Life-Cycle Pavement Cost Analysis (LCPCA) Examples
VRAM - UBCO

Abbreviations: M = Route Mainline; IS = Route Inside Shoulder; OS = Route Outside Shoulder; R = Ramps

Roadway Data:

Mainline Route:

Length = 5,817 ft

Width = (4) 12-ft Lanes + (2) 4-ft Inside Shoulders + (2) 10-ft Outside Shoulders = 48 ft + 8 ft + 20ft = 76 ft

Area ((2) 26-ft Mainline) = (5,817 ft) x (52 ft) x (1/9 yd^2/ft^2) = 33,610 yd^2

Area ((2) 4-ft Inside Shoulders) = (5,817 ft) x (2) x (4 ft) x (1/9 yd^2/ft^2) = 5,170 yd^2

Area ((2) 8-ft Outside Shoulders) = (5,817 ft) x (2) x (8 ft) x (1/9 yd^2/ft^2) = 10,341 yd^2

Ramps (All combined):

Length = 7,762 ft

Width = 16-ft Lane + 4-ft Inside Shoulder + 8-ft Outside Shoulder = 16 ft + 4 ft + 8 ft = 28 ft

Area (Mainline, Inside Shoulder, and Outside Shoulder) = (7,762 ft) x (28 ft) x (1/9 yd^2/ft^2) = 24,148 yd^2

HMA Pavement Treatment Cost

Route Mainline and Shoulders: 13 inches of HMA Pavement
Ramps: 10 inches of HMA Pavement

Pay Items:

Route (Mainline & Inside Shoulder)

165 lb/sys QC/QA - HMA, 4, 76, Surface, 9.5 mm
275 lb/sys QC/QA - HMA, 4, 76, Intermediate, 19.0 mm
990 lb/sys QC/QA - HMA, 4, 64, Base, 25.0 mm
300 lb/sys QC/QA - HMA, 4, 76, Intermediate, OG, 19.0 mm (Drainage Layer)
6 inches of Compacted Aggregate, No. 53 (Separation Layer)
Geotextile for Pavement, Type 2A
Subgrade Treatment Type IBC (14" Chemical Modification using Cement)

Route (Outside Shoulder)

165 lb/sys QC/QA - HMA, 2, 64, Surface, 9.5 mm
275 lb/sys QC/QA - HMA, 2, 64, Intermediate, 19.0 mm
990 lb/sys QC/QA - HMA, 2, 64, Base, 25.0 mm
300 lb/sys QC/QA - HMA, 4, 76, Intermediate, OG, 19.0 mm (Drainage Layer)
6 inches of Compacted Aggregate, No. 53 (Separation Layer)
Geotextile for Pavement, Type 2A
Subgrade Treatment Type IBC (14" Chemical Soil Modification using Cement)

Ramps (Mainline, Inside and Outside Shoulders)

165 lb/sys QC/QA - HMA, 3, 70, Surface, 9.5 mm
275 lb/sys QC/QA - HMA, 3, 70, Intermediate, 19.0 mm
660 lb/sys QC/QA - HMA, 3, 64, Base, 25.0 mm
250 lb/sys QC/QA - HMA, 4, 76, Intermediate, OG, 19.0 mm (Drainage Layer)
4 inches of Compacted Aggregate, No. 53 (Separation Layer)
Geotextile for Pavement, Type 2A
Subgrade Treatment Type IBC (14" Chemical Soil Modification using Cement)

Initial Construction Cost:

