GREEN

VS

GREY

“We don’t have time to think, let’s act now! Save our planet.”

Prototyping the sustainable residential block in Russia, Moscow.

Wood vs Concrete

Made by Anastasia Shepel

Introduction

Since time immemorial there have been debates about what kind of residential building is better - wooden or concrete. This question can be approached from different sides and in the end the decision about the main material used for construction will depend only on the desire of the customer, the builder, the investor.

In this paper I have tried to analyze this issue of the eternal opposition of wood and concrete from a theoretical, analytical and practical point of view.

The theoretical part is aimed at a more detailed analysis of different concrete products - new concrete substitutes, their characteristics and their possible applications.

The analytical part includes a comparison of concrete and wood on several parameters the most important of which are economic and environmental. The prototype mobile application for any audience, where I have clearly shown the comparative analysis of concrete and wood, helps to understand the thinking of the population and their needs. In the future, this app will be used to monitor the trend of increasing or decreasing demand for certain residential homes for potential buyers.

The practical part involves applying all the information collected not only about concrete and wood, but also about trends in housing and development in general. I have created a prototype of a sustainable residential block in the village of Lopotovo, Istrinsky district of Moscow, the owners of which are my father and a group of investors (who wished not to mention their names).

I have worked with the leading experts in the field of concrete construction in Italy (DLC and Bianchi companies), visited numerous exhibitions dedicated to wood building, interviewed representatives of business and politics and held meetings with two leading wood construction companies in Russia - Holz House and Wood House to understand the suitability of my design solution and to learn about the latest trends in architecture and sustainable housing construction.

The Lopotovo prototype of a sustainable housing block may serve as a guide for investors and builders in Russia in the future. Now many construction companies in Russia will move to the world standards and certificates LEED and ESG. But the main problem today for Russia is the unresolved issue of standards for high-rise residential buildings using wooden constructions, and all the regulations and fire standards are quite outdated and do not correspond to the technologies that already exist.

Largely in order to begin a discussion of this issue, the layout of the residential block, after its detailed elaboration and urban planning with the accompanying economic and legal justification will be presented at the end of the summer of 2022 in an open all-Russian competition "RF House" - a meeting of architects, politicians, deputies and deputy ministers of construction. The members of the jury were announced 4.01.2022.

"We don't have time to think, let's act now! Save our planet."

Content

Buzzwords - “green” and “sustainable”

After more than three decades of talk about the potential of building green, we’ve still failed to change the way we design and construct buildings so that the built environment stops being a dominant contributor to runaway climate change. Sustainable and green building is the future of construction.

Buzzwords like “green” and “sustainable” make us feel good, but they are often not fully understood when spoken about in relation to construction. “Green” and “sustainable” are often used as the same thing. However, they do not mean it. There is another level to these terms that are much clearer in their explanation: Green buildings and sustainable/green construction. “Green Buildings” are also not quite the same as “Green and Sustainable Construction”. So what’s the difference? Let’s break this down.

Sustainable construction is defined as the “avoidance of the depletion of natural resources in order to maintain an ecological balance.” It is less focused on the environmental impact of the building process like in green construction but instead the resources which are used, how we use them, and being smart about recycling and minimizing waste. In turn, this does mean being more sensitive to the environment, but it’s more focused on the resources themselves.

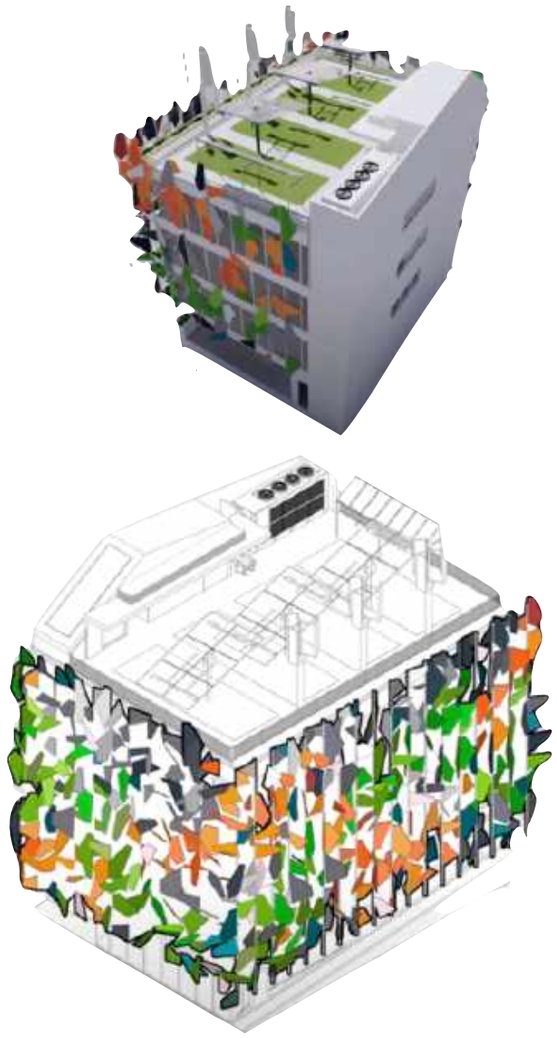
As an example Ashmount Primary School by Penoyre & Prasad North London is a zero-carbon school . The building minimizes energy consumption and is powered with renewable energy and a gas-fired plant.

But what about green? Green is no longer the color. Green is now seen as a mindset. In a technical sense it is defined as something that is “less harmful or more sensitive to the environment.”

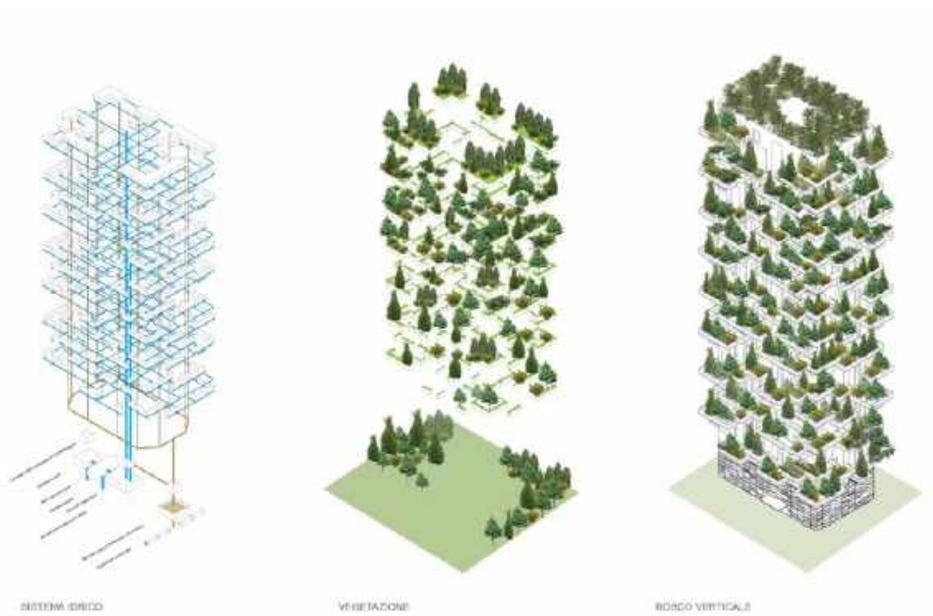
In relation to construction this “green” movement is done in two ways:

1. **Green Building**
2. **Green Construction**

The U.S. Green Building Council defines green building as the “designing, constructing, and operating [of] buildings to maximize occupant health and productivity, use fewer resources, reduce waste and negative environmental impacts, and decrease life cycle costs.” This includes : location and transport, protecting the natural habitat , festive use of water , reduce energy consumption, incorporate recycling systems , thermal control and noise pollution , design innovation , regional priority. For example “Pixel building” in Melbourne, Australia.



Another example is “Bosco Verticale” in Milan, Italy where I’ve been recently.



All these examples required LEED certificate. Leadership in Energy and Environmental Design. It is the most recognized green certificate used for green building classification around the world.

A green building is one thing, but green or sustainable construction is a whole game of its own. Since it is not required, very few contractors think about it in their site building plan. It's clear that green and sustainable construction are a part of each other unlike green building which is more about the management of the finished product.

One important aspect of green construction is the choice by contractors to use sustainable building materials. Identifying sustainable building materials may seem easy, but when you really think about it, how easy is it? For years, our buildings have been primarily made up of concrete, steel, glass and brick. Concrete is actually one of the most used building materials in the world. It's also one of the worst materials.

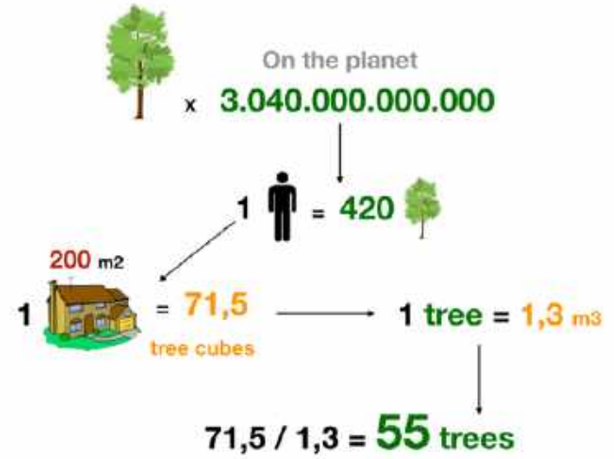
Sustainable building materials are here to stay! There are so many different sustainable and green building materials for the modern contractor to choose from. The ability to bring alternatives to the industry through our own recommendations (as a new generation of architects) could lead to green building jobs, waste reduction and cost savings.

There are new kinds of sustainable building materials being discovered, modified and created every day. Here are some of my favorites :

- Bamboo
- Papercrete & Other Concrete Alternatives
- Lumber & The Rise of Wooden Skyscrapers
- Straw Bales To Build Walls
- Wool
- **Trepel** – new material, will be discussed later

Numbers never lie

For a clearer analysis, I did a simple mathematical calculation to try to confirm my theory that it is possible to build wooden houses for the world's current population! Of course this is a utopian development, but the very fact that this theory is possible allows me, as a future urban planner, to think seriously about replacing concrete as the main building material with wood. For the calculation, reliable figures and approved residential standards for the end of 2021 were taken.



(Need 55 ordinary trees to build wooden house of 200 m2)

420 / 55 = 7,6

7,6 * 200 = 1.530 m2

Every person can build from wood

3.040.000.000.000 / 55 = 55.272.727.272 houses of 200m2 can be built

55.272.727.272 * 200 = 11.054.545.454.545 m2 in total

m2 for one person (standards)

11.054.545.454.545 / 35 = 315.844.155.844 people can be provided with housing

315.844.155.844

Can be provided with housing

7.890.000.000

People now

11.054.545.454.545 - (7.890.000.000 * 35) =
10 778 395 454 545 m2 not in use

10 778 395 454 545 m2 / 200 m2 = 53 891 977 273
houses not in use

53 891 977 273 * 55 = 2.964.058.749.999
trees not in use

97% trees can be saved

Calculations made by author.

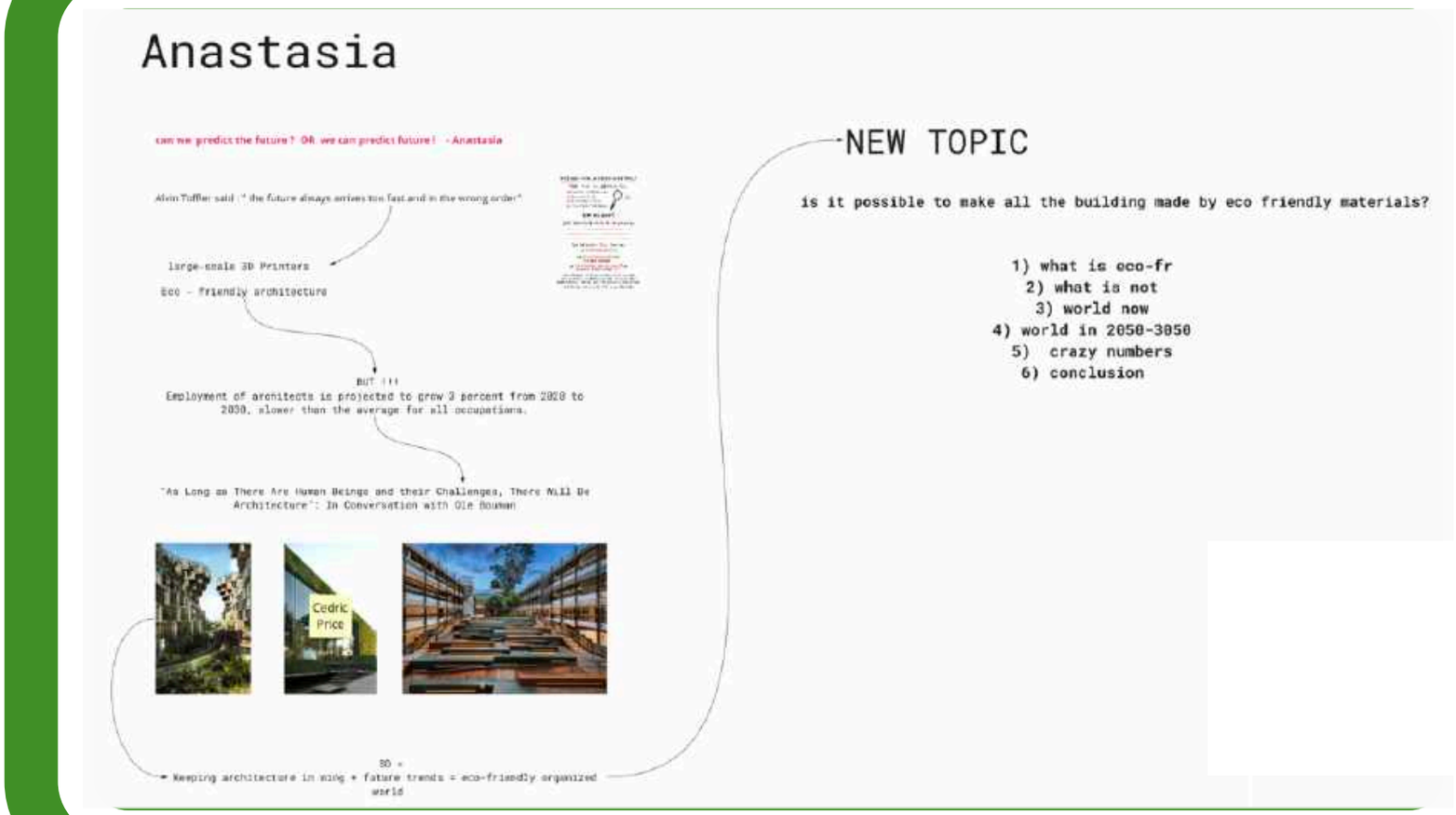
We need to act now!

Experts warn that life on our planet can only be preserved with rapid, dramatic action. As a global community, we must decide upon the kind of world we want to see.

We are now seeing history being made with the changes that many governments, companies and organizations are making or planning to make in the nearest future and they are all based on a common goal – preservation of our planet.

Photos made by author - screenshots from video.

1C



Screenshot from MIRO board - finding the topic for TED talk.

Link for video https://youtu.be/RPhdbb3HGKE

SCAN ME

1D

2A
B

As cities cope with rapid population growth - 2.5 billion people will be living in them by 2050 - and struggle with sprawl, politicians, planners and architects are increasingly interested in the vertical city paradigm.

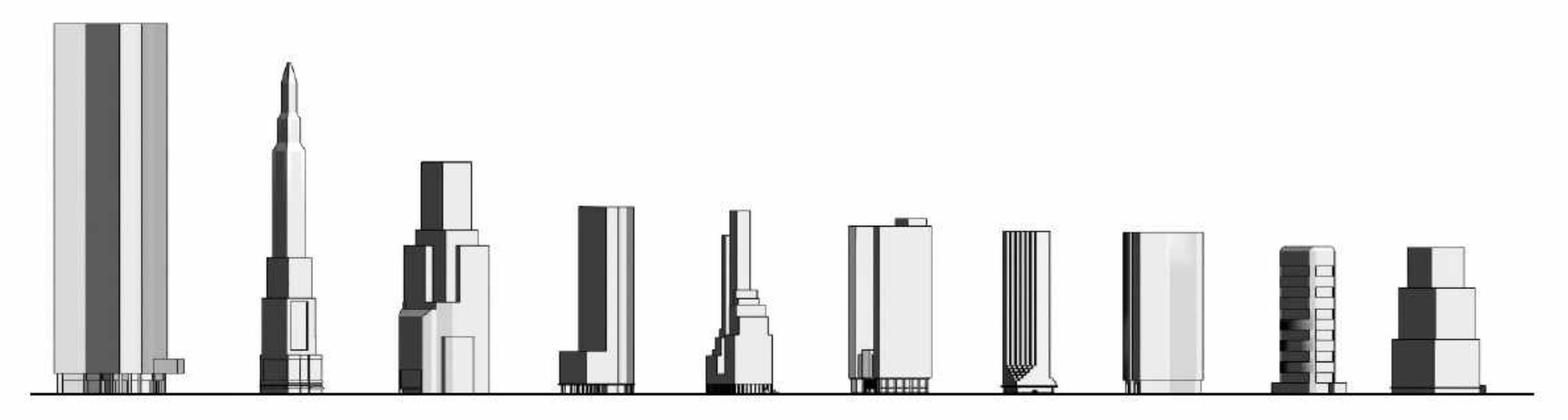
A. What is a tall building?

There is no universally accepted definition of tall building. Governments around the world define tall buildings in different ways. Leicester City Council in the UK defines a tall building as any structure over 20 m in height, and/or a building of any height that is substantially higher than the predominant height of the buildings in the surrounding area, and/or a building that would make a significant impact on the city's skyline.

B. The Tall Building Construction Boom

Since 1990, most cities have seen a steady increase in urban dwellers. In 1990, 43 percent of the world's population lived in urban areas, and by 2015, this had grown to 54 percent. By 2050, urban population will increase about 2.5 billion people. That is, the projected urban population increase is 80 million people a year. This is equivalent to about 1.5 million new urban dwellers a week or 220 thousand a day.

While tall buildings are not the only way to accommodate a growing urban population - it can also be done with mid-rise buildings - cities are rapidly building tall buildings all over the world. Indeed, since 2000, cities have built more tall buildings than in the previous 115 years - 1885 is considered the birth date of skyscrapers. These new buildings are also reaching record heights. Before 2000, for example, only 24 supertalls were built. Since then, more than 84 supertalls have been built.



Sustainability as a Framework

The concept of sustainable development remains of paramount importance to our cities.

The UN World Urban Forum (WUF), the premier conference on cities, uses «sustainable development» as a guiding theme for its many activities.

Importantly, the WUF uses the term «sustainable» in each of its objectives as follows:

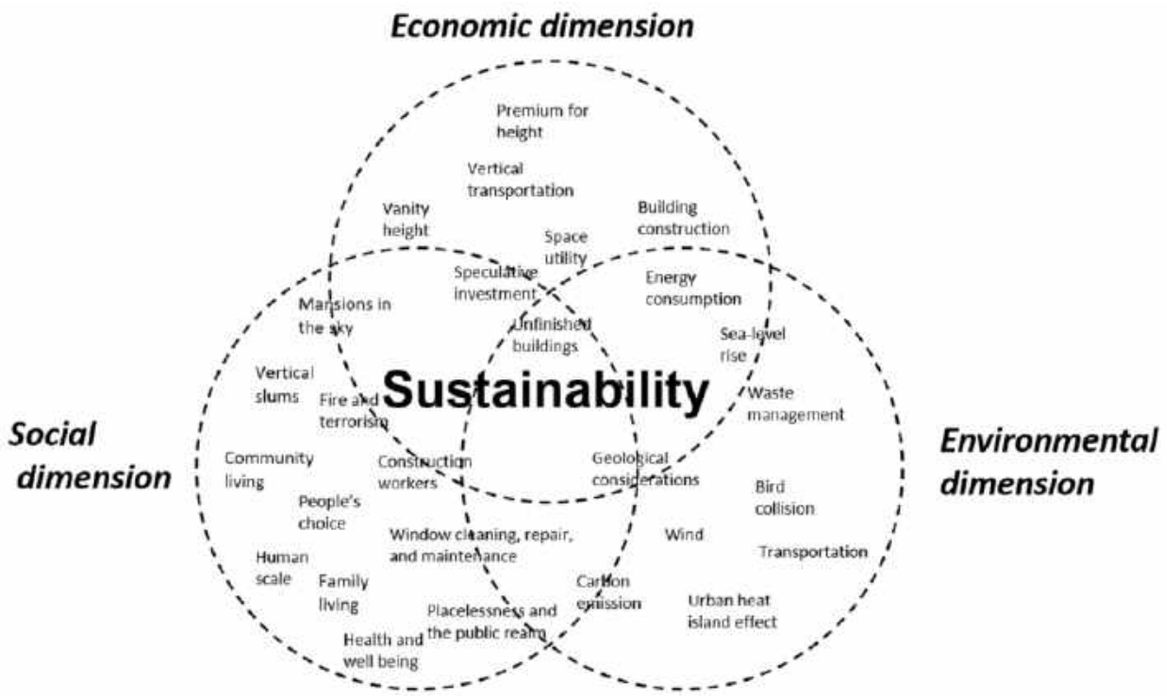
- To raise awareness of sustainable urbanization among stakeholders and constituencies, including the general public
- To improve collective knowledge about sustainable urban development through inclusive, open debates, exchange of lessons learnt and best practices and commendable policy makers
- Increase coordination and cooperation among different stakeholders and constituencies to promote and implement sustainable urbanization

Therefore, sustainability addresses a wide-spectrum of planning and design issues (e.g., housing, economic growth, water, land, energy, waste recycling, transportation, tourism, parks, open spaces) and illustrates their interconnectedness. It helps us to adapt our activities to the constraints and opportunities of the natural systems we need to support our lives.

Leon Krier in his book "The Architecture of Community" presents sustainable urbanism as «an ethical and civilizing vision of universal stature». Sustainability offers an inclusive framework represented in its three conceptual pillars (the social, the economic, and the environmental) or the «3P» of people, profit, and the planet, where:

- «people» represents community well-being and equity;
- «profit» represents economic vitality; and
- «planet» represents conservation of the environment.

Using «sustainability» as a guiding framework to organize the many issues related to tall building developments – represented below.



2D

2E

2F

D. Disparity in Quality of Life

Tall buildings can serve a wide range of tenants of different classes and incomes, including the upper, middle and lower classes. Criticism, however, has focused on high-rise buildings that serve either the poor or the wealthy. This issue will be taken into account in following chapters and solved in designed sustainable block created by author (chapter 11).

E. People's Choice

Recent large-scale high-rise projects in China are teaching us new lessons about sustainability. The Chinese government is encouraging the construction of high-rise cities to accommodate the new mass urban population flocking from rural areas. But the Chinese have largely shunned these cities because they dislike their design, layout, architectural styles, schools, and amenities. Of course, these cities were created in a hurry, trying to accommodate hundreds of thousands of people in a few years, and consequently, urban planners removed residents from the design process and deprived them of the opportunity to express their preferences. The design process did not take into account that many of the intended residents were rural dwellers accustomed to low-rise rather than high-rise living.

F. Health and Well-Being

Many studies have shown that occupants of high-rise buildings experience emotional stress and other negative psychological conditions. Studies show that unwanted social interaction between occupants due to the sharing of floors and utilities leads to stress and tension. In addition, the greater the degree of sharing of rooms and utilities, the higher the level of stress. Further, high building densities, poor design and layout, high flow of people in and out, and lack of open recreational and social spaces are likely to exacerbate these problems. In particular, tall buildings in poor neighborhoods suffer from high population concentrations, overcrowding, lack of open and social spaces, and are characterised by a high degree of separation of space and utilities. In contrast, the occupants of high-rise buildings may suffer from isolation and loneliness.

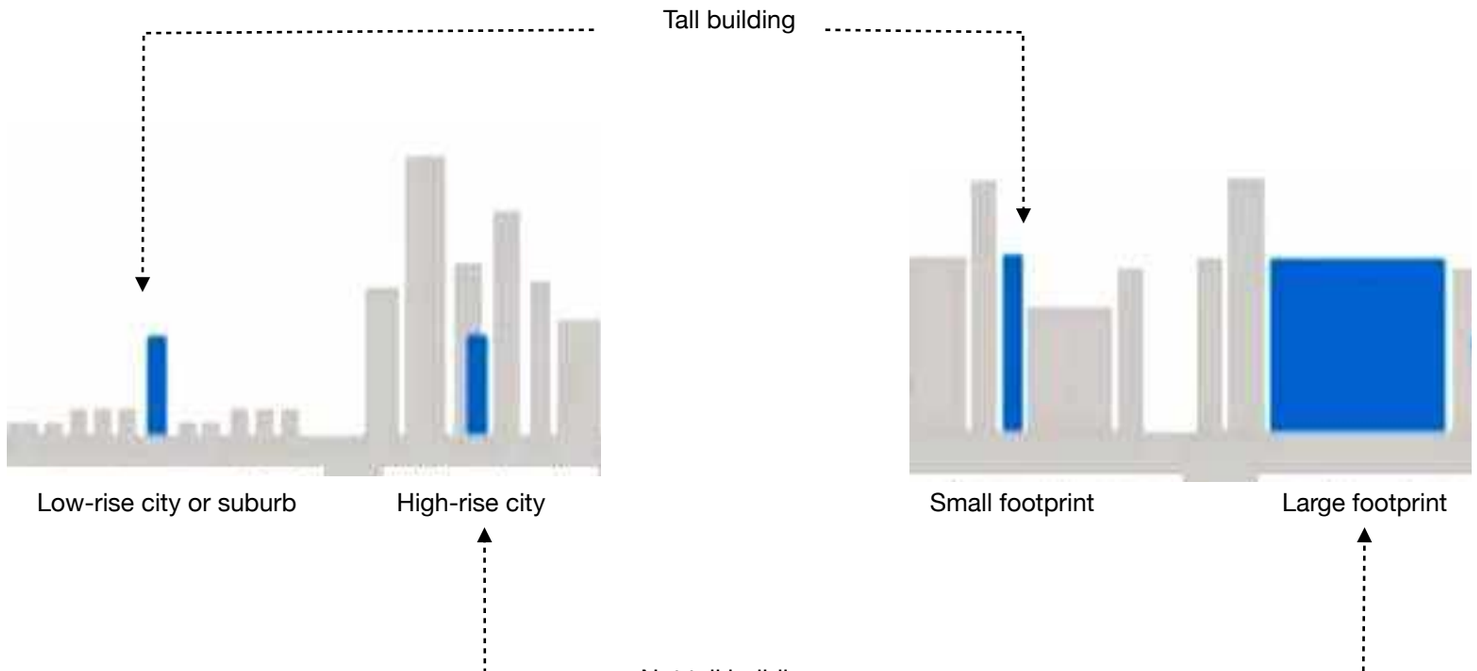
G. Environmental Dimension

Skyscrapers have a large carbon footprint when built, operated, maintained and demolished at the end of their life cycle. They put significant pressure on infrastructure and transport systems, creating congestion and congestion.
In addition, tall buildings have a negative impact on the microclimate due to wind vortexes and turbulence around their bases, creating discomfort for pedestrians. They cast shadows on neighboring buildings, streets, parks and open spaces, and can obscure window views, reduce access to natural light and impede natural ventilation.

H. Sub-conclusion

Overall, the path to a sustainable vertical city is not an easy one; there are certain challenges that need to be addressed. Architects and planners will face obstacles, difficulties and challenges that are not likely to be found in low-rise development.

A simple, elegant and logical design, combined with the exploration and experimentation of new forms, is likely to create a suitable contemporary living environment. Ultimately, using modern technology, local culture, local context, the natural environment and cost-effective solutions, we can collectively set humanity on the path to sustainable cities.



2G
2H

Working team and problematic question - challenge for human beings

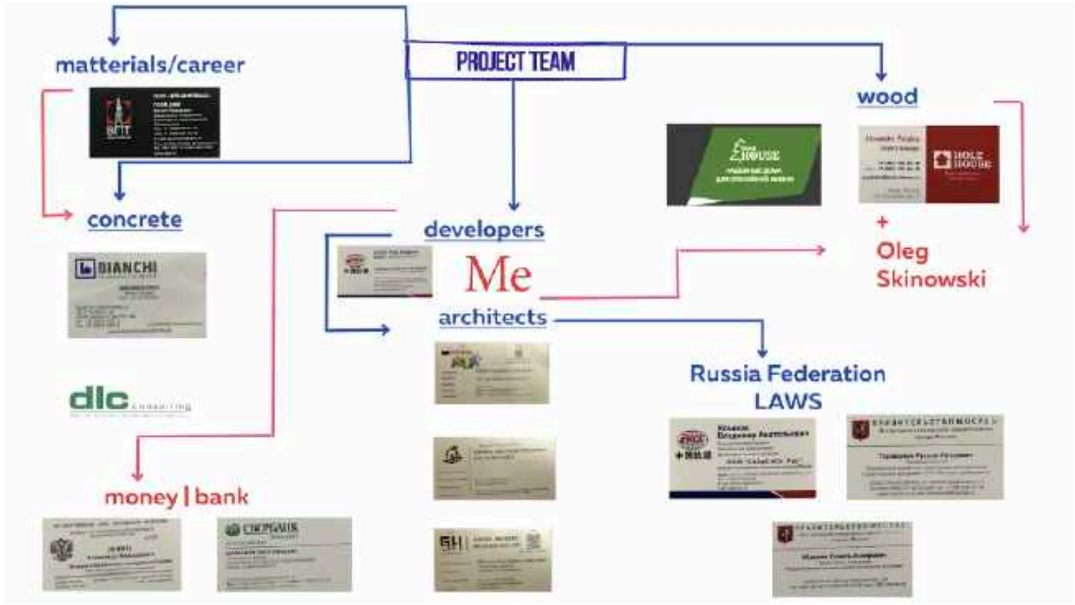
Nowadays the question of ecological construction and the choice of appropriate materials is very acute. As statistics shows - every year the average temperature of the planet is increasing, the amount of emissions into the atmosphere will soon be close to the critical point. At this rate, life on our planet will soon become unfit for humans because of global warming and the destruction of the ozone layer of the atmosphere which protects us from the radioactive rays of the sun.

For many decades there has been a debate about which material is better - concrete or wood. What is more economical and environmentally friendly? What is the development trend of this issue in Russia? What kind of housing requires the population?

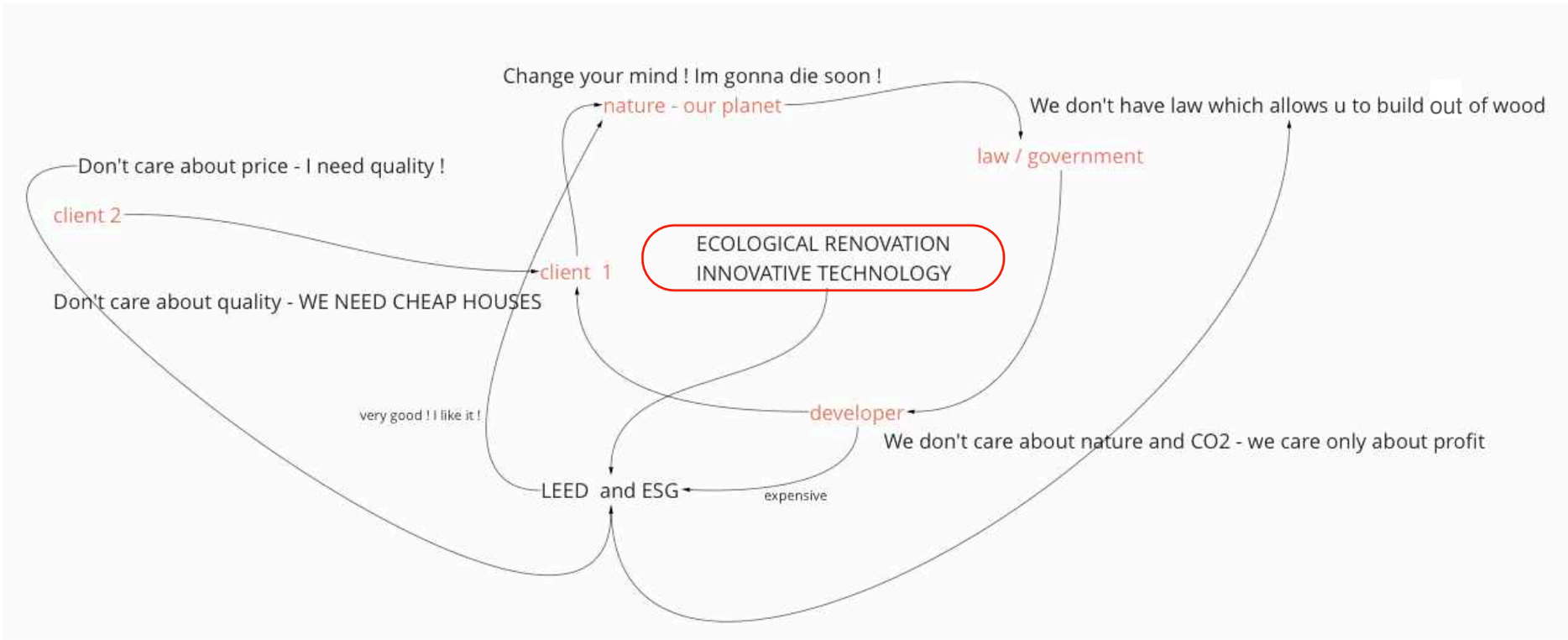
Today the construction of a capital object, a building with one function - residential is no longer relevant. Flexibility and multi-functionality of residential space, a desire for individual design planning solutions, a search for optimal functioning in a complex development with proposals for the original types of planning structure of the areas to be renovated, more systematic zoning of built-up areas - this is the modern demand for urban planning activities, for the quality of the urban environment.

That is why, in this work, I will try to design a prototype of a sustainable residential block that will meet most of the parameters of sustainable construction. I hope my prototype will appeal to the leading builders and interest a large number of people, encourage them to care about nature and think about the future.

To resolve these issues I gathered a team of experts in the field of wood and concrete construction, current architects of today and past decades to better understand trends and trends, people from the government who helped me understand the political aspect in more detail, geologists and developers (the view from the developer and/or land owner).



Visual storyboard of my challenge



Infographics made by author.

The political part.

Within the framework of Russian law, I cannot assert specific things, but as an outside observer, their discussion is possible.
As of today, the situation with housing and the decision-making on the construction of certain objects is as follows:

3A

Visual moldboard of my challenge

3A

B.1 Introduction

The Russian Federation has large forest resources and a need for economic transition towards decarbonization following the sustainability targets of global environmental policies.
In the context of climate change, while reducing deforestation and forest degradation lowers greenhouse gas emissions, forest management can maintain or enhance forest carbon stocks and sinks. Wood products can store carbon over medium and long-term, as well as substitute for emissions-intensive materials such as concrete and steel in the construction sector.

Overall, the aim is to secure the sustainability of forest ecosystem service provisioning and at the same time, maintain economic opportunities and well-being.

There is a need for new, more efficient approaches to forestry and forest management and planning - Climate-Smart Forestry (CSF). CSF is grounded on the concepts of sustainable forest management, with a strong focus on climate and ecosystem services. It builds on three mutually reinforcing components:

- Increasing carbon storage in forests and wood products, in conjunction with other ecosystem services by taking into account related climatic and anthropogenic vulnerabilities;
- Enhancing the health and resilience of forests through adaptive forest management; and
- Using wood resources sustainably to substitute non-renewable, carbon-intensive materials.

The bioeconomy development can play an extremely important role of deep decarbonization in the Russian economy.

The country has the natural resources and human capital to expand the bioeconomy sectors, and thereby reach the national goals of modernization, introduction of innovations, and efficiency improvement.

B.2 Major characteristics of Russian forests

The term «forest resources» is used in many ways in Russian forest literature.

In a wider sense, forest resources refer to forested areas, including all biotic components (plants, animals, fungi, microorganisms) on land as well as their associated features that create forest environments and a broad range of products and services. (Sheingauz and Sapozhnikov, 1983).

Russia has the largest area of forest in the world. Table below shows definitions of important forest land categories.

Forest fund – all land managed by the state forest authorities	**Forest land is further divided into**
• forest land – land designated for growth of forests	• forested area – forest land covered by forest at the moment of the inventory (according to national definition of forest*), and
• non-forest land – land that is either unsuitable for forest growth, or intended for other purposes related to forestry	• unforested area – land designated for forest, but temporarily without forest cover, including burnt areas and dead stands due to disturbances impacts, clear-cuts and regeneration areas as well as sparse forests not meeting the national definition of forest

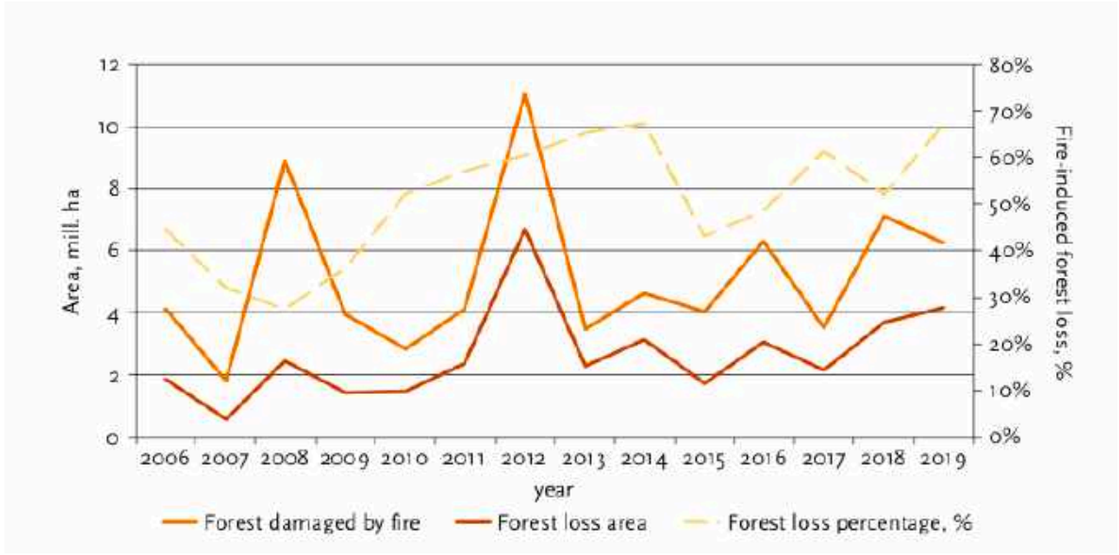
* National forest definition in Russia (following Lesoustroitelnaja Instrukzija, 2018): Forest is defined as land covered by i) forest vegetation including forest stands of natural and artificial origin (with a relative stocking of at least 0.4 for young forests and at least 0.3 for other forest stands), ii) shrubs (where tree species cannot grow due to harsh natural conditions or dedicated shrub farms including willows, nut-bearing, and industrial crops), iii) forest tree plantations in short rotation.

B.3 Natural forest disturbances

Russian forest dynamics are highly impacted by diverse disturbances.

In 2014–2017, ac- cording to the state statistics (Rosstat, 2018), damages in Russian forests were caused by fires (63%), insects (15%), weather conditions (11%), diseases (10%), and other factors such as industrial pollution (~1%).

Analysis of the graph : From 2006 till 2019 forest loss area increase from 2 ha to 4 ha, area of forest **damages*** by fire increase from 4 ha to 6 ha and forest loss in percentage increase from 43% to 66%. Hence, in long term period, rise of price for wooden recourses might be possible.



Multi-year dynamics for forest burnt and dieback area as estimated with **MODIS*** data.

* Damaged forest area refers to the amount of damage that occurred in the year of reporting. The reports consider a forest area as «dead forest» when at least 2/3 of trees in a forest stand are defoliated or when the relative growing stock volume of living trees is below a threshold of 0.3.

* The MODIS sensor detected 8000 to 20 000 fire events annually in 2001–2019

B.4 Forest governance and use - Governance structures in Russian forestry

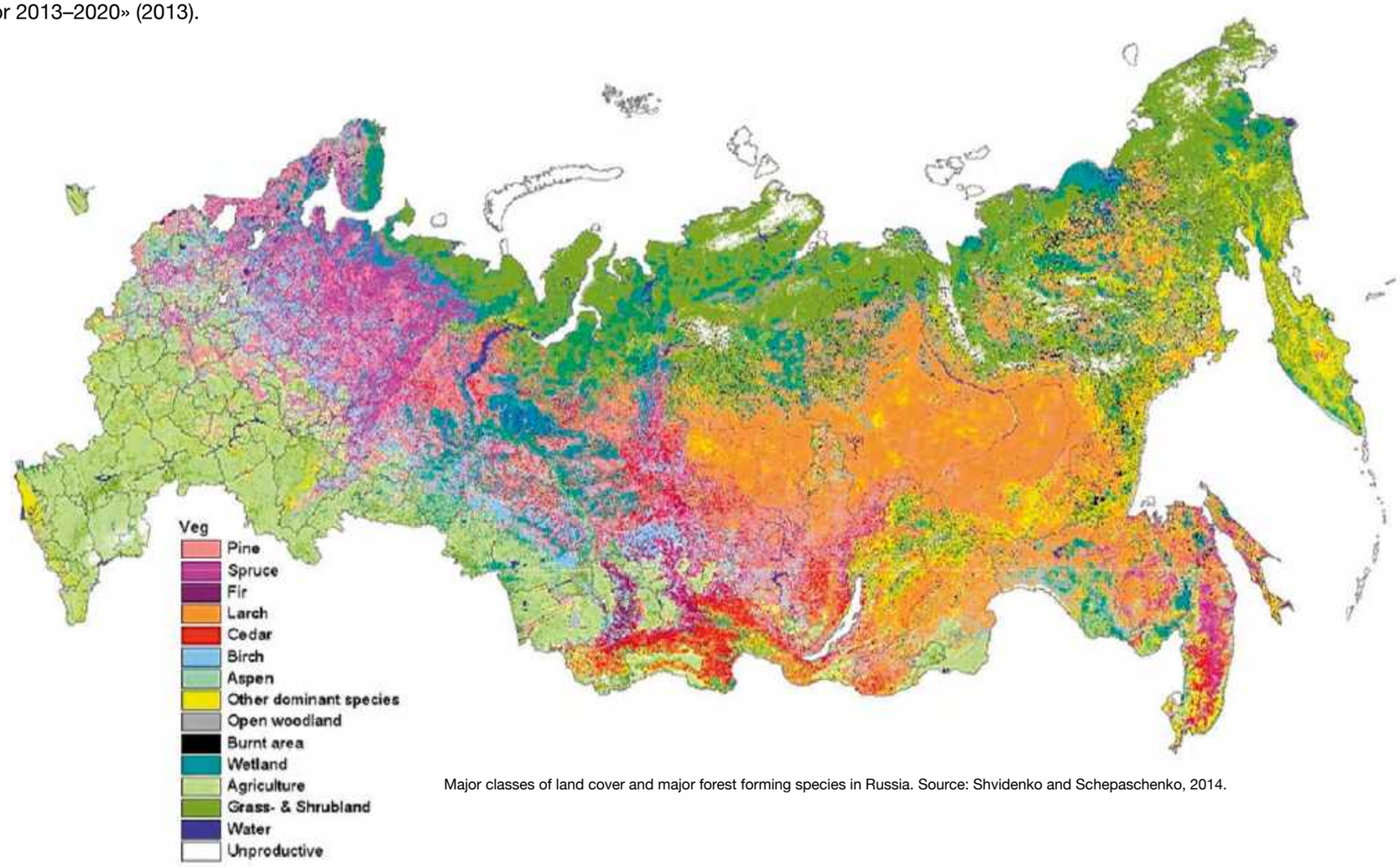
The Forest Code of the Russian Federation (Federal Law of the RF No 119-FZ, 2006) is the main document regulating forest-related matters in Russia. Federal forest legislation has changed several times over the last 25 years, including about 40 amendments of the Forest Code (2006).

