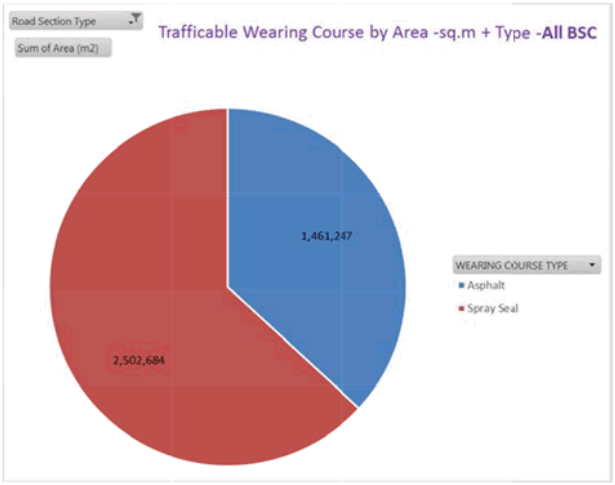
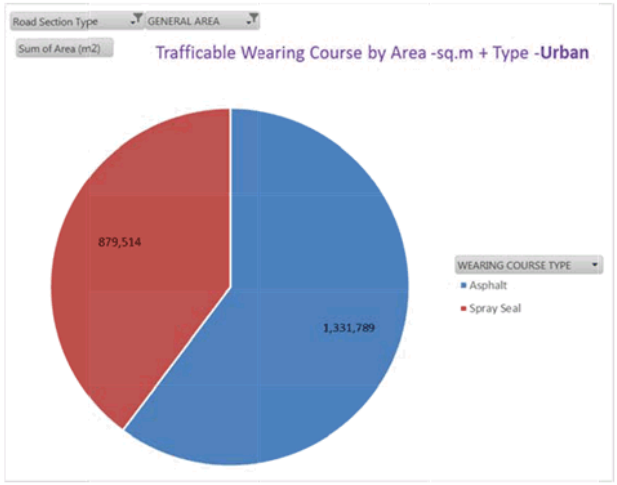
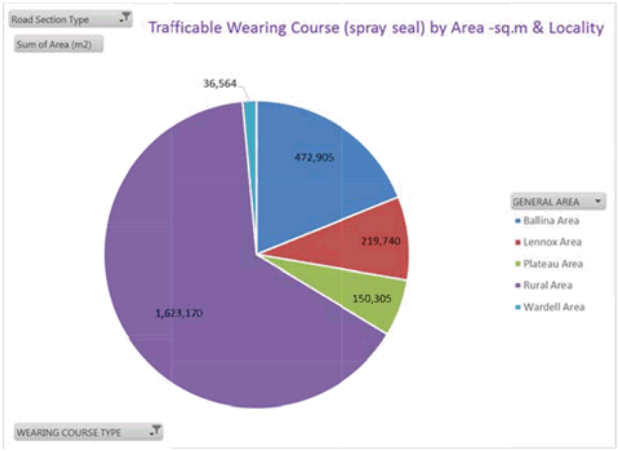
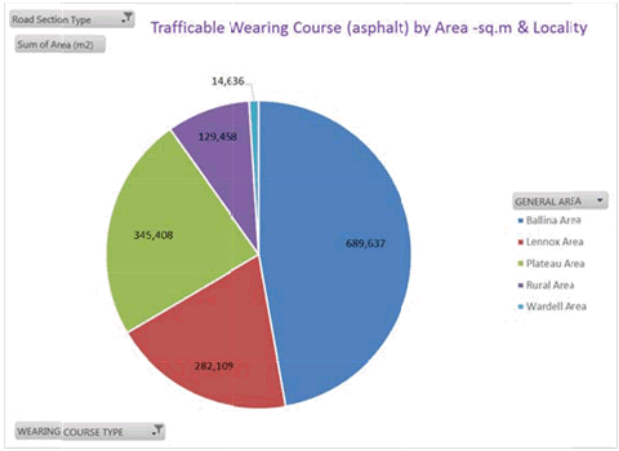
Ballina Council Local & Regional Road Wearing Course Analysis 2014

Current Wearing Course Summary


Road Section Type
Sum of Area (m2)
Trafficable Wearing Course by Area -sq.m + Type -All BSC
1,461,247
2,502,684
WEARING COURSE TYPE
Asphalt
Spray Seal


Road Section Type
GENERAL AREA
Sum of Area (m2)
Trafficable Wearing Course by Area -sq.m + Type -Urban
879,514
1,331,789
WEARING COURSE TYPE
Asphalt
Spray Seal


Road Section Type
Sum of Area (m2)
Trafficable Wearing Course (spray seal) by Area -sq.m & Locality
36,564
472,905
219,740
150,305
1,623,170
GENERAL AREA
Ballina Area
Lennox Area
Plateau Area
Rural Area
Wardell Area
WEARING COURSE TYPE


Road Section Type
Sum of Area (m2)
Trafficable Wearing Course (asphalt) by Area -sq.m & Locality
14,636
129,458
345,408
689,637
282,109
GENERAL AREA
Ballina Area
Lennox Area
Plateau Area
Rural Area
Wardell Area
WEARING COURSE TYPE

Unit Rates & Design Lives (by NAASRA Class) Summary

Spray Seals

NAARSA Class	description	Unit cost –$ per sq.m	Design Life -years
2	2 -Rural: distributer	$5	15
3	3 -Rural: arterial	$5	20
4	4 -Rural: local roads	$5	25
5	5 -Rural: single use road	$5	30
6	6 -Urban: principal avenue	$5	15
7	7 -Urban: distributer to local streets	$5	20
8	8 -Urban: local streets	$5	25
9	9 -Urban: local lanes	$5	30

Asphalt

NAARSA Class	description	Unit cost –$ per sq.m	Design Life -years
2	2 -Rural: distributer	$20	30
3	3 -Rural: arterial	$20	35
4	4 -Rural: local roads	$20	40
5	5 -Rural: single use road	$20	40
6	6 -Urban: principal avenue	$20	30
7	7 -Urban: distributer to local streets	$20	35
8	8 -Urban: local streets	$20	40
9	9 -Urban: local lanes	$20	40

Works Effects Assumptions

Reconstruction

- Resets Roughness to 50 NRM counts
- Resets Cracking to 0%
- Resets patching to 0%
- Resets surface defects to 0%
- Resets rutting to 0 mm
- Pavement Life = 60 years

Asphalt Overlay (wearing course)

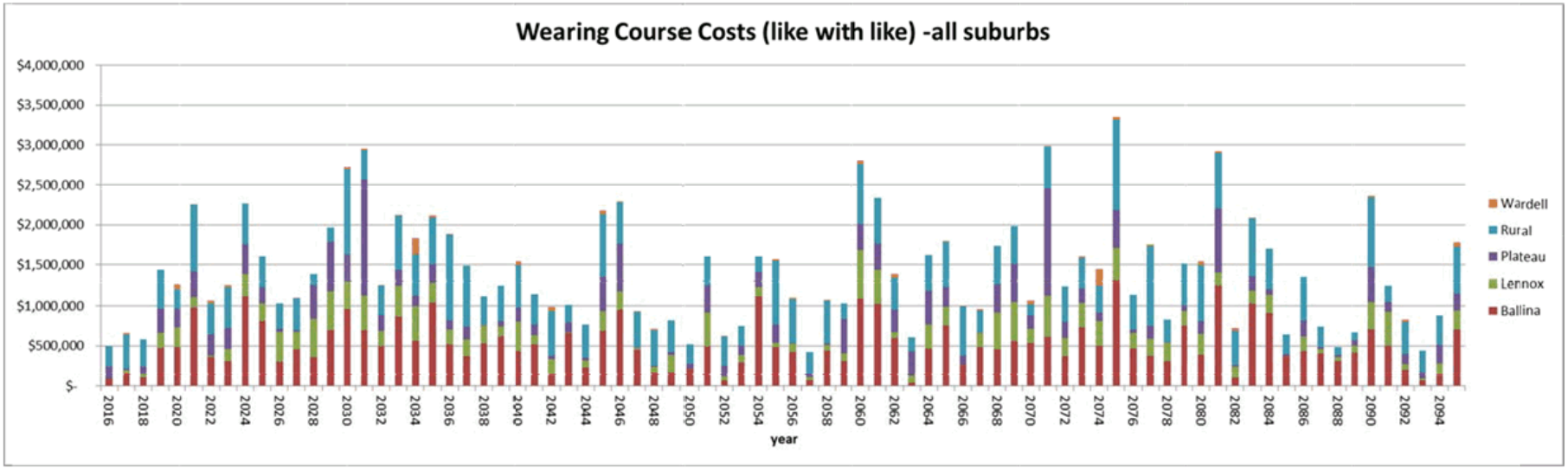
- Reduces Roughness by 20 NRM counts
- Resets Cracking to 0%
- Resets surface defects to 0%
- Resets rutting to 0 mm

Spray Seal (wearing course)

- Reduces Roughness by 5 NRM counts
- Resets Cracking to 0%
- Resets surface defects to 0%

Financial Analysis (80 years)

Scenario 1: Current Wearing Course breakup (replace like with Like)

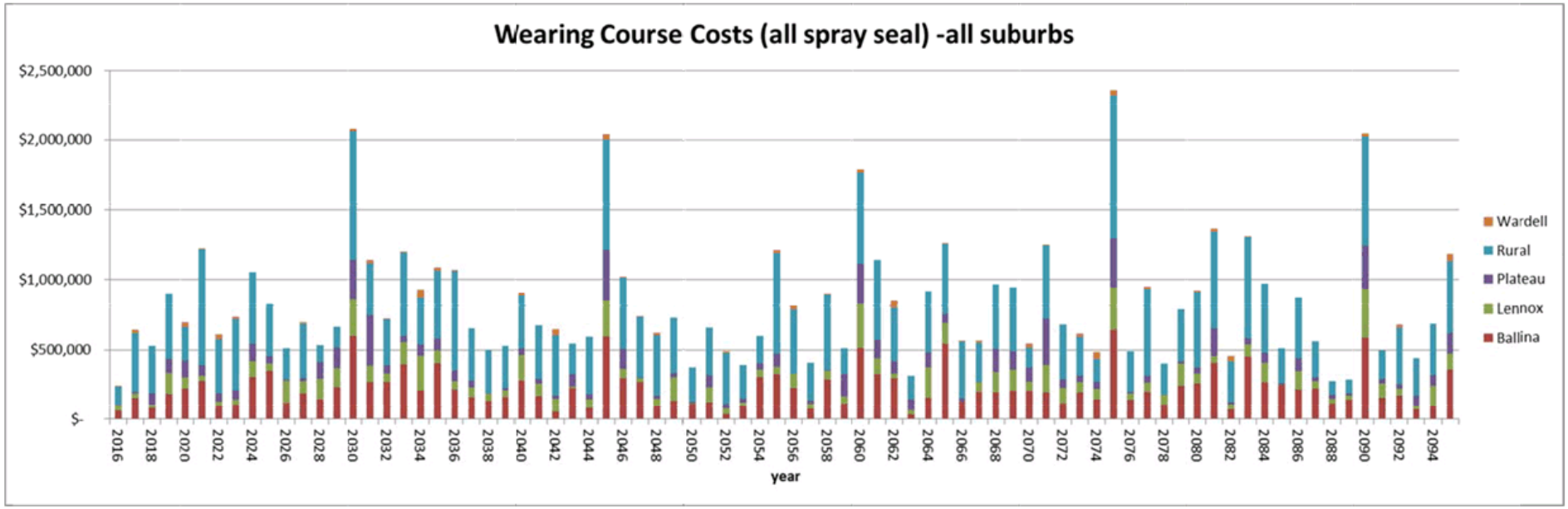


Scenario 1: Current Wearing Course breakup (replace like with Like) -10 year projection

