

Accelerated Creep(ing): A 'buy & forget' mentality for Chinese homes

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Introduction

China has continued an unprecedented level of economic growth over a twenty year period which is the direct result of evolving reforms to its land use policies that have privatized the housing market and continued an extraordinary push for urban development. Since the 1990s, the Chinese government has operated with the fundamental belief that an urbanite is worth far more to its country's GDP than a rural resident; thus faster and increased urbanization has been a key proponent to its continued growth (Ren, 2013). The structure of the political system exacerbates this condition by putting pressure on developers to build as quickly as possible. For Chinese politicians, it's a numbers game, local government officials are evaluated on the short-term economic growth during their cycle in office and if they want promotion they need it to be able to literally show what they've built. The schemes of predecessors are often abandoned to start new developments so that credit can be clearly given to a single individual (Shepard, 2015). As Bosker (2013) points out, "*Personal success is measured by the number of units they sell. They are less concerned with increasing land values and developing a genuine, multi-dimensional, and vibrant community.*" The expedited speed of construction leaves little time for proper design development and reflection, let alone assurance that construction procedures and regulations are being strictly followed across all units in the development.

A thirty year time period of community-based living (danwei) where no one was able to own their own home has fuelled a Chinese obsession with property (the 1949-1978 Reform Period). The ability for an individual to purchase a home has become an important indicator of one's success. While other forms of domestic and foreign investments are viewed with heavy risk, purchasing of additional homes is viewed as a safe and prosperous way to invest one's money. It is a physical, tradeable object that one can use to represent their wealth, success and years of labour. It is not uncommon for a family to own several homes – 21% of urban households possess more than 1 home (Shepard, 2015). This obsession helps establish a progressive market for homes that are purchased as a commodity rather than a home to live in. While one can easily 'forget' about the money they invest in a mutual fund or bond, investing in a home is not as simple - while the market value of many homes may have tripled (or more) over the last decade, the real value of the homes over their long-term future may be very different. The purchasing of a home and the owner's physical location are often geographically disconnected and many of the purchased homes are units in high-rise buildings. There is a general expectation across all residential types that nothing has to be done until someone decides to move in - Figure 1.

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Figure 1 'Entrances': many doors of unoccupied homes have the plastic shipping wrap still partially intact (left) while others have been replaced with more ornate doors and adorned with Chinese good fortune messages and in this case gold chandeliers and shoes (right)

Given the described context, *'what are the physical implications of combining cheap and quick construction with an unoccupied 'buy & forget' mentality'?* And more specifically, the focus of this issue, *'how has this context effected the often long-term and gradual creep of material deterioration'?* The questions at hand are discussed with a case study from a residential estate in Chongqing, China. Brief overviews of the Chinese land system, the city of Chongqing and the estate are presented to provide a useful context for discussion. Subsequently, a narrative crafted from interviews with residents along with photographic evidence of several common circumstances are presented to describe and illustrate the revealed condition of accelerated creep(ing). Lastly a discussion is held regarding the long-term impact and reality of such precarious conditions.

Chinese Land System

Details of the Chinese land system including its susceptibility to coercion and corruption is outside the scope of this article (c.f. Miller, 2012), the intent here is to simply provide a brief overview of the process for contextual purposes. As a starting point, The National Government gifts 'urban land'³ to local governments who in turn lease the land to developers to build on. With regards to residential development, a developer is able to lease the land for 70 years from the local government. This is a one-time fee as no annual tax comes from the land (e.g. property tax). This is different compared to industrial and commercial uses where the local government can impose annual taxes (e.g. production tax) and thus why the cost of land for residential use is generally higher depending on the location. A developer can obtain the land either through negotiation with the local government or by bidding in the open market – the former is often much cheaper. Given the current government system, land development is the primary funding mechanism for local governments which again adds pressure to develop faster and more land in order to keep itself afloat.