State forest management at the federal level is exercised by the Ministry of Natural Resources and Environment and its subordinate body, the Federal Forestry Agency of the Russian Federation. Forest management is decentralized, and state supervisory functions related to forests are transferred to government authorities in 85 administrative regions (subjects of the Russian Federation), which are grouped into eight Federal Districts.

The currently valid strategic forest policy documents include: «Fundamentals of state policy in the field of use, guard, protection and reproduction of forests in the Russian Federation for the period up to 2030» (2014), the Forest Code (2006), the «Strategy for the development of the Russian Federation's forest complex until 2030» (2018) and the State program of the Russian Federation «Forestry development for 2013–2020» (2013).

B.5 Ecosystem functions and services of Russia's forests - Tree species diversity

More than 90% of Russian forests are boreal forests : that means a relatively simple structure and species composition of forests, but at the same time, a huge diversity of growth conditions and forest types. Native coniferous include four genera: larch (35.7%), spruce (10.1), fir (1.9%), and pine, which is divided in two-needle (mainly Scots pine, 15.5%) and three-needle (Siberian and Korean pine, 5.1%) sub-genera. Dominant softwood deciduous species are birch (15.3%) and as- pen (3.1%). Deciduous hardwoods comprise only a small share, but include a significant number of valuable species (oak, ash, beech, maple, etc.).



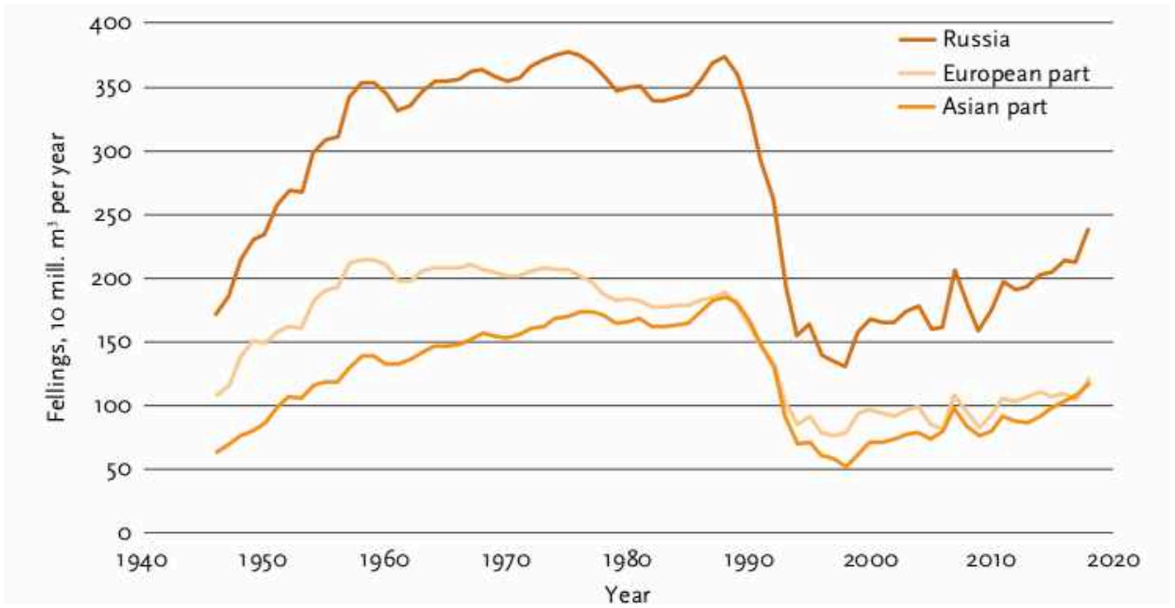
Major classes of land cover and major forest forming species in Russia. Source: Shvidenko and Schepaschenko, 2014.

B.6 Provisioning services of forests – wood products

Historically, the amount of harvested wood has varied in conjunction with political, social and economic changes in Russia (Felling in Russian Federation, 1996; www.fed- stat.ru, 2019). As show below, there was a period of substantial growth (from about 160 to 350 mill. m3/year) during the restoration after World War II (1945–1960s).

From 1950 till 1990 there were pic of transportation wood from Russia to Asian part (China in general). However, from 1995 there were dramatic politic changes in Russian regulations regarding China. President Vladimir Putin in September 2020 demanded a total ban on exports of roughly processed or unprocessed coniferous and valuable hardwood timber from the country from 1 January 2022. This decision hit Primorsky Krai, from which timber is exported to China.

Russia is now systematically switching from exporting round timber to exporting processed (and therefore higher quality and more expensive) timber. According to the «TransLes» think tank, the share of unprocessed wood exports in total logging fell from 24% to 8% between 2007 and 2018. With the most extensive forests in the world, Russia, with 228 m3 per year, is only the fifth-largest logging country after the USA, China, India and Brazil after the Siberian forests. Thus the logging companies in Russia will now only work for domestic producers and builders which will lead to an increased supply of timber and further price reductions in the long term.



The dynamics of wood harvesting in the Russian Federation in 1946–2019. Data source: Official state statistics.

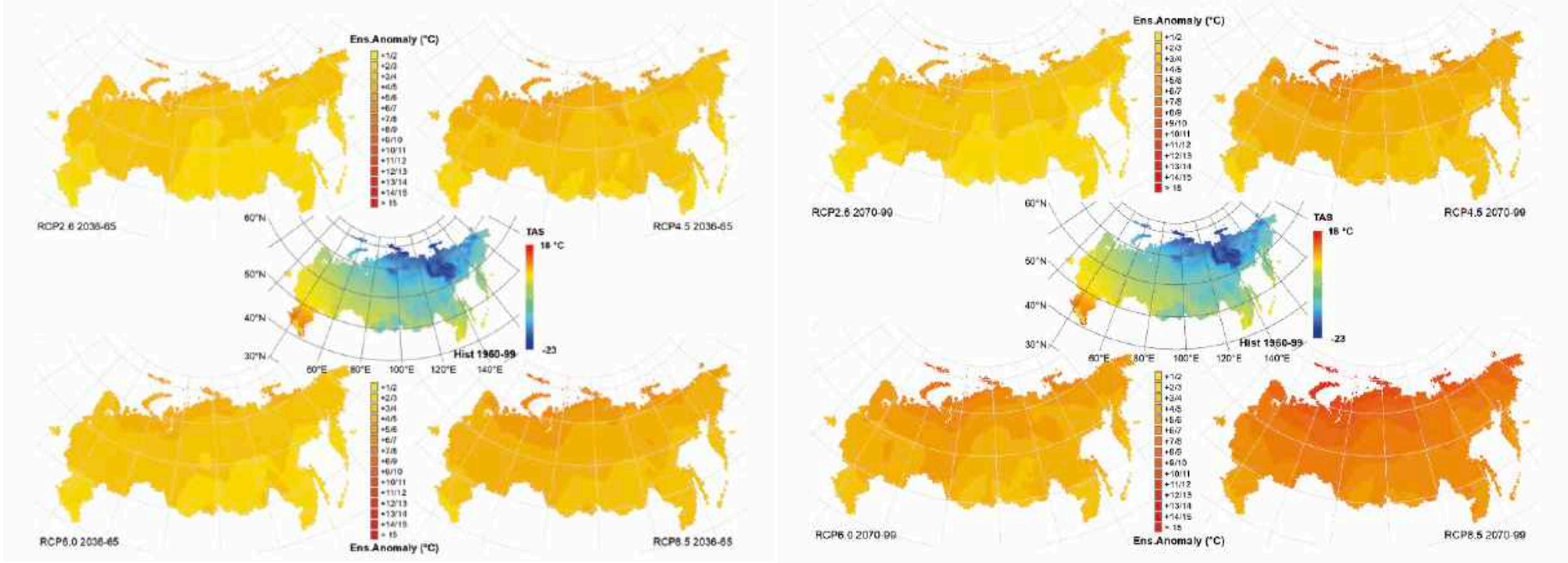
B.7 Observed changes of Russian climate in recent decades

Recent scientifically documented changes in climate have impacts on all climatic features, including temperature, precipitation, wind, and cloudiness. The regional changes can differ from global trends and Russia presents a good example for this, as the average annual temperature anomaly in the whole country has reached about 1.6 °C, which is much higher than the global anomaly of 0.9 °C.

B.8 Climate change scenarios for 80 years

The temperature anomalies show a similar trend to the observed recent past with a consistent warming in the northern and eastern regions of Russia and to some extent in south-west Siberia. All the scenarios of radiative forcing produce substantial warming already in the medium term (2036–2065). The temperature signal is already clear in the recent past observational period and in several Russian regions mean annual temperature increase for 1.5 °C. Besides annual temperatures and precipitation, weather extremes are playing a fundamental role in shaping the response of the forest sector to climate change.

The **IPCC** (Intergovernmental Panel on Climate Change) special report on climate extremes documented for both European and Asian regions of Russia an increase in climate variability in terms of the number of hot days and enhanced hydrological extremes with increasing rainfall intensity, particularly in the central and far east regions.



Mean annual temperature scenarios for the time period 2036–2065 and 2070–2099 for the climate forcing RCP2.6, RCP4.5, RCP6.0 and RCP8.5 following the IPCC terminology.

B.9 Climate-Smart Forestry in Russia and potential climate change mitigation benefits. Approach and general scenario assumptions

Central part of Russia (including Moscow and «Lopotovo» region):

- relatively small forest area
- mostly mixed forests with good growth rates
- intensively managed
- domestically oriented market situation

Expanding forest area	Afforestation on abandoned agricultural lands
Forest regeneration	• Better selection of site-adapted species • Regenerate forests with improved breeding materials
Thinning and cutting regimes	Increase share of thinnings in total harvests
Dealing with natural disturbances	• Reduce emissions from forest fires and insect outbreaks • Increase share of broadleaved species to reduce fire risk
Wood use	**Increased use of wood (construction, furniture)**
Planning	Better spatial planning (logistics, harvesting, protection)

B.10 The role of the bio-economy in climate change mitigation in Russia

As discussed in previous chapters, Russian forests represent a vast carbon stock and sink. In addition, there are several ways in which wood-based products can contribute to a net reduction of carbon emissions. Firstly, there is the carbon stored in the products themselves. The more durable the products are, the longer lasting their carbon storage will be. Secondly, a net carbon reduction could be achieved by replacing fossil-based materials with bio-based, renewable materials. All these components reflect to potential benefits with lifecycle emissions of different products and production systems.

B.11 The link between bio-economy and climate change mitigation

While the Russian economy is heavily dependent on fossil fuels, there is a big untapped potential for energy efficiency improvements and a switch to low or neutral emission energy sources. Forests were considered as one of the key solutions for Russia to reduce carbon emissions by over 80% by 2050 (SDSN-IDDRI, 2014).

Two major objectives are essential for Russian forests to support ambitious mitigation policies:

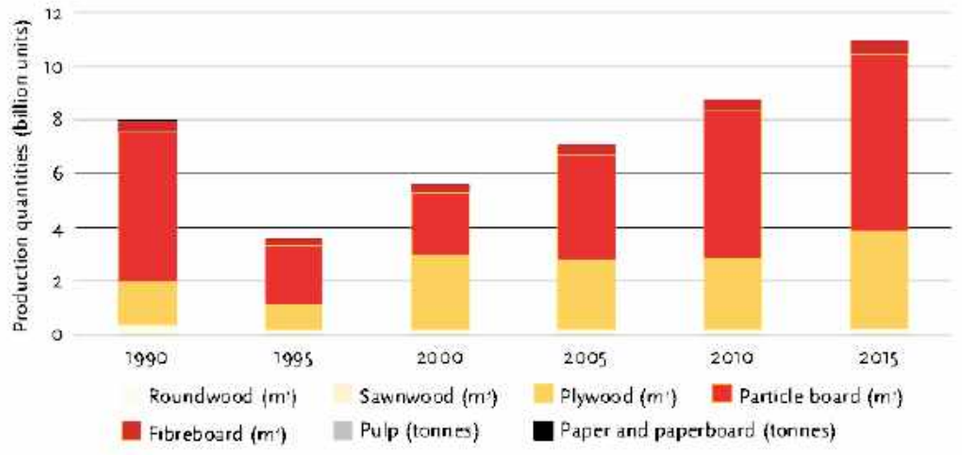
1. To increase carbon sequestration by forest ecosystems
2. To increase the consumption of biofuels, wood construction materials and other bio-based products that could substitute fossil fuels and emission-intensive products.

Low-carbon alternatives dealing with forest carbon sequestration and an expansion of the bio-economy should therefore be attractive for Russia.

B.12 State of Russian forest industry and potential for bio-economy

The dominant branches of the Russian forest industry are logging, pulp and paper, ply- wood, furniture, biofuels, wooden house construction and non-wood forest products, such as resin and tall oil (Government, 2018). Currently, the contribution of the forest sector to the Russian economy is significantly lower than the estimated potential.

The forest sector experiences a number of problems, such as lack of skilled workers due to low wages in the sector, lack of legislative mechanisms to stimulate the construction and operation of forest roads, low investment attractiveness of new industries for processing of wood, and e.g. poor consolidation of logging industry. (Ernst & Young, 2018). However, after the collapse of the 1990s, the output volume of the main types of forest products has grown steadily for most indicators.

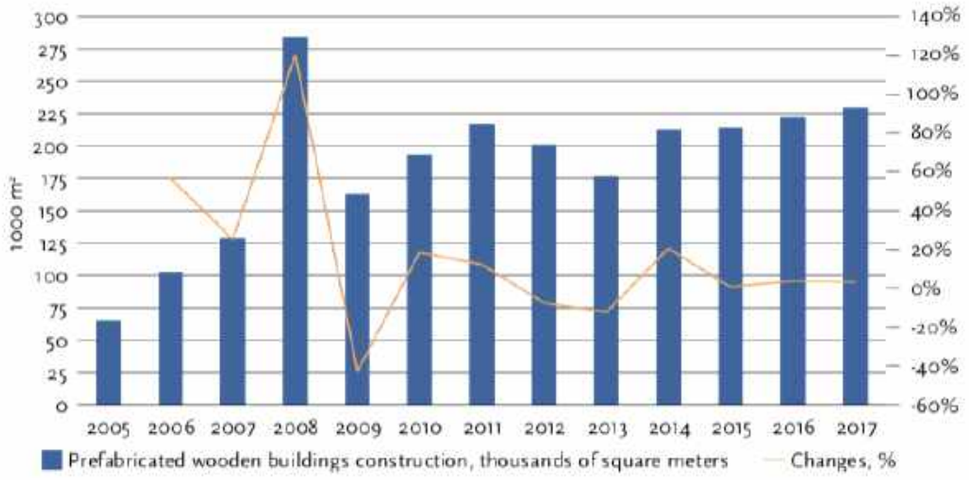


Basic wood products in the Russian Federation, 1990–2015. Sources: Government, 2018; IndexBox, 2016.

According to the graph, from 2005 till 2015 the plywood production quantities in billion units constantly rises and reached the mark in 4 billion units. Leaning on the wood market today I can assume that same trend will continue in the next 20 years according to Russian government political changed in relation to timber construction.

B.13 Wood-based construction in Russia

Wood-based construction in Russia is characterized by low volumes. The share of buildings with wooden walls is around 10% of the total (Federal State Statistic Service, 2019). As shown below , the production of prefabricated wooden buildings in Russia demonstrated steady growth in 2005–2011 and slower growth up to 2017 and might grow till now.



In April 2020, two regulatory documents (“Public buildings with wooden structures. Design rules” (Ministry of construction, 2019a) and “Multicompartment residential buildings with wooden structures. Design rules” (Ministry of construction, 2019b)) were approved, allowing the construction of wooden buildings up to **56 meters high** (about 16 stores).

B.14 Projections for wood-based construction

Table 1 shows four possible scenarios on wood construction in Russia. In the first and second scenario, the wood-based construction as share of total residential construction is based on data in Table 2 below .

Mill.m2	2020	2025	2030
Residential construction in total (mill.m2)	120.0	145.0	170.0
Low - rise	85.5	95.0	105.0
Low - rise wooden	32.8	50.0	69.0

Table 1 - Housing construction in Russia, source : FAO 2012.

Information source and projection scenario	2030	2050
Wood construction based on Russian forest sector outlook study to 2030, and Trent by 2050.	69.0	128.0
Wood construction based on Russia forest sector outlook study to 2030, and growth after 2030 at the rate 5% per year.	69.0	183.1
Prefabricated wooden housing, based on strategy of forest sector development by 2030, and after 2030 at a growth rate of 5% per year.	13.6	36.1

Table 2 - Scenarios of wood construction development by floorspace (mill.m2 / year) in Russia.

Projections presented in Table 2 for the year 2050 very heavily from 36.1 to 183.1 (mill. m2/year). Such a big variation gives evidence that wood construction is at a turning point and may demonstrate fast growth in the future.

B.15 Conclusions

Forest resources

There is no doubt about the global importance of the Russian Federation's forests in terms of forest area, carbon stock, influence on global climate, potential as a renewable resource, as well as biodiversity preservation. Russia has the largest areas of primary boreal forests in the world and only a relatively small fraction of the total forest resources is utilized economically.
Major challenges for the management of the forests are abandoned agricultural land areas and migration of people from rural to urban areas. As the regions are different, there is no one approach that would suit all and regional forest management plans need to be developed further with deeper consideration of region-specific measures.

Climate change impacts, adaptation and mitigation

For the sustainability of Russian forests and its forest sector, it is of high importance to mitigate the climate change impacts and the associated forest disturbance risks. Post-disturbance forest restoration should also get increasing attention.

Climate change and its effects on site productivity, species ranges, and disturbance regimes threaten the forests and its service provision in vast areas. However, disturbances present also a «window» of opportunity to change practices e.g. by adapting the tree species composition to the changing climate and working towards future site-suitability.

Forest management

Forests can contribute to climate change mitigation targets and, at the same time, develop a more effective forest utilization. From the total area of operational forests (approximately 600 mill. ha), only about half is currently accessible. Forest management should be improved to mitigate climate change and to adapt to climate change impacts especially in the European part of Russia and the southern zones of the rest of Russia.

Many forests in Russia are nowadays regenerated naturally, but the use of artificial regeneration (or regeneration that combines natural and artificial regeneration) allows to introduce provenances and breeding material that is better adapted to future climatic conditions.

Enabling environment for a bio-economy

Strong, ambitious and effective climate policies and policy instruments are needed and they need to be implemented with urgency according to global worming and huge emissions of CO2. The development of new/emerging bio-economy markets and investing in new environmentally friendly products based on sustainably produced wood is supported by increased global consumer awareness and readiness, and incentives including government stimulus.

Prominent areas of new/ emerging bio-economy in terms of environmental, economic and social impacts include:

- Major growth potential exists for new wood-based construction technologies such as CLT: for example, if by 2050 new floor space area build by CLT in Russia would be 128 mill. m2, this could lead to 43.9 mill. tons of avoided annual CO2 emissions.
- Substantial amount of wood waste in Russia could be used to substitute fossil coal in energy production.

The forest-based bio-economy has a lot of growth potential that can be important to Russia during the global transition to reduce emissions. Increasing the use of wood in multistory construction can bring significant climate change mitigation benefits when **replacing** fossil counterparts such as concrete, steel, polyester and nylon.

Such development of bio-economy would require strong political will, suitable legislation, new investments to forest-based industries, and increased awareness of consumers. In addition, relevant legislation should be preceded by the development of a circular forest bio-economy strategy adopted by all stakeholders.

Introduction

Earlier we discussed the positive prospects for the development and consumption of wood as the main building material for construction.

But as is usually the case, there is a second side and perspective in the development of the concrete industry.

In this section I will try to consider not only the new way of building concrete houses from 150 m2 to 500 m2 (demo vide attached) , but also new materials - **trepel and warm concrete.**

For a visual demonstration of the new construction technology will be given examples of Lego cottages construction. My Italian colleagues were directly involved in the creation of new technology construction, which allowed to reduce the construction time from 3 months to 10 days (my interview for Moscow 24 channel) and, accordingly, to reduce carbon dioxide emissions during the construction.

Italian colleagues

Mr. Bianchi - head of Bianchi Italy company

Mr.Dallago - head of DLC Italy company

Concrete renovation in Russia - 5 different iterated versions of concrete villa

3C

In order to adequately address the issue of sustainable housing (villas) I needed to create 5 different options for villas that could be created from concrete slabs. As these houses are in the premium construction segment (separate plot and individual construction) it was very important to choose the shape of the buildings and the layout of the different areas inside - kitchen, wet areas, balconies, bedrooms, etc.

After creating and discussing these designs, one option of a 150m2 villa was chosen as the starting point for further work on the project.

Each project was made by author in ArchiCAD22.

Project N1.

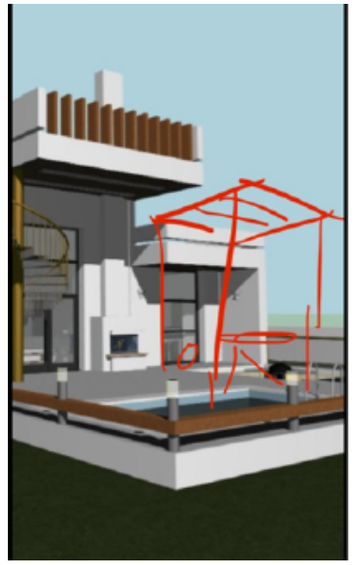
Each project involves panel construction and the use of architectural concrete, which will allow you to make different decorative elements that are not possible with wood.

Concrete renovation in Russia - different iterated versions of concrete villa

Project N2.

The main mistake in those examples - multiple different elements which will be difficult to produce on one factory

The solutions as to combine all 5 tapes to one and draw the exact design according to defined elements : slab , tegolo, trave , fondant and latrina.



Drawings with remarks.

Each project involves panel construction and the use of architectural concrete, which will allow you to make different decorative elements that are not possible with wood.

Concrete renovation in Russia - different iterated versions of concrete villa

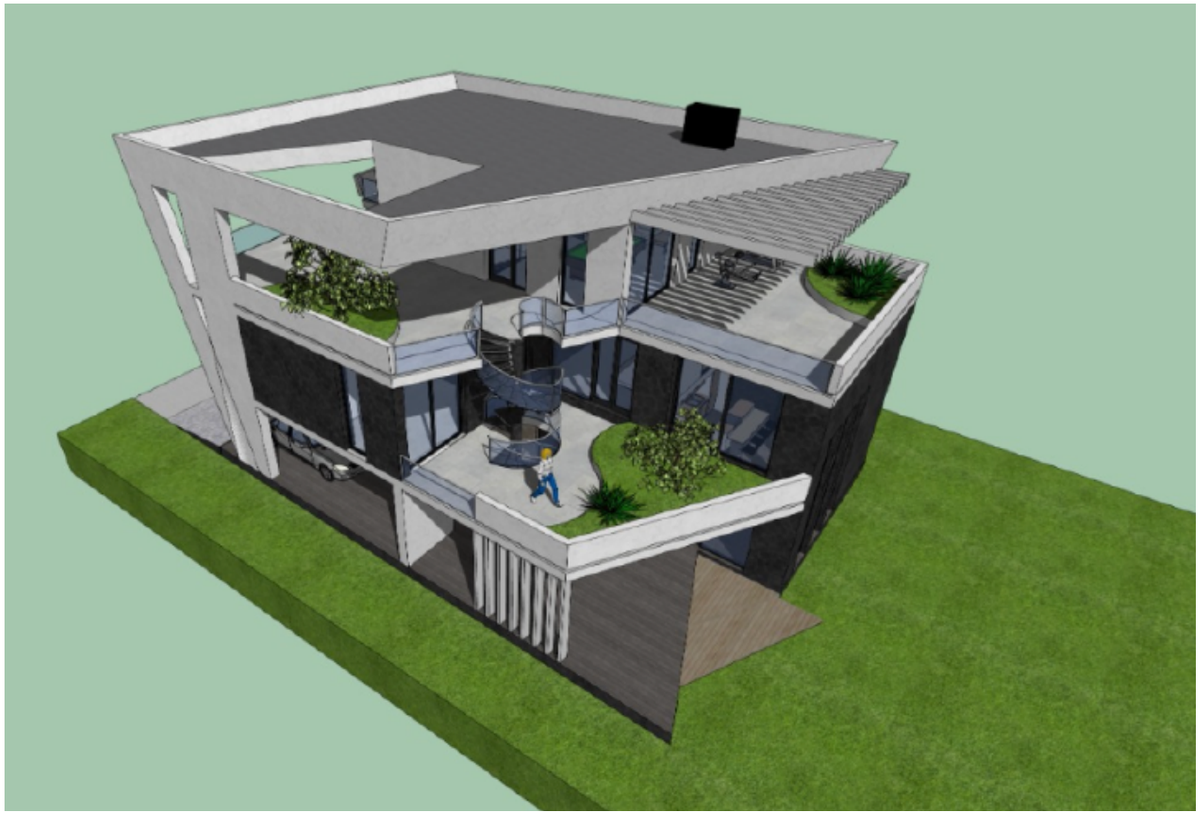
Project N3.

Each project involves panel construction and the use of architectural concrete, which will allow you to make different decorative elements that are not possible with wood.

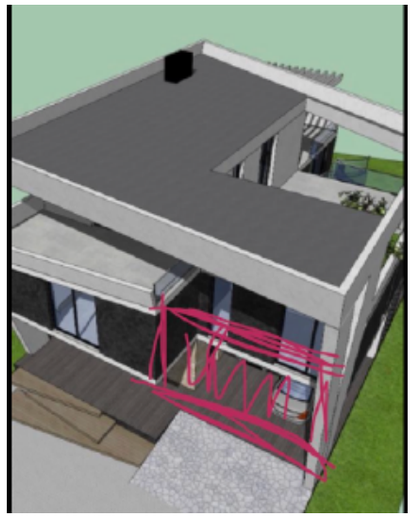
Project N4.

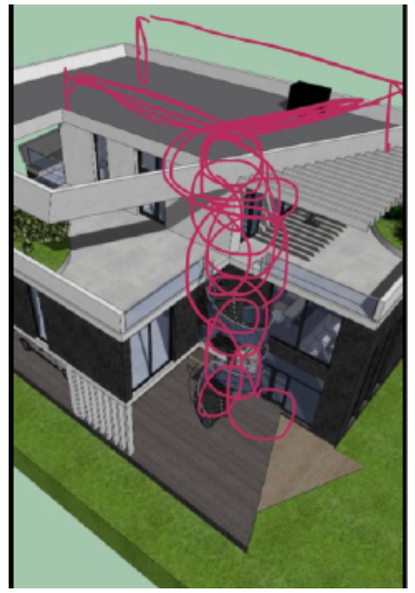
Each project involves panel construction and the use of architectural concrete, which will allow you to make different decorative elements that are not possible with wood.

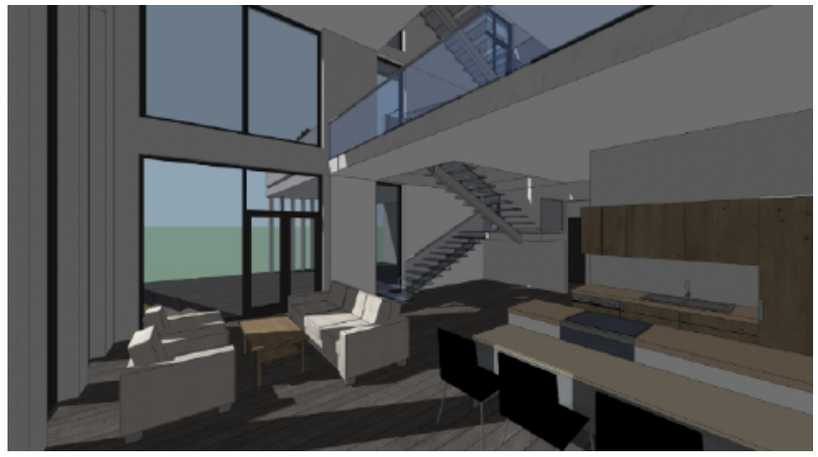
Concrete renovation in Russia - different iterated versions of concrete villa

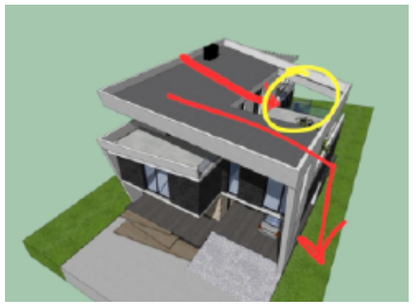


Project N5.









Drawings with remarks.

Bad example:

1) More than 13 elements
2) Difficult roof structure
3) Hard to produse
4) No records in terms of Russia climate conditions (snow on the roof = big problem)
5) No outside staircase
6) A lot of concrete

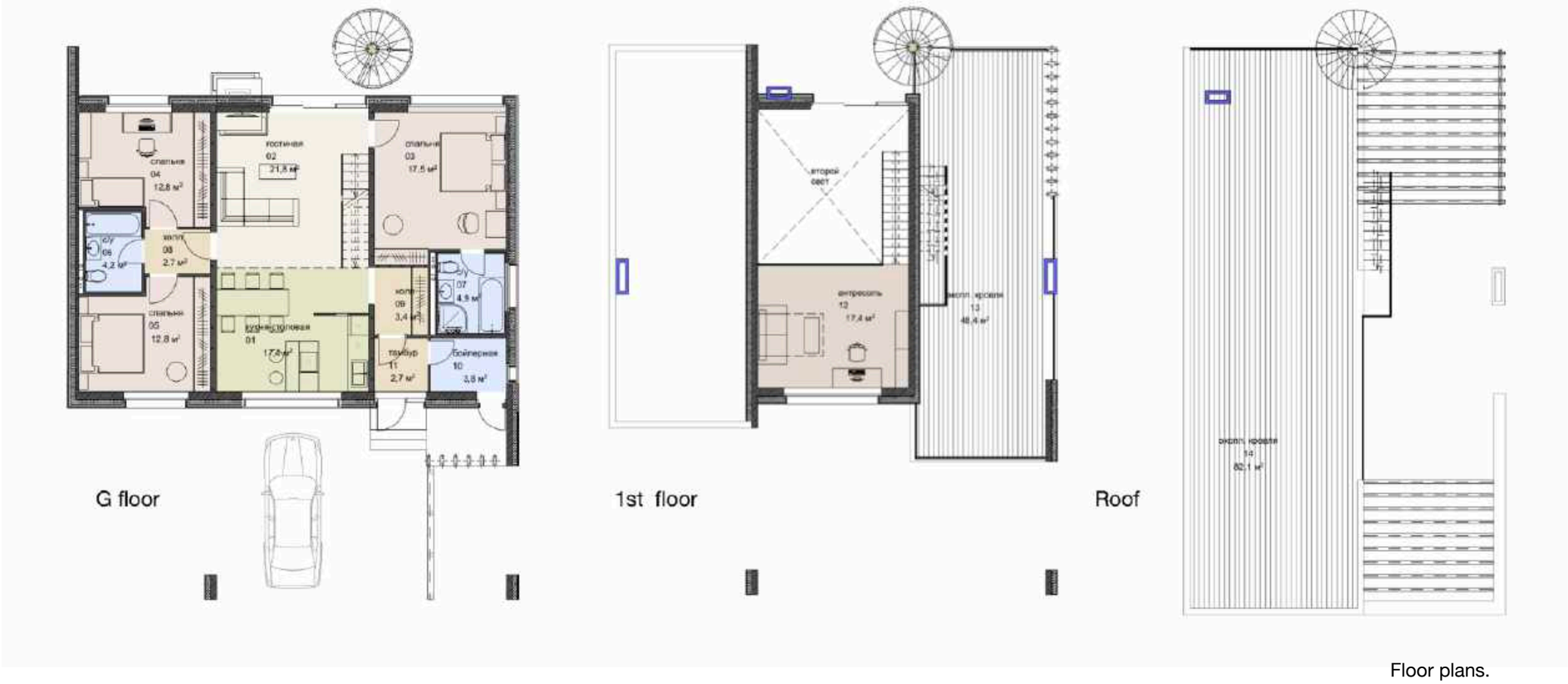
3C

Each project involves panel construction and the use of architectural concrete, which will allow you to make different decorative elements that are not possible with wood.

Evaluation and solution

I DECIDE TO COMBINE - sketch 1 , 3 and 4 according to mentioned remarks. The main structure states the same but the superstructure and some face elements were constant as - outside staircase, operated roof and BBQ zone with swimming pool.

Developed visualization of concrete house of 150m2.



Floor plans.

Evaluation and solution

Accumulated experience in industrial construction
apartment buildings allows our company to apply the idea of unification of building structures made of prefabricated reinforced concrete or small- piece materials to create various planning solutions for individual houses, with a range of areas from 100 to 500 m2.

When creating an architectural appearance, we relied on the latest trends in world architecture and experience in the development of industrial production.

MODERN, PRACTICAL, ORGANIC
- the basic principles of organizing the internal space of the house.

FAST, QUALITATIVE, COMFORTABLE
- this is our idea in the implementation of structural solutions of the building.

Elevation plans.

Link for video : **https://youtu.be/p0ux0pTmeaA**

SCAN ME

Joint Project Implementation Plan - parts of our agreement

1.1. PLANNING AND COORDINATION
DLC Consulting will present within 5 days from the date of receipt of the order its execution program, indicating the name of the managers of the project.
Similarly, Anastasia will indicate the name of the persons to be referred to whom will support the project planning. The same person will also have to countersign the benefits in the economy and the attestations of the execution of the different activities.
The modifications that can occur during the execution of the work can change the conditions and the final timing of the job, so it is necessary that, after initial approval, every request as well as any variation/deviation from the plan will be formalized in written. The person in charge of management has power of analysis for the development of the project.
He will also be appointed to sign the end of the different phases of the project.

1.2. ACCEPTANCE
Following written communication from DLC Consulting, in which the work is declared completed, the parties will meet within 10 working days from the communication, in order to make the checks deemed as necessary to accept the regular execution and completion of the work, as established in the order.

(…)

11.2
DLC Consulting and Anastasia undertake to collaborate in good faith with the aim to solve any dispute that could arise from this agreement. In case of disputes concerning the interpretation, execution or termination of this agreement, which could not be friendly solved, DLC Consulting and Anastasia provide that the resolution of the disputes shall be held in international arbitration proceedings based in Switzerland (in the Lugano forum), with a Tribunal composed by 3 (three) arbitrators nominated in accordance of the international standards. The arbitration will be held in Switzerland in English.

10.3.
During the arbitration proceedings the terms and conditions of this agreement shall be fulfilled from both Parties except for matters concerning the dispute.

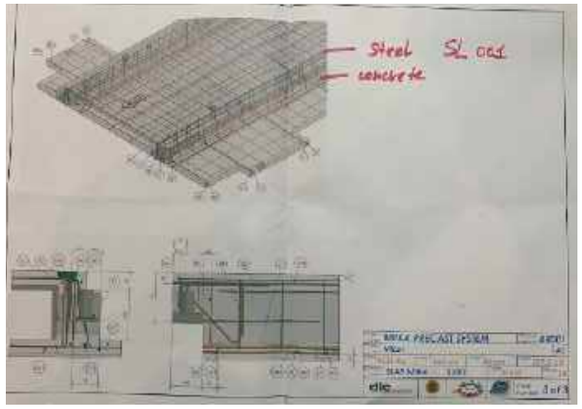
Developed design of concrete house for 150m2 - visualization based on my archiCAD drawings.

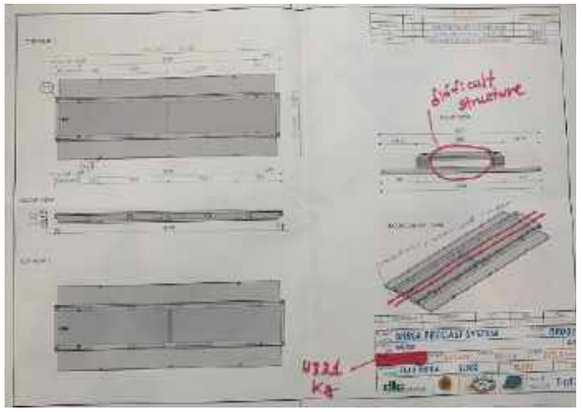
Italy - DLC studio

After the contract between me (as the customer) and the company DLS (contractor), we will begin to work and lay out the selected cottage 150m2 in parts to facilitate the construction and creation of floor panels.

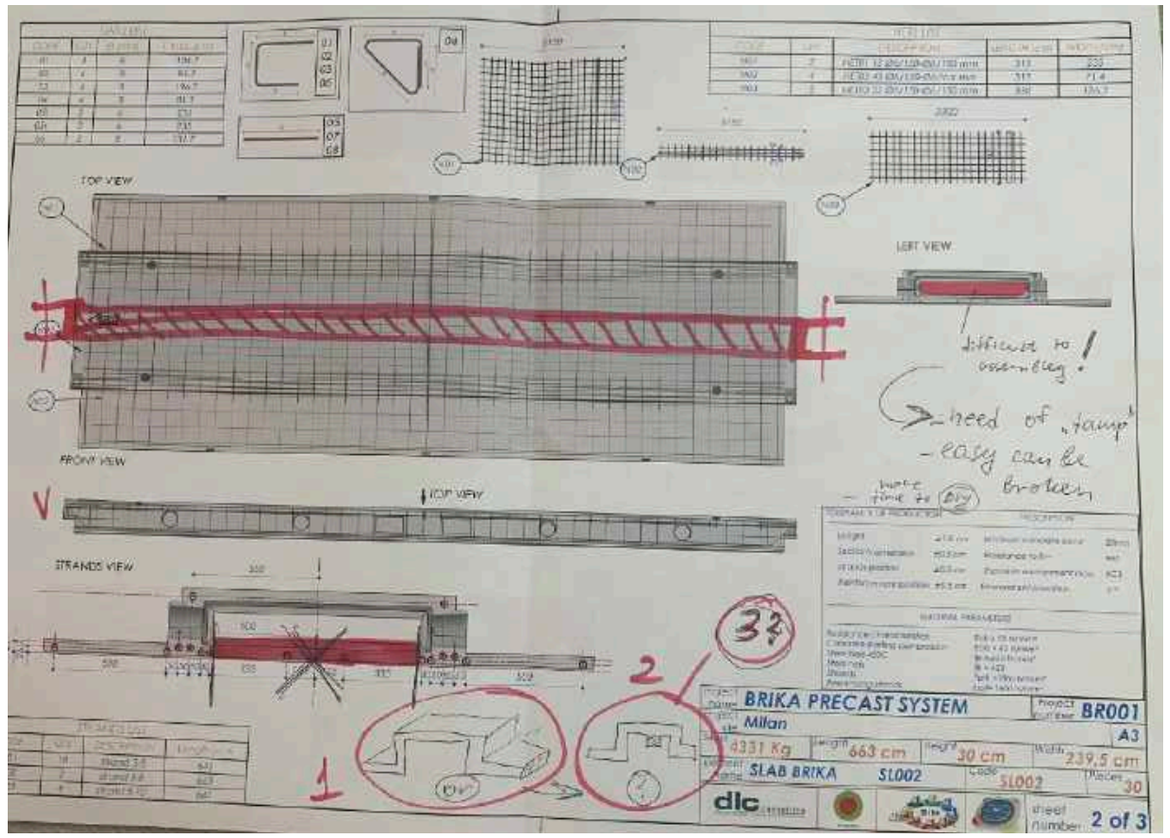
Already at the first meeting, I was detected deficiencies in the floor panel that I was offered by the Italian company. It was clear that the Italian company had already used this panel in previous projects and decided, in order to reduce time and minimize costs, to offer me the same.

The submitted drawings were corrected and our further joint work was aimed at finding new building materials and the division of the selected cottage into 5 elements, which I had previously submitted made of Lego.





According to precast drawings at the first meeting we have noticed few mistakes in precast concrete panel.

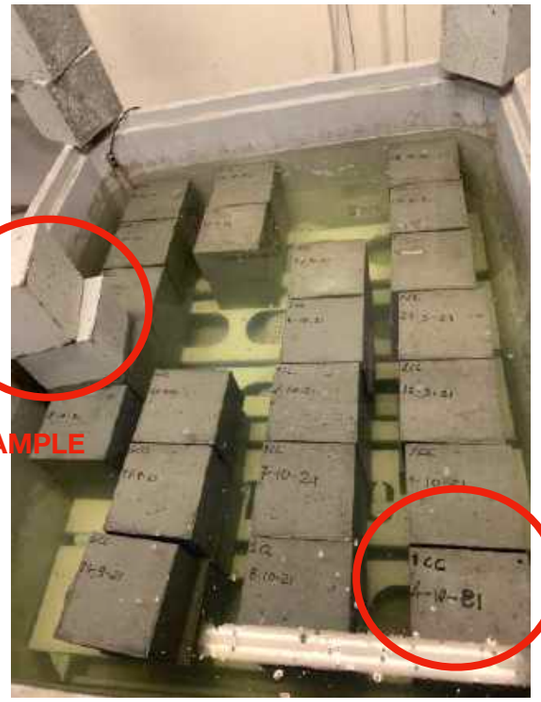


As a working platform were taken previous drawing of DLC precast panel.

Collaborative work should brings the new technology and detailed drawings of precast structure (firstly mentioned as wooden) to small villas from 1-4 floors max.

According to my previous challenge about wooden skyscrapers I understood that : WOOD IS NOT SUITABLE FOR WHAT IM LOOKING FOR

3C

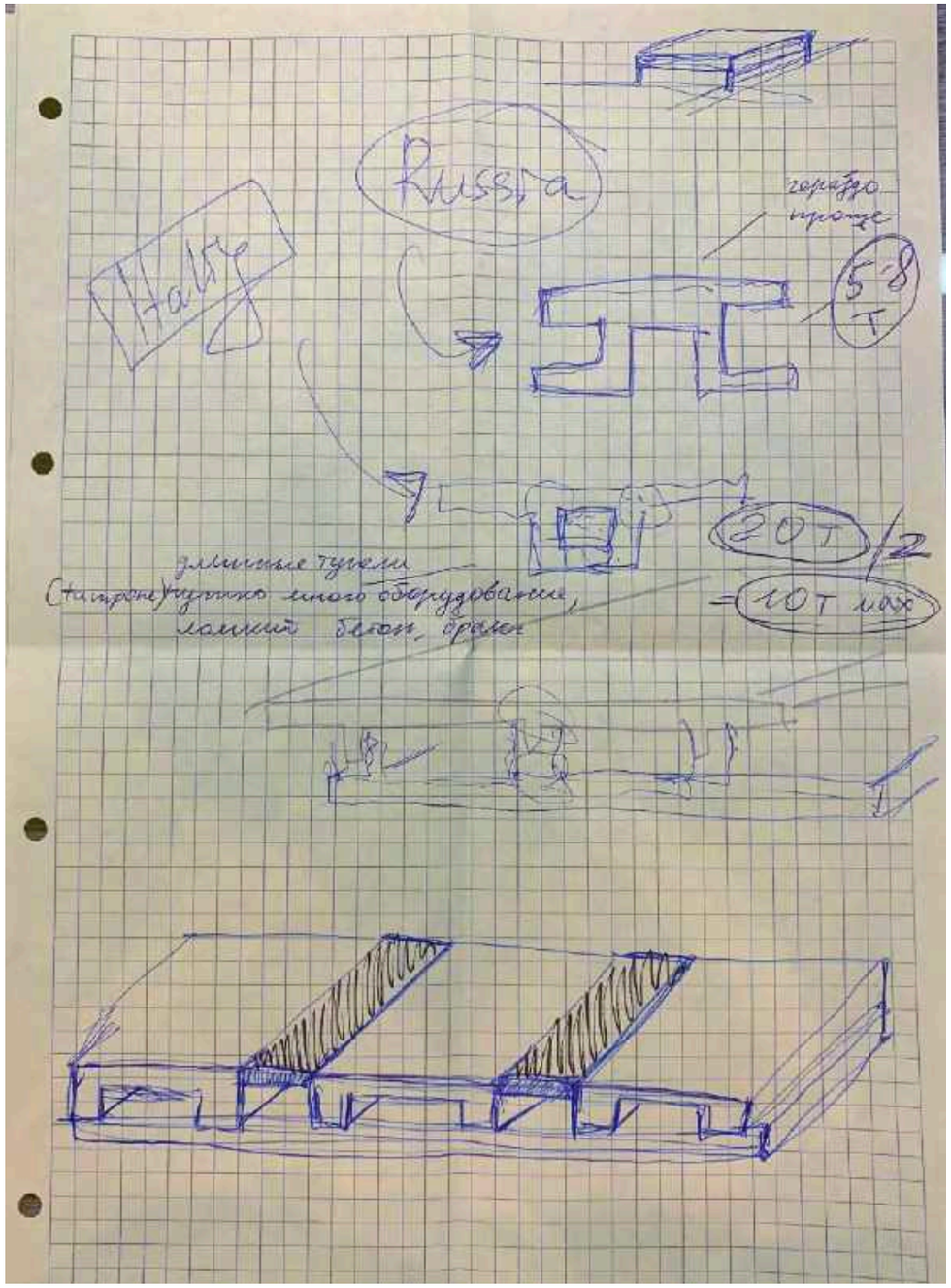


MY EXAMPLE

MY EXAMPLE

CHECKING THE STRENGTH IF CONCRETE IN WATER +10 DEGREES

PRESTRESSING THE CONCRETE

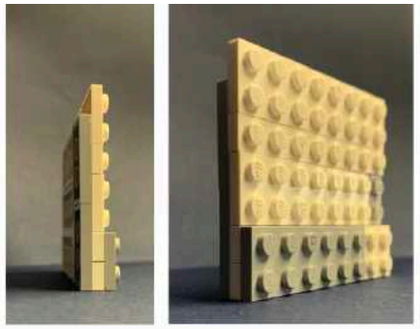


Sketch by author - future panel.

