

PHILIPS

FastFlex LED module

Application Suggestions Guide

Rules of thumb for road lighting

Introduction to this guide

Thank you for your interest in the Philips FastFlex LED module Gen 2.

We have created this *Application Suggestions* booklet to help facilitate the design-in process. **Given the number of changeable factors, all results are only an indication and cannot replace an optimized lighting advice.**

The tables in this guide cannot replace actual testing for a specific installation. A number of factors can impact optical performance of a luminaire in a given application. Some assumptions were made in order to make the calculations (see next page).

Your measurement results (e.g. uniformity, flux, ...) may be different for many reasons, some of which are listed below.

1. *Road surface cover type and reflectivity index*
2. *Road width*
3. *Pole height*
4. *Pole spacing to pole height ratio*
5. *Luminaire design impact on lens optical performance*
6. *Luminaire glass impact on LOR*

Philips makes no guarantees regarding compliance to regulatory norms and assumes no legal liability or responsibility for loss or damage resulting from the use of these guidelines.

Key assumptions

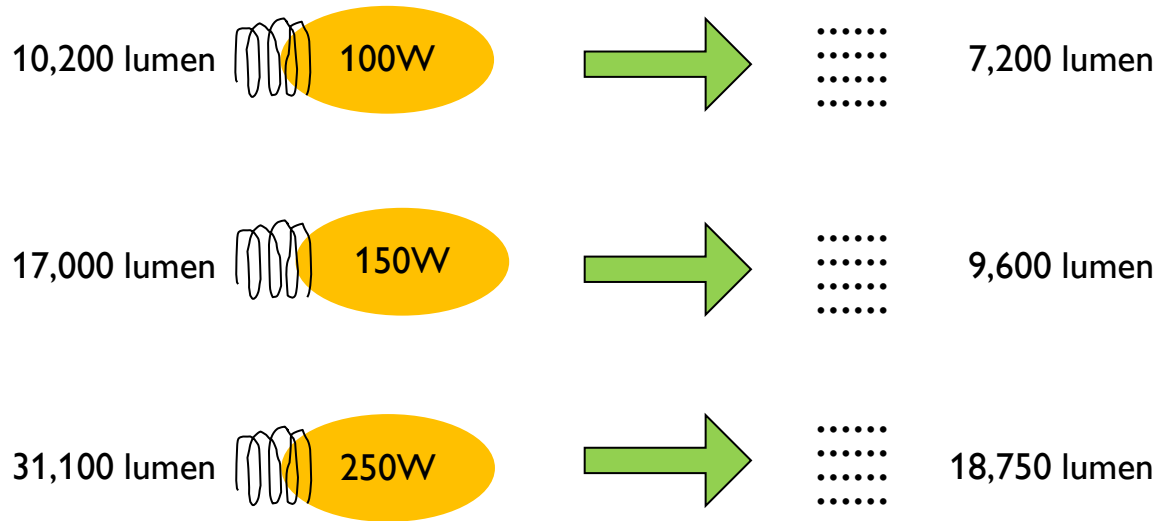
1. Compliance calculations are based on CIE 115 – 2010 norm
2. Focus on ME class roads
3. Road surface reflection table C2 with $Q_0 = 0.07$ (normal standard asphalt)
4. Tilt angle is 5°
5. Overhang is zero
6. HPS luminaire LOR is 70%

These are the assumptions Philips used to calculate the table values.
As each project is unique, not all situations will be covered by this booklet.

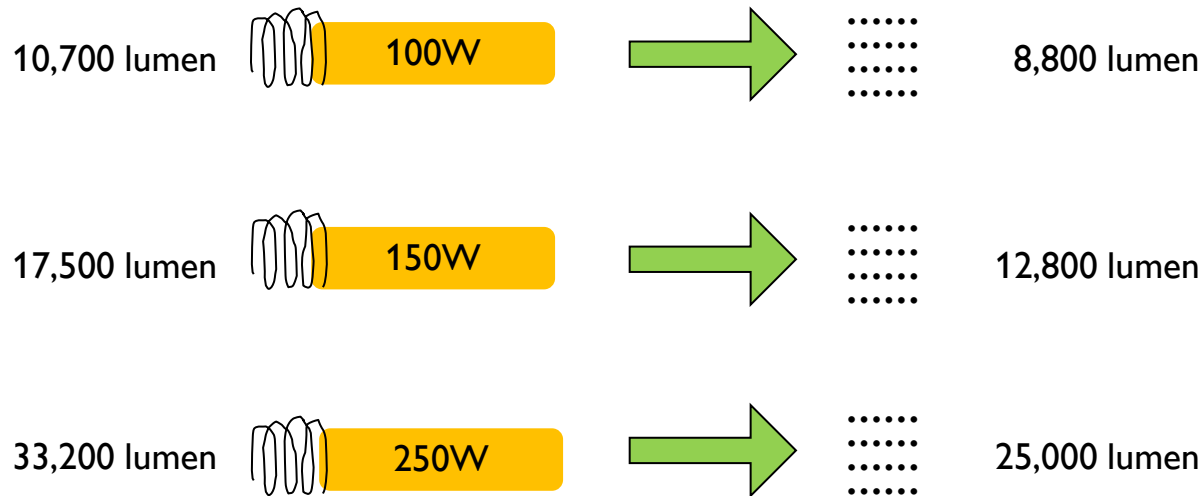
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Lumen package replacement for HPS lamps

