

OxyTech Software Validation

OxyTech guarantees that the software of entirely its own production called:

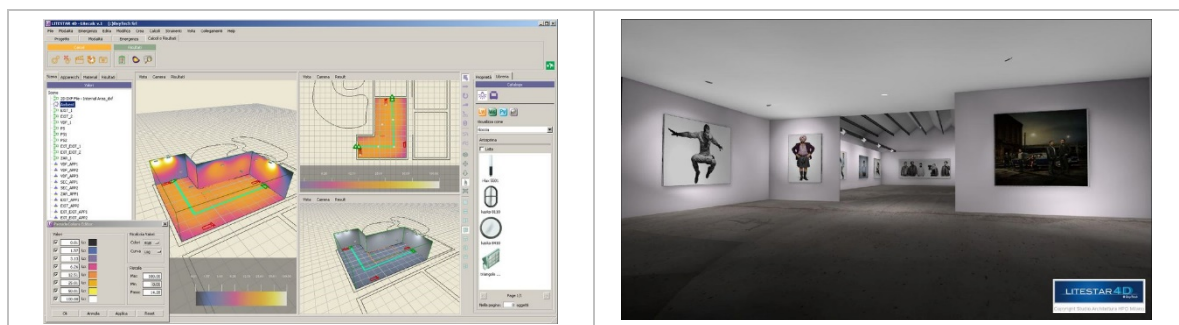
- ▶ LITESTAR 4D from version 6.00 onwards

has been developed according to the following International Recommendations and Norms:

1 LITESTAR 4D Modules

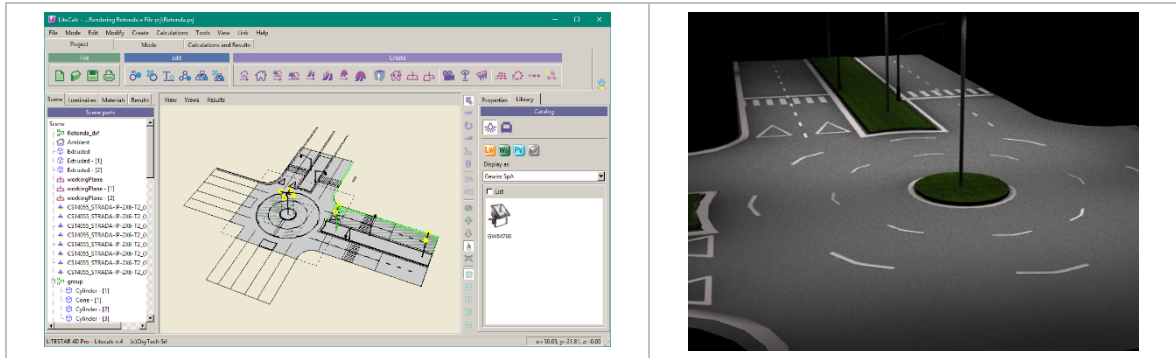
1.1 Lighting Calculation Module for Interiors – Litecalc

| | |
|-------------------|---|
| ▶ CIE 24:1973 | Photometry of indoor type luminaires with tubular fluorescent lamps |
| ▶ CIE 40:1978 | Calculation for interior lighting – Basic method (basic calculation) |
| ▶ CIE 52:1982 | Calculation for interior lighting – Applied method (advanced calculation) |
| ▶ CIE 55:1983 | Discomfort glare in the interior working environment (glare calculation) |
| ▶ EN 12464-1:2011 | Lighting of work places. Indoor work places |



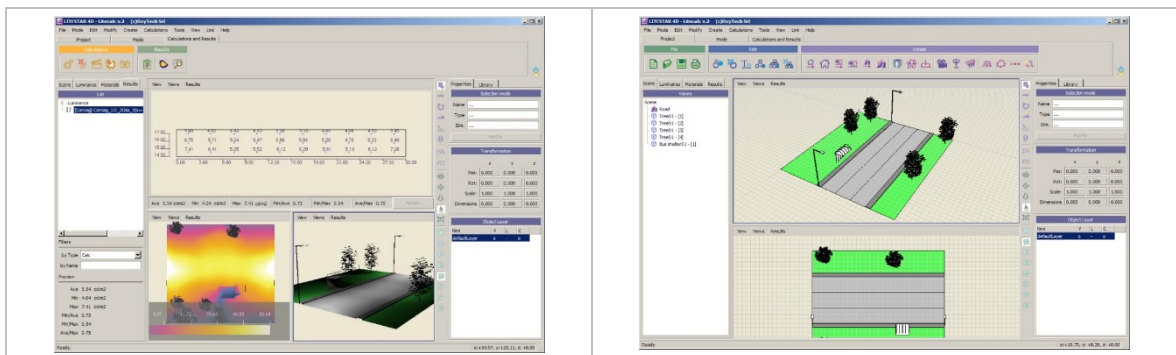
1.2 Lighting Calculation Module for Outdoor Areas - Litecalc