By using 5 different elements made out of lego I have divided chosen villa to achieve formula represented below :

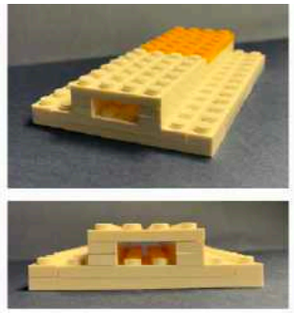
SIMPLE = FAST = SUSTAINABLE = NEW

1



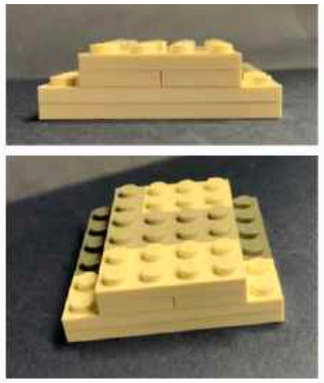
FONDATION

2



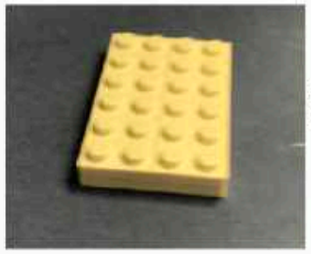
TEGOLO

3



TRAVE

4



SLAB **AND** EXTERNAL WALLS

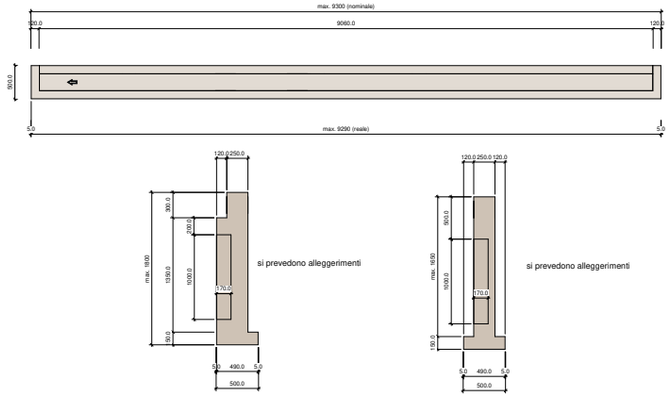
5

LASTRINA

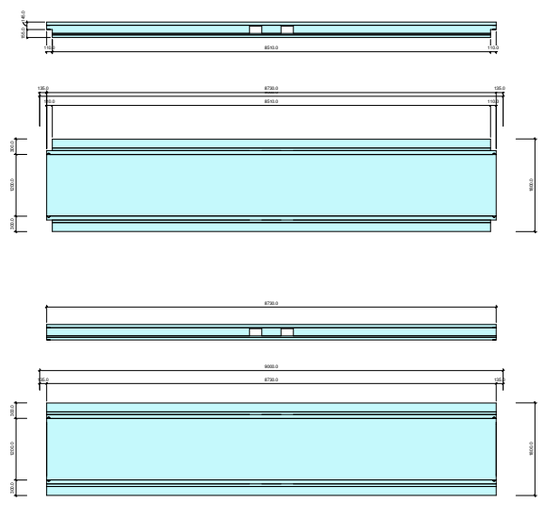
Lego model made by author.

Computer version of 5 Lego elements presented by an Italian company

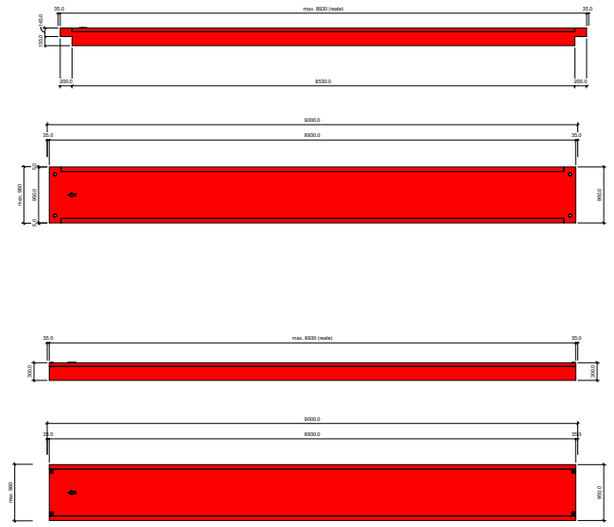
1



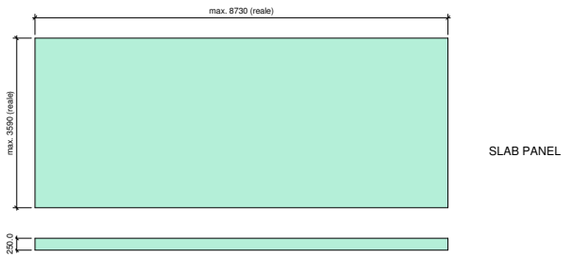
2



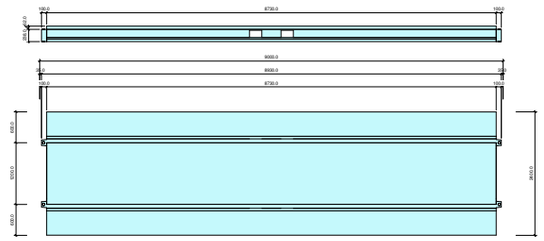
3

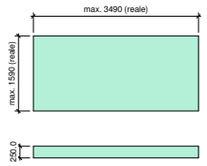


4

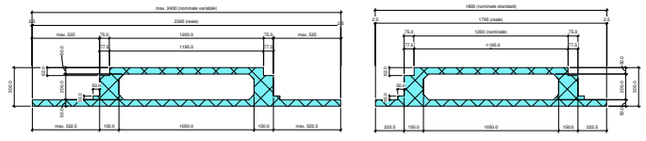


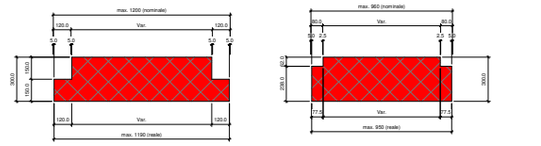
SLAB PANEL





BALCONY





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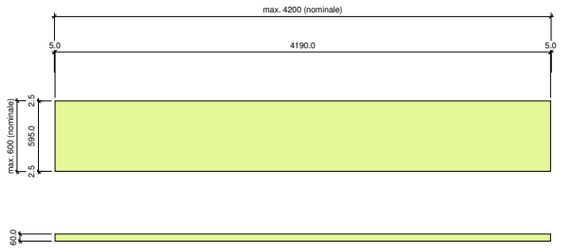
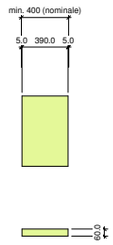
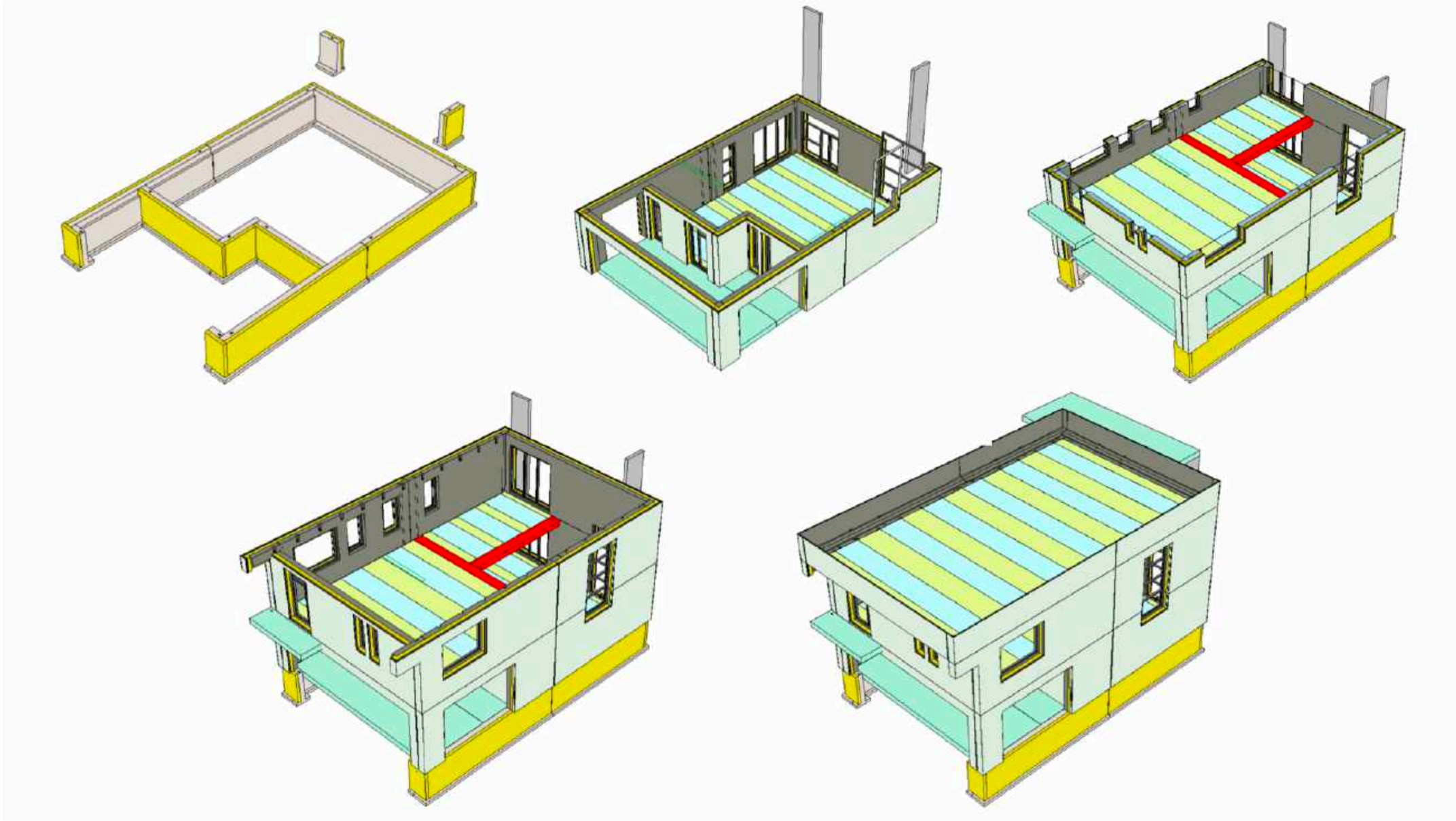




3C

Computer version of construction process and layout for components



Interview for Moscow 24 channel

Link for video : **https://youtu.be/Epyyd__QxtA**

Innovated house technology with allowed developers to build the house in 7-10 days!

3C

In view of the persistent notions that concrete is harmful to the environment, I began to look for alternatives to this material. Today there are many materials that belong to the cement-containing materials.

Accordingly, it is very important to understand for what kind of construction will be used this or that material. This paper will present 2 possible substitutes for concrete and iron-concrete: **warm concrete* and trepel***.

The raw material, zeolite (trepel), is a sought-after, environmentally friendly fertiliser, used in the construction industry for the production of cellular glass, commercial and aerated concrete. The demand for this product greatly exceeds the available supply at the moment. Our products are intended for the mass markets inside Russia, and have serious export potential.

***Warm concrete** is a concrete mix, in which polystyrene foam granules are added, which significantly increases the strength and thermal resistance of the building material. Structures made with this type of mortar do not require additional insulation.

***Trepel** - cracked ash is an active hydraulic additive used in the production of Portland cement and Pozzolanic Portland cement. Trepel is also used in the manufacture of bricks used for thermal insulation of walls and filling the frames of buildings.

Warm concrete - photo made by author.

Warm concrete characteristics

Preparation of ultra-lightweight concrete (UB) based on special technology using low density glass granulant (LPG):
- Bulk lightness of less than 100 kg/mÇ (produced by firing technology from siliceous sedimentary and volcanic rocks).
- strength up to 10.0/mPa.
- thermal conductivity coefficient λB1=0.17W/(m°C).

High technological and durability indices of UB on PSG provides possibility of its application in single-layer panels (for example, for Moscow region the thickness [of panels or wall stones] will be 500 mm. In a variant, for the use of single-layer panels in the cottages - the material can be used in foundations and wall panels, both internal and external. In addition, we consider the possibility of using UB material for the production of cottage foundations (subject to the use of blown waterproofing and without additional insulation).

My suggestions for inclusion in the cottage design:

Apply UB of PSG in foundations, walls, partitions, sanitary cabins, external floor slabs and boarding.

The panels shall be assembled in segments.

Density, kg/m3	Concrete nominal class
400	B 1,5
500	B2,5
600	B3

Warm concrete - photo made by author.

1) Concern: Strength

It is declared that the strength (assuming on cubic specimens) for warm concrete can be up to 10 MPa. As reported in Eurocode 2 (also valid and in phase of harmonisation in Russian Federation), the minimum cubic compressive strength to be considered is 15 MPa for Low Strength Concrete and 20 MPa for Normal Strength Concrete.

Moreover, the declared resistance class of the suggested concrete is maximum **B3**, which in Russian regulations typically means that concrete has a characteristic cubic compressive strength of just **3 MPa.**

Even if it could gain up to 10 MPa, the fact that it is not a structural concrete, would mean that the current assumptions for the behaviour of reinforced concrete would not be valid anymore. This has to do with concrete behaviour and steel bond. Alternative formulations may be found, but after a comprehensive experimental programme which would take time, money, and an effort which is probably not worth.

2) Concern: Thermal performance

It is declared that, for the classes described (up to B3), the thermal conductivity coefficient λ is equal to 0.17 W/(m°C).

This value is about 4 times higher than traditional insulating materials available in the market. This means that, in order to compensate the thermal efficiency of a typical insulating layer of 150 mm having λ = 0.04 W/(m°C), the thickness of the warm concrete should be at least equal to 150*0.17/0.04 = **638 mm**.

Conversely, a thickness of warm concrete wall of 500 mm would correspond to the thermal performance of an insulation layer having thickness equal to 500*0.04/0.17 = 118 mm.

3) Concern: Added mass

It appears evident from the information received that the density of warm concrete is variable, and that it increases with the strength.

Assuming a density of 600 kg/m^3, associated to a strength as low as 3 MPa, the wall 0.5 m thick would weigh 600*0.5 = 300 kg/m^2. Assuming the equivalent thickness of a traditional insulation material (0.12 m, as calculated above), with density ranging from 30 kg/m^3 to 100 kg/m^3, even employing a high-density insulation material weighing 78 kg/m^3, as the rockwool employed for external insulating coat as suggested in the official website of Rockwool company, the weight would be 78*0.12 = 9.4 kg/m^2, **which is 32 times less.**

The use of a **normal insulation** material coupled with structural reinforced concrete would help much in reducing the total weight of the wall panels, facilitating their handling in the factory, their transportation and their assemblage.

4) Concern: Structural connections

All structural connections would need to be redesigned and conceived, since they are employed in normal strength concrete. Unfortunately, it is currently unknown how the connection systems would need to be redesigned in a concrete with such **low strength.**

Testing the strengths of concrete.

5) Concern: Production time and procedure

Normal strength concrete of good quality **(like class B45 or B50**) is normally employed in precast construction also due to their rapid development of strength, which allows to fit with fast production lines where hardening and curing should last from 6 to 12 hours to the maximum, after which the element is removed from the metallic mould and the production chain can proceed with the next element.

The higher cost of good quality concrete gets compensated by the **reduced curing time** and by an enhancement of the **production speed.**

Currently, no information is available about the h**ardening process of warm concrete**, and serious concern is moved towards the process of remolding, the minimum strength it should have at the moment of lifting, and its hardening speed.

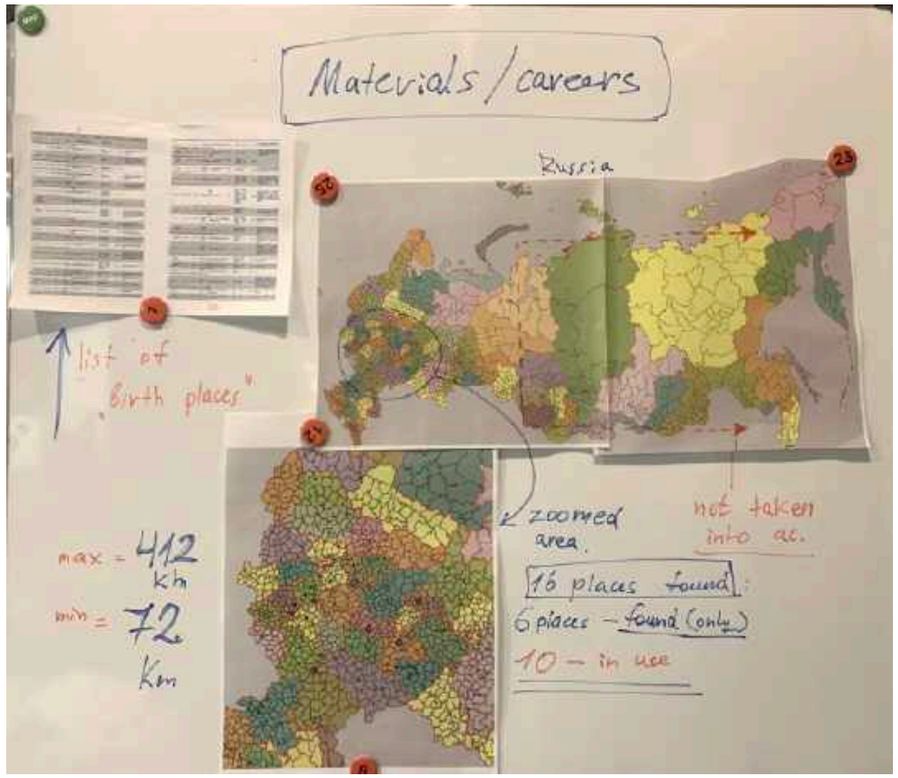
6) Concern: Discontinuity of finishes

As a final remark, the **finishes would be discontinuous**, meaning that the external and internal surface of the walls would be much different from that of the slabs: in the internal environment, where heavy-duty prestressed slabs are employed in order to limit weight and control deflection, the concrete needs to be of the higher quality of normal strength class, which is characterised by a nice-looking finishes effect which would however look much different with respect to that of another concrete class, especially so different as the warm concrete is supposed to be.

The use of a common finishes employing lightweight insulation coating with plaster/falsebrick/timber boards finishing would make the whole exposed surface more **homogeneous.**

In order to move forward in my search for new materials I turned to an oil company I know -NEO GEO. The company not only produces oil but also explores new mineral deposits. Valery Recrutin - geologist, told me about all possible natural resources deposits that I could use in future as an architect.

Valery Recrutin -The company's leading geologist, who interviewed me and together we mapped mineral deposits all over Russia.

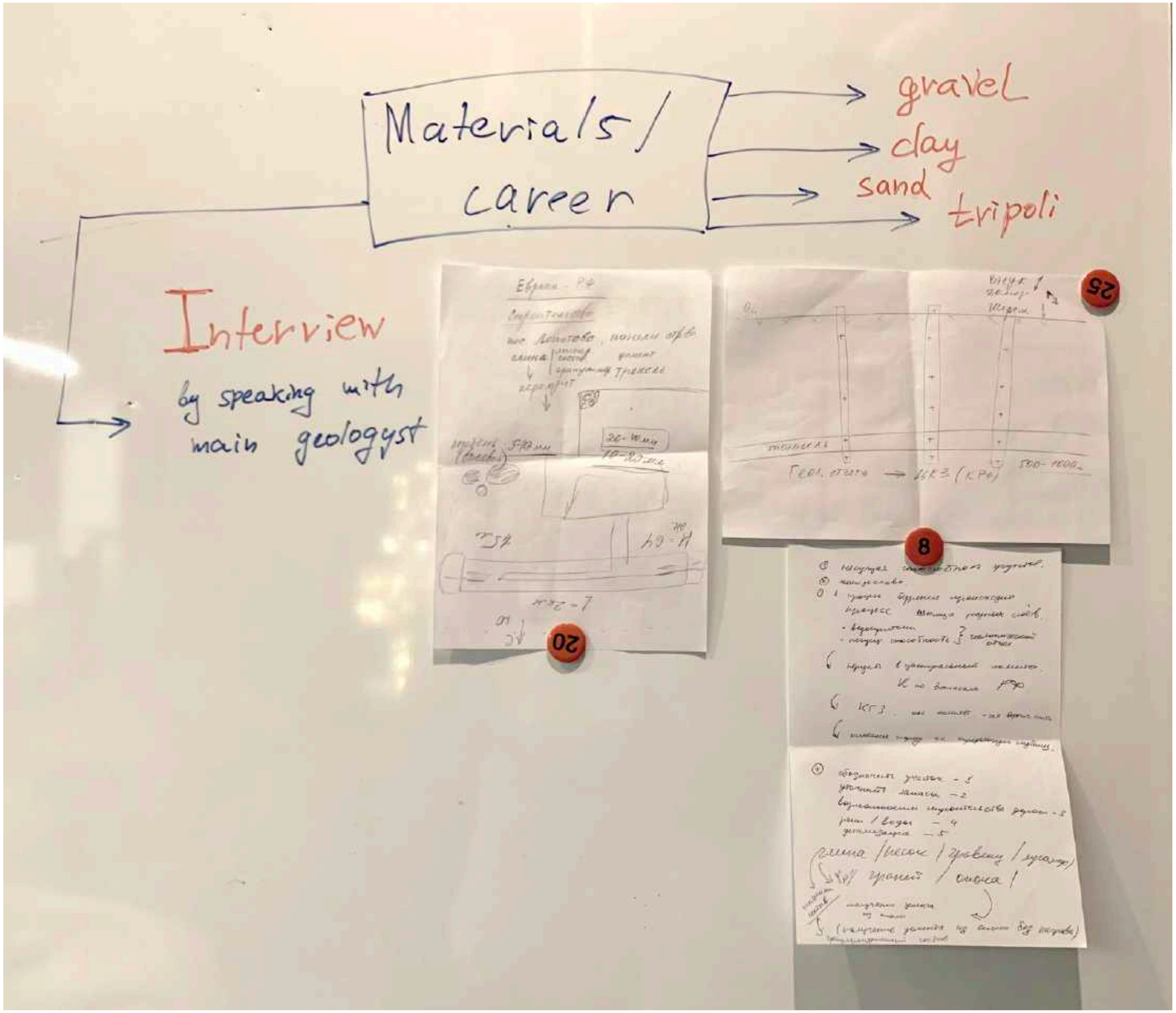


We have made a map with bullet point and after analysis, I set up the physical model.

Red - trepel (mineral consist of silicone and clay)

Blue - chalk

Green - clay



Interview with Valery Recrutin - results.
Photo taken by author - whiteboard with collected information.

Problem today

100% of the housing being commissioned today has a multi-layer wall construction using short-lived, hygroscopic and fire-hazardous insulation, and in 20 years will require an overhaul with replacement of the façade system and insulation.

If the service life of a building envelope is 20 years before its envelope is overhauled, there is no point in buying such a house on credit - it will physically depreciate faster than the loan is paid off.

Solving ways :

One-layer building envelopes with a thickness of 0.5 m (panels, blocks, monolith). 0,5 m (panels, blocks, monolith) of light structural and heat-insulating cellular concrete (LCTB) D500 B3-3,5 on ultralight closed-porous glassy aggregates.

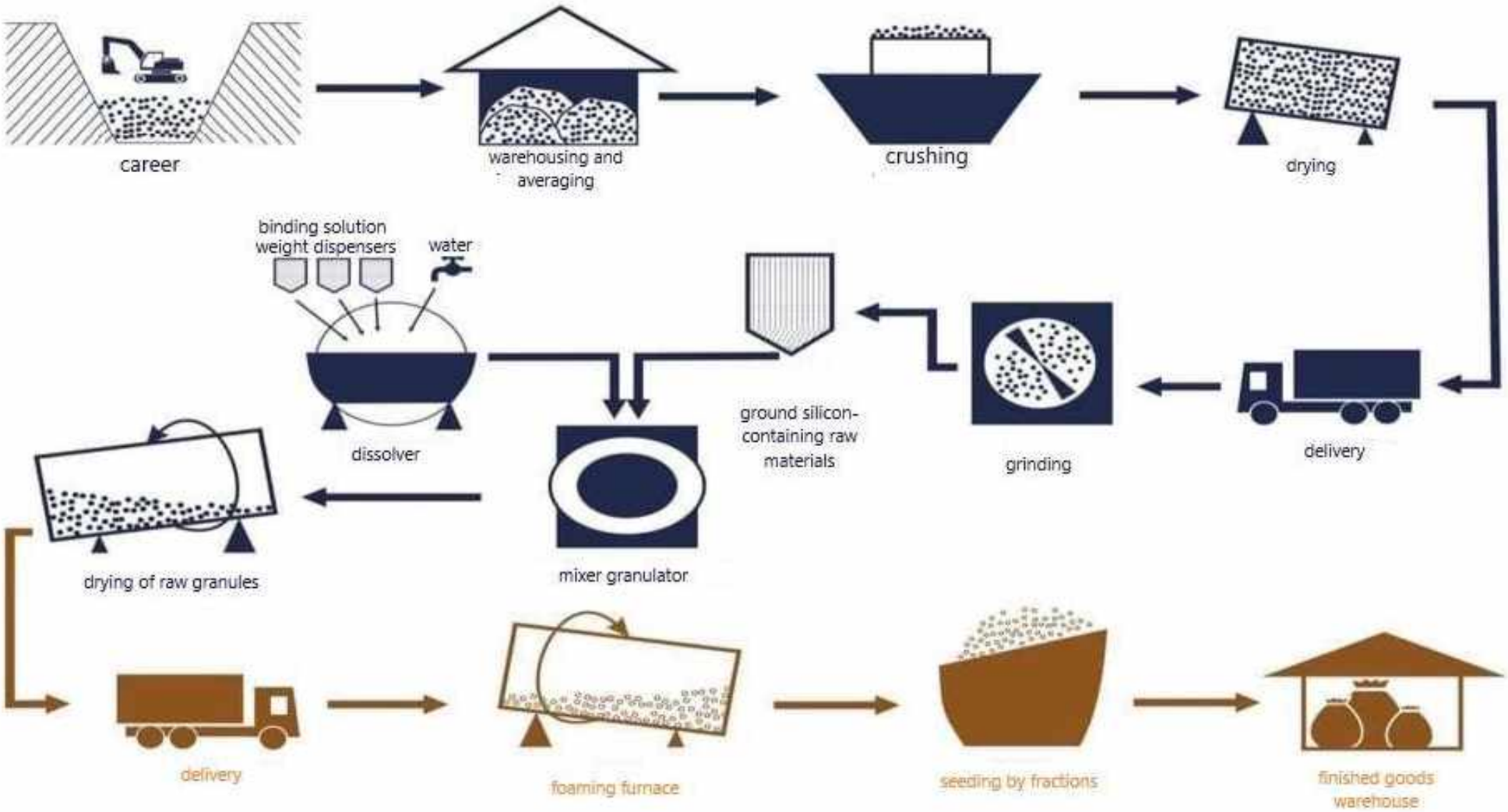
Glassy aggregates:
1) Granulated cellular glass (CCG, cellular glass granulate)
2) Granulated cellular glass ceramic (GGC)

Glass foam ceramics is a closed cell cell cellular material based on silicate glass, produced in a two-stage process by sintering a powder of finely ground glass, usually batch glass and plate glass.

The main advantage of cellular glass ceramic is unlimited raw material base in the form of amorphous siliceous rocks - trepels, flakes, diatomites, zeolites, perlites, which are spread in all regions of Russian Federation.

Trepel - scale.

PROCESS FLOW DIAGRAM



The raw material base of industrial house building

The labour-intensive and **deindustrialisation** of housing construction due to the multi-layered, hand-assembled envelope structures on the building site is increasingly transcending industry boundaries and becoming a social problem.

Thermal insulation and facade works, which are carried out at height and in the Russian climate, take more than six months in the construction cycle, with all the economic consequences that follow.

Moreover, the durability and maintainability of multilayer wall structures, whose service life is comparable to that of a mortgage, is also a serious deferred problem, increasing the costs of housing maintenance.

At the same time, the multi-layer wall panel construction, whose load-bearing base remains structural concrete, is overweight which is not justified functionally.

What I can suggest :

1. The optimal way out of the dead-end of multilayer building constructions is single-layer walls made of lightweight concrete on glass aggregates.

2. Depending on the building construction, the use of one cubic meter of the granulated cellular glass ceramic in the ultra-light structural and heat-insulating concrete ensures the construction of 1 to 3 square meters of dwelling.

3. One ruble spent for the ultralight glassy aggregate provides housing construction by 20-50 rubles, reducing the construction costs by 5-10 rubles per m2.

4. The technology has passed the stage of pilot production and is ready to scale up and organize industrial production.

5. At an optimum production capacity of 100 thousand m3 per year, the estimated cost of a cubic meter of glassy aggregate is 1900-2400 rubles/m3.

Triple - different size of granules

PORAVER® - Company brings new technology

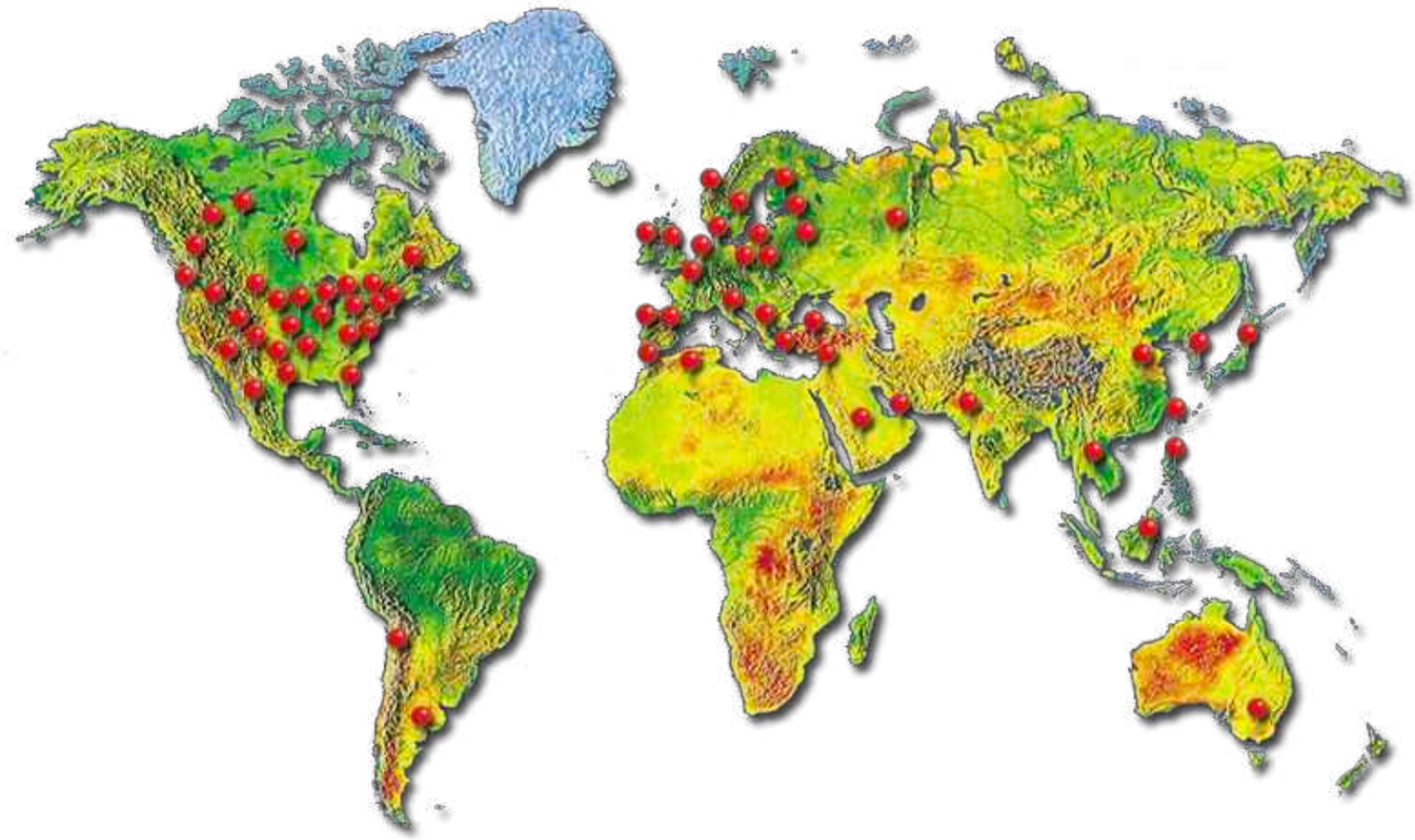
68 000 t/year of recycled glass

340,000 m3/year production capacity (500,000 m3 with planned plant)

The world's largest producer of cellular glass pellets

48 countries supplied

Poraver® sales network



Worldwide sales network sales network with 37 representatives and a branch in Canada are a clear indication of our continuous international growth.
This allows us to operate locally and provide optimum support to our customers and potential customers in 48 countries of supply.

Poraver® expanded glass granulate is a versatile, lightweight aggregate used in high quality building materials and industrial products.

Density **500-550** kg/m3, compressive strength 20-30 kg/cm2. thermal conductivity - 0,13-0,15 W/m deg.

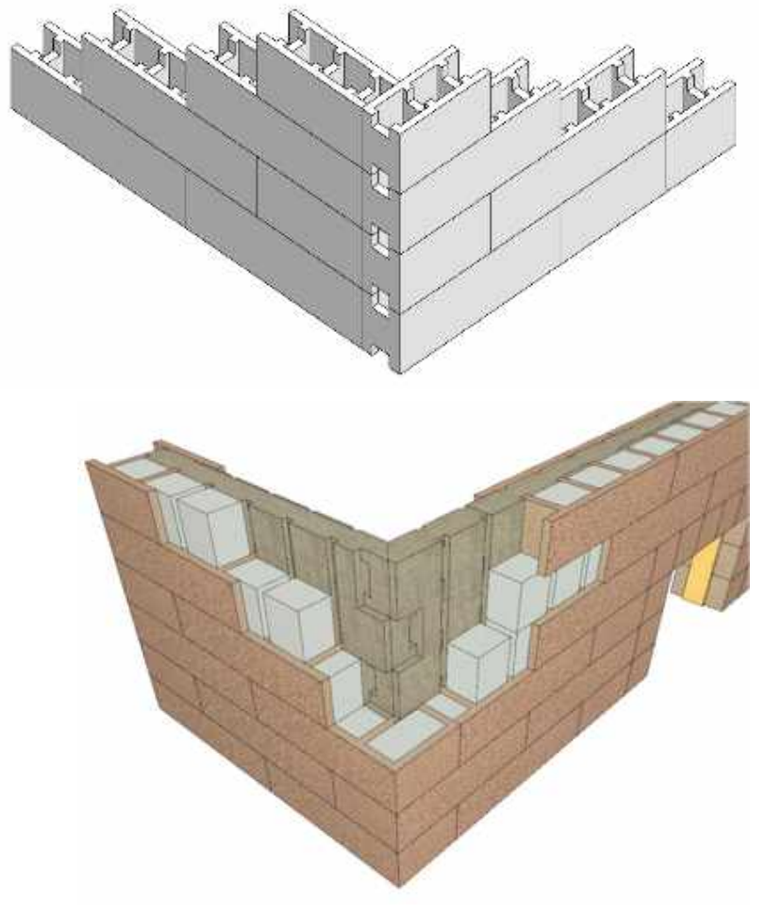
Structure - sand-less porous concrete on lightweight aggregate type of granulated cellular glass (cellular glass ceramics).

Cement consumption is 200 kg/m3, the consumption of lightweight aggregate with bulk density of 200 kg/m3 - 1 m3/m3.

House stricture.

1. The raw material is siliceous rocks such as trepel, diatomite, opock - these are sedimentary rocks of diatom algae pencils consisting of active amorphous (non-crystalline) SiO2 (unlike quartz, which is crystalline and chemically inactive).

2. The second component of glass is a sodium-containing raw material, sodium hydroxide and/or sodium carbonate (soda ash). It is expensive, but glass cannot be made without sodium.



Corner areas of masonry walls made of trepel blocks.

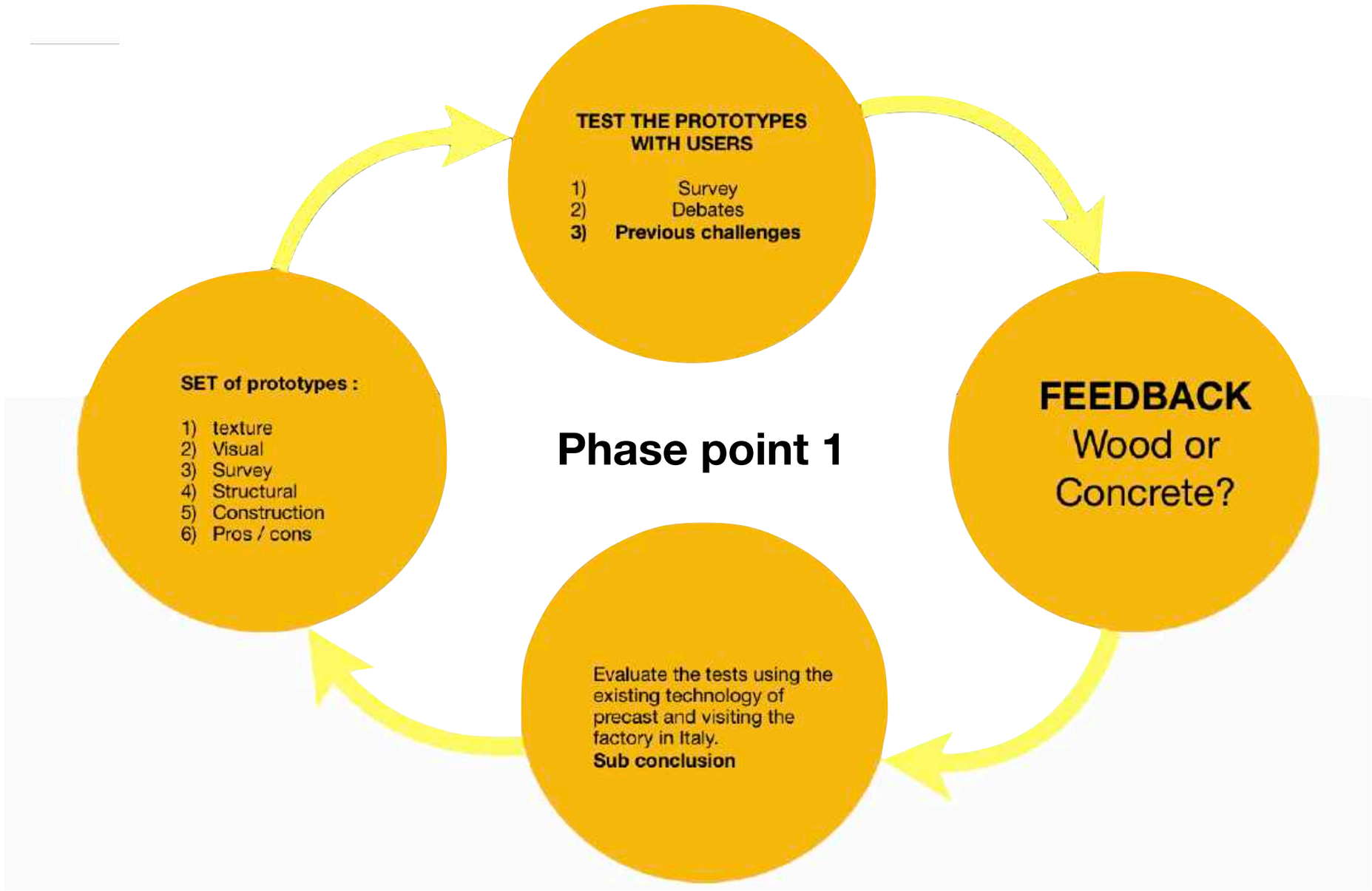
Introduction

The main part of my work is a comparison of the two previously mentioned materials - concrete (and its new concepts) and wood.

After certain conclusions and analyses that were presented earlier, it is very important to connect all these aspects. In this chapter I will compare wood and concrete, present the steps of this comparison and present interviews with leading wood construction companies. Furthermore, I have conducted numerous surveys of the population and analyzed statistics on wood and concrete construction.

This chapter also presents the stages of production of concrete and timber. Interview with Governor of the Sakhalin Region Valery Lemarenko (27/11/2021) highlights the question of how to reduce negative effect from wood production.

As it is very difficult to separate the ecological and economical aspects of building, I have tried to cover these issues as precisely as possible.



