Life-Cycle Costs Summary
I-10 Deck Park Tunnel

Case	Description	One-Time Costs 1st year $	One-Time Costs LCC PV $	Total Utility 1st year $	Total Utility Undisc LCC PV $	Total Utility LCC PV $	Maintenance 1st year $	Maintenance LCC PV $	Total Undisc LCC PV $	Total LCC PV $	Net Savings NS
					Life-Cycle COSTS						
Existing Base Case	Original HPS Luminaires	$2,000,000	$2,395,138	$335,219	$8,429,678	$4,943,718	$45,000	$660,455	$12,303,098	$7,999,310	*n/a*
Revised Base Case	Replace HPS w/ Same, & Paint Curbs White	$3,500,000	$3,947,367	$335,219	$8,429,678	$4,943,718	$49,000	$719,162	$14,003,098	$9,610,246	*n/a*
Opt-1a - Increase Lth to 250	Higher-Wattage Replacement Luminaires	$3,600,000	$4,083,709	$552,743	$13,899,705	$8,151,702	$51,500	$755,854	$19,700,705	$12,991,265	*n/a*
Opt-1b - Increase Lth to 350	Higher-Wattage Replacement Luminaires	$5,000,000	$5,483,709	$754,410	$18,970,981	$11,125,831	$54,000	$792,545	$26,234,481	$17,402,086	*n/a*
Opt-2 - Apply Darker Finishes	Concrete Stain/Paint and Landscaping	$4,250,000	$4,733,709	$335,219	$8,429,678	$4,943,718	$0	$0	$13,593,178	$9,677,427	*n/a*
Opt-3 - Shade Structures	325' Long at Both Tunnel Entrances	$11,500,000	$11,983,709	$335,219	$8,429,678	$4,943,718	$54,000	$792,545	$22,193,178	$17,719,972	*n/a*
Opt-4 - Increase Ceiling Reflectance	88% (70% mean) Reflective White Coating	$4,225,000	$5,492,148	$335,219	$8,429,678	$4,943,718	$59,000	$865,929	$16,543,178	$11,301,794	*n/a*
Opt-5 - Revise Maintenance Proced.	Group-Relamp & High-Lumen Lamps	$3,532,000	$4,015,709	$335,219	$8,429,678	$4,943,718	$61,000	$895,283	$14,400,178	$9,854,710	*n/a*
Opt-6 - Upgrade Lighting Controls	Luminance Sensors & Wireless Technology	$3,540,000	$4,023,709	$295,299	$7,422,821	$4,353,539	$50,000	$733,838	$13,126,321	$9,111,087	*n/a*
Opt-7a - New LED Luminaires	4100K & 6500K Luminaires	$5,748,160	$5,836,787	$640,016	$16,091,199	$9,437,261	$84,000	$1,232,848	$24,134,612	$16,506,897	*n/a*
Opt-7b - New Induction Luminaires	4100K Luminaires	$4,966,105	$5,428,032	$795,148	$19,995,410	$11,726,624	$24,000	$352,242	$26,468,735	$17,506,898	*n/a*
Opt-7c - Metal Halide Luminaires	in Combination w/ 4100K LED or Induction	$3,649,648	$4,081,128	$556,754	$14,000,569	$8,210,855	$75,000	$1,100,758	$20,338,717	$13,392,740	*n/a*

** alternative with least life-cycle cost*
*** alternative with most rapid simple payback*

					Life-Cycle SAVINGS (negative entries indicate increased costs)						
Revised Base Case	Replace HPS w/ Same, & Paint Curbs White	($1,500,000)	($1,552,229)	$0	$0	$0	($4,000)	($58,707)	($1,700,000)	($1,610,936)	($1,610,936)
Opt-1a - Increase Lth to 250	Higher-Wattage Replacement Luminaires	($1,600,000)	($1,688,572)	($217,524)	($5,470,028)	($3,207,984)	($6,500)	($95,399)	($7,397,608)	($4,991,955)	($4,991,955)
Opt-1b - Increase Lth to 350	Higher-Wattage Replacement Luminaires	($3,000,000)	($3,088,572)	($419,191)	($10,541,303)	($6,182,114)	($9,000)	($132,091)	($13,931,383)	($9,402,776)	($9,402,776)
Opt-2 - Apply Darker Finishes	Concrete Stain/Paint and Landscaping	($2,250,000)	($2,338,572)	$0	$0	$0	$45,000	$660,455	($1,290,080)	($1,678,117)	($1,678,117)
Opt-3 - Shade Structures	325' Long at Both Tunnel Entrances	($9,500,000)	($9,588,572)	$0	$0	$0	($9,000)	($132,091)	($9,890,080)	($9,720,663)	($9,720,663)
Opt-4 - Increase Ceiling Reflectance	88% (70% mean) Reflective White Coating	($2,225,000)	($3,097,010)	$0	$0	$0	($14,000)	($205,475)	($4,240,080)	($3,302,485)	($3,302,485)
Opt-5 - Revise Maintenance Proced.	Group-Relamp & High-Lumen Lamps	($1,532,000)	($1,620,572)	$0	$0	$0	($16,000)	($234,828)	($2,097,080)	($1,855,400)	($1,855,400)
Opt-6 - Upgrade Lighting Controls	Luminance Sensors & Wireless Technology	($1,540,000)	($1,628,572)	$39,920	$1,006,857	$590,178	($5,000)	($73,384)	($823,223)	($1,111,777)	($1,111,777)
Opt-7a - New LED Luminaires	4100K & 6500K Luminaires	($3,748,160)	($3,441,649)	($304,797)	($7,661,521)	($4,493,544)	($39,000)	($572,394)	($11,831,514)	($8,507,587)	($8,507,587)
Opt-7b - New Induction Luminaires	4100K Luminaires	($2,966,105)	($3,032,894)	($459,929)	($11,565,732)	($6,782,906)	$21,000	$308,212	($14,165,637)	($9,507,588)	($9,507,588)
Opt-7c - Metal Halide Luminaires	in Combination w/ 4100K LED or Induction	($1,649,648)	($1,685,990)	($221,535)	($5,570,891)	($3,267,137)	($30,000)	($440,303)	($8,035,619)	($5,393,431)	($5,393,431)

Analysis Assumptions:

DOE/FEMP Fiscal Year	2011	
Real Discount Rate for this Analysis	4.6%	
Study Period (years covered by the LCC analysis)	25	
# of Years before Project Occupancy or Opration	0	
DOE Fuel Price Escalation Region	4	*(West)*
Analysis Sector	3	*(Industrial)*

Existing Base Case
Original HPS Luminaires

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: **West**
Analysis Sector: **Industrial**

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS		
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)													
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Real Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring PV $	Year Date	Undiscouted Total Costs PV$	Discounted Total Costs PV $
0	Initial	$2,000,000	$2,000,000	n/a	n/a	n/a	$335,219	0.05%					$45,000			$2,000,000	$2,000,000
1		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,370	$320,477	$320,621	$45,000	$43,021	2011	$380,370	$363,642
2		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,521	$306,383	$306,659	$45,000	$41,129	2012	$380,521	$347,788
3		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,672	$292,910	$293,305	$45,000	$39,320	2013	$380,672	$332,626
4		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,823	$280,028	$280,533	$45,000	$37,591	2014	$380,823	$318,124
5		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,974	$267,713	$268,316	$45,000	$35,938	2015	$380,974	$304,254
6		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,125	$255,940	$256,632	$45,000	$34,358	2016	$381,125	$290,990
7		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,276	$244,685	$245,457	$45,000	$32,847	2017	$381,276	$278,303
8		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,428	$233,924	$234,768	$45,000	$31,402	2018	$381,428	$266,170
9		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,579	$223,637	$224,544	$45,000	$30,021	2019	$381,579	$254,565
10		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,731	$213,802	$214,766	$45,000	$28,701	2020	$381,731	$243,467
11		$0	$0	Ballasts	$130,160	$79,365	$335,219	0.05%	1.85%	$336,882	$204,400	$205,414	$45,000	$27,439	2021	$512,042	$312,217
12		$0	$0	Ballasts	$130,160	$75,875	$335,219	0.05%	1.85%	$337,034	$195,411	$196,469	$45,000	$26,232	2022	$512,194	$298,575
13		$0	$0	Ballasts	$130,160	$72,538	$335,219	0.05%	1.85%	$337,185	$186,817	$187,913	$45,000	$25,078	2023	$512,345	$285,529
14		$0	$0	Ballasts	$130,160	$69,348	$335,219	0.05%	1.85%	$337,337	$178,601	$179,730	$45,000	$23,976	2024	$512,497	$273,054
15		$0	$0	Ballasts	$130,160	$66,298	$335,219	0.05%	1.85%	$337,489	$170,747	$171,903	$45,000	$22,921	2025	$512,649	$261,123
16		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,641	$163,238	$164,417	$45,000	$21,913	2026	$382,641	$186,331
17		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,793	$156,059	$157,258	$45,000	$20,950	2027	$382,793	$178,207
18		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,945	$149,196	$150,410	$45,000	$20,028	2028	$382,945	$170,438
19		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,097	$142,635	$143,860	$45,000	$19,147	2029	$383,097	$163,007
20		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,249	$136,362	$137,595	$45,000	$18,305	2030	$383,249	$155,900
21		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,401	$130,366	$131,603	$45,000	$17,500	2031	$383,401	$149,104
22		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,553	$124,633	$125,872	$45,000	$16,731	2032	$383,553	$142,603
23		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,706	$119,152	$120,391	$45,000	$15,995	2033	$383,706	$136,386
24		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,858	$113,912	$115,148	$45,000	$15,292	2034	$383,858	$130,440
25		$0	$0	Recycle	$97,620	$31,714	$335,219	0.05%	1.85%	$339,011	$108,902	$110,134	$45,000	$14,619	2035	$481,631	$156,467
		$2,000,000	**$2,000,000**		$748,420	**$395,138**	$8,380,475			$8,429,678	$4,919,931	**$4,943,718**	$1,125,000	***$660,455***		***$12,303,098***	***$7,999,310***

Revised Base Case
Replace HPS w/ Same, & Paint Curbs White

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: **West**
Analysis Sector: **Industrial**

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS		
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)													
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring PV $	Year Date	Undiscouted Total Costs PV$	Discounted Total Costs PV $
0	Replace HPS & Paint Curbs White	$3,500,000	$3,500,000	n/a	n/a	n/a	$335,219	0.05%		[illegible]			$49,000			$3,500,000	$3,500,000
1		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,370	$320,477	$320,621	$49,000	$46,845	2011	$384,370	$367,466
2		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,521	$306,383	$306,659	$49,000	$44,785	2012	$384,521	$351,444
3		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,672	$292,910	$293,305	$49,000	$42,816	2013	$384,672	$336,121
4		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,823	$280,028	$280,533	$49,000	$40,933	2014	$384,823	$321,465
5		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,974	$267,713	$268,316	$49,000	$39,133	2015	$384,974	$307,449
6		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,125	$255,940	$256,632	$49,000	$37,412	2016	$385,125	$294,044
7		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,276	$244,685	$245,457	$49,000	$35,766	2017	$385,276	$281,223
8		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,428	$233,924	$234,768	$49,000	$34,193	2018	$385,428	$268,961
9		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,579	$223,637	$224,544	$49,000	$32,690	2019	$385,579	$257,234
10		$0	$0	Re-paint Curbs	$50,000	$31,890	$335,219	0.05%	1.85%	$336,731	$213,802	$214,766	$49,000	$31,252	2020	$435,731	$277,908
11		$0	$0	Ballasts	$130,160	$79,365	$335,219	0.05%	1.85%	$336,882	$204,400	$205,414	$49,000	$29,878	2021	$516,042	$314,656
12		$0	$0	Ballasts	$130,160	$75,875	$335,219	0.05%	1.85%	$337,034	$195,411	$196,469	$49,000	$28,564	2022	$516,194	$300,907
13		$0	$0	Ballasts	$130,160	$72,538	$335,219	0.05%	1.85%	$337,185	$186,817	$187,913	$49,000	$27,308	2023	$516,345	$287,759
14		$0	$0	Ballasts	$130,160	$69,348	$335,219	0.05%	1.85%	$337,337	$178,601	$179,730	$49,000	$26,107	2024	$516,497	$275,185
15		$0	$0	Ballasts	$130,160	$66,298	$335,219	0.05%	1.85%	$337,489	$170,747	$171,903	$49,000	$24,959	2025	$516,649	$263,160
16		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,641	$163,238	$164,417	$49,000	$23,861	2026	$386,641	$188,278
17		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,793	$156,059	$157,258	$49,000	$22,812	2027	$386,793	$180,069
18		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,945	$149,196	$150,410	$49,000	$21,808	2028	$386,945	$172,218
19		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,097	$142,635	$143,860	$49,000	$20,849	2029	$387,097	$164,709
20		$0	$0	Re-paint Curbs	$50,000	$20,339	$335,219	0.05%	1.85%	$338,249	$136,362	$137,595	$49,000	$19,933	2030	$437,249	$177,867
21		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,401	$130,366	$131,603	$49,000	$19,056	2031	$387,401	$150,659
22		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,553	$124,633	$125,872	$49,000	$18,218	2032	$387,553	$144,090
23		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,706	$119,152	$120,391	$49,000	$17,417	2033	$387,706	$137,808
24		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,858	$113,912	$115,148	$49,000	$16,651	2034	$387,858	$131,799
25		$0	$0	Recycle	$97,620	$31,714	$335,219	0.05%	1.85%	$339,011	$108,902	$110,134	$49,000	$15,919	2035	$485,631	$157,766
		$3,500,000	**$3,500,000**		$848,420	**$447,367**	$8,380,475			$8,429,678	$4,919,931	**$4,943,718**	$1,225,000	***$719,162***		***$14,003,098***	***$9,610,246***

Opt-1a - Increase Lth to 250
Higher-Wattage Replacement Luminaires

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: **West**
Analysis Sector: **Industrial**

	NON-ANNUAL RECURRING COSTS					ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS		
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring PV $	Year Date	Undiscouted Total Costs PV$	Discounted Total Costs PV $
0	Replace High-Watt HPS & Paint Curbs White	$3,600,000	$3,600,000	n/a	*n/a*	*n/a*	$552,743	0.05%					$51,500			$3,600,000	$3,600,000
1		$0	$0		$0	$0	$552,743	0.05%	1.85%	$552,992	$528,435	$528,673	$51,500	$49,235	2011	$604,492	$577,908
2		$0	$0		$0	$0	$552,743	0.05%	1.85%	$553,241	$505,196	$505,651	$51,500	$47,070	2012	$604,741	$552,721
3		$0	$0		$0	$0	$552,743	0.05%	1.85%	$553,490	$482,979	$483,631	$51,500	$45,000	2013	$604,990	$528,631
4		$0	$0		$0	$0	$552,743	0.05%	1.85%	$553,739	$461,739	$462,571	$51,500	$43,021	2014	$605,239	$505,592
5		$0	$0		$0	$0	$552,743	0.05%	1.85%	$553,988	$441,433	$442,427	$51,500	$41,129	2015	$605,488	$483,556
6		$0	$0		$0	$0	$552,743	0.05%	1.85%	$554,237	$422,020	$423,161	$51,500	$39,320	2016	$605,737	$462,481
7		$0	$0		$0	$0	$552,743	0.05%	1.85%	$554,486	$403,461	$404,734	$51,500	$37,591	2017	$605,986	$442,325
8		$0	$0		$0	$0	$552,743	0.05%	1.85%	$554,736	$385,718	$387,109	$51,500	$35,938	2018	$606,236	$423,047
9		$0	$0		$0	$0	$552,743	0.05%	1.85%	$554,986	$368,755	$370,251	$51,500	$34,358	2019	$606,486	$404,609
10		$0	$0	Re-paint Curbs	$50,000	$31,890	$552,743	0.05%	1.85%	$555,235	$352,538	$354,128	$51,500	$32,847	2020	$656,735	$418,865
11		$0	$0	Ballasts	$143,176	$87,301	$552,743	0.05%	1.85%	$555,485	$337,035	$338,707	$51,500	$31,402	2021	$750,161	$457,410
12		$0	$0	Ballasts	$143,176	$83,462	$552,743	0.05%	1.85%	$555,735	$322,213	$323,957	$51,500	$30,021	2022	$750,411	$437,441
13		$0	$0	Ballasts	$143,176	$79,792	$552,743	0.05%	1.85%	$555,985	$308,043	$309,850	$51,500	$28,701	2023	$750,661	$418,343
14		$0	$0	Ballasts	$143,176	$76,283	$552,743	0.05%	1.85%	$556,235	$294,496	$296,357	$51,500	$27,439	2024	$750,911	$400,078
15		$0	$0	Ballasts	$143,176	$72,928	$552,743	0.05%	1.85%	$556,486	$281,545	$283,452	$51,500	$26,232	2025	$751,162	$382,612
16		$0	$0		$0	$0	$552,743	0.05%	1.85%	$556,736	$269,164	$271,108	$51,500	$25,078	2026	$608,236	$296,187
17		$0	$0		$0	$0	$552,743	0.05%	1.85%	$556,987	$257,327	$259,302	$51,500	$23,976	2027	$608,487	$283,278
18		$0	$0		$0	$0	$552,743	0.05%	1.85%	$557,237	$246,010	$248,010	$51,500	$22,921	2028	$608,737	$270,932
19		$0	$0		$0	$0	$552,743	0.05%	1.85%	$557,488	$235,191	$237,210	$51,500	$21,913	2029	$608,988	$259,124
20		$0	$0	Re-paint Curbs	$50,000	$20,339	$552,743	0.05%	1.85%	$557,739	$224,848	$226,881	$51,500	$20,949	2030	$659,239	$268,169
21		$0	$0		$0	$0	$552,743	0.05%	1.85%	$557,990	$214,960	$217,001	$51,500	$20,028	2031	$609,490	$237,029
22		$0	$0		$0	$0	$552,743	0.05%	1.85%	$558,241	$205,507	$207,551	$51,500	$19,147	2032	$609,741	$226,698
23		$0	$0		$0	$0	$552,743	0.05%	1.85%	$558,492	$196,469	$198,513	$51,500	$18,305	2033	$609,992	$216,818
24		$0	$0		$0	$0	$552,743	0.05%	1.85%	$558,744	$187,829	$189,868	$51,500	$17,500	2034	$610,244	$207,369
25		$0	$0	Recycle	$97,620	$31,714	$552,743	0.05%	1.85%	$558,995	$179,569	$181,600	$51,500	$16,731	2035	$708,115	$230,044
		$3,600,000	**$3,600,000**		**$913,500**	**$483,709**	$13,818,575			$13,899,705	$8,112,480	**$8,151,702**	$1,287,500	***$755,854***		***$19,700,705***	***$12,991,265***

