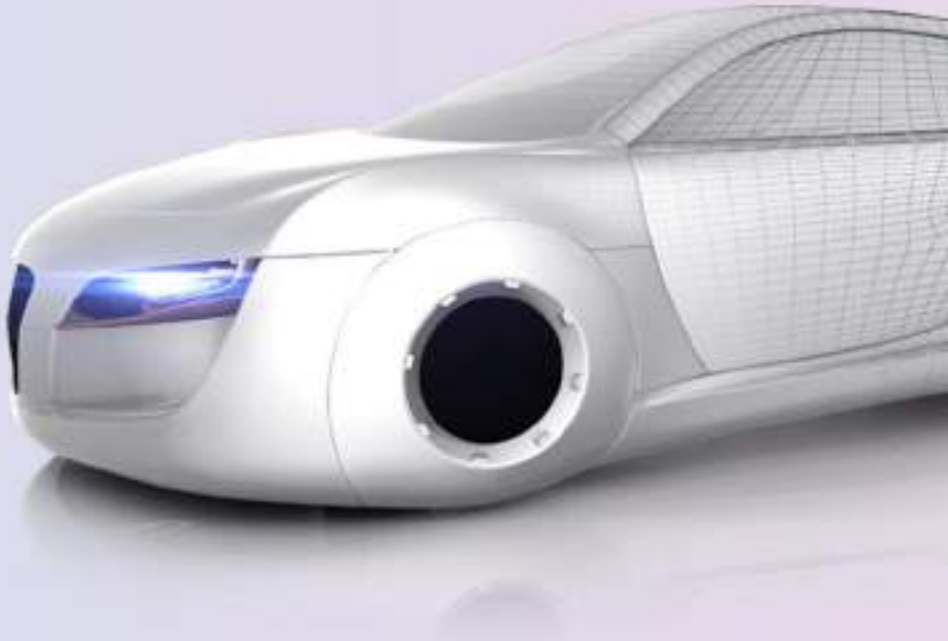
DUBAI WORLD CONGRESS
FOR SELF-DRIVING TRANSPORT
OCT | 2019

Quo Vadis: Policy Governance and Infrastructure Investment in the Era of Multimodal Self-driving Transport

Eugene Chao
Research Associate, The Wharton School



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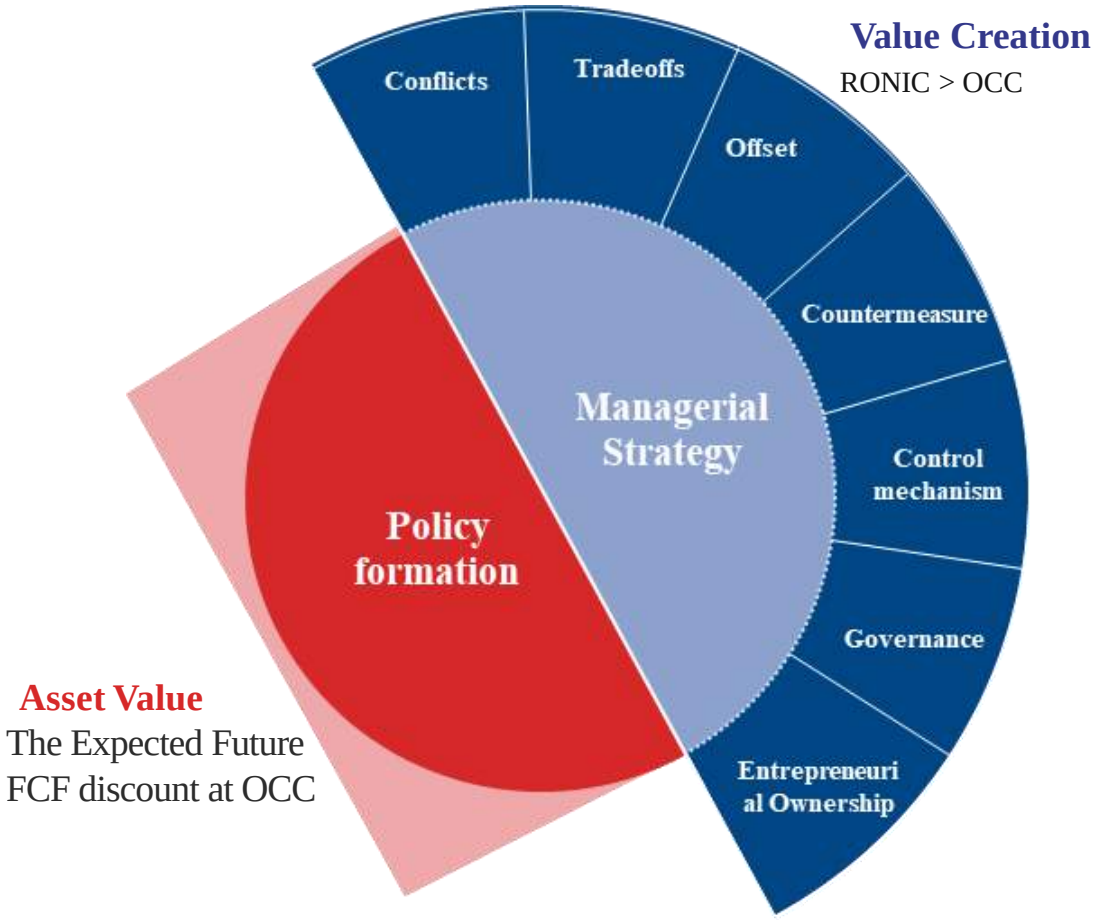
Outline

Introduction of the WAII and the Team

No.	Theme
1.	Overview of infrastructure investment landscape
2.	What kind of city do people want? (Not investor!)
3.	Decision Making and Investment Concepts
4.	Case Studies: Mistakes and Lessons a. Governance case – Moscow b. Problem diagnosis – Türkiye c. Decision scenario – Luxembourg d. Activism engagement – Belgrade e. Managerial barrier – New York f. Evaluation method – Tianjin
5.	Conclusions

Latest Activities



An ounce of information is worth a pound of data.
An ounce of knowledge is worth a pound of information.
*An ounce of **understanding** is worth a pound of knowledge.*
- Russell Ackoff, 1999

The Alternative Investments Initiative focuses on private equity, hedge funds, venture capital, and asset allocation. The Initiative is a global hub for the development of leading-edge research in alternative investments, which is integrated into the Wharton School's curriculum, and presented in public forums. It is a center that furthers the exploration of the theory and practice of investing in this asset class bringing together practitioners, alumni, students, and academics.

- **Infrastructure Investments (FNCE 311/811)**
- The Finance of Buyouts and Acquisitions (FNCE 251/751)
- Shareholder Activism and Corporate Governance (FNCE 387/887)
- Advanced Topics in Private Equity (FNCE884)
- Advanced Private Equity Seminar (FNCE 395/895)
- Business Strategy, Private Equity and Corporate Law (Penn Law 854)
- Corporate Restructuring (FNCE 391/891)
- FinTech (FNCE885)
- Hedge Funds (FNCE 386/886)
- Energy Finance (FNCE756)

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The Wharton School offers an Executive Education week long program: **Private Equity: Investing and Creating Value**. This 5-day program is designed for institutional investors as well as investment professionals aspiring to be better private equity investors.

The Team

Dr. Kevin Kaiser
The Wharton School

Macquarie - The Story of the Millionaire's Factory[1]

- King of Capital in infrastructure investment and the remarkable rise, fall, and rise again story of Macquarie

Since its beginning nearly 50 years ago, the rise of Macquarie Group and the coincident rapid creation of a large number of millionaires within the bank has garnered considerable public attention and given rise to the nickname: "the Millionaire's Factory." Much of that success has been built on Macquarie's early embrace and mastery of a new form of investing – private investment in public infrastructure projects. As a combination merchant bank and private equity fund manager, along with being an asset operator and manager, the firm grew from its origins in its home territory of Australia and is now the global leader in transport and infrastructure privatizations across the world.[2] With its success came imitators, but Macquarie remains the largest investor/manager of infrastructure investments in the world, with nearly USD 90B in assets under management (AUM) devoted to infrastructure as of 2018.

In spite of, or perhaps as a result of, its success, Macquarie Group has also attracted its share of detractors, who cynically label it the 'silver donut,' and the 'vampire kangaroo[3],' among other monikers meant to indicate that the investment bankers and fund managers have extracted, rather than created, the wealth they enjoy.

After listing on the Australia Stock Exchange (ASX) in 1996 at an initial offering price of $6, the shares of Macquarie Group (MQG) rocketed to nearly $100 by 2007. But the bank was hit hard by the Global Finance Crisis (GFC) and saw its share price sink as low as $17 by February 2009.[4] After successfully navigating the difficulties of the early months of the GFC, Macquarie has since recovered to trade above $100 through 2018 (as of October 13, 2018, **Exhibit 1**). Macquarie set a new precedent when it became the first large Australian financial institution to name an Asian woman, Shemara Wikramanayake, as its next CEO.[5] What are the lessons for investors and fund managers seeking to learn from Macquarie's success in infrastructure investing and establish a value creating position in this booming alternative asset class?

The Early Days

Macquarie opened for business in 1969 in in Sydney as Hill Samuel Australia (HSA), an outstation of the UK merchant bank Hill Samuel. The company originated from a business founded

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[1] This case was prepared by Eugene Chao (RA, Wharton) and Kevin Kaiser (Adjunct Professor of Finance, Wharton) for class discussion only. The current version is a draft – please do not distribute without permission.

[2] Cameron Gordon, Senior Lecturer in Banking and Finance University of Canberra "Competing in Global Niche Markets: The Case of Macquarie Bank", International Journal of Bank Marketing, August 2008, p.7

[3] Financial Review: Why the British are calling Macquarie 'The Vampire Kangaroo' https://www.afr.com/street-talk/why-the-british-are-calling-macquarie-the-vampire-kangaroo-20160913-grfobp

[4] James Dunn, "Macquarie – how the mighty have changed", Switzer Daily, July 17, 2015, http://www.switzer.com.au/your-money/investment-advice/share-trading/feature/macquarie-how-the-mighty-have-changed/, accessed August 2018.

[5] Emily Cadman, "Macquarie Group Appoints First Female CEO," Bloomberg, July 25, 2018, https://www.bloomberg.com/news/articles/2018-07-25/macquarie-appoints-wikramanayake-as-new-ceo-as-moore-retires, accessed August 2018.

The Team

Emer. Professor Vukan R. Vuchic
University of Pennsylvania
U.S. HSR Board of Trustee
APTA Lifetime Award

CEO Jim Venturi
Rethink Studio
Robert Venturi the recipient of
Pritzker Architecture Prize (1991)

Andy Wu
Strategy & Entrepreneurship
The Youngest Assistant Prof.
HBS

P&Q's 2019 Best 40 Under 40 MBA Professors

BY: NATHAN ALLEN ON APRIL 22, 2019 | 0 COMMENTS 26,348 VIEWS

HARVARD | BUSINESS | SCHOOL

The Structure of Board Committees

Kevin D. Chen
Andy Wu

Entrepreneurial Governance Framework

Working Paper 17-032

HARVARD BUSINESS SCHOOL

HBS CASE

How Entrepreneurs Can Turn Lead Into Gold

10 APR 2019 | by Michael Blanding

Innovative about creating new products, entrepreneurs often lose imagination when it comes to funding their dreams. **Andy Wu** reveals alternatives beyond friends and family.

Walmart Inc. Takes on Amazon.com

As Walmart entered 2018, it faced critical decisions about its future. E-commerce w
the industry leader, Amazon.com, had captured Walmart's long-held crown as t
retailer in the world. Amazon grew revenue ten times in the past decade, compare
in overall sales for Walmart. With the recent acquisition of Whole Foods for $13 bil
moving aggressively into the offline world and challenging Walmart in its biggest b

Yet, Walmart was not standing still. It had bought Jet.com for $3 billion in 2016
e-commerce revenues had grown to $11.5 billion in 2017, there was no debate in Ben
remained far behind. The question for Walmart CEO, Doug McMillon, and Marc Lo
Jet.com and head of Walmart.com, was how the company should respond to it
competitor (Exhibits 1a and 1b).

Amazon

The Early Years 1994–2001

Jeff Bezos founded Amazon in 1994 to exploit the Internet, a technology into
online. He determined that selling books online had the most promise because th
available was greater than even the largest brick-and-mortar store could stock
advantage, Bezos and his wife drove west to start "Earth's Biggest Bookstore" in Se

Amazon offered 1 million titles for sale on its opening day in July 1995. Next year
over 2.5 million book titles for sale, with revenue doubling every quarter. (Exhi

Main Case POPULAR

Walmart Inc. takes on Amazon.com

David J. Collis; Andy Wu; Rembrand Koning; Huaiyi CICI

Pub Date: Jan 15, 2018
Product #: 718481-PDF-ENG
Discipline: Strategy
Length: 30 p

R/GA: Corporate Venture Studio vs. Accelerator

International advertising agency R/GA served a roster of global clients, launching well-known global marketing programs for the Samsung Galaxy and Nike+. To extend the agency's digital and technology capabilities, R/GA launched R/GA Ventures, a business unit for corporate partners to generate innovation through the creation of startups and investments in disruptive technologies.