Developers construct elaborate showrooms typically near the estate location with numerous show room models varying in scale from the overall site (typically multiple buildings and housing options) to individual apartment units and villas. The models are accompanied with elaborate brochures selling a 'lifestyle' rather than just a home and a pricing matrix that illustrates the square metre prices for the units based on a handful of variables (e.g. unit direction, floor level). Almost all units will be sold simply on the models and brochures presented either prior to the start of construction or during construction. The

³ Rural land is different as it's actually owned by individuals or rural collectives. This land should be purchased or compensated for by the local government. The land value of rural land is a fraction of urban land; however, local governments have the authority to change the land over which immediately increases its value (up to 40x).

interior of the units are unfinished. They typically will be composed of a raw concrete structure with pipes and electrical infrastructure connections exposed - some will parge the concrete structure with a thin coat of mortar to give it a nicer look. Depending on how well the units have presold, the developer may decide to finish a handful on a lower level as model units. These model units are generally finished in very ornate styles reminiscent of mid-twentieth century European luxury. The floor plans are cellular, but the drawings indicate to owners which walls are load-bearing and which are not. Upon completion the developer will hire a management company for the estate. The management company can stay on if the newly formed housing board (an elected group of residents) is happy with their performance. The housing board has the legal right to change the management company at any time. The management company's efforts focus on security, maintaining the exterior and lobby spaces and helping residents with various requests.

Chongqing

Chongqing, China's largest inland city, is located at the confluence of the Yangtze and Jialing rivers. It is very much a mountainous city with a varied topography into which its buildings and urban infrastructure are cut. China is typically divided into five main climate regions with Chongqing falling within the *hot summer, cold winter region* - Figure 2. Despite this description, Chongqing has a humid subtropical climate with long hot and humid summers and damp and relatively mild winters, temperatures occasionally reach freezing. The city is set between mountains on all sides which limits air movement (wind) and the temperature difference between day and night is relatively consistent (2-4 degrees). In 1997 Chongqing became the fourth directly-controlled municipality under the central government in Beijing (Han and Wang, 2001). This identification has allowed it to become the primary benefactor of the central government's push to move development inland (e.g. China's 'Go West' strategy, 1999). However, it is still considered a Tier 2 city⁴ from a market perspective hence its development is very much government led.



Figure 2 Map of China

The municipality of Chongqing stretches across 84,403km² with a population of 30 million (58% urbanized). It's important to note that in China the distinction between urban and rural land is more of an administrative label rather than a representation of density and what's actually built on it (Campanella, 2008). Thus, the municipality of Chongqing is made up of a mixture of urban (districts) and rural (counties) areas – Figure 3. The greater urban area is made up of 10 districts stretching a fraction of the municipality's land (6,346km²) but holds about 1/3 of its population (85% urbanized). Central Chongqing what Westerners would consider to be the 'city' of Chongqing is 1,435km² with a population of 5 million (95% urbanized). Central Chongqing has a traditional central 'downtown' area (Yuzhong district, 100% urbanized), but its rapid development over the

⁴ The tier labelling system for Chinese cities is an unofficial system that represents a city's economic development which includes GDP, infrastructure, transportation systems, etc. The tier system is often used to help companies prioritize key markets.

past 20 years has created a city with multiple centres along with a developing transportation infrastructure. The city's topography and dispersion has made it a car-orientated city, but its high population density means it suffers from severe traffic congestion throughout day and night.

