Plug-In City Outlets

Revisioning the Form of Urban Logistics

by

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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ABSTRACT In support of a modal shift towards rail for goods movement, a reconceptualization of urban and interurban mobility frameworks leads to the proposed infrastructural fitting for the urban periphery. Keller Easterling's *situating* serves as a tool for engaging the serial aspects of the project territory in order to leverage widespread change. The intervention is born of the premise that while the 'last mile' of the supply chain must remain predominantly road based, the 'second-last mile' between concentrated distribution clusters is an opportune target for modal shifting initiatives. Towards this end the thesis envisions alternative, elaborated templates for distribution cluster design which optimize instrumental capacity as well as generate new performative possibilities through the conflation of productive, consumptive, and logistical activities. The hybridized type is demonstrated on a greenfield, industrial zoned site in the outer fringes of the Greater Toronto Area. Standard warehouse morphologies are retooled to serve the unfolding trends of agglomeration and just-in-time delivery while functioning as revolutionized, streamlined terminals of inland intermodal exchange. A unique urban condition is created where the freight-intensive logistics cluster interfaces a transit-supportive arterial corridor in the surrounding suburban fabric. Here, a thickened seam is developed to engage pedestrian-scaled experience, offer richness through surprising functional juxtaposition, and capitalize on the potentials for efficient local connections to regional distribution agents.

Advisor	Geoff Thün
Committee	Anne Bordeleau
	Lola Sheppard
Examiner	Charles Waldheim

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To my friends, who made it bearable. Kate Gould for your thoughtful advice, residents of Melville and Le Conservatoir, Dani Shalmone, for your confidence, and my family, for your unwavering support and understanding.

For my family

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All illustrations, maps and photographs have been produced by the author unless otherwise sourced in this list.


MELBOURNE
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L.A

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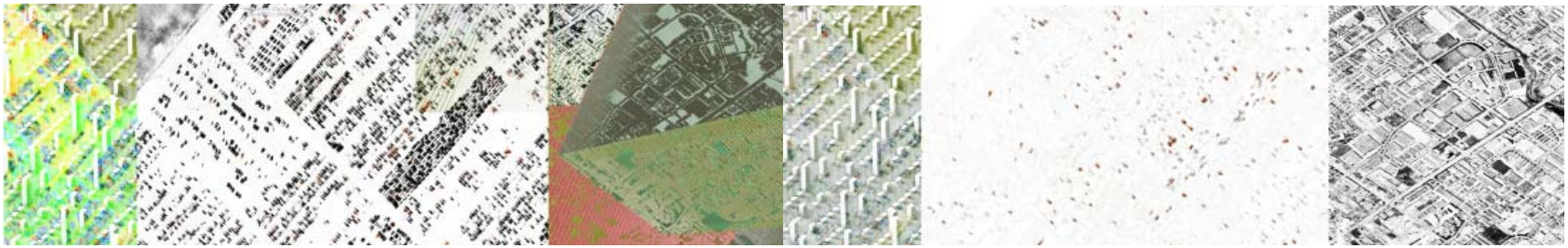

Fig 0.2 Serial Urbanity

INTRODUCTION

The homogenizing effects of globalization have infiltrated cities worldwide. Propelled by frictionless communication, mass production and carbon-based fuel, these forces overwrite nonconformity in barrelling towards the universal and immediate bottom line. As production specializes around the world, supply chains are increasingly dispersed to take advantage of regional disparities in labour, resource or managerial assets. To date, the benefits offered by playing off such disparities overshadow the costs of increasing the distances spanned between each supply chain link, and the associated ecological footprint. Freight movements already account for nearly 30 percent of world oil consumption,[1] and will soon surpass that used for all other transport forms combined.[2] For the abundance of research and strategic investment geared at reducing auto dependency in favour of public and active transit, there is no commensurate counterpart aimed at shifting truck traffic within and between cities to more sustainable modes such as rail.

Since the 1960s, extended supply chains have been directly enabled by the standardized container, allowing distributors to capitalize on the relative advantages of various transport modes in succession. Yet with the break-even cost point between road and rail still sitting above 800km,[3] the container's full potential for complete and adjustable intermodal optimization has yet to be exploited. While the 'last mile' of the supply chain must remain predominantly road based, the 'second-last mile' between concentrated distribution clusters is targeted as an opportunity for modal shifting initiatives.

Throughout the world, the challenges of green logistics condense at these single storey, Post-Fordist 'high cube' logistics centres which act as adapters for inter/intracity rhythms of supply and consumption. They aggregate in strips along highway corridors and pools surrounding intermodal hubs. Indifferent to immediate adjacencies, their placement is derived by optimizing distances to multiple remote valves of material flow. High cubes are repeatedly banished to the urban fringes and engulfed again by residential sprawl. They are crudely developed with minimal capital for earliest returns, enforcing a reciprocal relationship between low intensity land use and diesel truck dependency.

As gateways to the global marketplace, high cubes represent the pivotal outlets into which regional economic lifelines connect. Yet in spite of this crucial role, the high cubes' effects are locally adverse when inserted as coarse functional monocultures which lack responsive interface with a multifaceted and multiscalar urban fabric. Concentrations of trucks present safety hazards to pedestrians, and vast expanses of blank warehouse façade are bewildering to the human scale. The competing agendas of the goods movement industry and transit oriented development are acutely dissonant where industrial zones abut intensification corridors served by higher order transit. It is here that the work address both passenger and goods movement as an interdependent problem requiring an integrated solution.

The work is structured in three parts of increasing specificity. Part 1: FIELD offers meditations on the serial operations which describe the project territory. Propelled by Keller Easterling's *situating*,[4] a strategy of adaptive template design is adopted to harness the momenta of existing market forces and leverage widespread change. Part 2: FLOWS positions the problem of transport fluidity in its economic and ecological context, calling for localized interventions with regional systemic concerns. Part 3: FORM studies the existing strains upon transport infrastructure in the Greater Toronto Area, and identifies sites with greatest transformative potential. A retooled industrial cluster typology is proposed offering renewed rail competitiveness. Where the cluster interfaces the surrounding fabric, a unique urban condition conflates productive, consumptive, and logistical activities to generate new performative possibilities.

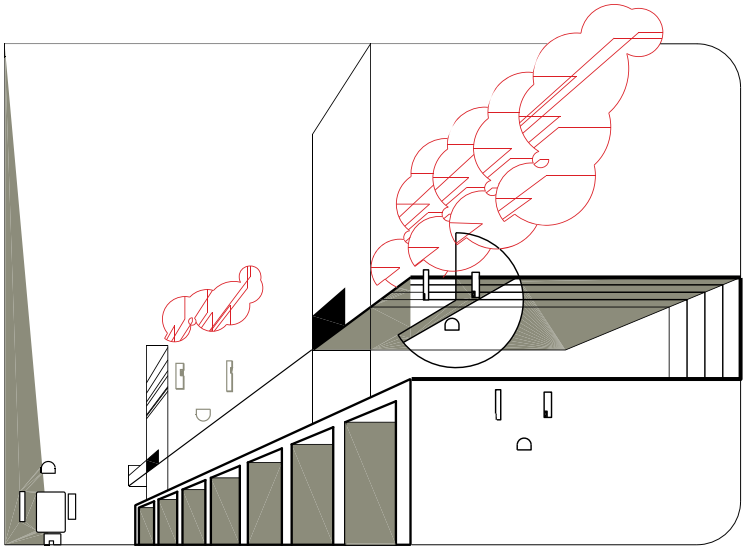

Fig 0.3 Plug-in lifelines

Fig 1.1 UPS distribution hub, Chicago, IL

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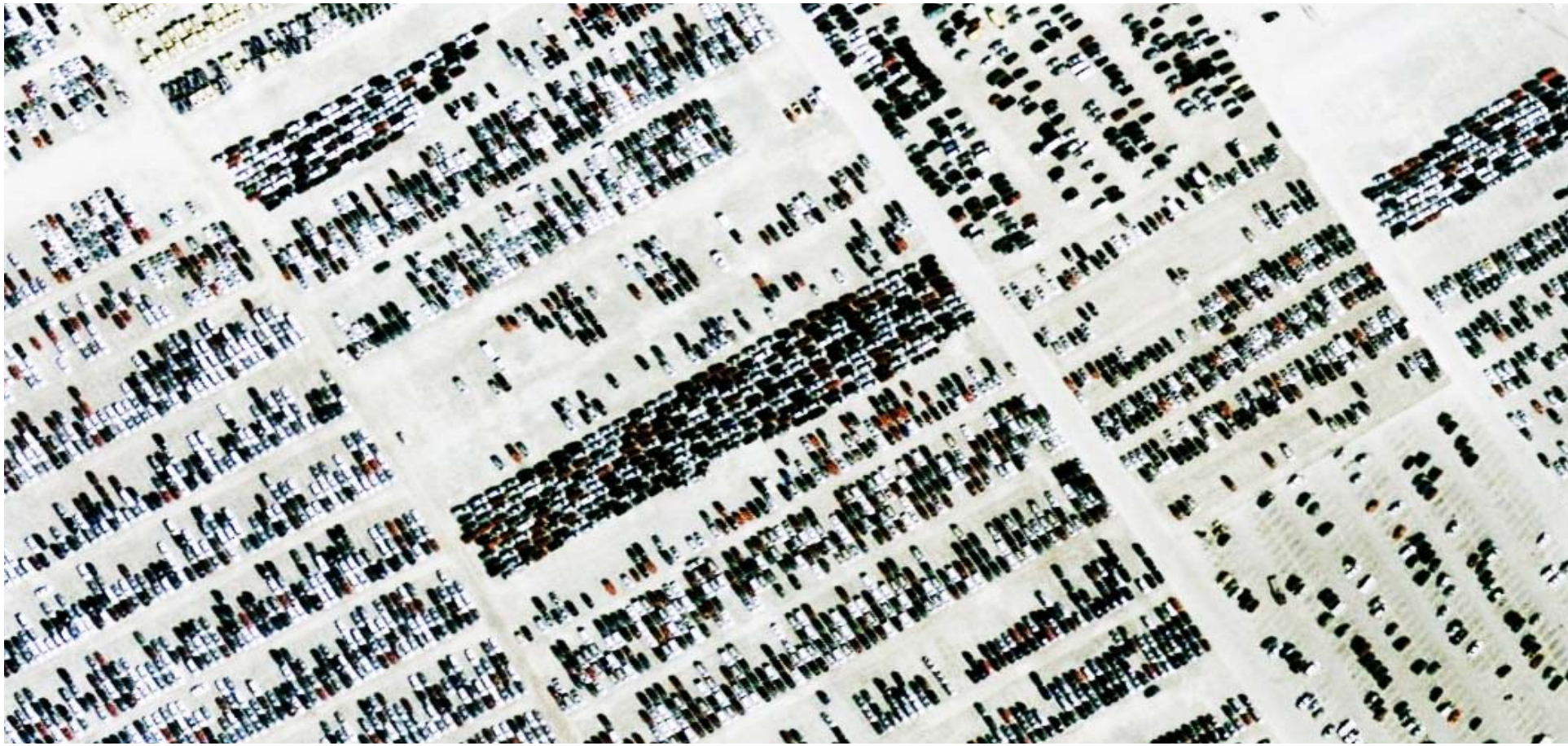


01.1 SITUATING
WITH (PLUG-IN) CITY OUTLETS

Fig 1.2 Parking lot in Milton, ON

Capitalist production has unified space. This unification is at once an extensive and intensive process of *banalization*.[1] So argues Guy Debord in his 1967 work *The Society of the Spectacle*, and these words resonate even more profoundly today. Here, capitalism is touted as the proponent of individualism. Yet it also works to isolate. Isolation is both its basis and its mode of proliferation; It ensures that individuals will continue to consume the images of its antidotes.

Keller Easterling describes this logic as the self-reflexive algorithm.[2] Debord continues to describe its mechanism, stating:

> The accumulation of commodities produced in mass for the abstract space of the market, which had to break down all regional and legal barriers, and all the corporative restrictions of the Middle Ages that preserved the quality of craft production, also had to destroy the autonomy and quality of places. This power of homogenization is the heavy artillery which brought down all Chinese walls.[3]

As its momentum bears on spatial constructs, its cities assume the morphologies of its metabolism. The features of the capitalist city are smoothed and legible in series rather than as individual units. Ingredients are grouped according to type, forming organs with carefully prescribed boundary interfaces. Debord's explains,

> Integration into the system requires that isolated individuals be recaptured and isolated together: factories and halls of culture, tourist resorts and housing developments are expressly organized to serve this pseudo-community that follows the isolated individual right into the family cell.[4]

This culminates in the suppression of the street,[5] where unprescribed cross-pollination between dissimilar elements may result in complexity, friction, internal bleeding, or richness. The archetypal example of the suppressed street is found in the modern suburb. Lewis Mumford elaborates that

> Suburbia offers poor facilities for meeting, conversation, collective debate, and common action – it favours silent conformity, not rebellion or counter-attack. So suburbia has become the favoured home of a new kind of absolutism: invisible but all-powerful.[6]

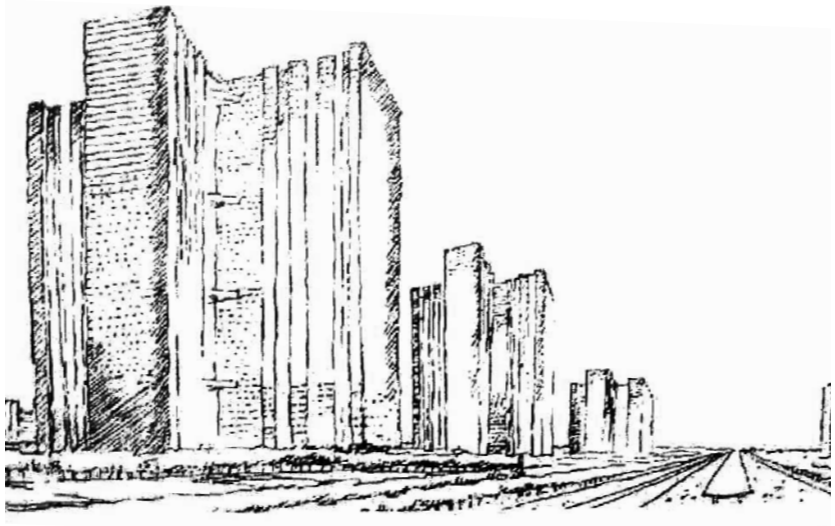
In response, critics lament the now tangible "placelessness" while planners seek to recreate lost identity and collective memory through the devices of New Urbanism.[7] However in light of Easterling's *situating*,[8] this approach seems limited, bordering dangerous as a speed bump on a highway. By understanding the concept of site as fundamentally a verb, Easterling invokes the broader field of conditions within which it operates. Debord and the Situationists too, as their name indicates, were sensitized to these exchanges. Yet Easterling's Situating is more directly an affront to the uprooted critic, in allowing sites to perversely be "no place".[9]

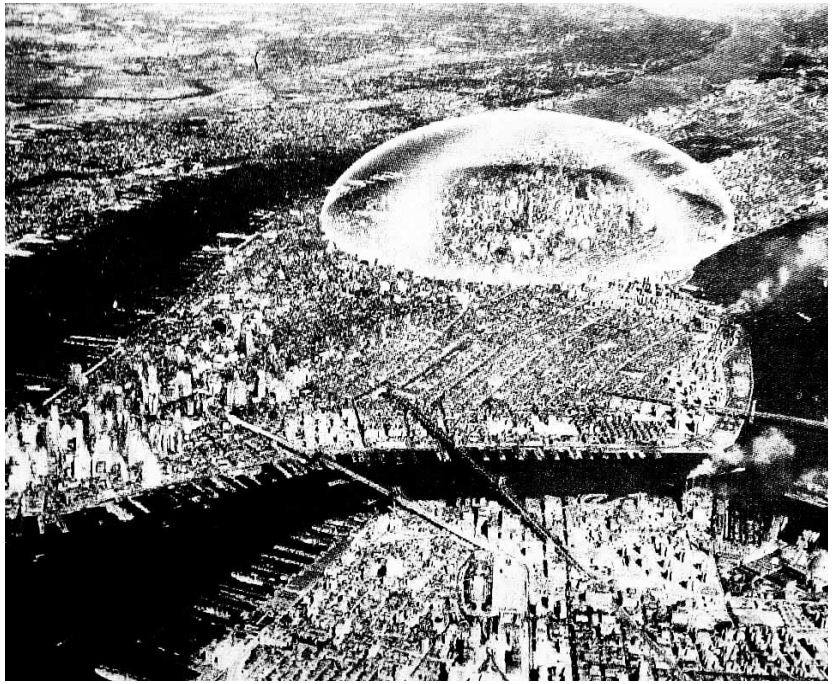
This may sound at first like a resignation, but in this case, the attitude of "if you can't beat 'em, join 'em" may offer paths to new reservoirs of agency. Situating does not undermine a site's unique identity. Rather, it calls for an additional sensitivity to the mechanisms that shape it, and are shaped by it.

To treat a site as "no place" is to understand it as no one place, or as the consequence of a function which propagates across the entire 'experience economy'.[10] As functional cogs in Debord's *Society of the Spectacle*, they are both infused with all its momentum and equipped with the means to affect it. In *Organization Space*, Easterling writes that

> To truly exploit some of the intelligence related to network thinking, an alternative position might operate from the premise that the real power

Fig 1.3 Zoning boundary in Mississauga, ON





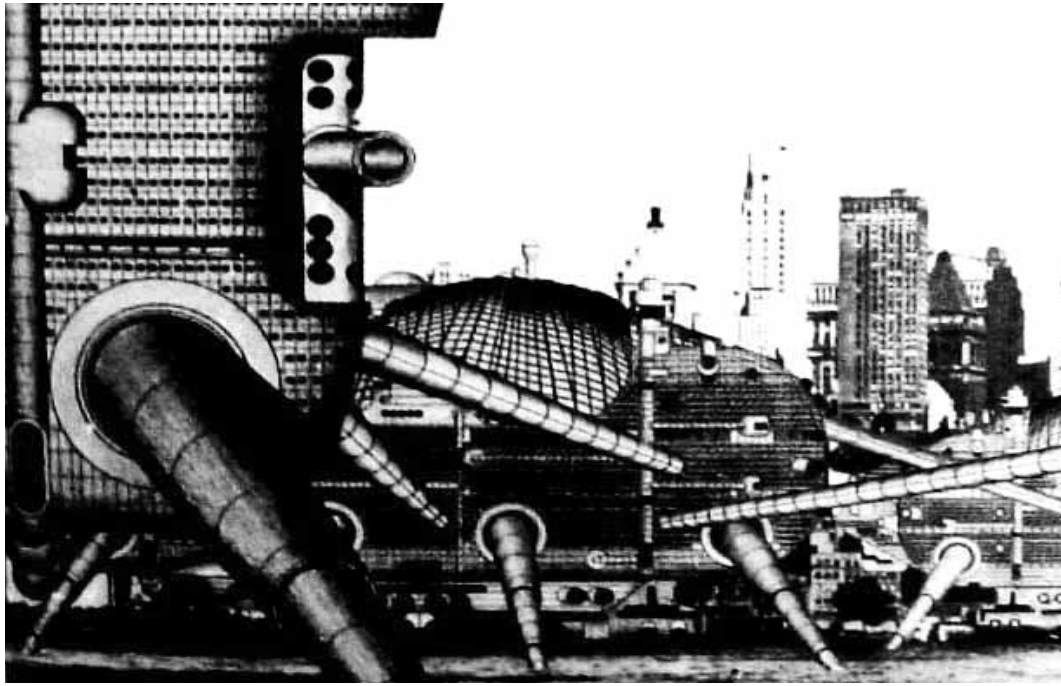
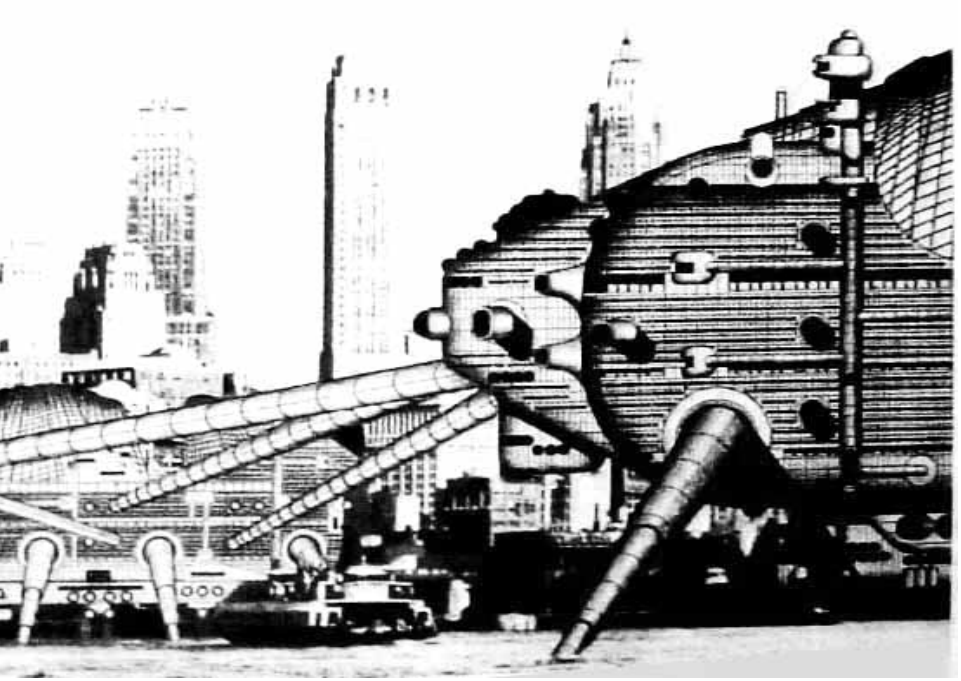


Fig 1.5 Left: Le Corbusier, Radiant City, 1938
Fig 1.6 Bottom Left: Buckminster Fuller, Project for a Geodesic Dome over Manhattan, 1962
Fig 1.7 Bottom Right: Ron Herron, 'Walking City', 1964



> of many urban organizations lies within the relationships among multiple distributed sites that are both collectively and indivisibly adjustable.[11]

This attitude then proves optimistic, offering grounds for investigating what adjustments might be possible. An adjustment with greatest impact is one that harnesses or redirects an existing force to itself become self-propagating.

EXPOSING MALLEABLE TERRAINS

In "From Object to Field", Stan Allen too calls for architects to engage in the active sequences which comprise the project territory. He writes, "By looking for a precise and repeatable link between the operations of construction, and the overall form produced by the aggregation of those parts, it becomes possible to begin to bridge the gap between building and form-making."[12]

In a context of mass production, this 'form-making' could also mean a kind of 'formwork making', or template design. What is proposed is then not an object, but a mode of visualizing where a degree of control is relinquished to a rule outside the purview of the designer. The product is then inherently adapted for some compatibility with its site.

As Archigram along with many other visionaries have shown, even the most unusual alternative conceptions of city habitation have *some* fitting for compatibility with existing systems, whether they are infrastructural, such as a plug, or related to a deep seated market desire.

However in seeking to undertake form-making as recourse to the isolating and seemingly frozen city, designing compatible fittings cannot be an afterthought. **One may argue that a situated design is not justified by its fitting, but defined by it.**

In *Organization Space*, Easterling examines sites that "interface a wave of consumption to recondition or overwrite a space."[13] Using the two powerful examples of the American interstate highway and the suburban subdivision, she illustrates how well situated interventions had momentous, 'snowball' effects.

Fig 1.8 John W. Morley, Cartoon with caption “Nature’s Carpet”, 1944

Her analysis accounts for many details of their respective anatomies. The cloverleaf for example, was the result of an engineer’s priority for perfectly uninterrupted traffic flow at a time when an engineering and legislation were closely tied.

The cul-de-sac was initially employed to promote safe pedestrian activity within a protected parallel path network, as in Radburn. But later, the distinct pedestrian path was abandoned, and cul-de-sacs were instead employed to maximize developed area on odd strips of land, to reduce infrastructural costs, or to phase development without appearing incomplete, all the while maintaining their original identity as readily ‘approvable’ to authorities.

Both the highway and the subdivision *concepts* can be understood as strategic fittings, while these particular formal *attributes* may represent sub-fittings into their conceptual framework.

Easterling’s optimism stems from the view that these attributes are always malleable, and may result in fundamental changes in the larger frameworks which they fit into. If they are well designed, they may offer the potential for a broader range of functionality. This is the intelligence of the system, which may emerge from any dumb or seemingly limiting substrate. In this light, the suppression of the street in Debord’s model is only provisional.

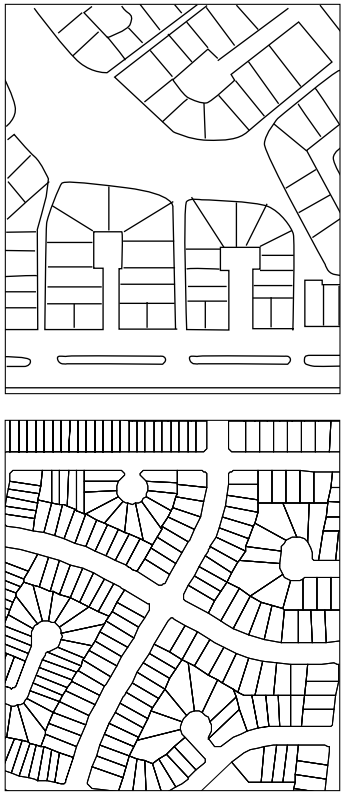


Fig 1.9 Cul-de-sacs in Radburn, NY. Built in the 1920s.

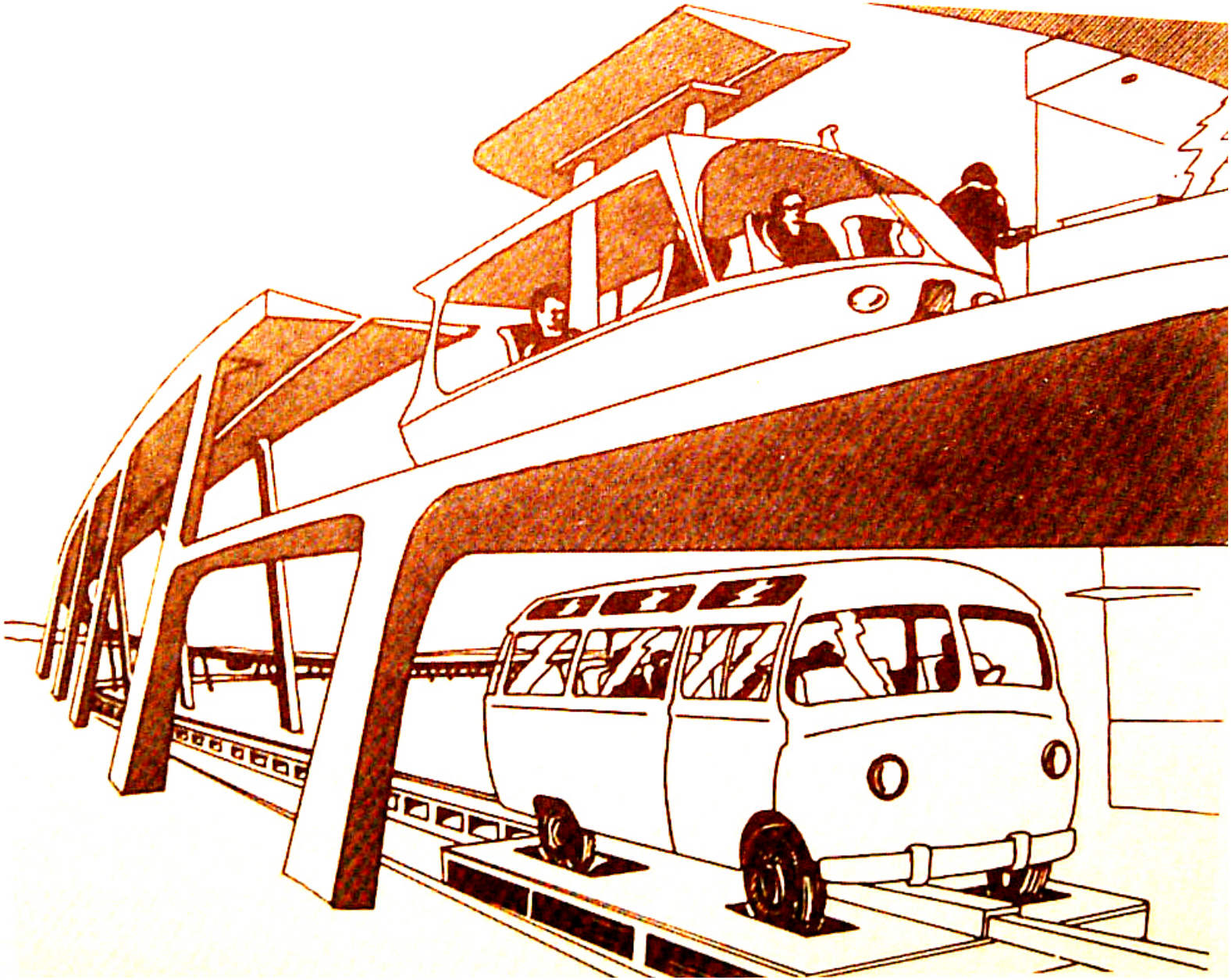
Fig 1.10 Cul-de-sacs in Brampton, ON. Built in the 1990s.

AWAITING DIFFERENTIATION: THE NORTH AMERICAN HIGHWAY NETWORK

Like many capitalist products, the highway was packaged as a proponent of individualism, yet tailored to the agendas of commerce. It was spurred by an urgency to accommodate the glut of vehicles already sold.[14] Easterling reads the highway as a potentially differential, intelligent concept which was 'dumbed down' by traffic engineers in its nascent stages. The increased power bestowed upon the engineers is partially attributed to the interwar technocracy movement's influence and its positivistic associations with artificial intelligence, predictability, and optimization within complexity.[15] Easterling recounts that

> The equations always yielded the highway as a fixed register of dynamic equilibrium or movement at a particular speed. Traffic engineering principles determined everything from the dimension of the highway to the turning radius of the driveway, and they also governed the hierarchy of tertiary, secondary, and minor streets. Even minor streets were sized for large phantom vehicles moving at top speeds.[16]

Although it was endorsed as an intercity network, it was deprived of specialized means for interface with the complexities of the city. Its narrow focus on speed resulted in a sealed system, like the railroad. As it was decreed to pass through city fabric uninterrupted,[17] it could only interrupt.



Mumford reliably criticized this overlooked opportunity to provide differentiation at the highway's intersections. He wrote,

> Instead of adding a new element of flexibility and breadth to a railroad system that had become rigid in its concentration on intercontinental traffic and had produced a linear distribution of population, the highway engineers have largely been duplicating the railroad system…Rejecting the opportunity of enlarging the scope of our public transportation system, our public authorities have been dismantling it; and in the very act of doing this, they are both undermining the city and degrading the countryside…[18]

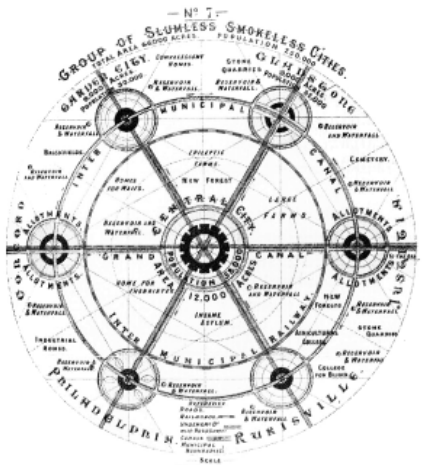
Laurence Halpin, a 1960's American planner, sought to increase the intelligence of nationwide transportation systems. Expanding the narrow focus of the highway engineers, (whom he called "boors"), he explored the potentials of multiplying the array of available commuting modes.

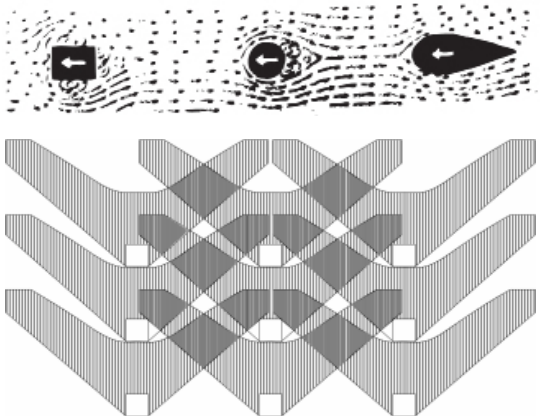
He speculated on possible effects and interactions between hydrofoils, electric cabs, monorails, funiculars, and jet-tubes with the presumption that a wider array of options would provide more specialized and adaptive service.[19]

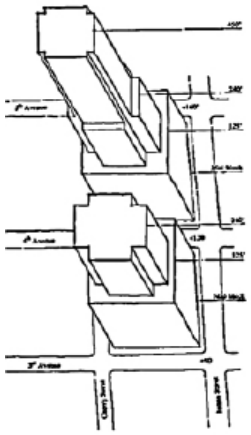
By allowing vehicles, intersections, and roadsides to perform in ways that went beyond the confines of conventional *auto* traffic engineering, Halpin's pursuits aimed to provide a forum for more intelligent functionality. His work drew from copious data collection in the spirit of the technocrats and later complexity theorists.[20]

However the ultimate design of the interstate exhibits a more steadfast conformance to conventional engineering principles. This is because intermodal interchanges might obstruct continuous speed,[21] and furthermore not adapt to bureaucratic interests advocating the car as the exclusive mode. When limited to its own "internally consistant"[22] logic, the highway fails in service to the complexity surrounding it. Instead, it spawns fixtures adapted to its own, dumb morphology.

Fig 1.11 Francois Girauld, "Dual mode air cushion vehicles", 1969


— N° 7 —
GROUP OF SLUMLESS SMOKELESS CITIES.
GARDEN CITY
GUISBOROUGH
MUNICIPAL
CANAL
CENTRAL PARK
GRAND AVENUE
PHILADELPHIA
RUNCORN





Yet these fixtures themselves need not be equally as dumb. Halpin's superposition of parallel, cooperative networks is not precluded as a future possibility, and in fact has already been realized in part with the truck-sized railcar.

When the design site is conceived as a broader communication network, heterogeneous fittings which adapt to the specificities of location become essential.[23] Easterling summarizes that "multiplicity, differentiation, and diversity are understood to strengthen a network, and the smarter the system, the more its operation runs counter to conventional notions of efficiency."[24] We must recall that the internet, laden with parallelism and dispersedly organized, was born of a dumb, and centrally-controlled computer.

ADAPTIVE FITTINGS FOR SERIAL EFFECTS

The isolated suburb, like the highway, realizes space as a distributed commodity to the same extent as the farm plots which it displaced from the Jeffersonian grid. The subdivision represents another instance where form-making resulted from strategic manipulation of field conditions. Even before mass production was in full swing, developers built tracts of homogenous, low density housing to expedite their approvals for mortgage insurance from the Federal Housing Association. As both controller and financial supporter of this effort, the FHA assisted in priming their market. This model exhibited its greatest power, however, when it continued to serve private interests long after government insurance was needed, thereby demonstrating its adaptability.

Other examples of adaptive fittings can be found in all stripes. They may take the form of a technology, a unit, a code, a system, or a boundary. They may move through fields by market economy or by ordinance. They may range from the introduction of structural steel to the one-size-fits-all coffee cup lid. They may be a diagram which influences planning policy, a zone or a green belt. They may increase the intelligence of the system,

Top Left To Bottom Right:

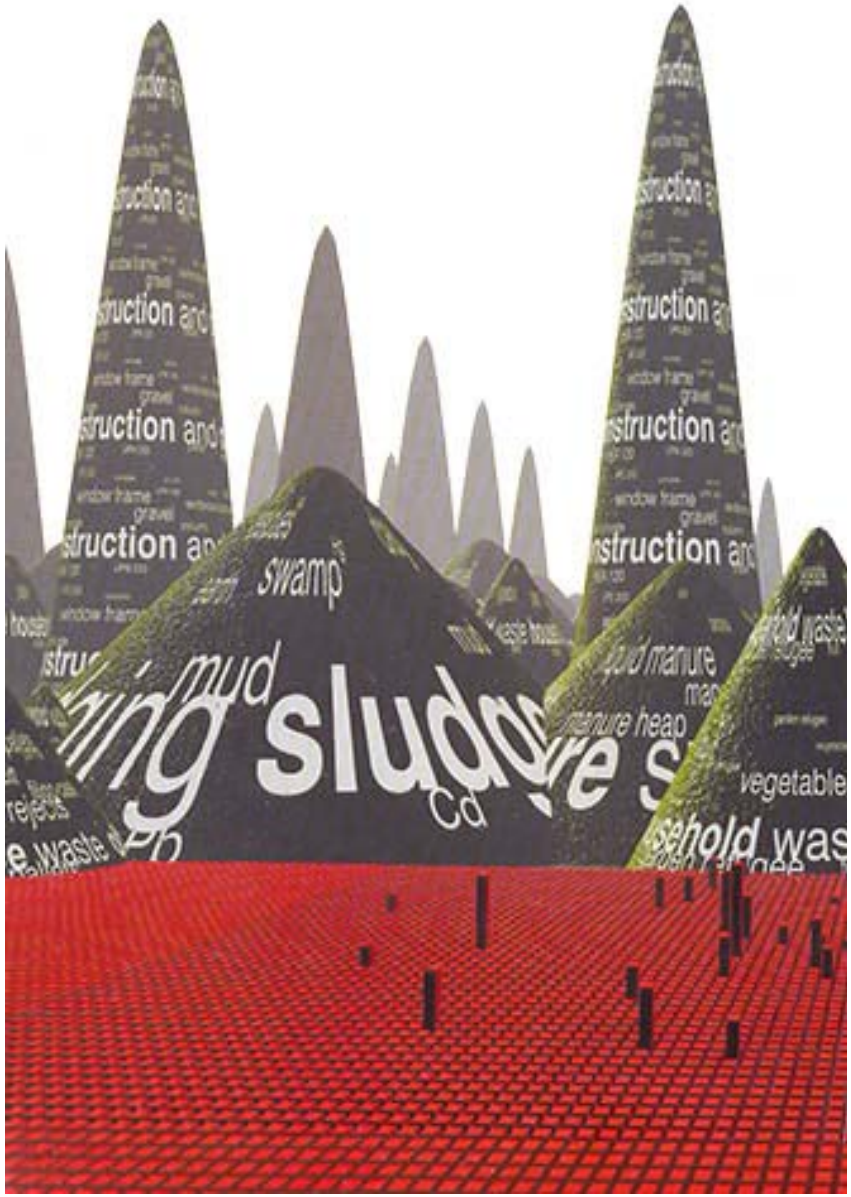
Fig 1.12 Ebenezer Howard, Ideal diagram for Garden Cities around a central city, 1898

Fig 1.13 Diagram illustrating principles of 'Streamlining', 1932

Fig 1.14 Diagram of optimal building spacing to promote sunlight penetration, early 1900s.

Fig 1.15 Maximum build-out diagram for Seattle Municipal Civic Center Master Plan, 1999

Fig 1.16 One size fits all coffee cup lid


swamp
mud
sludge
Cd
Pb
manure heap
vegetable
household waste
window frame
gravel
rejects

or constrict it. The pedestrian path in Radburn offered a safe route between home and school. Now, in its absence, we wonder about the health impacts of child inactivity.

The most effective fittings are those which remain attuned to their contexts, and once designed, may adapt to serve new complexity and circumstance rather than hinder it.*[25] In undertaking situated design, the most problematic sites may also be the richest in opportunity. The congested highway is in want of a pressure release valve, and the suburb has learned to adopt and clone with great consistency. Easterling reminds us that even while an intelligent design runs counter-intuitively to its field, it must nonetheless be compatible enough to sufficiently engage with it.