In January 2018, Stephen Plumlee, R/GA's Global Chief Operating Officer and Managing Partner for R/GA Ventures, was eager to make the final decisions for their next corporate innovation program with the Los Angeles Dodgers, the third program with the Dodgers and R/GA's 11th overall. The previous year had been eventful for R/GA Ventures, with the operation of three programs: its third IoT program, for the first time in London; the Marketing Tech Venture Studio Demo Day with Snap, Inc.; and its Media Tech Venture Studio with Verizon Ventures.

The format of R/GA Ventures programs initially followed the traditional "accelerator" model. However, in 2017, Plumlee pivoted the programs toward what he called a "venture studio." Plumlee wanted R/GA Ventures to maximize success for its corporate partners through a primary focus on corporate engagement, rather than investment returns.

Plumlee envisioned a platform for innovation to support not only the investment goals, but, even more importantly, the strategic goals of the corporate partners. He believed that some of the most common features of traditional accelerator programs needed to change to maximize the benefits for both the corporate partners and the startups. These common features included the general orientation towards fundraising, the early-stage profile of participating startups, the large size of each program cohort, and the co-location of each of the startups in the same venue for the duration of the program.

Main Case NEW

R/GA: Corporate Venture Studio vs. Accelerator

Andy Wu; Grant Son; Aastha Thakkar

Pub Date: Dec 19, 2018
Product #: 719414-PDF-ENG
Discipline: Entrepreneurship
Length: 23 p

The New York Times

Thinking Big and Bigger About New York

ReThink Studio

MOSCOW URBAN FORUM

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NEWS BUSINESS PROGRAM SPEAKERS VENUE AWARDS PARTNERS LIBRARY ARCHIVE • FEST RU

BACK

July 5. Klyazma Hall. 15:10 - 15:40

Case

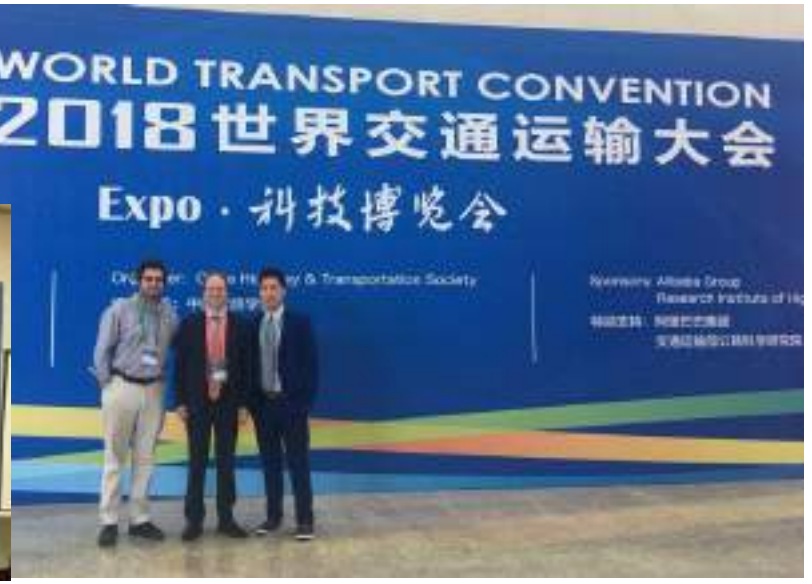
Urban planning startup. How to rethink the New York City transport model

The New York City transport system is one of the best in the world. The only drawback is that the system is built to connect the city's neighbourhoods to Manhattan. The system does a great job of getting the residents to and from downtown. But in the case of journeys between districts, the transport model is not so effective. ReThinkNYC is a system of the city so that all neighbourhoods of the city are connected.

THE WALL STREET JOURNAL.

Europe Edition ▾ | September 8, 2018 | Today's Paper | Video

La Guardia's Runways Come Up Short



World Transport Convention, Beijing (June 2018)

Informat

Literature Review

The Article

Wharton ALTERNATIVE INVESTMENTS Initiative
University of Pennsylvania

Submission date: June 20th, 2019

Conference theme:

2019 Dubai World Congress for Self-driving Transport (SDT)

Title:

Quo Vadis: Policy Governance and Infrastructure Investment in the Era of Multimodal Self-driving Transport

Authors:

Eugene Chao*, Research Associate, The Wharton Business School Finance Dept, Philadelphia, USA

*Corresponding author

Abstract:

Infrastructure investment is a common scheme to boost economic productivity and carrying it out involves a multilateral decision. In the realm of infrastructure investment, what are the critical roles the policy-makers and legislative-enablers should take? What scale and magnitude of investment are enough to ensure the intended outcome? Is there an interrelation or a contradiction between investing in different asset classes? What are the corresponding measures to avoid the likelihood of investment offset? How could policy governance, legislative structure, and managerial strategy maximize the synergistic value among investment returns and positive spillovers to further empower a nation's long-term competitiveness? Cities around the globe are either in the transition stage of repositioning their long-term competitiveness or in the development stage of large-scale metropolitan planning. Within the governmental leadership, decisions have been found in these two settings: the outstanding commitments on the modernization of efficient infrastructure systems and the transformative mindset to recapitalize city's assets: both developable and underutilized lands. This article presents a surgical diagnosis of investment decision-making in the scope of multimodal self-driving transport (SDT) and examines the economic growth driven by the process of policy formation and managerial strategy toward city development. First, prior to the fund allocation, the prerequisite is to decide what kind of city do people want? Cities built around transit, as an example, would look and operate drastically different from cities built around cars. The interrelation between self-driving transit and cars and the corresponding investment activities is well articulated. Second, investment decisions need to differentiate between the intended outcomes generated by investing in value-creating vs. value-destroying projects. Third, the review of cities' transformational experiences offers common mistakes and meaningful lessons to shape a better future outcome. It is time to regain the momentum in paying systematic attention to the process of investing in infrastructure.

Keywords: *Infrastructure Investment, Policy Governance, Legislative Consistency, Managerial Strategy and Growth on Value Creation, Livable Cities*

Abstract

Infrastructure investment is a common scheme to boost economic productivity and carrying it out involves a multilateral decision. In the realm of infrastructure investment, what are the critical roles the policy-makers and legislative-enablers should take? What scale and magnitude of investment are enough to ensure the intended outcome? Is there an interrelation or a contradiction between investing in different asset classes? What are the corresponding measures to avoid the likelihood of investment offset? How could policy governance, legislative structure, and managerial strategy maximize the synergistic value among investment returns and positive spillovers to further empower a nation's long-term competitiveness? Cities around the globe are either in the transition stage of repositioning their long-term competitiveness or in the development stage of large-scale metropolitan planning. Within the governmental leadership, decisions have been found in these two settings: the outstanding commitments on the modernization of efficient infrastructure systems and the transformative mindset to recapitalize city's assets: both developable and underutilized lands. This article presents a surgical diagnosis of investment decision-making in the scope of multimodal self-driving transport (SDT) and examines the economic growth driven by the process of policy formation and managerial strategy toward city development. First, prior to the fund allocation, the prerequisite is to decide what kind of city do people want? Cities built around transit, as an example, would look and operate drastically different from cities built around cars. The interrelation between self-driving transit and cars and the corresponding investment activities is well articulated. Second, investment decisions need to differentiate between the intended outcomes generated by investing in value-creating vs. value-destroying projects. Third, the review of cities' transformational experiences offers common mistakes and meaningful lessons to shape a better future outcome. It is time to regain the momentum in paying systematic attention to the process of investing in infrastructure.

1. Overview of Infrastructure Investment Landscape

Global Public Infrastructure Investment

CNN travel — Luxembourg makes all public transport free

European Commission — Juncker Plan exceeds original €315 billion investment target

REUTERS — China spends $73 billion on transport infrastructure in March quarter: ministry

Bloomberg — Saudi Arabia Kicks Off $426 Billion Infrastructure Bonanza

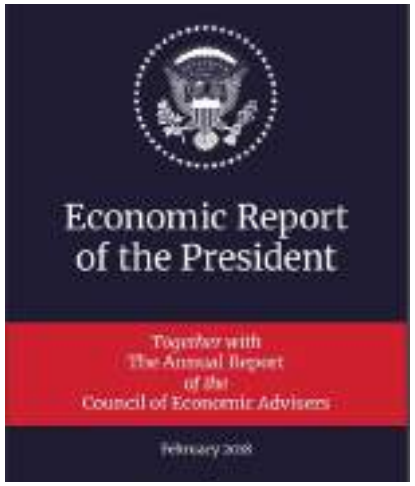
Infrastructure Australia — Infrastructure Priority List

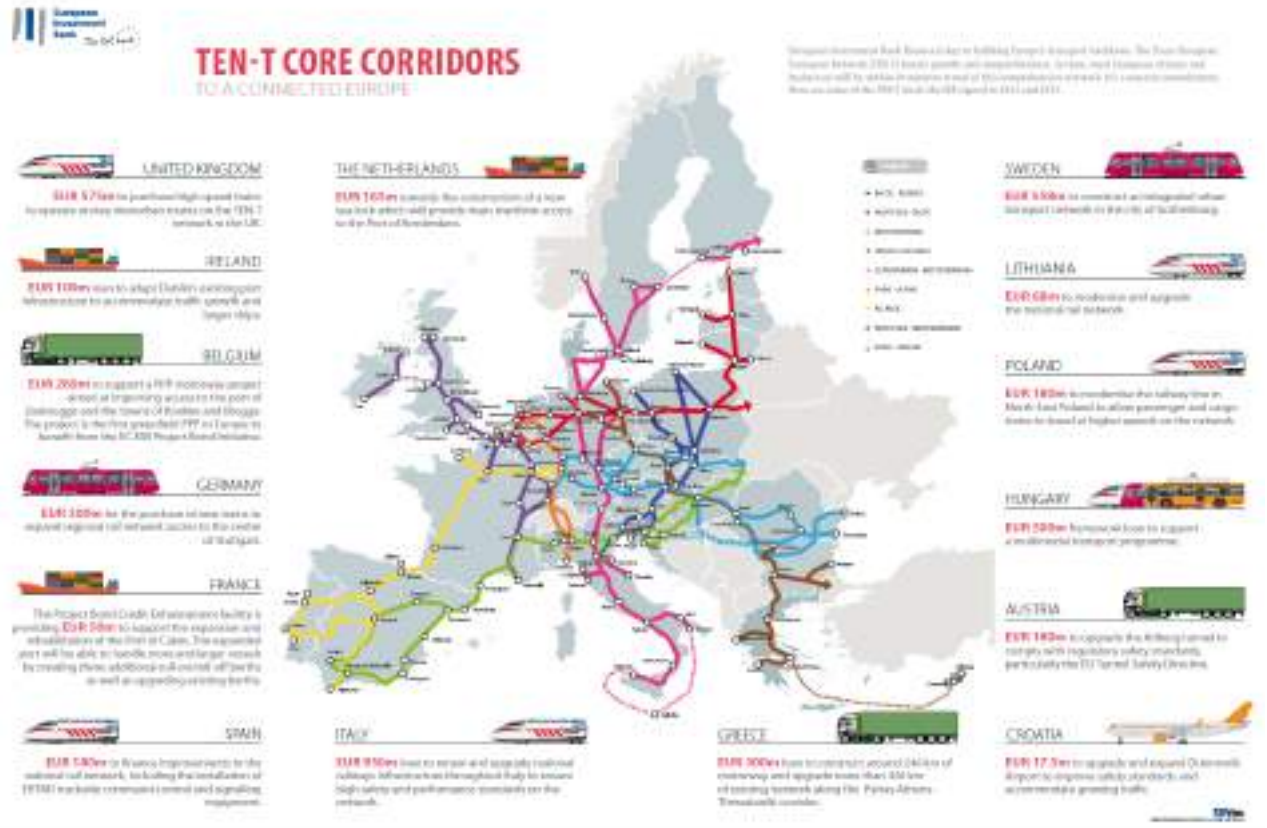
Global Railway Review

SNCF's train of the future: Connected, driverless and emission-free
The SNCF Group's mission is to make mobile living easier and enable everyone – passengers, companies, and transport and logistics operators – to take back their time. But how? Carole Desnost, Head of Innovation and Research at SNCF, explains this will be done by delivering shorter distances and travel times, more attractive public transport and...
https://buff.ly/2EGM3q

GLOBALRAILWAYREVIEW.COM
SNCF's train of the future: Connected, driverless and emission-free

