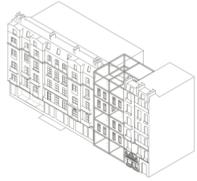


THE GENIUS, THE TUNNEL AND THE CARPENTER

SHRINKING GREATER PARIS / HOUSING SOLUTIONS THAT GEORGE, AMAL AND THE PLANET CAN AFFORD



Son of a carpenter, grandson of a carpenter, great grandson of a carpenter... George belongs to a family of wood craftsmen whose family origins date back to shortly after the French Revolution.

Born in Paris in 1980, George grew up on rue du faubourg Saint-Antoine, in the family flat right above the workshop. As the tallest landmark along his childhood path, the Spirit of Freedom («Génie de la Liberté» or the «Genius») sitting above the July Column on Place de la Bastille was for young George a figure as familiar as it was mysterious.

After completing his studies in the carpentry trade (and landing his first job), George had to leave his parents' flat and Paris altogether, given how rents were spiking. Today,

he lives in the Paris suburb of Antony with his wife Amal and their boy Téo.

The apartment of faubourg Saint-Antoine was sold 15 years ago and is now merely a cherished memory. But as a stroke of luck, as George often says, the workshop remained in family hands. His commute to get there does take a full hour, but every time upon exiting the Bastille metro station he can behold the winged hero of his youth.

An associate history teacher at a high school in Antony, Amal is just a short bus ride from work, and sometimes she even walks.

That evening, as dinner wound down, the conversation once again turned to their living situation.

The birth of their second child was imminent (the name,

already chosen, will not be divulged here, apologies) and they were living in a 50 sqm unit. George and Amal both knew they had to move. But where? Into what? How much space? Which neighborhood? Each time the subject had resurfaced of late, the questions overwhelmed and a feeling of despair set in.

In their area, the price per square meter had kept rising year after year. They had already given up on the idea of buying a place a while back.

For once, Amal didn't seem as pessimistic about their predicament as George. That morning, in opening the mail, she had received a flyer from the Greater Paris Metropolitan Authority extolling the virtues of a «middle ground» option for Paris area.

AFFORDABLE HOUSING CRISIS IN GREATER PARIS

A systemic challenge...

When discussing the issue of affordable housing in Paris, topics need to be addressed in a systemic manner, given that the technical, financial and political parameters leading to possible solutions are so multifaceted.

...to be treated at the appropriate spatial scale

First of all, Paris needs to be placed in a more regional context, namely by establishing its position within the Greater Paris Metropolitan Area

(Métropole du Grand Paris). An urban zone comprising 7 million residents (2.2 million inside Paris' city limits), Greater Paris today confronts with a wide array of social, economic and environmental challenges, which while jeopardizing its capacity to offer a high-quality lifestyle to residents at the same time does offer plenty of opportunities to seize as the area transforms into a harmonious urban space.

The relationship between Paris and its inner ring of suburbs must also be investigated more closely. Gentrification, densification of economic

activities, traffic congestion and poor transportation connections in the suburbs are some of the concerns that undermine Paris' appeal by barriers greatly influencing housing affordability across a number of Greater Paris neighborhoods.

...as well as the appropriate temporal scale

This metropolitan area must also find a way to accommodate another 700,000 residents by the year 2035, within an already extremely dense urban layout. Paris is already the world's 6th densest city!).

As a result of demographic pressure and the appeal of the city's built environment as financial vehicles for national and international investors, real estate prices keep climbing, and middle-income households are increasingly relegated to the area's outer extremities, in places with a lower quality of life: long commute times, fewer urban amenities, more limited infrastructure.

