

## Annual Power Engineering Exchange (APEX)

### The Christchurch LED Upgrade Project

Lighting design for LED conversion of the 30,000 street lights in Christchurch

Michael Fang - Intermediate Design Engineer (Connetics)



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### Road Lighting Design



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## Aims of Road Lighting Design



- Safe movement
- Reduce the fear of crime at night



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## Aims of Road Lighting Design



- Safe movement
- Reduce the fear of crime at night
- Aesthetic



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# Standards and Specifications



- AS/NZS 1158 series
- NZTA M30 Specification
- CCC Infrastructure Design Standard
- CCC Construction Standard Specification
- Crime Prevention through Environmental Design



# Technical Calculation



- Perfect Lite

**PERFECT LITE - V Category Lighting - AS/NZS 1158**

I-Table File Name: C:\Users\fangm\Desktop  
 Initial Lamp Flux: 9.428 Klms  
 Luminaire Description: 70W  
 Lamp Wattage and Type: 70W  
 Stores Code:

Job Name: 2170

Lighting Category: **V4** Road Side

Arrangement No.: **1** Single Carriageway -

Mounting Height: **8.5** Upcast Arrangement

Luminaire Spacing: **41** upto: **43**

Lane Width: **2.5** Lanes per Carriageway

Median Width: **0** (Not applicable for Single Carriageway)

Overhang - 1st Row: **1** - 2nd Row: **0**

Outreach Size: **3.6** Outreach Size:

Carriageway Traffic Flow:  One Way  Two Way

**New Zealand Mode**

RESULTS FOR RUNNING SAASTAN WITH NOMINATED SPACINGS  
 [ NEW ZEALAND MODE ]

Job name: Waterloo Rd - L1

Luminaire I-table: G:\Design\_Lighting\4...I-Tables\2019\CCC CAT V selected supplier\ITron 1 - STU-W optic\I-TRON 1 0CS  
 STU-W 4.5-6M VEX 77W.cie

Luminaire Description: I11STU-W4\_5-6M 10090 lms

Lamp wattage & type: 70w

Light Source: LED

Stores Code: Luminous Flux: 10.09 Klms

Upcast Angle: 5 Degrees Arrangement: 1 Single-Left

Lane Width: 3.5 m Lanes per Carriageway: 4

Mounting Height: 10.6 m Total Carriageway Width: 14 m

Maintenance factor: 0.78

Overhang 1st Row: 0 m

Outreach Size: 3.6

Traffic Flow: Two Way

Lighting Category: V4

Spacing (m)	Traffic	Lane R	Table	LBar	Uo	U1	UWLR	TI	Eal	Esr	Comply with*
(m)	Direct-	No.	(>=0.50)	(>=0.33)	(>=0.3)	(=3)	(=20)	(=50)	(=50)	(=50)	V4
	ion		or (>=0.55)	(>=0.31)							
44.00	Normal	2	CIER2	.52	0.53	0.61	.01	8.30	83.45	66.56	AGREE
44.00	Normal	2	CIER2	.54	0.51	0.67	.01	7.63	83.45	66.56	AGREE
44.00	Oncoming	1	CIER2	.54	0.42	0.66	.01	4.80	66.56	83.45	AGREE
44.00	Oncoming	2	CIER2	.52	0.43	0.85	.01	5.95	66.56	83.45	AGREE
45.00	Normal	1	CIER2	.50	0.53	0.58	.01	8.44	83.38	66.58	AGREE
45.00	Normal	2	CIER2	.52	0.51	0.65	.01	7.76	83.38	66.58	AGREE
45.00	Oncoming	1	CIER2	.53	0.42	0.68	.01	4.89	66.58	83.38	AGREE
45.00	Oncoming	2	CIER2	.51	0.43	0.83	.01	6.04	66.58	83.38	AGREE
46.00	Normal	1	CIER2	.49	0.54	0.55	.01	8.57	83.36	66.54	NO
46.00	Normal	2	CIER2	.51	0.52	0.64	.01	7.88	83.36	66.54	AGREE



## Technical Calculation



- Perfect Lite
- AGI32

Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	
Horizontal PEDX	Illuminance	Lux	64.57	82.91	34.95	
Surround 1	Illuminance	Lux	37.41	60.43	10.68	
Surround 2	Illuminance	Lux	40.11	60.25	13.04	
Vertical PEDX 1	Illuminance	Lux	39.99	43.29	32.85	
Vertical PEDX 2	Illuminance	Lux	38.07	42.78	29.42	