The studies of MVRDV employ a methodical tactic of exploring the constraints of a situation. The results are hoped to uncover the best outlets around which to design their plugs. This is facilitated by a protracted process of negotiation and meticulous collection of 'bottom-up' data. MVRDV's *Metacity Datatown* represents one of the broadest and purest examples of globally situated urbanist logic. The embedded rules of its interactions are mapped onto the *datascape*, or parametric terrain. They extrapolate formulae from trends and let them loose in a tightly bound petri-dish scenario, with the belief that the raw numbers, in an 'extremized situation' will lead to "frontiers, edges, and therefore to inventions."[26] In forbidding the externalization of any necessary element, they anticipate the inevitable clash between different "ruling forces"[27] and proceed to examine the formal implications of various balances of power. These endeavors reflect the technocratic ideals from a half a century earlier, that with sufficient information, an optimized format for governance can be calculated.

In assessing the potentials of this tactic, three of its limitations must be acknowledged. Firstly, the number of factors tested must invariably be selected and limited. Secondly, the model must assume deterministically that the traits assigned to units are static and predictable, thereby constricting the degree of complexity represented by any result. Bart Lootsma illustrates this point in stating that while the suppression of eccentric traits

Fig 1.17 Cropped image from MVRDV *Datascape*

is useful in seeking to observe larger trends, “these individual expressions also represent private entrepreneurship, ad hoc collaborations, flows of money and power that together form new multiplicities, gravities, turbulences, swarms, herds and flocks that have an even greater power – even if it has no representative form.”[28] Lastly and most importantly, the model may only assist in strategizing effective means for the implementation of a plan which has been determined by other lines of reasoning. While the *datascape* may work to relay the consequences of numerous trade-offs, it may never govern alone without a basis for establishing priority.

In spite of these limitations, the broadly situated approach offers a means for advancing an alternate priority set beyond the simple vote. Rather than surrender to neo-capitalism, a fitting may be installed to “direct its flows.”[29] Only such anticipatory designs will convince a democratic society to take the necessary risks or sacrifices in opting for a fitting which enlarges the capacities of its resource-limited domain. As each region specializes, it becomes more dependent on others. Unlike Datatown, our cities have the capacity to plug into reserves and externalize undesired consequences. Situating designs for *globally* situated cities then must tap both wires of lifeline and of shame.

Fig 1.18 Poster by Archigram

Fig 2.1 Intermodal terminal in Vaughan, ON

02

Fig 2.2 Road-Marine intermodal terminal, Hong Kong. *Through containerization, the amount of man-hours required to unload a fully loaded container ship was reduced by 97%.*[5]

02.1 TRANSPORT FLUIDITY

"There is a clear and widely accepted association between the quality of transport infrastructure and the level of economic development within a particular country or region…This relationship is two-way, with transport acting as an important facilitator of economic development as well as providing and outlet for capital investment as economies grow."[1]

The incremental globalization of production systems has been enabled by successive breakthroughs in transport and communication technologies.[2] The result is an increasingly frictionless functional operation of global trade, and the emergence of higher-order organizational structures (multinational corporations) capable of superseding or circumventing the agency of individual national governmental controls. Supply and production chains are globally distributed to take advantage of regional disparities in labour, resource or managerial assets. To date, the benefits offered by playing off such disparities overshadow the costs of increasing the distances spanned between each link in the supply chain, and the associated ecological footprint.

The relative speed and low cost of transportation has instead been celebrated for bringing about "the annihilation of space by time",[3] whereby the physical world "becomes a simple geographic mapping of a temporalised, and otherwise despatialised, personal experience."[4] The friction inherent in freight transport protocols is further smoothed by the emergence of third and fourth-party logistics providers, who maneuver nimbly as lubricants to competition, and amalgamate supply chains to capitalize on ever greater economies of scale. As independent agents, they reduce the complex reality of freight transport to a single transaction with their client, offering just-in-time, door-to-door, best price, flat rate.

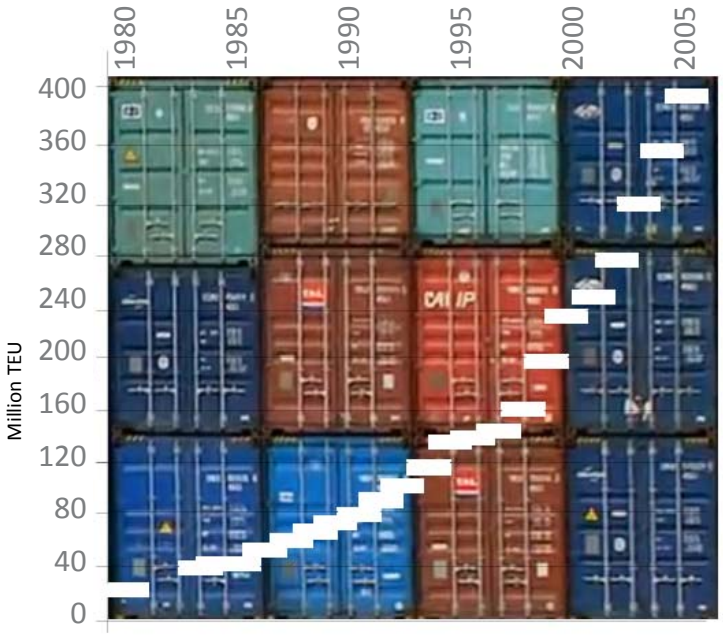


Fig 2.3 World Container Traffic

DISINTEGRATING LIFELINES

Accordingly, the problems of freight transport remain low on policy agendas and research initiatives, in spite of freight's responsibility for nearly 30 percent of world oil consumption.[6] This share is expected to grow both proportionally and absolutely. By 2030, more energy will be used worldwide for freight transport than for all other vehicular uses combined.[7] Transport growth and economic growth (GDP) are closely linked.[8] The reciprocal aspects of this relationship are now being re-examined in light of the rising significance of megaregions to national revenues. The clustering of specialized skill associated with the post-Fordist era has lent new metrics to the competitive unit. In contrast to the postwar model of integrated national economies, the new regionalism skips between the conglomerate city and continental scales. Megaregions are recognized as population magnets, centres of cultural and technological innovation, and the most powerful economic engines driving their nations' economies.[9] North American cities are now following European and Asian examples in developing comprehensive strategic plans for megaregions at a level beyond their individual constituent jurisdictions. As gateways to global trade, the megaregions' ability to transport goods efficiently becomes essential to nationwide economic vitality. In North America, this fluidity is of particular importance due to its reliance on the value-added activities of assembly and distribution.[10] **The infrastructure supporting the flow of goods then becomes a top concern for regional planning and investment, representing the outlets into which nationwide economic lifelines connect.**

While capitalism and transport technologies have together resulted in a mass drive toward equalization among nations, the benefits do not distribute evenly.[11] Rather, they have resulted in the production of distinct, absolute spaces: multiple spheres within which the leveling effects apply.[12] In many ways, the 'shrinking of space' between key centers coincides with a 'widening of space' between economically marginal locations, lacking capital for adequate transport and communications infrastructure.[13] The boundaries to these spheres, however, are pervious. Aging infrastructure in North America is threatening its prospects for new investment, as maintenance costs outpace sources of funding.[14] Metropolitan regions are exploring innovative financing systems to raise new funds for repair and expansion, such as tax incentives, real estate value capture, and public private partnerships.[15] Yet given the scale and lifespan of these investments, perhaps it is also time to reconsider the intelligence of the hardware itself.

Fig 2.4 Emerging Megaregions in North America

FROM PUSH TO PULL LOGISTICS

Goods movement in North America is facilitated by a number of modes and linkages, each fraught with both advantages and limitations. **The rise of the standardized container in the 1960s revolutionized the linkages, yet resulted in mass transformations in the ways the modes were deployed.** The development of compatible management units and corresponding handling equipment allowed transhipment times to be reduced from days to minutes,[16] opening up the possibility for supply chains to be vastly more flexible and responsive. This simple fitting allowed distributors to capitalize on the relative advantages of each mode in succession, rendering trade over long distances more viable with respect to cost and scheduling. This integration of modes permitted a further integration between remote economic activities. Consequently, trade grew three times as much as production between 1950 and 2005, and economies are increasingly interdependent around the globe.[17]

Fig 2.6 McKenna Logistics is a third party logistics provider offering supply chain management and delivery services. Their clients are distributors or manufacturers who sell to retailers such as Wal-Mart. They do not own the trucks they deploy, nor the merchandise they deliver. Typical of their genre, their assets are limited to the warehouse building itself (shown). Leaner still are the fourth party logistics providers, who are primarily information-based. A fourth party logistics provider integrates the resources of producers, retailers, and third-party logistics providers to build integrated, optimized supply chain networks.

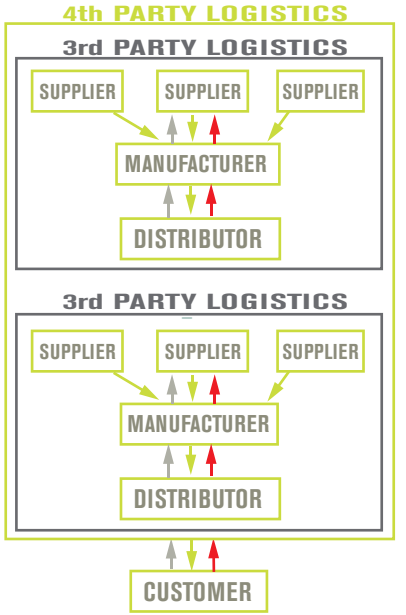
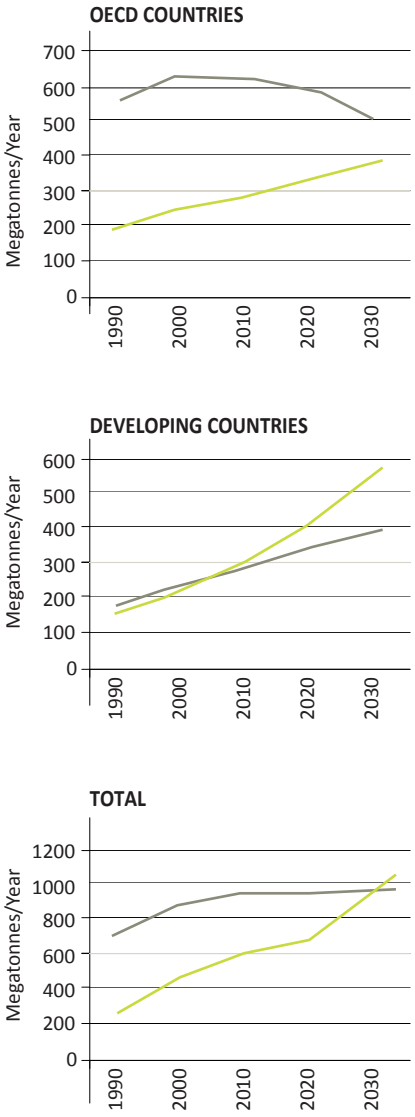


Fig 2.5 Third and Fourth Party Logistics
Product Flow
Information Flow
Recycled or Returned Items Flow

Fig 2.7 Worldwide fuel use projections by **heavy trucks** and **all other vehicles**

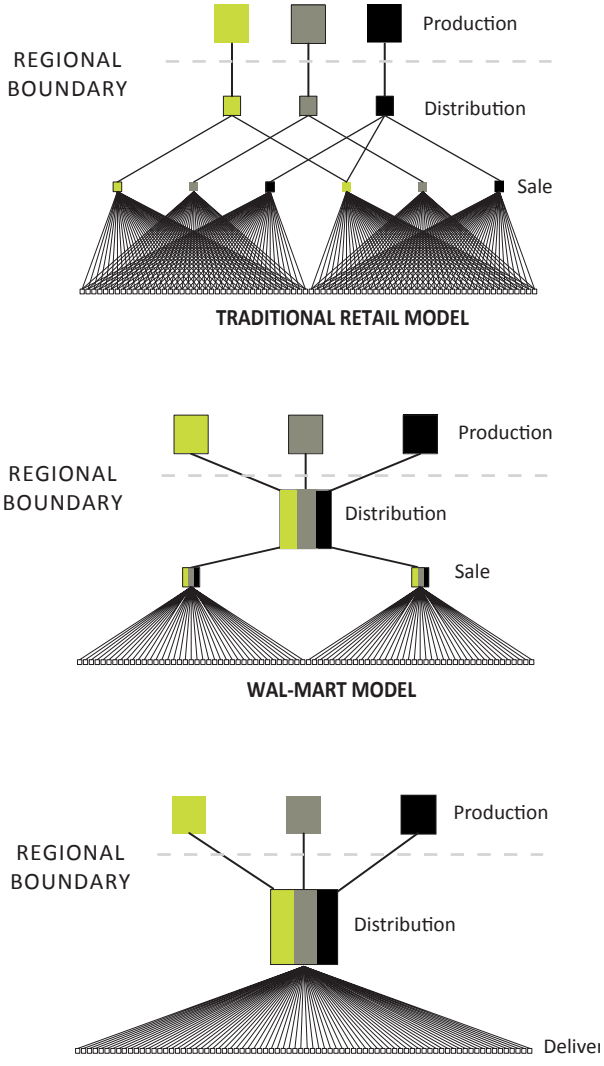


The prospects of intermodalism combined with improvements in information and communication technology have resulted in an emergent paradigm shift from 'push' and 'pull' logistics, or from inventory-based to replenishment-based. This strategy is used for fine-tuning supply quantities and locations to synchronize with real-time demand. Through tracking of sales, third and fourth party logistics providers trigger production only as required. Inventory is kept mainly in circulation, reducing the costs of holding and warehouse real estate. **The distribution centre then becomes the nexus of the system**, as the pivotal adapter between flows of supply and consumption.[18] Freight transfers to and from this node become smaller, more frequent, and subject to tighter time constraints.[19] The embeddedness of the shift is legible in the basic morphology of distribution centres: an equal volume of sales now requires more doors and less space.

PERI-URBAN HUBS

The Post-Fordist production model combined with the consolidation strategies of logistics has resulted in a massification upwards in the production chain (large sea shipments), coupled with an increasingly finer atomization of land shipments to the end user.[20] The former process is associated with reduced line-haul rates due to economies of scale. Logistics providers therefore seek to postpone the atomization of container batches as far inland as possible. This strategy is known as the hub and spoke model. Distribution hubs are often found clustered together in the peripherals of megaregions. While the presence of such hubs increases the efficiency of the system overall, their local negative impacts are concentrated within the urbanized area. Such hubs consume vast areas of valuable land and exacerbate urban road congestion. They depend on trucks with 7 times more NOx than cars per vehicle-km, and 17 times more particulate matter.[21] The Just-in-time tendency towards smaller and more frequent deliveries amplifies traffic volumes further still, with hectares of warehouse storage area displaced onto public road systems.

Fig 2.8 Evolution of distribution scale over time



INTERMODALISM AND MODAL CHOICE

Road transport can be classified as the dominant and most privileged mode in North America over the past 50 years. Trucking has benefited from decades of cheap oil and subsidized highways,[22] and offers the greatest flexibility for the lowest capital of all available modes. The limitations of trucking, however, are well understood, and are becoming more severe with expiring fuel supplies, emissions concerns, and increasing traffic volumes on limited highway capacity.[23] Expansion of road networks using conventional means requires significant land areas and potentially lengthy land acquisition manoeuvres; Furthermore, this tactic is known to only induce further congestion due to personal vehicle use.[24] Trucks are also limited by their physical dimensions, capping the potential for economy of scale at a single trailer load. It can be argued that if trucks along with personal vehicles were charged with the numerous externalized costs such as urban sprawl and greenhouse gas emissions, then the balance of movements would shift towards rail.

Rail consumes less than a quarter of the energy used by trucks per ton-km.[25] Compared with a four lane highway, a rail line carries more than twice the capacity using half of the surface area (fig 2.10).[26] It is currently the dominant mode for commodities of low cost per volume,[27] with relatively fixed consumption rates such as wheat and coal.[28] Publicly provided and maintained road and highway networks lend a profound advantage to the trucking mode. On the contrary, rail is crippled by high capital and maintenance costs,[29] as well as property taxes on corridor lands which vary by region.[30] Considerable recent investment in high-throughput intermodal terminals at ports has benefited rail's modal share, allowing it to become an effective extension of marine supply routes.[31] Inland, many metropolitan regions have developed extensive road-rail intermodal terminals within the urbanized footprint. This allows distributors to couple the long-range fuel economy of rail with the short-haul flexibility of trucks and LTL (Less Than Truckload) vehicles for first and last mile connections.

These final connections to the retailer or consumer represent a uniquely complex challenge to distribution, as economies of scale become difficult to apply, and these deliveries tend to occur in congested urban settings.[32] The problems of urban road congestion cannot be entirely circumvented by opting for rail unless the track networks were expanded to provide route flexibility comparable to road networks – an effective overhaul in urban mobility. Some cities with extensive passenger rail networks have begun to use this same infrastructure for freight circulation, while other strategies of night-delivery, truck-only lanes, underground freight tunnels and drop boxes are also being explored. In spite of its high capital cost, the prospects for rail expansion within urbanized areas are bright compared to road in light of its modest space requirements and energy benefits, particularly for electric, grid tied rail coupled with renewable energy sourcing.[33] As congestion costs rise and oil prices surge, a modal shift is anticipated.[34] In considering rail or 'intermodalism' as the more viable future transport strategy, both its paths and linkages must be examined.

Fig 2.9 Cost breakdown of truck and rail (450 km trip)

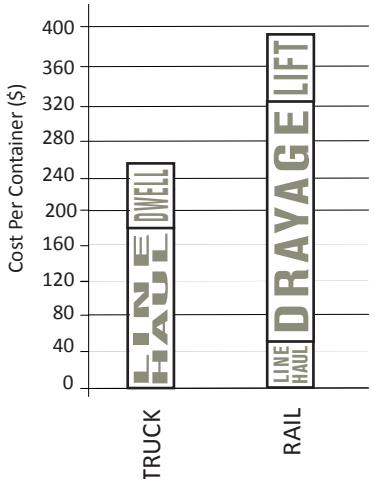


Fig 2.10 Spatial performance of truck versus rail

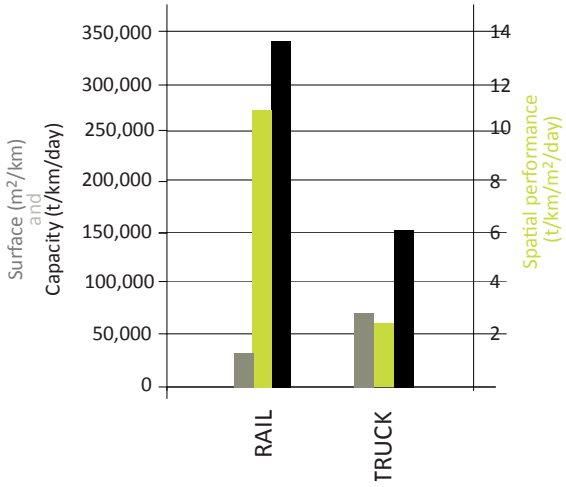
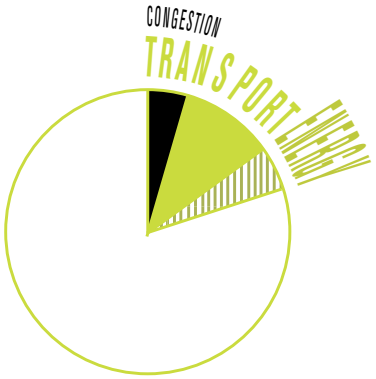


Fig 2.11 Average haul distance of truck vs. rail

Fig 2.12 Cost of finished goods



HISTORICAL OVERVIEW OF RAIL IN NORTH AMERICA

Track mileage surged in the beginning of the 20th century, yet heavy regulation limited margins and investment potential. Increasing truck competitiveness associated with the interstate highway system resulted in a rationalization and contraction of track mileage in the latter part of the century.[35] Prior to US deregulation in the 1980s, public policy often barred companies from owning multiple transportation modes.[36] The implicit competition between modes stunted the development of integrated road-rail networks, particularly with respect to efficient transhipment technology suited to smaller scale, inland gateways.[37] While centralized, federal planning in the US created a unified and comprehensive highway system, further competition between numerous private rail carriers resulted in multiple limited-capacity routes and dispersed transhipment facilities, often at sub-optimal locations.

In the 1980s, double stacking technology multiplied rail's productivity and increased its competitiveness,[38] however trucking continued to gain ascendancy. A resurgence of rail commenced at the beginning of the 21st century, as the de-industrialization of North America induced more long distance shipments, and the rising price of oil increased rail's demand.[39] Investment in long distance track route quality and capacity has accordingly been stronger in recent years, yet will require additional billions to retain its current market share.[41]

CURRENT BARRIERS TO RAIL In North America, barriers to a modal shift remain pervasive. While rail costs per ton-km are nearly half that of road, these savings are overwhelmed by the terminal costs of rail, consisting of both lift costs and drayage (fig 2.13).[42] Lift costs are those associated with the operation of the intermodal terminal. Drayage refers last-mile trucking costs, including driver waiting times at the terminal and urban traffic congestion.

The current break-even point for cost equivalency between road and road-rail intermodal with the necessary transhipments included sits around 800km.[46] This reality is far from ideal, as roughly three quarters of merchandise movements travel less than 750km,[47] resulting in a persistently overwhelming market share for trucks both within and between cities in spite of their environmental drawbacks.

New track layout designs coupled with ICT developments have been shown to potentially bring rail's competitive threshold down to 250 km.[43] However an alternative strategy requiring comparable spending and reform could allow the terminal bottleneck to be simply circumvented, which would recalibrate this balance entirely. Without significant overhaul, the problems of urban road congestion will persist. Sub-optimal terminal locations exacerbate this condition. Due to the considerable space requirements of intermodal terminals, many rail carriers have taken advantage of abandoned yard sites and their adjacent, disused storage areas.[44] These sites were often in the middle of congested urban areas with obscured highway access. As railway carriers rationalize their facilities, a parallel process of suburbanization occurs as terminals are built outside the fringes of urban areas, resulting in longer average hauls and further highway congestion.[45] **The container's full potential for complete and adjustable road-rail optimization has yet to be exploited.**

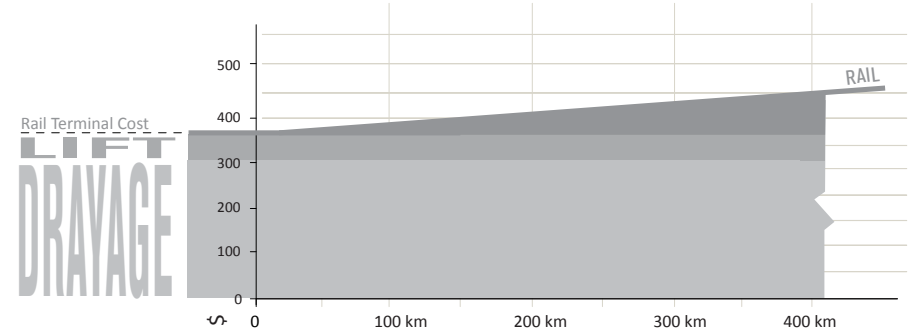


Fig 2.13 Rail Terminal Cost Breakdown

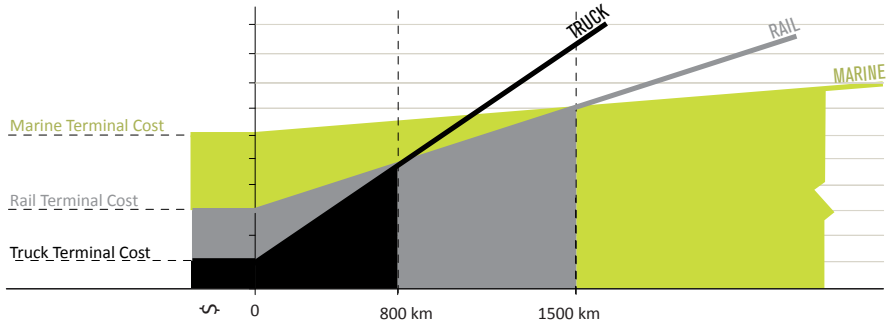


Fig 2.14 Break-even distances for **truck,** rail, and marine, existing scenario

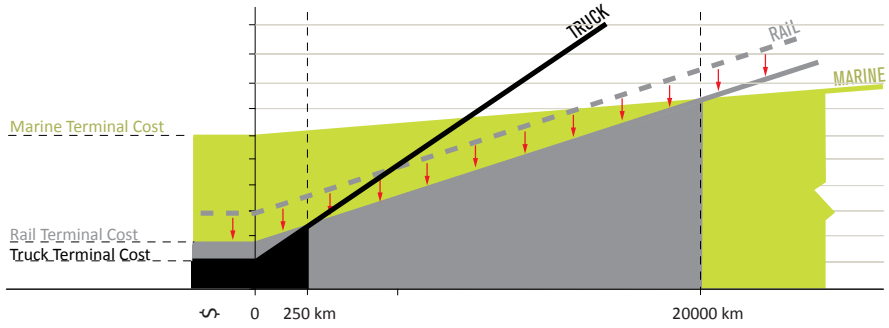


Fig 2.15 Hypothetical break-even distances for **truck,** rail, and marine, after reduction in rail terminal cost

Fig 2.16 Logistics hub outside Carlisle, PA

Carlisle enjoys the economic benefits of a thriving logistics industry, but there are several drawbacks. The American Lung Association ranked Carlisle 14th of the 25 most polluted counties in the U.S. for short-term particle pollution in 2007. Downtown business owners also complain that truck traffic is depleting their pedestrian customer bases.

02.2 GREEN LOGISTICS:
A REGIONAL APPROACH

"The successful implementation of green logistics must come from the complex interplay of both global and local environmental governance. Indeed, the most important policy recommendations, implementations, and operationalization of green logistics that would work occur a the local level."[48]

In seeking to undertake 'green logistics' while adhering to the demands of just-in-time delivery, a number of paradoxes emerge.[49] Many of these lie outside the purview of regional planning authorities, such as the global increase in rates of long-distance, international trade. However as described above, the paradox is inherently multifaceted, and thus local implications must be regarded with equal weight. As stated in a 2007 article in *The Journal of Planning Literature*, **"The megaregion may be large enough to address the crux of the issue, and small enough to make the practical political organization possible."**[50] This concept can be extended to smaller megaregion components such as the metropolis, from where the intervention may prove to have 'trickle-up' effects.

In viewing the green logistics paradox from a more local perspective, additional issues come to the forefront of a scale more manageable to the urban planning discipline. Primary among these are the complimentary trends of excessive truck traffic radiating from freight centres, and the low-intensity land use of these facilities themselves. Uses within freight centres include manufacturing and assembly, warehousing, intermodal transfer, and trucking support such as parking and maintenance.[51] These activities tend to be space consumptive, expensive to serve with public services, offer low fiscal benefits, and cause noise and light grievances.[52] Their poor interfaces also create holes in the urban fabric. Concentrations of trucks present safety hazards to pedestrians and cyclists, and vast expanses of blank warehouse façade are bewildering to the human scale. Furthermore, their extreme low densities undermine local intensification agenda, particularly where they abut avenues served by higher order transit. Any comprehensive attempt to address green logistics at the local level must contend with these general issues in conjunction with the particular aims and initiatives of the region.

Fig 2.17 The Great Lakes Megaregion

THE GOLDEN HORSESHOE IN THE GREAT LAKES MEGAREGION

The Great Lakes Mega-Region is home to 40 million people – 10% of the US population and 30% of the Canadian population.[53] Over 50% of Canada's manufacturing outputs and 25% of Canada's Agricultural produce are generated here.[54] This region is attributed with a surging population replete with strong intellectual resources, as well as physical resources such as water and farmland. Other strengths include specialization in the sectors of logistics, research and design, agriculture, food processing, health care, and social services. [55]

The region faces challenges that could undermine its strengths if left unchecked. Both are typified in the Greater Golden Horseshoe, comprised of the combined Toronto and Hamilton commuter catchments, where population is expected to rise from 8 to 12 million by 2030.[56] The GGH is host to roughly 30%of Canada's economic activity,[58] and is the most significant generator of goods movement activities in Canada.[59] Integrally linked with Canada's largest concentrations of production and consumption, it has developed a key role as the point of consolidation and redistribution for retail goods at a national and international scale.[60] Within the boundaries of the GGH there are roughly one million goods-related vehicle movements daily, comprising about 10% of all road traffic.[61] The GGH contains the third largest concentration of industrial floor space in North America, and its ability to sustain economic competitiveness rests heavily the continued fluidity of transport for goods.[62]

The internal efficiency and intercity linkages of the GGH are threatened by critical levels of road congestion, particularly on a limited number of key corridors. The cost of these delays is estimated at $5 billion annually for the movement of goods alone,[64] or 30% of all shipment costs.[65] Already low rail service levels for freight are exacerbated by intermodal terminals reaching capacity, resulting in frequent overloads and costly backlogs.[66] While the existing railway rights of way can accommodate additional rail infrastructure, capital is lacking and demand is curbed by the cost and delays of transhipment. Cost competitiveness of rail is further crippled by significantly heavier

property taxation of railway corridor lands compared with surrounding regions.*[67] Passenger rail options are limited and infrequent, often impeded by slower freight train speeds on the same line of track. Sprawling urban footprints are threatening the supplies of farmland and wildlife habitat, while creating commensurate demands for roads and servicing.

Fragmentation in regional governance has resulted in weak land use controls and lowered servicing fees as municipalities compete for rapid development. In the peripherals of the GGH, a dominance of low density development has resulted in a diluted tax base and unmanageable servicing costs – public transit being primary among these. Most constituent municipalities lack substantial venture capital for new infrastructural projects, and their borrowing for capital expenditures is constrained by provincial regulations.[68] They are dependant on sporadic, one-off grants from higher levels of government, or inconsistent foreign investment.[69]

GOLDEN HORSESHOE DEVELOPMENT IMPERATIVES AND INITIATIVES

In light of these pressing issues, the province of Ontario has derived a set of development imperatives aiming to curb sprawl and promote intensification within the GGH. A main feature of the 2006 "Places to Grow" plan is the requirement for 40 percent of new growth to be contained within the existing built up area by 2015 (fig 2.25).[70] This prescription is driven by the desire to make optimal use of existing infrastructure, and encourages infill over expansion. Building upon that goal, 25 centres (fig 2.29) have been given minimum density targets to meet by 2031.[71] The presence of dense nodes coupled with intensification arteries helps to ease congestion by rendering higher service levels of public transit more financially practicable.

To compliment this initiative, Metrolinx was established to oversee the instalment of "integrated, multimodal transportation networks"[72] throughout the GGH. Its plans include subway extension, new light rail transit lines, in addition new and improved bus rapid transit routes. A number of generalized directives were derived for smoothing

"Think globally,
act locally,
plan regionally"

– Gavin Newsom
Mayor of San Francisco[73]

the movement of goods throughout the region, however an explicit plan of action is lacking. Noteworthy suggestions are to separate freight rail from intercity passenger routes, and prioritize overall efficiency of the rail network over individual carrier gains.[74] Grants and incentives are indicated as possible means of rail promotion, yet there is no mention of improving rail competitiveness over the longer term through systemic changes such as an alleviation of corridor property taxes. On the whole, it seems to be accepted that private organizations will continue to take responsibility for new freight-related infrastructure, and that public agents may best deal with freight indirectly by freeing up roads with the provision of public transit. Public private partnerships are loosely suggested as means of spearheading network improvements, however no signs of investment to this end are apparent.

None of the suggestions outlined by Metrolinx offer meaningful remedies to the glut of truck traffic or the sprawl of distribution facilities induced by the movement of goods. As outlined earlier, while rail service levels are important, transfer times and 'last mile' haulage are the dominant drawbacks of intermodalism. Proportions of transit ridership are expected to rise after the new network expansions,[75] however absolute vehicle use may still increase when one takes population growth into account. Levels of congestion as well as total truck miles traveled can only be expected to increase in the current scenario, as freight centres move farther and farther from the urban core in search of large, greenfield sites.

Freight transport presently accounts for 12 percent of all energy use in Canada, and 40 percent of all transport related consumption.[76] While the disciplines of Transit Oriented Development are gaining ground as the most viable solution to reduce passenger related vehicle use, there exists no counterpart to address the unhindered growth in freight related emissions and congestion.

It can be concluded that any attempt to expedite green logistics will require a more elemental retooling of existing conditions. Current cost estimates of this region's

infrastructure gap are measurable in tens of billions.[77] Infrastructural investment must work to assist a modal shift toward rail, and alternative morphologies of distribution centres must be explored which address the transit supportability and productive capability of these facilities on their own terms.

The relative performative capacities of mobility infrastructure and distribution facilities are closely linked. A strategic fitting may work to reprogram this relationship, allowing changes in one to affect the other. In suggesting new frameworks for urban mobility, an incremental approach must be taken. For example, it would be unfeasible at the outset to eliminate trucking completely, and serve all urban retail locations by rail. However at present, 97% of all truck traffic travelling farther than 200 km is destined for distribution centres.[78] Given the existing trend toward consolidation and agglomeration of these facilities, it becomes possible to envision a network of strategic goods movement facilitated by rail which specifically targets these vincula. Linking logistics centres directly to the intercity rail network would represent a great step toward reducing long-haul trucking, and pave the way for furthering this goal for intra-city applications.

The impacts of rapid growth on infrastructure affect not only capacity but also reliability, which is of paramount value to industry. Networks under pressure will seize at critical nodes, causing bottlenecks and backlogs. A distributed solution with ample redundancy is required to secure the steady flow of labour, goods, and in turn, information, which is both fundamental driver and competitive advantage in contemporary 'pull' logistics systems.

Fig 2.18 Traffic at the Canada-US border.
97% of all truck traffic travelling farther than 200 km is destined for a distribution centre.[79]

Fig 2.19 A transport capsule behind a passenger tram using the same trackage in Amsterdam. The 'City Cargo Project' aimed at reducing city traffic consists of three stages. First, goods destined for the inner city are delivered to transfer depots at the edge of the city. Next they travel by tram to transfer points located throughout the inner city. From here, small electric vehicles take them to their final address.

Could inner-city trucking be eliminated?

Fig 2.20 Chicago's largest intermdal terminal is surrounded by goods movers which rely on rail. Rail cars are shunted along spurs extending to each address, thereby eliminating drayage and lifting expenses.

Could all goods movers cluster around intermodal terminals?

Fig 2.21 A Toronto goods mover connects opportunistically to both rail and higway networks. In a nearby classification yard, the rail cars are assembled into longer trains.

Could all goods movers string themselves along the edges of rail lines?

Fig 2.22 Along Toronto's Georgetown rail line, two tracks are used for local commuter rail, while the third is shared between freight and long distance passenger uses. The speed of long distance passenger travel is limited by the lower speed thresholds for freight trains.

Could parallel networks specialize by speed?

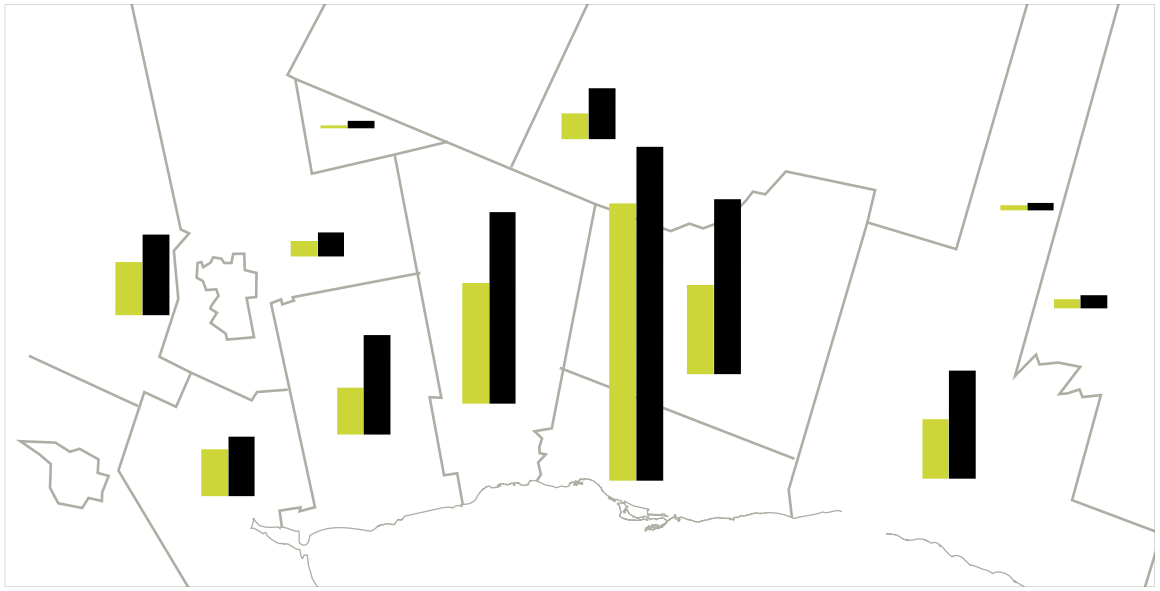
02.3 THE AGENCY OF LINKAGE:
SUPPLY CHAIN INCURSIONS TOWARD A MODAL SHIFT

The aim is to transform the reciprocal relationship between land use and mobility infrastructure, in support of a modal shift toward rail. A study of existing tensions and synergies between activities, proximities, and transport strategies offers cues to this end. The following questions are then posed:

What if the movement patterns of both goods and people were conceived as a rational whole?

What would the resultant urban form look like?

What kind of interventions might bridge the current reality with that envisioned?



500,000 Trips
2001
2031

Fig 2.23 Growth in inter-regional travel volumes (3 hour a.m. peak period)

0.5 - 2.5
0.2 - 0.5
> 0.2

Fig 2.24 Change in average delay, morning peak 3h. period (min/trip/km)

LAND USE/MOBILITY RECIPROCITY

A graphical analysis locates areas of inefficiency and strain within the urban area. The following trends are exposed:

TREND: ROADS AT CAPACITY

Congestion increases proportionally with the percentage increase of total vehicle trips, indicating a road system operating at capacity. As the city expands, congestion intensifies.

Fig 2.25 Urbanized land, business-as-usual

TREND: RAPID LAND CONSUMPTION

Greenfield land supplies within the green belt will be virtually exhausted by 2031. To permit ongoing growth and discourage leapfrogging, new strategies for intensification are needed.

