

06 | CONCLUSIONS

6.1 CONCLUSION TO PROJECT

The dissertation succeeded in answering the research questions by firstly demonstrating how interior design can improve the efficiency of South African Shoprite interiors by balancing minimising resources and maximising the user experience through that which is in the power of the discipline of interior design. By improving the efficiency, Shoprite's brand promise of providing the lowest possible prices in a satisfying and convenient first world shopping environment which is comfortable and enjoyable, became evident within the interior space.

This was done by identifying the national and international standards for efficient interior design by analysing appropriate theories and interior artefacts. The standards identified were those which are appropriate to South African Shoprite interiors. The numerous theories on retail design and branding, as well as resource efficiency was then applied to the design of specific interior components within the supermarket in order to illustrate how the efficiency is improved. The interior components selected were those which proved to have the most potential to solve the problems within existing Shoprite supermarkets and thereby improve the efficiency.

Utilising the minimum amount of resources within the design demonstrated the impact of interior design on the energy, water and material efficiency, as well as the indoor environmental quality of the supermarket. This was revealed by specifically exploring ways to minimise the air conditioning, refrigeration, water heating and lighting load within store, which are the highest energy consumers in South African supermarkets (which can be controlled by the interior designer). Next, water consumption was addressed by specifying low flow water fittings within the design in order to complement Shoprite's proposed greywater system. The material selection involved selecting appropriate materials, considered in terms of their environmental impact, use, local availability and end of life. The above aspects were also considered in terms of indoor environmental quality, which includes thermal and visual comfort, water surveillance, selecting environmentally friendly materials and finishes, as well as the ergonomics and acoustics in store. These interior design strategies allow for a more comfortable, productive and healthy interior environment which improves the shopping experience. It also enables improved operational efficiency in store, which serves to keep the prices of the products low and can allow for larger financial turnover for Shoprite.

The user experience was further maximised through establishing an appropriate brand identity in store which meets the target market's aspirations and which they can relate to. This creates value by meeting consumers' need for a pleasant shopping experience. This was done by applying strategies to interiorise the Shoprite brand, so the store unmistakably speaks Shoprite, with an essence of local, informal retail inspiration. The design elements allow bright, dynamic and positive communication in store, as it was established that this is the kind of communication the target market relates to. The design also created suitable typologies for the different departments in store, while providing simple and intuitive circulation and communication. The elements improve the navigation, ambience and productivity in store, allowing for a more convenient, comfortable and enjoyable shopping experience. The above holds the opportunity to improve customer loyalty towards the brand by differentiating Shoprite from its competitors.

By minimising resources and maximising the user experience, the interior space therefore relates to the brand promise, allowing Shoprite to demonstrate their narrative instead of just talking about them in advertisements.

In essence, the design of Shoprite interiors is a balance between the price of the product and the price of society by allowing prices to stay low through enhanced operational efficiency, while making customers feel valued by providing a satisfying shopping experience.

The project also addressed the design issue by contributing to Shoprite's climate change adaptation strategies to lower business risks and thereby improve their sustainability efforts. Also by utilising business opportunities by offering innovation in services and operations in store by enhancing the efficiency; and improving execution of the business strategies across business functions by fulfilling the brand promise within the interior. The project lastly contributes to Shoprite's growth strategy by improving the efficiency of existing stores and allowing opportunity to generate more revenue.

6.2 LIMITATIONS TO THE STUDY

A limitation to the study is that the research method of research through design could not be completed due to time constraints. The design is still in need of the necessary iterations, experimentations and critique. This forms a recommendation for further study, as it will further enrich the project.

6.3 CONTRIBUTIONS

The project contributes to the discipline of interior design in the following ways:

- It provides interior design guidelines for achieving an appropriate retail interior which balances minimising resources and maximising the user experience to meet the needs of a specific target market. More specifically, it meets the needs of South Africa's fastest growing consumer segment, the LSM 4-7 segment or the mass middle market, which could benefit a number of retailers.
- It illustrates how theory can be combined with associations as research method, which was established by Dr. Raymund König in his doctoral thesis. This allows the design to generate meaning by creating appropriate connotations in the mind of the target market through visual communication. This enables a more relevant design, which the target market can relate to.
- The project serves to strengthen the participation of interior designers within the retail sector by revealing the positive impact interior design can have on retail environments in terms of improving in-store efficiency in order to increase financial turnover.
- By illustrating the key role fulfilled by the interior designer in retail design (relating the store interior to the brand promise), the project assists in establishing the identity of the interior design profession.

6.4 RECOMMENDATIONS

Firstly, **graphic design** will have to be carefully considered as the proposed symbols used in the design will greatly influence the new brand identity created in store. It will allow the symbols to come to life in order to maximise the ease of navigation in store in a way that resonates with the target market (informal retail inspiration). This will add to the convenience and satisfaction of the shopping experience.

Next, the project recognised that retail design is a very complex environment that is dependent on a number of role players to successfully execute a retailer's design and identity. A total shopping experience can thus only truly be achieved if all role players cooperate to execute a retailer's strategy. Additional design aspects, beyond the interior designed components presented in the project, therefore influence the overall user experience and the use of resources within the interior. Additional, key considerations which could enrich the project by further enhancing the efficiency, are elaborated on below.

Although the project focused on minimising resources and maximising the user experience of Shoprite supermarkets to allow the Shoprite brand to create value for its customers beyond the products being sold, the products still remain the main focus in any supermarket and therefore largely influence the shopping experience and brand identity. In order for Shoprite interiors to become truly efficient, **visual merchandising** therefore needs to be considered as an additional, key layer to the proposed design. Only then can a final layout be determined, which best situates the interior components in a way that is convenient and relevant to consumers, allows for productivity of the employees and provide opportunity to maximise impulse purchases.

The store layout can significantly impact a retailer's performance. It helps attract customer's attention and can therefore contribute to the uniqueness of the store and the user experience.

As the layout of a supermarket is primarily concerned with increasing sales, additional research is required on **consumer behaviour** and **needs** in terms of merchandise. Analysing the transaction data of Shoprite supermarkets can assist in better understanding consumer behaviour and will aid in accurately determining appropriate **cross merchandising** of products, which hold great opportunity to increase impulse sales and therefore profit. In addition, the transaction data will accurately determine which of the interior components truly deserve prime location in store (especially which department should be situated beyond the entrance of the store).

An appropriate layout can also serve to increase convenience since the proper placement of the interior components can enhance navigation in store. The proper placement of products can also minimise wasted steps and motions in the shopping process to further increase shopping convenience or better yet, be arranged in such a way that customers do not realise how far they travel and are encouraged to buy additional merchandise along the way.