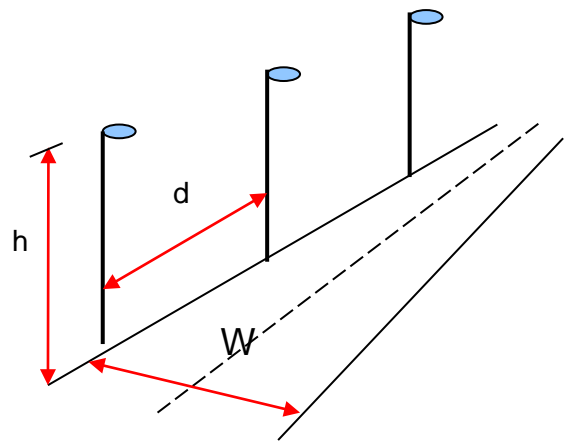
FastFlex lumen package to replace SON Ovoid lamps



FastFlex lumen package to replace SON Tubular lamps

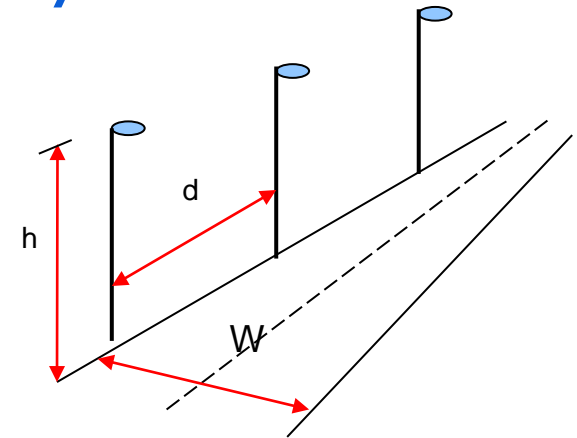


Pole arrangement: Single-sided



8-meter roadway, single-sided pole layout

FastFlex lens II-X
 Road type Single carriageway 2 lanes (2x4m)
 Road width (W) 8 meters
 Pole arrangement Single-sided
 Pole height (h) 8 meters

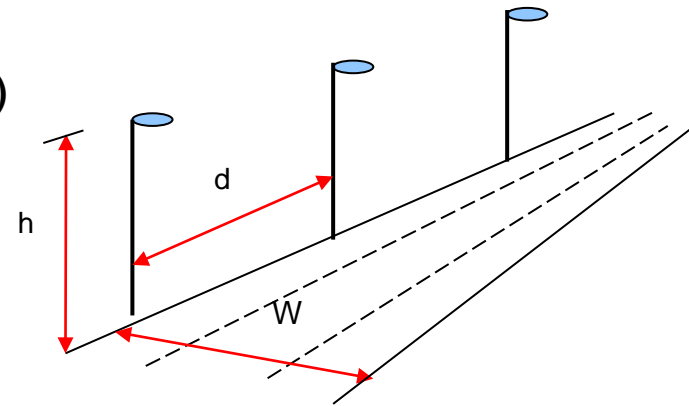


Road class	M1	M2	M3	M4	M5
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	U _l ¹	U _l ¹	6,400 lumen	4,800 lumen	3,200 lumen
Pole distance (d)	32 meters	32 meters	32 meters	32 meters	32 meters
Light output	-	-	U _l ¹	U _l ¹	4,800 lumen
Pole distance (d)	40 meters	40 meters	40 meters	40 meters	40 meters
Light output	-	-	U _l ¹	U _l ¹	5,600 lumen

¹ Uniformity lengthwise not met

10-meter roadway, single-sided pole layout

FastFlex lens II-X
 Road type Single carriageway 3 lanes (3x3.3m)
 Road width (W) 10 meters
 Pole arrangement Single-sided
 Pole height (h) 10 meters