Row Labels	Sum of 2016	Sum of 2017	Sum of 2018	Sum of 2019	Sum of 2020	Sum of 2021	Sum of 2022	Sum of 2023	Sum of 2024	Sum of 2025
Ballina Area	**$ 98,742.00**	**$ 153,507.50**	**$ 114,402.00**	**$ 470,936.00**	**$ 485,421.00**	**$ 978,523.90**	**$ 355,764.00**	**$ 304,682.50**	**$ 1,121,407.00**	**$ 808,307.50**
Ballina East	$ 7,222.00	$ 128,448.00	$ 16,412.50	$ 199,864.00	$ 38,592.00	$ 687,150.00	$ 2,907.00	$ 71,451.00	$ 590,598.00	$ 303,617.00
Ballina Island	$ 24,958.00	$ 21,495.50	$ 93,623.00	$ 132,584.00	$ 253,678.00	$ 77,878.00	$ 202,091.00	$ 219,880.00	$ 340,525.00	$ 476,630.50
Ballina North	$ 8,708.00	$ 3,564.00	$ 4,366.50	$ -	$ 20,342.00	$ -	$ -	$ -	$ -	$ 28,060.00
Ballina West	$ 37,590.00	$ -	$ -	$ 138,488.00	$ 5,913.00	$ 213,495.90	$ 150,766.00	$ 13,351.50	$ 190,284.00	$ -
Rural -Cumberlum	$ 20,264.00	$ -	$ -	$ -	$ 166,896.00	$ -	$ -	$ -	$ -	$ -
Lennox Area	**$ -**	**$ 37,839.00**	**$ 25,511.00**	**$ 192,861.50**	**$ 249,043.00**	**$ 127,120.00**	**$ 24,282.00**	**$ 149,814.00**	**$ 258,071.50**	**$ 223,882.00**
Lennox Head	$ -	$ 37,839.00	$ 25,511.00	$ 115,189.00	$ 142,652.00	$ 6,360.00	$ -	$ 98,560.00	$ 187,988.00	$ -
Lennox Heights	$ -	$ -	$ -	$ 45,994.00	$ 106,391.00	$ 119,374.00	$ 17,480.00	$ 51,254.00	$ 20,448.00	$ 174,106.00
Skennars Head	$ -	$ -	$ -	$ 31,678.50	$ -	$ 1,386.00	$ 6,802.00	$ -	$ 49,635.50	$ 49,776.00
Plateau Area	**$ 134,880.00**	**$ 20,160.00**	**$ 94,899.00**	**$ 303,738.00**	**$ 236,916.00**	**$ 312,872.00**	**$ 263,468.00**	**$ 271,140.00**	**$ 375,348.00**	**$ 199,256.00**
Alstonville	$ -	$ 13,860.00	$ 75,507.00	$ 135,546.00	$ 236,916.00	$ 174,800.00	$ 73,268.00	$ 118,300.00	$ 200,852.00	$ 199,256.00
Wollongbar	$ 134,880.00	$ 6,300.00	$ 19,392.00	$ 168,192.00	$ -	$ 138,072.00	$ 190,200.00	$ 152,840.00	$ 174,496.00	$ -
Rural Area	**$ 256,964.00**	**$ 427,080.50**	**$ 342,679.00**	**$ 465,918.00**	**$ 239,401.50**	**$ 828,357.50**	**$ 389,529.50**	**$ 511,006.00**	**$ 511,969.50**	**$ 368,835.50**
Rural -Alstonvale	$ 126,319.00	$ 41,030.00	$ 21,655.00	$ 43,772.00	$ -	$ 198,620.00	$ 12,600.00	$ -	$ 6,993.00	$ 6,188.00
Rural -Bagotville	$ -	$ 3,577.00	$ -	$ -	$ -	$ 64,960.00	$ 36,082.00	$ 69,264.00	$ -	$ 48,748.00
Rural -Brooklet	$ 23,503.00	$ 13,566.00	$ -	$ -	$ -	$ 11,395.00	$ 32,649.00	$ -	$ -	$ 11,395.00
Rural -Coolgardie	$ -	$ -	$ 2,886.00	$ -	$ -	$ 41,124.00	$ -	$ -	$ -	$ 25,524.50
Rural -Dalwood	$ -	$ -	$ -	$ 13,356.00	$ -	$ 85,974.00	$ -	$ 97,321.50	$ -	$ -
Rural -Empire Vale	$ -	$ -	$ -	$ 18,125.00	$ 28,359.00	$ 22,712.00	$ -	$ 55,612.00	$ 36,662.00	$ -
Rural -Fernleigh	$ 4,294.00	$ 96,045.00	$ -	$ -	$ -	$ 11,727.00	$ 65,913.00	$ -	$ 61,060.00	$ 33,514.00
Rural -Keith Hall	$ -	$ -	$ -	$ 44,250.00	$ -	$ 9,292.50	$ -	$ 4,911.50	$ -	$ -
Rural -Knockrow	$ -	$ 14,000.00	$ -	$ 63,990.00	$ 8,265.00	$ 5,486.00	$ 60,696.00	$ 47,485.00	$ 64,080.00	$ -
Rural -Lynwood	$ -	$ -	$ -	$ 53,019.00	$ 12,325.00	$ 19,085.50	$ -	$ -	$ -	$ -
Rural -Marom Creek	$ -	$ -	$ 27,471.00	$ -	$ 11,942.00	$ 71,286.00	$ -	$ -	$ 30,523.50	$ 62,764.00
Rural -McLeans Ridges	$ 31,698.00	$ -	$ -	$ -	$ 14,496.00	$ -	$ -	$ -	$ -	$ -
Rural -Meerschaum Vale	$ -	$ 47,173.50	$ 40,600.00	$ 35,406.00	$ 26,062.50	$ 29,051.00	$ 14,800.00	$ 62,639.50	$ 46,400.00	$ -
Rural -Newrybar	$ -	$ -	$ 40,964.00	$ 31,996.00	$ -	$ 51,050.00	$ 10,818.00	$ 4,480.00	$ -	$ -
Rural -Patches Beach	$ 31,808.00	$ -	$ 70,065.00	$ 13,932.00	$ 25,298.00	$ -	$ -	$ 50,625.00	$ -	$ -
Rural -Pearces Creek	$ -	$ 6,441.00	$ 41,131.50	$ -	$ -	$ -	$ 2,352.00	$ -	$ 108,180.00	$ 57,798.00
Rural -Pimlico	$ -	$ 25,418.00	$ 15,105.00	$ 22,610.00	$ 35,788.50	$ -	$ -	$ 32,474.00	$ 27,231.00	$ -
Rural -Rous	$ -	$ -	$ 1,025.00	$ -	$ 6,945.00	$ -	$ 52,582.00	$ 68,643.00	$ 23,010.00	$ 49,475.00
Rural -Rous Mill	$ -	$ -	$ -	$ -	$ -	$ 7,238.00	$ -	$ -	$ -	$ -
Rural -South Ballina	$ -	$ -	$ -	$ -	$ 41,422.50	$ 22,837.50	$ -	$ -	$ -	$ 33,950.00
Rural -Teven	$ -	$ 107,464.00	$ 61,460.00	$ 30,640.00	$ 13,336.00	$ 102,951.00	$ 68,563.50	$ -	$ 81,601.00	$ 39,479.00
Rural -Tintenbar	$ 20,580.00	$ 22,400.00	$ -	$ 46,500.00	$ 15,162.00	$ -	$ -	$ 40,104.50	$ -	$ -
Rural -Tuckombil	$ 9,795.00	$ 49,966.00	$ -	$ -	$ -	$ -	$ -	$ 9,920.00	$ 26,229.00	$ -
Rural -Uralba	$ 8,967.00	$ -	$ 20,316.50	$ 48,322.00	$ -	$ 73,568.00	$ -	$ -	$ -	$ -
Wardell Area	**$ -**	**$ 21,495.00**	**$ -**	**$ -**	**$ 55,676.00**	**$ 1,512.00**	**$ 34,149.50**	**$ 20,792.00**	**$ -**	**$ -**
Wardell	$ -	$ 21,495.00	$ -	$ -	$ 55,676.00	$ 1,512.00	$ 34,149.50	$ 20,792.00	$ -	$ -
Grand Total	**$ 490,586.00**	**$ 660,082.00**	**$ 577,491.00**	**$ 1,433,453.50**	**$ 1,266,457.50**	**$ 2,248,385.40**	**$ 1,067,193.00**	**$ 1,257,434.50**	**$ 2,266,796.00**	**$ 1,600,281.00**

Financial Analysis (80 years)

