Sustainability | Performance | Comfort

PJC +PARTNERS

Sustainability | Performance | Comfort

OBJECTIVE AND CONTENTS

Objective

This document intends to provide an overview of PJC, the services offered, how we approach our work, a sampling of the projects we have been involved and some idea of why we believe we are unique.

Contents

- What we do
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- Who we are
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  - Project example: Sasol Headquarters
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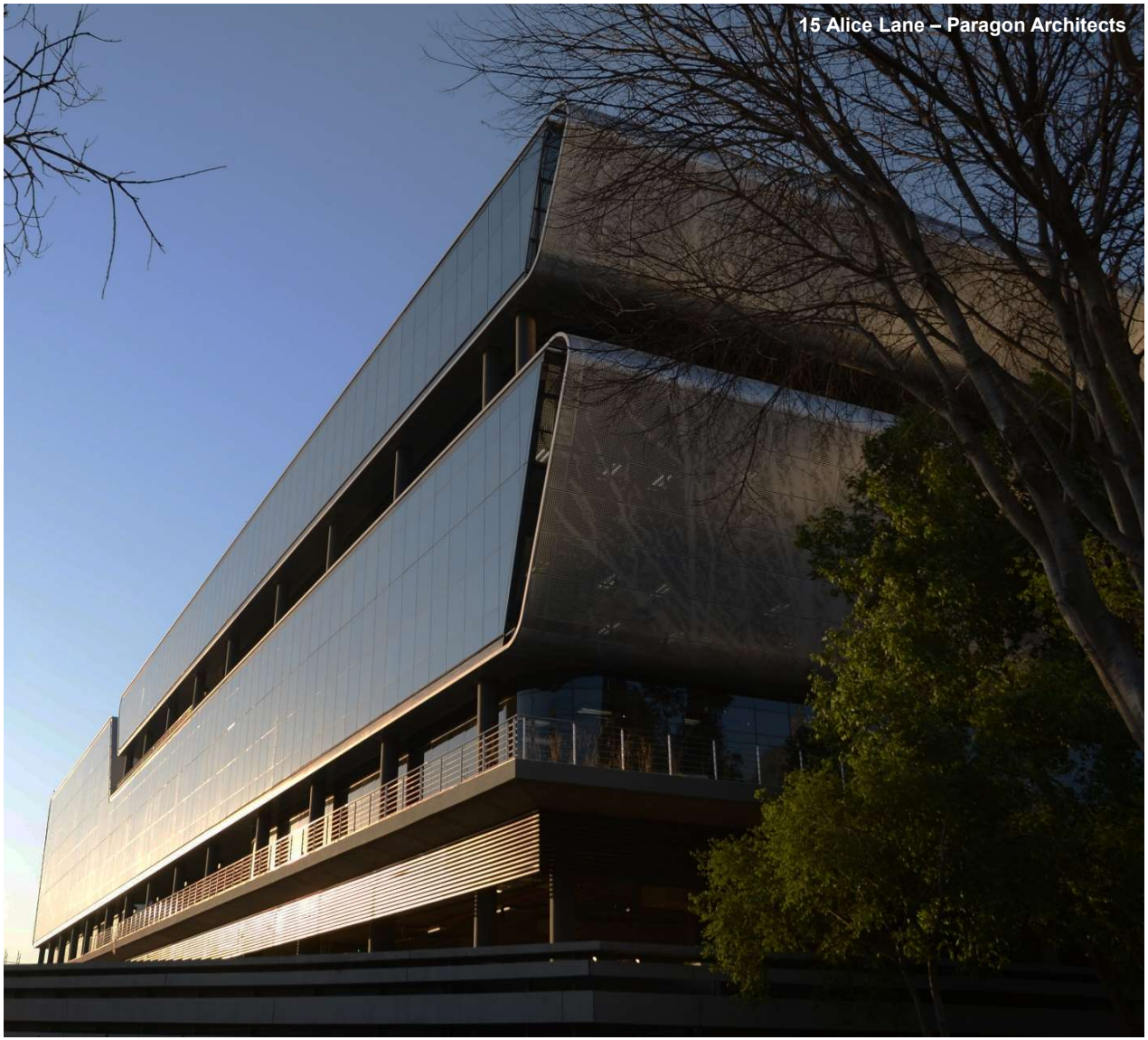
- Why are we needed?


15 Alice Lane – Paragon Architects

PJC VALUES

RESPONSIBILITY DEFINES US

A sincere responsibility is core to who we are. A responsible and sustainable approach to the environment, to each other and to our clients infuses our choices, processes and solutions.

IT'S OUR PROBLEM AND WE LOVE IT

This is an attitude. We don't see problems - we see challenges that we embrace and own. We don't just meet our clients' needs - we complement and amplify their visions for their built environments. Our style is collaborative and we measure our success by how much we problem-solve, innovate and enhance.

IT'S IN THE WAY WE DO THINGS

Our integrity is based solidly in the robust and transparent way we do things. A culture of enquiry means we are always questioning and testing what we do, making our findings, knowledge and processes open and transparent. We take complicated information and make it digestible, understandable and accessible.

CONTINUOUS LEARNING ENSURES OUR EDGE

We constantly extend ourselves through challenging our own processes and learning from everything. Errors are recognised as valuable opportunities for learning and improvement. Our innovative approach to learning, processes and methodology ensures our reputation for pioneering and "boundary-pushing

THE JOY OF COLLABORATIVE DESIGN AND WORK

Our positive and warm work environment is created through respect, caring, collaboration and having fun! Because making a difference is deeply meaningful to us, we do as much social outreach as we can – ensuring that at least some of our energy can go where it has greatest impact.

Bio-Climatic Performance

We provide solutions to enhance the performance of the planned + built environment and the quality of our indoor + outdoor spaces.

- Sustainable Design Management
- Passive + Low Energy Design
- Daylight + Visual Comfort
- Integrated Water Design
- SANS 10400-XA
- Green Building Certification
- Low Carbon + Healthy Materials
- Independent Commissioning Process
- Post-occupancy Monitoring + Tuning
- Urban Environmental Performance
- Indoor + Outdoor Comfort
- Education + Research

WHAT WE DO

PJC + Partners was originally established as PJ Carew Consulting in 2004. We are a multidisciplinary team of experienced professionals from diverse disciplines, working together to provide comprehensive assessment, consultation and sustainable design solutions in the built and planned environment.

In 2018, PJ Carew Consulting invited its senior management as partners on its journey, rebranding as PJC + Partners.

Sustainable Design Management

- Provide the green budget early on, get it signed off and coordinate its implementation. We get more 'green' into our projects at a lower capital cost. This means getting the project from an initial thought to a physical structure or simply testing viability without the greenwash. This service can be provided on its own as a planning and feasibility exercise on projects targeting sustainability strategies.

Passive and Low Energy Design

- Make it work from the beginning - Define and develop the overall energy and comfort strategy as it impacts the architectural design and building services. This is derived from the understanding of climate and building physics as a fundamental design discipline.

Daylight and Visual Comfort

- Balance light and sight - Define and develop the overall lighting, daylight, glare and visual comfort strategy as it impacts the architectural design and building services. This is derived from the understanding of the holistic interaction between natural and artificial light, and human sight.

Integrated Water Design

- Get the most out of every drop - Define and develop the overall water strategy and related waste systems with a focus on integration of services, low-impact wastewater technologies, landscaping, stormwater management and water-wise urban drainage systems.

Green Building Documentation (Green Star, EDGE, Net Zero)

- Good design = certification points - Provide compliant specification, write the majority of the reports and coordinate the minimum supporting documentation necessary making it easy for the client, team and contractor. Facilitate the whole certification process with the accreditation organisation.

Building Performance Modelling and Simulations

- We understand that garbage in = garbage out. We model and simulate both for building compliance as well as to inform our design strategies. Our library of tools and software includes allows us to analyse building performance with respect to solar radiation, daylight availability, glare mitigation, energy usage, artificial lighting and thermal comfort impact.

SANS 10400-XA Compliance Verification and Reporting

- Verification of the theoretical energy consumption of your building against the minimum legislative code for compliance according to SANS 10400-XA via rational modelling and simulations without compromising design and costs.

WHAT WE DO – CONTINUED

We have been around for 20+ years, and our set of services has grown with our experience.

All our services are offered as a stand-alone service or as a full package for a high-performance building or precinct.

Note – we don't replace your conventional design team, we put them on steroids.

Low Carbon and Healthy Materials

- Sorry…. no "new building" smell and no headaches - Define appropriateness of construction materials chosen, how they are used and where they are sourced. This service incudes embodied carbon comparative analyses during design for a low carbon built environment.

Independent Commissioning Process

- Seriously…. make it work from the beginning – performance quality assurance from inception to handover to verify that the systems are tailored to the client's needs, operate as intended and are moulded to the occupant's behaviour.

Indoor Environmental Quality Optimisation

- Prioritise occupant well-being through IEQ optimisation. Simulate, measure, monitor and test IEQ aspects to promote the well-being and comfort of users and occupants.

Post-Occupancy Monitoring and Tuning

- Compared to its design and construction period, a building is operational for more than 20 years. Just like your car, it needs to be regularly monitored and tuned in addition to the maintenance process. We look at metering data, carry occupant engagement surveys and review maintenance logs to continually optimise the energy, water and comfort performance.

Urban Environmental Performance

- Think bigger than 1 building. For campuses, precincts and estates, there are opportunities for greater efficiencies and economies of scale for sustainability initiatives. This service is offered through a complement of the following:

  – *Outdoor comfort*

  We have a fantastic climate and outdoor spaces can be designed to work with that to optimise the duration that people spend outside – good for health, public interaction and retail opportunities.

  – *Sustainable sites*

  We work with the design and planning team to ensure that an integrated strategy is developed which act as the guiding principles, including performance targets from pre-design to operation for the master planning and/or urban design of a site.

WHAT WE DO – CONTINUED

In addition to providing traditional consulting services, we have tailored some of our services to be “product-like” to fit the needs of any team at a point in time in the project delivery, without us being part of the full consulting team.

Furthermore, we have learnt from all of our projects and believe that these lessons should and must be shared with our peers in the industry and the academic community.

Targeted Offerings

- In order to assist design teams in getting immediate value out of us without us having to be part of the full consulting team, we have broken some of our services into “products”. This provides a cost-effective means for design teams to verify quick assumptions and code compliance or test design iterations. Ask us for our product brochures:
  - *Façade Solar Performance*

    A tool to inform the design of a performance façade and to find the balance between transparent glazing, daylighting potential, glare mitigation and the thermal comfort of the occupants without compromising the energy impact of the HVAC systems.
  - *Contractor Green Star and Commissioning Documentation Management*

    Assist Contractors with their Green Star documentation deliverables which can be supplemented as the commissioning specialist for Contractors.
  - *CLEAR Homes*

    Comfortable and Low Energy ARchitecture for Homes providing concise, affordable and practical input into single-owner residential design and construction covering the overall energy, comfort and water strategies. This includes the principles of Passive House and Active House in the context of the local region and climate.