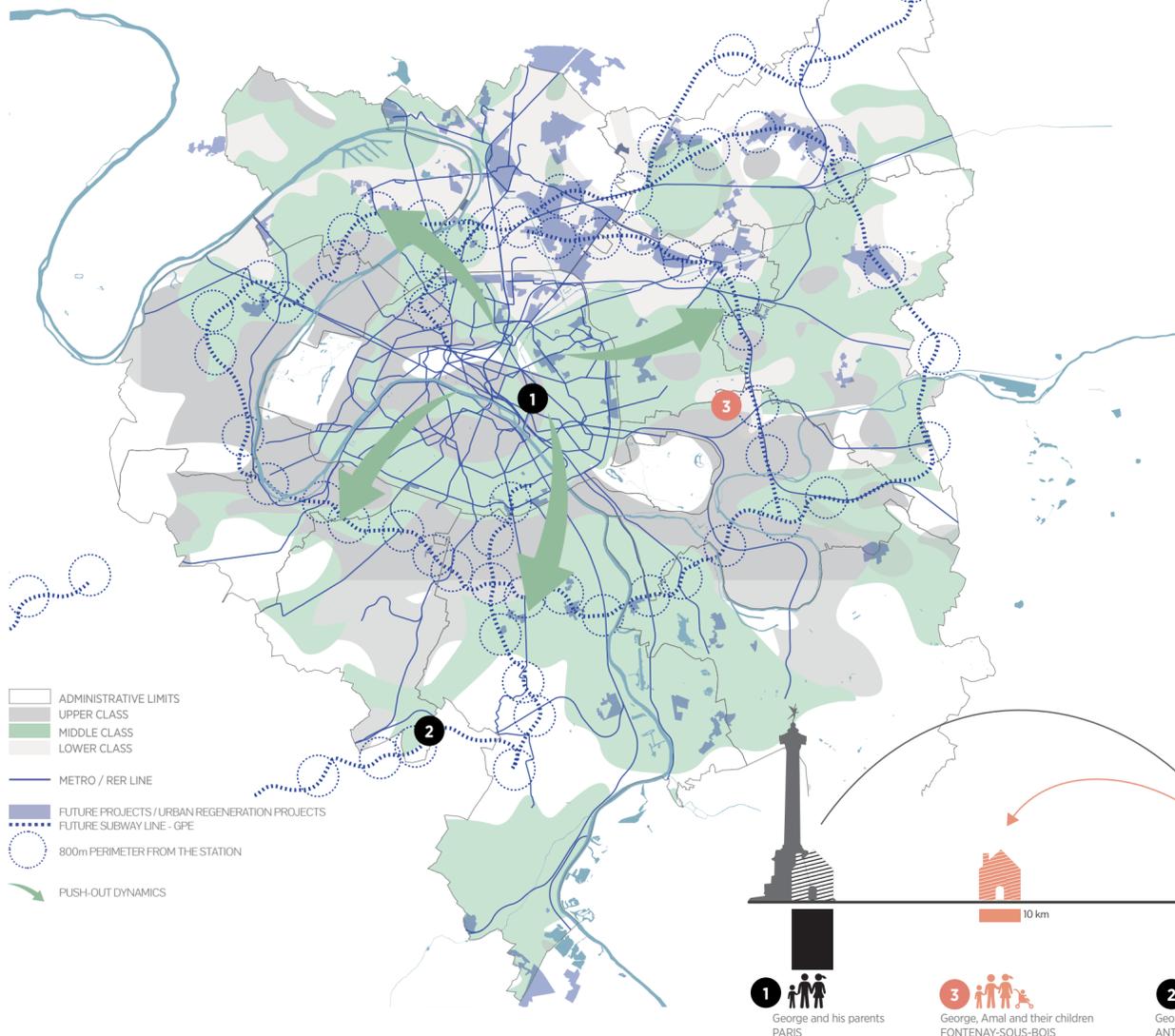
...with a lofty ambition :

Proposing an affordable housing solution for 'Greater Parisians' thus necessitates tackling these challenges head on, in the aim of providing middle-income households with the means to own high-quality, well-designed accommodations near their place of work or activity and close to all the urban amenities of downtown Paris.

... through reliance on a truly unique metropolitan dynamic

Luckily, Greater Paris is viewed as an exceptionally bustling area for the 2020-2030 period, with several large-scale projects forging new development hubs and residential configurations, namely: 200 km of rail transit lines as part of the Grand Paris Express program, urban renewal projects, and the 2024 Olympic Games. Moreover, the ongoing institutional transformation, shifting oversight of planning, housing, and development strategies from municipalities to the metropolitan level, is enhancing Greater Paris' relevance in the decision-making process. Despite its fragmentation and overloaded demand, the Paris Metropolitan Area is undergoing a major alteration that needs to be acknowledged in the affordable housing solutions being proposed, both for the individuals concerned and for the planet.

WITHSTANDING GENTRIFICATION...



AN ACCELERATING PACE OF GENTRIFICATION AND WIDENING SOCIAL DIVIDE

With an average price per square meter topping €10,000 as of 2019, the Paris housing market has become unaffordable to three-fourths of its residents. The City of Paris continues to champion a proactive policy in favor of public housing: the 20+% of subsidized units does make it possible to maintain some semblance of social diversity. Yet each year Paris loses several thousand inhabitants, most of them belonging to the middle and working classes. In conjunction with this trend, former working class neighborhoods have been gentrifying with the arrival of high-earning households enamored by the «authentic» Paris charm.

And this phenomenon is even more pronounced at the Paris periphery: the once more affordable cities that form Paris' inner ring of suburbs have witnessed real estate spikes mirroring those of the capital city, forcing the middle class to find housing further and further away from the metropolitan core.

As an initial impact, Greater Paris residents now spend on average 90 minutes a day riding public transit, with tremendous disparities between Paris and its periphery. Secondary impact: with on average 250 km of traffic bottlenecks during rush hour, Paris' Ring Road and principal arterials are saturated daily, and some public transit networks are now operating at full capacity after a 20% increase in ridership over a 10-year span.