Opt-1b - Increase Lth to 350
Higher-Wattage Replacement Luminaires

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: West
Analysis Sector: Industrial

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring (e.g., maintenance) PV $	Year Date	Discounted Total Costs PV $
0	Replace High-Watt HPS & Paint Curbs White	$5,000,000	$5,000,000	n/a	n/a	n/a	$754,410	0.05%		[illegible]			$54,000			$5,000,000
1		$0	$0		$0	$0	$754,410	0.05%	1.85%	$754,749	$721,233	$721,558	$54,000	$51,625	2011	$773,183
2		$0	$0		$0	$0	$754,410	0.05%	1.85%	$755,089	$689,516	$690,136	$54,000	$49,355	2012	$739,491
3		$0	$0		$0	$0	$754,410	0.05%	1.85%	$755,429	$659,193	$660,083	$54,000	$47,184	2013	$707,267
4		$0	$0		$0	$0	$754,410	0.05%	1.85%	$755,769	$630,203	$631,338	$54,000	$45,109	2014	$676,448
5		$0	$0		$0	$0	$754,410	0.05%	1.85%	$756,109	$602,489	$603,846	$54,000	$43,126	2015	$646,971
6		$0	$0		$0	$0	$754,410	0.05%	1.85%	$756,449	$575,993	$577,550	$54,000	$41,229	2016	$618,779
7		$0	$0		$0	$0	$754,410	0.05%	1.85%	$756,790	$550,663	$552,400	$54,000	$39,416	2017	$591,816
8		$0	$0		$0	$0	$754,410	0.05%	1.85%	$757,130	$526,446	$528,344	$54,000	$37,683	2018	$566,027
9		$0	$0		$0	$0	$754,410	0.05%	1.85%	$757,471	$503,295	$505,337	$54,000	$36,025	2019	$541,362
10		$0	$0	Re-paint Curbs	$50,000	$31,890	$754,410	0.05%	1.85%	$757,812	$481,161	$483,331	$54,000	$34,441	2020	$549,662
11		$0	$0	Ballasts	$143,176	$87,301	$754,410	0.05%	1.85%	$758,153	$460,001	$462,283	$54,000	$32,926	2021	$582,511
12		$0	$0	Ballasts	$143,176	$83,462	$754,410	0.05%	1.85%	$758,494	$439,772	$442,152	$54,000	$31,478	2022	$557,093
13		$0	$0	Ballasts	$143,176	$79,792	$754,410	0.05%	1.85%	$758,835	$420,432	$422,898	$54,000	$30,094	2023	$532,784
14		$0	$0	Ballasts	$143,176	$76,283	$754,410	0.05%	1.85%	$759,177	$401,942	$404,482	$54,000	$28,771	2024	$509,536
15		$0	$0	Ballasts	$143,176	$72,928	$754,410	0.05%	1.85%	$759,518	$384,266	$386,868	$54,000	$27,505	2025	$487,302
16		$0	$0		$0	$0	$754,410	0.05%	1.85%	$759,860	$367,367	$370,021	$54,000	$26,296	2026	$396,317
17		$0	$0		$0	$0	$754,410	0.05%	1.85%	$760,202	$351,212	$353,908	$54,000	$25,139	2027	$379,047
18		$0	$0		$0	$0	$754,410	0.05%	1.85%	$760,544	$335,766	$338,496	$54,000	$24,034	2028	$362,530
19		$0	$0		$0	$0	$754,410	0.05%	1.85%	$760,886	$321,000	$323,756	$54,000	$22,977	2029	$346,733
20		$0	$0	Re-paint Curbs	$50,000	$20,339	$754,410	0.05%	1.85%	$761,229	$306,884	$309,657	$54,000	$21,966	2030	$351,963
21		$0	$0		$0	$0	$754,410	0.05%	1.85%	$761,571	$293,388	$296,173	$54,000	$21,000	2031	$317,173
22		$0	$0		$0	$0	$754,410	0.05%	1.85%	$761,914	$280,485	$283,275	$54,000	$20,077	2032	$303,352
23		$0	$0		$0	$0	$754,410	0.05%	1.85%	$762,257	$268,151	$270,940	$54,000	$19,194	2033	$290,134
24		$0	$0		$0	$0	$754,410	0.05%	1.85%	$762,600	$256,358	$259,141	$54,000	$18,350	2034	$277,491
25		$0	$0	Recycle	$97,620	$31,714	$754,410	0.05%	1.85%	$762,943	$245,084	$247,856	$54,000	$17,543	2035	$297,113
		$5,000,000	**$5,000,000**		$913,500	**$483,709**	$18,860,250			$18,970,981	$11,072,300	**$11,125,831**	$1,350,000	***$792,545***		***$17,402,086***

Opt-2 - Apply Darker Finishes
Concrete Stain/Paint and Landscaping

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: West
Analysis Sector: Industrial

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring PV $	Year Date	Discounted Total Costs PV $
0	First Cost	$4,250,000	$4,250,000	n/a	n/a	n/a	$335,219	0.05%		[illegible]			$0			$4,250,000
1		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,370	$320,477	$320,621	$0	$0	2011	$320,621
2		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,521	$306,383	$306,659	$0	$0	2012	$306,659
3		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,672	$292,910	$293,305	$0	$0	2013	$293,305
4		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,823	$280,028	$280,533	$0	$0	2014	$280,533
5		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,974	$267,713	$268,316	$0	$0	2015	$268,316
6		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,125	$255,940	$256,632	$0	$0	2016	$256,632
7		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,276	$244,685	$245,457	$0	$0	2017	$245,457
8		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,428	$233,924	$234,768	$0	$0	2018	$234,768
9		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,579	$223,637	$224,544	$0	$0	2019	$224,544
10		$0	$0	Re-paint Curbs	$50,000	$31,890	$335,219	0.05%	1.85%	$336,731	$213,802	$214,766	$0	$0	2020	$246,656
11		$0	$0	Ballasts	$143,176	$87,301	$335,219	0.05%	1.85%	$336,882	$204,400	$205,414	$0	$0	2021	$292,715
12		$0	$0	Ballasts	$143,176	$83,462	$335,219	0.05%	1.85%	$337,034	$195,411	$196,469	$0	$0	2022	$279,931
13		$0	$0	Ballasts	$143,176	$79,792	$335,219	0.05%	1.85%	$337,185	$186,817	$187,913	$0	$0	2023	$267,705
14		$0	$0	Ballasts	$143,176	$76,283	$335,219	0.05%	1.85%	$337,337	$178,601	$179,730	$0	$0	2024	$256,013
15		$0	$0	Ballasts	$143,176	$72,928	$335,219	0.05%	1.85%	$337,489	$170,747	$171,903	$0	$0	2025	$244,831
16		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,641	$163,238	$164,417	$0	$0	2026	$164,417
17		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,793	$156,059	$157,258	$0	$0	2027	$157,258
18		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,945	$149,196	$150,410	$0	$0	2028	$150,410
19		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,097	$142,635	$143,860	$0	$0	2029	$143,860
20		$0	$0	Re-paint Curbs	$50,000	$20,339	$335,219	0.05%	1.85%	$338,249	$136,362	$137,595	$0	$0	2030	$157,934
21		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,401	$130,366	$131,603	$0	$0	2031	$131,603
22		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,553	$124,633	$125,872	$0	$0	2032	$125,872
23		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,706	$119,152	$120,391	$0	$0	2033	$120,391
24		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,858	$113,912	$115,148	$0	$0	2034	$115,148
25		$0	$0	Recycle	$97,620	$31,714	$335,219	0.05%	1.85%	$339,011	$108,902	$110,134	$0	$0	2035	$141,848
		$4,250,000	**$4,250,000**		$913,500	**$483,709**	$8,380,475			$8,429,678	$4,919,931	**$4,943,718**	$0	***$0***		***$9,677,427***

Opt-3 - Shade Structures
325' Long at Both Tunnel Entrances

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: West
Analysis Sector: Industrial

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring (e.g., maintenance) PV $	Year Date	Discounted Total Costs PV $
0	Shade Structure	$11,500,000	$11,500,000	n/a	n/a	n/a	$335,219	0.05%		[illegible]			$54,000			$11,500,000
1		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,370	$320,477	$320,621	$54,000	$51,625	2011	$372,247
2		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,521	$306,383	$306,659	$54,000	$49,355	2012	$356,014
3		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,672	$292,910	$293,305	$54,000	$47,184	2013	$340,490
4		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,823	$280,028	$280,533	$54,000	$45,109	2014	$325,642
5		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,974	$267,713	$268,316	$54,000	$43,126	2015	$311,442
6		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,125	$255,940	$256,632	$54,000	$41,229	2016	$297,861
7		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,276	$244,685	$245,457	$54,000	$39,416	2017	$284,872
8		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,428	$233,924	$234,768	$54,000	$37,683	2018	$272,450
9		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,579	$223,637	$224,544	$54,000	$36,025	2019	$260,570
10		$0	$0	Re-paint Curbs	$50,000	$31,890	$335,219	0.05%	1.85%	$336,731	$213,802	$214,766	$54,000	$34,441	2020	$281,097
11		$0	$0	Ballasts	$143,176	$87,301	$335,219	0.05%	1.85%	$336,882	$204,400	$205,414	$54,000	$32,926	2021	$325,642
12		$0	$0	Ballasts	$143,176	$83,462	$335,219	0.05%	1.85%	$337,034	$195,411	$196,469	$54,000	$31,478	2022	$311,409
13		$0	$0	Ballasts	$143,176	$79,792	$335,219	0.05%	1.85%	$337,185	$186,817	$187,913	$54,000	$30,094	2023	$297,799
14		$0	$0	Ballasts	$143,176	$76,283	$335,219	0.05%	1.85%	$337,337	$178,601	$179,730	$54,000	$28,771	2024	$284,783
15		$0	$0	Ballasts	$143,176	$72,928	$335,219	0.05%	1.85%	$337,489	$170,747	$171,903	$54,000	$27,505	2025	$272,337
16		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,641	$163,238	$164,417	$54,000	$26,296	2026	$190,713
17		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,793	$156,059	$157,258	$54,000	$25,139	2027	$182,397
18		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,945	$149,196	$150,410	$54,000	$24,034	2028	$174,443
19		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,097	$142,635	$143,860	$54,000	$22,977	2029	$166,837
20		$0	$0	Re-paint Curbs	$50,000	$20,339	$335,219	0.05%	1.85%	$338,249	$136,362	$137,595	$54,000	$21,966	2030	$179,901
21		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,401	$130,366	$131,603	$54,000	$21,000	2031	$152,604
22		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,553	$124,633	$125,872	$54,000	$20,077	2032	$145,949
23		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,706	$119,152	$120,391	$54,000	$19,194	2033	$139,585
24		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,858	$113,912	$115,148	$54,000	$18,350	2034	$133,498
25		$0	$0	Recycle	$97,620	$31,714	$335,219	0.05%	1.85%	$339,011	$108,902	$110,134	$54,000	$17,543	2035	$159,391
		$11,500,000	**$11,500,000**		$913,500	**$483,709**	$8,380,475			$8,429,678	$4,919,931	**$4,943,718**	$1,350,000	***$792,545***		***$17,719,972***

Opt-4 - Increase Ceiling Reflectance
88% (70% mean) Reflective White Coating

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: West
Analysis Sector: Industrial

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring (e.g., maintenance) PV $	Year Date	Discounted Total Costs PV $
0	First Cost	$4,225,000	$4,225,000	n/a	n/a	n/a	$335,219	0.05%					$59,000			$4,225,000
1		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,370	$320,477	$320,621	$59,000	$56,405	2011	$377,027
2		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,521	$306,383	$306,659	$59,000	$53,925	2012	$360,584
3		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,672	$292,910	$293,305	$59,000	$51,553	2013	$344,859
4		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,823	$280,028	$280,533	$59,000	$49,286	2014	$329,819
5		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,974	$267,713	$268,316	$59,000	$47,119	2015	$315,435
6		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,125	$255,940	$256,632	$59,000	$45,047	2016	$301,679
7		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,276	$244,685	$245,457	$59,000	$43,066	2017	$288,522
8		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,428	$233,924	$234,768	$59,000	$41,172	2018	$275,939
9		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,579	$223,637	$224,544	$59,000	$39,361	2019	$263,905
10		$0	$0	Re-paint Curbs & Ceiling	$800,000	$510,238	$335,219	0.05%	1.85%	$336,731	$213,802	$214,766	$59,000	$37,630	2020	$762,635
11		$0	$0	Ballasts	$143,176	$87,301	$335,219	0.05%	1.85%	$336,882	$204,400	$205,414	$59,000	$35,975	2021	$328,690
12		$0	$0	Ballasts	$143,176	$83,462	$335,219	0.05%	1.85%	$337,034	$195,411	$196,469	$59,000	$34,393	2022	$314,324
13		$0	$0	Ballasts	$143,176	$79,792	$335,219	0.05%	1.85%	$337,185	$186,817	$187,913	$59,000	$32,881	2023	$300,585
14		$0	$0	Ballasts	$143,176	$76,283	$335,219	0.05%	1.85%	$337,337	$178,601	$179,730	$59,000	$31,435	2024	$287,447
15		$0	$0	Ballasts	$143,176	$72,928	$335,219	0.05%	1.85%	$337,489	$170,747	$171,903	$59,000	$30,052	2025	$274,884
16		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,641	$163,238	$164,417	$59,000	$28,731	2026	$193,148
17		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,793	$156,059	$157,258	$59,000	$27,467	2027	$184,725
18		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,945	$149,196	$150,410	$59,000	$26,259	2028	$176,669
19		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,097	$142,635	$143,860	$59,000	$25,104	2029	$168,964
20		$0	$0	Re-paint Curbs & Ceiling	$800,000	$325,429	$335,219	0.05%	1.85%	$338,249	$136,362	$137,595	$59,000	$24,000	2030	$487,024
21		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,401	$130,366	$131,603	$59,000	$22,945	2031	$154,548
22		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,553	$124,633	$125,872	$59,000	$21,936	2032	$147,808
23		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,706	$119,152	$120,391	$59,000	$20,971	2033	$141,362
24		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,858	$113,912	$115,148	$59,000	$20,049	2034	$135,197
25		$0	$0	Recycle	$97,620	$31,714	$335,219	0.05%	1.85%	$339,011	$108,902	$110,134	$59,000	$19,167	2035	$161,015
		$4,225,000	**$4,225,000**		$2,413,500	**$1,267,148**	$8,380,475			$8,429,678	$4,919,931	**$4,943,718**	$1,475,000	***$865,929***		***$11,301,794***

Opt-5 - Revise Maintenance Proced.
Group-Relamp & High-Lumen Lamps

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: West
Analysis Sector: Industrial

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring (e.g., maintenance) PV $	Year Date	Discounted Total Costs PV $
0	First Cost	$3,532,000	$3,532,000	n/a	n/a	n/a	$335,219	0.05%		[illegible]			$61,000			$3,532,000
1		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,370	$320,477	$320,621	$61,000	$58,317	2011	$378,939
2		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,521	$306,383	$306,659	$61,000	$55,753	2012	$362,412
3		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,672	$292,910	$293,305	$61,000	$53,301	2013	$346,606
4		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,823	$280,028	$280,533	$61,000	$50,957	2014	$331,490
5		$0	$0		$0	$0	$335,219	0.05%	1.85%	$335,974	$267,713	$268,316	$61,000	$48,716	2015	$317,032
6		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,125	$255,940	$256,632	$61,000	$46,574	2016	$303,206
7		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,276	$244,685	$245,457	$61,000	$44,525	2017	$289,982
8		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,428	$233,924	$234,768	$61,000	$42,567	2018	$277,335
9		$0	$0		$0	$0	$335,219	0.05%	1.85%	$336,579	$223,637	$224,544	$61,000	$40,695	2019	$265,240
10		$0	$0	Re-paint Curbs	$50,000	$31,890	$335,219	0.05%	1.85%	$336,731	$213,802	$214,766	$61,000	$38,906	2020	$285,562
11		$0	$0	Ballasts	$143,176	$87,301	$335,219	0.05%	1.85%	$336,882	$204,400	$205,414	$61,000	$37,195	2021	$329,910
12		$0	$0	Ballasts	$143,176	$83,462	$335,219	0.05%	1.85%	$337,034	$195,411	$196,469	$61,000	$35,559	2022	$315,490
13		$0	$0	Ballasts	$143,176	$79,792	$335,219	0.05%	1.85%	$337,185	$186,817	$187,913	$61,000	$33,995	2023	$301,700
14		$0	$0	Ballasts	$143,176	$76,283	$335,219	0.05%	1.85%	$337,337	$178,601	$179,730	$61,000	$32,500	2024	$288,513
15		$0	$0	Ballasts	$143,176	$72,928	$335,219	0.05%	1.85%	$337,489	$170,747	$171,903	$61,000	$31,071	2025	$275,902
16		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,641	$163,238	$164,417	$61,000	$29,705	2026	$194,122
17		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,793	$156,059	$157,258	$61,000	$28,398	2027	$185,656
18		$0	$0		$0	$0	$335,219	0.05%	1.85%	$337,945	$149,196	$150,410	$61,000	$27,149	2028	$177,559
19		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,097	$142,635	$143,860	$61,000	$25,955	2029	$169,815
20		$0	$0	Re-paint Curbs	$50,000	$20,339	$335,219	0.05%	1.85%	$338,249	$136,362	$137,595	$61,000	$24,814	2030	$182,748
21		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,401	$130,366	$131,603	$61,000	$23,723	2031	$155,326
22		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,553	$124,633	$125,872	$61,000	$22,679	2032	$148,552
23		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,706	$119,152	$120,391	$61,000	$21,682	2033	$142,073
24		$0	$0		$0	$0	$335,219	0.05%	1.85%	$338,858	$113,912	$115,148	$61,000	$20,729	2034	$135,877
25		$0	$0	Recycle	$97,620	$31,714	$335,219	0.05%	1.85%	$339,011	$108,902	$110,134	$61,000	$19,817	2035	$161,665
		$3,532,000	**$3,532,000**		$913,500	**$483,709**	$8,380,475			$8,429,678	$4,919,931	**$4,943,718**	$1,525,000	***$895,283***		***$9,854,710***