Source: https://ec.europa.eu/commission/files/factsheet-juncker-plan-reaches-eu315-billion-investment-target_en



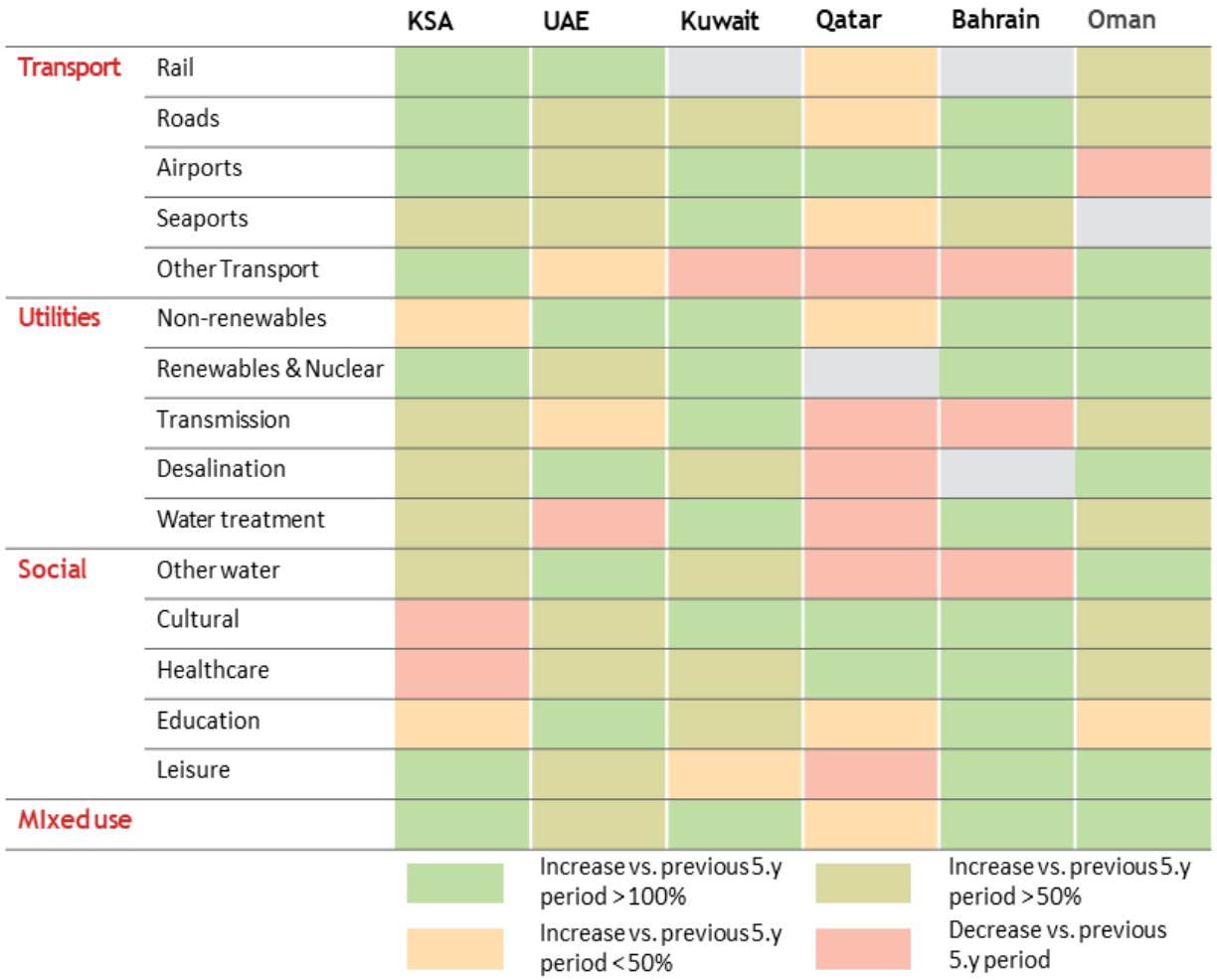


Source: The Route Map to a connected Europe, 2016
https://www.eib.org/en/infocentre/publications/all/the-route-map-to-a-connected-europe.htm

Persian Gulf Infrastructure Investment – Regional Profile

Expected infrastructure investment 2019-2023

% increase over 2014-2018 period



1. Mixed use includes construction of mixed use infrastructure projects (such as NEOM, Red Sea Project, etc.)

Source: MEED Projects as at 8 March 2019, Oliver Wyman Analysis

Selective infrastructure investment schemes in the Persian Gulf countries

		TOOLS MENTIONEDON THE PLAN		SPECIFIC COMMITTED INVESTMENTS		
Long-term plan	Short-term plan	Privatization	PPP	Utilities	Transport	Social infrastructure
Economic Vision 2030 for Bahrain	National Development Strategy 2015-2019	✓	○	○	○	○
New Kuwait 2035	Kuwait Mid-Range Development plan 2015/16-2020/21	✓	✓	✓ Utilities and Water treatment	✓ Rail, ports, airports, roads	✓ Education and Healthcare
Oman 2020 Vision	Five-year Plan 2016-2020	✓	○	✓ Utilities	✓ Rail, ports, airport	○ Goals defined; investments not defined
Qatar National Vision 2030	Second National Development Strategy 2018-2022	✓	✓	✓ Utilities and Water treatment	✓ Rail, ports, airport	✓ Goals defined; investments not defined
Saudi Vision 2030	NTP 2015-2020	✓	✓	✓	✓ Rail, ports, airports, roads	✓ Education and Healthcare
UAE Vision 2021	Strategic Plan 2017-2021	✓	○	✓ Solar PV, Waste-to-energy, Water treatment	○	○

✓ Covered and specific investments are defined as part of the plan

○ Covered but specific investments not defined as part of the plan

Source: National Development Programs of each country, Oliver Wyman Analysis

UAE' Infrastructure and Vision 2021:

- National growth and city development -

Investments in infrastructure

In 2005, H. H. President Sheikh Khalifa bin Zayed Al Nahyan ordered the implementation of comprehensive infrastructure and service facilities throughout the country, for which AED 16 billion has been allocated. The order aims to enhance economic and social progress and to ensure the highest quality of infrastructure. The order covers two sectors:

The infrastructure sector

It comprises grants of residential lands and villas, development of roads and bridges, constructing, developing and maintaining dams and developing fishermen's harbours.

The economic, social and health sector

Under this sector, the President increased the national investments for water and electricity to AED 5 billion and AED 700 million respectively.

The Follow up Committee of Initiatives of the President has accomplished a large number of developmental, strategic and services projects, which include thousands of residential units. The general report of the committee in 2014 revealed that the committee has implemented 125 projects amounting to AED 6.5 billion.

Projects which were completed or were in progress until October 2014 comprised building 7 hospitals, 7 dams, 3 mosques, 35 roads projects, 4 harbours, 3 projects for water and sewerage disposal and 3 projects for water and electricity.

HH Sheikh Mohammed @H... · 16h

Dubai Metro was once a dream. I was 10 years old when I visited London in 1959 with my father who insisted to see a train's cockpit. 50 years later, Dubai Metro came true in 2009. Nothing is impossible if you can dream it.

"مترو دبي.. حلم قديم من أحلام دبي.. كنت في العاشرة مع والدي في لندن عام 1959 عندما أصر أن يكون في مقدمة القيادة لأحد قطاراتها... وبعد خمسين عاماً في 2009 أصبح واقعاً... لا يوجد في الحياة مستحيل إذا استطعت أن تتخيله".

صاحب السمو الشيخ محمد بن راشد آل مكتوم (رعاه الله)

[N] BUSINESS

The National

Jan 1, 2019

Dubai approves 2019 budget with focus on infrastructure ahead of Expo 2020

► Government has set expenditures at Dh58.8 billion, slightly higher than the Dh56.6bn for 2018

United Arab Emirates

U.AE

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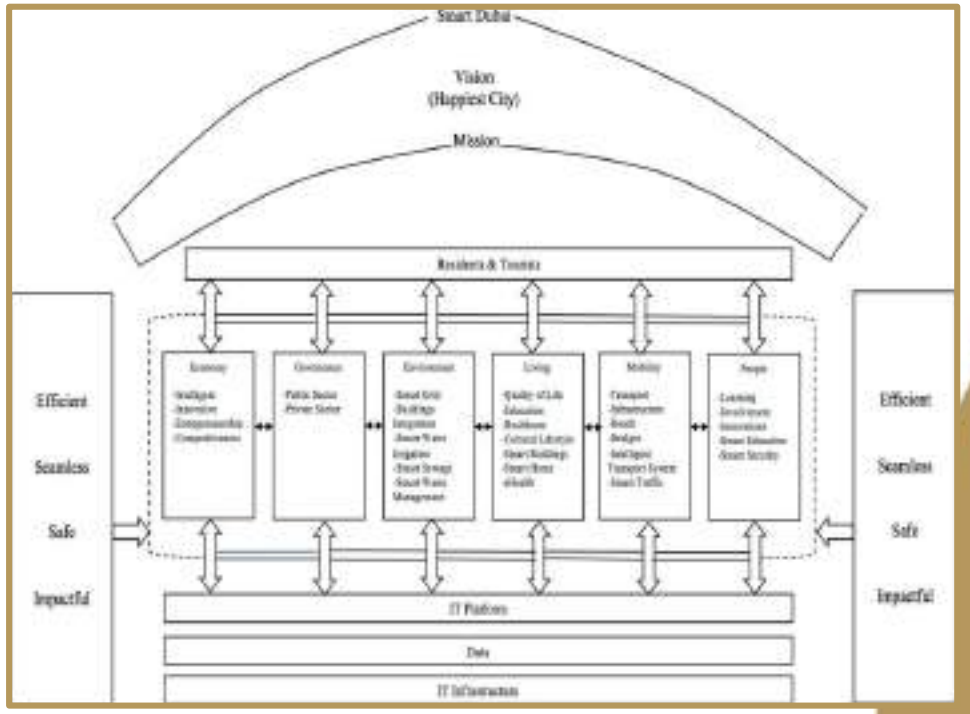
Source: https://www.government.ae/en/information-and-services/infrastructure/infrastructure-and-vision-2021

United Arab Emirates

VISION 2021

UNITED ARAB EMIRATES

UNITED IN AMBITION AND DETERMINATION



Partnerships Bulletin

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20 September 2019

TAGS
Abdulrahman Saleh Al Saleh, Aref Abdulrahman Ahli, Dubai

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Dubai sets up PPP unit

Dubai's Department of Finance (DOF) has established a unit focusing on PPPs.

Aref Abdulrahman Ahli, executive director of the planning and general budget sector at the DOF, said the department "has established a dedicated PPP unit," as it finalises operating guidelines based on PPP best practices and devises a uniform budgeting approach to manage PPP liabilities and aggregate fiscal exposure.

Abdulrahman Saleh Al Saleh, director general of Dubai's DOF, said: "We are continuously aspiring to enhance financial sustainability of the public sector and provide stimulus for economic growth in the Emirate of Dubai.

"In line with these aspirations, [the] DOF is placing key focus on public-private partnerships aiming to leverage local and international private sector expertise, efficiency, and innovation."

