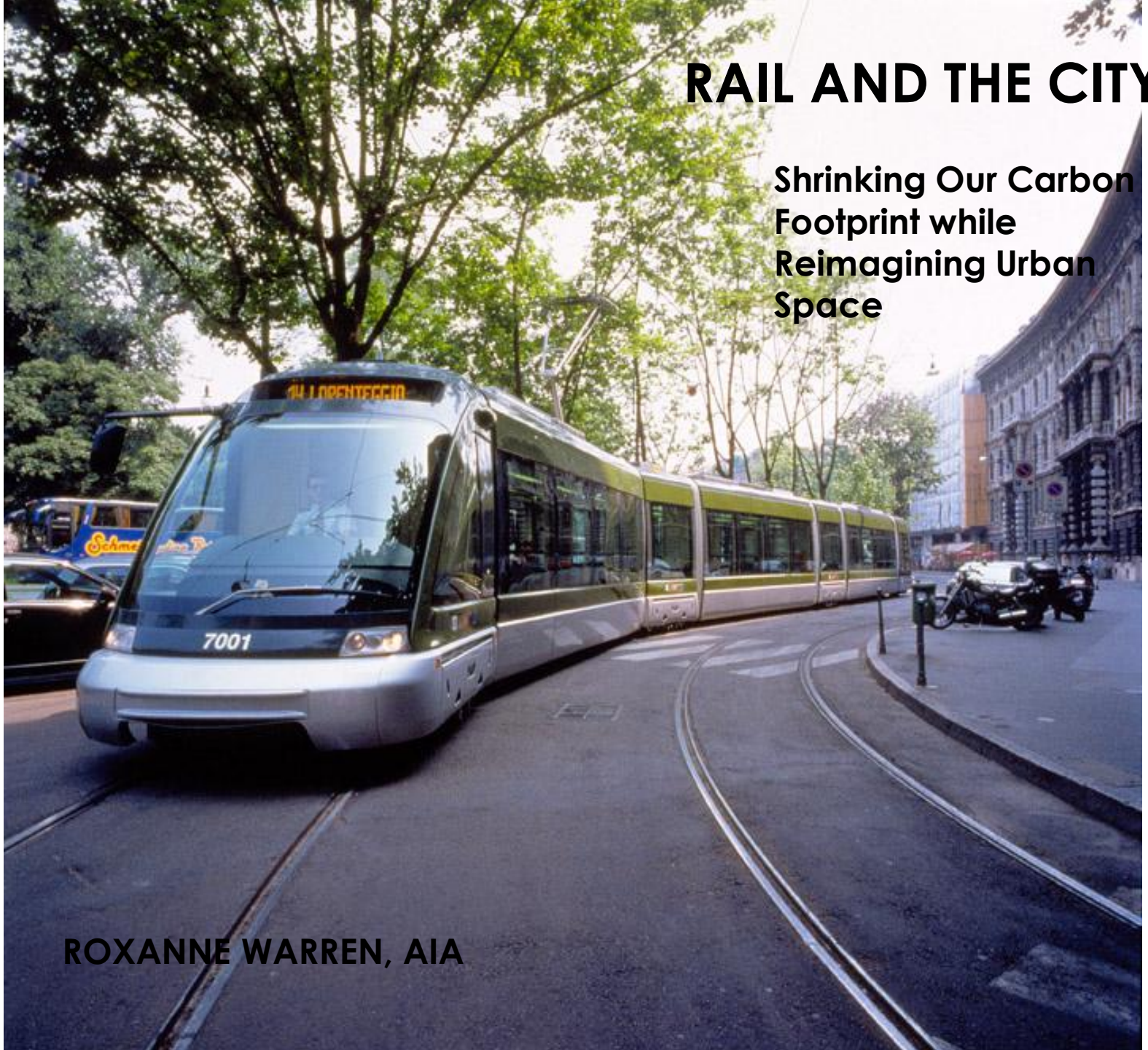

RAIL AND THE CITY

Shrinking Our Carbon Footprint while Reimagining Urban Space

ROXANNE WARREN, AIA

RAIL AND THE CITY

- CLIMATE CHANGE, AND BENEFITS OF HIGH-DENSITIES
- THE SPACE CONSUMED FOR CARS, AND SOLO DRIVING
- DEVELOPMENT OVERBLOWN
- DETERMINING NEEDS FOR RAIL INFRASTRUCTURE
- THE UNIQUE FEATURES OF RAIL
- HOW DID WE LOSE THESE VALUABLE ASSETS?
- A MODEST CORRECTION TO GOVERNMENT POLICIES
- REDESIGN OF TRAMS AS LIGHT RAIL, WORLDWIDE
- INTERCITY RAIL IN THE US
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- HIGH-SPEED RAIL POTENTIAL IN THE US
- SHRINKING THE IMPACT OF ACCESS TO RAIL STATIONS

CLIMATE CHANGE which is poised to inundate coastal cities with flooding worldwide – and must be our ***first*** concern – is integrally related to our reliance upon cars and planes, and its replication across the globe.