Opt-6 - Upgrade Lighting Controls
Luminance Sensors & Wireless Technology

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: West
Analysis Sector: Industrial

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring (e.g., maintenance) PV $	Year Date	Discounted Total Costs PV $
0	First Cost	$3,540,000	$3,540,000	n/a	n/a	n/a	$274,879	0.05%		[illegible]			$50,000			$3,540,000
1		$0	$0		$0	$0	$274,879	0.05%	1.85%	$275,003	$262,791	$262,909	$50,000	$47,801	2011	$330,232
2		$0	$0		$0	$0	$274,879	0.05%	1.85%	$275,126	$251,234	$251,460	$50,000	$45,699	2012	$315,822
3		$0	$0		$0	$0	$274,879	0.05%	1.85%	$275,250	$240,185	$240,510	$50,000	$43,689	2013	$302,042
4		$0	$0		$0	$0	$274,879	0.05%	1.85%	$275,374	$229,623	$230,036	$50,000	$41,768	2014	$288,862
5		$0	$0		$0	$0	$274,879	0.05%	1.85%	$275,498	$219,525	$220,019	$50,000	$39,931	2015	$276,258
6		$0	$0		$0	$0	$274,879	0.05%	1.85%	$275,622	$209,871	$210,438	$50,000	$38,175	2016	$264,204
7		$0	$0		$0	$0	$274,879	0.05%	1.85%	$275,746	$200,641	$201,274	$50,000	$36,496	2017	$252,675
8		$0	$0		$0	$0	$274,879	0.05%	1.85%	$275,870	$191,817	$192,509	$50,000	$34,891	2018	$241,650
9		$0	$0		$0	$0	$274,879	0.05%	1.85%	$275,994	$183,382	$184,126	$50,000	$33,357	2019	$231,106
10		$0	$0	Re-paint Curbs	$50,000	$31,890	$274,879	0.05%	1.85%	$276,118	$175,317	$176,108	$50,000	$31,890	2020	$252,911
11		$0	$0	Ballasts	$143,176	$87,301	$274,879	0.05%	1.85%	$276,243	$167,607	$168,439	$50,000	$30,487	2021	$298,679
12		$0	$0	Ballasts	$143,176	$83,462	$274,879	0.05%	1.85%	$276,367	$160,236	$161,104	$50,000	$29,147	2022	$285,616
13		$0	$0	Ballasts	$143,176	$79,792	$274,879	0.05%	1.85%	$276,491	$153,190	$154,088	$50,000	$27,865	2023	$273,125
14		$0	$0	Ballasts	$143,176	$76,283	$274,879	0.05%	1.85%	$276,616	$146,453	$147,378	$50,000	$26,640	2024	$261,180
15		$0	$0	Ballasts	$143,176	$72,928	$274,879	0.05%	1.85%	$276,740	$140,012	$140,960	$50,000	$25,468	2025	$249,758
16		$0	$0		$0	$0	$274,879	0.05%	1.85%	$276,865	$133,855	$134,822	$50,000	$24,348	2026	$169,114
17		$0	$0		$0	$0	$274,879	0.05%	1.85%	$276,989	$127,968	$128,951	$50,000	$23,277	2027	$161,735
18		$0	$0		$0	$0	$274,879	0.05%	1.85%	$277,114	$122,341	$123,336	$50,000	$22,254	2028	$154,677
19		$0	$0		$0	$0	$274,879	0.05%	1.85%	$277,239	$116,961	$117,965	$50,000	$21,275	2029	$147,928
20		$0	$0	Re-paint Curbs	$50,000	$20,339	$274,879	0.05%	1.85%	$277,364	$111,817	$112,828	$50,000	$20,339	2030	$161,813
21		$0	$0		$0	$0	$274,879	0.05%	1.85%	$277,488	$106,900	$107,914	$50,000	$19,445	2031	$135,301
22		$0	$0		$0	$0	$274,879	0.05%	1.85%	$277,613	$102,198	$103,215	$50,000	$18,590	2032	$129,397
23		$0	$0		$0	$0	$274,879	0.05%	1.85%	$277,738	$97,704	$98,720	$50,000	$17,772	2033	$123,751
24		$0	$0		$0	$0	$274,879	0.05%	1.85%	$277,863	$93,407	$94,421	$50,000	$16,991	2034	$118,351
25		$0	$0	Recycle	$97,620	$31,714	$274,879	0.05%	1.85%	$277,988	$89,300	$90,310	$50,000	$16,243	2035	$144,901
		$3,540,000	**$3,540,000**		$913,500	**$483,709**	$6,871,975			$6,912,321	$4,034,335	**$4,053,840**	$1,250,000	***$733,838***		***$9,111,087***

Opt-7a - New LED Luminaires
4100K & 6500K Luminaires

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: West
Analysis Sector: Industrial

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring (e.g., maintenance) PV $	Year Date	Discounted Total Costs PV $
0	First Cost	$5,748,160	$5,748,160	n/a	n/a	n/a	$618,616	0.05%		[illegible]			$84,000			$5,748,160
1		$0	$0		$0	$0	$618,616	0.05%	1.85%	$618,894	$591,411	$591,677	$84,000	$80,306	2011	$692,442
2		$0	$0		$0	$0	$618,616	0.05%	1.85%	$619,173	$565,403	$565,912	$84,000	$76,774	2012	$662,245
3		$0	$0		$0	$0	$618,616	0.05%	1.85%	$619,452	$540,538	$541,268	$84,000	$73,398	2013	$633,365
4		$0	$0		$0	$0	$618,616	0.05%	1.85%	$619,730	$516,767	$517,697	$84,000	$70,170	2014	$605,744
5		$0	$0		$0	$0	$618,616	0.05%	1.85%	$620,009	$494,041	$495,153	$84,000	$67,084	2015	$579,328
6		$0	$0		$0	$0	$618,616	0.05%	1.85%	$620,288	$472,314	$473,591	$84,000	$64,134	2016	$554,064
7		$0	$0		$0	$0	$618,616	0.05%	1.85%	$620,567	$451,543	$452,968	$84,000	$61,314	2017	$529,902
8		$0	$0		$0	$0	$618,616	0.05%	1.85%	$620,847	$431,686	$433,242	$84,000	$58,617	2018	$506,793
9		$0	$0		$0	$0	$618,616	0.05%	1.85%	$621,126	$412,701	$414,376	$84,000	$56,039	2019	$484,692
10		$0	$0		$0	$0	$618,616	0.05%	1.85%	$621,405	$394,552	$396,331	$84,000	$53,575	2020	$463,555
11		$0	$0		$1	$1	$618,616	0.05%	1.85%	$621,685	$377,201	$379,072	$84,000	$51,219	2021	$443,340
12		$0	$0	Recycle	$97,620	$56,906	$618,616	0.05%	1.85%	$621,965	$360,613	$362,565	$84,000	$48,967	2022	$480,912
13		$0	$0		$3	$2	$618,616	0.05%	1.85%	$622,245	$344,754	$346,776	$84,000	$46,813	2023	$405,517
14		$0	$0		$4	$2	$618,616	0.05%	1.85%	$622,525	$329,593	$331,675	$84,000	$44,754	2024	$387,833
15		$0	$0		$5	$3	$618,616	0.05%	1.85%	$622,805	$315,098	$317,232	$84,000	$42,786	2025	$370,921
16		$0	$0		$0	$0	$618,616	0.05%	1.85%	$623,085	$301,241	$303,417	$84,000	$40,905	2026	$354,743
17		$0	$0		$0	$0	$618,616	0.05%	1.85%	$623,365	$287,993	$290,204	$84,000	$39,106	2027	$339,273
18		$0	$0		$0	$0	$618,616	0.05%	1.85%	$623,646	$275,328	$277,567	$84,000	$37,386	2028	$324,478
19		$0	$0		$0	$0	$618,616	0.05%	1.85%	$623,927	$263,220	$265,480	$84,000	$35,742	2029	$310,327
20		$0	$0		$0	$0	$618,616	0.05%	1.85%	$624,207	$251,645	$253,919	$84,000	$34,170	2030	$296,794
21		$0	$0		$0	$0	$618,616	0.05%	1.85%	$624,488	$240,578	$242,862	$84,000	$32,667	2031	$283,851
22		$0	$0		$0	$0	$618,616	0.05%	1.85%	$624,769	$229,998	$232,286	$84,000	$31,231	2032	$271,473
23		$0	$0		$0	$0	$618,616	0.05%	1.85%	$625,050	$219,883	$222,170	$84,000	$29,857	2033	$259,634
24		$0	$0		$0	$0	$618,616	0.05%	1.85%	$625,332	$210,214	$212,496	$84,000	$28,544	2034	$248,312
25		$0	$0	Recycle	$97,620	$31,714	$618,616	0.05%	1.85%	$625,613	$200,969	$203,242	$84,000	$27,289	2035	$269,197
		$5,748,160	**$5,748,160**		$195,253	**$88,627**	$15,465,400			$15,556,199	$9,079,283	**$9,123,179**	$2,100,000	***$1,232,848***		***$16,506,897***

Opt-7b - New Induction Luminaires
4100K Luminaires

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

DOE Region: West
Analysis Sector: Industrial

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring (e.g., maintenance) PV $	Year Date	Discounted Total Costs PV $
0	First Cost	$4,966,105	$4,966,105	n/a	n/a	n/a	$795,148	0.05%		[illegible]			$24,000			$4,966,105
1		$0	$0		$0	$0	$795,148	0.05%	1.85%	$795,506	$760,180	$760,522	$24,000	$22,945	2011	$783,466
2		$0	$0		$0	$0	$795,148	0.05%	1.85%	$795,864	$726,749	$727,403	$24,000	$21,936	2012	$749,339
3		$0	$0		$0	$0	$795,148	0.05%	1.85%	$796,222	$694,789	$695,727	$24,000	$20,971	2013	$716,698
4		$0	$0		$0	$0	$795,148	0.05%	1.85%	$796,580	$664,234	$665,431	$24,000	$20,049	2014	$685,479
5		$0	$0		$0	$0	$795,148	0.05%	1.85%	$796,939	$635,023	$636,453	$24,000	$19,167	2015	$655,620
6		$0	$0		$0	$0	$795,148	0.05%	1.85%	$797,297	$607,097	$608,738	$24,000	$18,324	2016	$627,062
7		$0	$0		$0	$0	$795,148	0.05%	1.85%	$797,656	$580,398	$582,229	$24,000	$17,518	2017	$599,747
8		$0	$0		$0	$0	$795,148	0.05%	1.85%	$798,015	$554,874	$556,875	$24,000	$16,748	2018	$573,623
9		$0	$0		$0	$0	$795,148	0.05%	1.85%	$798,374	$530,472	$532,625	$24,000	$16,011	2019	$548,636
10		$0	$0		$0	$0	$795,148	0.05%	1.85%	$798,733	$507,144	$509,431	$24,000	$15,307	2020	$524,738
11		$0	$0	Ballasts	$143,176	$87,301	$795,148	0.05%	1.85%	$799,093	$484,841	$487,246	$24,000	$14,634	2021	$589,182
12		$0	$0	Ballasts	$143,176	$83,462	$795,148	0.05%	1.85%	$799,452	$463,519	$466,028	$24,000	$13,990	2022	$563,481
13		$0	$0	Ballasts	$143,176	$79,792	$795,148	0.05%	1.85%	$799,812	$443,135	$445,734	$24,000	$13,375	2023	$538,901
14		$0	$0	Ballasts	$143,176	$76,283	$795,148	0.05%	1.85%	$800,172	$423,647	$426,324	$24,000	$12,787	2024	$515,394
15		$0	$0	Ballasts	$143,176	$72,928	$795,148	0.05%	1.85%	$800,532	$405,016	$407,759	$24,000	$12,225	2025	$492,912
16		$0	$0		$0	$0	$795,148	0.05%	1.85%	$800,892	$387,205	$390,002	$24,000	$11,687	2026	$401,689
17		$0	$0		$0	$0	$795,148	0.05%	1.85%	$801,253	$370,177	$373,019	$24,000	$11,173	2027	$384,192
18		$0	$0		$0	$0	$795,148	0.05%	1.85%	$801,613	$353,898	$356,775	$24,000	$10,682	2028	$367,457
19		$0	$0		$0	$0	$795,148	0.05%	1.85%	$801,974	$338,334	$341,239	$24,000	$10,212	2029	$351,451
20		$0	$0		$0	$0	$795,148	0.05%	1.85%	$802,335	$323,455	$326,379	$24,000	$9,763	2030	$336,142
21		$0	$0		$0	$0	$795,148	0.05%	1.85%	$802,696	$309,231	$312,166	$24,000	$9,334	2031	$321,500
22		$0	$0		$0	$0	$795,148	0.05%	1.85%	$803,057	$295,632	$298,572	$24,000	$8,923	2032	$307,495
23		$0	$0		$0	$0	$795,148	0.05%	1.85%	$803,419	$282,631	$285,570	$24,000	$8,531	2033	$294,101
24		$0	$0		$0	$0	$795,148	0.05%	1.85%	$803,780	$270,201	$273,135	$24,000	$8,156	2034	$281,290
25		$0	$0	Recycle	$191,340	$62,160	$795,148	0.05%	1.85%	$804,142	$258,319	$261,241	$24,000	$7,797	2035	$331,198
		$4,966,105	**$4,966,105**		$907,220	**$461,927**	$19,878,700			$19,995,410	$11,670,202	**$11,726,624**	$600,000	***$352,242***		***$17,506,898***

Opt-7c - Metal Halide Luminaires in Combination w/ 4100K LED or Induction

Analysis Month/Year: 10/2011
Yrs before "On-Line": 0

Years of Project Service: 2011
Years in Analysis Period: 4.6%

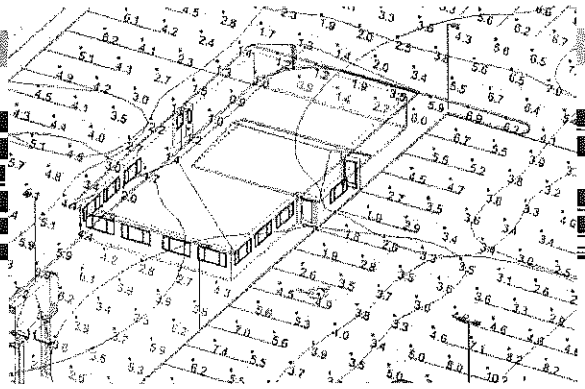
DOE Region: West
Analysis Sector: Industrial

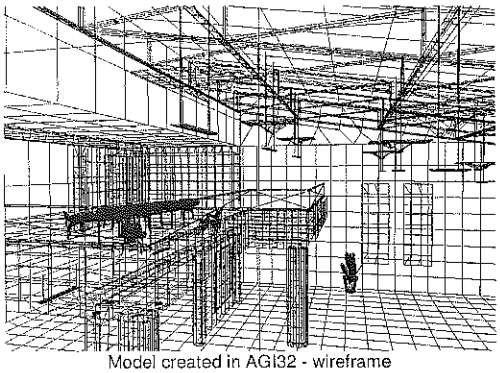
	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS						ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year #	Description of Cost	Constant $	Discounted PV $	Description of Cost	Constant $	Discounted PV $	Annual Recurring Electric Constant $	Electric Differential Escalation %	Electric Nominal Escalation %	Escalated only (no discount) PV $	Discounted only (no fuel esc) PV $	Discounted Electric w/Fuel Esc. PV $	Annual Recurring (e.g., maintenance) Constant $	Discounted Recurring (e.g., maintenance) PV $	Year Date	Discounted Total Costs PV $.
0	First Cost	$3,649,648	$3,649,648	n/a	n/a	n/a	$556,754	0.05%					$75,000			$3,649,648
1		$0	$0		$0	$0	$556,754	0.05%	1.85%	$557,005	$532,270	$532,509	$75,000	$71,702	2011	$604,211
2		$0	$0		$0	$0	$556,754	0.05%	1.85%	$557,255	$508,862	$509,320	$75,000	$68,548	2012	$577,869
3		$0	$0		$0	$0	$556,754	0.05%	1.85%	$557,506	$486,484	$487,141	$75,000	$65,534	2013	$552,675
4		$0	$0		$0	$0	$556,754	0.05%	1.85%	$557,757	$465,090	$465,927	$75,000	$62,652	2014	$528,579
5		$0	$0		$0	$0	$556,754	0.05%	1.85%	$558,008	$444,636	$445,638	$75,000	$59,897	2015	$505,534
6		$0	$0		$0	$0	$556,754	0.05%	1.85%	$558,259	$425,083	$426,232	$75,000	$57,263	2016	$483,494
7		$0	$0		$0	$0	$556,754	0.05%	1.85%	$558,510	$406,389	$407,670	$75,000	$54,744	2017	$462,415
8		$0	$0		$0	$0	$556,754	0.05%	1.85%	$558,761	$388,517	$389,918	$75,000	$52,337	2018	$442,255
9		$0	$0		$0	$0	$556,754	0.05%	1.85%	$559,013	$371,431	$372,938	$75,000	$50,035	2019	$422,973
10		$0	$0		$0	$0	$556,754	0.05%	1.85%	$559,264	$355,097	$356,698	$75,000	$47,835	2020	$404,533
11		$0	$0	Ballasts	$143,176	$87,301	$556,754	0.05%	1.85%	$559,516	$339,480	$341,165	$75,000	$45,731	2021	$474,197
12		$0	$0	Ballasts	$143,176	$83,462	$556,754	0.05%	1.85%	$559,768	$324,551	$326,308	$75,000	$43,720	2022	$453,490
13		$0	$0	Ballasts	$143,176	$79,792	$556,754	0.05%	1.85%	$560,020	$310,278	$312,098	$75,000	$41,797	2023	$433,688
14		$0	$0	Ballasts	$143,176	$76,283	$556,754	0.05%	1.85%	$560,272	$296,633	$298,507	$75,000	$39,959	2024	$414,750
15		$0	$0	Ballasts	$143,176	$72,928	$556,754	0.05%	1.85%	$560,524	$283,588	$285,508	$75,000	$38,202	2025	$396,639
16		$0	$0		$0	$0	$556,754	0.05%	1.85%	$560,776	$271,117	$273,075	$75,000	$36,522	2026	$309,597
17		$0	$0		$0	$0	$556,754	0.05%	1.85%	$561,029	$259,194	$261,184	$75,000	$34,916	2027	$296,100
18		$0	$0		$0	$0	$556,754	0.05%	1.85%	$561,281	$247,795	$249,810	$75,000	$33,380	2028	$283,190
19		$0	$0		$0	$0	$556,754	0.05%	1.85%	$561,534	$236,898	$238,932	$75,000	$31,912	2029	$270,844
20		$0	$0		$0	$0	$556,754	0.05%	1.85%	$561,786	$226,480	$228,527	$75,000	$30,509	2030	$259,036
21		$0	$0		$0	$0	$556,754	0.05%	1.85%	$562,039	$216,520	$218,575	$75,000	$29,167	2031	$247,743
22		$0	$0		$0	$0	$556,754	0.05%	1.85%	$562,292	$206,998	$209,057	$75,000	$27,885	2032	$236,942
23		$0	$0		$0	$0	$556,754	0.05%	1.85%	$562,545	$197,895	$199,953	$75,000	$26,658	2033	$226,612
24		$0	$0		$0	$0	$556,754	0.05%	1.85%	$562,798	$189,192	$191,246	$75,000	$25,486	2034	$216,732
25		$0	$0	Recycle	$97,620	$31,714	$556,754	0.05%	1.85%	$563,051	$180,872	$182,918	$75,000	$24,365	2035	$238,997
		$3,649,648	**$3,649,648**		$813,500	**$431,480**	$13,918,850			$14,000,569	$8,171,349	**$8,210,855**	$1,875,000	***$1,100,758***		***$13,392,740***

