

City Logistics Living Labs - an ecosystem for efficient city logistics innovation uptake.

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ABSTRACT

The main objective of the city logistics living labs is to foster long-term co-operative relationships between local authorities, industry and academia to enable pro-active implementation of sustainable logistics measures along with monitoring and evaluation tools to enhance freight policy in urban areas. This contribution defines city logistics living labs as an ecosystem which is necessary for more efficient scaling up and uptake of innovations in urban freight. Within the project CITYLAB several cities are investigating how the living lab approach can be applied to city logistics.

Keywords: living labs, co-creation approach, city logistics, transport innovations

Summary

The main objective of the city logistics living labs is to foster long-term co-operative relationships between local authorities, industry and academia to enable pro-active implementation of sustainable logistics measures along with monitoring and evaluation tools to enhance freight policy in urban areas. This contribution defines city logistics living labs as an ecosystem which is necessary for more efficient scaling up and uptake of innovations in urban freight. In city logistics living labs the principles of the living labs approach, such as real-life setting, active user involvement, co-creation and iterative innovation processes are brought together on the macro level of the city, aiming to facilitate the uptake of logistics innovations in cities. Political and policy support for the urban freight, existence of the efficient stakeholder communication and cooperation platforms, monitoring and evaluation of the urban freight solutions and existence of the efficient knowledge transfer channels are defined as the key components of the city logistics living lab environment.

Within the European H2020 Civitas project CITYLAB (www.citylab-project.eu), several cities are investigating how the living lab approach can be applied to city logistics. The cities have different combinations of the elements of the city logistics living lab environments, facilitating the uptake of the logistics innovation at the local level.

Introduction

There is increasing interest in city logistics in the public domain due to the associated negative impacts on congestion, emissions, noise, and the use of space in dense urban areas. Many solutions are trialled to make urban logistics processes and transport more sustainable. However, a significant change towards more sustainable urban freight transport has not yet occurred:

- Many 'best practices' are very local and are often not transferred to other areas/regions;
- Even if proved to be successful, transport innovations have a difficulty in scaling up;
- Failed initiatives are usually not evaluated and not reported, thus limiting the knowledge and improvement possibilities;
- Many initiatives or demonstrations show that an intervention is technically possible, but implementation in real life city logistics operations on the longer term is often limited.

These issues are hard, and make it very difficult to make a real change in urban freight transport that lasts longer than testing or demonstrating the feasibility of a technical solution or soft measure. Causes of limited scaling up of innovations generally point towards a poor preparation of innovation deployment processes, due to limited stakeholder involvement, unclear business models or uncertainty in the environment (Quak et al, 2016). Urban freight transport innovations are often implemented within a context, where, for example:

- urban logistics is often not part of a long term policy strategy and subject to change due to elections;
- data on urban freight transport is often either lacking or very scattered which makes acting on urban freight transport difficult;
- there is a high number of stakeholders involved in urban freight transport processes often with conflicting interests.

Research performed for the EU by Tomassini et al (2016) indicated that financial sustainability is the key factor that determines whether an urban mobility measure (performed under an EU-financed

project) will be maintained over the lifetime of a project. Another key factor believed to influence sustainability performance in urban mobility is political commitment, including citizens' support. When the legal and political frameworks cooperate effectively to leverage a measure, positive results in the longer term may show up.

To really make a change and make a transition to a more sustainable and more efficient urban freight transport system, a new or another approach is necessary. The underlying assumption of this contribution is that by forming *city logistics living labs*, we can achieve more than by demonstrating a solution in urban freight. Applying the living lab principles of real-life setting, active user involvement, co-creation and iterative innovation processes to the logistics innovation processes on the city level contributes to the levels of innovation uptake. In concrete city logistics projects we see that cooperation of the researchers, local authorities and industry partners is often highly beneficial, however, remains limited to that specific project / issue. The transition to a more sustainable urban logistics system requires a long term and continuous cooperation between industry, authorities, as well as research. City logistics living labs create an environment at the city level that enables this cooperation and facilitates a faster roll out of urban transport innovations.

