

Session 3.8: Innovative Practices for Occupant Wellbeing – Bioclimatic Design

Bringing Sustainable Neighbourhood Design into Reality – Case Sharing by Brickell City Centre, Miami

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ABSTRACT

Place making is one of Swire Properties' key strategies in integrating our sustainability commitment in our business. Brickell City Centre is our latest project in Miami, United States, which showcases our commitment and brings sustainable neighbourhood design into reality.

Brickell City Centre is a 5.4 million square feet mixed-use development comprising shopping mall, two office towers, one hotel and two residential towers across four city blocks. The buildings are inter-connected by the 150,000 square feet Climate Ribbon™ forming an inviting central concourse and semi-open space for people to gather. We believe we have introduced a vibrant and connected community hub for Miami city.

Climate Ribbon™ provides a naturally lit, covered, naturally cooled environment for pedestrians. This pedestrian-friendly design is complemented with its connectivity with surrounding pedestrian walkways, bike paths and a site-integrated Metromover light rail station, allowing our properties to connect to mass transit networks. A two-storey parking garage spans the entire underground area beneath the development site, freeing up above-ground surface area and allowing for more traffic control.

Brickell City Centre incorporates various planning and design elements from LEED Neighbourhood Development (ND), and is targeted to achieve LEED ND Gold certification. Various new green building design features and needs from the neighborhood have been adapted.

As a symbol of sustainability, Climate Ribbon™ encourages natural breeze, water recycling and visual connectivity. Its "scoops" at the eastern end of the development collect the southeast trade winds which are guided through the central concourse and ended with "spoilors" at the western and northern ends by creating low pressure. This passive design eliminates the need for mechanically ventilating the large volume of the multi-story, multi-block shopping concourse. Significant energy savings as well as more efficient space planning and a quieter environment without all the mechanical equipment are significant benefits from the outset.

This paper will further explain the details of the environmental design and how the community can be influenced in a better way.

Keywords: *sustainable neighborhood, microclimate, rainwater recycling*

1. INTRODUCTION

1.1 Place making as a transformative idea for improving neighbourhood

Place making is a multi-faceted approach to the planning, design and management of spaces. It improves the gathering places within a community covering its streets, sidewalks, parks, buildings and other spaces¹, and invites greater interaction between people and the build environment and therefore creating a living space². This aligns with Swire Properties' Sustainable Development 2030 Strategy where Place, People, Partner, Performance (Environment) and Performance (Economic) are identified as the five important pillars. We aim to transform places while retaining their character to support communities and enhance people's lives.

Mixed-use development is one of the key elements in successful place making. It creates a hub for people's different needs and become a self-sustained neighborhood. This translates to Swire Properties classic urban proposition – all uses in one place: retail, restaurants, office and hotel. This proposition replicates in Hong Kong (Cityplaza, Citygate, Pacific Place), mainland China (Indigo and Taikoo Li Sanlitun in Beijing, Taikoo Hui in Guangzhou, Sino-Ocean Taikoo Li in Chengdu) and now in Brickell City Centre (BCC) in Miami, United States.

1.2 Brickell city centre

Located at the centre of South Florida's international trade and finance corridor, Brickell City Centre comprises 5.4 million square feet of office, residential, hotel, retail and entertainment space. The building compositions are two condominium towers, two office buildings, a EAST hotel and a 500,000 square feet open-air shopping centre integrates shopping, dining and public space.

The Climate Ribbon™ is part of Brickell City Centre's overall people-centred, human-scale design. It is an elevated trellis of steel, glass and canvas placing above the main pedestrian thoroughfare of the shopping centre, binding each building together.