AN ENVIRONMENTAL PERFORMANCE FALLING FAR SHORT OF OBJECTIVES

In France, the building industry accounts for nearly 45% of final energy consumption and 27% of greenhouse gas emissions. Considerable progress is still required in order to reach carbon neutrality by 2050, as enshrined in the 2015 Paris Climate Agreement.

The Paris Region (Île-de-France) is highly dependent on imports from other regions for its basic building materials: in 2018, more than 50% of aggregates needed to produce concrete were shipped in from other regions. Moreover, it has become increasingly difficult to open new quarry sites, given the level of urban growth and the multiple environmental impacts caused by such activity.

The recycling of waste originating from the construction sector is wholly inadequate and offers considerable potential before optimization. In France, this sector generates some 40 million tons of waste a year, of which over 90% stem from demolition and renovation works, with barely 50% of this tonnage being recycled. And a sizable share of the waste (especially concrete recovered from demolition) is actually being «downcycled», i.e. not reused in new building projects.

2020-2030: THE POTENTIAL FOR TRANSFORMATION THROUGH MAJOR PROJECTS

Several large-scale projects, offer opportunities to improving both the affordability and sustainability of housing.

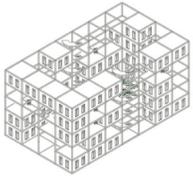
One of the leading projects is *Grand Paris Express*, which by 2035 calls for 200 kilometers of new rail lines, allowing 2 million more users to make daily trips from 68 new stations. It is estimated that adjacent to these stations another 250,000 to 400,000 housing units will be built. Accounting for 45 million tons of excavated earth, this project also constitutes an abundance of materials and a recycling potential equivalent to all construction volumes being recycled today throughout the Paris Region.

Approximately 20,000 housing units are slated for demolition across the region as part of the project to refurbish the area's large housing complexes. Such undertakings will inspire new urban spaces, accompanied by the construction of new more comfortable and environmentally-friendly units, serving as a pool of recycled materials.

The issue of affordable housing in Paris thus involves a revised central focus, which is why we've decided to lay out here a metropolitan-scale rationale. Paris' problems require metropolitan solutions!

THE GENIUS, THE TUNNEL AND THE CARPENTER

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— Here, take a look, this might be the solution for us...

George immediately picked up and started reading the document, his spirits improving as the contents became clear.

Based on a new long-term ground leases (bail réel solidaire (BRS)), which legally separates land parcels from built property, this «middle ground» option for Greater Paris offers the possibility to acquire a housing unit for a 50+-year period, at a price substantially lower than the going market rate.

The once-distant prospect of purchasing a flat had suddenly become plausible, especially in a city they truly love.

Greater Paris' «middle ground» option covers an array of

development programs, including one in Fontenay-sous-Bois (where some of Amal's family lives), adjacent to the new Val de Fontenay train station. The 17-storey building comprises loggias, hanging gardens and terraces. The ground floor common areas feature shops, a laundry facility and a shared workshop. This project encapsulates the municipality's transformation to assimilating the Greater Paris metropolitan vision.

George and Amal could see themselves already installed! They'll choose an upper-floor unit, with a view of the Eiffel Tower. Téo will have a nice 10-m² room all to his own, as will the new arrival. The living room will overlook a private yard where the children will be able to play to their heart's content (provided of course they respect the vegetable patch). George's commute to his Bastille workshop and prized

genius will be a mere 20 minutes. Amal will waste no time requesting a transfer to the high school in nearby Rosny-sous-Bois, a 20-minute walk from the new place.

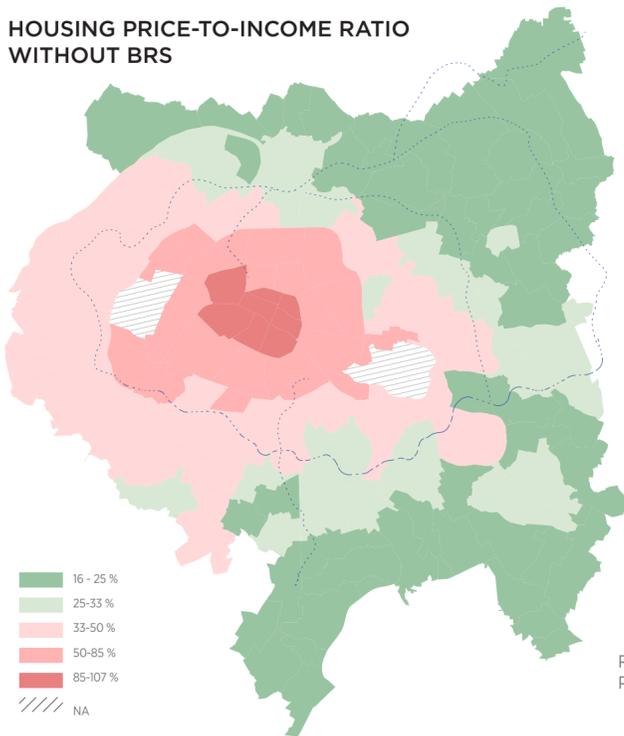
And come that day when the children have grown up and left home and when George and Amal will be looking at the South of France or the Atlantic to retire, they'll resell their flat using the same BRS system. What could be smoother.