Surface (Route…M & IS)	(38,780 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($82.72/t)	=	$264,650.23
Surface (Route…OS)	(10,341 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($70.01/t)	=	$59,727.81
Surface (Ramps)	(24,148 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($84.86/t)	=	$169,058.94
VRAM (M & Ramps)*	(38,792 lft) x ($2.29/lft)	=	$88,833.68
Liquid Asphalt Sealant	(38,792 lft) x ($0.14/lft)	=	$5,430.88
Intermediate (Route…M & IS)	(38,780 yd^2) x (275 lb/yd^2) x (1/2000 t/lb) x ($78.51/t)	=	$418,634.95
Intermediate (Route…OS)	(10,341 yd^2) x (275 lb/yd^2) x (1/2000 t/lb) x ($67.79/t)	=	$96,389.75
Intermediate (Ramps)	(24,148 yd^2) x (275 lb/yd^2) x (1/2000 t/lb) x ($74.58/t)	=	$247,631.70
Joint Adhesive, Intermediate*	(38,792 lft) x ($0.50/lft)	=	$19,396.00
Base (Route…M & IS)	(38,780 yd^2) x (990 lb/yd^2) x (1/2000 t/lb) x ($68.50/t)	=	$1,314,932.85
Base (Route…OS)	(10,341 yd^2) x (990 lb/yd^2) x (1/2000 t/lb) x ($66.15/t)	=	$338,608.29
Base (Ramps)	(24,148 yd^2) x (660 lb/yd^2) x (1/2000 t/lb) x ($72.03/t)	=	$573,995.55
Intermediate OG (Route)	(49,121 yd^2) x (300 lb/yd^2) x (1/2000 t/lb) x ($64.01/t)	=	$471,635.28
Intermediate OG (Ramps)	(24,148 yd^2) x (250 lb/ yd^2) x (1/2000 t/lb) x ($64.01/t)	=	$193,214.19
Compacted Aggregate, No.53 (Route)	(6/12 ft/in) x (76 lft) x (5,817 ft) x (1/27 yd^3/ft^3) x ($50.44/ yd^3	=	$412,946.68
Compacted Aggregate, No.53 (Ramps)	(4/12 ft/in) x (28 lft) x (7,762 ft) x (1/27 yd^3/ft^3) x ($50.44/ ft^3)	=	$135,338.62
Tack (Route….M, IS & OS)	(49,121 yd^2) x (4) x ($0.31/$yd^2$)	=	$60,910.04
Tack (Ramps)	(24,148 yd^2) x (4) x ($0.31/$yd^2$)	=	$29,943.52
Geotextile for Pavement, Type 2A (Route)	(49,121 yd^2) x ($1.11/$yd^2$)	=	$54,524.31
Geotextile for Pavement, Type 2A (Ramps)	(24,148 yd^2) x ($1.11/$yd^2$)	=	$26,804.28
Subgrade Treatment, Type IBC (Route)	(49,121 yd^2) x ($8.97/$yd^2$)	=	$440,615.37
Subgrade Treatment, Type IBC (Ramps)	(24,148 yd^2) x ($8.97/$yd^2$)	=	$216,607.56
Common Excavation (Route)	(49,121 yd^2) x (12 in) x (1/36 yd/in) x ($14.72/ yd^3)	=	$241,020.37
Common Excavation (Ramps)	(24,148 yd^2) x (12 in) x (1/36 yd/in) x ($14.72/ yd^3)	=	$118,486.19
Aggregate for Underdrain (Route)	(5,817 lft) x (2) x (2) x (14 in) x (18 in) x (1/144 ft^2/in^2) x (1/27 yd^3/ft^3) x ($52.59/$yd^3$)	=	$79,311.56
Aggregate for Underdrain (Ramps)	(7,762 lft) x (2) x (14 in) x (18 in) x (1/144 ft^2/in^2) x (1/27 yd^3/ft^3) x ($52.59/$yd^3$)	=	$52,915.28
Geotextile for Underdrain (Route)	(5,817 lft) x (2) x (2) x (74 in x 1/12 ft/in) x (1/9 yd^2/ft^2) x ($3.77/$yd^2$)	=	$60,104.69
Geotextile for Underdrain (Ramps)	(7,762 lft) x (2) x (74 in x 1/12 ft/in) x (1/9 yd^2/ft^2) x (3.77yd^2$)	=	$40,100.79
Outlet protector (Route)	(60 each) x ($879.07/each)	=	$52,744.20
Outlet protector (Ramps)	(40 each) x ($879.07/each)	=	$35,162.80

