Rockdale Gardens

Interior Light Level Study – Megaman Compact Reflector GU10

Demand Management and Planning Project (DMPP)

S6006 001

CUNDALL

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A	Issued for review and comments	14/02/2006
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The success and realisation of the proposed initiatives will be dependant upon the commitment of the design team, the development of the initiatives through the life of the design and also the implementation into the operation of the building. Without this undertaking the proposed targets may not be achieved.

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Executive Summary

This report, prepared by Cundall for DMPP, provides the results of the light level assessment of the Megaman compact reflector GU10 lamps with regards to compliance with Australian Standard for Interior Lighting and in comparison with regular halogen downlight lamps.

The maintenance illuminance recommended by the Australian Standard is 40 lx for passageways and 160 lx for lobbies/foyer, as measured at floor level.

The results of the field measurement found that the 9W compact reflector lamps do not achieve the average illuminance level recommended by AS1680.2.1-1993 in either the corridor or the lift lobby areas. The field measurements found the average light levels of the existing tungsten halogen lamps complied with the recommended levels in both the corridor and the lift lobby areas. However, the uniformity of illuminance provided by the tungsten halogen lamps is below the level recommended in the Australian Standard.

1 Introduction

Cundall was commissioned by Demand Management and Planning Project (DMPP) to provide a light level study on the Megaman Compact Reflector GU10 lamps installed at 3-7 Keats Ave, Rockdale. The aim of this study was to verify whether a direct replacement of regular dichroic (tungsten halogen) lamps with the compact reflector lamps will result in light levels that comply with the Australian Standard for Interior Lighting (AS 1680).

The field measurements were carried out in a U-shaped foyer with tungsten halogen lamps on one half of the surveyed area replaced by the compact reflector lamps (with fittings). The maintenance illuminance recommended by Australian Standard Interior Lighting Part 2.1: Circulation Spaces and Other General Areas (AS 1680.2.1-1993) is 40 lx for passageways and 160 lx for lobbies/foyer, as measured at floor level.

2 Test Conditions

2.1 Survey Date

The field measurements were carried out on Friday 10 February 2006, beginning at 9:45am and finishing at 10:45am.

2.2 Equipment

A Topcon illumination meter IM-2D (Serial No. 00426086) rented from Tech-Rentals (Asset No. 87330) was used to measure the lux levels of the test area. The meter was last calibrated by LightLab International on 16 March 2005 and the Photometric Test Report is attached as Appendix B.

2.3 Surveyed Area Description

The surveyed area was the lift lobby at level 10 of Rockdale Gardens. The area is completely enclosed with no access to natural daylight. The ceiling is painted matt white, the walls matt cream and the floor has a dull grey carpet floor covering. The doors along the corridor are glossy grey in colour. The area is ventilated by supply air.

