

# CTBUH Journal

International Journal on Tall Buildings and Urban Habitat

Tall buildings: design, construction and operation | 2010 Issue IV

## **Hong Kong International Commerce Centre**

The Vertical Living Kids Research Project

Tuned Liquid Dampers for Slender Tall Buildings

Greening Modernism: Westraven Tower

Educational Studio: The Remaking of Mumbai (II)

Tallest World Records

Talking Tall: Dormitowers

# Editor's Message

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Front cover: Hong Kong ICC, view from Hong Kong Island.

Back cover: Hong Kong ICC Façade Detail.

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It is with a mix of strong emotions that I hand over the editorial reigns of the CTBUH Journal to Jan Klerks from this edition onwards. Alongside the sadness I feel

knowing that work pressures are now preventing me from continuing as sole editor, I am delighted to stand at this particular vantage point and survey how tremendously our publication has grown – in both size and stature – over the last three years. I will continue my involvement within the editorial board of the Journal. However the recent growth and lingering ambition embodied within the Journal calls for an editor who can invest what is needed to realize the potential of this publication. I am pleased to pass the torch to Jan, who has been the CTBUH Communications Manager for the past two years, and is a man with endless insight into

new ways for the Journal to inform and inspire its readership.

It was a great pleasure to see the Journal develop to its current level in such a short time. I am excited to transform my role into a liaison between the Journal and industry. As a practicing structural engineer with Arup in New York, I hope to offer perspectives and ideas that will further enrich the content of the Journal. I look forward to my future work with Jan in this role and offer him my full support as he infuses the position of editor with his unique understanding of (and curiosity in) the tall building industry. I would like to thank all authors, co-editors, peer reviewers, contributors and above all, the readers, who helped in making the Journal what it is today.

Best Regards,

Zak Kostura



Zak has done a tremendous job in bringing the CTBUH Journal to the level it is now, and it is both a pleasure and a challenge to present a Journal which lives up to the reputation

which he has helped create. I'm very much looking forward to building upon the works of the past, while taking future opportunities to report on relevant and timely topics such as tall buildings, urban density, the urban habitat and sustainability.

This Journal issue features all of these. The case study presents the supertall International Commerce Centre in Hong Kong, which is located on top of one of the busiest hubs of public transportation in the world. We also have a look at some of the technical and stability implications of building tall and slender in very dense, compact urban environments. The green redevelopment of the Westraven Tower in Utrecht, the Netherlands, also demonstrates how an old

1970's building can be turned into an example of sustainable retrofit in 2010.

Another great paper in this issue studies the ways in which kids experience the dense and urban environment. In addition, Antony Wood's High-rise Studio at the Illinois Institute of Technology is thinking beyond the current constraints to imagine and test the future of tall buildings and urban habitat; the results of these studies are very thought-provoking. To learn more about the emerging trend of tall dormitory towers, we invited a British developer to share some insights on bringing students back into the city by building student towers.

To conclude, I would like encourage all to provide feedback on specific articles or the Journal by sending a **Letter to the Editor**. I am looking forward to hearing from you.

Best Regards,

Jan Klerks

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### Case Study: International Commerce Centre

"More than an iconic statement, the Hong Kong ICC fundamentally alters the way tall buildings are seen today. Rather than just being objects in isolation, transit integrated tall buildings represent a sustainable model for future high-rise development."

...skeletal

...skeletal

# 30

### Application of Tuned Liquid Dampers for the Efficient Structural Design of Slender Tall Buildings

"Tall, slender buildings on restricted sites present structural engineers with dynamic problems that are difficult to resolve. This performance-based design approach remains investigating separate structural systems and the design of the corresponding optimal parameters to achieve adequate static and dynamic building responses for an efficient structure."

...skeletal

# 38

### The Remaking of Mumbai (II) A CTBUH-IIT Educational Design Studio

"Many of the projects this year were inspired particularly by the sustainability implications of land use and how to incorporate 'horizontal' land-consuming functions vertically in the sky, thus challenging the traditional functions of office, residential, and hotel which predominate in tall buildings. The end results are thus one that require a projection into the future for the viewer..."

...skeletal

“Tall buildings are a different proposition to just undertaking functional development of lower-rise buildings. There is something more significant in creating a building that adds a little bit more personality to the city's urban landscape, which will be viewed for generations to come.”