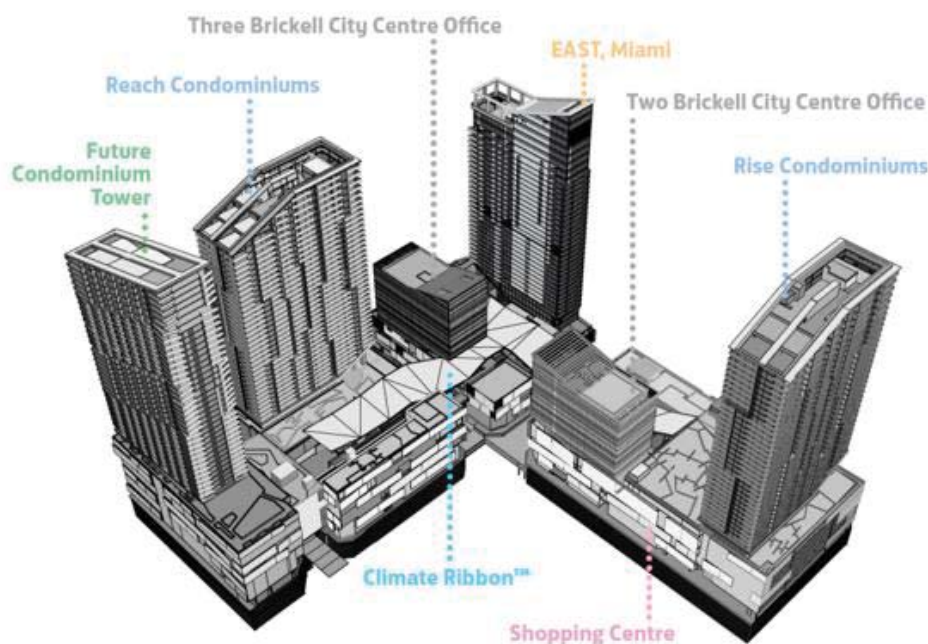


Figure 1: Overview of the Brickell City development

- Reach and Rise are twin luxury condominium towers comprising 780 total units
- EAST, Miami is one of Swire Hotels' lifestyle business hotels
- Two Brickell City Centre and Three Brickell City Centre together offer over 260,000 sq ft of prime office space
- The 500,000 sq ft open-air shopping centre integrates shopping, dining and public space
- The 100,000 sq ft Climate Ribbon™ improves the microclimate of the public spaces

2. CREATING A SUSTAINABLE NEIGHBORHOOD

Integral to the design and development of Brickell City Centre is a commitment to sustainability principles within its neighborhood. These include improving connectivity in multiple ways (to public transportation, minimized vehicular circulation for a project this size, increased pedestrian circulation); improved neighborhood micro-climate as per heat island effect; and the overall improvement of having a thriving mixed-use development energizing the neighborhood and providing new places to live, work and play where before there were empty blocks. From the initial concept for the project, BCC was designed to improve the neighborhood by factoring in the multiple layers of connectivity. The objective was to create an urban retail environment that is linked to the surrounding streets, sidewalks and public transit; BCC's precedents were Rockefeller Center instead of a suburban mall. This was

done by having multiple entry points as well as by creating pedestrian promenades along the center of each block on multiple levels, so they could cross the streets without conflicting with vehicular circulation. The expensive commitment was made to have two levels of below-grade parking for 2600 cars, allowing retail and lobbies to face the streets at the podium levels instead of the typical Miami parking podium. Access to the parking and loading docks was designed from the beginning with the goal to get cars/ trucks off the streets as quickly as possible, circulate within the building in order to exit where it was most expedient to leave the neighborhood, all efforts that reduces vehicles circling the city streets. Neighborhoods and retail thrives when there is connectivity, with people flowing through BCC as it becomes the city's centre, located at the historic crossroads of Tamiami Trail (South 8th Street) and Brickell Avenue.