FREEZING LAND COST TO MAKE HOUSING AFFORDABLE

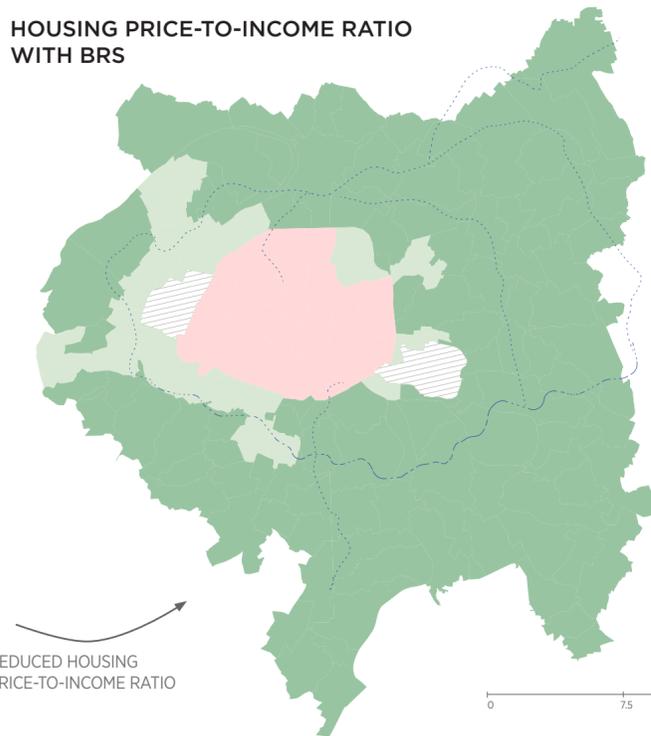
Within the jurisdiction of the Greater Paris Metropolitan area, land costs account for 10% to 40% of total residential development costs, and this onerous land component can even reach 70% percent in Paris. But what makes land so expensive? This phenomenon is mainly due to the interplay between real estate and land markets: residential property prices determine land prices. As such, any surge in real estate prices due to myriad factors

(e.g. domestic and international financial environments, local demand trends, government incentives) basically drives up land prices since housing production costs (i.e. construction costs, financial fees, taxes, developer's profit) remain relatively stable in both space and time. This is why land, as the residual value in production costs, is the critical lever in making housing more affordable for middle-income households like Georges and Amal's..

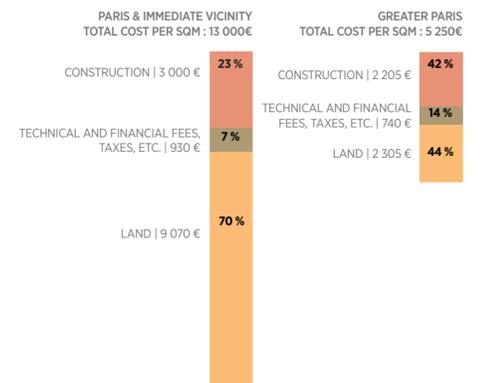
HOUSING PRICE-TO-INCOME RATIO WITHOUT BRS



