LIGHTING STRATEGY

MOSMAN HIGH SCHOOL MAJOR UPGRADE

LIGHTING SERVICES

JHA

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Key Contact	Marc Estimada

Prepared By

Company	JHA
Address	Level 23, 101 Miller Street, North Sydney NSW 2060
Phone	61-2-9437 1000
Email	Marc.Estimada@jhaengineers.com.au
Website	www.jhaservices.com
Author	John Stefani
Checked	John Stefani
Authorised	Marc Estimada

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1 INTRODUCTION

JHA Engineers have been engaged by Multiplex to provide the design of lighting services for the proposed Mosman High School development located at 745 Military Road, Mosman.

The proposed Mosman High School development seeks detailed built form approval of new teaching and educational facilities, as detailed below:

Development consent is sought for the following works:

- Demolition of Building B, Building C and part Building E;
- Removal of existing sports court and surrounding retaining walls and nominated trees;
- Construction of a new part 3/ part 4 storey building plus lift overrun and net enclosure to rooftop multi-court (Building G) on the corner of Military Road and Belmont Road providing:
- Administration and staff facilities;
- Multipurpose gym/hall;
- Library;
- Canteen facilities;
- General and senior learning units;
- Science learning unit;
- Health / PE and performing arts unit; and
- Learning and admin support unit.
- Associated landscaping works including new outdoor play areas, a rooftop play space and rooftop multi-purpose court; and
- Relocation of the main pedestrian entrance from Military Road to Belmont Road.

The document is designed to achieve a summarised, succinct and coherent written description detailing information on the lighting strategy to be implemented to the new Building G. The document will also identify the recommended lighting levels and specific requirements as per Australia Standards & EFSG requirements and will be used a guide for the detailed design development.

The document is not designed as a specification or bill of materials, nor is it intended to provide detail of the equipment, fitting or services selection.

2 LIGHTING STRATEGY

2.1 ASPIRATIONAL BRIEF

The lighting design for the Project aims to not only achieve an elegant and discreet solution that will enhance the aesthetic qualities of the new building G, but also to provide a robust system which is energy efficient for the school.

The aspirations of the overall lighting design will be delivered through design solutions that benchmark internationally accepted best practice recommendations to support the functionality of the school's interior and exterior spaces. The design will achieve high visual comfort, and sensitively respond to the building fabric and the immediate environment by considering the following key points:

- Relationship to site and immediate surrounds i.e. existing building and infrastructure, reduce light spill into surrounding sensitive receivers
- Flexibility to accommodate the various functional requirements of the school
- Coordination and integration with architecture, fire strategies, and other engineering services disciplines
- User comfort and experience
- Energy efficiency
- Technology – appropriate, tested and robust;
- Light - efficient and appropriate artificial sources balanced with natural light sources
- Safety
- Controllability
- Reliability
- Adaptability
- Maintainability
- Expandability
- Value for Money

2.2 ENERGY

Supporting the global movement to preserve and use natural resources and monitor energy consumption and costs, the project not only has an opportunity but also a responsibility to achieve a successful sustainable solution with minimal impact on the environment. The design will consider a holistic approach to attain a low energy sustainable solution.

2.3 TECHNOLOGY

Technological advancement is a key consideration within the new building G. The design will incorporate smart design principles to compliment the building's technical capabilities. Design considerations will assist in enhancing the flexibility and function of the space.

2.4 OBJECTIVES AND GUIDELINES

The design objective is to respond to the Mosman DCP whilst adopting best practice recommendations in accordance with Australian code compliance.

