7.3 Climatic Building Design

Building Orientation and Depth

A natural axis has been developed that orients buildings approximately north-east, in order to strike a compromise between an ideal due-north orientation for solar control and the preferred direction for capturing cooling breezes. As the development of the campus has shown, minor variation within these controls does not dilute the broad planning intent, provided the alignment of arcades to the open campus green is maintained.

Refer Diagram 7.3.1

While building depth is partly a function of the building program it is also constrained by the need to minimise eastern and western exposure, and also by the need to bring daylight to the interior. These constraints suggest a depth of approximately 20m as the most practical for buildings aspiring to daylight and aspect.

Environmentally Sustainable Design Principles

Principles of environmentally sustainable design (ESD) are central to the 2012 Campus Master Plan, as they have been since planning commenced for the University's Sippy Downs campus. While not all principles can be implemented in all buildings (laboratories must be mechanically ventilated, for example), it is the intent of the University that deviations from ESD principles are the exception, not the rule. It is intended the ESD principles of the 2012 Campus Master Plan, exemplified in buildings already realised on-campus, can serve as a direct influence on the surrounding development of Sippy Downs, in conjunction with local Development Control Plans and urban design master planning processes.

The orientation, relative position and shape of building floor plates will dictate the typical heating and cooling loads experienced by new development, as well as maximising access to natural light and ventilation.

Introducing daylight into buildings reduces their energy consumption through a reduction in the use of artificial lighting sources. Additionally, ready access to daylight can promote physical and psychological wellbeing in the building occupants. To provide access to natural light, buildings should typically have a north orientation (i.e. long in the east-west direction). This promotes daylight penetration to the rear of the building. Buildings without a north orientation can still achieve daylight penetration to the rear of the building with some kind of roof treatment, allowing sun access to still occur. Lot layout and building location should also be mindful of heat loads through east and west facades. As it is difficult to prevent heat gain through low angle solar radiation, minimising exposed east and west facades should be a key influence on lot orientation and building placement.

The 2012 Campus Master Plan remains committed to naturally ventilated buildings, a principle to which the University has been committed since commencing operation. Building orientation and the design of operable glazing systems are two key areas influencing access to fresh air and natural cooling of indoor environments. Occupants should be encouraged to open windows wherever possible to enjoy the benefits of natural ventilation. In a mixed mode scenario building controls should ensure that open windows and air conditioning of the space do not occur simultaneously. Designs for naturally ventilated spaces should always be mindful of the required thermal comfort of the occupants.

Fixed or controllable shading devices offer thermal protection by reducing heat gain on the building exterior, and can also assist in mitigating glare. As building cooling loads and energy consumption can thereby be significantly decreased, wherever possible permanent sun shades, whether fixed or operable, should be provided to the openings of all buildings. While high performance glass can often deliver equivalent performance it is not easy to replace in the event of breakage and the embedded energy is higher. Further, the use of shading devices satisfies the objective that the University should not only pursue ESD principles but should be seen to be pursuing them. With the exception of verandas and covered

walkways, opportunities for shade at the ground plane will largely be found through landscape elements, rather than building structures. Balconies and roof overhangs are also shading devices, which can provide the additional benefit of offering breakout space.

Optimum insulation levels will minimise heat gain during summer and provide adequate protection from the cold in winter. It is recommended that due to the warmer climate in Sippy Downs, insulation levels be predominantly designed for warmer conditions to minimise heat gain and protect from radiant heat.

The effects of thermal mass should be engineered to provide positive benefits to building occupants. Care should be taken to avoid the negative effects of thermal mass, such as re-radiation of heat when it is not desirable.

Energy

The University of the Sunshine Coast is committed to a reduction of its energy consumption to the maximum degree possible, commensurate with continuing to achieve its wider academic objectives. The primary means of building energy reduction is the adoption of the ESD principles discussed above, particularly the optimisation of daylight in order to reduce artificial lighting, and the design for natural ventilation in order to eliminate the need for air conditioning. If air conditioning must be provided, mechanical plant should be designed for maximum energy efficiency, with a consideration of mixed mode technology.

At a smaller, yet nevertheless important scale, the use of lighting controls (sensors, automated switch-off and zoning in larger shared spaces) can help reduce energy consumption, as can enabling 'energy save modes' on all office equipment to allow for low standby electricity consumption. Similar strategies can be adopted through the installation of timers on water boilers, coffee machines, water chillers and all other equipment which does not have to operate overnight. Encouraging staff to turn off computers (and monitors) after hours can further reduce power consumption. Sub-metering will assist in tracking the energy consumption of specific and larger electricity consumers.

Additional strategies for reducing energy consumption include on-site generation of renewable electricity, for example through domestic solar hot water or self-sufficient solar powered public lighting lamp posts. Although currently natural gas supply to the site is an expensive and seemingly unfeasible option, the future possibility of natural gas as an energy source should be considered as an alternative to electricity. Natural gas emits about one quarter fewer carbon emissions than does coal generated electricity.