Richard Simpson, page 46

## London Skyline Going Up

In May 2009, the Planning Officer for the City of London, Peter Rees, told UK-based Building Design Magazine that, "If a major project has not started in the city already, it is unlikely to start. I'm not thinking years, I'm thinking decades. ... After the Wall Street crash, it took 20 years to recover." Merely one year later, news articles read that previously mothballed tall building projects in London are being resurrected. This development is credited to a recent surge in the amount charged for rent and a looming shortage of high quality office space. As a result, in June of this year, Rees corrects himself in an interview for the London Evening Standard, "How quickly history rights itself. As of this moment I'm not aware of any project that's still on hold. People are either on site, in the process of tendering or are concluding deals."

Given the current global financial situation, this might come as an interesting surprise. We asked a few of our UK-based CTBUH members how they perceive this development. Advisory Group member Simon Lay of WSP reports the following, "We are indeed seeing some interesting signs of limited recovery. This is most evident in London where there has been some movement from large investment banks and insurers to seek out new premises, perhaps seeking to strike a long-term deal while the rental market is low. There are also some signs that clients with access to funding are seeking to take advantage of depressed

contract values, which again has led to some projects starting up again. All such projects are running major value engineering exercises and contractors are hiring engineering teams to review previous designs with a fresh pair of eyes to seek out alternative design options."

Phillip Oldfield, academic at the University of Nottingham, notes the following, "One reason I feel that many of these towers were not 'lost' to the economy and are now being realized is the quality of their design. The Heron Tower with its stacked 'villages' of office space, the super-mixed-use London Bridge Tower with its sustainable credentials, 122 Leadenhall Street with its outstanding ground floor interface, all represent unique and progressive tall building design. A more long term trend that will occur or perhaps is already occurring in the UK, is the construction of residential and mixed-use towers. I think people are beginning to want to live in the city again, with the sustainability and recreational benefits it brings, and this will bring a new generation of residential towers into being."

CTBUH's UK Country Leader and Davis Langdon partner Steve Watts noted about this development, "Essentially, the limited pool of contractors with the necessary experience and capabilities could pick and choose their projects, and they would price risks, real or perceived, accordingly. They were also looking to limit their exposure to such schemes, preferring to earn their returns on more straightforward buildings. Thus, a number of



122 Leadenhall Street © British Land

landmark buildings were hit by price increases of around 20% in just one year. With agents telling anyone willing to listen that there is a growing shortage of good, quality office space in the Capital, and returning rental values in 2013–14, developers have started to dust off their on-hold designs with a view to getting them delivered as quickly as possible. And that means there is little or no appetite to compromise planning permissions by fundamentally changing the design, even with rationalization in mind. But finance is still problematic. It is no coincidence that some of these projects have Middle Eastern backing. Sovereign wealth funds have provided the money that banks did not have, and have appreciated the long-term value of trophy assets – investments with the bonus of a weak Sterling on their side. And whilst there are some signs that finance may be being released, funders have a different and more robust approach to risks, and will require a significant pre-let."

## ...cities

“The 21<sup>st</sup> century will not be dominated by America or China, Brazil or India, but by the city. In an age that appears increasingly unmanageable, cities rather than states are becoming the islands of governance on which the future world order will be built. This new world is not – and will not be – one global village, so much as a network of different ones.”

*Parag Khanna, senior research fellow at the New America Foundation.  
From "Beyond City Limits", Foreign Policy, Sept/Oct 2010.*



EverRich 2 © DWP Architects

## Vietnam Projects

For an area in District 7 of Ho Chi Minh City, the Vietnamese architects DWP designed a self-sustaining community in a single continuous loop, resembling a roller coaster. At 630,000 square meters (6.8 million square feet) and reaching heights of 45 floors, the **EverRich 2** project is substantial by any measure. There are 3,100 apartment units ranging from 120 to 250 square meters (1,300 to 2,700 square feet) each with two floors of mixed retail and public space at ground level. The architects have produced a clever design that maintains good views from all apartments, and incorporates a number of sustainable ideas including natural ventilation, sky gardens, green roofs and elevation shading treatments that will make the building very efficient in terms of energy usage.

On May 7, Vietnam's Ocean Bank and Petrovietnam Construction Corporation publicly presented plans for a 102-story tower on a 25-acre area in Me Tri commune in Hanoi's outlying district of Tu Liem, Vietnam. The 528-meter (1,732-foot) tall **PVN Tower** is named after its main tenant PetroVietNam, being the trading name of Vietnam Oil and Gas Group. The estimated investment cost will be more than US\$1 billion. Construction of the project is scheduled to begin in early 2011 and is expected to be completed within three years. The building is considered to be a future icon of the Vietnam Oil and Gas Group.