2.4.1 MOSMAN DCP

The design objective shall respond to the Mosman council's DCP objectives as stated under Par 4 – General Planning Controls. The provisions below shall be designed / allowed to meet / align with the Mosman council's DCP objectives

OBJECTIVES

- To have buildings that incorporate more sustainable energy sources, fitouts, fixtures and systems.
- To have adequate lighting to provide a sense of security for the occupants and visitors to buildings and to the public areas around the building

PROVISIONS

- Buildings are to incorporate energy saving devices in the area of lighting. This includes the use of:
  - Energy efficient light fittings with high efficiency reflectors,
  - Fluorescent lamps, LED lighting or solar lighting,
  - Motion detectors to turn lights on and off automatically,
  - Motion sensor on and off timers and daylight controls to switch outdoor lighting on and off. Similar controls are encouraged for common areas such as hallways and stairwells,
  - Individual areas / rooms should have individual light switches installed and clearly labelled for each area
  - Where incandescent or halogen lights are installed they should be controlled by dimmer switches,
  - Natural lighting such as skylights and window size and placement should be utilised to minimise the need for additional lighting.
- Lighting is to be provided to public and private spaces such as entries of buildings, driveways, parking areas, pedestrian walkways and the underside of awnings, to promote safety and security during periods of low natural light.
- Lighting should not create glare, dark shadows or nuisance to neighbours, and may need to be hooded, shielded or directed away from adjacent premises to minimise impact.
- To control light spill, outdoor lighting should be designed consistent with AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting.

2.4.2 CODES AND COMPLIANCE

Whilst the creation of an appropriate lighting atmosphere is considered the highest priority, the following policies, acts, ordinances, regulations and codes will be considered as part of the design:

- The Standards Association of Australia
- The Building Code of Australia NCC 2019
- EFSG requirements – DG63 Lighting
- AS4282 – Control of the Obtrusive Effects of Outdoor Lighting
- AS1680 – Interior Lighting
- AS2560 – Sports Lighting
- AS1158 – Lighting for roads and public spaces – Pedestrian

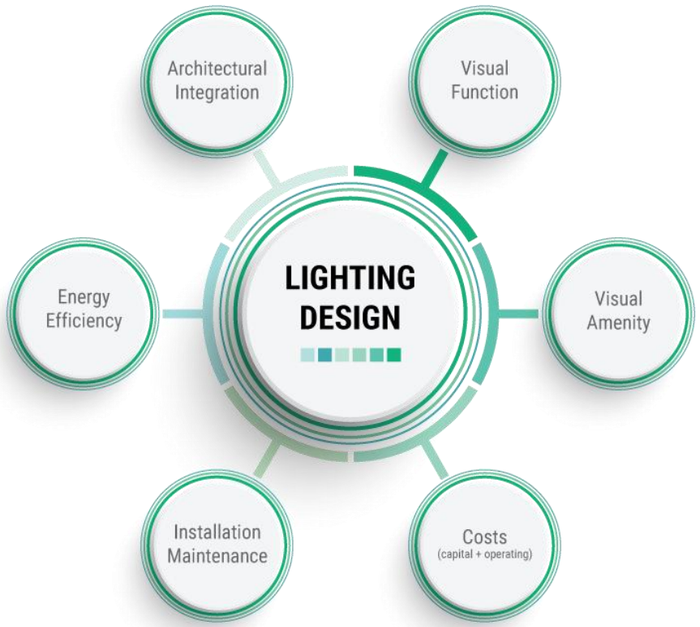
2.5 LIGHTING DESIGN OBJECTIVES

Light is a major part of the project since it has a direct influence on the perception and the definition of this distinguished landmark educational institution. The important issues to consider are the illuminance levels provided, the selection of luminaires, luminaire colour temperature, luminaire colour rendering, the use of daylight, the control of light, and the location of luminaires to ensure minimal impact to the fabric of the architecture and to avoid negative impact and obtrusive effects to the neighbouring properties/ receivers.

Throughout the support spaces, light should create a comfortable, varied, inviting and interesting atmosphere, in support of the vision, intention and design of the architecture.