Wood

0

Concrete

1

STORYBOARD wood/concrete

4-8 months




Stages of wooden house constructed

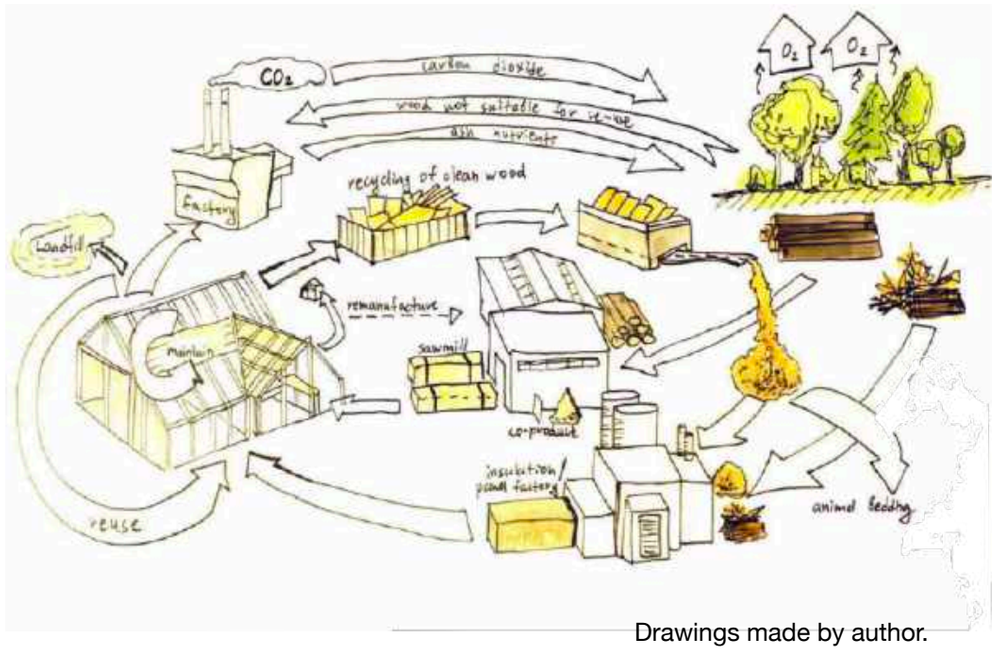
1-3 months



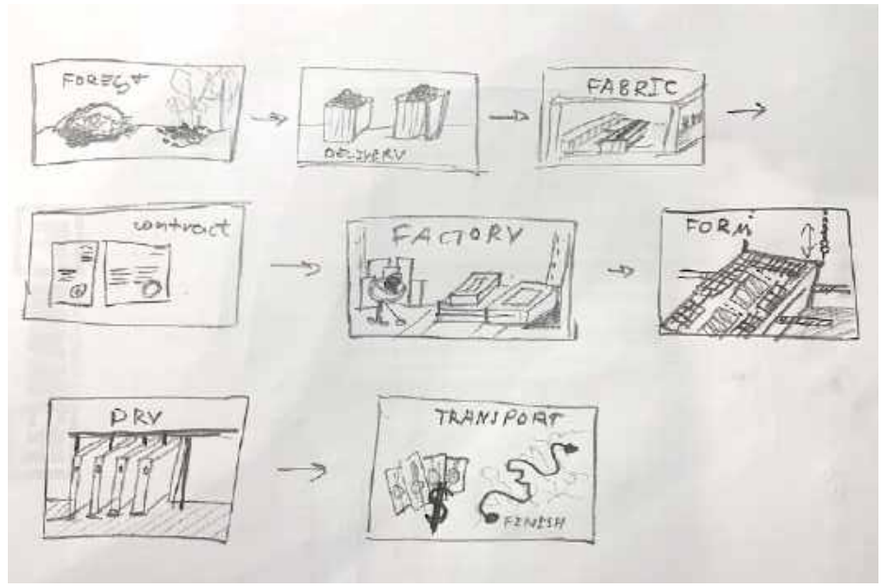





Stages of concrete panels production



Drawings made by author.



Drawings made by author.

3D

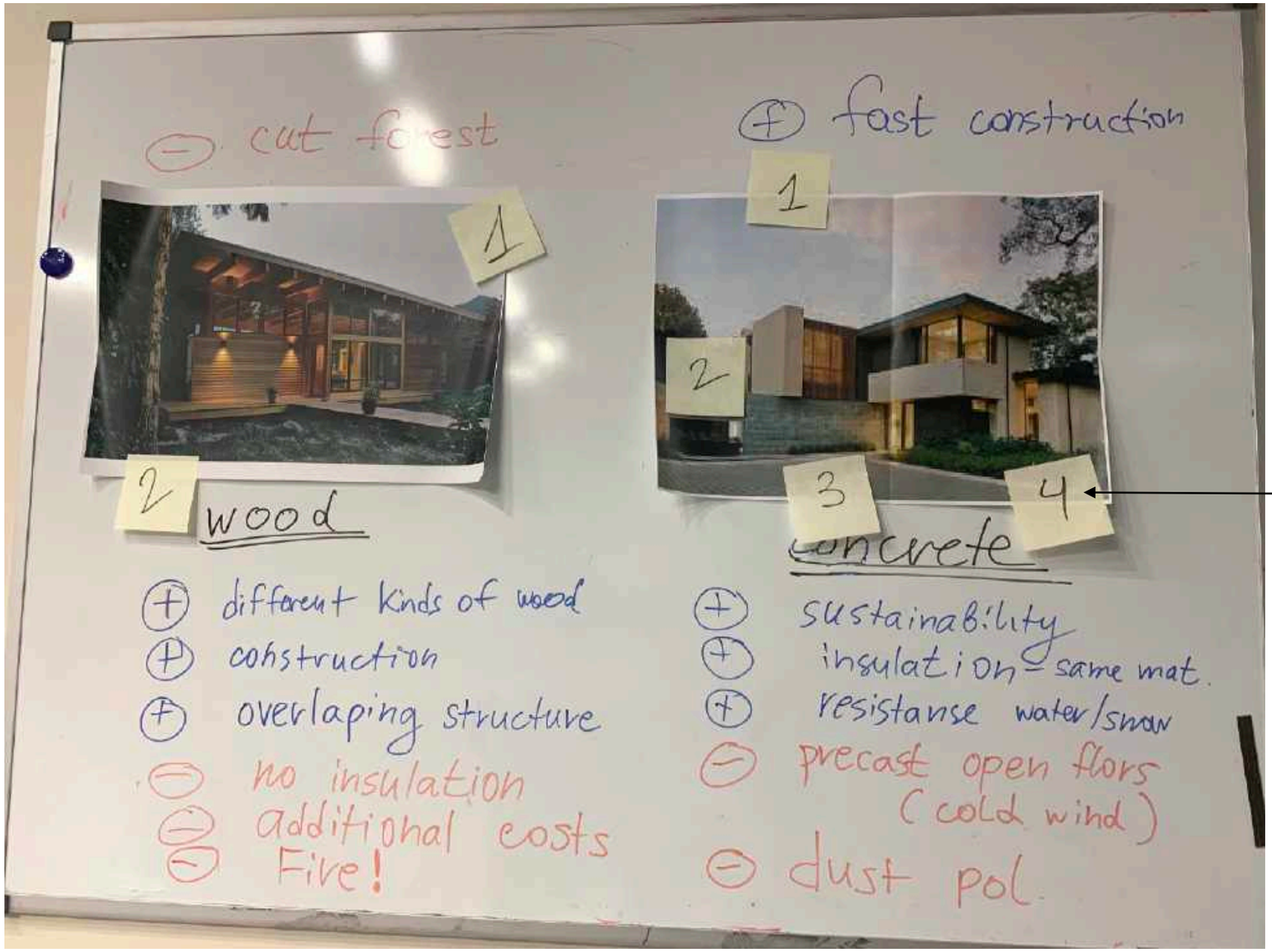
Wood

0

Concrete

2

SERVEY (will be added in mobile application as well)



People voted for one project or another, made of wood or concrete, based on visual qualities alone.

Visual interpretation same houses with same area and destiny of use.

3D

Wood

1

Concrete

2

3D

SERVEY (will be added in mobile application as well)

Texture test with valid examples.

Wooden blocks with section cut.

5 people prefer according to survey the wooden texture instead of natural concrete.

Only **2** people choose concrete without any prefabrication and paint.

Cement / concrete blocks.

Wooden blocks - made by author.

Wood

1

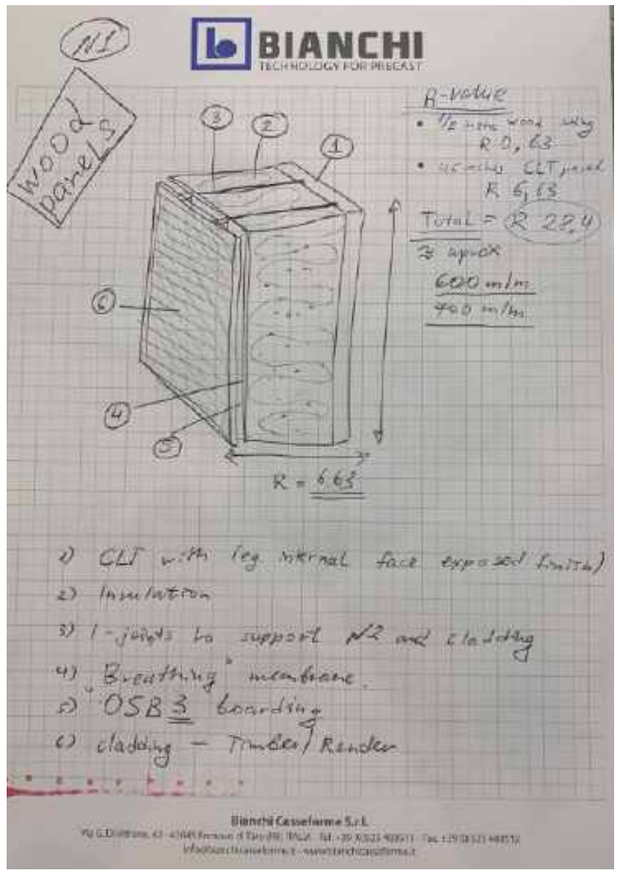
Concrete

3

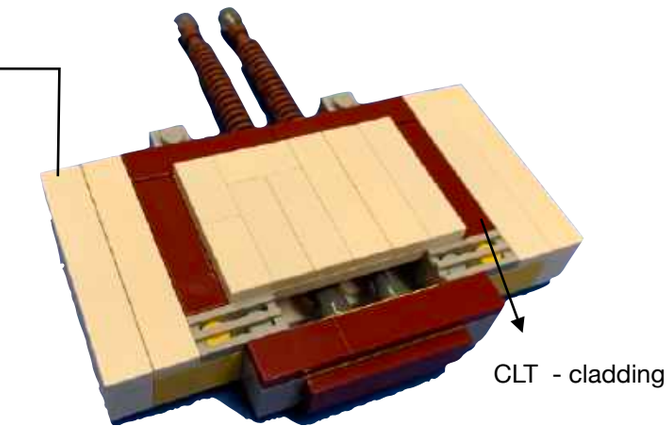
STRUCTURE wood

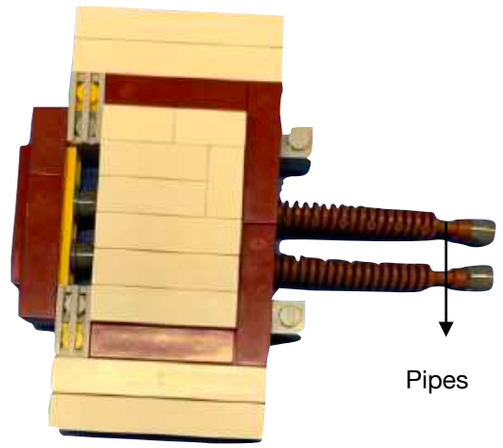
Wooden panels are very difficult in prefabrication.
All pipes for heating and water are connected after setting up the panels together.

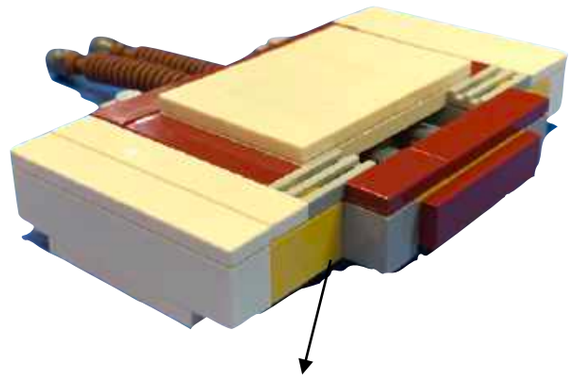
LEGO structure attached.



Drawings by author.







3D

Wood

1

Concrete

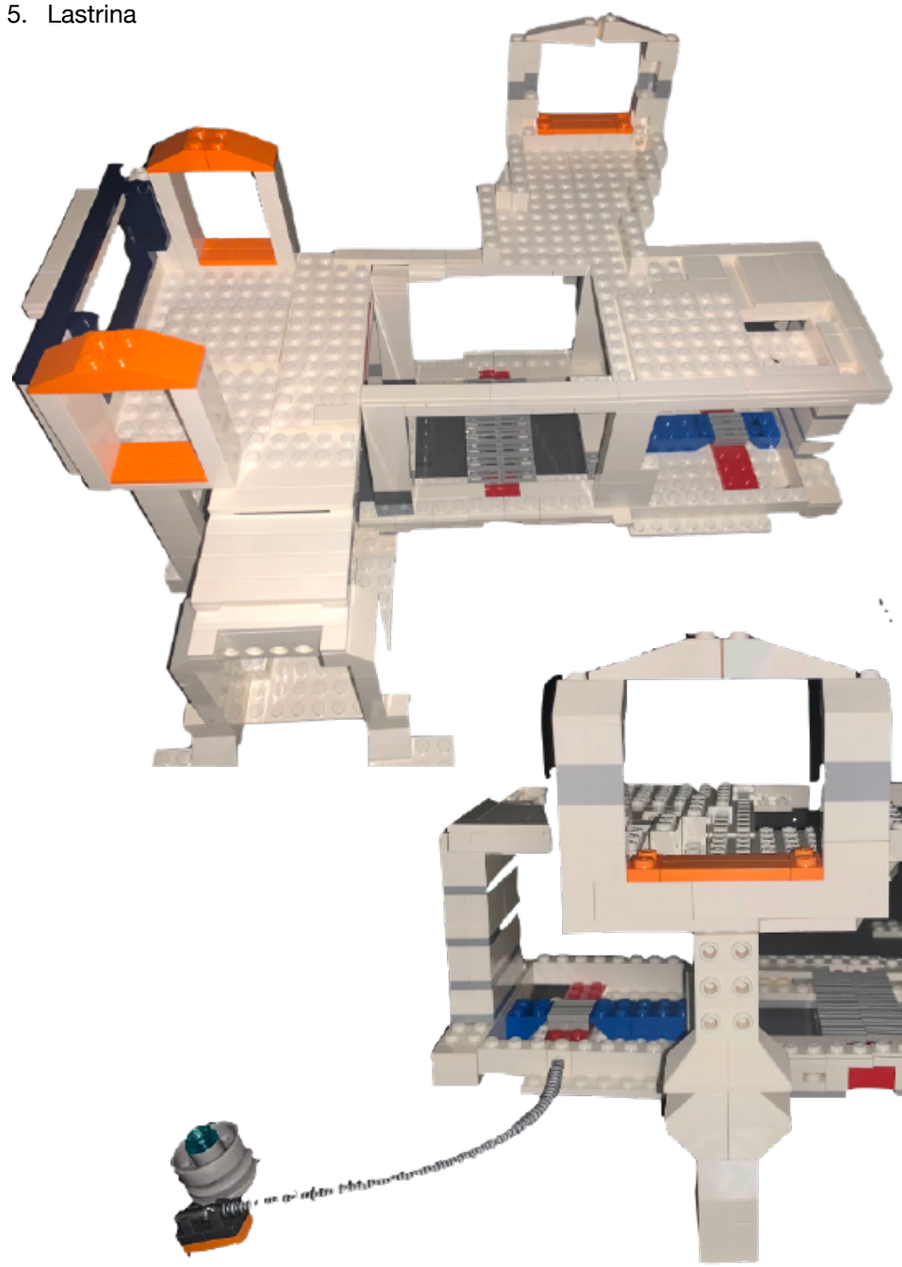
3

3D

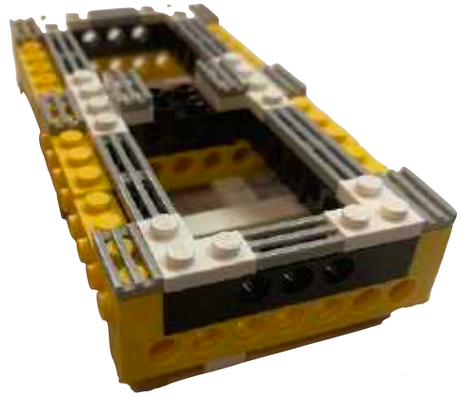
STRUCTURE concrete

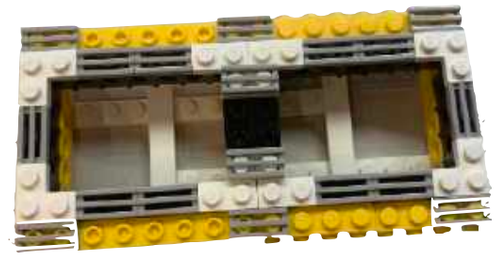
As presented earlier in chapter 3C - only 5 elements are needed to create a concrete house:

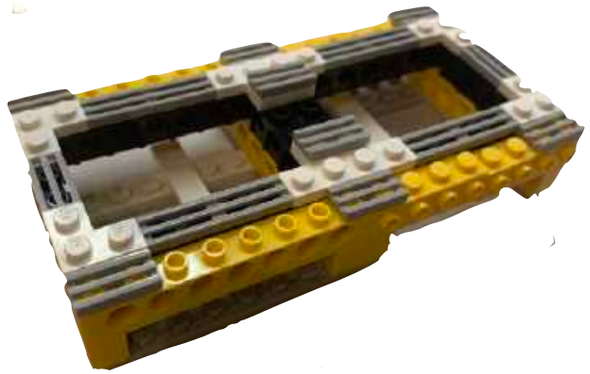
1. Foundation
2. Tegolo
3. Slab and external walls
4. Trave
5. Lastrina



Water tank - 45 cm deep under the ground level.

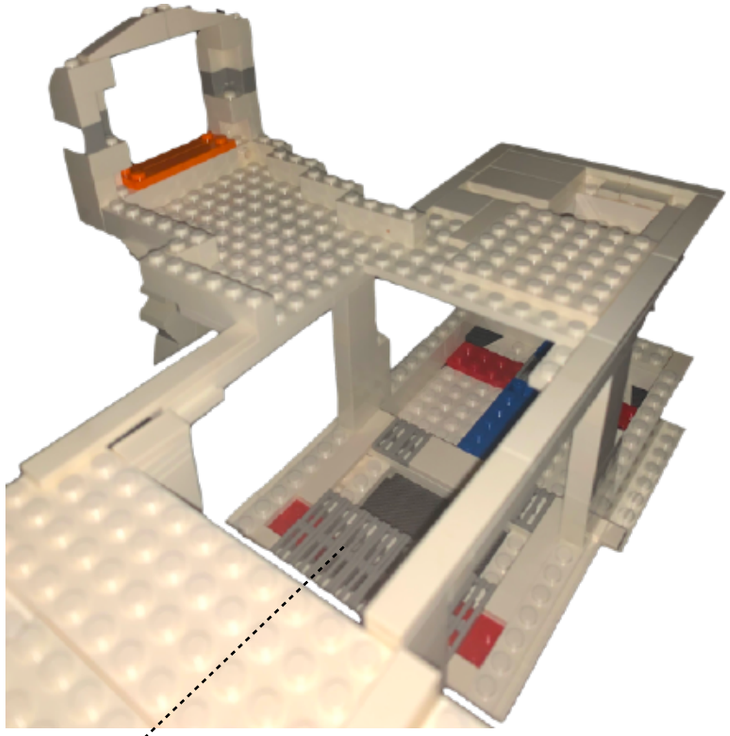


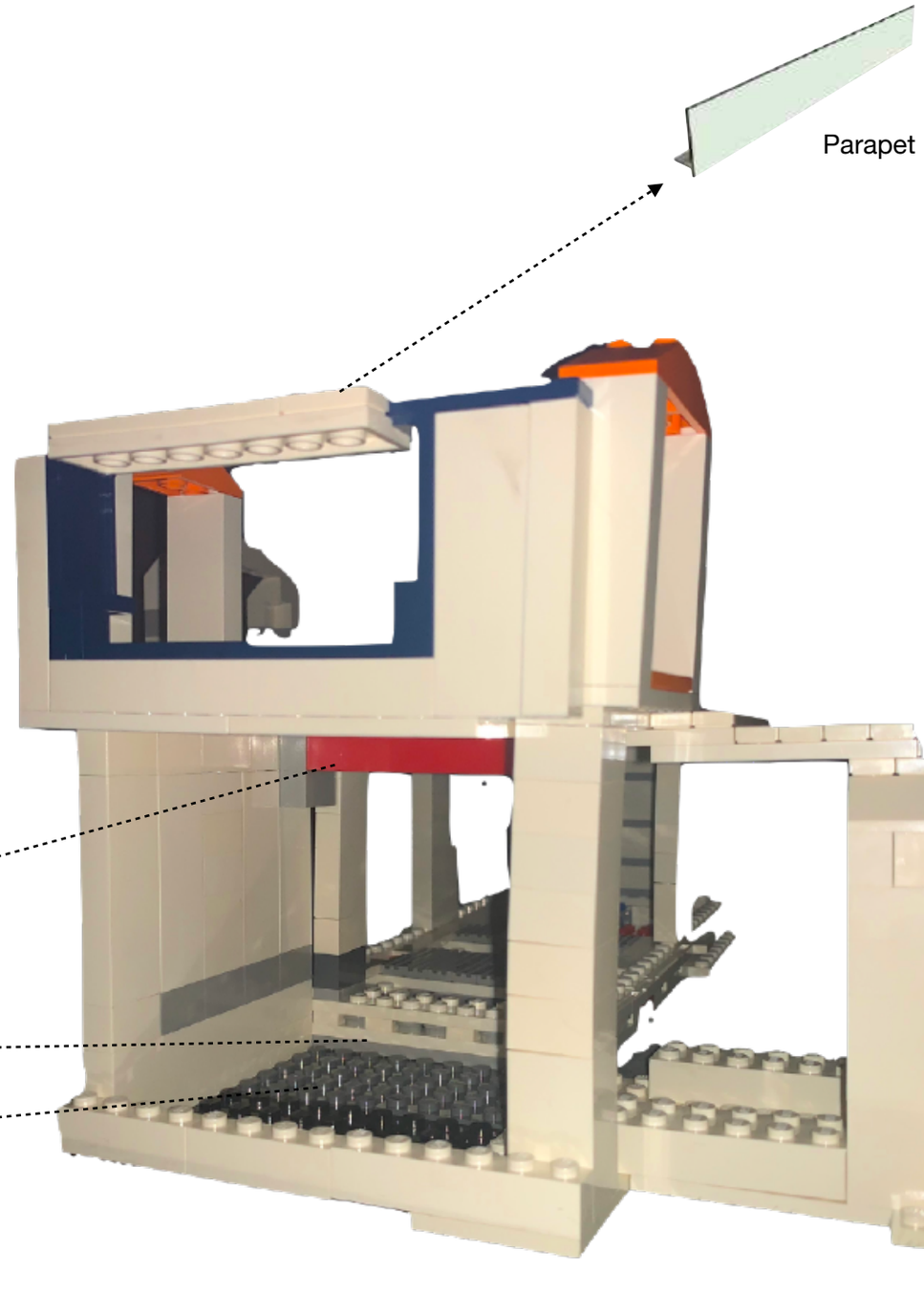


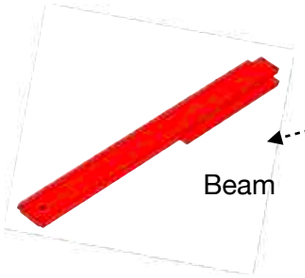


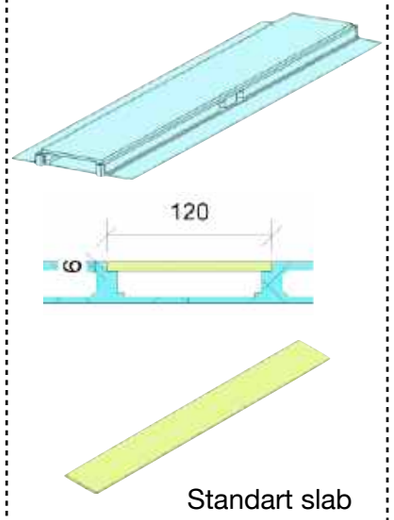
Form for concrete panel - made out of steel and lifting mechanism.

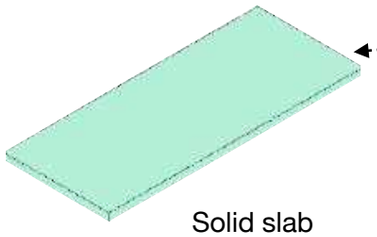
CONSTRUCTION concrete











The structure of the load-bearing elements of a paneled concrete cottage is a lego model.

3D

Wood

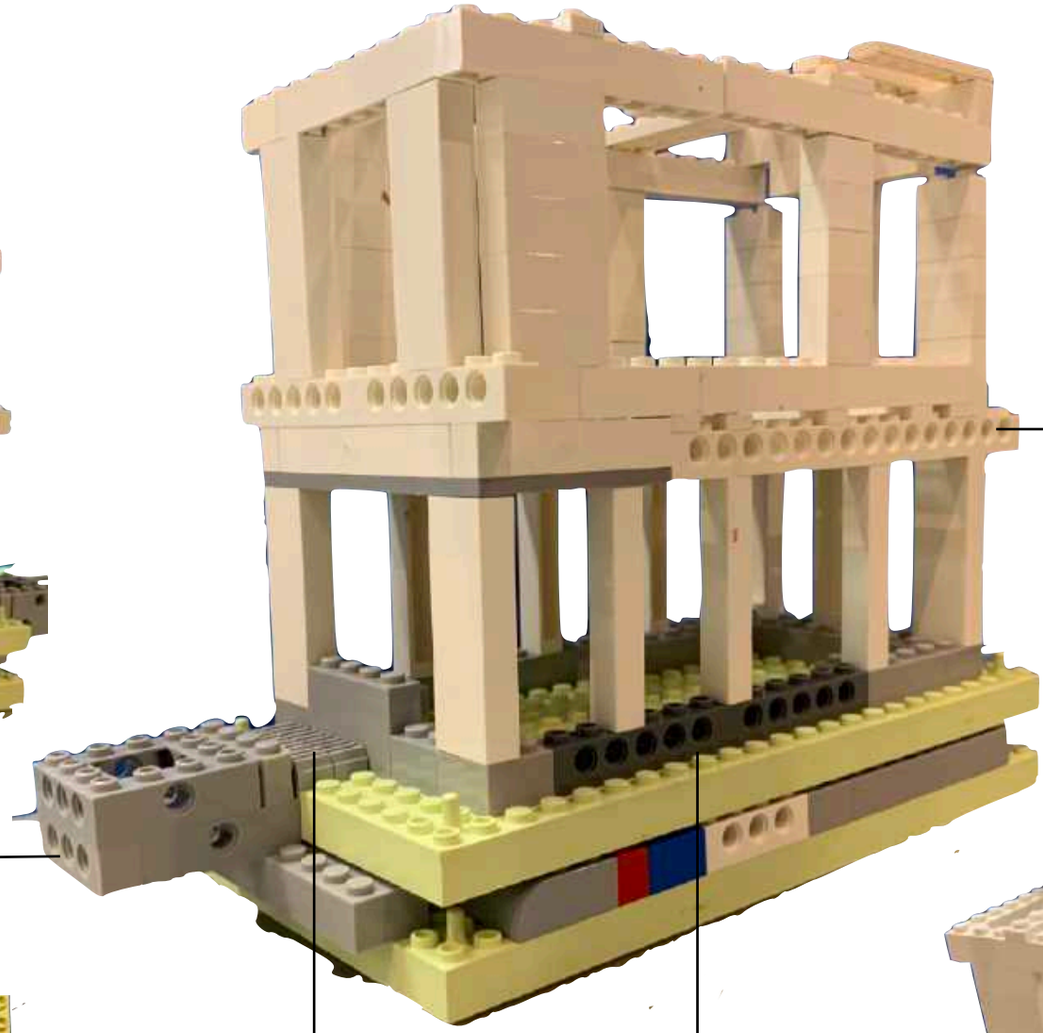
1

Concrete

4

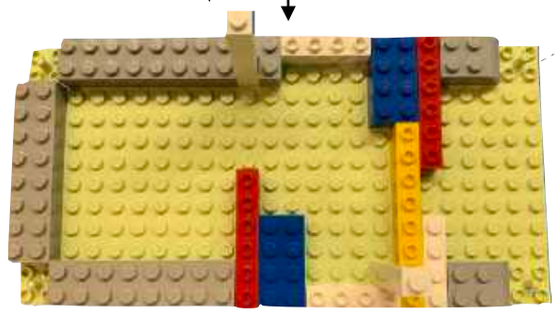
3D

CONSTRUCTION wood



LEGO structure - used **12** elements instead of 5 as concrete.

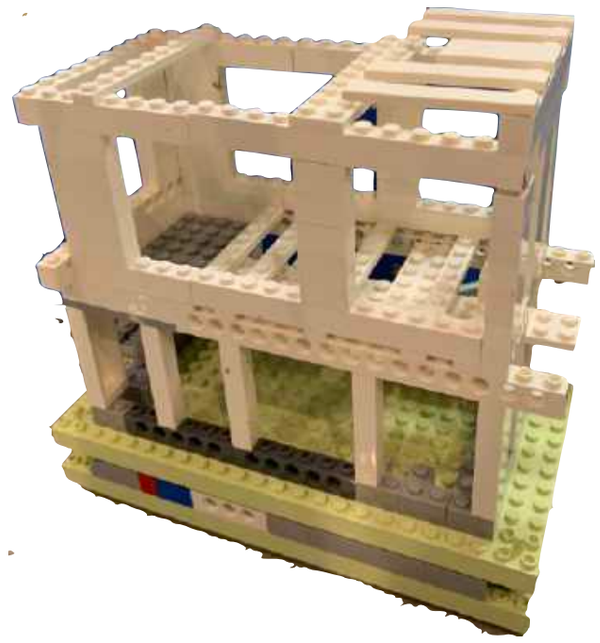
Holes in timer beams for additional communications.



Ground floor with pipes and heating system.

Wet area

Heating floor holes



3D

CONSTRUCTION wood - references from Wood exhibition

The previous prototype of the wooden building structure (made of Lego) is based on those exhibits I saw at the **"Future of Wooden Construction"** exhibition.
As we can see, the building frame itself is quite different from my previous lego model - a concrete house.

In the construction of a wooden house it is very essential to choose what to build it out of - solid timber, glued laminated timber, wooden panels, or a mixture of several techniques.

Author in front of execution stand.

While talking to professionals at the fair, we could not agree on which construction method was better in many respects.

A. Solid timber - the most reliable, but long and expensive to build.
B. A glulam beam - to build faster, cheaper, but this material consists of sawdust (recycled wood log).
C. Wooden panels are the most budgetary and short-lived material that is most often used for the interior decoration of the house.

Structural elements - photos made by author.

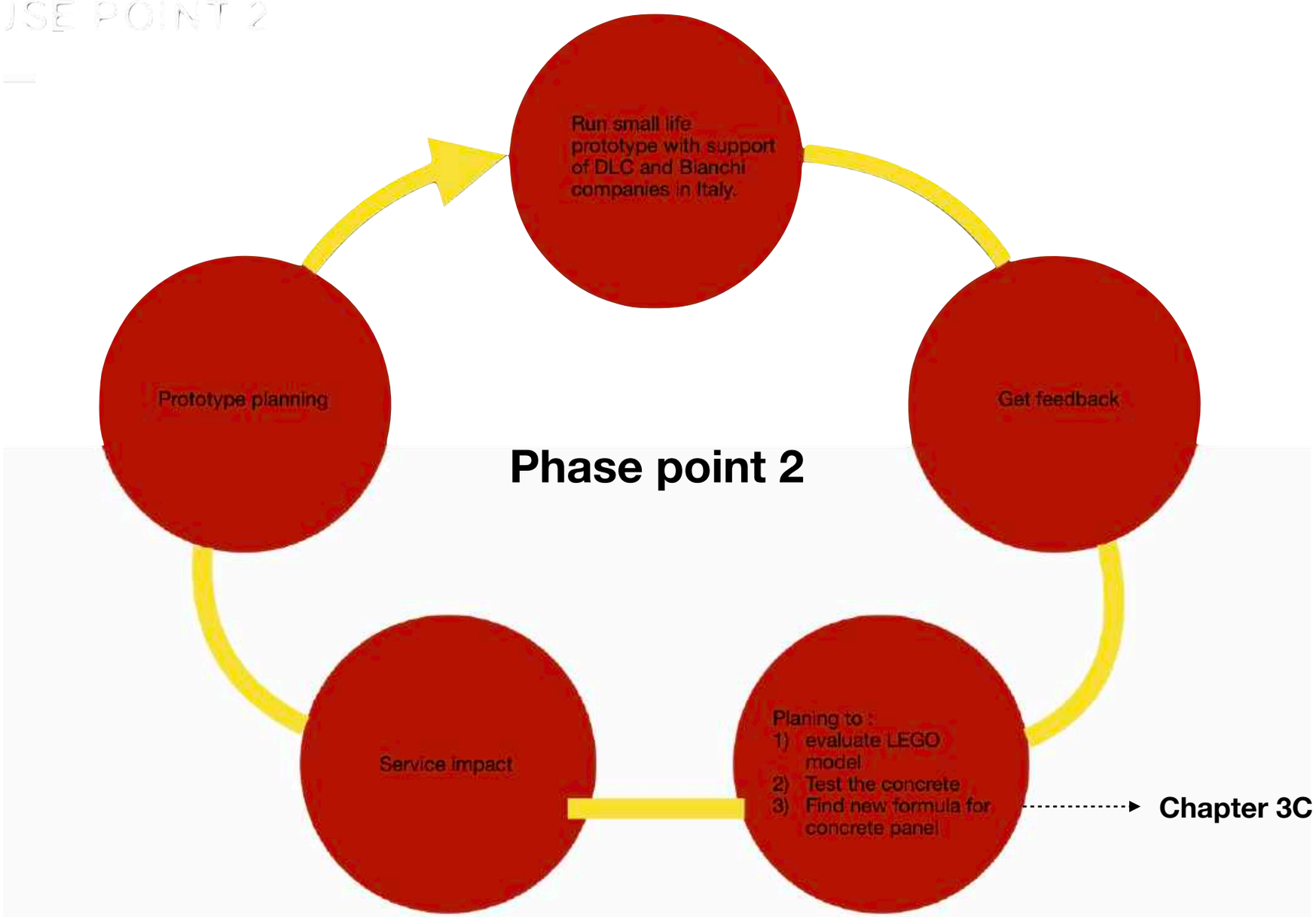
According to LEGO structure prototype it was identified that for wooden house we need more structural elements, time and labour respectively.

Clarify all pros and cons for wood and concrete.

Try to apply concrete form on wooden structure.

WHY SOMETIMES IT IS IMPOSSIBLE TO USE WOOD?

JSE POINT 2



Phase point 2

Wood

1

Concrete

5

3D

EVALUATE

CONCRETE vs WOOD

PROS	CONS
DURABLE, STURDY , CAN BE USED FOR LONG TERM COMMERCIAL PROJECTS	If a cheap version of portland cement is used during the production of concrete, it can easily get desegregated when coming in contact with alkalies.
Economical and cost-effective in comparison to other similar construction products in the market, such as asphalt.	requires constant and regular reinforcement to avoid the risk of getting cracks. - in solid structure (not panels)
Can withstand even high temperatures and extreme weather conditions.	
Inert and fire-resistant.	
strength and sustainability increase over time.	has a low tensile strength
flexible and can be used as a foundation for various structural projects.	
can be easily molded into any shape	requires more labor and force, in comparison to other similar materials if production is not automatized.
requires very little maintenance and can be easily sealed or refurbished with the help of a concrete **sealant**.	

PROS	CONS
READILY ACCESSIBLE	QUICK STRUCTURAL DEPRECIATION
LESS EXPENSIVE THAN GLASS OR SOLID CONCRETE STRUCTURE (NOT PANELS)	HIGH MAINTENANCE COSTS
VERSATILE	SUSCEPTIBLE TO MOISTURE AND MOLD
LIGHT AND EASY TO TRANSPORT - ONLY IF PANEL IS READY TO ASSEMBLY	VULNERABLE TO FIRE
MACHINABLE	LESS EFFECTIVE SOUNDPROOFING MATERIAL
BIODEGRADABLE	PRONE TO NOISY AND CREAKING FLOORS

Wood

2

Concrete

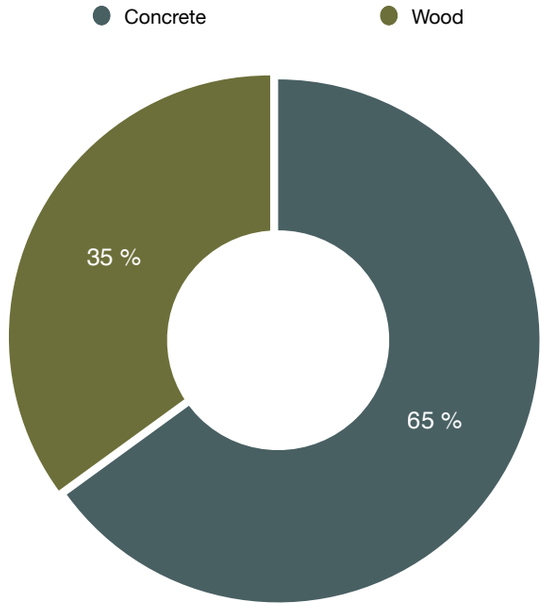
6

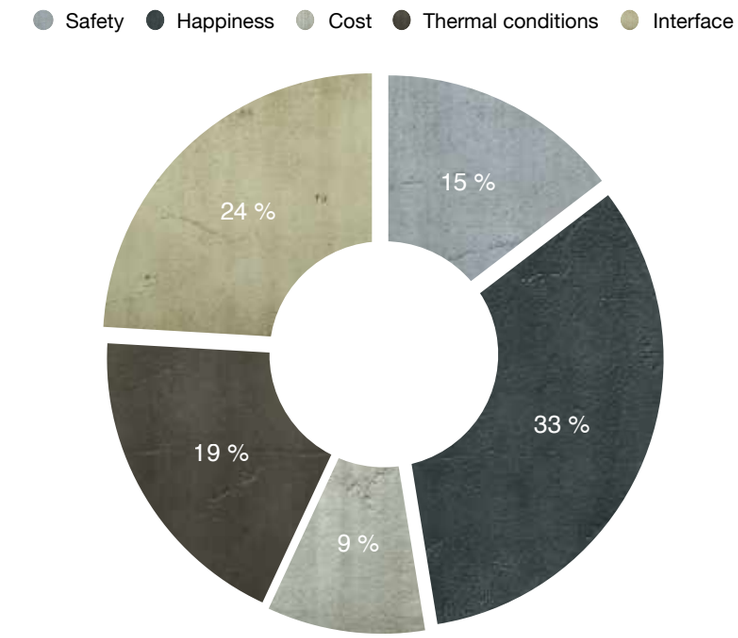
3D

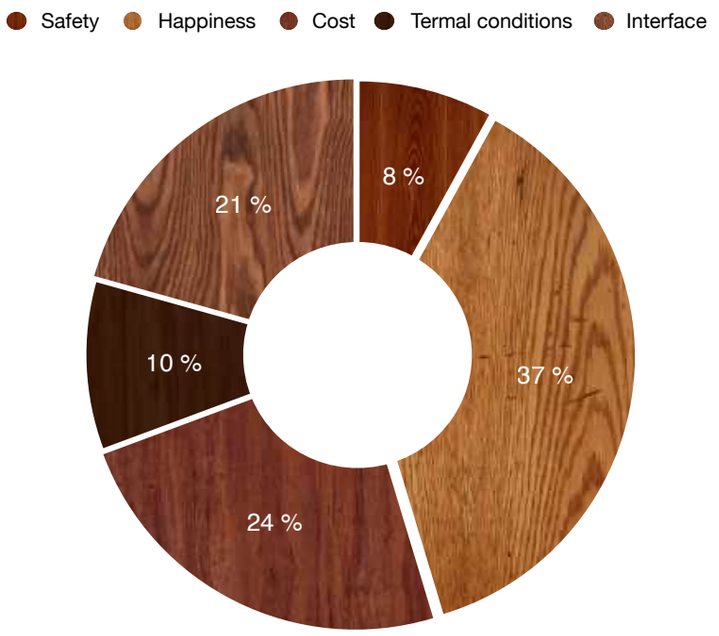
Sustainability - data collection

I step back a bit and came to the idea of sustainability design and it’s components. Rather than designing the house I divided my design into components and make a survey.

Preferences according to survey - **40** people were asked to chose their future house made out of wood or concrete.







Wood

3

Concrete

7

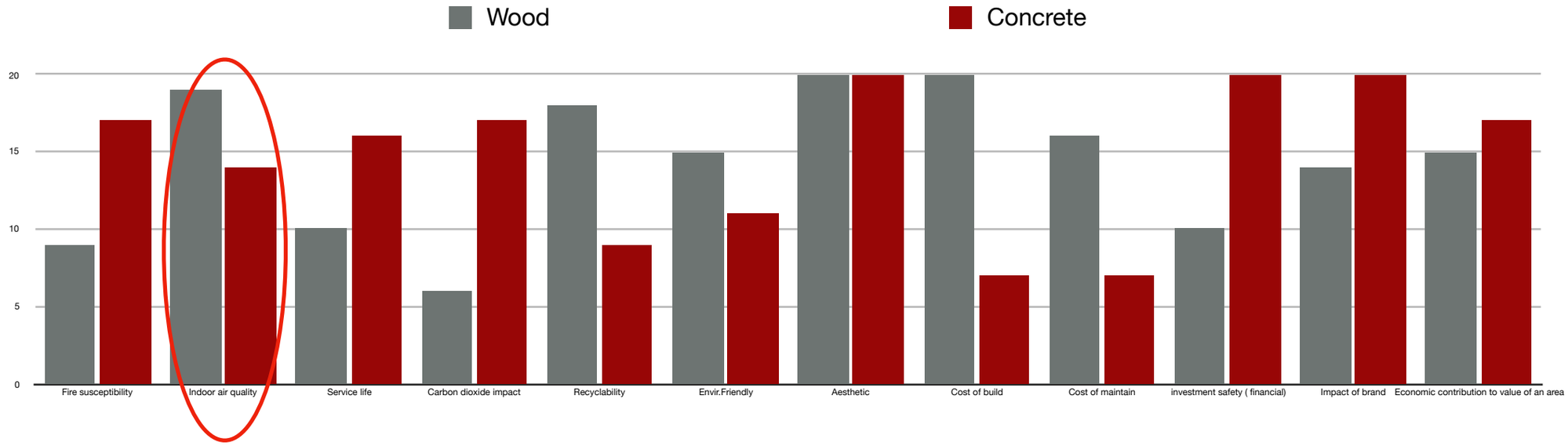
Sustainability - data collection

Comparing the wooden structure house according to all standards of living with concrete base structure.

Even after some structure development my team and I changed the quality of indoor air quality by analysis of the structure of the concrete itself.

The concrete slabs will be made of clay-ceramic.

Large-sized blocks of warm ceramic give better air circulation, there will be no electromagnetic emissions from the same wi-fi, as there will be no composite reinforcement and the metal frame of the house will be introduced into the concrete structures.