2.4 Condition of Interior Surfaces

Ceiling – clean
Walls – clean
Floor – average

2.5 Lamp/Luminaire Details

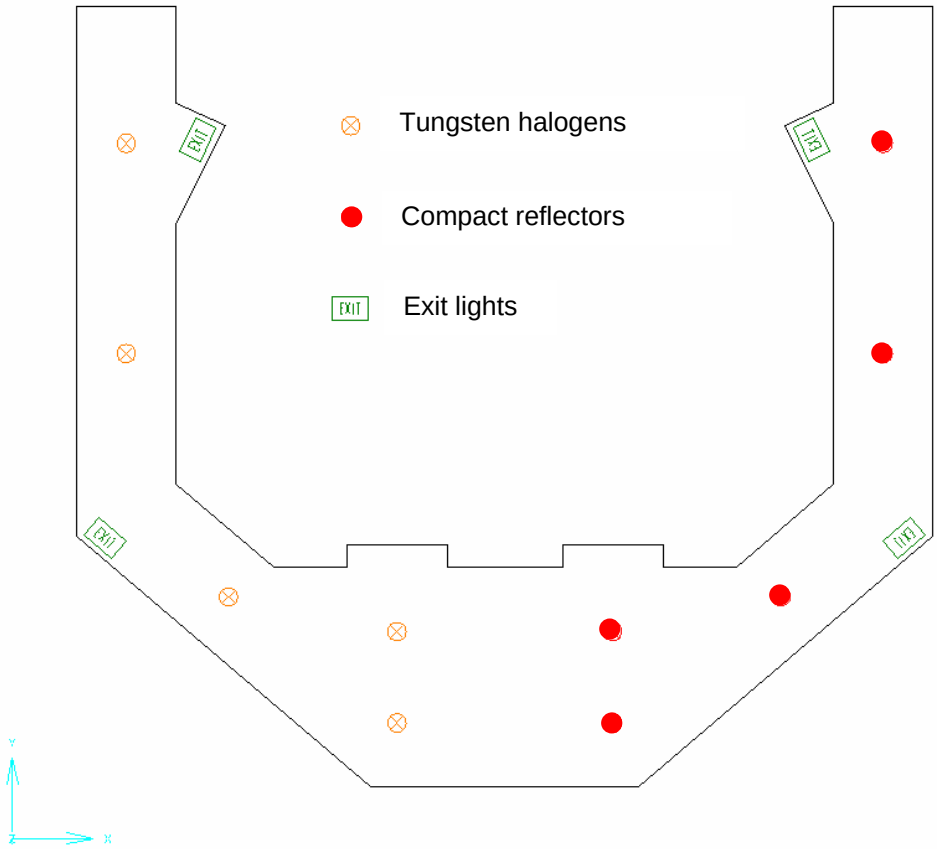
The building manager, David Ellis, confirmed that the compact reflector lamps were installed approximately one week prior to the survey and had been switched on for 24 hours/7 days per week since installation. Although the wattages of the installed lamps were not verified by visual inspection, the building manager claimed that the compact

reflectors are rated at 9W and the tungsten halogens at 20W (lamp only). Four emergency exit lights are also present in the surveyed area. The models of the lamps in this study are:

Tungsten halogen lamps – BriLight Tungsten Halogen GU 5.3 MR16 12V 20W BAB 38°

Compact reflector lamps – Megaman Compact reflector GU10 BR0709i (9W, 4000K coolwhite)

The diagram below shows the distribution of the fittings.



2.6 Supply Voltage

The supply voltage has been assumed to be within the nominal range of 230V for the compact reflectors and stepped down to 12V for the tungsten halogens.

2.7 Room Temperature

The room temperature at the time of measurement was approximately 25°C.

2.8 Maintenance/Replacement Schedule

The standard maintenance schedule for the halogen lamps is replacement every 6-8 weeks due to failure.

3 Methodology

The surveyed area was split into two sections for measurement. Furthermore, each section was divided into a grid of approximately 1 m² and illuminance measurements were taken at the centre of each square at floor level as per AS 1680.1.