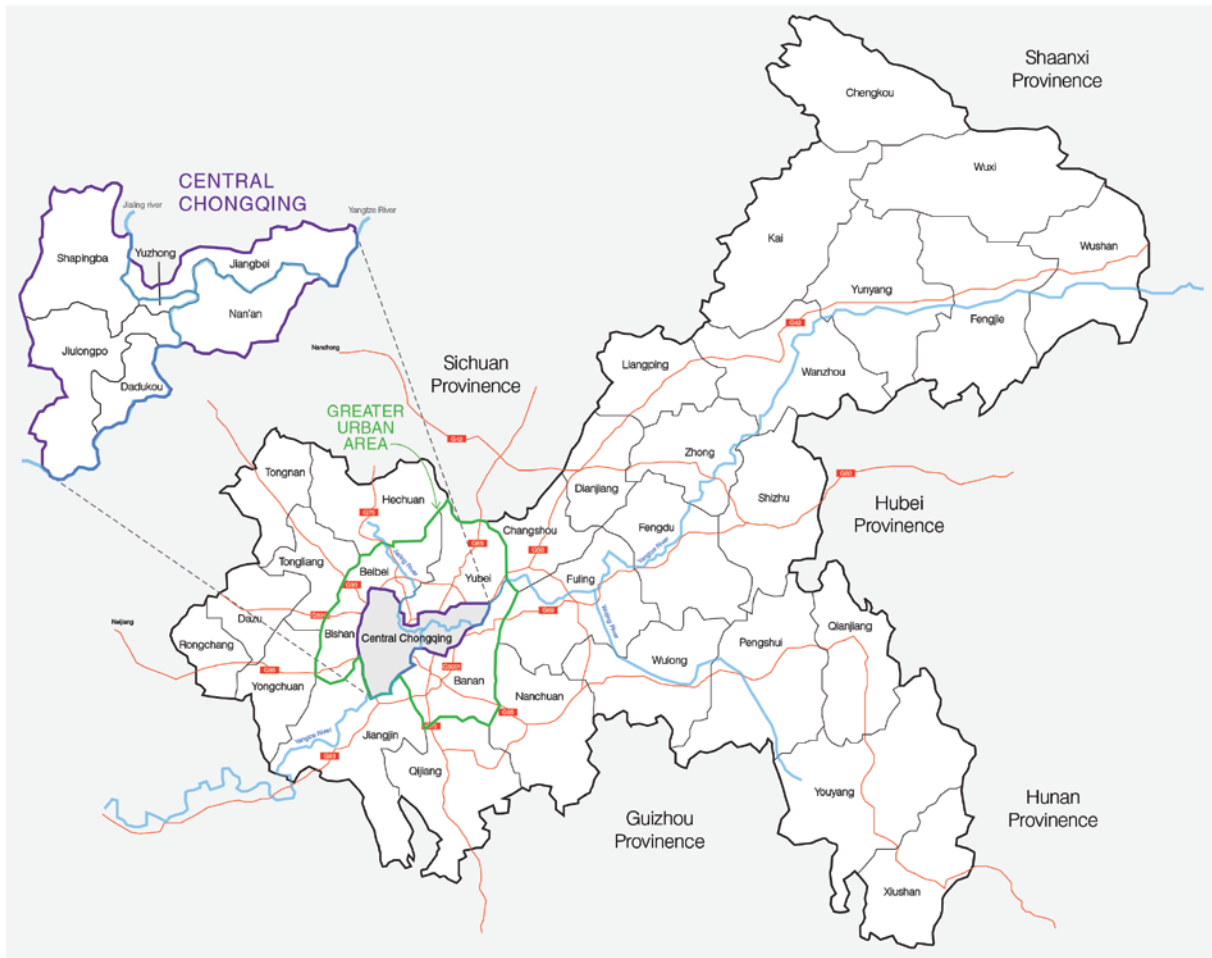


Figure 3 Map of Chongqing municipality

The estate

The 'upmarket' residential development of *Ever Green Lake* is a gated community that is situated within the Nan'an district in Central Chongqing. A Singapore-based developer purchased the land in the 1980s at the start of the post-reform era (1979 -). The estate was designed by a prominent Chinese architecture practice from the South-east of China and built just over 10 years ago between 2003 and 2006. Thus, the homes were constructed within the timeframe of the Chinese Golden Age of construction – these types of 'suburban' estates were a response to a growing demand for a contrasting luxury lifestyle of 'detached' homes set in a quiet, low-density, green environment (Bosker, 2013). The estate has a total of 405 houses with three types of homes – detached villas⁵, terraced houses and semi-detached houses. Homes vary in size between 200m² – 700m² with the largest homes surrounding the lake. The exterior of the homes are of a Western style in the realm of colonial revival; however, like much of Chinese Western influenced architecture it is a result of a selective combination of desired elements. The homes are less a response to actual residents' needs and more a response to a progressive, modern and luxurious lifestyle. One can notice quickly that the occupied homes are clearly 'home' to the rich with the number and types of cars and the types of exterior upgrades applied to the homes (doors, gates, garden, etc.). In addition, every home has a garden ranging from 80m² - 200m². According to the management company, the estate is just under 20% building density with almost 55% greenery – Figure 4.