In total :

Wood = 172

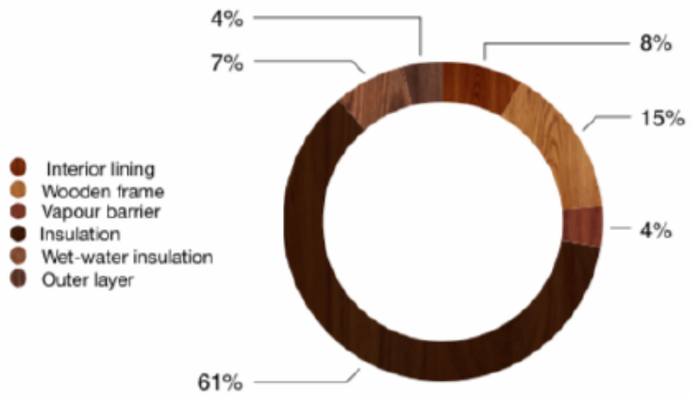
Concret = 175

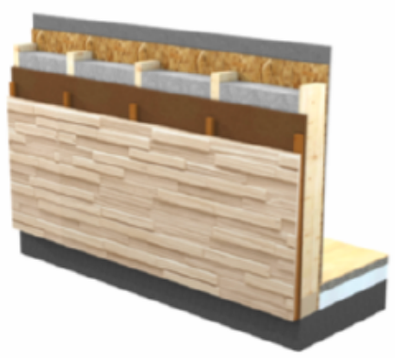
3D

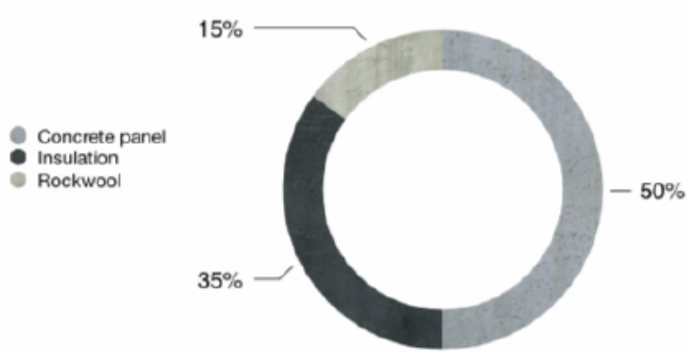
Sustainability - data collection

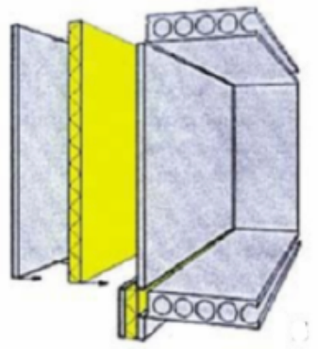
The fewer materials are used to build a building, the faster it can be done. Moreover, by using local resources (sand, clay, wood) it is possible to reduce construction and transport costs.

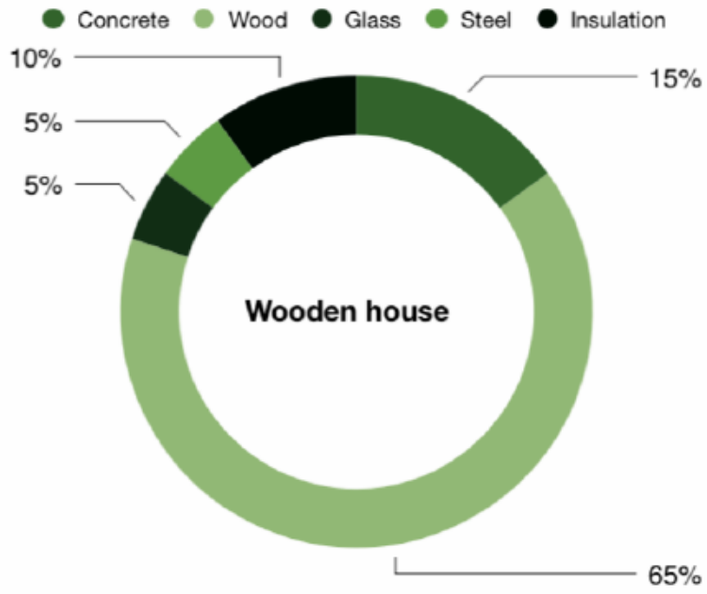
Composite elements of wooden panel and concrete panel in proportions.

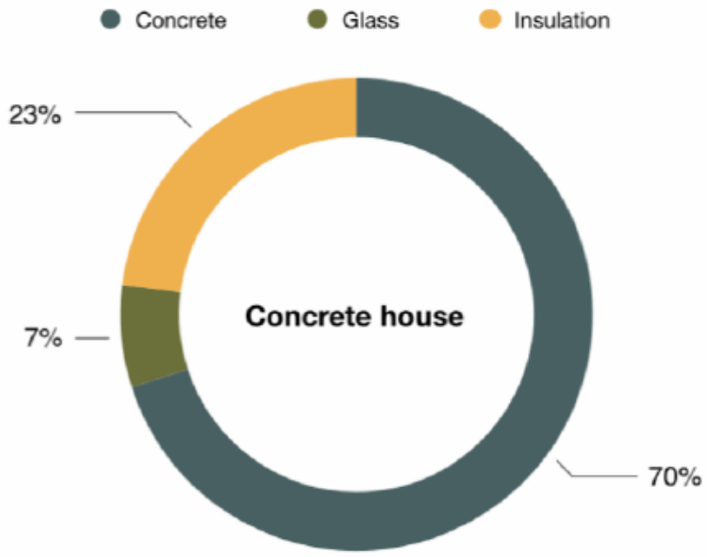












3D

Wood factory

The production and processing of wood uses **much less energy** – known as embodied energy – than most other building materials.

1) Giving wood products lower carbon footprint
2) Low-emission substitute
3) Ecological
4) No limits for size of the panel

However , wood factory :

1) Needs a lot of electricity (90-180 kVat)
2) Produced dust and sawdust
3) Very noisy
4) Some machines might have low productivity
5) Low accuracy
6) The large thickness of the saws and the tips leads to a reduction in the output of finished lumber relative to the amount of raw material at the input.

Photos of wooden factory made by author.

How to reduce negative effect from wood production

Interview with Governor of the Sakhalin Region Valery Lemarenko 27/11/2021 - by phone.

- **Me :** How can the disadvantages of high noise and low productivity in sawmills be addressed? How to make them the most in demand in the housing market?

- Well first buy some equipment to reduce energy consumption, for example a clean regulator to put on the sawmill motor. A primitive thing to say, yes... Or an industrial building, for example, could be insulated and thus use less energy for heating. So any investment that either saves energy, or reduces the carbon footprint, or actually utilizes it, or by investing in greenery.

- **Me:**Do you mean the cost of creation or recycling?

- Absolutely.

- **Me:** And how are these costs recovered?

- It's worth trying these carbon units. They will negotiate with each other just as they do for the sale of any other commodity such ass cars, ships, concrete, metal.

- **Me:** If I understood correctly, you are talking about the market battles for raw materials and fuel?

- That is correct. Sales will literally be negotiated by neighbors. One producer has surplus carbon units and the other is short of them. For the next 10 years it will simply burst into the trade market from manufacturers and homebuilder owners. But there has to be a system in place for someone to give something to someone. That is, different countries have to recognize the accounting and calculation of these carbon units. Otherwise, the production of any material for construction will be unprofitable due to the inability to sell the carbon waste.

https://www.bfm.ru/ BFM.RU

Wood

4

Concrete

6

3D

Concrete factory - visiting in Italy

In Italy I visited a concrete factory where concrete panels are made for construction. Of course it would not be objective to compare European production with that in Russia, but the principle of these enterprises is the same.

Concrete will be crucial for much-needed climate-resilient construction. But the cement industry must develop its own decarbonisation plan. Cement production (such as this plant in Italy or Russia) accounts for 8% of the world's carbon dioxide emissions.

Researchers and governments must work with the cement industry to reduce its carbon footprint, contributing to the climate-resilient construction that the world so desperately needs.

It is also necessary to consider the weaknesses of such concrete production plants.

A. The capacity of the mixing plant is low, with an average of 10-30 cubic meters of mix per hour.
B. The need for frequent loading of aggregates and cement.
C. Unrepairable equipment in the field, but it is rather a problem of counterfeit products. MBZs from reputable construction equipment manufacturers are reliable and stable.

Photos of the facade and outside space - made by author in Italy.

Precast machines inside - photos made by author.

After visiting a concrete plant and an exhibition on timber construction, it became necessary to talk to the leading timber companies in Russia (unfortunately, they were not present at the exhibition). For a more detailed analysis of the industry, I analyzed not only the Russian market, but also the foreign market.

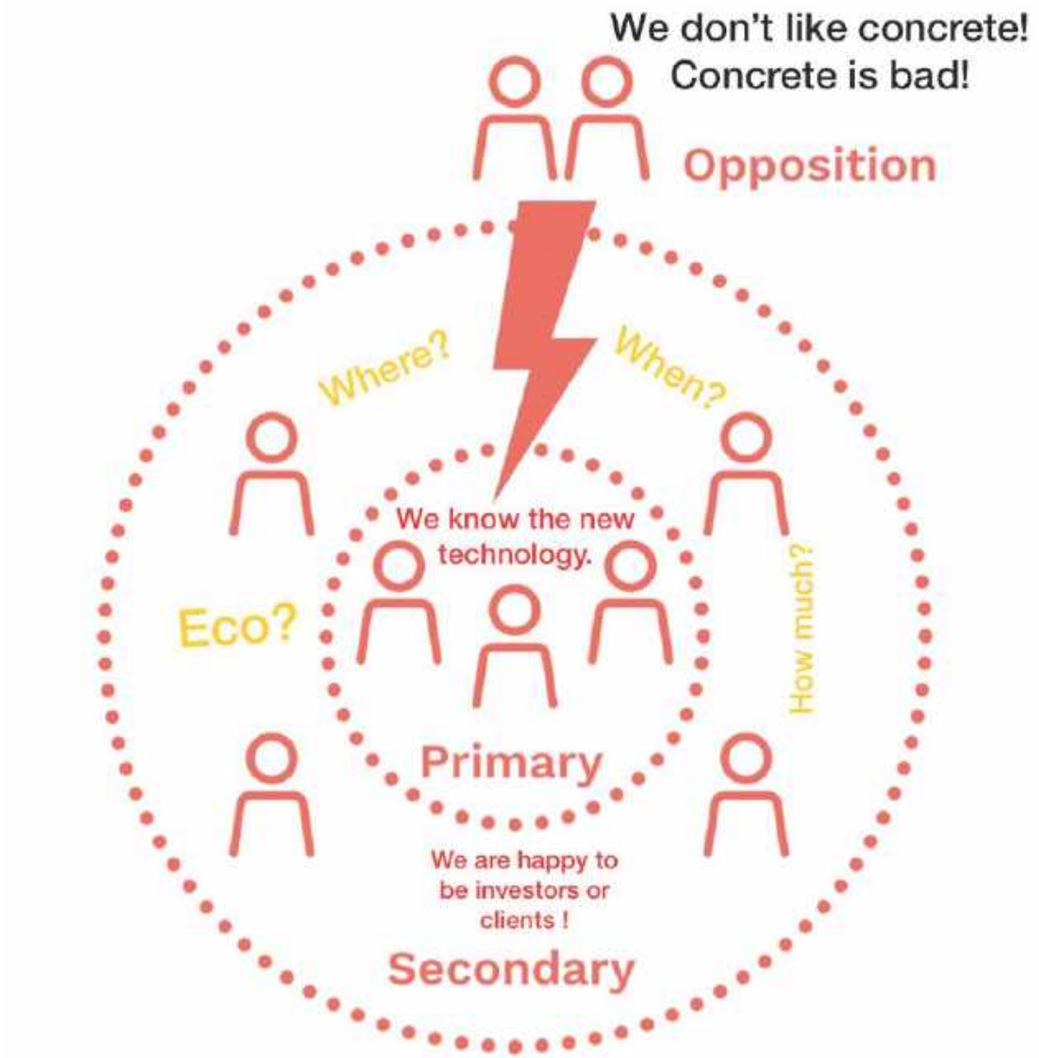
An important factor for every investor and buyer is price.

As I said in my interview for the Moskva 24 channel (chapter 3C) , today the Central Bank of Moscow provides loans not only for those who want to buy a flat (mortgage) as it used to be, but also allows you to use the mortgage money to build a house.

Today's pricing policy is divided into 3 phases:

1. 6 million roubles for all Russians.
2. 12 million roubles for Muscovites
3. 30 million rubles for those who are ready to mortgage a flat.

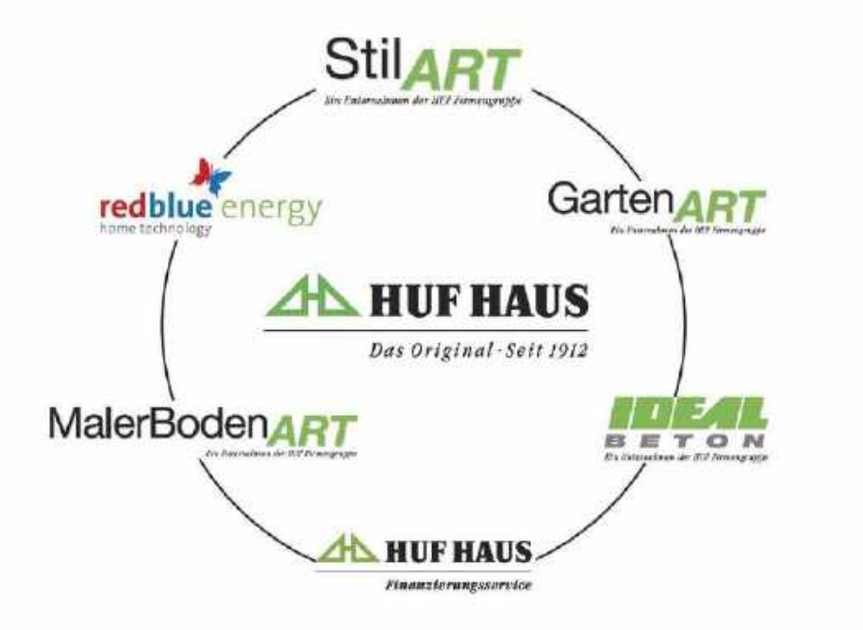
Thus the maximum price for which residents can buy a house - about 20-23 million rubles which is the equivalent of 204 thousand pounds.



Infographics made by author.

HUF HAUS

A. **Entrepreneurship with a sense of family 109 years.**
B. In the early 1970s HUF HAUS developed the technique of producing iconic timber and glass architecture off-site and revolutionised the classical timber frame construction industry.
C. Over 10,000 families already belong to the HUF family. Design a house exactly according to your wishes.
D. New building with high-quality materials.
E. Better energy efficiency
F. Use of the latest technologies.
G. Huf Haus starts at around **£300** per sq ft," says Bindewald. Most pre-owned Huf Hauses **cost** at least **£1 million.**



SHOW HOUSE AUSBLICK
House: Concept house
Dimensions: 18,40 x 10,00 m
Living area: 176,32 m²
Roof pitch: Butterfly 4°/flat roof/6,7°

HUF HOUSE ART 6
House: ART 6
Dimensions: 13,60 m x 15,00 m
House Foot print: 204,93 m
Roof pitch: 25°/18°
Knee Wall Height: 2,13 m/3,02 m

HUF HOUSE ART 9
House: ART 9
Dimensions: 22,00 m x 17,20 m
House Foot print: 329,44 m²
Roof pitch: 30°/FD
Knee Wall Height: 1,03 m

https://log-homes-sale.com/

A. **Log House”**, - woodworking company, was founded in 1992 and initially engaged in the production of sawn timber and molded products.
B. Our company is also interested in cooperation with various kinds of building companies and organizations working for industry.
C. Since 2004, “Log House” has entered the international market for the supply of timber and sawn timber to the countries of the European Union and Asia.
D. Cooperation on the principle of «Agent».
E. Cooperation on the principle of «dealer-representative".
F. Our company is also interested in exporting products. We work with intermediaries and directly.


Additional Info

Total area:
151 m2
Living space:
151 m2
Rounded logs (basic kit):
from 100 USD
Profiled beam (basic kit):
from 140 USD
Glued beams (basic kit):
from 200 USD m2 by floor
Handcrafted log cabins (basic kit):
from 150 USD m2 by floor
Cost "Under the Key":
from 450 USD m2 by floor
Basic kit price:
20 300 USD


Additional Info

Total area:
84 m2
Living space:
84 m2
Rounded logs (basic kit):
from 100 USD
Profiled beam (basic kit):
from 140 USD
Glued beams (basic kit):
from 200 USD m2 by floor
Handcrafted log cabins (basic kit):
from 150 USD m2 by floor
Cost "Under the Key":
from 450 USD m2 by floor
Basic kit price:
13 500 USD

Additional Info

Total area:
245 m2
Living space:
245 m2
Rounded logs (basic kit):
from 100 USD
Profiled beam (basic kit):
from 140 USD
Glued beams (basic kit):
from 200 USD m2 by floor
Handcrafted log cabins (basic kit):
from 150 USD m2 by floor
Cost "Under the Key":
from 450 USD m2 by floor
Basic kit price:
30 100 USD

3D

HOLZ HOUSE

A. The company was founded in 1998.
B. Preservative treatment of wood to prevent the appearance of bluestain, fungi and molding ("Remmers" manufactured in Germany).
C. Have international experience in Switzerland, Italy, Russia.
D. Have implemented more than 2000 projects of various designation in Russia and CIS countries.

Total area:	480,94 m^2
1st floor area:	301,97 m^2
2nd floor area:	178,97 m^2
Premises area:	377,4 m^2
Terraces and balconies area:	103,54 m^2
Number of floors:	2
Number of bedrooms:	5
Number of bathrooms:	4

Total area:	160,4 m^2
1st floor area:	160,4 m^2
Premises area:	77,87 m^2
Terraces and balconies area:	82,56 m^2
Number of floors:	1
Number of bathrooms:	1

Total area:	226,8 m^2
1st floor area:	133 m^2
2nd floor area:	113.8 m^2
Premises area:	191,4 m^2
Terraces and balconies area:	35,4 m^2
Number of floors:	2
Number of bedrooms:	3
Number of bathrooms:	2

3D

Phone call (as a client) :

Me : Hello, I was interested in your project of 160m2 and tell me please about how you actually working.

Alexander: hi, yes sure. So the wood transporting fro Kirov (953 km away from Moscow) and we supervising all stages of construction of your project.

Me : So you brings your own people to the construction site?

Alexander: Yes! All our house are turnkey buildings. We provide full technical supervision, the work of the foreman and pour the foundation which is Monolith, already on your territory.

Me : how long does it takes?

Alexander: Usually it takes 4 months to assemble a house of up to 300 square meters, but now there is a very large queue at the factory. That is, until February we will not be able to create your project, we can only postpone your construction until the end of February.

Me : Ok, and what about price?

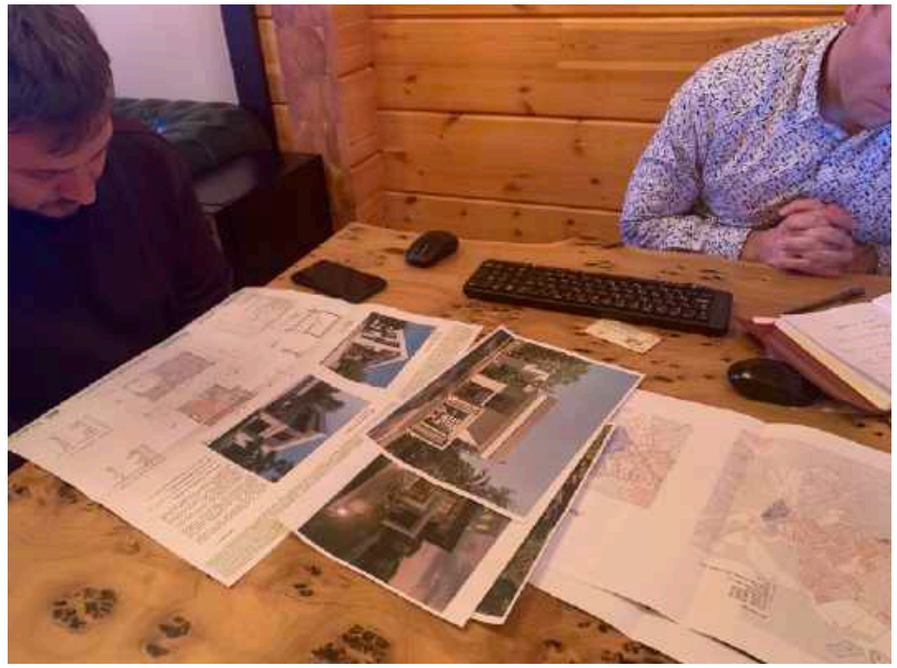
Alexander: Normally it's between 11 and 15 millions of rubles.

Me : Ok, got it! Lets set up the meeting in your office on Monday 29/11/2021 and walk through the more detailed questions.

Alexander : Yes sure! N problem! Waiting you in our office!

Interview 29/11/2021

Fave their own factory which can produce 1600m3 every month, equals 19 200m3 during the year.

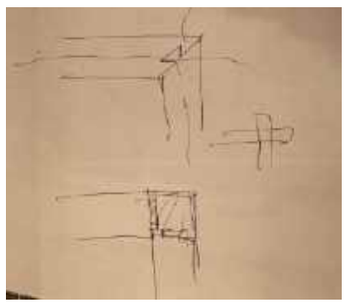


Result :

1) Holz will count the prices of materials calculated for my project house of 150m2.
2) As far as Holz has their own wood factory (built own 6 hectares) they will set up the working plan for future renovation
3) Introduced me to local architecture - Oleg Skukowski.
4) During our conversation we agreed to save the plans and elevations of my design but slightly change the facade of the building according to standards use of wood.
5) Very friendly and described for me a lot of nuances.

All photos made by author.

3D



Additions for the interview

According to latest news and facts about lack of wood in Russia and high prices, I was surprised that Holz has stable market structure and FC certificate. Such FSC requirements allowed them to cut as much trees as they need with guarantee of high quality of product.


FOREST CERTIFICATION

CERTIFICATE

FC-FM/COC-001732

ООО «Хольц Хаус»

Holz House LLC

Соответствует требованиям FSC
Complies with FSC requirements in part of

Лесоуправление и продажа круглых лесоматериалов
Forest management and sales of round wood

Оценка проводилась по стандарту
FSC-STD-RUS-V6-1-2012
The evaluation was based on the standard
FSC-STD-RUS-V6-1-2012

Дата выдачи / *Date of issue* — **24.03.2021**

Действителен до / *Valid until* — **23.03.2026**

Руководитель органа по сертификации / *Director of the Certification body* — Н.А. Трушневская / *Mrs. Trushevskaia Natallia*

FSC www.fsc.org

The mark of responsible forestry

Screenshots from «Holz House» web-site.

3D

Collaborative work - early stages working agreement

S.HOLDING

SHEPEL HOLDING

For the company "Holz House", Moscow, www. holz-house.ru
e-mail: dom@holz-house.ru
tel: +7 800 333-47-43
From the leading architect of Shepel Holding LLC
Shepel Anastasia Alekseevna

Dear company "Holz House"

During the pandemic, in our country and around the world, there was an urgent need of the population for country cottages with their own plot. People who lived in small, uncomfortable apartments dream of their own country house and fresh air. Our company has developed a project continuation using the latest innovative technologies in the cottage construction industry called "HOUSE 5", the main advantages of which is the ability to locate a cottage on 0.06 - 0.15 hectares of land and its construction without the use of wet processes.

Our houses IZHS-150 of the DOM 5 series meet five main building rules - **MODERN, PRACTICAL, ORGANIC** - the basic principles of organizing the internal space of the house. **QUICKLY, QUALITATIVELY,COMFORTABLE** - this is our idea in the implementation of structural solutions of the building. Priceresidential building K-150 is 8.35 million rubles. and does not exceed 55.7 thousand rubles. / sq. m.

After a survey of the population, Shepel Holding was faced with the question of the difficulty of resolving problems and disputes. The DOM 5 project does not meet the buyers' requirements. In view of the environmental movement and the high interest of people in the environmental friendliness of the building, it is necessary to reconsider the point of view on the use of concrete as the main material.

Thus, I ask you, without changing the existing layout and appearance of the building, to make it out of wooden structures, beams. I ask you to calculate and provide a project proposal for the integrated development of the territory of the village of Lopotovo, an estimate for the construction of a house K-150 using wooden structures.

The existing estimate for 2021 on prefabricated reinforced concrete structures for the K-150 house is indicated in Appendix No. 1.

Appendix # 1

Appendix # 2

Sincerely,
A.A. Shepel
Shepel Holding LLC.

11/30/2021

3D

https://wood-house.su/

The advantages of working with Wood House:

1) expert advice on all stages of construction;
2) a preliminary study of the territory of development, study of soils 3B about the selection of homes based on the characteristics of the area and the wishes of the client;
3) own production of sawn timber; on the reliability of the company;
4) contract, the exact terms of the works; about providing the client with complete information about the final cost of the object;
5) convenient credit programs;

BUILDING TYPE: Combined houses

Seasonality: ROUND YEAR

Living area. 138 M2

Total area: 163 m

Dimensions: 10 11 M

FLOOR: 2 floors

Construction time: from 70 days

Building type: Combined houses

Seasonality: All year round

Living space: 127 M2

Total area: 200 м

Dimensions: 14.6 ° 12.2m

Number of storeys: 2 floors

Construction time: from 70 days

Phone call (as a client) :

Me : Hello, I was interested in your project of 150m2 and tell me please about how you actually working and costs.

Andrey: Hi, normally it's 30.000 rubles for 1 m2. If we speaking about particular house it might cost around 3-4 millions.

Me: From where you actually transporting the wood?

Andrey : Moscow region.

Me: Ok, but where exactly from?

Andrey: Moscow region as I said.

Me; Ok, thanks! And what if I want to build up more than 300 houses?

Andrey: it will be better you come to our office, because the prices will be different and time lags for such large request.

Me: Ok perfect! See you on Tuesday 30/11/2021.

3D

Interview 30/11/2021

Dialers from wood factory - don’t have their own production.

Results :

1) According to companies preferences and choice, they won’t be able to start working on my project till January.
2) All wood that they ordering will be transported to 5 different project that they are working on now.
3) Firstly «Wood House» asked me about supporting information and documents about land such as geology, geodesy and gene plan which I don’t have.
4) Was difficult to communicate due to , as I thought, lack of interest of the company to help in this project.

Conclusion :

1) Sent formal letter with question about costs, time and materials. Waiting for answer

All photos made by author.

3D

Wood

4

Concrete

7

Results from collaborative work with wood companies

3D

The main aspect of our work together was the calculation of the estimates for the concrete house, which I provided as an example. (Details can be seen in the official letter to «Holz House»).

I calculated one estimate for a 150 m2 concrete house.
The other one - preserving the basic structure of the building but made by wood - was done by the company «Holz House».

Name \ unit	price per unit (₽)	price (₽)
foundation construction cb m.	**3750**	**562 000**
Materials used	**13 120**	**2 722 330**
hollow slabs \ m²	11 200	997 200
3-layer boards exterior \ m²	15 000	1 365 900
columns \ m²	20 330	146 280
Interior Partitions \ m²	11 210	302 450
Cost construction and installation work and delivery \ sq.m.	**8**	**1 361 170**
windows/doors \ sq.m.	**12 383**	**1 857 430**
plastic windows \ sq.m	8 450	166 740
plastic stained glass windows \	21 500	1 139 720
interior doors \ pieces	7 000	70 000
exterior doors \ pieces	30 000	60 000
Stained glass exterior doors sq.m.	21 500	420 970
Cost construction and installation work \ sq.m.	**3 700**	**557 230**
Stairs	**870**	**130 000**
Stairs inside \ pieces	100 000	100 000
Cost construction and installation work stairs sq.m.	**3 700**	**557 230**
Multipurpose flat roofing	**4 000**	**600 000**
MEP systems	**6 170**	**925 000**
heating \ set	3 500	525 000
water supply \ set	670	100 000
water supply \ set	2 000	300 000
finish work \ sq.m.	**8 800**	**1 319 900**
sanitary engineering ModulBau \ set	160 000	640 000
tile installation \ sq.m.	2 000	51 820
laminate \ sq.m.	500	52 350
interior finish wall \ sq.m	600	201 410
outdoor finish wall \ sq.m.	740	301 930
suspended ceilings \ sq.m.	370	52 500
Total	**67 180**	**10 065 040**

102 700 pounds

HOLZ HOUSE

HOUSE K-150

PREPARATORY WORK

No.	Work	Unit ism	Qty	Price unit, rub.	Price, rub.	materials	Unit ism	Qty	Price unit, rub.	Price, rub.
						Bio-toilet rental	months	3.00	9,000.00	27,000.00
						Arrangement of a residential camp and construction site		1.00	70,000.00	70,000.00
	TOTAL				**0.00**	**TOTAL**				**97,000.00**

I. FOUNDATION DEVICE (Reinforced concrete slab 200mm with ribs up)

No.	Work	Unit ism	Qty	Price unit, rub.	Price, rub.	materials	Unit ism	Qty	Price unit, rub.	Price, rub.
	Geodetic works on marking axes, marks	m2	114.00	150.00	17 100.00					
	Development of PRS and foundation pit H=300mm	m2	114.00	350.00	39 900.00	Soil planning or removal from the site	m2	specified after departure to the site		
	Laying geotextile on the base	m2	114.00	200.00	22 800.00	Geotextile	m2	130.00	150.00	19 500.00
	Distribution and compaction of sand (H=300mm)	m2	114.00	750.00	85 500.00	Sand, 20m3	flight	3.00	28,000.00	84 000.00
	Footing device 80mm	m3	8.00	5 500.00	44,000.00	Under concrete M200	m3	8.00	5 200.00	41 600.00
	Panel formwork device	m2	23.00	700.00	16 100.00	Edged board 50x150/200mm	m3	2.30	15,000.00	34 500.00
	Waterproofing device gluing 1 layer	m2	114.00	700.00	79 800.00	Waterproofing roll, 10m2	ruble	18.00	1 500.00	27,000.00
						Bituminous mastic, 20kg	jar	6.00	3,200.00	19 200.00
	Installation of the reinforcing cage of the slab	tons	3.14	20,000.00	62 750.00	Fittings f 12 A III, 12m	tons	2.70	91,000.00	245 700.00
						Fittings f 8 A III, 12m	tons	0.34	92,000.00	31,050.00
						knitting wire	tons	0.10	135,000.00	13 500.00
	Acceptance of concrete mix with vibration H=0.2m	m3	20.00	6,000.00	120,000.00	Concrete M300	m3	20.00	6 500.00	130,000.00
	Pouring a concrete grillage (h) 100x150mm under the walls	m.p.	77.40	900.00	69 660.00	Grill materials (h) 100x150mm under the walls	m.p.	77.40	500.00	38 700.00
						Backhoe loader work	change	2.00	28,000.00	56,000.00
						The work of the concrete pump	change	2.00	32,000.00	64,000.00
						Garbage removal, 20m3	flight	1.00	27,000.00	27,000.00
						Consumables	comp	1.00	35,000.00	35,000.00
	TOTAL				**557 610.00**	**TOTAL**				**866 750.00**

II. INSTALLATION OF THE BUILDING

No. p.p.	Work	Unit ism	Qty	Price unit, rub.	Price, rub.	Materials and mechanisms	Unit ism	Qty	Price unit, rub.	Price, rub.
	Installation of waterproofing on grillage	m	77.40	400.00	30 960.00	Waterproofing roll, 10m2	ruble	10.00	1 500.00	15,000.00
	Installation of scaffolding	set	1.00	25,000.00	25,000.00	Edged board 50x150 mm.	m3	5.00	15,000.00	75,000.00
	Installation of the lining board	m3	0.90	12,000.00	10 800.00	Edged board 50x150 mm. Larch	m3	0.90	44,000.00	39 600.00
	Antiseptic	m3	0.90	3,000.00	2700.00	antiseptic	l	20.00	200.00	4000.00
	Wall mounting	**m3**	**79.00**	**7000.00**	**553,000.00**	Glued wall beam **185x202 mm** (Needles), **Kit includes:** - profiled according to the selected profile; - cutting of cups according to design documentation (dispensing project; - end cuts for casing boxes; - antiseptic in the factory, Teknol-Aqua 1410-01 (TEKNOS); - processing at the factory of the ends of parts with a compound that prevents cracking of the ends of Teknol-JRM (TEKNOS); - drilling channels in the bursa for studs, dowels, electrics; - Packed in a branded film to protect against external factors;	**m3**	**79.00**	**70,000.00**	**5,530,000.00**
						Stud M12 galvanized	comp	1.00	173 800.00	173 800.00
						Coupling M12 galvanized				
						Nut galvanized				
						Washer galvanized				
						Nagel L=1200 mm				
						Shrink compensator				
						BMF, beam support				
						ruffed nails				
						Cup polytherm				
						PSUL cups				
						Mezhventsovy heater	comp	1.00	67 700.00	67 700.00
	Laying of glued interfloor overlapping	m3	3.00	10,000.00	30,000.00	Beams glued according to the project	m3	5.00	65,000.00	325,000.00
	Installation of glued poles	m3	1.50	11,000.00	RUB 16,500.00	Beams glued according to the project	m3	1.50	65,000.00	97 500.00
	Installation of casing boxes	PC	22.00	4000.00	88 000.00	Casing materials	set	22.00	4 500.00	99,000.00
						Delivery of the house kit to the site	flight	2.00	60,000.00	120,000.00
						The work of the crane on the assembly of the house kit	change	2.00	28,000.00	56,000.00
						Crane work on unloading house kit	set	2.00	28,000.00	56,000.00
						Garbage container, 20m3	PC	1.00	27,000.00	27,000.00
						Consumables	set	1.00	40,000.00	40,000.00
	TOTAL				**RUB 756,960.00**	**TOTAL**				**6 725 600.00**

III. COVERING AND ROOFING DEVICE

No. p.p.	Work	Unit ism	Qty	Price unit, rub.	Price, rub.	materials	Unit ism	Qty	Price unit, rub.	Price, rub.
	The device of the truss system									
	Installation of scaffolding	set	1.00	1 350.00	220 050.00	Rafters glued according to the project	m3	6.00	65,000.00	390,000.00
						Set of fixing materials (rafters, roofing)	set	1.00	79 900.00	79 900.00
	Roof installation									
	Installation of lining of overhangs	m2	54.00			Planed frontal board 140x20 mm (needles)	m2	65.00	1 150.00	74 750.00
	Lathing and counter lathing device	m2	326.00			Bar 45x45mm dry planed	m3	3.50	44,000.00	154,000.00
	Lathing device inside for insulation	m2	125.00			Planed board 20x100/150	m3	1.00	44,000.00	44,000.00
	Antiseptic	m3	5.80			antiseptic	l	100.00	200.00	20,000.00
	Vapor barrier installation	m2	125.00	2500.00	407 500.00	Vapor barrier Delta	m2	150.00	200.00	30,000.00
	Installation of waterproofing	m2	163.00			Hydro - windproof membrane Delta	m2	225.00	180.00	40 500.00
	OSB solid flooring device	m2	163.00			OSB boards (2500*1250*12mm)	m2	188.00	650.00	122 200.00
	Laying insulation 250 mm	m3	31.00			Insulation, stone wool 40-45	m3	31.00	3 950.00	122 450.00
	Installation of shingle roofing	m2	163.00			Materials for the installation of roofing, taking into account the components:	m2	163.00	3,000.00	489,000.00
						Consumables	set	1.00	30,000.00	30,000.00
						Roofing crane work	change	1.00	28,000.00	28,000.00
						Garbage container, 20m3	PC	1.00	27,000.00	27,000.00
	Installation of a drainage system	m.p.	40.75	800.00	32 600.00	Materials for the drainage device, taking into account the accessories:	comp	1.00	82 600.00	82 600.00
	TOTAL				**660 150.00**	**TOTAL**				**1,734,400.00**

IV. INSTALLATION OF PVC WINDOWS AND DOORS

No. p.p.	Work	Unit ism	Qty	Price unit, rub.	Price, rub.	materials	Unit ism	Qty	Price unit, rub.	Price, rub.
	Filling openings with window blocks	m2	65.00	3 500.00	227 500.00	Plastic window blocks Rehau, 3-chamber 70 mm white, 2-chamber double-glazed window 40mm	m2	65.00	18,000.00	1,170,000.00
	Filling openings with door blocks	m2	33.00	3 500.00	115 500.00	Plastic door blocks Rehau, 3-chamber 70 mm white, 2-chamber double-glazed window 40mm	m2	33.00	20,000.00	660,000.00
						Consumables	set	1.00	20,000.00	20,000.00
	TOTAL				**343,000.00**	**TOTAL**				**1,850,000.00**

141 330 pounds

Total materials:	**RUB 11,273,750.00**
Total work:	**RUB 2,317,720.00**
Total:	**RUB 13,591,470.00**
Transportation and overhead costs:	**RUB 296,000.00**
Estimated total:	**RUB 13,887,470.00**

Results from collaborative work with wood companies

3D

Author

Provided design of the house 150m2 by author .

BIM models from «Wood House» company according to given (initial) design provided by author.

Wood

6

Concrete

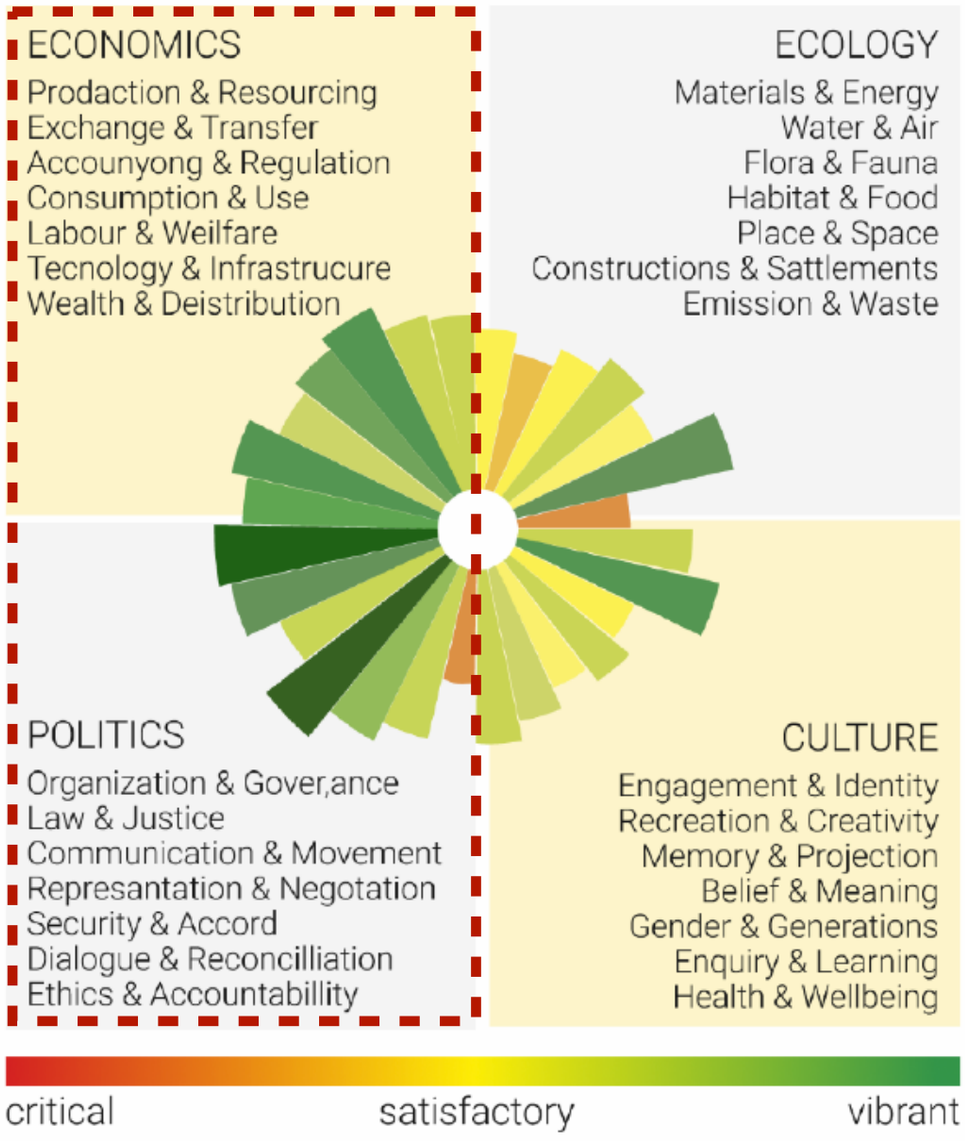
8

Sustainability circle

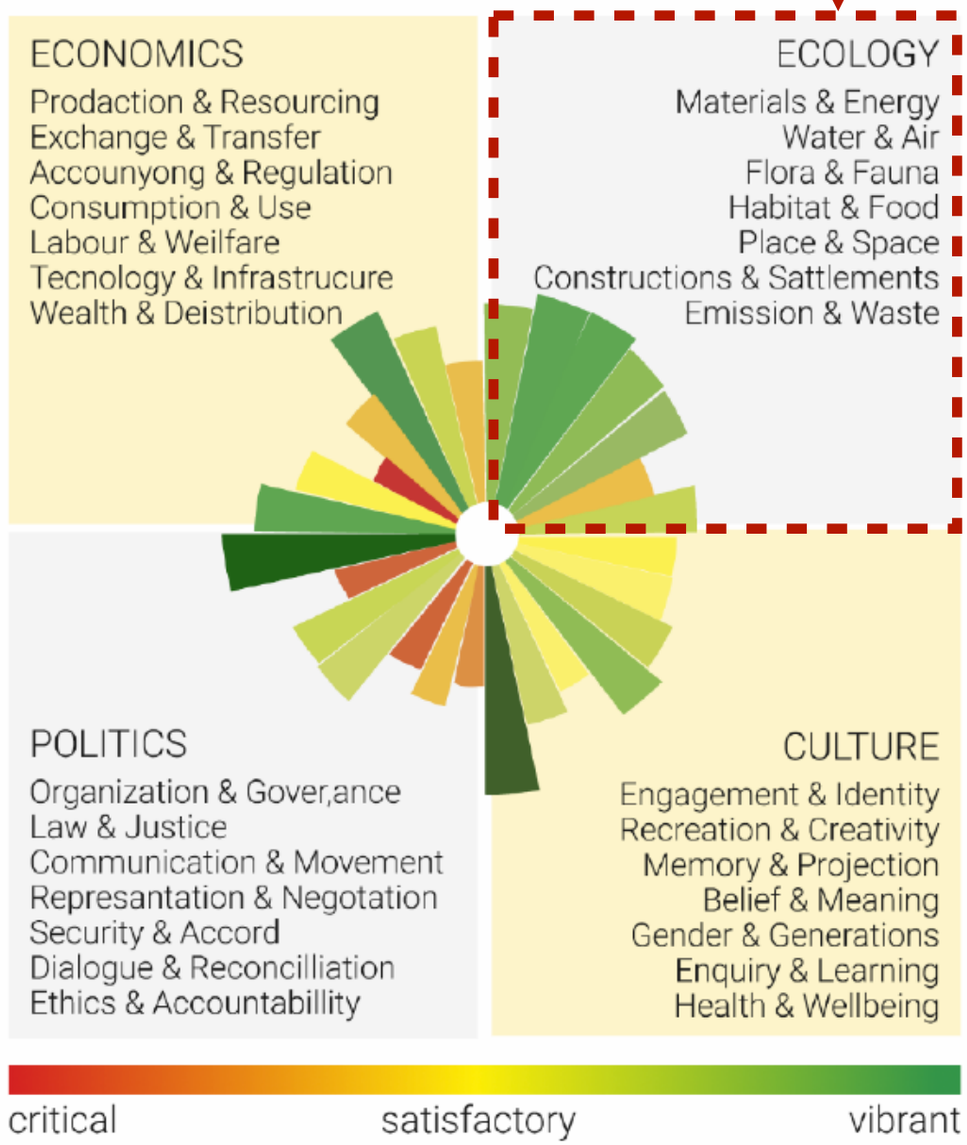
3D

+2

CONCRETE RENOVATION



WOOD RENOVATION



Rose diagrams were made by author according to previous analysis.