Pipe, Circular, Type 4, 6 in. (Route)	(5,817 lft) x (2) x (2) x ($5.98/lft)	=	$139,142.64
Pipe, Circular, Type 4, 6 in. (Ramps)	(7,762 lft) x (2) x ($5.98/lft)	=	$92,833.52
CA, Wedge, No.53 (Route)	(2) x (2) x (5.65 ft^2) x (5,817 lft) x (1/27 yd^3/ft^3) x (1.69 t/yd^3) x ($27.76/t)	=	$228,428.30
CA, Wedge, No.53 (Ramps)	(2) x (5.65 ft^2) x (7,762 lft) x (1/27 yd^3/ft^3) x (1.69 t/yd^3) x ($27.76/t)	=	$152,403.34
30% Contingency of Pavement Items		=	$2,079,745.27
Total Cost			$9,012,229.39

*Assume 4 mainline joints and 2 ramp joints.

Maintenance Costs:

Crack Seal Cost:

Age 3			
Mainline Route	(5,817 ft) x (1/5,280 mile/ft) x (100 ft/mile) x 4 ln x ($1.0/lft)	=	$440.68
Ramps	(7,762 ft) x (1/5,280 mile/ft) x (100 ft/mile) x 1 ln x ($1.0/lft)	=	$147.01
Traffic Maintenance	5% of Contract Cost	=	$29.38
Total Cost			$617.07
Age 6			
Mainline Route	(5,817 ft) x (1/5,280 mile/ft) x (200 ft/mile) x 4 ln x ($1.0/lft)	=	$881.36
Ramps	(7,762 ft) x (1/5,280 mile/ft) x (200 ft/mile) x 1 ln x ($1.0/lft)	=	$294.02
Traffic Maintenance =	5% of Contract Cost	=	$58.77
Total Cost			$1,234.15
Age 9			
Mainline Route	(5,817 ft) x (1/5,280 mile/ft) x (200 ft/mile) x 4 ln x ($1.0/lft)	=	$881.36
Ramps	(7,762 ft) x (1/5,280 mile/ft) x (200 ft/mile) x 1 ln x ($1.0/lft)	=	$294.02
Traffic Maintenance	5% of Contract Cost	=	$58.77
Total Cost			$1,234.15
Age 12 & Beyond			
Mainline Route	(5,817 lft) x (1/5,280 mile/ft) x (200 ft/mile) x 4 ln x ($1.0/lft)	=	$881.36
Ramps	(7,762 lft) x (1/5,280 mile/ft) x (200 ft/mile) x 1 ln x ($1.0/lft)	=	$294.02
Traffic Maintenance	5% of Contract Cost	=	$58.77
Total Cost			$1,234.15

Rehabilitation Costs:

1.5" Mill and 1.5" HMA Overlay Cost (PM at Age 15):

Milling Cost (Route…M, IS, & OS)	(49,121 yd^2) x ($1.31/$yd^2$)	=	$64,348.51
Milling Cost (Ramps...M, IS, & OS)	(24,148 yd^2) x ($1.31/$yd^2$)	=	$31,633.88
Tack (Route..M, IS, & OS)	(49,121 yd^2) x ($0.31/$yd^2$)	=	$15,277.51
Tack (Ramps..M, IS, & OS)	(24,148 yd^2) x ($0.31/$yd^2$)	=	$7,485.88
Partial Depth Patch on TL (Route)	(33,610 yd2) x (440 lb/yd2) x (1/200 t/lb) x (1%) x ($125.77/t)	=	$9,299.69
Partial Depth Patch on TL (Ramps)	(13,800 yd2) x (440 lb/yd2) x (1/200 t/lb) x (1%) x ($131.47/t)	=	$3,991.43
Surface (Route…M & IS)	(38,780 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($82.72/t)	=	$264,650.23
Surface (Route…OS)	(10,341 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($70.01/t)	=	$59,727.81
Surface (Ramps)	(24,148 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($84.86/t)	=	$169,058.94
VRAM (M & Ramps)*	(38,792 lft) x ($2.29/lft)	=	$88,833.68
Liquid Asphalt Sealant	(38,792 lft) x ($0.14/lft)	=	$5,430.88
Traffic Maintenance	5% of Contract Cost	=	$35,984.42
Total Cost			$755,672.86

*Assume 4 mainline joints and 2 ramp joints.