Flexibility in the lighting design is crucial in achieving a successful outcome to balance low levels of daylight in the basement levels, reduce contrast, and minimise glare. Visual comfort within the auditorium is paramount as it transforms to accommodate the various functional requirements. Lighting control is a significant aspect to consider to achieve a flexible layered lighting approach i.e. functional, accent, and ambient lighting.

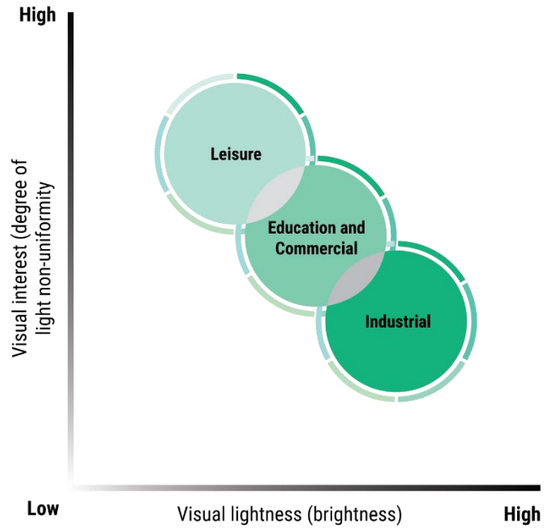
The internal lighting scheme should consider façade and exterior connections of the building to provide a cohesive and harmonious solution that connects the interior and exterior where appropriate and enhance the facades connection to the landscape. The design must also connect to the street and immediate exterior environment whilst avoiding impact to neighbours by ensuring deign compliance to AS4282.



The following lighting strategies will be implemented:

- The lighting design will only highlight the building feature element while minimising the reflectance to neighbouring buildings, especially residential buildings.
- Special consideration to external luminaire selection will be made in particular the light intensity and distribution.
- Lighting calculation will be carried out to demonstrate the compliance to AS4282.
- Luminaires on the rooftop and/or podium will be controlled by timer to ensure illumination shall not exceed 10pm on any day. In addition, a local lighting control switches will be installed in the nearest electrical switchboard to override the system.
- Low glare luminaires will be utilised throughout the external lighting.
- Timers and photoelectric sensors will be installed for energy savings.
- Building entrance and external walkways will be well lit to maximised the opportunities for casual surveillance.
- Up-lighting luminaires will be avoided to minimise the sky glow.

2.6 LIGHTING DESIGN PARAMETERS



2.6.1 VISUAL QUALITIES OF LIGHT

The lighting will focus on establishing a palette of colour temperatures that best suit the interior function and finishes. Introduction of subtle strokes with colour temperature/colour/optics/intensity may be explored to create functional unique spaces within the new Building G. Light should be used to *reveal* the architectural features in both outdoor and indoor learning environments.

Correlated colour temperature (CCT) of a light source is a measure of the hue of the white light output of that source. It is denoted in Kelvin (K) degrees that refer to the temperature of a theoretical black body radiator which, when heated up to a certain temperature, emits the same hue equivalent as the light source in question.

Practically, correlated colour temperature gives an indication of how cool or how warm the light output of a light source appears. Colour temperatures of less than 3500 K are commonly named as warm white. The lower the correlated colour temperature of a light source, the warmer the appearance; and the higher the colour temperature, the cooler the appearance of the light source.

(Pinterest and google)

Colour Rendering Properties (CRI) The spectral properties of the light sources have a direct influence on the colour appearance of the surfaces within the spaces. The choice of light sources should be made to create the intended visual atmosphere, being mindful about all the materials and surfaces, their forms and colours. Colour rendering is of particular importance in the enhancing the interior visual quality within various rooms of the building G.

(Pinterest and google)

2.6.2 LIGHTING INTENSITY AND UNIFORMITY

Lighting will be designed to achieve the adequate illumination levels addressed by the relevant guiding documents (AS1680, AS1158 and AS2560). Each space within the building would require a certain lighting level depending on its function. Uniformity of lighting levels throughout the spaces is important for achieving a comfortable visual atmosphere. Brightness differences within the field of view, i.e. high contrast might cause discomfort for tasks such as reading, or viewing a particular surface and should be avoided. Nevertheless, in addition to a uniform general lighting, ambient lighting and accent lighting has the potential to enhance the architectural quality and draw attention to intended focal areas.

