Understanding the Differences Between the Three Sports Lighting Design Criteria Presently Utilized for the Sports Lighting Market

1. Illuminating Engineering Society (IES), "Maintained Footcandle Based Design".

   IES based design recognizes both non-recoverable and recoverable light loss factors in determining an appropriate Light Loss Factor (LLF) to provide the systems capability of exceeding target light levels for the life of the system, naturally utilizing proper maintenance.

   It should be understood both by the consultant, designer and owner that the greater the LLF the more light the system will provide and therefore the more costly the system to operate. With this in mind, it should be evaluated whether the cost of a greater LLF includes in upfront cost compared to shorter maintenance cycling to attain the desired light levels. i.e. Is it desirable to incur $30,000.00 in initial cost or clean and/or re-lamp 5 times at $6,000.00?

2. "Constant Light", a new lighting design concept which addresses lumen depreciation by manipulation of capacitance. Since the target light level is established as the highest light level to be achieved fewer fixtures and associated operating cost will result.

The shortcoming of the "constant light approach" is that only lumen depreciation is addressed. The twenty-six factors presented in the IES LM-61 regarding non-recoverable light loss factors are not taken into consideration. Nor, are the effects of short-cycling, dirt depreciation and tilt factor not to mention "Field Factor".

3. USL/FFB provides light levels for 5,000 hours and if needed, due to those conditions that use the field factor maybe addressed by engaging the Field Factor Booster (FFB) which will increase light output by 15%.

A more detailed discussion follows:

The Illuminating Engineering Society (IES) has clearly expressed in numerous publications with the express purpose to serve as guidance for those composing sports lighting specifications that there are several factors which must be considered when establishing the criteria upon which a sports lighting design should address.

These factors fall into two categories: Recoverable Light and Non-Recoverable Light.

<u>Recoverable Light</u>:

Recoverable light results from normal operational conditions such as lumen loss caused by aging of the lamp and light loss due to dirt accumulation on the lens, lamps and reflector surfaces. These can be addressed by re-lamping, cleaning or even to a degree by a new technique labeled "Constant Light", which only addresses lumen depreciation and does so by means of manipulating capacitors to compensate for lumen loss associated with normal aging of the system.

Non-Recoverable Light:

The IES's publication LM-61: Identifying Operations Factors for Installed HID Luminaires, addresses the issues termed "Non-Recoverable Light".

36 IES members compiled the LM-61 and established that twenty-six items exist which could effect in a negative way the difference between the computer - derived predictions and actual field results.

These factors are not predictable and vary from component to component. The IES states in LM RP-6-01 and LM-61 that their cumulative negative effect could amount to 15%.

How does each of the above mentioned criteria respond to the causes and effects regarding these known factors when establishing a design?

1) IES: De-rate the lumen output of the lamp, which results in more light, higher operating cost but with the objective being the target light level should be the lowest light level the system should provide for the entire life. To establish the proper LLF to address those factors which account for light loss should be undertaken under experienced and knowledgeable understanding of the factors controlling light depreciation for a sports lighting system.
2) Constant Light: Disregards everything in LM-6 and only deals with lumen depreciation.
3) USL Field Factor Booster. The USL approach is to acknowledge both Recoverable and Non-Recoverable light.

If a minimum light level is required for a facility the design should be based upon IES Maintained Light Levels applying an LLF satisfactorily to provide the facility with the desired light levels both in the short and long term.

If a lower initial light level is acceptable and that level is kept constant within levels of tolerance and these levels are sustained within 10% for a period of 5,000 hours then the "constant light" design criteria is a good choice.

The best of both worlds is to provide a system which will provide the desired light levels for 5,000 hours and have the capability of addressing the potential 15% deficit light caused by the "field factor" issues with the system incorporating a "field factor booster", available if needed and not used if not needed.

What are the actual light levels provided by utilizing:
A) "Constant Light"?
B) IES Industry Standards?

**based on 300 hour annual usage

30 Footcandle Target Level

Constant		IES Maintained (0.70 LLF)		IES Maintained (0.80 LLF)
30(27)	Day 1	43	Day 1	38
30	Year 1	39-43	Year 1	34-38
30	Year 2	38-39	Year 2	33-34
30	Year 3	37-38	Year 3	32-33
30	Year 4	36-37	Year 4	31-32
30	Year 5	35-36	Year 5	31-31
30	Year 6	34-35	Year 6	30-31
30	Year 7	34-34	Year 7	30-30
30	Year 8	34-34	Year 8	30-30
30(27)	Year 9	43	Year 9	38

Group Relamp →

50 Footcandle Target Level

Constant		IES Maintained (0.70 LLF)		IES Maintained (0.80 LLF)
50(45)	Day 1	71	Day 1	63
50	Year 1	65-71	Year 1	57-63
50	Year 2	63-65	Year 2	55-57
50	Year 3	61-63	Year 3	53-55
50	Year 4	60-61	Year 4	52-53
50	Year 5	58-60	Year 5	51-52
50	Year 6	57-58	Year 6	50-51
50	Year 7	57-57	Year 7	50-50
50	Year 8	57-57	Year 8	50-50
50(45)	Year 9	71	Year 9	63

Group Relamp →

70 Footcandle Target Level

Constant		IES Maintained (0.70 LLF)		IES Maintained (0.80 LLF)
70(63)	Day 1	100	Day 1	88
70	Year 1	91-100	Year 1	80-88
70	Year 2	88-91	Year 2	77-80
70	Year 3	85-88	Year 3	75-77
70	Year 4	83-85	Year 4	74-75
70	Year 5	82-83	Year 5	71-74
70	Year 6	81-82	Year 6	70-71
70	Year 7	80-81	Year 7	70-70
70	Year 8	80-80	Year 8	70-70
70(63)	Year 9	100	Year 9	88

Group Relamp →

100 Footcandle Target Level

Constant		IES Maintained (0.70 LLF)		IES Maintained (0.80 LLF)
100(90)	Day 1	143	Day 1	125
100	Year 1	130-143	Year 1	114-125
100	Year 2	126-130	Year 2	110-114
100	Year 3	122-126	Year 3	107-110
100	Year 4	119-122	Year 4	105-107
100	Year 5	117-119	Year 5	102-105
100	Year 6	115-117	Year 6	100-102
100	Year 7	114-115	Year 7	100-100
100	Year 8	114-114	Year 8	100-100
100(90)	Year 9	143	Year 9	125

Group Relamp →

Conclusion: Less Energy = Less Light