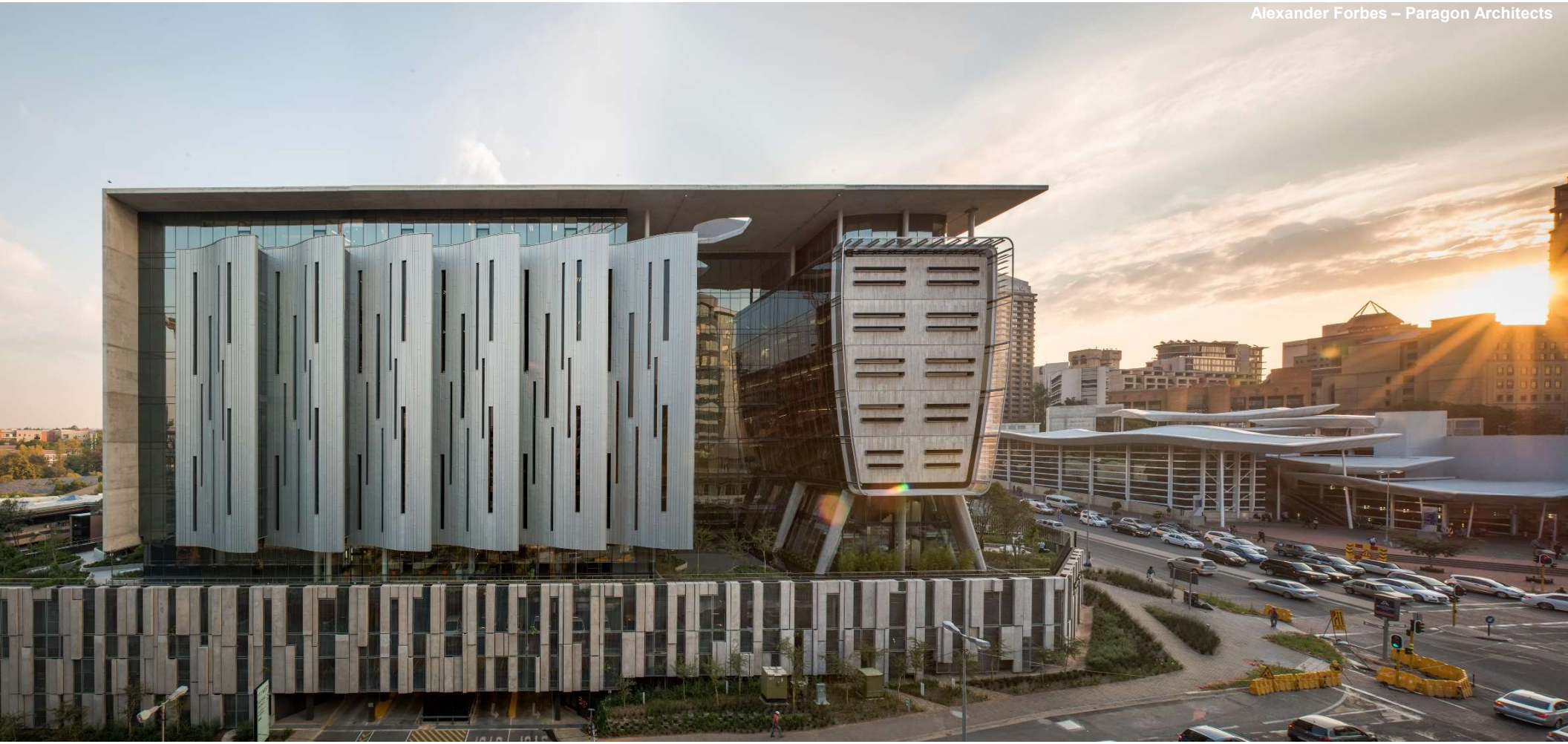
Education and Research

- We love sharing what we do with our peers and the next generation. Over the years, we have and continue to attend local and international conferences, publish papers, lecture at universities and participate in talks and workshops in the industry. Our educational and training portfolio include:
  - *Lectures and presentations*
  - *Multi-day workshops*
  - *Collaboration on papers*
  - *Research and Development*

ALEXANDER FORBES

Sandton - Zenprop - Paragon Architects -40,000m2: Appointed as the Green Building Specialist for our full services. The project achieved a 4 Star Green Star SA Design and As Built Rating.

Design input highlights. Shading design for North West façade, atrium daylighting and glare control.


Alexander Forbes – Paragon Architects

WHAT WE HAVE DONE

We have been around for 20+ years!

While the scale and scope varies, some are Green Star, many are not, the constant is that we have had a fundamental input into the performance of these buildings. The earlier we have been involved, the more profound the impact.

Our project experience range from single-owner residential homes to large mixed-use developments across various regions and climates.

We create comfortable spaces while enhancing environmental performance and safeguarding occupant well-being.

We encourage you to contact us for any case study of any type of project we may have done pertaining to your current needs!

Email us at hello@pjc.co.za.



KHAYELITSHA SERVICE CENTRE



CENTURY CITY URBAN SQUARE



SASOL HEAD OFFICE



REWARDSCO OFFICES



PHILIP MORRIS SOUTH AFRICA



WITS SCIENCE CENTRE



115 WEST - ALEXANDER FORBES



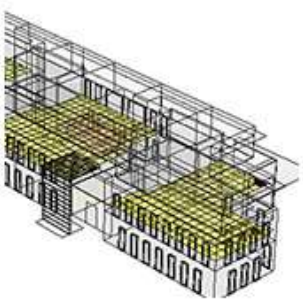
EASTGATE 20



7 FOUNTAINS PRIMARY SCHOOL



VELE SECONDARY SCHOOL



CECILIA SQUARE



IXOPO SISONKE DPW OFFICES

7 FOUNTAINS PRIMARY SCHOOL AND VELE HIGH SCHOOL

Foreign donor funded and East Coast Architects - 1200 and 450 learner schools in KZN and Limpopo provinces respectively. Appointed to establish a passive design strategy to increase the comfort conditions in a climates that experiences extremes of both cold and heat. The brief was to specifically avoid the use of complex technologies that require high levels of maintenance. Vele came runner up in the US Green Building Council's Greenest School in the World competition in addition to a number of other architecture and sustainability awards.

Design input highlights – both buildings are designed to cooled and heated naturally with glare free daylight – energy bills as low as 25% compared with other schools and winter absenteeism is close to 0% (its warmer in the school that at home.)



7 Fountain Primary School – East Coast Architects

WHO WE HAVE DONE IT FOR

Our variety of projects is matched by the variety of clients.

We wouldn't be here without the people who choose to work with us.

Our ability to produce high performance and green buildings is rooted in strong connections. We support each other, and we support our clients and peers.

While clients are important, it's also worth checking in with our peer consultants as we are only as good as the team.

We want to earn their trust as collaborators and partners.

You are welcome to contact us for any reference checks.

Email us at hello@pjc.co.za.



WITS SCIENCE STADIUM – URBAN SOLUTIONS AND SAVAGE AND DODD

Johannesburg - Wits University - Urban Solutions and Savage and Dodd Architects - 4,500m2 1st year large open plan science laboratories and raked lecture venues in reclaimed athletics stadium. Appointed for passive and low energy design services.

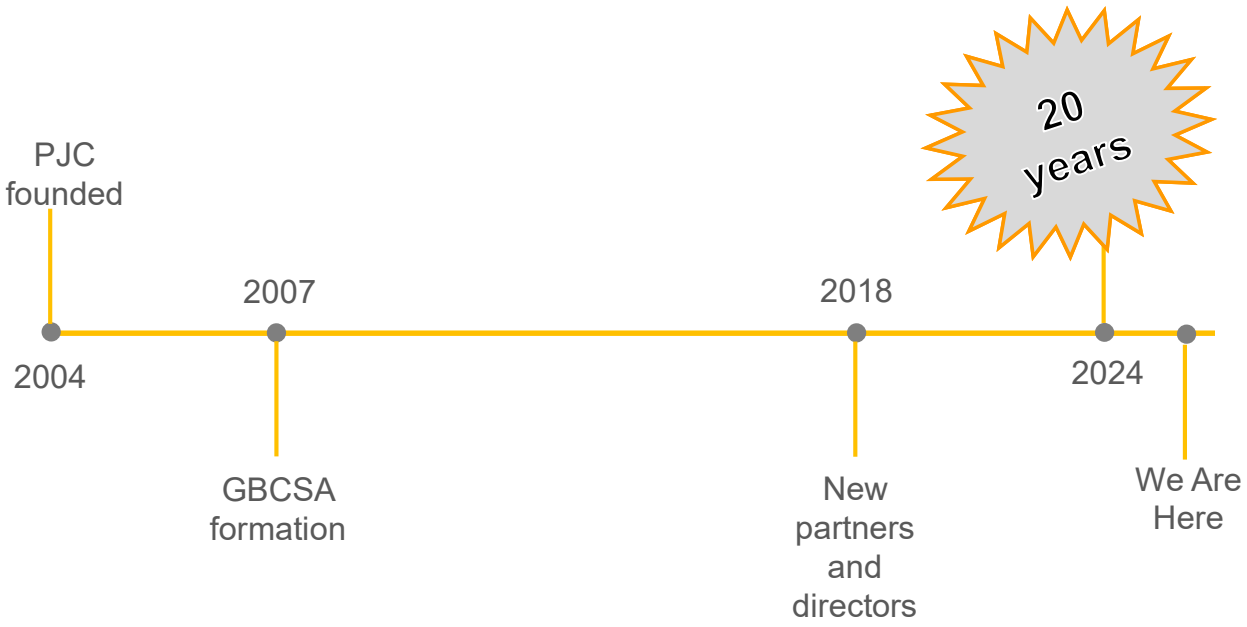
Design input highlights : 400 seater auditorium with glare free daylight. 1st academic building with structural cooling (underfloor heating pipes in the concrete cooling or heating the structure during off-peak electricity hours) in South Africa, potentially the world. All paid through via the saving achieved on the façade originally the walkways on the north façade were to be enclosed in a glass façade with shading devices and we indicated that in the Johannesburg climate this was unnecessary. Wits Capital projects have provided feedback that this is the “quietest building on campus” with regards to complaints.



Wits Science Stadium – Urban Solutions and Savage and Dodd

WHO IS PJC

- Mix of engineers, architects, scientists and technologists
- 20+ years of legacy
- Project experience from single-owner residential homes to large mixed-use developments
- Frequent collaboration with our peers and industry bodies
- Research and education values



WHO WE ARE

Our diversity is our strength.