1.5" Mill and 1.5" HMA Overlay Cost (PM at Age 27):

Milling Cost (Route…M, IS, & OS)	(49,121 yd^2) x ($1.31/$yd^2$)	=	$64,348.51
Milling Cost (Ramps..M, IS, & OS)	(24,148 yd^2) x ($1.31/$yd^2$)	=	$31,633.88
Tack (Route....M, IS, & OS)	(49,121 yd^2) x ($0.31/$yd^2$)	=	$15,277.51
Tack (Ramps..M, IS, & OS)	(24,148 yd^2) x ($0.31/$yd^2$)	=	$7,485.88
Partial Depth Patch on TL (Route)	(33,610 yd2) x (440 lb/yd2) x (1/200 t/lb) x (2%) x ($125.77/t)	=	$18,599.37
Partial Depth Patch on TL (Ramps)	(13,800 yd2) x (440 lb/yd2) x (1/200 t/lb) x (2%) x ($131.47/t)	=	$7,982.86
Surface (Route…M & IS)	(38,780 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($82.72/t)	=	$264,650.23
Surface (Route…OS)	(10,341 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($70.01/t)	=	$59,727.81
Surface (Ramps)	(24,148 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($84.86/t)	=	$169,058.94
VRAM (M & Ramps)*	(38,792 lft) x ($2.29/lft)	=	$88,833.68
Liquid Asphalt Sealant	(38,792 lft) x ($0.14/lft)	=	$5,430.88
Traffic Maintenance	5% of Contract Cost	=	$36,648.98
Total Cost			$769,628.53

*Assume 4 mainline joints and 2 ramp joints.

1.5” Mill and 4” HMA Overlay Cost (MSO at Age 38):

Milling Cost (Route…M, IS, & OS)	(49,121 yd^2) x ($1.31/$yd^2$)	=	$64,348.51
Milling Cost (Ramps...M, IS, & OS)	(24,148 yd^2) x ($1.31/$yd^2$)	=	$31,633.88
Tack (Route….M, IS, & OS)	(49,121 yd^2) x (2) x ($0.31/$yd^2$)	=	$30,455.02
Tack (Ramps...M, IS, & OS)	(24,148 yd^2) x (2) x ($0.31/$yd^2$)	=	$14,971.76
Partial Depth Patch on TL (Route)	(33,610 yd^2) x (440 lb/yd^2) x (1/200 t/lb) x (3%) x ($125.77/t)	=	$27,899.06
Partial Depth Patch on TL (Ramps)	(13,800 yd^2) x (440 lb/yd^2) x (1/200 t/lb) x (3%) x ($131.47/t)	=	$11,974.29
Full Depth Patch on TL (Route)	(33,610 yd^2) x (1,760 lb/yd^2) x (1/200 t/lb) x (1%) x ($137.09/t)	=	$40,546.84
Full Depth Patch on TL (Ramps)	(13,800 yd^2) x (1,375 lb/yd^2) x (1/200 t/lb) x (1%) x ($142.77/t)	=	$13,545.30
Patch SGT, Type ID (Both)	(33,610 + 13,800 yd^2) x (1%) x ($29.38/$yd^2$)	=	$13,929.06
Surface (Route…M & IS)	(38,780 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($82.72/t)	=	$264,650.23
Surface (Route…OS)	(10,341 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($70.01/t)	=	$59,727.81
Surface (Ramps)	(24,148 yd^2) x (165 lb/yd^2) x (1/2000 t/lb) x ($84.86/t)	=	$169,058.94
VRAM (M & Ramps*	(38,792 lft) x ($2.29/lft)	=	$88,833.68
Liquid Asphalt Sealant	(38,792 lft) x ($0.14/lft)	=	$5,430.88
Intermediate (Route…M & IS)	(38,780 yd^2) x (275 lb/yd^2) x (1/2000 t/lb) x ($78.51/t)	=	$418,634.95
Intermediate (Route…OS)	(10,341 yd^2) x (275 lb/yd^2) x (1/2000 t/lb) x ($67.79/t)	=	$96,389.75
Intermediate (Ramps)	(24,148 yd^2) x (275 lb/yd^2) x (1/2000 t/lb) x ($74.58/t)	=	$247,631.70
Joint Adhesive, Intermediate*	(38,792 lft) x ($0.50/lft)	=	$19,396.00
Var Depth O Wedge (Route)	(2) x (2) x (0.25 ft^2) x (5,817 lft) x (1/27 yd^3/ft^3) x (1.69 t/yd^3) x ($27.76/t)	=	$10,107.45
Var Depth O Wedge (Ramps)	(2) x (0.25 ft^2) x (7,762 lft) x (1/27 yd^3/ft^3) x (1.69 t/yd^3) x ($27.76/t)	=	$6,743.51
Traffic Maintenance	5% of Contract Cost	=	$81,795.43
Total Cost			$1,717,704.04