This contribution is based on the research within the European H2020 Civitas project CITYLAB (www.citylab-project.eu). In CITYLAB seven cities (London, Amsterdam, Rotterdam, Brussels, Southampton, Oslo, Rome and Paris) are exploring how city logistics would benefit from a living lab approach. The project focuses on four axes that call for improvement and intervention: highly fragmented last mile deliveries in city centres; inefficient deliveries to large freight attractors and public administrations; urban waste, return trips and recycling; logistics sprawl. Within these axes, CITYLAB supports seven implementations that are being tested, evaluated and rolled out. Each city has a different combination of the elements of the city logistics living lab environments, facilitating (or not) the uptake of the logistics innovation at the local level. Each city on the regular basis collects data on the progress of implementation, as well as on the living lab process it follows.

In this paper, through the examples of CITYLAB city logistics living labs we illustrate how the living lab approach is a suitable new way of working, facilitating the design, planning and uptake of urban logistics innovation and under which conditions. We first define how the living lab approach can be applied to city logistics, distinguishing implementation and city level. We then propose a definition of a city logistics living lab, highlighting how that is different from the traditional way of working in urban freight transport. Next, this paper focuses on the specific factors of the living lab environment which form the city logistics living labs. Differences in living lab environments are illustrated using the CITYLAB cities as examples. In the conclusion we discuss the importance of the city logistics living labs as an environment facilitating the roll out of city logistics innovations.

City Logistics Living Labs

The concept of Living Labs owes its first insights in the potentials of information technology, when IT R&D was moved into in vivo settings—in other words, to 'wired' living settings such as in a building or part of a city—thereby enabling to monitor and respond to users' responses and interactions, with the ultimate aim to speed up development and deployment of innovations. In Europe, the concept of living labs was already recognized by the European Commission in 2006 as a key tool for open innovation. Since then, living labs have spread over Europe in various waves, first focusing on new ICT tools but later extending to other fields, such as sustainable energy, health care, and safety.

Leminen (2012) define living labs as "physical regions or virtual realities, or interaction spaces, in which stakeholders form public-private-people partnerships of companies, public agencies, universities, users, and other stakeholders, all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts". Hammer-Jakobsen and Bjerre (2011) see living labs as "collaborations between organizations with a shared interest in understanding people's unmet needs in the context of everyday life. They offer the possibility of gaining new insights into people's experiences and engaging in co-creation and co-production with end-users". Schuurman (2015) defines living labs as "an organized approach (as opposed to an ad hoc approach) to innovation consisting of real-life experimentation and active user involvement by means of different methods involving multiple stakeholders, as is implied in the Public-Private-People character of living labs". Overall, various definitions of living labs commonly address the importance of the real-life environment, the involvement of multiple stakeholders, active end user involvement in design and operation process, co-design and co-creation processes and iterative knowledge and learning creation process.

However, in the living lab research grows the importance attributed to the context in which innovative solutions and whole specific living labs are set up. Coorevitsand Jakobs(2017) are saying that often the context of the living labs is not sufficiently taken into consideration but it proves to be an important factor influencing the development of the innovation process. This is also supported by Trousse and Verilahn(2016), saying that while living labs differ initially “because of the active participation of users early on in the innovation process and experimentation in realistic conditions, it also puts the emphasis on creating an innovation ecosystem based on a public-private-people partnership in the case of social projects and on developing intermediation processes to reconcile the conflicting interests of all those involved”. They are arguing that “the concept of the ecosystem is central here, since creating a real momentum for dialogue between stakeholders in the form of collaborative processes, combining professional knowledge, activism and practical knowledge to encourage the emergence of both technological and social innovation is at the heart of the process”. Thus, in this contribution we are inspired by the definition of the living labs given by EnOLL referring to living labs as to “user-centred, open innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings”.

The achievements of the living lab movement go beyond fostering the development of demos, pilots, experiments and test beds: it changes the emphasis from the solution as an isolated object to the process of integration with its environment. It allows the creation of experimentation environments that are sufficiently connected with real world stakeholders and their business models, to allow near-simultaneous development and deployment. Interestingly, the Living Lab concept has not been used explicitly yet for city logistics, despite the characteristics of urban freight systems being well suited by the living lab approach (Nesterova and Quak , 2016).