Source: https://www.researchgate.net/publication/321694768_Smart_City_and_Smart_Tourism_A_Case_of_Dubai
https://www.vision2021.ae/docs/default-source/default-document-library/uae_vision-arabic.pdf?sfvrsn=b09a06a6_6

EXPO 2020: ONE YEAR TO GO

With a year to go before World Expo 2020 opens its doors to visitors in Dubai, work is in full swing to deliver iconic structures, country pavilions, the extension of the Dubai Metro's Red Line and other integral site elements

SUSTAINABILITY PAVILION:
- **Architect:** Grimshaw Architects
- **Net construction value:** $24m
- **Status:** Finishing works under way
- **Post expo:** Will be converted into District 2020 Children & Science Centre

EXPO VILLAGE:
Residential community for Expo participants
Status: Construction of first set of residential blocks is expected to finish in November 2019

ROUTE 2020 METRO LINE:
- **Status** Construction expected to be completed in March 2020
- Includes dedicated Expo metro station

THEMATIC DISTRICTS:
- **Subthemes:** Opportunity, Mobility and Sustainability
- **Design:** Hopkins & Partners
- **Status:** Completed in May 2019

سبيل
Sabeel
2020

'SABEEL 2020':
Initiative in collaboration with Art Jameel, inviting designs for the 45 drinking water fountains to be installed across the site

DUBAI EXHIBITION CENTRE:
Net construction value: $303m
Status: Construction works under way

MOBILITY PAVILION:
- **Architect:** Foster + Partners
- **Net construction value:** $80m
- **Status:** Construction works under way
- **Post expo:** Will be converted into office buildings

UAE PAVILION:
- **Architect:** Santiago Calatrava
- **Net construction value:** $96m
- **Status:** Construction complete and finishing works under way

THE BIG MILESTONE:
Crowning of Al-Wasl Plaza dome

OPPORTUNITY PAVILION:
- **Architect:** Cox Architecture
- **Net construction value:** $22m
- **Status:** Design works complete and main contractor appointed
- **Post expo:** Will be dismantled

ON-SITE NURSERY:
Currently home to about 400,000 shrubs and 13,000 mature trees. An additional 450,000 shrubs and 4,000 trees will be added in leadup to Expo

POST-EXPO
Site will be transformed into District 2020, an integrated community that will reuse upto 80 per cent of the Expo's built environment

All built structures for Expo 2020 have been designed to achieve LEED Gold certification

AL-WASL PLAZA:
'Heart of the Expo site'
- **Architect:** Adrian Smith + Gordon Gill
- **Status:** The final piece in the steel trellis dome was installed on 15 September 2019. Finishing works are under way
- **Post expo:** Will be converted into exhibition and concert venue

GENERAL FACTS:

32,000
Workers engaged on site

100 million+
Work hours completed

300,000
Number of people that can be accomodated on site per day, which is more than three times the capacity of London's Wembley Stadium

192
Country pavilions

30,000+
Volunteers who will work during the event

50%
Women in Expo delivery team

60%
Emiratis employed in Expo delivery team are women

AED2bn
Expected in food and beverage sales from 200 outlets

55.4%
Total Expo contracts awarded to small and medium-sized enterprises

Sources: MEED Projects, Expo 2020 Dubai

MEED
Middle East business intelligence

Major trends in 2019 Q1 – Q2: Ridesharing IPOs and Private equity infra fundraising

48hills
Independent San Francisco news + culture

Uber's plans include attacking public transit

Documents filed for IPO reveal plans to privatize transportation, getting riders off public buses and trains and onto "Uber buses."

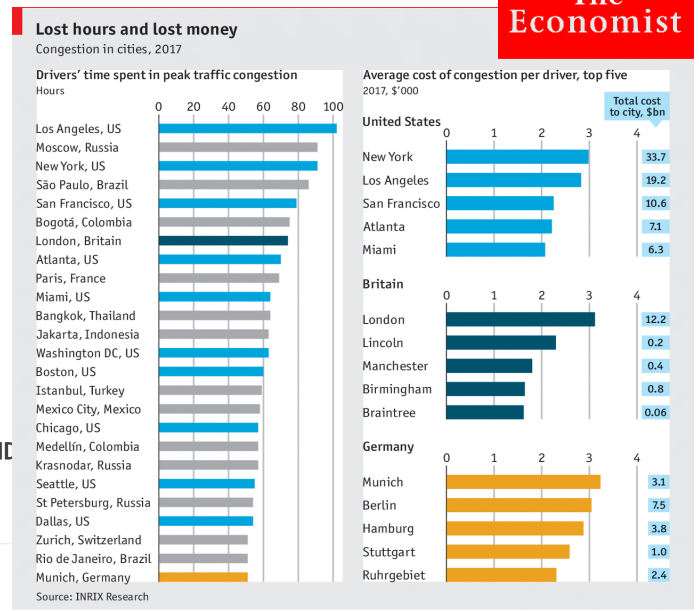
BY TIM REDMOND - MAY 6, 2019

Uber has acknowledged in a federal filing that its long-term goal is to privatize public transportation around the world.

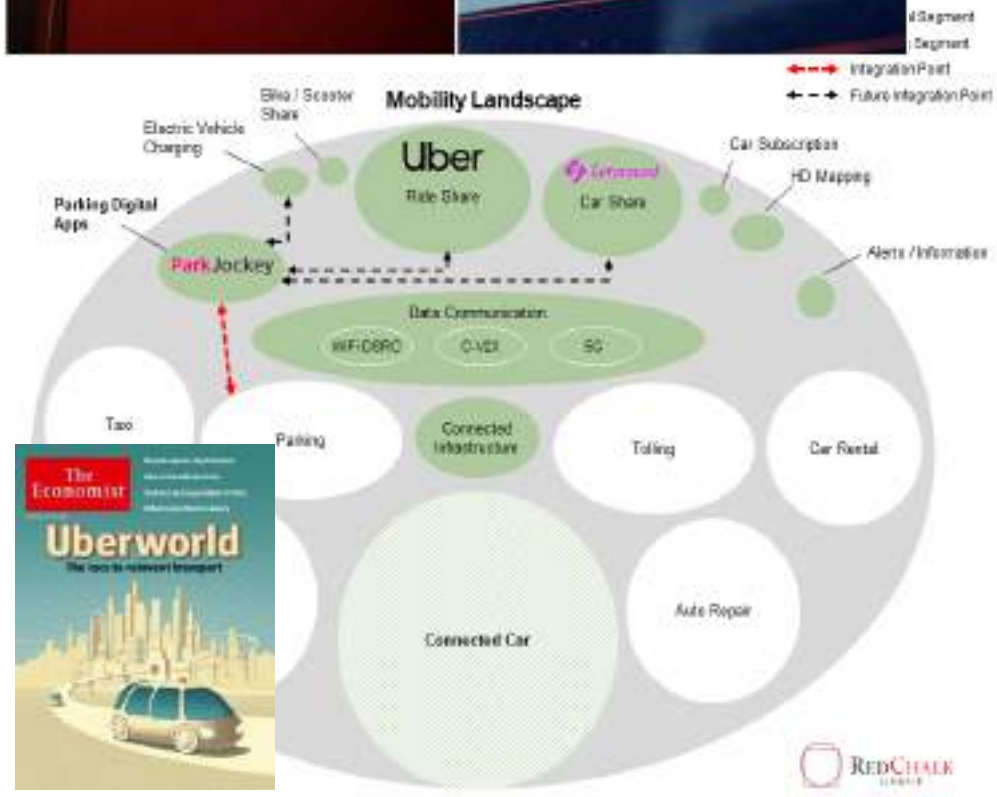
In a document filed with the Securities and Exchange Commission, the ride-hail company reports that it seeks, as part of its growth strategy, not just to get people out of private cars but to get them off public buses and trains.