*Assume 4 mainline joints and 2 ramp joints

PCCP Treatment Cost

Mainline and Shoulders: 10.5 inches of PCCP
Ramps: 9 inches of PCCP

Pay Items:

Mainline and Shoulders:
10.5 in. QC/QA PCCP with 14-ft wide slab for outside lane with D-1 Contraction Joints @ 15 ft spacing on 3" HMA OG on 6 inches of Compacted Aggregate, No. 53, on Geotextile for Pavement, Type 2A, on Subgrade Treatment Type IBC (14" Chemical Modification using Cement)

Ramps (Mainline, Inside Shoulder, and Outside Shoulder):
9 in. QC/QA PCCP with D-1 Contraction Joints @ 16 ft spacing on Subbase for PCCP, on Subgrade Treatment Type IBC (14" Chemical Modification using Cement)

Initial Construction Cost:

Route…M, IS, & OS (10.5" PCCP)	(49,121 yd^2) x ($45/$yd^2$)	=	$2,210,445.00
Ramps (9" PCCP)	(24,148 yd^2) x ($40/$yd^2$)	=	$965,920.00
Intermediate OG (Route)	(49,121 yd^2) x (300 lb/yd^2) x (1/2000 t/lb) x ($64.01/t)	=	$471,635.28
9″ Subbase for PCCP (Ramps)	(24,148 yd^2) x (9/12 in/ft) x (1/3 yd/ft) x ($56.72/$yd^3$)	=	$342,418.64
Geotextile for Pavement, Type 1B (Route)	(49,121 yd^2) x ($1.11/$yd^2$)	=	$54,524.31
Compacted Aggregate, No.53 (Route)	(6/12 ft/in) x (76 lft) x (5,817 ft) x (1/27 yd^3/ft^3) x ($50.44/ yd^3)	=	$412,946.68
D-1 Joints (Route)	(5,817 lft) x (1/15 J/lft) x (76 lft) x ($8.86/lft)	=	$261,129.01
D-1 Joints (Ramps)	(7,762 lft) x (1/16 J/lft) x (28 lft) x ($8.86/lft)	=	$120,349.81
Subgrade Treatment, Type IBC (Route)	(49,121 yd^2) x ($8.97/$yd^2$)	=	$440,615.37
Subgrade Treatment, Type IBC (Ramp)	(24,148 yd^2) x ($7.85/ yd^2)	=	$216,607.56
Common Excavation (Route)	(49,121 yd^2) x (12 in) x (1/36 yd/in) x ($14.72/ yd^3)	=	$241,020.37
Common Excavation (Ramps)	(24,148 yd^2) x (12 in) x (1/36 yd/in) x ($14.72/ yd^3)	=	$118,486.19
Aggregate for Underdrain (Route)	(5,817 lft) x (2) x (2) x (14 in) x (18 in) x (1/144 ft^2/in^2) x (1/27 yd^3/ft^3) x ($52.59/$yd^3$)	=	$79,311.56
Aggregate for Underdrain (Ramps)	(7,762 lft) x (2) x (14 in) x (18 in) x (1/144 ft^2/in^2) x (1/27 yd^3/ft^3) x ($52.59/$yd^3$)	=	$52,915.28
Geotextile for Underdrain (Route)	(5,817 lft) x (2) x (2) x (74 in x 1/12 ft/in) x (1/9 yd^2/ft^2) x ($3.77/$yd^2$)	=	$60,104.69
Geotextile for Underdrain (Ramps)	(7,762 lft) x (2) x (74 in x 1/12 ft/in) x (1/9 yd^2/ft^2) x ($3.77/$yd^2$)	=	$40,100.79
Outlet protector (Route)	(60 each) x ($879.07/each)	=	$52,744.20
Outlet protector (Ramps)	(40 each) x ($879.07/each)	=	$35,162.80
Pipe, Circular, Type 4, 6 in. (Route)	(5,817 lft) x (2) x (2) x ($5.98/lft)	=	$139,142.64