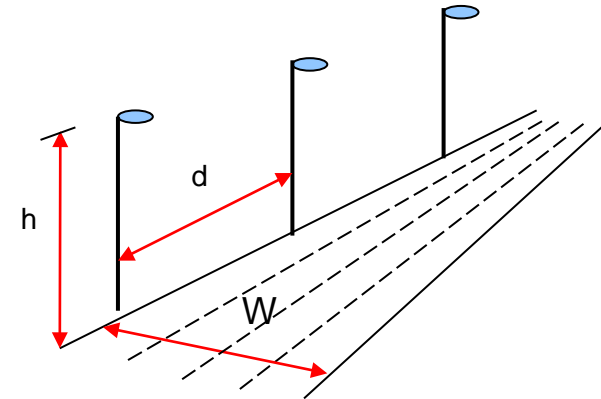


Road class	M1	M2	M3	M4	M5
Pole distance (d)	30 meters	30 meters	30 meters	30 meters	30 meters
Light output	U _l ¹	U _l ¹	11,200 lumen	8,000 lumen	5,600 lumen
Pole distance (d)	40 meters	40 meters	40 meters	40 meters	40 meters
Light output	-	-	U _l ¹	U _l ¹	7,200 lumen
Pole distance (d)	50 meters	50 meters	50 meters	50 meters	50 meters
Light output	-	-	U _l ¹	U _l ¹	8,800 lumen

¹ Uniformity lengthwise not met

12-meter roadway, single-sided pole layout

FastFlex lens II-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Single-sided
 Pole height (h) 12 meters

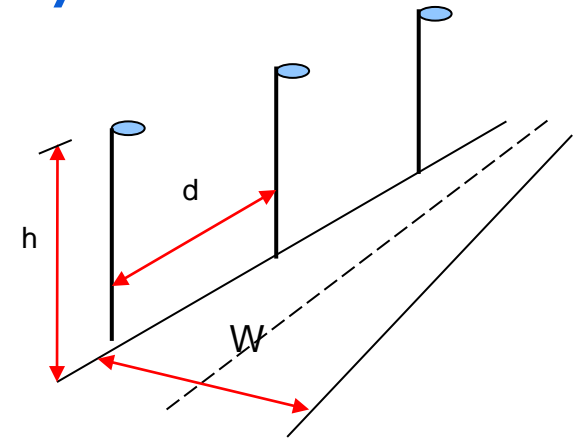


Road class	M1	M2	M3	M4
Pole distance (d)	36 meters	36 meters	36 meters	36 meters
Light output	U _l ¹	U _l ¹	16,251 lumen	12,000 lumen
Pole distance (d)	48 meters	48 meters	48 meters	48 meters
Light output	-	-	-	10,400 lumen
Pole distance (d)	60 meters	60 meters	60 meters	60 meters
Light output	-	-	-	-

¹ Uniformity lengthwise not met

8-meter roadway, single-sided pole layout

FastFlex lens III-X
 Road type Single carriageway 2 lanes (2x4m)
 Road width (W) 8 meters
 Pole arrangement Single-sided
 Pole height (h) 8 meters

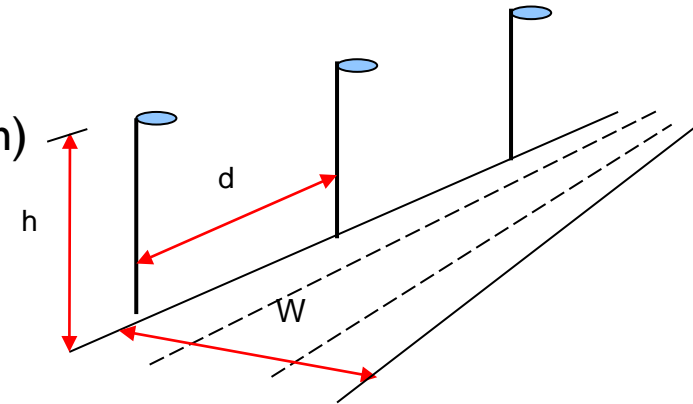


Road class	M1	M2	M3	M4	M5
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	13,600 lumen	10,400 lumen	7,200 lumen	5,600 lumen	4,000 lumen
Pole distance (d)	32 meters	32 meters	32 meters	32 meters	32 meters
Light output	U _l ¹	U _l ¹	8,800 lumen	7,200 lumen	4,800 lumen
Pole distance (d)	40 meters	40 meters	40 meters	40 meters	40 meters
Light output	-	-	-	-	5,600 lumen

¹ Uniformity lengthwise not met

10-meter roadway, single-sided pole layout

FastFlex lens III-X
 Road type Single carriageway 3 lanes (3x3.3m)
 Road width (W) 10 meters
 Pole arrangement Single-sided
 Pole height (h) 10 meters