Scientific, engineering and architecture backgrounds with a broad spectrum of experience brings wide angle perspective in parallel to zoomed in focus.

Email us at hello@pjc.co.za to request the resumes of our team members.

Partner and Director: Yogesh Gooljar

As of mid-2018, Yogesh has joined Paul as a partner after having been with the firm for seven years. Yogesh is originally from Mauritius and after completing his BSc Electro-Mechanical Engineering studies, he went on to work for WSP, an international multi-disciplinary company in the building industry, in their Cape Town office as a building services engineer. He joined PJC in 2011 and has been instrumental in setting up the independent commissioning process services.

- Registered Professional Engineer
- BSc Eng (Electro-Mechanical) Engineering
- Green Star (SA) Accredited Professional Practitioner
- Green Star (SA) Independent Assessor
- Green Star (SA) Technical Advisory Group member
- Qualified Commissioning Process Provider



Partner and Director: Mlondolozi Hempe

After completing his Bachelor of Architectural Studies at NMMU, Mlondolozi gained experience in an architectural practice developing competency in various projects with a varying portfolio of private, public and educational buildings .He subsequently started work as an Environmental & Sustainability Design intern, assisting project managers to facilitate the design of high performance sustainable buildings where he gained experience in sustainable design strategies and building performance simulations. He then moved up to be one of the project managers within the firm successfully achieving Green Star certifications for some of the most prestigious buildings in the country. From 2018 Hempe held the position of directorship at PJC driving the companies building performance department.

- Registered Professional Architectural Technologist
- Bachelor of Architectural Studies
- Green Star (SA) Accredited Professional
- EDGE Expert



WHO WE ARE

Member organisations

Our team members are widely accredited, and we are members of organisations with our peers.

GREEN BUILDING COUNCIL SOUTH AFRICA

MEMBER ORGANISATION

ECSA

Engineering Council of South Africa

SAIMechE

South African Council for the Architectural Profession

ASHRAE® South Africa Chapter

International Building Performance Simulation Association

CENTURY CITY URBAN SQUARE – RABIE PROPERTY

Century City – Rabie Property - Vivid Architects – 21,000m2 The Century City Urban Square is a mixed use scheme: offices, conference centre, hotel, residential, retail. Appointed as the Green Building Specialist for our full suite of services. This project received the first As Built certification for a Green Star SA As Built Rating for Mixed Use Buildings using the Custom tool.

Design input highlights: Centralised additional treatment of a treated effluent water supply to levels where toilets can be flushed and use of the water in the cooling towers for the HVAC system – only 30% of the water consumption of the building is potable water.



Century City Urban Square – Vivid Architects

HOW WE DO IT

Sustainable Integrated Design

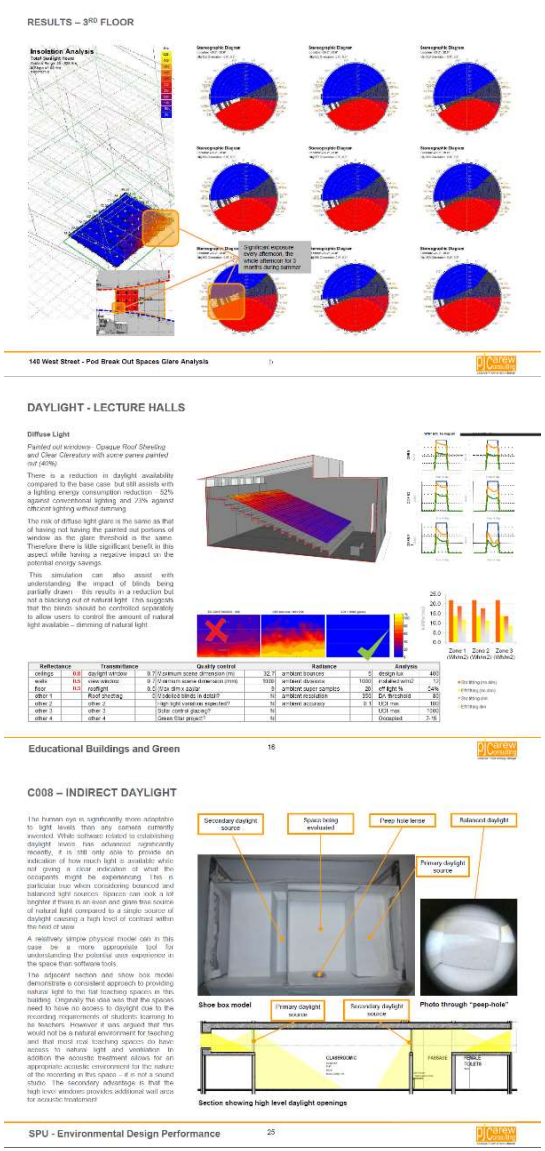
We do not send our co-consultants on wild eco goose chases - our proposed interventions are researched in-house, often beforehand in parallel to projects through our research and development activities.

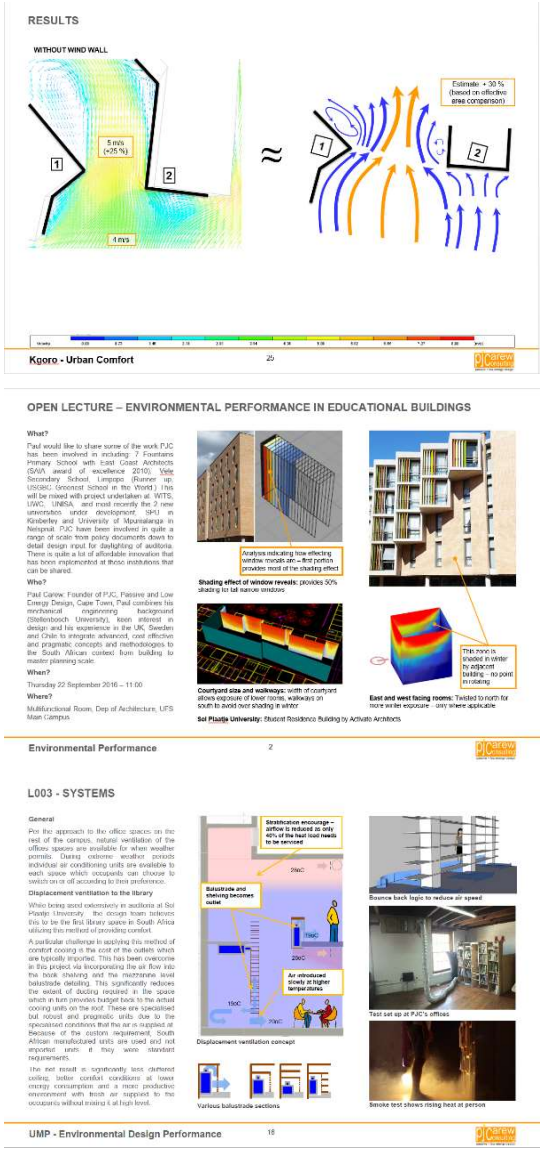
When we propose the idea, it is well founded, supported through quantification and qualification and to the same level as the commercial base case and we know what it will cost.

We eat our vegetables first – we sort out the basics and then look at the new and intriguing.

Our Plan B is always efficient to ensure that fall back positions are beneficial to the project.

While we have some fancy tools and fancy ideas, we make them pragmatic, affordable, buildable and maintainable, mainly through drawing in the rest of the design team, client and contractor who always have a critical part to play in making these ideas realistic.



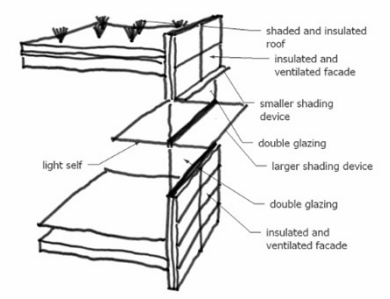


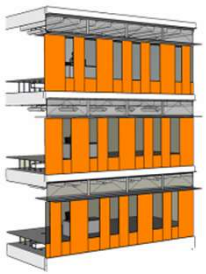
HOW WE DO IT

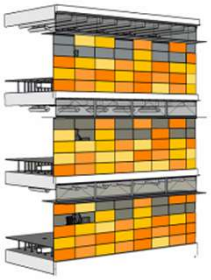
Systems Approach

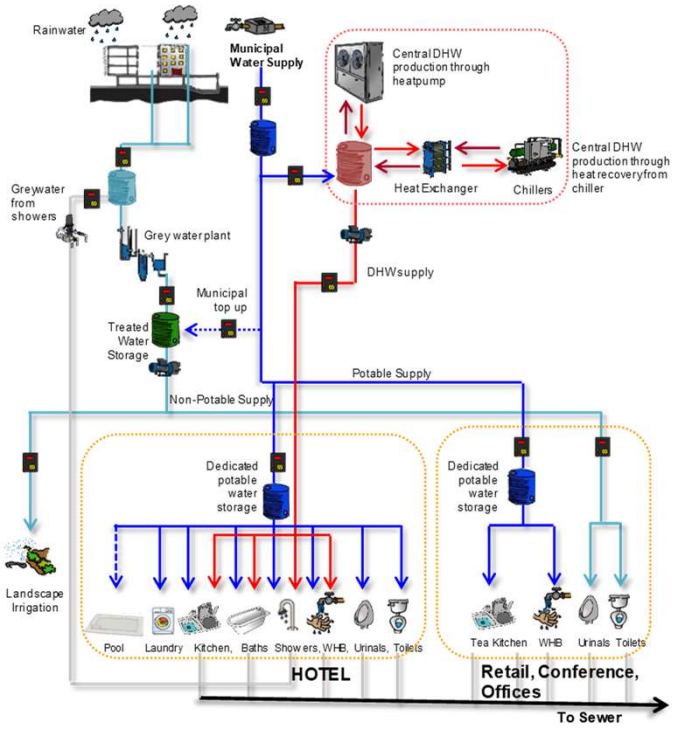
We approach our projects holistically with an understanding that the elemental parts of a project are best solved in context as well as in relation with other elements and systems, rather than in isolation.