Scenario 2: All Public Road Surfaces remain or revert to Spray Seal

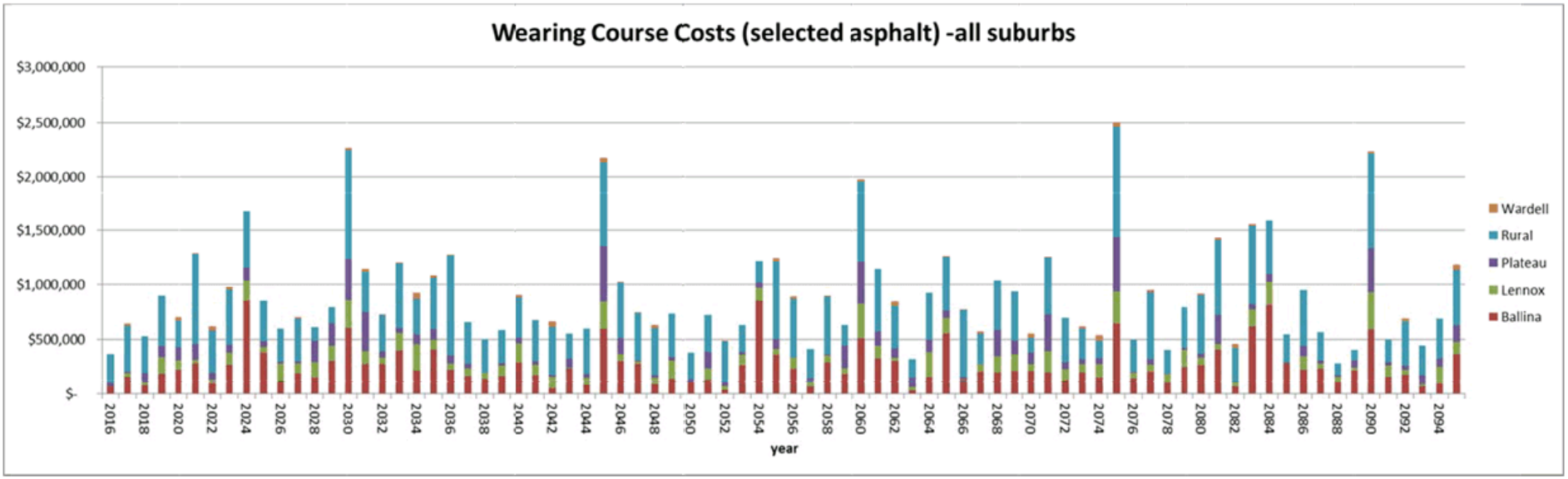


Scenario 2: All Public Road Surfaces remain or revert to Spray Seal -10 year projection

Row Labels	Sum of 2016	Sum of 2017	Sum of 2018	Sum of 2019	Sum of 2020	Sum of 2021	Sum of 2022	Sum of 2023	Sum of 2024	Sum of 2025
Ballina Area	**$ 70,549.50**	**$ 152,688.50**	**$ 79,722.00**	**$ 178,314.50**	**$ 218,541.00**	**$ 273,418.90**	**$ 98,310.00**	**$ 102,929.50**	**$ 300,272.50**	**$ 346,979.50**
Ballina East	$ 7,222.00	$ 127,629.00	$ 16,412.50	$ 107,333.50	$ 20,203.50	$ 173,650.50	$ 2,907.00	$ 32,781.00	$ 150,852.00	$ 79,488.50
Ballina Island	$ 24,958.00	$ 21,495.50	$ 58,943.00	$ 36,359.00	$ 130,358.50	$ 35,461.00	$ 57,711.50	$ 56,797.00	$ 101,849.50	$ 239,431.00
Ballina North	$ 8,708.00	$ 3,564.00	$ 4,366.50	$ -	$ 20,342.00	$ -	$ -	$ -	$ -	$ 28,060.00
Ballina West	$ 9,397.50	$ -	$ -	$ 34,622.00	$ 5,913.00	$ 64,307.40	$ 37,691.50	$ 13,351.50	$ 47,571.00	$ -
Rural -Cumberlum	$ 20,264.00	$ -	$ -	$ -	$ 41,724.00	$ -	$ -	$ -	$ -	$ -
Lennox Area	**$ -**	**$ 32,010.00**	**$ 25,511.00**	**$ 158,366.00**	**$ 84,802.00**	**$ 37,589.50**	**$ 24,282.00**	**$ 37,453.50**	**$ 119,834.50**	**$ 55,970.50**
Lennox Head	$ -	$ 32,010.00	$ 25,511.00	$ 115,189.00	$ 50,243.00	$ 6,360.00	$ -	$ 24,640.00	$ 65,087.00	$ -
Lennox Heights	$ -	$ -	$ -	$ 11,498.50	$ 34,559.00	$ 29,843.50	$ 17,480.00	$ 12,813.50	$ 5,112.00	$ 43,526.50
Skennars Head	$ -	$ -	$ -	$ 31,678.50	$ -	$ 1,386.00	$ 6,802.00	$ -	$ 49,635.50	$ 12,444.00
Plateau Area	**$ 33,720.00**	**$ 9,765.00**	**$ 80,355.00**	**$ 97,584.00**	**$ 122,265.00**	**$ 78,218.00**	**$ 65,867.00**	**$ 67,785.00**	**$ 122,424.00**	**$ 52,355.00**
Alstonville	$ -	$ 3,465.00	$ 75,507.00	$ 55,536.00	$ 122,265.00	$ 43,700.00	$ 18,317.00	$ 29,575.00	$ 78,800.00	$ 52,355.00
Wollongbar	$ 33,720.00	$ 6,300.00	$ 4,848.00	$ 42,048.00	$ -	$ 34,518.00	$ 47,550.00	$ 38,210.00	$ 43,624.00	$ -
Rural Area	**$ 256,964.00**	**$ 427,080.50**	**$ 342,679.00**	**$ 465,918.00**	**$ 239,401.50**	**$ 828,357.50**	**$ 389,529.50**	**$ 511,006.00**	**$ 511,969.50**	**$ 368,835.50**
Rural -Alstonvale	$ 126,319.00	$ 41,030.00	$ 21,655.00	$ 43,772.00	$ -	$ 198,620.00	$ 12,600.00	$ -	$ 6,993.00	$ 6,188.00
Rural -Bagotville	$ -	$ 3,577.00	$ -	$ -	$ -	$ 64,960.00	$ 36,082.00	$ 69,264.00	$ -	$ 48,748.00
Rural -Brooklet	$ 23,503.00	$ 13,566.00	$ -	$ -	$ -	$ 11,395.00	$ 32,649.00	$ -	$ -	$ 11,395.00
Rural -Coolgardie	$ -	$ -	$ 2,886.00	$ -	$ -	$ 41,124.00	$ -	$ -	$ -	$ 25,524.50
Rural -Dalwood	$ -	$ -	$ -	$ 13,356.00	$ -	$ 85,974.00	$ -	$ 97,321.50	$ -	$ -
Rural -Empire Vale	$ -	$ -	$ -	$ 18,125.00	$ 28,359.00	$ 22,712.00	$ -	$ 55,612.00	$ 36,662.00	$ -
Rural -Fernleigh	$ 4,294.00	$ 96,045.00	$ -	$ -	$ -	$ 11,727.00	$ 65,913.00	$ -	$ 61,060.00	$ 33,514.00
Rural -Keith Hall	$ -	$ -	$ -	$ 44,250.00	$ -	$ 9,292.50	$ -	$ 4,911.50	$ -	$ -
Rural -Knockrow	$ -	$ 14,000.00	$ -	$ 63,990.00	$ 8,265.00	$ 5,486.00	$ 60,696.00	$ 47,485.00	$ 64,080.00	$ -
Rural -Lynwood	$ -	$ -	$ -	$ 53,019.00	$ 12,325.00	$ 19,085.50	$ -	$ -	$ -	$ -
Rural -Marom Creek	$ -	$ -	$ 27,471.00	$ -	$ 11,942.00	$ 71,286.00	$ -	$ -	$ 30,523.50	$ 62,764.00
Rural -McLeans Ridges	$ 31,698.00	$ -	$ -	$ -	$ 14,496.00	$ -	$ -	$ -	$ -	$ -
Rural -Meerschaum Vale	$ -	$ 47,173.50	$ 40,600.00	$ 35,406.00	$ 26,062.50	$ 29,051.00	$ 14,800.00	$ 62,639.50	$ 46,400.00	$ -
Rural -Newrybar	$ -	$ -	$ 40,964.00	$ 31,996.00	$ -	$ 51,050.00	$ 10,818.00	$ 4,480.00	$ -	$ -
Rural -Patches Beach	$ 31,808.00	$ -	$ 70,065.00	$ 13,932.00	$ 25,298.00	$ -	$ -	$ 50,625.00	$ -	$ -
Rural -Pearces Creek	$ -	$ 6,441.00	$ 41,131.50	$ -	$ -	$ -	$ 2,352.00	$ -	$ 108,180.00	$ 57,798.00
Rural -Pimlico	$ -	$ 25,418.00	$ 15,105.00	$ 22,610.00	$ 35,788.50	$ -	$ 32,474.00	$ -	$ 27,231.00	$ -
Rural -Rous	$ -	$ -	$ 1,025.00	$ -	$ 6,945.00	$ -	$ 52,582.00	$ 68,643.00	$ 23,010.00	$ 49,475.00
Rural -Rous Mill	$ -	$ -	$ -	$ -	$ -	$ 7,238.00	$ -	$ -	$ -	$ -
Rural -South Ballina	$ -	$ -	$ -	$ -	$ 41,422.50	$ 22,837.50	$ -	$ -	$ -	$ 33,950.00
Rural -Teven	$ -	$ 107,464.00	$ 61,460.00	$ 30,640.00	$ 13,336.00	$ 102,951.00	$ 68,563.50	$ -	$ 81,601.00	$ 39,479.00
Rural -Tintenbar	$ 20,580.00	$ 22,400.00	$ -	$ 46,500.00	$ 15,162.00	$ -	$ -	$ 40,104.50	$ -	$ -
Rural -Tuckombil	$ 9,795.00	$ 49,966.00	$ -	$ -	$ -	$ -	$ -	$ 9,920.00	$ 26,229.00	$ -
Rural -Uralba	$ 8,967.00	$ -	$ 20,316.50	$ 48,322.00	$ -	$ 73,568.00	$ -	$ -	$ -	$ -
Wardell Area	**$ -**	**$ 21,495.00**	**$ -**	**$ -**	**$ 32,585.00**	**$ 1,512.00**	**$ 34,149.50**	**$ 20,792.00**	**$ -**	**$ -**
Wardell	$ -	$ 21,495.00	$ -	$ -	$ 32,585.00	$ 1,512.00	$ 34,149.50	$ 20,792.00	$ -	$ -
Grand Total	**$ 361,233.50**	**$ 643,039.00**	**$ 528,267.00**	**$ 900,182.50**	**$ 697,594.50**	**$ 1,219,095.90**	**$ 612,138.00**	**$ 739,966.00**	**$ 1,054,500.50**	**$ 824,140.50**

Financial Analysis (80 years)

Scenario 3: Scenario 2 + selected roads remain in AC due to traffic considerations & aesthetics



Scenario 3: Scenario 2 + selected roads remain in AC due to traffic considerations & aesthetics -10 year projection