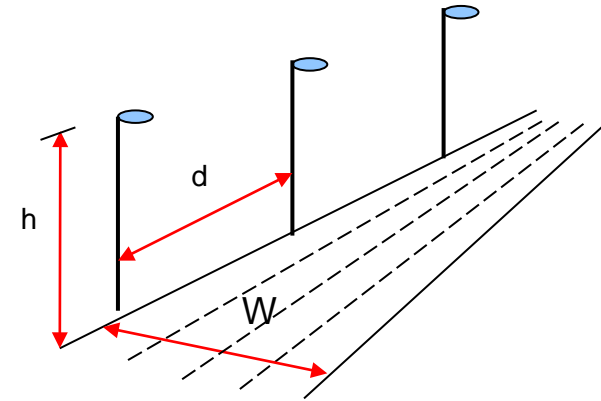
Road class	M1	M2	M3	M4	M5
Pole distance (d)	30 meters	30 meters	30 meters	30 meters	30 meters
Light output	Φ^2	16,251 lumen	11,200 lumen	8,000 lumen	5,600 lumen
Pole distance (d)	40 meters	40 meters	40 meters	40 meters	40 meters
Light output	U_1^1	U_1^1	16,251 lumen	10,400 lumen	7,200 lumen
Pole distance (d)	50 meters	50 meters	50 meters	50 meters	50 meters
Light output	-	-	-	-	8,800 lumen

¹ Uniformity lengthwise not met

² Flux too low

12-meter roadway, single-sided pole layout

FastFlex lens III-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Single-sided
 Pole height (h) 12 meters



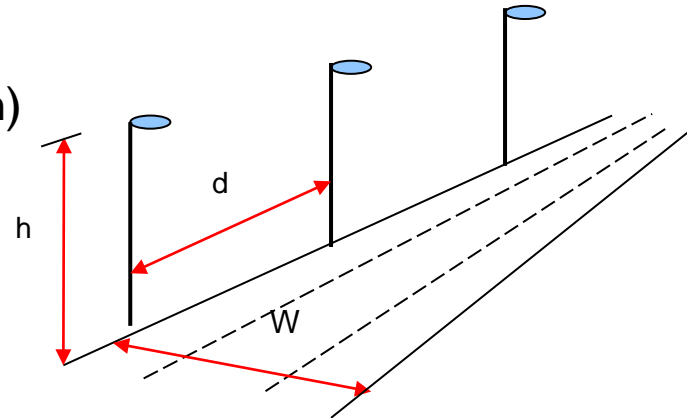
Road class	M1	M2	M3	M4
Pole distance (d)	36 meters	36 meters	36 meters	36 meters
Light output	-	U_1^1	17,411 lumen	12,000 lumen
Pole distance (d)	48 meters	48 meters	48 meters	48 meters
Light output	U_1^1	U_1^1	Φ^2	16,251 lumen
Pole distance (d)	60 meters	60 meters	60 meters	60 meters
Light output	-	-	-	-

¹ Uniformity lengthwise not met

² Flux too low

Type IV-X lens, 10-meter roadway, opposite

FastFlex lens IV-X
 Road type Single carriageway 3 lanes (3x3.3m)
 Road width (W) 10 meters
 Pole arrangement Single-sided
 Pole height (h) 8 meters

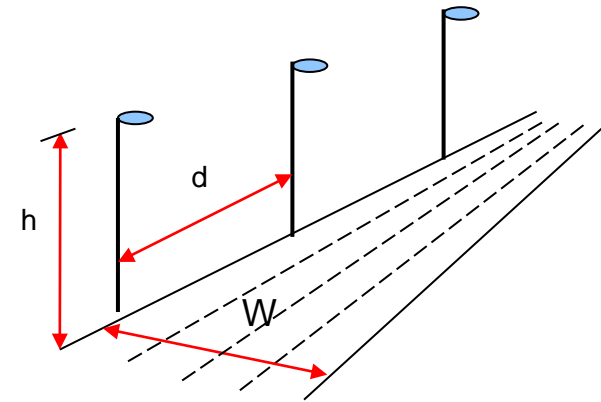


Road class	M1	M2	M3	M4	M5
Pole distance (d)	16 meters	16 meters	16 meters	16 meters	16 meters
Light output	U _l ¹	U _l ¹	8,800 lumen	6,400 lumen	4,800 lumen
Pole distance (d)	20 meters	20 meters	20 meters	20 meters	20 meters
Light output	U _l ¹	U _l ¹	10,400 lumen	8,000 lumen	5,600 lumen
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	-	-	-	-	6,400 lumen

¹ Uniformity lengthwise not met

12-meter roadway, single-side pole layout

FastFlex lens IV-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Single-sided
 Pole height (h) 10 meters

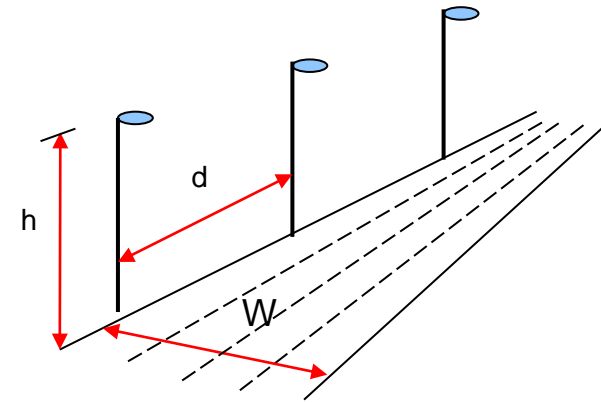


Road class	M1	M2	M3	M4	M5
Pole distance (d)	20 meters	20 meters	20 meters	20 meters	20 meters
Light output	Φ^2	19,733 lumen	12,800 lumen	9,600 lumen	6,400 lumen
Pole distance (d)	25 meters	25 meters	25 meters	25 meters	25 meters
Light output	Φ^2	Φ^2	16,251 lumen	12,000 lumen	8,000 lumen
Pole distance (d)	30 meters	30 meters	30 meters	30 meters	30 meters
Light output	-	-	-	-	10,400 lumen