HOUSING PRICE-TO-INCOME RATIO WITH BRS



REDUCED HOUSING PRICE-TO-INCOME RATIO



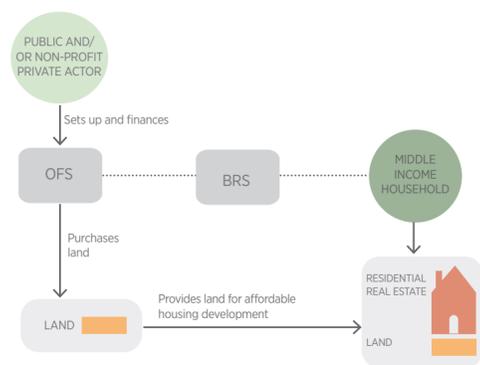
PRODUCTION COST OF A NEW UNIT



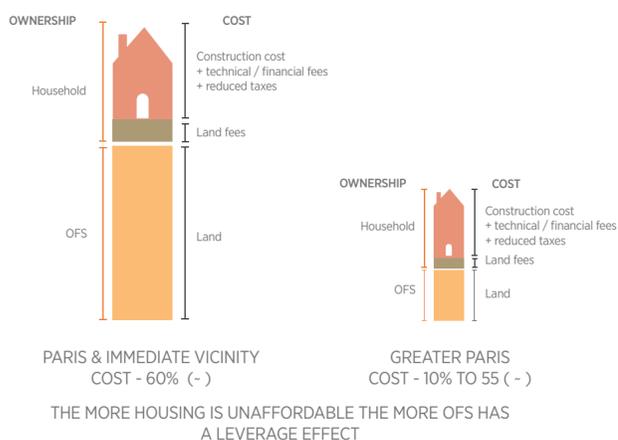
GEORGE AND AMAL'S ANNUAL INCOME



AN INCREASED INCOME HOUSING GAP



LAND ENGINEERING PRINCIPLE



GEORGE AND AMAL CAN EVENTUALLY AFFORD A HOUSE IN PARIS IMMEDIATE VICINITY

AFFORDABLE HOUSING FOR PEOPLE: THE POWER OF LAND ENGINEERING

Any significant production of affordable housing in tight markets, such as Greater Paris, then requires freezing land costs through public land provision...or else differentiating land and real estate ownership.

Herein lies the first pillar of our solution, which is currently experimented by a number of community land trusts (*organismes de foncier solidaire* (OFS)) in the Greater Paris Metropolitan area (e.g. in Malakoff, Bagneux, Gennevilliers, Ivry, Kremlin-Bicêtre, Montreuil, Paris). Our project is in fact capable of scaling up this land engineering solution to expand middle-income home ownership at the metropolitan scale.

COMMUNITY LAND TRUSTS AND LONG-TERM GROUND LEASES

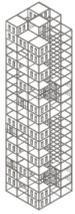
Since the 2014 ALUR law (on housing accessibility and urban renewal), public and private actors (i.e. municipalities, public land banks, social housing providers, foundations) are now eligible to set up an OFS in order to acquire land and support affordable housing provision. The concept works as follows: the OFS acquires land and makes it available to a development firm committed in selling the housing units at a reduced price to targeted middle-income households. Their annual income must be less than 59,046 EUR for a family of four in the Greater Paris area. Moreover, homeowners have to sign a long-term ground lease (*bail réel solidaire* (BRS)) with the OFS to benefit from this subsidized homeownership scheme. They also access state-sponsored soft housing loans (*prêt à taux zero* (PTZ)) and pay the OFS a monthly land fee ranging from 1 to 5 EUR/m². In addition to reducing housing costs and facilitating home ownership, OFS and BRS are powerful land policy tools by helping regulate land and real estate prices, removing more land stock from speculative market dynamics, and extending the impact of initial public investment over the long run.

WELCOME TO PARIS IMMEDIATE VICINITY

The transformative power of the OFS-BRS land engineering program is remarkable in the Greater Paris area and generates a positive, albeit uneven, impact on housing affordability. Overall, it allows households like Georges and Amal's to access home ownership within a larger number of municipalities closer to the metropolitan core and all along the Grand Paris Express transit lines. Living in Paris immediate vicinity then actually becomes a possibility, illustrating the OFS-BRS system's maximal impact. Estimates show that acquisition costs decline by some 60% in the most centrally located areas, where land prices are most expensive, while this reduction gradually diminishes moving toward the periphery. Logically, this contraction in housing costs positively affects the annual housing expenditure/household income ratio. All Paris districts, except the 19th arrondissement, however remain out of reach: housing expenditure exceeds one-third of Georges and Amal's combined revenue, which serves as the housing affordability threshold according to international standards.

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This Greater Paris Metropolitan project appealed to them for another reason as well. Constructed using material excavated from tunnels bored for the Grand Paris Express transit rail lines, the buildings of this development display very handsome and modernist facades. George and Amal adore this architectural style and are particularly impressed now that they've become aware of the advantages of earthen materials and the need to emphasize this resource going forward.

Never one to overlook a professional opportunity, George took special note of an important detail in the project presentation. Unit construction would in part rely on the reuse of materials recovered from demolition, including

wood frames. George was already contemplating how his business could benefit from such projects.

Not to go unnoticed is that the electric bill for this unit will be significantly lower than what they're paying today in a much smaller apartment for the three of them.

It's nearly 1 am. George and Amal haven't seen the time fly by. They've been discussing the project for three hours... and that's just the beginning.

A few months later...

Life in their beautiful Fontenay-sous-Bois flat, «with a view of the Eiffel Tower from the living room couch», is even better than they had hoped.

In no time, George has become a respected figure in the

building. He gives woodworking classes on Saturday to any and all residents. Amal, who never thought of herself as having a green thumb, now gladly spends hours taking care of their garden. Every now and again, she discovers curiosities under the foliage in the vegetable patch: toy cars, dinosaurs, rubber balls.

AFFORDABLE HOUSING FOR THE PLANET

Our project is intended to build housing units whose environmental impact will be minimized. As such, we're proposing shifting away from a linear mindset toward the housing production process and instead embracing a circular economy rationale. In applying the precepts of circular economy, we take into consideration the demolitions planned for future urban renewal programs, as well as for Grand Paris Express transit projects, as sources of locally-generated building materials for reuse in building eco-designed housing units.