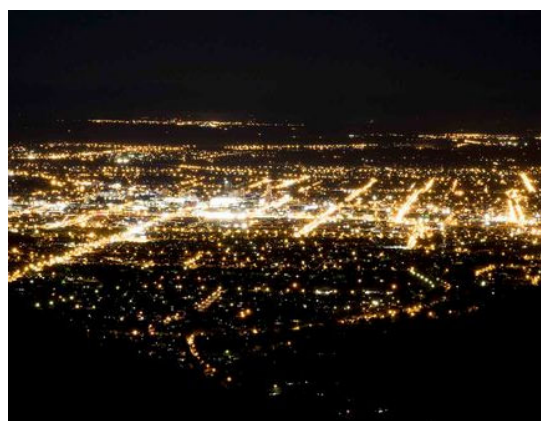


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## Christchurch LED Project



- NZTA funded
- More than 30,000 lights
- Provide lighting design with a target design compliance rate of 95%
- Central Management System
- Save more than \$1.5 million/year, reduce carbon emissions by approximately 1500 tonnes/year



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## Central Management System



- Remote control individual lights



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## Central Management System



- Remote control individual lights
- Monitoring power usage and report fault



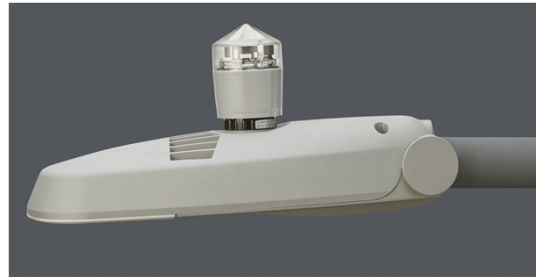
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## Central Management System



- Remote control individual lights
- Monitoring power usage and report fault
- Photocell

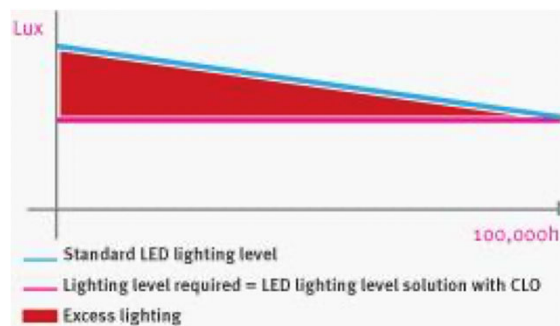


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## Central Management System



- Remote control individual lights
- Monitoring power usage and report fault
- Photocell
- Curfew dimming and CLO dimming

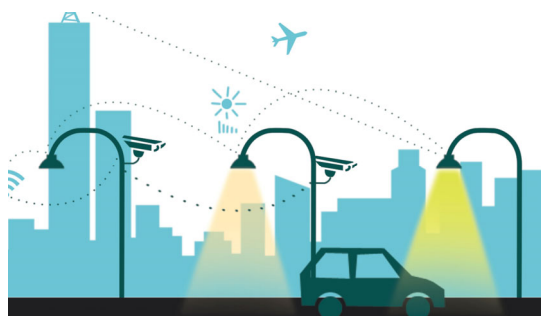


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## Central Management System



- Remote control individual lights
- Monitoring power usage and report fault
- Photocell
- Curfew dimming and CLO dimming
- Sensors

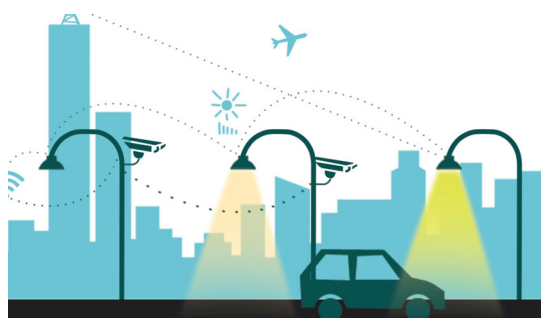


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## Central Management System



- Remote control individual lights
- Monitoring power usage and report fault
- Photocell
- Curfew dimming and CLO dimming
- Sensors
- Communication infrastructure

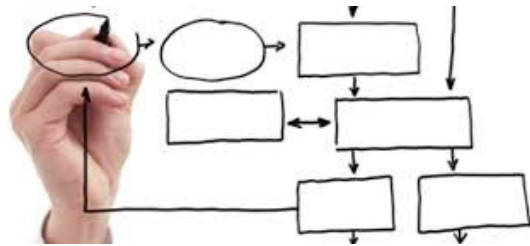


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# Design Methodology - Other Council



- Like for like substitute
- Pros: Quick and simple
- Cons: Difficult to confirm compliance