Pipe, Circular, Type 4, 6 in. (Ramps)	(7,762 lft) x (2) x ($5.98/lft)	=	$92,833.52
CA, Wedge, No.53 (Route)	(2) x (2) x (5.65 ft^2) x (5,817 lft) x (1/27 yd^3/ft^3) x (1.69 t/yd^3) x ($27.76/t)	=	$228,428.30
CA, Wedge, No.53 (Ramps)	(2) x (5.65 ft^2) x (7,762 lft) x (1/27 yd^3/ft^3) x (1.69 t/yd^3) x ($27.76/t)	=	$152,403.34
30% Contingency of Pavement Items		=	$2,036,773.60
Total Cost			$8,826,018.94

Preventive Maintenance – Concrete Pavement (Age 10):

Joint Seal Cost:

D-1 Joints (Route)	(5,817 lft) x (1/15 joints/ft) x (76 lft) x (10%) x ($1/lft)	=	$2,947.28
D-1 Joints (Ramps)	(7,762 lft) x (1/16 joints/ft) x (28 lft) x (10%) x ($1/lft)	=	$1,358.35
Longitudinal Joint (Route)	(5,817 lft) x (4) x (10%) x ($1/lft)	=	$2,326.80
Longitudinal Joint (Ramps)	(7,762 lft) x (10%) x ($1/lft)	=	$1,552.40
Traffic Maintenance	5% of Contract Cost	=	$409.24
Total Cost			$8,594.07

Concrete Pavement Restoration (Age 18):

D-1 Joints (Route)	(5,817 lft) x (1/15 joints/ft) x (76 lft) x (20%) x ($1/lft)	=	$5,894.56
D-1 Joints (Ramps)	(7,762 lft) x (1/16 joints/ft) x (28 lft) x (20%) x ($1/lft)	=	$2,716.70
Longitudinal Joint (Route)	(5,817 lft) x (4) x (20%) x ($1/lft)	=	$4,653.60
Longitudinal Joint (Ramps)	(7,762 lft) x (20%) x ($1/lft)	=	$3,104.80
Partial Depth D-1 Joint Repair (TL Route)	(5,817 lft) x (1/15 J/lft) x (52 lft) x (1 lft)) x (3%) x ($51.30/sft)	=	$31,034.86
Partial Depth D-1 Joint Repair (TL Ramps)	(7,762 lft) x (1/16 J/lft) x (16 lft) x (1 lft)) x (3%) x ($51.30/sft)	=	$11,945.72
Partial Depth Long. Joint Repair (Route)	(5,817 lft) x (4 Joints) x (1 lft)) x (3%) x ($51.30/sft)	=	$35,809.45
Partial Depth Long. Joint Repair (Ramps)	(7,762 lft) x (1 Joints) x (1 lft)) x (3%) x ($51.30/sft)	=	$11,945.72
Full depth PCCP Patch (TL Route)	(33,610 yd^2) x (1.5%) x ($247.90/sys)	=	$124,978.79
Full Depth PCCP Patch (TL Ramps)	(13,800 yd^2) x (1.5%) x ($247.90/sys)	=	$51,315.30
Full Depth Patch Subbase (Route)	(33,610 yd^2) x (9/36 in//yd) x (1.5%) x ($56.72/$yd^3$)	=	$7,148.85
Full Depth Patch Subbase (Ramps)	(13,800 yd^2) x (9/26 in/yd) x (1.5%) x ($56.72/$yd^3$)	=	$2,935.26
Patch SGT, Type ID (Both)	(33,610 + 13,800 yd^2) x (1.5%) x ($29.38/$yd^2$)	=	$20,893.59
Traffic Maintenance	5% of Contract Cost	=	$15,718.86
Total Cost			$330,096.04