⁵ Within the last two years construction of villas has been made illegal by the Chinese government as a wasteful form of housing.



Figure 4 Green lined road

While purchasing a home came with the optimism of continued growth surrounding the community, little has been built with regards to amenities and supporting commercial infrastructure. An estate brochure advertises a five-star club, exclusive hospitals, elite kindergartens, supermarkets, public transportation systems and more. Within the estate at the entrance there is a large restaurant and community centre, office building but this appeared to be all but abandoned during our trips to the estate - Figure 5. The estate remains relatively isolated as a commuter community. The closest food market is 45 minutes away by foot; as well as, the closest metro train stop. There are a lack of quality schools in the vicinity which is of top importance to Chinese and according to residents traffic congestion has actually gotten worse which is a problem as most workplaces are not located nearby.



Figure 5 Community building at entrance

However, all the homes are sold. They were all sold within two years of completion. Like other similar residential developments a proportion of homes would have been purchased by speculators to sell later on or by wealthy investors as a novelty, but others would have been acquired by families with the intent to move in. The management company claimed that over 75% of the homes were occupied, but a quick survey walking through the estate estimated that number more accurately to be just over half (about 55%). By residents' accounts this has however steadily increased, with one early occupier saying five years ago it was less than a third full. *So why didn't families move in immediately?* Some stated they didn't have the money to immediately finish the home, while others told us they were waiting for the surrounding infrastructure to build up.

The progression of development outside the estate has been much slower than all had expected – the lack of convenience was stated as a major deterrent for friends and other family members who have not yet moved in. *So why do residents tolerate the inconvenience?* The common response was they love the environment of the estate – quiet, low-density, ‘private’ and lots of green space. The estate is in an active form of transformation - approximately a quarter of the homes (a mix of occupied and unoccupied) appeared to be actively engaged in some level of retrofitting – Figure 6.



Figure 6 (Re)construction: replacement of windows and lower panels (left)⁶; stripped back to the concrete structure (right).

Accelerated Creep(ing)

Upon visiting the community, the result is a remarkable juxtaposition of luxuriously kept homes directly adjacent to weathered, dilapidated and unoccupied homes - Figure 7. *How could these homes be only 10 years old? How had the material deterioration advanced so quickly?* Was the root cause physical (construction flaw) and/or social (type of home didn't fit how they wanted to live)? For the homes in poor condition, much of the exterior decorative work, balustrades, mouldings, veneer panels, etc. were not only stained but broken, with concrete/plaster spalling off the units. The overriding impression was poor construction and poor maintenance of the housing units, but the high quality landscaping still made the development an attractive place.

⁶ The home on the left did a refit prior to moving in, but didn't have enough money to refit the windows. Two years on now, they have money to refit the windows and the lower panels while living in the home.



Figure 7 'Neighbours': well-kept homes (right) are directly adjacent to homes that have never been occupied (left).

It was easy to forget that residences in this type of housing development can be simply a commodity with a value on the real estate market. A range of scenarios were hypothesized and are presented on a continuum between two sets of values – a pure investment (left) and a home for living (right) – Figure 8. The spectrum helps contextualize the existing condition where all scenarios are present, but what makes the estate situation so interesting is that the outer two are the most prevalent and in direct physical relation to each other. And in discussing with residents, there were no concerns with the value of their home with regards to the adjacent unoccupied and deteriorating properties. Discussion with an owner who had not moved in to their house yet stated they bought their home because a friend had purchased one and the price was not very high. Since purchasing the home seven years ago, they've done nothing but plant two trees in the back garden. While a few of the homes were confirmed to be rented, this is typically not a viable option because while the cost of a home is typically extremely high, the rental yield is incredibly low, around 1% (Shepard, 2015). In addition, some claim that finishing a home can reduce the value of it on the second-hand market (increased amount of work to refinish). Over the 6 months investigation we could find between 20-25 homes in the estate for sale online – about half of them (9) were finished (occupied) while the other half remained unfinished (never occupied). Over the last three months two of the homes were sold. There are no 'for sale' signs or physical indication that a home is for sale on the property itself.