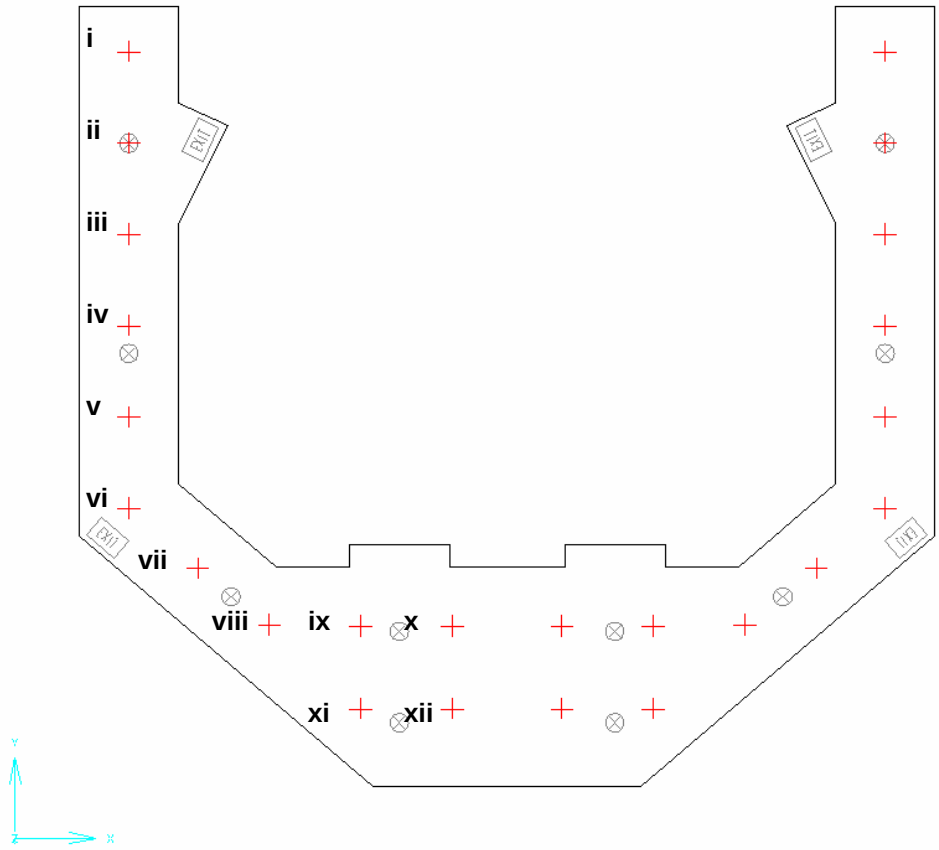
The measurements within the respective areas were used to provide the overall average illuminance results. The minimum average illuminance at all times through the life of the lighting system recommended by AS 1680.2.1 is 40 lx for passageways and 160 lx for lobbies/foyer, as measured at floor level.

In addition, the uniformity of illuminance was calculated, which is a measure of the difference between the minimum illuminance and the average illuminance expressed as a ratio. AS 1680.2.1 specified that the uniformity of illuminance over the entire space, at floor level, should be not less than 0.5.

4 Results

4.1 Tungsten Halogen Lamps

The measurement locations are shown in the diagram below.



Meter Percentage Error = -6.2% (range up to 200 lx)

Corridor		
Measurement	Measured Lux level (lx)	Error Corrected Lux level (lx)
i	80.1	85.4
ii	96.1	102.5
iii	58.7	62.6
iv	86.9	92.6
v	28.1	30.0
vi	20.1	21.4
vii	65.5	69.8
viii	151.7	161.7
Average	73.4	**78.3**

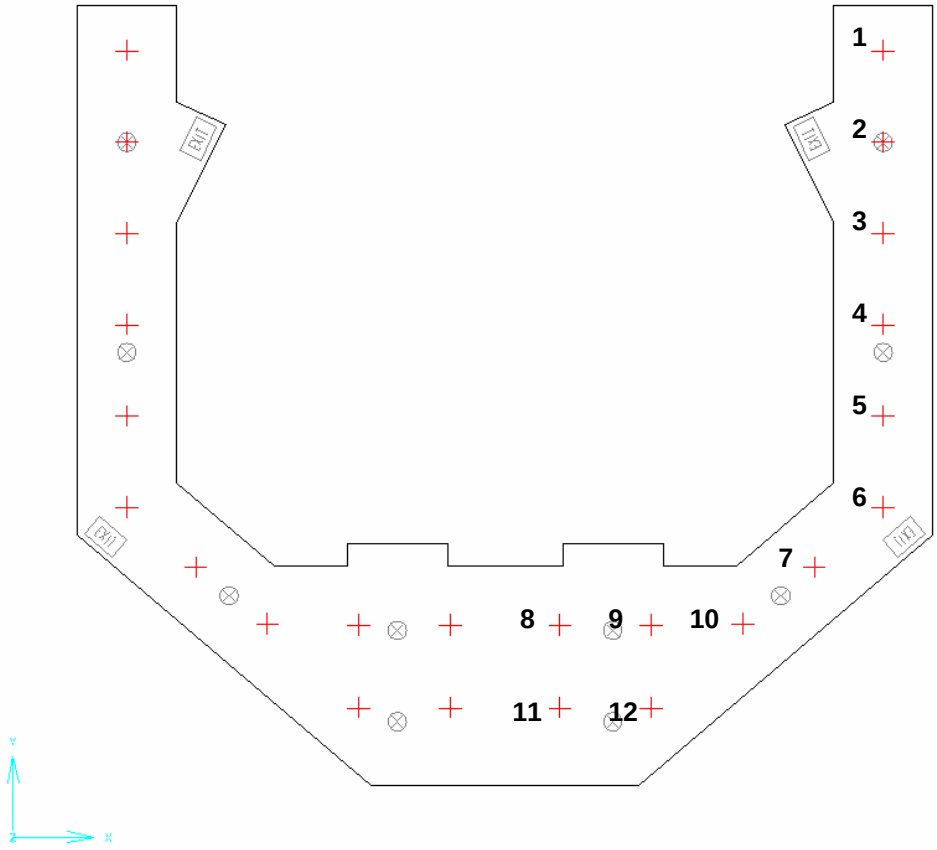
Lift lobby		
Measurement	Measured Lux level (lx)	Error Corrected Lux level (lx)
ix	214.0	228.1
x	242.0	258.0
xi	218.0	232.4
xii	119.0	126.9
Average	198.3	**211.4**