Concrete Pavement Restoration (Age 30):

D-1 Joints (Route)	(5,817 lft) x (1/15 joints/ft) x (76 lft) x (30%) x ($1/lft)	=	$8,841.84
D-1 Joints (Ramps)	(7,762 lft) x (1/16 joints/ft) x (28 lft) x (30%) x ($1/lft)	=	$4,075.05
Longitudinal Joint (Route)	(5,817 lft) x (4) x (30%) x ($1/lft)	=	$6,980.40
Longitudinal Joint (Ramps)	(7,762 lft) x (30%) x ($1/lft)	=	$4,657.20
Partial Depth D-1 Joint Repair (TL Route)	(5,817 lft) x (1/15 J/lft) x (52 lft) x (1 lft)) x (5%) x ($51.30/sft)	=	$51,724.76
Partial Depth D-1 Joint Repair (TL Ramps)	(7,762 lft) x (1/16 J/lft) x (16 lft) x (1 lft)) x (5%) x ($51.30/sft)	=	$19,909.53
Partial Depth Long. Joint Repair (Route)	(5,817 lft) x (4 Joints) x (1 lft)) x (5%) x ($51.30/sft)	=	$59,682.42
Partial Depth Long. Joint Repair (Ramps)	(7,762 lft) x (1 Joints) x (1 lft)) x (5%) x ($51.30/sft)	=	$19,909.53
Full depth PCCP Patch (TL Route)	(33,610 yd^2) x (3%) x ($247.90/sys)	=	$249,957.57
Full Depth PCCP Patch (TL Ramps)	(13,800 yd^2) x (3%) x ($247.90/sys)	=	$102,630.60
Full Depth Patch Subbase (Route)	(33,610 yd^2) x (9/36 in//yd) x (3%) x ($56.72/$yd^3$)	=	$14,297.69
Full Depth Patch Subbase (Ramps)	(13,800 yd^2) x (9/26 in/yd) x (3%) x ($56.72/$yd^3$)	=	$5,870.52
Patch SGT, Type ID (Both)	(33,610 + 13,800 yd^2) x (3%) x ($29.38/$yd^2$)	=	$41,787.17
PCCP Profiling or Diamond Grind (Both)	(33,610 + 13,800 yd^2) x (100%) x ($5.00/$yd^2$)	=	$237,050.00
Traffic Maintenance	5% of Contract Cost	=	$41,368.71
Total Cost			$868,743.01

Unbounded Concrete Overlay (Age 40):

Mainline and Shoulders:
9 in. QC/QA PCCP with 14-ft wide slab for outside lane with D-1 Contraction Joints @ 15 ft spacing, on
110 lb/sys QC/QA - HMA, 2, 64, Intermediate, 9.5 mm, on
Existing Concrete

Ramps (Mainline, Inside Shoulder, and Outside Shoulder):
8 in. QC/QA PCCP with D-1 Contraction Joints @ 16 ft spacing on Subbase for PCCP, on
110 lb/sys QC/QA - HMA, 2, 64, Intermediate, 9.5 mm, on
Existing Concrete

Cost:

Route…M, IS, & OS (9" PCCP)	(49,121 yd^2) x ($40/$yd^2$)	=	$1,964,840.00
HMA Intermediate (Route…M & IS)	(49,121 yd^2) x (110 lb/yd^2) x (1/2000 t/lb) x ($65.0/t)	=	$175,607.58
Ramps…M, IS, & OS (8" PCCP)	(24,148 yd^2) x ($38/$yd^2$)	=	$917,624.00
HMA Intermediate (Route…M & IS)	(24,148 yd^2) x (110 lb/yd^2) x (1/2000 t/lb) x ($65.0/t)	=	$86,329.10
D-1 Joints (Route)	(5,817 lft) x (1/15 J/lft) x (76 lft) x ($8.86/lft)	=	$261,129.01
D-1 Joints (Ramps)	(7,762 lft) x (1/16 J/lft) x (28 lft) x ($8.86/lft)	=	$120,349.81

Full depth PCCP Patch (TL Route)	(33,610 yd^2) x (3%) x ($247.90/sys)	=	$249,957.57
Full Depth PCCP Patch (TL Ramps)	(13,800 yd^2) x (3%) x ($247.90/sys)	=	$102,630.60
Full Depth Patch Subbase (Route)	(33,610 yd^2) x (9/36 in//yd) x (3%) x ($56.72/$yd^3$)	=	$14,297.69
Full Depth Patch Subbase (Ramps)	(13,800 yd^2) x (9/26 in/yd) x (3%) x ($56.72/$yd^3$)	=	$5,870.52
Patch SGT, Type ID (Both)	(33,610 + 13,800 yd^2) x (3%) x ($29.38/$yd^2$)	=	$41,787.17
CA, Wedge, No.53 (Route)	(2) x (2) x (2.53 ft^2) x (5,817 lft) x (1/27 yd^3/ft^3) x (1.69 t/yd^3) x ($27.76/t)	=	$102,287.36
CA, Wedge, No.53 (Ramps)	(2) x (2.1 ft^2) x (7,762 lft) x (1/27 yd^3/ft^3) x (1.69 t/yd^3) x ($27.76/t)	=	$56,712.92
Traffic Maintenance	5% of Contract Cost	=	$204,971.17
Total Cost			$4,304,394.50

HMA PW Cost for Initial, Future Maintenance, and Future Rehabilitation			
Age in Years	Rehab.	Cost $	Present Worth Cost $
0	Initial Construction Cost	9,012,229.39	9,012,229.39
3	Crack Seal	617.07	556.57
6	Crack Seal	1,234.15	1,003.98
9	Crack Seal	1,234.15	905.53
12	Crack Seal	1,234.15	816.74
15	Mill and Resurface	755,672.86	451,054.04
18	Crack Seal	617.07	332.21
21	Crack Seal	1,234.15	599.27
24	Crack Seal	1,234.15	540.50
27	Mill and Resurface	769,628.53	304,012.69
30	Crack Seal	617.07	219.85
33	Crack Seal	1,234.15	396.58
36	Crack Seal	1,234.15	357.70
38	Mill and 2 lifts HMA Overlay	1,717,704.04	464,745.34
41	Crack Seal	617.07	150.59
44	Crack Seal	1,234.15	271.64
47	Crack Seal	1,234.15	245.00
50	Salvage Value	343,540.81	-61,512.14
Total HMA PW Cost			$10,176,925.47

PCCP PW Cost for Initial, Future Maintenance, and Future Rehabilitation			
Age in Years	Rehab.	Cost $	Present Worth Cost $
0	Initial Construction Cost	8,826,018.94	8,826,018.94
10	PM Concrete Pavement	8,594.07	6,092.50
18	Concrete Pavement Restoration	330,096.04	177,710.88
30	Concrete Pavement Restoration	868,743.01	309,514.38
40	Unbounded Concrete Overlay	4,304,394.50	1,087,171.54
50	Salvage Value	2,582,636.70	-462,429.82
Total PCCP PW Cost			$9,944,078.43

$PW = F\ [1/(1+i)^n]$

Where: F = Future Construction Cost
i = Discount rate (3.5%)
n = Number of years from year zero

Initial Construction Cost and PW of Future Rehabilitation & Maintenance Cost

X1 = HMA Section = $10,176,925.47

X2 = PCCP Section = $9,944,078.43

$$\% \text{ Difference} = \frac{(X1 - X2)}{(X1 + X2)/2}$$

2.31%