2.6.3 DAYLIGHT IN DESIGN

With the daylight ingress into the building being minimal, the electric lighting system will supplement the lack of daylight to rooms away from fenestrations. Electric lighting to zones surrounding windows must be assessed and rationalised to minimise use of energy.

2.6.4 INTEGRATED DESIGN

The design will consider opportunities within the site and form of the building. The primary aim is to provide a flexible design that responds to a broad range of operational uses. The lighting scheme, where possible, should be integrated into the building's architecture to create an elegant lighting design solution. Where visible the luminaires are to suit the architectural language of the building. This consideration is to be extended to emergency lighting and exterior lighting. Where possible, the emergency lighting is to be integrated into luminaires. The exterior lighting, where visible is to consider the daylight appearance.

2.6.5 ELECTRIC LIGHTING CONTROL

The lighting control system is to provide a seamless operation, enhance the visual and spatial aesthetics and also help in achieving reductions in energy use. Luminaires are to be grouped in zones with pre-set programmed scenes. It is important that the user interface is simple and uncomplicated. Lighting control devices should be located away from general public's access. According to EFSG lighting requirement, new lighting shall be DALI compatible should the smart lighting control system is required by the school. Final lighting control system will be determined/ developed during the detailed design development stage.

2.7 LIGHTING METHODOLOGY AND PROPOSE SCOPE OF WORKS

Propose scope of works included are as listed below.

OUTDOOR LEARNING SPACE

Outdoor learning space has proved to improve confidence, self-awareness, and assist in the development of collaborative-working and communication skills. The illumination strategies to these outdoor learning spaces must assist in creating a functional outdoor environment after hours and in low lighting conditions. Lighting treatments to improve surface illumination to be explored.

PRACTICAL ACTIVITY AREA / GENERAL LEARNING SPACE

A level of illuminance should be provided to suit specific tasks without over lighting the space. Local task lighting should be provided to areas requiring higher levels of illumination, as opposed to higher ambient lighting levels to reduce unnecessary energy consumption.

ROOFTOP OUTDOOR PLAY / LEARNING

The existing external sport court has no lighting. Subject to the school's requirement, new luminaires will be proposed to meet relevant Australian standards.

New post-top luminaires with back shield and well-controlled optics will be positioned in parallel to the boundary facing the school court to reduce possible obtrusive light to the closest neighbouring property and to the night-sky. The luminaire selection and mounting height will be reviewed and refined during detailed design development. The spacing, positioning and orientation will be designed in accordance with AS2560, AS1158.1 and AS4282.

Lighting to the rooftop court shall be controlled via a combination of photoelectric cells and lighting timers with a manual override switch located in the nearest electrical cupboard. Rooftop lights shall be switched off during daytime, after practice hours, when the court is not in use. Illumination on the roof court will be programmed to not exceed 10pm on any day.

According to latest AS4282 (2019), the site has been categorised as Zone A3 (Suburban areas in towns and cities). The rooftop court lighting shall be designed to meet the criteria of Zone A3 as defined in Table 3.2 – Maximum Values of Light Technical Parameters and Table 3.3 Maximum Luminous Intensities per Luminaire. Lighting calculation will be carried out to demonstrate the compliance to relevant Australian Standards.

AMENITIES

Change room lighting may consider an integrated lighting approach, with lighting to the basin area and the toilet. Lighting is to be controlled via occupancy sensors for on/off control as an energy saving measure. The correlated colour temperature and lighting scheme is to support the architectural design intent and desired 'mood' and materiality of the space.