Row Labels	Sum of 2016	Sum of 2017	Sum of 2018	Sum of 2019	Sum of 2020	Sum of 2021	Sum of 2022	Sum of 2023	Sum of 2024	Sum of 2025
Ballina Area	**$ 70,549.50**	**$ 152,688.50**	**$ 79,722.00**	**$ 178,314.50**	**$ 218,541.00**	**$ 273,418.90**	**$ 98,310.00**	**$ 266,012.50**	**$ 853,442.50**	**$ 374,489.50**
Ballina East	$ 7,222.00	$ 127,629.00	$ 16,412.50	$ 107,333.50	$ 20,203.50	$ 173,650.50	$ 2,907.00	$ 32,781.00	$ 520,617.00	$ 106,998.50
Ballina Island	$ 24,958.00	$ 21,495.50	$ 58,943.00	$ 36,359.00	$ 130,358.50	$ 35,461.00	$ 57,711.50	$ 219,880.00	$ 285,254.50	$ 239,431.00
Ballina North	$ 8,708.00	$ 3,564.00	$ 4,366.50	$ -	$ 20,342.00	$ -	$ -	$ -	$ -	$ 28,060.00
Ballina West	$ 9,397.50	$ -	$ -	$ 34,622.00	$ 5,913.00	$ 64,307.40	$ 37,691.50	$ 13,351.50	$ 47,571.00	$ -
Rural -Cumberlum	$ 20,264.00	$ -	$ -	$ -	$ 41,724.00	$ -	$ -	$ -	$ -	$ -
Lennox Area	**$ -**	**$ 32,010.00**	**$ 25,511.00**	**$ 158,366.00**	**$ 84,802.00**	**$ 37,589.50**	**$ 24,282.00**	**$ 111,373.50**	**$ 182,494.00**	**$ 55,970.50**
Lennox Head	$ -	$ 32,010.00	$ 25,511.00	$ 115,189.00	$ 50,243.00	$ 6,360.00	$ -	$ 98,560.00	$ 127,746.50	$ -
Lennox Heights	$ -	$ -	$ -	$ 11,498.50	$ 34,559.00	$ 29,843.50	$ 17,480.00	$ 12,813.50	$ 5,112.00	$ 43,526.50
Skennars Head	$ -	$ -	$ -	$ 31,678.50	$ -	$ 1,386.00	$ 6,802.00	$ -	$ 49,635.50	$ 12,444.00
Plateau Area	**$ 33,720.00**	**$ 9,765.00**	**$ 80,355.00**	**$ 97,584.00**	**$ 122,265.00**	**$ 141,743.00**	**$ 65,867.00**	**$ 67,785.00**	**$ 122,424.00**	**$ 54,203.00**
Alstonville	$ -	$ 3,465.00	$ 75,507.00	$ 55,536.00	$ 122,265.00	$ 43,700.00	$ 18,317.00	$ 29,575.00	$ 78,800.00	$ 54,203.00
Wollongbar	$ 33,720.00	$ 6,300.00	$ 4,848.00	$ 42,048.00	$ -	$ 98,043.00	$ 47,550.00	$ 38,210.00	$ 43,624.00	$ -
Rural Area	**$ 256,964.00**	**$ 427,080.50**	**$ 342,679.00**	**$ 465,918.00**	**$ 239,401.50**	**$ 828,357.50**	**$ 389,529.50**	**$ 511,006.00**	**$ 511,969.50**	**$ 368,835.50**
Rural -Alstonvale	$ 126,319.00	$ 41,030.00	$ 21,655.00	$ 43,772.00	$ -	$ 198,620.00	$ 12,600.00	$ -	$ 6,993.00	$ 6,188.00
Rural -Bagotville	$ -	$ 3,577.00	$ -	$ -	$ -	$ 64,960.00	$ 36,082.00	$ 69,264.00	$ -	$ 48,748.00
Rural -Brooklet	$ 23,503.00	$ 13,566.00	$ -	$ -	$ -	$ 11,395.00	$ 32,649.00	$ -	$ -	$ 11,395.00
Rural -Coolgardie	$ -	$ -	$ 2,886.00	$ -	$ -	$ 41,124.00	$ -	$ -	$ -	$ 25,524.50
Rural -Dalwood	$ -	$ -	$ -	$ 13,356.00	$ -	$ 85,974.00	$ -	$ 97,321.50	$ -	$ -
Rural -Empire Vale	$ -	$ -	$ -	$ 18,125.00	$ 28,359.00	$ 22,712.00	$ -	$ 55,612.00	$ 36,662.00	$ -
Rural -Fernleigh	$ 4,294.00	$ 96,045.00	$ -	$ -	$ -	$ 11,727.00	$ 65,913.00	$ -	$ 61,060.00	$ 33,514.00
Rural -Keith Hall	$ -	$ -	$ -	$ 44,250.00	$ -	$ 9,292.50	$ -	$ 4,911.50	$ -	$ -
Rural -Knockrow	$ -	$ 14,000.00	$ -	$ 63,990.00	$ 8,265.00	$ 5,486.00	$ 60,696.00	$ 47,485.00	$ 64,080.00	$ -
Rural -Lynwood	$ -	$ -	$ -	$ 53,019.00	$ 12,325.00	$ 19,085.50	$ -	$ -	$ -	$ -
Rural -Marom Creek	$ -	$ -	$ 27,471.00	$ -	$ 11,942.00	$ 71,286.00	$ -	$ -	$ 30,523.50	$ 62,764.00
Rural -McLeans Ridges	$ 31,698.00	$ -	$ -	$ -	$ 14,496.00	$ -	$ -	$ -	$ -	$ -
Rural -Meerschaum Vale	$ -	$ 47,173.50	$ 40,600.00	$ 35,406.00	$ 26,062.50	$ 29,051.00	$ 14,800.00	$ 62,639.50	$ 46,400.00	$ -
Rural -Newrybar	$ -	$ -	$ 40,964.00	$ 31,996.00	$ -	$ 51,050.00	$ 10,818.00	$ 4,480.00	$ -	$ -
Rural -Patches Beach	$ 31,808.00	$ -	$ 70,065.00	$ 13,932.00	$ 25,298.00	$ -	$ -	$ 50,625.00	$ -	$ -
Rural -Pearces Creek	$ -	$ 6,441.00	$ 41,131.50	$ -	$ -	$ -	$ 2,352.00	$ -	$ 108,180.00	$ 57,798.00
Rural -Pimlico	$ -	$ 25,418.00	$ 15,105.00	$ 22,610.00	$ 35,788.50	$ -	$ 32,474.00	$ -	$ 27,231.00	$ -
Rural -Rous	$ -	$ -	$ 1,025.00	$ -	$ 6,945.00	$ -	$ 52,582.00	$ 68,643.00	$ 23,010.00	$ 49,475.00
Rural -Rous Mill	$ -	$ -	$ -	$ -	$ -	$ 7,238.00	$ -	$ -	$ -	$ -
Rural -South Ballina	$ -	$ -	$ -	$ -	$ 41,422.50	$ 22,837.50	$ -	$ -	$ -	$ 33,950.00
Rural -Teven	$ -	$ 107,464.00	$ 61,460.00	$ 30,640.00	$ 13,336.00	$ 102,951.00	$ 68,563.50	$ -	$ 81,601.00	$ 39,479.00
Rural -Tintenbar	$ 20,580.00	$ 22,400.00	$ -	$ 46,500.00	$ 15,162.00	$ -	$ -	$ 40,104.50	$ -	$ -
Rural -Tuckombil	$ 9,795.00	$ 49,966.00	$ -	$ -	$ -	$ -	$ -	$ 9,920.00	$ 26,229.00	$ -
Rural -Uralba	$ 8,967.00	$ -	$ 20,316.50	$ 48,322.00	$ -	$ 73,568.00	$ -	$ -	$ -	$ -
Wardell Area	**$ -**	**$ 21,495.00**	**$ -**	**$ -**	**$ 32,585.00**	**$ 1,512.00**	**$ 34,149.50**	**$ 20,792.00**	**$ -**	**$ -**
Wardell	$ -	$ 21,495.00	$ -	$ -	$ 32,585.00	$ 1,512.00	$ 34,149.50	$ 20,792.00	$ -	$ -
Grand Total	**$ 361,233.50**	**$ 643,039.00**	**$ 528,267.00**	**$ 900,182.50**	**$ 697,594.50**	**$ 1,282,620.90**	**$ 612,138.00**	**$ 976,969.00**	**$ 1,670,330.00**	**$ 853,498.50**

Network (condition) Analysis (80 years)

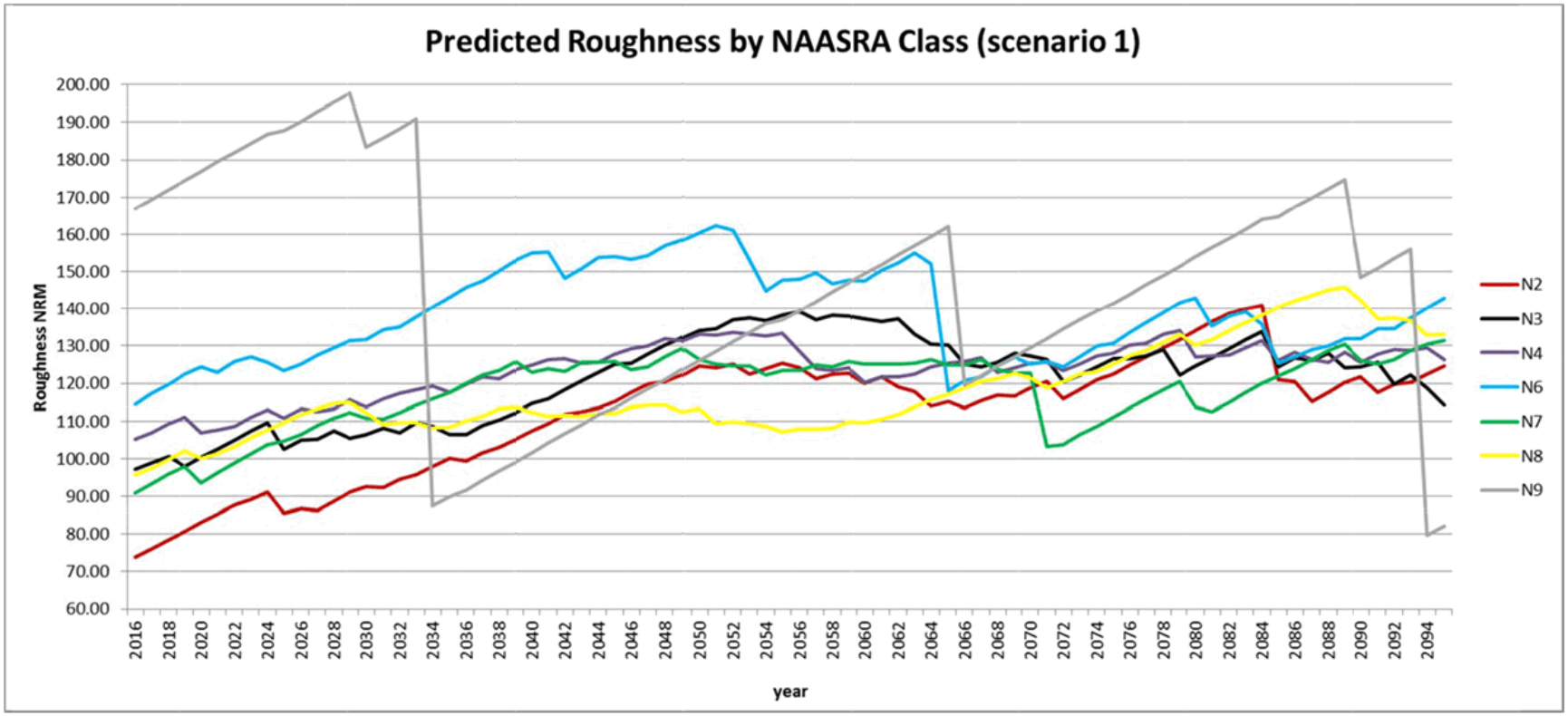
Modelled Roughness over an 80 year period, based on assumptions as shown on page 3, for 3 scenarios as described above.