Uniformity of illuminance = 21.4/78.3 = **0.27**

Lamp lumen depreciation and luminaire depreciation over the lifetime of the lamps is assumed to be zero due to their short lifetime (1000 – 1300 hours). Thus, the expected average output of the halogen lamps at time of replacement is 73.4 lx and 198.3 lx for the corridor and the lift lobby respectively.

4.2 Compact Reflector Lamps

The measurement locations are shown in the diagram below.



Meter Percentage Error = -6.2% (range up to 50 lx)

Corridor		
Measurement	Measured Lux level (lx)	Error Corrected Lux level (lx)
1	15.5	16.5
2	22.7	24.2
3	24.3	25.9
4	23.7	25.3
5	26.1	27.8
6	27.6	29.4
7	31.0	33.0
8	29.9	31.9
Average	25.1	**26.8**

Lift lobby		
Measurement	Measured Lux level (lx)	Error Corrected Lux level (lx)
9	36.0	38.4
10	33.8	36.0
11	40.3	43.0
12	34.2	36.5
Average	36.1	**38.5**

Uniformity of illuminance = 16.5/26.8 = **0.62**

Manufacturer's data on lamp lumen depreciation was unavailable. Therefore, lamp lumen depreciation of 30% is assumed (as per tubular fluorescent).

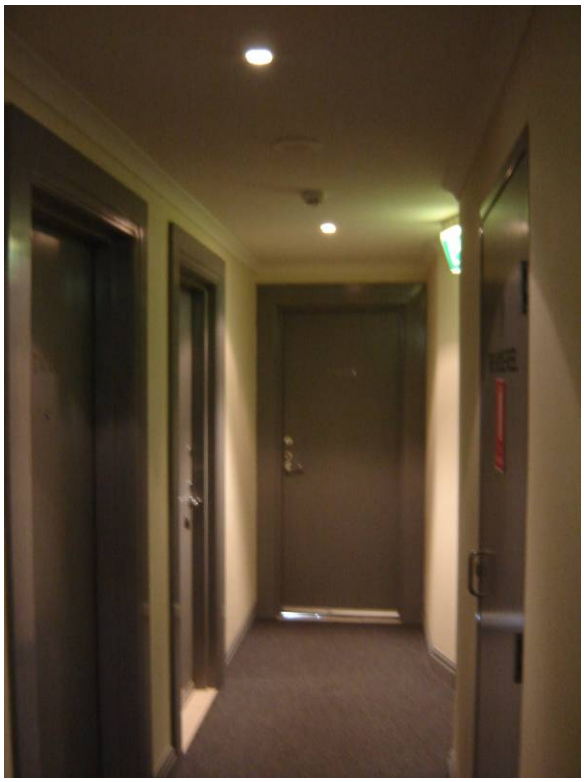
Light loss factor = 0.7

Thus, the expected average output of the compact reflector lamps at time of replacement is **18.8** lx and **27.0** lx for the corridor and the lift lobby respectively.

5 Discussion

The field measurements of light level indicated that the 9W compact reflector lamps are substantially less bright than the tungsten halogen lamps and do not comply with the illuminance level recommended by AS1680.2.1-1993.