- Emissions from transportation are the fastest growing source of greenhouse gases. ***If current population trends continue*** – by the year 2050, ***2 to 3 billion cars*** may be on the world's roads, ***compared with 800 million cars today – and emissions are expected to have increased by 300% percent***.

- Also by 2050, if current ***migratory*** trends continue, some 70% of humanity is likely to be living in cities**.** Besides the potential cultural benefits of city living**, *the likely ecological and economic benefits of more compact development are vast, and make great sense for a future of growing populations and scarcer resources*.** As densities of development are increased, significant savings per dwelling unit can be realized in the costs of land, utilities, construction materials, in the energy needed for space heating and cooling, and in the fuel, raw materials, and land consumed for transportation – not to mention, in the vital preservation of watersheds**.** ***The economic benefits are but a reflection of the most basic of benefits – the ecological ones – which are the survival issues for all of humankind*.**

- So our focus should be on the ***cities*** – rendering them ***more <u>livable/walkable,</u> and more <u>fluidly functioning</u>*.** This may be realized with ***rail transit infrastructure*** – ***both <u>within</u> and <u>between</u> the cities*** – that is, ***on both local and intercity*** levels – including streetcars, light rail trams, metros, light rail mini-metros, intercity, and high-speed rail.

To date, the US has subsidized most heavily and the public is most heavily reliant on travel modes ***– automobiles and aircraft – that demand very large amounts of <u>space</u> and <u>fuel</u> per passenger.*** Certainly, cars ***en masse*** preclude ***<u>both</u>*** the fluid functioning and walkability of cities. ***So cities have obviously not been a top priority to date*** – ***and this must change***.

Currently, with our suburban sprawl and large cars, the US consumes more gasoline than the next twenty countries combined. Between 1990 and 2010, with less than 5 percent of the planet's population, we accounted for nearly one quarter of the world's petroleum consumption. Especially because our patterns of sprawl are being emulated worldwide, ***meaningful efforts to reduce the carbon emissions generated by both automobiles and aircraft ought to begin here in our own country.***

THE SPACE CONSUMED FOR CARS

To meet the traditional guidelines of the lending institutions that finance development, ***we provide, when we build, not one, but two or three parking spaces per car*** – one at home, one at work or school, one at the shopping center, entertainment or vacation spot, etc. This is true whether we are building in rural areas, in suburbs, or in cities, with the exception of only a few cities that are still served by regular, around-the-clock public transit systems. When access drives are included, at least 300 to 350 square feet are allocated for each off-street parking space. ***So we are dedicating 600 to 1050 square feet to each private car for the purpose of its storage alone***, even before streets and highways are counted. Zoning in the US also typically mandates minimum parking spaces for each building type.

So, even if the issue of cleaner and more easily accessible automotive fuel is resolved, it is the <u>space</u> consumed by private motoring that's the insoluble element.

THE RESULT = DEVELOPMENT OVERBLOWN

Scattered development near the interchange of US Route 1 and Connecticut Turnpike includes the Milford Shopping Center, a movie theater, three motels, four factories, and a trailer park, each of which requires its own parking field…

Cities have been totally transformed: aerial view of downtown Hartford, CT, **1957**
but less than four decades later…

…aerial view of the same area in downtown Hartford, **1995**, after demolition of many buildings, the construction of an interstate highway running through the heart of the city, and vast parking facilities **= *a very poor walking environment.***

DETERMINING NEEDS FOR RAIL INFRASTRUCTURE

In the late nineteenth century, it was explicitly argued by US geographer-social scientist Henry Gannet that it was only the highly developed parts of the nation that should be considered in determining the infrastructural needs of those areas. That is, ***while the overall average population density of the United States is roughly only half that of Europe, the US average includes vast areas that are only sparsely populated, and should not be conflated with the densities of the heavily populated areas in determining infrastructural needs***. But such conflation has been pervasive in the twentieth and twenty-first centuries. Combined with ***an over-representation of the rural states in the nation's Congress, and with a booming market in automobiles, this has led to the undervaluing of city-supportive passenger rail transportation***.

The clear alternative to widespread reliance on private motoring is a comprehensive and well-coordinated network of public transportation. If this sounds to conservative ears "a little too much like socialism," it is because there is considerable confusion about the very meaning of socialism. A socialist society is one in which the means of production and distribution – industry, agriculture, banking and commerce – have been deprivatized. ***In a democratic society, in contrast, a rise in the well-being of the public-at-large through smoothly functioning public transportation, good public health and education systems, and the like, equates to social well-being, not socialism*** – as shown in the Scandinavian countries, which are among the most civilized on earth, despite being monarchies.

For a democratic society to agree to substantial public investments in urban infrastructure, there needs to first be a sense of common public purpose, and for this the conversation ought not to be limited to narrowly economic terms. For example, the late historian and thinker Tony Judt pointed out that ***"…the French and the Italians…and most of continental Europe…have long treated their railways as a social provision… the railway station and the facilities it provides to even the smallest of communities are both a symptom and a symbol of society as a shared aspiration."*** But in the US and UK, noted Judt, ***"We too readily assume that the defining feature of modernity is the individual: the non-reductible subject, the free-standing person, the unbound self, the un-beholden citizen."*** Little wonder that our favored mode of travel, the private car, directly reflects this self-image.