Selected Roads for Scenario 3 (replacement of selected Roads –like with like)

- Ballina Street (30:028) -Lennox Head
- Bugden Avenue (40:031) -Alstonville
- Main Street (40:001) -Alstonville
- River Street (20:013) -Ballina Island
- MR 545 - Angels Beach Drive (MR 545)
- MR 545 - Bangalow Road (MR 545)
- MR 545 - Byron Bay Road (MR 545)
- MR 545 - The Coast Road (MR 545)
- MR 695 - Tamarind Drive (MR 695)
- MR 7734 - Rifle Range Road (MR 7734)
- MR 7734 - Teven Road (MR 7734)
- MR 7734 - Tintenbar Road (MR 7734)
- MR 7735 - Ross Lane (MR 7735)

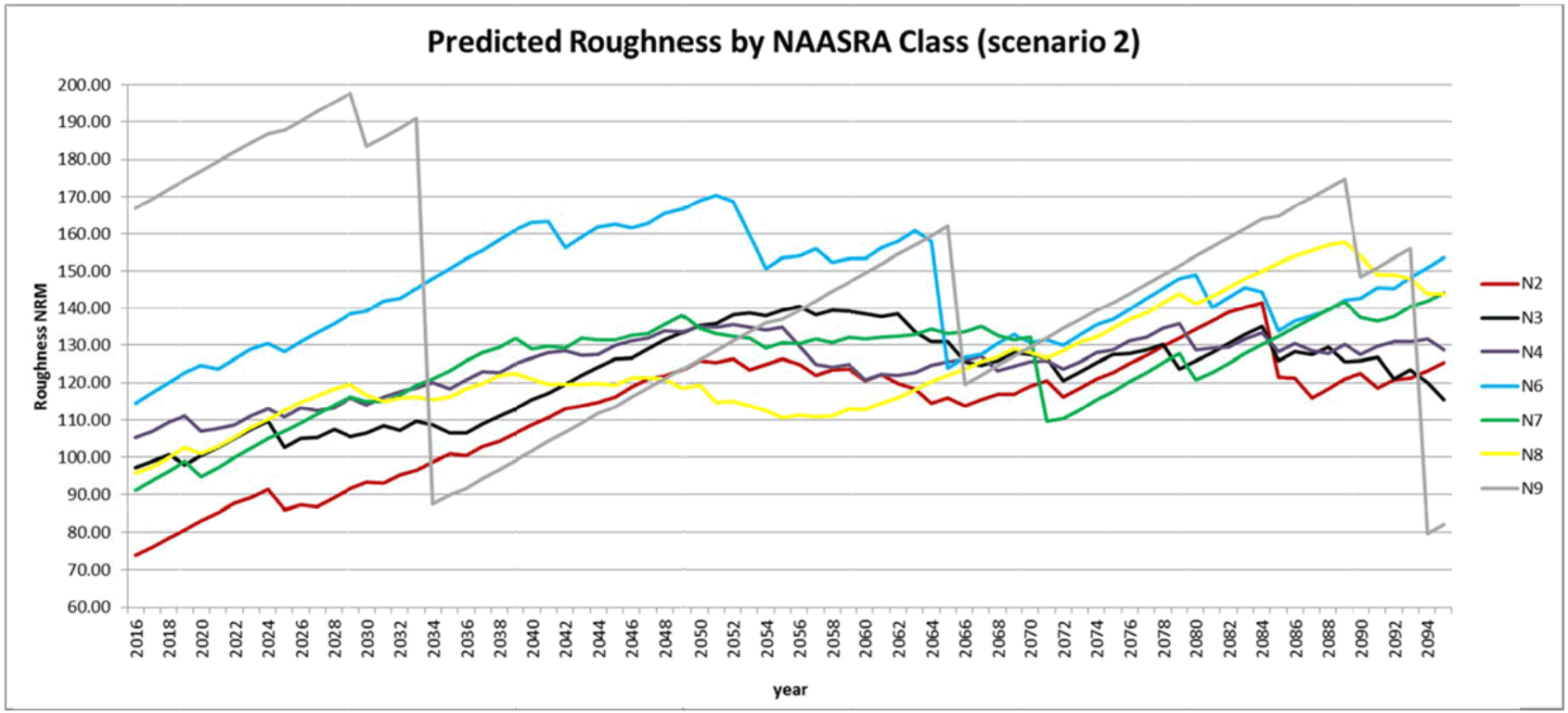
Network Analysis (80 years)

Scenario 1: Current Wearing Course breakup (replace like with Like)



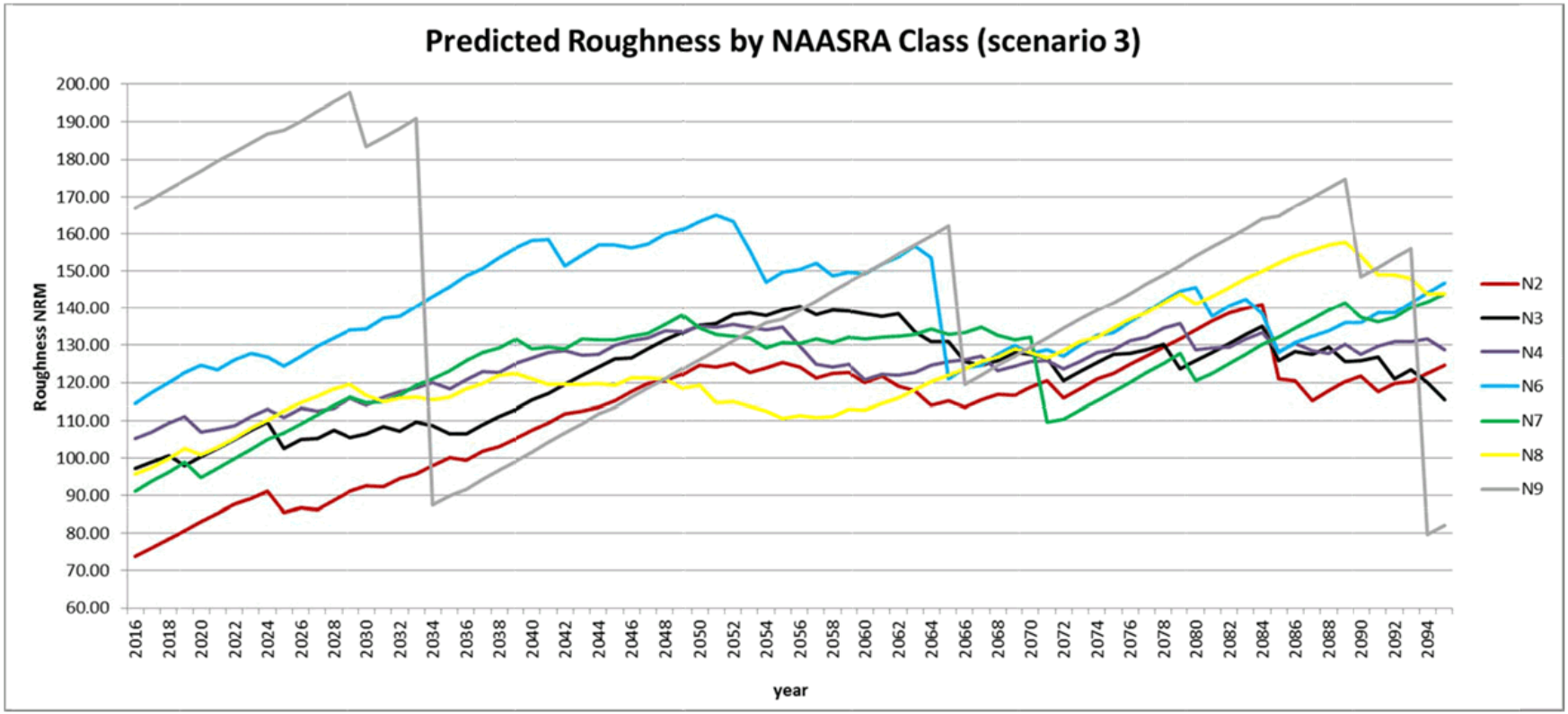
Network Analysis (80 years)

Scenario 2: All Public Road Surfaces remain or revert to Spray Seal



Network Analysis (80 years)

Scenario 3: Scenario 2 + selected roads remain in AC due to traffic & aesthetics



Findings

There seems to be considerable savings to be made for scenario 2 & 3. Looking over a 10 year period it can be shown that,

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	10 Year Total	10 Year Average
Scenario 1 -like with like	$ 490,586	$ 660,082	$ 577,491	$ 1,433,454	$ 1,266,458	$ 2,248,385	$ 1,067,193	$ 1,257,435	$ 2,266,796	$ 1,600,281	$ 12,868,160	$ 1,286,816
Scenario 2 -all spray seals	$ 361,234	$ 643,039	$ 528,267	$ 900,183	$ 697,595	$ 1,219,096	$ 612,138	$ 739,966	$ 1,054,501	$ 824,141	$ 7,580,157	$ 758,016
Scenario 3 -selected asphalt	$ 361,234	$ 643,039	$ 528,267	$ 900,183	$ 697,595	$ 1,282,621	$ 612,138	$ 976,969	$ 1,670,330	$ 853,499	$ 8,525,873	$ 852,587
Savings (1 to 2)	$ 129,353	$ 17,043	$ 49,224	$ 533,271	$ 568,863	$ 1,029,290	$ 455,055	$ 517,469	$ 1,212,296	$ 776,141	$ 5,288,003	$ 528,800
Savings (1 to 3)	$ 129,353	$ 17,043	$ 49,224	$ 533,271	$ 568,863	$ 965,765	$ 455,055	$ 280,466	$ 596,466	$ 746,783	$ 4,342,287	$ 434,229

The reduction in network health (based on roughness) is most apparent in those sun networks that have a large existing proportion of asphalt wearing courses, these being