The photos below demonstrate the contrast in illuminance between the two types of light fitting, with the tungsten halogens on the left and the compact reflectors on the right.

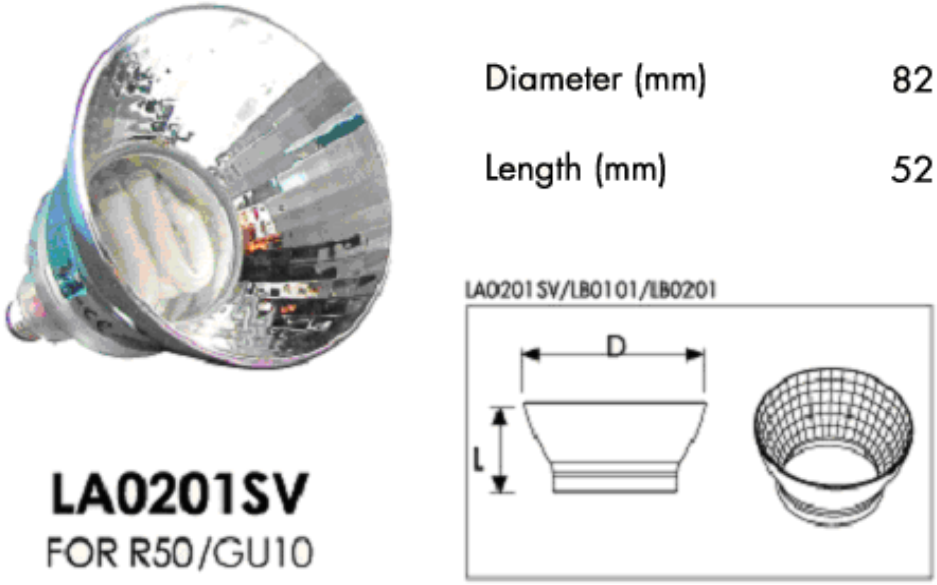


As shown in the photos above, the light distribution of the tungsten halogen downlights is much more focused in the downward direction while the compact reflectors have a comparatively wide angle of light distribution. This study found that the uniformity of illuminance provided by the tungsten halogens is below the level recommended by the Australian Standards.

The compact reflector lamps provide a more uniform illuminance than the halogen lamps and comply with uniformity of illuminance recommendation by the Australian Standards. The compact reflector also produced significantly less heat, which was positively noted by the tenants and the building manager. In addition, the long expected lifetime (15000

hours) of the compact reflectors is expected to considerably reduce the maintenance costs of lighting.

The recommended light level may be achieved by upsizing to the 11W compact reflector model (BR0711i) with the snap-in reflector (LA0201SV) attached (see picture below). However, the snap-in reflector attachment may adversely affect illuminance uniformity of the compact reflectors. The actual result of this strategy can only be confirmed from a field measurement.



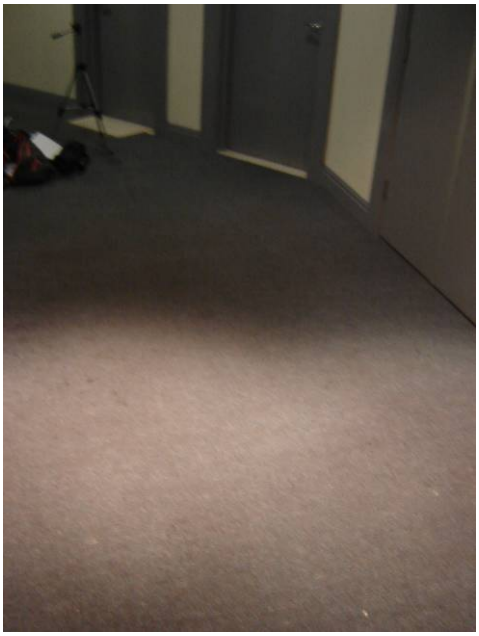
6 Conclusions

The retrofitted Megaman 9W compact reflectors do not comply with the illuminance level recommended by AS1680.2.1-1993 in either the corridor or the lift lobby areas. The existing 20W tungsten halogen lamps do comply with the illuminance level recommended by AS1680.2.1-1993 in both the corridor and the lift lobby areas.