- Greenbelt
- Urbanized area 2000
- Urbanized area 2000-2015
- Urbanized area 2015-2031

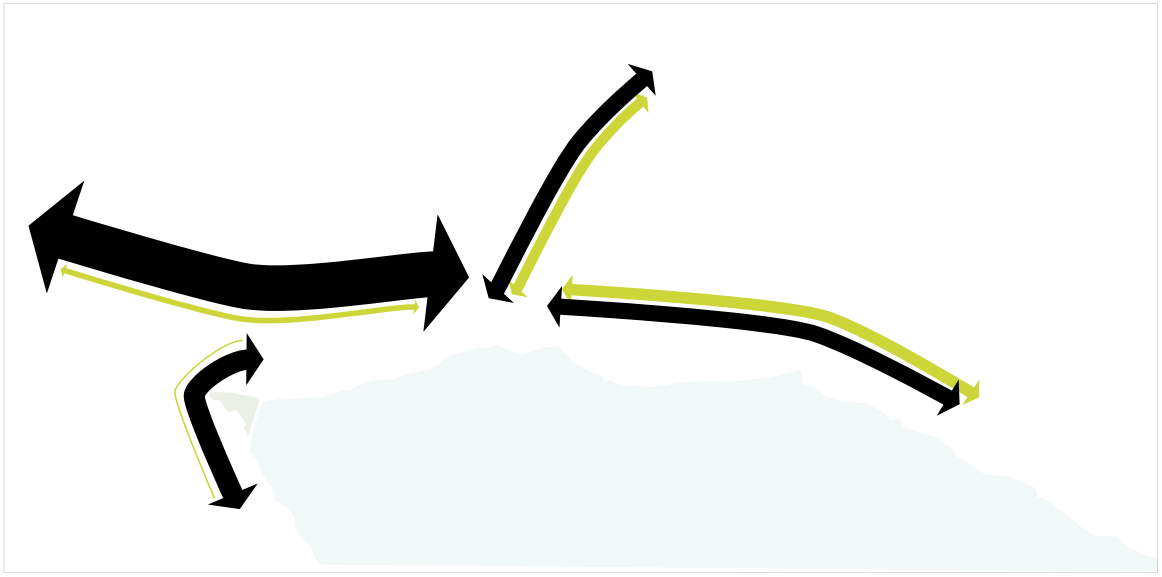


Fig 2.26 Daily long distance goods movement

TREND: TRUCKING DOMINATES

Truck modal share overwhelms that of rail for goods movement, capturing 80% of the market.[1]

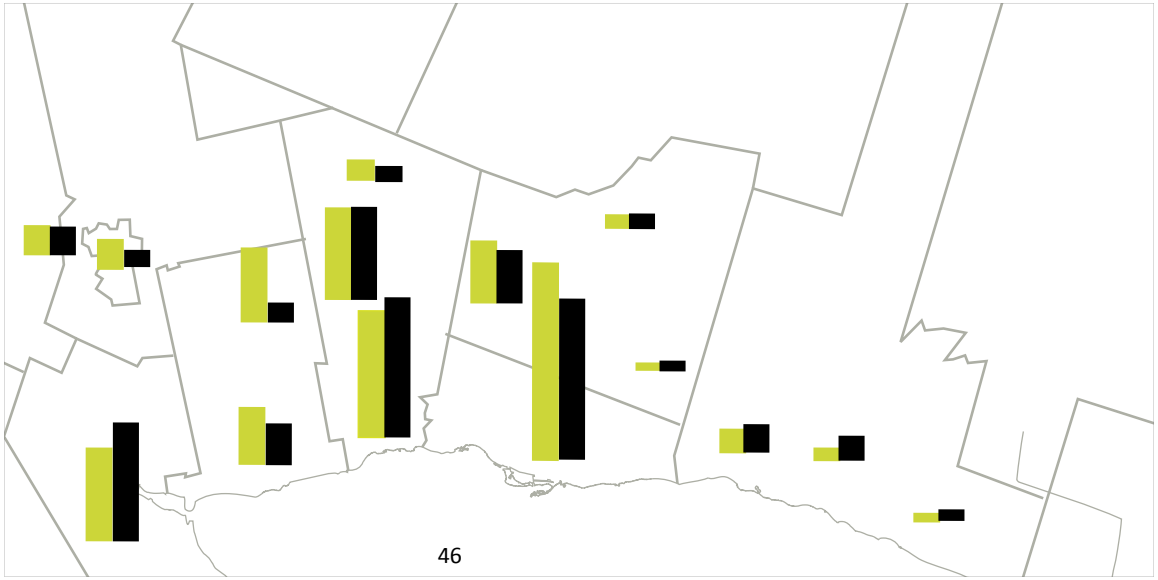
- 25,000 TEU
- Rail
- Truck

TREND: CONCENTRATION OF TRUCKING ACTIVITIES

Truck traffic originates in concentrated pockets of industrial land, which tend to cluster around intermodal terminals. Absolute truck traffic volumes are greatest, however, inside the City of Toronto, representing the greatest proportion of truck delivery destinations.

Greenbelt
Industrial use
Intermodal terminal

Fig 2.27 Land consumption - Industrial Uses



500,OOO Trips
Origins
Destinations

Fig 2.28 Long distance truck origins and destinations (tons)

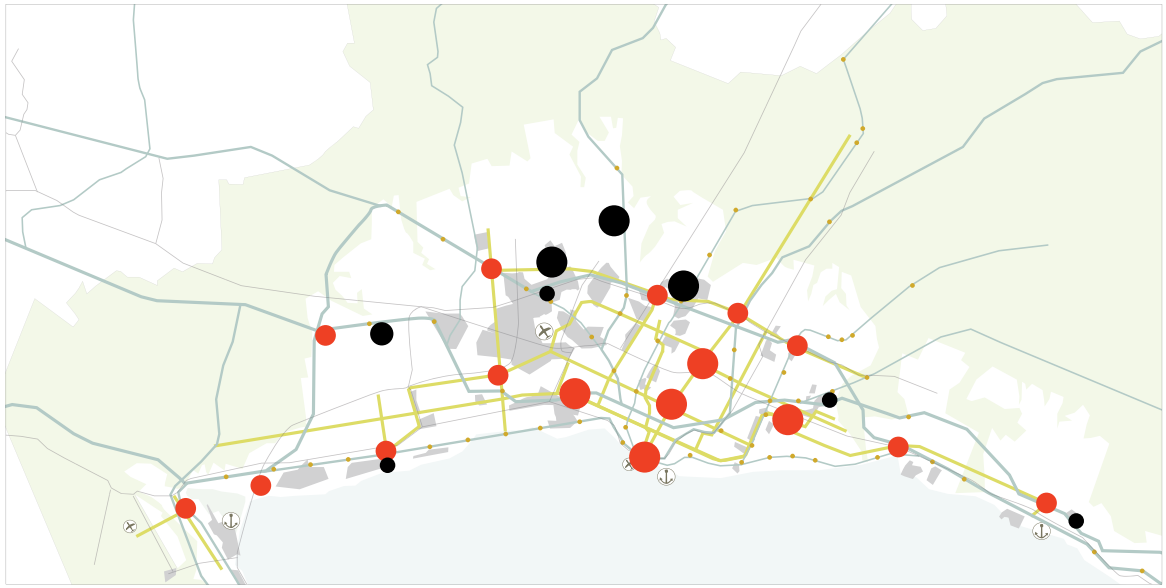


Fig 2.29 Metrolinx +15 year transit strategy

Fig 2.30 Metrolinx +25 year transit strategy

TREND: GROWTH CENTRES CLASH WITH FREIGHT CENTRES

Intermodal terminals and urban growth centres are interspersed. Prospective rapid transit corridors bisect truck-intensive industrial areas. The two disparate land use types compete for the mobility infrastructure which links their nodes together. Industrial uses are typically very low in density, demanding wide, high speed roads. Transit supportive routes on the contrary must be of higher density, and accommodate a range of speeds. The conflict between these disparate agendas represents an opportunity for new mediation strategies.

- Highway
- Subway/BRT/LRT
- Rail
- Passenger rail stop
- Designated growth centre
- Intermodal terminal
- Greenbelt
- Existing industrial use

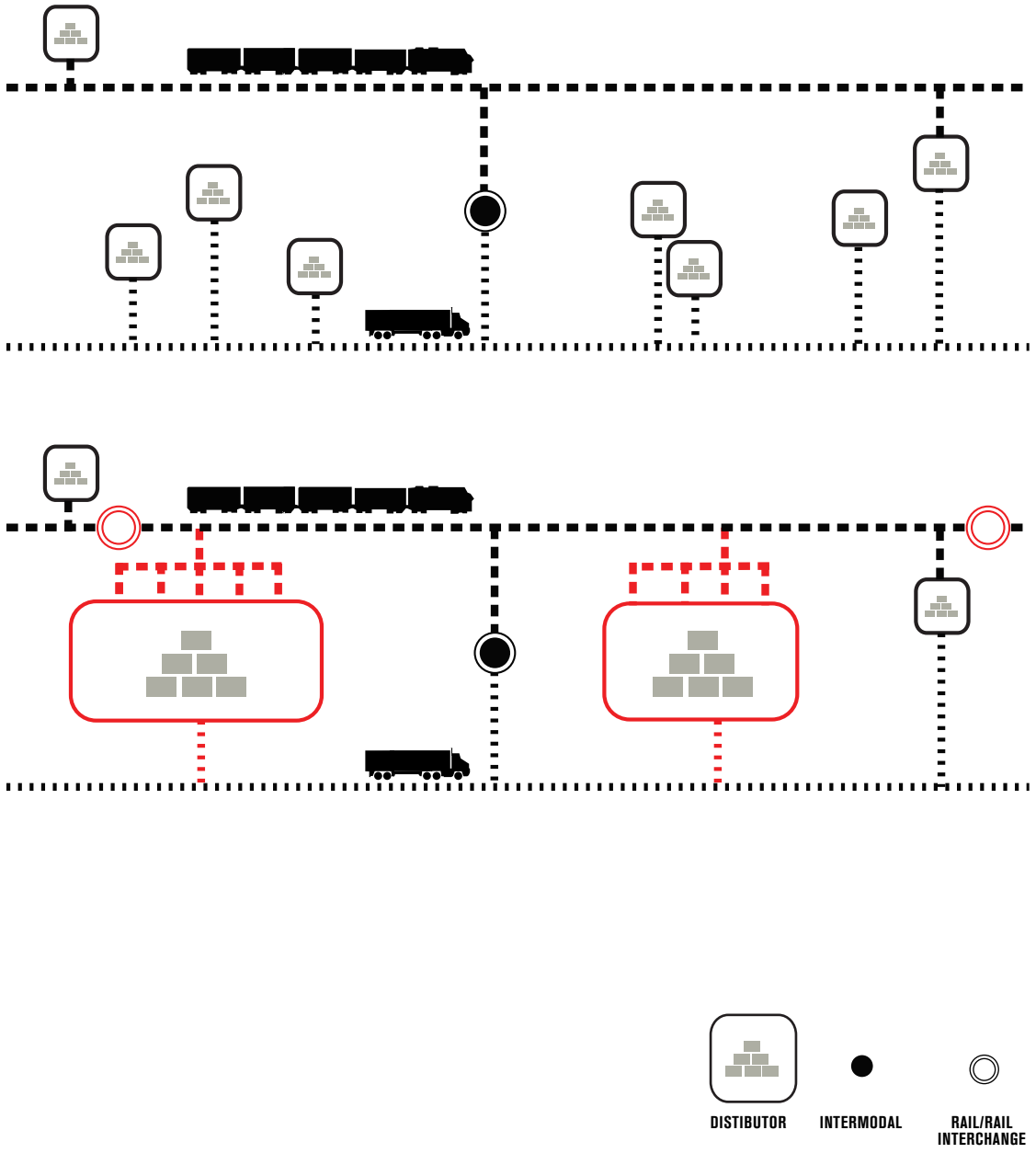


Fig 2.31 High cube reconceived

1. EXISTING

Distribution centres are accessible only by road, with the less common exception of bulk commodity shipping facilities. The majority of rail based freight may only reach distribution centres via a limited number of crowded intermodal terminals. This step results in long turnaround times, costly drayage, and aggravated road congestion.

2. PROPOSED

Distribution centres are amalgamated into fused logistics clusters. New rail infrastructure targets these nodes, connecting them directly to the broader network. Upon entering the city-region, incoming freight trains are reassembled into smaller groupings in the classification yard of the existing intermodal terminal. New terminals with specialized rail/rail transloading equipment arise to serve the clusters, allowing them to bypass delays at the main intermodal terminal completely.

HIGH CUBE RECONCEIVED

The proposed alternative freight mobility network tampers with the existing road-oriented bias of urban and inter-urban mobility. An incremental approach is taken to extend rail movements farther down the supply chain.

Rather than terminating at the intermodal station, **rail based freight routes branch out and fray upon entering the city.** Extensions to the existing rail network target pockets of industrial land throughout the urban periphery which are designated for transformation into a new, conglomerate industrial type. Within these 'fused logistics clusters', multiple enterprises undertaking fabrication, warehousing, wholesale, retail and distribution are bundled to take to take advantage of similar supply and delivery patterns, allowing for both the sharing of resources and the capturing of improved economy associated with freight consolidation. Centralized functions include human resources, transportation/ freight management, information systems, shared equipment and customer service. An array of value-added and peripheral services are incorporated, such as labelling, packing, inspection, customs processing and brokering.

A revolutionized lifting system (fig. 3.5) allows for the unloading of containers directly from rail flatbeds. This eliminates the need for time-consuming transfers at clogged intermodal terminals and costly drayage. With streamlined rail access, the clusters become magnets to a range of industrial types seeking fuel conservation, scale economy, faster turnaround times, improved competitiveness and more sustainable business practice.

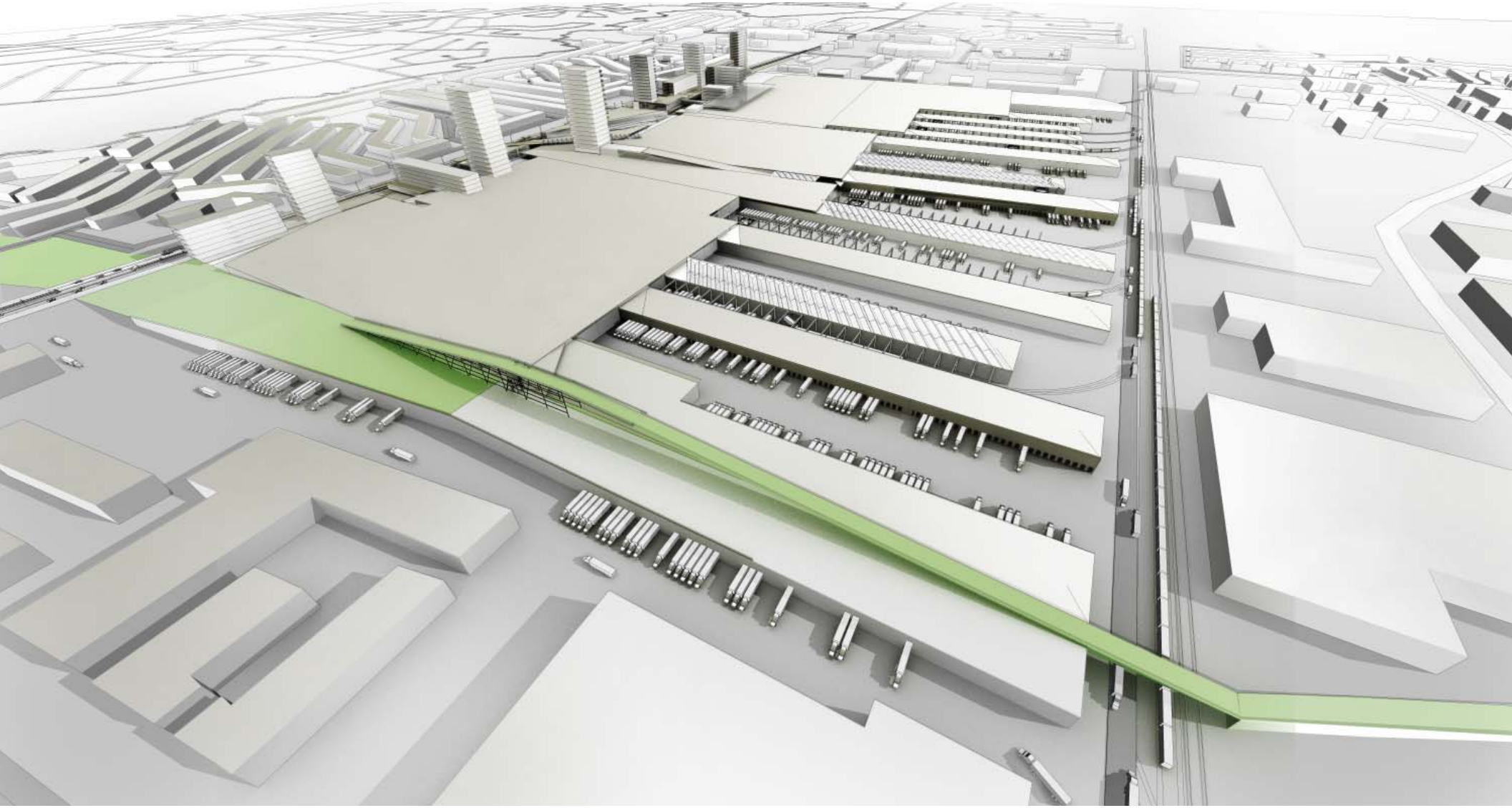
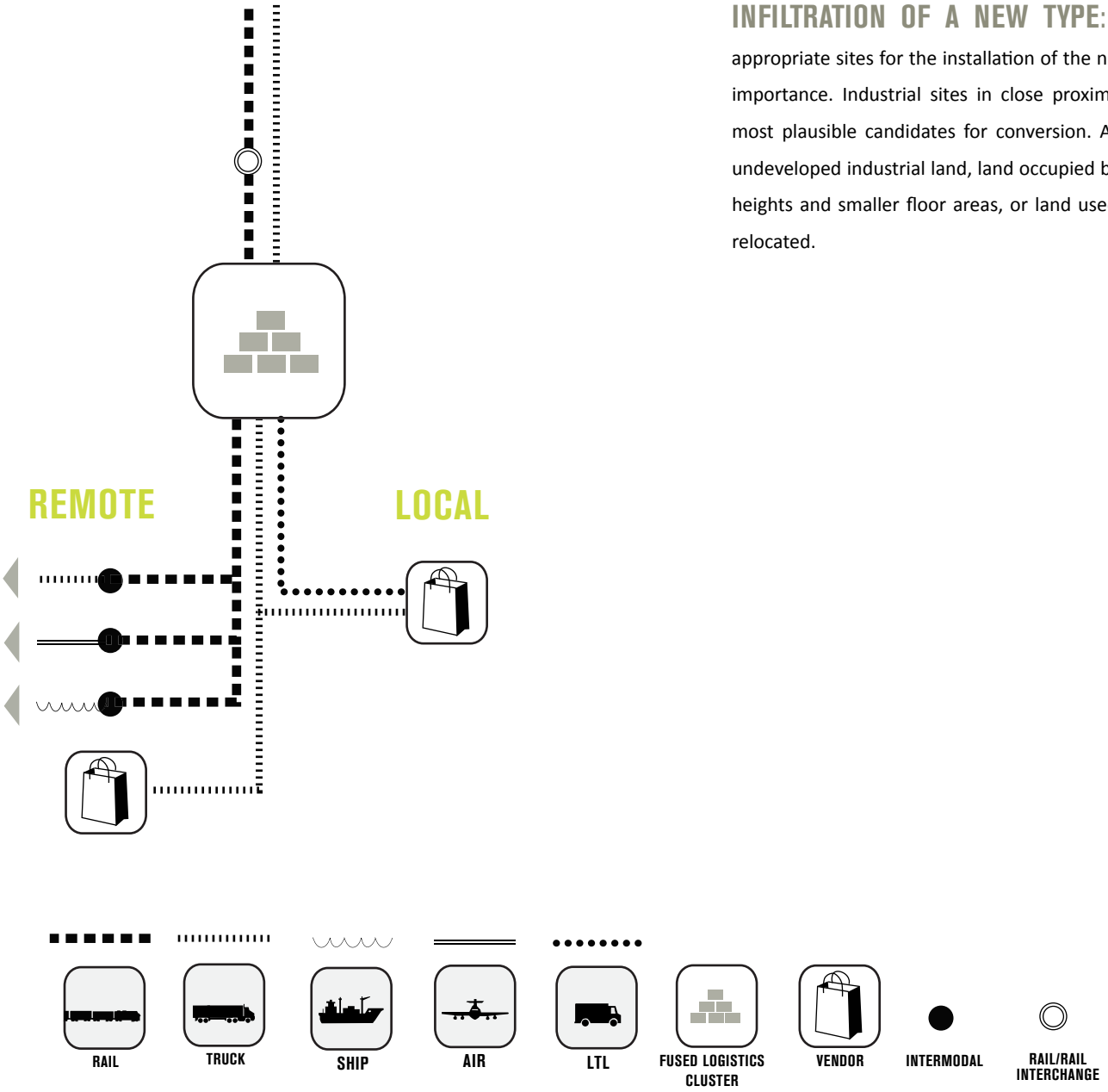


Fig 2.32 Fused logistics cluster

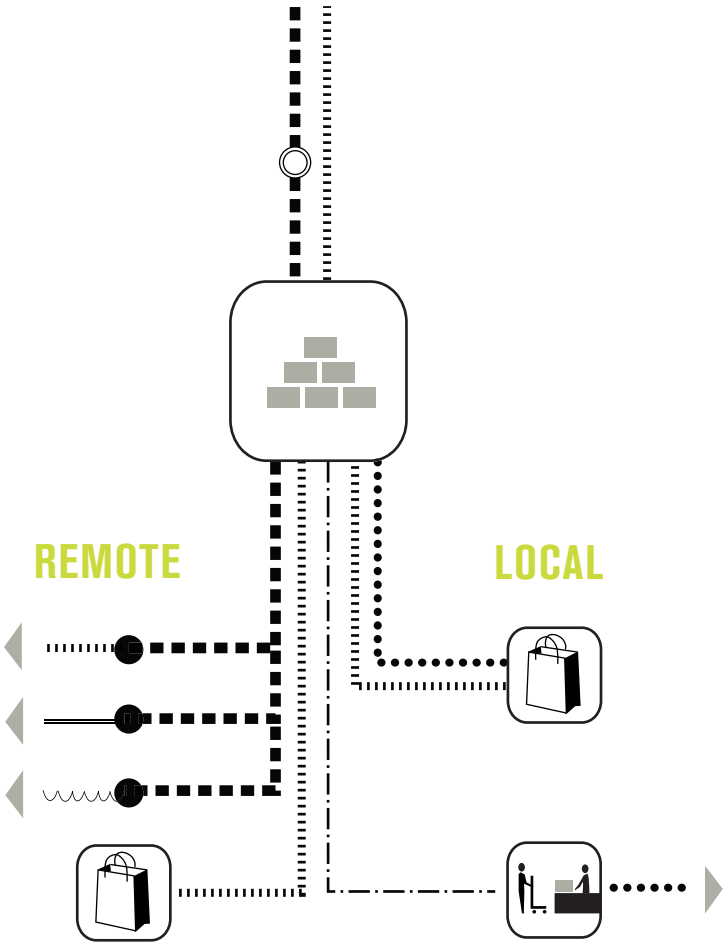
Fig 2.33 Embedded potentiality: Industrial areas with rail access



INFILTRATION OF A NEW TYPE: RAIL CORRIDORS

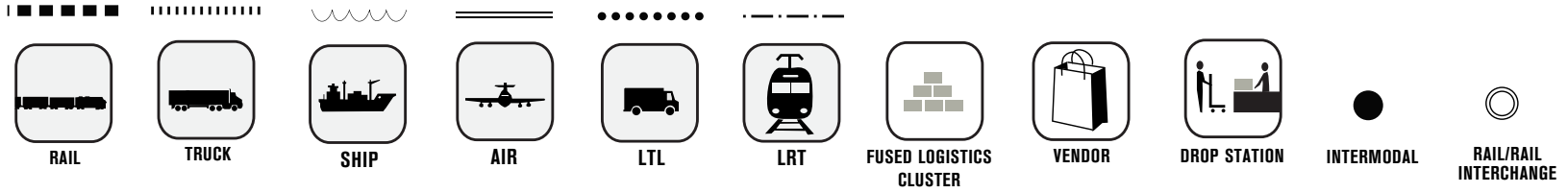
In determining appropriate sites for the installation of the new type, rail connections are of paramount importance. Industrial sites in close proximity to rail thoroughfares or spurs are the most plausible candidates for conversion. A first wave of cluster construction utilizes undeveloped industrial land, land occupied by aging industrial buildings with low ceiling heights and smaller floor areas, or land used for outdoor storage which may be easily relocated.

Fig 2.34 Embedded potentiality: Industrial areas with light rail access



INFILTRATION OF A NEW TYPE: LRT CORRIDORS

LRT track routes offer another layer of modal shifting potentiality for intracity goods movement. Small local shipments may bypass congested highways by utilizing carriers adapted to LRT tracking. Similar to Amsterdam's City Cargo Project, the goods then proceed to pick-up stations positioned off the main LRT lines throughout the inner city. Small trucks or electric carts retrieve these shipments here, and deliver them to the final address. As local traffic comprises half of all truck trips in the GTA,[2] substituting these trips with rail-based conveyance would represent a great step toward relieving urban congestion, and improving quality of life. Industrial sites adjacent to existing or prospective light rail transit corridors are ideal testing grounds for this application.



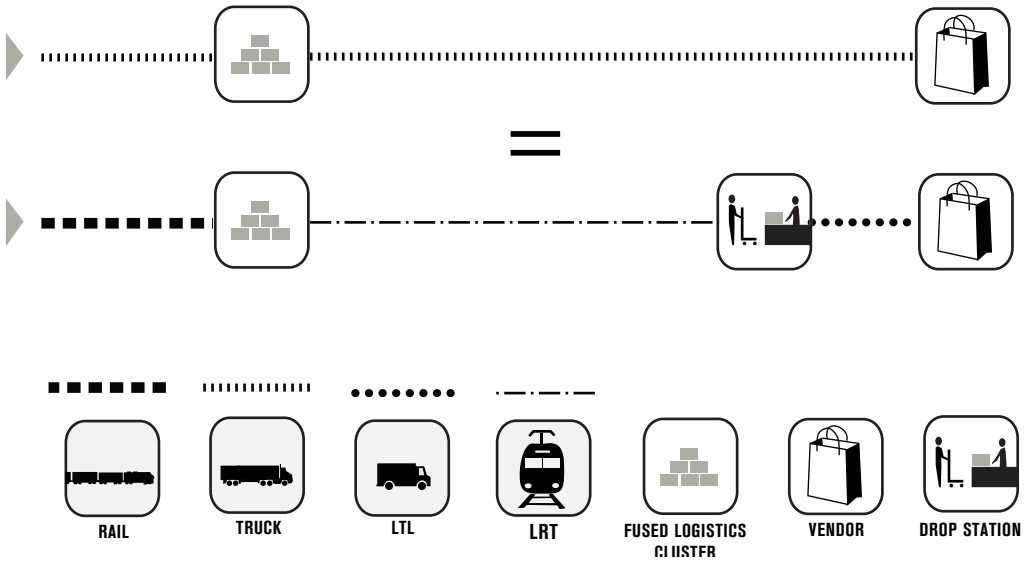


Fig 2.35 Embedded potentiality: Industrial areas with rail and light rail access

INFILTRATION OF A NEW TYPE: LAYERED POTENTIALITY

Superimposing the two sets of possible sites reveals those locations with greatest entrenched potential. Priority is given to sites with both rail access and existing or prospective LRT access. Future expansion of both rail and LRT networks could multiply the number of sites which meet these conditions. Clusters locating here may facilitate direct transhipment between local and continental rail networks.

Many other factors enter into the process of site selection. Cluster development in the inner city is restrained, as congestion levels are prohibitive. Similarly, 'leapfrogging' outside the greenbelt boundary is discouraged as this leads to elevated average travel distances. Local adjacencies and sensitivities must also be carefully negotiated.

Special measures may be required to obtain larger areas of strategically opportune land for further conversion. Financial incentives such as rental subsidies or compensation for moving costs could help to coerce all the owners and tenants within a particular area to relocate to newly constructed fused logistics clusters. In a likely scenario, the existing trend toward consolidation among logistics providers continues to increase their demand for larger and more accessible warehouse space. **Just as the big box 'category killer' spread virally once conceived, so the fused cluster format becomes a natural evolutionary step for distributors needing to scale up in order to compete.**

Fig 2.36 Phasing Scenario 1: Underutilized land in an industrial zone is converted to the new format, taking advantage of LRT and freight rail access. An industrial property in a sub-optimal location relocates. Its former site is then re-zoned.

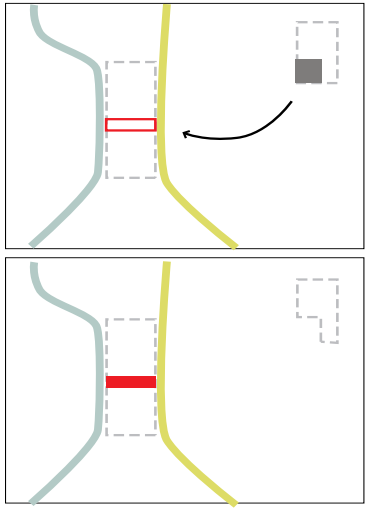
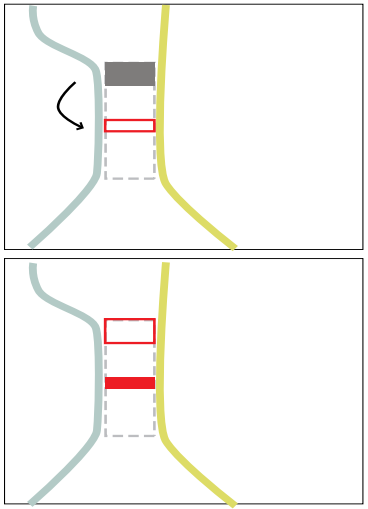


Fig 2.37 Phasing scenario 2: Underutilized land in an industrial zone is converted to the **new format**, taking advantage of LRT and freight rail access. An industrial property in a nearby location relocates. Its former site is then made available for similar conversion.



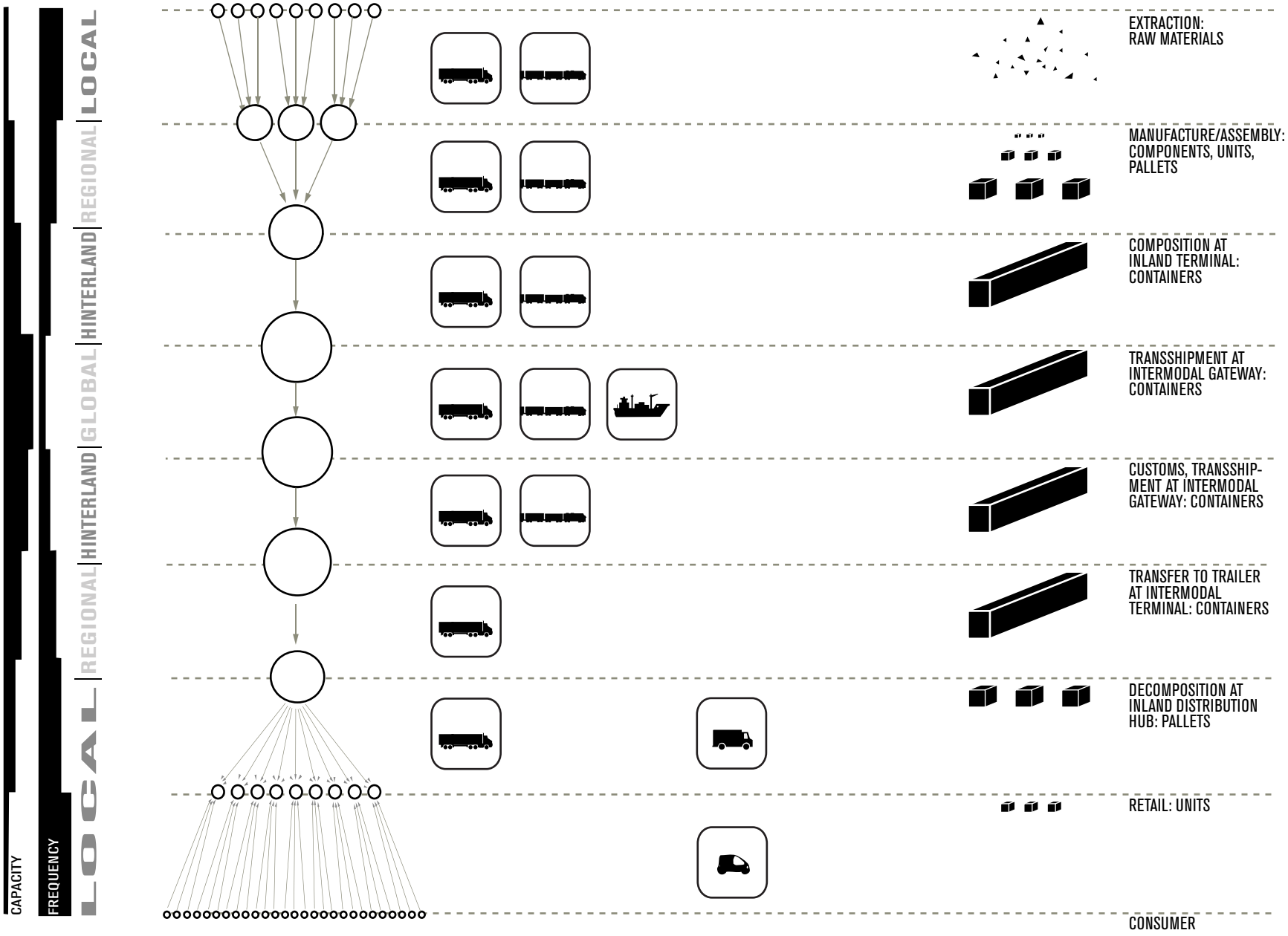


Fig 2.38 Massification/Atomization by Mode **Existing** and **Proposed**

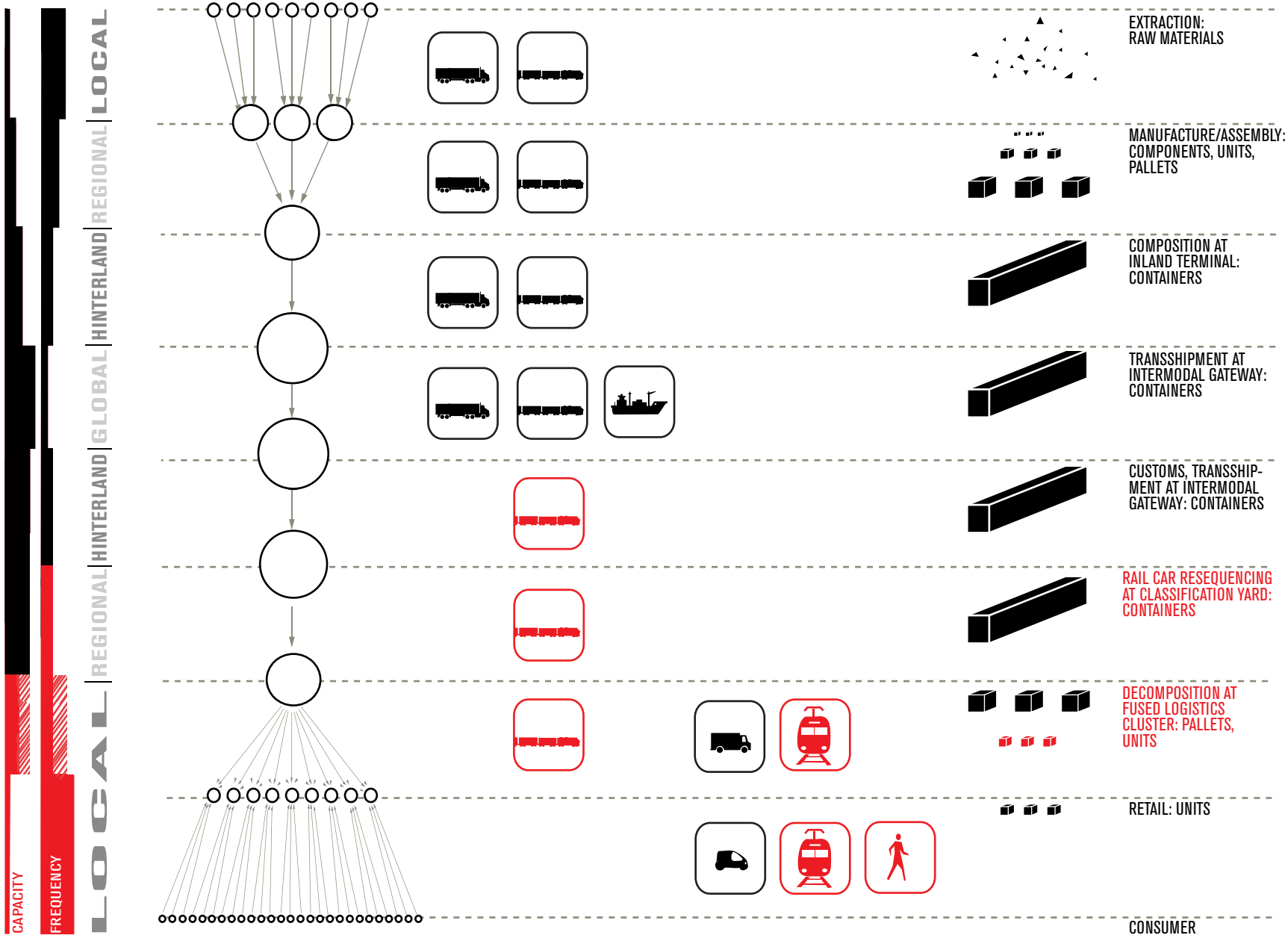

CAPACITY
FREQUENCY
LOCAL
REGIONAL
HINTERLAND
GLOBAL
HINTERLAND
REGIONAL
LOCAL
EXTRACTION:
RAW MATERIALS
MANUFACTURE/ASSEMBLY:
COMPONENTS, UNITS,
PALLETS
COMPOSITION AT
INLAND TERMINAL:
CONTAINERS
TRANSSHIPMENT AT
INTERMODAL GATEWAY:
CONTAINERS
CUSTOMS, TRANSSHIP-
MENT AT INTERMODAL
GATEWAY: CONTAINERS
RAIL CAR RESEQUENCING
AT CLASSIFICATION YARD:
CONTAINERS
DECOMPOSITION AT
FUSED LOGISTICS
CLUSTER: PALLETS,
UNITS
RETAIL: UNITS
CONSUMER

Fig 2.39 Demonstration site

DEMONSTRATION SITE A pilot example of a fused logistic cluster is demonstrated on a greenfield site in the city of Brampton, near the outer northwest peripherals of the Greater Toronto Area. The site exists at the confluence of two key factors which define its embedded potential to catalyze modal shifts. Its eastern edge is Hurontario Street, a prospective light rail transit corridor under Metrolinx's 15 year plan.[3] Along its western edge runs a minor branch of rail line owned by Canadian Pacific which connects to international, transcontinental routes.

Brampton's vast industrial zones typify the quintessential low intensity, Post-Fordist development template. The sectors of wholesale, logistics, and advanced manufacturing dominate here.[4] They are lured by Brampton's vast tracts of greenfield land served throughout by 400 series highways. Brampton's edge location is ideal for distribution facilities with frequent connections to both local and remote supply chains. The city contains roughly 70 million square feet of industrial space, the fourth largest concentration in Canada after Mississauga, Montreal and Vaughan.[5] The expansive land areas consumed by these facilities contribute significantly to the spreading and decentralization of the urban footprint. Such negative effects are rivalled only by the subdivisions of single family detached housing.