Carnegie 57 © Christian de Portzamparc

## Project Progress

The financially-challenged **Carnegie 57** project in New York City has seen its hopes of getting completed increased dramatically. Abu Dhabi based Aabar Investments is participating for US\$1.3 billion in the 75-story skyscraper, which will stand at 306 meters (1,005 feet) tall when completed in 2013. Funding issues delayed construction of the project after the foundation of the building was completed. With three quarters of the initial financing in place, a work permit has been approved to continue working on the next phase of the tower.

Four clocks with a 43-meter (141-foot) diameter have been installed on all faces of the 601-meter (1,972-foot) tall **Mecca Royal Clock Hotel Tower**. The Holy Mecca Clock was set in motion one minute after midnight on August 11, the first day of the holy month of Ramadan, by order of King Abdullah bin Abdulaziz Al-Saud of Saudi Arabia. The clock was designed by German and Swiss engineers and will be visible from more than 25 kilometers (16 miles) away. Upon completion in 2011, besides becoming the second tallest building in the world, the clock tower will be the tallest building in Saudi Arabia and the tallest and largest hotel tower in the world.

On August 3, the Port Authority of New York and New Jersey signed a tentative deal to move the Condé Nast headquarters to **1 World Trade Center**, the 541-meter (1,776-foot) skyscraper, formerly known as Freedom Tower, is currently under construction in New York City. Introducing a high-profile tenant such as the worldwide magazine publishing company is considered a milestone in the development of New York's future tallest tower. Signing a private anchor tenant will help spur interest from other potential tenants, which may produce higher rents. ↗



Mecca Royal Clock Hotel Tower © Dar al-Handasah Shair & Partners

# Case Study: International Commerce Centre



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## David Malott

David Malott specializes in the design and planning of supertall buildings and complex mixed-use developments. With over 15 years of experience as an architectural designer and project director working on projects throughout Asia, he has contributed to the firm's strong presence in China, Japan, and Hong Kong. He was made a director of the firm in 2009.

Since joining KPF in 1998, David has served as Senior Designer for some of the firm's most recognized achievements, including the 492-meter Shanghai World Financial Center, awarded the Best Tall Building Worldwide by the Council on Tall Buildings and Urban Habitat in 2008, and the 490-meter International Commerce Center in Hong Kong. He also played a key role in the design of Roppongi Hills in Tokyo, the largest private-sector urban redevelopment project in Japan's history, and the recently completed One Central luxury mixed-use development in Macau.

Presently, he is leading the design of the 588-meter Ping An International Finance Center in Shenzhen, currently under construction. With a floor area of over 460,000 square meters (5 million square feet) and 115 floors of retail, office, and observation facilities above grade, the PAIFC is targeted to be the world's tallest and largest LEED certified building when completed in 2015.

## ...skeletal

“If Miami is a city of surfaces, of pink plaster and deco doodahs, this building is skeletal, naked.”

Rowan Moore, *Architectural Review's* journalist, describing Herzog & de Meuron's 1111 Lincoln Road, Miami. From "1111 Lincoln Road," *The Architectural Review*, June 2010

“More than an iconic statement, the Hong Kong ICC fundamentally alters the way tall buildings are seen today. Rather than just being objects in isolation, transit integrated tall buildings represent a sustainable model for future high-rise development.”

Soaring 484 meters (1,588 feet) above Victoria Harbor, the International Commerce Centre (ICC) is the essence of Hong Kong in one destination: high-powered finance, global tourism, luxury shopping, and world-class hospitality, all gathered in a single tower built over a sophisticated transportation network spanning the Pearl River Delta.

The iconic image of twin lighthouses on opposite shores of the harbor is underlined by the three-minute subway link between ICC, sited at the tip of Kowloon Peninsula, with the central business district across on Hong Kong Island. With the design of ICC, the Architects addressed the challenge of bridging this divide, using expressive formal gestures and innovative technologies that connect the tower with Hong Kong's mass transit infrastructure.

## Poetry of Motion

This case study explores the design of the building at three scales of connectivity. ICC, at the macro level, forms part of a sustainable urban network. The tower's internal mechanisms and form both physically and symbolically connect it to Kowloon Station. The details of the tower bring the poetry of motion into being.