1. USE AVAILABLE LOCAL MATERIALS

At present, the Paris Region imports nearly 80 million tons (MT) of products annually, of which 14 MT are building materials. Recycling is extremely limited: less than 10 MT a year total. A major challenge inherent in achieving sustainable housing is to lower imports and raise the share of recycled material use.

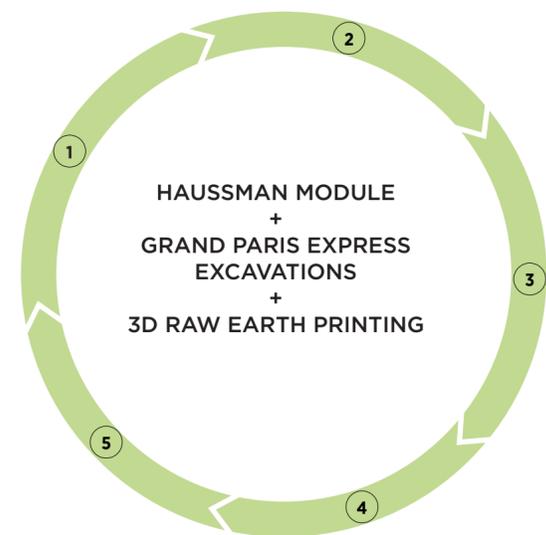
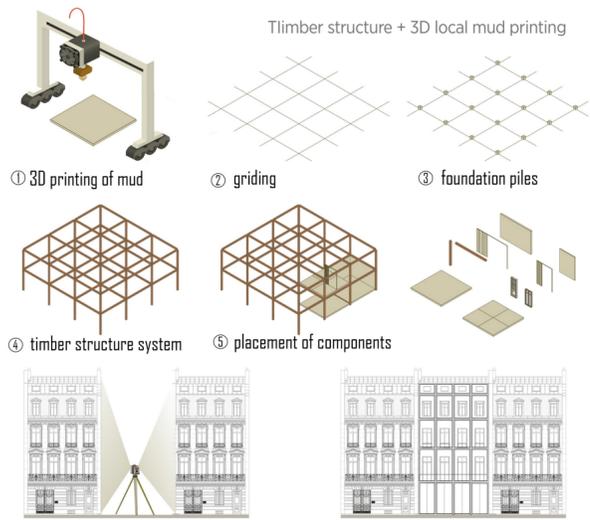
GREATER PARIS METROPOLITAN AREA RECYCLING ACTIVITY



5. INDUSTRIAL PRODUCTION

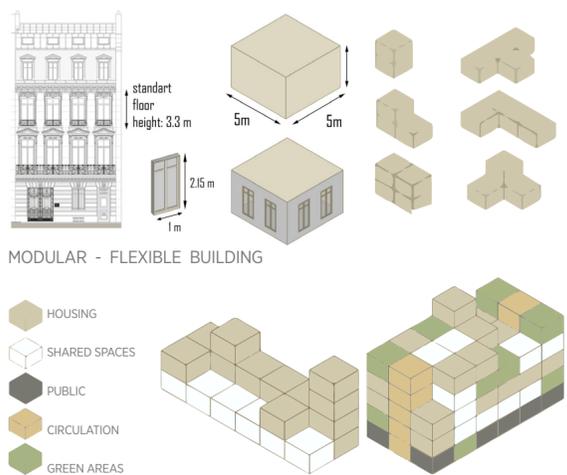
These construction decisions enable both an infinite number of configurations and an industrial production mode for the structural elements that becomes entirely customizable for the interior, thus allowing occupants to lay out their space as they see fit, once again serving to lower costs.

BIO - GEO SOURCED MATERIALS



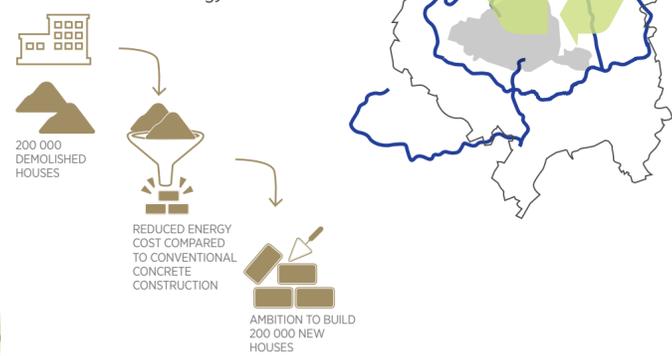
4. MODULAR AND REUSABLE BUILDINGS

Thanks to the lightweight wood partitions and underlying design according to a single layout, the interior fit-out of the modules necessitates minimal effort: partitions may be embedded and moved at will depending on the desired modifications. Also, dismantling has been anticipated in the choice of materials and digitally managed by virtue of BIM data.