STORE

A level of illuminance should be provided to suit specific tasks within the storage areas without over lighting the space. Gradation of light levels between circulation and storage areas should be considered to compliment the function of the space. Local task lighting should be provided to areas requiring higher levels of illumination, as opposed to higher ambient lighting levels to reduce unnecessary energy consumption.

HALL / GYM

Illumination methodologies in the gymnasium should aim at providing a uniform lighting solution for sports activities and also for visual tasks (use as examination hall). Allow for flexibility through the use of lighting control systems to dim and adjust the surrounds to create various moods within the space.

FAÇADE AND EXTERIOR

Concealed subtle highlights to feature elements within the architecture space will enhance night time presence and assist in wayfinding and safe navigation through the site. The design solution shall establish a visual connection between various zones within the campus and create a unique identity for the campus.

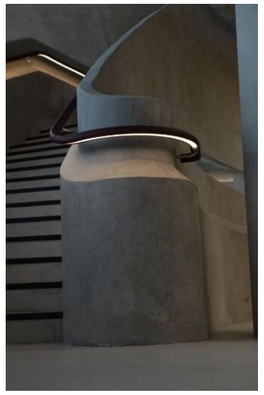
The selection and finishes of all external light fittings will be coordinated with the Architect. Luminaire selection shall be low glare fittings.

External lighting will be LED type light sources only. Lighting will be controlled via a combination of photoelectric cells and the lighting control system/timer with a manual override control.

Lighting shall generally be low height, low intensity and discreetly positioned so as to avoid spill lighting and shall be designed in accordance with AS1158.1 and AS4282. The entrances to the new building G from Military Road and new walkways will be well lit for casual surveillance.

Obtrusive lighting will be carefully considered during the external lighting design to ensure compliance with AS4282 and to minimize any spill onto neighbours or to the night sky. JHA understand the sensitivity of the residential neighbours, and as such will consider obtrusive lighting with care.

According to latest AS4282 (2019), the site has been categorised as Zone A3 (Suburban areas in towns and cities). The façade and exterior lighting shall be designed to meet the criteria of Zone A3 as defined in Table 3.2 – Maximum Values of Light Technical Parameters and Table 3.3 Maximum Luminous Intensities per Luminaire. Lighting calculation will be carried out to demonstrate the compliance to relevant Australian Standards.



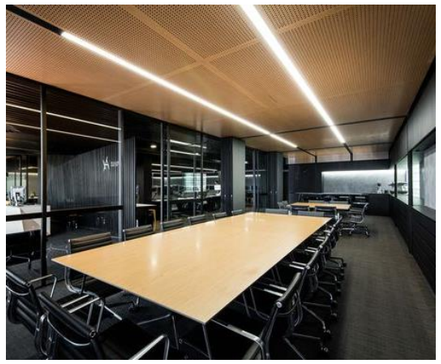
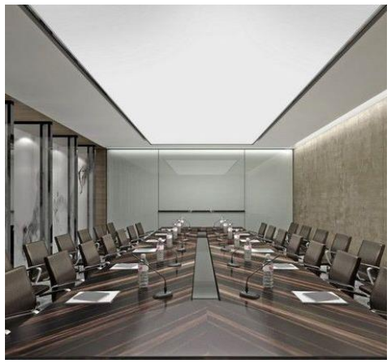
STAFF ROOMS

Illumination methodologies in the staff rooms should aim at providing a uniform lighting solution to task areas and workstations. Allow for flexibility through the use of lighting control systems to dim and adjust the surrounds to create various moods within the space.

