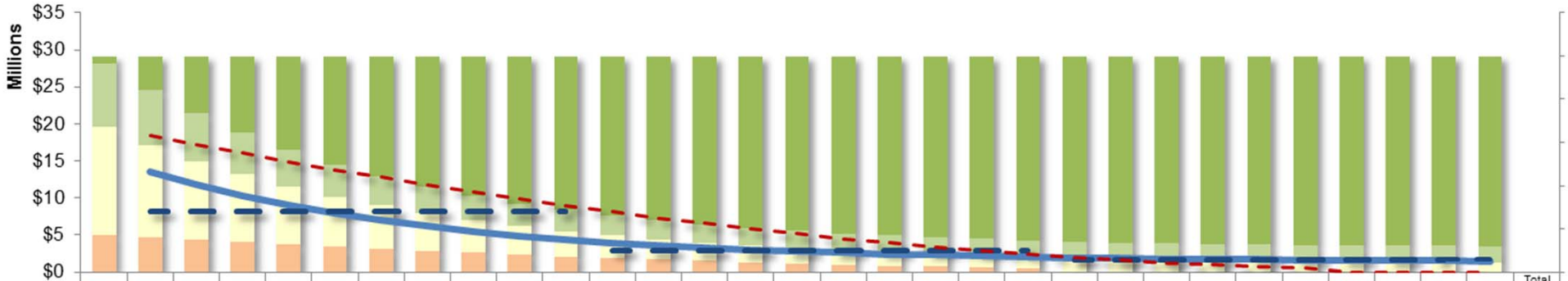


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	Total 2016-45
Condition Grade 1	3%	18%	30%	41%	50%	57%	63%	68%	72%	76%	78%	80%	81%	82%	83%	84%	85%	85%	86%	86%	87%	87%	87%	87%	87%	87%	88%	88%	88%	88%	88%	
Condition Grade 2	30%	25%	22%	19%	17%	15%	14%	13%	12%	11%	10%	10%	9%	9%	9%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	
Condition Grade 3	50%	43%	37%	31%	27%	23%	20%	17%	15%	13%	12%	11%	10%	9%	8%	7%	7%	6%	6%	6%	6%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
Condition Grade 4	16%	14%	11%	9%	6%	5%	3%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Condition Grade 5	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Percentage backlog	17%	14%	11%	9%	6%	5%	3%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Renewals cost	4.6	15.9	13.8	12.0	10.4	9.0	7.7	6.6	5.6	4.7	3.9	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.8	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	126.7
Renewals average	.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	126.7
Backlog liability	19.7	16.1	12.9	10.0	7.5	5.4	3.6	2.1	1.1	.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