Wood

7.5

Concrete

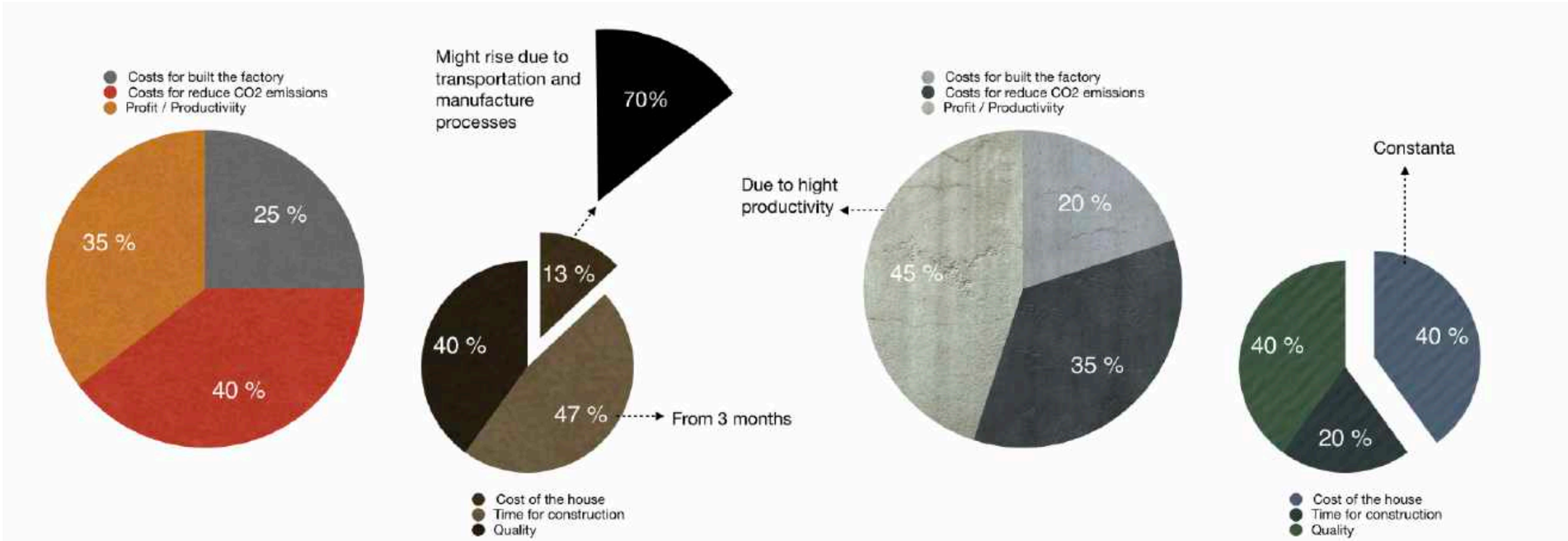
9

Developer's choice vs client's choice

3D

WOOD

CONCRETE



DEVELOPERS

CLIENTS

DEVELOPERS

CLIENTS

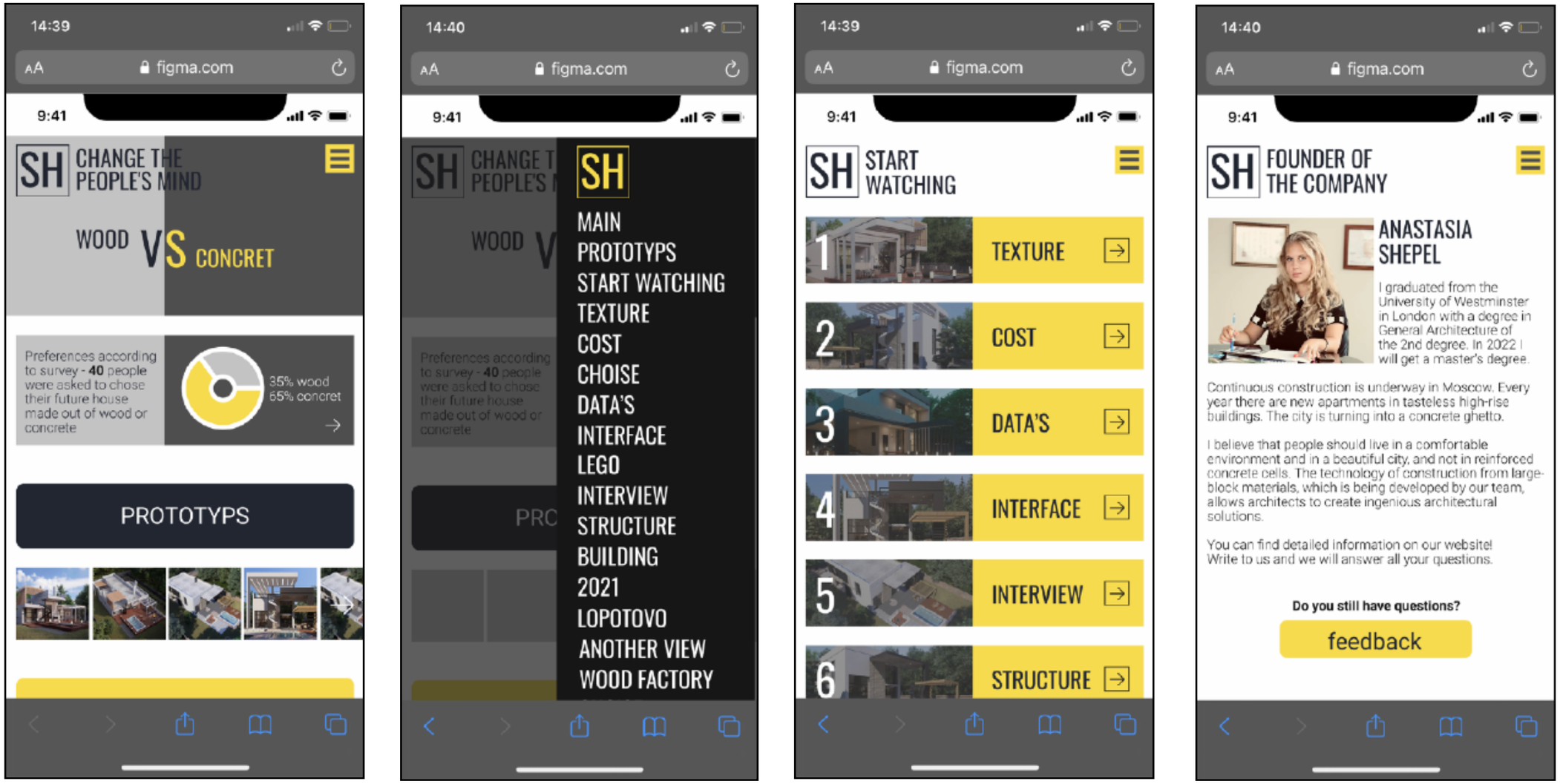
0.5

1

0.5

0.5

Diagrams were made by author according to previous interviews and estimates.



Screenshots of mobile app - made by author.

Today there are more and more debates and questions on the topic of economically and environmentally sustainable industrial housing. Since we build for people we have to ask people, potential customers, what they would like to see - what kind of environment they would like to be in.

For this purpose, I created a mobile application that will allow us to collect the necessary information from different populations in the shortest possible time and get their opinions and feedback.

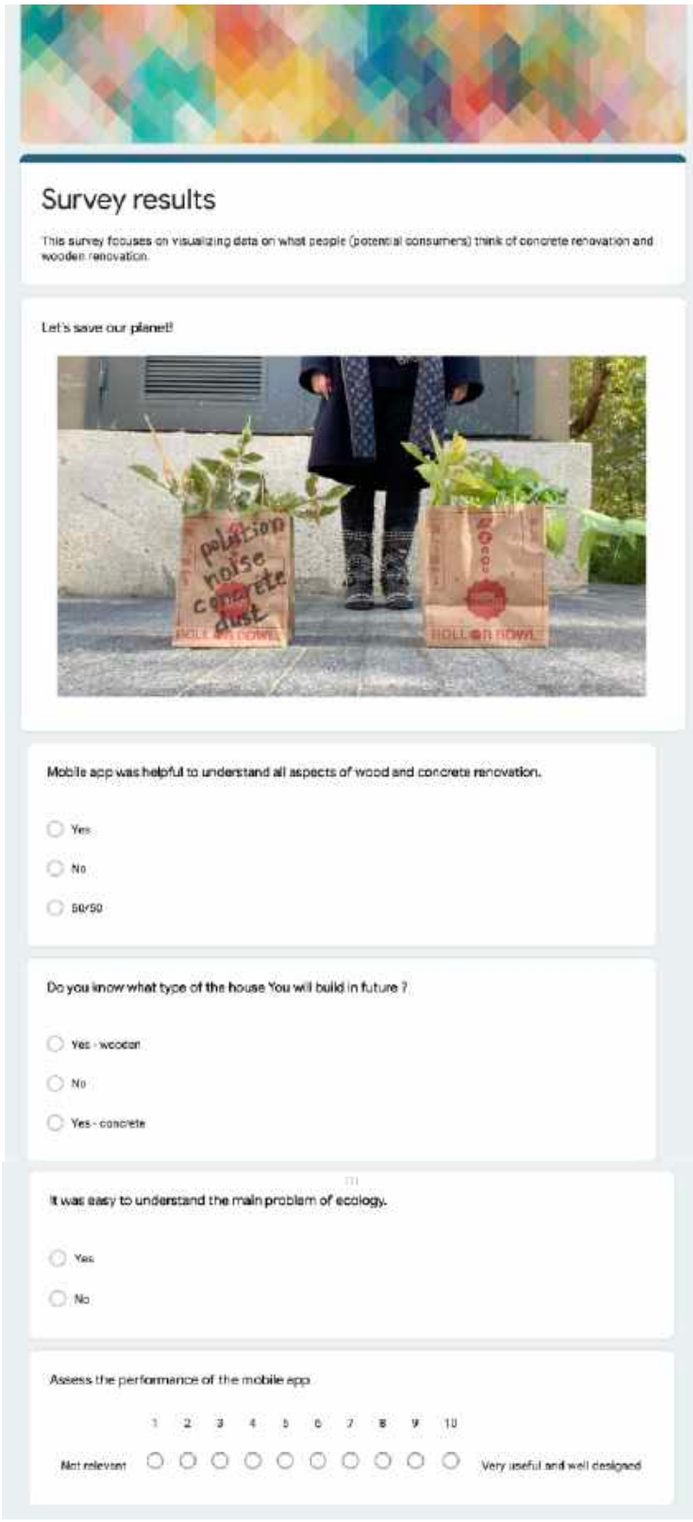
Wood

8.5

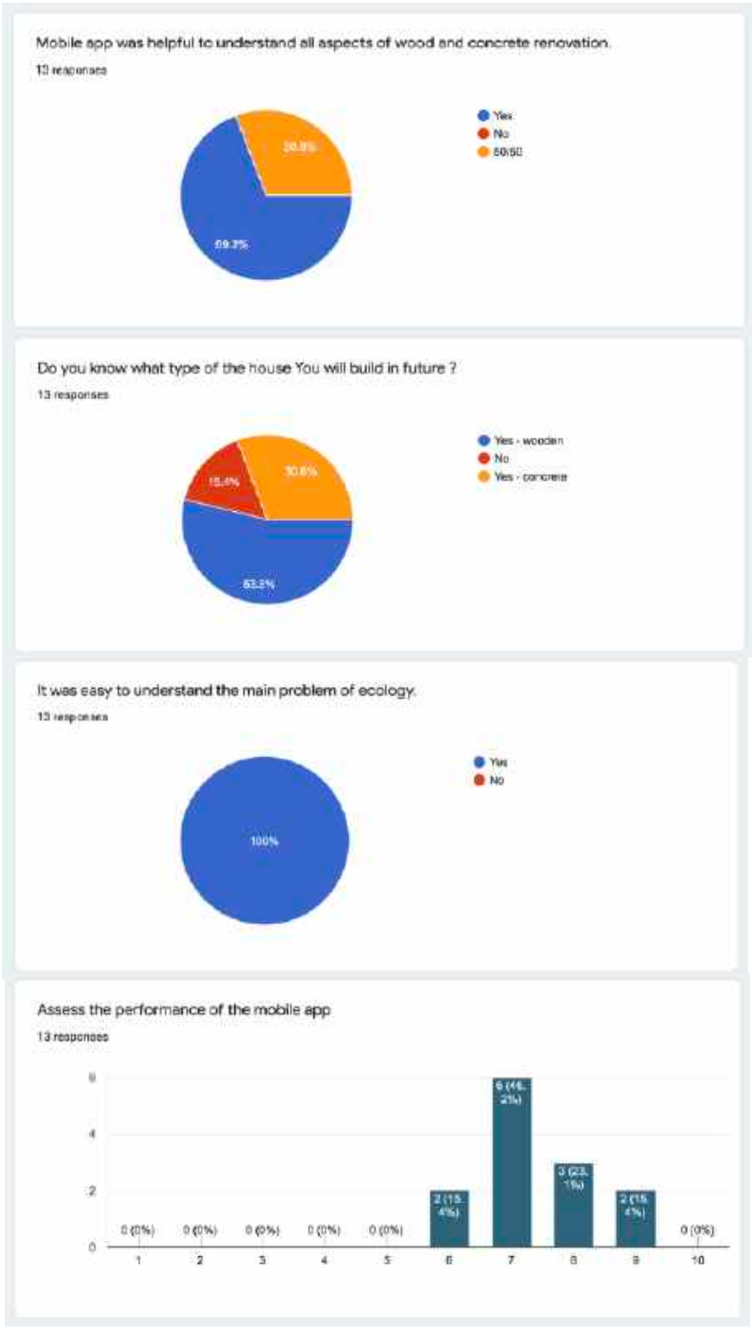
Concrete

9

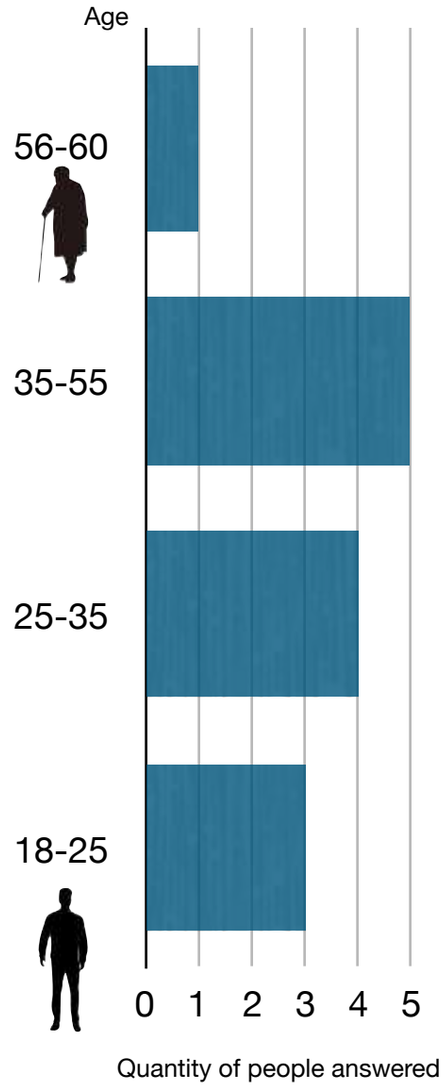
Prototype 2 - mobile application – results



Questions - made by author.



Summary.



3E

Link for video : **https://youtu.be/GT4562gVNNQ**

Video presents how people use my application

3E

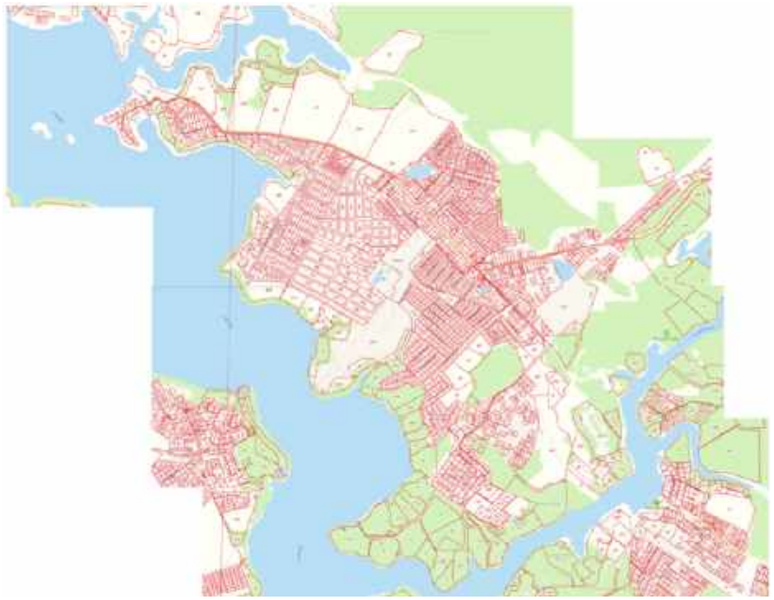
Introduction

This work would be meaningless if there was no practical application of my research.

For practical application, I have chosen an area 61 km from the centre of Moscow - the village of Lopotovo in the Istra district. This area is in the coastal area from the Istra reservoir and is a favorable area for further development.

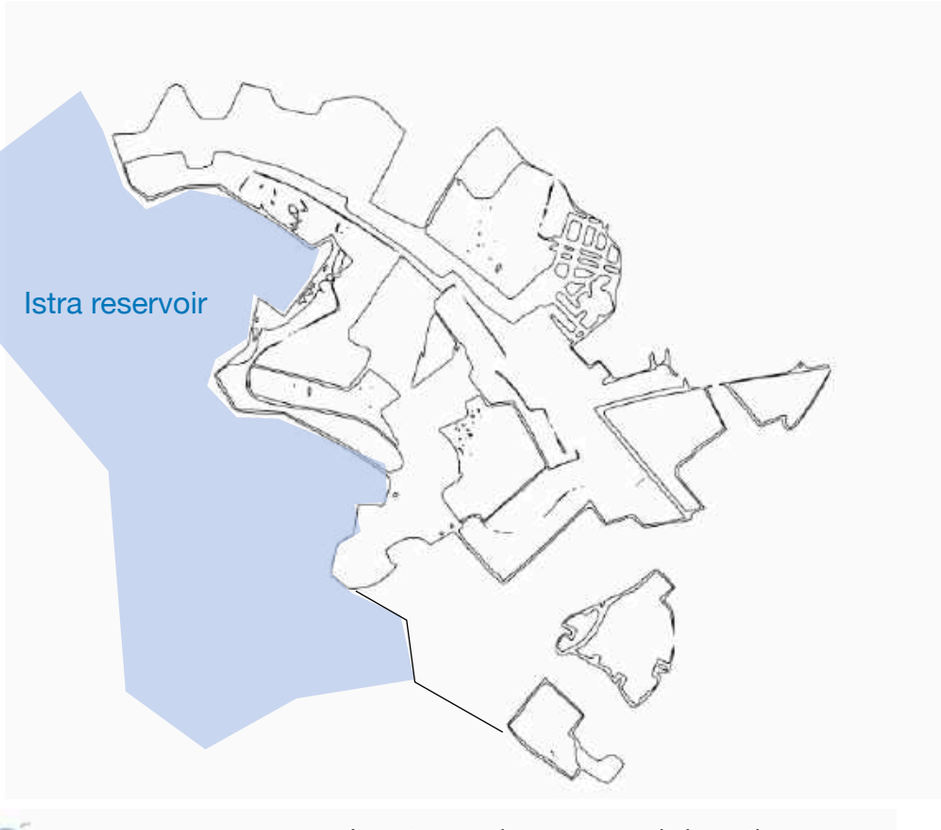
Nowadays there are only 131 person living in that area and very few developed sites with 1 pharmacy , 2 shops and no schools at all.

The cadastral map shows the boundaries of the plots which foresee a future residential development in 2050. 20% of the plots are owned by the city and are not expected to be renovated in the next 20-25 years due to lack of interest from developers and investors in the area. 50% belongs to my father (landowner) and 30% to investors.

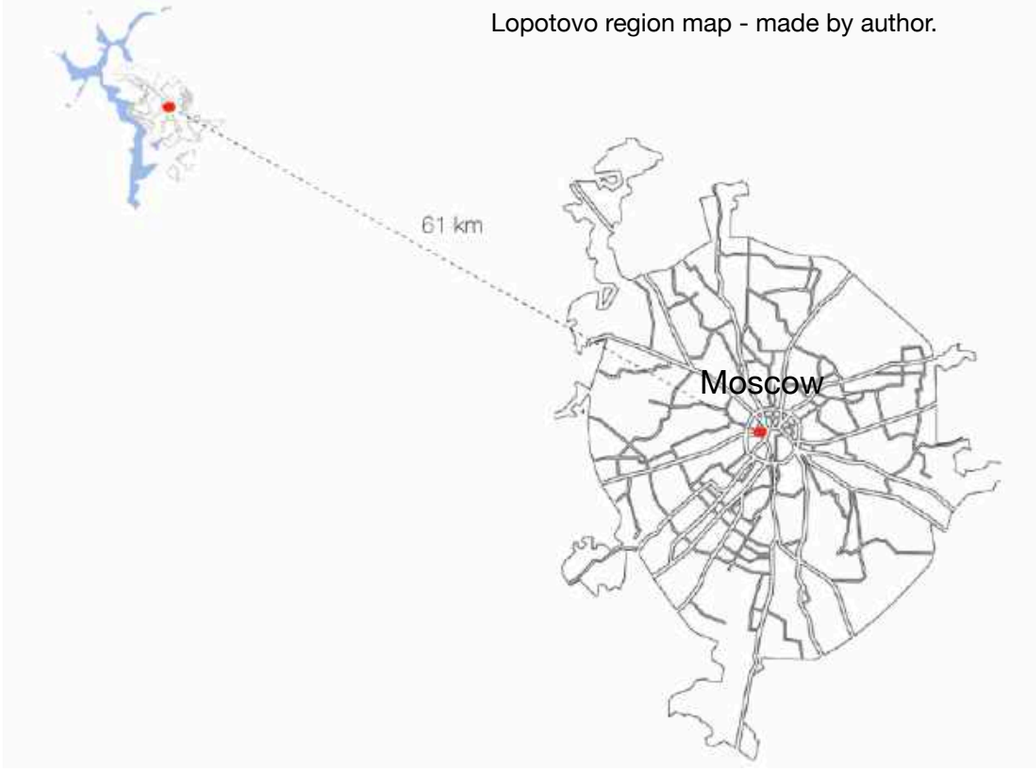


Cadastral map

I have a tremendous responsibility to future generations and to our environment, because the face of our future cities and regions will depend on me as an architect and representative of the interests of generation zoomers.



Lopotovo region map - made by author.



Location map - made by author.

Ecological passport of the city district of Istra

General information
Istra district is an administrative - territorial unit (district) and a municipal formation of the same name (municipal district) that existed until March - July 2017 in the north - west of the Moscow region of Russia.

On March 10, 2017, by law No. 21/2017 - OZ, the municipal formation of the Istra municipal district was transformed into the municipal formation of the urban district of Istra, with the abolition of all settlements previously included in it.

On July 8, 2017, the administrative - territorial unit of the Istra district is transformed into a city of regional subordination Istra with an administrative territory.

The administrative center is the city of Istra.
The main river is Istra.
Population (01.01.2017) - 121 363 people.
The area of the urban district is 1268.97 hectares.
The population density is 95.64 people / sq. Km.

Minerals

On the territory of the district there are deposits of minerals: boulder - gravel, sand, loam and clay. Deposits of federal significance are given as of 01.01.2010.

I. Construction sands
II. Sand - gravel materials
III. Low-melting clays and loams

Novo - Jerusalem (No. 100) deposit of low-melting clays and loam for brick is being developed and has 4 sections:

1. Efimonovsky, located 6 km north of the Novo- Jerusalemskaya railway station, 6-5 km north - west of the city of Istra, 2 km north - east of the Northern section;
2. Western, located 4 km north-west of the railway station Novo- Yerusalimskaya, adjoins from the north and north-west to the Northern section;
3. The 1988 exploration area is located 0.2 km west of the village of Efimonovo between the Efimonovsky and Severny areas;
4. Severny, located 4 km north - west of the railway station Novo- Jerusalem, 4-5 km west of the city of Istra.

Vi. Peat deposits.

Specially protected natural areas

1. State nature reserve of regional significance "Upper reaches of the Big Sister River":
total area of protected areas: 5,274.5 hectares;

Protected ecosystems: spruce and small-leaved - spruce oxalis, oxalis - ferns and blueberries - oxalis green moss groups, oxalis - reed grass, shrub forb - oxalis and bilberry broad grass forests; mixed forests with the participation of spruce, oak and small-leaved species, wide-herb shrubs; slope mixed forests with maple and elm shrubby broad-herb; damp and swampy birch forests; gray alder stands are wet herb.

2. State nature reserve of regional significance "Valley of the river. Malaya Istra ": total area of protected areas: 480.7 hectares;

3. State nature reserve of regional significance "Spruce - broad-leaved forest on the left bank of the Boldenka River": total area of protected areas: 369.8 hectares;

MASTER PLAN OF SOKOLOVSKOYE RURAL SETTLEMENT, SOLNECHNOGORSK MUNICIPAL DISTRICT, MOSCOW REGION REGULATION ABOUT TERRITORIAL PLANNING

SECTION 1.
Parameters of functional zones

1.1 Planning organization of the territory
Sokolovskoye Rural Settlement Solnechnogorsk Municipal District

The main directions of spatial planning organization of the territory of the rural settlement Sokolovskoye Solnechnchnchnogorsky municipal district are based on the priorities of urban development in Moscow region and are as follows:

1. Formation of zones for placement of capital construction of regional (Moscow region) value - planned areas of concentration of urban activity.
2. Formation of zones of planned placement of capital construction objects of public purpose - planned territories of new public construction and development of social infrastructure on the territory of rural settlement Sokolovskoye.
3. Determination of areas for locating capital construction objects of local importance necessary for exercising the powers of local government (social services, pre-school and school educational institutions).
4. Defining zones for the location of planned residential development.
5. Preservation of the historical and cultural potential and the interconnected system of landscapes (natural, historical and cultural, rural, township).
6. Preservation and development of the system of protected areas.
7. Formation of a system of landscaped areas for public use. 8.
8. Reconstruction of highways taking into account the perspective intensity of traffic, modernization of the local transport network.
9. Reconstruction of existing and construction of new objects of the engineering infrastructure on the territory of the rural settlement: centralized water supply systems; centralized systems of household sewerage with the transfer of effluents to the local facilities of complete biological treatment.
10. Measures to close cemeteries located in the water protection zones of rivers and streams.

Мировое сообщество должно выработать единый подход к глобальной климатической проблеме и стимулированию развития и обмена технологиями снижения выбросов, а не искать виновных и не использовать односторонние протекционистские меры

«Роснефть» уделяет особое внимание восстановлению лесов.

ФОТО ПРЕСС-СЛУЖБЫ ПАО «НК «РОСНЕФТЬ»

The world community must develop a unified approach to the global climate problem and stimulate the development and exchange of emission reduction technologies, rather than look for culprits or use unilateral protectionist measures - ROSNEFT.

ность предложения на мировом рынке углеводородов.

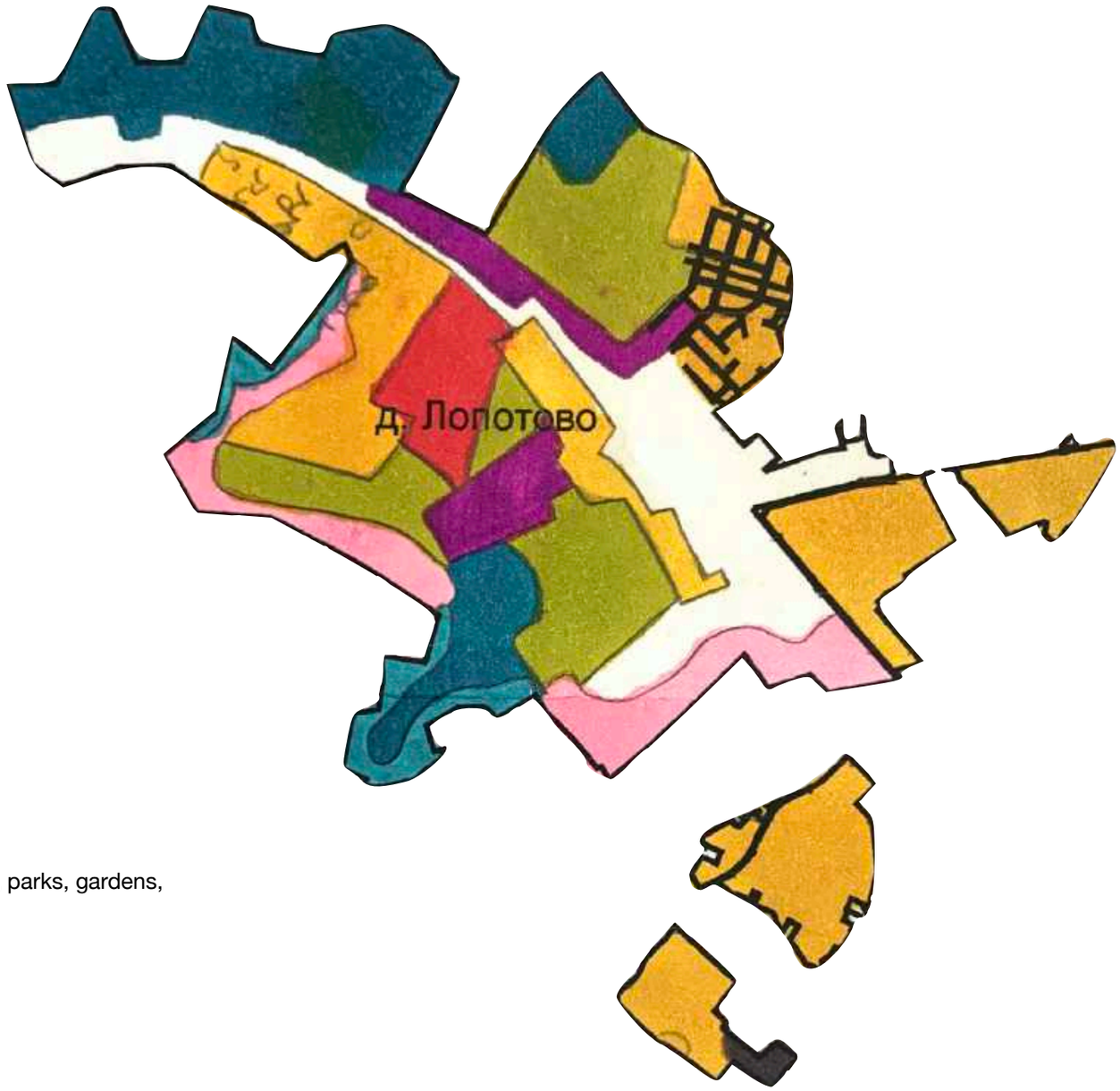
ФОТО ПРЕСС-СЛУЖБЫ ПАО «НК «РОСНЕФТЬ»

«Энергетический переход должен быть синхронизирован с обеспечением энергоресурсами, надежными поставками металлов и других материалов, развитием технологий, а также адаптацией потребительского поведения. Без этого основная концепция, отраженная в самом слове «переход» как развивающийся во времени процесс, будет неработоспособна», – считает глава «Роснефти»

"The energy transition must be synchronized with the provision of energy resources, reliable supplies of metals and other materials, the development of technology, and the adaptation of consumer behavior.
Without this, the basic concept reflected in the word 'transition' itself as a time-developing process will be unworkable," says the head of ROSNEFT.

Cut from newspapers - made by author.

Satellite map photo.



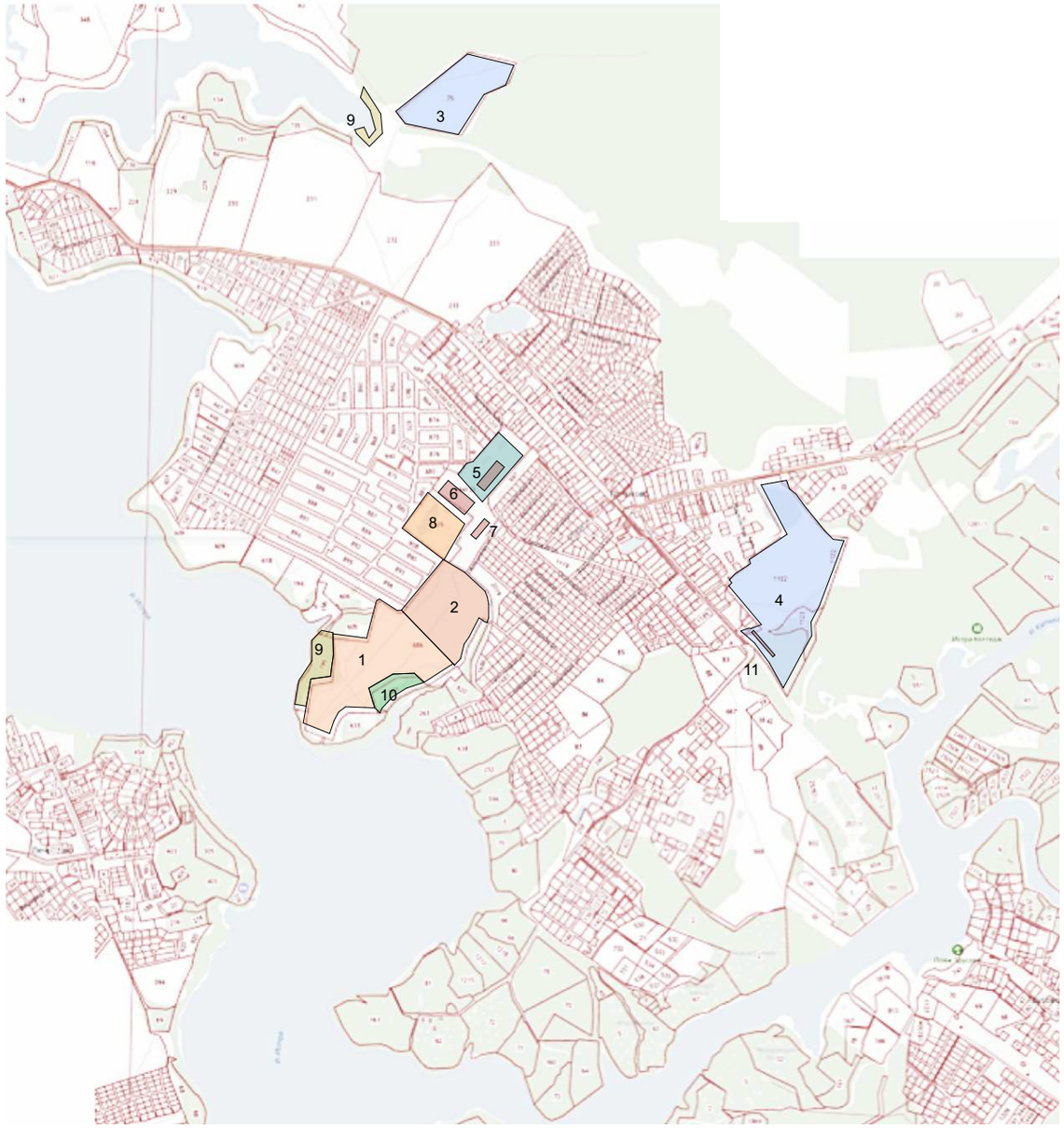
Functional zones*

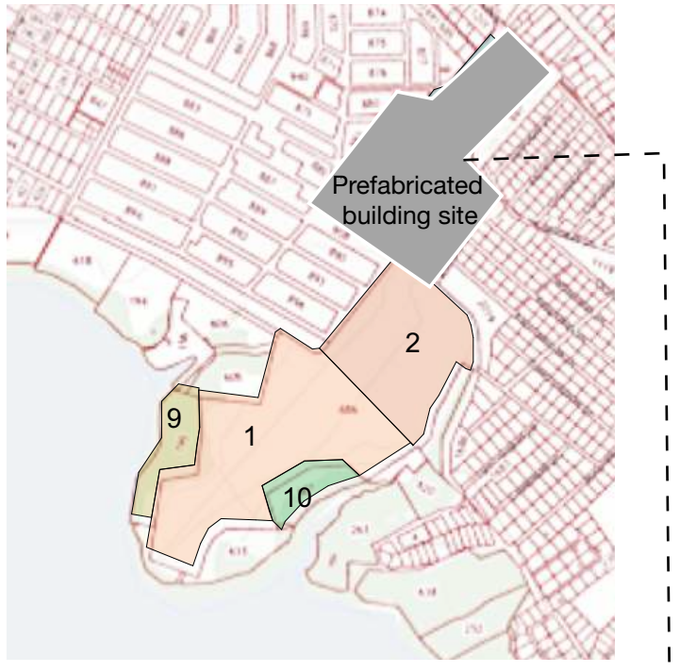
- 1) Residential zones
- 2)Residential development zone
- 3) Multifunctional public residential zone
- 4) Public-business zones
- 5) Transport infrastructure zone
- 6) Industrial zone of agricultural enterprises
- 7) Zone of the planted public areas (forest parks, parks, gardens, public gardens, boulevards, urban forests)

Map colored by author - information taken from national register.

"Applied taking into account the requirements of Sp 2.1.4.2625-10 "Zones of sanitary protection of sources of drinking water supply of the city of Moscow" (approved by Decree of the Chief State Sanitary Doctor of the Russian Federation of 30.04.2010 N 45) and other regulations on establishment of zones of sanitary protection of sources of drinking water supply.

Option 1 - Improvement of the «Lopotovo» area.





WE ARE MAKING PROGRESS AND WE ARE MOVING IN THE RIGHT DIRECTION, BUT WE HAVE TO BE REALISTIC BECAUSE THESE THINGS TAKE TIME

4B

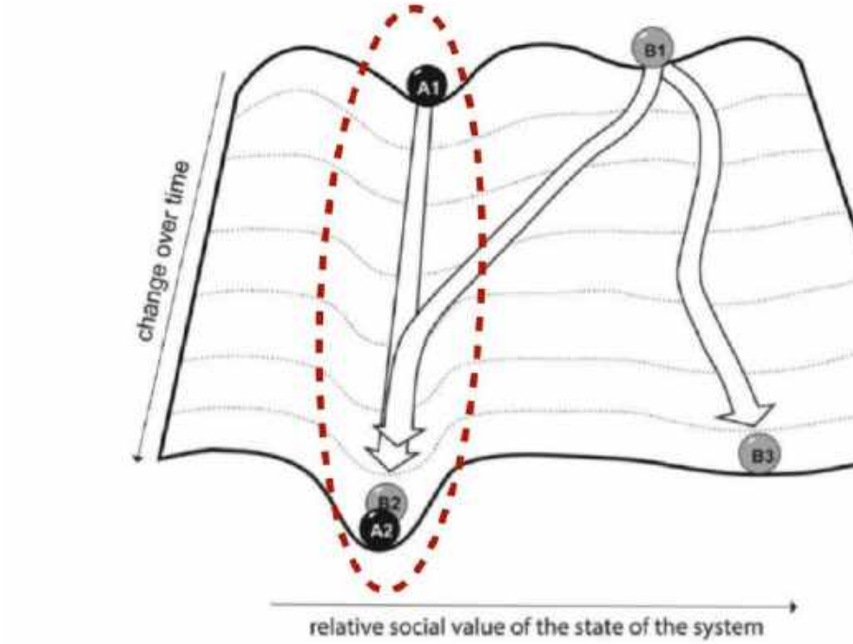
Cycle implementation scheme

One of the most important aspects of designing such a large area is to consider all phases of construction.

In the future, the construction and development of the area will be done in phases - the first phase near the shore, the second in the centre of the area and the last (the furthest part from the shore).

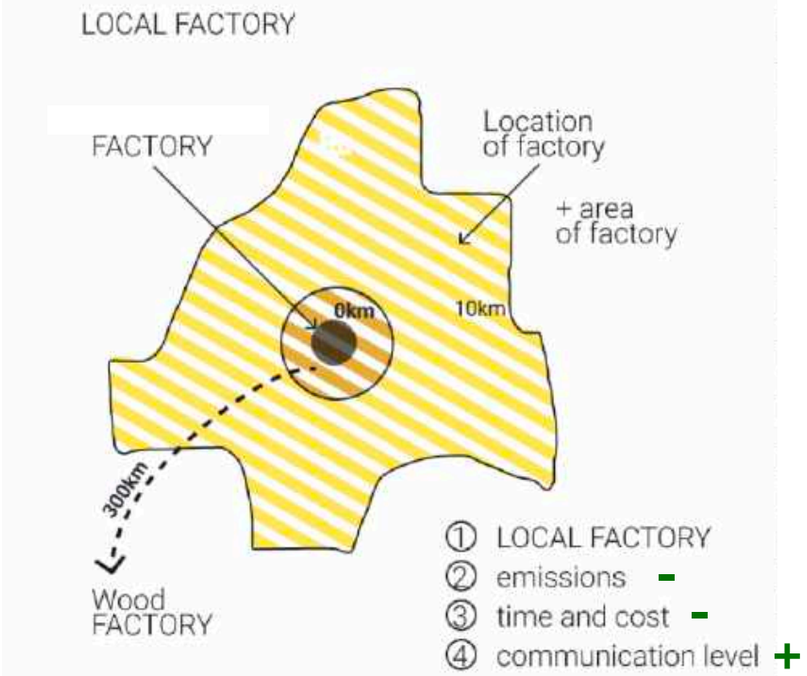
For the smooth work of all participants of the process (builders, investors, foremen and architects) it is necessary to create a single object which will provide the construction with materials. If construction materials are delivered from other regions of Moscow, there will be problems with timing and pricing.

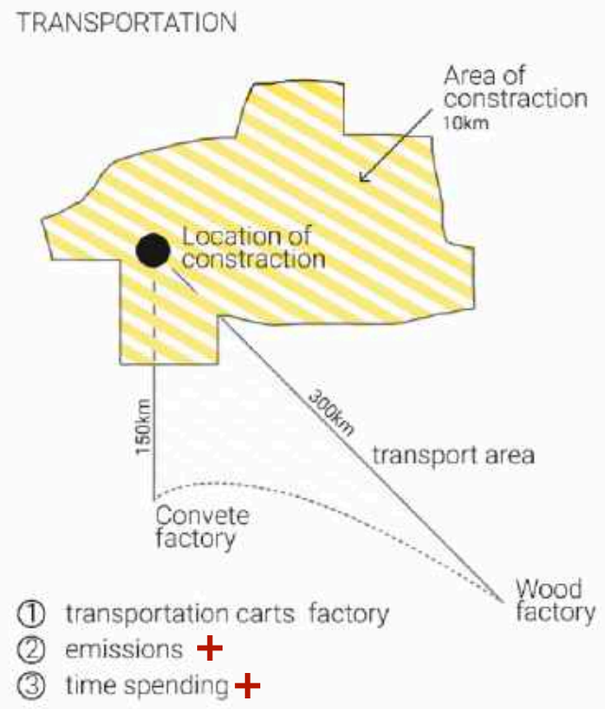
This practice is presented in great detail in the book «Site Matters».