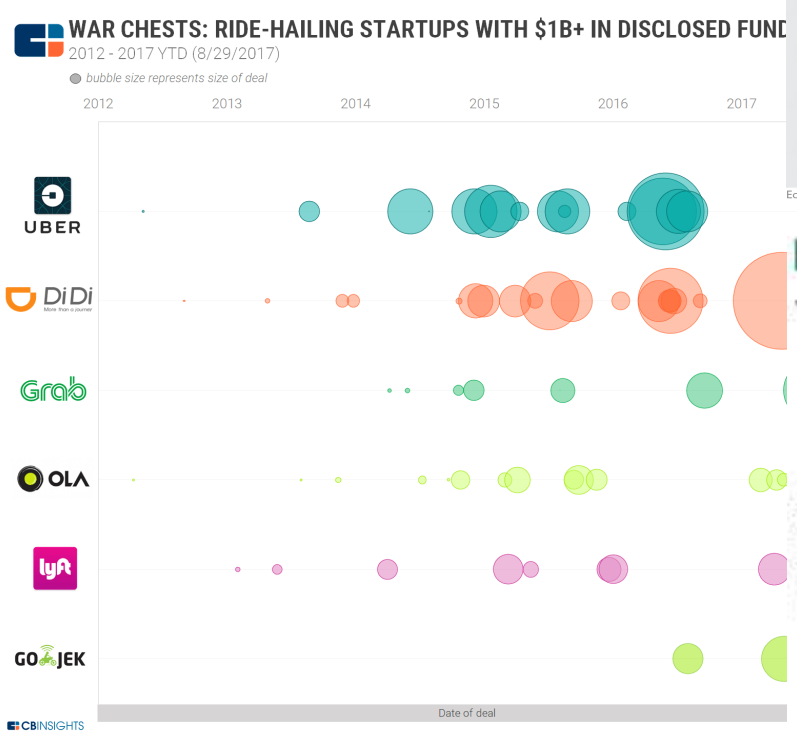
The hidden cost of congestion

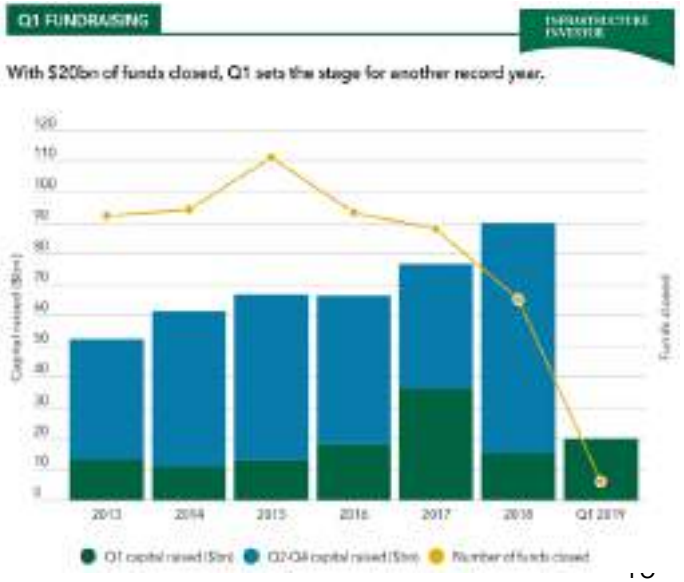
The Economist



Economist.com

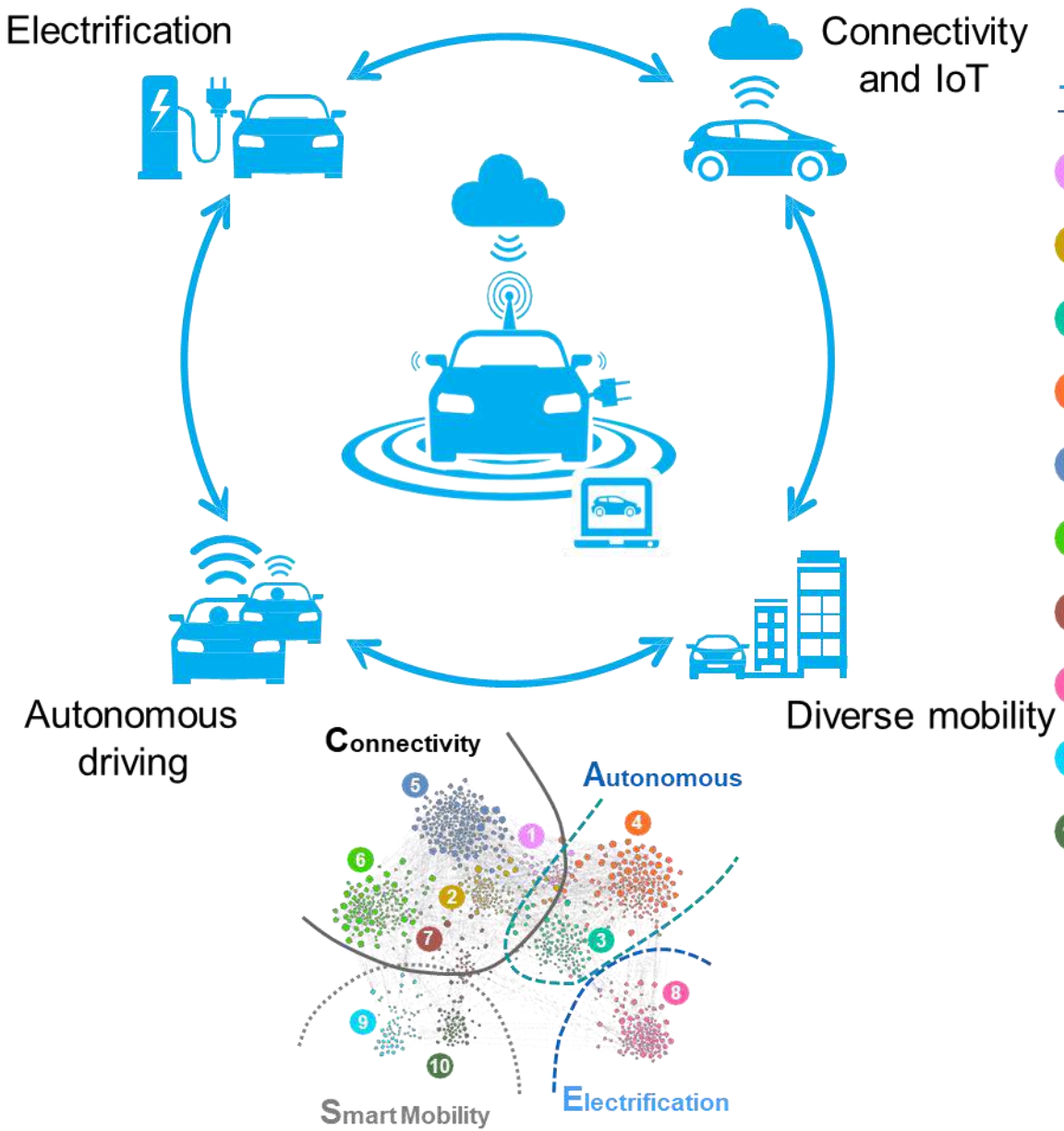


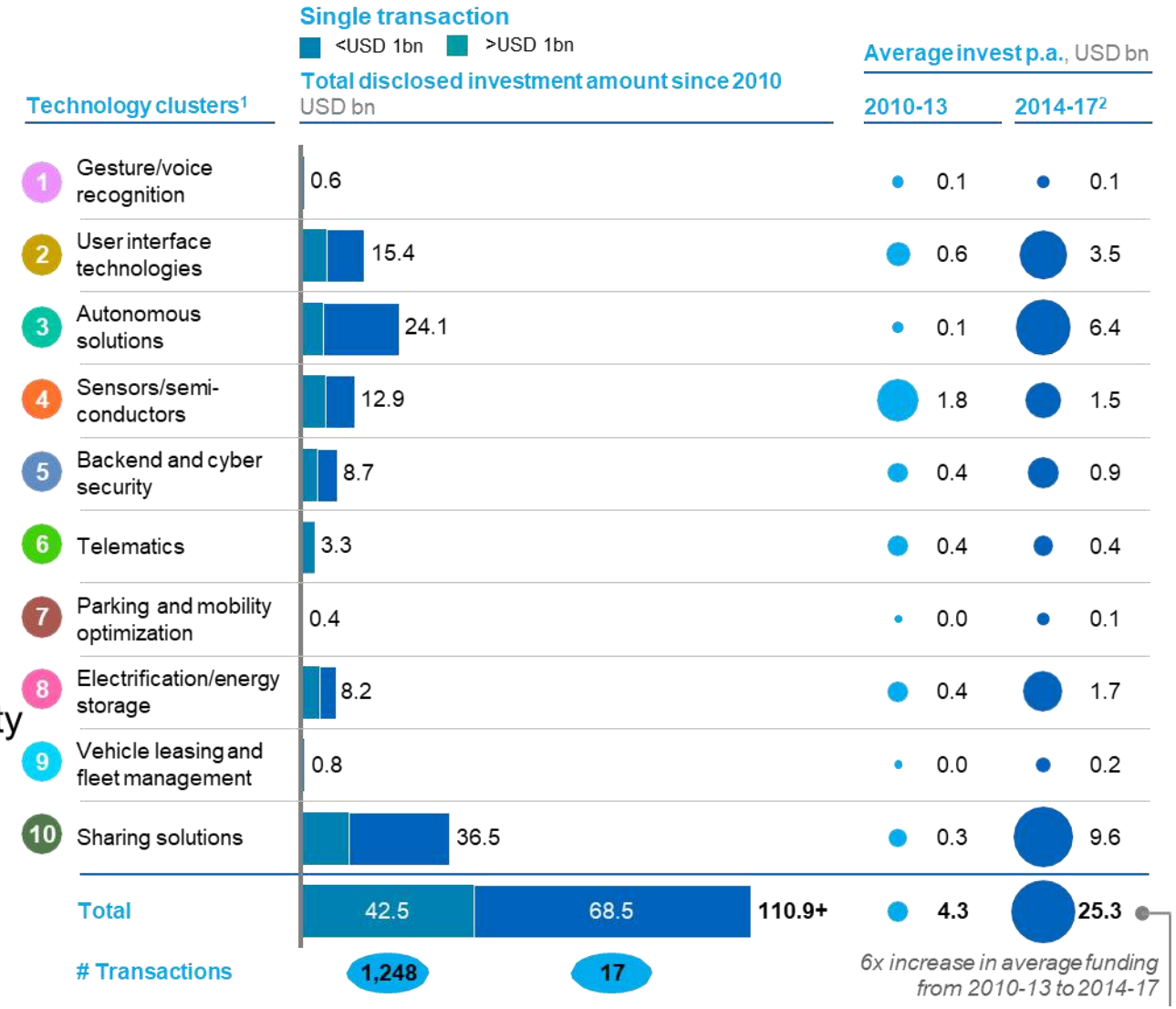




of bubbles are illustrative and denote the current relative addressability of various segments

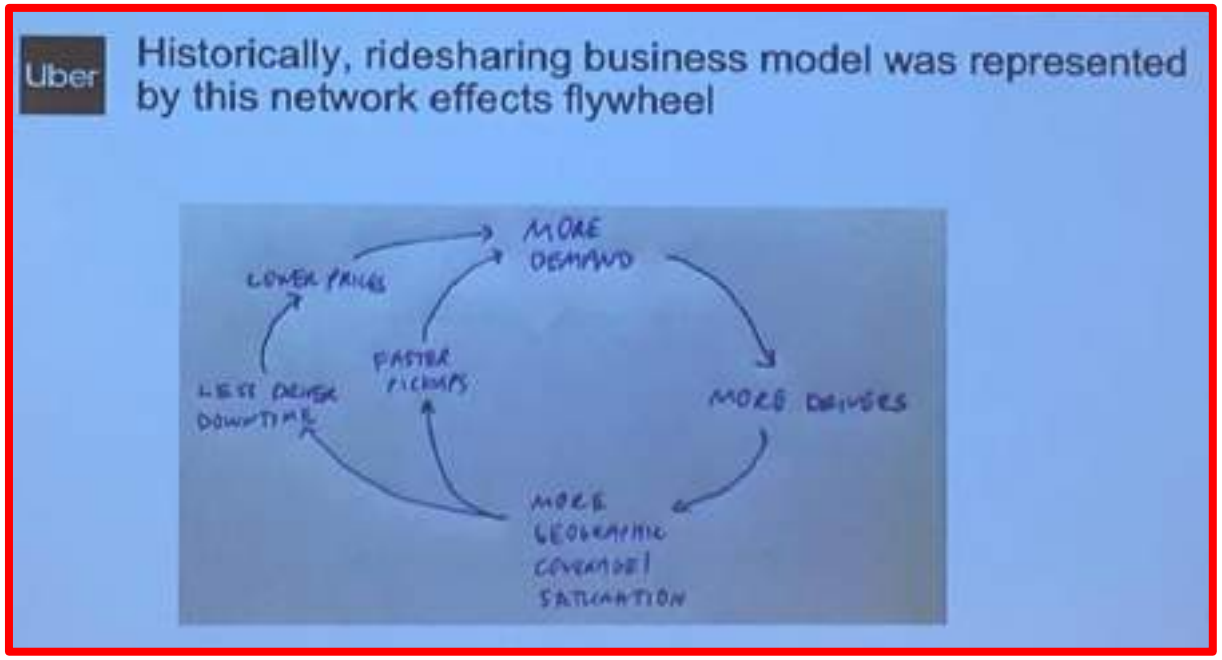
Four disruptive technology-driven trends

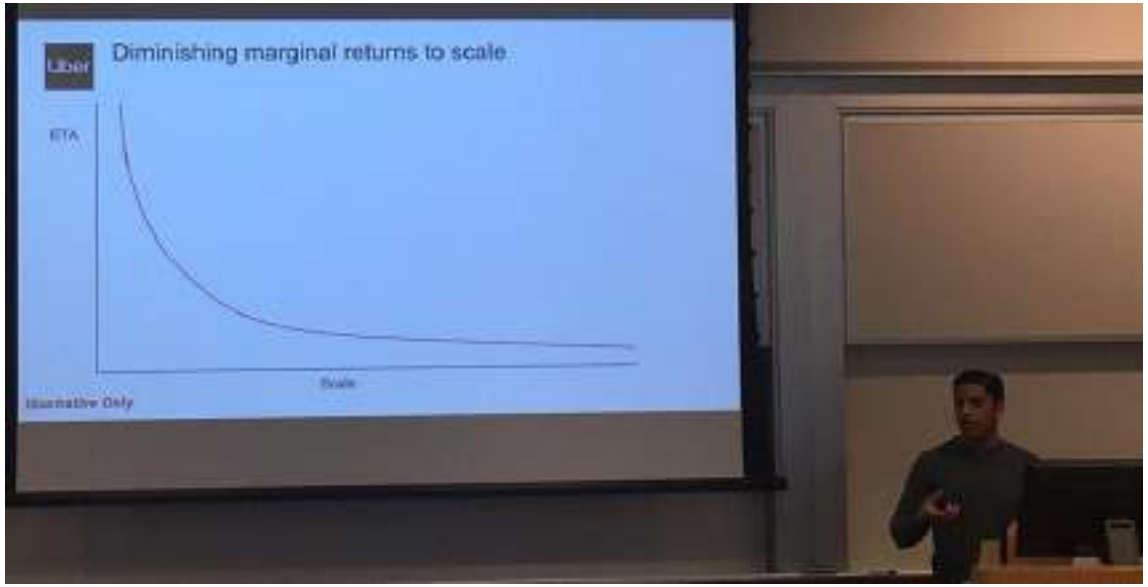




McKinsey&Company Center for Future Mobility: Trends and implications, Dec 2017

Uber at The Wharton School





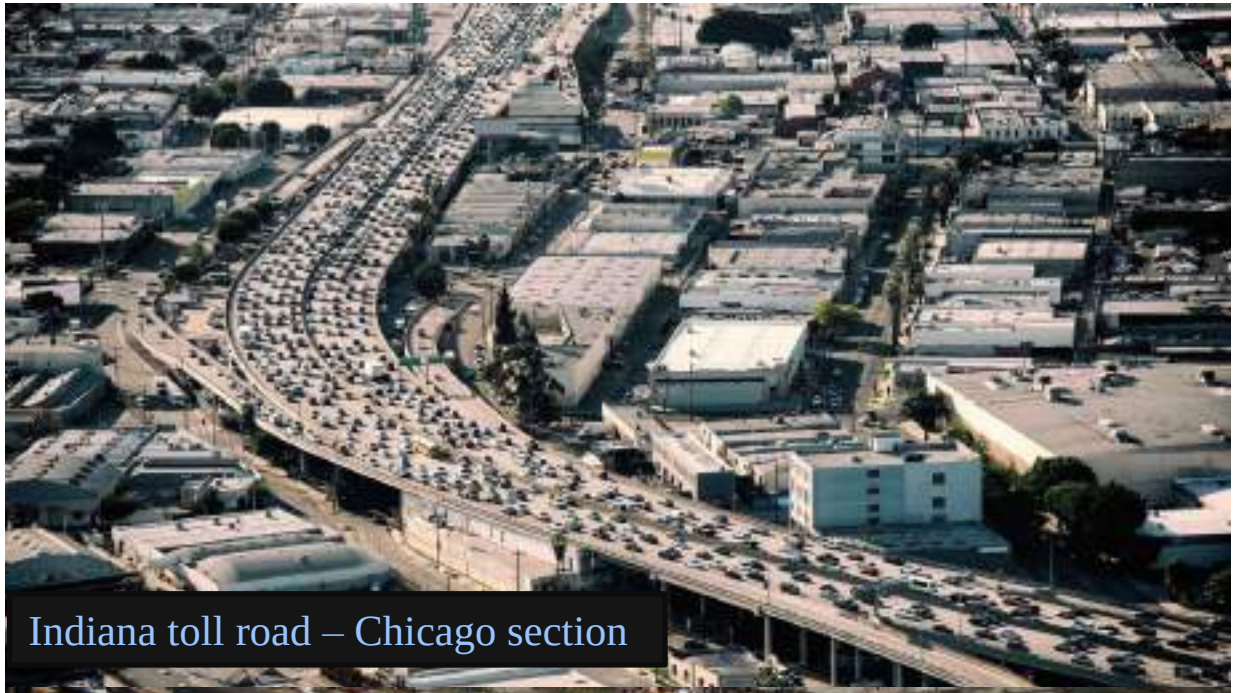
Disruptive Innovative Transportation Technology ≠ NPV > 0

Disruptive Innovative Transportation Technology ≠ NPV > 0 (Con't)

2. What Kind of City Do People Want? (Not investors!)

Some are too busy to make money!