As the LSM 4-7 segment is the largest consumer segment, marketing strategies such as advertisements, product offerings and product placement need to respond to specific locations in order to truly meet the needs of the different consumers in different areas or different age groups. This will add additional value to the design by making it more relevant to the target market.

Next, the design and specifications of **display units**, whether it be shelving, racking or custom made fixtures, should be carefully considered as they also hold further opportunity to enhance the user experience by effectively displaying the products.

If these recommendations are fulfilled, it can allow the project to evolve into a roll out strategy for Shoprite supermarkets.

*Please note: key authors are indicated in bold text

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CORPORATE IDENTITY



COMPANY OFFERING

Fast Moving Consumer Goods (FMCG) retail operation
(Shoprite Holdings 2014c).

- Groceries
- Fresh food
- Non-foods
- Small appliances



COMPANY POSITIONING

GOAL

- Offering consumers of all income levels the Group's **lowest possible prices**
- Providing all communities in Africa with food and household items in a **1st world shopping environment**.
- At the same time the Group, inextricably linked to Africa, **contributes** to the **nurturing of stable economies** and the **social upliftment** of its people
(Shoprite Holdings 2014c).



MISSION

The guiding mission of the Shoprite Group of Companies is **to be the consumers' preferred shopping destination**, by retailing food and non-food products at the Group's lowest prices from conveniently located outlets in an environment that is conducive to a **comfortable and enjoyable shopping experience** (Shoprite 2014b).

SUSTAINABILITY

Shoprite acknowledges that the **degradation of the environment** will undermine their ability to produce **resources cost effectively** (Shoprite Holdings 2011).

Questionable Property Division Statement

"In-house store designers follow **design principles sympathetic to the environment** - energy efficiency. Designs & store layouts reflect the **latest international retail trends**. Freshness & integration of specialist apartments also impact on store layouts & ambience"
(Shoprite Holdings 2009).

ELECTRICITY CONSUMPTION

- Energy monitoring system for benchmarking
- Energy efficient lighting (fluorescent lighting only) - energy saving of 6 Mw
- Smart refrigeration
- Tele-maintenance system



WATER CONSUMPTION

- Proposed greywater system
- Water-wise indigenous plants for new stores



CDP

- 4 Reports (not satisfactory) Electricity = bulk of carbon emission
- Extra costs (Project can help):
 - Carbon tax
 - Operation cost
 - Emissions reporting
 - Fuel & energy tax
 - Capital expenditure increase due to green building



WASTE RECYCLING & PACKAGING

- National Environmental Waste Act of 2008
- Reclamation centre for damaged goods
 - reduce waste to landfills
 - baling & selling
- Reusable roll-tainers replaced wooden pallets
 - reduce staff effort
 - reduce shrink wrapping
- Increased use of crates & tote bins to reduce cardboard boxes
(Shoprite Holdings 2013b, 2014g)



Geographic Spread

Over the past 17 years, Shoprite has expanded throughout Africa and have become the leaders in expansion across Africa (A.T. Kearney 2014 and Shoprite Holdings 2014d).

SA does however remain the leader of Shoprite's African business, dominating more than 3/4 of the market (A.T. Kearney 2014).

- Angola
 - Botswana
 - Ghana
 - Lesotho
 - Madagascar
 - Malawi
 - Mauritius
 - Mozambique
 - Namibia
 - Nigeria
 - South Africa
 - Swaziland
 - Uganda
 - Zambia
 - DRC
- (Shoprite Holdings 2014d)



Stores

More than 280 corporate outlets and almost 40 franchise stores serve consumers in 15 countries in world-class supermarkets (Shoprite Holdings 2014d).

- Total number of corporate stores: 2020
- 230 Confirmed new stores to June 2016 (Shoprite Holdings 2014f).

R260m sales loss (closed 15 Dec) (Shoprite Holdings 2013a).

Economic development

Policy: Reducing dependance on international suppliers by empowering local suppliers.

- Small local suppliers deliver fresh produce & perishable products.
 - most receive assistance to meet Group's requirements in terms of volumes & product specifications.
 - Group provides support & development programs aimed at assisting locals to achieve the required standards & produce.
- Poverty development
 - job creation
 - black suppliers
 - black female suppliers
 - economic activity & land development in disadvantaged communities & rural areas.



Social & Ethics

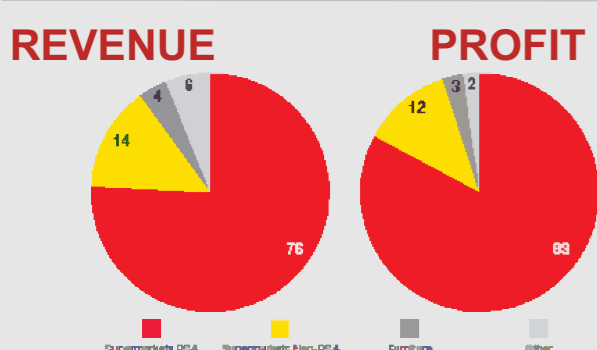
1 of the largest contributors to skills development in SA:

- Job and skills development opportunities.
- Employs more than 17 313 local nationals in its non- South African operations.
 - 123 100 employees in total (99% from local communities)
 - 11762 new jobs in 2014
- Proudly local products highlighted in store (exclusive advertising space).



Sustainable Efforts

THIS YEAR WE PREVENTED OVER R1 BILLION IN PRICE INCREASES FROM REACHING OUR SHOPPERS



FIRE PREVENTION STRATEGY
HIV AIDS TRAINING
ACCESS TO MEDICATION
EMPLOYEE SATISFACTION = HIGHER PRODUCTIVITY

11 762 NEW JOBS CREATED IN 2014

123 100 people employed in total

BLACK REPRESENTATION 95.9%

130 NEW CORPORATE STORES BY JUNE 2015
Total CSI spend R118 456 338

South African National food inflation **6.1%**
Shoprite Checkers Internal food inflation **4.7%**
B-BBEE Level 4 contributor
Group turnover grew **10.5%**
Number of food safety incidents ZERO