Resource

Figure 9.2 **In dynamic systems, small differences of energy input and system character can produce big differences in outcome. Landforms are used as metaphors for potential system trajectories. Imagine a grooved and warped pool table: even small inputs of energy can "tap" a system from a flat zone into a groove. More energy would be needed to shift the system back out of that trajectory. Moving to a deeper groove represents an increase in resilience. Moving to a flatter part of the surface represents a loss of resilience. System A maintains its relative value over time, while increasing its resilience to perturbations (A1 to A2). A small perturbation of System B could tip it into a less valuable state that is very resilient (B1 to B2), or its performance might vary a lot over time and become less resilient at a condition of higher value (B1 to B3).**

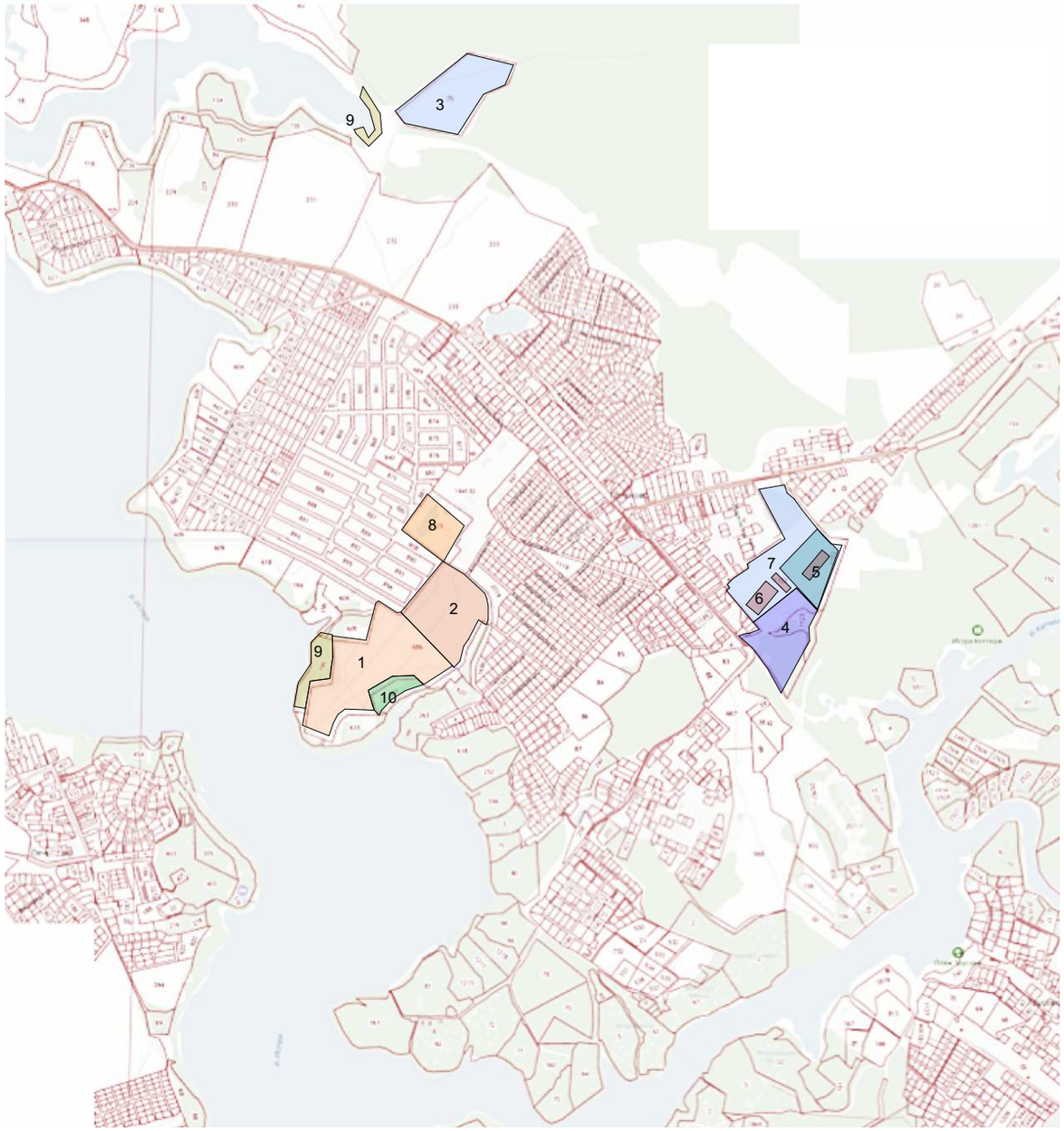


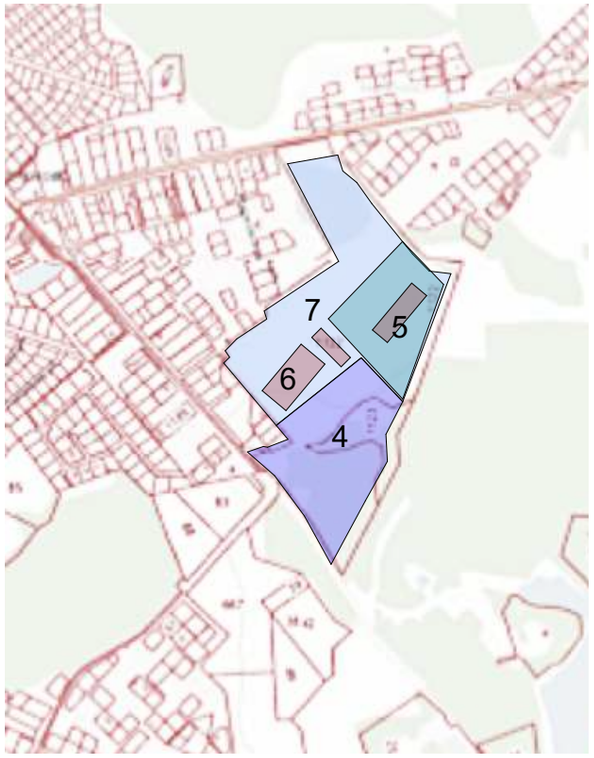


Drawings by author - 2 different options of development.

4B

Option 2 - Improvement of the «Lopotovo» area.



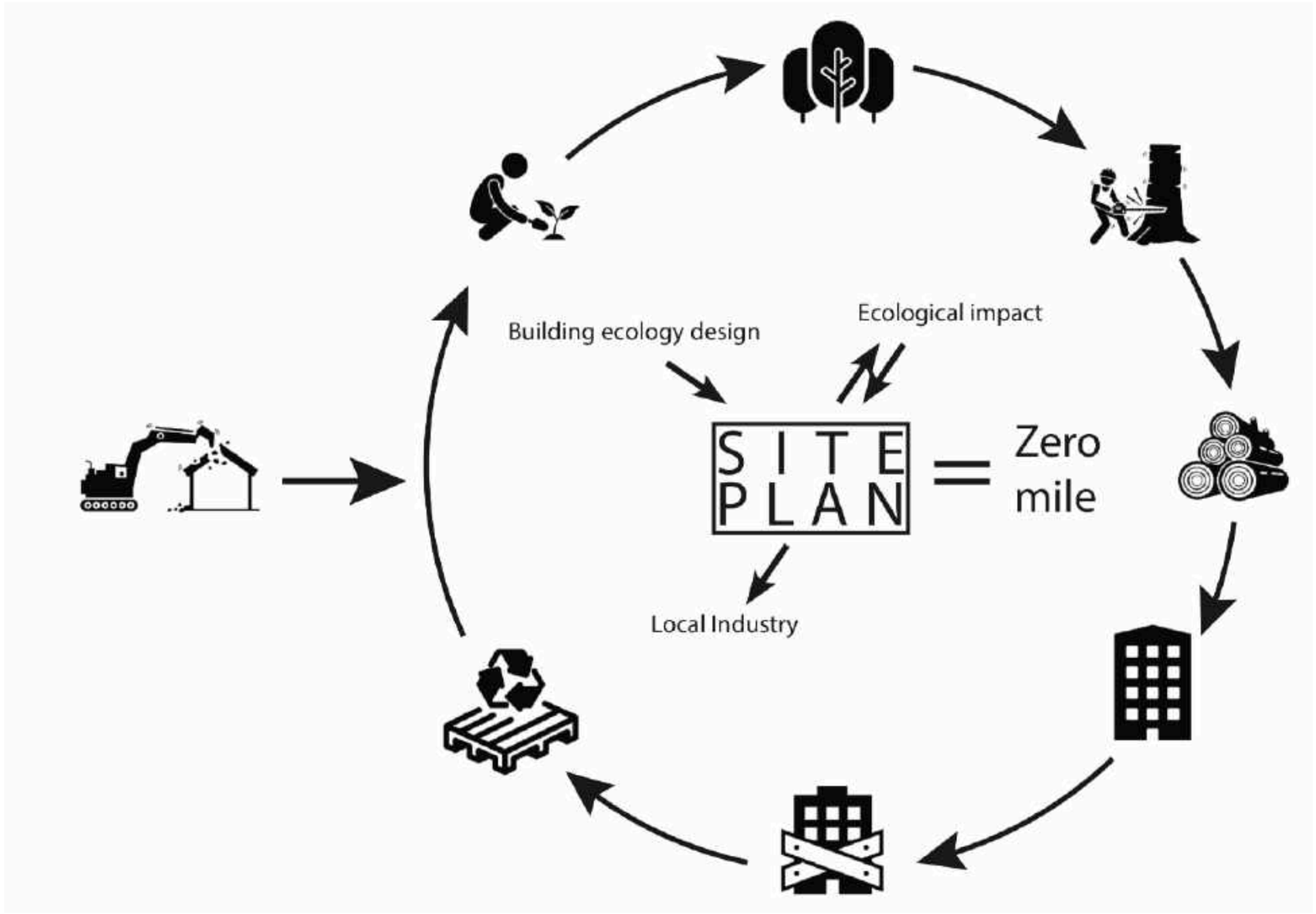


The previous site plan was slightly modified after discussion - the central production factory was removed according to government regulations. However - mobile (temporary) factory can be placed but price for construction and demolishing will rise.

4B

Nowadays, it has become necessary to start creating self-sufficient buildings because this will facilitate the economy of the country and have a positive effect on the environment later on.

The process of creating self-sufficient buildings can be divided into its operation and the process of production. And while the principles of self-sufficiency are discussed in the following sections, the process of producing buildings takes place in the urban environment.

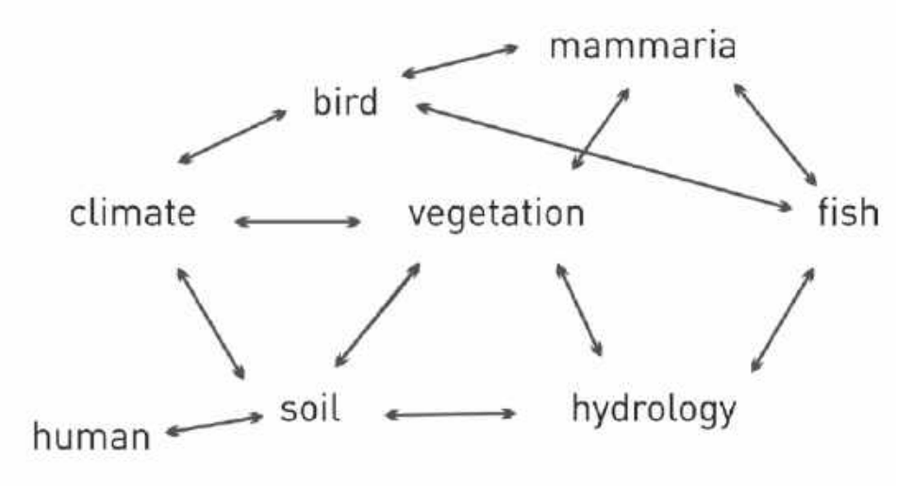


Infographics - wood construction

Building ecology related to:

- **“meso environment”** is the environment in which the building is located. It includes the soil, groundwater, air, and neighboring structures and natural features
- **“meta environment”** is the building itself. It includes the building shell or envelope, the structure, equipment, services, finishes, and furnishings.

According this, two aspects of building ecology will be considered - urban environment (meso) and buiding design inself (meta).



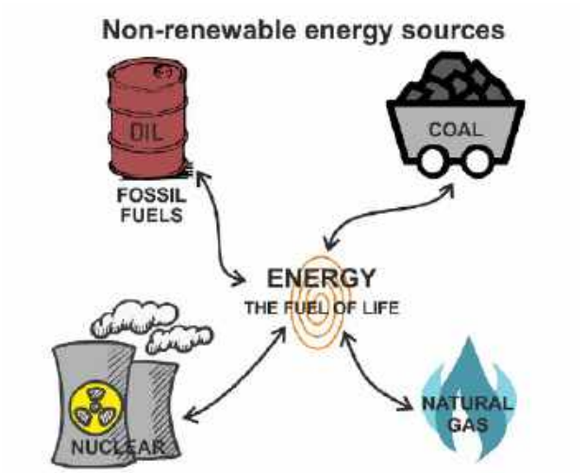
Infographics - meso and meta

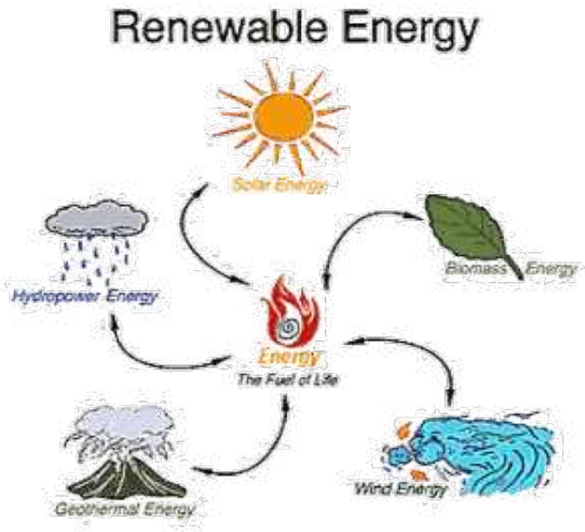
Emanuele Naboni

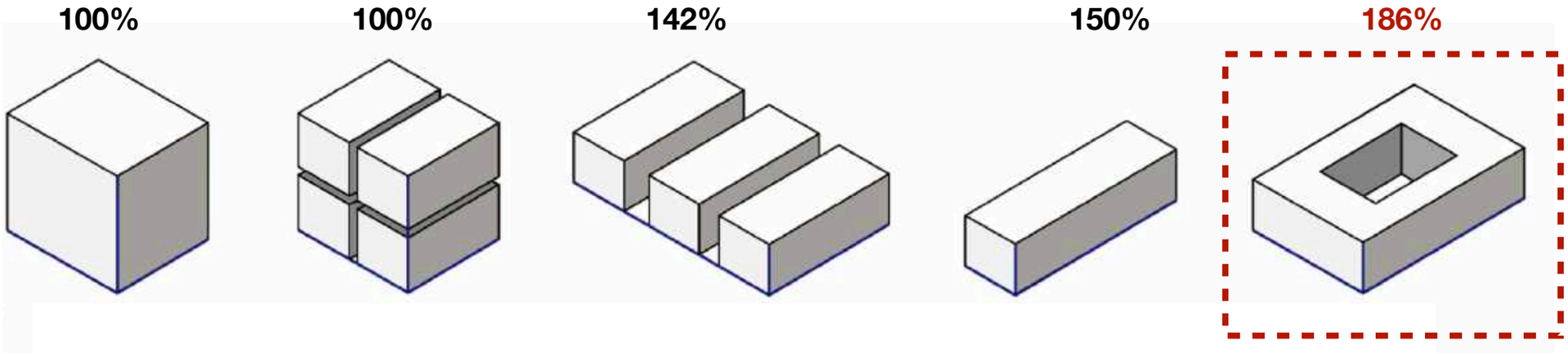
KADK

P.M.: If you were to imagine an ideal city of the future, would all houses in it be energy positive? And could we make the cities that already exist that way?

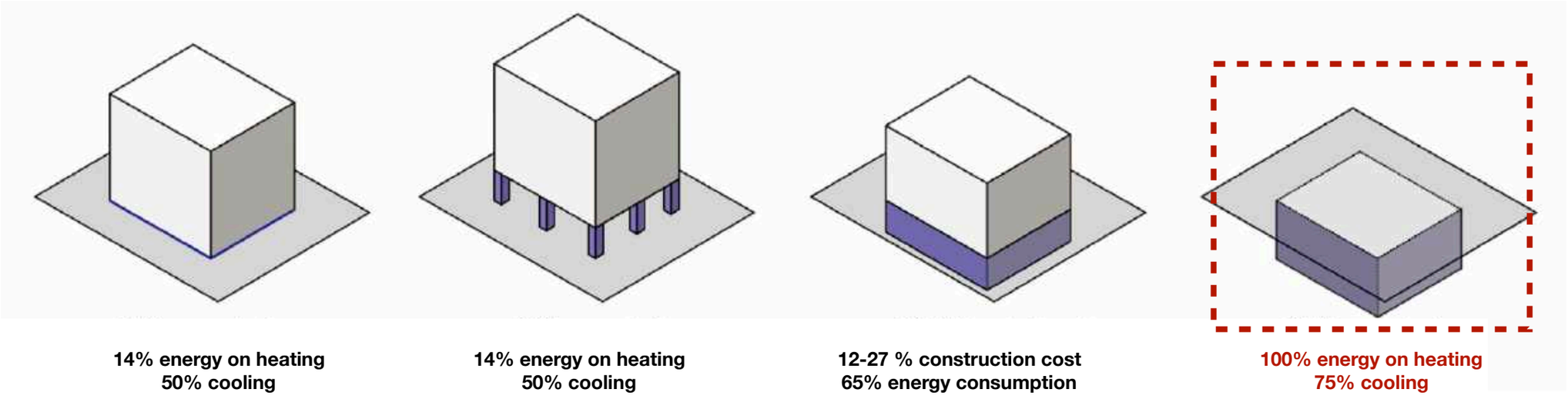
E.N. - The first thing needed for energy-efficient buildings is the right design. Secondly, we need to use renewable energy sources - geothermal, solar, wind.







Dependence of building shape on non-energy consumption.



14% energy on heating
50% cooling

14% energy on heating
50% cooling

12-27 % construction cost
65% energy consumption

100% energy on heating
75% cooling

Mario Bodem

ING+ARCH

Mario Bodem: Our main theme is energy efficiency in architecture, especially in the context of climate change and CO2 emissions. Construction is responsible for almost 50% of CO2 emissions.

P.M.: You mean passive houses?

M. B.: Yes. You can call it passive houses. Today's technology, you can save up to 90% energy. If there are 10 billion people on the planet by 2050, and they live in cities, our entire CO2 budget will go just to build houses for them.

Wood

1. Materials are reusable
2. Resource is renewable
3. No need on transportation
4. No CO2 emissions
5. On cite fabrication/ prefabrication
6. Great insulation
7. Physical properties

Visualization made by author - future faced materials of the building in Lopotovo region. BIM draft

Concrete

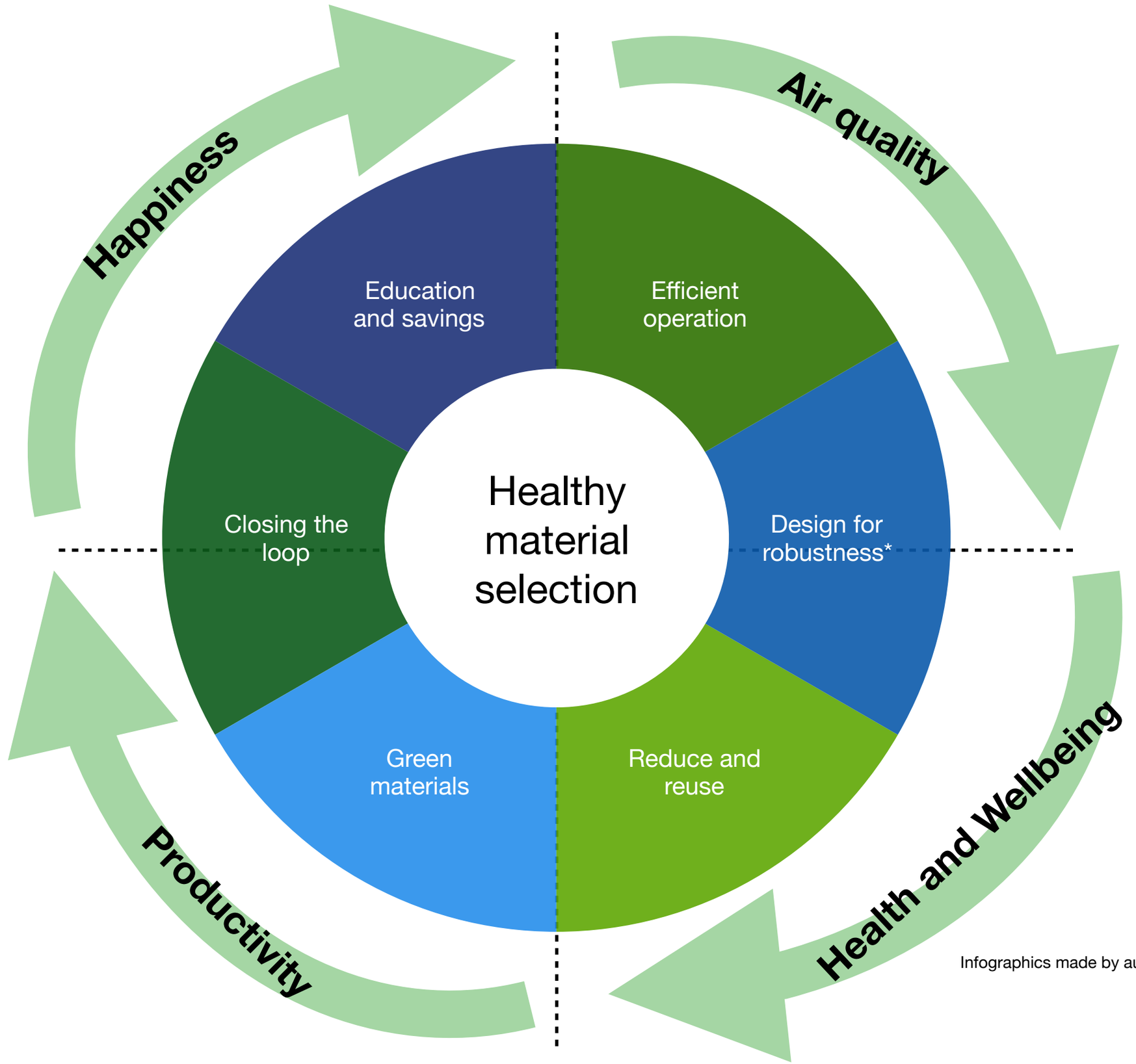
1. Physical properties
2. Flexible design

Protection

1. Mechanical protection
2. Protection from rain
3. Wind-proofing
4. Reflection of light radiation and thermal radiation
5. Absorption of thermal radiation
6. Reflection of electromagnetic radiation

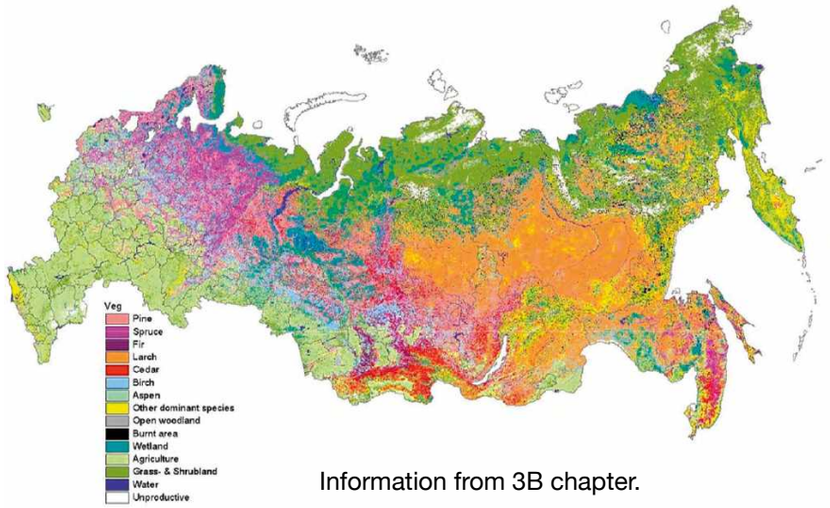
Connection

1. Visual contact
2. Light
3. Air permeability/ Natural ventilation
4. Solar radiation
5. Heat gain
6. Storage of heat

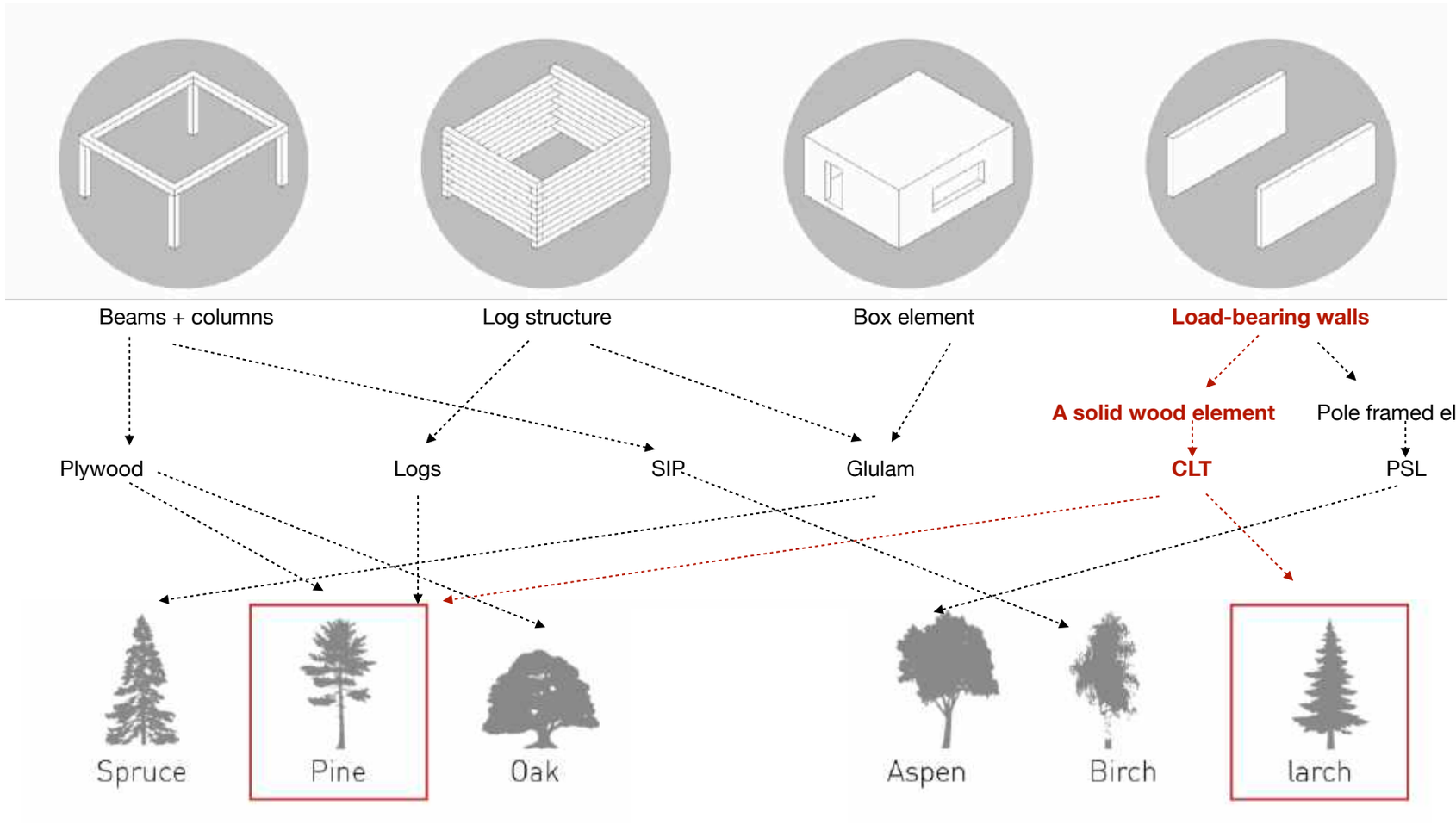


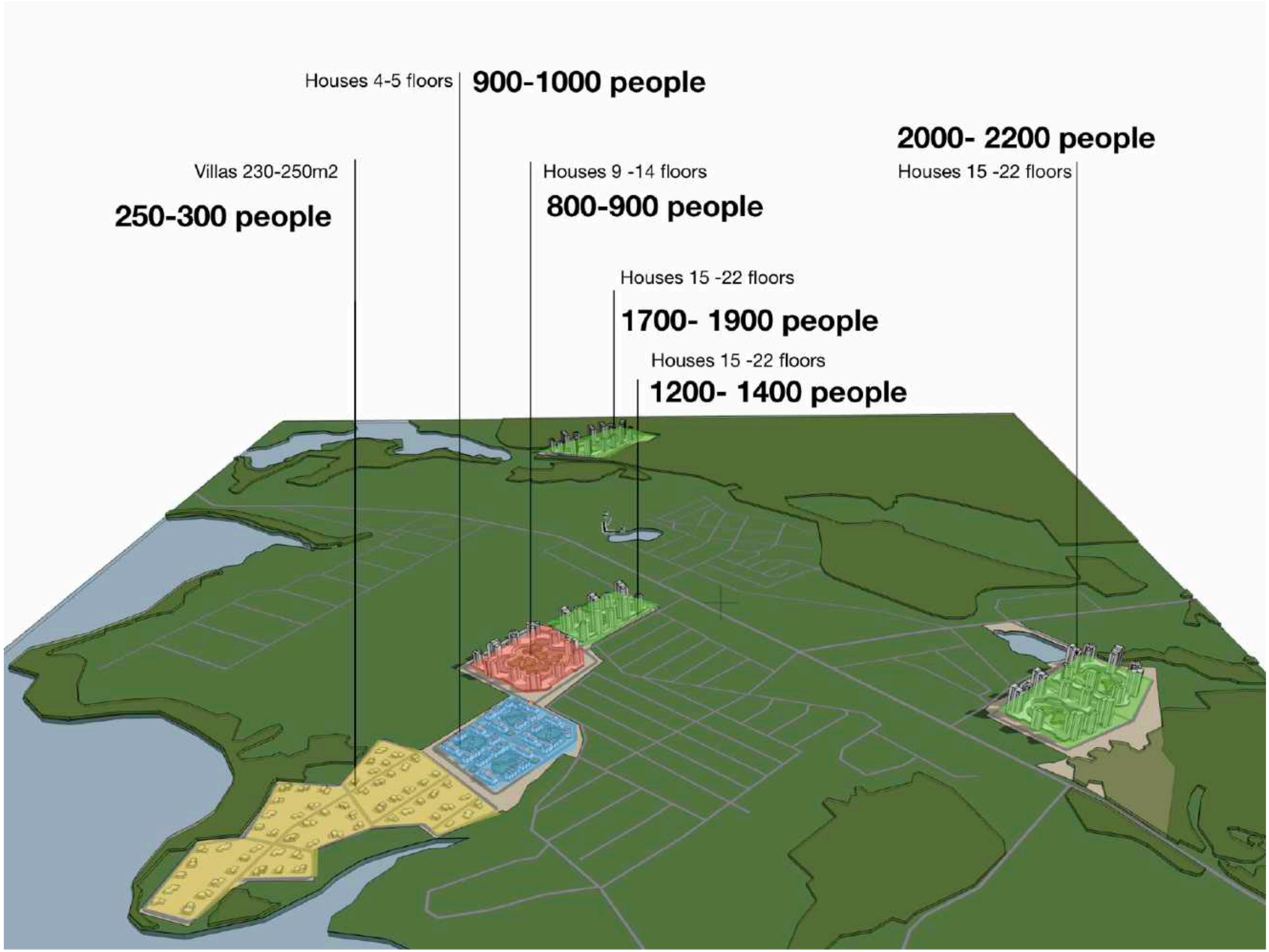
Infographics made by author.

*__Robustness__ is the property of being strong and healthy in constitution.



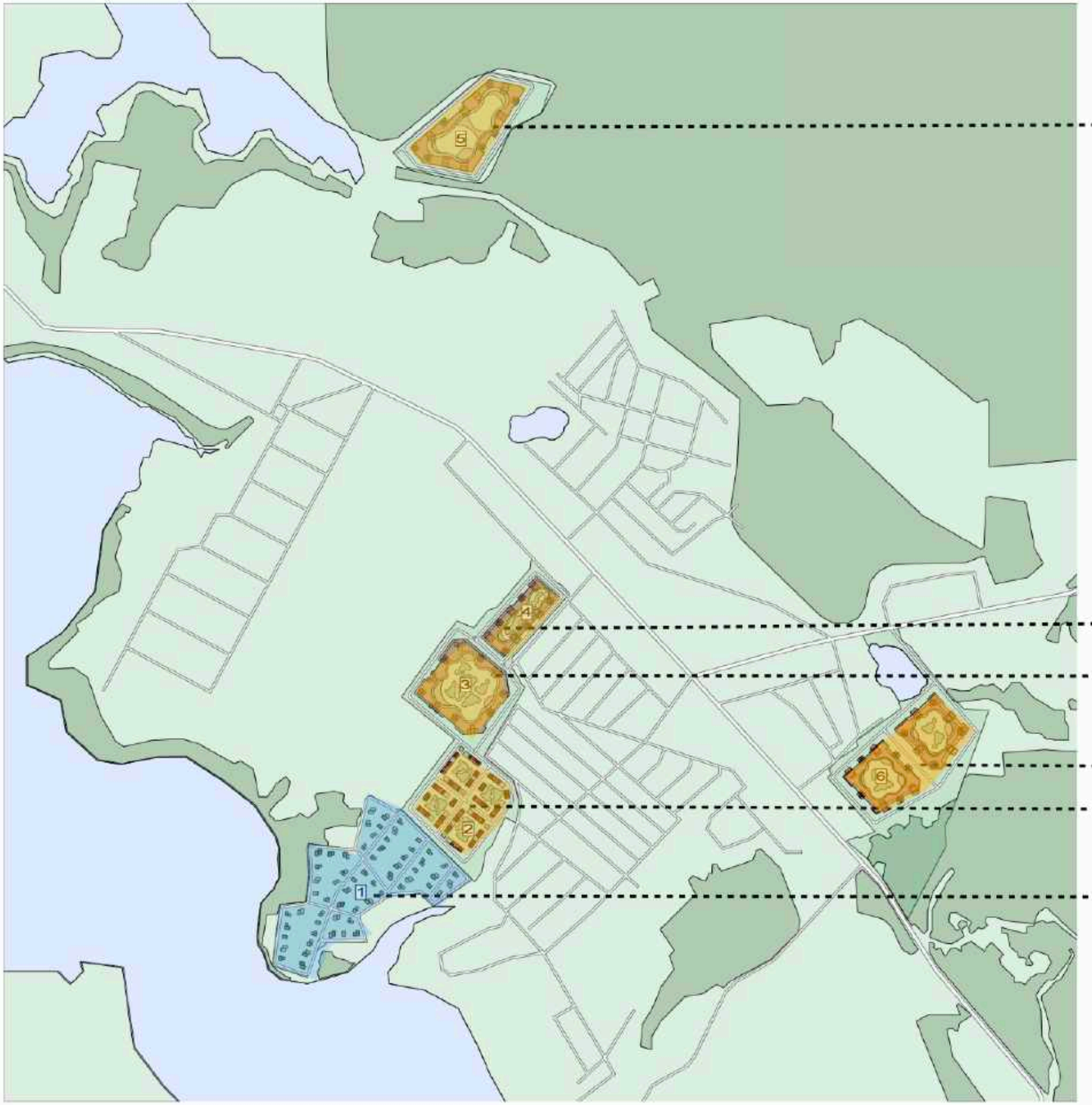
Information from 3B chapter.





Lopotovo area - project made by author.

4D



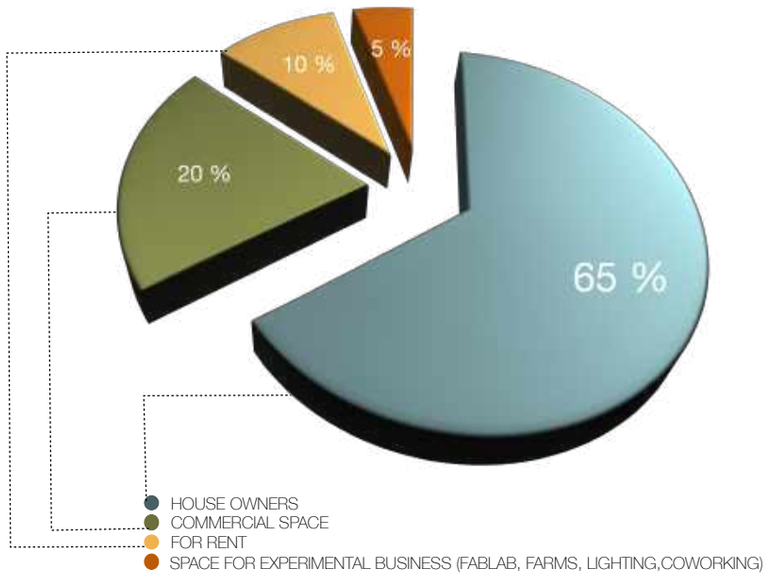
87%

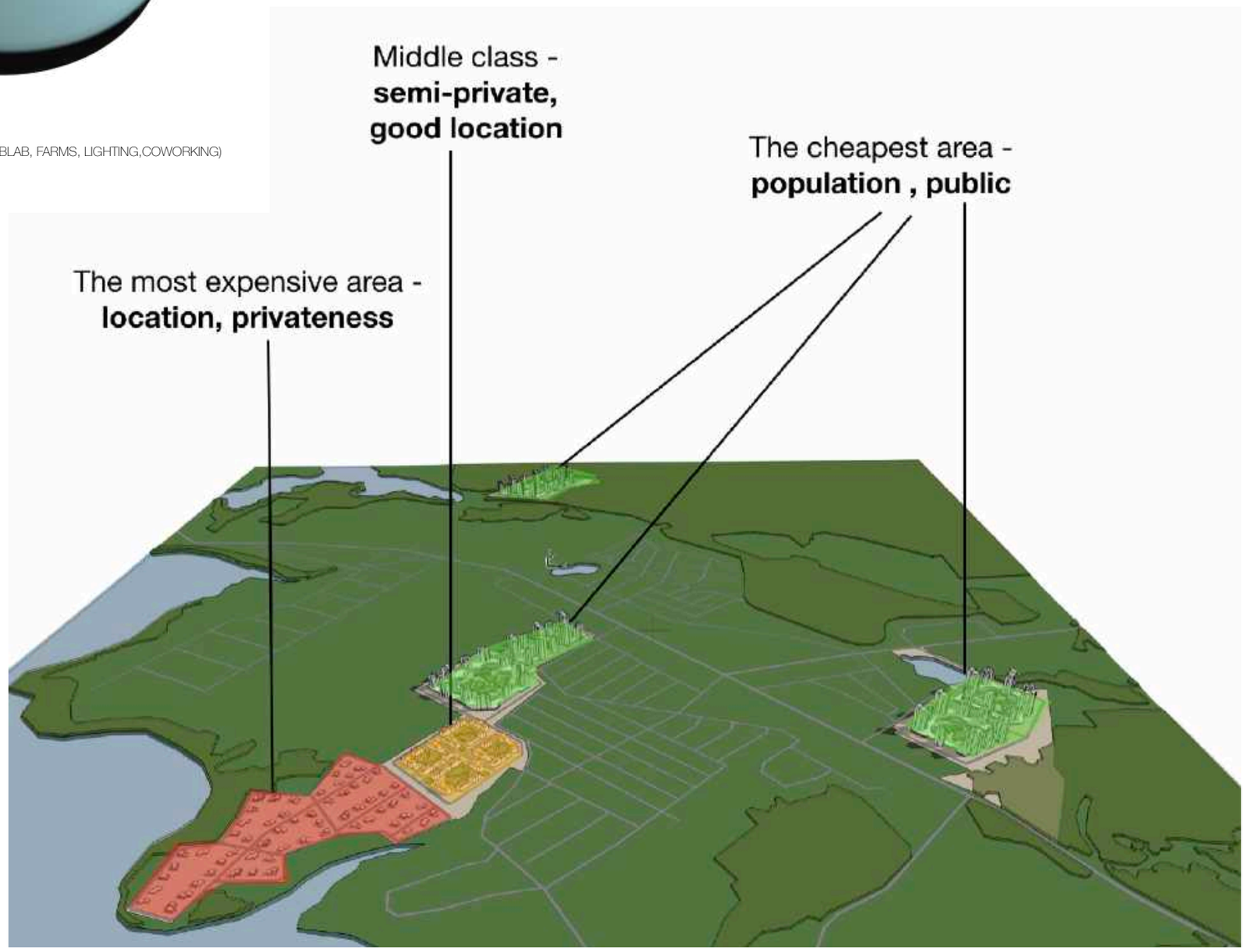
WOOD
(CLT +GLULAM)

13%

TREPEL + CONCRETE

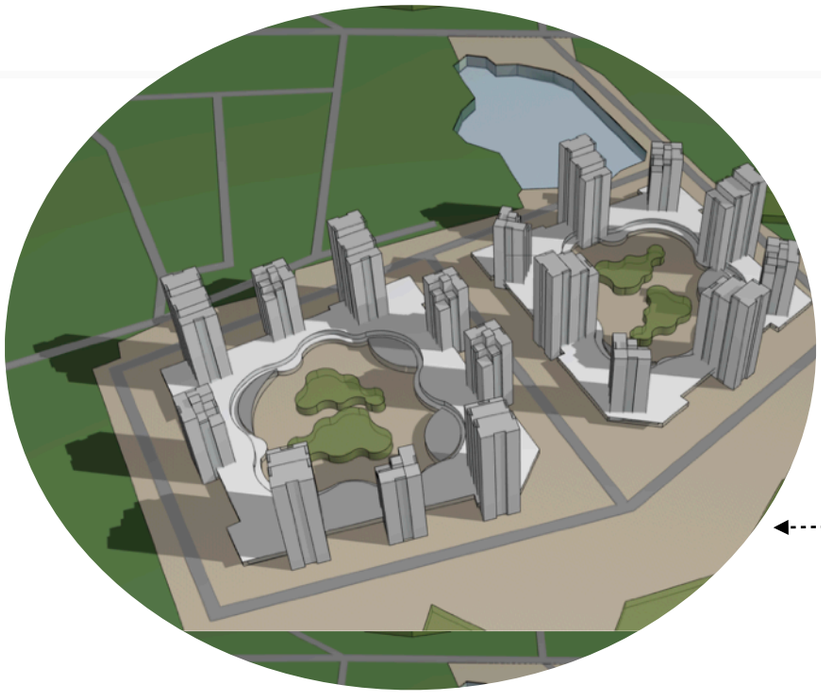
NEW ECOLOGICAL BLOCK SPECIFICS





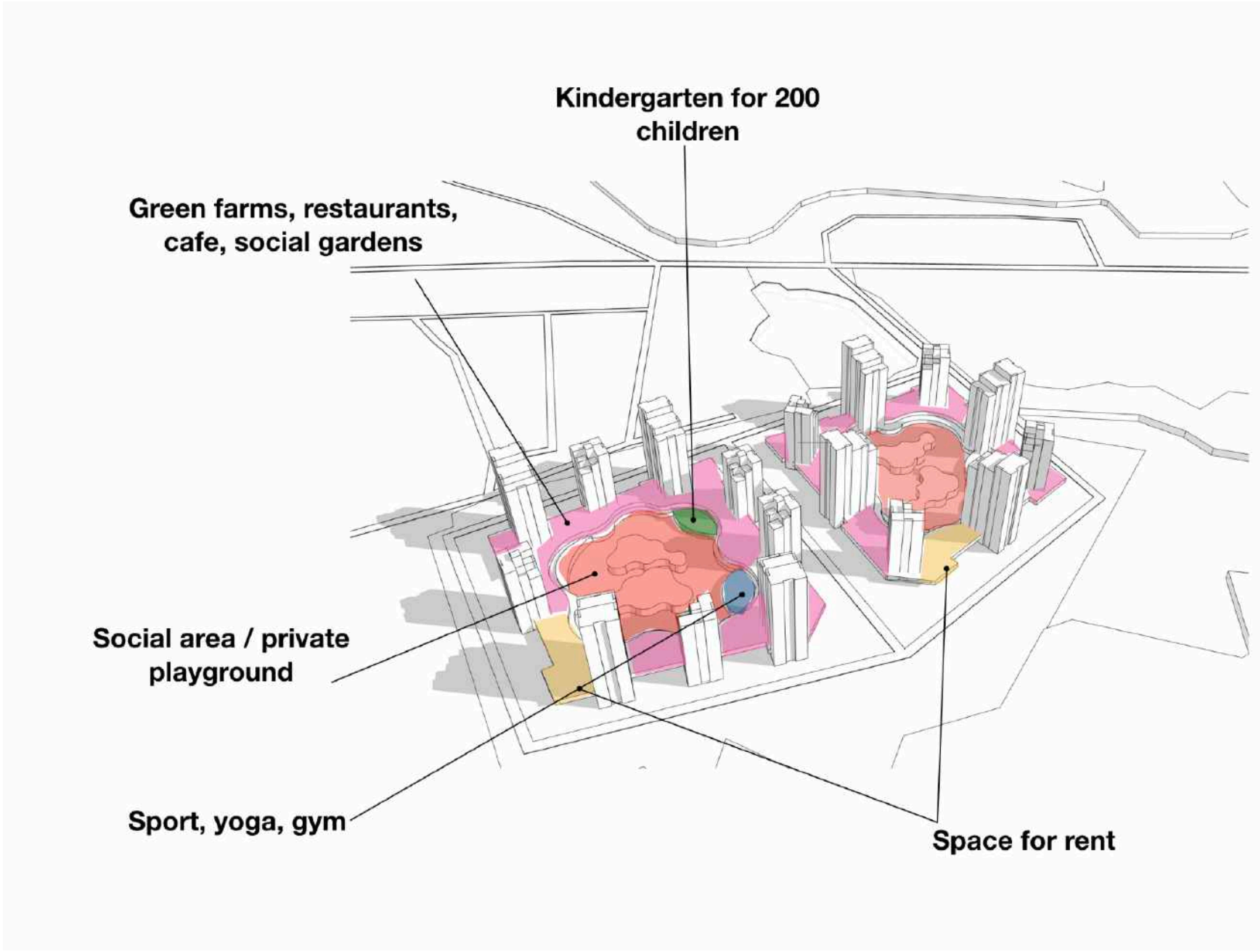
4D

4D



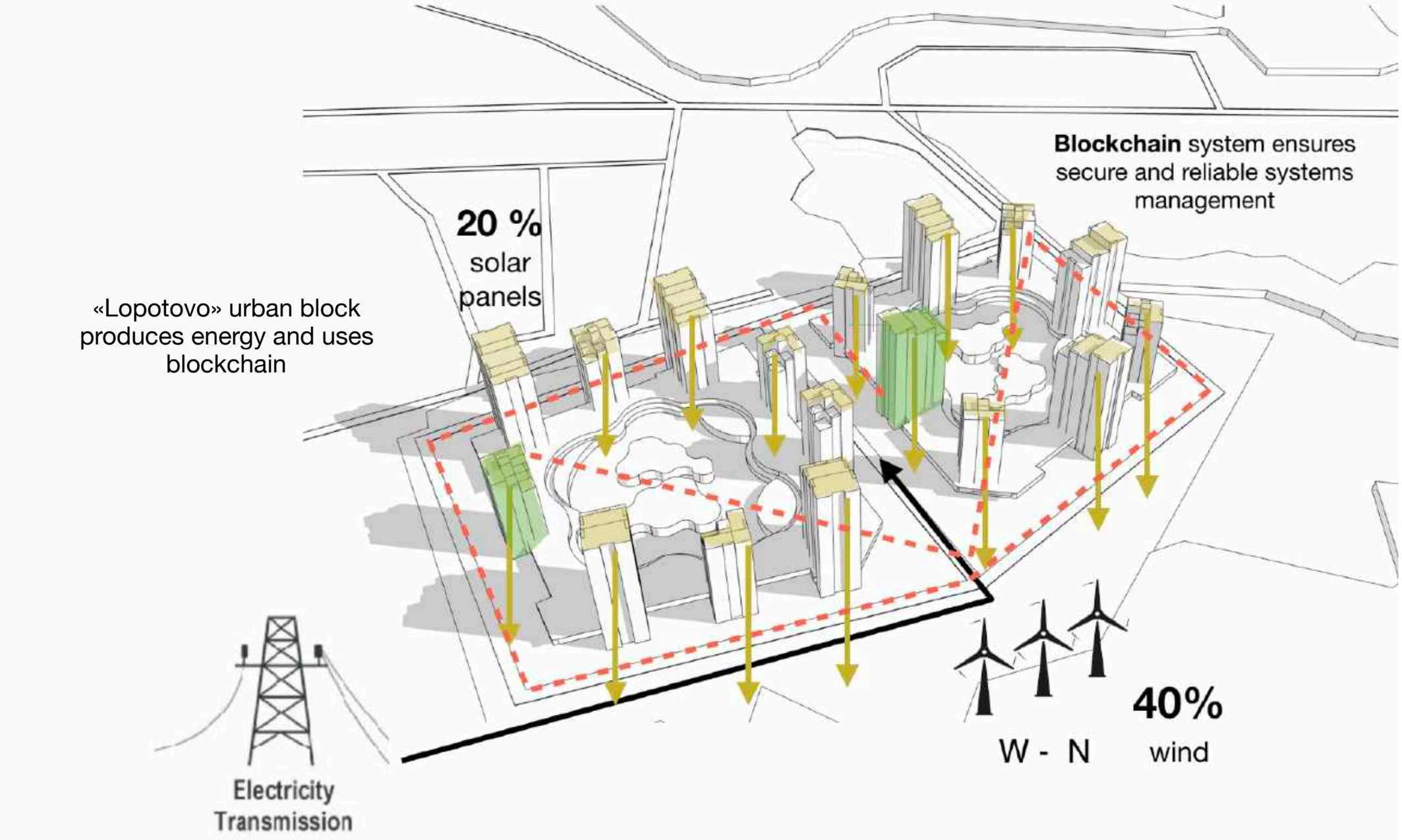
Zoomed area with will be discussed in details.