Materials

The 2012 Campus Master Plan neither prescribes nor proscribes materials. However, designers should take into account the palette of materials already used on-campus when making decisions about appropriate materials. Generally materials and material assemblies that repel, rather than trap, heat and that retain their integrity under conditions of high humidity; while allowing for flexibility and user interaction, will be preferred. Glazed areas of the building envelope are of particular importance, requiring a consideration of the balance needed between thermal and visual characteristics.

Materials should also be chosen with a consideration of the ESD principles discussed above, such as recycled content, durability, low volatile organic compound (VOC) content, the ESD credentials of manufacturers (for example,. their ability to develop or work within the controls of an Environmental Management Plan), the potential for disassembly and their avoidance of environmentally damaging chemicals in either their content or manufacture.

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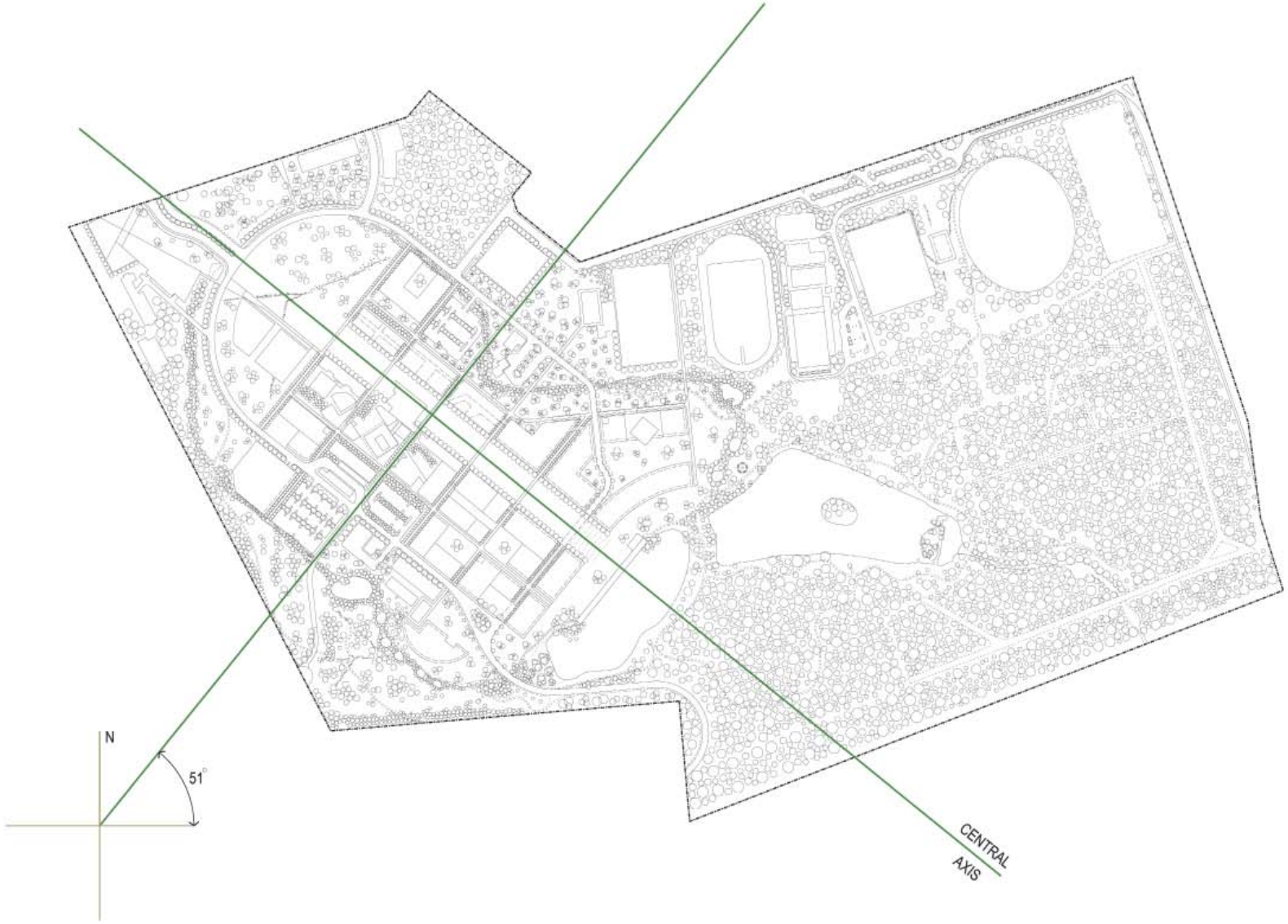

Diagram | 7.3.1

Building Orientation