ATTACHMENT #1

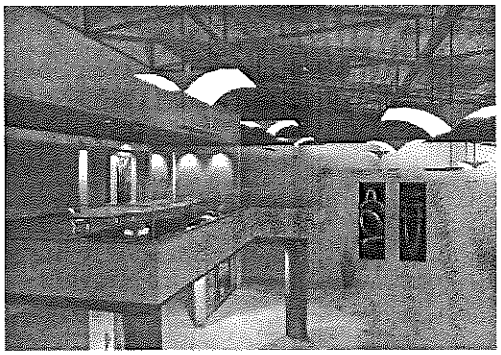
AGi32 lighting software
by Lighting Analysts

THIS STUDY UTILIZED THE RECENTLY-RELEASED VERSION 2.2 , WHICH INCORPORATES RECENT INDUSTRY ADVANCEMENTS IN ROADWAY LIGHTING DESIGN STANDARDS.





Model created in AGI32 - wireframe



Rendered: radiosity plus raytrace

AGi32 lighting software

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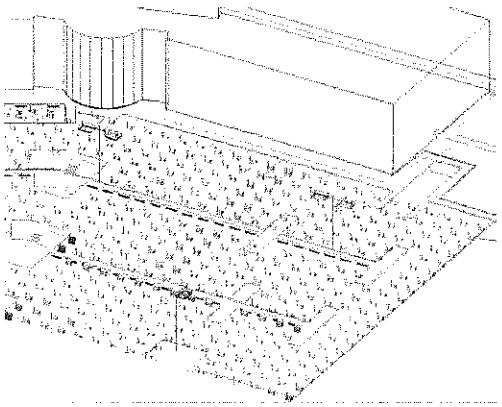

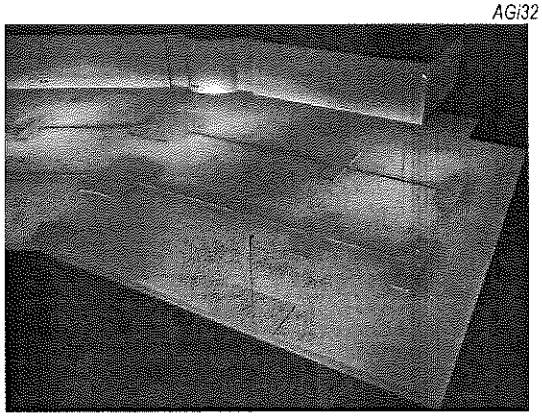

Specific Calculations

AGI32 can perform a variety of illumination engineering calculations for your specification requirements. Which entities you compute will depend on the lighting application.

Application	Computation possibilities
Interior	Illuminance (fc or lux) Horizontal, Vertical, Variable meter aiming Luminous Exitance (lms/sq ft or lms/sq m) Lighting Power Density (watts/ sq ft) Unified Glare Rating Luminance (cd/m^2) in rendered pseudocolor
Exterior (general)	Illuminance (fc or lux) Horizontal, Vertical, Variable meter aiming Luminous Exitance (lms/sq ft or lms/sq m) from surfaces Lighting Power Density (watts/ sq ft) Luminance (cd/m^2) in rendered pseudocolor
Sports	Illuminance (fc or lux) Horizontal, Vertical, Variable meter aiming (TV illuminance) CIE Glare Rating Uniformity Gradient, Coefficient Variance Aiming diagrams
Roadway	Illuminance (fc or lux) Horizontal, Vertical, Variable meter aiming Lighting Power Density (watts/ sq ft) Pavement Luminance (cd/m^2) [IES, CIE, CIE-AS methods] Veiling Luminance Small Target Visibility (STV)
Daylighting	Illuminance (fc or lux) Horizontal, Vertical, Variable meter aiming Daylight Factor (DF), automatic LEED 2.1 criteria Luminance (cd/m^2) in rendered pseudocolor Luminous Exitance (lms/sq ft or lms/sq m) from surfaces

AGi32 lighting software
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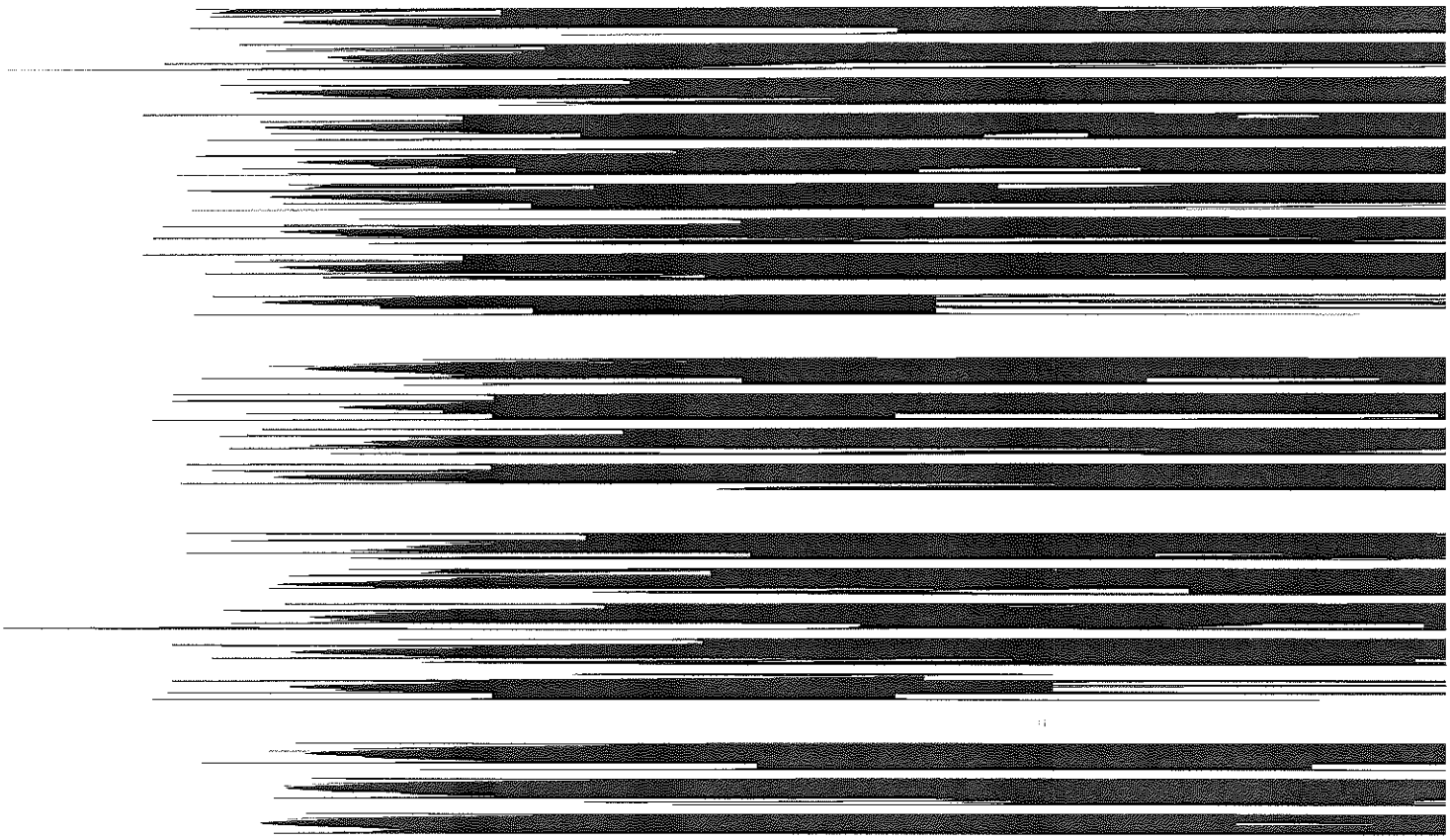
Roadway Calculations in AGi32 Version 2.1

Introduction



Roadway Optimizer	page 2
Calculation Points – Roadway command	page 5
Roadway Calculations in 3-dimensional Environments	page 7
Roadway Standard Configuration Tool	page 9

[1] Roadway specific calculations refers to the calculation of pavement luminance and related quantities

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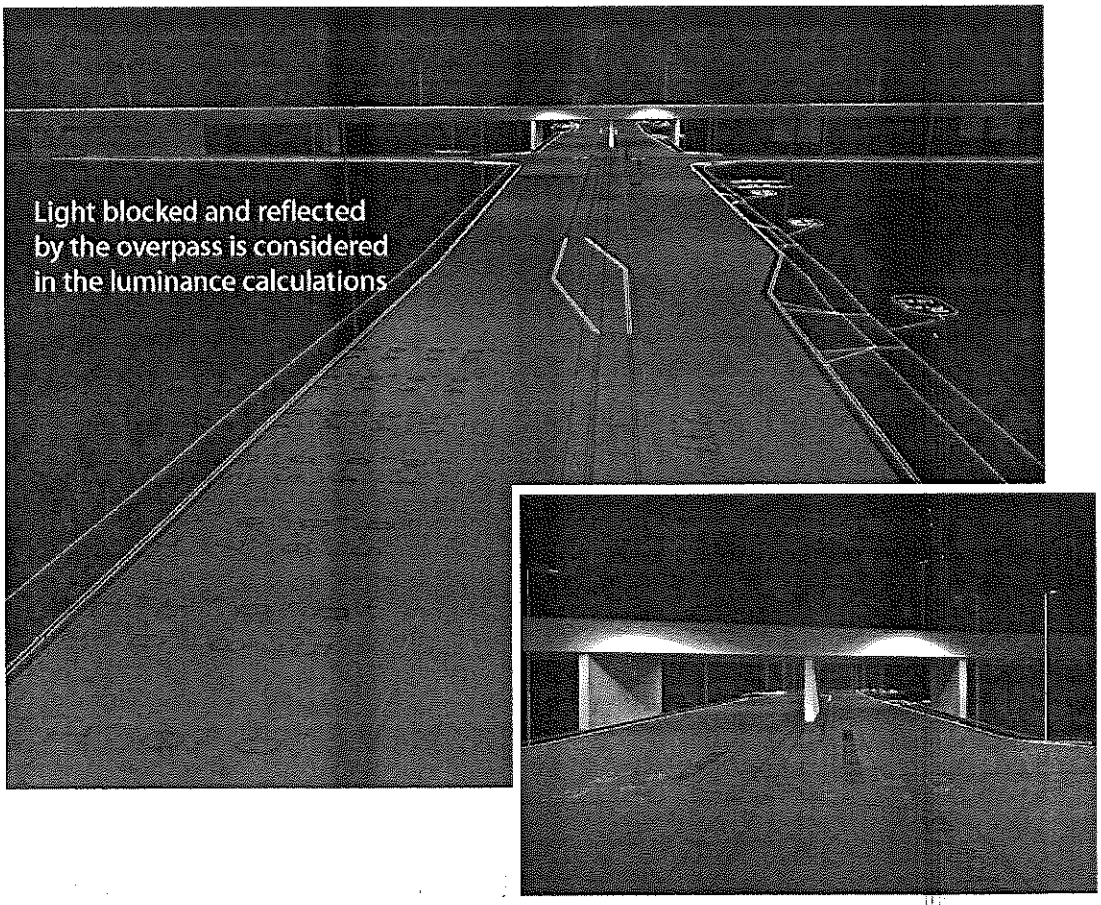

Figure 8 – Reflective surfaces (objects) considered in the roadway calculations

Roadway Standard Configuration Tool

There are a number of unique calculations associated with each international roadway standard (North American IES-RP-8-2000, British BSEN 13201-3.2003, European CIE-140-2000, Australian AS1158.2-2005 and New Zealand NZ1158.2-2005). Consider that any software tool must compute a multitude of metrics such as: Illuminance, Pavement Luminance, Veiling Luminance, Visibility Level, Surround Illuminance, Background Luminance, and more for each specific roadway section to be analyzed. Each international standard stipulates similar but different calculations and parameters can vary dramatically.

At Lighting Analysts, we believe we may be the only people that have ever tried to support all of the popular international roadway standards giving us a unique perspective when constructing our new roadway calculation engine. Placing all of the standard calculations in a single software tool begged for underlying code that could handle variations in calculation specifics such that each standard could simply modify a few variables and utilize the same engine. We are proud to have achieved this goal, but perhaps more importantly, we arrived at a landmark decision in the process: Why not

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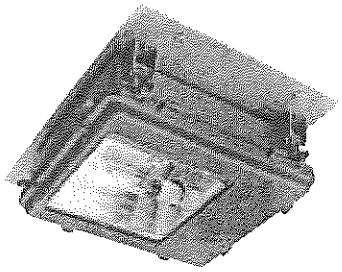
ATTACHMENT #2

TUNNEL GUARD™ LUMINAIRE



APPLICATIONS

- For tunnels and underpasses

SPECIFICATION FEATURES

- Ⓤ /ⓤ 1598 Listed **Suitable for Wet Locations**
- Available with option for Ⓤ1598A "Suitable for Outdoor, Salt Water Marine Locations" Contact factory
- Low-glare, specialized photometrics
- Flat surface for semi-recessed ceiling mounting
- No-tool fixture removal for quick maintenance (surface mounted only)
- Heavy-duty die-cast aluminum housing
- Zinc-rich epoxy charcoal gray powder paint finish on housing
- Stainless steel external hardware
- Door assembly hinged and latched for no-tool installation and removal
- Terminal Board is standard
- Tempered glass lens
- ALGLAS® finish on aluminum reflector
- No-tool lamp replacement
- Plug-in no-tool replaceable ignitor
- Standard unit comes with 4 feet of #12-3 cable out the back of the unit
- Unistrut mounting adapter kit available – contact factory
- Luminaire normally shipped with hinges and latches. **CEILING MOUNTING PLATE (CMPxxx) IS REQUIRED AND MUST BE ORDERED SEPARATELY.** (See Mounting Accessory Selection Table listing.)