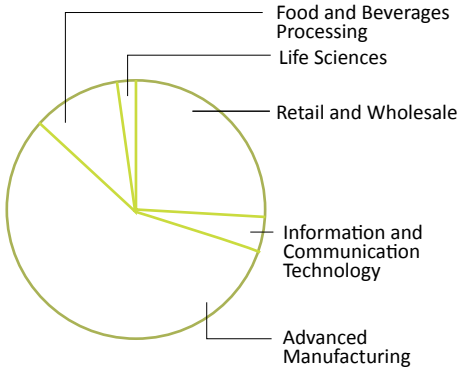


Fig 2.40 Brampton's business sectors

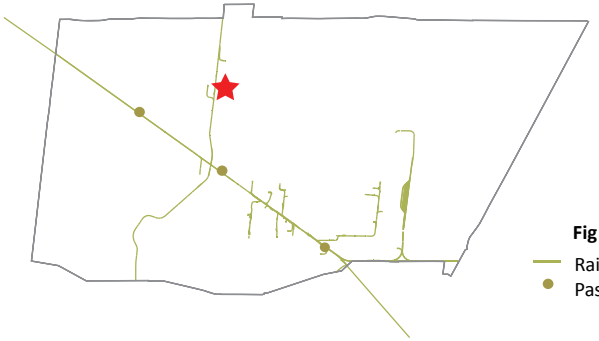


Fig 2.41
Rail
Passenger rail stops

Fig 2.44
Greenways
Rivers

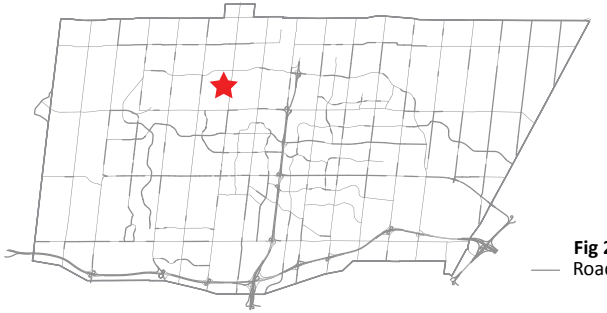


Fig 2.42
Roads4

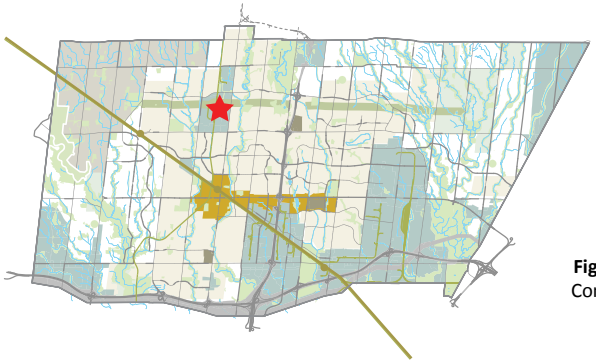


Fig 2.45
Composite

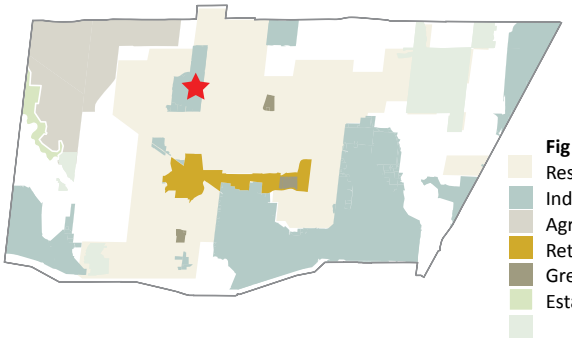


Fig 2.43
Residential
Industrial
Agricultural
Retail Centres
Green belt
Estates

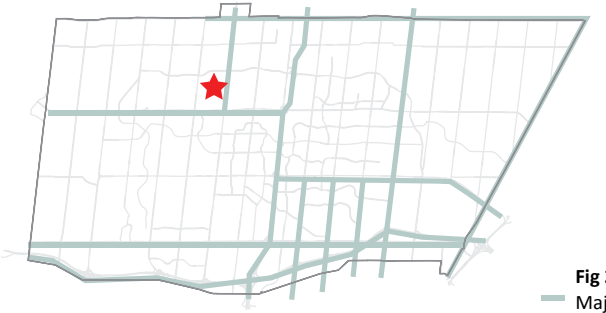


Fig 2.46
Major truck traffic corridors

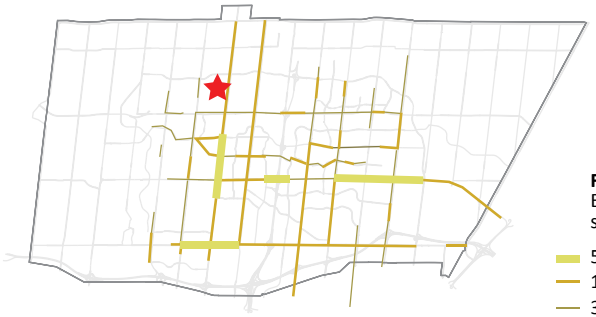


Fig 2.47
Existing transit service

5-10 min
10-20 min
30-60 min

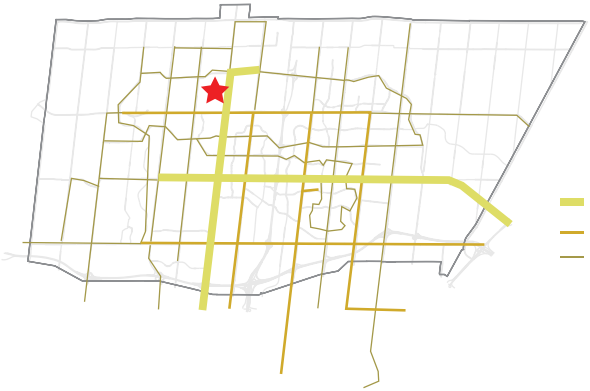


Fig 2.48
Proposed transit service 2011

5-10 min
10-20 min
30-60 min

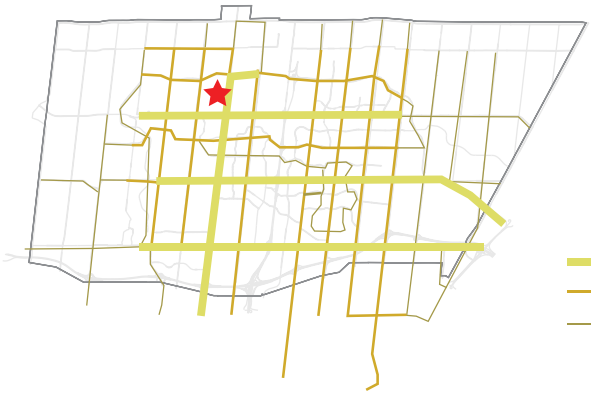
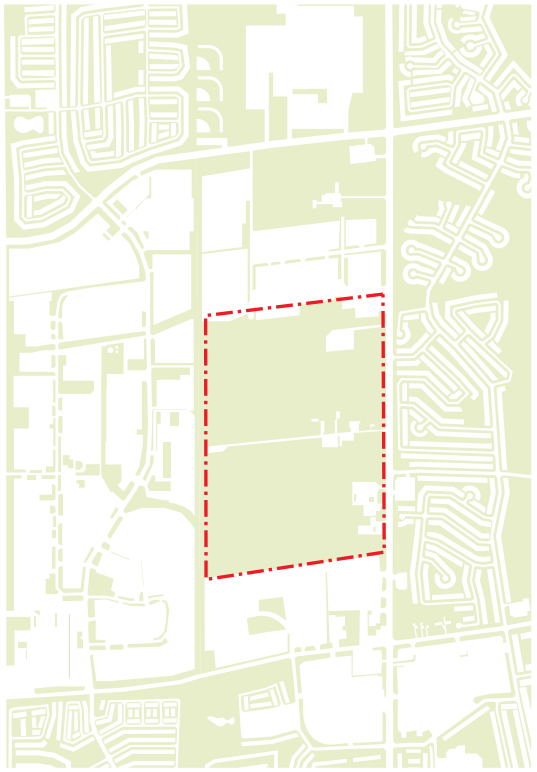


Fig 2.49
Proposed transit service 2021

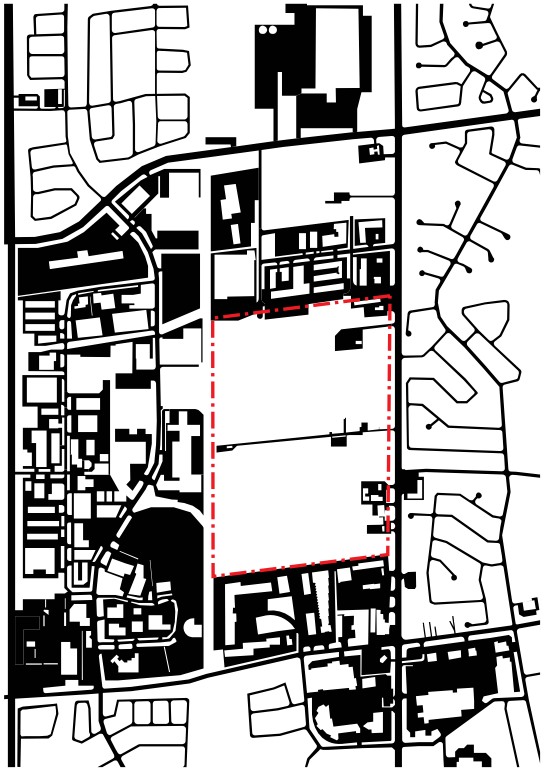
5-10 min
10-20 min
30-60 min

The city's population of 450,000 is expected to surge to 725,000 by 2031, and an additional 100,000 jobs will be attracted to the area.[6] Longer term growth may also be anticipated, in light of momentous immigration rates coupled with global trends toward urbanization. Congestion costs are expected to rise accordingly, aggravated by the excesses of truck traffic on key arterials. The rapidly evolving condition marks a fleeting opportunity for the testing of new morphologies on limited supplies of remaining greenfield land, without the complication of demolition or conversion.

GREEN COVERAGE



PAVED SURFACE



COMMERCIAL, INSTITUTIONAL,
RESIDENTIAL, INDUSTRIAL

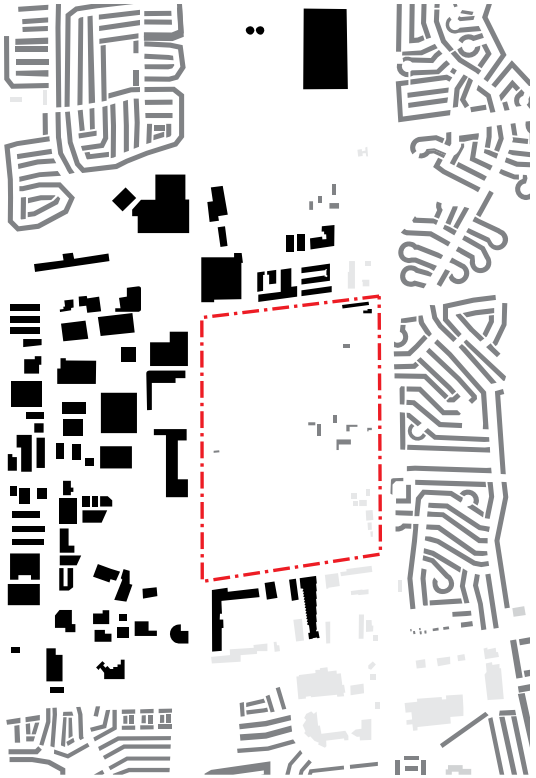


Fig 2.50 Site context

The northern edge of the site connects to an extensive public greenway system, leading to a broad network of paths, rivers, and recreation areas. The convergence of these factors invites an exploration of how freight-intensive and public/active transit-supportive development might coexist in a productive and mutually beneficial relationship.

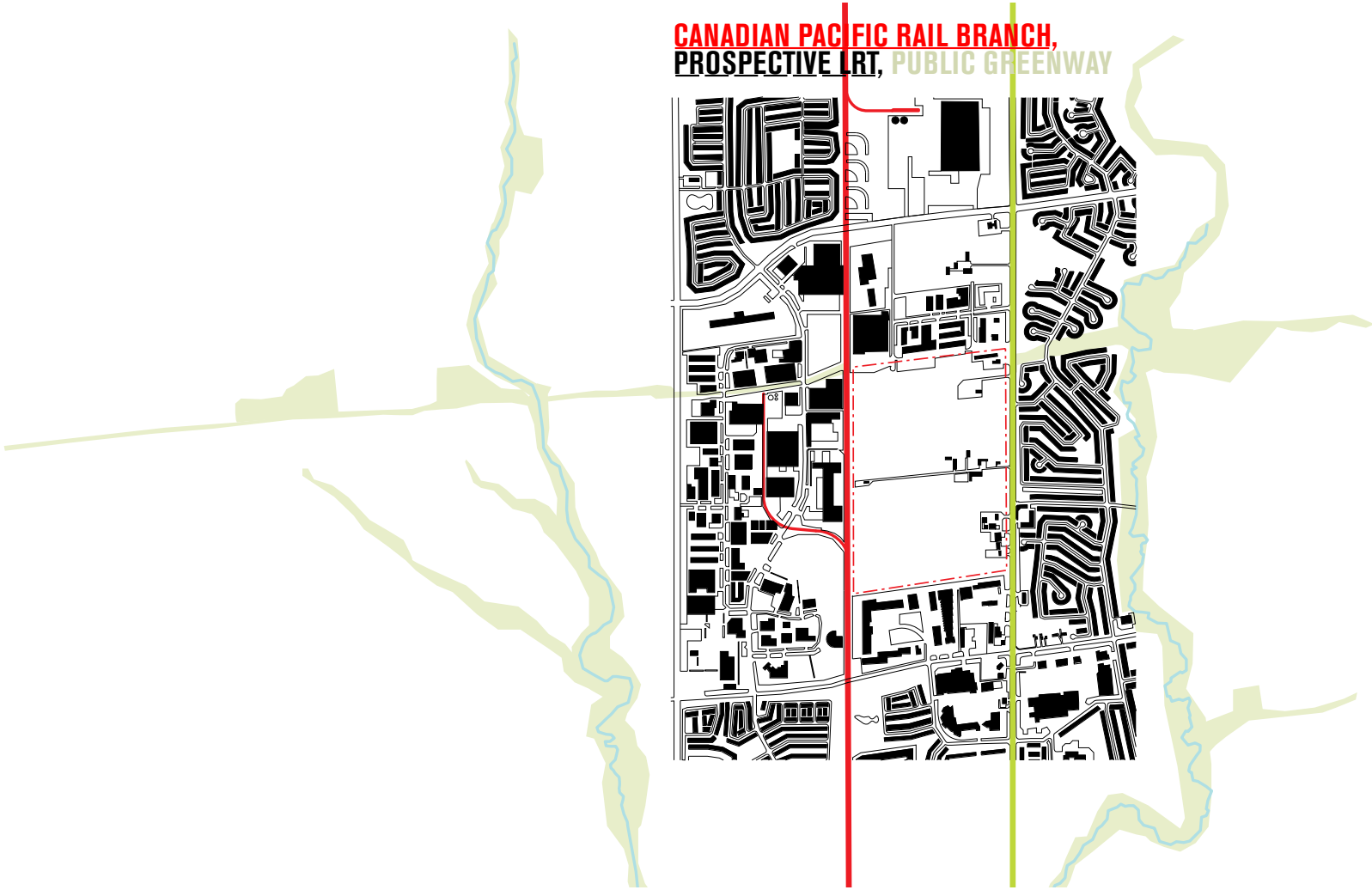


Fig 3.1 Industrial zone in Brampton, ON

03

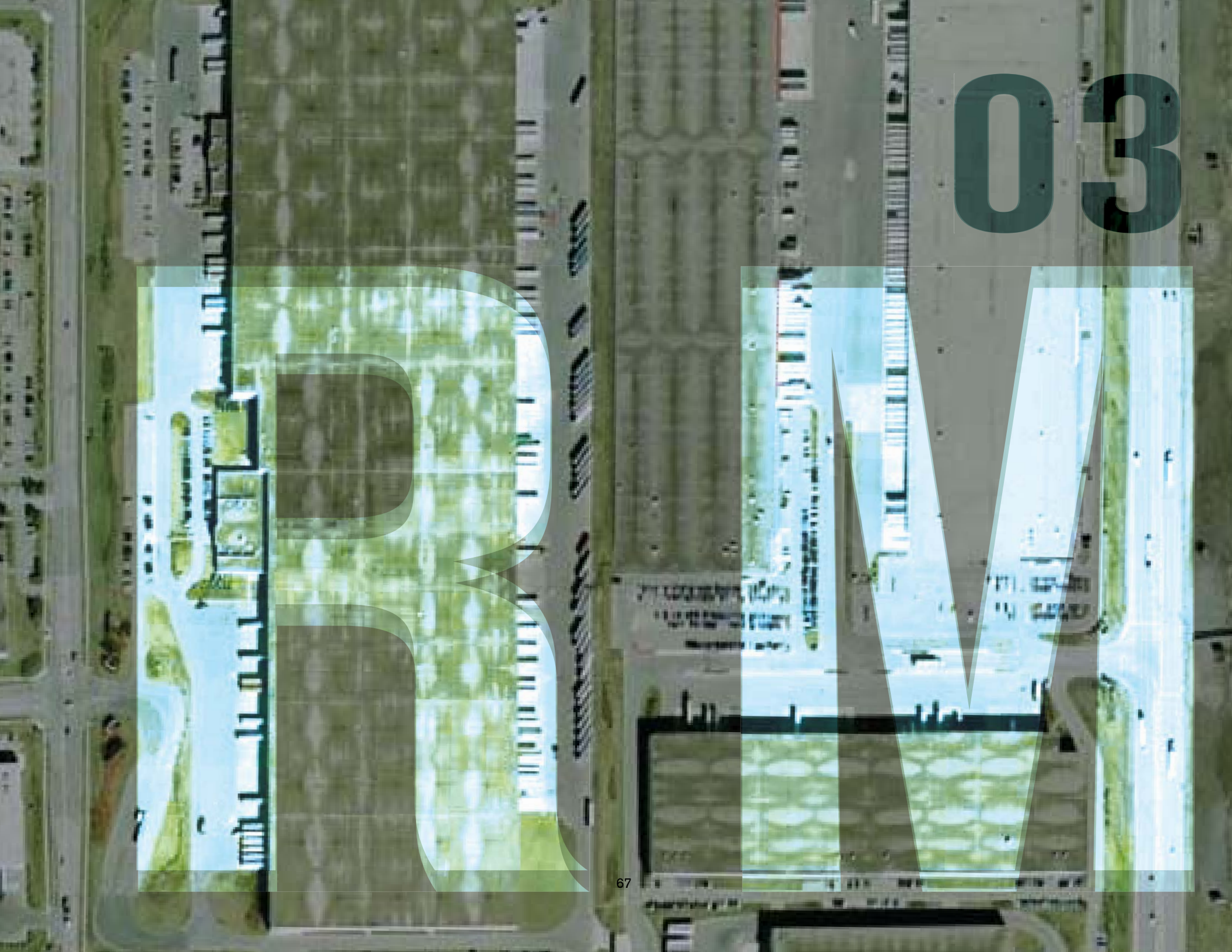


Fig 3.2 Trimming the dross

03.1 A NEW MORPHOLOGY

Metrics of the cluster's logistical faculties determine the formal approach. The configuration is derived from the same area ratios, conveyance technologies, and internal flow patterns found in standard industrial typologies. An extrapolation of such existing trends allows us to anticipate the next evolutionary step in transport supporting forms. The existing standard industrial typology is boiled down to its essence and retooled.

DESIGN TACTIC: TRIMMING THE DROSS In conventional industrial developments, roughly half of the land area is consumed by vehicle circulation uses. These tend to encircle each individual building, in spite of the fact that vehicular access to only one or two faces is required. In the proposed module, circulation areas are reduced to a minimum, and setbacks between buildings are eliminated. The elimination of setbacks offers a number of benefits. Firstly, it allows for the possibility of size flexibility. By merging together, distributors may realize the efficiencies gained in consolidating freight, as well as centralizing shared assets such human resources, equipment, and information systems. Excess space may be severed and rented out in a converse operation. Secondly, the enlarged contiguous roof area offers the most flexible surface for a variety of outdoor use types, effectively duplicating the ground plane. These uses might include racing tracks, industrial scaled agriculture, zipcar/RV/commuter parking, solar collection, grazing pastures, or seasonal amusement parks. This contributes to the last advantage of eliminated setbacks, which is overall increased land use intensification and the associated servicing and transport savings.

The first formal operation is therefore to amass the warehouse spaces together. The problem of access is then addressed using this consolidated form as a point of departure.

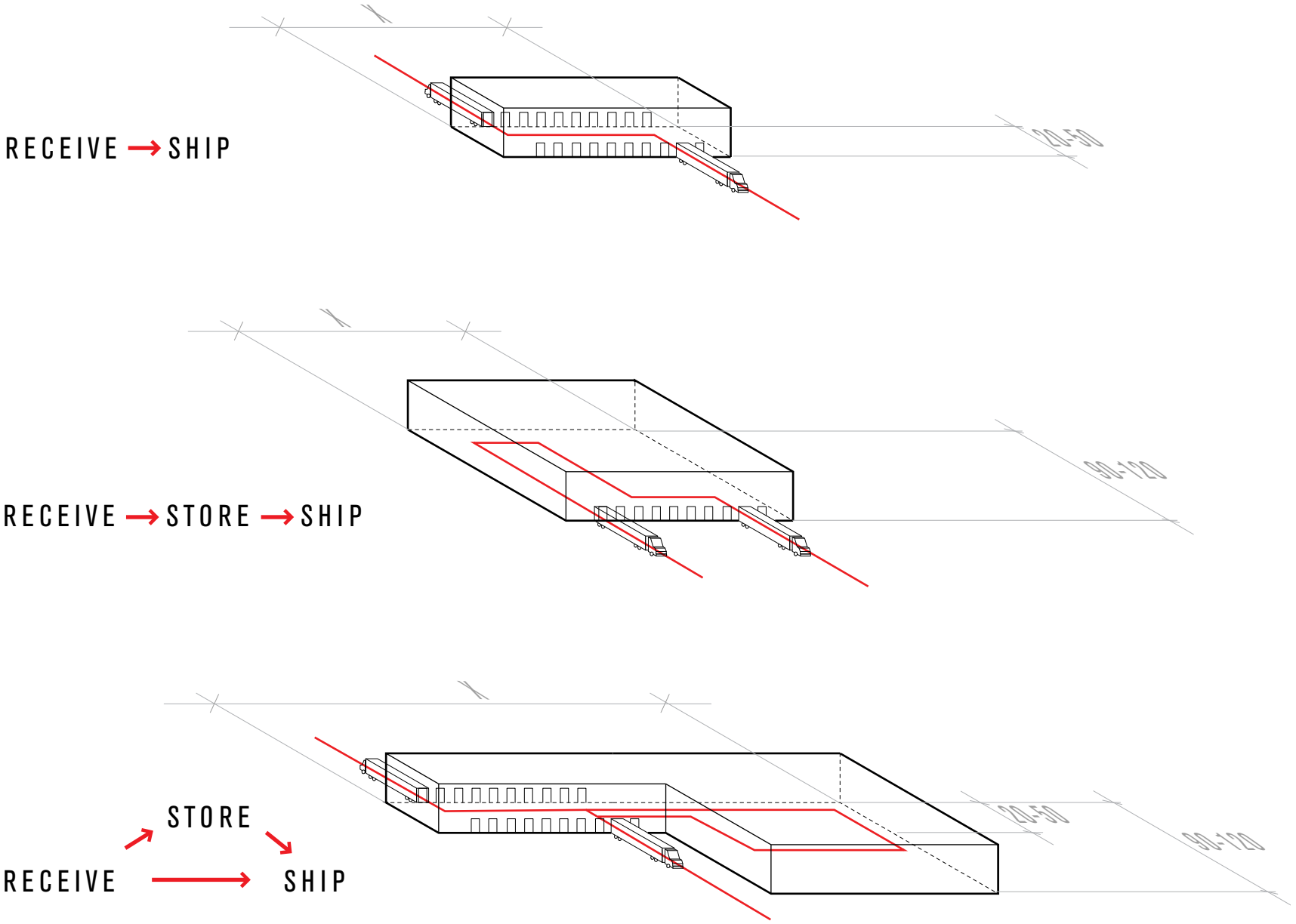


Fig 3.3 Form follows flow

DESIGN TACTIC: FORM FOLLOWS FLOW

The form of the fused logistics cluster strives to serve as a platform for transition between existent and burgeoning trends in distribution patterns. In the traditional system, inbound items are stowed away in vast inventory areas until called upon by a customer. The associated internal flow pattern is known as cyclic loading and requires a building width of 90 to 120m for efficient internal flow of goods.[7] Increasing sophistication in information management associated with the just-in-time model has resulted in the emergence of a relatively new logistics technique known as cross docking. Here, the need for long term storage is eliminated by synchronizing warehouse inputs and outputs within a margin of hours. This method allows for reduced handling and greater functional efficiencies in cases where throughput is high and demand can be precisely anticipated.[8] Cross docking requires a narrower width of 20 to 50m, allowing for limited sorting areas between ports at opposite faces for incoming and outgoing respectively.[9] This direct receiving-to-shipping flow pattern may be augmented with receiving-to-storage and storage-to-shipping steps in between, as found in the cyclic model. A section that is varied in width proves optimal to operations deploying both cross-docking and conventional operations.[10] The number of doors per square meter is determined using the benchmark of 1:1000 for cyclic loading functions, and 1:500 or less for cross docking applications.[11]

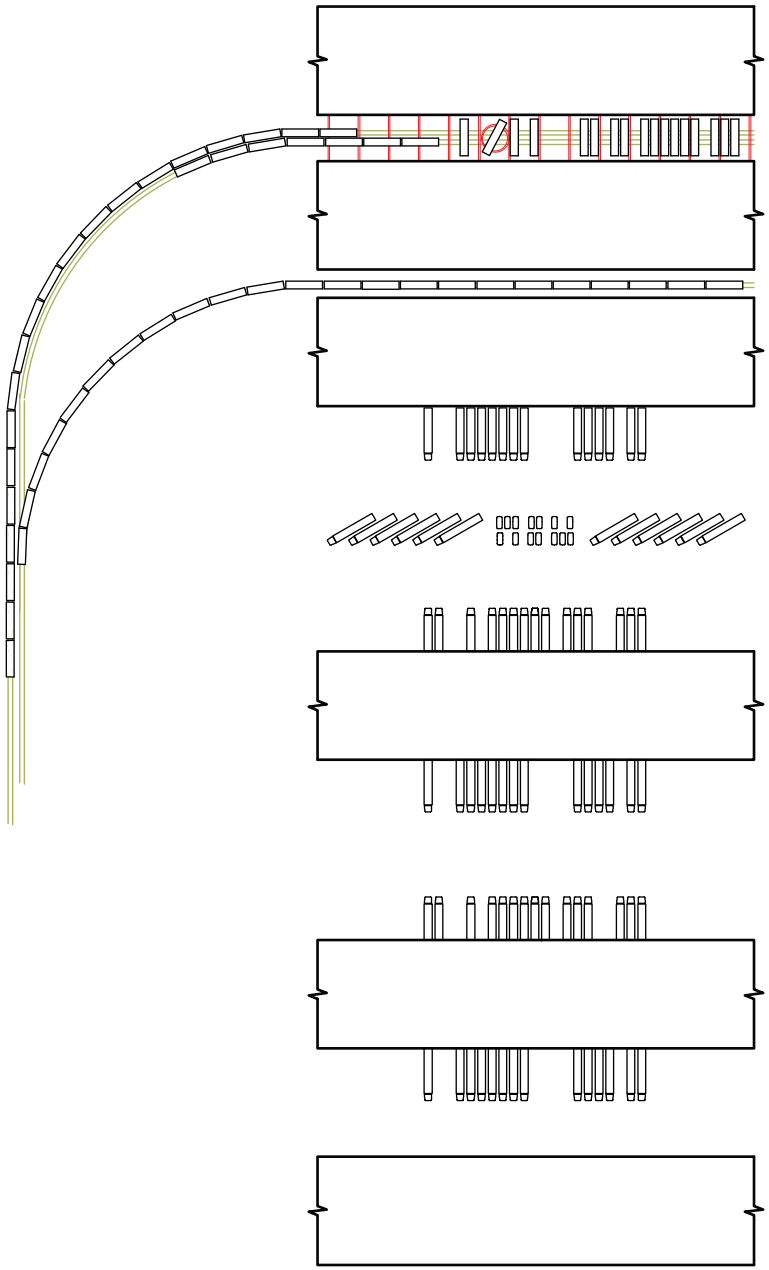


Fig 3.4 Docking bay metrics, **existing** and **proposed**

DESIGN TACTIC: TRANSFORMING THE PORTS The ports of the conventional distribution centre are adapted for trucks only, with the less common exception of bulk commodity transport which may be funneled directly from below. The standard container opens only at the ends, which precludes the possibility of unloading directly while arranged in a train formation. Containerized goods arriving by rail are generally trans-shipped onto flatbed trailers at an intermodal terminal prior to reaching the distribution centre, resulting in a temporal bottleneck and significant associated costs (fig 2.13). Linking the new logistics cluster directly to rail systems requires innovative use of existing technology, to allow standard containers to be docked directly from rail for unloading. A system is proposed by which inbound/outbound containers are lifted from rail flatbeds by sliding gantry cranes, and rotated 90 degrees for direct loading/unloading. This eliminates the need for costly transhipment, drayage and the consumption of vast urban land areas associated with these functions.

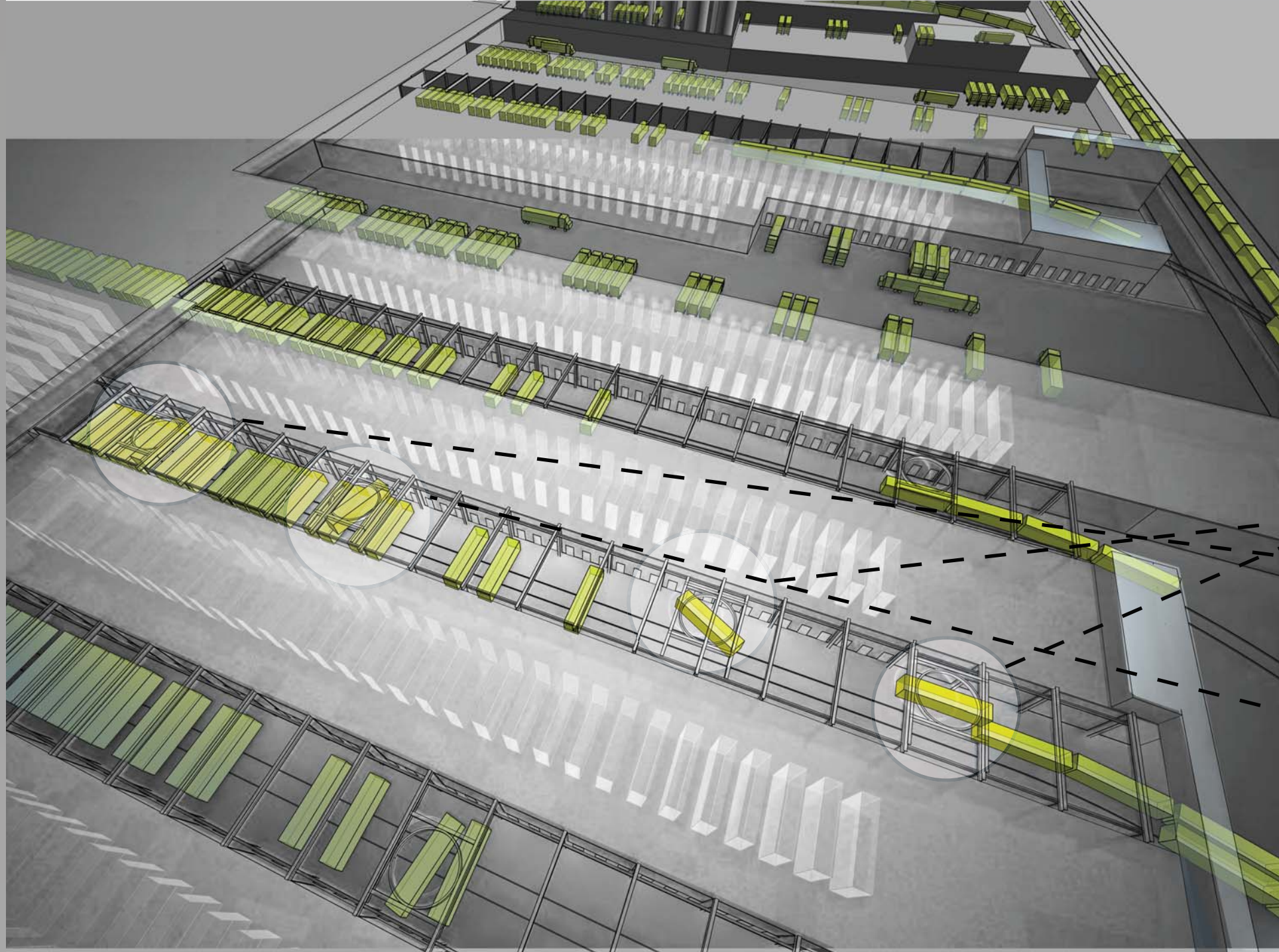
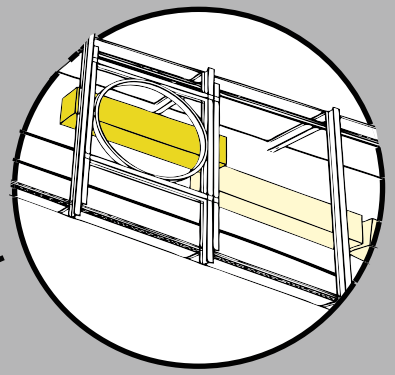
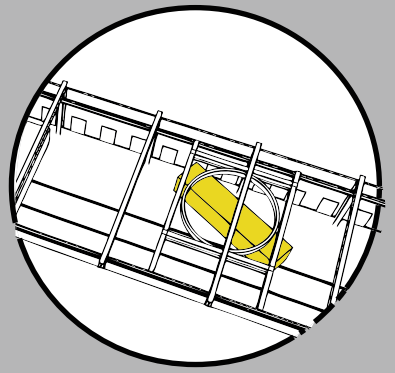


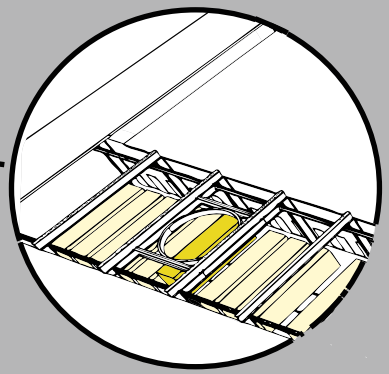
Fig 3.5 Proposed truck-free docking system



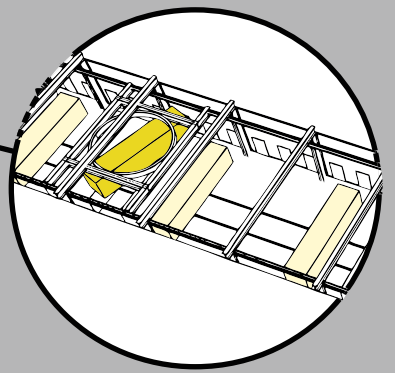
1 *The container is lifted 4m. up from its flatbed on the inbound rail line by an overhead track-mounted sliding gantry crane.*



2 *The gantry crane carries the container towards a specified port, rotating the container 90 degrees on centre as it travels. Docks nearest to the storage body centre are filled first.*



3 *The container is lowered in front of the specified dock for unloading and/or reloading.*



4 *The container is lifted 4m, rotated 90 degrees once again, and deposited onto the outbound flatbed.*

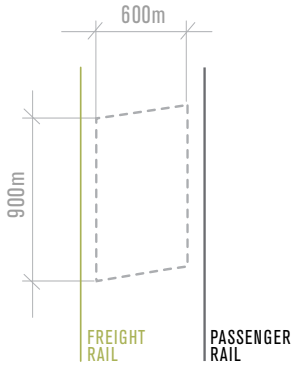


Fig 3.6 Key site parameters

MORPHOLOGICAL STUDY

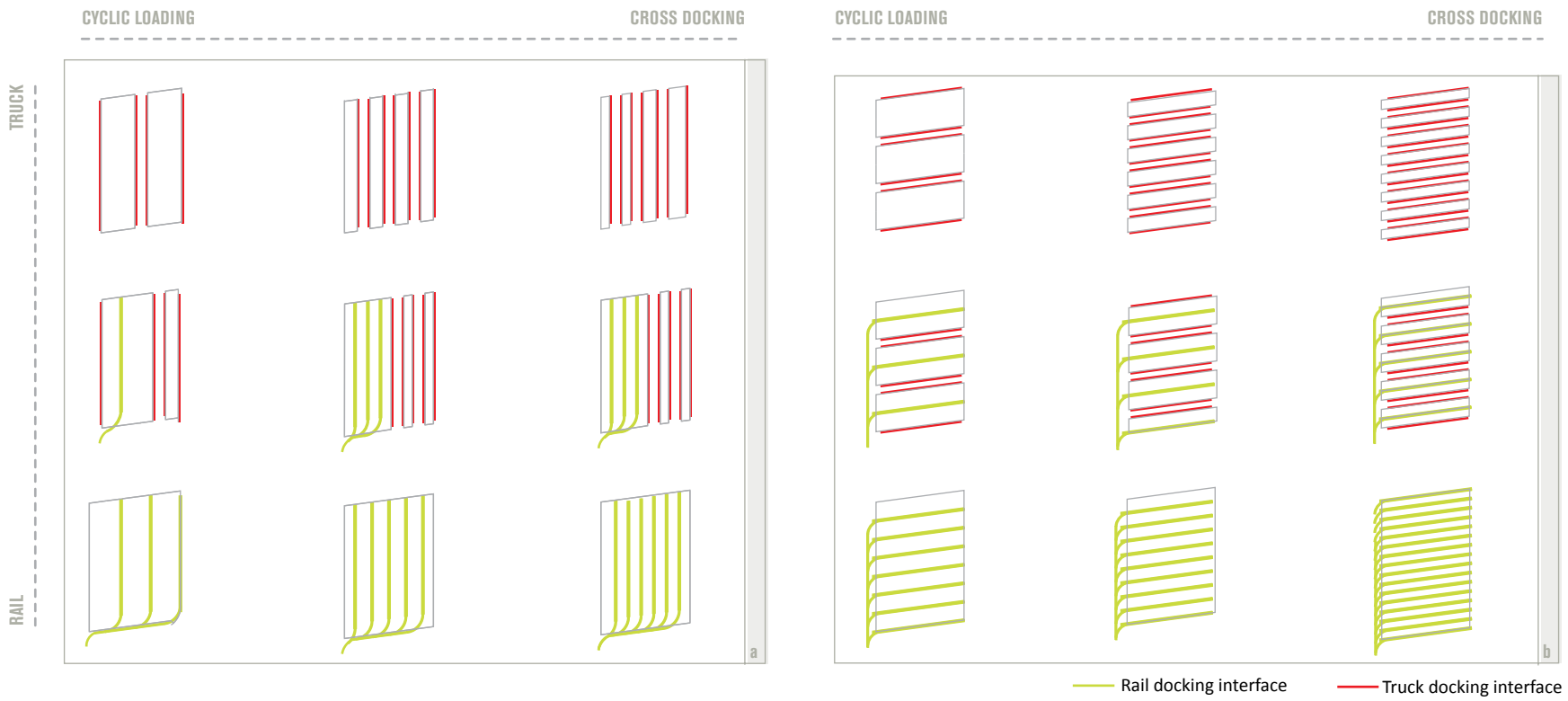
A number of morphological types are tested to explore the implications of pursuing both cyclic loading and cross docking, of single and varied width, facilitated by both truck and rail, in various combinations and degrees. The study operates within the key parameters of the selected site (fig 3.6), however sites with different proportions or adjacencies may suggest alternative patterns for access and circulation. Relevant criteria for each of the tested variables are preserved, such as turning radii for truck and rail, and workable warehouse proportions. The formal results of toggling these basic factors are assessed against the following priorities:

FIGURE | UNIFORM WIDTH | a - b

Fig 3.7 Morphological study

- Maximizing usable area of the site
- Maximizing contiguous roof area for flexibility in rooftop programming options
- Maximizing adjustability, i.e. ease of renovation from truck to rail dock interfaces, or cyclic to cross docking flow patterns
- Maximizing divisibility while preserving workable proportions as well as door to floor area ratios
- Maximizing polarization of the site to separate truck and rail traffic from pedestrian oriented areas in range of LRT service