| | |
|-------------------|--|
| ▶ CIE 43:1979 | Photometry of floodlights |
| ▶ EN 12464-2:2004 | Lighting of work places. Outdoor work places |



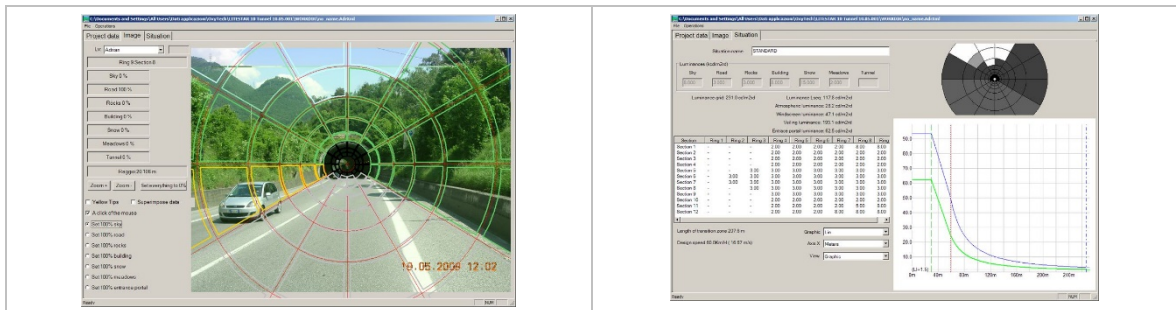
1.3 Lighting Calculation Module for Roads - Litecalc

| | |
|-----------------------|---|
| ▶ CIE 27:1973 | Photometry of road lighting luminaires (photometric data table) |
| ▶ CIE 30.2:1982 | Road lighting calculations (Stan program) |
| ▶ CIE 34:1977 | Road lighting lantern and installation data: photometrics, classification and performance |
| ▶ CIE 66:1984 | Road surfaces and lighting (road surfaces determination) |
| ▶ CIE 140:2000 | Road Lighting Calculations |
| ▶ D.M. 27/9/17 | Criteri Ambientali Minimi per l'acquisizione di sorgenti luminose per illuminazione pubblica, l'acquisizione di apparecchi per illuminazione pubblica, l'affidamento del servizio di progettazione di impianti per illuminazione pubblica - aggiornamento 2017 (Decree of the Italian Ministry for the Environment) |
| ▶ CEN/TR 13201-1:2014 | Road Lighting – Part 1: Guidelines on selection of lighting classes |
| ▶ EN 13201-2:2015 | Road Lighting – Part 2: Performance requirements |
| ▶ EN 13201-3:2015 | Road Lighting – Part 3: Calculation of performance |
| ▶ EN 13201-5:2015 | Road Lighting – Part 5: Energy performance indicators |
| ▶ R.D. 1890-2008 | Reglamento de eficiencia energética en instalaciones de alumbrado exterior y sus Instrucciones técnicas complementarias EA-01 a EA-07 (Spanish Standard) |
| ▶ UNI 10819:1999 | Inquinamento luminoso del cielo (Italian Standard) |