# Design Methodology - Christchurch



- Design Spreadsheet setup





# Design Methodology - Christchurch



- Design Spreadsheet setup
- Parameter review & rounding

APPENDICES

A ROUNDED DESIGN PARAMETER

Column/Pole Type	Arm Type	M/N (m)	M/N (Rounded)	Quantity	Carriageway width (m)	Rounded value (m)
Orion / Telecom pole	S12	9.35	9.3	1623	0 - 8.5	Check why so narrow
Spunlite highway pole	H20	10.5	10.5	1218	8.5 - 10.5	10
11m Sectional steel pole	3m Spunlite Mitred Single Outreach Arm	11	10.5	1150	10.5 - 12.5	12
Orion / Telecom pole	S20	9.45	9.3	1060	12.5 - 14.5	14
10.6m Spunlite Sectional Steel Pole GP	3m Spunlite Mitred Single Outreach Arm	10.6	10.5	816	14.5 - 16.5	16
Orion / Telecom pole	S19	9.1	9.3	589	16.5 - 18.5	18
Orion / Telecom pole	S02	6.7	6.7	566	18.2 - 20.5	20
Orion / Telecom pole	S16	9.35	9.3	406		
Spunlite Tall suburban	H20	9	9.3	318		
Spunlite highway pole	H12	10.5	10.5	286		
11m Sectional steel pole	2m Spunlite Mitred Double Outreach Arm	11	10.5	182		
Spunlite Tall suburban	H12	9	9.3	165		
Spunlite highway pole	A10	10.5	10.5	161		
10.6m Spunlite Sectional Steel Pole GP	2m Spunlite Mitred Single Outreach Arm	10.6	10.5	159		
11m Sectional steel pole	3m Spunlite Mitred Double Outreach Arm	11	10.5	139		
7.4m Sectional steel pole	Curved 1.5 metre outreach arm	7.4	7.4	138		
11m Sectional steel pole	Fabricated Steel 4 mtr single	11	10.5	126		
12m Sectional steel pole	S22	12	12	94		
Orion / Telecom pole	S01W	7.7	7.4	90		

Overhang (m)	Rounded value (m)
-1 to 1	0
1 to 2.5	2
2.5 to 5	3



# Design Methodology - Christchurch



- Design Spreadsheet setup
- Parameter review & rounding
- Shortlist luminaire base on commonest design scenarios

Scenarios	Subcategory	Carriageway width (m)	Mounting height (m)	Arrangement	Overhang (m)	Location
Scenario 1	V2	14	9.3	Single sided	1	Straight road
Scenario 2	V2	14	10.5	Single sided	1	Straight road
Scenario 3	V3	14	9.3	Single sided	1	Straight road
Scenario 4	V4	14	9.3	Single sided	1	Straight road
Scenario 5	V2/V3/V4	14	9.3	Typical intersection	1	Intersection



## Design Methodology - Christchurch



- Design Spreadsheet setup
- Parameter review & rounding
- Shortlist luminaire base on commonest design scenarios
- Build calculation Matrix



## Design Methodology - Christchurch



- Design Spreadsheet setup
- Parameter review & rounding
- Shortlist luminaire base on commonest design scenarios
- Build calculation Matrix
- Develop VBA programming to determine best performed luminaire and optimize wattage

```

Sub DesignBySpecifiedRow()
    Dim RComp As Integer
    Dim SComp As Integer
    Dim TRComp As Integer

    Worksheets("Design Spreadsheet").Activate
    StartRow = UserForm1.Startingrow
    EndRow = UserForm1.Endingrow

    firstrow = StartRow
    Do
        IF firstrow > EndRow Then Exit Do
        Counter = 0
        Do
            If Cells(firstrow + Counter, 16) = "" Then Exit Do
            Counter = Counter + 1
        Loop
        lastrow = firstrow + Counter - 1

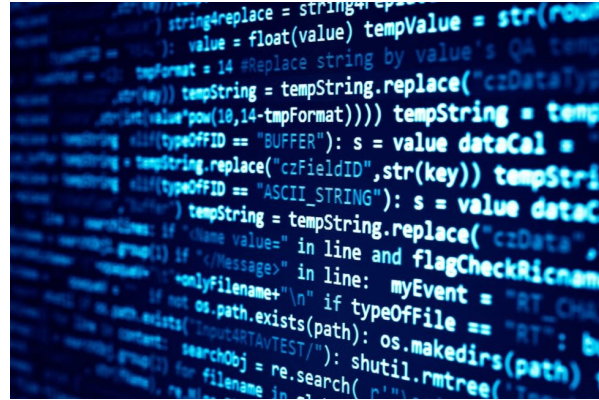
        ToRC
        RComp = Compliance(firstrow, lastrow)
        ToSasta
        SComp = Compliance(firstrow, lastrow)
        ToIT
    
```



# Programming and Engineering



- Highly customized shortcut
- Match Orion ID and RAMM ID
- Auto-fill doc



# Questions?