Cities built around cars - Disastrous consequence of highway expansion



Indiana toll road – Chicago section

Minibus-taxis (so called: Danfos) in Lagos, Nigeria

Bloomberg

Published on June 19 2019, 5:00 PM

$70 Billion Toll-Road Plan to Connect Indonesia's Sprawl

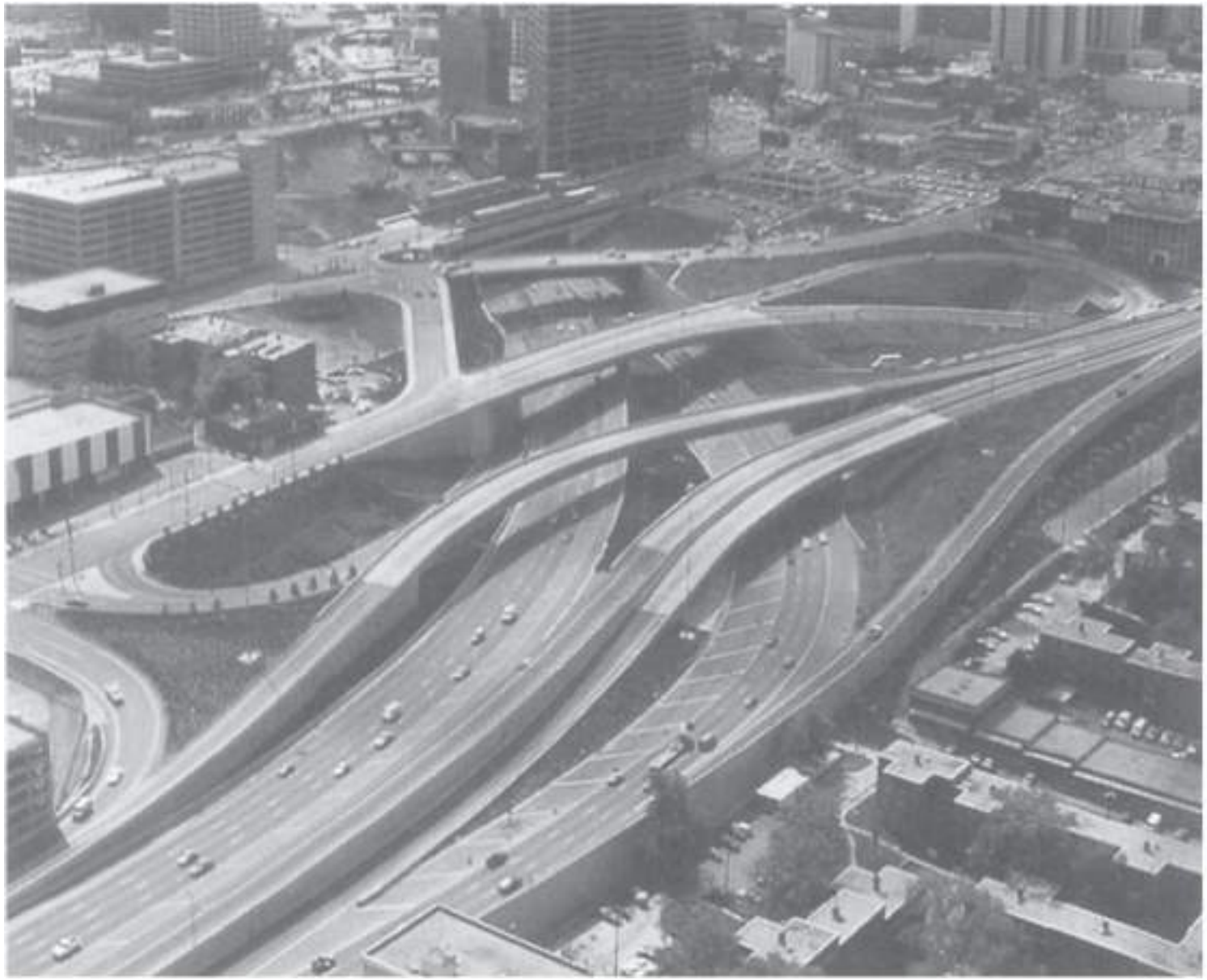
Toll plaza merged from 25 lanes to 4 lanes in Beijing - Hebei section

I-405 freeway 24 bidirectional lanes in San Diego section

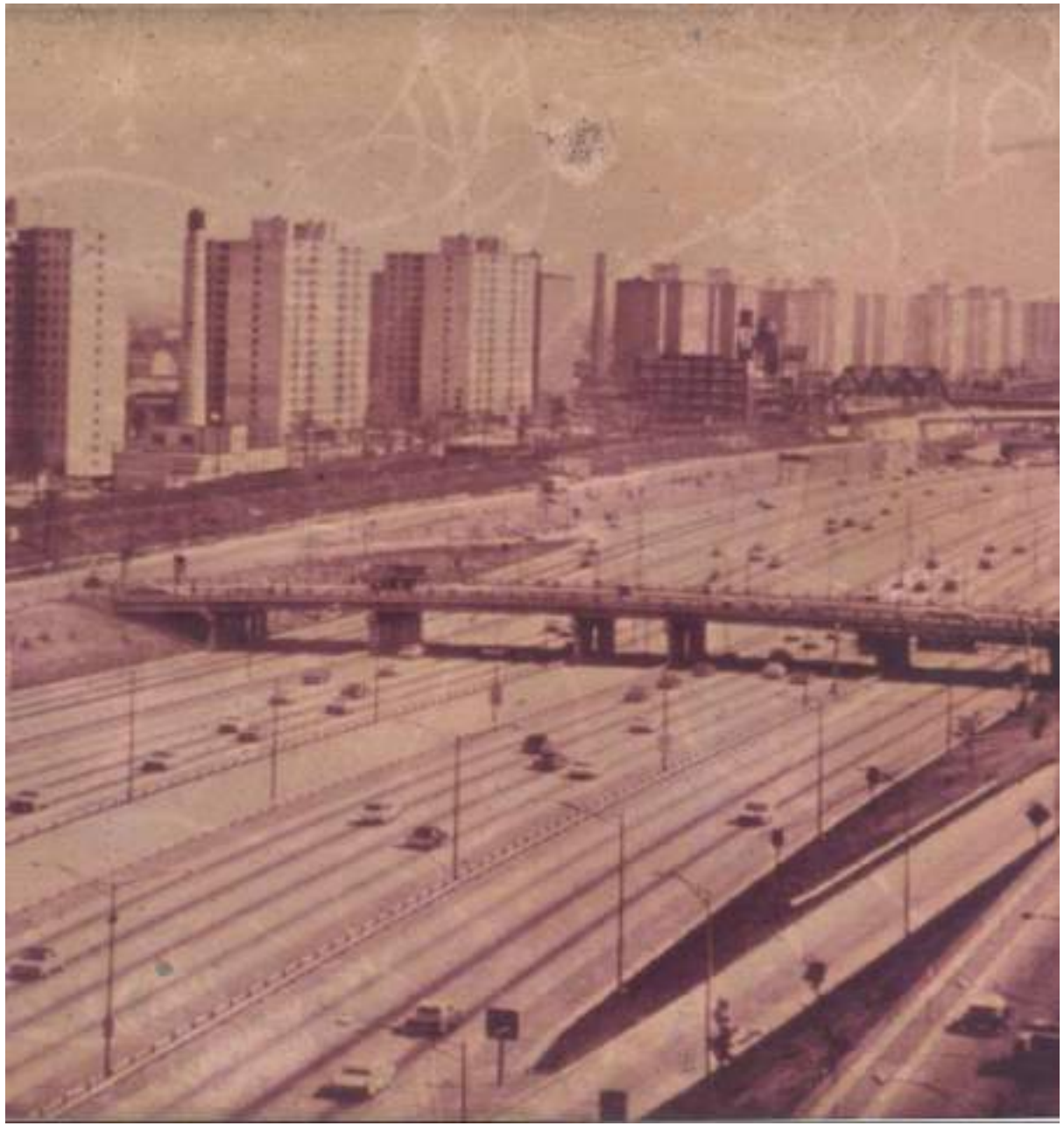
Superbly designed urban highways can serve low density suburbs, but not urban cores, due to their large space consumption - Austin, Texas

Sprawling suburbs and poor planned "edge cities" means: high cost of infrastructure, excessive consumption of land/resource, and social segregation – Los Angeles, California

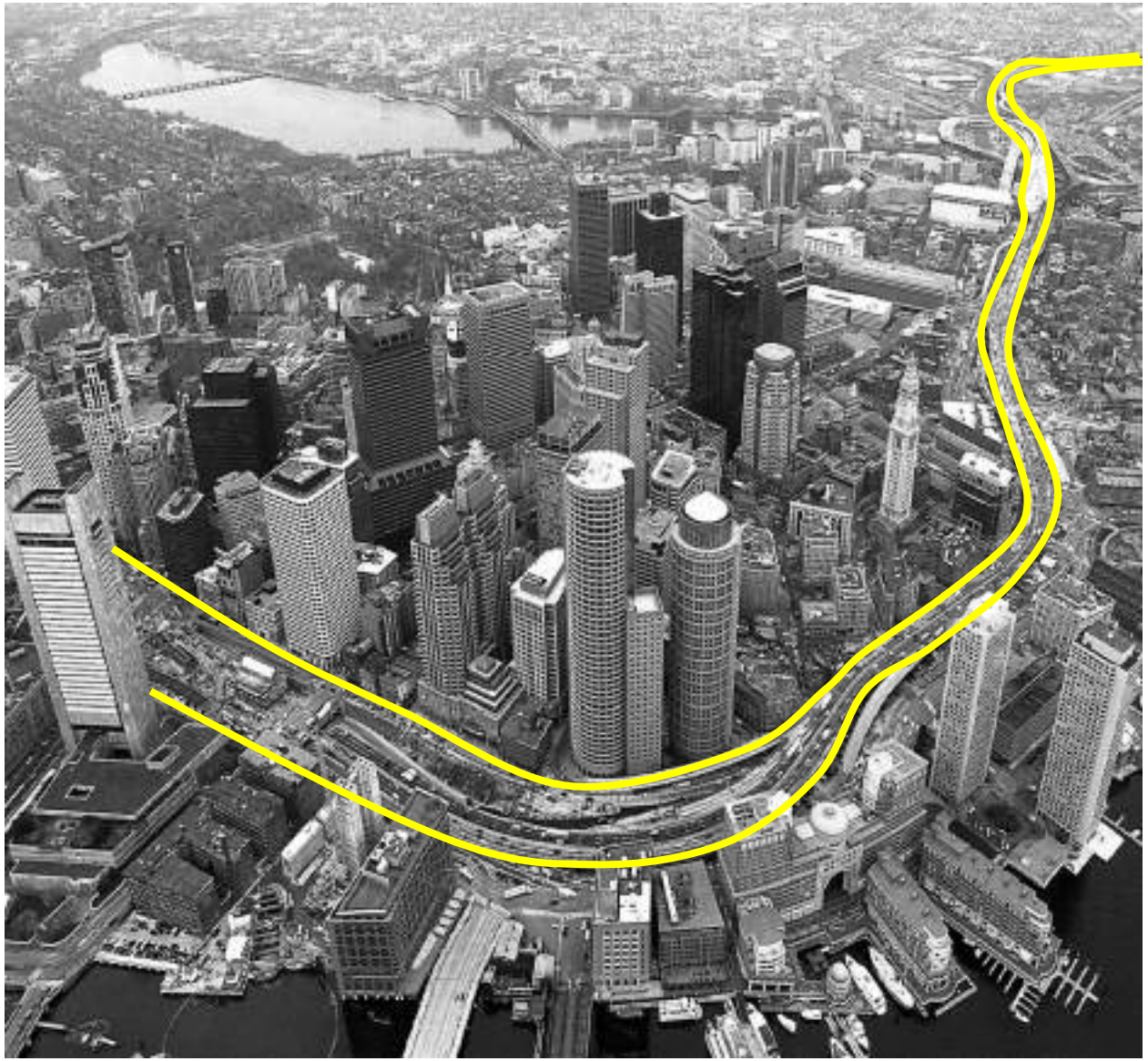
Impact on livability: the more accommodations for cars (highways, streets, parking), the less attractive the city is for people - Atlanta, Georgia



Cut-throat CBD highway – Chicago, Illinois



Boston Big Dig – A $25bn Lesson: Converted 14-lane CBD highway to a greenbelt parkway



Source: https://www.reddit.com/r/boston/comments/6so8p0/before_and_after_the_big_dig_xpost/
https://www.mass.gov/info-details/the-big-dig-project-background