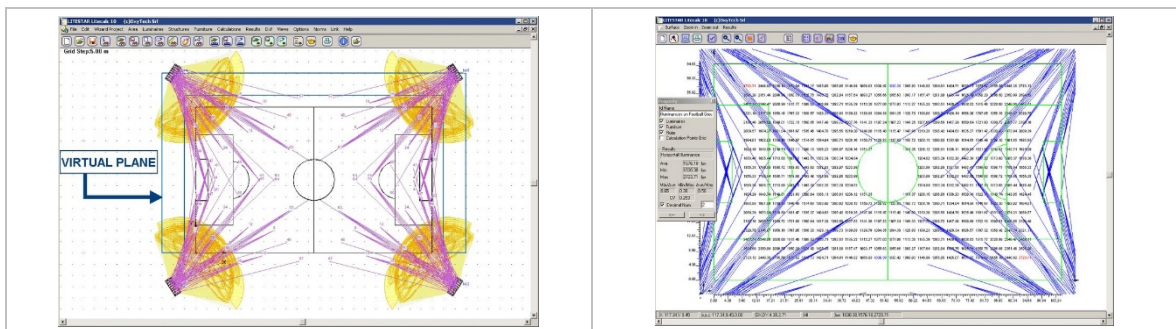
1.4 Lighting Calculation Module for Tunnels - Litecalc

| | |
|-----------------|---|
| ▶ CIE 27:1973 | Photometry of road lighting luminaires (photometric data table) |
| ▶ CIE 30.2:1982 | Road lighting calculations (Stan program) |
| ▶ CIE 34:1977 | Road lighting lantern and installation data: photometrics, classification and performance |
| ▶ CIE 66:1984 | Road surfaces and lighting (road surfaces determination) |
| ▶ CIE 88:2004 | Guide for the Lighting of Road Tunnels and Underpasses |
| ▶ CIE 140:2000 | Road lighting calculations |
| ▶ EN 13201:2015 | Road Lighting |



1.5 Lighting Calculation Module for Sport Areas - Litecalc

| | |
|---------------------|--|
| ▶ CIE 43:1979 | Photometry of floodlights |
| ▶ CIE 57:1983 | Lighting for football |
| ▶ CIE 83:1989 | Guide for the lighting of sports events for colour television and film systems |
| ▶ CIE 112:1994 | Glare evaluation system for use within outdoor sports and area lighting |
| ▶ UNI 9316:1989 (*) | Sports lighting (Italian Norm) |
| ▶ EN 12193:2008 (*) | Sports Lighting |
| ▶ FIFA 2016 (*) | Lighting Design of Football Stadiums |



(*) Only for LITESTAR 10

2 General

- ▶ IES LIGHTING GUIDE
- ▶ EN 13032 Measurement and presentation of photometric data of lamps and luminaires

3 Collaboration

The program has been developed with the collaboration of the following companies or corporations:

- ▶ Milan Polytechnic –Industrial Design Faculty – Light and Color Dept.: Rendering Module (from vers.6.00)

4 Field Tests

The program has been tested on the field by OxyTech on various occasions and have always found correspondence between the measured values and the calculated ones.

The program has also been tested by OxyTech customers, such as lighting manufacturers, public bodies, designers and specialized distributors for the past 20 years. During this period, the correspondence between the measured values and the calculated ones has always been confirmed, which guarantees the the validity of the calculation algorithms of the program.

Correspondence in comparisons between lighting engineering calculations and real cases is valid in the case of equal secondary parameters (voltage applied to the luminaires and their working temperature, surface reflectance values etc.): it is therefore advisable to consider a margin of error of $\pm 10\%$.

5 Comparative Tests with CIE Inspection Procedures

OxyTech has carried out comparative tests with the standard inspection procedure foreseen by CIE40-52 Recommendations finding perfect correspondence with forecast values.

This inspection has been carried out in parallelepiped shaped areas and has been taken as reference sample for the development of all successive modules.

Comparative tests have also been carried out on the roads module with the procedure foreseen by the STAN program of CIE30 Recommendations, finding, also in this case, perfect correspondence with forecast values.

6 Tests with Similar Software

OxyTech has over the years carried out comparative tests with similar software generally finding excellent correspondence with the values calculated with the various systems.

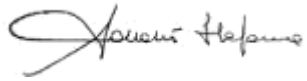
7 Quality System Iso 9001:2008

OxyTech has adopted the procedures of ISO 9001 Norm for the development of its software and the quality manual is fully operational. The manual is available to anyone who is interested.

The present Validation Declaration neither annuls nor limits the terms of the License Contract.

Cornaredo (Milan), April 2nd 2019

OxyTech Srl



(Eng. Stefano Borsani)

(BoD President)