## Transit Integrated Tall Buildings: A Sustainable Paradigm

Beyond its picturesque profile, ICC speaks to the promise of the tall building as a sustainable paradigm, in which individual buildings form part of a larger ecosystem of vertical centers linked by horizontal networks of public transportation.

Increasing density in city centers is more effective in preserving land resources and reducing energy usage than the

alternative of urban sprawl. Amongst high-income societies, Hong Kong ranks as the most efficient in annual per capita energy use at 2,600 kgoe (kilograms of oil equivalent) compared to 4,180 kgoe in Germany; 7,885 kgoe in the United States; and 10,350 kgoe in the UAE (OECD 2007, OECD 2008). And while Hong Kong is associated with images of busy streets and concrete jungles, only 2% of its total area is urban or built-up. Forest, grassland, and cropland constitute 72%, and wetlands and water bodies make up 25% of Hong Kong's total area (World Research Institute 2003). Examples of building high-rise density

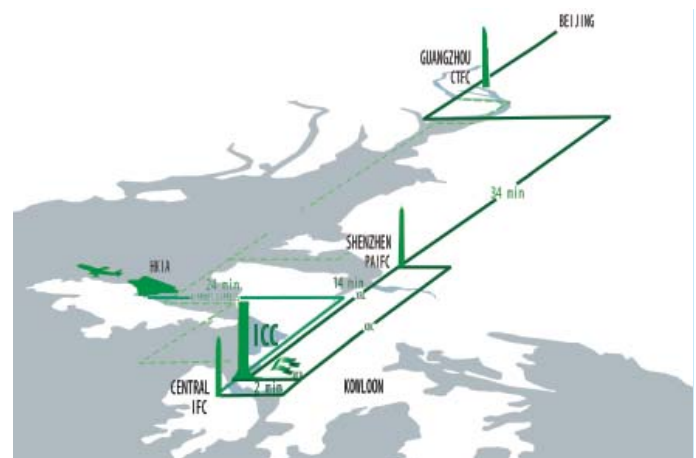


Figure 1. Public transportation connections from ICC

atop rail stations such as New York's Met Life Building over Grand Central Station (1960) and more recently KPF's JR Central Towers in Nagoya, Japan (2002) established fundamental principles for integrating the tall building with transit. In Hong Kong, the practice has achieved a level of integration and scale without precedent. This is made possible by

the combination of strong central planning, a powerful transit authority (Hong Kong's MTRC), and an innovative development culture.

### Kowloon Station Development

Sited above Kowloon Station, ICC is integrated with a public transportation infrastructure that carries 11 million passenger journeys per day

(Hong Kong Special Administrative Region 2009). ICC's success as a development stems from its seamless connections with Central, Hong Kong International Airport, and mainland China via a network of high-speed rail, subway, buses, and ferry terminals (see Figure 1). Comprising over one million square meters (10.77 million square feet) of built-up area on 135,630 square meters (1.46 million square feet) of reclaimed land, the Kowloon Station Development (KSD) is billed as a "super transport city." According to Sun Hung Kai Properties Group, the developer of ICC, "The density of construction around the station reflects how modern rail can provide a catalyst for the creation of a highly-compact and efficient 'vertical city' (Luk et al. 2003)."

KSD features nearly 675,000 square meters (7.27 million square feet) of high-rise residential and service apartments, 100,000 square meters (1.07 million square feet) of retail, 232,500 square meters (2.50 million square feet) of class "A" office space, and two hotels – the W and the Ritz-Carlton – the latter of which is located at the top of ICC. This small city is built entirely around Kowloon Station, linked by a superblock podium that spans the rail corridor to create an elevated ground plane with gardens, public plazas, and outdoor cafés on the station roof. The KSD superblock will extend into the future West Kowloon Cultural District, a HK\$21.6 billion (US\$2.7 billion) government-financed venture that will feature 17 arts and culture venues including performing arts theatres, concert halls, museums, and a 15,000-seat outdoor performance venue along a waterfront park.