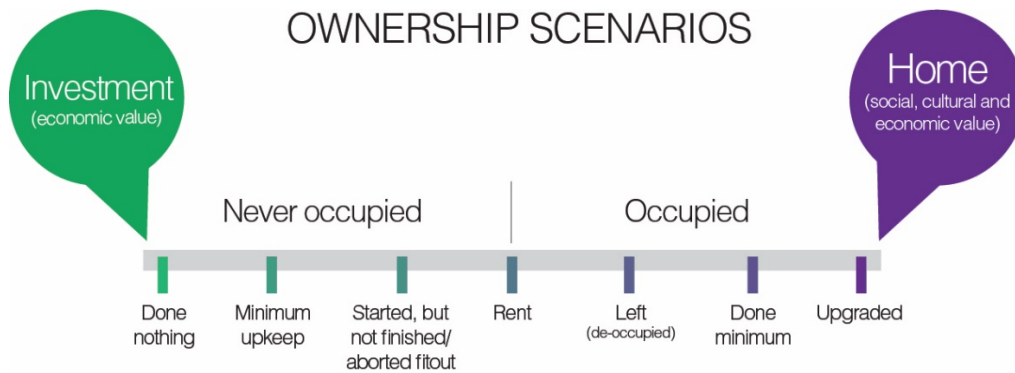


Figure 8 Ownership scenarios

The Homes

The homes are all clad with a veneer system that appeared to be done as quickly and cheaply as possible. When installing a veneer system whether it is anchored or adhered, a significant design requirement is to make sure the backup system can resist water penetration. The exterior finishes appeared to be directly adhered to the concrete structure. It appeared that the only act done prior to adhering the panels was *parging* - a thin coat of mortar to help smooth the surface and seal it against moisture. In such a case, water and water vapour that infiltrates/diffuses the exterior cladding has nowhere to go but into the house. This is especially a problem at openings (doors/windows/vents) because in this case they were poorly sealed - a lack of tight-fitting components and use of weather stripping and caulking has left openings extremely vulnerable – Figure 9.



Figure 9 Example of poorly sealed opening

In addition, cheap and relatively non-durable panels have led to the severe and quick deterioration of the exterior with stains, cracks and large chunks falling off – all of which provide additional opportunities for water infiltration. The weathered and deteriorated condition of the exterior mouldings/trim is often the first and most obvious sign of poor construction. Mouldings are regularly stained, cracked and shattered with large chunks missing. It appears the hollow cast-in-place concrete/plaster solution has fallen victim to the infiltration of water that probably settled inside and caused havoc with the occasional freeze/thaw cycle. This condition is worsened by the inadequate rebar/metal wiring used to tie the moulding back to the structure along with a lack of movement/expansion joints compromising the integrity of the solution. Residents who have redone the cornice moulding have commented on how they've chosen to use a more solid, durable solutions such as stone or polyurethane to help remedy the condition. A lack of movement joints in the veneer panels as well fails to cater for differential movement in the structure which increases opportunities for cracking, tenting and debonding – Figure 10. The multiple opportunities for infiltration significantly increase the amount of water passage into the home. While water infiltration seemed less obvious from the ground floor slabs, one has to wonder if the site was properly graded to shed water and the slab poured on top of a water penetration layer. In addition, workers on site explained that they've often had to replace the roofing because of water infiltration (no water barrier) and that rainwater pipes were poorly installed, leaked and failed to move collected water away from the home. Rather than admitting there was an issue with the exterior finishes, the estate management team stated that some of the residents found the exterior materials were not to their liking and wanted to update them to a more fashionable choice.



Figure 10 Brick veneer falling off, stained cornice moulding and poorly sealed window openings (left); stained, hollow cornice moulding broken with insufficient metal anchorage exposed (right)

What does all this water infiltration add up to? It was obvious walking through a handful of empty homes that water infiltration through openings was a serious issue leading to the severe growth of mould – Figure 11. One could easily smell this upon entering an unoccupied home. The hot temperatures and high level of humidity provide an ideal climate for the growth of mould - high levels of air ventilation and infiltration will add to the moisture problems (poor construction can create 10 times the air exchange rate). Many residents confirmed the abundant amount of water that enters the homes through the windows and doors. Given the mould growth patterns and locations, it also appeared that some mould growth was due to severe diffusion and infiltration through the concrete structure itself.