- NAASRA Class 6
- NAASRA Class 7
- NAASRA Class 8

NAASRA Class	Scenario	2015	2025	2035	2045	2055	2065	2075	2085	2095
N2	1	71.4	85.6	100.2	115.1	125.3	115.3	122.5	121.0	124.6
N2	2	71.4	86.0	100.9	116.3	126.3	115.9	122.7	121.5	125.5
N2	3	71.4	85.6	100.2	115.1	125.3	115.3	122.5	121.0	124.6
N3	1	96.3	102.5	106.3	125.2	138.3	130.3	126.6	124.5	114.2
N3	2	96.3	102.5	106.3	126.3	139.5	131.0	127.5	125.8	115.4
N3	3	96.3	102.5	106.3	126.3	139.5	131.0	127.5	125.8	115.4
N4	1	102.7	110.8	117.6	127.9	133.3	125.4	127.9	126.1	126.5
N4	2	102.7	110.8	118.4	129.9	134.8	125.7	128.8	128.2	128.6
N4	3	102.7	110.8	118.4	129.9	134.8	125.7	128.8	128.2	128.6
N6	1	111.8	123.4	143.2	154.0	147.6	118.2	130.7	125.4	142.8
N6	2	111.8	128.3	150.7	162.5	153.4	124.0	137.0	133.8	153.5
N6	3	111.8	124.5	145.8	157.0	149.7	121.1	133.4	128.0	146.8
N7	1	88.2	104.8	117.6	125.9	123.4	124.9	110.9	121.8	131.5
N7	2	88.4	106.8	123.3	131.5	130.7	133.0	117.7	132.3	144.0
N7	3	88.4	106.8	123.3	131.3	130.7	133.0	117.5	132.1	143.8
N8	1	93.2	109.6	108.3	112.0	107.1	117.0	125.1	140.3	133.0
N8	2	93.2	112.5	116.2	119.3	110.6	121.9	134.6	152.0	143.8
N8	3	93.2	112.5	116.2	119.3	110.6	121.9	134.6	152.0	143.8
N9	1	164.4	187.8	89.9	113.6	136.9	161.9	141.4	164.8	82.2
N9	2	164.4	187.8	89.9	113.6	136.9	161.9	141.4	164.8	82.2
N9	3	164.4	187.8	89.9	113.6	136.9	161.9	141.4	164.8	82.2

The effect of roughness on other NAASRA Classes is minimal.

11.7 Pavement of The Ridgeway, Cumbalum

Delivery Program	Engineering Works
Objective	To seek Council's decision regarding the pavement finish and length for The Ridgeway reconstruction project.

Background

The Ridgeway was built in November 2003 by the developers of the Ballina Heights Estate.

A section of pavement (approximately 330m in length) is programmed to be replaced as part of the 2014/15 roads capital works program. The section of pavement has a deteriorating asphalt surface and relatively poor sub base conditions. The works will remove and replace the top pavement layer with some improvements to subsoil drainage works proposed.

Previous advice to Council regarding our road rehabilitation program has identified that for economic efficiency it is generally the preferred option to reinstate the wearing surface with a bitumen (2 coat) seal and not Asphaltic Concrete (AC) which is the current wearing surface for some of the Shire's urban roads.

Some exceptions to this approach have in the past included:

- Roads located within the CBD
- Heavily trafficked intersections
- Car parks (subjected to 'screwing' action of vehicles) and
- Pavement shape correction which can only be achieved with AC overlay.

It is anticipated that due to the relative young age of the existing wearing surface that there may be an expectation from the community that Council would replace the wearing surface with a like for like AC surface and not a bitumen reseal. However, having regard to the cost difference between the two types of seals, the design choice is submitted to Council for determination.

The Council is also advised that it was the intention for these works to be completed in the 2014 calendar year, however the works have been deferred until now to enable a start following the opening of Ballina Heights Drive as this will assist to minimise disruption to the motorists in the area by providing an alternative traffic route. This approach will also improve the efficiencies of the work activities by reducing the amount of traffic affecting the works area. As the opening of Ballina Heights Drive has been delayed, the Ridgeway pavement works are now scheduled for the first quarter of 2015.

Key Issues

- Project Cost and Life Expectancy
- Amenity
- The need for consistency in the approach for the replacement of pavement wearing resurfaces across the Shire.

Information

The current allocated construction budget for The Ridgeway is $361,000.

The general cost comparison between a two coat bitumen seal is approximately $8.50/m^2 and an AC surface is approximately $25/m^2 (including a $5/m^2 for a primerseal).

The life expectancy for a two coat seal is somewhere in the order of 12-15 years while and asphalt surface would normally provide somewhere in the vicinity of 20-25 years. Over the life cycle of the pavement the option to provide a bitumen seal as the wearing surface is cheaper than AC.

As previously advised to Council via bulletin items, in relation to the consideration of noise, asphalt surfaces are generally quieter than a two coat seal however research has identified that the difference is difficult to discern in respect of a change in amenity for residents, particularly for the lower range speed limits.

On some occasions the change in surface type applied by Council has generated inquiries or complaints. In response to this, a report titled *Road Surface Noise Levels Study* was commissioned by Council in November 2013 to provide some further data to assess the performance of our roads.

A copy of this report is provided as attachment one.

It is noted the report does not represent a scientific type study. The methodology simply selected a few road locations that could provide reasonable comparisons.

The report identifies changes of approximately 3 – 6 decibels, however for lower speed zones the changes are typically at the lower end of this range. The report describes these changes as noticeable.

While a direct road to road comparison can yield a noticeable result, it is important to note that most roads in the urban environment comprise a bitumen seal and these provide a noise service level that is accepted and considered a reasonable level of impact on local amenity.

Currently The Ridgeway is classified as an urban local road. It has been subject to reasonably high traffic movements in recent times, however as a result of the Ballina Heights Drive works traffic volumes are expected to decrease.

Sustainability Considerations

- **Environment**
  The purpose of this report is to consider noise impacts.

- **Social**
  The purpose of this report is to consider the impacts on social amenity from a change in road surface.

- **Economic**
  The efficient management of Council's infrastructure assets is important to support economic development.

Legal / Resource / Financial Implications

Current estimates for the works to incorporate a bitumen (2 coat) seal are approximately $296,000 whilst the asphalt (AC) option has been estimated at $365,000. A saving of $69,000 is forecast if the preferred approach of a bitumen reseal is adopted. The available budget for this project is $361,000.

Consultation

No consultation has been conducted with Ballina Heights Estate residents in respect of this issue.

Options

There are two options for consideration by Council;

1. The Ridgeway pavement renewal project is completed with a bitumen seal at an estimated cost of $296,000.

   The advantage of this option is that it represents an estimated budget saving of $69,000, allowing those funds to be used on other road construction projects. Another advantage is that the use of this type of seal is consistent with the approach Council has been delivering for its reseal program and pavement rehabilitation program for several years. A bitumen seal is preferred on a whole of life cost basis and provides a level of service that is accepted within the community.

2. The Ridgeway pavement renewal project is completed with an asphaltic concrete seal at an estimated cost of $365,000.

   This option recognises that for this project the change in seal type is occurring after only a relatively short period of time and therefore they may be an increased expectation within the local community to retain the current surface type. The advantage of this option is that it provides a superior surface.

Ultimately the allocation of financial resources and the determination of levels of service is a matter for Council.

As Council is aware, there are many challenges to address in the management of our road infrastructure and in response to these demands it is essential that Council identify and maximise savings to the extent possible.

As two coat bitumen seals provide an acceptable level of service in the community and having regard to the available budget saving and maintaining a consistent approach in the delivery of Council services, on balance, the bitumen seal is preferred and therefore option one forms the recommendation to this report.

The second recommendation then endorses the current pavement strategy.

In respect to the second recommendation, another option that Council could consider is to receive a report, or a draft policy, that identified certain main feeder roads that possibly could be maintained to a higher standard through the use of AC.

The Micromex report, earlier in this agenda, highlights that roads are typically the service of highest importance to the community (ranked first in 2014 and 2008 and second in 2012). Therefore there may be some merit in maintaining roads that are regularly used by residents at an AC level, as this could potentially result in higher satisfaction levels with the community and improve the overall perception regarding the condition of Council's roads.

Road examples that could be maintained at the higher standard include:

- River Street – from Teven Interchange to the Town Centre – as the main southern route into Ballina
- Tamarind Drive – from the Tamarind Drive interchange to Cherry Street – again a main access to Ballina
- Angels Beach Drive – from North Angels to Ballina Central – main feeder route from the north into Ballina

These are examples only with the point being that roads that are regularly used, could provide higher satisfaction levels to the community, if maintained to a higher level, which in turn helps to install increased confidence in the Council and also local pride in the roads.

The Micromex report performance gap for roads decreased from 2.01 to 1.55 between the 2012 and 2014 surveys, which is an excellent result, particularly for a regional / rural council. In recent times Council has undertaken AC works on River Street and Tamarind Drive as part of the highway transfer, with these works funded by a one-off transfer of funding from the RMS. Angels Beach Drive has also had a recent AC overlay. These works may have contributed to this overall perception of improved roads or possibly it has just been the works that have been on-going throughout the Shire, as Council has increased its road funding significantly in recent years, largely due a program of special rate variation increases.

This is a more theoretical commentary about importance and perception and whether or not Council wishes to expend more monies on certain roads is ultimately a service level question for Councillors, as more monies expended on any one road, results in less funds for other road works. If Council wishes to further investigate this discussion then recommendation two could be amended to the following:

That Council receive a further report on policy options to maintain identified feeder roads to a higher standard (i.e. AC) in recognition that this may result in higher satisfaction levels to the community regarding the condition of the road network.

RECOMMENDATIONS

1. That Council endorses a two coat seal as the road wearing surface for the The Ridgeway rehabilitation project on the basis that this change will

provide significant financial savings to Council, is consistent with Council's current practice, and it is a surface type that is considered by the community at large as a surface that provides a reasonable level of service.

2. That Council endorses, for all future asset management considerations for projects of this type and for the reseal program, that staff follow the practice in point one above which prefers a bitumen seal in lieu of an asphaltic concrete (AC) seal, except for the exception cases as per the examples discussed in the above report.

Attachment(s)

1. Road Noise Levels Study

Ambience Audio Services
Acoustic Measurement and Analysis

15 Tamarind Close
Richmond Hill NSW 2480

Phone: 02 6625 1733
Fax: 02 6625 1788
Mobile: 0429 405 070

Ballina Shire Council
Road Surface Noise Levels Study

Prepared by
Garry Hall
11/11/13

11.7 Pavement of The Ridgeway, Cumbalum.DOC

1 INTRODUCTION

Ambience Audio have been engaged by Ballina Shire Council to conduct a noise survey of the noise levels from selected different types of road surfaces. The aim of the survey is to compare the noise levels from different pavements and give a quantifiable and subjective comparison.

Measurements were conducted in general accordance with procedures laid down in Australian Standard AS 2702 -1984: '*Acoustics – Methods for the Measurement of Road Traffic Noise Levels.*'

Data from the sound level meters were downloaded into Bruel & Kjaer Type 7815 Environmental Noise Software and Excel spreadsheet for analysis. A manual count (where practical) of the types of vehicles and estimated speed of the vehicles passing the sound level meters during the monitoring periods was noted. The temperature, humidity, wind direction and speed and a description of the surrounding area were also noted.