² Flux too low

12-meter roadway, single-side pole layout

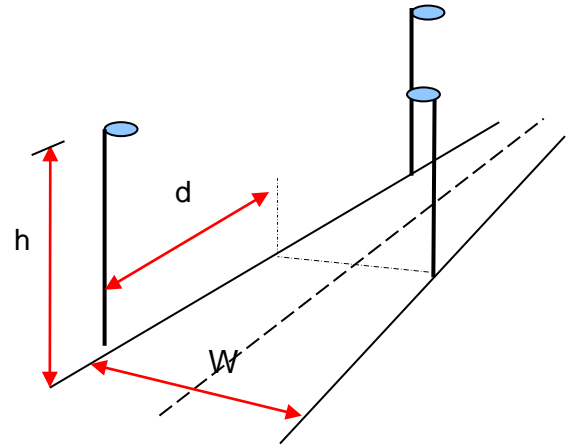
FastFlex lens IV-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Single-side
 Pole height (h) 12 meters



Road class	M1	M2	M3	M4	M5
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	Φ^2	Φ^2	16,251 lumen	12,800 lumen	8,800 lumen
Pole distance (d)	30 meters	30 meters	30 meters	30 meters	30 meters
Light output	-	-	-	16,251 lumen	11,200 lumen
Pole distance (d)	36 meters	36 meters	36 meters	36 meters	36 meters
Light output	-	-	-	-	12,800 lumen

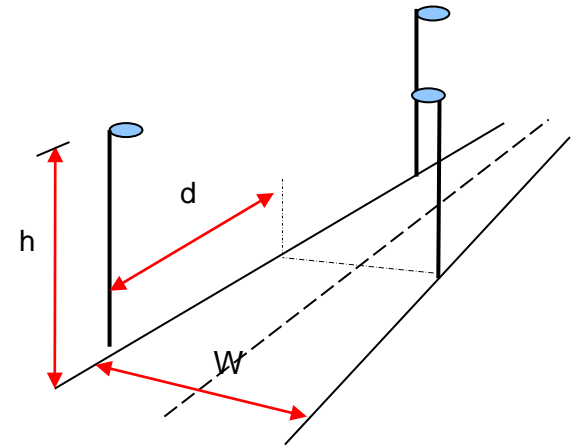
² Flux too low

Pole arrangement: Staggered



8-meter roadway, staggered pole layout

FastFlex lens II-X
 Road type Single carriageway 2 lanes (2x4m)
 Road width (W) 8 meters
 Pole arrangement Staggered
 Pole height (h) 8 meters

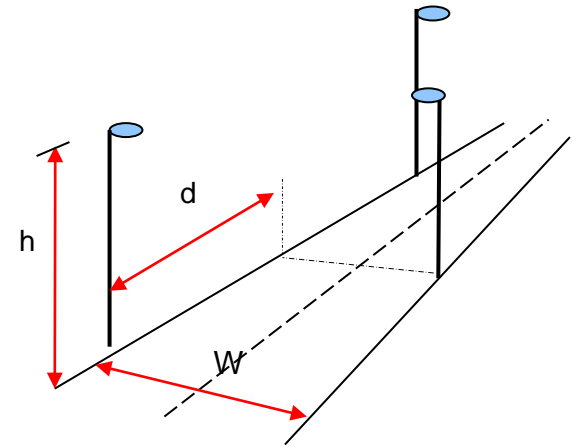


Road class	M1	M2	M3	M4	M5
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	U _l ¹	U _l ¹	U _l ¹	U _l ¹	3,200 lumen
Pole distance (d)	32 meters	32 meters	32 meters	32 meters	32 meters
Light output	-	-	-	-	-
Pole distance (d)	40 meters	40 meters	40 meters	40 meters	40 meters
Light output	-	-	-	-	-

¹ Uniformity lengthwise not met

8-meter roadway, staggered pole layout

FastFlex lens III-X
 Road type Single carriageway 2 lanes (2x4m)
 Road width (W) 8 meters
 Pole arrangement Staggered
 Pole height (h) 8 meters