FOCUSING ON THE ENVIRONMENTAL IMPACT OF OUR VALUE CHAIN

Over 1 000 000 reusable crates in use

R85 000 000 Fossil fuel cost savings
2.89% LOCAL SUPPLY

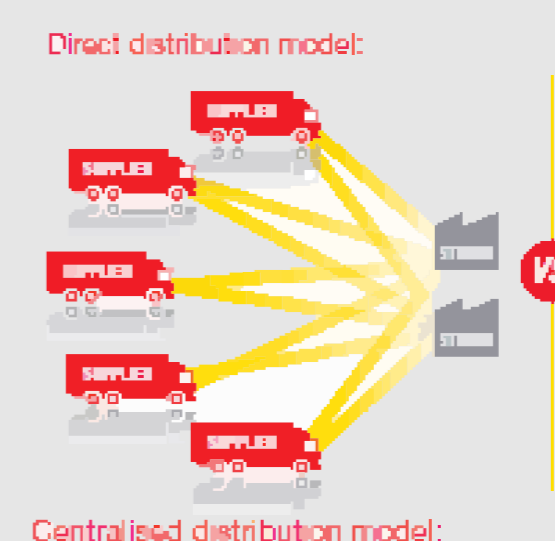


LOWEST PRICES



DEGRADATION OF THE ENVIRONMENT = INFLUENCES COST

1ST WORLD SHOPPING ENVIRONMENT



Direct emission reductions
Tons of CO₂ **77 000**

ENVIRONMENTALLY FRIENDLY FUELS FOR REFRIGERATION IN TRUCKS

PACKAGING INCREASES COST & GENERATES WASTE

MATERIALS WHICH INCREASE SHELF LIFE & REDUCE FOOD WASTE

REDUCE INCREASE RECYCLABILITY

BRAND IDENTITY



The Shoprite brand remains the **core business** of the Group and the **main brand** since it started from a small chain of supermarkets in 1979 (Shoprite 2015b). Today it is rated the most valuable retail brand in SA, worth R8.9 billion (Shoprite Holdings 2014b)

BRAND OFFERING

Supermarkets offer consumers a **modern shopping convenience** at the Group's **low prices** (Shoprite Holdings 2014e).



Logo



BRAND PROMISE

Offering customers lower prices they can **trust** in a satisfying and convenient, **1st world shopping environment** which results in a **comfortable** and **enjoyable shopping experience**

(Shoprite Holdings 2014a, 2014c, 2014e; Shoprite 2015b, 2015c)



BRAND PHILOSOPHY

Shoprite's winning philosophy is to operate a chain of modern supermarkets where customers can be sure to pay the Group's low prices on their basic food and household requirements in a convenient shopping environment. (Shoprite Holdings 2014e).

Consumer policies are geared at ensuring a **satisfying** and convenient shopping experience. (Shoprite 2015c).

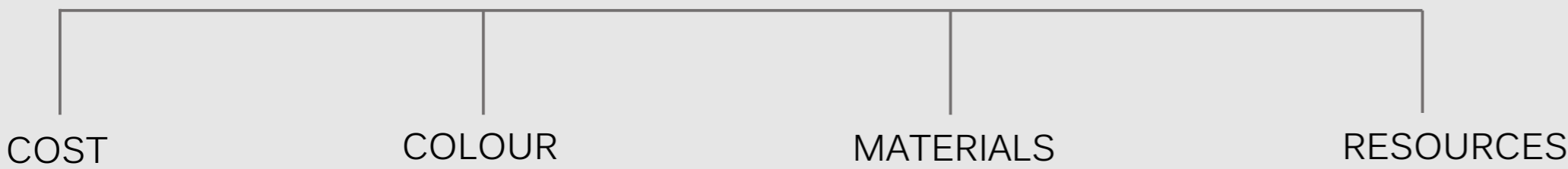
BRAND STRATEGY

The guiding mission of the Shoprite Group of Companies is **to be the consumers' preferred shopping destination**, by retailing food and non-food products at the Group's lowest prices from **conveniently located outlets** in an environment that is conducive to a comfortable and enjoyable shopping experience (Shoprite 2015c).

- Trust
- Convenience
- Advancement

(Shoprite 2015b, 2015c and Shoprite Holdings 2014e).

Design limits



Stores

In SA, Shoprite has 2 store formats (Shoprite Holdings 2014e)

Supermarkets:

Sell a comprehensive range of groceries, fresh food, non-foods and small appliances.

Size: 2500m² - 4500m².

Superstores:

Offers extended ranges of basic grocery and household products, service departments and a bigger range of non-food and DIY items. There is currently only 1 in SA that caters for a similar consumer market.

Outlets

Total 1581 corporate stores

Brand Summary Target market LSM 4 7

- Group's flagship brand
- Most existing stores in SA & across Africa
- Most proposed new stores in SA & across Africa 2015:
- 119 SA
- 44 non-SA (Shoprite Holdings 2014f, 2014g)

Biggest Impact

SAVE OVER R1000 ON YOUR SHOPPING WITH EeziCoupons

As Eezi as...

- Step 1: Scan the barcode on the coupon.
- Step 2: Enter the code on the app.
- Step 3: The discount will be applied to your bill.

A If your phone has internet access, get EeziCoupons by going to www.shoprite.mobi

B If your phone does not have internet access, dial *12969*11

C Alternatively, you can download our coupon app and send your discount code to your cellphone.

(Shoprite 2015e).

Mobile Community

Mobisite gives you access to EeziCoupons (Shoprite 2015e).

TARGET MARKET

Mass middle market

Middle- to- lower- income consumers (Shoprite Holdings 2014e).



Figure Appendix A1: South Africans (Nerve 2010)

Community Networks



Shoprite Community Network, Shoprite's R1 million festive season #Shareforgood food donation campaign, Mobile Soup Kitchens, Cuppa for CANSA, Stay safe at home, at work and at play –the shoprite stay safe women's road show, Dash 4 Warmth, Shoprite in conjunction with Age in Action, Charing knowledge by donating books (Shoprite 2015d).

House Brand



Convenient Services



Consumer Centre:

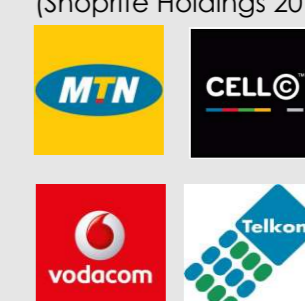
At the entrance of the stores customers have the opportunity to air their wishes and views & get valuable information on a variety of topics through the consumer centre (Shoprite Holdings 2014).



More than 200 different third party accounts can be paid at the Money Market counter, including 80 different municipalities nation-wide, water and electricity, property rates and taxes, telephone accounts and funeral policy payments (Shoprite Holdings 2014i and Shoprite 2015g).



Phone cards (Shoprite Holdings 2014j).