2. REUSE AND RECYCLE MATERIALS

With 45MT of earth to be excavated by 2030, the Grand Paris Express project represents a materials source equivalent to all products recycled throughout the metropolitan area. Building with compressed earth block is now a proven technique and serves to apply the principles of «supply-driven architecture», in using a material whose embodied energy is one-third that of concrete.



3. ECO DESIGN

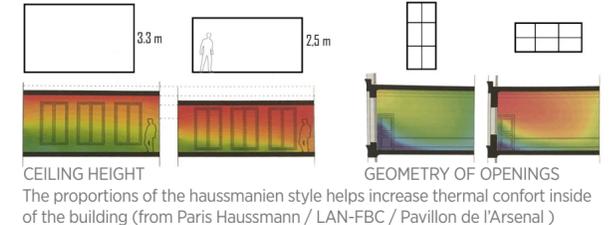
The extensive use of materials originating from major construction projects will be associated with 4 design principles:

- Design for disassembly: components and systems will be easily disassembled, replaceable or reusable to an unlimited extent
- Traceability: housing units will be considered as a pool of materials, managed by reliance on BIM
- Modularity: buildings are designed to be modular so as to avoid their demolition
- Energy efficiency: the units, whose configuration has been inspired by Haussmann's design, will offer a net positive energy.

BIO - GEO SOURCED CONSTRUCTION MATERIALS



CLIMATE CONFORT - CONFORTABLE AND SOBER



RENEWABLE ENERGY, GREEN TERRASSES AND ROOFTOPS, ACTIVE AND SUSTAINABLE MOBILITIES

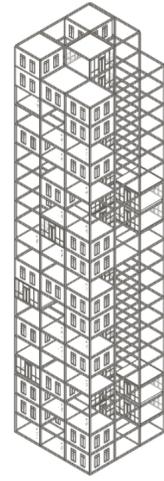
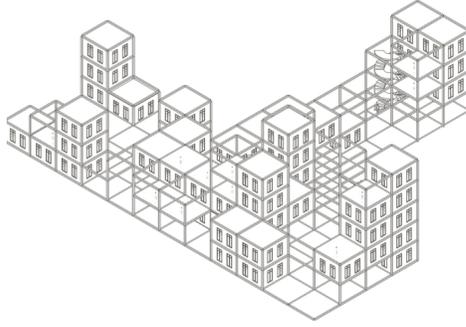
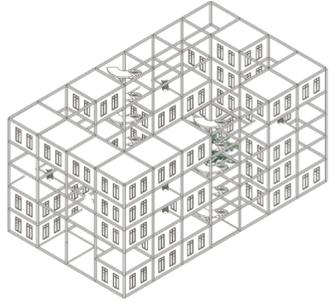
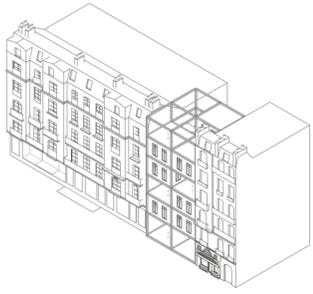