National highway revolts in the U.S. history

Federal Reserve Bank of Philadelphia

Working Papers
Research Department

WP 19-29
July 2019

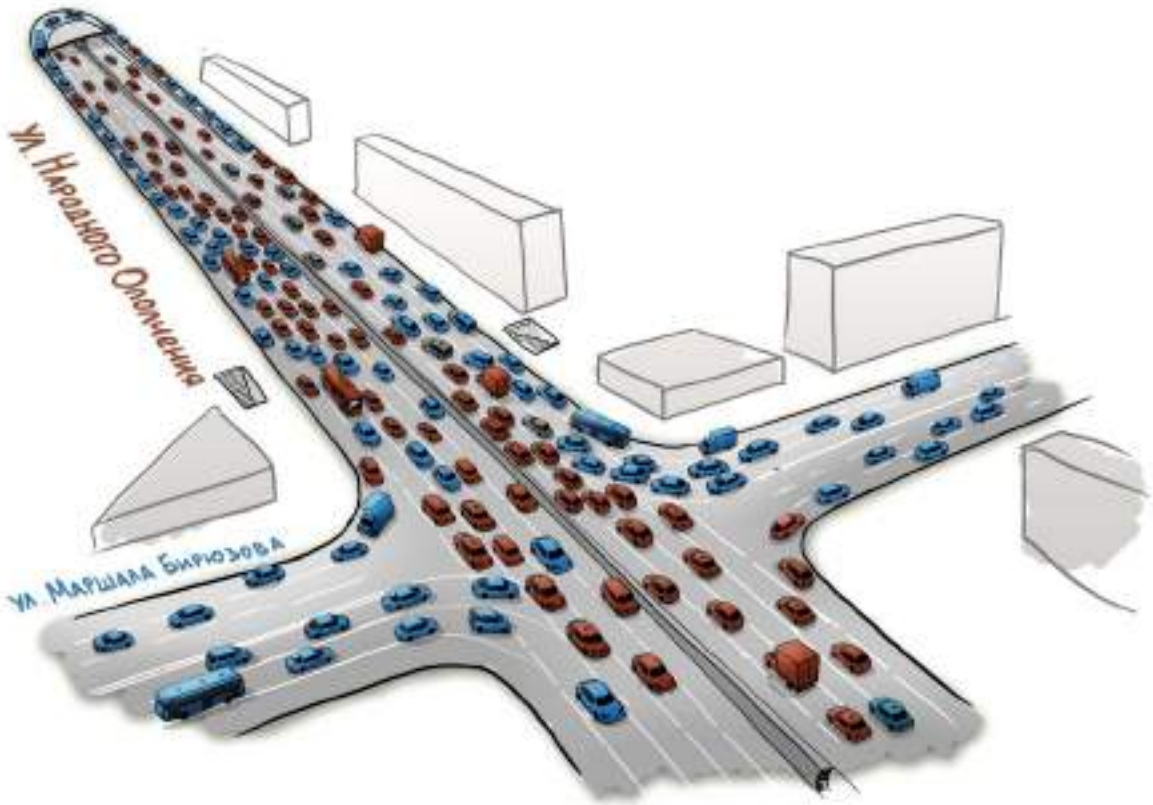
Freeway Revolts!

Jeffrey Brinkman
Federal Reserve Bank of Philadelphia Research Department

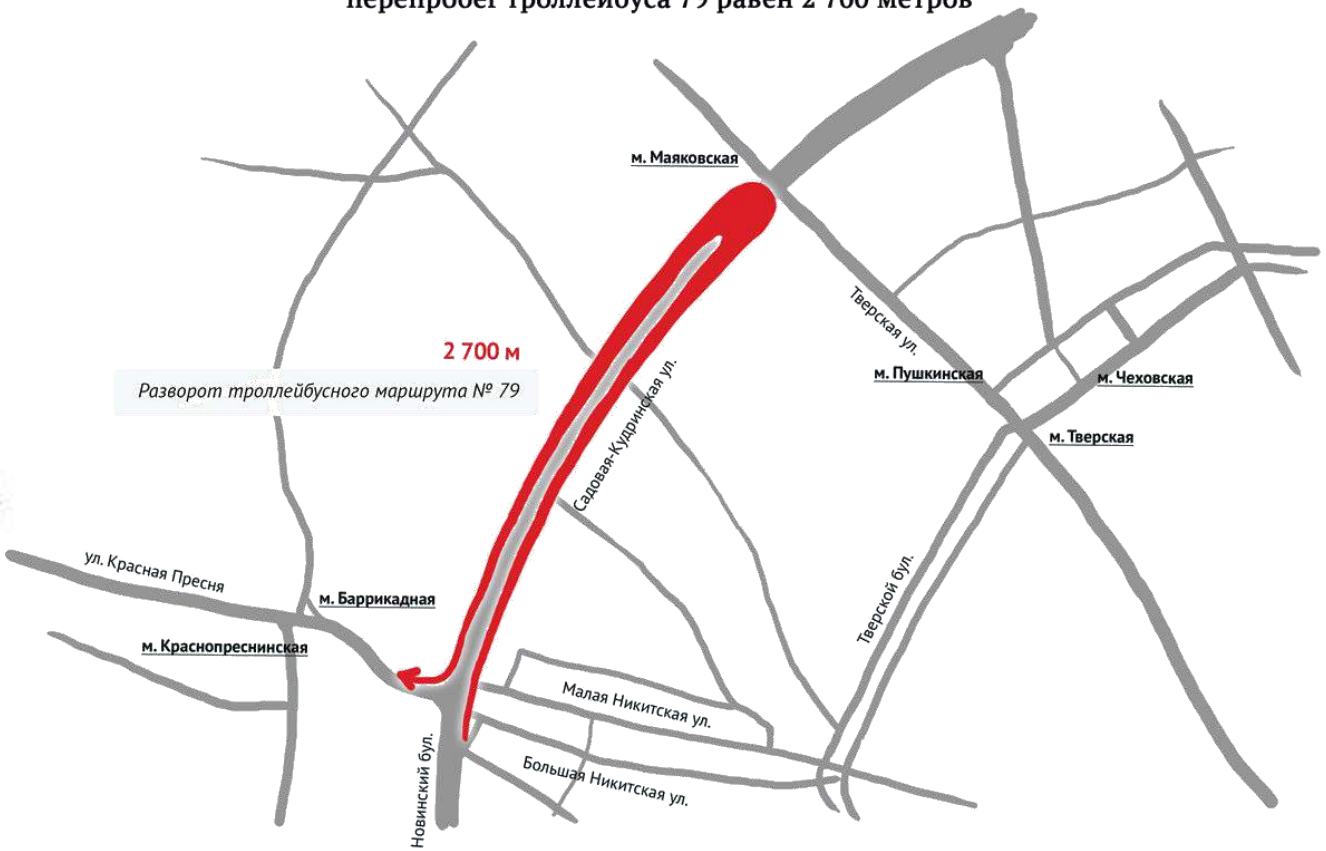
Jeffrey Lin
Federal Reserve Bank of Philadelphia Research Department

Examined the efficiency of using government capital to highway investment and its nation' growth

Moscow highway detour



В районе станции метро «Баррикадная»
перепробег троллейбуса 79 равен 2 700 метров



Cities struggle with finding a balance between transit and highway investments

Highway in parallel with an exclusive ROW lane on Jl. Sudirman, South Jakarta

Highway in parallel with a metro line in Thailand - BTS Skytrain

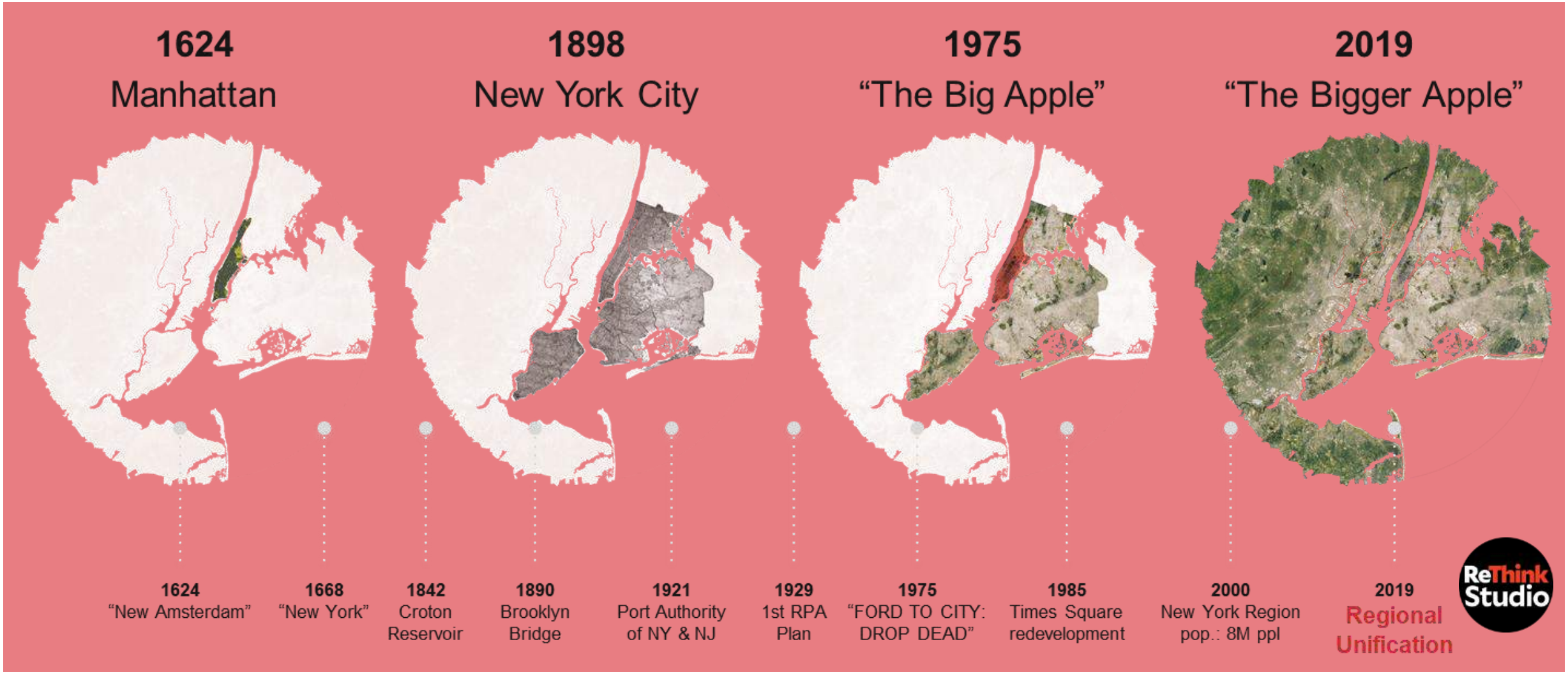
Highway in parallel with a metro line in Emirates Road – between Dubai and Sharjah

Highway in parallel with an overcapacity BRT in İstanbul, Türkiye

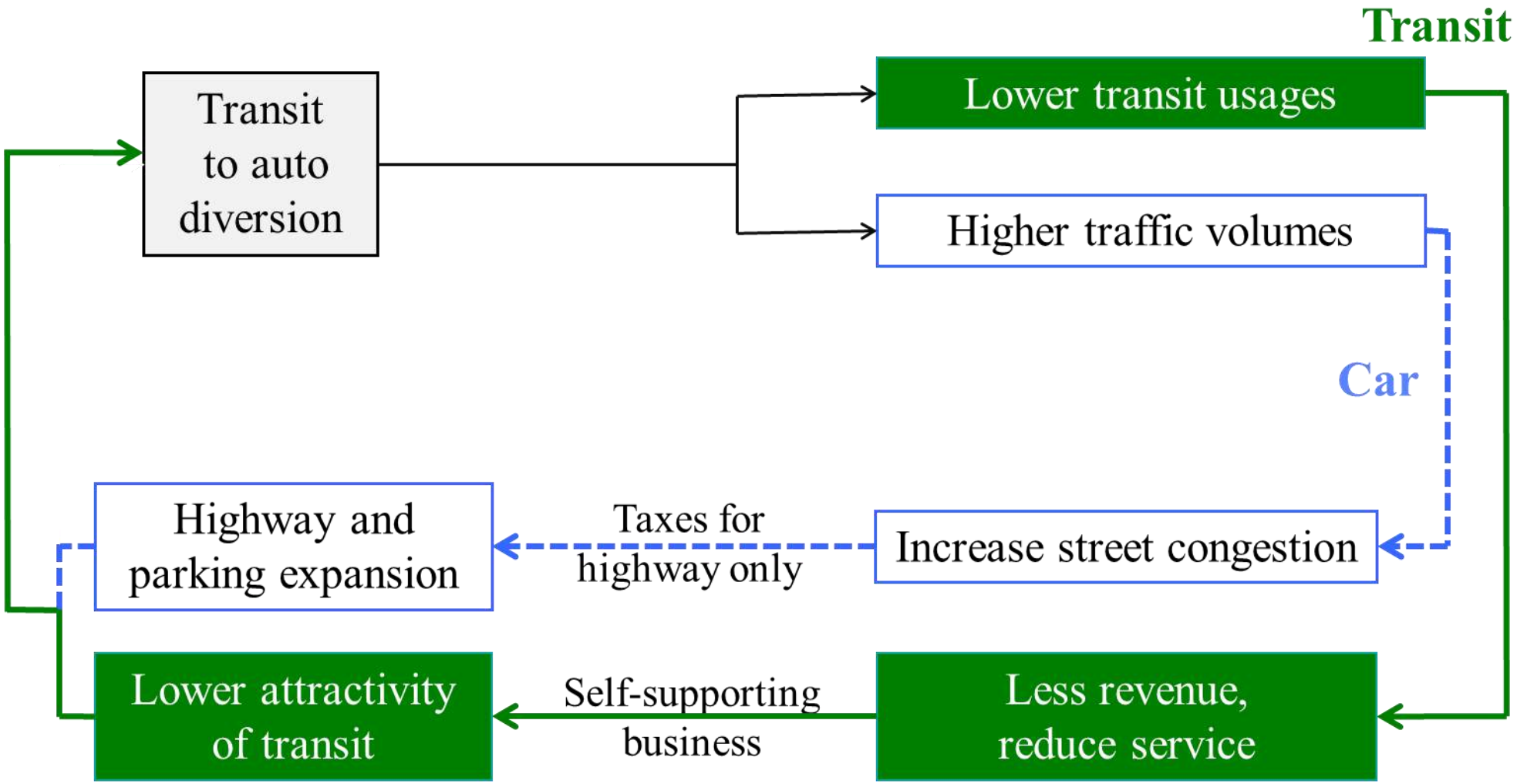
Repositioning city's long-term competitiveness

