Environmental Implications of Privatised Public Space in Gated Residential Neighbourhood: Case Study of China's Small Residential District

Wu Deng, Ali Cheshmehzangi, and Tong Yang

***Abstract*—Gated neighbourhood is well-defined by enclosed walls and gates with clear physical boundaries. The most distinctive feature of gated neighbourhoods is that their public spaces are normally privatised. The construction and operation of the public space within a gated neighbourhood consumes energy and resources, and sequentially has impacts on the environment. This paper argues such environmental impacts from the construction and operation of the public space should be also "privatised", i.e. it should be jointly owned by all property owners of a gated neighbourhood. Through examining a case study neighbourhood in China, this research indicates the environmental outcomes due to the privatisation of the public space cannot be ignored. De-privatising the public space from gated neighbourhoods through sound urban planning can help to improve environmental sustainability as well as social sustainability in tandem.**

***Index Terms*—Environmental outcomes, China's small residential district, gated neighbourhood, privatised public space.**

I. Privatised Public Space in Gated Neighbourhood

Galster synthesizes a number of neighbourhood definitions and classifies them into two categories [1]: one with a purely geographical perspective and the second with an integrated social and geographical perspective. Some researchers look at the neighbourhood as a purely geographical unit. For example, Keller defines neighbourhood as a "place with physical and symbolic boundaries" [2]. Golab uses the phrase "a geographical entity with specific (subjective) boundaries" [1]. Others have attempted to integrate social and geographical dimensions, as in Hallman's definition: "a limited territory within a larger urban area, where people inhabit dwellings and interact socially" [3]. Warren defines neighbourhood as "a social organization of a population residing in a geographically proximate locale" [1].

Open neighbourhood or open community is the major residential form in many countries. In this residential form, neighbourhood area is a concept largely defined by the individual's perception towards the immediate environment beyond his home. As Saville-Smith et al. observe, neighbourhood boundaries are loosely defined although those boundaries will typically go beyond a household's directly adjacent neighbours [4].

On the other hand, gated neighbourhood is a neighbourhood with clear physical boundaries, which tends to "cluster around housing development that restricts public access, usually through the use of gates, booms, walls and fences" [5]. Gated neighbourhood often includes a variety of facilities and services in the public space of a gated neighbourhood. In addition, security staff or CCTV systems may be employed to prevent unauthorized access. From the perspective of the ownership over the public space, Blakely and Snyder define gated neighbourhood as "residential areas with restricted access such that normally public spaces have been privatised" [6]. This definition presents the central feature of gated neighbourhood, i.e. the privatisation of public space. Compared to an open neighbourhood, gated neighbourhood is defined by physical barriers in the form of walled or fenced perimeters with staffed entrances, it precludes public access to the "public" space within it such as roads, sidewalks, parks, open space, playgrounds – resources that previously would have been accessible to all citizens [7]. The public space within the neighbourhoods can be very diverse. It may range from "a mere concentrated green space as the minimum to a variety of extras such as playgrounds, a clubhouse, and swimming pools" depending on the price range of the properties [8].

The privatisation of the public space within a gated neighbourhood is legally acknowledged. For example, Clause 73 of China's Real Right Law stipulates that the roads, green lands, common facilities and houses, and other public place are commonly owned by all the property owners of a gated neighbourhood. This means that residents are not only the owner of their apartments, but also the joint owners of the public space.

A top consideration for gating is security [8]. Beside this, other factors also appear significant including the desire for status, privacy and the investment potential of gated dwellings [5]. As the costs for constructing and operating the public space are shared by all property owners (e.g. included in the unit area price of an apartment or the service fee charged by a professional property management company), it is economically incentivised and legally feasible to enclave the neighbourhood, thus exclude public access.

II. Environmental Implications of Privatised Public Space in Gated Neighbourhood

The privatisation of the public space has significant environmental implications. Since the residents of a

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particular gated neighbourhood are the owners or joint owners of the whole neighbourhood, they presumably 'own or jointly own' the environmental outcomes during the construction and operation of the whole neighbourhood. In other words, the environmental auditing of a resident (or a household) should not only include the energy and emissions attributable to the construction and operation of his/her apartment, but also take into account the individual shares of the environmental outcomes generated by the construction and operation of the public space.