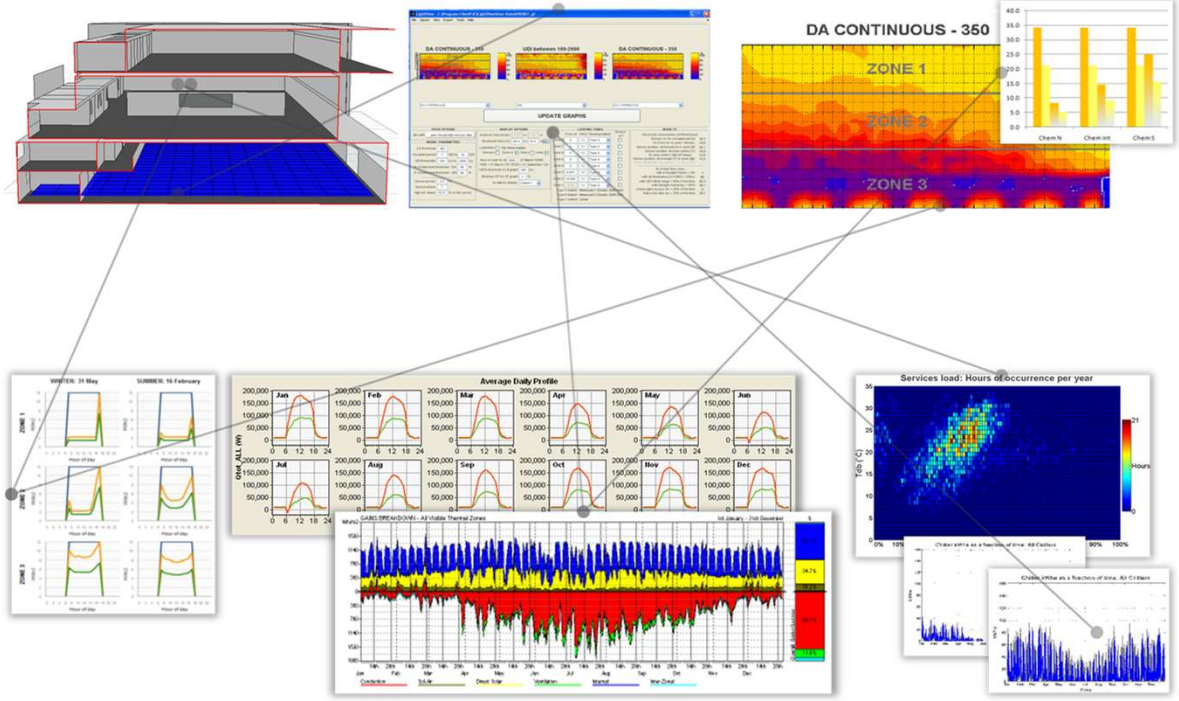
We are comprehensive and pro-active with the desired aiming to achieve solutions that are pragmatic and tested with the optimal practical value for money.









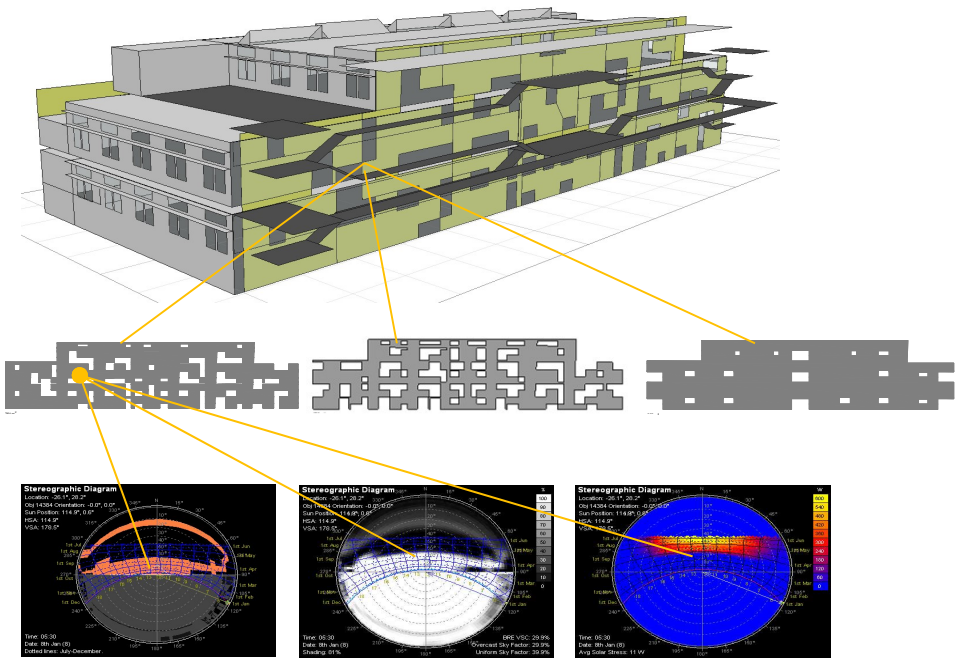


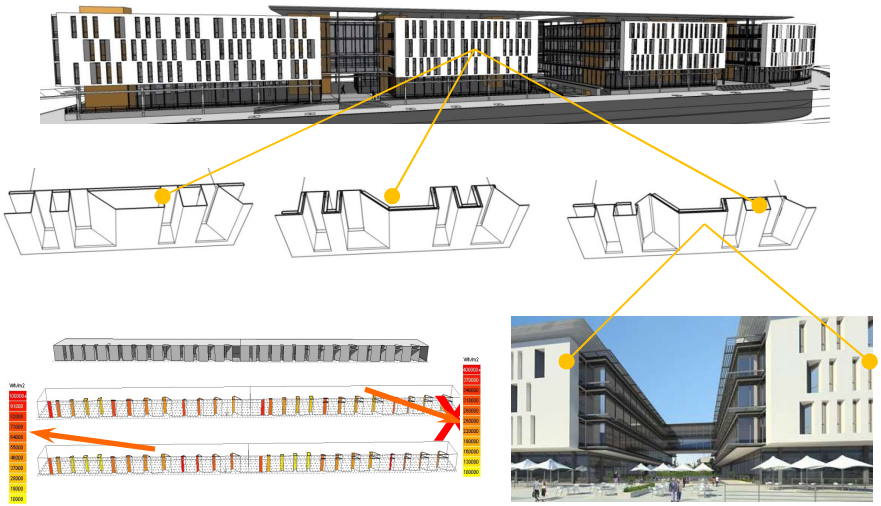
HOW WE DO IT

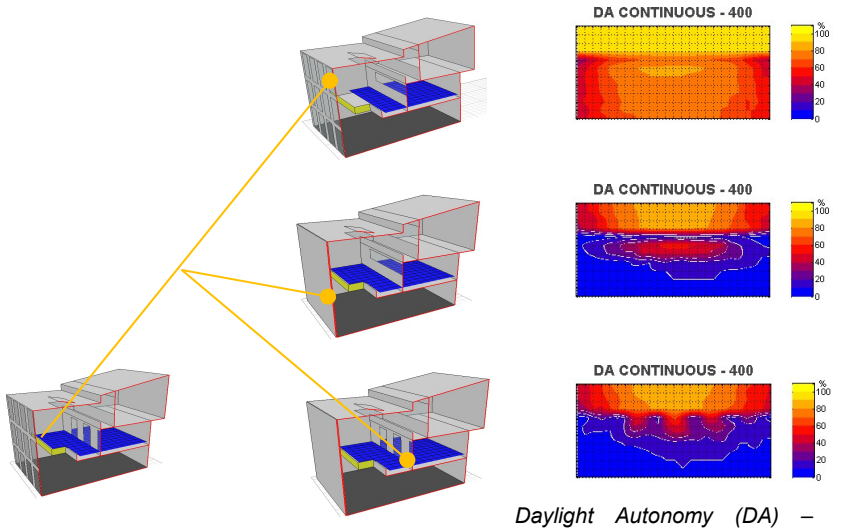
Analyses and Iterations

Our methodologies are backed by data-driven processes, without leaving the human component behind.

All our building performance analyses are iterative and tailored to the specific issues and questions of the project, rather than modelling for the sake of modelling.







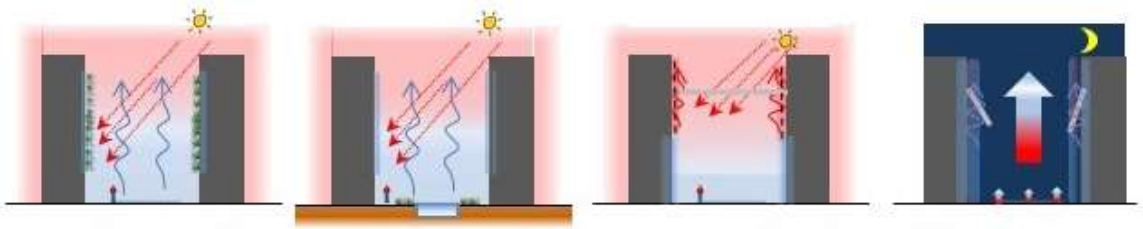
Daylight Autonomy (DA) – duration that the design lux level can be met by daylight and not electric lighting.