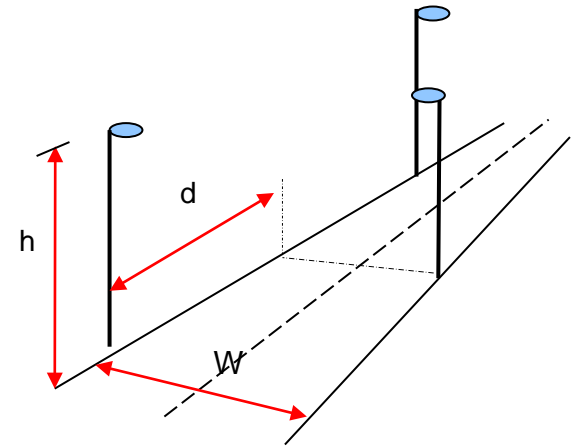


Road class	M1	M2	M3	M4	M5
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	U _l ¹	U _l ¹	6,400 lumen	4,800 lumen	3,200 lumen
Pole distance (d)	32 meters	32 meters	32 meters	32 meters	32 meters
Light output	-	-	-	-	-
Pole distance (d)	40 meters	40 meters	40 meters	40 meters	40 meters
Light output	-	-	-	-	-

¹ Uniformity lengthwise not met

8-meter roadway, staggered pole layout

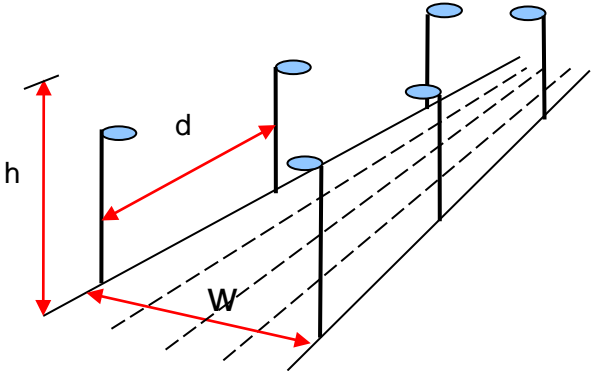
FastFlex lens IV-X
 Road type Single carriageway 2 lanes (2x4m)
 Road width (W) 8 meters
 Pole arrangement Staggered
 Pole height (h) 8 meters



Road class	M1	M2	M3	M4	M5
Pole distance (d)	16 meters	16 meters	16 meters	16 meters	16 meters
Light output	-	-	-	-	4,000 lumen
Pole distance (d)	20 meters	20 meters	20 meters	20 meters	20 meters
Light output	-	-	-	-	7,200 lumen
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	-	-	-	-	-

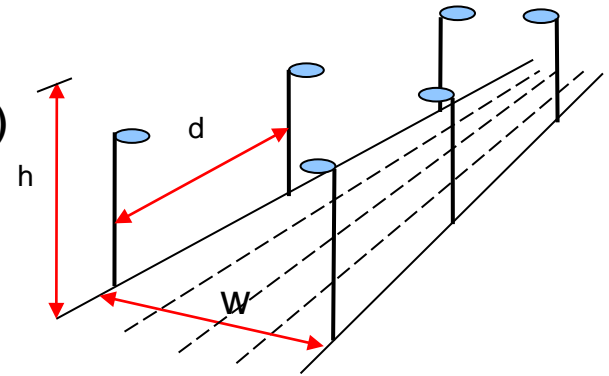
¹ Uniformity lengthwise not met

Pole arrangement: Opposite



10-meter roadway, opposite pole layout

FastFlex lens II-X
 Road type Single carriageway 4 lanes (4x3 m)
 Road width (W) 12 meters
 Pole arrangement Opposite
 Pole height (h) 6 meters

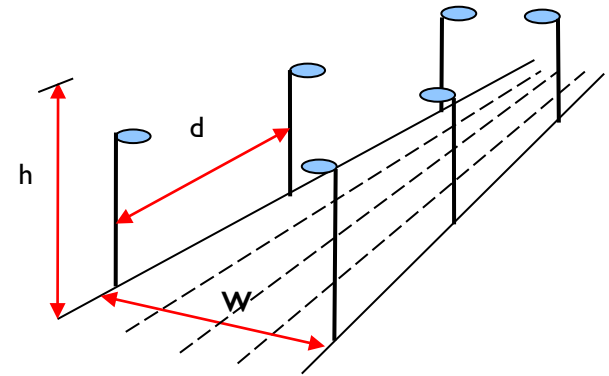


Road class	M1	M2	M3	M4	M5
Pole distance (d)	18 meters	18 meters	18 meters	18 meters	18 meters
Light output	U _l ¹	U _l ¹	3,200 lumen	< 3,200 lumen	< 3,200 lumen
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	-	-	4,000 lumen	3,200 lumen	<3,200 lumen
Pole distance (d)	30 meters	30 meters	30 meters	30 meters	30 meters
Light output	-	-	-	-	<3,200 lumen

¹ Uniformity lengthwise not met

12-meter roadway, opposite pole layout

FastFlex lens II-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Opposite
 Pole height (h) 8 meters