A buyer purchases a property (e.g. apartment or a house) in a gated neighbourhood and at the same time he purchases part of the public space of the neighbourhood. It is argued that a gated neighbourhood built environment should be evaluated as a whole by integrating the public space rather than at individual building level, because:

1) Gated neighbourhood is an integrated planning unit thus assessment should be conducted on the whole rather than on its constituent elements, in order to generate a holistic picture and aid decision-making at the planning stage.
2) Cole observes that the current building environmental assessment methods cover those performance issues over which owners and the design team excise some level of control. Thus public space is not typically accounted for in current methods [9]. Gated neighbourhood, on the contrary, is fully controlled by the planning and design team and assessment can successfully examine both buildings and the public area in an integrated way.
3) Evaluation at individual building level cannot reveal the environmental outcomes generated by the construction and running of the public space. Thus, the full range of individual residents' environmental accountability is not reflected.

Literature review has revealed that little research has been undertaken for the environmental implications of the public space of a gated neighbourhood. Current research on gated neighbourhoods has been focused either on their social dimension, e.g. security, social segregation, social stratification, or the relationships between gated neighbourhoods and their urban contexts, e.g. urban forms, spatial discontinuity, transportation, accessibility. This paper will use China's Small Residential District as case study to quantitatively evaluate the environmental outcomes of the privatisation of the public space.

III. China's Small Residential District

The concept of Small Residential District (SRD), sanctioned by national planning codes, has become the basic unit in planning and developing residential construction in China [8], [10]. It is designed by professional planners and architects. It is a planned neighbourhood where housing is integrated with communal facilities like kindergartens, clinics, restaurants, convenience shops, and communication infrastructure [10], all under the control of a professional property management company. The SRD is a kind of gated neighbourhood characterized by a close perimeter of walls and fences.

As estimated by Sun, between 1991 and 2000, 83% of housing development in Shanghai is in this form and 80% of Guangdong's population is living in SRDs [11]. While national statistics are not available, these figures give a rough picture of how extensively the SRDs have influenced both the urban form and people's lives. It is safe to say that the SRD is "the housing form for the majority of Chinese residents" [8].

The lifestyle of residents in different SRDs may also be diverse, mainly attributable to the fact that the estate is created as an 'enclave' of those with similar socio-economic status by affordability filtration [12]. This is confirmed by researchers like Wang and Shi who estimate 7.5 times difference of energy consumption between the top 10 percentile income households and the lowest 10 percentile, mainly attributable to the larger housing area and the use of private cars [13]. If the difference in size and variety of public area across different SRDs is considered, the gap would be even larger. Thus, the environmental profiles of different SRDs can vary greatly.

In brief, the physical characteristics of the Chinese SRD can be summarized as follows:

1) The SRD is the basic and compulsory planning level in Chinese urban development.
2) As the major residential form in urban China, the SRD can be located in any part of the city, e.g. city center or suburban.
3) It is a type of 'gated or walled or enclosed neighbourhood' that gives it a defined and organized physical boundary.
4) The residents of an SRD not only own their apartments, but also a share of the public area.
5) The size and variety of publicly shared open area and buildings vary greatly across SRDs depending on their unit prices. Some SRDs may have larger public areas and various facilities (e.g. playgrounds and shops) within the SRD boundaries while others may only have a central green area.
6) The residential building type of SRD concentrates on either medium rise or high rise buildings.
7) SRDs are under the supervision of a professional housing management company that is nominated by the owners corporation. It is responsible for maintaining, cleaning, guarding, gardening and other public duties.