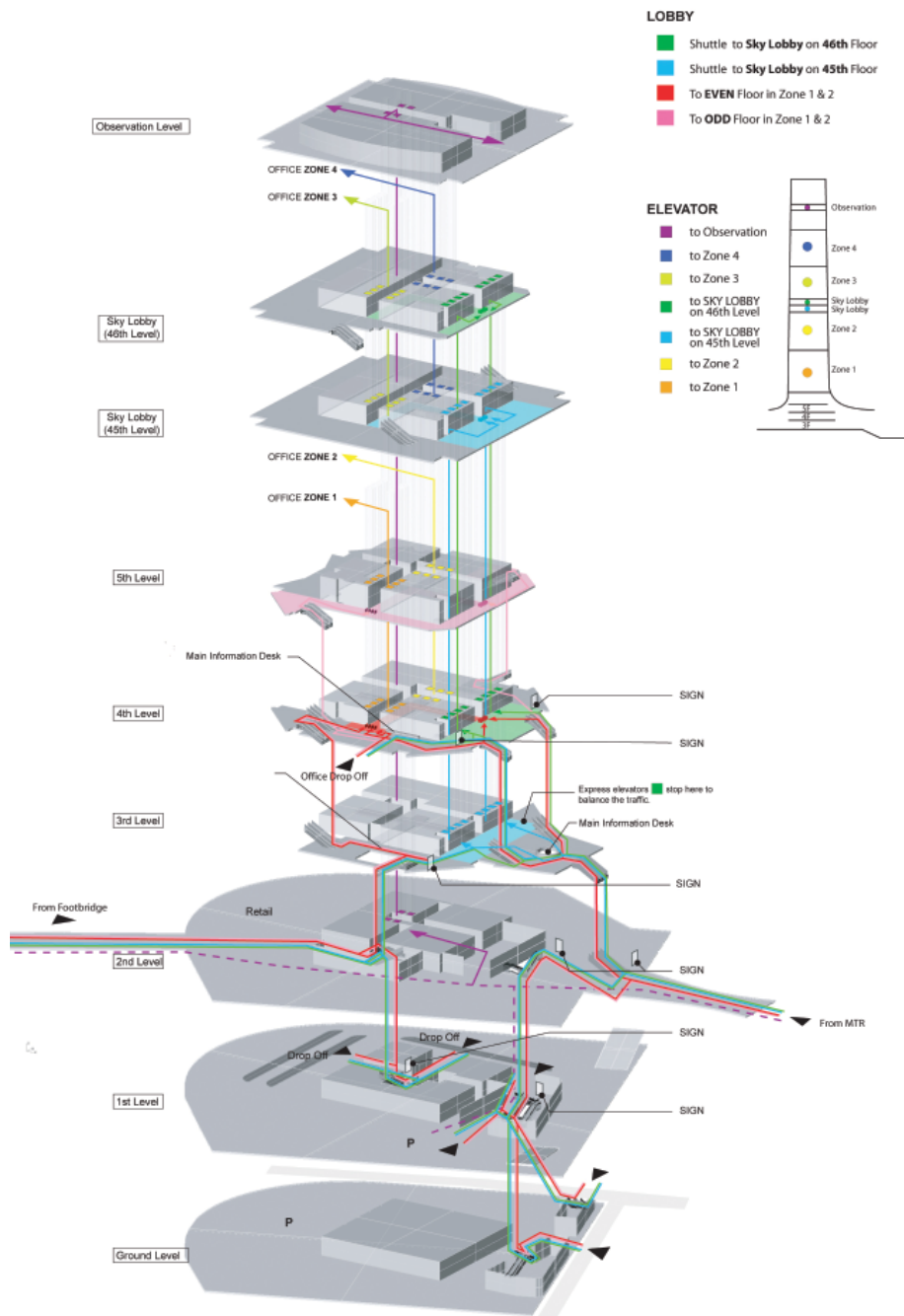


Figure 2. Vertical circulation zoning

### Connection to Mainland China

In 2015, the introduction of the Express Rail Link (XRL), connecting Hong Kong with the major cities in the Pearl River Delta, will transform the region into a transportation supercity of 120 million people, which will produce five percent of the world's manufactured goods and one-third of China's trade value. The XRL terminal, to be constructed adjacent to ICC, will carry 100,000 passengers per day across one of the world's most heavily trafficked borders. Travel time from ICC to Shenzhen's central business district will

# Can Tall Buildings be Child-Friendly? The Vertical Living Kids Research Project



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## Carolyn Whitzman

Dr. Carolyn Whitzman is an Associate Professor in Urban Planning at the University of Melbourne. She is the author of *Suburb, Slum, Urban Village: Transformations in a Toronto Neighbourhood 1875–2002* (University of British Columbia Press, 2009), *The Handbook of Community Safety, Gender, and Violence Prevention: practical planning tools* (Earthscan, 2008), and the co-author of *Safe Cities: guidelines for planning, design, and management* (Van Nostrand Reinhold, 1995). Previously, she worked for the City of Toronto on healthy city initiatives. Dr. Whitzman has an international reputation for her work on the prevention of violence. Current research interests include the development and evaluation of integrated violence prevention initiatives at the local government level, increasing independent mobility for children, and the policy implications of planning for healthy and equitable cities in a national and international context.