Packaging



APPENDIX B

CASE STUDY 1: THE FALLS PICK N PAY



Figure Appendix B1: View of The Falls Pick n Pay, as seen from the parking lot (Leading Architecture & Design 2012)

Name: The Falls Pick n Pay ('Green Flagship Store')
Location: Corner of Hendrik Potgieter Road & Johan Street in Little Falls, Roodepoort, Gauteng, South Africa
Date: 2013
Building type: Retail
Architects/ Interior Designer: Boogertman & Partners
Size: 10 000 m²
Cost: R160 million
Exterior material: Glass, steel & stone

Situated in one of South Africa's most rapidly expanding areas, the new Pick n Pay 'green flagship store' embodies fresh, variety and innovation (Pick n Pay 2013). For that reason, the shop displays are more organic and less structured layout than traditional stores (Atterbury News2013). The colour palette is neutral to allow for maximum flexibility of the store layout, as seen in the figures below.



Figure Appendix B2: Interior of The Falls Pick n Pay showing neutral material palette and light quality (Boogertman & Partners 2014)

In terms of the construction of the store, advanced energy efficiency, resource efficiency and environmentally responsible principles were implemented in combination with aesthetic ambience (Pick n Pay 2013 and Building & Décor 2014). The key consideration in the design of the store was however energy efficiency. A range of energy efficient initiatives, which comply with guidelines and rating criteria set by the Green Building Council of South Africa (GBCSA), were implemented, which reduces the electricity consumption (Building & Décor 2014). These initiatives include:

ENERGY EFFICIENCY

1. LIGHTING

1.1 Daylighting

- Daylight harvesting within the store is enabled by sustainable building design and technologies, such as **building orientation, fenestration and louvers** (Atterbury News 2013).
- Skylights** bring daylight into the stores, reducing electricity demand.

1.2 Artificial lighting

- LED lighting** is used for external signage, minimizing electricity consumption.
- Dimmable fluorescent fittings** are used indoors for optimal energy usage. These adjust automatically, depending on the ambient lighting conditions.

Incorporated into the overhead bulkheads are 'real time' building power usage displays which enable customers to view the amount of electricity used in store. This creates awareness of a reduced environmental impact to encourage the public to follow suit (Building & Décor 2014).

2. HEATING AND COOLING

- Detailed attention was paid to **refrigeration and air conditioning** within the store, since it can account for almost half of the store's energy bills, says Building & Décor (2014).
- External cavity walls** are used in the construction to stop heat from entering the store and to keep heat inside the building on cold days.
- Solar control glass** is applied to **west-facing facades** to reduce heat loads. This reduces energy consumption by making the air conditioning more effective.
- Locally manufactured **horizontal louvers** are installed to screen off the shop fronts from exposure to the sun. This further reduces heat loads.
- Specialised "Rigifoam 85mm Lambdaboard" **roof insulation** was used, which has very high thermal properties. This reduces the amount of heat entering the store through the roof.
- A **CO₂ monitoring system** is implemented to allow fresh air intake to be controlled, reducing the demand on air conditioning.
- Heat pumps** are also used for heating water.

MATERIALS

- Construction materials with **recycled content** are used.
- The insulation material has **zero ozone depletion properties** (ODP) (RigiFoam 2013).
- The insulation is also cleanable, washable and solvent-resistant, which makes it ideal for **future retrofits**.
- As mentioned, a neutral material palette further allows for **flexibility** of the interior layout, making the space more sustainable as less intervention will be required for future adaptation.

WATER

- Rainwater run-off** from the roof and other areas are filtered and stored in steel **tanks** and used for **irrigation**.
- Bioswales**, which are designed to remove silt and pollution from surface run-off water, assist with retaining the rainwater before it is absorbed into the ground.
- Greywater** is recycled and use for irrigation.
- Only **indigenous and water-wise vegetation** has been used and is watered through drip irrigation to save water.

CASE STUDY 2: MAGNIFY CREDIT UNION



Name: Magnify Credit Union – South Lakeland Branch
Location: Lakeland, Florida, United States
Date: 2009
Building type: Commercial
Architect: Straughn Trout Architects, LLC
Size: 1 265m²
Exterior material: Glass, brick, and cement

Figure Appendix B3: Interior of Magnify Credit Union (WBDG 2014)

This LEED - Gold accredited building makes use of a roof-mounted photovoltaic array, digital daylight monitoring and rainwater harvesting to achieve a carbon neutral, net zero energy facility which generates 116% of the energy required for its operation (Architecture 2030 2011).

The flagship branch's mission is to achieve financial education and environmental awareness. The first sustainable action taken by the project, was therefore to purchase a previously developed property. Furthermore, the interior layout allows for programmatic flexibility of private and public spaces which will allow for further development in identity over time (WBDG 2014).

The building requires less operational costs than conventional buildings its size, reduced maintenance, improved durability, enhanced safety and security, maximum functionality and accessibility, as well as unbeaten indoor environmental and experiential qualities. The property value also significantly increased due to its unique operating independence from the municipality (WBDG 2014).



Figure Appendix B4: Diagram showing optimised energy usage (WBDG 2014)

ENERGY EFFICIENCY

Net Zero Energy is achieved by **reduced energy loads**, **increased equipment efficiency**, and **on-site photovoltaics (PV)**. **Energy and water metering** were also installed in order to track the buildings sustainable initiatives (Architecture 2030 2011).

Reduced energy loads were further achieved by the implementation of the following strategies:

1. LIGHTING

1.1 Daylight

Natural daylighting reduces the artificial illumination requirements through:

- **Clerestory daylighting**
- **Pedestrian level glazing**

Daylighting directly improves productivity by creating a user-friendly work environment (Architecture 2030 2011).

1.2 Artificial lighting

- Daylight Management System control: Digital **compact fluorescent lighting dimmers** with **photo sensors**, monitors the interior lighting levels and dims the artificial lights when natural daylight sufficiently illuminates a space.
- **Occupancy sensors** also automatically turn lights off in unoccupied offices.

A touch screen kiosk provides occupants with live building data, a "green features" map, as well as explanatory animations educating the public about the various sustainable design elements (WBDG 2014). Additionally, Energy Star labelled appliances are used to further lower electricity consumption.

2. HEATING AND COOLING

- **Cool Roof:** A **solar reflective roofing membrane** was installed to reflect heat away from the building.
- Passive cooling is achieved by use of a "**double roof**" design. The double roof is created by elevating the PV panels above the building which defers direct heat gain on the building through natural convection between the two roof layers.
- The primary **north/south orientation** of the **building** further minimizes solar heat gain during cooling times.
- Energy efficient **insulated glazing** is used to further reduce heat loads.
- Large **roof overhangs** block out direct sunlight during summer to minimise heat gains (figure top right).
- **Sunshades** are used for the same purpose, while allowing direct sunlight in during winter for heating (figure top right).
- Increased **wall insulation** also reduces solar heat gain.