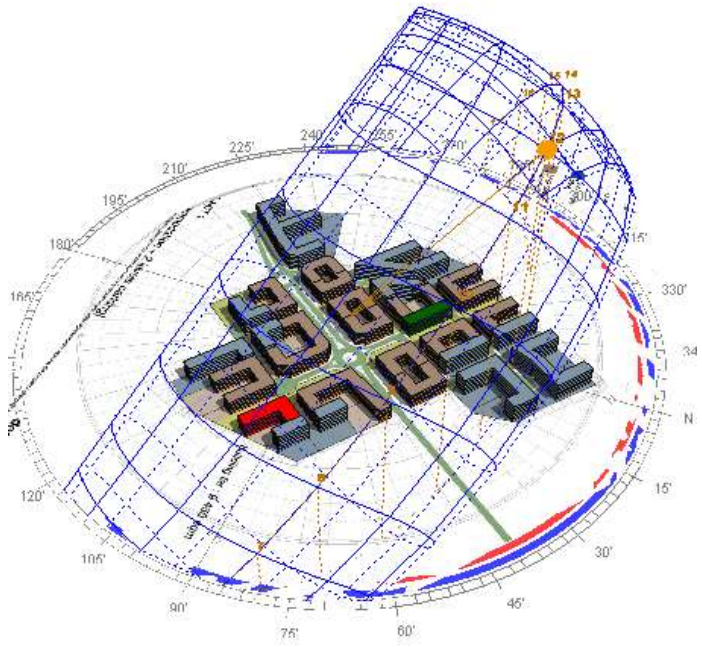
HOW WE DO IT

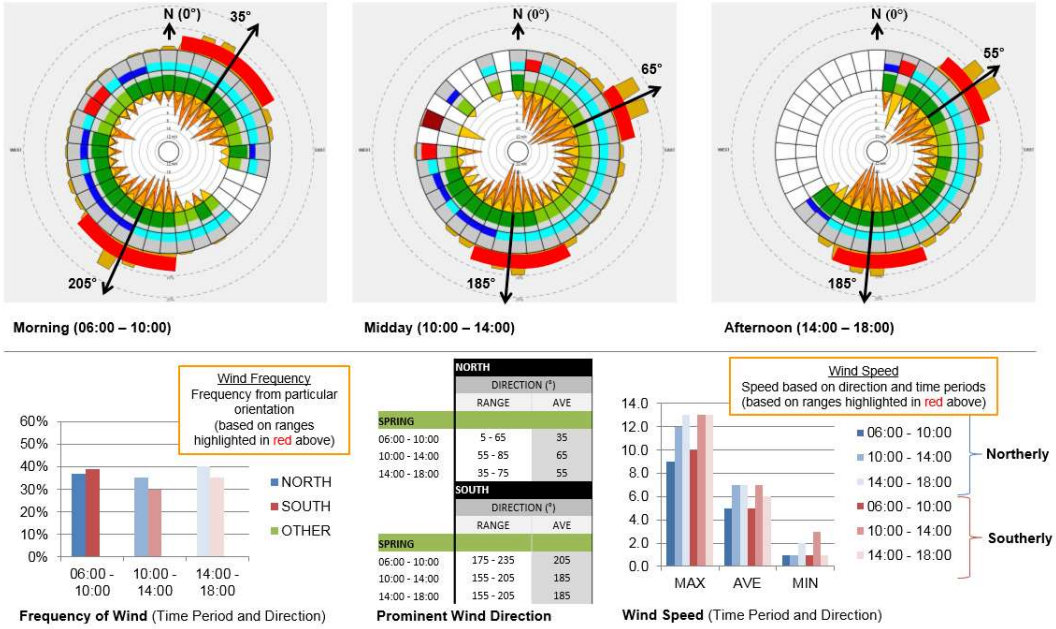
Site context

We apply our core thinking to multiple scales of development, including precincts, residential estates, urban development and university campus.

The site context, user variety and corresponding climates are always taken in consideration before and during any of our design development and analyses.







HOW WE DO IT

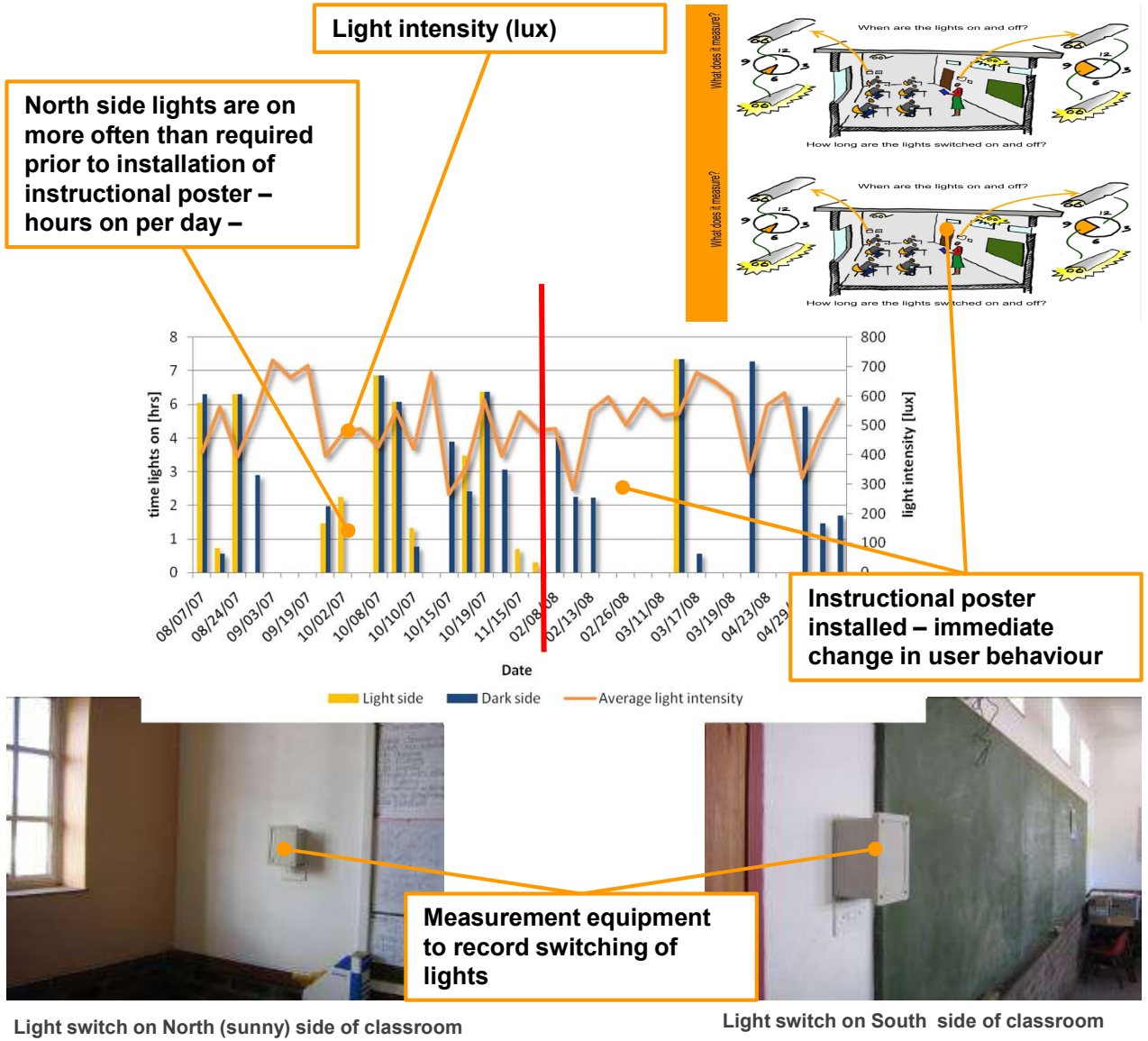
Measured results – 7 Fountain Primary School – Daylight and lights

A significant consumer of energy in school buildings can be lighting.

An appropriate daylight strategy considering glare in combination with a corresponding lighting control strategy can result in significant savings – Vele High School electricity bills are 75% lower per learner than an adjacent school largely attributed to reduction in lighting use.

At Vele, the vast majority of classrooms have the larger windows on the sunny side (north) with the chalk boards on the south side. The lighting has been banked and switched accordingly - a light switch for the lights on the north side of the classroom adjacent to the windows rather than the door on the south side. The lights on the south and close to the chalk board are switched at the door. This is in lieu of a daylight sensor which has a lifespan of 7 years and would be a significant replacement cost to the schools in the future. The separate locations associate the switches with the natural light source and change habit of switching all lights on when entering the room.

This strategy was measured. While the daylight strategy worked in that there were very few hours when the lights were on, the teacher of the classroom often switched on the incorrect lights – she had placed her desk on the sunny side next to the switch that was intended to only be used at night. However, as soon as instructional signage was installed the behaviour changes.



Light switch on North (sunny) side of classroom

Light switch on South side of classroom

HOW WE DO IT

Prototyping and Testing - University of Mpumalanga – Library displacement ventilation

A displacement ventilation system distributes cool air from an air handling unit (AHU) through a diffuser. The cool air is distributed at a very low velocity to avoid draft and discomfort.

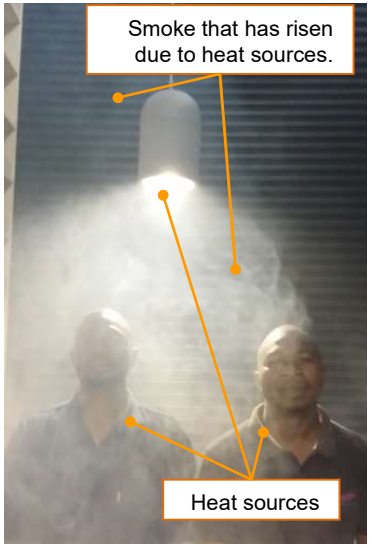
We saw an opportunity in this, and suggested the bookshelf itself becomes an HVAC component (or the HVAC component becomes a bookshelf).

While displacement ventilation offers an immediate 20% energy and system size benefit in this climate due to higher supply air temperatures and a reduction in over dehumidification, our South African budget just cannot afford the imported outlets; so, we turned the bookshelf into one.

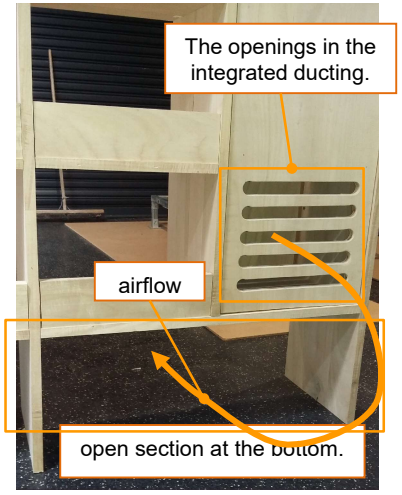
The saving in ducting allowed us a more energy efficient cooling plant at no additional cost.

Displacement ventilation achieves better air quality and thermal comfort for users but commercial outlets are expensive. We designed out the need for the outlets – in this case by blowing the air back at a wall in an unoccupied zone, allowing it to slow down to an unnoticeable speed.

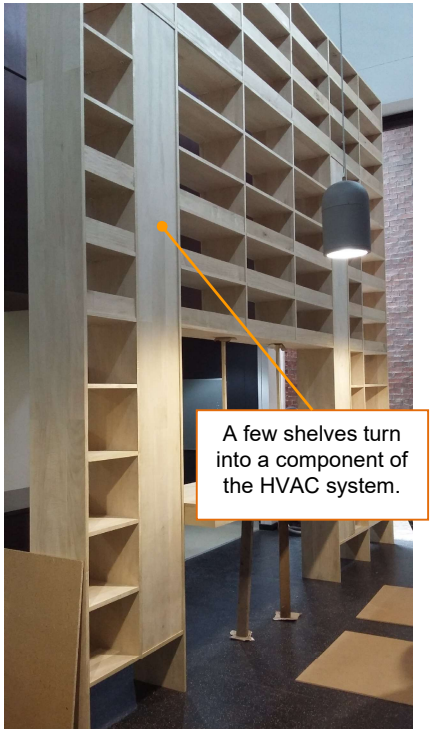
To prove the efficacy of the concept, we did rapid prototyping within our own offices, followed by mock-up testing on-site, with successful outcomes.



Smoke for demonstration rising at "heat sources".



Detail of the displacement ventilation diffusor



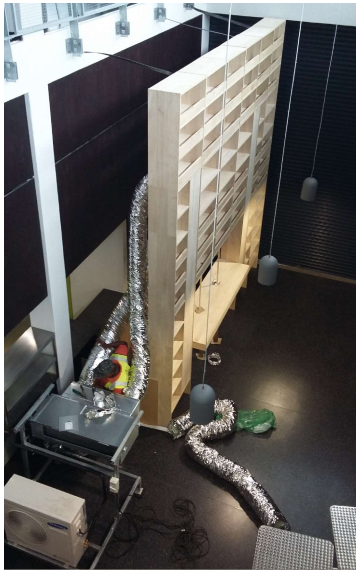
Design of the book shelving.