ORDERING NUMBER LOGIC

PRODUCT IDENT	WATTAGE	LIGHT SOURCE	VOLTAGE	BALLAST TYPE	AMBIENT °C	IES DISTRIBUTION TYPE	BEAM ROTATION	COLOR	OPTIONS
XXX	XX	X	X	X	X	XXX	XX	XX	XXX
TUN= Tunnel Guard Luminaire	07 = 70 10 = 100 15 = 150 (55V) 20 = 200 25 = 250 40 = 400	S = HPS M = MH Standard: Lamp not included.	60Hz 1 = 120 2 = 208 3 = 240 4 = 277 5 = 480 D = 347	See Ballast and Photometric Selection Table A = Autoreg G = Mag-Reg with Grounded Socket Shell H = HPF Reactor or Lag K = Hot Restart M = Mag-Reg N = NPF Reactor or Lag P = CWI with Grounded Socket Shell	4 = 40	See Ballast and Photometric Selection Table CBM = Counter-Beam HTV = Horizontal Type V SYM = Symmetrical (Medium Base Lamp) STM = Symmetrical (Mogul Base Lamp) MC3 = Medium, Cutoff, Type III MC4 = Medium, Cutoff, Type IV	NOTE: Determined by the orientation of luminaire on tunnel ceiling. Tunnel drawings of mounting configurations required.	CG = Charcoal Gray	F = Fusing

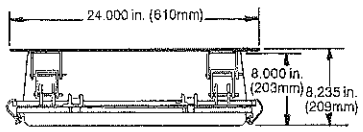
PHOTOMETRIC SELECTION TABLE

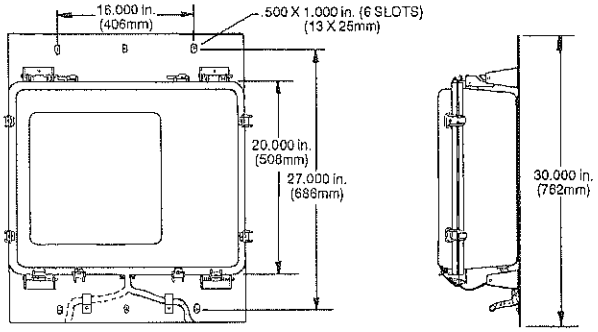
Wattage	Light Source	Socket Base Size	Photometric Distribution	Photometric Curve Number 35-17-----

TUNNEL GUARD™ LUMINAIRE

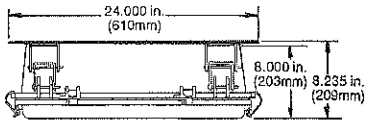
FIXTURE DIMENSIONS

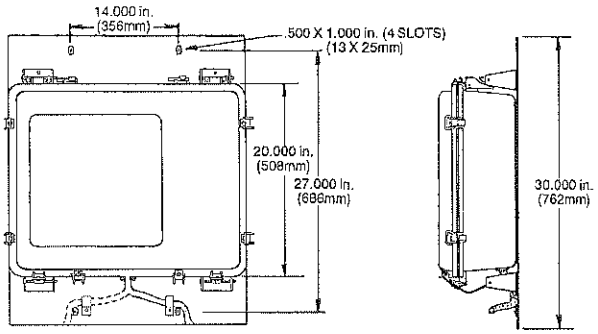
CMP001 - Ceiling Mounting Plate





CMP002 - Ceiling Mounting Plate





DATA

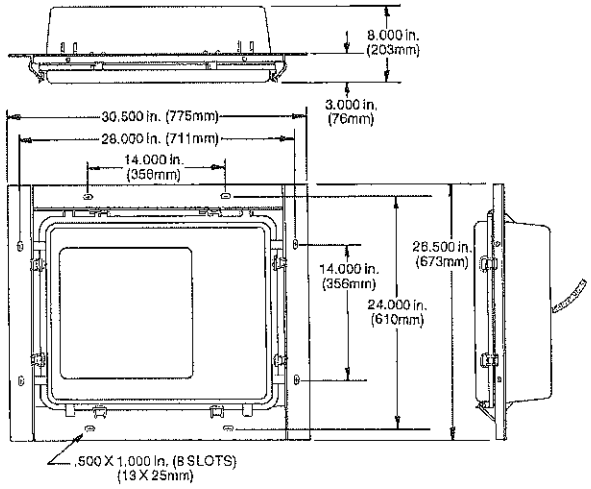
Approximate Net Weight	60 lbs	27 kgs
Suggested Mounting Height	16 ft.	5 M

MOUNTING ACCESSORY SELECTION TABLE

ONE REQUIRED PER LUMINAIRE

CMP001 = Ceiling Mounting Plate (with six bolts)
CMP002 = Ceiling Mounting Plate (with four bolts)

Semi-Recessed Mounting (No UL)



REFERENCES

See Page R-48 for start of Accessories.
See Page R-52 for Explanation of Options and Other Terms Used.

BALLAST SELECTION TABLE

Wattage	Light Source	Ballast Type / Voltage 60HZ 120,208,240, 277,480	347 120x347
70, 100, 150 (55V)	HPS	G, H, K, M, N	G,H,M*,N
200, 310	HPS	A, M	N/A
200, 310	HPS	A, M	N/A
250, 400	HPS	A, G, K**, M	A, G, M
250, 400	HPS	A, G, K**, M	A, G, M
400	MH	A	A
400	MH	A	A

NOTE: N/A = Not available
*Not available in 120X347V
**400W watt only

BASF

The Chemical Company

ATTACHMENT #3

PRODUCT DATA

09 90 00 Painting

PARKCOAT™

Highly reflective, water-based, acrylic coating for the interior of parking structures

Description

Parkcoat™ is a one-coat water-based, VOC-compliant acrylic coating with an 88% light reflectance rating. Use it on the interior walls and ceilings of parking garages for added light and security.

Yield

Concrete (precast and cast in place): 125 – 175 ft²/gallon (3.1 – 4.3 m²/L)

Concrete block, brick, or stucco: 100 – 150 ft²/gallon (2.5 – 3.7 m²/L)

Coverage rates will vary with the texture and porosity of the substrate. Test applications or actual job-site substrate samples will determine the actual rate.

Wet and dry mils:
See page 3 for chart.

Packaging

5 gallon (18.93 L) pails

55 gallon (208 L) drums; special order only

Color

White

Shelf Life

18 months when properly stored.

Storage

Store in unopened containers in cool, clean, dry area. Protect Parkcoat™ from freezing in the container; do not store below 35° F (2° C).

Features	Benefits
• Water based	Has low odor
• VOC compliant	Environmentally friendly
• High light reflectivity	Enhances the security of garages; offers an economical alternative to additional lighting
• No dirt pick-up	Maintains attractive appearance
• One-coat coverage	Lowers labor and material costs; returns structures to service quickly

Where to Use

APPLICATION

- Parking structures
- Ceilings
- Walls
- Beams
- Columns

LOCATION

- Overhead and vertical
- Interior and exterior
- Above grade

SUBSTRATE

- Concrete
- Brick
- Stucco
- Block
- Primed wood or metal

How to Apply

Surface preparation

1. Concrete must be fully cured (28 days), structurally sound, clean, and dry.

2. Mildew and fungus must be completely removed before the application of Parkcoat™. Wash surfaces vigorously with a solution of 1 tablespoon of detergent and 1 – 2 pints of liquid bleach in 1 gallon of water (0.125 – 0.25 liters per liter). Rinse thoroughly with clean water.

3. Pressure clean (minimum 2,100 psi) to remove all dust, dirt, grease, oil, loose particles, laitance, foreign materials, release agents, peeling and defective coatings, and chalk.

4. Allow surface to dry a minimum of 24 hours before proceeding.

Priming

Highly chalky surfaces must be properly cleaned, and they require an appropriate primer. See Chalky Surface Primer VOC (Form No. 1017908) for instructions.

Sonneborn

Technical Data

Composition

Parkcoat™ is a proprietary blend of acrylic polymers with special additives dispersed in a water base.

Typical Properties

PROPERTY	VALUE
Weight per gallon, lbs (kg) (ASTM D 1475)	10.6 (4.8)
Solids by weight, % (ASTM D 2369)	51.4
Solids by volume, % (ASTM D 5201)	44.8
Viscosity at 77°F (25°C), KU (ASTM D 562)	122 – 131
pH	8.8 – 9.3

Test Data

PROPERTY	RESULTS	TEST METHODS
Tensile Strength, psi (MPa)	567 (3.9)	ASTM D 412
Elongation at break,%	35	ASTM D 412
Water vapor, dry perms	2.1	ASTM D 1653
wet perms	15	ASTM E 96
Light Reflectance, %		ASTM E 1164
Parkcoat	88	
Light Concrete	52	
Dark Concrete	27	
Parkcoat over Light Concrete	88	
Parkcoat over Dark Concrete	88	
Flame Spread*	10	ASTM E 84
Smoke Development*	10	ASTM E 84

Test results are averages obtained under laboratory conditions. Reasonable variations can be expected.
*Scale of 0-200; 0 is best

›lication

BRUSH

Use a stiff-fiber or nylon short-bristled brush. On open-textured surfaces, thoroughly work the coating into the pores of the surface to fill completely. Flow the coating onto the surface using straight strokes.

ROLLER

Using a fully loaded 1/2 – 3/4" (13 – 19 mm) nap roller, apply the coating to the surface in a uniform manner. Do not overroll.

SPRAY

For spray equipment recommendations, contact the equipment manufacturer.

Drying Time

Drying time is 2 – 4 hours at 70° F (21° C) and 50% relative humidity.

Clean Up

Clean brushes, rollers, and tools with water and mild detergent immediately after use.

For Best Performance

- Apply a 4 by 4 ft (1.2 by 1.2 m) test area to verify acceptable color, texture, and adhesion before proceeding with any project.
- Protect from freezing in the container.
- Apply at temperatures above 40° F (4° C).
- Highly chalky surfaces require a primer (see Priming section).
- Do not apply over fresh concrete; allow to fully cure at least 28 days.
- Do not apply to damp, frozen, or frost-covered surfaces.
- Not for use as a wearing surface.
- Make certain the most current versions of product data sheet and MSDS are being used; call Customer Service (1-800-433-9517) to verify the most current versions.
- Proper application is the responsibility of the user. Field visits by BASF personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.

Health and Safety

PARKCOAT™

Caution

Parkcoat™ contains crystalline quartz silica and zinc oxide.

Risks

May cause eye, skin or respiratory irritation. Ingestion may cause irritation. INTENTIONAL MISUSE BY DELIBERATELY IN HALING THE CONTENTS MAY BE HARMFUL OR FATAL.

Precautions

KEEP OUT OF THE REACH OF CHILDREN. Avoid contact with eyes, skin and clothing. Use with adequate ventilation. DO NOT take internally. Wash thoroughly after handling. Use impervious gloves, eye protection and if the TLV is exceeded or if used in a poorly ventilated area, use NIOSH/MSHA approved respiratory protection in accordance with federal, state and local regulations. Keep container closed when not in use.

ATTACHMENT #4

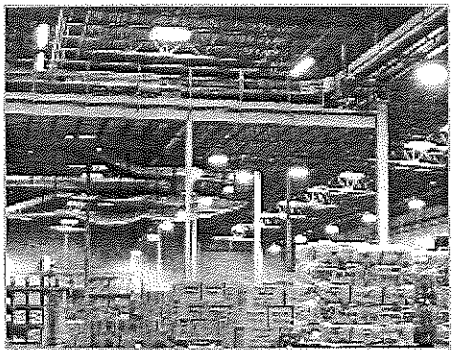
GE
Lighting

Lower Disposal Costs.
Lower Maintenance Costs.

One Lamp. Two Solutions.

Ecolux® NC™

Non-Cycling, Low Mercury HPS Lamps



Applications:

Roadway Lighting

Parking Areas

Industrial

Wherever you have fluorescent lighting, use GE Ecolux® and Ecolux® XL reduced mercury fluorescent lamps.

Reduced mercury for lower disposal costs.

Environmentally-friendly Ecolux®NC™ lamps feature mercury reduction of 56% up to 93% vs. standard HPS lamps and a lead-free base. Passes the EPA Toxicity Characteristic Leaching Procedure Test (TCLP), substantially lowering disposal costs (up to $4 per lamp reduction), where applicable.*

Non-cycling makes end-of-life replacement quick and easy.

Most high pressure sodium lamps will cycle on and off when approaching end of life, making expired lamps difficult to locate and replace. The Ecolux NC lamps simply die, they will not light, so it is easy to spot for replacement. This can reduce maintenance service trips thus reducing labor costs by $20 per lamp in a typical streetlighting system.

More light.

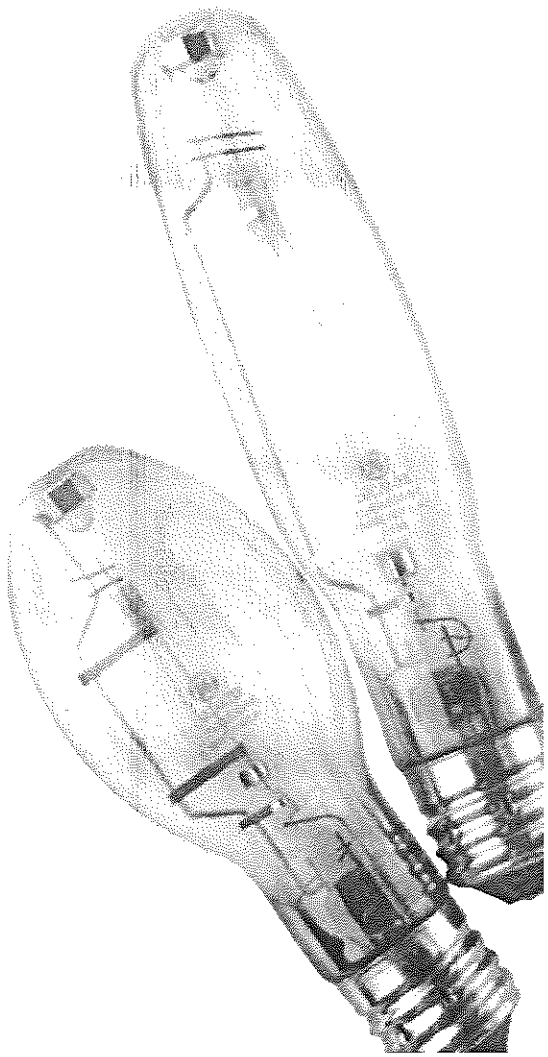
Popular 100- and 400-watt types feature 6% and 11% higher initial lumens, respectively, than standard lamps. Other wattages deliver the same high light output as standard HPS lamps.

Direct replacement of existing HPS lamps.

GE Ecolux NC lamps fit standard high pressure sodium sockets. No new ballasts or fixtures are needed.

Longer life and same outstanding efficiency as standard HPS lamps.

*State regulations vary. Consult your state EPA.



imagination at work

GE Ecolux LU Non-Cycling, Low Mercury High Pressure Sodium Lamp Specifications

PRODUCT INFORMATION	CLEAR 70-WATT ELLIPTICAL	CLEAR 100-WATT ELLIPTICAL	CLEAR 150-WATT ELLIPTICAL	CLEAR 250-WATT TUBULAR	CLEAR 400-WATT TUBULAR	CLEAR 200-WATT TUBULAR
Product Code	14672	14673	40390	14674	14675	45059
ANSI or IEC Code	S62ME-70	S54SB-100	S55SC-50	S50VA-250	S51WA-400	S66WA-200
Description	LU70/ECO/NC	LU100/ECO/NC	LU150/55/ECO/NC	LU250/ECO/NC	LU400/ECO/NC	LU200/ECO/NC
Physical Characteristics						
Burning Position	Universal	Universal	Universal	Universal	Universal	Universal
Bulb Designation	ED23.5	ED23.5	ED23.5	ED18	ED18	ET18
Bulb Material	Hard Glass	Hard Glass	Hard Glass	Hard Glass	Hard Glass	Hard Glass
Bulb Nominal Diameter, mm (in.)	75 (2 15/16")	75 (2 15/16")	75 (2 15/16")	57 (2 1/4")	57 (2 1/4")	57 (2 1/4")
Base Type	Mogul	Mogul	Mogul	Mogul	Mogul	Mogul
(Material)	(Brass/No Lead)	(Brass/No Lead)	(Brass/No Lead)	(Brass/No Lead)	(Brass/No Lead)	(Brass/No Lead)
Light Center Length, mm (in.)	127 (5")	127 (5")	127 (5")	146 (5 3/4")	146 (5 3/4")	146 (5 3/4")
Max. Overall Length, mm (in.)	197 (7 3/4")	197 (7 3/4")	197 (7 3/4")	248 (9 3/4")	248 (9 3/4")	248 (9 3/4")
Arc Length, mm (in.)	30 (1 1/8")	38 (1 1/2")	43 (1 5/8")	70 (2 3/4")	86 (3 3/8")	
Max. Bulb Temp. °C	400° C	400° C	400° C	400° C	400° C	400° C
Max. Base Temp. °C	210° C	210° C	210° C	210° C	210° C	210° C
Eccentricity: Bulb to Base	3°	3°	3°	3°	3°	3°
Eccentricity: Bulb to Arc Axis	3°	3°	3°	3°	3°	3°
Luminaire Characteristics — Open or Enclosed						
Nominal Lamp Watts	70	100	150	250	400	200
Nominal Lamp Volts	52	55	55	105	100	
Maximum Lamp Amps – Starting	2.4	3.2	4.8	4.5	7.5	
Nominal Lamp Amps – Operating	1.6	2.1	3.2	3.0	4.6	3.0
Max. Current Crest Factor	1.8	1.8	1.8	1.8	1.8	1.8
Ballast OCV, Minimum	110	110	110	198	198	198
Starting Pulse Requirements						
Pulse Peak Volts (min.)	2500	2500	2500	2500	2500	2500
(max.)	4000	4000	4000	4000	4000	4000
Min. Pulse Width (microseconds)	1 @ 2250	1 @ 2250	1 @ 2250	1 @ 2250	1 @ 2250	1 @ 2250
Min. Pulse Repetition	50 per second	50 per second	50 per second	50 per second	50 per second	50 per second
Min. Pulse Peak Current (amp)	0.2	0.2	0.2	0.2	0.2	0.2
Photometric Characteristics						
Initial Lumens	6300	9800	16000	29000	54000	22000
Mean Lumens @ 50% Rated Life	5670	8820	14400	26100	48600	19800
Average Rated Life (hrs.)	30000	30000	40000	40000	40000	30000
Color Rendering Index @ CCT (K)	23 @ 1900	23 @ 2000	23 @ 2000	30 @ 2000	30 @ 2100	22 @ 2200
Warm Up Time (Minutes) to 90%	3 to 4	3 to 4	3 to 4	3 to 4	3 to 4	3 to 4
Hot Restart Time (Minutes) to 90%	5 maximum	5 maximum	5 maximum	5 maximum	5 maximum	5 maximum
CIE Chromaticity Coordinates: X-	0.536	0.530	0.527	0.529	0.525	
CIE Chromaticity Coordinates: Y-	0.414	0.424	0.418	0.417	0.421	

Reference Lumens - Rated average lamp lumens obtained under controlled laboratory conditions in a prescribed burning position. Initial Reference Lumens refer to the lamp's lumen output after 100-hours burning. Mean Reference Lumens refer to the lamp lumen output at the mean lumen point during lamp life. The mean lumen point occurs at 50% rated life for high pressure sodium lamps. Lamp performance on typical systems under typical service conditions will vary from the reference lumens ratings.

Lumen maintenance is measured under specified test conditions at rated lamp watts for lamps that have been operated 10 or more burning hours per start on typical commercial ballasts. Rated mean lumens are measured at 50% of rated life, at rated lamp watts.

For spot relamping calculations, use an estimated average life (@ 10 hours/start) of 30,000 hours corresponding to 50% burnouts.