Figure Appendix B5: Exterior & interior views of roof overhang, sunshades and energy efficient insulated glazing (WBDG 2014)

MATERIALS

- **Life-cycle cost analysis** was done throughout the design and construction process to minimise cost by comparing initial construction costs with long term operating costs as well as qualitative benefits to the building occupants.
- 16% of the materials (by cost) were extracted and manufactured **within an 800km radius** of the project, reducing the need for excessive transportation fuel.
- The interior finish materials contain **high recycled content**. These include carpet systems, porcelain tile flooring, recycled glass wall tiles, rubber flooring with shredded and cleaned tire rubber, recycled aluminium mill work panels, and counter tops of recycled paper which include inlays of bamboo, recycled credit cards and recycled currency.
- **100%** of building materials are thus **diverted** from disposal in **landfills**.
- The **embodied energy** in building materials and assemblies are **reused**.
- Lastly, **no energy** was used for **demolition** and **removal of debris**, which further adds to the sustainability of the project.

INDOOR AIR QUALITY

The indoor air quality (IAQ) was improved using the following strategies, says the WBDG (2014):

- Carpets, pads and other products with off-gassing characteristics were **opened and aired** for at least one week before installing it inside the building.
- HVAC equipment was **protected from weather**, prior to installation, while **daily replacement of return air filters** for all HVAC equipment also took place **during construction**.
- **Low-emitting materials** including adhesives, sealants, paints, wood stains, carpet systems and composite wood systems were chosen to reduce or **eliminate volatile organic compound (VOC)** off-gassing.
- Furthermore, **indoor cleaning chemicals** are contained in a **sealed closet** with a dedicated exhaust fan.
- Lastly, a permanently installed **entry system** captures **dirt** and particulates from entering the building.

WATER

1. Rainwater harvesting

- Rainwater harvesting from the **roof** with a series of **cistern tanks** and filters are used, which provide more than double the water required for flushing and irrigation.
- **Indigenous vegetation** is used to save water.

2. Interior intervention

- **Low-flow water fixtures**, including faucets and water closets, further reduce water use by 45%.

CASE STUDY 3: NASA SUSTAINABILITY BASE



Name: NASA Sustainability Base
Location: Moffett Field, California, United States
Date: 2013
Building type: Retail
Architects: William McDonough + Partners
Size: 15 240m²
Exterior material: Glass, concrete, steel & aluminium

Figure Appendix B6: Exterior view of NASA's Sustainability Base (McDonough 2012)

The LEED – Platinum accredited campus embodies NASA's culture of innovation (Pepitone 2012). The architect firm, William McDonough + Partners have a focus on clean air, soil, water and power, which is economically, equitably, ecologically, and elegantly enjoyed states McDonough (2012). They believe that design is the signal for human intension and they have a strong Cradle to Cradle philosophy, which considers materials from creation to eventual recycling.

The NASA campus building was designed to embody human health and well-being, as well as being highly energy- and water efficient.

Common services are aligned along an interior pathway of the open plan office, grouping 25 to 30 people in order to achieve team building and collaboration. This actively supports health and well-being of occupants and creates a positive workplace for NASA employees (view figures below) (McDonough 2012).



Figures Appendix B7: Open office floor plan allows for flexibility and productivity (McDonough 2012)

ENERGY EFFICIENCY

The interior design strategies to achieve energy efficiency are depicted in the figure below.