Figure 11 Middle floor level w/ extensive water & mould

Talking to residents who have occupied their homes, the dampness issue doesn't go away by simply removing the existing mould and occupying the home. Even residents who have applied various solutions to reduce water infiltration and vapour diffusion claim the problem persists. One resident described still having a strong smell of mould throughout the house after moving in 6 months ago. They've added water protection to the home, but still the smell of dampness continues throughout all three levels of the home. Another resident expressed dampness issues 2 years after moving in, he dug a trench around the home to help shed water away. Many owners have installed large overhangs above openings; reclad the veneer and mouldings and upgraded their windows and doors – Figures 12 and 13. One resident stated he replaced the windows before even moving in because he noticed how much water entered the home through them. To characterise the quality of the windows, in a couple of the unoccupied homes, glass panes had appeared to have simply fallen out of the window frame and laid on the ground shattered. Another resident stated he reconstructed his entire entrance because of water damage. This appeared to be a clear pattern as a majority of occupied homes had redone their entrance. Thus, many of the materials and components have become collateral damage to water infiltration as an accelerated form of material creep(ing).



Figure 12 Large overhangs cast over the homes



Figure 13 Exterior of the home has been completely redone with no sign of the original exterior remaining.

The reality is the 'fix' and abatement process was (and remains) far from perfect. While the exterior finishes can be replaced and stains can be removed from the concrete structure, if the issue of water infiltration and diffusion are not properly removed the condition will return. Workers stated the conventional solution is simply to (re)clad with an improved veneer adhered with a thermal mortar. While this will likely reduce water infiltration for now, a strict requirement for a refit job should be to add a proper vapour diffusion retarder (VDR) to help seal (wrap) the wall from exterior water. This would have to be done over the entire exterior envelope and work precisely with all opening details. A drainage mat (or rainscreen mat) could be added on top of the VDR to reduce moisture problems by separating the exterior veneer from the VDR and creating an airspace (cavity) that allows the wall to breathe and stay dry. The breathable net product allows for air movement and for water to drain to the exterior (e.g. flashing with weep holes). But most importantly, getting the existing concrete thoroughly dried out would prove to be especially difficult because the humid and damp year-round climate conditions keep an abundance of moisture in the air – i.e. the existing moisture in the concrete will continue to find its way out seeking equilibrium with the interior even if the exterior is sealed up properly. The visible cracking in the concrete is not believed to be structural, but forms of shrinkage or temperature cracks. In addition, residents stated that the interior mortar layer that was applied was 'too thin' as it commonly cracks and falls off. Water infiltration appeared to be present at many of the cracks since mould and staining often occurred around them. Owners appeared to have 'fixed' some of the cracks with a coat of smooth mortar applied over the top - one can visibly see the colour difference in a diagonal pattern.

Furthermore, some residents complained about pipes leaking and needing to replace them with a higher grade. It is not clear if the pipes were simply poorly installed or an issue with material deterioration (e.g. corrosion). One worker commented that the water-supply pipes were generally too small which exacerbated the situation. Water leakage in the walls could also be another source for mould issues in the occupied homes. We were told by construction workers that the entrance location has often been switched with the neighbouring window to reduce pipe runs so as not to have pipes running above the door – Figure 14.



Figure 14 Door filled in on the right and window on the left expanded to include door; blue tinted canopy also added

Corrosion is the deterioration of a metal by a chemical reaction with its environment. It is clear by the level and rate of corrosion on all of the original exterior metal that none of it was treated with any anti-corrosion efforts (e.g. reactive coating). The high temperatures and relative humidity levels of Chongqing enhance the severity of the corrosion. The metal railings for the exterior stairs and balconies are an excellent example. In the case of one of the townhouse styles the exterior staircase in the front yard leads to an additional entrance door on the second level. However, all three floors belong to the same unit and given the layout of the home it would seem unlikely for the unit to be split rendering the staircase redundant. At first the estate would not allow owners to remove the staircase, but later changed its view after many owners complained – Figure 15.