30 Year Renewal Cost= $127m

1st 3 years average renewal cost= $13.9m annually

Years to address backlog = 30



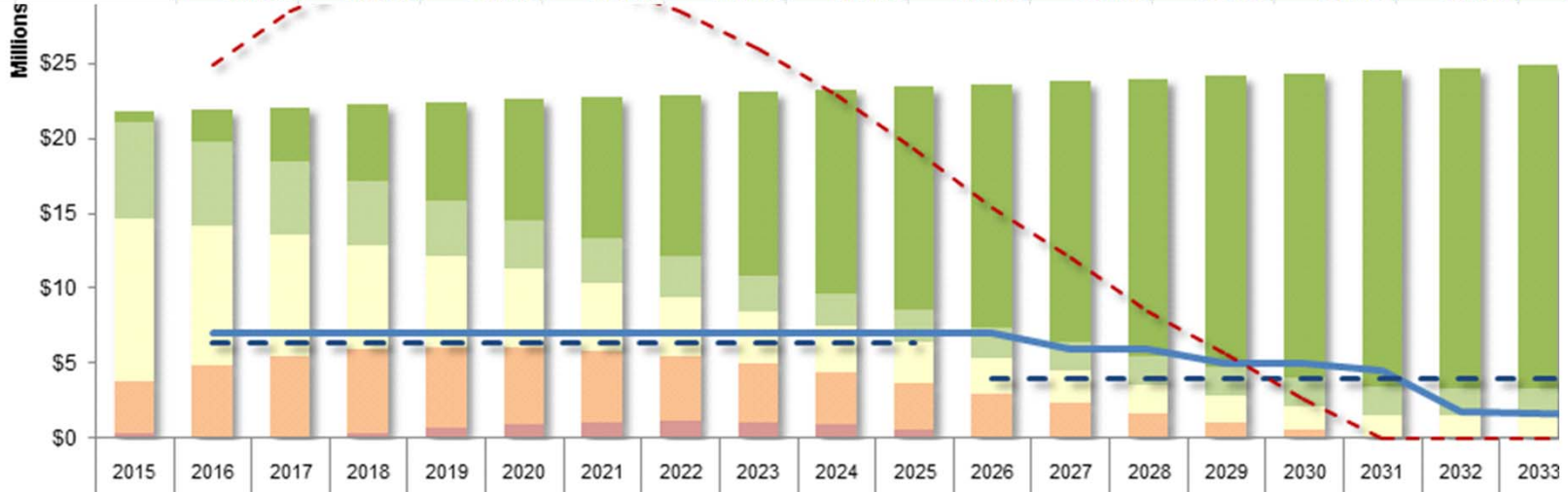
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	Total 2016-45
Condition Grade 1	3%	16%	27%	36%	43%	50%	56%	61%	65%	68%	71%	74%	76%	78%	79%	81%	82%	83%	84%	85%	85%	86%	86%	87%	87%	87%	87%	88%	88%	88%	88%	
Condition Grade 2	30%	25%	22%	19%	17%	15%	13%	12%	11%	10%	10%	9%	9%	8%	8%	8%	8%	8%	8%	8%	8%	8%	7%	7%	7%	7%	7%	7%	7%	7%	7%	
Condition Grade 3	50%	43%	37%	31%	27%	23%	20%	17%	15%	13%	12%	10%	9%	8%	8%	7%	7%	6%	6%	6%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
Condition Grade 4	16%	16%	15%	14%	13%	12%	11%	10%	9%	8%	7%	7%	6%	5%	5%	4%	3%	3%	3%	2%	2%	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%	
Condition Grade 5	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Percentage backlog	17%	16%	15%	14%	13%	12%	11%	10%	9%	8%	7%	7%	6%	5%	5%	4%	3%	3%	3%	2%	2%	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%	
Renewals cost	4.6	13.5	11.8	10.3	9.0	7.9	7.0	6.2	5.5	4.9	4.4	4.0	3.6	3.3	3.0	2.8	2.6	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.7	1.6	1.6	1.5	1.5	1.5	125.5
Renewals average	.0	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	125.5
Backlog liability	19.7	18.4	17.2	16.0	14.9	13.8	12.7	11.7	10.7	9.8	8.9	8.0	7.2	6.5	5.8	5.1	4.4	3.9	3.3	2.8	2.3	1.9	1.5	1.2	.9	.6	.4	.3	.1	.0	.0	.0

30 Year Renewal Cost= $126m

1st 3 years average renewal cost= $11.9m annually

Budget impact on condition

Headings	2015 result	2016 result	2017 result	2018 result	2019 result	2020 result	2021 result	2022 result	2023 result	2024 result	2025 result	2026 result	2027 result	2028 result
Renewals cost	-	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	6,000,000	6,000,000
Backlog liability	19,685,181	24,960,731	28,557,186	30,705,860	31,608,896	31,442,687	30,360,961	28,497,534	25,968,763	22,875,722	19,306,128	15,336,037	12,031,335	8,449,058
Percentage outside LOS	17.4%	21.90%	24.87%	26.54%	27.12%	26.77%	25.66%	23.90%	21.62%	18.90%	15.84%	12.49%	9.72%	6.78%
Renewals actual		7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	6,000,000	6,000,000