As defined previously, the living labs encompass a set of distinguishing characteristics: real life setting, multi-stakeholder engagement, co-creation, active end user involvement and iterative learning experience. Applying these principles is possible on the level of the individual companies addressing logistics innovations (e.g. P&G Supply Network Innovation Center). In this case, co-creation with frequent integration of the user feedback in the design and implementation of the solution, as well as possibility of the continuous improvement/adjustment of the solution during the design process are distinguishing features.

City logistics living labs are applying identified principles on the level of the whole municipality, addressing urban logistics innovations in the overall city context. In this case, city logistics living lab creates favourable conditions at the city level for the scaling up and uptake of logistics innovations. In city logistics, a living lab becomes a “test environment for cyclical development and evaluation of complex, innovative concepts and technology, as part of a real-world, operational system, in which multiple stakeholders with different backgrounds and interests work together towards a common goal, as part of medium to long-term study” (Lucassen , 2014). In practical terms, it is a working partnership where local government along with industry, retail, commerce, services and academic partners collaboratively develop new approaches and policies to promote sustainable logistics. As issues arise, changes in policy occur and new concepts emerge, the parties involved in the logistics living lab can easily alter their focus and address and evaluate new ideas.

Set-up of a city logistics living lab has to fulfil three important conditions (Quak , 2016):

- **Inclusiveness:** connection of all relevant stakeholders and business models within a city, with a joint recognition of a problem and solution spaces.
- **Anticipatory capability:** means to (collectively) make predictions of the effects, based on simulations, gaming or more simplified means of analysis.
- **Responsiveness:** measuring of impacts and agreements to respond to this with the aim to ultimately deploy a solution.

The city logistics living lab provides a trusted environment where the individual parties can expose and discuss their problems with an urban freight transport community; identify potential solutions and understand how they have been applied elsewhere; work together with city authorities, industry partners and research partners to test the feasibility of such solutions; implement and trial live projects; evaluate projects medium to long-term through the collection of data between the partners.

Elements of the city logistics living labs

A city logistics living lab creates a context for the efficient implementation of urban freight transport innovations and comprises the following elements:

- Policy and political framework to work on the urban freight in the city;
- Established regular cooperation and communication mechanisms/platforms between the main stakeholders involved in urban freight innovations;
- Continuous monitoring and analysis of data on urban freight, that facilitate the decision making process;
- Iterative learning process and consistent knowledge transfer.

Concrete logistics innovations/implementations are placed at the heart of the city logistics living lab supporting environment. It provides the researchers, local authorities and industry partners with an opportunity to work together at a more general urban freight level. A city logistics living lab facilitates that implementation builds upon the learnings from the previous trials. Supported by the current policy and mobilizing the strong cooperation between local authorities, industrial and research partners it has increased chances for the wider uptake and roll out.

Political and policy framework for the urban freight transport development

Political commitment to the importance of urban freight transport and its framing in concrete policy plans/measures are important factors for the stability of the city logistics living labs. Targeted urban freight transport policies create a framework for the local development of urban freight transport and establishes priorities where the efforts can be concentrated. Sustainable urban logistics plans (as one of the forms of the urban freight planning) support “local public decision-makers and stakeholders in “governing” city logistics measures and enhancing freight distribution processes towards economic, social environmental sustainability and efficiency” (IEE, ENCLOSE project).

As mentioned by Wefering (2014) “planning has become an increasingly complex task, and planners (as well as policy makers) are faced with many, often contradictory demands: maintaining a high quality of life while also creating an attractive environment for businesses; restricting traffic in sensitive areas while not curbing the necessary movement of goods and people; ensuring mobility for all while being confronted with financial constraints. In addition there are wider issues to be addressed, with regards to public health, climate change, oil dependency, noise and air pollution, etc.” An integrative approach to urban freight, looking both into cross-sectoral cooperation, as well as integration of multiple urban freight transport stakeholders is necessary in order to assure the continuation of the urban freight transport measures. This approach can be reflected within sustainable urban mobility or logistics plans which are currently being supported by the EU, but also can be a part of the regular urban freight transport plan, like in a case of Brussels or Paris (CITYLAB living lab cities). City logistics living labs provide a set up for the practical implementations of the cooperation approach to city logistics laid out in SUMP (sustainable urban mobility plans), SULP (sustainable urban logistics plans), and other urban freight transport plans.