LIMITLESS COMBINATIONS



THE GENIUS, THE TUNNEL AND THE CARPENTER

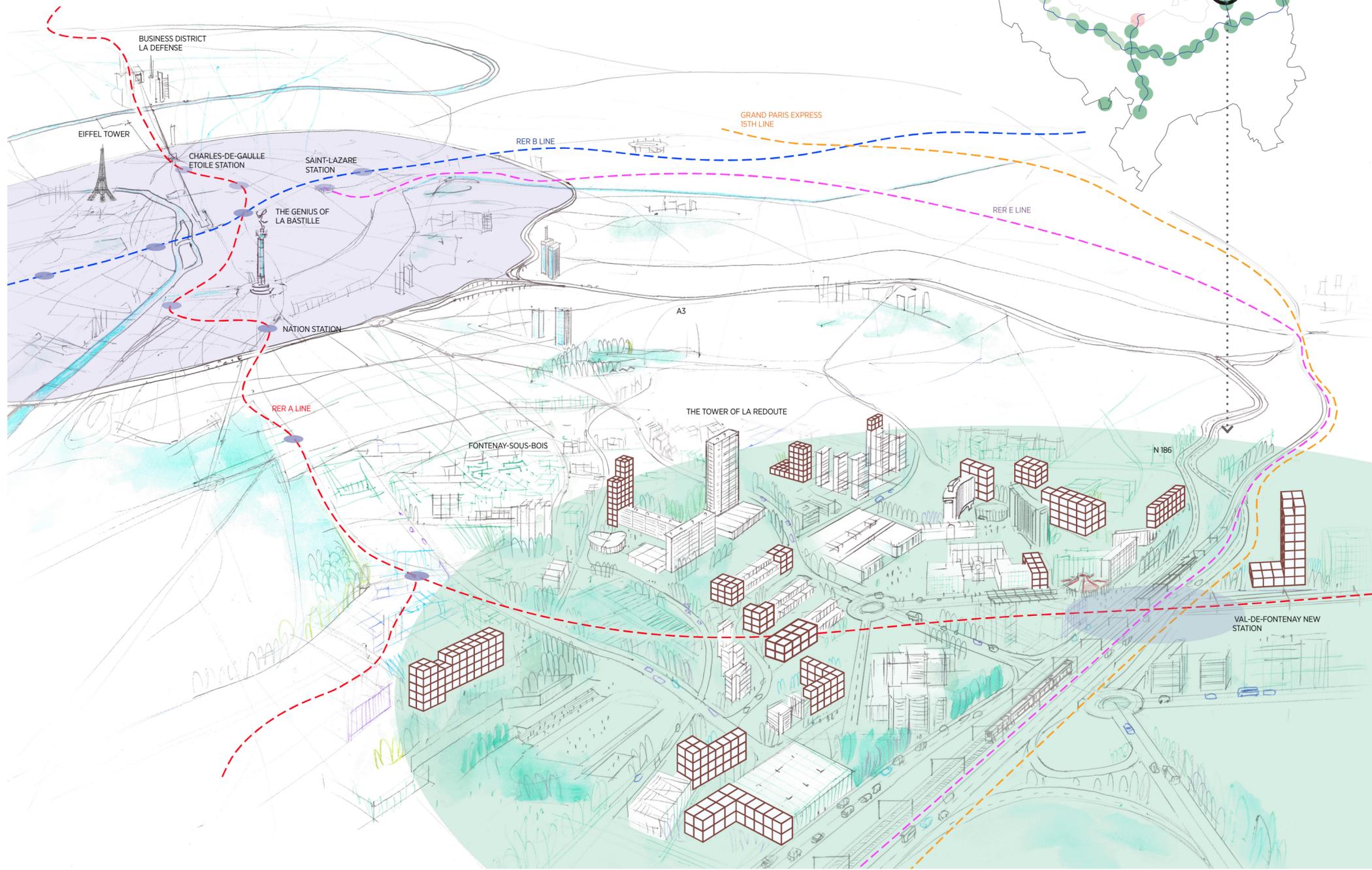
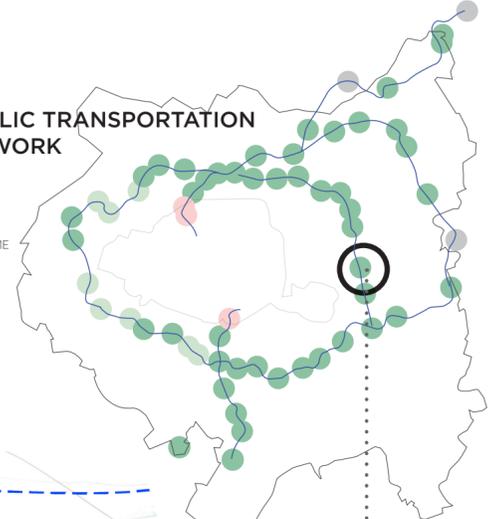
SHRINKING GREATER PARIS / HOUSING SOLUTIONS THAT GEORGE, AMAL AND THE PLANET CAN AFFORD



A NEW METROPOLITAN TERRITORY AND IDENTITY

THE NEW PUBLIC TRANSPORTATION STATION NETWORK

EACH ZONE REPRESENTS A PERIMETER OF 800m AROUND THE FUTURE GRAND PARIS EXPRESS STATIONS. THEY ARE COLORED ACCORDING TO THE BRS HOUSING PRICE-TO-INCOME RATIO.



TEN YEARS TO BUILD 100,000 AFFORDABLE, SUSTAINABLE, AND WELL-LOCATED HOUSING UNITS

Materials are available but the challenge lies in setting up the supply chain: technical validations (scheduled for 2020) and contractor training in application of new processes. Cities and real estate developers have a fundamental duty in this respect, and some have already begun to discharge it.

From a land planning perspective, the 800-m easement designated around rail stations offers a prime location for attractive development programs. As a result, a number of acceleration initiatives are already underway, with calls for projects to reshape the metropolitan area that will generate nearly 9,000 additional units.

As for financing, initiatives abound: an OFS was recently launched in Paris, and subsidized housing developers are rallying behind new projects. Some 2,000 «BRS» long-term leased units are due to come online in the Paris Region by 2024, which is quite an accomplishment in such a short time yet still insufficient to be labeled as a widespread affordable housing solution. With a forecast of 100,000 such units by 2030, accounting for over half of all new units area-wide, our project has reached the critical mass necessary to be considered a real paradigm shift.

The needs and solutions have been identified, now it's time to strengthen the organization and bolster the will to follow through with implementation. Let's hope these proposals will inspire candidates running in the March 2020 municipal elections!

2021 : George and Amal buy their apartment at Fontenay

2023 : George specializes in the development of volumes capable

2027 : George and Amal resale and buy another partment with a carpentry workshop