Caution—THE FOLLOWING INSTRUCTIONS MUST BE COMPLIED WITH TO HELP AVOID POSSIBLE SHATTERING AND EARLY FAILURE OF THE LAMP.
General Electric Company will not be responsible for poor lamp performance, personal injury or property damage resulting from failure to follow these instructions.

WARNING
- This is a vacuum jacket lamp and may implode if broken. As a precaution, wear safety glasses and gloves when installing or removing lamp.

CAUTION
- Electrically insulate any metal to glass support in fixture to avoid decomposition of the glass.
- Protect lamps from direct contact with liquids (such as rain, sleet or snow) to avoid breakage from thermal shock.
- Screw lamp firmly but not forcibly into the socket to minimize loosening due to vibration. Do not use excessive force as the glass bulb may break.
- Do not scratch glass bulb because it may break during installation or later during lamp operation.
- Turn power off and let lamp cool before removal to avoid potential burn and electrical shock hazard during lamp replacement.
- Do not touch the lamp base shell during operation to avoid potential electrical shock hazard.

Information provided is subject to change without notice. Please verify all details with GE.
values are design or typical values when measured under laboratory conditions, and GE
kes no warranty or guarantee, express or implied, that such performance will be
tained under end-use conditions.

For additional product and application information, please consult GE's Website: www.gelighting.com

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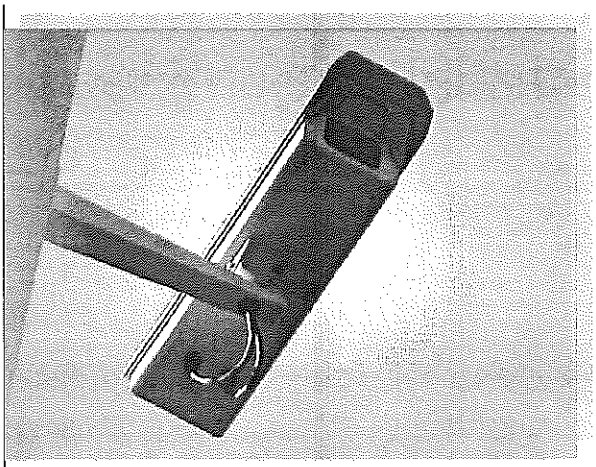
PLC MULTIPOINT, INC.

PHOTO LIGHTING CONTROL & SYSTEMS

SENSOR

Tunnel Photo Diode Sensor

Luminance & Illuminance Measurement



DESCRIPTION

PLC-Multipoint Photo Diode sensor provide a linear analog input signal to controllers proportional to the light measured. Sensors shall be enclosed in heated weatherproof housings to prevent icing and condensation. Sensors signal the controller via 4-20mA current loops.

OPERATION

As the light level increases during the day, the analog photodiode sensor responds with an increasing current. When the sensor saturates at its full scale output, it remains stable, until the light level drops and the sensor output begins to decrease.

Luminance Measurement

TLUM Tunnel luminance sensors provide analog measurement in Candelas per square meter (cd/m²) that target reflected light at each traffic direction's entrance portal. Long distance signal transmission, up to 5,000 feet is accomplished through a 4-20mA current loop. TLUM Tunnel luminance sensors see a restricted field of view, e.g. 20° and are aimed at the tunnel portals composing the field of vision that a driver at a safe stopping distance before entering the portal.

The TLUM sensor is capable of measuring outdoor ranges of 0 to 10,000 Candelas per square meter (cd/m²). An amplifier in the sensor enclosure provides sensitivity adjustment for the sensor. Sensors located in severe weather environment are protected from accumulated snow and ice through the use of thermostatically heated housings. Sensors subject to corrosive gases are housed in a gasket enclosures.

Illuminance Measurement

TMAS Tunnel illuminance sensors provide analog measurement in Foot-candles. TMAS sensors may be mounted to monitor ambient light near each entrance tunnel portal in unidirectional traffic bores or be located in a compromise location when both traffic directions share the same bore. The TMAS sensor mounting location is selected from several factors; unidirectional or bi-directional traffic flow, dominant traffic direction, time of year requiring most contrast lighting and maintainability.

FEATURES

Luminance: (TLUM)

- Measuring range of 0 - 10,000 cd/m².
- Photometric filter accuracy of 1% total area, error with CIE function error of 2%.
- Calibrated using NIST traceable reference photometer.
- Factory calibrated analog zero and span.

Illuminance: (TMAS)

- Low measuring range: 0 - 650 Fc
- High measuring range: 0 - 6,500 Fc
- Powered by 18-30VDC with polarity protection.
- 2 wire loop powered 4-20mA signal.
- Range changeable in the field, to either to 1/2 or twice the factory setting.
- Factory full scale response time 10 minutes.
- Time changeable for full scale response to 1 second, and 10 or 20 minutes.
- Program changes over 4-20mA signal wires up to 5,000 ft. away.

Photo Diode Sensors: (Both TLUM & TMAS)

- Blue-Enhanced Photo Diode
- Provide linear response, repeatability and minimal temperature effects over the range of the sensor.
- Components rated for 0° –60°C and housed in thermostatically controlled heated enclosure. Switching ON at 10°C and OFF at 27°C.
- 2 year warranty.

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Rev.2006-09-20

SENSOR

PHOTO DIODE SENSOR TECHNICAL DATA

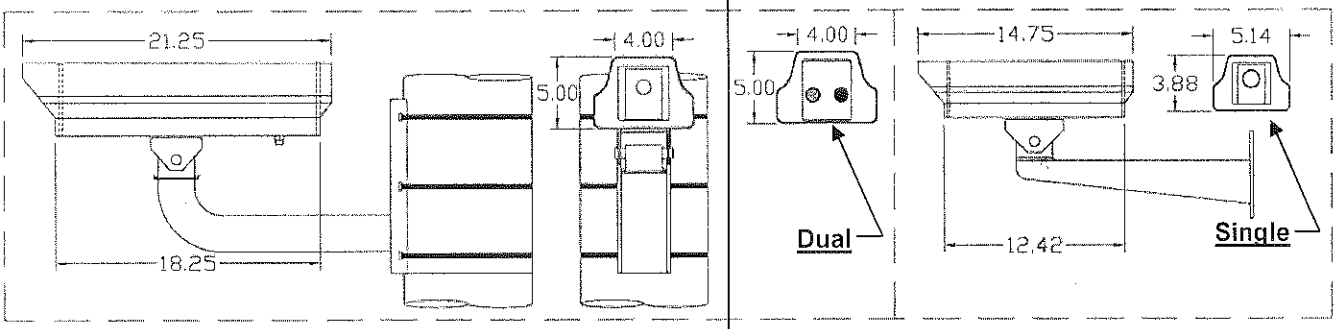
LUMINANCE

Accuracy: ?	Repeatability +/- 1% Linearity +/- 2% at 70 F (21 C) Temperature +/- 10%
Overall Tolerance:	+/- 12% over the spec light & temp. range
Operating Temp:	ON at 10°C and OFF at 27°C
Sensor Type:	Blue-enhanced Photo Diode
Sensor Ranges:	Housing — Factory Cal. Waterproof — 0 - 10,000 cd/m²
Compliance Voltage:	24VDC & 120VAC +/-1VDC
Field of View:	20 degrees
Protection:	Fused and MOV
Sensor Output:	4.0 - 20mA +.1/ - .1mA
Notes:	Photometric filter accuracy of 1% total area error with a CIE function error of 2%.

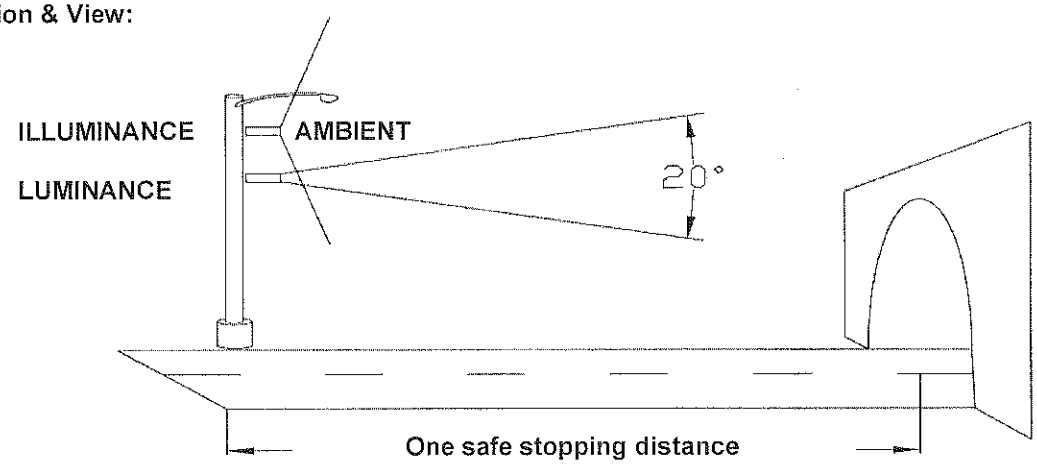
ILLUMINANCE

Accuracy:	Repeatability +/- 5% Linearity +/- 2% at 70 F (21 C) Temperature +/- 10%
Operating Temp:	-40 F to 140 F. (-40C to 60C)
Sensor Type:	Blue-enhanced Photo Diode
Sensor Ranges:	Housing — Factory Cal. Low: Waterproof — 0 - 650 Fc High: Waterproof — 0 - 6,500 Fc
Compliance Voltage:	24VDC +6VDC / -6VDC
Protection:	Non Polarized Voltage Limited
Loop Burden:	<10 VDC
Sensor Output:	4.0 - 20mA +.1/ - .1mA
Overall Tolerance:	+/- 12% over the spec light & temp. range
Notes:	Field scalable with MAS-CAL. See MAS & MAS-CAL data sheet for more info.

Dimension:



Sensor Location & View:



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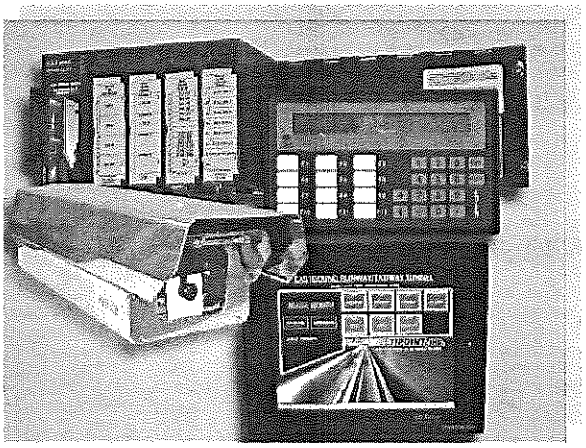
PLC MULTIPOINT, INC.

PHOTO LIGHTING CONTROL & SYSTEMS

T54-1

Tunnel Lighting
Microprocessor Controller



CONTROLLER

DESCRIPTION

PLC-Multipoint T54-1 controller is a microprocessor based lighting controller and operator interface used for night and contrast lighting control applications. The T54-1 receives a linear analog light level signal from either a PLC-Multipoint **TLUM** Luminance measuring sensor or a **TMAS** Illuminance measuring sensor and provides a maintained signal output for each of six controlled output levels.

ADJUSTABILITY/OPERATION

All sensor input have a sensitivity adjustment to allow for precise full scale range scaling. Each of the 12 channels has a night or contrast lighting mode, an adjustable input delay, separate high and low setpoints for switching the lighting outputs and an adjustable hold-on-timer.
The T54-1 monitors up to 4 luminance or illuminance Photo sensors and independently switches 12 dry contact relay outputs. All configuration is accomplished through a two line, forty character text display with a numeric and function keypad or through an 800 x 600 Windows CE graphics front panel operator interface display.

CONSTRUCTION

The microprocessor controller is an industrially packaged modular unit with flash memory, analog inputs and relay outputs. Program and factory defaults are stored in flash memory. The operator interface connects to the controller via serial communications. The T54-1 is housed in a NEMA 1, 4 or 12 enclosure depending on the location. The T54-1 is pre-wired and tested to UL508A requirements for industrial control equipment.

APPLICATION

The T54-1 controller is used in transportation lighting control in highway or freeway tunnels where each traffic direction has its own bore. Multiple switching levels provide precise lighting controls in portal, threshold and transition tunnel zones. Customized interface to supervisory computer (SCADA) systems include the following protocols.

- Modbus
- Modbus TCP
- SNP
- Genius

COMMUNICATION

The T54-1 controller communication hardware supports RS232, RS485 and Ethernet standards using Copper or Fiber Optic media. T54-1 controller has a capacity for future expansion and integration. The T54-1 controller and photo sensors can also be directly wired or communicate through network. The T54 architecture supports Hot Synchronized Dual Processor redundancy.

FEATURES

- Uses TLUM luminance sensors with the range of 0 - 10,000 cd/m².
- Uses TMAS illuminance sensors with ranges of 0 - 750 FC or 100 - 6,500 FC.
- Front panel selector switches can override each output channel for maintenance.
- Optional time clock allows time of day control.
- Easy to use operator interface allows fast setup and configuration.
- Factory program and configurations are stored in flash memory.
- Field changes are stored in battery backed memory for up to two years without power.
- Adjustable ascending time delay for lightning, descending time delay for clouds.
- HID fixtures are protected with adjustable Hold-On-Time to prevent short cycling and Cool-Down-Time to prevent hot re-strikes.

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CONTROLLER

TECHNICAL DATA

T54-1 SYSTEM

Accuracy:	12 bit analog to digital conversion 0.5% resolution.
Sensor:	Luminance Sensors - (See **TLUM** data) Illuminance Sensor - (See **TMAS** data)
Input:	Switch position Auxiliary dry contact
Power:	120VAC input and switching 24VDC low voltage 75VA minimum required
Deadband:	Adjustable contrast or night lighting over full range of sensor.
Output:	12 single pole 20A contacts wired to terminal blocks.
Operators:	12 Hand / Off / Auto selector switches with integral pilot lights.
Enclosure:	Nema1 standard, 4 or 12 optional.
Option:	Time-clock SCADA interface
Listing:	ETL accreditation for industrial control equipment. UL508A Certified.

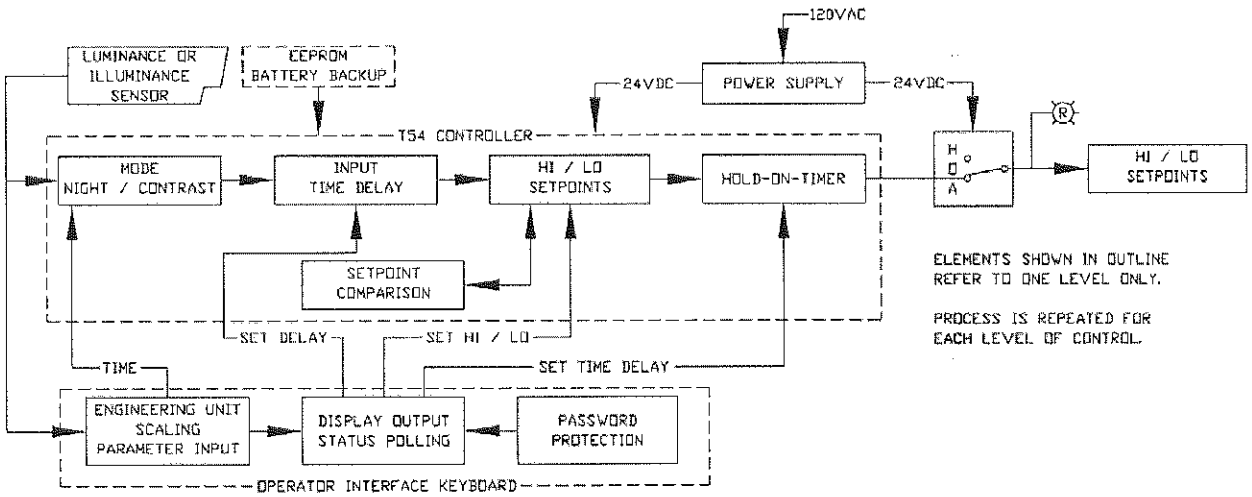
OPERATOR INTERFACE

Type:

***TEXT**	2 line LCD in Nema4 housing with numeric keypad and function keys.
***GRAPHICS**	800 x 600 Windows CE touch screen graphic terminal.

Menu:

F1	MENU
F2	AUTO STATUS
F3	REVIEW LEVEL
F4	CONTROL CONFIGURATION PROGRAM: NIGHT / CONTRAST INPUT TIME DELAY HIGH / LOW SETPOINT HOLD ON / OFF TIME TEST: (NO TIMERS) RUN: MANUAL ON/OFF/AUTO
F5	SENSOR CONFIGURATION ENGINEERING UNIT RATIO & OFFSET
F6	STAGGER START / STOP INTERVAL
F7	DISPLAY RESET



T54-1 System Block Diagram

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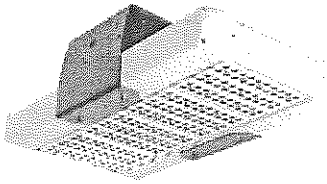
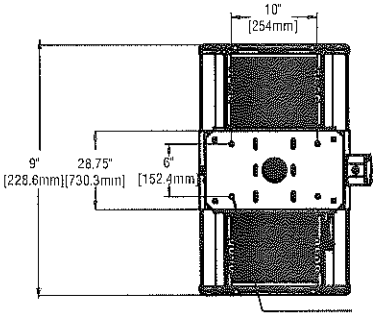
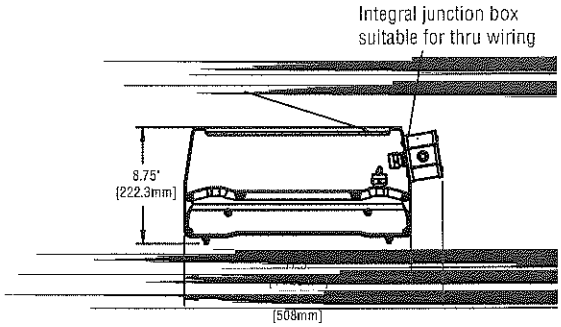
ATTACHMENT #7

PKG-EDG-40-CM THE EDGE® LED Transportation Mount – 40° Flood

Rev. Date: 7/19/11







Notes:

Product	Family	Optic	Mounting	# of LEDs (x 10)	LED Series	Voltage	Color Options	Drive Current Not Field Adjustable
PKG	EDG	40[1]	CM[2]	18	D	UL	SV	350
				20		Universal	Silver	350mA
				22		120–277V	BK	525
				24		UH	Black	525mA
						Universal	BZ	625
						347–480V	Bronze	625mA
							PB	700[3]
							Platinum	700mA
							Bronze	
							WH	
							White	

Factory-Installed Options
Please type additional options in manually on the lines provided above.

