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Retrofitting Russian cities; Addressing housing conditions in the regional masterplan for Berezniki, Solikamsk and Usolye

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Abstract: *The condition of the Soviet era Russian housing stock is gradually worsening. This poses a major challenge for municipalities in how to deal with cities in which the majority of residential areas are dilapidated. Residents have a poor quality of life and the image and attractiveness of the cities suffer. This paper presents the research and proposals involved in a masterplan for an agglomeration of three Russian cities, with a population of approximately 262,000. The research investigates and quantifies the condition of housing in the cities and proposes strategies on how to improve the stock over a 20-year period. The city scale involves demolition and replacement, renovation and repair and considers the relocation of residents during the processes. On a smaller scale this involves design proposals to be employed during the redevelopment to ensure the new housing is more sustainable.*

Housing condition, prefabrication, Russia, municipality.

1. Introduction

The poor condition of Soviet era housing, particularly the prefabricated buildings, is recognised as a question of increasing relevance for many Russian cities (1)(2). Residents live in dilapidated buildings, consuming large amounts of heat energy (3). Neighbourhoods are characterised by vast, low quality public space. According to expert estimates approximately 150,000 flats become uninhabitable every year due to lack of repairs (1). This not only means a poor quality of life for the residents of these buildings, but it poses a significant challenge for municipalities when it comes to dealing with a city composed of such buildings.

The most widely acknowledged cause of poor quality residential developments is the lack of maintenance, which stems from the weak policies on maintenance structures when the majority of the stock was privatised in the early 1990s (6)(1).The funding and trust in the maintenance companies suffers to this day. However, the monotonous buildings and loose urban structure themselves create a sense of anonymity and lack of ownership of anything outside the apartment, which is recognised as playing a role in the lack of collaboration on the maintenance issue, thus further contributing to the degradation of the buildings, and to the cities they comprise (7)(8)(9). The prefabrication construction industry that produced these developments still dominates the market, and while construction technolgy has improved somewhat, the planning model used remains relatively unchanged since the Soviet times(8). While policies regarding maintenance still need to be strengthened, the replacement or reconstruction of buildings and redevelopment of these housing areas is inevitable. Should the

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future want to see a more sustainable housing stock, and more attractive cities supporting a better quality of life, it is important that these rebuilding processes take into consideration the critiques on urban and architectural level.

The way in which residential areas can be redeveloped and reconstruction options for prefabricated buildings is a well investigated topic, with proposals being presented every year in architectural and urban forums, conferences, articles and university research projects, as was the theme for the Moscow Architectural Biennale 2012. However, the research into this housing issue on a city-scale has not received as much attention, particularly outside the major cities of Moscow and St. Petersburg. The government have set up emergency rehousing programs beginning in 1998, which aim to alleviate the most urgent cases first (3), and incentives for construction of new housing (10). However, according to expert studies the rate of both new build and renovation is too slow to meet demands of those needing rehousing (1). City-scale analysis would give municipalities an understanding of what the extent of their problem is, spatially and in numbers. It could also provide a basis for exploring and evaluating which types of block scale strategies are necessary and viable to be implemented to best achieve a more sustainable housing stock and better kept residential areas.

This paper presents an overview of the research and proposals involved in the masterplan for an agglomeration of three Russian cities, with a total of approximately 262,000 inhabitants. The plan was commissioned by mining company Uralkali together with local administrations, primarily because of geological insecurity, due to mining under the cities, causing increasing population decline. Though safety remained a priority, housing quality was focused on as another contributor to outmigration and a key issue for the city to address.

1.1 The masterplan-motivation

180 km North of Perm the agglomeration of Berezniki, Solikamsk and Usolye (BSU) sits on 30% of the world's potash reserves. Despite its strategic economic importance, the region's population has been steadily declining over the last decades, weakening its workforce supply and hindering industrial growth. The primary reason being the geological insecurity, though the national phenomenon of inter-regional migration for education and more diverse employment opportunities also plays a role(5). The flooding of the mine under Berezniki in 2007 gave rise to the formation of three sinkholes. This was a major cause for concern for the citizens for their own personal safety and the integrity of their properties. Aside from the sink holes, surface deformations and building cracks have also appeared due to insufficient backfilling in the mining areas stretching underneath the cities of Berezniki and Solikamsk.