THE UNIQUE FEATURES OF RAIL

In 1832, when railways were first introduced in the streets of New York, it became very quickly obvious to the operators of horse-drawn omnibuses that ***with the extremely low rolling resistance of steel-on-steel contact***, their horses could pull heavy loads of passengers much more easily over rails than over rough pavement.

The invention of the first railway in England by George Stevenson in 1825 was a major breakthrough in ***capacity, speed, comfort and reliability*** of transportation – ***all qualities that rail still retains, in contrast with other modes***. Because rail vehicles are externally guided by their track, they *require a minimum width of right-of-way*, *have superior riding quality*, *greater permanence*, *stronger identity*, and *low operating costs per unit of capacity in high-capacity ranges*.

With these benefits, rail swiftly and vastly stimulated the growth of cities. The extension of rail lines was eagerly financed by real estate developers, who were strongly motivated by the profits to be made by purchasing outlying lands and making them easily accessible by rail. Streetcars were initially powered by horses, but were gradually converted to electricity, which was cleaner and less costly. In 1902, there were 16,645 miles of electric streetcar in the US. By 1912, these had nearly doubled to 30,438 miles.

All kinds of rail transit were simultaneously being developed around the globe. However, it has been noted by transportation expert Vukan Vuchic that: ***"During the first decades of the twentieth century, rail transit in US cities was in many respects more advanced and more extensively used than in any other country."***

HOW DID WE LOSE THESE VALUABLE ASSETS?

In the middle of the 20th century many of the US cities still had comprehensive networks of streetcars; however most of them did not survive much longer. ***They were literally starved for cash, as regulatory bodies had prohibited increases in transit fares commensurate with the rising costs of labor and operations***. In some cites, fares were still limited to five cents through the end of World War II. Nor was there any significant public assistance to public transit, either financial or in securing reliable rights-of-way on city streets – which were sorely needed with the new influx of automobiles into the cities.

The unprecedented freedom and flexibility offered by the automobile were not the only reasons for its dramatic ascendency, nor for the corresponding decline of rail and other public transit systems in the US. Rather, ***the country's conversion to an automobile-based transportation system was heavily influenced by industry lobbying and a concerted and fiercely fought battle on the part of interested corporations***.

Between 1936 and 1949, ***National City Lines – a company backed by the Big Three automakers, major oil companies, tire manufacturers, and the trucking and construction industries – succeeded in buying up and closing down more than 100 trolley lines in 45 US cities and replacing them with buses.*** Their interest was not in selling buses; it was in selling cars, rubber tires and gasoline, and they accomplished this on a stunning scale. By 1949, ***when National City Lines was convicted of this conspiracy, and fined a mere five thousand dollars, critical damage to US urban rail transit had essentially been achieved.***

Meanwhile, ***a lack of appreciation for cities was reflected in prohibitive zoning and public policies.*** The 1938 US federal planning guidelines were based on the premise that the transportation mode of the future ***would*** be the automobile, so this became a self-fulfilling prophecy. The guidelines mandated that new residential roads be laid out along circuitous routes, which are typically unfeasible to serve with transit. This was reinforced after WW II, when the federal Housing Loan Program ***required that its loans be used to buy only new homes*** – most of which were available ***only outside*** of the cities.

Then in 1956, the ***Interstate Highway Act*** committed the US federal government to funding 90% of a new 44,000-mile network of toll-free expressways, which effectively ***ensured the complete triumph of the automobile over mass transit alternatives in the US*** and killed off the vestiges of balanced public transit that remained in 1950s America. Advance knowledge of where the new highways and their entrance and exit points were being constructed ***instigated intensive real estate speculation outside the cities, which resulted in profits often multiplied by a factor of five.***

A MODEST CORRECTION TO GOVT. POLICIES

A decade later, civic leaders and public officials began to realize that ***the need for public transit had actually increased with the flood of cars into the cities***. While there had been no federal assistance to transit since 1950, ***in 1964 an Urban Mass Transit Act was signed into law, and renewed in 1970***. It provided cities and states with capital grants for up to ***50%*** of the costs of transit improvements – a step in the right direction, but parsimonious in comparison with the ***80%*** of construction costs then being granted for highway projects. Gradually increasing financial resources led to acceleration of the ***construction of heavy rail metros***. While in 1970, only five US cities had metros, by 2007 there were 12 of them. (Worldwide, the number of metros had increased from 17 in 1950 to 110 by the year 2000.)

REDESIGN OF SURFACE TRAMS AS LIGHT RAIL

- However, ***surface*** ***transit in the US had received very little attention, since priority of the city streets had been given over to cars***. While streetcar systems had been allowed to whither in favor of cars in the US, the same could be said about streetcars in France. The French streetcars declined between 1945 and 1973, when they remained in only 3 cities.

- This was not the case in Germany, where there was a higher regard for the value of its streetcars. ***After WW II, Germany not only retained its 56 streetcar networks but began upgrading them to "light rail" standards*** – these often included providing rights-of-way that were separated from other forms of traffic for at least limited portions of the routes – which are essential for reliable travel time.