Figure 15

Redundant exterior stairs which have been removed by many owners (left); corrosion of exterior metal balustrades (right)

Added segregation and delineation of space between homes exists as well - many gates and walls have been added between and across driveways and yards. Many of the driveway gates have striking ornamentation and lighting – Figure 16. The open and light white picket fences found in the original renderings and photos appear for the most part to be gone, replaced with more durable, opaque solutions.



Figure 16 Orientate driveway gate with LED screen

Retrofitting the home

The homes benefit from a very simple load-bearing construction method of concrete and brick that allows for small teams of labours to retrofit the homes easily using manual and traditional methods. There is generally no need for heavy machinery or highly technical skills or knowledge. We watched workers mix concrete in a large barrel in the driveway and carry it to the side of the house as a small assembly line of bamboo sticks and buckets – Figure 17.



Figure 17 Workers mixing and carrying concrete to side of house

The adaptation activities range from small jobs that allow for continuous occupancy to stripping everything back to the concrete structure. According to workers, when an owner decides to (re)fit the home it takes a couple of months to strip the exterior back to the structure and 2 to 3 years to finish. Because these homes are generally not their primary homes, there is no rush, the construction (refit) process is a relatively long-term project. Usually a group of about 5-10 workers will do the job with generally traditional tools. Purchasers of the (second-hand) homes don't care about the existing condition of the home and assume to pay to refinish the home the way they would like it. Most homes will incur a major refit prior to occupation; depending on the desire and amount of money the owner has will determine the extent of the initial pre-occupation refit. Subsequent partial refits are common as well which creates a continuous construction site feel to the estate.

The main problem is that poor construction methods and materials have led to series moisture issues and in warm, humid climates, tight construction is imperative. With the structures remaining empty and unheated they basically get hot, cold, damp – stay damp, dry, crack, spall and fall off. The use of inexpensive finish techniques without the prep work behind it (moisture barriers, insulation, anchorage systems) has led to accelerated creep(ing). Both the developer (Singapore) and the architect (South-east China) were from outside the climate zone in somewhat dryer, less humid climates which could partially account for the lack of moisture diffusion and choice of poorly durable materials. In addition they probably did not consider the occasional freeze/thaw cycle which has exacerbated problems. A lack of knowledge and skills with regards to the construction workers themselves plays a significant role as even today when reapplying new veneer panelling it appears that all that is used is a 'lick & stick' method without proper retarders and adhesion techniques.

Some of the residents stated that they were aware that the construction quality was poor, but that they enjoyed the environment and viewed it as a trade-off. One resident stated how his son had bought him a similar size luxury apartment close to where he lives, but won't move there since he values the quiet, low-density environment of Ever Green Lake . It was also apparent that from the resident's perspective there were no mechanisms in place for them to take action against anyone with regards to the quality of the homes. Thus, repairing the home when it failed seemed to be acceptable to all residents. It was clear that the inhabitable exterior space has tremendous value. The design of the doors, entranceways and gardens take precedence over the failings of the cornice mouldings and veneer panelling because of their importance as Feng shui driven elements – Figure 18.



Figure 18 The redone entrance (left) and front gate (right) give the Western style homes a more Chinese appearance

The home pictured below added a new portico entrance which protrudes out from the existing frame, re-cladded the entire exterior including the moulding and changed all the windows – Figure 19. For comparison, the adjacent home in the photo is

a mirrored version of how the home would have originally looked. In addition, the owners added an elevator shaft and built a 3 metre concrete wall to separate the back garden from the neighbour.



Figure 19 Redone home (centre) next to mirrored home (left) illustrating 'original' finish

Interestingly many of the unoccupied homes have found intermediate uses. Their driveways are regularly used for additional parking and their yards are very active full of vegetables grown by other residents or staff employed to 'mind' the property in the absence of the owners. In addition, driveways and yards are used as garbage dumps and to store materials for neighbouring construction projects. Inside the homes one can find the storage of random fixtures and construction materials and tools. A toilet in the middle of a room, a bath sitting on the front porch, a sink lost in the back yard. In entertaining fashion, many of the unoccupied homes have been breached with the name and contact information of various decoration (fit-out) companies written in chalk on the concrete walls – Figure 20. Furthermore, a couple of the homes have been converted to be used as businesses – Figure 21.