ACCESS



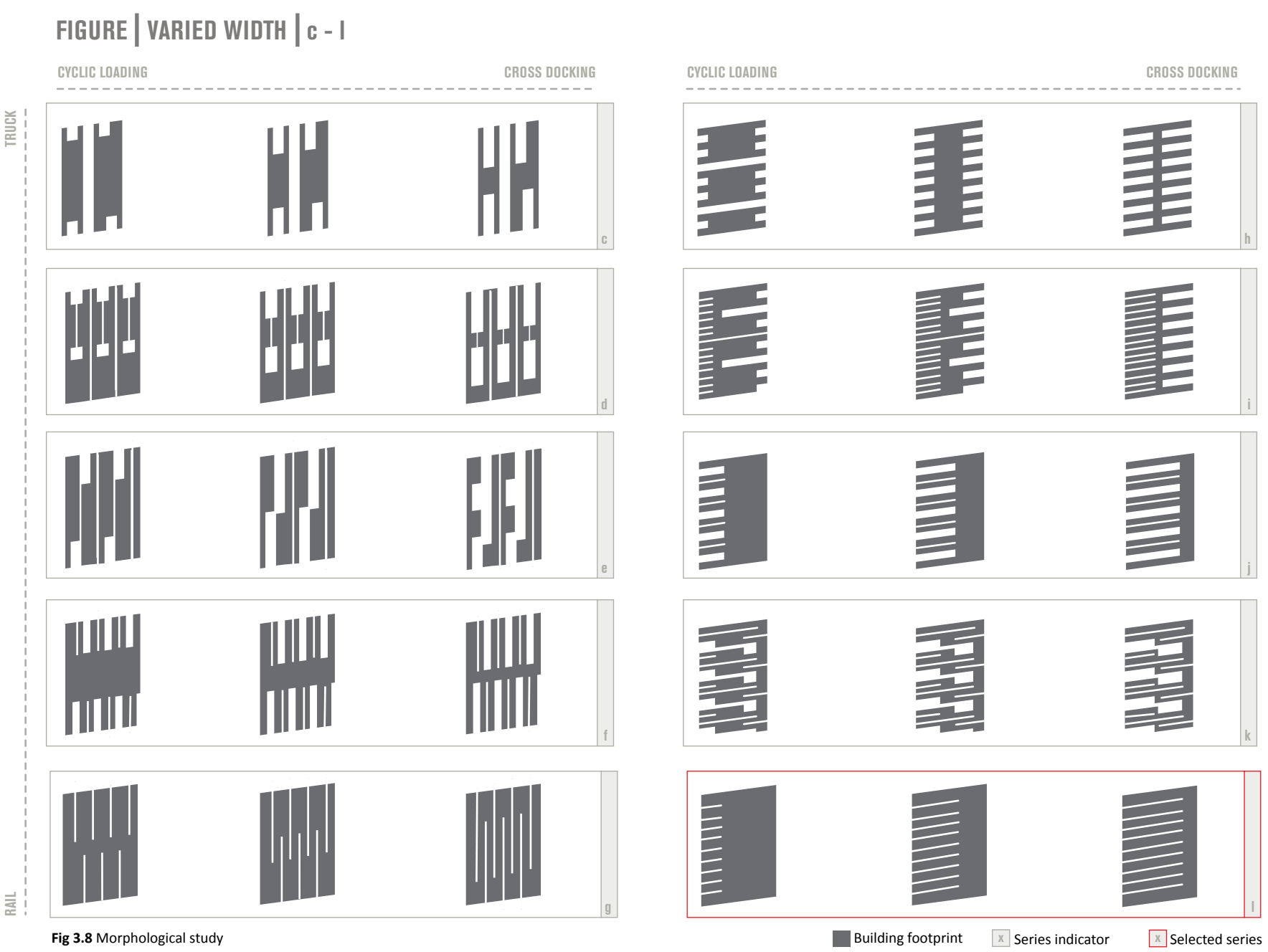


Fig 3.8 Morphological study

ACCESS

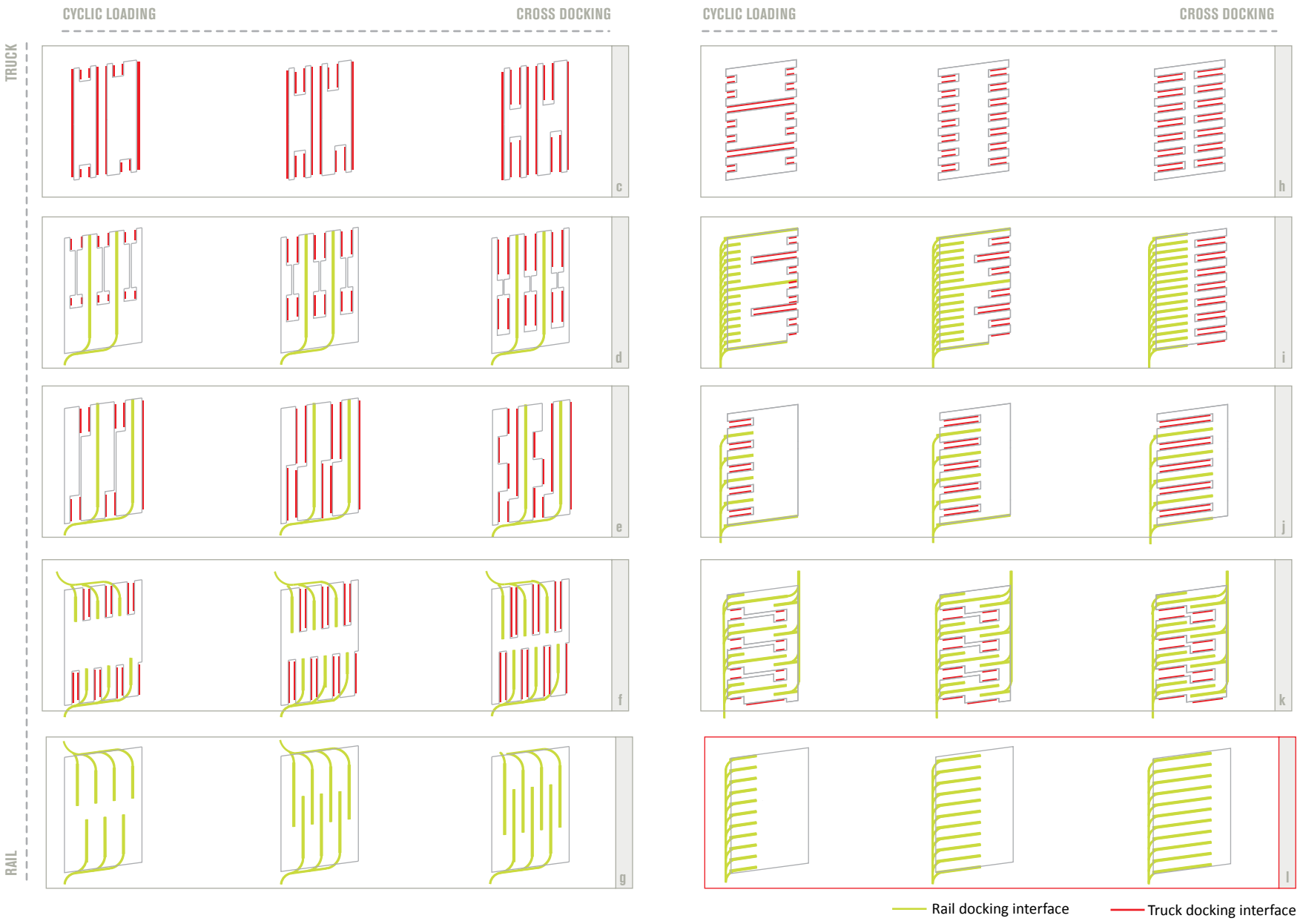

CYCLIC LOADING
CROSS DOCKING
CYCLIC LOADING
CROSS DOCKING
TRUCK
RAIL
c
h
d
i
e
j
f
k
g
l
Rail docking interface
Truck docking interface

FIGURE | VARIED WIDTH | I

CYCLIC LOADING

CROSS DOCKING

TRUCK

RAIL

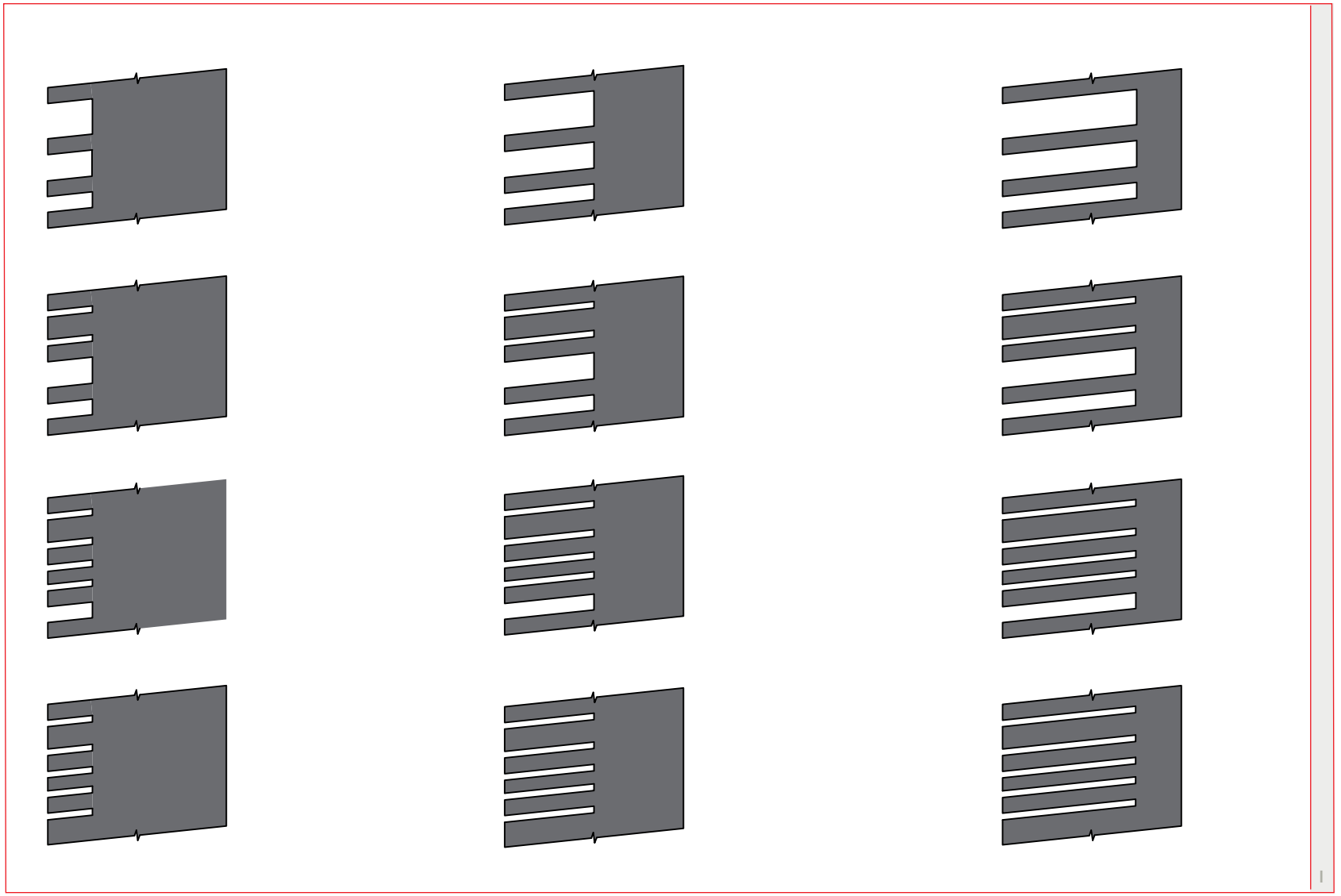


Fig 3.9 Morphological study

Building footprint

x Selected series

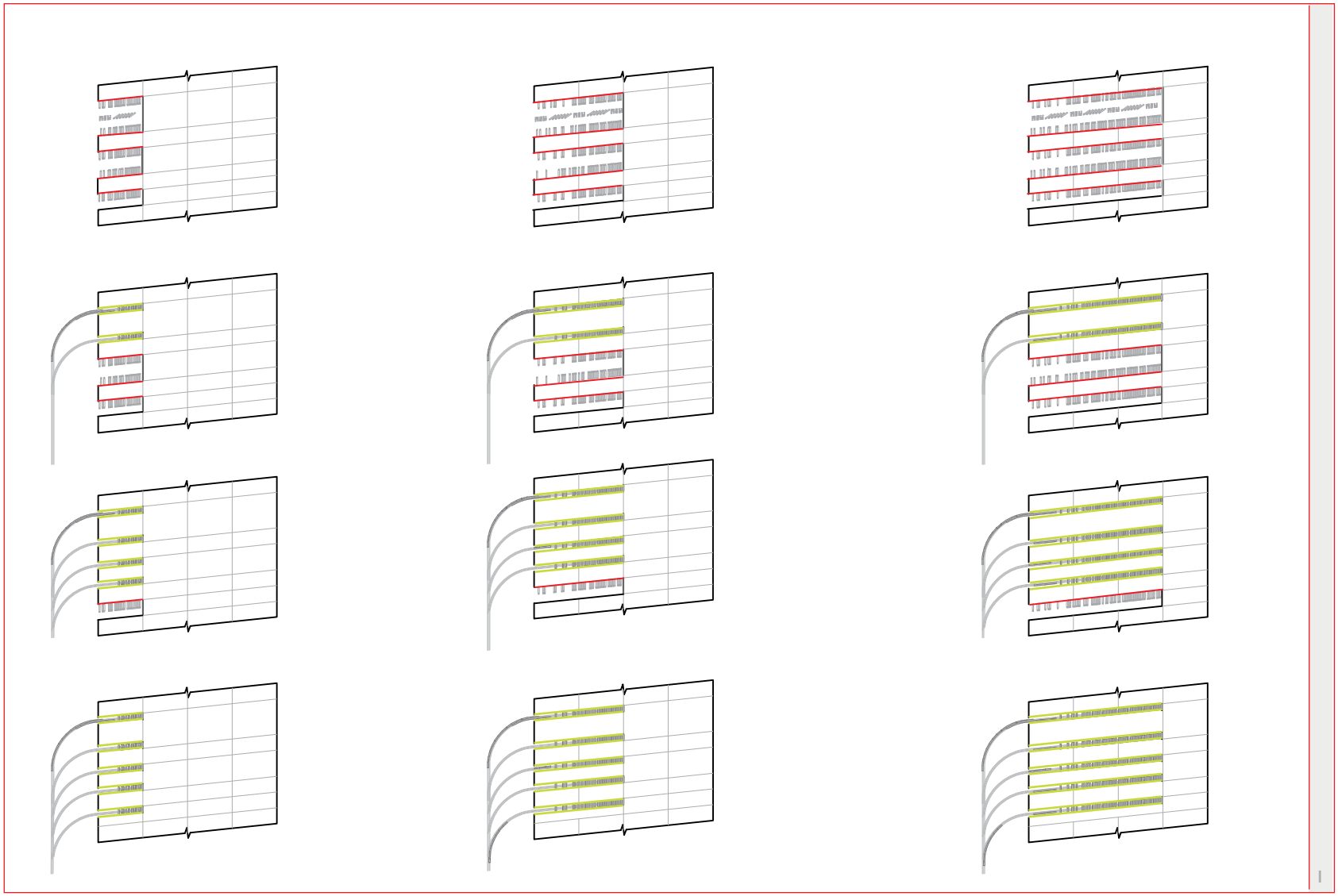
ACCESS

CYCLIC LOADING

CROSS DOCKING

TRUCK

RAIL



Rail docking interface

Truck docking interface

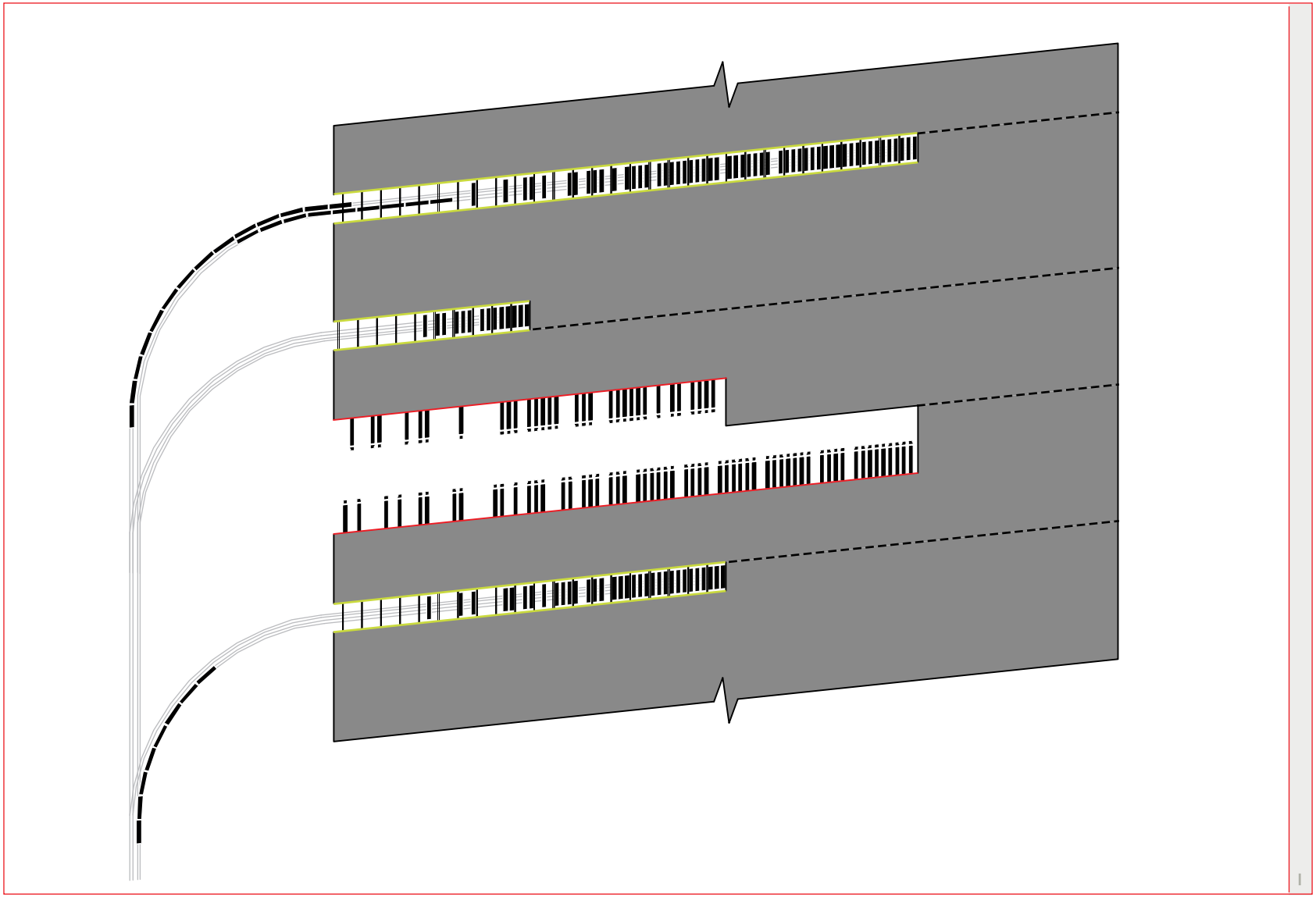
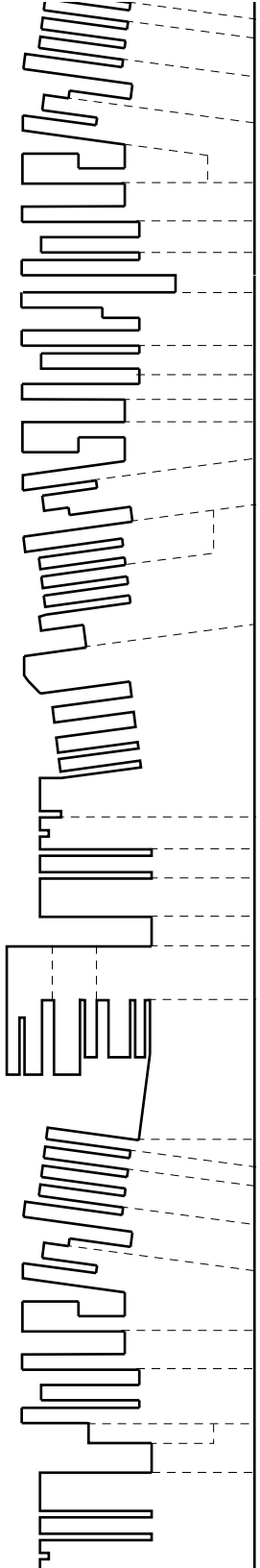


Fig 3.10 Formal resolution

Building footprint | Selected series | Rail docking interface | Truck docking interface | Possible suite division



FORMAL RESOLUTION For the selected site, a horizontal, varied width configuration with both truck and rail access from the west proved to be an optimal base condition in all categories of assessment (fig 3.10). Docking for both modes occurs within porous, fingerlike extrusions, extending toward the rail line. These are narrow enough to facilitate cross docking, while cyclic flow is permitted in the wider adjacent body. Depending on their rate of inventory exchange, tenants may elect for a higher or lower dock:storage area ratio. The length of these fingers may be adjusted accordingly (fig 3.9) Party walls may be removed or shifted should the need for expansion or contraction arise.

The warehouse/distribution facilities are designed to introduce rail gradually to the goods mobility network, allowing tenants to capitalize on the benefits of rail without dislocating themselves from other trading partners who have not yet done so. Tenants are offered dock interface options for both rail and road, and may tailor the respective proportions of these to their particular business requirements. As the modal shift towards rail progresses, tenants may enlarge the proportion of docking interface compatible with this mode.

The base condition may be repeated to form a linear band, and inflected to suit properties of varying proportions with a range of adjacencies and access constraints.

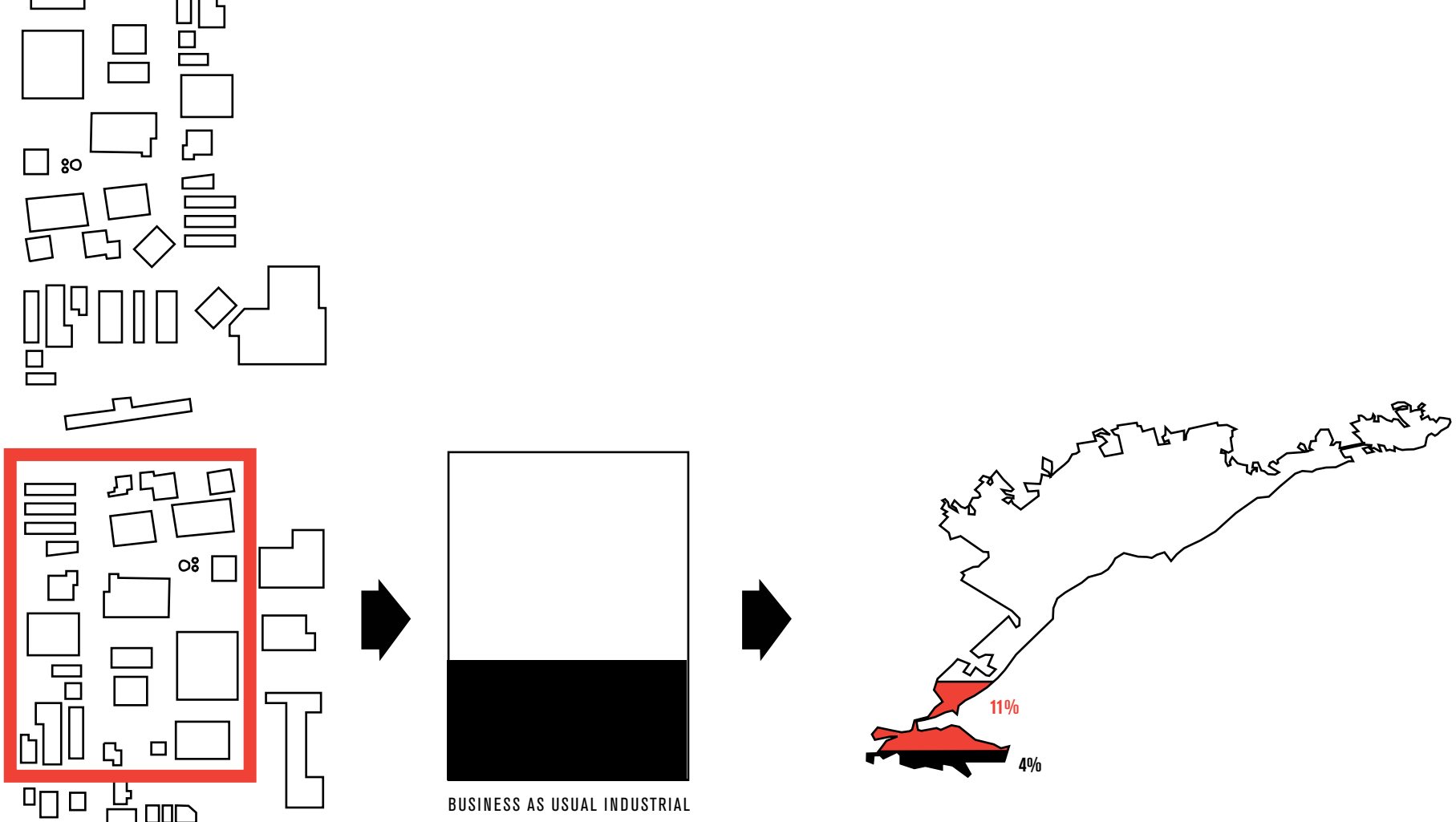
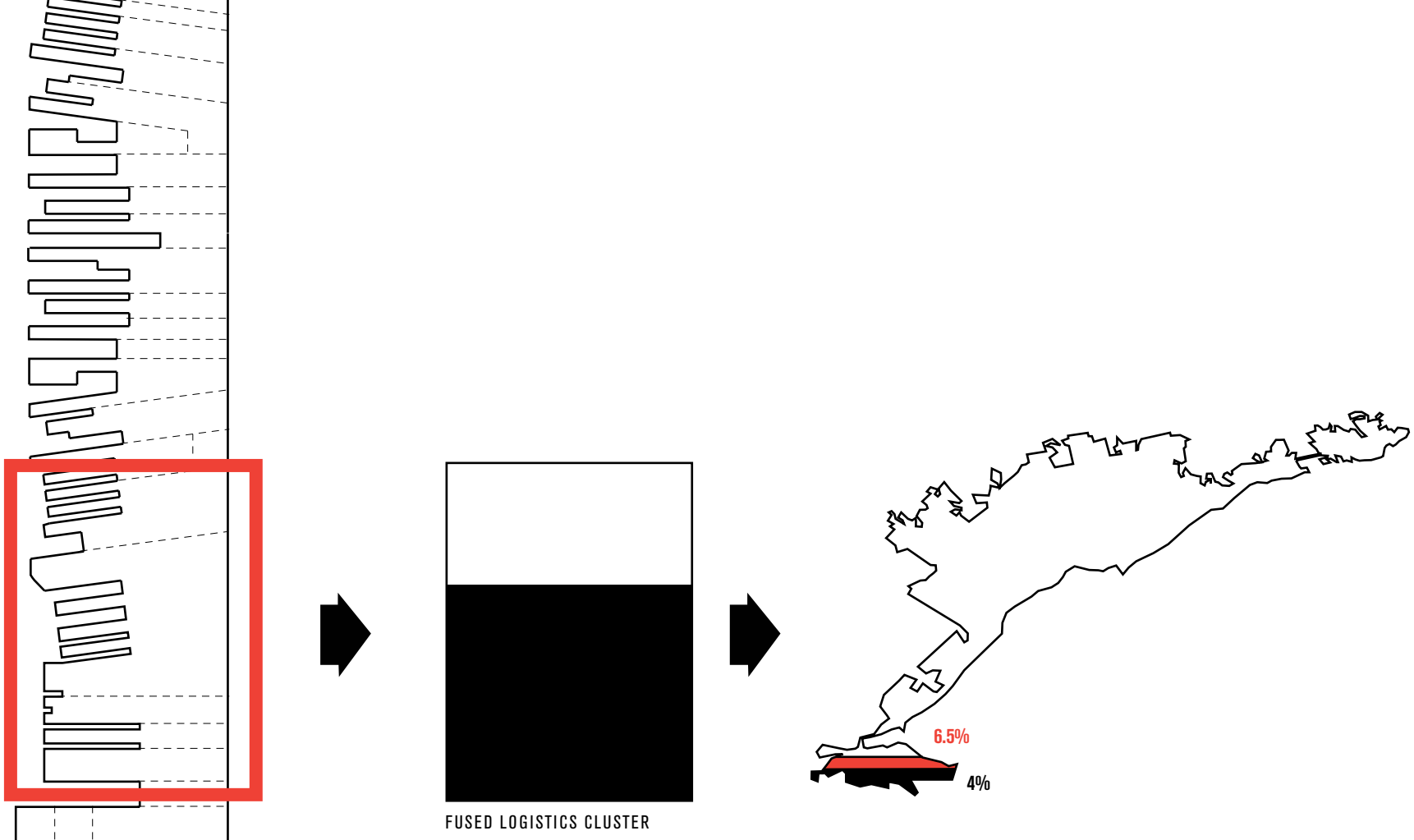
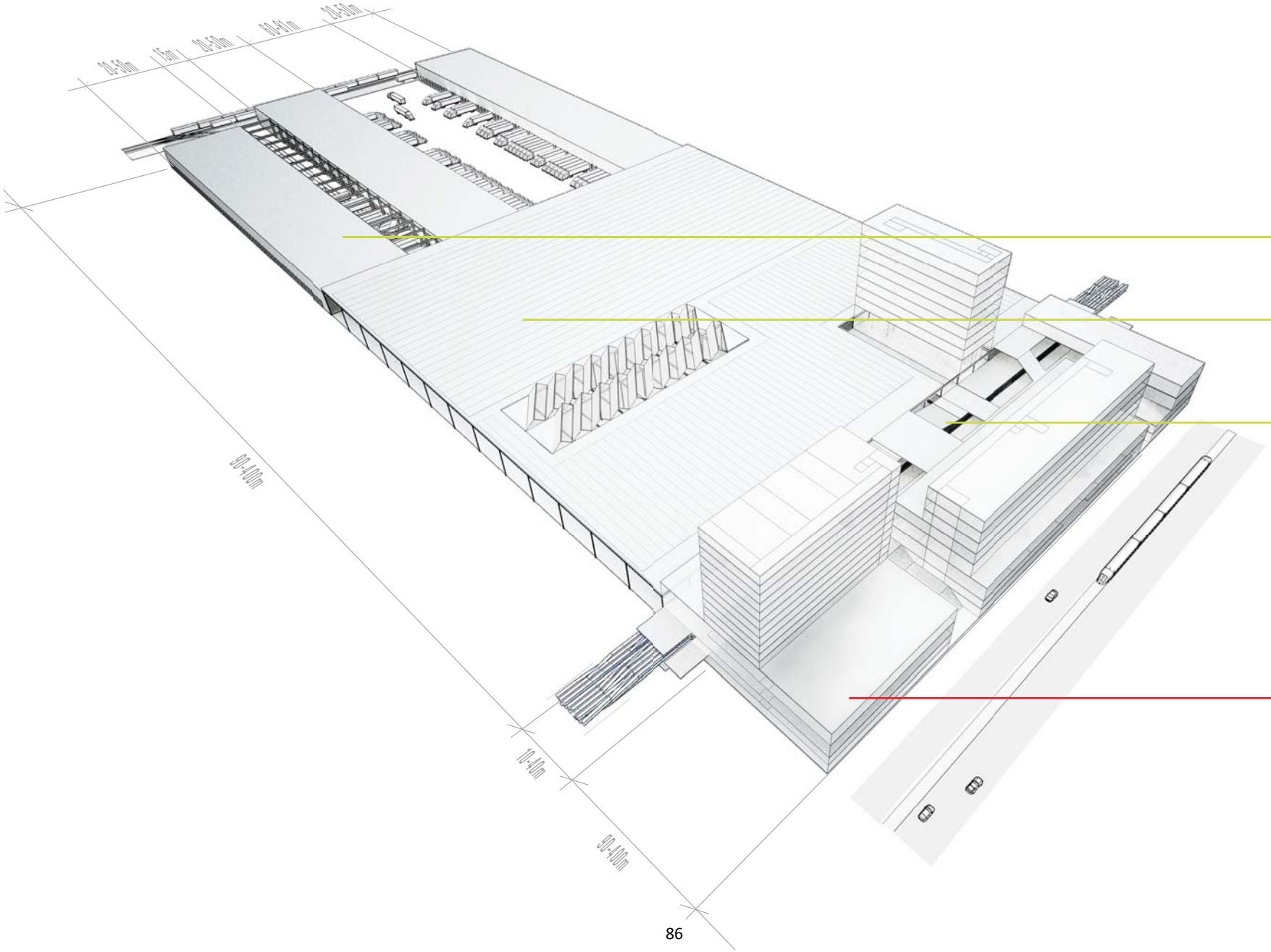


Fig 3.11 Land savings



FUSED LOGISTICS CLUSTER

LAND SAVINGS When compared to a typical industrial park, the fused logistics cluster offers a denser footprint. Through the elimination of setbacks and the rationalization of vehicular circulation paths, greater efficiency in land use can be achieved. The city-wide land use implications of each typology are compared. If all the industrial floor space in the Greater Toronto Area was relocated to fused logistics clusters of a configuration similar to that shown, this could potentially free up 20% of the entire urban footprint for any number of productive uses.


0.5-5m
15m
10-50m
0.5-5m
2.5-10m
90-400m
10-40m
90-400m

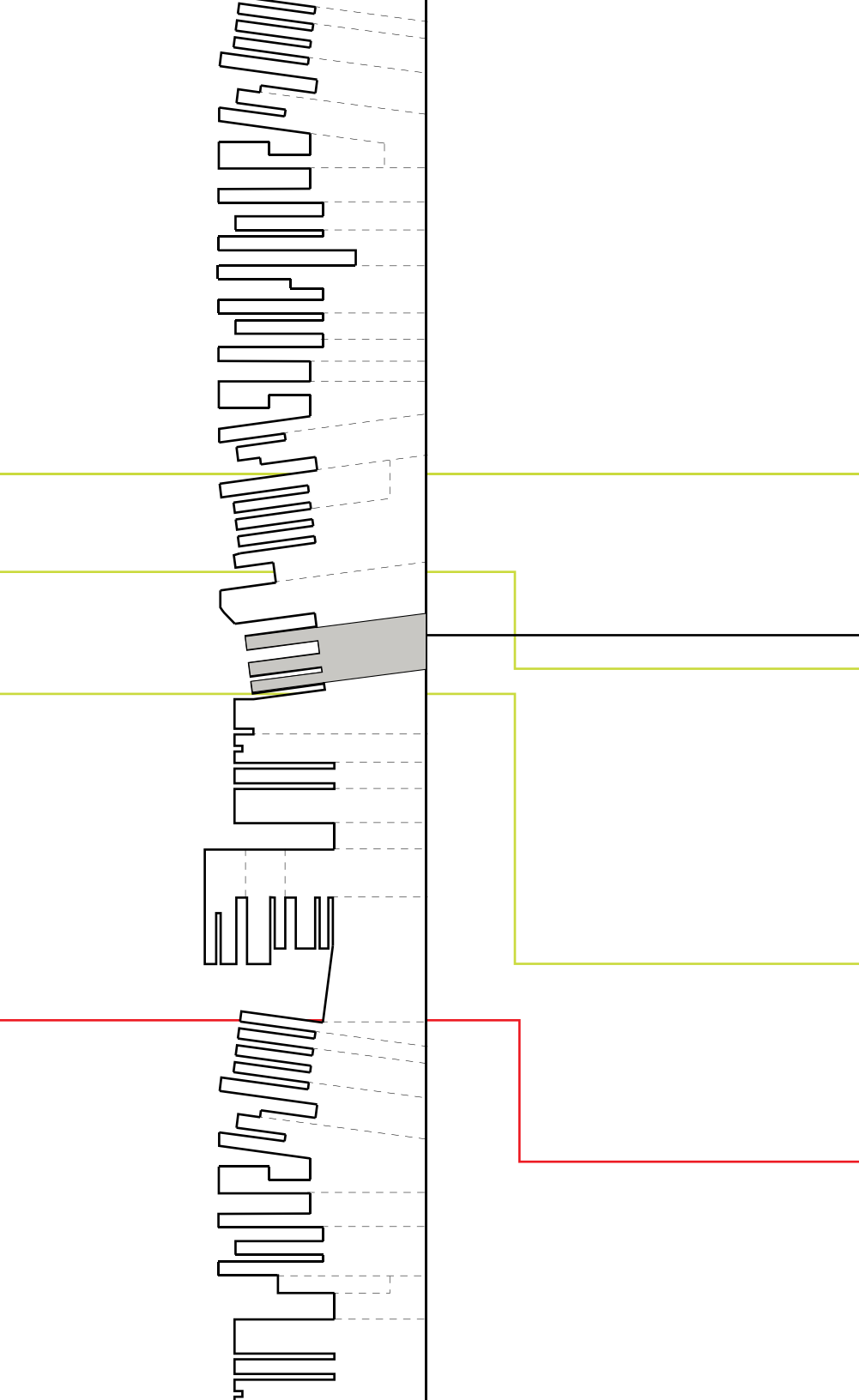


Fig 3.12

ANATOMY OF THE TYPE:
LOGISTICS AND PLUG-IN URBAN INTERFACE

A versatile template for logistics cluster design is derived through expanding upon the selected base condition.

CROSS DOCK

Incoming goods are received by truck or rail. From here they are either sent to longer term storage or combined with other outbound goods of similar destination location. Incoming goods may also serve as supplies for higher order assembly processes within the complex.

STORAGE/ASSEMBLY

Goods with longer turnover times are retained in the storage area. Non-noxious manufacture or assembly may also take place in the body of the cluster. Such functions would benefit from the smooth connections to both component/material supply chains as well as ease of shipment to the customer.

CHASE

The chase permits seamless integration between the logistical operations of each warehouse suite by providing a fast and fluid circulation path between them. As such, it acts as the essential artery enabling the fused logistics cluster to attain its greatest potential for supply-chain shortcutting and freight consolidation. Less-than-truckload shipments generated by suites at opposite ends of the cluster may easily be combined into a single shipment. The physical armature of the chase consists of a layered cross section facilitating electric fork lift travel and conveyor belt transport.

SEAM

The seam acts as a heterogeneous urban interface which is both complementary to the cluster's context as well as synergetic with its functional content. The program may include a range of uses such as residential and big box commercial, varying from site to site according to local needs. Height and massing are tailored to sympathize with surroundings.