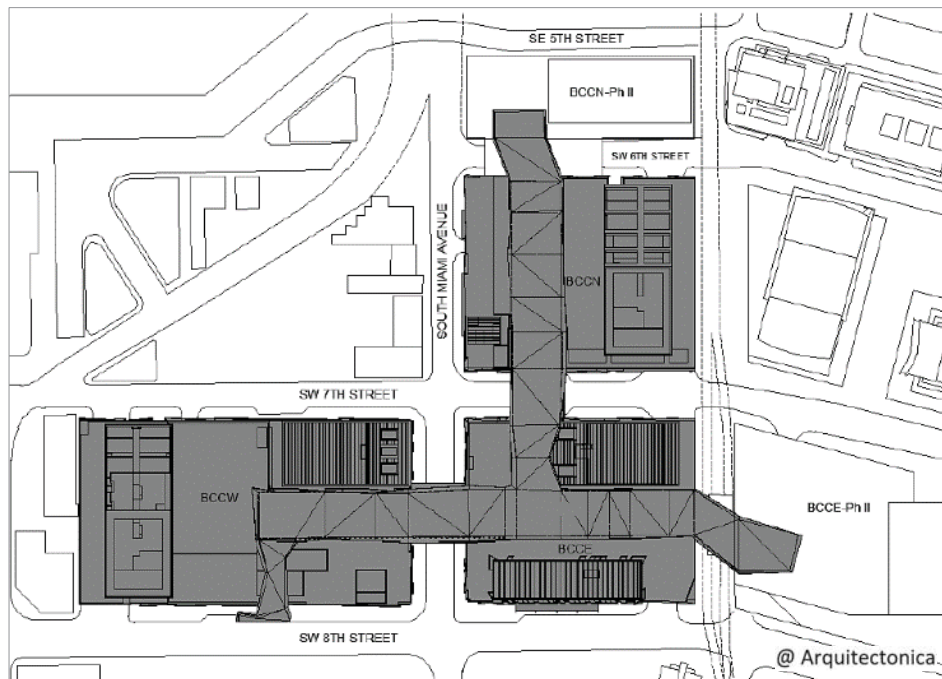


Figure 2: A layout map showing the location of BCC and its vicinity

BCC expanded the adjacent Metromover Station, adding escalators and extending the elevator to connect to the main concourse level above the light-rail platform. Integrating with this station allows easy access to the city light-rail transit network, including the nearby Metrorail, which will soon connect to the high-speed All-Aboard to Orlando. Other public transportation includes surrounding Metrobus stops and new Miami Trolley stops. This encourages BCC residents and visitors to adopt efficient transportation modes and move away from extensive use of single-occupancy vehicles and their heavy reliance on petroleum.

The Climate Ribbon™ above the central shopping concourse connects five towers (residential, office and hotel) across five city blocks, providing interconnected walkways at multiple levels, open civic spaces, active street fronts and tree-lined sidewalks, making it a pedestrian-friendly project. The connectivity with bike paths also allows BCC occupants and visitors to commute in a healthy and environmentally friendly way.

In addition, minimal parking footprint is achieved as the retail and office parking is in two levels of below grade parking. This enabled there to be more pedestrian friendly walkway and sidewalks, articulated building fenestration and the elimination of the bulky above grade parking typical of development in Miami. The pedestrian safety is also considered and improved by multiple access points. This below grade parking allows access from one location and egress from another, working with the one way street system, and thus, reduces traffic congestion and accidents.



Figure 3: Brickell City development

Brickell City Centre is further enhanced by its greenery extended over all concourse levels, amenity decks and streetscape with plant selection primarily of drought-tolerant native species. The landscape design by ArquitectonicaGEO includes regionally appropriate plant communities that transition from coastal dunes, to hammock and tropical foliage. The cumulative effect of BCC's extensive landscaping, with nearly half (46%) of the total roof area landscaped, reduces the ambient temperature within Brickell City Centre and the surrounding neighborhood as the landscaping absorbs the sun's warmth instead of deflecting it, an exemplary example of the heat island effect at work. The landscaping also improves everyone's physical and emotional well-being. Simply the sight of all the variety of landscaping, as biophilia studies have shown, reduces stress, lowers heart rates and increases a calm mood. The scents and leaves moving in the breezes also benefit the senses of smell and hearing, soothing everyone amidst the landscaping.