- ***Light rail, both surface and grade-separated, has been used as "mini-metros" for small cities, connecting city centers with suburbs. It can run in multiple-unit trains, depending upon demand. Low floors permit ease and speed in boarding***. The upgrading of streetcars to light rail has been a very fast-growing trend globally since the early 1980s, with both new and upgraded systems being developed in Europe, Asia, Oceana, and the Americas. There are at least 175 rail tram systems throughout Europe, from genuinely antique to thoroughly modern.

- ***France has more than made up for lost time. Since 1985, that country has been developing modern light rail tramway networks as a major and integral part of the mobility and aesthetic transformation of their cities of all sizes***; they now have 65 LR routes with 435 miles of double track in 30 cities. ***Combining pedestrianization with light rail has been an important ingredient in this transformation of French cities***, and toward this end, transportation professionals have worked in close partnership with urban planners. ***An important reason for light rail's popularity within cites is that, being above ground, it allows enjoyment of the cityscape. Very beautiful light rail vehicles such as those in Milan, Barcelona and Strasbourg are designed to maximize this advantage – they are highly transparent, with large windows so that the passengers don't feel boxed in or strictly separated from the pedestrian life of the street.***

Strasbourg – the low floor allows the system to move almost like a moving walkway

Two tram lines crossing in the center of Orléans – 27 cities have similar systems.

Strasbourg city center

INTRA-CITY RAIL TRANSPORT – LIGHT RAIL TRAM

Low-floor light rail tram in Milano

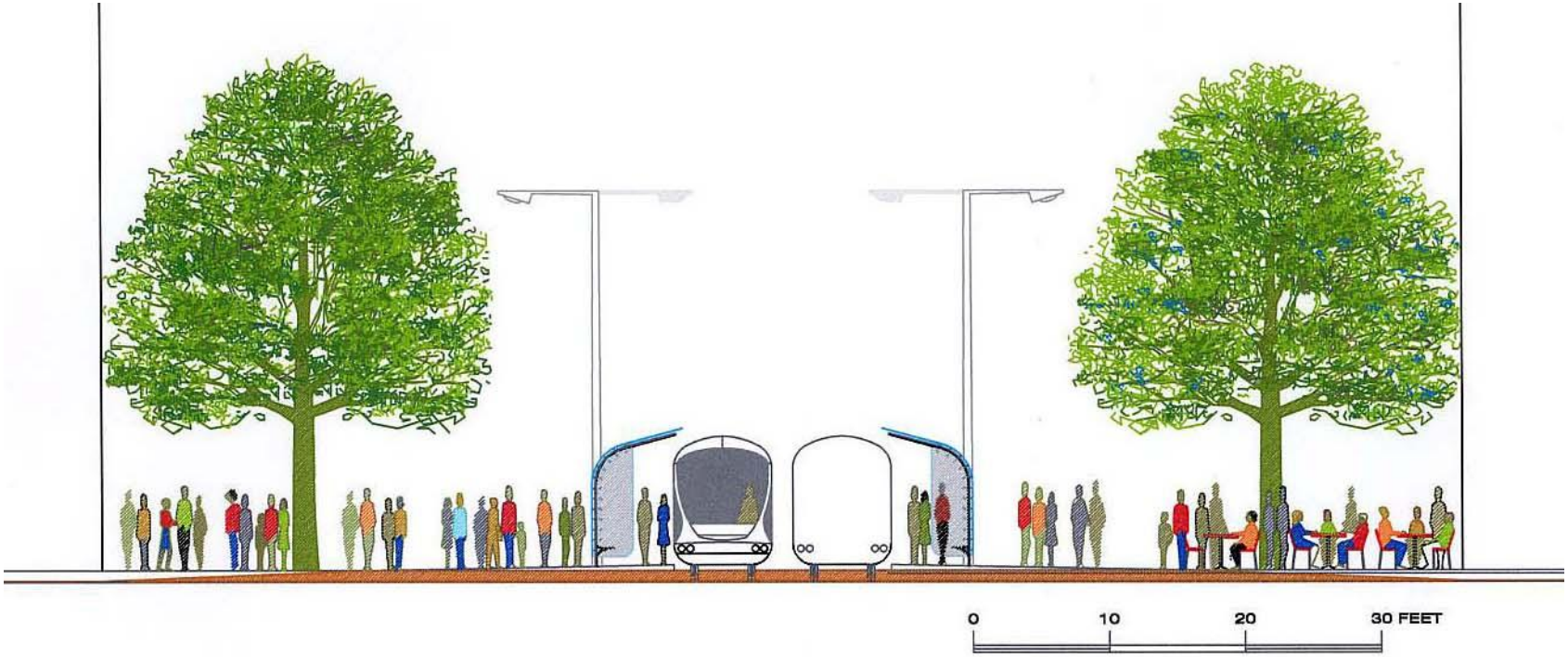
INTRA-CITY RAIL TRANSPORT – LIGHT RAIL TRAM

Low-floor light rail in Barcelona

Freiburg, Germany's car-free center, where the lines of the city's extensive light rail transit network converge. ***The center of Freiburg is essentially limited to trams, pedestrians, and bicycles.***

Pedestrians and streetcars mix well on ***a main boulevard in Istanbul***.