1.2 Objectives

The aim of the masterplan was to deliver strategies to provide a better, safer quality of life in the area that would retain and attract citizens, so that the required workforce would be available for the area to reach its economic potential. In this paper we focus specifically on the housing strategy provided. In early field trips and meetings with local stakeholders it became apparent that buildings and the residential areas in general were in a poor state, and named as contributing factor to outmigration. Therefore, the housing strategy aimed to answer

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the following questions. Condition: What is the actual condition housing and extent of the problem in BSU? Causes: What are the factors contributing to the condition of the residential areas in the context of BSU? Proposals: Which urban and architectural design solutions could provide more sustainable housing for the future, offering a better quality of life?

2. Condition

In analysing the quality of residential buildings, the aim was to gauge the scale of the problem rather than give precise building level information. The outcome should give the local municipalities an understanding of what ball-park figures they were dealing with in terms of units needing to be: demolished and replaced; renovated; repaired or retained. It would also give them a time plan over 20 years of when works should be done and in what order, to manage people movement, to spread out costs, and to mitigate the worsening of the situation.

2.1 Data Sample

Data on the building condition was collated from the data available from the Central Technical Inventory (CTI). Each building in Russia has a 'technical passport' which notes the buildings percentage of wear: 0% is no wear at all, the building is in perfect condition and above 70% the building is deemed uninhabitable. The percentage of wear is noted whenever a technical inventory is carried out on the building, which happens when: the building is constructed; a change is made to the building; on request of the residents due to concerns about the building condition(11). This data was only available for multi-unit buildings, which thus comprised the study and which house 85% of the population. Individual houses were however identified for relocation when located in unsafe areas.

The urban fabric of these multi-unit residential areas in BSU can be differentiated according to construction period, and block type ranging from low- to medium-rise semi-open perimeter blocks in the Stalin era to medium- to high-rise free plan microrayons from the Khrushchyovka era to present times. (The microrayon is a planning model used for residential developments, conceived in Soviet times, ranging from 10-60 hectares in size.

2.2 Collation and mapping

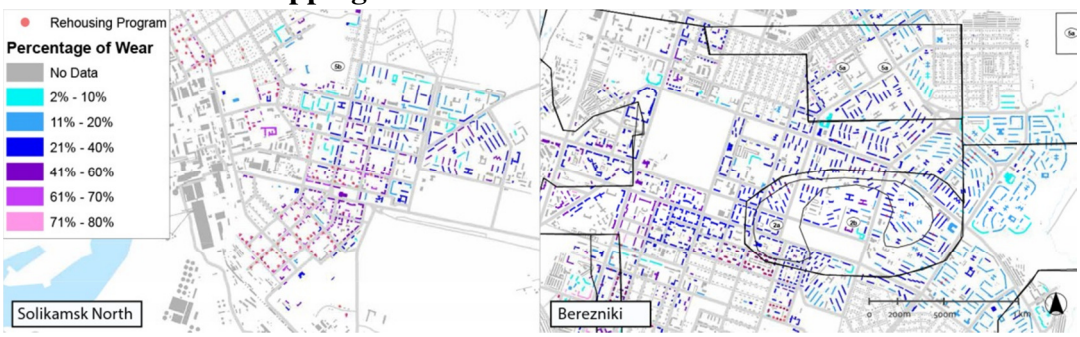

Figure 01. Samples of Percentage of Wear mapping 2013, Solikamsk North (left), Berezniki (right).

The first step was to project the building wear data forward to the current year, then 2013. The percentage of wear given was together with an inventory date and from this, together with the date of construction, it was possible to estimate a percentage wear per year for each building. These were compared to check for correlation. The majority of buildings showed an

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approximate average percentage of wear of 1% per year, which was taken as confirmation on the method. Having input the data into Geographic Information Systems (GIS), the buildings were mapped with their current percentage of wear, to spatially illustrate the condition of housing (fig. 01). The wear percentages were also cross referenced with their building year, geographical location – particularly in relation to the deformations caused by mining- and their construction type.