Smoke indicating the airflow. Rising at the heat source – in this case a person, barefoot to provide an indication of potential draft



Detail of connection air supply ducting to the shelving design.



Overview of the test setup at the client's premises.

HOW WE DO IT

Implementation and Verification – Independent Commissioning Agent

There is no point in commissioning something that isn't meeting the clients requirements in the first place.

Commissioning is more that fiddling with controls to make sure everything is operating. It's about verifying that what is installed meets the clients initial brief.

As independent commissioning agents, we use the process as the measuring stick to make sure all communication indicates that client requirements and performance criteria are being met in a systematic and controlled manner.

From the design documents to the tender specifications, to the contractors' response to the initial fiddling with controls to a full year of post occupation adapting the systems to how the user actually occupies the building.

One ends up with a building that is operating like a finely tuned instrument.



UCT HASSO PLATTNER D-SCHOOL AFRIKA

The Hasso Plattner d-school Afrika* building encapsulates design thinking in every way. This architectural marvel located at UCT's middle campus is a 4-story building and breaks all rules on what a traditional academic space would look and feel like- a space where innovation comes to life. PJC was a core contributor to the 6-Star Green Star Design and As-built certifications of the UCT d-School, laying out, supporting and implementing the environmental performance strategies encompassing energy, water, materials, comfort and well-being. Project highlights are the atrium and building envelope detailed design, and te TABS and mixed-mode ventilation as the comfort strategy.



WHAT WE HAVE PUBLISHED

We have our finger on the pulse of the future.

Teaching at prominent international schools of architecture, producing peer reviewed publications and regular conference attendance brings rich ideas that we slowly bring into reality by adapting them to our climatic and socio-economic context.

You are welcome to request a list of our publications to access our academic papers and/or industry articles.

Email us at hello@pjc.co.za

























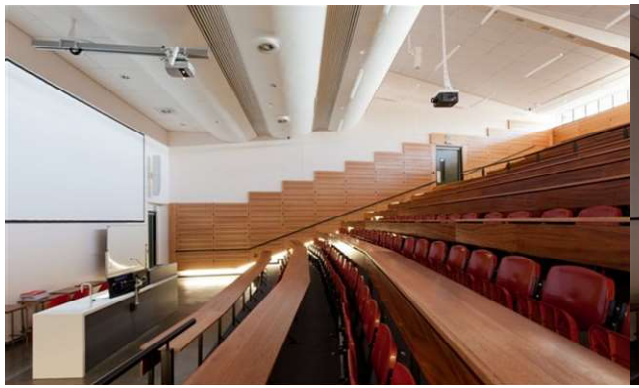






WHY US?

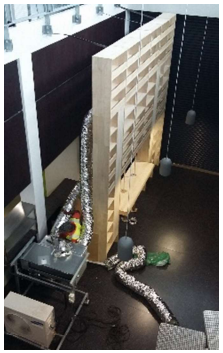
We are financially focused - to make ideas affordable we strip them down to their essentials and then see if they still work… and often they work better for it. We work in a ZAR environment, not a USD or EUR – we can't buy our way out, we have to think our way out. The adjacent images are of some of the innovation that we have brought to projects often at lower capital cost. We test these ideas, create bespoke software, calculations build prototypes for other to contribute, to understand.



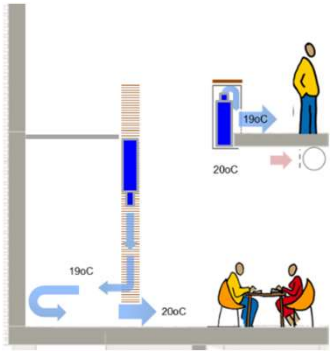

Glare free daylit auditorium at Wits Science Stadium


First office building cooled and heated via it structure






First library in South Africa with buoyancy driven ventilation. Through the book shelves to lower costs



WHY ARE WE NEEDED?

Why can't conventional teams deliver this?

Conventional teams can easily deliver conventional buildings. However, if you want something exceptional but still functional and costs effect, then we can assist significantly:

All our projects are "green" projects compared to a conventional team who might have 1 green project per 10 – we therefore are able to provide a wider variety of approaches, up to date costs with a high level of detail very early on when it has the biggest impact – this enhances the design team and reduces technical and procurement risk to the client when considering alternatives.

We are able to link the architectural aspects with the engineering aspects in a way that glues the various consultants together. Being independent from these aspects and still technically astute we are best positioned to balance the requirements and costs across the components and disciplines – e.g. what portion of the green budget should go on the envelope vs the mechanical vs the electrical systems?

We are equipped to move as fast as the architect does at the every early stages of the design – we can support and enjoy this rapidly iterative process that is often so frustrating and uncomfortable for conventional consultants. We are able to bring quantified input into assist the architects appreciate correct intuition from whim, what is relevant to the specific project content and what can be left behind. This creates an optimised sketch design that offers the best foundation for the rest of the consultants to respond to, at a stage where they are a little more comfortable with the level of resolution.

We need the rest of the consultants and acknowledge that. In order to be specialists in this field we had to accelerate our experience by excluding detailed design, procurement documentation, detailed coordination from our services. We strongly appreciate these aspects, but are not able to do it ourselves. In addition individual team members often have excellent and relevant ideas but just are not always well placed to bring them into the project. We facilitate in having a strong view and being able to tweak what is needed to make a better fit for the idea.

We have some of the most advanced analysis algorithms, design approach and ways to communicate the results in this field internationally - simply put, very few people can do this

PROJECT CASE STUDIES & DESIGN HIGHLIGHTS

SASOL HEADQUARTERS

The new Sasol corporate office is located in Sandton, Katherine Street, accommodating approximately 3000 staff members initially It was designed by Paragon Architects and is owned by Alchemy Property Developments. The 11 storey, 70 000m2 development aimed at pushing the boundaries of sustainable design. PJC worked closely with the team to achieve the targeted 5-star Green Star SA – Office v1 Design rating. Some of the project highlights include the performance façade and baffles which accent the skylight.



SASOL HEADQUARTERS – PERFORMANCE FAÇADE - PARAGON ARCHITECTS

Integral to both the energy and indoor environmental quality of this 67,000m2 office building building is the design of the building envelope. The performance of the envelope varies according to orientation and the nature of the occupancy behind the envelope.

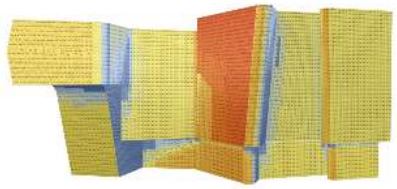
The façade of the building is entirely high-performance glazing made in Germany The glazing is being selected to balance the solar control performance with the daylight availability. This is achieved through what is known as spectrally selective glazing - only 40% of the heat in the solar radiation spectrum is related to visible light. Spectrally selective glazing reflects a significant component of the non-visible wavelengths while allowing in more visible light compared to conventional tinted or reflective glazing that is indiscriminate.

The glazing reduces glare and heat, thus ensuring the thermal comfort of the building's occupants. The glazing is a combination of reflective glass spandrels and vision glass. However, in some situations, peak exposure still results in blinds being too hot for adjacent occupants and in other cases the annual exposure is too great from an energy consumption perspective

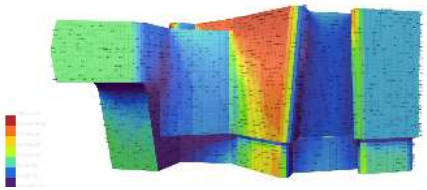
Simulation software was used to assess the performance of the high- performance glazing and this then enabled us to recommended a suitable ratio of vision glass to reflective glass spandrels as well as window sills and overhangs where shading would be required to ensure the thermal comfort of the building's occupants..



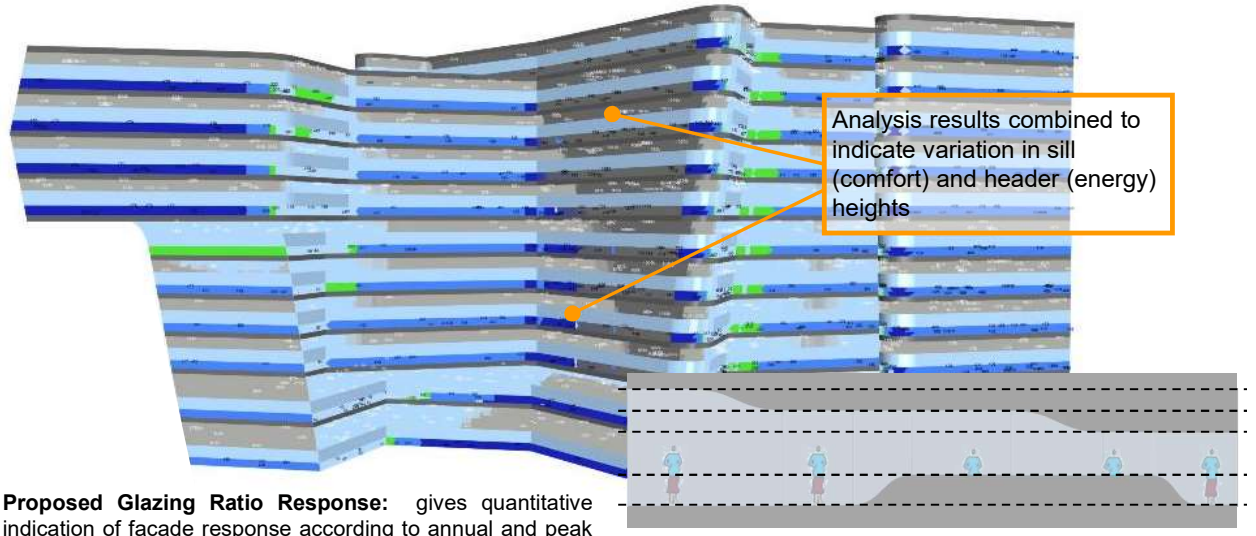
Façade concept: gives notional indication of glazing ratio varying according to exposure and orientation



Peak Riadiaton: HVAC and Comfort (W/m2)



Annual Radiation: Energy Consumption (kWhr/m2/a)



Proposed Glazing Ratio Response: gives quantitative indication of façade response according to annual and peak exposure

Various potential glazing ratios:

SASOL HEADQUARTERS – ATRIUM BAFFLES - PARAGON ARCHITECTS

The Sasol headquarters were designed with two atriums to bring light and external views into the deep office floor plates, a North atrium and South atrium. The baffles which accent the skylights are designed to deflect direct sunlight entering the building and thus reduce the solar heat gain of the building.