Figure 20 Ground floor with mould, cracking, storage and fit-out company's contact information



Figure 21 A branch of the Chongqing Survey Institute

Discussion & Conclusions

One could argue these homes were built simply to fall into ruin. The irony here is that they are generally pleasant places in which to live. Those who took the time to visit the home prior to moving in and undertake both remedial and finishing works on the property were more satisfied upon occupation – the deterioration was not as bad and the understanding of what needed for improvements was better. There is a general belief that the tolerance level of owners for material deterioration is incredibly high as a result of the unprecedented speed of physical and economic growth experienced by a single generation where previous conditions were so much worse. This is combined with a clear indication that the residents have an expectation for their homes to deteriorate over time – an expectation that is not gauged against any preconceived longevity. The Vice Minister (Qiu Baoxing) of the Housing and Urban-Rural Development ministry stated at the Sixth International Green Building and Energy Conservation Conference in 2010 that the average building in China will only last 25 to 30 years before being torn down – as a comparison, average housing in Britain lasts 132 years and 74 years in the USA (Shepard, 2015). When the livelihood of a system is based on the (re)leasing of land and the (re)construction and economic growth that it spurs, there is no incentive for buildings to last a long time. The interesting paradox here is the purchasing of homes for investment or for future use - *what does this projected longevity mean for someone who purchases a home to retire in or for a child to live in 15-20 years down the road?* It raises the interesting question of *what are the owners actually purchasing?* Given the Chinese land system they are not purchasing the actual land and every year on reduces the time left on the lease and its long-term value.⁷ Are they merely investing to hold a container of space that comes with the opportunity to (re)construct a home at a completely separate and additional cost?

It could be considered that they are purchasing the closest opportunity they have to build their own home. With the exception of the very elite who may have the opportunity to negotiate with a developer about what is built, the vast majority of buyers will purchase from what the developer decides to put forward – i.e. there is no chance for individuals to lease land directly from the government and build what they would like. Thus, rather than think about how much money they are *losing* by removing all the exterior elements, owners think about how much they are *saving* by using the existing concrete structure. There are obvious limitations to this as for example one home in the estate that was adding extensively to the outside in a

⁷ It's worth noting that a law was passed in 2007 that provides owners with a level of reassurance that the government will not take the land away from them at the end of the lease period; however the owner is likely to have to pay to lease the land from the government again.

distinct appearance was brought to management's attention by neighbours and forced to stop construction - Figure 22. This would suggest on one hand that owners generally don't need to seek approval prior to constructing significant retrofits (unlike in Western countries), but on the other hand there are some rules that need to be followed.



Figure 22 Original frame of home is behind the new arcade; home was additionally extended to cover almost all of the garden space

The neglectful condition of the housing is currently tolerated because a second-hand home buyer is willing and able to spend millions of yuan to refurbish and wait years to occupy the home because the economy is still good and the property market remains in its infancy stages. *But what happens when the economy can no longer support such a wasteful method of construction and the cost of such comprehensive refits become untenable?* As the Chinese market continues to evolve, at what point will buyers of 'second-hand' homes begin to demand much better conditions and refuse to pay a significant sum of money for a home that is not well kept? This is the common foundation for real estate markets in Western countries. *So what could developers build that might not be as wasteful?* Could they simply sell individuals the right to build on the land or like in most Western countries the opportunity to discuss and customise what is built? The limitation here is that many of the homes are not purchased to be lived in immediately suggesting the need to sell the owner a physical commodity. *What if the developer simply built a water-proof shell leaving the exterior to be finished like the interior?* Would it affect the quality of the environment any more or less than the accelerated deterioration of the existing exteriors? The answer is probably much simpler - build better homes that are more durable and less susceptible to neglect and/or maintain the upkeep of the investment i.e. do more than simply the current 'buy & forget' mentality. The case study exhibits well that sustainability is dependent on not only design but also construction quality and maintenance.

The *Evergreen Lake estate* is an excellent example of how the combination of poorly designed and poorly constructed homes is exacerbated with a lack of occupation. It provides a visual manifestation of accelerated creep(ing). A subsequent question for future research would be if and how this condition is transferable to larger scale high-rise residential buildings in China that now sit empty as well? The exterior of many of these buildings already show an accelerated form of material creep(ing).

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