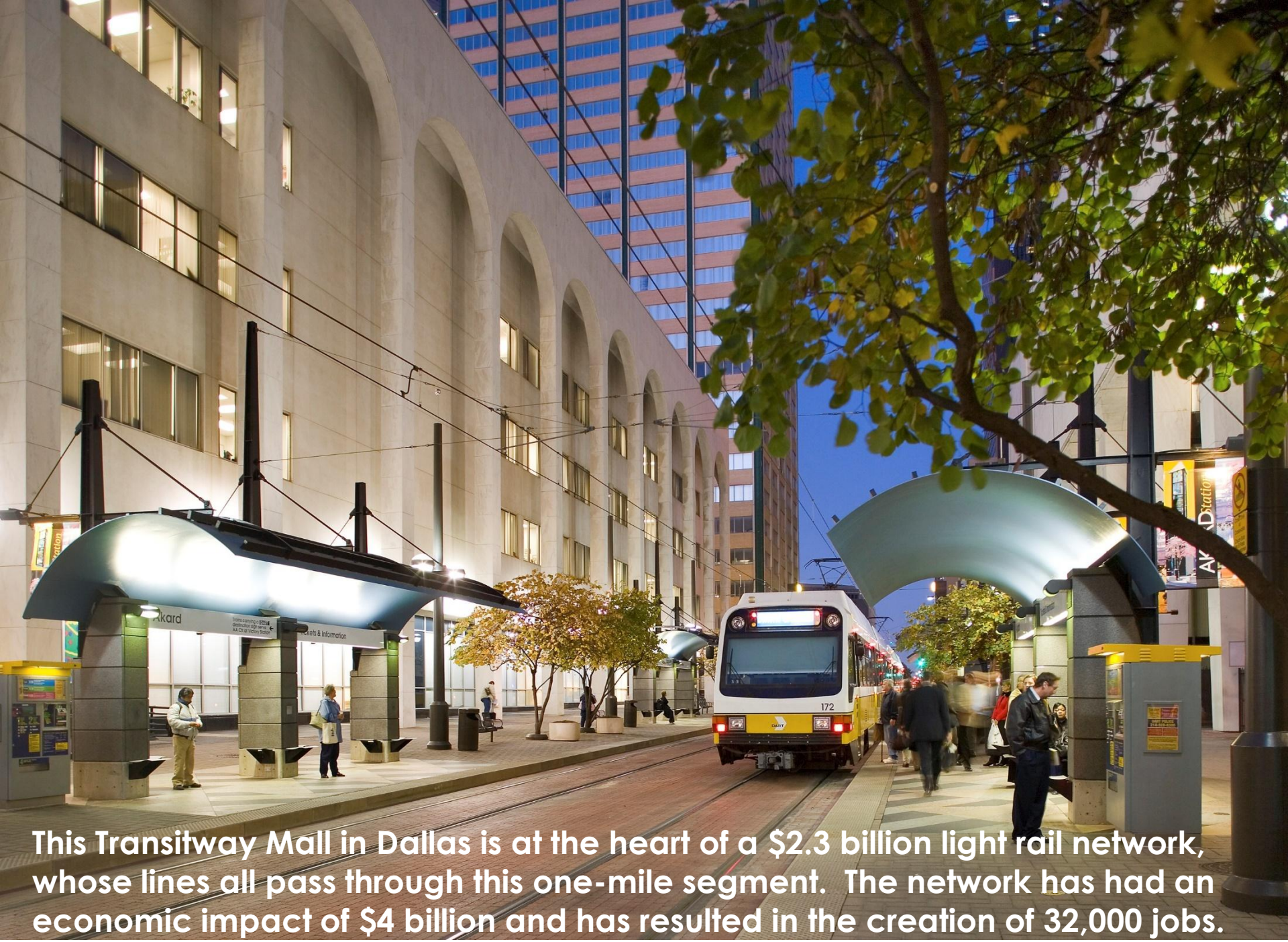
Zurich's Bahnhofstrasse — a high-end, car-free shopping boulevard, served by a light rail line that links the main regional rail station with the city's ferries — is a model for the **vision42** ***proposal for Manhattan's 42nd Street***.



vision42 proposal for Manhattan's 42nd Street – a river-to-river, landscaped, auto-free light rail boulevard.

San Jose – since the early1980s, new light rail's been introduced in 30 North American cities, and 24+ more U.S. systems are in planning

light rail *auto-free* streets in the U.S. include those in Houston, Dallas, San Diego, Sacramento, Portland and Minneapolis



This Transitway Mall in Dallas is at the heart of a $2.3 billion light rail network, whose lines all pass through this one-mile segment. The network has had an economic impact of $4 billion and has resulted in the creation of 32,000 jobs.