These sustainable elements in BCC are aligned with the principles of Smart Growth oriented development, for instance, promote mixed land uses serviced by a variety of transportation modes and create walkable site. These enable BCC to obtain recognition from Smart Growth Partnership. Along with the same sustainable neighbourhood concept, BCC is designed with the goal of achieving LEED Neighbourhood Development Gold certification for the mixed-use development complex.

3. CLIMATE RIBBON™

The Climate Ribbon™ acts like a shelter to improve the environmental performance for the general public mainly addressing 3 issues through passive design approach:

- Enhance natural ventilation
- Provide sun shade
- Promote rainwater harvesting



Figure 4: A 100,000 sq ft faceted canopy of steel and glass undulates between the mall, hotel, offices and residential towers

Detail scientific analysis and modelling simulation have been conducted before optimizing the current final design.

3.1 A breeze path

One of the common design practices on ensuring thermal comfort in pedestrian area is by mechanical ventilation or air conditioning system. However, Climate Ribbon™ strives to take the passive design approach which is more environmental friendly. The challenge is how we can introduce a feasible design with respect to the local prevailing wind condition and providing a comfortable condition for public walking underneath the canopy structure in summer time.



Figure 5: The semi-open space underneath the Climate Ribbon™ in retail concourse

The degree of thermal comfort is expressed as Standard Predicted Mean Vote (SPMV) which is a thermal comfort index with consideration on humidity, temperature, wind speed, solar exposure and human activity level in predicting pedestrian comfort levels.

Microclimate simulations have been conducted on the public area underneath the canopy structure, under 5 time slots of day and 4 seasonal periods.

After various canopy designs and corresponding CFD simulations, an optimized design was agreed as indicated in Figure 6 below. The results below indicate that the overall thermal comfort underneath the Climate Ribbon™ in summer time is significantly cooler than the surrounding sidewalks.



Figure 6: Thermal dynamic simulation results showing the thermally comfortable zone created underneath Climate Ribbon™ [At mid-day in summer period]

Furthermore, we have simulated the breezing flow pattern under different prevailing directions. Figure 7 below indicates a 3D result with breezing flow from South East 8th Street into the pedestrian street from the south side. Wind will split and leave the pedestrian street at the north and west ends. The sectional diagram (Fig. 7) shows how the wind flow pattern and magnitude from east to west. The simulated results indicate that air flow will be maintained at approximately 3 to 4.6 m/s at all times throughout the centre. The thermal conditions at approximately 90% of the locations studied in the public realm under the Climate Ribbon™ will be better than outdoor ambient levels.

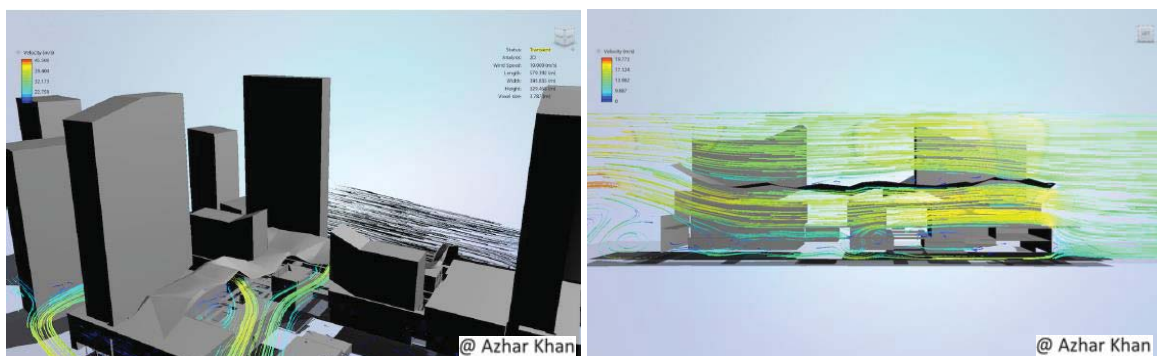


Figure 7: Simulate the breezing flow pattern under different prevailing directions

The reality of the micro-climate is also improved by BCC's lush and extensive landscaping designed by ArquitectonicaGEO. It contributes to the physical micro-climate by reducing solar heat gain. With nearly half (46%) of the total roof area landscaped, including multiple green roofs, the ambient temperature within Brickell City Centre

and the surrounding neighborhood is reduced as the landscaping absorbs the sun's warmth instead of deflecting it, an exemplary example of the heat island effect at work.