Total : 6850 - 7700 people


Kindergarten for 200 children
Green farms, restaurants, cafe, social gardens
Social area / private playground
Sport, yoga, gym
Space for rent

Sustainable residential building block uses only **40%** of energy from central electrical grid

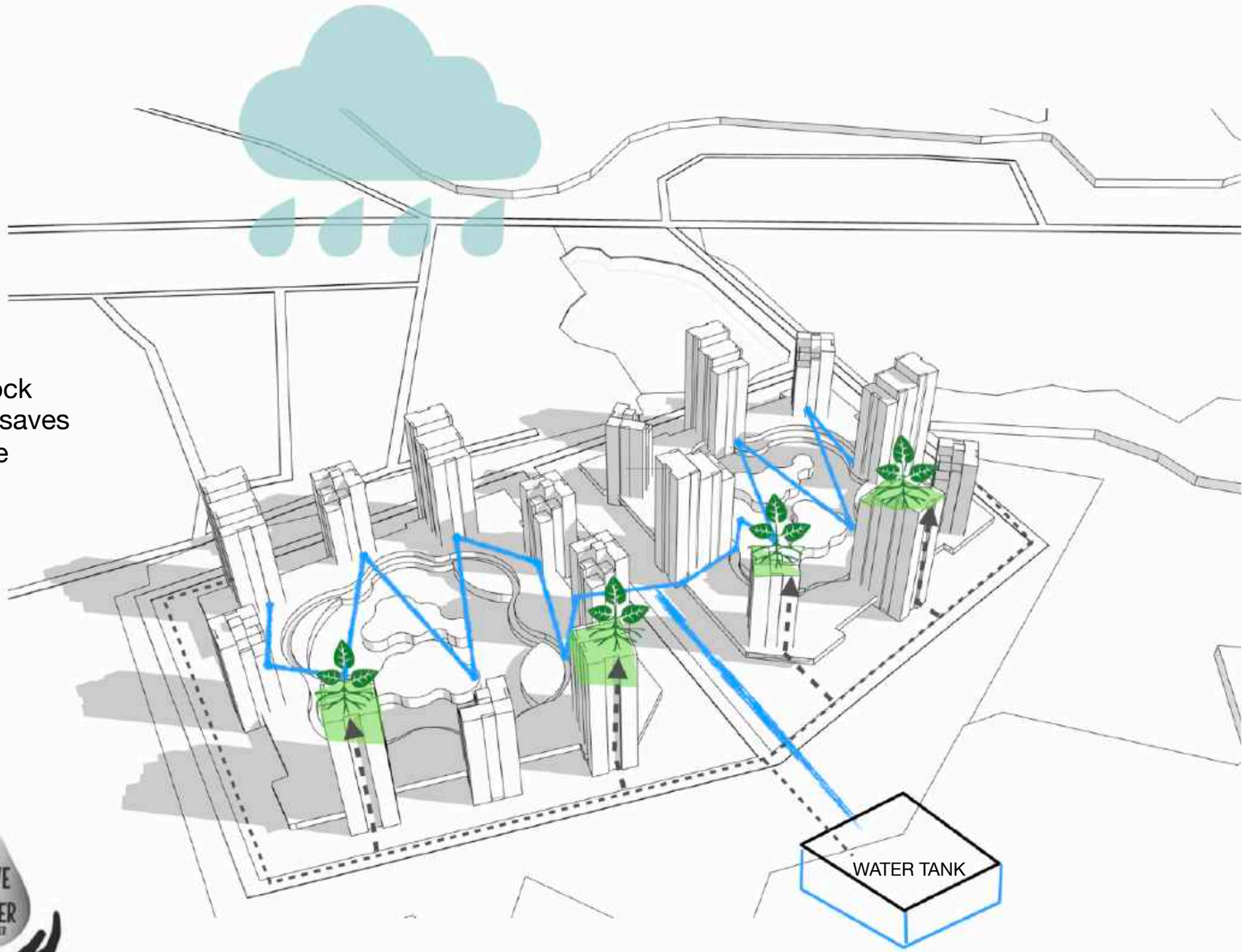
«Lopotovo» urban block produces energy and uses blockchain



WATER

Sustainable residential building block uses only
60% from central water supply

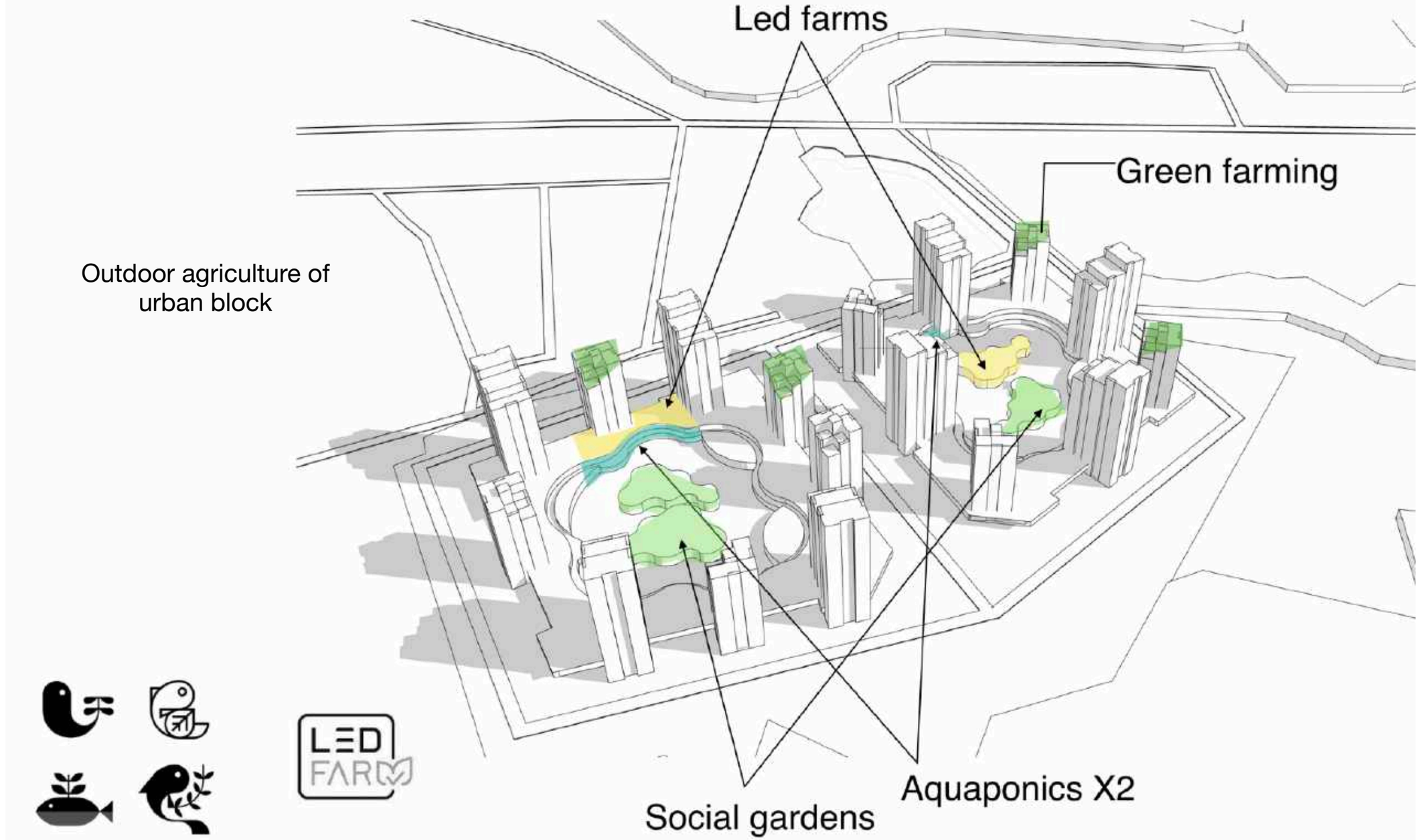
«Lopotovo» urban block
recycles grey water and saves
over **40%** of income



4D

«Lopotovo» urban block produce indoor agriculture such as: led farm, aquaponics

Outdoor agriculture of urban block



MATTER

In order to 'close the loop', Lopotovo sustainable block designed to efficiently recycle waste with a focus on biomass waste, which can be used for recycling, such as composting and generating methane, and plastic waste, which will be recycled into materials for prototyping at Fablab.

90 kg per year

x 7000 people **=** **38,5** tones of compost per year

Organic matter recycles to compost

4D

60 kg per year

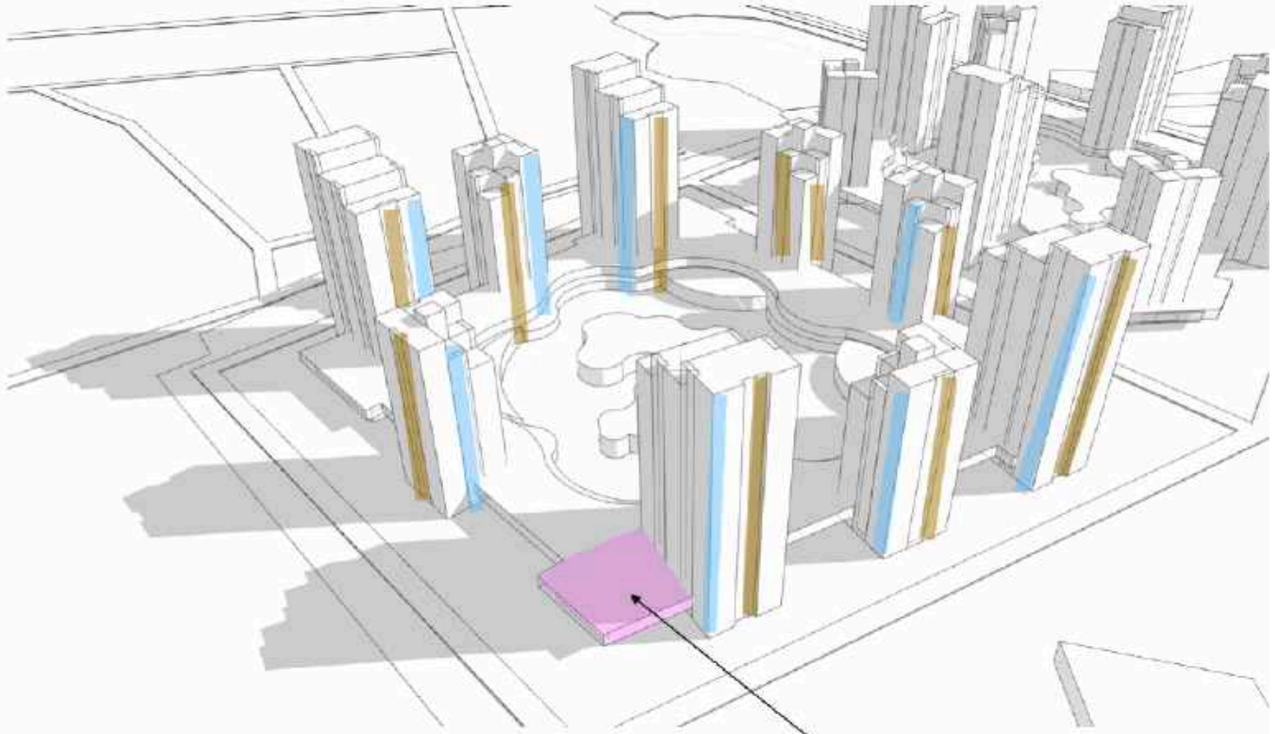
Sorting

Shredding

Stock

Design

Fabrication - prototyping, 3D printing, testing.



Plastic matter recycles in FabLab

All citizens, through this application, become part of a peer-to-peer node in a network that aims to streamline the administrative process in the city.
Numerous phone apps have already been created for city residents, but their popularity is growing very slowly.

If you optimize all the information on a sustainable silt block people will soon be living in, you can solve many everyday problems - parking congestion, lift and home phone breakdowns, ordering cleaning services to your home and allowing you to report security problems in the complex.

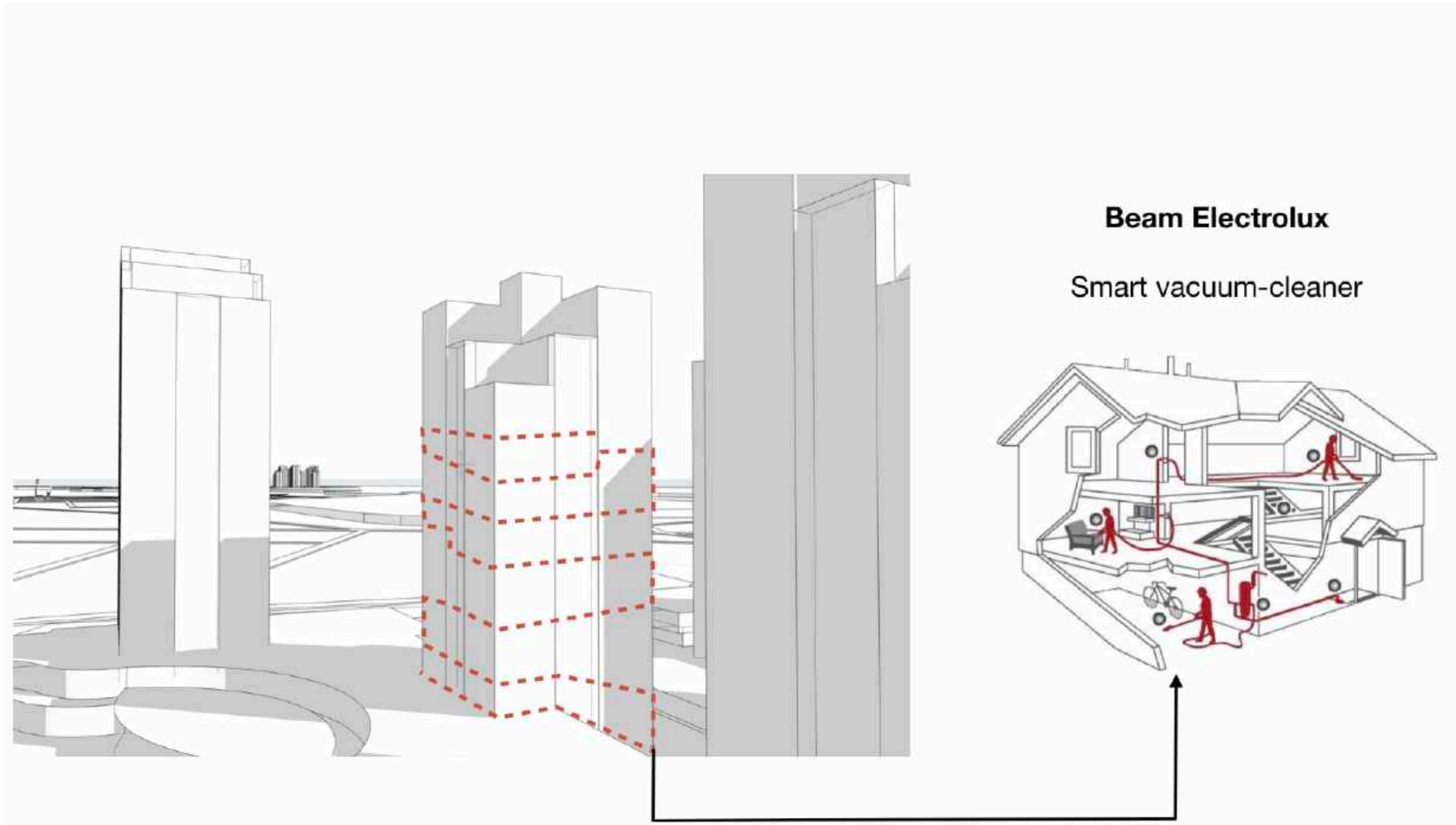
This system facilitates access to resources services and infrastructure over the current scheme of private ownership. Moreover, connectivity between all the blocks ensures a more efficient distribution of resources, services and infrastructure and increases the city's efficiency.

Urban block uses smart technologies to measure all factors of living

TECHNOLOGY

Beam Electrolux central hoovers (or central hoovers, stationary hoovers) are the world's best selling built-in hoovers. In some countries, such as Canada (which, by the way, is as similar to our climate as possible), the market share of the brand reaches 59%! In our country, according to our estimates, it is gradually approaching 50%.

The reasons for the brand's popularity are reliability of operation, high suction power, low noise level, stylish design, abundance of well-thought-out technical solutions, and maximum compliance with Russian operating conditions.



4D

Block 1

Private cottages made out of precast trepel-concrete panels.

Can be built in 7 days max.

Each villa has their own swing pool and backyard.

Houses 150-230 m2

COST - 25.000.000 rubles
252 500 pounds

2D view from map

3D view from map

BIM Visualization of trepel houses - made collaboratively with author and architects abroad.

Block 2

Semi -private cottages made out of wood panels and timber bar.

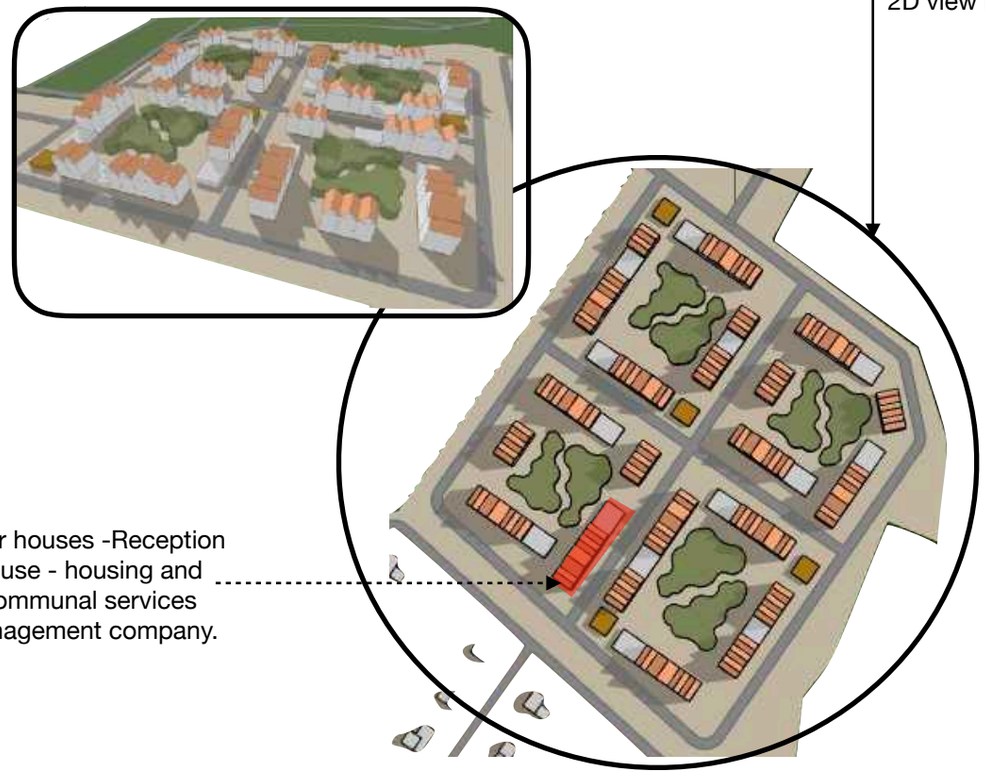
Can be built in 60 days max.

Houses of 4-5 floors

COST - FROM 3.500.000 rubles 35.000 pounds
TO 20.000.000 rubles 200.000 pounds

Archicad drawings - made by author.

2D view from map



Tiber houses -Reception house - housing and communal services management company.

Zoomed area of block 2.

Block 3

Discussed previously

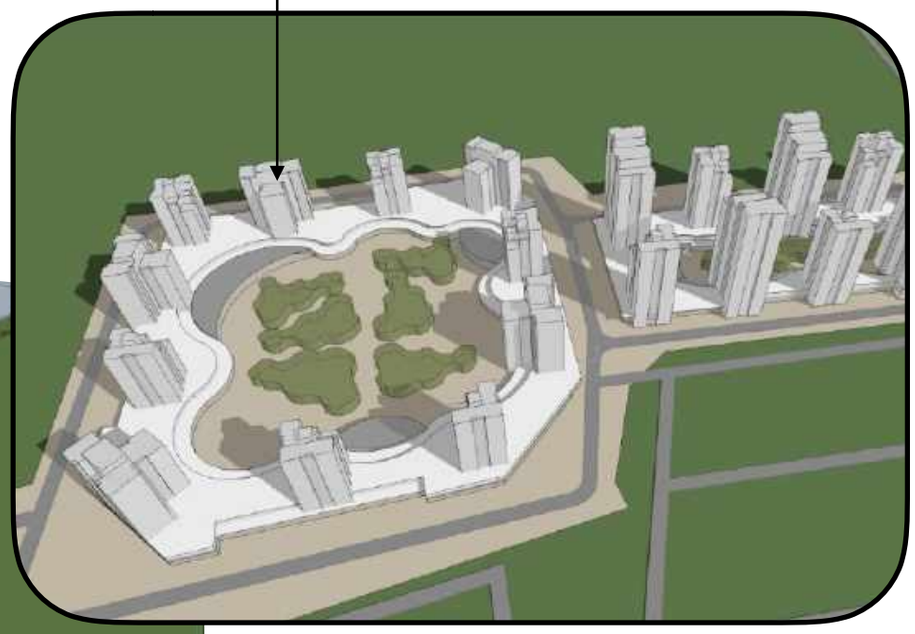
Main building material - CLT and Glulam super structure with metal support (due to high)

As it was previously mentioned - such tall wood building construction will be approved in the nearest 5 years.
(Chapter 3B.13)

2D view from map

Houses of 15-22 floors tall

Houses of 9-14 floors tall



3D view from map - zoomed parts

I can honestly admit that this is the first time I have done this kind of work as I used to do landscaping and create projects for 2-3 private houses at the most.

In this work, for clarity and simplified understanding, I worked for the first time in BIM and this is what came out. Of course this is a rough draft and requires a lot of modifications, but it seems to me, for the first time turned out very well.

Block 3 - BIM draft made by author.

Block 3 - BIM draft made by author.

Block 2 - BIM draft made by author.

Block 2 - BIM draft made by author.

Block 3 - BIM draft made by author with some photoshop additions.

User journey's

Customer journey map

Review Goals

Customers:
Want to bye house/flat.
Want to live successfully.
Price = quality of future house.

Architect:
Want to introduce new ideas in best possible way.
Get possible feedbacks and sell flat/house.

Empathy Map

Get feedback of customers emotions and feelings.
If necessary - step back and wait for answer.

Affinity Diagram

Affinity Diagram helps to shift from casting wide range of information and housing offers to gaining focus on the right solution for my audience.

Share & Use

Once the property is built - the management company or landlord gives the keys to the buyer after the remaining debt has been paid off.

1

Gather Research

Review all relevant users research, which includes both qualities and quantitive findings to provide insights into the customers experience.

2

3

Touchpoint & Channel Brainstorms

Generate list of the customers want and needs (price, floor, space, family members, necessary facilities).
Show mobile application to change customers way of thinking about wooden house.

4

5

Brainstorm with Lenses

Goal - generate as many connections and ideas about future collaborative work as possible in a short period of time.

6

7

Sketch

Conclude all previous aspects and make draft of apartment purchase agreement.

8

Redefine

After signing the contract, the customer must provide an advance payment (if the dwelling is built) or pay a deposit of 3% of the value of the dwelling.

9

Infographic - made by author.

7A

User journey's

Developers (real estate) journey map

"The more they ask, the more you think, the more you think, the more expensive it is"

Infographic - made by author.

7B

Government journey map

The developer undertakes to repay the loan in full in cash or 50/50 (part of the money and part to give the bank the residential meters of the constructed building)

In the case of a large development, the developer (client), with the permission of the state, amends the urban development plan of the land and receives a new master plan for the development.

Developer

Future of the project - positive trend

3 mounts

1-6 mounts

Bank

Investor

City / Government

Lends to a construction site where the developer is the main client

- Receives income from the sale of commercial and residential premises.
- Receives income from the functions of the general contractor, general designer and the function of organizing sales.
- Increases the reputation of construction companies, the recognition of new technologies in the Russian market

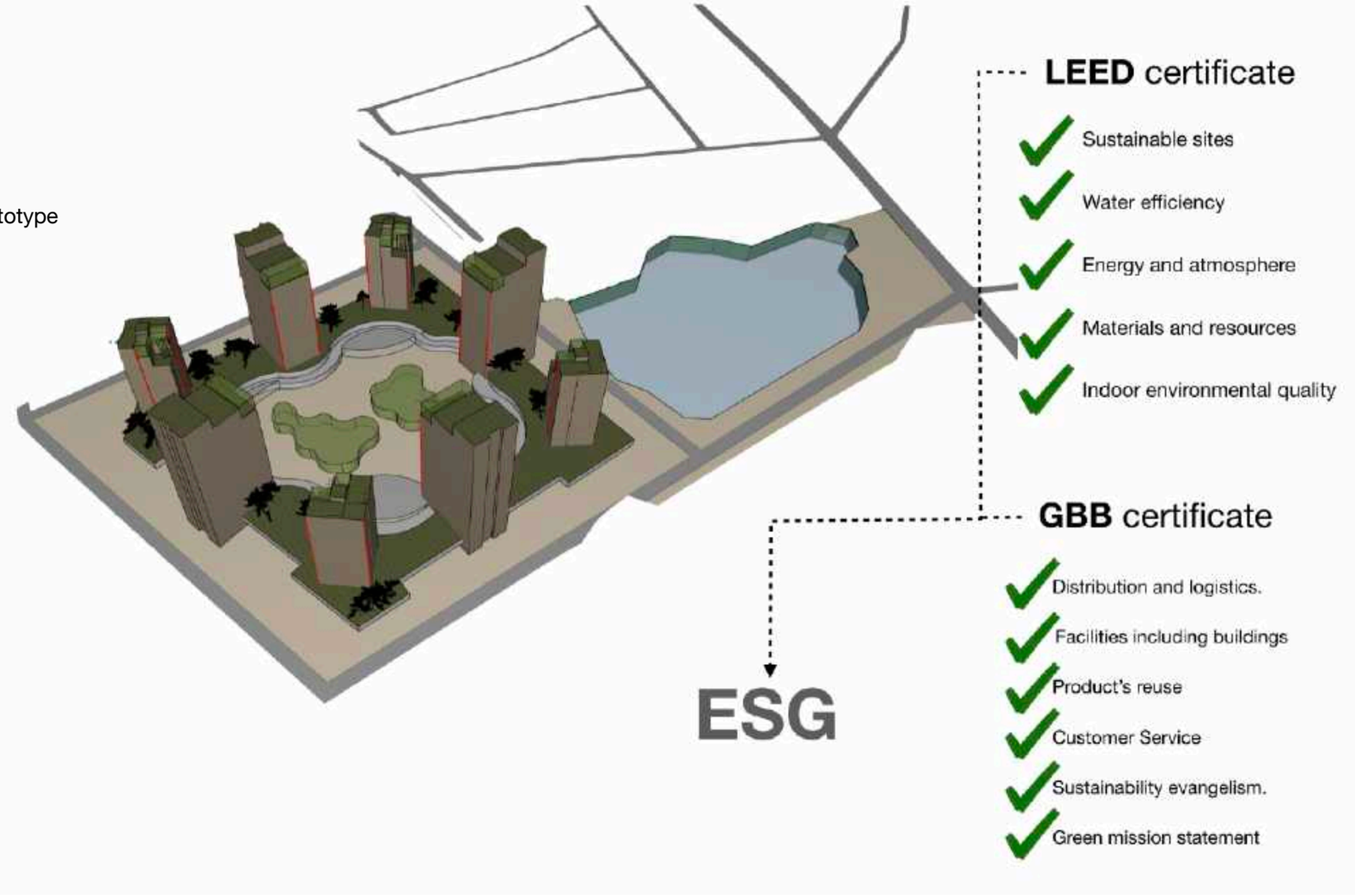
- Actively involves the economic activity of irrationally used land plots.
- Comprehensive development of the area.
- Increases the reputation and improvement of the area by attracting a foreign investor and the absence of budgetary funds in the project.
- Creation of new jobs in the local factory production.
- Attracting customers with low prices and an increase in demand in the market, which will lead to economic growth.

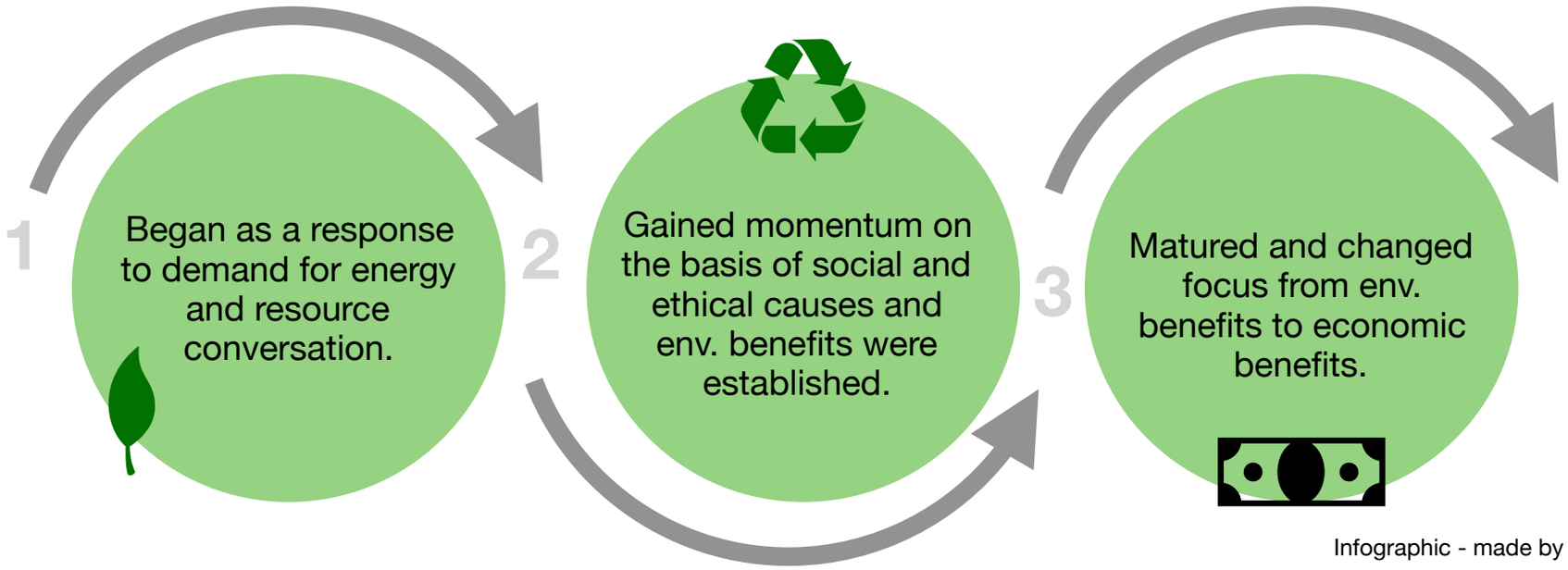
Ongoing supervision of construction and operation **1-5 years**

Infographic (very simple) - made by author.

Block 3

Colored version of prototype





Infographic - made by author.

Payback

Conventional home	Green home
	
150. 000 $	153. 000 $
Average building costs 125$ / m2	Average building costs 2% premium
	
Annual energy costs 3000 $ (normal usage)	Annual energy costs 2250 $ (25% less)

Perception vs reality

LEED - certified buildings cost on average 2% more than comparable conventional buildings, yet public perception is quite a different thing.

62% - yes

26% - no

12% - unsure

Average Payback Period = 3 years

(without government rebates of 3-5 years)

Infographic - made by author.

It is not possible to create favorable infrastructure and favorable living conditions if there is no clear example.

I am very fortunate that the neighborhood where I live now is designed according to most of the trends of today's world - certified by LEED.




Photos made by author - model of my living block. Moscow centre.

It is also impossible to follow trends if you don't follow the market and the latest technology. To do this, I have visited many exhibitions and spoken to different segments of the population in order to better understand the whole issue of ecological housing and people's attitudes to the issue.

Name-tags from exhibitions

Small prizes - ecological forum in Moscow

Material collected from wooden exhibition

Sub conclusion

At the moment there are many factors that hinder the development of economic housing in Russia (lack of proper legislation, lack of agreement between investors and developers, economic and political differences). In spite of this more and more people (population) are of the opinion that the state of ecology in the world today is in a critical state. There is an urgent need for coordinated change and we need to start now!

From my TED speech, one can conclude that by now many people understand the difference between a green building and a green construction. We are also increasingly using environmentally friendly materials in construction, which will soon replace old-fashioned concrete and monolithic construction methods.

As cities cope with rapid population growth - 2.5 billion people will be living in them by 2050 - and struggle with sprawl, politicians, planners and architects are increasingly interested in the vertical city paradigm. Leicester City Council in the UK defines a tall building as any structure over 20 m.Before 2000, for example, only 24 supertalls were built. Since then, more than 84 supertalls have been built.

Leon Krier in his book "The Architecture of Community" presents sustainable urbanism as «an ethical and civilizing vision of universal stature». Sustainability offers an inclusive framework represented in its three conceptual pillars (the social, the economic, and the environmental) or the «3P» of people, profit, and the planet, where:

- «people» represents community well-being and equity;
- «profit» represents economic vitality; and
- «planet» represents conservation of the environment.

Skyscrapers have a large carbon footprint when built, operated, maintained and demolished at the end of their life cycle. They put significant pressure on infrastructure and transport systems, creating congestion and congestion. By using modern technology, local culture, local context, the natural environment and cost-effective solutions, we can collectively set humanity on the path to sustainable cities.

Today the construction of a capital object, a building with one function - residential is no longer relevant. Flexibility and multi-functionality of residential space, a desire for individual design planning solutions, a search for optimal functioning in a complex development with proposals for the original types of planning structure of the areas to be renovated, more systematic zoning of built-up areas - this is the modern demand for urban planning activities, for the quality of the urban environment.
To resolve these issues I gathered a team of experts in the field of wood and concrete construction, current architects of today and past decades to better understand trends, people from the government who helped me understand the political aspect in more detail, geologists and developers (the view from the developer and/or land owner).

The Russian Federation has large forest resources and a need for economic transition towards decarbonization following the sustainability targets of global environmental policies. The country has the natural resources and human capital to expand the bioeconomy sectors, and reach the national goals of modernization, introduction of innovations, and efficiency improvement.

President Vladimir Putin in September 2020 demanded a total ban on exports of wood which has had a positive impact on the country's domestic economy and increase use of wood in construction. From 2005 till 2015 the plywood production quantities in billion units constantly rises and reached the mark in 4 billion units. Leaning on the wood market today I can assume that same trend will continue in the next 20 years according to Russian government political changed in relation to timber construction.

Projections presented in B14 chapter shows that wood-based construction areas increase from 36.1 to 183.1 (mill. m2/year). Such a big variation gives evidence that wood construction is at a turning point and may demonstrate fast growth in the future. Besides annual temperatures and precipitation, weather playing a fundamental role in shaping the response of the forest sector to climate change. In this way, the confrontation between concrete and wood became essential. But at the moment there are at least two materials that can replace concrete - warm concrete and trepel. There are also new construction technologies that have been applied in the design of 150m2 to 500m2 cottages which allows panel houses to be finished in 7-10 days maximum. Read more in my interview - Moscow 24.   I developed this technology together with my Italian colleagues.

The problematic question of whether concrete or wood is better has been tackled from a variety of angles. The results of my interviews and analysis of the data show that the two materials scored almost identically. It was very interesting to learn that the pricing for a concrete house and a wooden house is almost the same. A wooden house can be built for 3 million or 30 million roubles, while a concrete house with the same floor area will cost from 10 million to 25 million roubles.

By testing the mobile app, I was able to see once again that all those surveyed saw the environmental problem and were willing to build wooden houses.

For practical application, I have chosen an area 61 km from the centre of Moscow - the village of Lopotovo in the Istra district. This area is in the coastal area from the Istra reservoir and is a favorable area for further development. Nowadays there are only 131 person living in that area and very few developed sites with 1 pharmacy , 2 shops and no schools at all.

Numerous attempts to renovate the area have led to the fact that the most favorable scenario is integrated timber construction with future LEED certification. The only problem is that at the moment there is no law in the Russian Federation that allows the construction of wooden houses over 56 meters (16 storeys). In the next 5 years this issue will be resolved.

I contacted the founder of GREEN ZOOM, Vera Anatolievna, in order to give an adequate assessment of my project. GREEN ZOOM is a set of measures aimed at realizing the goals of sustainable development and improving the comfort of the urban environment. It is also a list of practical recommendations for improving energy efficiency, water efficiency and sustainability of civil buildings.

The global Sustainable Development Goals are contained in "Transforming Our World: The 2030 Agenda for Sustainable Development". It contains 17 goals and 169 global targets, the most important of which is Goal 13: Combat Climate Change. In response to global trends, GREEN ZOOM pays close attention to various measures to improve the energy efficiency of facilities and reduce greenhouse gas emissions related to energy production.

Vera Anatolievna's assessment - "I looked it up. I'm not going to say anything about the architecture, as I'm not an architect. Otherwise: a project with a sustainable development approach. 30% of solutions - implemented and shown in the video.
About central networks: there should rather be alternative sources. For renewables - you have to look at the location. Few places have wind. Would like to hear more about biodiversity and waste management. Scenarios of people's lives, how colleagues see the assessment of the comfort of the built environment. All in all, a good project."

The main innovation of my project is that it is a universal project for any region, not only in Russia but also abroad. The only factor that complicates the application of this project on the territory of the Russian Federation is the current absence (2022) of laws on the construction of wooden buildings higher than 16 floors.

For foreign countries, my project is unique in the area of cost as materials which I propose to use for the construction of facilities several times cheaper than currently used. "1 cubic meter of trepel costs 4,600 roubles = 43 pounds, while 1 m3 of concrete = 7,300 = 69.5 pounds" - as the candidate of engineering sciences of Russia Orlov Alexander Dmitrievich asserts. The technology of dividing the cottage into 5 basic elements reduces the cost not only of the paneling process but also of the house construction, which allows saving 20% of the entire house-building price.

Link for video : **https://youtu.be/75uPv3kGHy0**