The results were evaluated for the subjective change in level were there were two different road surfaces.

2 SITES AND TEST CONDITIONS

The selected sites were:

1. Tanamera Drive Alstonville (east of Green Street) – assess traffic noise levels for the 10/7mm sprayed bitumen surface and adjoining asphalt surface
2. Cherry Street Ballina (north of Swift Street) - assess traffic noise levels for the 14/7mm sprayed bitumen surface and adjoining concrete surface
3. Byron Bay Road Lennox Head (80 km/hr zone north of Ballina Street) - assess traffic noise levels for the 10/7mm sprayed bitumen surface and adjoining asphalt surface
4. Angels Beach Drive Ballina (80 km/hr zone north of Bangalow Road) - assess traffic noise levels for the asphalt surface
5. The Coast Road Flat Rock (80 km/hr zone north of Condon Drive) – assess traffic noise levels for the 10mm sprayed bitumen surface
6. Martin Street Ballina (between Tamar St and Crane St) - assess traffic noise levels for the 14/7mm sprayed bitumen surface.

2.1 Tanamera Drive Alstonville

Date	07/11/13	Road Surface 1	10/7 sprayed bitumen
Start Time	2:47pm	Road Surface 2	asphalt
End Time	3:42pm	Centre to SLM (m)	7
Temp (°C)	31	**Description of surrounding area**	
Humidity (%RH)	40	Suburban residential , local traffic serving residential estate, approx 10m setback from kerb	
Wind Direction	North		
Wind Speed (m/s)	2		
Posted Speed Limit (km/h)	50		
Estimated Vehicle Speed (km/h)	40 - 55		

Notes

Corner intersection near one of the monitoring locations.
Engine noise due to acceleration and braking excluded from results.
Single individual pass-bys best data for comparison.
Measurement period shorter due to increase in traffic flows which gave uncorrelated data.

Ballina Shire Council - Road Surface Noise Levels Study
Ambience Audio Services Page 3 of 16 Prepared 12/11/13

2.2 Cherry Street Ballina (north of Swift Street)

Date	01/10/13	Road Surface 1	Concrete
Start Time	10:38am	Road Surface 2	10/7 sprayed bitumen
End Time	11:53am	Centre to SLM (m)	11
Temp (°C)	30	**Description of surrounding area**	
Humidity (%RH)	60	Urban/ commercial/ residential / schools , main road, reflective surface on opposite side of road	
Wind Direction	SW		
Wind Speed (m/s)	1		
Posted Speed Limit (km/h)	50		
Estimated Vehicle Speed (km/h)	35 - 50		

Notes

Main road – generally traffic speed at lower than posted speed limit of 50km/h.
Mainly tyre noise. Engine noise on heavy vehicles.
Good traffic flows to give sufficient data.

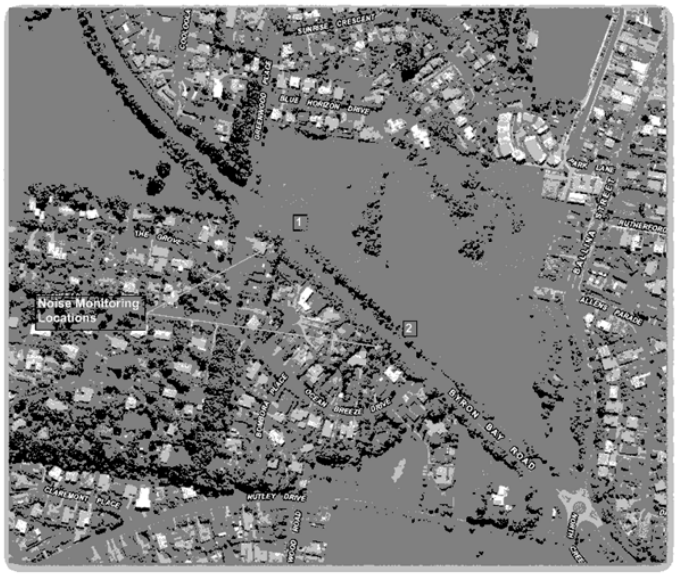
Ballina Shire Council - Road Surface Noise Levels Study
Ambience Audio Services Page 4 of 16 Prepared 12/11/13

2.3 Byron Bay Road Lennox Head (80 km/hr zone north of Ballina Street)

Date	26/09/13	Road Surface 1	asphalt
Start Time	3:00PM	Road Surface 2	10/7 sprayed bitumen
End Time	4:10PM	Centre to SLM (m)	7
Temp (°C)	26	**Description of surrounding area**	
Humidity (%RH)	75	Suburban residential , farm land, main road servicing Ballina - Lennox Head – Byron coast, approx 20m setback from kerb, embankment giving slight noise reduction to residential estate on SW of measuring location.	
Wind Direction	NE		
Wind Speed (m/s)	1.5 – 3.5		
Posted Speed Limit (km/h)	80		
Estimated Vehicle Speed (km/h)	75 - 85		

Notes

Corner intersection near one of the monitoring locations.
Engine noise due to acceleration and braking excluded from results.
Measurement comparison only valid for 12 minutes (2nd noise logger stopped)



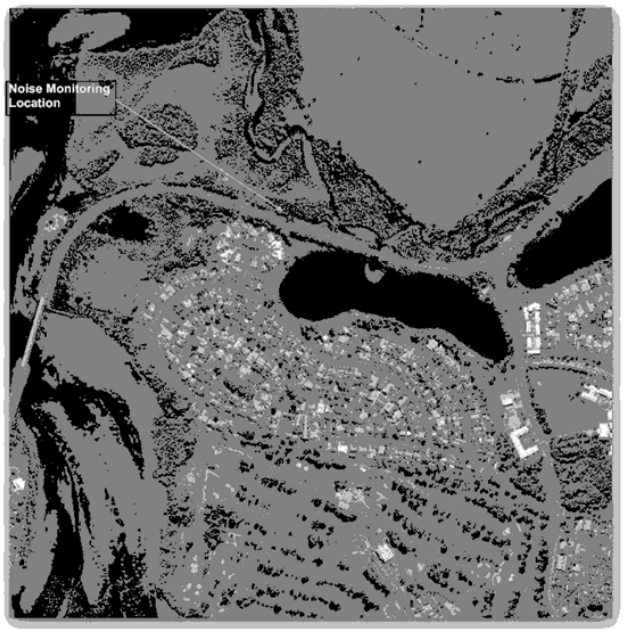
Ballina Shire Council - Road Surface Noise Levels Study
Ambience Audio Services Page 5 of 16 Prepared 12/11/13

2.4 Angels Beach Drive Ballina (80 km/hr zone north of Bangalow Road)

Date	30/10/13	Road Surface 1	Asphalt
Start Time	2:34pm	Road Surface 2	na
End Time	4:34pm	Centre to SLM (m)	7
Temp (°C)	29 - 27	**Description of surrounding area**	
Humidity (%RH)	46 - 52	Suburban residential generally 200m, small estate approx 30m from edge of carriageway, wetlands, farming, main road servicing Ballina - Lennox Head – Byron coast and western part of east Ballina.	
Wind Direction	North		
Wind Speed (m/s)	2 - 3		
Posted Speed Limit (km/h)	80		
Estimated Vehicle Speed (km/h)	80		

Notes

Good traffic flows to give sufficient data.
Tyre noise dominant on modern cars.



2.5 The Coast Road Flat Rock (80 km/hr zone north of Condon Drive)

Date	26/09/13	Road Surface 1	14/7 sprayed bitumen
Start Time	2:47pm	Road Surface 2	14/7 sprayed bitumen
End Time	3:42pm	Centre to SLM (m)	7
Temp (°C)		**Description of surrounding area**	
Humidity (%RH)		Farmland , beach reserve, main road Ballina - Lennox Head – Byron.	
Wind Direction			
Wind Speed (m/s)			
Posted Speed Limit (km/h)	50		
Estimated Vehicle Speed (km/h)	40 - 55		

Date	01/11/13	Road Surface 3	14/7 sprayed bitumen
Start Time	12:07pm	Centre to SLM (m)	7
End Time	1:37pm		
Temp (°C)	26		
Humidity (%RH)	48		
Wind Direction	na		
Wind Speed (m/s)	<0.5		

Notes

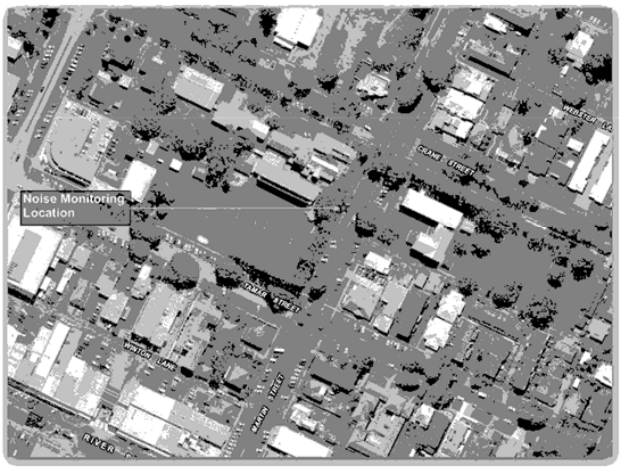
3 locations over 2 days

2.6 Martin Street (Between Tamar Street and Crane Street)

Date	01/10/13	Road Surface 1	10/7 sprayed bitumen
Start Time	12:57pm	Road Surface 2	na
End Time	2:27pm	Centre to SLM (m)	12
Temp (°C)	31	**Description of surrounding area**	
Humidity (%RH)	40	Urban/ commercial/ residential / schools , local traffic	
Wind Direction	SW		
Wind Speed (m/s)	1 - 2		
Posted Speed Limit (km/h)	50		
Estimated Vehicle Speed (km/h)	30 - 45		

Notes

Generally traffic slower than posted speed limit of 50km/h - raised pedestrian crosswalk at Crane Street intersection.
Good traffic flows to give sufficient data.
School holidays.