INTERVIEW ROOMS (IN ADMIN AREA)

Lighting to the interview room is to be flexible, with dimmable lighting to suit different purposes and functional requirements. Lighting of vertical surfaces may be beneficial in this space. The lighting design for the interview rooms should be cohesive with the surrounds. The lighting design seeks to address the following key issues:

- Designing lighting atmosphere to suit best to the architectural context
- Lighting quality with respect to light distribution and illuminance levels. Australian Standard AS/NZS 1680 should be used as guidance for illuminance levels i.e. 160 lux general with 240-320 lux task lighting. However, the lit atmosphere and surface brightness should be used as design parameters rather than solely illuminance levels
- Maximization of daylight to reduce the need for electric lighting.
- The provision of a lighting control system that provides operational lighting to the various functional spaces to fulfil visual task requirements with optimum efficiency.
- Consideration of task light usage in joinery and service areas to minimise energy consumption for interview areas
- Minimisation of maintenance/ lamp replacements


QUANTITATIVE AND QUALITVE LIGHTING DESIGN CRITERIA

The interior and exterior lighting design will consider a layered approach that gives personality and atmosphere to each space. Layers also enhance the set moods in each space by providing more intimate highlights to features or zones. Lighting layers can be applied to create visual progressions from one space to another, particularly when connecting interiors to exteriors or can give emphasis to an individual feature. These layers are generally defined as:

Base lighting layer

Providing an ambient level of light which can be supplemented by a secondary layer of lighting elements, or be dimmed to allow supplemental lighting elements to bring emphasis to key zones or features.

Accent Lighting Layer

This layer is used to create highlights and often doubles as task lighting for reading, kitchen workspaces, or may be purely decorative and act as a feature itself.

There are several lighting typologies that can be adopted in response to an architectural vision that demand no lighting equipment to be visible within the ceiling fabric. Each typology must enhance the use and aesthetic of the individual space and the overall architectural intent. Lighting typologies may include:

Cove Lighting

For upward cove lighting located around the periphery of spaces - it is important that such designs consider the uniformity of ceiling lighting, requirements for lighting wall features such as paintings, as well as the potential for high glare ratios associated with darker ceiling regions. It is important to note that up-lighting of ceilings will not provide light to walls which may require supplemental lighting, especially where features are to be displayed on walls.

Wall Sconces and recessed wall up-lighting

Wall Sconces and recessed wall up-lighting can act as functional lighting or accenting to interiors or exteriors. These lighting elements act in a similar way to cove lighting and locations need to consider the requirements of any objects requiring wall space. Recessed up-lighting is generally utilised to accent architectural features while providing supplemental ambient light.

Pendant Lighting

May be used to provide localised lighting for interior features or be more generally located to provide a high level of ambient lighting that can be used as an ambient layer to which further layers of light may be introduced. All selections of pendant lighting must consider the architectural vision.

Floor standing lamps

Provide localised lighting for individual needs such as task lighting. Must consider the architectural vision and task requirements.

Room Type	Quantitative Lighting Levels (AS1680/AS1158) standards
Outdoor Learning Space	160-240lux
Practical Activity Area / General Learning Space	240-320lux
Rooftop Outdoor Play / Learning (to AS2560.2.4)	100lux - Recreation or training
Stairs	80lux
Amenities	80lux
Store	40-160lux
Staff Rooms	240-320lux
Hall / Gym	240-320lux
Interview Room	240-320lux
External Circulation	20lux

2.8 ESD INITIATIVES

While a formal Green Building Council of Australia (GBCA) full certification will not be sought for the project, a standard equivalent to a 4-Star Green Star Design & As-Built v1.3 initiatives will still be considered, developed and constructed as part of the project such as:

- All propose lighting will be energy efficient LED type lighting with high frequency lighting ballasts;
- LED lighting near windows to be controlled by daylight dimming;
- Energy Efficiency of lighting systems to be minimum 10% better than NCC 2019 Section J6 deemed to satisfy requirements;
- Intelligent lighting control system will be implemented to provide time scheduling, lighting zones configuration and dimming functions;
- Motion sensors and/or timer switches in classrooms and amenities to control lighting via manual on, manual off, auto off strategy;
- Metering and monitoring system to allow the college to review and benchmark energy consumption;
- LED lighting to provide quality of light, with illumination of both vertical and horizontal surfaces, dimming control to suit the tasks.