43K	4300K Color Temperature[4]
F	Fuse[5,6]
DIM	0–10V Dimming[7,8]

Footnotes

1. Distribution similar to flood 40°
2. Ceiling mounting system
3. Not available with 240 LEDs
4. Color temperature per fixture; minimum 70 CRI
5. When code dicates fusing use time delay fuse
6. Not available when UH voltage is selected
7. Control by others
8. Refer to dimming spec sheet for availability and additional information

LED PERFORMANCE SPECS

# of LEDs	Initial Delivered Lumens – 40° Flood Optic @ 6000K	Initial Delivered Lumens – 40° Flood Optic @ 4300K	System Watts 120–480V	Total Current @ 120V	Total Current @ 230V	Total Current @ 277V	Total Current @ 347V	Total Current @ 480V	L_{70} Hours* @ 25° C (77° F)	50K Hours Lumen Maintenance Factor* @ 15° C (59° F)
350mA (Standard) Fixture Operating at 25° C (77° F)										
180	19,661 (18)	18,120 (18)	189	1.58	0.82	0.68	0.54	0.39	>150,000	90%
200	21,845 (20)	20,134 (20)	220	1.83	0.96	0.79	0.63	0.46	>150,000	
220	24,030 (22)	22,147 (22)	242	2.02	1.05	0.87	0.70	0.50	>150,000	
240	26,215 (24)	24,160 (24)	262	2.18	1.14	0.95	0.76	0.55	>150,000	
525mA Fixture Operating at 25° C (77° F)										
180	27,525 (18)	25,368 (18)	291	2.43	1.27	1.05	0.84	0.61	125,000	88%
200	30,584 (20)	28,187 (20)	327	2.73	1.42	1.18	0.94	0.68	125,000	
220	33,642 (22)	31,006 (22)	363	3.03	1.58	1.31	1.05	0.76	125,000	
240	36,700 (24)	33,825 (24)	396	3.30	1.72	1.43	1.14	0.83	125,000	
625mA Fixture Operating at 25° C (77° F)										
240	42,992 (24)	39,623 (24)	505	4.21	2.20	1.82	1.46	1.05	110,000	86%
700mA Fixture Operating at 25° C (77° F)										
180	33,620 (18)	30,986 (18)	417	3.48	1.81	1.51	1.20	0.87	104,000	86%
200	37,356 (20)	24,429 (20)	470	3.92	2.04	1.70	1.35	0.98	104,000	
220	41,091 (22)	37,872 (22)	513	4.28	2.23	1.85	1.48	1.07	104,000	

* For recommended lumen maintenance data see TD-13

NOTE: All data subject to change without notice.

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Made in the U.S.A. of U.S. and imported parts.
Meets Buy American requirements within the ARRA.

PKG-EDG-40-CM THE EDGE® LED Transportation Mount – 40° Flood

Rev. Date: 7/19/11

General Description

Slim, low profile design. Fixture is constructed from rugged extruded aluminum, die cast aluminum and stamped metal components. LED driver is mounted in extruded aluminum fixture ends and sealed for weather-tight operation. High performance aluminum heatsinks specifically designed for high lumen output applications. Heavy gauge stainless steal mounting brackets are designed for direct mount to solid surfaces. External wet location junction box provided with fixture for field wiring connections. Five year limited warranty on fixture.

Electrical

Modular design accommodates varied lighting output from high power, white, 6000K (+/- 500K per full fixture), minimum 70 CRI, long life LED sources. Optional 4300K (+/- 300K per full fixture) also available. 120–277V 50/60 Hz, Class 1 LED drivers are standard. LED drivers have power factor >90% and THD <20% of full load. Units provided with integral 10kV surge suppression protection standard. Surge protection tested in accordance with IEEE/ANSI C62.41.2.

Testing & Compliance

UL listed in the U.S. and Canada for wet locations. Consult factory for CE Certified products. Dark Sky Friendly. IDA Approved. RoHS compliant.

Finish

Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultra-durable silver powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Bronze, black, white and platinum bronze powder topcoats are also available. The finish is covered by our 10 year limited warranty.

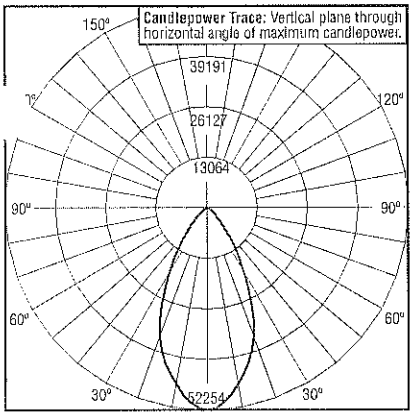
Fixture and finish are endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117.

Patents

U.S. and international patents granted and pending. BetaLED is a division of Ruud Lighting, Inc. For a listing of Ruud Lighting, Inc. patents, visit www.uspto.gov.

Field-Installed Accessories

Photometrics



Preliminary candlepower trace of 6000K, 240 LED EDGE series luminaire with 40° flood optic distribution with 42,992 initial delivered lumens operating at 625mA.

NOTE: All data subject to change without notice.

Made in the U.S.A. of U.S. and imported parts.
Meets Buy American requirements within the ARRA.

ATTACHMENT #8

McGRAW-EDISON®

Catalog #		Type	
Project			
Comments		Date	
Prepared by			

DESCRIPTION

The Valet™ LED luminaire features a rugged and low-profile housing construction incorporating patented, modular LED LightBAR™ technology. Through superior optical control, Valet delivers uniform and energy-conscious illumination optimized to improve vehicular movement and pedestrian safety in parking structure applications. UL/cUL listed for wet locations.

SPECIFICATION FEATURES

Construction
One-piece, low copper die-cast aluminum housing features heavy wall construction for superior heat transfer and resistance to corrosion. Formed aluminum faceplate is secured via four (4) stainless steel fasteners, and is recessed for clean mating of door and housing. Optional tamper-proof Torx™-head fasteners offer vandal resistant access to the electrical compartment.

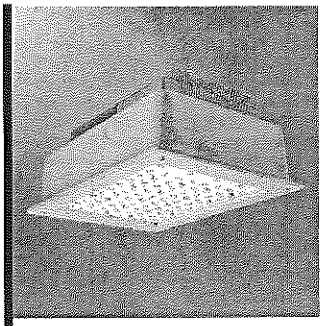
Optics
Choice of eight (8) patented, high-efficiency AccuLED Optics™ manufactured from injection-molded acrylic. Optics are precisely designed to shape the distribution, maximizing efficiency and application spacing. Optional GL optics internally shield the drive lane and pedestrians from direct source viewing. Offered standard in 4000K (+/- 275K) CCT and nominal 70 CRI.

Electrical
LED drivers mount to die-cast aluminum back casting for optimal heat sinking and operation efficiency. 120-277V 50/60Hz, 347V 60Hz or 480V 60Hz operation. Shipped standard with Cooper Lighting proprietary circuit module designed to withstand 10kV of transient line surge. 50,000 + hour life with >70% lumen maintenance. The Valet LED luminaire is suitable for operation in -30°C to 40°C ambient environments. LightBARs feature an IP66 enclosure rating.

Mounting
Standard fixture mounts to a square or octagonal 4" surface or recessed j-box via heavy gauge painted quick mount box complete with tool-less removable cable allowing for hands-free fixture wiring. Single carton packaging of housing and quick mounting box for contractor friendly arrival of product to site. Optional mounting methods include rigid or free-swinging 3/4" pendant including bird guard, trunnion mount, wall mount and direct lag surface mount.

Finish
Cast components and mounting box finished in a Super TGIC polyester powder coat paint, 2.5 mil nominal thickness for superior protection against fade and wear. Standard colors include black, bronze, grey, white, dark platinum, and graphite metallic. RAL and custom color matches available.

Warranty
Valet features a five-year limited warranty.



VPL
VALET LED

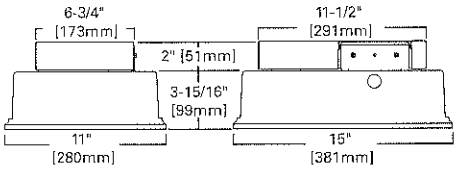
1 - 4 LightBARs
Solid State LED

PARKING GARAGE LUMINAIRE

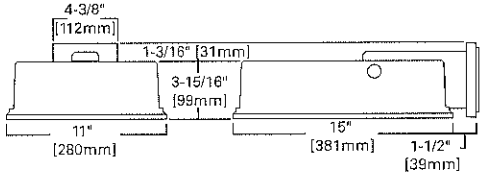
SustainabLEDesign

MOUNTING METHODS

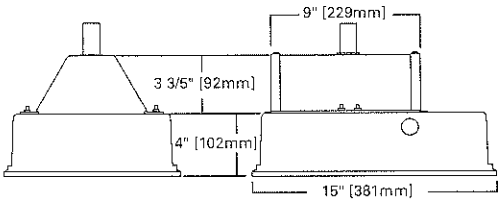
J-Box Mount [Standard]



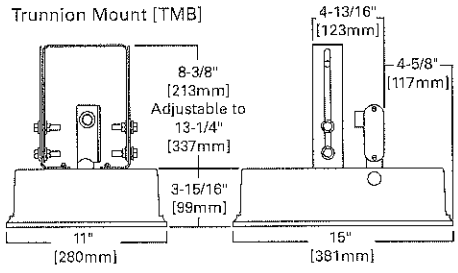
Wall Mount [WM]



Pendant Box / Bird Guard [PBG]



Trunnion Mount [TMB]



CERTIFICATION DATA
UL/cUL Listed
LM79 / LM80 Compliant
IP65 Fixture Rating, IP66 LightBARs
ARRA Compliant
ISO 9001

ENERGY DATA
Electronic LED Driver
>0.9 Power Factor
<20% Total Harmonic Distortion
120-277V/50 & 60hz, 347V/60hz, 480V/60hz
-30°C Minimum Temperature
40°C Ambient Temperature Rating
50°C (Optional) Ambient Temperature Rating

SHIPPING DATA
Approximate Net Weight:
16 lbs. (8 kgs.)

POWER AND LUMENS BY BAR COUNT

Number of LightBARs	DISTRIBUTION										
	Power [Watts]	Current @ 120V [A]	Current @ 277V [A]	GL2	GL3	GL4	CQ	SQ	WQ	RW	CFP
	7 LED LIGHTBAR										
C01	27	0.23	0.13	1,869	1,895	1,842	1,959	1,929	1,965	1,866	1,742
C02	54	0.46	0.21	3,708	3,761	3,655	3,886	3,827	3,899	3,702	3,457
C03	77	0.65	0.29	5,463	5,540	5,384	5,725	5,638	5,744	5,454	5,093
C04	101	0.86	0.37	7,266	7,369	7,161	7,615	7,499	7,640	7,254	6,774
	21 LED LIGHTBAR										
B01	27	0.23	0.13	2,299	2,331	2,266	2,409	2,373	2,417	2,295	2,143
B02	51	0.43	0.20	4,561	4,625	4,495	4,780	4,707	4,796	4,554	4,252
B03	73	0.62	0.28	6,719	6,814	6,622	7,042	6,935	7,065	6,708	6,264
B04	95	0.81	0.35	8,938	9,064	8,808	9,366	9,224	9,397	8,923	8,332

LUMEN MULTIPLIER

Ambient Temperature	Lumen Multiplier
10°C	1.04
15°C	1.03
25°C	1.00
40°C	0.96
50°C	0.92

ORDERING INFORMATION

SAMPLE NUMBER: VPL-B02-LED-E1-SQ-AP

		LED						

Product Family
VPL=Valet Parking Garage Luminaire

Number of LightBARs [1, 2]
B01=[1] 21 LED LightBAR [3]
B02=[2] 21 LED LightBARs
B03=[3] 21 LED LightBARs
B04=[4] 21 LED LightBARs
C01=[1] 7 LED LightBAR [3]
C02=[2] 7 LED LightBARs
C03=[3] 7 LED LightBARs
C04=[4] 7 LED LightBARs

Lamp Type
LED=Solid State Light-Emitting Diodes

Voltage
E1=Electronic (120-277V)
347=347V
480=480V

Distribution
GL2=Type II w/ Glare Control
GL3=Type III w/ Glare Control
GL4=Type IV w/ Glare Control
CQ=Concentrated Type V Square
SQ=Type V Square
WQ=Wide Type V Square
RW=Rectangular Wide
CFP=90 Degree Forward Throw Perimeter

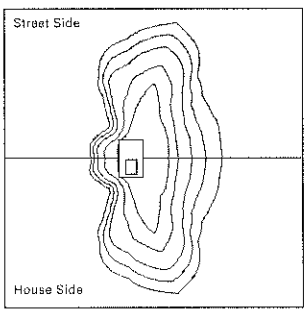
Finish
AP=Grey
BZ=Bronze
BK=Black
DP=Dark Platinum
GM=Graphite Metallic
WH=White

Options [4]
2L=Bi-Level Switching Capable [5]
WM=Wall Mount
HA=50 Degrees C High Ambient Temperature Rating [6]
L90=Optics Rotated 90 Degrees Left
R90=Optics Rotated 90 Degrees Right
TR=Tamper Resistant Fasteners
TMB=Trunnion Mount with Connection Box. (some assembly required)
PBG=Pendant Box/Bird Guard [6]
SM=Surface Mount [8]
7060=70 CRI/6000K CCT [9]
8030=80 CRI/3000K CCT [9]
LCF=LightBAR Cover Plate Matches Housing Finish
ICP=Integral Cold Weather Battery Pack (Specify 120V or 277V) [10, 11]
OSX=Integral Occupancy Sensor [12]

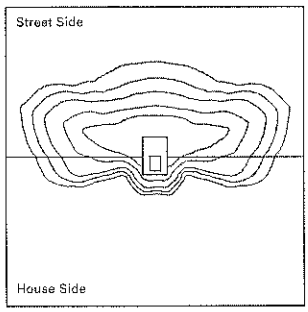
Accessories [13]
MA1253=10kV Circuit Module Replacement

NOTES:
1 Standard 4000K CCT and nominal 70CRI.
2 21 LED LightBAR powered at 350mA, 7 LED LightBAR powered at 1A.
3 Not available w/ 2L Bi-level switching option.
4 Add as suffix.
5 Available in models with B02 or C02, B03 or C03, and B04 or C04. Low-Level output varies by bar count specified. Consult Factory.
6 Not available in models with B04 or C04.
7 Adjustable to accept a rigid or free-swinging pendant configuration.
8 Surface mount configuration limited to 25 degrees C ambient conditions.
9 Consult Factory for lead times and lumen multiplier.
10 Available with B01 and C01 configurations only. Rated for 25 degrees C ambient operating temperature.
11 Must specify voltage.
12 Housed in external box mounted to the luminaire. Available in B02-B04 and C02-C04 configurations. Replace X with number of BARs (0S2). Default time delay setting is 15 minutes. Standard lens covers up to 12' mounting height, 360 degrees and maximum 20' diameter. Not available with HA option. For other configurations, consult customer service.
13 Order separately.

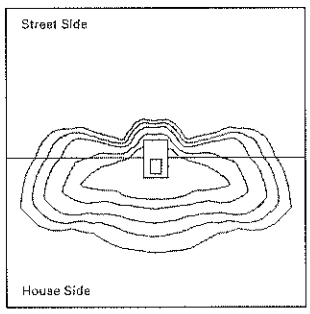
OPTIC ORIENTATION



Standard

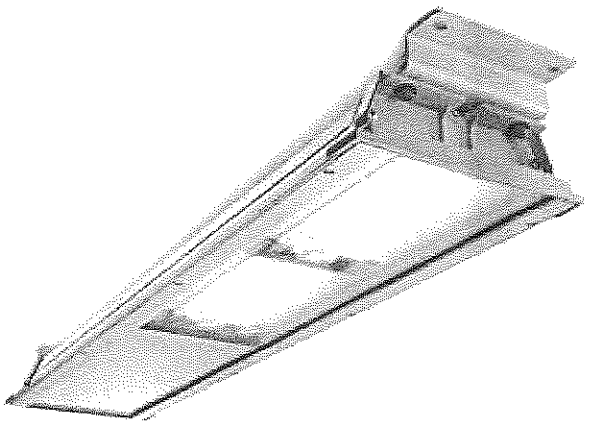


Optics Rotated Left @ 90° [L90]



Optics Rotated Right @ 90° [R90]

ATTACHMENT #9



TunLite LED – energy saving, solid, maintenance-free performance for tunnel lighting

TunLite LED

Tunnel operators need lighting for motorists, cyclists and pedestrians that also minimizes energy costs and disruptive maintenance. The TunLite is an LED-based luminaire for tunnel and underpass lighting. Its patented lens system allows a more efficient distribution than with conventional technologies. Luminance is the same while illuminance is is reduced, which leads to lower energy consumption. The optical concept also improves the spacing-to-height ratio. Light output can easily be adjusted and there is a choice of three different beams. Slim and pre-cabled, TunLite is easy to install, while its robust pure anodized housing, reliable LED sources and multiple drivers mean zero-maintenance.