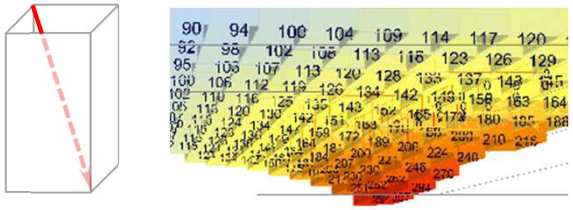
By calculating the depth at which the sun angles enter through the skylights, the baffles can be accurately positioned to deflect the direct sun and minimize the thermal gains of the building ensuring the thermal comfort of the occupants. As the sun angles vary throughout the day as well as throughout the year, so do the depths of the baffles thus creating the undulating skylight surface.

The concept of the baffles was a new innovation and thus PJC had to conduct experiments and research to assess the viability of the shading strategy.

The following images and data represent some of the research that PJC conducted.



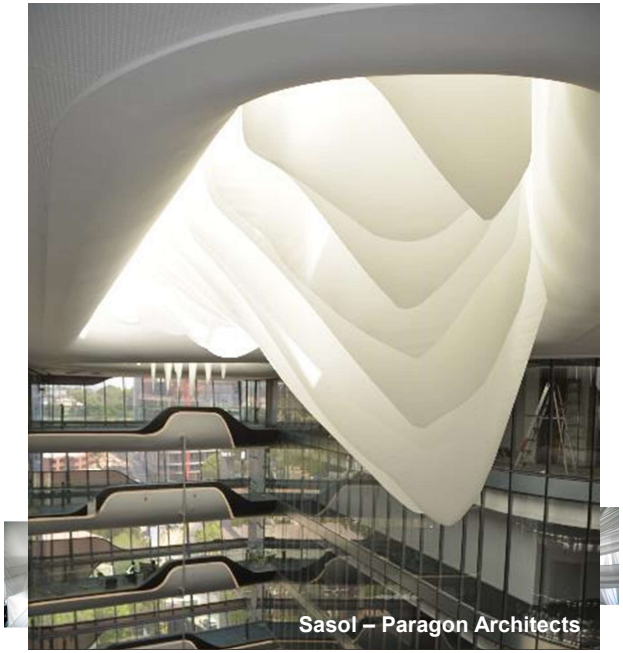
Original competition concept – Paragon Architects



Simplification of concept into something that can be generated parametrically - one of many



Physical model we built in our office - one of the options (not implemented) to test how the fabric would behave



Final implementation – from upper floor levels



Final implementation – view from lower down

SOL PLAATJE UNIVERSITY AND UNIVERSITY OF MPUMALANGA

Wits University was the initial client, various architects for the first 14 buildings, 5,000 and 15,000 new universities in Kimberley and Nelspruit respectively. Appointed to undertake the sustainability master planning from policy level down to detailed input in the building design.

Design input highlights : Sol Plaatje - central grey water system serving campus from treated shower water from student residence. Central cooling and heating plant providing district cooling and heating via structure (pipes in the concrete) to the middle campus. Displacement ventilation to auditoria. UMP - displacement ventilation (buoyancy driven low energy system) incorporated into the library book shelving resulting in a high efficiency system at a lower investment cost.



Sol Plaatje University, C001 and C002– Activate Architects and Savage and Dodd

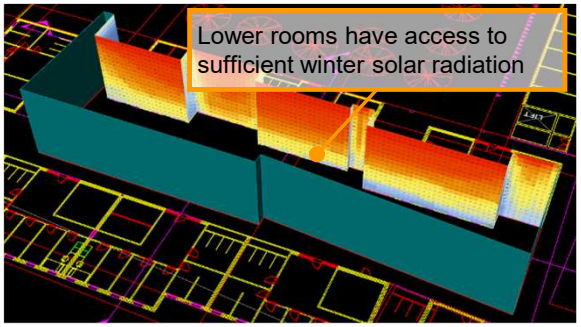
SOL PLAATJE UNIVERSITY – STUDENT RESIDENCE – ACTIVATE ARCHITECTS

The solar design of this building was approached from a macro to micro perspective. Student residence rooms are quite different to other space typologies in that there are very little internal heat gains. They have a low occupant and equipment density and lights are typically left off the whole day. This makes them easier to deal with during summer with regards to cooling, but more challenging to keep warm during the winter as this space type struggles to generate enough heat internally to keep itself warm. Therefore heat from the sun starts playing a significant role i.e. excluding solar gains in summer and including solar gains in winter is essential. This was achieved in 3 levels of scale.

Macro - The number of north orientated rooms were maximised by having an east west orientated courtyard to offer maximum exposure. The width of the courtyard was optimised to reduce the number of over shaded rooms at lower levels of the south block.

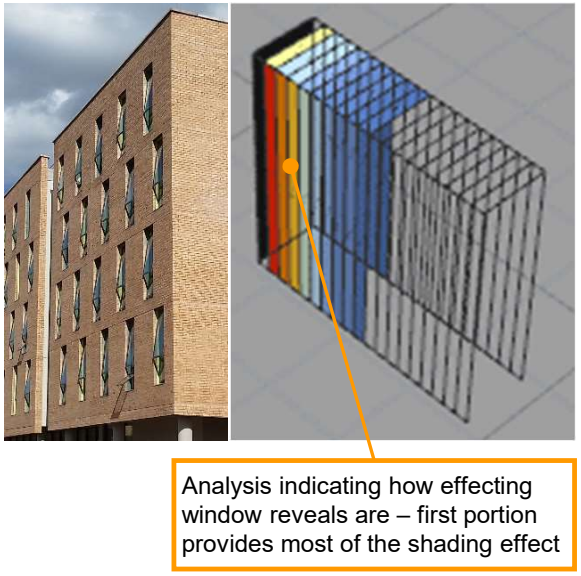
Meso - Walkways, often designed on the north of buildings to assist with summer shading end up over shading in winter. These were relocated to the south in these buildings in order to reduce this.

Micro - North facing windows intrinsically need very little shading because of how the sun moves through the year. The height to witdh proportion was optimised so that just the depth of the window reveal provides the required shading and resulting cost savings were used to deal with the few rooms on the east and west.

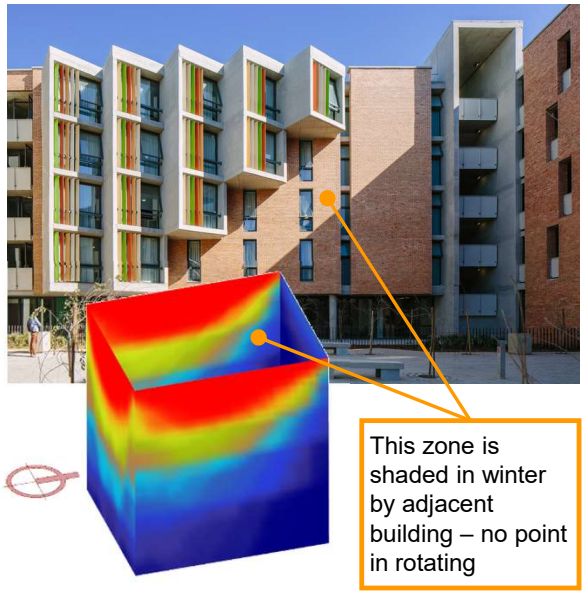




Courtyard size and walkways: width of courtyard allows exposure of lower rooms, walkways on south to avoid over shading in winter



Shading effect of window reveals: provides 50% shading for tall narrow windows



East and west facing rooms: Twisted to north for more winter exposure – only where applicable

THERMALLY ACTIVATED BUILDING STRUCTURE – RADIANT HEATING AND COOLING

The base principle of TABS is to activate the exposed structure of the building in order to provide comfort by mainly influencing the surface temperatures that the occupants are exposed to; thus providing comfort more effectively through radiation rather than convection.

It involves embedding water carrying pipes within the structure of the building and consequently, passing chilled or heated water through the structure. Due to the fact that air is not used to cool or heat the building, occupants are encouraged to open the windows for additional comfort and fresh air.

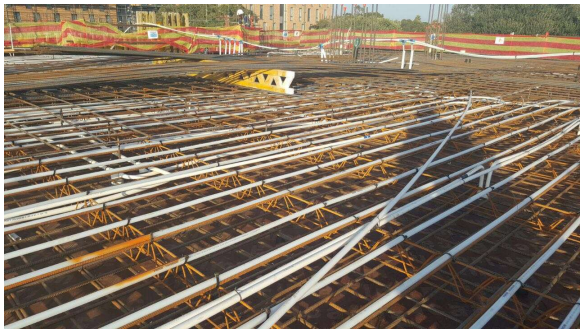
In conjunction with the combination of mechanical and natural ventilation, TABS provides a more effective method for thermal comfort compared to systems which deal with air temperatures only while having significant energy benefits throughout the year. We have managed to assist in bring the costs of TABS to below conventional HVAC installations.

Our project examples

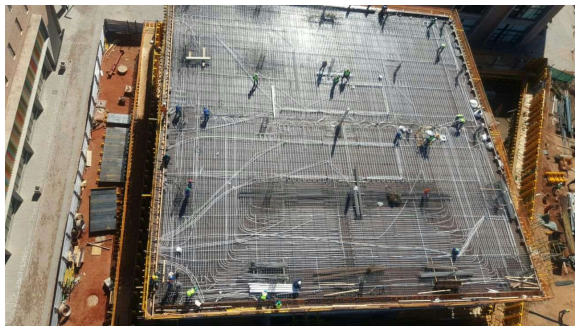
- Wits Science Stadium – 4,500m2 of teaching laboratory – 2nd TABS building in South Africa
- Shared Services Office Building – 3,200m2 of office space for provincial government – first TABS building in South Africa
- Sol Plaatje University – 35,000m2 of university buildings with TABS serviced by a district cooling plant – fresh air to office spaces via natural ventilation



Exposed concrete thermally activated slabs - Office



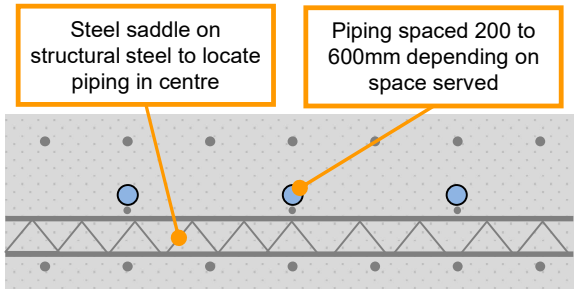
Pipes attached to steel saddles for quick installation