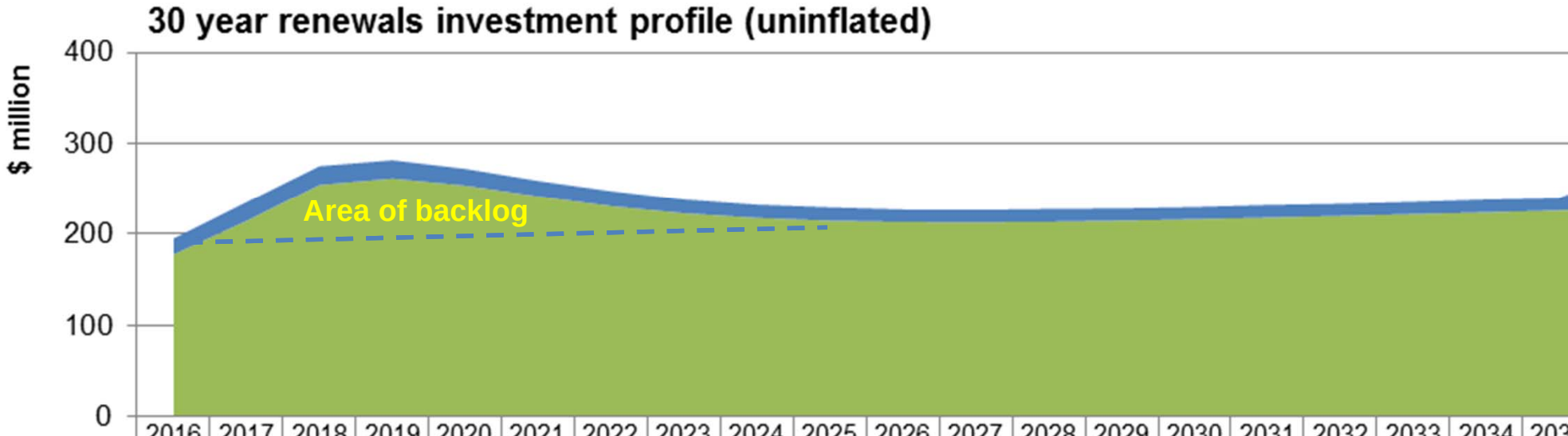


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Condition Grade 1	1,163	3,662	6,132	8,573	10,987	13,372	15,731	18,062	20,366	22,645	24,897	27,124	29,005	30,865	32,384	33,887	35,212	35,639	36,03
Condition Grade 2	10,719	9,271	8,051	7,028	6,174	5,468	4,887	4,414	4,035	3,736	3,505	3,335	3,215	3,134	3,088	3,066	3,066	3,083	3,102
Condition Grade 3	18,042	15,574	13,446	11,615	10,044	[illegible]	[illegible]	6,571	5,742	5,042	4,453	3,961	3,553	3,218	2,945	2,724	2,549	2,412	2,308
Condition Grade 4	5,818	7,993	9,035	9,308	9,101	8,613	7,975	7,275	6,567	5,887	5,254	4,679	3,852	2,705	1,805	846	-	-	-
Condition Grade 5	485	-	109	524	1,020	1,455	1,746	1,850	1,748	1,438	928	231	-	-	-	-	-	-	-
Percentage backlog	17.4%	21.9%	24.9%	26.5%	27.1%	26.8%	25.7%	23.9%	21.6%	18.9%	15.8%	12.5%	9.7%	6.8%	4.5%	2.1%	0.0%	0.0%	0.0%
Renewals cost	.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.0	6.0	5.0	5.0	4.5	1.7	1.6
Renewals average	.0	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Backlog liability	19.7	25.0	28.6	30.7	31.6	31.4	30.4	28.5	26.0	22.9	19.3	15.3	12.0	8.4	5.6	2.6	.0	.0	.0