2.2.1 Correlation of building year, typology and construction type

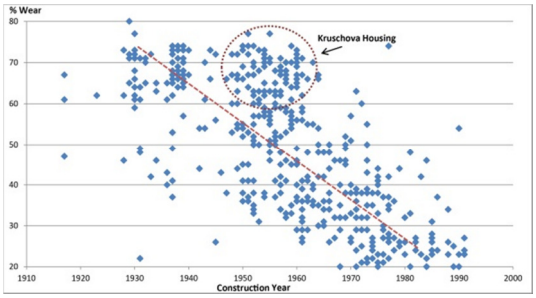

Figure 02. Percentage Wear by Construction Year

The building year showed the biggest correlation with the percentage of wear: the older the building the higher the percentage of wear. However, the Krushchyovka series from the 1960s-1980s show a slightly higher level of wear for their age (fig. 02). The information available on construction type was too detailed and too vaired to extract relevant correlations.

2.2.2 Geographical location

Deformations due to mining were not apparent within this data set; most of inventories were made before 2007. The buildings which were affected by the deformations due to mining were identified by a list of buildings formulated by a special committee for the emergency relocation rehousing program. The percentage of wear of buildings did not correlate with the presence of mines under the buildings. In fig. 01, in the inset ‘Solikamsk North’, high percentages of wear can be seen across the city, though this city has not been undermined. This illustrates that the analysis of this housing stock data is significant for other Russian cities and not solely for the unique situation of cities over mines.

2.3 Assigning strategies to percentages of wear over time

Determining whether a building should be demolished, renovated or repaired depends on the building condition and viability of the investment. The upper limit is set by Russian regulations, where by buildings with over 70% wear are deemed uninhabitable. With rate of wear appearing to be 1% per year on average, buildings estimated at 50% or more wear now are expected to require replacement within the next 20 years. These are assigned ‘(Future) Demolition’, as due to the scale of the housing issue which has to be addressed in 20 years, it was seen as more financially efficient to invest funds in renovation of buildings in better condition so that they do not deteriorate further, rather than in those which are close to being uninhabitable. Repair is recommended for buildings in the early stages of disrepair, to avoid future degradation, requiring minimum investment by homeowners. Renovation is then recommended for buildings between 30 and 50% wear.

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2.4. 1 Results – housing program

The pie chart (fig. 03) shows the results of the analysis of over 1,600 multi-unit dwellings, containing over 97,000 individual apartments. Of this data 7,708 units are assigned for demolition by the emergency rehousing program, and a further 7,061 units are assigned for demolition due to their location in zones unsafe for inhabitation. The need for relocation is unique to this context, where the governmental commission of the Russian federation declared that it did not want any houses rebuilt on areas which had been undermined. If this was not the case these buildings would be demolished and replaced in the same area.

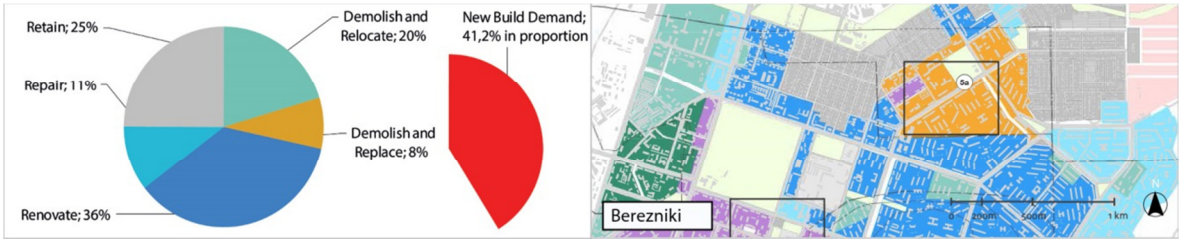

Figure 03. Pie-chart of strategies applied to Multiunit housing by % of total(left), strategy map section (right).

2.4.2 Phasing of housing program

This program was then phased into four five-year phases using the GIS model, The strategies were applied in order of priority over the 20-year period. The program also took into consideration the construction of new units for relocated residents and expected new comers.

3. Causes leading to poor condition of housing:

- Deformation of the structures due to subsidence: These units were identifiable by cross referencing the emergency rehousing program units with their geographical location.
- Poor quality construction: the buildings from the Khrushchev era (from 1950s) in particular were originally intended as temporary housing, with an maximum lifespan of 25 years (4).
- Poor levels of maintenance: The state handed over ownership of the individual apartment units to residents in most cases free of charge during the privatisatin period. The maintenance of buildings and associated open spaces, previously resting with the state, was to be taken on by private companies, funded by fees paid by homeowners. The policies both on the setting up of maintenances companies and home owners associations to communciate with these companies were weak. It proved difficult for homeowners to trust in this system, to rely on maintenance companies and to rely on their neighbours to also pay fees for repairs. This lead to a lack of funding and so very low levels of maintenance of both buildings and open spaces.
- Lack of sense of ownership and identity of place: There are no privately owned open spaces in the residential areas and the semi-private or communally owned spaces are unrecognisable. The legally defined plot of land associated with the building, is not demarcated by any lines in the landscape around the property - such as footpaths or roads. This reinforces the idea that all residents own is their own apartment, which reduces the will to pay fees for the upkeep of the rest. All the open space should be maintained by either maintenance companies or the municipality, which again suffers from lack of funding.