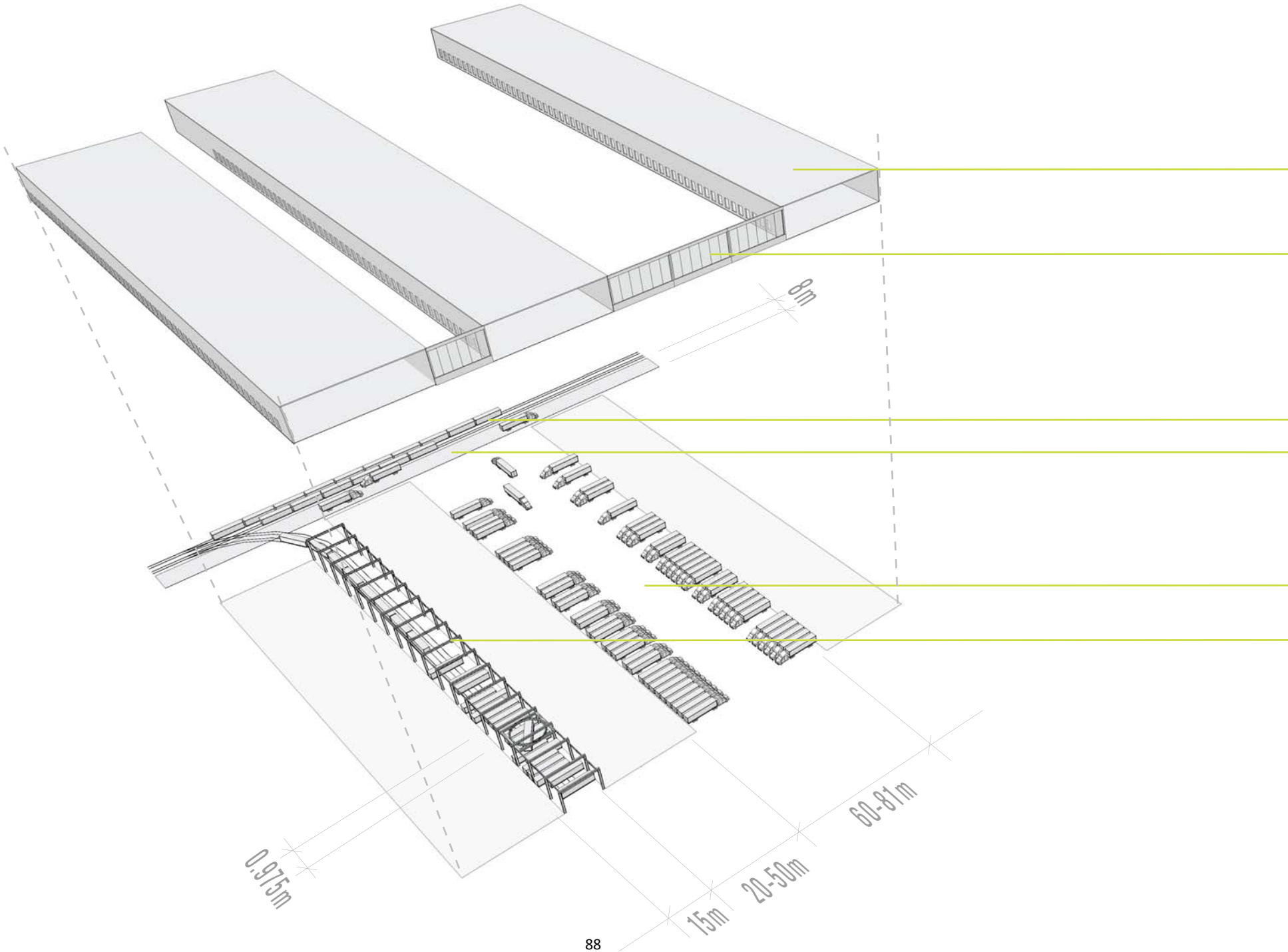

8m
0.975m
15m
20-50m
60-81m

Fig 3.13

CROSS DOCK

COMPONENTS

TRUCK/RAIL DOCKING

MODES

TRUCK

RAIL

CONVEYOR

FORKLIFT

Docks 3250 o.c.

Glazing allows natural light into adjacent storage area

Containers in cue are held in parallel rail lines
Containers are moved into poistion for lifting by automated shunting devices which latch onto flatbeds

8m two-way truck lane

A single truck docking bay serving two rows of docks may be converted to two rail docking bays serving four rows of docks (fig 3.39)

Rotating/sliding gantry cranes are mounted on steel framing 9750 o.c. to accord with dock spacing

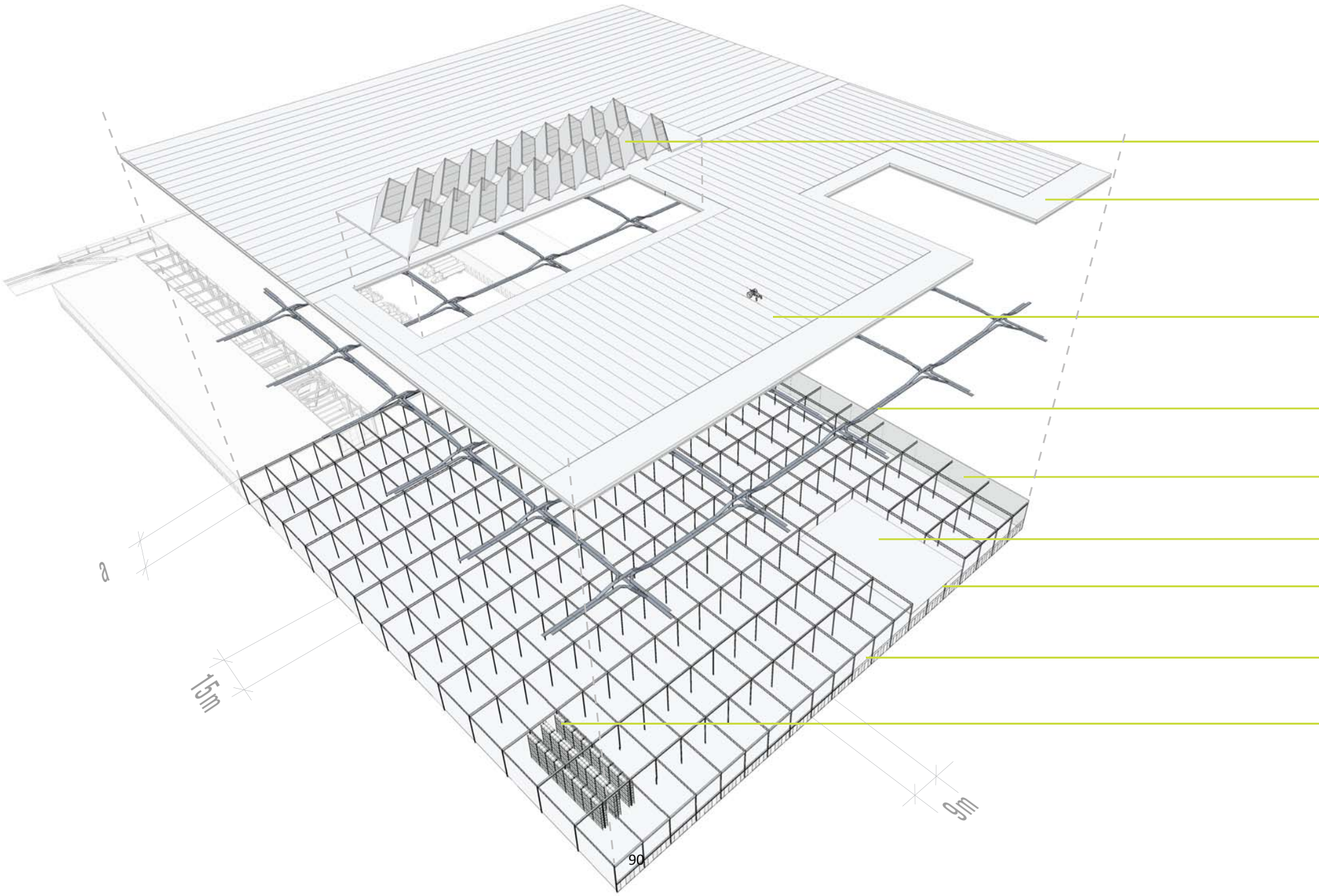

a
15m
9m

Fig 3.14

STORAGE/ASSEMBLY

COMPONENTS

ROOFTOP AGRICULTURE

DISTRIBUTION INVENTORY

ADVANCED MANUFACTURING

PACKAGING AND SHARED EQUIPMENT

MODES

CONVEYOR

FORKLIFT

HARVESTING VEHICLES

Saw-section skylights with south facing PV and north facing glazing allow natural light into storage areas and provide supplementary power

Pedestrian/cyclist path network accessible to public

The roof of the storage/assembly area is engineered for intensive occupations. These might include industrial scaled agriculture, racing tracks, zipcar/RV/commuter parking, grazing pastures, driving ranges, or seasonal amusement parks. The choice of uses may depend on local needs, political climate, or economic circumstances.

Suspended or floor mounted conveyors reduce forklift travel times and associated labour costs. Automated pickers may further improve both operational efficiency as well as storage capacity by permitting reduced aisle widths

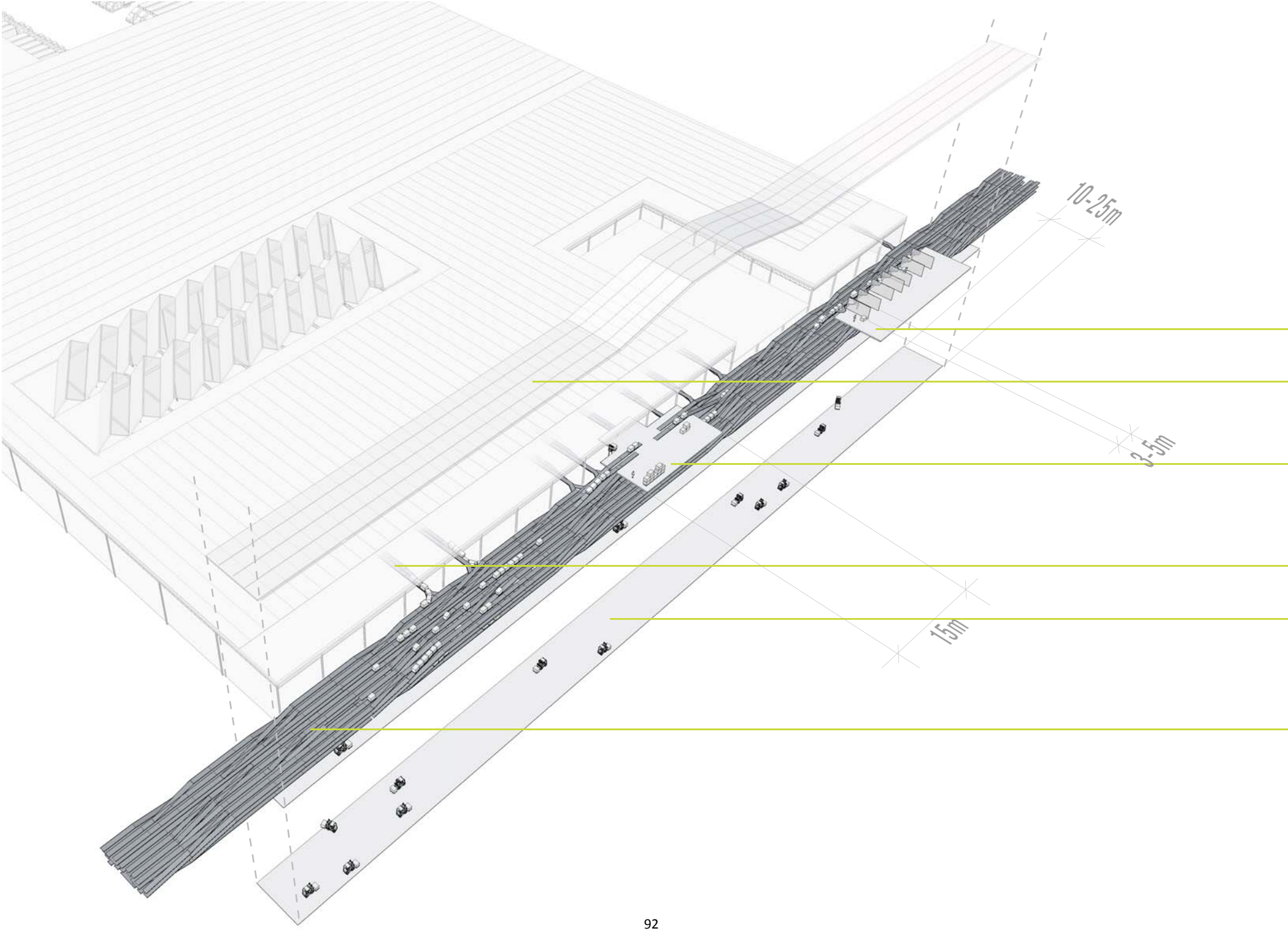
Party walls between suites may be shifted to allow for floor area swapping between tenants

Administrative areas located at perimeter in range of natural light

Lowered ceiling areas beneath administration serve as forkift charging stations

Glazed and porous partition for visibility, light permeability, and forklift access to chase

Structural grid spacing of 9m x 15m allows for aisle widths ranging from 2-5m for standard pallet shelving to accommodate a range of forklift/automated picker types


10-25m
3-5m
15m

COMPONENTS

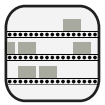
CHASE

DROP OFF POINT

VENDING LOUNGE

TRANSSHIPMENT TO LIGHTRAIL

MODES



CONVEYOR

FORKLIFT

BOX CART

LIGHTRAIL

Fig 3.15

CHASE

The vending lounge is a series of private/semiprivate rooms in which visitors may browse, inspect or purchase items held on reserve anywhere within the cluster. Interactive displays allow for targeted searches or casual perusal of real-time inventory. Selected items are transported to the associated room via the conveyor network for inspection and/or automated purchase on the spot. Vending lounges may be located anywhere with access to conveyors.

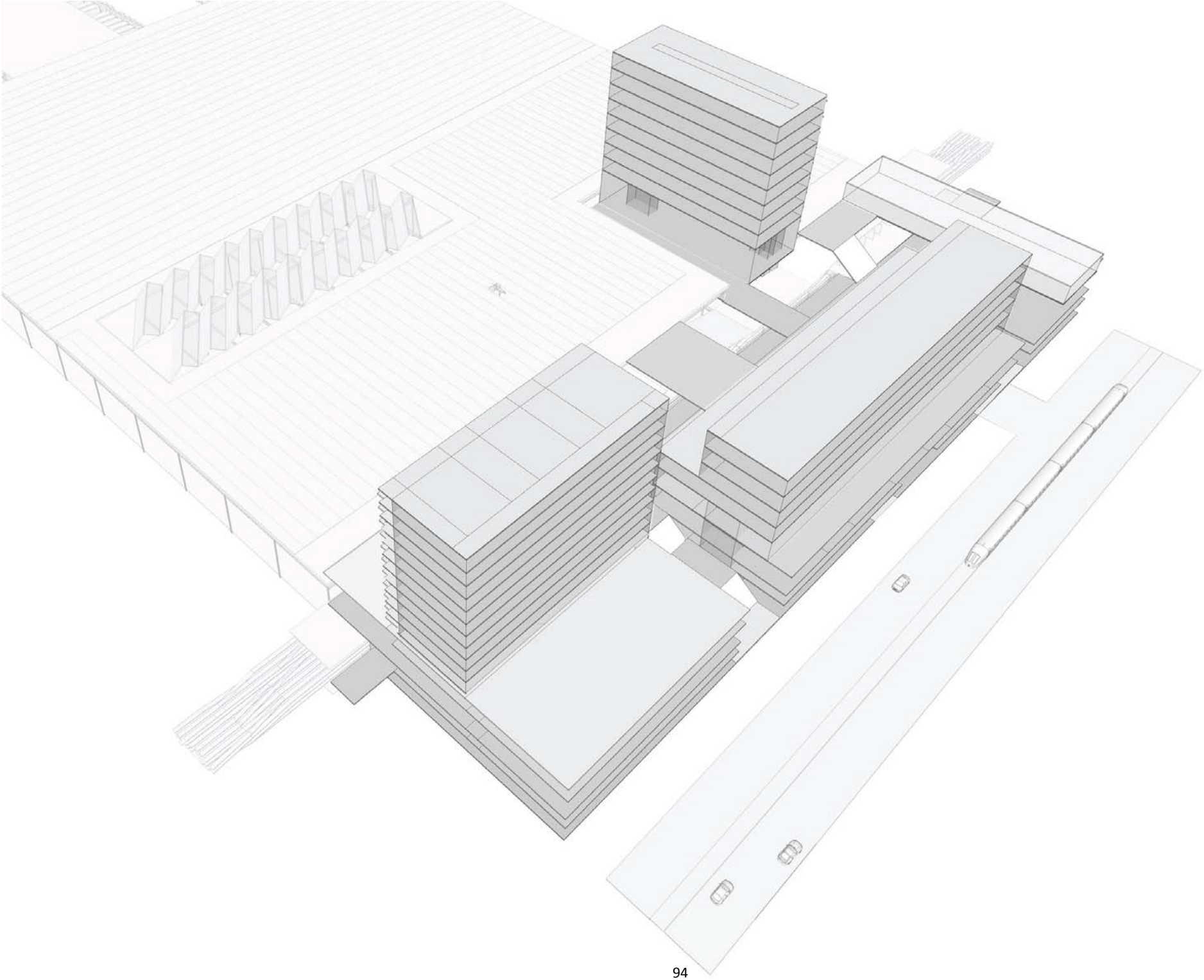
The chase enclosure is glazed to permit natural light permeance and spectatorship of chase activity from without.

Drop off points allow seam program elements to plug into the complex for all pickup and delivery requirements. Drop off points are located above or adjacent to the chase at a max. elevation of 8m, accessible to both forklifts and conveyors.

Conveyor strands from storage areas connect to the main conduit as often as required. A finer mesh of conveyor connectivity is constructed by tenants with higher throughput in order to minimize forklift driver travel distances or eliminate the necessity for forklifts altogether within the suite.

The electric forklift highway provides a fast and fluid connection between suites to facilitate operational consolidation throughout the complex.

Upper levels of the chase are occupied by a bundle of conveyors facilitating smooth and efficient automated circulation throughout the complex. The width of the conveyor cluster varies according to goods traffic volumes. The strands of the conveyor may be bundled tightly or frayed apart to permit visibility and access through their midst.



COMPONENTS

GREENHOUSE

MED. SCALE WHOLESALE

MED. SCALE ASSEMBLY

INFORMATION CONTROL/OFFICES

BIG BOX SUPERMARKET

BIG BOX RETAIL

LIVE-WORK STUDIO/ARTISAN WORKSHOP

CONVENIENCE/ SPECIALTY FOOD RETAIL

SMALL SCALE RETAIL/SERVICES

FARMER'S MARKET

RESTAURANTS

PEDESTRIAN WALKWAYS

P

PARKING

MODES

FORKLIFT

BOX CART

CAR

LRT

WALK

Fig 3.16

SEAM

The seam is heterogeneous in nature. Its mass and composition may vary according to context. The typified condition demonstrates how a number of standard program types might populate this zone.

Commercial and community uses tend toward the lower, public areas. Office and residential uses tend toward the upper, private areas. A multi layered public concourse threads these elements together. Beginning at street level, it rises gently to culminate in gratifying views over the expanse of roofscape. Public access paths perpendicular to the arterial road act as block subdivisions. These blocks may function as incremental units for gradual seam construction over time.

Overall density spikes at the seam to capitalize on the LRT. Commercial uses at the base range from the small scale, independent vendor to the big box retail. These elements plug directly into the flows of the chase. In doing so, they fluidly connect to remote networks of supply and consumption. By coordinating operations with others in the complex, smaller enterprises may introduce new scale economies into their supply chains. Retail or wholesale venues locating here might be supplied from anywhere within the massive storage areas. Shortcutting the supply chain in this way eliminates the most energy intensive last mile of the supply chain. The spatial layouts and stocking rhythms of these commercial spaces evolve as they exploit the possibilities presented by the new format. Over time, new models of retail and systems of production emerge.

The template must also come equipped with the necessary fiscal tools to spearhead the realization of such large scale, progressive projects. Dialogue across a wide cross section of stakeholder representatives helps to identify strategies to this end. Forums such as the Southern Ontario Gateway Council must be activated, bringing together the voices of the trucking, railway, air and marine industries, as well as courier companies, distributors, manufacturers, logistics providers, transit providers, and all levels of government. Together, along with new orders of regional scale governance, they could identify prospective tenants, sources of capital, and sites for subsequent applications. Public-private-partnerships and user pay schemes could help work toward self-financing over the longer term. To establish a sound empirical basis for demonstrating the proposal's economic potential, new legislation must require goods movers to share data on their travel behaviours. More detailed studies may then work to develop precise tactical strategies as well as convince future investors of the product's larger, catalytic potential.


Image © 2009 First Base Solutions

03.2 APPLICATION

A closer inspection of the site's context informs how the new typology is applied and inflected. Directives outlined in 'Anatomy of the Type' serve as an elaborated zoning law, ensuring that increments of land development will lead to a coherent operational whole once the site is built out completely. For example, even though the chase may prove unnecessary to the first unit constructed, a space allowance for this use must be designated for the future. Similarly, property nearest to the LRT corridor must consist of finer grained, mixed use programming with a specified maximum street frontage area per suite to accommodate the pedestrian experience.

The majority of the site's land is owned by a retired farmer who owns a rooming house for horses. Adjacent former farm plots have been sold to developers, who are seeking out industrial tenants to venture on custom design-build projects (fig 3.18). A number of other sparse commercial uses populate the eastern edge of the site, such as gas stations, coffee shop franchises, and a used car dealership. The demonstration assumes that the entire site footprint can obtained for conversion to the fused cluster format. Displaced businesses are compensated or re-accommodated within the new configuration.

Fig 3.17 Demonstration site

In suggesting possible programming options for the seam, activities found in nearby areas are taken as indicators for local demand. East of Hurontario, the development is predominantly single family detached residential with a density of roughly 17 units per hectare. Two new high-rise condo towers will soon be constructed to the north of the site. Intermittent strip malls and car related services are found along the arterial road. In the areas immediately west and south of the site, industrial and commercial uses are interspersed. Here we find a dominance of wholesale, fabrication and distribution enterprises, as well as an eclectic array of various other establishments including karate classes, bible assembly, more car services, a bingo hall, a pub, a motel, and Islamic society centre, a polish foods specialty store, a party rentals store, and so on. This expansive collection of overlapping uses testifies to the resiliency of each type. Provided their basic requirements and sensitivities are tended to, community functions, goods movement infrastructure, and a variety of entrepreneurial activities may share a site or a footprint. The scheme proposed for the undeveloped site seeks to accommodate a similar multiplicity of use types in their existing state. Through a strategic reconfiguration of this rich kit of parts, the same auto oriented landscape becomes transit oriented, while the truck oriented freight activities evolve to become rail oriented.

Fig 3.18 Site photos: a story of transition


TRY US AUTO
454-5954
SINCE 1990
GMC


Life Tabernacle
Ministries
Sunday
Service
Morning Service
Evening Service

Fig 3.19 An eclectic mix of uses within a singe strip mall adjacent to the site.

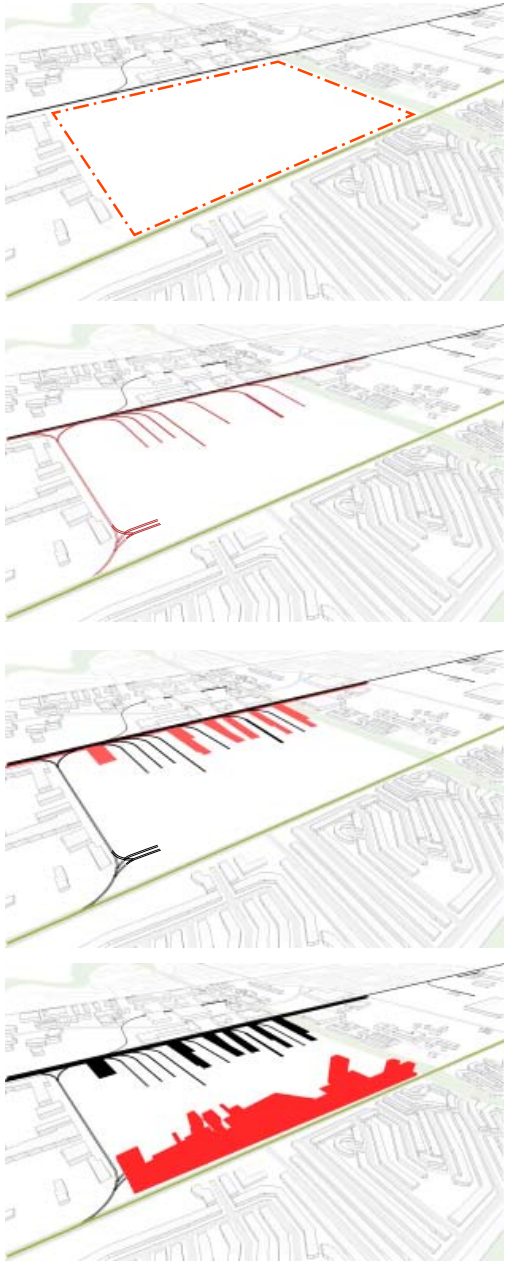


Fig 3.20 Site strategies

Rail docking interfaces

Rail-LRT connection

Truck docking interface

New truck access road parallel to CP rail line

Plug-in urban interface

Logistical components such as the cross-dock and storage/assembly areas are either speculatively built, or tailored to the specific preferences of prospective tenants. The demonstration exhibits a range of possible balances between cross-dock and cyclic flow as well as truck and rail docking. Flexible components such as the roof and seam programming are added gradually, in accordance with market demands or local government incentives. The cluster functions as a cooperative venture, with a percentage of tenant fees put toward the operational costs of shared items such as the chase or packaging equipment. Fees are negotiated on a case by case basis, according to the tenant's use. These fees may be offset in part with income from rooftop space rental.

The cluster incorporates a multiplicity of uses which range broadly in scale. A gradient is established from largest to smallest in as one progresses east toward the Hurontario boundary. Box stores, power centres, and wholesalers have limited street frontage. The bulk of their areas is concealed behind a layer of finer grained commercial uses (fig 3.22), offering a denser and more varied experience to the pedestrian traveller.

Rooftop uses are determined by the users below. In the scenario presented, industrial scaled agriculture is the dominant rooftop use. Speculation of this type is likely for a number of reasons. In addition to rising transport costs, food availability will be threatened by the by the evolving tastes of the middle class in developing countries towards meat products, as well as the use of agricultural products for biofuel. In light of these factors, the demand for secure flows of local food will increase. Adjacent tenants partner together to offer up larger lots which are preferable for industrial scale farming. These surfaces have the unique advantage of being large enough for great scale economy in farming operation, while also benefiting from an urban location with immediate connections to efficient inter/intracity transport networks.

Areas with higher energy use and/or daylight requirements may augment their rooftop production with saw-sectioned PV/skylight units. As automated operations dominate many of the storage/assembly areas, PV/skylight units are most often installed over cross docking areas where the density of manual labour is higher. Additional roof areas serve as a zipcar rental lot., as well as a summer/winter sports camp/skating rink. A commuter lot sits in a central location at roof level. As commuters trickle down towards the street via a network of pedestrian paths, they are filtered through a rich array of small commercial businesses which thrive on their traffic.

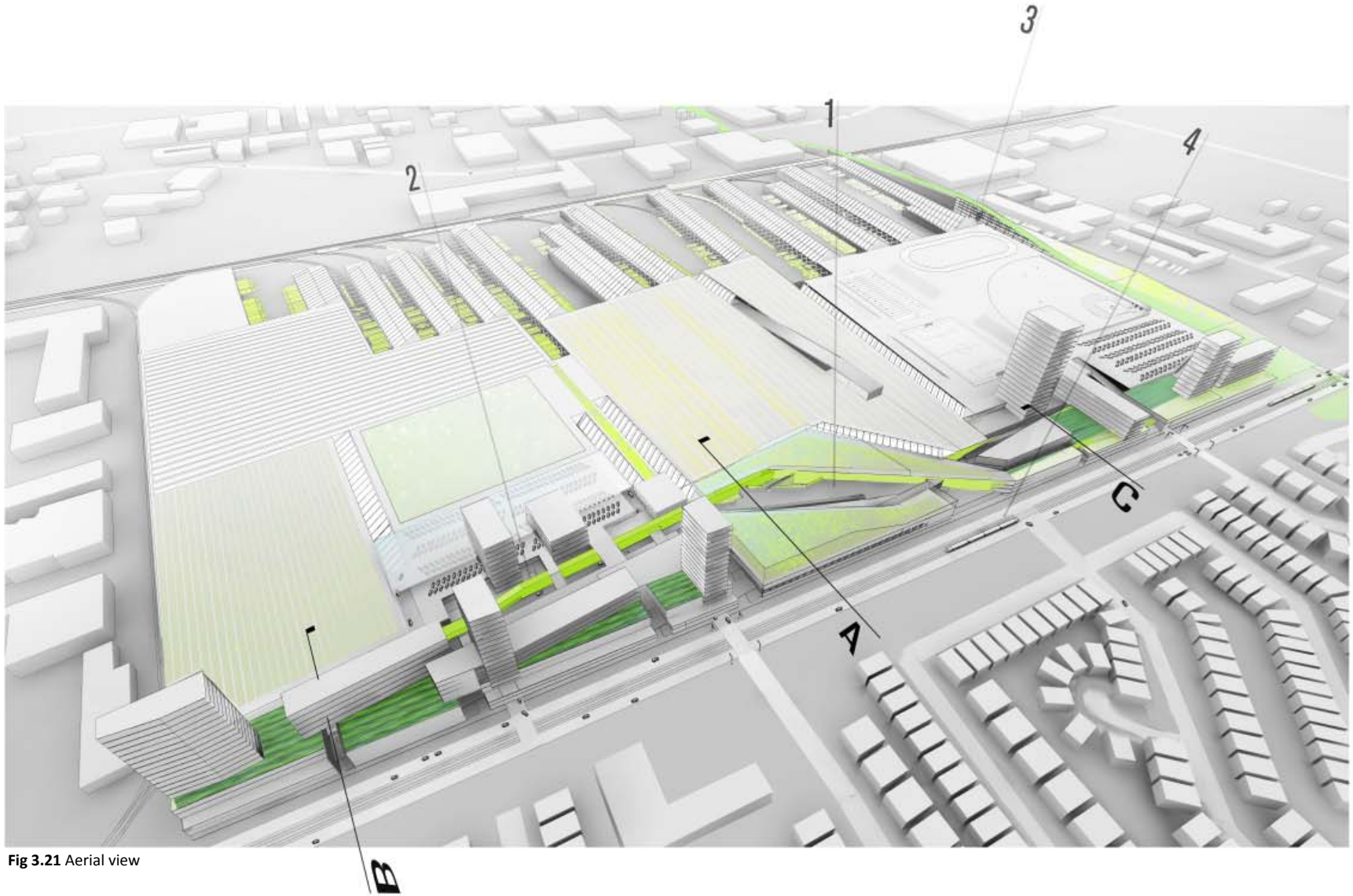
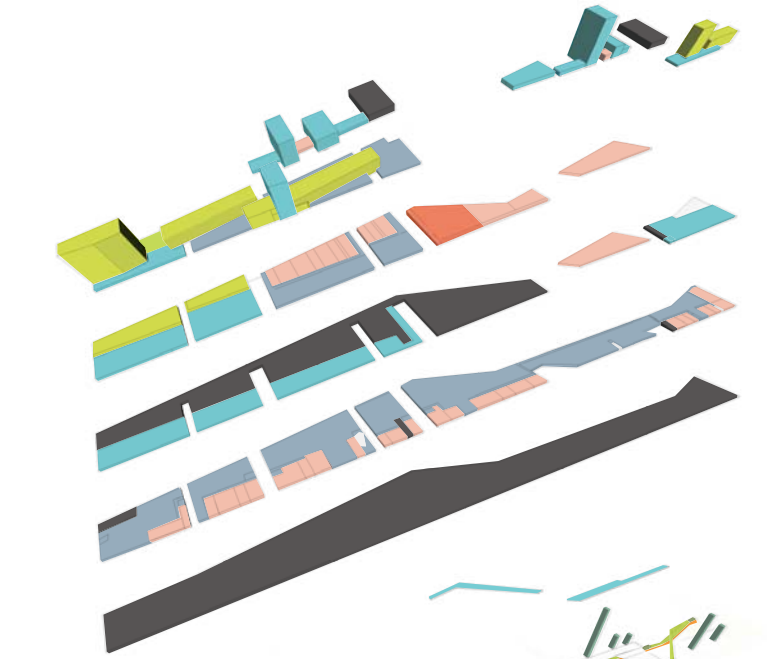
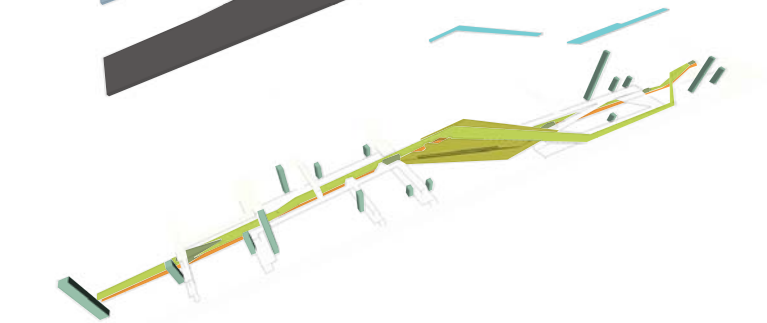


Fig 3.21 Aerial view





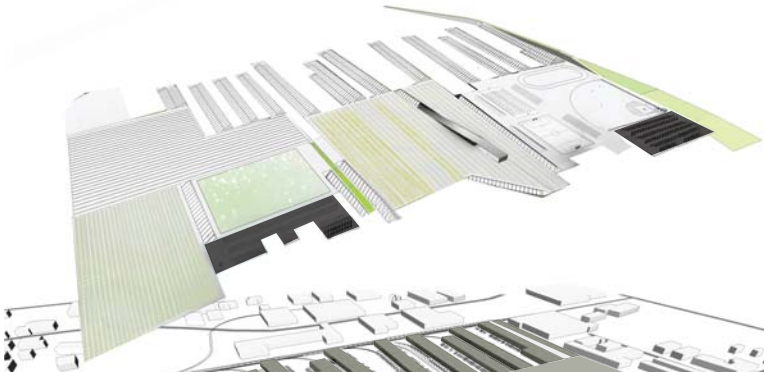
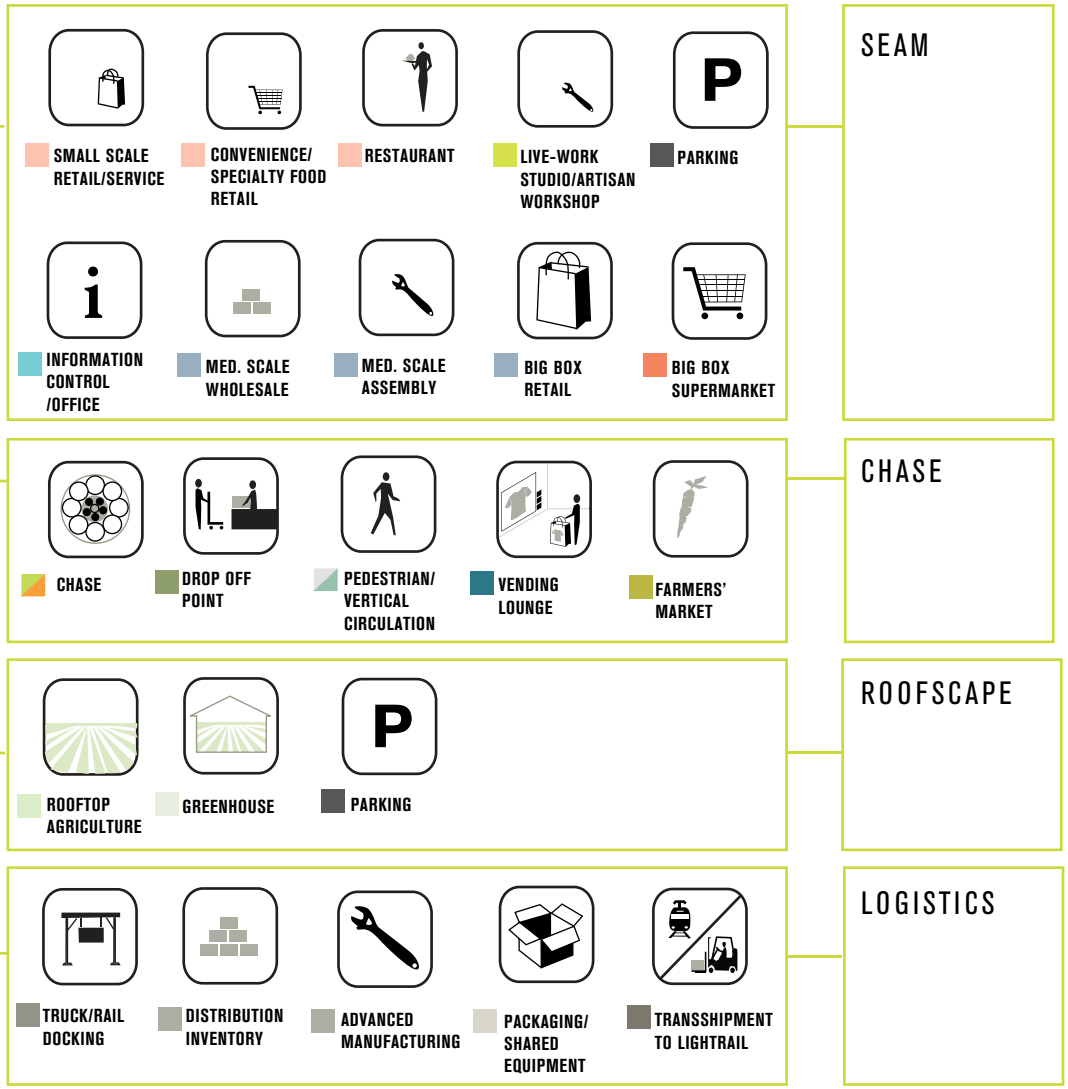
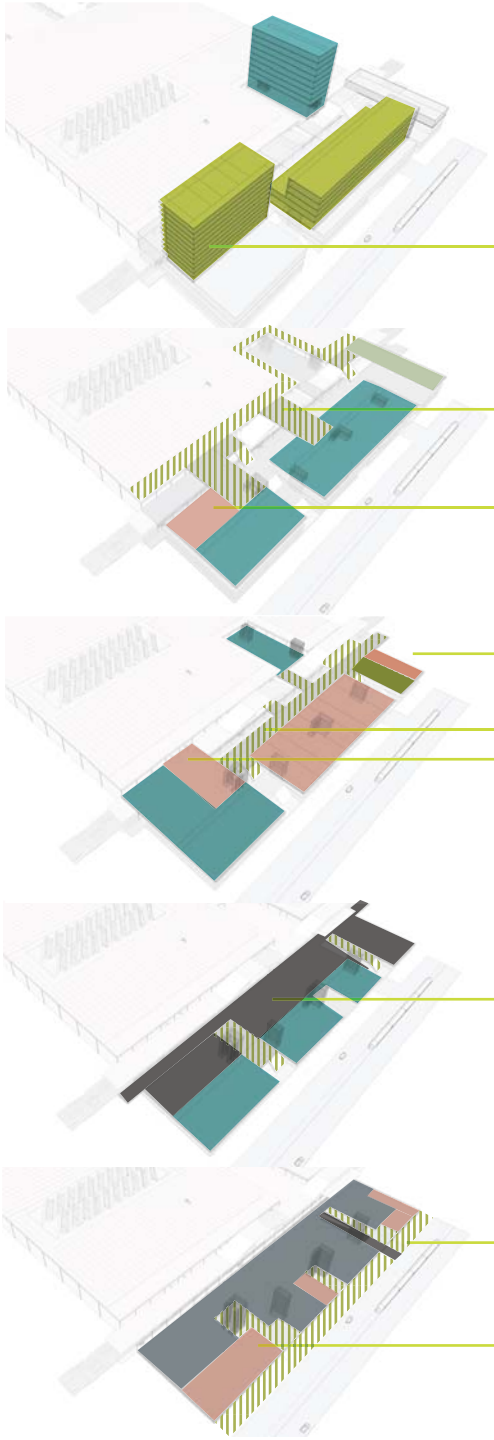


Fig 3.22

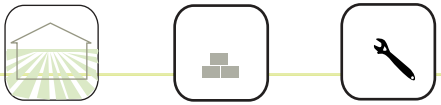
FUSED LOGISTICS CLUSTER

COMPONENTS




+...
+12.00
+7.00
+4.00
+0.00

COMPONENTS



GREENHOUSE

MED. SCALE WHOLESALE

MED. SCALE ASSEMBLY

INFORMATION CONTROL/OFFICES

BIG BOX SUPERMARKET

BIG BOX RETAIL

LIVE-WORK STUDIO/ARTISAN WORKSHOP

CONVENIENCE/ SPECIALTY FOOD RETAIL

SMALL SCALE RETAIL/SERVICES

FARMER'S MARKET

RESTAURANTS

PEDESTRIAN WALKWAYS

PARKING

Fig 3.23

SEAM DETAIL

Live-work studio suites and artisan workshops overlook the expanse of rooftop agriculture