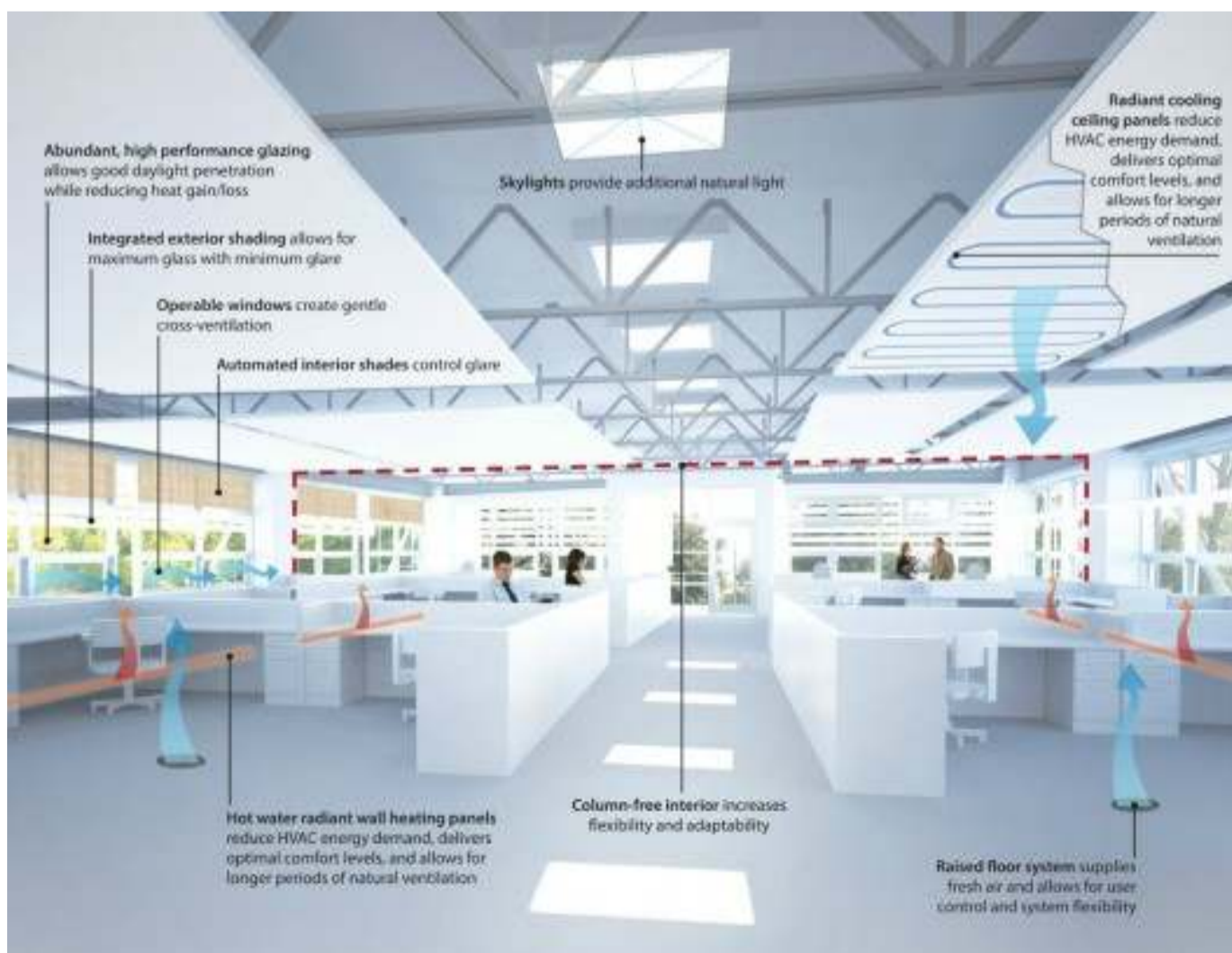


Figure Appendix B8: NASA Sustainability Base Interior Strategies (ArchDaily 2012)

The energy efficient strategies include:

1. Lighting

1.1 Daylight

- The interior is exposed to maximum daylight and views to the exterior, by use of an “**exoskeleton**” which is defined as a hyper-efficient structure that provides **thermal mass** for insulation, **shade** for residents, and **architectural elements** such as terraces and armatures (Lee 2006).
- Light penetrates deep into the building through use of **tall floor to floor heights**, **large windows**, **skylights** on the second floor and narrow building floor plates.
- Exterior aluminium shades mitigate glare and reduce heat gain

1.2 Artificial lighting

- Modelling suggests that electrical lighting will only be needed 42 days of the year, due to the exposure of natural daylight.

2. HEATING AND COOLING

- Thermal comfort is achieved through a super **insulated exterior metal panel** system with **high performance glazing**. This provides a tight, warm envelope for cool mornings.
- **Operable windows** can be controlled by users to ensure thermal comfort.
- The building management systems create gentle **cross-ventilation** which cools the building interior.
- Further, localised heating or cooling is provided by **radiant panels**, allowing for longer periods of natural ventilation.

MATERIALS

- **Cradle to Cradle** certified products were used when available, cost effective, and achievable through a competitive tender process.
- When these products could not be implemented, other products were evaluated for their Cradle to Cradle potential. This included comparing products in a similar material class on a relative scale of **human** and **ecological** performance.
- Material use considerations included utilizing an external braced frame to **reduce** the amount of steel (by weight) in the building. The lightweight insulated metal panel cladding also reduced the amount of material required for construction.
- Materials that were beneficial to human and ecological health were designed for technical and/or biological cycles to achieve **material health**.
- When these materials were not available due to performance requirements, remaining materials were evaluated for obvious **risks** to the **biosphere**.
- Material content considerations included **recyclable/recycled** materials, **salvaged** materials, and **locally available** and/or **rapidly renewable** materials as well as **certified wood**.
- The main components of the design (concrete, steel, glass, aluminium), although **high in embodied energy**, have **high recycled content** and are **regionally available**, making them a sustainable option.
- The lobby areas also **reuse** oak flooring from a transonic wind tunnel on the NASA Ames Campus.

Design for disassembly was facilitated by choosing a steel structure (rather than concrete) that can be easily dismantled as well as repaired. Exterior cladding was also provided in **pre-fabricated** unitised components. This extends the life of the materials and allows them to be easily reused.

INDOOR AIR QUALITY

Indoor Air Quality is supported by utilising **raised access floors** throughout open areas, allowing for user and system **flexibility**. The floor is connected to a **dedicated outdoor air system** which provides **fresh air** distribution when building's windows are closed.

WATER

Greywater recycling enables 90% less portable water usage that buildings of similar size.

CONCLUSION TO CASE STUDIES

Strong parallels can be drawn between the strategies used in the three examples. This clarifies which interior design strategies are viable in achieving sustainable building interiors. These are:

- Maximising **natural daylight** in the interior in order to enhance the **energy efficiency** of the building as well as enhancing the **quality of light** in the interior.
- Making use of **energy efficient lighting** such as LEDs and fluorescent lighting.
- Installing **controls** and **monitoring devices** to save electricity.
- Providing **overhangs** and **shading devices** in order to avoid heat gain and improve thermal performance.
- Properly **insulating** the structure by use of **roof** and **wall** insulation as well as **high performance glazing** in order to further reduce heat loads and save on air conditioning.
- Making use of **locally manufactured, recycled content** materials as much as possible. These should also preferably be **low maintenance** materials which are **easy to assemble** and **disassemble**.
- Use products which do not pollute the indoor environment, such as **low- or no VOC products** in order to enhance the indoor air quality within the building.
- Provide access to **fresh air** through **operable window** in order to enhance occupant **health** and **well-being**.
- **Harvest rainwater** and reuse **greywater** in order to reduce water consumption and specifying **low flow water fixture**.
- Use a neutral material and colour palette in the interior in order to maximise **flexibility** of the space and to allow for **future adaptation**.

These guidelines will provide a successful starting point which will lead to a sustainable interiors.

The four interdependent regions which have the biggest impact on the interior environment, as proven by the case studies and some additional sources, are illustrated below:

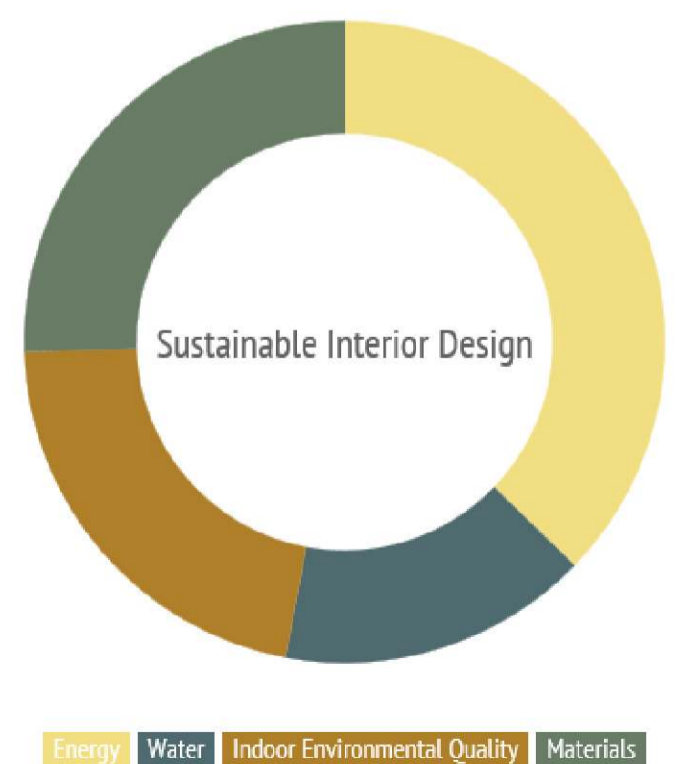
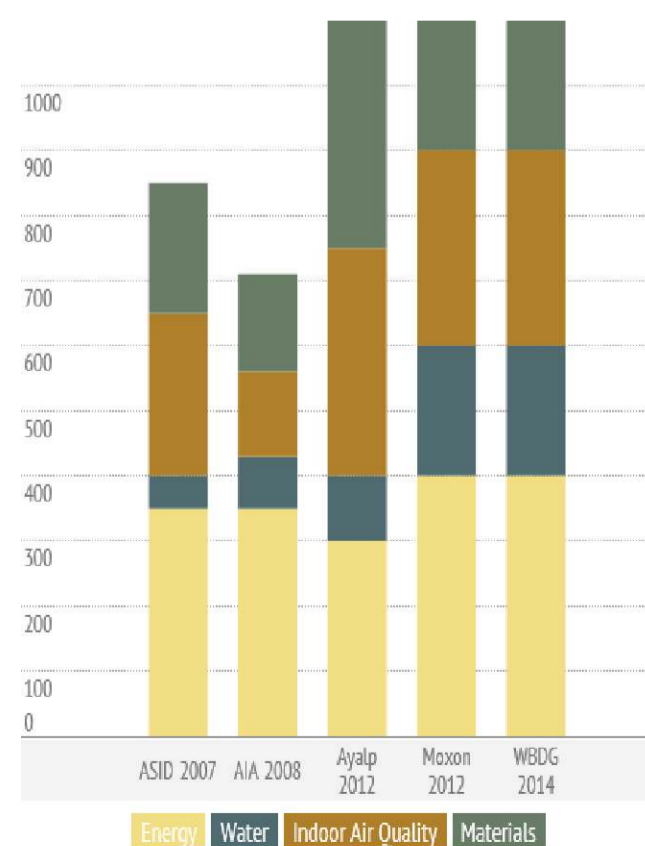


Figure Appendix B9: Graphic summary of the theoretical synthesis of various sources (Author 2015 - info gathered from ASID 2007, AIA 2008, Ayalp 2012, Moxon 2012 and WBDG 2014)

APPENDIX C

Sample Board

* Please note: the following page is reduced from A1 format

CEILING
1200 x 600 x 19mm thick **ULTIMA+ 7663M**
mineral ceiling as per Armstrong SA

SUSPENDED CEILING CLADDING
3660 x 1830 x 12mm **SupaWood**
Bison SA
Spray painted with Economical Contractors Paint
(acrylic) as per EcoPaint SA
Colour: Plascon Strawberry Daiquiri 100
Finish: Matt

12 mm
SUPA WOOD
PG BISON

WALL PANEL
3660 x 1830 x 12mm thick **Melawood** using
BisonBord substrate as per PG Bison SA
Colour: Iceberg White
Finish: Linear (a deep textured, straight wood grain)
Colour: VENZA Oak
Finish: Peen (a textured, stippled finish)

MELAWOOD
VENZA OAK
PEEN FINISH

SIGNAGE & MENU'S
REPRESENTATION
10mm thick **Xanita Board** as per Maizey SA

COUNTERTOP
3660 x 1830 x 9mm thick BisonBord clad with
10mm moulded **Surino Solid Surfacing** as per
PG Bison SA
Colour: Glacier White
Colour: Hot

PLASCON
DC 34
Strawberry Daiquiri

MELAWOOD
ICEBERG WHITE
LINEAR FINISH

DRYWALL FINISH
300 x 150 white ceramic tiles as per Union Tiles

COUNTER BASE FRONT PANEL
3660 x 1830 x 12mm BisonBord as per PG
Bison SA
Formica HPL finish as per PG Bison SA
Colour: Signal Red
Finish: Matt
Colour: VENZA Oak
Finish: Matt

COUNTER BASE CARCASS
3660 x 1830 x 16mm **BisonBord** as per PG
Bison SA

PLASCON
Y6-B2
Fresh Scent
Y6-B2-3
WALLS
Economical Contractors Paint (acrylic) as per
EcoPaint SA

DELIVERY WALL
Economical Contractors Paint (acrylic) as per
EcoPaint SA
Colour: Plascon Chakalaka R7-B1-2
Finish: Matt

FLOOR AROUND DELI
2000mm wide x 2.5mm thick **Marmoleum**
Real sheeting as per FloorWorx SA
Colour: Bleeckerstreet 3127

KITCHEN FLOOR
2mm thick x 2000mm wide Compact Vinyl
Surestep Original sheeting as per FloorWorx
Colour: 171512 Oyster

SALES FLOOR
2000mm wide x 2.5mm thick **Marmoleum**
Real sheeting as per FloorWorx SA
Colour: Bleeckerstreet 3127


















EATING AREA FLOORING
2000mm wide x 2.5mm thick **Marmoleum**
Striato sheeting as per FloorWorx SA
Colour: Pacific Beaches 5216