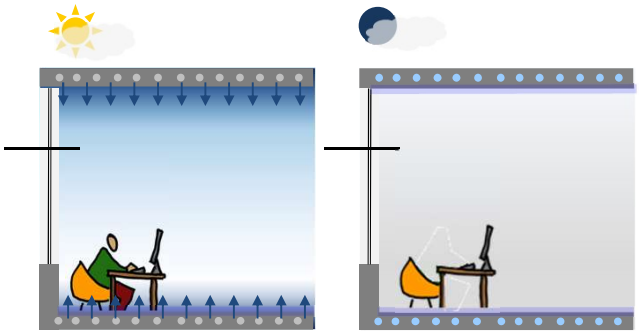
Installation of the TABS piping system – SPU Library



Sol Plaatje University, C002– Activate Architects



Laying of pipes



The system is activated at night to recharge the slab

UNIVERSITY OF MPUMALANGA LIBRARY – COHEN GARSON ARCHITECTS

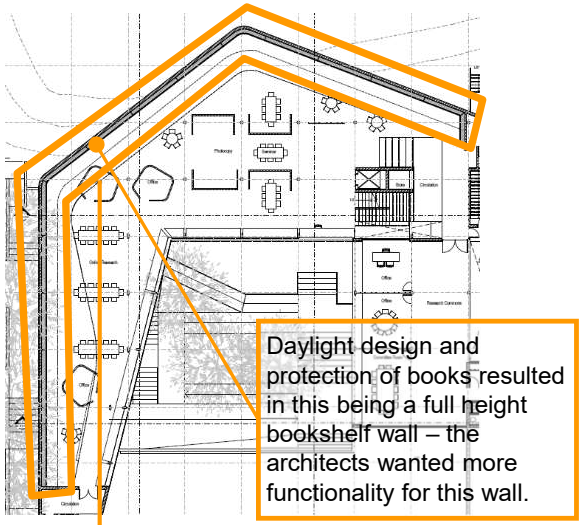
In addition to our broader appointment of sustainability master planning, we were involved in the sketch and detail design stages of projects to provide specific support related to building performance. For this library we assisted with the daylight design, solar control and air conditioning concept. Indirect daylight was provided to the areas where books would be stored through a high level continuous clerestory over a double volume space and balanced by further glazing adjacent to seated areas where users could control blinds as required and direct sunlight would not penetrate through to the books. The HVAC system was designed to be incorporated into the bookshelf system and serve the space through displacement ventilation. This reduced the extent of ducting and outlets which resulting in sufficient cost savings to afford a more complex and efficient packaged rooftop unit. By providing air at a higher temperature, over dehumidification in this sub-tropical climate was reduced resulting in a 20% reduction in cooling capacity from the system.



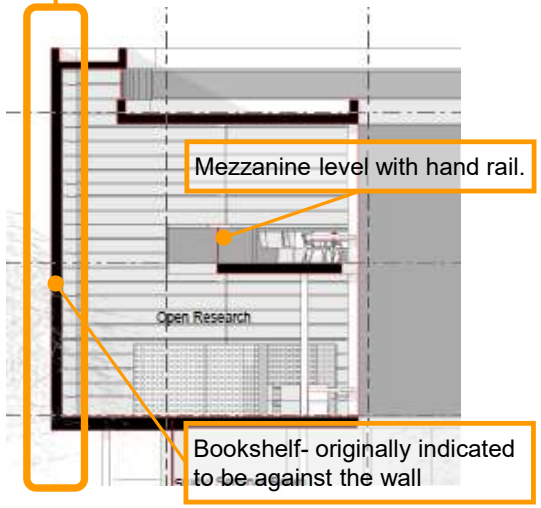


UNIVERSITY OF MPUMALANGA – LIBRARY DISPLACEMENT VENTILATION

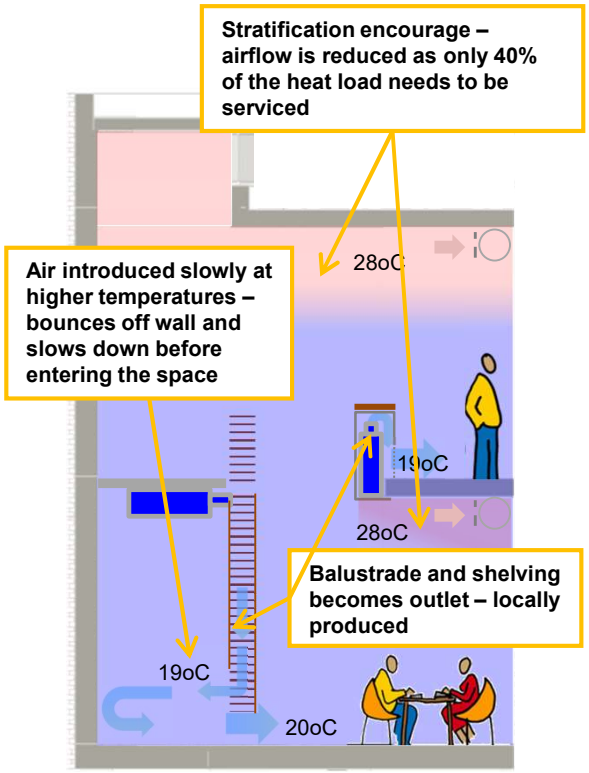
The architects of this small library in a sub-tropical climate requested the HVAC engineers to integrate their mechanical system design with a long solid wall that extends the length of the banana shaped space. Unfortunately they asked them in the wrong way, through a suggestion that the ducting be contained in a large cavity within the wall itself. Understandably the engineers thought this would not be great for maintenance access and buildability and continued to design a conventional system with extensive ceiling based ducting. It was purely a case of miscommunication – the architects wanted the wall and bookshelves to do more than just house books which could be redundant in the lifespan of the building. We saw an opportunity in this, and suggested the bookshelf itself becomes an HVAC component (or the HVAC component becomes a bookshelf?) While displacement ventilation (see next page) offers an immediate 20% energy and system size benefit in this climate due to higher supply air temperatures and a reduction in over dehumidification, our South African budget just cannot afford the imported outlets. So we turned the bookshelf into one. To access the books at high level a gantry was required and I suggested that we move the bookshelf to the outside of that gantry – to save money with the shelf now being the handrail and also to create a 1200mm zone where air coming out of the bookshelf could bounce off the wall, and slow down to avoid draft at low level. The saving in ducting allowed us a more energy efficient cooling plant at no additional cost.



Lower floor plan of library



Section showing double volume with mezzanine



Displacement ventilation concept



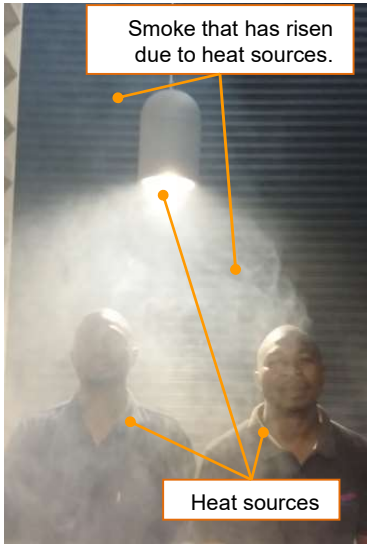
Testing of air movement at mezzanine level

UNIVERSITY OF MPUMALANGA – LIBRARY DISPLACEMENT VENTILATION

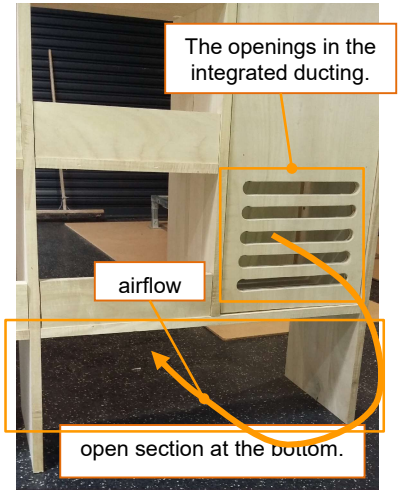
A displacement ventilation system distributes cool air from an air handling unit (AHU) through a diffuser. The cool air is distributed at a very low velocity to avoid draft and discomfort. Cool air forms a thin layer over the floor before it rises due to a heat loads such as lights, laptop, occupants, etc. In this system there is minimal mixing of air. A layer of hot air is formed at the top of the space. As long as one removes air from this hot layer at the same rate it is being produced by the heat loads, one can stop it from dropping into the zone where the occupants are. About 60% of the heat dissipates upwards and so the amount of air provided to the space is reduced matching flow rates of conventional air conditioning even with higher air temperatures provided. Displacement ventilation achieves better air quality and thermal comfort for users but commercial outlets are expensive. We design out the need for the outlets – in this case by blowing the air back at a wall in a unoccupied zone, allowing it to slow down to an unnoticeable speed.



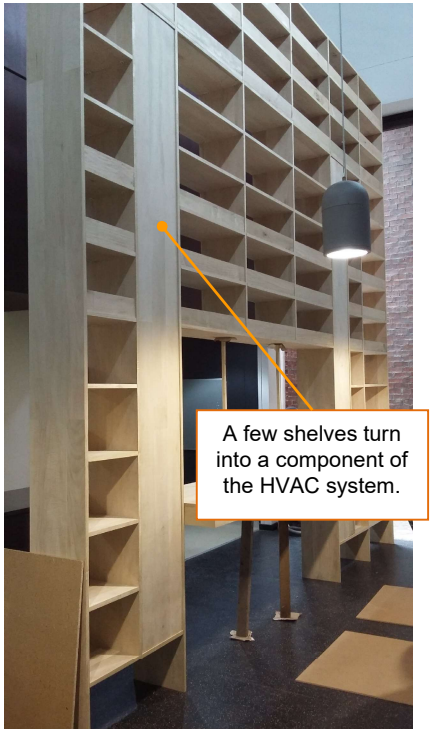
Quick to fail – testing in our own offices



Smoke for demonstration rising at "heat sources".



Detail of the displacement ventilation diffusor



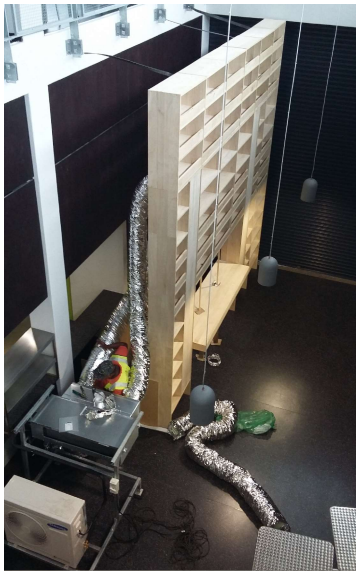
Design of the book shelving.



Smoke indicating the airflow. Rising at the heat source – in this case a person, barefoot to provide an indication of potential draft



Detail of connection air supply ducting to the shelving design.



Overview of the test setup at the client's premises.

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