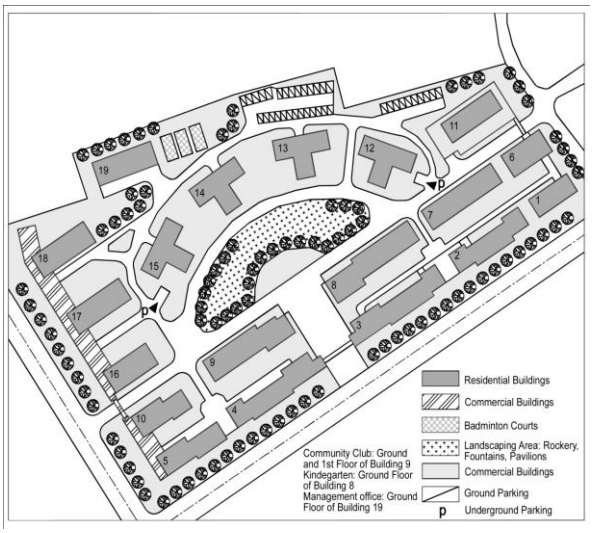

Fig. 1. The layout of the case study SRD.

A Chinese SRD, completed in 2008, is selected for case study analysis in this research, with 350 households living in the SRD. It has a site area of 3.68 ha with a total residential construction area of 44,030 m2. It comprises 5 three-storied townhouse style residential buildings, 10 six-storied medium-rise residential buildings (without elevators) and 4 twelve-storied high-rise residential buildings (with elevators installed). It has internal walkways and roads, walls, parking lots with permeable pavement, an underground car parking area and landscaping in the form of green area, fountain, and pavilions. It also has a kindergarten, a management office area, a community social club and a badminton court. There are also some commercial area that is built on the interval space between buildings (Fig. 1).

IV. Environmental Outcomes of Thepublic Space in the Case Study SRD

The life cycle material consumption of the buildings and the public spaces for the case study SRD is shown in Table I. The details of the analytical scope, assumptions and calculation processes were previously studies by the first author in [14] and [15]. From the case study analysis, the public space includes two components: the open space such as roads, walkways, ground parking lots, landscaped areas, etc., and community facilities such as gyms, clubs, playrooms, etc. The public space is shared owned by all residents in a particular neighbourhood.

TABLE I: Material Consumption of the Case Study SRD

Material/SRD component	Steel (tonne)	Timber (m3)	Cement (tonne)	Aluminium (tonne)	Tiles (tonne)	PVC (tonne)
Residential buildings	1866	1,441	6888	43	415	67
Public space	170	86	2015	3	22	2
The SRD has a total life cycle material consumption of 12,872 tonnes.						

Source: adapted from in [14] and [15].

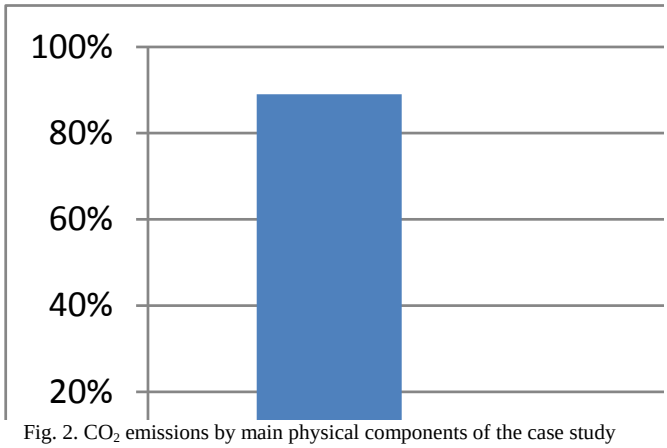

Fig. 2. CO_2 emissions by main physical components of the case study SRDs (%).

Based on the material consumption and energy used to operate the SRD, the total life-cycle energy consumption and CO_2 emission can be quantified, which are 691,939 GJ and 131,681 tonnes (excluding traffic between home and work) respectively. The total life cycle energy consumption and carbon emission involve material related energy consumption and carbon emissions (e.g. manufacturing, transport of materials, recurring materials during the building life cycling), energy used in the construction process and operational energy (electricity, LPG and water used to operate the residential buildings and the public space).