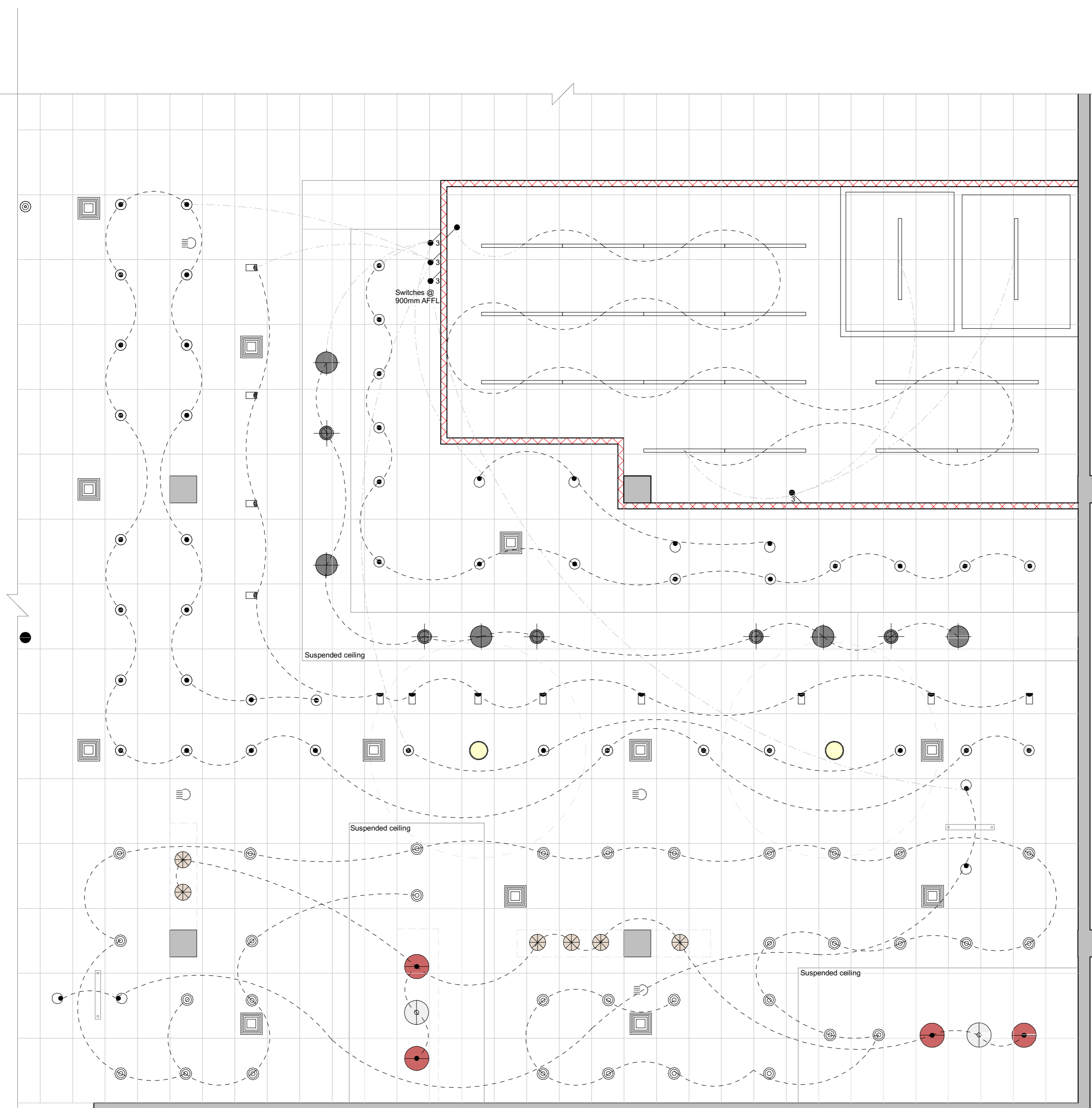
FEATURE WALLS
Economical Contractors Paint (acrylic) as per
EcoPaint SA



Deli Ceiling Plan

* Kindly refer to page 46 for guidelines.

ELECTRICAL LEGEND	
LIGHT FITTINGS	
	3500 Solutube® 290 DS Daylighting System, 23-28m² Light Coverage, 9m+ Potential Length
	Maxos LED 4MX850 by Philips, SA 1500 x 60 Surface mounted LED, White (WH) sheet metal
	LuxSpace Accent Performance, fixed version, RS751B, LED 39S by Philips, SA 1680 Adjustable surface mounted LED; White (WH)
	LuxSpace Accent Performance, adjustable version, RS751B, LED 39S by Philips, SA 1680 Adjustable surface mounted LED ; White (WH)
	SlyID Fresh Food, Performance 3C-track version, LED26S, light source colour Fresh Food Meat (FMT) by Philips, SA 1190 LED track light ; White (WH)
	ROYALE, PEN144 BK GD by illumina, SA 4000 x 230 high aluminium pendant in black and gold colour 1 x max 60 W E27 lamp required
	PORTOBELLO, IPEN7298_260_BK by illumina, SA 2600 x 320 high metal pendant
	LuxSpace Compact Power BBS495 (UGR19 version) by Philips, SA 2180 Surface mounted LED, White (WH) with high-gloss mirrors
	TANSY RED, IPEN7245_450_RD by illumina, SA 4500 x 500 high metal and glass pendant light 1 x 22-40 W (max 60 W) T5 required
	TANSY WHITE, IPEN7245_450_WT by illumina, SA 4500 x 500 high metal and glass pendant light 1 x 22-40 W (max 60 W) T5 required
	REPLICA SEPPKO KOHO SECTO PENDANT, IPEN7022_1_WD by illumina, SA 3000 x 600 high natural wood pendant light 1 x 7-40 W (max 60 Watt) E27 required
POWER SUPPLY COMPONENTS	
	LIGHT SWITCH
	3 WAY LIGHT SWITCH
HVAC, COMMUNICATIONS & FIRE FIGHTING	
	A/C OUTLET
	SPEAKERS
	SECURITY CAMERA
	FIRE ALARM



CEILING PLAN
SCALE 1:50

Figure Appendix C1: Deli Ceiling Plan (Author 2015)

Here, sonder U sou ek dit beslis nie gemaak het nie! Dankie vir al die krag, geduld en eindelose genade.

Ma, Nina, jy is my inspirasie! Dankie dat ma my hele lewe lank al vir my 'n voorbeeld stel van hoe om hard te werk en nooit op te gee nie. So baie dankie vir al ma se liefde en ondersteuning. Dankie dat ma die laaste vyf jaar van studies vir my moontlik gemaak het en dat ma altyd in my bly glo.

Raymund, dankie dat jy die potensiaal in my projek raak gesien het en dat jy vir my 'n visie gegee het van hoe om hom uit te voer. Dankie vir al jou moeite en insette en dat jy my gemotiveer het om nou en dan te slaap.

Barbara, *thank you for all your knowledge and guidance and for going out of your way to help me.*

Laura, my “lifeline”, dankie vir al jou idees, opinies en motivering. Dankie dat jy saam met my laat aande gely het en altyd geluister het hoe ek 'n duisend keer oor die selfde dinge kla.

Carla, jy het my “sane” gehou. Dankie vir al jou hulp wanneer ek op my desperaatste was. Dankie dat jy altyd in my en al my idees glo, al is hulle hoe sleg.

Oom Piera en tannie Suzette. Dankie dat julle my lief het soos julle eie kind en dat julle altyd in my glo. Dankie vir al die motiverende oproeppe, boodskappe en op die nippertjie se hulp. Ontsettend baie dankie vir al die tydskrifte wat my vir vier jaar inspirasie gebring het wanneer ek nie meer kon dink nie.

Vir al die ander wonderlike mense in my lewe, dankie vir al julle ondersteuning en moed inpraat.