Minimum light levels according to AS 1680 may be achieved with the 11W compact reflector model and the use of the snap-in reflector attachment although this would require verification with a field measurement.

7 Appendix A

Below: Contrast between the tungsten halogen (foreground) and the compact reflector (background) as seen at the lift lobby.



Clockwise from bottom: Floor; wall; and ceiling finishes in the lift lobby.

8 Appendix B

Photometric Test Report

LightLab
INTERNATIONAL

Report of Test

LSA8978

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Photometric Test Report Number LSA8978

Client		Tech Rentals
Contact Person		Joan Carter
Client Address		12 Maroondah Hwy Ringwood Vic 3031
Meter Description	Make	Topcon
	Model	IM-2D
Serial Number		426086
Reference Surface		Front face of meter body
Notes		

Nature of Test

To determine the illuminance response of of the meter when tested over a range of values.
To determine the response of the meter when illuminated with light transmitted through three coloured filters.

Test Procedure

The measurements were made on a four metre optical rail in conjunction with suitable filters and baffling to ensure the elimination of stray light. The light source used was a LightLab Secondary standard lamp operating at a colour temperature equivalent to the CIE Standard Illuminant A. The calibrated intensity of the Secondary standard lamp is traceable back to the Australian National Measurement Laboratory.

Uncertainties of Measurement

Measurement uncertainties are calculated at the 95% confidence interval with a factor k = 2 and are estimated to be:

Illuminance:	Refer table of results
Temperature:	+/- 1.0 degree C
Luminous Transmittance	Refer table of results

Authorised Signatory

Peter Lawrance
Approved Signatory

Date of Test 16th March, 2005
Date of Report 16th March, 2005

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Meter Range Setting	True Value (lux)	Meter Display Reading	Meter Display Multiplier	Reading Correction (lux)	Percentage Error (%)	Estimated Uncertainty (lux)
auto	1950	1865	1	85	-4.4	2.5% + 0.5
auto	1500	1411	1	89	-5.9	2.5% + 0.5
auto	1000	939	1	61	-6.1	2.5% + 0.5
auto	800	752	1	48	-6.0	2.5% + 0.5
auto	600	564	1	36	-6.0	2.5% + 0.5
auto	500	470	1	30	-6.0	2.5% + 0.5
auto	400	376	1	24	-6.0	2.5% + 0.5
auto	300	282	1	18	-6.0	2.5% + 0.5
auto	200	187	1	13	-6.5	2.5% + 0.5
auto	100	93.8	1	6.2	-6.2	2.5% + 0.1
auto	50	46.9	1	3.1	-6.2	2.5% + 0.1
auto	20	18.6	1	1.4	-7.0	2.5% + 0.1
auto	10	9.3	1	0.7	-7.0	2.5% + 0.1
auto	0	0.1	1	-0.1	n/a	0.1

Note: lux values in the correction column are to be added to the scaled meter display to determine the accepted value.

Luxmeter Spectral Characteristics

Nominal filter colour	Filter chromaticity coords x	Filter chromaticity coords y	Measured transmittance	Filter calibrated transmittance
Red	0.691	0.309	0.23 +/- 0.05	0.20
Green	0.371	0.446	0.52 +/- 0.05	0.52
Blue	0.146	0.164	0.05 +/- 0.05	0.05

Test Temperature 22.0 degrees C

Report Version 2.7 (December 13, 2004)

Lux Meter Cal Report.xls

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NATA calibrated asset history report

Model TOP, IM-2D-NATA Asset No 87330

This instrument,being a NATA certified item is carefully checked prior to each use and requires special care
to ensure its calibration integrity over its calibration cycle of twelve (12) months.

We seek your co-operation in handling and storing this/these item(s) accordingly, and would ask if you could report any problems that you experience on this report sheet. This will enable us to investigate any possible calibration error, and so keep the instrument in perfect operating condition.

With Thanks.

Date of use	Any difficulties - please detail	Organisation and contact