In addition to the contribution to micro-climate, this passive design in the semi-open area eliminates the need for mechanically ventilating the large volume of the multi-story, multi-block shopping concourse. Wind breeze flowing along the concourse also leads to significant energy savings as well as more efficient space planning and a quieter environment without all the mechanical equipment are significant benefits from the outset.

On top of computer simulation, physical model using wind tunnel test has been conducted to measure building performance under various dynamic buffeting conditions. Figure 8 below indicates the model created for wind tunnel test with a gust wind speed of almost 300km/h, which results in up to 6.5kN/m² wind load. The blade structure has been modelled to demonstrate the structural liability even under strong wind condition.



Figure 8: Wind tunnel test to measure building performance under various dynamic buffeting conditions

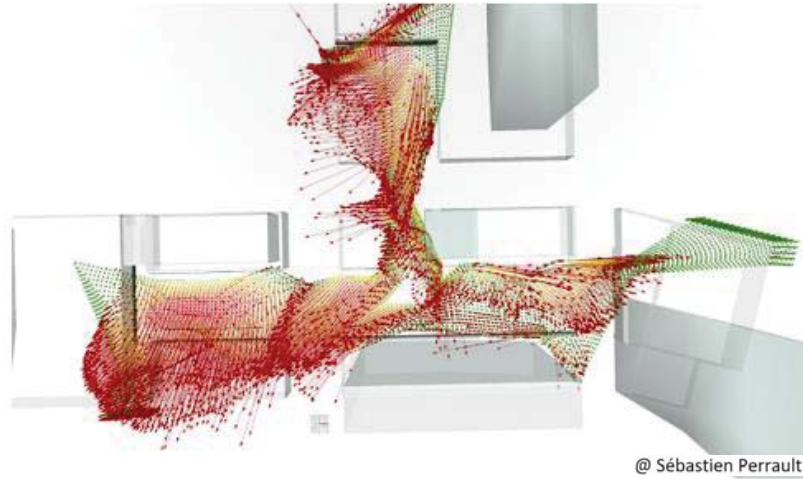
3.2 A sun shade

During the design stage of the Climate Ribbon™, we faced another challenge on daylight issue. We intend to provide shading for the pedestrian street while maintains suitable degree of sunlight.

3D shading analysis using typical meteorological year (TMY) data for Miami has been conducted to determine the solar exposure at each location on an hourly basis. Annual sun path (Figure 9) for the site with consideration of the surrounding buildings has been simulated.

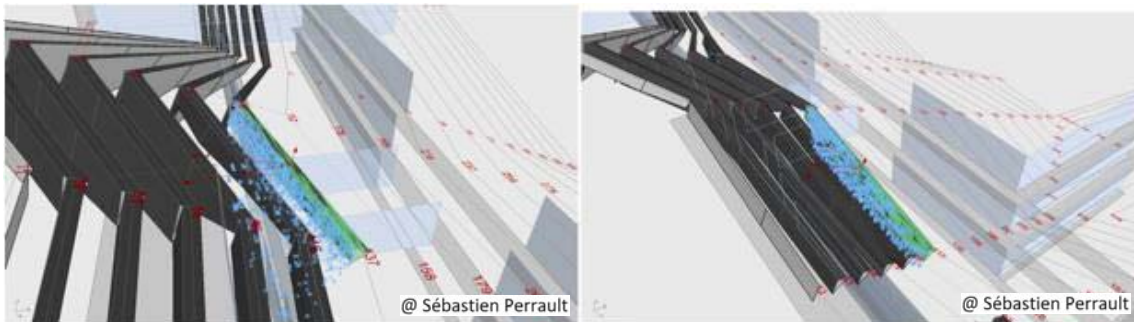
In addition, we manage to limit the amount of sun projecting directly into shop fronts. It is now demonstrated that the Hotel East can shade the North South Street from noonday direct sun. Furthermore, the west BCCW condominium tower can shade the East and West Streets from late afternoon direct sunlight.