INTERCITY RAIL IN THE US

- Until around 1920, rail was the only practical form of ***intercity*** travel, but in the US, the industry was subject to government regulations, labor inflexibility, and undue tax burdens. ***When the federal government began to heavily subsidize the construction of highways and airports***, and cars became attainable by most Americans, intercity passenger rail could not compete, and declined. Intercity ***bus lines*** had the financial advantage that their rights-of-way (the highways) were paid for and maintained by others.

- In 1970, Congress passed and Richard Nixon signed the Rail Passenger Service Act, out of which grew ***the hybrid public-private entity that came to be named Amtrak. Nearly everyone involved expected it to be a short-lived experiment.*** However, popular support has allowed Amtrak to continue in operation longer than its critics thought possible. It began with a fleet of hand-me-down locomotives and cars, most of which were some 20 years old, and became increasingly uneconomical to maintain as they aged.

- Decades of underfunding forced Amtrak to cut 42 of its routes in 1996, and brought it to the brink of collapse in 1997, at which point ***Congress threatened that it would be shut down if it did not turn a profit by 2002. The shutdown never occurred, due in large part to the fact that the public viewed train travel with renewed appreciation after the terrorist attacks of 9/11 had resulted in making air travel so cumbersome.***

- ***There has, in fact, been a steady increase in Amtrak ridership since 2002.*** In the fiscal year that ended in September 2012, Amtrak had carried 31.2 million passengers, the highest annual ridership since the railroad's creation. As a result, its operating loss was the lowest in 50 years, and down 19% from the previous year.

- ***The Northeast US contains Amtrak's only profitable corridor. By 2013, Amtrak was carrying more than 3 times as many travelers between New York and Washington as all airplanes combined.*** This is especially significant in light of the fact that the New York area airports account for ***one-half of the nation's flight delays.***

HIGH-SPEED RAIL WORLDWIDE

- The US currently has only one "high-speed" train, the "Acela" Express, which connects Boston, New York, Philadelphia and Washington. But on most of the Northeast Corridor, ***the Acela vehicles operate much more slowly than their maximum design speed because of the limitations of track and tunnels. Neither the Acela's speed, averaging only a sluggish 70 mph (half of that of the Paris-to-Lyons HSR) nor its reliability come even close to those of HSR systems in Europe or the Far East.*** Nevertheless, Acela is currently running at a 60% profit (that is, making 160% of its operating costs).

- While the future of public transport *within* cities and metropolitan areas lies with a mix of metros, light rail and buses, ***the future of travel between cities for distances of 100 to 500 miles belongs to high-speed rail (HSR).*** This fact has been acknowledged in more than 30 countries around the globe (including even Mexico and Morocco) that have built, or are in the process of building new HSR lines. ***A truly high-speed train is one capable of reaching speeds of over 124 mph (200 km/h) on upgraded conventional track, and of at least 155 mph (250 km/h) on new track especially designed for such speeds. By 2009, trains running on the most recently constructed lines in Europe were reaching speeds of 224 mph (360 km/h).***

- Japan pioneered HSR in 1964 with its 340-milelong Shinkansen bullet train from Tokyo to Osaka. Japan now has a HSR network of some 1,360 miles interconnecting all of its major cities. Until the tragic earthquake of March 11, 2011, these trains were routinely operating at speeds of up to 190 mph, safely moving hundreds of thousands of passengers per day while measuring any delays in seconds. ***HSR has, in many cases in Japan, as well as in Europe, nearly completely displaced short haul air travel (the most energy-intensive per mile). The bullet trains run as frequently as three minutes apart, so it is possible to travel on them quite conveniently without a schedule.*** As high-speed trains enter the cities, they merge with existing rails and operate at conventional speeds.

- Since Europe's first HSR, from Paris to Lyon, was initiated in 1981, ***the entire continent has made enormous strides toward fulfilling the vision of an integrated pan-European high-speed rail network*** which would incorporate the rail networks of its various countries and allow trains to cross borders within the European Union without having to stop. ***China has been constructing a HSR network that will interconnect almost all of that nation's cities that have a population over a half million.***

VELARO HIGH-SPEED RAIL – its vehicles run at 230 mph (386 km/h) between Madrid and Barcelona on the intra-continental European network.