“The challenge for urban planners, developers, and researchers is to respond to children’s articulate and nuanced understanding of their environmental preferences, and to proactively plan for child-friendly cities, including in the high-density environments increasingly being found in both inner city and suburban locales. Children should ‘belong’ in high-rise flats, just as they should belong everywhere else in a truly inclusive city.”

Australian skylines have undergone a profound change in recent years, with the emergence of new high-rise residential developments occurring in tandem with economic restructuring and changing household demographics. The Vertical Living Kids research project is sparked by a precipitous decline in children’s independent mobility across Australia, and by the fact that there is virtually no Australian research or media coverage of children living in central city apartments rather than more traditional suburbs. As intensification of Australian cities becomes orthodox in Australian planning circles, consideration must be given to how these environments can support children’s health and wellbeing, and their right to the city.

## The Vertical Living Kids Research Project

The research project entitled: “Vertical Living Kids: Creating Supportive High-rise Environments for Children in Melbourne, Australia” was conducted from July 2008 to December 2009 and funded by the Victorian Health Promotion

Foundation [VicHealth] (Whitzman & Mizrachi 2009). The research project had two objectives: to explore the built and social environmental determinants of children’s independent mobility (CIM) in central Melbourne’s high-rise housing, and to uncover international best practice in planning policy for these communities. Children’s independent mobility is defined as the freedom of those under 18 to explore public space without adult accompaniment (Hillman et al. 1990). Forty children and their parents (18 living in public housing and 22 in privately owned housing) – aged 8 to 12 and all in grades 4 to 6 of primary school – participated. We used a range of qualitative and quantitative techniques, including children being provided with a disposable camera for a week and then creating an annotated collage of their pictures, a travel activity diary filled out by children, GPS and accelerometers to measure energy expended and geographic

## ...legacy

“We’re here as stewards to protect this New York City icon... I’m not concerned about the views from my building, I’m concerned about the views of my building and its legacy.”

*Anthony Malkin, owner of the Empire State Building in response to a nearby proposed 1,200 foot development. From “King Kong 2.0 as Tower Topples NYC Skyline”, The Architect’s Newspaper, August 25, 2010.*



Public Housing Kids (18 children)	Private Housing Kids (22 children)
Nearby green open space (13 children)	Commercial spaces (18 children), major downtown shopping centers (12 children): milk bars, fast food shops, laneway shops downtown
Commercial spaces such as milk bars and other local shops (8 children)	Public spaces not specifically designated for children (17 children): Federation Square (large multi-purpose public space), Southbank promenade (riverside walk, with lots of shops and restaurants), City Library
	Play spaces (12 children): skate parks, adventure playgrounds, tennis courts, Flagstaff Gardens (mid-size park adjacent to downtown)
	Private amenities within apartments (7 children): communal green spaces, pools, tennis courts, but 4 of these children complained about restrictions on use
	Train stations and tram stops they use to get to places (7 children)

Table 1. Places children like and regularly use

Public Housing Kids (18 children)	Private Housing Kids (22 children)
Aspects of their housing estates (13 children): boring parks (for little children), "druggies" or "hobos" on the estate, lifts breaking down, graffiti and maintenance, limited variety of shops	Public transport and road safety concerns (12 children): difficult intersections to cross, noise from roads, volume of traffic (particularly truck traffic), tram stops dirty and trams crowded, approached by beggars at tram stops, people smoking at tram stops
	General personal safety concerns (6 children): "angry" or "scary drunks" (particularly near pubs), graffiti ("bozos trashing places")
	Landmarks that are "boring" (4 children): State Library, Arts Center

Table 2. Places children are concerned about / do not like

territory covered, a parental survey, and a desk-top policy review. In Australia, high-rise housing is defined as buildings comprising of four or more stories (Australian Bureau of Statistics 2004, 166). We interviewed children living in buildings between 4 to 50 stories high.