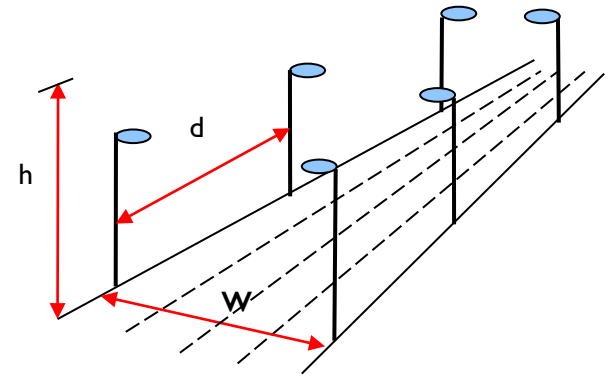


Road class	M1	M2	M3	M4
Pole distance (d)	24 meters	24 meters	24 meters	24 meters
Light output	8,000 lumen	6,400 lumen	4,000 lumen	3,200 lumen
Pole distance (d)	32 meters	32 meters	32 meters	32 meters
Light output	U _l ¹	U _l ¹	U _l ¹	U _l ¹
Pole distance (d)	40 meters	40 meters	40 meters	40 meters
Light output	U _l ¹	U _l ¹	U _l ¹	U _l ¹

¹ Uniformity lengthwise not met

12-meter roadway, opposite pole layout

FastFlex lens II-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Opposite
 Pole height (h) 10 meters

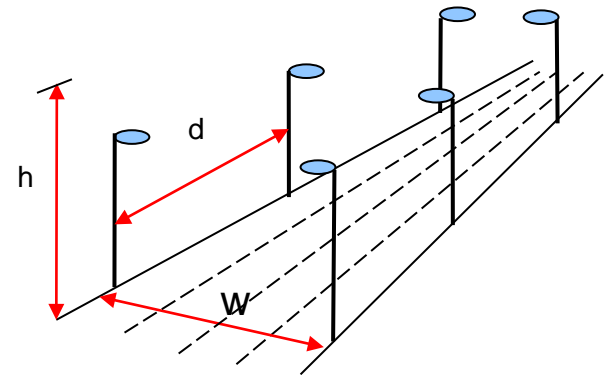


Road class	M1	M2	M3	M4
Pole distance (d)	30 meters	30 meters	30 meters	30 meters
Light output	U _l ¹	U _l ¹	5,600 lumen	4,000 lumen
Pole distance (d)	40 meters	40 meters	40 meters	40 meters
Light output	U _l ¹	U _l ¹	U _l ¹	U _l ¹
Pole distance (d)	50 meters	50 meters	50 meters	50 meters
Light output	U _l ¹	U _l ¹	U _l ¹	U _l ¹

¹ Uniformity lengthwise not met

12-meter roadway, opposite pole layout

FastFlex lens III-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Opposite
 Pole height (h) 6 meters

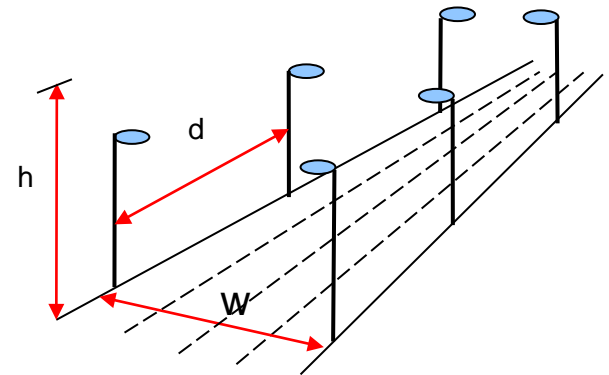


Road class	M1	M2	M3	M4	M5
Pole distance (d)	18 meters	18 meters	18 meters	18 meters	18 meters
Light output	5,600 lumen	4,000 lumen	3,200 lumen	<3,200 lumen	<3,200 lumen
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	7,200 ³ lumen	5,600 ³ lumen	4,000 lumen	3,200 lumen	<3,200 lumen
Pole distance (d)	30 meters	30 meters	30 meters	30 meters	30 meters
Light output	-	-	4,800 lumen	4,000 lumen	<3,200 lumen

³ TI too high. Generally SR < 0.50

12-meter roadway, opposite pole layout

FastFlex lens III-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Opposite
 Pole height (h) 8 meters