Benefits

- Energy reduction and excellent uniformity compared to conventional technologies
- Great modularity in lumen output and light distribution to cover all lighting requirements in any tunnel type.
- Pure anodized aluminum body provides perfect LED's heat management and extreme anti corrosion protection.
- Robust concept – no maintenance required
- Flat glass for easy cleaning
- Quick and easy to install

PHILIPS

sense and simplicity

TunLite LED

Features

- Efficient multi-layer optical system
- High-grade materials and finishing
- Over-dimensioned thermal and power management
- Multiple power supplies

Application

- Tunnels
- Underpasses
- Covered car parks
- Public and industrial areas

Specifications

• Type	BCP560
• Light source	Replaceable LED module LEDGINE; 48/56/64 LEDs
• Power (steady state in W, +/- 10%)	66 - 113 W (depending on version)
• Driver current	410 mA, 530 mA
• Inrush current	130 A / 230 V, Line at 140 µs, width at 50%
• Luminous flux	5900 - 9500 lm (depending on version)
• Correlated Color Temperature	4000 K
• Color Rendering Index	> 70
• Maintenance of lumen output - L70	100.000 hours at T
• Operating temperature range	-20 to +40°C
• Driver	Built-in, 120-277 V / 50-60 Hz
• Mains voltage	120-277 V / 50-60 Hz
• Controls system input	1-10 V
• Options	Lighting Controls: 1-10 V, Dyna-Dimmer or StarSense on request
• Optic	Multi-layer tunnel optic
• Optical cover	Hard, extra clear tempered glass
• Material	Housing: pure aluminum, anodized End caps: high-pressure, die-cast aluminum with marine grade coating layers. Cover: extra clear thermally hardened glass, 5 mm thick.
• Color	Natural anodized aluminum (RAL9006)
• Installation	Specific fixation and brackets available on request. Recommended mounting height: 5 to 6 m. Delivered with 2 m mains supply cable.

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Document order number: TUNLF100R01

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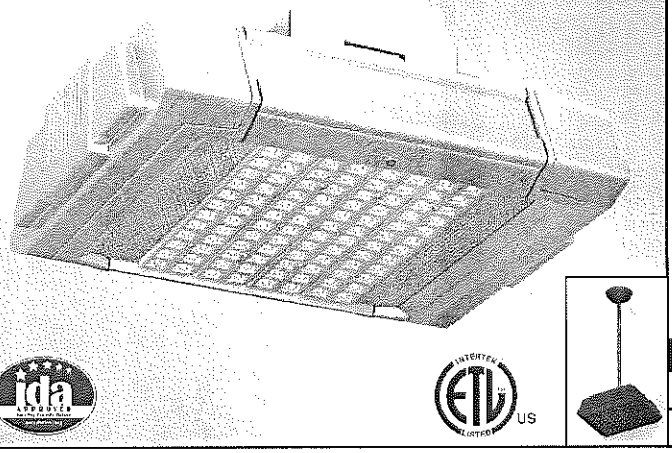
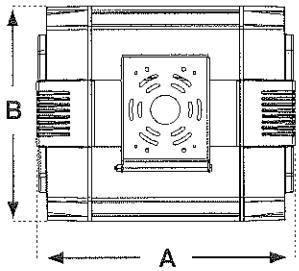
www.philips.com/roadwaylighting
A Division of Genlyte Thomas Group LLC

Element II - Garage/Canopy
LED

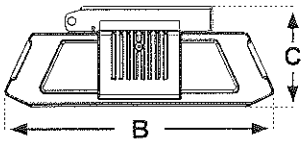
ATTACHMENT #10



Dimensional Drawings



Top View



Side View/End Cap

Fixture	A	B	C	Max. LEDs	Lbs
EL2-S	13⅞"	14½"	4"	72	24
EL2-1	17⅝"	14½"	4"	96	28½

The **Element II - Garage/Canopy** is a modularly-designed area luminaire that maximizes our latest ——— technology. Available in two sizes, it offers from 25 to 96 watts of LED lighting. The **Element II - Garage/Canopy** masters the art of efficient heat dissipation and electronic driver protection. It maximizes optics control; and features a wide array of energy and security options for optimal efficiency and safety.

Housing: The range of housing sizes is accomplished by utilizing a heavy-duty, extruded aluminum body, with heat radiating fins for cutting edge thermal management. Removable die-cast aluminum end caps allow for easy driver access.

Finish: The standard finish on the **Element II - Garage/Canopy** is a thermoset polyester powder coat painted finish in standard and custom colors.

Optics: Offered in Type I, II, III, IV and V distribution patterns, the **Element II - Garage/Canopy** qualifies as an IES full cutoff fixture; and is Dark-Sky certified to restrict light trespass, glare and light pollution for neighborhood-friendly lighting. Optional High-Low system and motion sensor available.

LEDs: The **Element II - Garage/Canopy** utilizes our latest high-performance ——— light engine, offering a minimum estimated life of 70,000 hours.

Ballast: The **Element II - Garage/Canopy**'s excellent thermal management rating results in increased lumen output. A high-performance LED driver operates at 120 thru 480 volts, 50 to 60 Hz, with a 90% power factor; and is rated for -40 °C operation.

Model	Optics	Source	Current	Kelvin	Voltage	Mounting	Finish	Options
EL2-S	Type I (T1)	# of LEDs	mA	4000K (4K)	120-277 *Universal voltage (UNV)	Ceiling Mount (CM)	White (WH)	Fusing *Specify voltage Single in-line fuse (SF120) (SF277)
		24 (24LC)	350 530 700					
	Type II (T2)	48 (48LC)	350 530 n/a	5500K (55K)	480 (5)	Pendant Mount *Specify pendant length (PM)	Bronze (BZ)	Double Inline Fuse (DF208) (DF240)
		72 (72LC)	350 n/a n/a (3) (5) (7)		347 (8)		Black (BK)	Dual Circuit (DC)
EL2-1	Type III (T3)	24 (24LC)	350 530 700				Forest Green (FG)	Cutoff Louver System (CLS)
		48 (48LC)	350 530 700				Grey (GY)	Motion Sensor (MS)
	Type IV (T4)	72 (72LC)	350 530 700				Silver Metallic (SL)	High-Low System (HL)
		96 (96LC)	350 530 n/a (3) (5) (7)				Custom Color (CC)	
	Type V (T5)							

Pair with:

Element
Area fixture.

For more detailed information on mounting, wiring or installation instructions, please consult factory. If poles are not ordered with fixtures, please specify mounting requirements. This document contains proprietary information of Visionaire Lighting, LLC. Any use of this information requires the written approval of Visionaire Lighting, LLC. In keeping with our TQM policy of continuous improvement, Visionaire reserves the right to change any specifications contained herein without prior notice.

VISIONAIRE LIGHTING
Performance in A Whole New Light
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www.visionairelighting.com

Housing
• The fixture housing is heavy-duty, extruded aluminum, with heat radiating fins. A perforated aluminum top cover protects the heat radiating fins from contaminants and directs constant air flow over them for maximum cooling.
• The fixture end caps are die-cast aluminum and easily removable with captive fastners for easy access to the LED drivers which are housed within the end-caps for cool operation.
• Silicone gasketing is utilized throughout the fixture for weathertight operation.

Thermal Management
• The **Element II - Garage/Canopy** provides excellent overall thermal management by maximizing the fixture's heat sink efficiency. This enables the **Element II - Garage/Canopy** to withstand higher ambient temperatures and drive currents without degrading LED life. The **Element II - Garage/Canopy** has a low thermal resistance rating. The heat radiating fins and perforated fixture components (see Thermal Convection Heat Management System cutaway below) create superior thermal management results.
• The L_{70} test determines the point in an LEDs life when it reaches 70 percent of its initial output. The **Element II - Garage/Canopy** series LEDs have been determined to last a minimum of 70,000 hours in 40 °C environments when driven at 350 mA. See LED Data Chart for additional test results.

Optical System
• The highest lumen output, **Evo/C LEDs** are utilized in the **Element II - Garage/Canopy** series. IES distribution Types I, II, III, IV and V are available. LED light assemblies come in multiples of 24 (minimum 24 to maximum 96 LEDs) and are field replaceable. The optical system qualifies as IES full cutoff; and is Dark-Sky certified to restrict light trespass, glare and light pollution.
• CRI values are 67 for 4000K and 72 for 5500K.

Quali-Guard® Finish
• A Quali-Guard® thermoset polyester powder coat painted finish is available in white and custom colors.

Mounting
• Galvanized steel ceiling mount bracket can be secured directly to recessed junction box, or to the ceiling. The housing hanger bracket allows fixture to be suspended from ceiling bracket while making wiring connection. The housing bracket then attaches to the ceiling bracket via a tool-less latch. A tamper-proof screw can then secure the bracket.

Electrical Assembly
• The **Element II - Garage/Canopy** is supplied with a choice of 350, 530 or 700 mA high-performance LED drivers that accept 120v thru 480v, 50 Hz to 60 Hz, input. Power factor of 90%. Rated for -40 °C operations.
• 6 kV surge protector supplied as standard.

Warranty
• Five (5) year Limited Warranty on entire system, including finish. For full warranty information, please visit VisionaireLighting.com.

Options
• Dual circuit
• Cutoff louver system
• Motion sensor
• High-low system

Please consult factory for custom options and available upgrades.

Listings
• **Element II - Garage/Canopy** is ETL listed, suitable for wet locations.
• LM79 and LM80. • RoHS compliant.
• Dark-Sky Friendly®, full cutoff certified by the International Dark-Sky Association.
• IP65 pending.
• Powder Coated Tough™
• DLC approved.

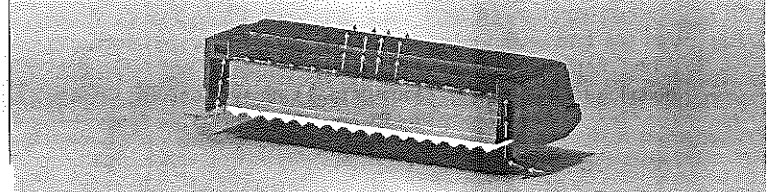
lighting facts
LED Product Partner

LED Data Chart for 5500K*

# Bars	# LEDs	Output mA	Initial Lumens T1	Initial Lumens T2	Initial Lumens T3	Initial Lumens T4	Initial Lumens T5	System Watts 120-277	L_{70} Hours @ 40° C
1 EL2-S EL2-1	24	350	2,021	2,109	2,250	2,020	2,121	25	200,000
		530	2,520	2,841	2,776	2,684	3,030	38	120,000
		700	2,995	3,377	3,243	3,030	3,675	51	70,000
2 EL2-S EL2-1	48	350	4,043	3,967	4,501	4,040	4,331	50	200,000
		530	5,042	5,663	5,553	5,368	6,087	76	120,000
		700**	5,990	6,532	6,485	6,102	7,349	102	70,000
3 EL2-S EL2-1	72	350	6,063	6,327	6,483	6,060	6,335	76	200,000
		530**	7,563	8,524	8,330	8,052	9,128	115	120,000
		700**	8,985	9,799	9,728	9,151	11,024	153	70,000
4 EL2-1	96	350	8,086	8,435	8,645	8,080	8445	100	200,000
		530	9,923	11,365	11,107	10,736	12,174	152	120,000
4 EL2-2	96	700	11,979	13,065	12,971	12,201	14,699	205	70,000

Visit www.VisionaireLighting.com for up-to-the-minute chart information, including types not listed here.
* For 4000K multiply values by 0.97 ** Not available for EL2-S

Thermal Convection Air Management System



Parking Garage Typical - Open Ceiling

50 Nominal Watts Driven at 530 mA – 6,087 Lumens

6.4	6.6	7.6	6.0	6.0	7.6	6.6
6.6	6.8	7.8	6.3	6.3	7.8	6.8
7.6	7.8	8.1	5.8	5.8	8.1	7.8
5.9	6.1	5.8	5.2	5.2	5.8	6.1
5.9	6.1	5.8	5.2	5.2	5.8	6.1
7.6	7.8	8.1	5.8	5.8	8.1	7.8
6.6	6.8	7.8	6.3	6.3	7.8	6.8

Mounting Height: 10 feet
30' Spacing - Center to Center

Average FC: 6.65
Max FC: 8.1
Min FC: 5.2
Max/Min: 1.56

VISIONAIRE LIGHTING
Performance In A Whole New Light
19645 Rancho Way • Rancho Dominguez, CA • 90220
Tel: (310) 512-6480 • Fax: (310) 512-6486
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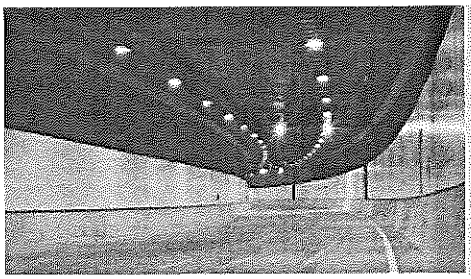
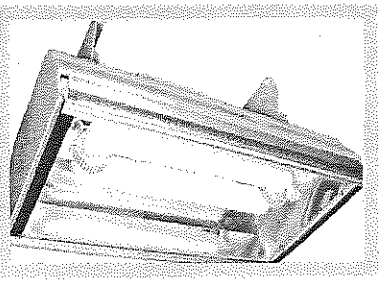
Tunnel Fixtures
TL SERIES

ATTACHMENT #11





APPLICATIONS

- Tunnels
- Overpasses
- Area/Safety Lighting
- Food Storage
- Agricultural

FEATURES

- 100,000 Hour Lifespan (IESNA)
- 10 Year or 60,000 Hour Warranty
- Square Profiled, Powder Coated Aluminum Housing
- Clear Tempered Glass Lens
- Gas-tight Silicon Seal for Wet Locations
- Surface Mounting with Bracket
- Ambient Temp Range: -30 to 130 deg F

Manufactured in the USA

c UL us LISTED

LAMP/GENERATOR

- 120-277V Universal Electronic Ballast
- Available 0-10V Dimmability, 2-way Communication
- Power Factor > 0.95, Operation Frequency 50-60Hz
- Instant-On, Flicker Free, Minimum Light Loss
- 100W—400W Square Tubular Lamp Design
- Color Temps Available: 3000K—5000K
- CRI > 85—Excellent Color Rendition

Product #	Wattage	Replaces	Lm/W	Lumens	IP Rating	Size	Lens
MHT-TL-100E	100	MH - 200W HPS - 200W	77.5	7,750	65	19"x15"	Glass
MHT-TL-150E	150	MH - 250W HPS - 300W	82.5	12,375	65	22"x15"	Glass
MHT-TL-200E	200	MH - 360W HPS - 400W	82.5	16,500	65	28"x15"	Glass
MHT-TL-250E	250	MH - 400W HPS - 500W	82.5	20,625	65	28"x15"	Glass
MHT-TL-300E	300	MH - 500W HPS - 750W	87.5	26,250	65	28"x15"	Glass
MHT-TL-400E	400	MH - 750W HPS - 750W	87.5	35,000	65	48"x15"	Glass

Available Options:

- Dimmable Ballast

Tunnel Fixtures
TL SERIES

Project: _____
Part Number: _____
Quantity: _____

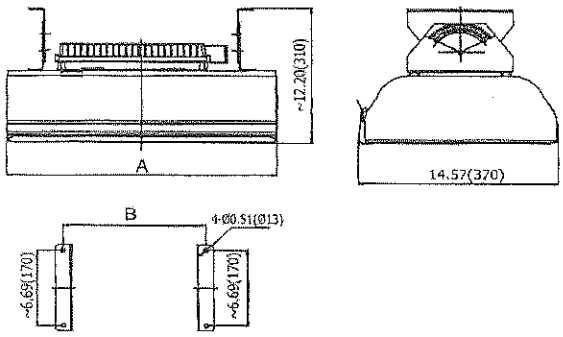
ORDERING CODES

MHT-TL - [ ]E - [ ] - [ ] - [ ] - [ ]

Wattage:	Color Temp:	Voltage:	Dimmable Ballast:	Options:
100, 150, 200, 250, 300, 400	3K = 3000K 4K = 4000K 5K = 5000K	U = Universal 3 = 347V	DB	UB = U Bracket LB = L Bracket

DIMENSIONS

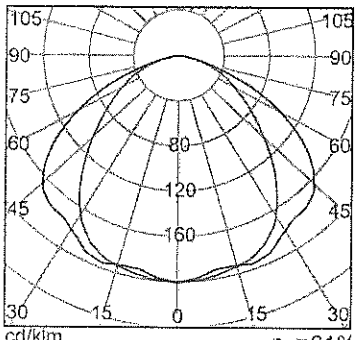
MHT-TL-100/150/200/250/300/400E



inches (mm)	100E	150E	200E	400E
Length (A)	18.5 (470)	21.7 (550)	35.9 (913)	35.9 (913)
Width	14.6 (370)	14.6 (370)	14.6 (370)	14.6 (370)
B (L Conn)	15.0 (380)	15.8 (400)	19.7 (500)	10.9 (276)
B (U Conn	12.6 (320)	12.6 (320)	16.5 (420)	27.6 (700)

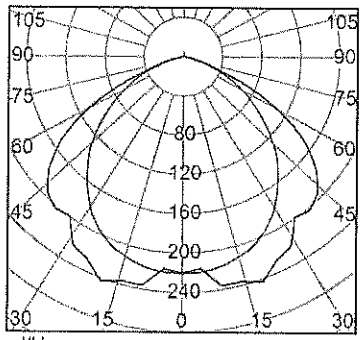
SAMPLE PHOTOMETRICS

MHT-TL-100E



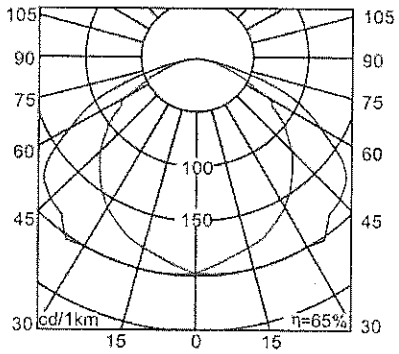
TL-100E /ST100W

MHT-TL-300E



MHTTL-300E/ST300W

MHT-TL-400E



MHTTL-400E/ST400W

- MHT Products are UL Listed/Labeled and Assembled in ISO9000/1 Certified US Facility
- Every product is quality tested and inspected prior to shipment
- MHT Lighting offers a 10-year, 60,000 hour Warranty (please see Warranty Terms and Conditions)
- Made in the USA of US and Imported Parts, Meets Buy American requirements within the ARRA

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, ,718) 524-4370, Fx: (718) 524-4390

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