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4.0 Proposals - Urban design solutions

A set of urban design principles was applied to both new build and redeveloped areas. The overarching aim of these principles was to break down the areas into a hierarchy of public to semi-private to private spaces, each of which the residents could identify with. Only streets squares and parks are to be public, and to be maintained by the municipality. Where possible, courtyards should be created, so that spaces within them are more enclosed. The residents living around these spaces can recognise what is theirs. The semi-private spaces in courtyards are to be taken care of the maintenance companies. The ground floor apartments are to have private gardens, reducing the amount of semi-private space that needs to be taken care of by maintenance companies, and reducing the shared costs on residents.

The urban form of the Stalin block was taken as a motif for the new or redeveloped blocks. The buildings in these courtyard blocks are simple in form to accommodate prefabricated building designs, however a mix in typologies is introduced to vary the appearance of the blocks and to diversify living options. The blocks and spaces should be of a human scale. Lower buildings placed closer together were favoured over larger buildings set further apart - the trend in prefabricated construction. Studies were made to ensure that the necessary densities and levels of insolation could be reached with these lower-rise blocks.

Figure 04. Urban design, introducing hierarchy in redeveloped residential areas.

4.1 Proposals - Architectural design solutions

The architectural solutions aimed to create a new local aesthetic, yet still based on prefabricated panel construction – as this would be the only method which could viably supply the number of homes needed within the time frame. The abundance of forest in the area inspired the idea to include timber panels in the design, which would also be prefabricated and could be combined with the concrete panel designs (fig. 05). Orientation was to be considered in the building typologies, and facades designed with reduced openings to the north to reduce heat loss, and increased openings to the south – allowing for passive solar gain. Varying typologies by orientation would also reduce monotony.

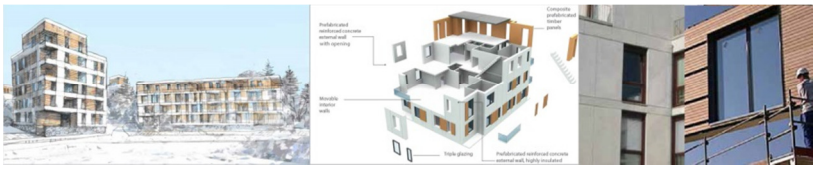

Figure 05. Architectural design, introducing variety and sustainability.

4.1.1 Panel and plan variety for typologies

Prefabrication plants can potentially produce a wide variety of panels for one building development. Panels can vary in opening sizes and types, and in finishes such as grooving,

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printing and engraving different textures in the concrete. The architectural proposal also wished to make use of this capability within the technology. The concept for each building typology was that on the same structural grid at least two different facades could be applied, which would employ a different composition of a set number of panels. And, within that same grid a variety of floor plans could be accommodated – allowing flexibility in unit size for the future. These design solutions can help increase individuality in building complexes while maintaining an efficient prefabrication process.

5. Conclusions

The work of the masterplan has illustrated how significant the housing issue is for local municipalities in terms of demolition, construction and renovation of housing and in terms of managing residents relocation. The design solutions also show the opportunities for change in urban and architectural form during the redevelopment process. The numbers of buildings needing to be address, coupled with the dominance of the prefabrication market in Russia indicate that developments in the prefabrication construction industry, taking on some of these design suggestions in both urban planning and architectural design, could have a major impact on the future sustainability of Russian housing and residential areas as a whole. Though these proposals would inevitably cost more on the outset, both in design and with less economy in construction, it would reduce the chances of cities like the BSU facing the same housing crisis again in years to come. While the impetus for the masterplan was somewhat unique, the data analysis, scenario modelling and empirical knowledge gathered in this process should be of value to municipalities of many Russian cities, as the housing is of similar stock and quality nationwide.

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