We embarked on this research because the concept of children growing up in high-rise housing is still treated as something abnormal in the Australian context. This is despite widespread high-rise public housing constructed in the 1960's, private market apartments being promoted as part of urban intensification from the 1980's onwards, and the fact that children routinely live in high-rise environments in many cities in the world, including London, New York, Singapore, and Hong Kong (Costello 2005). Partly, the issue was that high-rise housing was conflated with social issues in public housing; with the high-rise form itself "considered to be alien to the architectural and housing preferences of

the Australian urban citizenry" (Jamieson & Jacobs 1996, 78). As a result, both developers and planners involved in the massive redevelopment of Melbourne's waterfront and central business district in the 1980's and 1990's assumed that new residential towers would be populated by childless households, and accordingly designed and advertised them as family-free zones, without sufficient community services, facilities, and open space for families (Costello 2005; Fincher 2007).

However, families with children are found in these new central city flats. In 2001, 20% of the population in high-rise units across Australia were living as a family containing children (Australian Bureau of Statistics 2004, 169). In 2006, parents with children below the age of 12 comprised 7%, 5% and 9% of households residing in Docklands, Melbourne Central Business District, and Southbank respectively (City of Melbourne 2008, Appendix 2). By 2021, children aged 14 and below will comprise 7.7% of the total population of these areas,

equating to just over 4,000 people (City of Melbourne 2008, Appendix 19).

One of the few Australian studies to compare children's experiences in both public and private high-rise flats – conducted by Ross King and colleagues in Sydney (King 1974) – found significant differences between the two samples. Children residing in public housing generally played with friends living in the same block and had more independent mobility within smaller ranges. Children residing in private high-rise housing generally engaged in more home-based and structured activities, but also had a greater range in terms of distances travelled. The children in private housing generally responded to nearby facilities more positively, although child densities were greater in public housing (King 1974). In short, "apartment children do not live in a vacuum" but are "embedded in more encompassing social, cultural, and spatial systems that may alleviate or exacerbate any effects which may occur" as the result of the high-rise design (Van Vliet 1983, 227).

## Research Findings

Our research, undertaken 35 years later, largely mirrored the results of the 1974 King's study. Children in public high-rise housing experienced relatively high levels of independent mobility: 62% of their journeys were undertaken either alone or with other children, while only 17% of trips taken by the private high-rise sample were undertaken without adult accompaniment. 85% of parents in our admittedly small sample of 28 (20 of whom living in privately owned housing) said that their children were allowed to travel without a parent to school, 59% allowed them to travel to park or playground by the age of 12. In comparison, a recent study in Melbourne's suburbs found that only 59% of girls and 65% of boys aged 8 to 12 regularly walked or cycled to school, and 40% of girls and 48% of boys who regularly walked or cycled to parks, ovals, and playgrounds (Timperio et al. 2004, 42).

The geographies of children in public housing were dominated by local, designated play spaces that were perceived as unsatisfactory by the children (see Figure 1 and Table 1 ↗)

# About the Council

The Council on Tall Buildings and Urban Habitat, based at the Illinois Institute of Technology in Chicago, is an international not-for-profit organization supported by architecture, engineering, planning, development and construction professionals. Founded in 1969, the Council's mission is to disseminate multi-disciplinary information on tall buildings and sustainable urban environments, to maximize the international interaction of professionals involved in creating the built environment, and to make the latest knowledge available to professionals in a useful form.

The CTBUH disseminates its findings, and facilitates business exchange, through: the publication of books, monographs, proceedings and reports; the organization of world congresses, international, regional and specialty conferences and workshops; the maintaining of an extensive website and tall building databases of built, under construction and proposed buildings; the distribution of a monthly international tall building e-newsletter; the maintaining of an international resource center; the bestowing of annual awards for design and construction excellence and individual lifetime achievement; the management of special task forces/working groups; the hosting of technical forums; and the publication of the CTBUH Journal, a professional journal containing refereed papers written by researchers, scholars and practicing professionals.

The Council is the arbiter of the criteria upon which tall building height is measured, and thus the title of "The World's Tallest Building" determined. CTBUH is the world's leading body dedicated to the field of tall buildings and urban habitat and the recognized international source for information in these fields.

## Council on Tall Buildings and Urban Habitat



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