In Brussels (CITYLAB example), urban freight is specifically addressed in the Strategic Plan for Goods Traffic (2013), which identifies priority axes and specific measures for urban freight to address until 2020. This plan builds upon several principles similar to the city logistics living lab principles:

- A collaborative approach for the improvement of urban distribution in Brussels-Capital region. As stated in the plan, the Brussels-Capital region “has defined an action plan that defines perspectives for all in an intense spirit of collaboration and determination to find win-win solutions”. The common effort on the level of all 19 communes is encouraged, as well as overall collaboration of all the actors in the city logistics supply chains.
- Use the outcomes of a mobility thinktank and encourage research and innovation to adapt new urban distribution concepts to the Brussels context. Acting as a catalyst for innovation, this Think Tank will improve the information of the various players of goods traffic while allowing the development of innovative concepts. It aims to make regional collaboration easier between public and private players and triggers changes in attitudes vis-à-vis goods traffic.
- In the plan only a limited number of actions are identified for each strategic axis, as focus is put on the continuous improvement process. The idea behind is that the action plan has to be updated every two years to broach the hugely volatile market of urban deliveries, with a possibility to add new actions or modify their scope.

In Paris (CITYLAB example), the Paris Charter for Sustainable Urban Logistics, since 2013, brings together more than 80 organisations, institutions and associations in urban freight transport,

committed to progress in the field of urban logistics. This document represents the urban freight transport action plan for the city of Paris. It includes a clear ambition and scope and it identifies 16 projects presenting concrete initiatives for the logistics sector within a five-year duration (2013-2017), with some strategies aiming at a longer term (2020 – 2030).

Stakeholder cooperation

The higher the involvement of the stakeholders/users in the different stages of the Living Lab, the higher the expected benefits might be for both policy makers and businesses: higher acceptance of the proposed solution/technology, faster time to market, likelihood of higher adoption rate (Innovation Alcotra, 2011). Applied to the city logistics living lab, in practice, this means that on the city level it is necessary to have an established regular cooperation and communication mechanisms/platforms between the main stakeholders involved in urban freight innovations. These communication platforms should include at least local authorities, research institutes and industry.

“Bringing public and private sector decision-makers together in freight partnerships is an important step in building trust and enhancing the uptake of urban freight initiatives. Next, including researchers in these partnerships might not necessarily result in better interaction or understanding between actors, but it might help in finding common solutions or objectify effects of actions, which are required to improve the system” (Quak, 2016). City logistics living labs are an action driven freight partnership, where authorities, industry and research collaboratively work on the improvement of urban freight, fostering innovation deployment and improving communication and cooperation between different stakeholders of the urban freight transport system.

Dealing with involvement of external parties (stakeholders, users, customers) in a Living Lab is a continuous process. Experience from the existing urban Living Labs like Paris and London (CITYLAB living lab cities) show that there are several forms of stakeholder consultation (e.g. London freight quality partnership, London Freight forum, Paris freight charter, etc.). In Paris, in the wake of the Paris Charter for Sustainable Urban Logistics the freight forum was created, which is now providing the main platform of cooperation in urban freight transport. In this framework today, various representative organisations (shippers, carriers, 3PLs, store-owners, etc.) regularly get together in several implementation working groups to work with the various departments of the Paris municipality.

There is a lot of interaction between different groups of urban freight transport stakeholders in London which are formalized within the following frameworks:

- Central London Freight Quality Partnership (CLFQP) is a public/private partnership between the freight industry, local government, local businesses, the local community, environmental groups and others with an interest in freight. CLFQP is set up to develop a common understanding of, and to encourage innovative solutions for, freight transport and servicing activity in central London.
- Transport for London (TfL) co-ordinates the London Freight Forum, which brings together 160 logistics providers. It was set up to coordinate planning and preparations for the London 2012 Olympic and Paralympic Games and continued as a result of its perceived success. The forum consists of operators, businesses, trade associations, regulators and highway authorities, and provides the focus for ongoing engagement.