HIGH-SPEED RAIL ENVISIONED FOR THE US

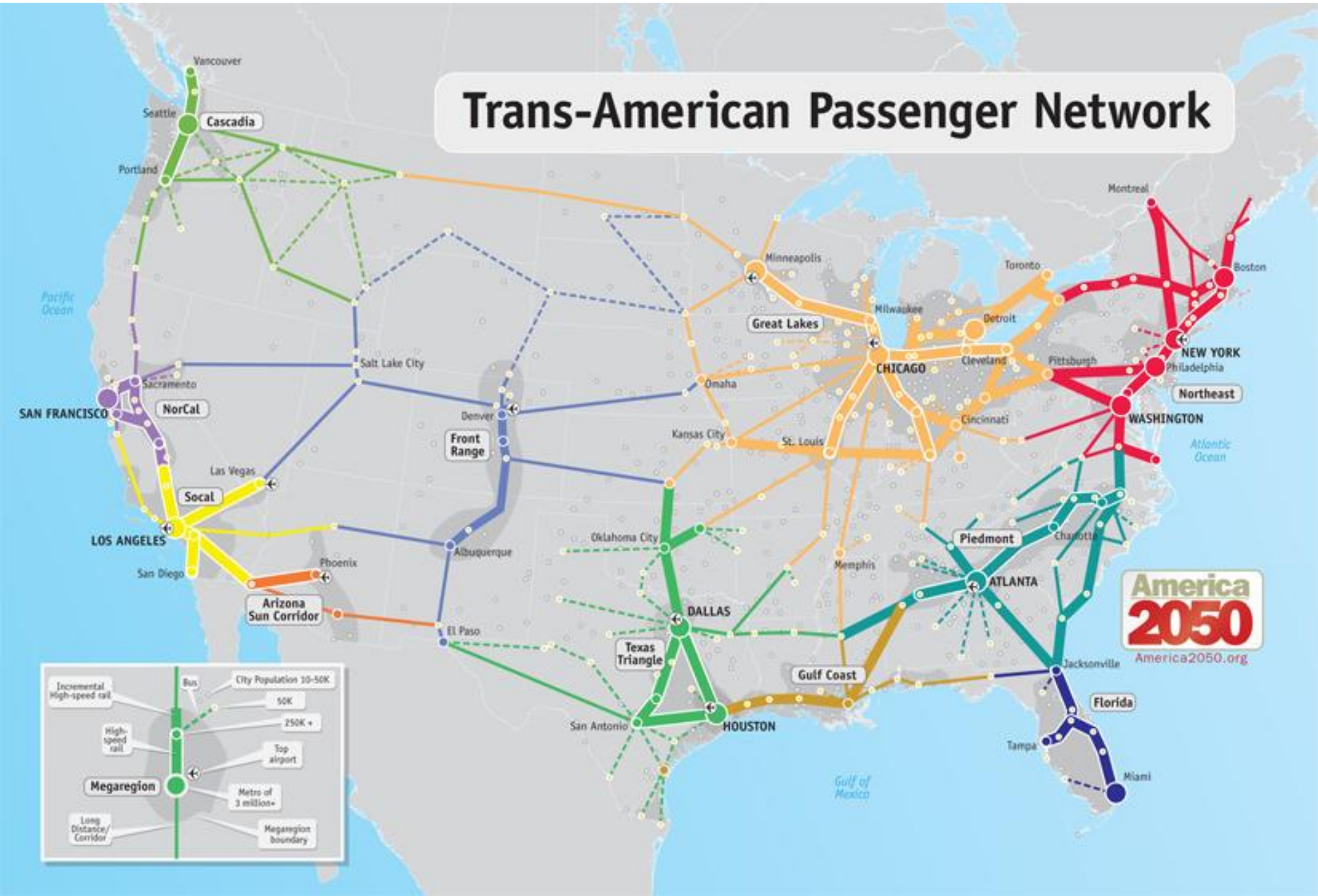
- As already noted, ***because rail vehicles are externally guided by their track,*** they require a ***minimum width of right-of-way***. In contrast, aircraft are, like automobiles, *capacity-constrained, and require a great deal of space*. Because it was so difficult to find sufficient space for ***the new Denver International Airport, it finally had to be built, in 1995, far from Denver – nearly in Kansas. This difficulty of finding sites for airports near urban centers has helped to ignite greater interest in high-speed rail*** – which has *huge* potential for replacing domestic air travel and *large* numbers of personal vehicles on trips of up to 500 miles.

- An advantage of replacing short-haul air flights such as the New York-to-Washington route with high-speed rail is that ***short-haul flights are much more energy-intensive per mile than long flights, since the great surge of energy required to get the plane up in the air is roughly the same*** whether the plane is traveling between New York and Washington or between New York and Europe.
- ***The US Northeast Corridor, encompassing Boston, New York, Philadelphia, Baltimore, and Washington, is home to more than fifty million people and generates more than two trillion dollars in economic activity, making it an ideal candidate for HSR.*** The corridor possesses well-developed, albeit underfunded local networks of rail transportation, and these, together with existing bus networks, could well serve to convey passengers to higher-speed rail. ***Plans are for it to be incrementally converted to HSR*** – a complex process.

- An ***84-mile route in Florida linking Tampa and Orlando*** was selected for the nation's first HSR line because of its relative simplicity and speed of construction. However, ***the money that had been allocated for it was turned down in 2011 by the state's newly elected governor***, and the HSR funds and attention have since shifted to the Northeast Corridor and California.
- The most ambitious of the US HSR proposals is for ***a 790-mile route in California***, for which ***speeds of 220 mph are envisioned***, comparable to those of the European, Japanese and Chinese HSR lines. It ***will connect Sacramento, San Francisco, Los Angeles, and San Diego***, and ***is said to have the largest market potential of all the US HSR proposals***.