Long term renewal needs

		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2016-45 total
Road	Carriageway	110.0	124.0	130.0	127.0	124.7	120.9	125.3	120.0	124.0	128.0	123.4	125.4	124.1	126.0	126.3	127.3	137.1	133.7	132.6	132.6	133.0	133.6	134.3	135.1	135.9	136.7	137.6	138.6	139.6	140.7	3,887.5
	Bridges	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.4	26.3	26.5	26.2	25.5	24.6	23.6	21.1	17.6	15.1	13.2	11.9	10.9	10.1	9.6	9.2	8.8	8.6	8.4	8.2	8.1	8.0	8.0	541.5
	Footpath	10.4	6.8	9.0	11.1	13.1	14.9	16.7	18.3	19.8	21.2	22.4	23.6	24.6	25.5	26.4	27.2	27.9	28.5	29.1	29.7	30.2	30.7	31.2	31.6	32.0	32.4	32.8	33.2	33.6	34.0	728.0
	Retaining walls	8.5	16.0	18.0	25.0	23.0	20.0	18.0	17.8	6.6	5.1	4.0	3.3	2.9	2.7	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.6	2.6	2.6	2.7	2.7	2.8	211.2
	Parking	10.5	9.5	11.4	10.2	9.1	8.1	7.3	6.7	6.2	5.9	5.8	5.7	5.7	5.8	5.9	6.0	6.2	6.3	6.4	6.6	6.7	6.8	6.9	7.0	7.1	7.3	7.4	7.5	7.6	7.7	217.4
	Signs	0.7	1.7	4.0	5.5	6.1	6.2	5.9	5.6	5.4	5.3	5.3	5.3	5.4	5.5	5.6	5.8	5.9	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	169.8
	Drainage	9.6	13.9	20.8	26.4	30.5	33.6	35.8	37.4	38.4	39.1	39.4	39.4	39.3	39.0	38.6	38.2	37.7	37.2	36.6	36.1	35.6	35.1	34.7	34.3	33.9	33.6	33.4	33.2	33.0	33.0	1,006.8
	Traffic systems	13.0	9.6	8.2	7.2	6.6	6.3	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.3	8.4	8.5	8.6	8.8	8.9	231.9
	Sea walls	7.6	12.2	11.7	9.5	7.2	5.3	3.9	2.9	2.2	1.7	1.4	1.2	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	83.0
	Cycle	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	16.6
	Corridor structures	0.0	0.7	4.4	6.5	6.9	6.3	5.3	4.3	3.5	3.0	2.6	2.4	2.3	2.3	2.3	2.4	2.4	2.5	2.5	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.9	3.0	93.3
	Streetlighting	12.7	13.6	18.3	19.8	19.5	18.5	17.1	15.9	14.8	14.0	13.4	13.1	12.9	12.8	12.9	13.1	13.3	13.6	13.9	14.3	14.7	15.1	15.5	15.9	16.3	16.7	17.2	17.6	18.0	18.5	462.9
Road Total		**209**	**235**	**262**	**275**	**273**	**267**	**268**	**262**	**254**	**257**	**251**	**252**	**250**	**252**	**250**	**249**	**257**	**252**	**251**	**251**	**251**	**252**	**253**	**254**	**256**	**257**	**259**	**261**	**263**	**265**	**7,650**
Public transport	Rail	7.2	7.9	12.1	14.5	14.4	13.6	14.3	15.0	15.4	15.7	15.8	15.9	15.9	15.9	15.8	15.8	15.8	15.8	15.8	15.8	45.8	45.8	45.8	45.8	45.9	45.9	45.9	46.0	46.0	46.1	747.2
	Bus	1.2	2.5	2.9	2.6	2.3	2.0	1.9	1.9	1.9	1.9	2.0	2.1	2.2	2.2	2.3	2.3	2.3	2.4	2.4	2.5	2.5	2.6	2.6	2.6	2.7	2.7	2.8	2.8	2.8	2.9	70.7
	Ferry	10.7	13.4	7.0	4.6	2.5	2.7	2.6	2.5	2.4	2.4	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3	2.3	2.3	2.3	95.7
	All PT	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	5.0
Public transport Total		**20**	**24**	**22**	**22**	**19**	**18**	**19**	**19**	**20**	**20**	**20**	**20**	**21**	**20**	**20**	**21**	**20**	**20**	**21**	**20**	**50**	**51**	**51**	**51**	**51**	**51**	**51**	**52**	**51**	**51**	**919**
Grand Total		**229**	**259**	**284**	**297**	**293**	**285**	**288**	**281**	**274**	**277**	**271**	**272**	**271**	**272**	**271**	**269**	**277**	**273**	**272**	**271**	**302**	**303**	**304**	**305**	**307**	**308**	**310**	**313**	**314**	**317**	**8,568**

Long term renewal needs



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	203
Total	195	235	275	282	272	259	248	238	233	229	227	227	228	228	230	232	234	236	238	24
Public transport	18	21	21	20	18	17	17	15	15	15	14	14	14	13	13	14	13	14	14	14
Road	178	215	255	262	254	242	231	223	218	215	213	213	214	215	216	218	220	222	224	22

Summary

- Identify long-term renewals cost pressures between asset classes across the portfolio
- Visibility of condition-based backlog risk
- Long-term investment for resolving backlog
- Mechanism for direct testing of trade-offs between funding, level of service and risk
- Provides communication of key asset management issues to decision-makers.

Renewal optimisation model benefits

- Optimized investment options for governing body and management
- Renewals decisions are made knowing condition and levels of service consequences
- Transparent system covering all assets
- Encourages meaningful debate on cost vs. outcomes

Future enhancements

- Shift to a stand-alone application
- Incorporate maintenance impacts
- Refinement of deterioration analysis
- Intervention informed by more factors
- Increased granularity


Thank you.
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