Continuous monitoring and analysis of data on urban freight

One of the biggest current challenges in urban freight is the absence of proper knowledge on what is really going on within different city logistics segments. There is very limited and fragmented information available on what, how and by which means goods are transported within a city. At the same time, finding answers to these questions on a city level is crucial, if we want to take cost and time efficient decisions on what, how and when to influence in a sector. Getting relevant data on urban freight is not an easy task. Some of the multiple reasons are: predominance of small companies in a landscape of multiple city distribution actors; no interests or unwillingness of operators to provide the data; privacy issues, etc. There are also no yet best practices for data collection on urban freight, so from the start one is faced with a variety of questions: how to collect, what type of indicators, with which frequency, how long. And, once data collection has started a new question arises - what can we do with it?

City logistics living labs provide another approach to data collection and analysis, attributing a lot of attention to the importance of data collection and monitoring and considering continuous monitoring of

a city environment as a key to the successful functioning of the system. Living labs are looking into how to combine traditional transport modelling approaches to urban freight transport data with more proactive data collection approach based on real-time data and predictive analysis. In Rotterdam there are several ways to improve the existing data, that is mainly on traffic and not on city logistics. A innovative city dashboard, co-developed by TNO and Rotterdam, provides real time information on the traffic and air quality, based on combining enriching several (open) data sources. The next step is to see if and how it is possible to get better information on city logistics. Currently, data mainly shows large trucks, vans and cars, but logistics routes, load factors and motives are not clear. To better steer or manage urban freight transport, knowing the rationale behind the logistics is crucial. In several ways new data is collected; 1) vehicle fleet scans provided information on the economics sector trucks and vans are operating in, 2) examining how existing cameras can be used for data in monitoring (now, these cameras are used for enforcement reasons) and finally 3) examine how logistics data from companies can be used; i.e. some companies shared their data (including trips, stops, etc.) from their vehicles with the city. The experiments showed that it was possible, but connecting many vehicles (with different transport management systems) is currently still too expensive.

Iterative learning process and consistent knowledge transfer

City logistics living labs are a working partnership where local government along with industry, retail, commerce, services and academic partners collaboratively develop new approaches and policies to promote sustainable logistics. Bridging experiences and feedback from different stakeholders and knowledge from implemented projects/measures/solutions, existence of efficient knowledge transfer channels is an important requirement of a living lab environment. City logistics living labs with their iterative learning process are bringing added value to all the stakeholders of the urban freight transport system.

For industry partners, being part of the city living lab environment and taking an active role in the stakeholder cooperation process is beneficial in several ways. Enhanced stakeholder cooperation processes facilitate communication between different stakeholders and understanding of the market by individual players. They provide a platform for communication and knowledge exchange, but also a platform to influence to a certain extent the decision-making process. Very importantly, it aims to align the ambitions and goals of individual players in the most productive way, in order to achieve common and individual market-players ambitions. At the same time, it is necessary to keep in mind that stakeholder cooperation is usually a “give and take” process, where investment of time, financial resources or data can also be expected from the business partners.

For the city authorities, having a living lab approach to the city logistics provides new opportunities to enable a bottom-up policy coherence to be reached, including the needs and aspirations of local and regional stakeholders, as well as industrial parties. Urban freight stakeholder communication platforms support urban freight policies and help to gain a common perspective. City Logistics living labs contribute, among other things: the mixing of different competencies in order to stimulate knowledge sharing and to increase understanding of the involved stakeholder’s/user’s vision; the identification of the changes in key stakeholder ambitions or goals at the early stages; the identification of the risk of non-compliance from some organisations and the uptake of mitigating actions when possible. From this set up the city obtains: support for their planning; a better understanding of the real challenges facing the industry; evaluation of the effectiveness of their policy measures.

Both, city and industrial partners can benefit from the added value brought by the research partners in the living lab process. This goes broader than innovative ideas brought by research, but also includes a neutral opinion on the relevance, efficiency and sustainability of the trialled solution and evaluation of the feasibility of the measure or solution. A research partner is also very well positioned to be a neutral coordinator of the city logistics living, having the ability to:

- Convene and host meetings between the partners
- Provide background literature and examples of solutions and best practice
- Undertake scoping and feasibility studies for the industry partners for minimal cost as part of managed student projects
- Act as secure data manager on behalf of the partners, undertaking analysis and providing longer term evaluation of any implemented measures.

In Southampton, the logistics Living Lab involves the city council, Meachers Global Logistics who operate the Southampton Sustainable Distribution Centre (SSDC), Southampton General Hospital and the two Universities. All the parties originally came together through a Memorandum of Understanding designed to promote best practice in sustainable logistics and to reduce their respective transport footprints, with the University of Southampton acting as the neutral co-ordinator of activities.