Access to the warehouse roof level are reached by a continuous pedestrian path which bridges across the concourse below

Health clubs, libraries, day care services, cafes, or bars may locate at warehouse roof level to benefit from views and access to pedestrian traffic along rooftop recreation pathways

A supermarket and adjacent farmer's market sell produce from both the community greenhouse above and nearby outdoor rooftop farm

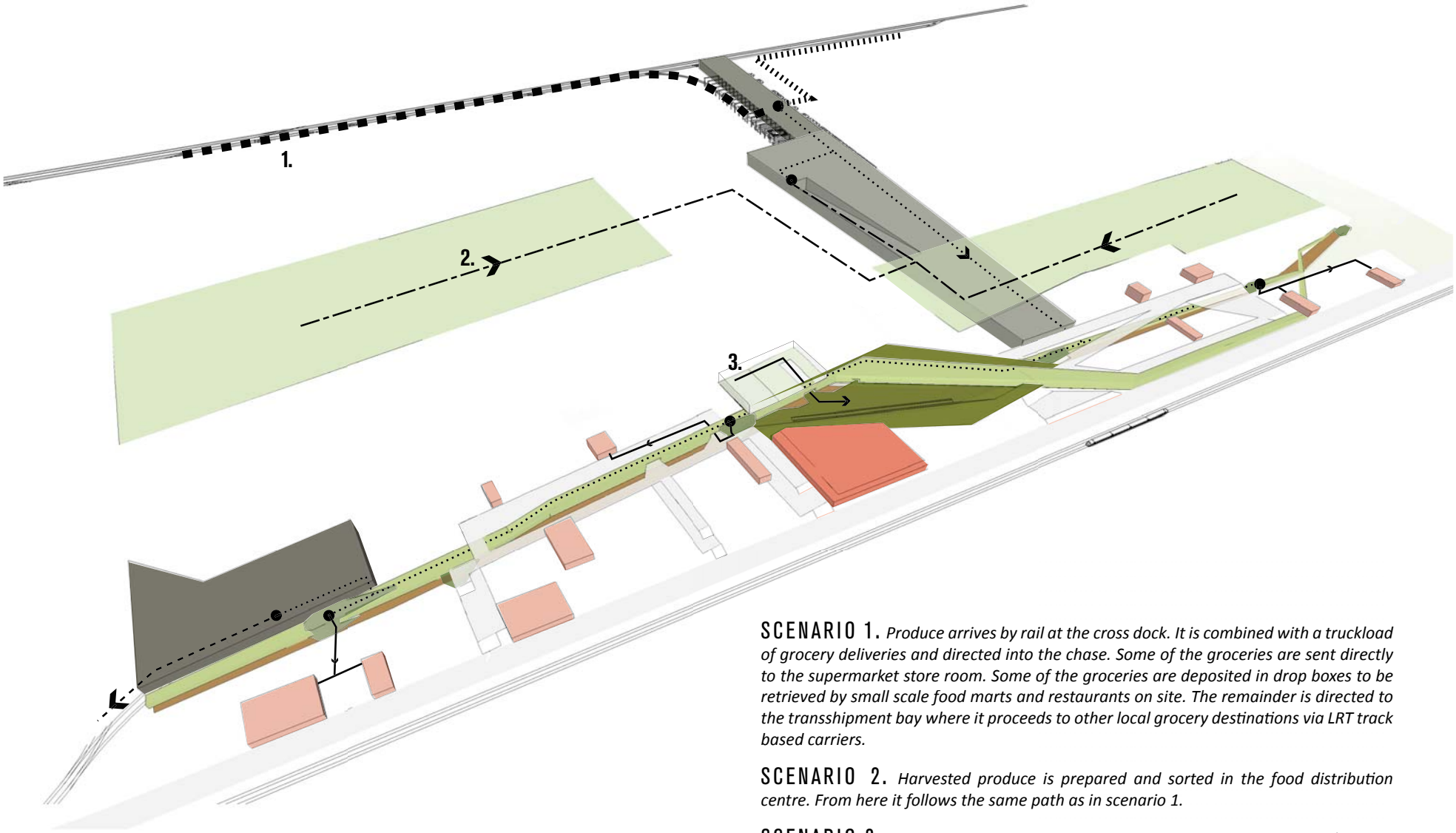
Pedestrian concourse overlooks chase activity and warehouse operations beyond

Live-work related uses such as lobbies, laundry or storage areas which do not require ample natural light may be located towards the interior of the complex, adjacent to and overlooking warehouse and chase areas

Short term visitor parking serving both concourse and grade level retail is open to above, allowing for convenient access without disorientation. Cars travel adjacent to the chase in a parallel flow

Long term parking for residents or employees is located below grade, accessible from the arterial road

Retail and services are accessible off both the concourse and arterial road. Essential amenities are encouraged to promote trip chaining and increased transit use by employees or visitors to the complex. Such amenities include banking services, a wide variety of eating establishments, drug stores, child care, dry cleaners, hair styling, office supply, copy and print shops, and overnight delivery



SCENARIO 1. *Produce arrives by rail at the cross dock. It is combined with a truckload of grocery deliveries and directed into the chase. Some of the groceries are sent directly to the supermarket store room. Some of the groceries are deposited in drop boxes to be retrieved by small scale food marts and restaurants on site. The remainder is directed to the transshipment bay where it proceeds to other local grocery destinations via LRT track based carriers.*

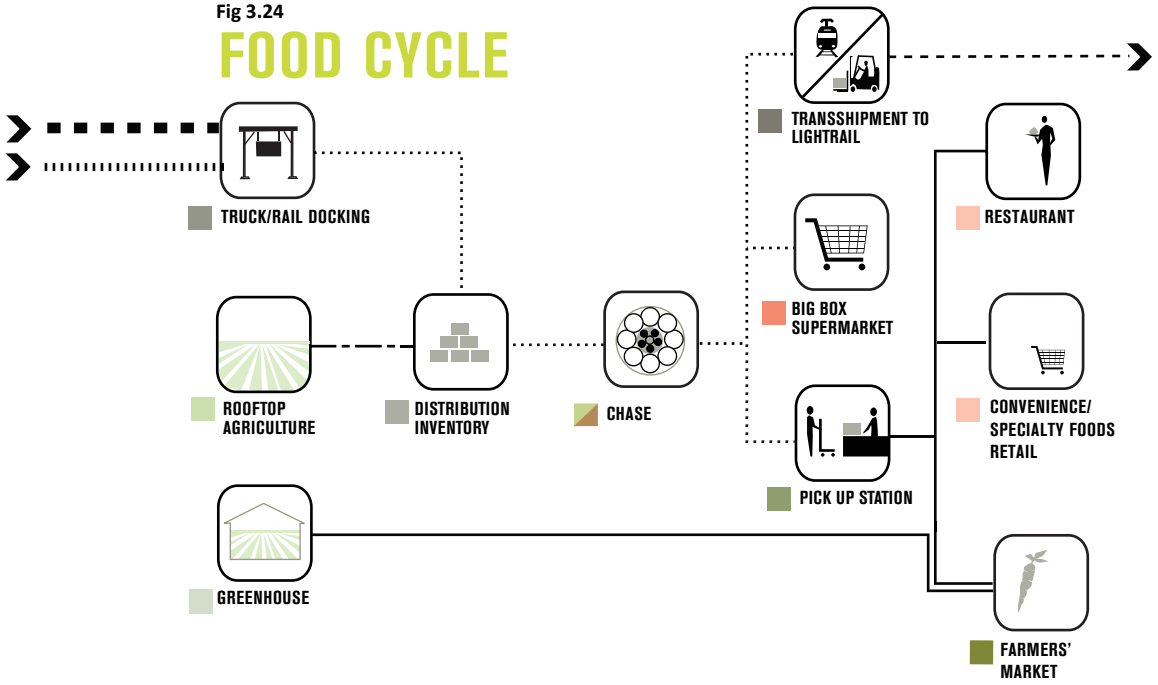
SCENARIO 2. *Harvested produce is prepared and sorted in the food distribution centre. From here it follows the same path as in scenario 1.*

SCENARIO 3. *Harvest from the greenhouse is brought directly to the indoor/outdoor weekly farmers' market for sale.*

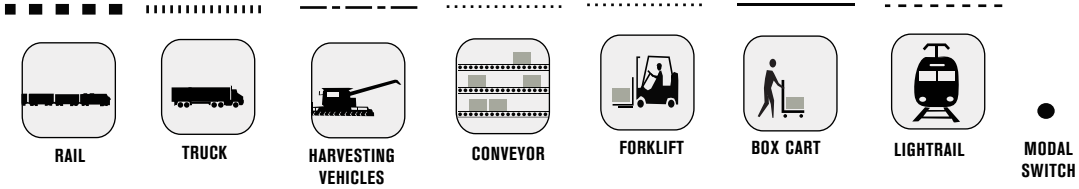
SYSTEMIC INTERACTIONS The chase serves as a smoothing agent to all internal goods circulation throughout the complex. Common supply chain strategies become the basis for new, synergetic relationships between producers, distributors, and consumers.

Fig 3.24

FOOD CYCLE



MODES



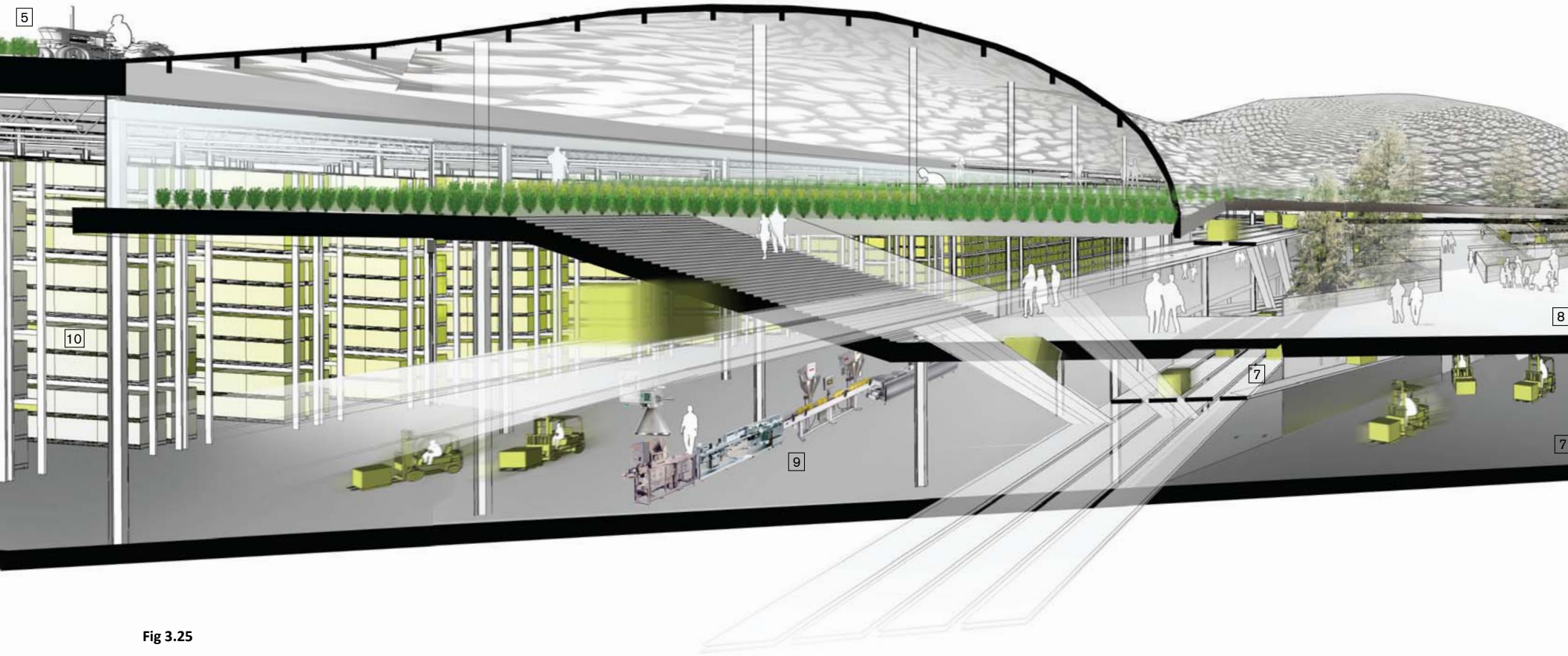
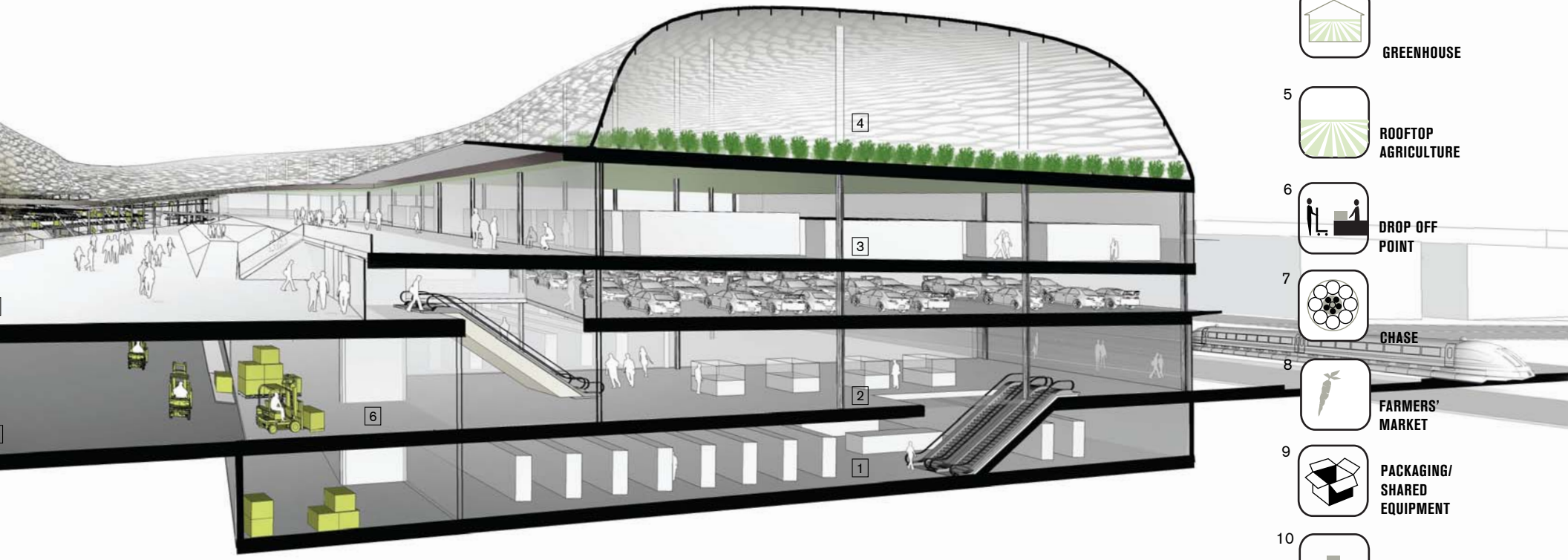


Fig 3.25

SECTION A



1 BIG BOX RETAIL

2 SMALL SCALE RETAIL/SERVICE

3 BIG BOX SUPERMARKET

4 GREENHOUSE

5 ROOFTOP AGRICULTURE

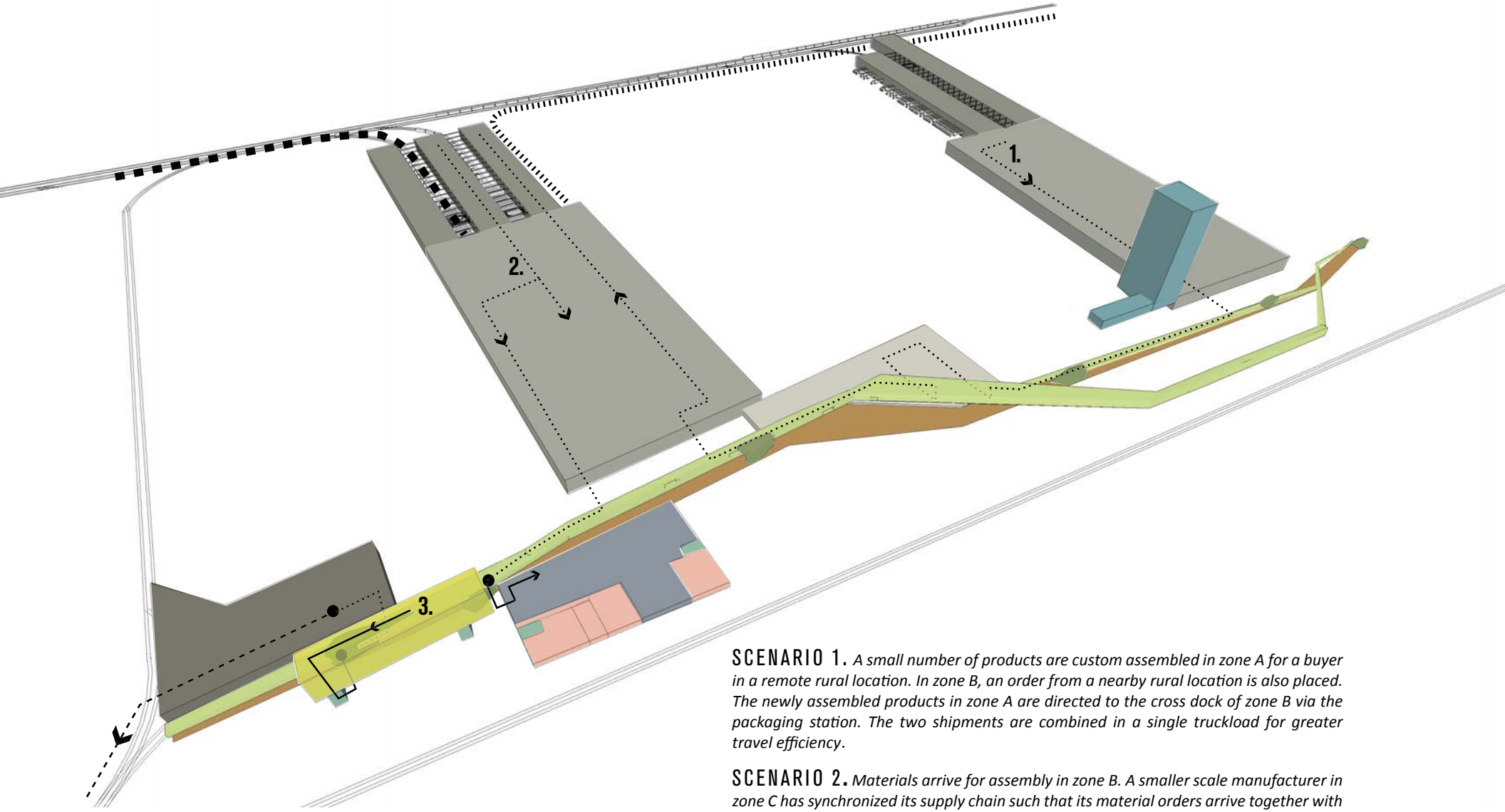
6 DROP OFF POINT

7 CHASE

8 FARMERS' MARKET

9 PACKAGING/ SHARED EQUIPMENT

10 DISTRIBUTION INVENTORY



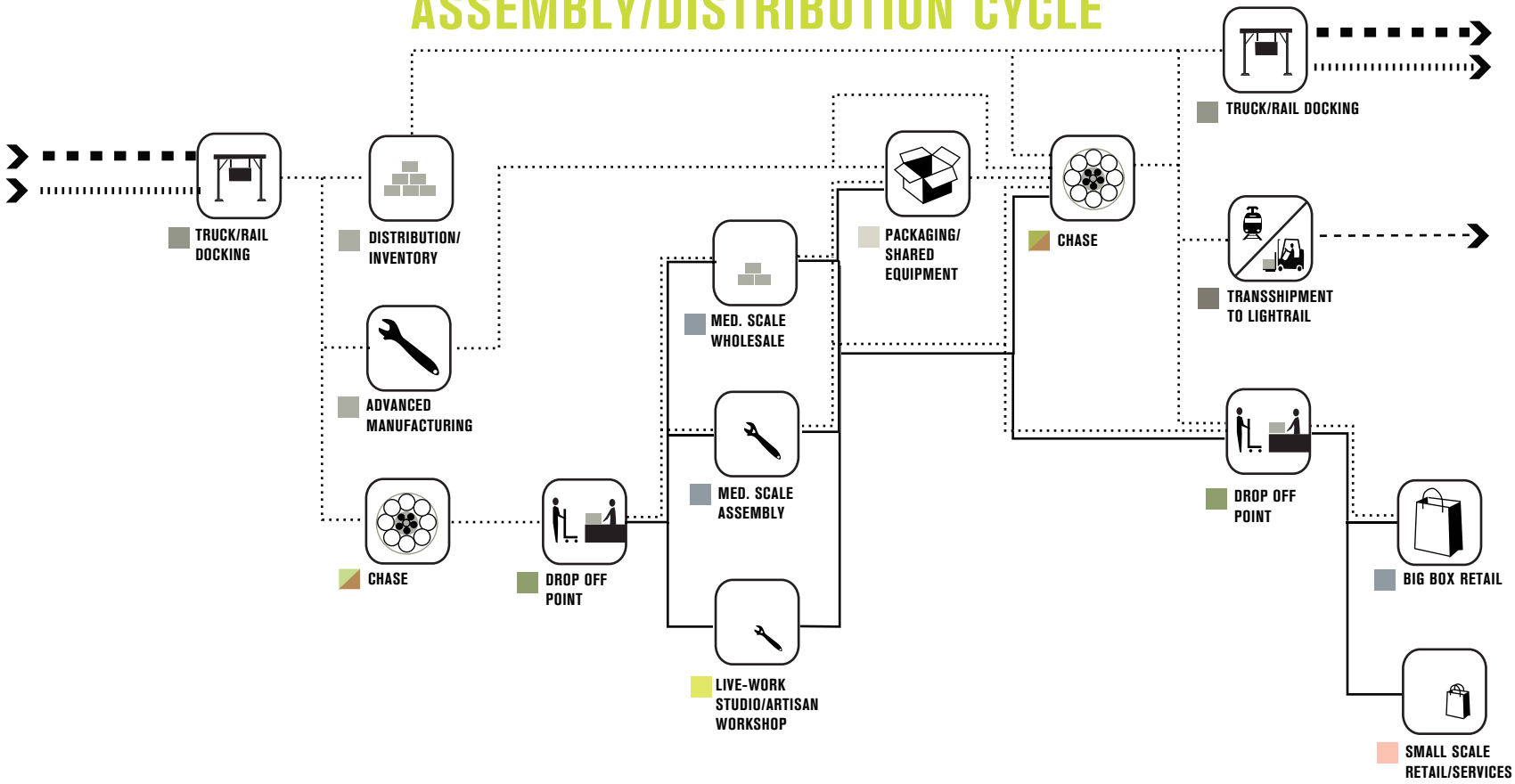
SCENARIO 1. *A small number of products are custom assembled in zone A for a buyer in a remote rural location. In zone B, an order from a nearby rural location is also placed. The newly assembled products in zone A are directed to the cross dock of zone B via the packaging station. The two shipments are combined in a single truckload for greater travel efficiency.*

SCENARIO 2. *Materials arrive for assembly in zone B. A smaller scale manufacturer in zone C has synchronized its supply chain such that its material orders arrive together with this shipment. These are retrieved at the nearest drop station.*

SCENARIO 3. *A local artisan residing in the complex receives an order from a downtown location. The delivery is deposited in the nearest drop station, and proceeds to the transshipment bay where it is sent to a downtown drop station via light rail carriers.*

Fig 3.26

ASSEMBLY/DISTRIBUTION CYCLE



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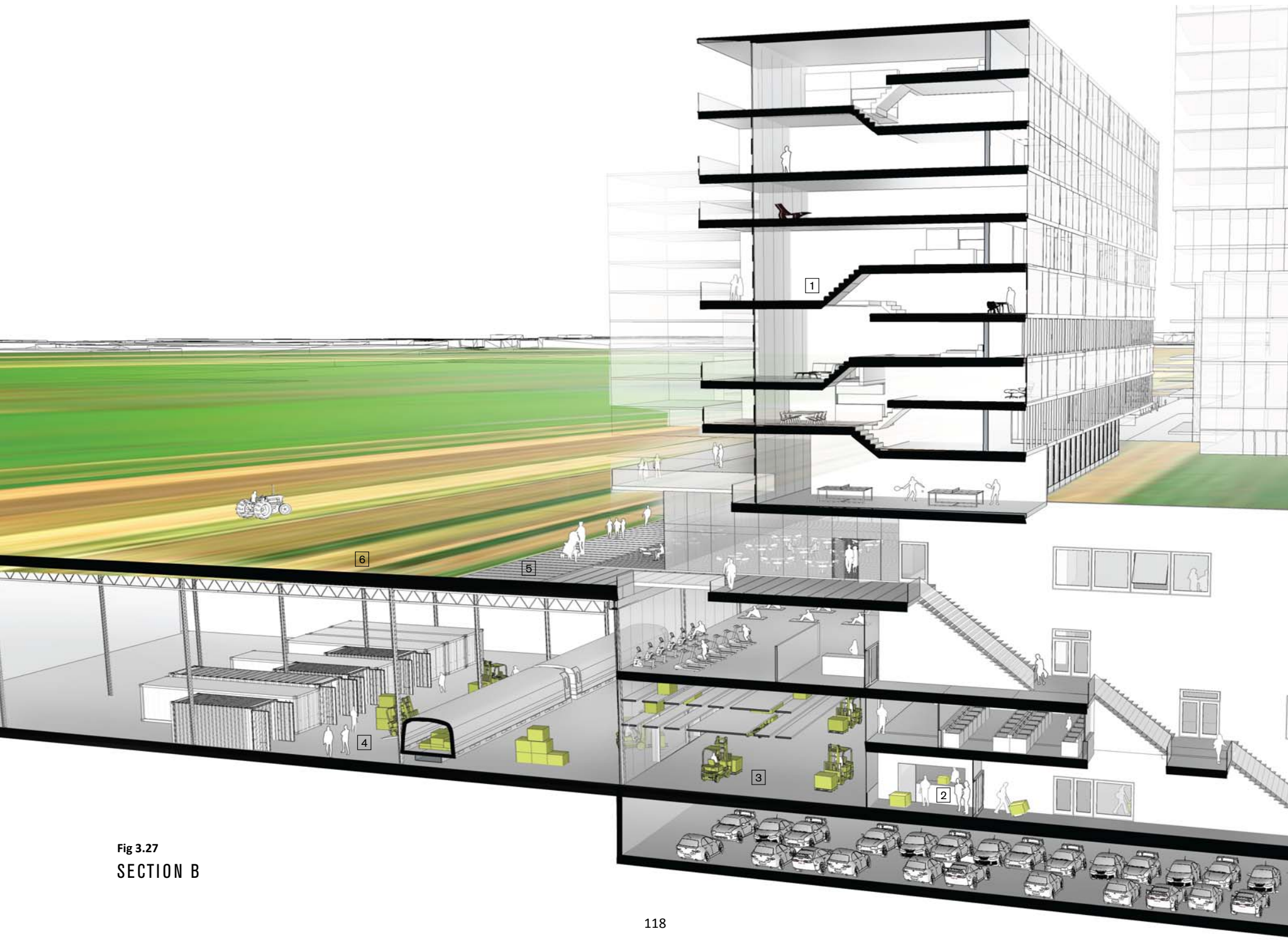


Fig 3.27

SECTION B

1 LIVE-WORK STUDIO/ARTISAN WORKSHOP

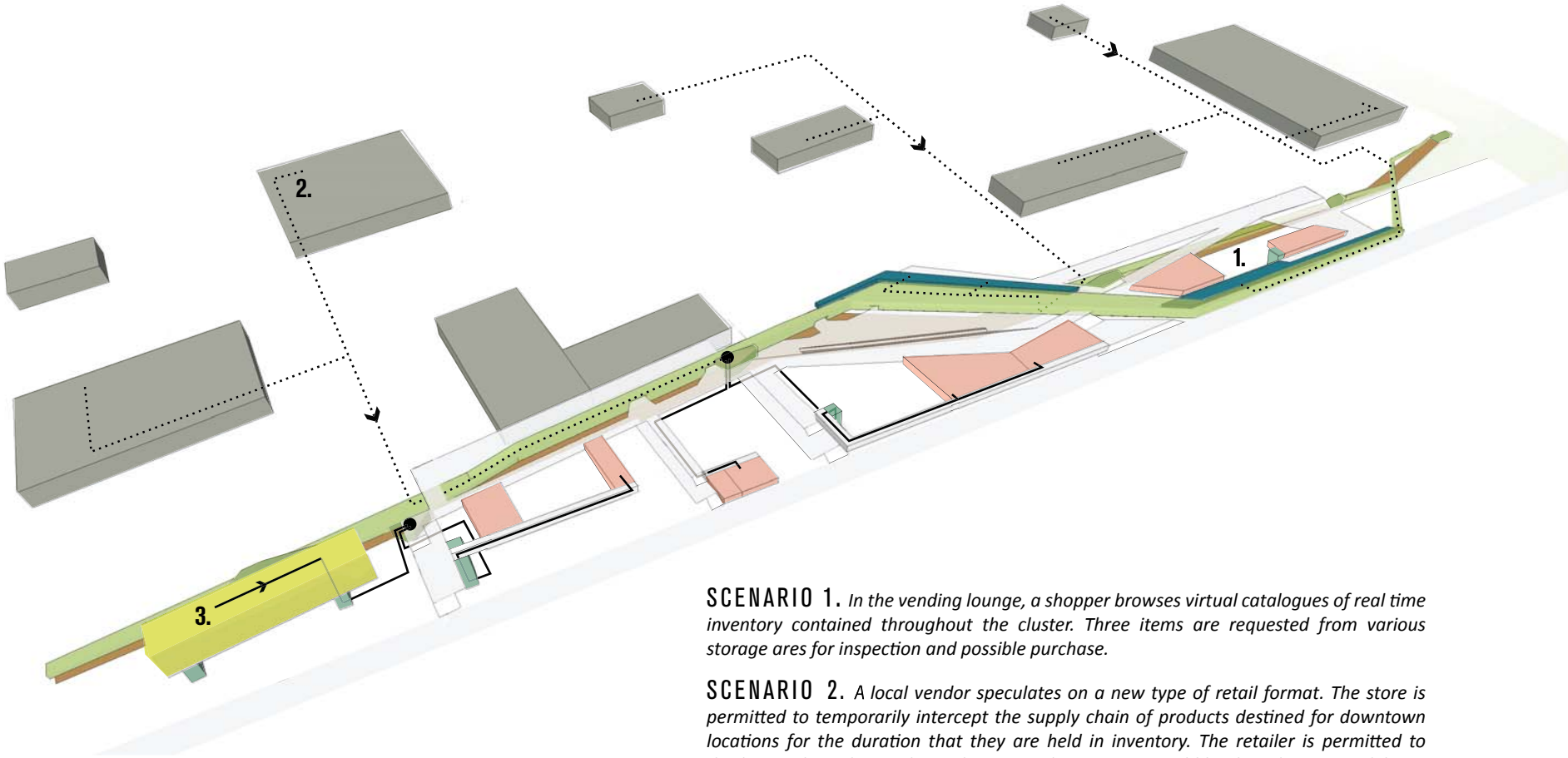
2 DROP OFF POINT

3 CHASE

4 TRANSSHIPMENT TO LIGHTRAIL

5 PEDESTRIAN/ VERTICAL CIRCULATION

6 ROOFTOP AGRICULTURE



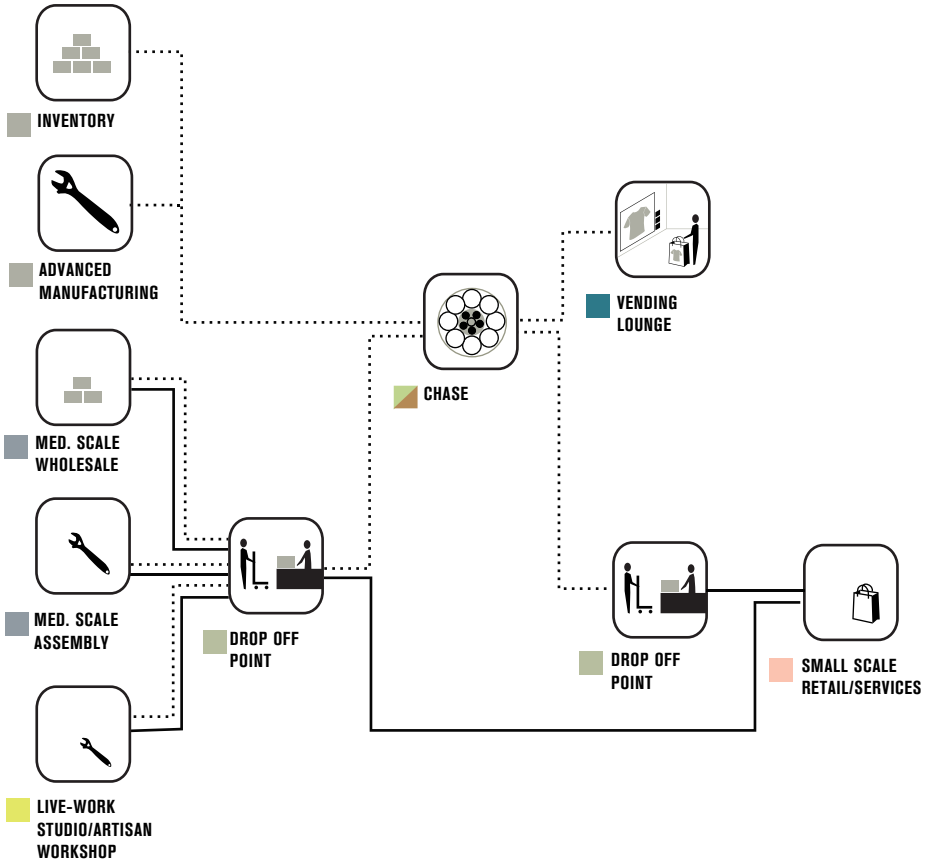
SCENARIO 1. *In the vending lounge, a shopper browses virtual catalogues of real time inventory contained throughout the cluster. Three items are requested from various storage ares for inspection and possible purchase.*

SCENARIO 2. *A local vendor speculates on a new type of retail format. The store is permitted to temporarily intercept the supply chain of products destined for downtown locations for the duration that they are held in inventory. The retailer is permitted to display stock on the condition that items that remain unsold by their downtown delivery date must be returned. The retailer opts to stock the most popular items as indicated by real time data.*

SCENARIO 3. *A local artisan displays newly completed works in a retail space fronting onto the high traffic pedestrian concourse, where it will be noticed by many*.

Fig 3.28

FLEX RETAIL



MODES

1 SMALL SCALE RETAIL/SERVICE

2 VENDING LOUNGE

3 CHASE

4 PEDESTRIAN CONCOURSE

5 MED. SCALE WHOLESALE

6 BIG BOX RETAIL

7 MED. SCALE ASSEMBLY

8 DROP OFF POINT

9 INFORMATION CONTROL/OFFICE

10 DISTRIBUTION INVENTORY

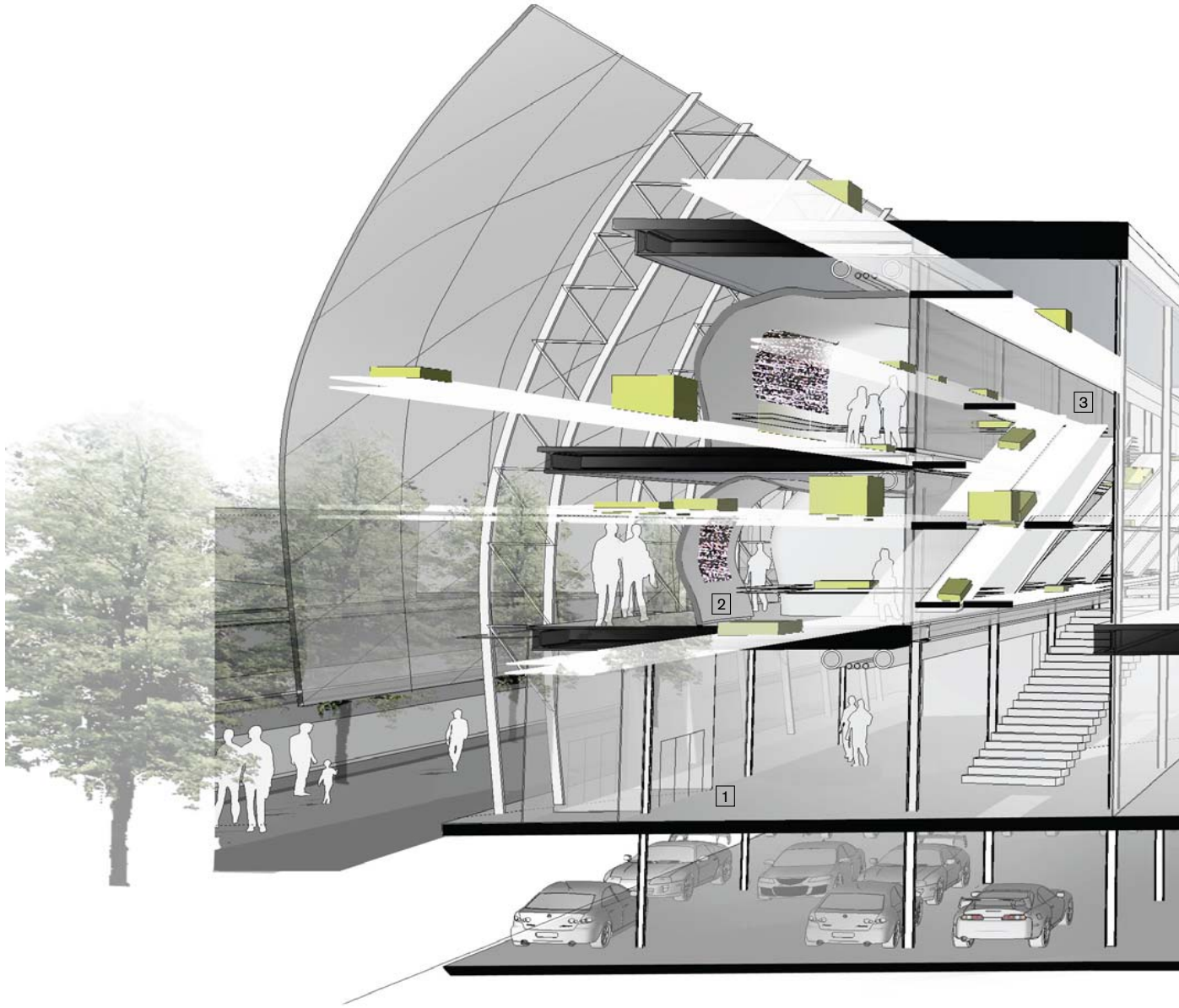
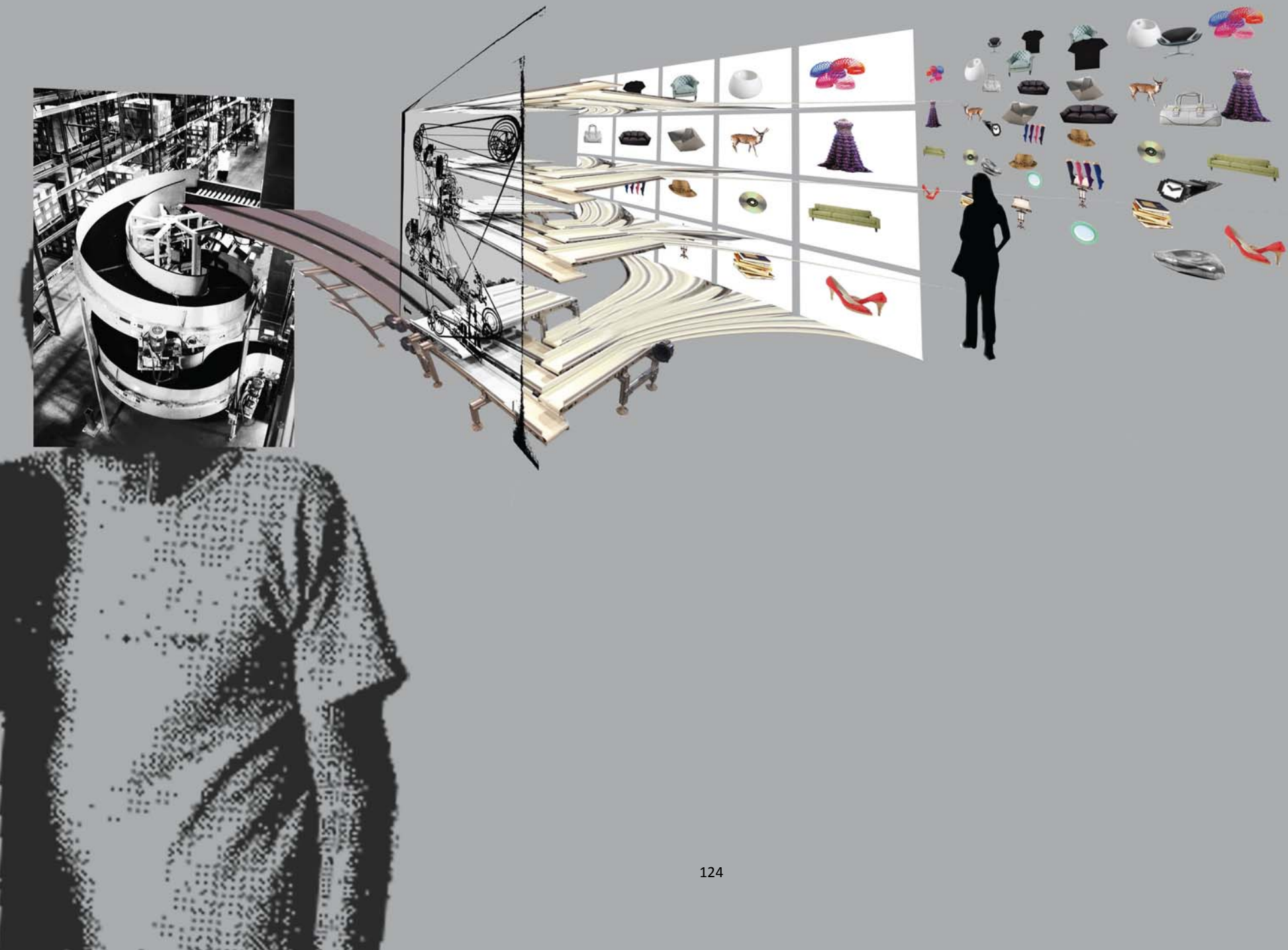


Fig 3.29

SECTION C



EPISODIC ENCOUNTERS The logistical functions of the warehouse penetrate the experience of the urban interface. The chase is showcased as an emblem of cooperation and responsible consumptive behaviours. Its transparent enclosure allows its flows to animate public spaces, as well as act as a window to the warehousing and manufacturing activities beyond. Back-of-house program such as storage and service corridors intersect with public life, creating a *heterotopia*[12] in which conventional hierarchies are challenged.