Regarding the blade angle design of the Climate Ribbon™, Figure 10 shows a mapping of annual direction and intensity of sun exposure for the pedestrian street and shop fronts. Optimized design is achieved with longitudinal blades perpendicular to the sun angles.



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Figure 9: Providing optimal alignment for sun protection by simulating the annual sun path for the site



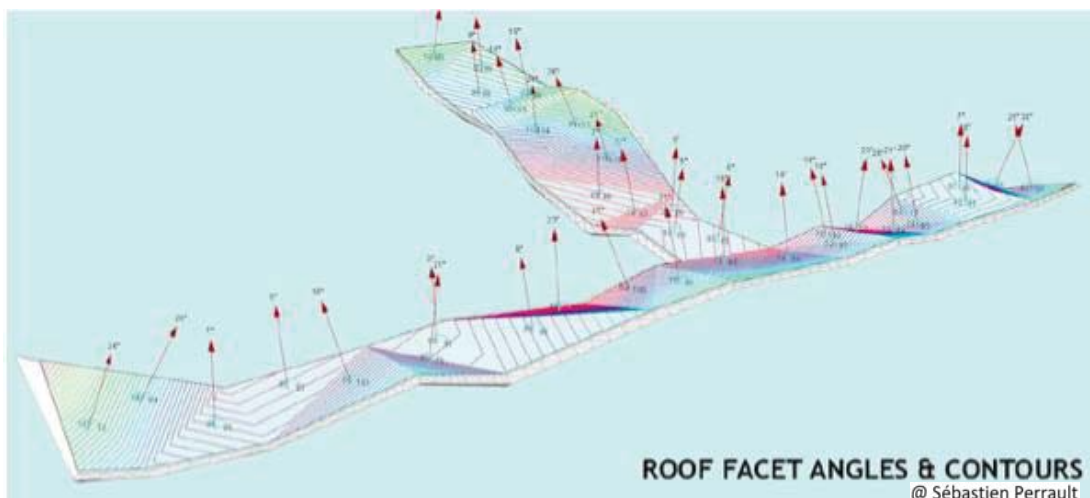
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Figure 10: Modelling on effect of different blade angles

3.3 A rainwater collector

Apart from natural ventilation and sun shading, we also considered the possibility of rainwater harvesting, with the end result of capturing all the water in a total of 6 cisterns that is needed for BCC's irrigation as well as some mechanical functions (see attached cistern location plan). Since the CLIMATE RIBBON™ is connecting the hotel, office and the residential towers with an area of 100,000 ft², we have introduced interesting contour with a fluid ceiling beneath of sinuous blades of architectural fabric shading. Quantity of rainwater collected and the corresponding pipe sizes have been predicted accordingly. With the local rainfall data available, it is predicted that 4.3 million gallons of rainwater for reuse annually. The harvested rainwater provides 100% of the irrigation water and cooling tower make-up water. Figure 11 provides an image of the contour with Climate Ribbon™ angled planes directing the rainwater to the cistern collection points, for information.



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Figure 11: 3D model of the roof facet angles and contours

4. CONCLUSION

Climate Ribbon™ provides a naturally lit, covered, naturally cooled environment for pedestrians and becomes an innovative solution to creating a favourable microclimate for the neighbourhood. It also connects five building blocks, providing interconnected walkways which leads to a pedestrian-friendly development. Integral with its connectivity with a site-integrated light rail station, Brickell City Centre becomes a vibrant and connected community hub in the heart of Miami.

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