3 RESULTS

3.1 Tanamera Drive Alstonville

Road Surface	LAeq dB (A)	Comment
Asphalt	63.5	Difference in noise level – quite noticeable Residents near road surface change would notice sudden increase of 5 decibels as vehicles travelled from north to south.
10/7 Sprayed Bitumen	68.8	
Difference (decibels)	5.2	

3.2 Cherry Street Ballina (north of Swift Street)

Road Surface	LAeq dB (A)	Comment
Concrete	61.4	Difference in noise level – noticeable
14/7 Sprayed Bitumen	64.7	
Difference (decibels)	3.3	

Individual 15 min Periods	1	2	3	4	5	Average (Extraneous Noises Deleted)
Concrete	61.0	62.4	61.4	62.4	61.2	61.4
14/7 Sprayed Bitumen	64.6	65.2	64.8	65.6	65.1	64.7
Difference (decibels)	3.6	2.8	3.4	3.2	3.9	3.3
Cars	413	391	494	598	698	
Heavy Vehicles	9	10	11	17	19	
% Heavy Vehicles	2	3	2	3	3	

3.3 Byron Bay Road Lennox Head (80 km/hr zone north of Ballina Street)

Road Surface	LAeq dB (A)	Comment
Asphalt	65.4	Difference in noise level – quite noticeable Residents near road surface change would notice sudden increase of 6.5 decibels as vehicles travelled from south to north.
10/7 Sprayed Bitumen	71.9	
Difference (decibels)	6.5	

3.4 Angels Beach Drive Ballina (80 km/hr zone north of Bangalow Road)

Road Surface	LAeq dB (A)	Vehicles per Hour	Comment
Asphalt	73.8	1243	Tyre noise more noticeable in modern cars (less engine noise). Mainly engine noise for trucks and buses

3.5 The Coast Road Flat Rock (80 km/hr zone north of Condon Drive)

Road Surface	LAeq dB (A)	Vehicles per Hour	Comment
14/7 L1 26/09	74.6	852	Tyre noise more noticeable in modern cars (less engine noise). Mainly engine noise for trucks and buses
14/7 L2 26/09	74.2	852	
14/7 L3 01/11	75.5	861	

3.5.1 Comparison of Road Surface Noise Levels Angels Beach Drive and The Coast Road

Individual 15 min Periods		1	2	3	4	5	6	7	8
Angels Beach Drive Ballina	LAeq,15min	**73.7**	**72.9**	**73.5**	**74.1**	**74.0**	**73.8**	**74.1**	**74.2**
750m north of North Creek Bridge	Cars	283	256	262	316	365	316	313	325
80Km/hr Zone	Heavy Vehicles	11	6	10	9	6	3	1	3
	% Heavy	3.7	2.3	3.7	2.8	1.6	0.9	0.3	0.9
	Total	294	262	272	325	371	319	314	328

The Coast Road Flat Rock	LAeq,15min	**75.9**	**75.0**	**76.1**	**74.7**	**75.6**	**75.5**
650m north of Condon Drive	Cars	231	196	236	192	227	183
80Km/hr Zone	Heavy Vehicle	6	4	5	2	6	3
	% Heavy	2.5	2.0	2.1	1.0	2.6	1.6
	Total	237	200	241	194	233	186

Coast Road - Same Traffic Volume as Angels Beach Rd	LAeq,15min	**76.8**	**76.2**	**76.6**	**76.9**	**77.7**	**77.8**

Difference (decibels)		3.0	3.3	3.0	2.9	3.6	4.1
Logarithmic Average (decibels)	**3.3**						

Notes

Coast Road traffic volume (01/11/13) was proportionally adjusted to allow for direct comparison of the same traffic flows on each surface. The Coast Road surface is generally 3 – 4 decibels higher than the Angels Beach Drive surface. The increase in noise level is considered to be noticeable.

3.5 Martin Street (Between Tamar Street and Crane Street)

Road Surface	LAeq dB (A)	Vehicles per Hour	Comment
10/7 Sprayed Bitumen	58.0	903	Mainly tyre noise on modern cars. Some engine noise on older cars.

Individual 15 min Periods	1	2	3	4	5	6
LAeq,15min	57.4	58.3	57.8	58.7	58.2	57.3
Cars	165	147	218	248	274	295
Heavy Vehicles	0	0	2	2	2	2
Total	165	147	220	250	276	297
% Heavy	0	0.0	0.9	0.8	0.7	0.7

4 TEST PROCEDURE

4.1 Instrumentation

Table 4.1 Instrumentation for Noise Monitoring

Instrument	Serial #	Calibration Date
Brüel and Kjær 2250L Sound Level Meter	2602785	November 2011
Brüel and Kjær 2250 Sound Level Meter	2449940	April 2012
Brüel and Kjær Acoustical Calibrator model 4231	2263303	June 2013

The sound level meters used during the noise survey conform to Australian Standard 1259 "Acoustics - Sound Level Meters", (1990) as type 1 precision sound level meters and have an accuracy suitable for both field and laboratory use.

The meters' calibrations were checked before and after the measurement periods with a Brüel and Kjær acoustical calibrator model 4231. No significant system drift occurred over the measurement periods.

The sound level meters and calibrator have been checked, adjusted and aligned to conform to the Brüel and Kjær factory specifications and issued with conformance certificates. The internal test equipment used is traceable to the National Measurement Laboratory at CSIRO, Lindfield, NSW.

4.2 Measurement Procedures

Measurements were made in accordance with the procedures laid down in:

1. Australian Standard AS 2702 -1984: '*Acoustics – Methods for the Measurement of Road Traffic Noise Levels.*'

2. Australian Standard AS 1055 – 1997 "*Acoustics – Description and Measurement of Environmental noise.*

Measurements at sites 1, 2, 3 and 6 were conducted with two logging sound level meters to record simultaneously the noise from passing vehicles on the two different road surfaces. Measurements at sites 4 and 5 were conducted with 1 sound level meter. Markers were used on the sound level meter during some of the noise monitoring to identify other acoustical events for later calculations and evaluations. The surface description was supplied by Ballina Shire Council.

The sound level meters were set at a height of 1.5 metres and located near the kerb. The distance from the kerb was determined by several factors:

- Width of carriageway
- Setback to buildings
- Nearby reflective surfaces
- Kerbside obstructions to sound level meter (parked vehicles)

Data that was affected by extraneous noises were deleted from calculations.

5 PERCEPTION OF CHANGES IN SOUND LEVELS

While there are variations in individual perception of the strength of a sound, studies have shown that to a good approximation the following subjective changes in sound pressure level.

Subjective Effect of Changes in Sound Pressure Level

Change in Sound level (decibels)	Change in Power		Change in Apparent Loudness
	Decrease	Increase	
3	1/2	2	Just perceptible
5	1/3	3	Clearly perceptible
10	1/10	10	Half or twice as loud
20	1/100	100	Much quieter or louder

Reproduced from: Engineering Noise Control Theory and Practise – Third Edition. David A Bies and Colin H HansenT

The sound is perceived twice as loud if the sound level increases by 10 dB. Similarly, a 20 dB increase in the sound level is perceived as four times as loud by the normal human ear.

Garry Hall

Acoustic Consultant
Ambience Audio Services

APPENDIX A

Definitions of Terms

Sound pressure level (L_p): A measurable quantity of the size or amplitude of the pressure fluctuations (sound waves) above and below normal atmospheric pressure compared to a reference pressure. Sound pressure levels are measured in decibels whereas sound pressure is measured in pascals (N/m^2).

Decibels (dB): a ratio of energy flows. When used for sound measurement, it is the ratio between a measured quantity of sound pressure and an agreed reference sound pressure. The dB scale is logarithmic and uses the threshold of hearing of 20 μPa (micro pascals) as the reference pressure. This reference level is defined as 0 dB.

Frequency (Hz): The number of pressure variations per second (cycles per second) is called the **frequency** of sound and is measured in **Hertz (Hz)**. The rumble of distant thunder has a low frequency, while a whistle has a high frequency. The normal range of hearing for a healthy young person extends from approximately 20Hz up to 20 000 Hz (20 kHz) while the range from the lowest to highest note on a piano is approximately 27.5 Hz to 4.2 kHz.

Spectral characteristics: The frequency content of noise.

"A" frequency weighting: The method of frequency weighting the electrical signal within a noise-measuring instrument to give a very approximate simulate to the human perception of loudness. The symbols for the noise parameters often include the letter "A" (e.g., L_{Aeq}, dBA) to indicate that frequency weighting has been included in the measurement.

Fast, Slow and Impulse time weightings: Standardised root-mean-square (rms) averaging times to help define fluctuating noise levels. Impulsive noises have high peak levels with a very short duration (e.g., gun shot), or a sequence of such peaks. The 'Slow' time weighting averages the fluctuations over a one second time base whilst the 'Fast' time weighting averages the fluctuations over a one-eighth of a second time base. Environmental assessment standards usually specify the time weighting (**F**, **S**, or **I**) to be used.

L_{Aeq}: The A-weighted equivalent continuous noise level. A widely used noise descriptor which provides an average of the energy of a constant level of noise which is the same as the varying noise signal being measured. The time in minutes, which the measurement was sampled, is indicated with a subscripted number e.g. $L_{Aeq,\ 15\ minute}$ is a 15-minute sample.

L_{AN}: The A-weighted sound pressure level that is exceeded for N per cent of the time over which a given sound is measured. e.g. **L_{A90}** is the A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured.

L_{A90} is commonly used to describe the **background noise level** for community noise assessments.

Ambient noise: The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Extraneous noise: Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by events such as concerts or sporting events. Normal daily traffic is not to be considered extraneous.

Background noise: The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor, fast time weighting.

References:

Measuring Sound Brüel and Kjær Sound & Vibration Measurements A/S September 1984

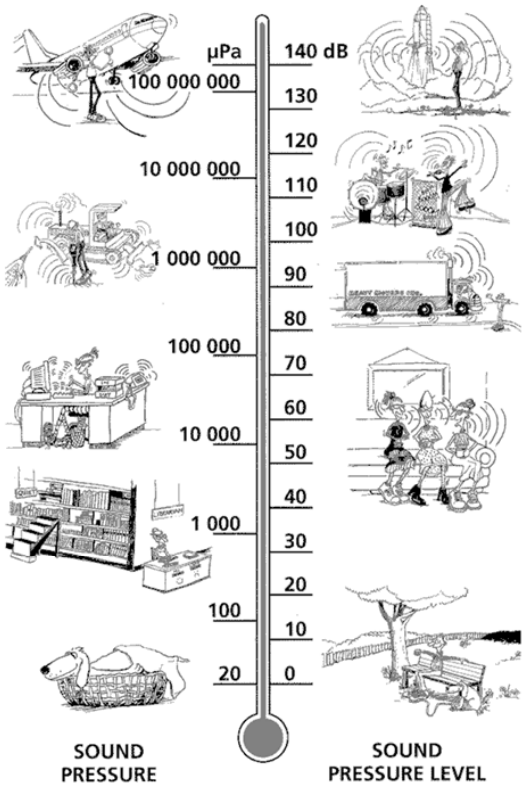
Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

New South Wales Industrial Noise Policy NSW Environment Protection Authority January 2000

Australian Standard AS 3671 – 1989 *Acoustics – Road traffic noise intrusion – Building siting and construction.*

APPENDIX B

Comparison of Sound Pressure Levels



Our hearing covers a wide range of sound pressures – a ratio of over a million to one. The dB scale makes the numbers manageable.

Reproduced from
Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001