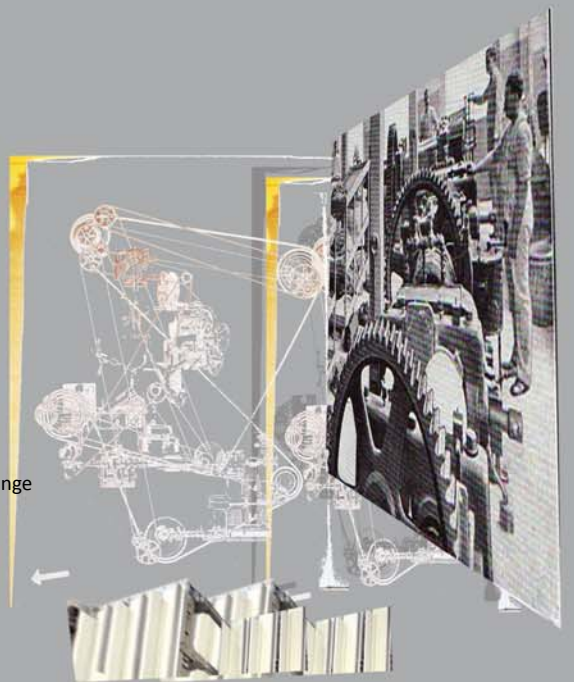


Fig 3.30 Visualization: Vending Lounge

Fig 3.31

1. THE MARKET

A weekly farmer's market occupies the central square. The greenhouse which covers the surrounding rooftops emphasizes the immediate nature of the food supply relationship. In wintertime, the market is held in an adjacent indoor space which is reached by a catwalk traversing the chase and overlooking the forklift highway.


ROCERY
FACTORY OUTLET
Custom Ceramics
DISCOUNT
U SHIP
AND CO.

Fig 3.32

2. THE CONCOURSE

A diverse mix of uses converge at the concourse level. Small scale retail captures pedestrian traffic filtering down from the rooftop commuter parking lots. Pedestrian paths connect short term parking immediately below with the concourse-level business and residential addresses. Resting and play areas offer opportunities for pause amidst the steady pulse of consumables which support daily lives throughout the city.

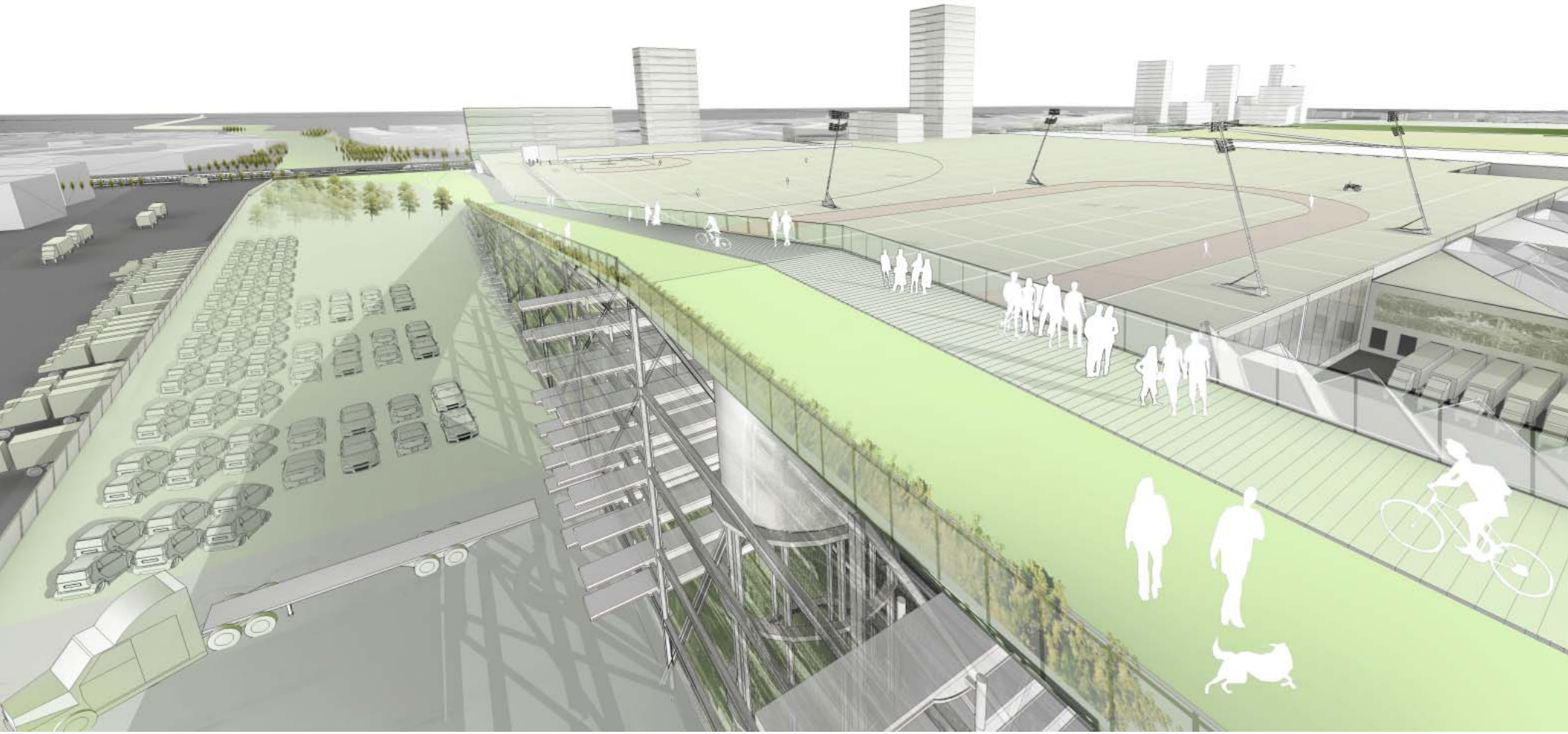


Fig 3.33

3. THE LOOKOUT

The existing greenway along the northern boundary of the site is transformed into an alluring destination for pedestrians and cyclists. The continuity of the greenway is preserved with a gentle ramp which rises up from the street to rooftop level. A water tower and outdoor vertical chassis shelving unit are combined together in a structure which serves as a public lookout point. A filament of the greenway peels upward to offer views over the vast roofscape in addition to the precisely choreographed motions of the trucks, cranes, and containers. As it descends on the western side, it bridges over the busy CP rail line. Raised above the bustling activities below, the duplicated ground plane creates its own world of profound calm.

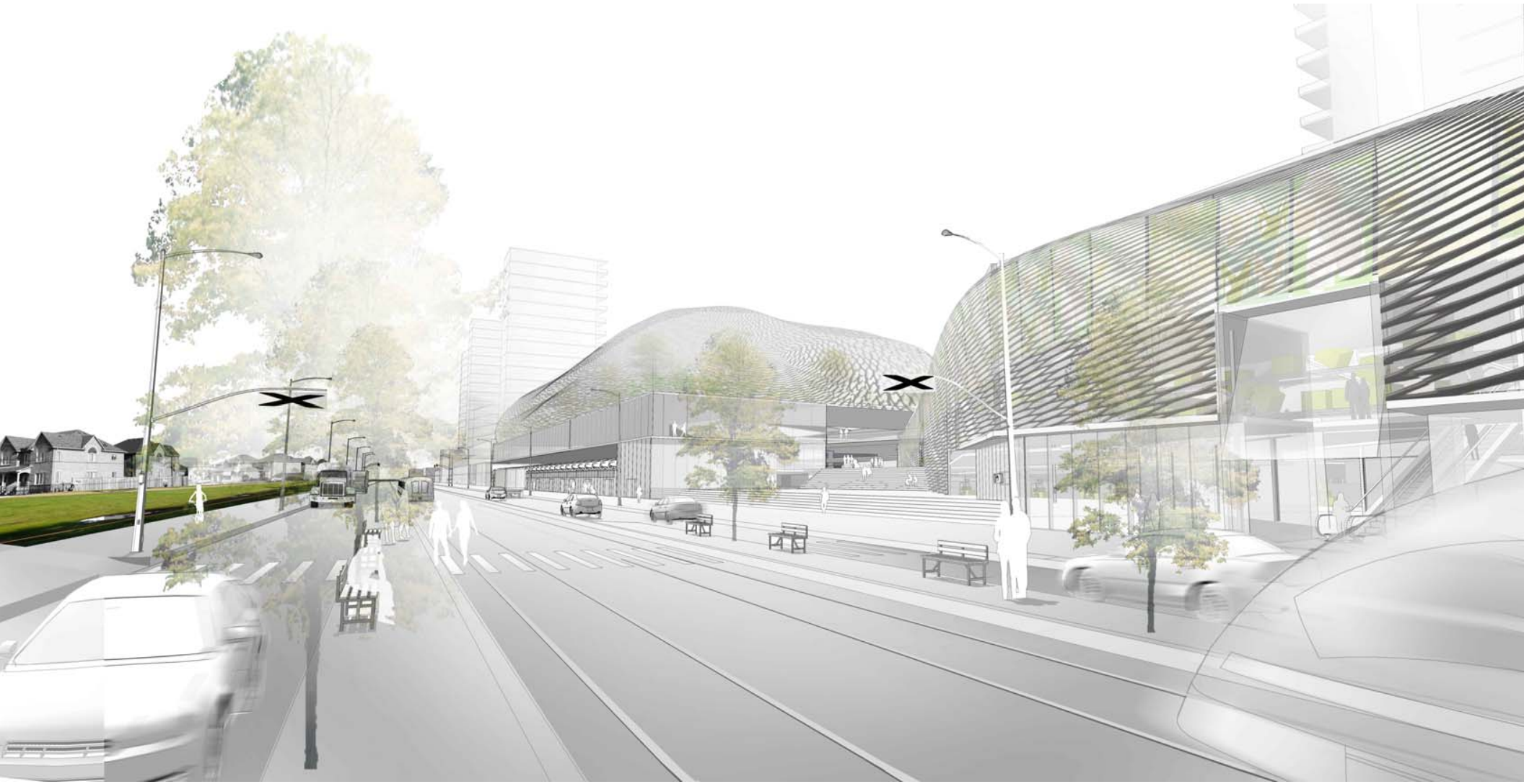


Fig 3.34

4. THE GATEWAY

The LRT stops by a grand entry to the concourse level and market. Strands of conveyors branch off from the main bundle to extend toward the street. Escaping light from the vending lounge's interactive digital displays animates the streetscape as catalogues are browsed within.

CONCLUSION

Within the Greater Toronto Area, intense road congestion and low rail service levels are threatening access to the global marketplace. The continued economic vitality of both the region and Canada at large rests heavily on finding new strategies towards sustained transport fluidity. Intermodalism is identified as an effective means of releasing the pressures of the system. Modest augmentations to the existing rail network would result in drastic improvements in overall performance due to rail's superior fuel economy, surface area needs, and carrying capacity. However at present, bottlenecks and strain at the intermodal linkages prevent optimized balance between the truck flexibility and the overall efficiency rail. These linkages are then targeted as launching points for catalytic intervention.

A new logistics cluster format circumvents the bottleneck by internalizing intermodal transfer. The trend toward agglomeration complements a strategy of localized rail network expansions within concentrated pockets of intense shipping activity. The proposed cluster serves as a nodal condition throughout which a finer articulation of both rail and truck ports are diffused. A unique lifting system allows for container unloading directly from rail flatbeds. This eliminates the need for drayage, which represents the greatest hindrance to rail's modal share. Instead, the smooth, direct connections to transcontinental routes offer renewed rail competitiveness for short and mid-range haulage.

Fig 3.35 Following page: Branding and consumer consciousness

The proposal realizes fertility within the frictions of competing land use types. An opportune locale for intervention is identified along an arterial road which is the front of maximum interference between goods-oriented and transit-supportive infrastructures. Typical of its zoning boundary condition, the arterial is flanked by vacuous buffer strips and retreating facades. Many of the routes designated as intensification corridors throughout the GTA can be described in this way. To serve as effective avenues for higher order rail-based transit, the arterials must absorb an influx of new uses and inhabitation types. In the proposed intervention, a unique urban condition is created which conflates the uses of a typical commercial arterial with those involving industrial production and distribution. A graduated urban interface at the street establishes functional specialization with managed permeability and overlap.

The cluster's metabolism and formal logic are appropriated by the urban phenomena it supports. Streamlined physical connections to global agents yield a site which is infused with competitive potential. Enterprises are lured by the obliteration of first and last mile liabilities. Their forms and logistical behaviours are rationalized in merging with those of the cluster. Conduits of the chase interlace with public experience and the commercial realm, permitting novel forms of engagement with the processes of production and consumption. Leveraged by access and scale economies, the configuration suggests new possibilities for entrepreneurial and cooperative ventures. Additional infrastructures are attracted by the surge in activity, which are instrumentally complicit. The smoothing effects spread across the city.


BIODEGRADABLE
FREE RANGE
LOCALLY GROWN
100% RECYCLED MATERIAL
GMO FREE
GRASS FED
FAIR TRADE
CERTIFIED ORGANIC


100% RECYCLED MATERIAL
CERTIFIED ORGANIC
GRASS FED
FREE RANGE
LOCALLY GROWN
BIODEGRADABLE
GMO FREE
FAIR TRADE
RAIL SHIPPED

An increasing sense of consumer responsibility has prompted marketers to brag about the environmental merits of their product, and producers to change their practices in order to do so. With the average consumer product travelling thousands of kilometres, the staggering environmental impacts of supply chain strategy and modal choice must not be overlooked as both consumer's concern and producer's marketing opportunity.

The furtive spatial designation of our city's loading operations stifles all dialogue on the subject. Freight centres and their activities are nonetheless intrusive when positioned as zones of alterity, like the restaurant kitchen, yet ultimately unconcealable. The street level exhibition of material flows gives cause for visitors to reconsider this hidden dimension of their purchasing power. A new public face for urban logistics brings its potentials out from obscurity.

ENDNOTES

introduction

1 Gilbert, Richard and Anthony Perl. *Transport Revolutions: Moving People and Freight without Oil.* London: Earthscan, 2008. 95, 122.
2 Moving the Economy, The Canadian Urban Institute. *Moving Goods in the New Economy: A Primer for Decision Makers*. Toronto: The Canadian Urban Institute. 2002. 15.
3 Research and Traffic Group. *Southern Ontario Gateway Transportation & Logistics Issues*. Southern Ontario Gateway Council. 29. <http://www.gatewaycouncil.ca/downloads2/RTG-Final-Rpt.pdf>
4 Easterling, Keller. "Forward" *Situating*. Ed. The Architectural League of New York. Young Architects Series. New York: Princeton Architectural Press, 2006. 11.

field

1 Debord, Guy. "The Organization of Territory" *The Society of the Spectacle*. New York: Zone Books, 1994. 165.
2 Easterling, Keller. Lecture. University of Waterloo. Cambridge, ON. Nov 29, 2007.
3 Debord, 24.
4 Debord, 172.
5 Debord, 172.
6 Sewell, John. *The Shape of the City: Toronto Struggles with Modern Planning*. Toronto: University of Toronto Press Incorporated, 1993. xv.
7 Harvey, David. "The New Urbanism and the Communitarian Trap: On Social Problems and the False Hope of Design" *Sprawl and Suburbia*. Ed. Stephen Graham. London: Blackwell, 2004. 21.
8 Easterling, "Forward" 11.
9 Easterling, "Forward" 11.
10 Easterling, "Forward" 11.
11 Easterling, Keller. *Organization Space: Landscapes, Highways, and houses in America*. Cambridge: The MIT Press, 1999. 4.
12 Allen, Stan. "From Object to Field." *Architectural Design* (May-June 1997): 27.
13 Easterling, *Organization Space*, 4.
14 Easterling, *Organization Space*, 76.
15 Easterling, *Organization Space*e, 68.
16 Easterling, *Organization Space*, 76.
17 Easterling, *Organization Space*, 76.
18 Easterling, *Organization Space*, 95.
19 Easterling, *Organization Space*, 94.
20 Easterling, *Organization Space*, 108.
21 Easterling, *Organization Space*, 77.
22 Easterling, *Organization Space*, 122.
23 Easterling, *Organization Space*, 77.
24 Easterling, *Organization Space*, 77.
25 Democracy itself can be seen as a fitting describable as such. The finer-grained city council structure advocated by the Situationists then represents one which produces even more adaptable results, and further still along this scale we find the Anarchists. Stan Allan criticizes an opposite extreme, arguing that the potency of architecture has "been eroded everywhere by a swollen bureaucratic apparatus"

(*Allan, 30*). The balance between bottom-up adaptability and top-down design coherency has been the subject of much contention in these circles (Marshall, Peter. *Demanding the Impossible: A History of Anarchism*. London: Fontana Press, 1993. 552.)

26 Maas, Winy. *Metacity Datatown*. Rotterdam: MVRDV/010 Publishers, 1999. 18.

27 Lootsma, Bart. "What is (Really) to be done?" *Reading MVRDV*. Ed. Veronique Patteeuw. Rotterdam: NAi Publishers, 2003. 27.

28 Lootsma, 27.

29 Allen, 30.

flow

1 Knowles, Richard, Jon Shaw and Iain Dochety. *Transport Geographies.* Malden, MA: Blackwell Publishing, 2008. 10.

2 Knowles et al., 17.

3 Knowles et al., 17.

4 Read, Stephen. "Productive Space" *Crossover. Architecture Urbanism Technology*. Ed. K. Michael Hays et al. Rotterdam: 010 Publishers, 2006. 347

5 Slack, Brian. "Intermodal Transportation" *Handbook of Logistics and Supply Chain Management*. Ed. Ann M. Brewer et al. Kildlington; Oxford: Elseveir Science Ltd., 2001. 143.

6 Gilbert, Richard and Anthony Perl. *Transport Revolutions: Moving People and Freight without Oil*. London: Earthscan, 2008. 95, 122.

7 Moving the Economy, The Canadian Urban Institute. *Moving Goods in the New Economy: A Primer for Decision Makers*. Toronto: The Canadian Urban Institute. 2002. 16.

8 Banister, David. *Unsustainable Transit: City Transport in the New Century*. New York: Routlege, 2005. 41.

9 Hidisyan, Pria. *Global Gateway Regions*. 2005. America 2050. 19. <http://www.america2050.org/pdf/globalgatewayregions.pdf>

10 Hidisyan, 24.

11 Smith, Neil. *Uneven Development*. New York: Basil Blackwell Publisher Ltd, 1984. 147.

12 Smith, 147.

13 Knowles et al. 17.

14 Hidisyan, 34.

15 Hidisyan, 34.

16 Slack, Brian. "Intermodal Transportation" *Handbook of Logistics and Supply Chain Management*. Ed. Ann M. Brewer et al. Kildlington; Oxford: Elseveir Science Ltd., 2001. 143.

17 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch5en/conc5en/tradeproduction.html>.

18 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch5en/conc5en/goodsflow.html>.

19 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch5en/conc5en/pushpulllogistics.html>.
20 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch5en/conc5en/lastmile.html>.
21 Jean-Paul Rodrigue, Brian Slack, Claude Comtois, "Green Logistics" *Handbook of Logistics and Supply Chain Management*. Eds. Ann M. Brewer, Kenneth J. Button, David A. Hensher. Kildlington, Oxford: Elseveir Science Ltd., 2001. 343.
22 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c2en.html>.
23 Thun, Geoff and Kathy Velikov. "The Post-Carbon Highway" *Fuel*. Ed. John Knetchel. Cambridge, Mass: MIT Press Ltd. 2008. 21.
24 Knowles et al., 20.
25 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c1en.html>.
26 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/spaperfroadrail.html>.
27 United States Department of the Interior, National Atlas of the United States. *Overview of U.S. Freight Railroads*. 29 April 2008. <http://www.nationalatlas.gov/articles/transportation/a_freightrr.html>.
28 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c1en.html>.
29 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c1en.html>.
30 Moving the Economy, The Canadian Urban Institute. *28.*
31 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c1en.html>.
32 Gilbert and Perl, 148.
33 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c1en.html>.
34 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c2ben.html>.
35 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c5en.html>.

36 Lanigan, Jack Sr., John Zumerchik, Jean-Paul Rodrigue, Randall Guensler, and Michael O. Rodgers. *Shared Intermodal Terminals and the Potential for Improving the Efficiency of Rail-Rail Interchange*. August 1 2006. Hofstra University. 2. <http://people.hofstra.edu/jean-paul_rodrigue/downloads/TRB2007_Shared_Terminals.pdf>.
37 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/doublestackrail.html>
38 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack.*The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c2ben.html>
39 Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c2ben.html>
41 Resor, Randolth R. and James R. Blaze. "Short-Haul Rail Intermodal: Can it Compete with Trucks?" *Transportation Research Record*. 1873. (2004): 49.
42 Resor et al., 50.
43 Resor et al., 50.
44 Resor et al., 45.
45 Resor et al., 50.
46 Resor et al., 49.
47 Rodrigue, Jean-Paul, Brian Slack, Claude Comtois. "Green Logistics" *Handbook of Logistics and Supply Chain Management*. Ed. Ann M. Brewer et al. Oxford: Elsevier Science Ltd., 2001. 349.
48 Rodrigue et al., "Green Logistics" 341.
49 Dewar, Margaret and David Epstein. "Planning for "Megaregions" *The United States Journal of Planning Literature*. Nov. 2007:120.
50 Metrolinx. *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area*. Feb. 2008. 5. <http://www.metrolinx.com/docs/general/RTPGreenPaper5.pdf>
51 Metrolinx, *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area.* 16.
52 Environment Canada. "Great Lakes Overview*"*. 19 Dec. 2007. <http://www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=FC147FA0-1>
53 Environment Canada."Great Lakes Overview*".*
54 Dewar et al., 113.
55 Dewar et al., 113.
56 Gillespie, Kerry. "More of Us, Living Better" *The Toronto Star*. 16 June 2006. A1.
57 Metrolinx, *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area*. 14.
58 Metrolinx, *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area*. 1.
59 Moving the Economy, The Canadian Urban Institute. 21.
60 Metrolinx. *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area.* 1.
61 Metrolinx. *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area*. 1.

62 Metrolinx. *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area.* 15.
64 Ministry of Public Infrastructure Renewal. *Growth Plan for the Greater Golden Horseshoe*. Ministry of Public Infrastructure Renewal. 2006. 7. <http://www.placestogrow.ca/index.php?option=com_content&task=view&id=9&Itemid=14>
65 Moving the Economy, The Canadian Urban Institute. 20.
66 Ross, Ian. "Multomodal Could Work: Expert." *Northern Ontario Business*. 4 May 2005. <http://www.northernontariobusiness.com/DisplayArticle.aspx?id=8800&LangType=1033&terms=multimodal+could+work>
67 Ontario's rail corridor taxation is 56 percent higher than the national average, and six times that of the U.S. This can be viewed as in inequitable given the argument that tax rates should not discriminate between competing industries or modes. (Moving the Economy, The Canadian Urban Institute. 28.)
68 Slack, Enid and Richard M. Bird. "Cities in Canadian Federalism." *Policy Options.* 29.1(2008):73.
69 Slack et al., 76.
70 Ministry of Public Infrastructure Renewal. *Growth Plan for the Greater Golden Horseshoe*. 14.
71 Ministry of Public Infrastructure Renewal. *Growth Plan for the Greater Golden Horseshoe*. 16.
72 Metrolinx. "About Us" <http://www.metrolinx.com/en/aboutUs.aspx>
73 Brand, Steward. Lecture. *Cities and Time.* The Long Now Foundation. April 8, 2005.
74 Metrolinx. *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area.* 20.
75 Metrolinx. The Big Move: Transforming Transportation in the Greater Toronto and Hamilton Area. Sept. 2008. 70. <http://www.metrolinx.com/Docs/DraftRTPandIS/Metrolinx%20Draft%20RTP%20-%20High%20Res.pdf>
76 Moving the Economy, The Canadian Urban Institute. 17.
77 Slack et al., 73.
78 Metrolinx. *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area.* 9.
79 Metrolinx. *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area.* 9.

form

1 Moving the Economy, The Canadian Urban Institute. 21.
2 Moving the Economy, The Canadian Urban Institute. 15.
3 Metrolinx. "15 Year Plan for Regional Rapid Transit and Highway Improvements." <http://www.metrolinx.com/Docs/DraftRTPandIS/Figure%20%204%20-%2015%20year.pdf>
4 City of Brampton Economic Development Department. *Advanced Manufacturing.* 2. <http://www.brampton.ca/economic-development/content_industry/industry_advmanuf.pdf>

5 City of Brampton. *Annual Economic Report 2002*. 6. <http://www.brampton.ca/economic-development/pdf/02annual.pdf>

6 City of Brampton. *Brampton Growth Management & Accelerated Official Plan Review Program.* 2005. 9. <http://www.brampton.ca/city_dept/plan_build/gr_mgm/dis-paper-jan05.pdf>

7 Ballis, Athanasios. “Freight Villages: Warehouse Design and Rail Link Aspects” *Transportation Research Record*. 1966 (2006): 30.

8 Supply Chain Logistics Consulting. “Cross Docking” <http://www.supplychainlogistics-consulting.co.uk/cross-docking.html>

9 Eagle, Cisco. “Cross Docking: What are the facility layout considerations?” <http://www.cisco-eagle.com/blog/index.php/category/cross-docking/>

10 Ballis, Athanasios. “Freight Villages: Warehouse Design and Rail Link Aspects” *Transportation Research Record*. 1966 (2006): 30.

11 Drury, Jolyon and Peter Falconer. *Buildings for Industrial Storage and Distribution*. Oxford: Architectural Press, 2003. 76

12 Foucault, Michael. “Of Other Spaces” *Diacritics* ed. Jay Miskowiec, Vol. 16, No. 1. (Spring, 1986): 24.

REFERENCES

books

Abruzzo, Emily A. *306090 06 Shifting Infrastructures*. New York: Princeton Architectural Press, 2004.

Banister, David. *Unsustainable Transit: City Transport in the New Century.* New York, London: Routlege, 2005.

Bart Lootsma. "What is (Really) to be done?" *Reading MVRDV*, Ed. Veronique Patteeuw. Rotterdam: NAi Publishers, 2003.Hong, Yu-Hung and Barry Needham. *Analyzing Land Readjustment: Economics, Law, and collective action*. Cambridge: The Lincoln Institute of Land Policy, 2007.

Ben-Joseph, Eran and Terry Szold. *Regulating Place: Standards and the Shaping of North America*. New York; London: Routledge, 2005.

Brewer, Ann M., Kenneth J. Button, and David A. Hensher. *Handbook of Logistics and Supply Chain Management*. Kildlington, Oxford: Elseveir Science Ltd., 2001.

Deleuze, Gilles and Felix Guattari. "The Smooth and the Striated," *A Thousand Plateaus: Capitalism and Schitzophrenia.* Mineapolis: University of Minnesota Press, 1987.

Dittmar, Hank and Gloria Ohland. *The New Transit Town: Best Practices in Transit-Oriented Development* Washington: Island Press, 2004.

Easterling, Keller. "Forward" *Young Architects 7: Situating*, ed. The Architectural League of New York.New York: Princeton Architectural Press, 2006.

Easterling, Keller. *Organization Space: Landscapes, Highways, and Houses in America*. Cambridge: The MIT Press, 1999.

Fishman, Robert. *New Urbanism: Peter Calthorpe vs. Lars Lerup*. New York: Distributed Arts Press, 2005.

Gilbert, Richard and Anthony Perl. *Transport Revolutions: Moving People and Freight Without Oil.* London: Earthscan, 2008.

Guy Dubord. "The Organization of Territory" *The Society of the Spectacle* [1967] New York: Zone Books, 1994.

Guy Dubord. "Separation Perfected" *The Society of the Spectacle* [1967] New York: Zone Books, 1994.

Harvey, David. *Spaces of Global Capitalism: Towards a Theory of Uneven Geographical Development*. London; New York: Verso, 2006.

Maas, Winy. *Metacity Datatown.* Rotterdam: MVRDV/010 Publishers, 1999.

Jourquin, Bart, Piet Rietveld, and Kerstin Westin. *Towards Better Performing Transport Networks.* London; New York: Routledge Taylor & Francis Group, 2000.

Knowles, Richard, Jon Shaw and Iain Dochety. *Transport Geographies.* Malden, MA; Oxford, UK; Carlton, AU: Blackwell Publishing, 2008.

Lewis, Paul, Mark Tsurumaki and David J. Lewis. *Opportunistic Architecture*. New York: Princeton Architectural Press, 2008.

Lister, Nina-Marie. "Placing Food" *Food* ed. John Knechtel. Cambridge, Mass; London, England: The MIT Press, 2008.

Lukez, Paul. *Suburban Transformations.* New York: Princeton Architectural Press, 2007.

Marshall, Peter. *Demanding the Impossible: A History of Anarchism*. London: Fontana Press, 1993. 551-53.

Read, Stephen. "Productive Space" *Crossover: Architecture Urbanism Technology*. Eds Hays, K. Michael, Akos Moravanszky, Muchael Muller, Frank R. Werner, and Gerd Zimmerman. Rotterdam: 010 Publishers, 2006.

Rem Koolhous. "What Ever Happened to Urbanism?" *Small, Medium, Large, Extra Large.* New York: Monacelli Press, 1995.

Sewell, John. *The Shape of the City: Toronto Struggles with Modern Planning.* Toronto: University of Toronto Press Incorporated, 1993.

Smith, Neil. *Uneven Development.* New York, Oxford: Basil Blackwell Publisher Ltd, 1984.

Stilgoe, John R. *Train Time: Railroads and the Immminent Reshaping of the United States Landscape.* Charlottesville, London: University of Virginia Press, 2007.

Thun, Geoff and Kathy Velikov. "The Post-Carbon Highway" *Fuel*. Ed. John Knetchel. Cambridge, Mass: MIT Press Ltd. 2008.

articles

Allen, Stan. “From Object to Field” *Architecture After Geometry*, Architectural Design, Vol 67, No 5/6 (May-June 1997): 24-31.

Berger, Allan. “Urban Land is a Natural thing to Waste. Seeing and Appreciating Drosscapes” *Harvard Design Magazine* no 23 (Fall 2005/Winter 2006): 48-56.

Ballis, Athanasios. “Freight Villages: Warehouse Design and Rail Link Aspects” *Transportation Research Record*. 1966. (2006): 27-33.

Bartholdi, John J. and Kevin R. Gue. “The Best Shape for a Crossdock” *Transportation Science* 35-2. (May 2004): 235-244.

Dewar, Margaret and David Epstein. “Planning for “Megaregions” *The United States’ Journal of Planning Literature*. (Nov. 2007): 108-124.

Foucault, Michael. “Of Other Spaces” *Diacritics* ed. Jay Miskowiec, Vol. 16, No. 1. (Spring, 1986): 22-27.

Resor, Randolth R. and James R. Blaze. “Short-Haul Rail Intermodal: Can it Compete with Trucks?” T*ransportation Research Record*. 1873. (2004): 45-52

Slack, Enid and Richard M. Bird. “Cities in Canadian Federalism” *Policy Options.* (December 2007 - January 2008): 72-77.

other

City of Brampton. *Transportation and Transit Master Plan*. September 2004. <http://www.city.brampton.on.ca/city_dept/plan_build/ttmp/finalreport/home.tml>

Clark, Greg. “Invest in Success: Leveraging the Return from Global Cities” presentation at the Institute of Municipal Finance and Governance. May 21 2008.

Hidisyan, Pria. *Global Gateway Regions*. 2005. America 2050. <http://www.america2050.org/pdf/globalgatewayregions.pdf>

Lanigan, Jack Sr., John Zumerchik, Jean-Paul Rodrigue, Randall Guensler, and Michael O. Rodgers. *Shared Intermodal Terminals and the Potential for Improving the Efficiency of Rail-Rail Interchange*. August 2006. Hofstra University. 2. <http://people.hofstra.edu/jean-paul_rodrigue/downloads/TRB2007_Shared_Terminals.pdf>

Metrolinx. *Moving Goods and Delivering Services: Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area*. Feb. 2008. <http://www.metrolinx.com/docs/general/RTPGreenPaper5.pdf>

Ministry of Public Infrastructure Renewal. *Growth Plan for the Greater Golden Horseshoe.* Ministry of Public Infrastructure Renewal. 2006. <http://www.placestogrow.ca/index.php?option=com_content&task=view&id=9&Itemid=14>

Moving the Economy, The Canadian Urban Institute. *Moving Goods in the New Economy: A Primer for Decision Makers.* Toronto: The Canadian Urban Institute. 2002.

The Neptis Foundation. *Toronto-Related Region Futures Study: Implications of Business-As-UsualDevelopment.* E 23. <http://www.neptis.org/library/index.cfm?cat_id=23>

Research and Traffic Group. *Southern Ontario Gateway Transportation & Logistics Issues*. Southern Ontario Gateway Council. <http://www.gatewaycouncil.ca/downloads2/RTG-Final-Rpt.pdf>

Rodrigue, Jean-Paul, Claude Comtois and Brian Slack. *The Geography of Transport Systems*. 2006. Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch5en/conc5en/tradeproduction.html>.

GLOSSARY
EXISTING AND PROPOSED

BRT
Bus Rapid Transit

bulk commodity
Unpackaged cargo that is generally liquid or granular. Unlike most cargo which must be transferred from rail to truck for unloading, bulk commodities may to be funneled from beneath railcars directly.

chase
The fluid circulation path which enables the seamless integration between the logistical operations of each warehouse suite within a *fused logistics cluster*. The physical armature of the chase consists of a layered and cross section facilitating electric forklift travel and conveyor belt transport.

classification yard
A marshalling yard where individual rail cars are assembled into longer trains or broken down according to their destinations.

consolidation
The combining of less-than-carload or less-than-truckload shipments to make full car/truckload shipments.

The combining of operations of two or more warehouse distribution facilities.

cross docking
A form of inventory management where goods are received at one door of the distribution center and shipped out through the other door on a very short amount of time without putting them in storage. It consequently contributes in the reduction of operating costs with an increase in the throughput and with a reduction of inventory levels. This type of flow pattern is best implemented at building sections of narrow width (20-50m.)

cyclic loading
A form of inventory management associated with longer turnover times where goods are generally stored in between receiving and shipping. This type of flow pattern is best implemented at building sections of wider width (90-120m.)

drayage
The movement of a container or trailer from the railroad *intermoda*l terminal to the customer's facility for unloading (or vice versa).

fourth party logistics
The use of specialist companies to provide expertise and coordination in *consolidating* the resources of producers, retailers, and third-party *logistics* providers to build integrated, optimized *supply chain* networks.

fused logistics cluster
A conglomerate industrial type in which multiple enterprises undertaking production, warehousing, retail, distribution and *logistics* are bundled to integrate resources and capitalize on freight *consolidation*. The cluster serves as a major shipping node where a fine mesh of truck and rail docking interfaces offer streamlined connections to larger transportation networks.

GGH
Greater Golden Horseshoe, comprised of the combined Toronto and Hamilton commuter catchments. With a population of over 8 million, the GGH is home to roughly 25 percent of Canada's population and 30 percent of its economic activity.

GTA
Greater Toronto Area

high cube
Short for 'High Cubic Volume'. Refers to storage facilities with a clear height or 8.5-12m, or containers with a clear height of 2.9m.

intermodal
The involvement of two or more modes in a trip from origin to destination.

just-in-time
An inventory reduction strategy that feeds production lines with products delivered on precise schedules. Developed by the auto-industry, it refers to shipping goods in smaller, more frequent lots.

last mile
The final stage in the *supply chain*, often from a distribution centre to the customer. Economies of scale are increasingly difficult to apply at this stage as the size of batches tends to diminish.

leapfrogging
A mode of peri-urban land development where development takes place in rural areas due to cost or legislative impediments to building contiguously with existing development.

logistics
All activities involved in planning, implementing, and overseeing the efficient handling, storage and flow of raw materials, in-process inventory, finished goods, services and related information along the *supply chain*.

LRT
Light Rail Transit

LTL
Less Than Truckload

supply chain
The material and informational interchanges in the *logistical* process stretching from acquisition of raw materials to delivery of finished products to the end user. All vendors, service providers, and customers are links in the supply chain.

third party logistics
The use of specialist companies to provide several combined *logistics* services such as storage, transportation, and inventory management. The services include mode selection, carrier management, private fleet management, information flow and billing.

transhipment
The transfer of goods between two modes in an intermodal journey.

The transfer of goods between two carriers of the same mode.

vending lounge
A series of private/semiprivate rooms in which visitors may browse, inspect or purchase items held on reserve anywhere within the *fused logistics cluster*. Interactive displays allow for targeted searches or casual perusal of real-time inventory. Selected items are transported to the associated room via the *chase* for inspection and/or automated purchase on the spot.

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