The city council has an urgent need to reduce CO₂ emissions as Southampton is one of several UK cities where pollution levels have failed EU emissions targets. The University of Southampton as the trusted third party was able to co-ordinate discussions between the partners and undertake feasibility studies on their behalf. The university identified personal deliveries to students living in halls of residence as an increasing issue. The volumes of packages being ordered were leading to increased workload on staff. Through dialogue between the living lab partners, the concept of consolidating halls post via the SSDC was conceived. The University undertook a survey of 400 students' retail habits whilst liaising with the halls managers to conduct an audit of packages received during the week immediately following the busy Black Friday (25 November 2016) sales event.

Working with Meachers Global Logistics, a consolidation scheme for halls post was designed and costed, suggesting that the current 13,000 annual courier visits to just under 9000 students in halls could be reduced to around 300 for an annual service cost of approximately £18 per student. After further dialogue between the partners in the LL, it was decided not to go ahead with a physical trial due to the uncertainty regarding 'same-day' delivery take-up by students going forward and how such services could be catered for. The whole activity has led to further ideas exchange and the two universities investigating the use of automated postal receipt systems and the use of locker banks in halls and other communal spaces to reduce vehicle impacts. This highlights how the collaborative approach with the logistics living lab can develop and transform ideas over time.

In an attempt to make cost savings but to also reduce their CO₂ footprint, Southampton City Council have been investigating the scope for switching elements of their 700 strong vehicle fleet to electric operation. This dialogue came about through the experiences of the living lab partners where the University of Southampton already operates electric service vehicles and through two student projects was able to evaluate the scope for such a switchover. Through interviews with fleet managers, tracking trials of vehicles and using historic round data, the council were able to understand which specific fleet operations would be most suitable for electric conversion and what the implications for infrastructure provision would be.

The existing business and personal relationships between the parties, emanating from the original memorandum of understanding have been key to enabling dialogue to continue and new ideas to be developed and explored as needs have changed.

City logistics living labs as enablers for the urban logistics innovations

Changing paradigms is not an easy task. The idea behind the city logistics living labs is that successful up-scaling of urban freight transport innovations requires a supporting environment on the city or neighbourhood level. In the field of city logistics many small-scale innovations and tests have taken place, but often large-scale deployment has not occurred. The living lab approach aims to contribute to innovation deployment in the city logistics, not necessarily by testing solutions never tested before, but in establishing the new ways of working that lead towards permanent and long-term change. By forming city logistics living labs, ambition is to establish a process in which implementations are tried out, supported by dynamic prediction and evaluation tools, where the direct environment is adapted to make it work, and where barriers are directly dealt with to have a maximum impact. In this articles we have presented examples of different elements of the city logistics living labs within CITYLAB cities. As the next step, the CITYLAB project will establish a link between the elements of the city logistics living lab environment and implementation results within each of the project cities.

A living lab differs from conventional demonstrations in that it creates an experimentation environment in which stakeholders together aim at achieving a long-term goal. How to get there is not yet defined exactly, but the goal is shared among all stakeholders, including the citizen, government, industry and research. Especially the city logistics environment, with its many stakeholders, often conflicting stakes and all kinds of different backgrounds, would benefit from such an approach. Living labs can be used by stakeholders for co-designing, co-exploring, co-experiencing and co-refining new policies,

regulations and logistics actions in real-life situations. This implies a process in which solutions and actions are tried out, supported by dynamic prediction and evaluation tools, where the environment is adapted to make it work at the same time, and where barriers are dealt with directly to have a maximum impact. It is a major leap forward from the traditional city logistics initiatives, in which demonstrations run with the aim to “prove” that the developed solution functions within a limited and temporary organizational setting. The majority of these have involvement of a limited number of stakeholders, mainly from the same group. The road towards the goal is described in detailed demonstration plans without involvement of other stakeholders, so the goal is not commonly shared. When the demonstration proves that the solution has effect or when the demonstration’s time is over, the demonstration is terminated and the situation goes back to where it was before. Because Living Lab approaches focus more on the environment, the ultimate goal is not only to prove that something works, but in addition, to allow absorption by the city, when it does.

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