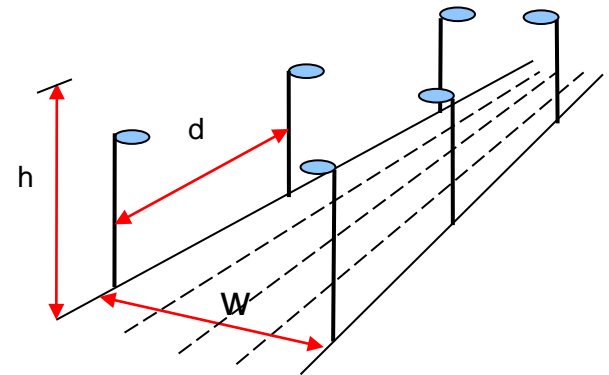


Road class	M1	M2	M3	M4	M5
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	U _l ¹	U _l ¹	6,400 lumen	4,800 lumen	3,200 lumen
Pole distance (d)	32 meters	32 meters	32 meters	32 meters	32 meters
Light output	-	-	-	-	-
Pole distance (d)	40 meters	40 meters	40 meters	40 meters	40 meters
Light output	-	-	-	-	-

¹ Uniformity lengthwise not met

12-meter roadway, opposite pole layout

FastFlex lens IV-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Opposite
 Pole height (h) 6 meters



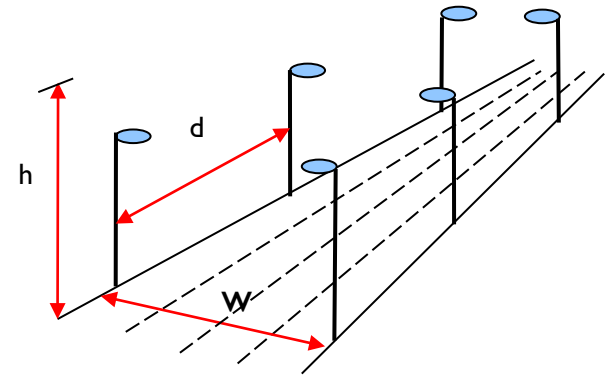
Road class	M1	M2	M3	M4	M5
Pole distance (d)	12 meters	12 meters	12 meters	12 meters	12 meters
Light output	5,600 lumen	4,000 lumen	3,200 lumen	Φ^4	Φ^4
Pole distance (d)	15 meters	15 meters	15 meters	15 meters	15 meters
Light output	7,200 lumen	5,600 lumen	4,000 lumen	3,200 lumen	Φ^4
Pole distance (d)	18 meters	18 meters	18 meters	18 meters	18 meters
Light output	U_1^1	U_1^1	4,000 lumen	3,200 lumen	Φ^4
Pole distance (d)	21 meters	21 meters	21 meters	21 meters	21 meters
Light output	-	-	-	-	3,200 lumen

¹ Uniformity lengthwise not met

⁴ Lumen output too high

12-meter roadway, opposite pole layout

FastFlex lens IV-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Opposite
 Pole height (h) 8 meters



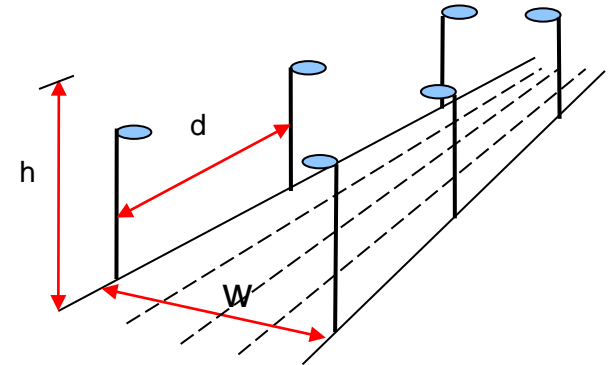
Road class	M1	M2	M3	M4	M5
Pole distance (d)	16 meters	16 meters	16 meters	16 meters	16 meters
Light output	8,800 lumen	6,400 lumen	4,800 lumen	3,200 lumen	Φ^4
Pole distance (d)	20 meters	20 meters	20 meters	20 meters	20 meters
Light output	11,200 lumen	8,000 lumen	5,600 lumen	4,000 lumen	3,200 lumen
Pole distance (d)	24 meters	24 meters	24 meters	24 meters	24 meters
Light output	U_i^1	U_i^1	U_i^1	U_i^1	3,200 lumen

¹ Uniformity lengthwise not met

⁴ Lumen output too high

12-meter roadway, opposite pole layout

FastFlex lens IV-X
 Road type Single carriageway 4 lanes (4x3m)
 Road width (W) 12 meters
 Pole arrangement Opposite
 Pole height (h) 10 meters



Road class	M1	M2	M3	M4	M5
Pole distance (d)	20 meters	20 meters	20 meters	20 meters	20 meters
Light output	U _l ¹	U _l ¹	6,400 lumen	4,800 lumen	3,200 lumen
Pole distance (d)	25 meters	25 meters	25 meters	25 meters	25 meters
Light output	U _l ¹	U _l ¹	8,800 lumen	6,400 lumen	4,000 lumen
Pole distance (d)	30 meters	30 meters	30 meters	30 meters	30 meters
Light output	U _l ¹	U _l ¹	U _l ¹	U _l ¹	4,800 lumen

¹ Uniformity lengthwise not met