Fig. 2 shows the life cycle CO_2 emissions of the public space and the residential buildings. The construction and operation of the public space constitute 11% of the total carbon emission and the residential buildings constitute 89%. These figures reflect that the energy consumption and CO_2 emissions related to the public area cannot be ignored.

V. Discussion

From the analysis, we can argue that 11% of the total life cycle carbon emission, or 14485 tonnes carbon, can be attributed to the construction and operation of the public space. As argued earlier, this amount of carbon emission should be "jointly owned" by all residents in this SRD, which is the consequence of privatising the public space. Given the total carbon emission is 131,681 tonnes and the SRD having a total residential construction area of 44,030m^2, a 100m^2 apartment owner should be "responsible" for 299 tonnes carbon emission. Part of his "responsibility", 33 tonnes carbon emission, is due to the construction and operation of the public space. In contrast, if this case study SRD is non-gated, which means the public space is not privatised and can be open to all users, the residents of this SRD thus do not need to take individual responsibilities for the environmental impact from the construction and operation of the public space. This also means an owner of a 100 m^2 apartment in a non-gated SRD will take an individually environmental responsibility of 33 tonnes carbon emission less.

SRDs are enclosed by walls and gates, and the community facilities and open space are owned by all residents. They are not open to people outside a particular SRD, for example, a gym within the studied SRD is not open to the public; thus, energy consumption and carbon emissions attributable to the construction and operation of the gym, should be also shared by all residents in the SRD. If the public space of a gated community is opened up to the general public, the average life cycle energy consumption and carbon emission can be reduced in terms of per resident or per construction area. This also helps to create genuine social interactivity that includes people from different neighbourhoods with different social and economic classes.

The privatisation of the public space also aggravates the traffic congestion in many cities. As indicated in Li and Li in [16], the urban road network density in Nanjing City in 2000 was around 4.4 km/km^2, however if considering the roads enclosed in gated neighbourhoods and other enclaves such as schools, the road density would be increased to 8.5 km/km^2. This implies a large part of the road network in Chinese cities cannot be used for releasing urban traffic problems because such roads are privatised. This ultimately reflects on how privatisation of public space can play a significant role in the urban environments. It leads to inefficient use of energy and resources, and impact urban environment as whole. The understanding of environmental implications of privatized public space is crucial to how lifestyle and living patterns are shaping in such urban environments. As a result, it is

important to note how SRDs are contributing to environmental outcomes of the city that are also playful in social and economic dimensions of urban living.

Sustainability acknowledges ecological, social, and economic welfare as its key dimensions. As stated by BRE, "it is insufficient for a development to contribute towards reductions in global carbon emissions, if residents feel excluded and isolated, suffer from poor health, will not go out for fear of crime, and have nowhere to meet their friends or watch their children play in safety" [17], and vice versa. The public space is important for urban residents to maintain an acceptable level of social sustainability. The question is how to increase resource efficiency and eventually improve urban environment while maintaining such an acceptable social sustainability. In this regard, an acceptable level of social sustainability means a public space that can satisfy the social demand of urban residents.

A hierarchically integrated urban spatial pattern may be a way to remove the inefficiencies due to privatising the public space within gated neighbourhoods. For example, Tianjin Eco City has proposed the following urban residential pattern:

1) A 400m × 400m residential block homes for 8000 residents or so.
2) Four such residential blocks are allocated with community facilities in the centre.
3) 4-5 neighbourhoods are further grouped into a district with urban facilities in the centre, which are within 300-500m walk distance.

By this way, the public space is moved out of the enclosed perimeter and is open up to the public. Enlarging the service scale will lead to de-privatise the public space and in the same time local residents still have access to various facilities in a walkable distance.

VI. Coclusions

From this study, we can point out how privatized public spaces of gated neighbourhoods can lead to inefficient use of resources and impact urban environment as a whole. The environmental outcomes due to the privatization of the public space cannot be ignored. This paper argues de-privatising the public space from gated neighbourhoods through sound urban planning can help to improve environmental sustainability as well as social sustainability in tandem.

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