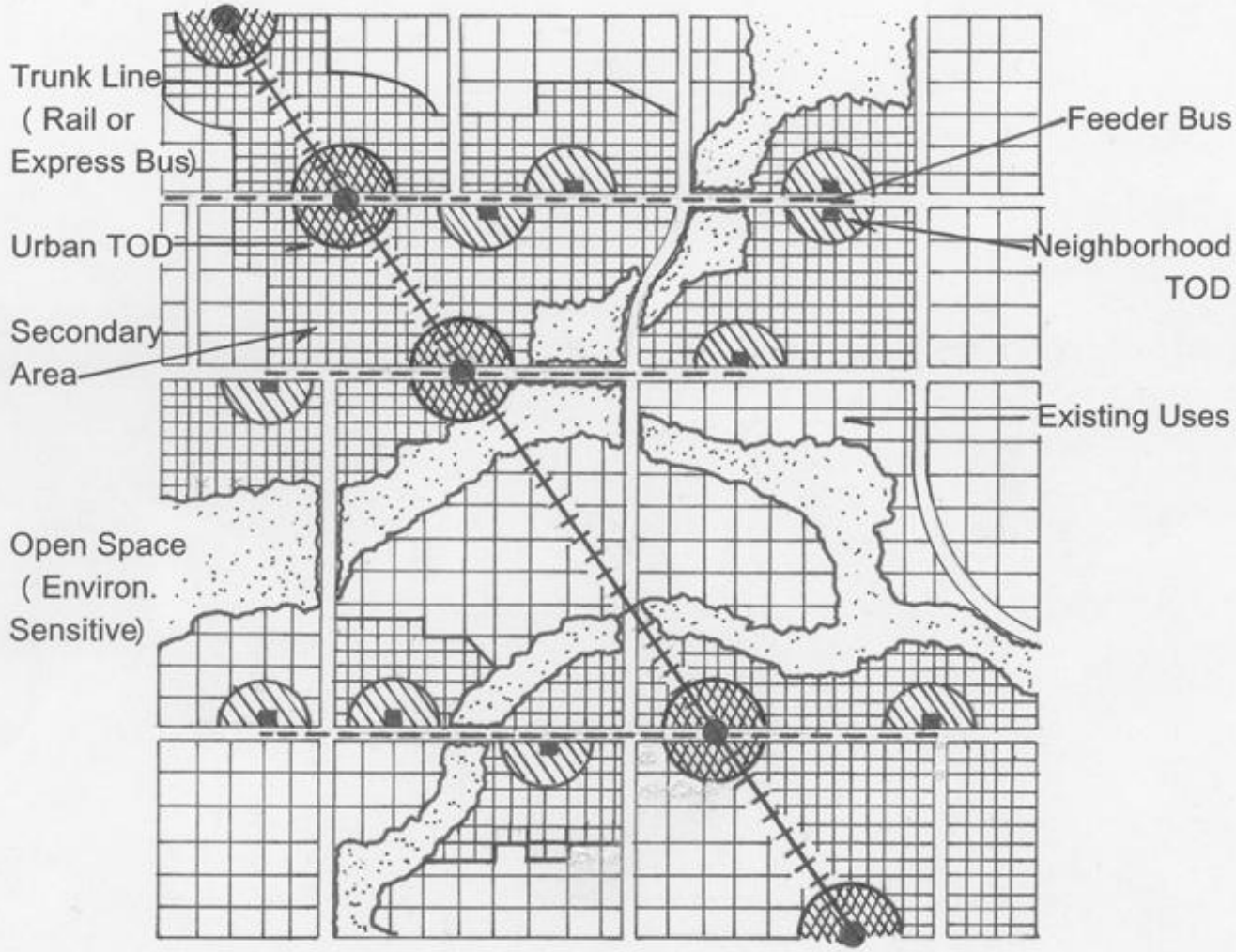
- Another ambitious plan that was proposed in 1991 in Texas would have linked Houston, Dallas-Fort Worth, and San Antonio. It was defeated three years later by opposition from ***competing airlines***; however, a new private entity, the ***Texas Central High-Speed Railway*** has taken up the challenge and ***hopes to run a bullet train between Dallas and Houston***. *Questions of access to the stations?*

HSR POTENTIAL FOR THE US: ELEVEN URBAN CORRIDORS HAVE BEEN DESIGNATED AS LIKELY CANDIDATES FOR HIGH-SPEED RAIL



FOR THE MAXIMUM ADVANTAGE WITH HIGH-SPEED RAIL, AND RAIL IN GENERAL, LOCAL (FEEDER)TRANSIT SYSTEMS AND TRANSIT-ORIENTED DEVELOPMENT

Otherwise, high-speed rail will only lead to more widespread sprawl.



(Concept map by Peter Calthorpe.)

Secure bike lockers at rail stations – example at station of Bay Area Rapid Transit.

Easy access for bikes on the Sky Train in Vancouver.

…and for non-bikers, THE SMART CAR

SHRINKING IMPACT OF ACCESS TO RAIL STATIONS

- Transit-oriented development, with walking to stations
- Cycling, with secure parking at stations or taking bikes onboard transit vehicles
- Mini-cars, with size-based pricing of parking

There's a nice logic to this size-based pricing. As the mode with the very least environmental impact, walking of course incurs no parking charge at all. As the next most compact and environmentally benign mode, cycling incurs only a modest fee for secure parking. And the parking fees for mini-cars will be one-third or less of those for standard cars.