The New York Times Mon 1 Apr 2019 14.53 EDT

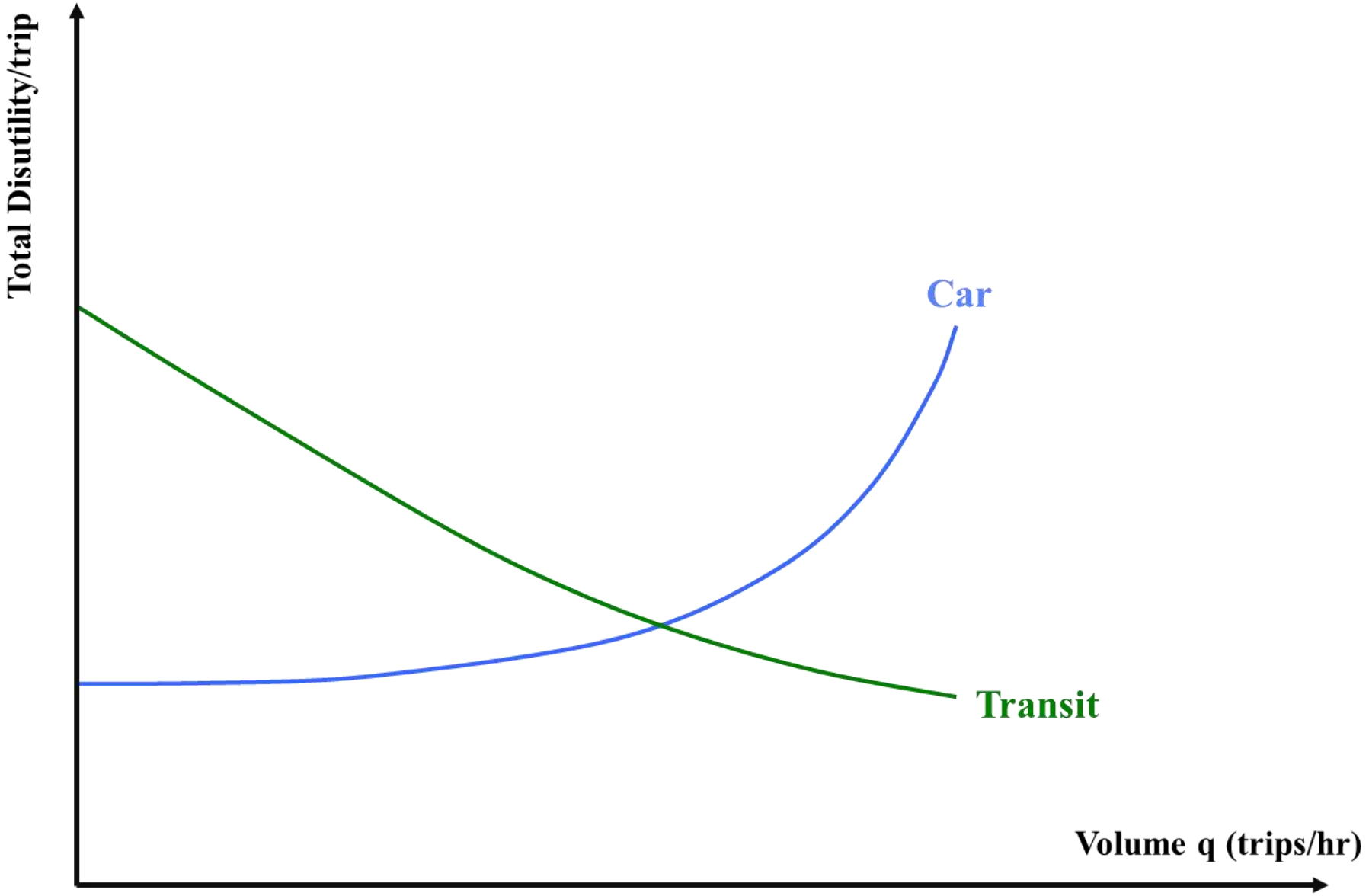
New York becomes first city in US to approve congestion pricing



The Collision of Cities and Cars and Vicious Circle

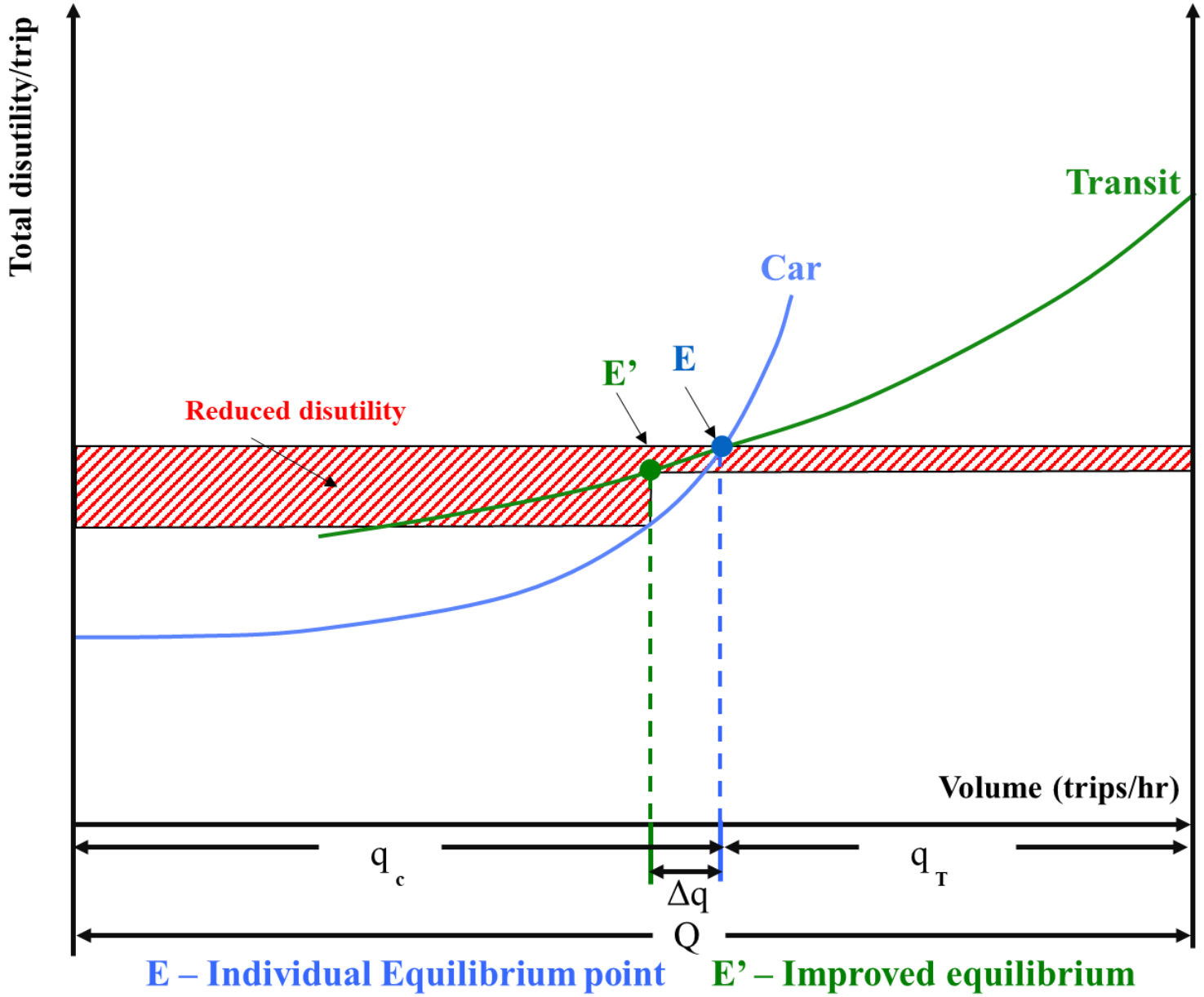


Interrelation between travel disutility and volume: Car vs. Transit

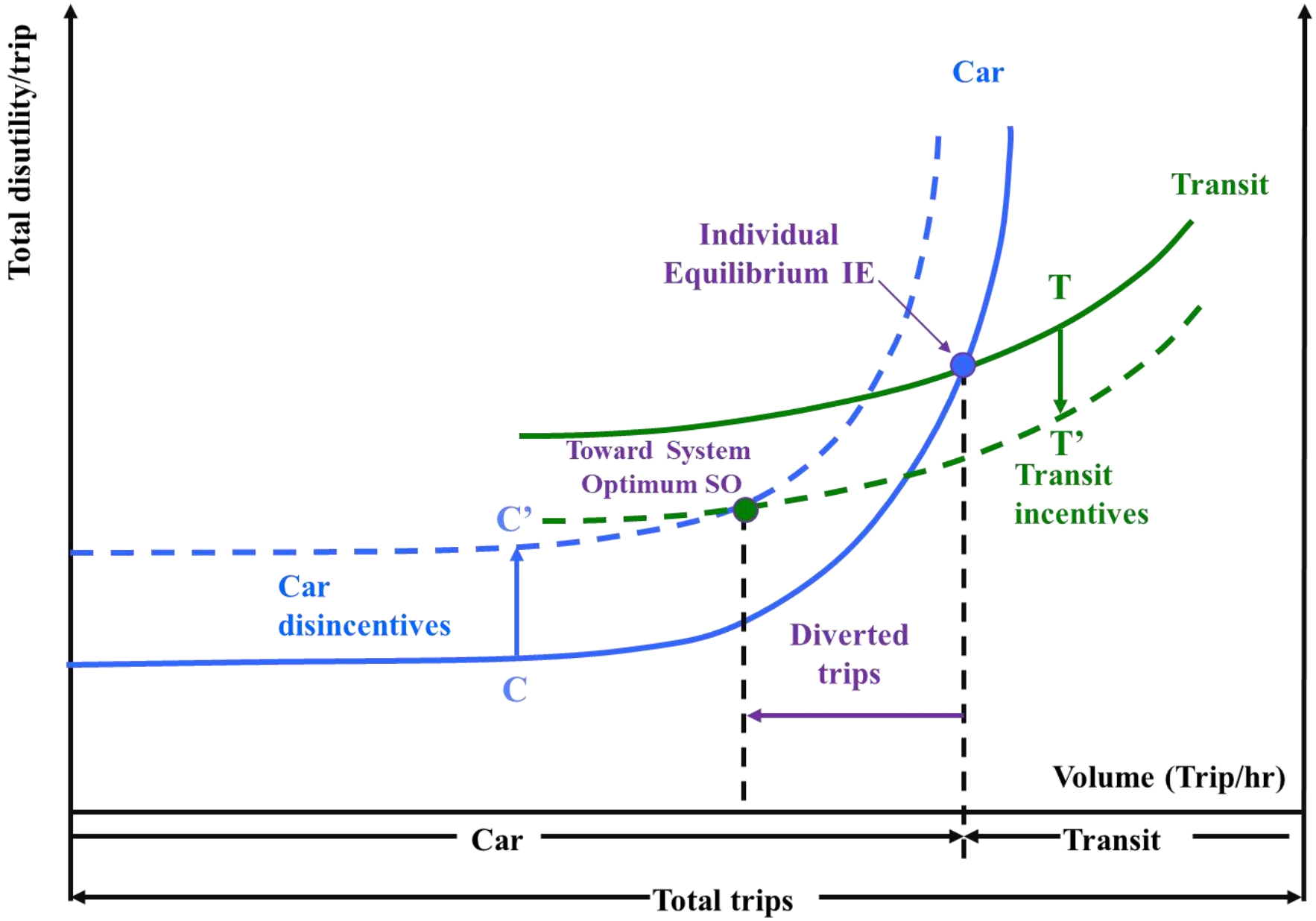


Disutility: user cost, travel time, safety, social cost, system externalities

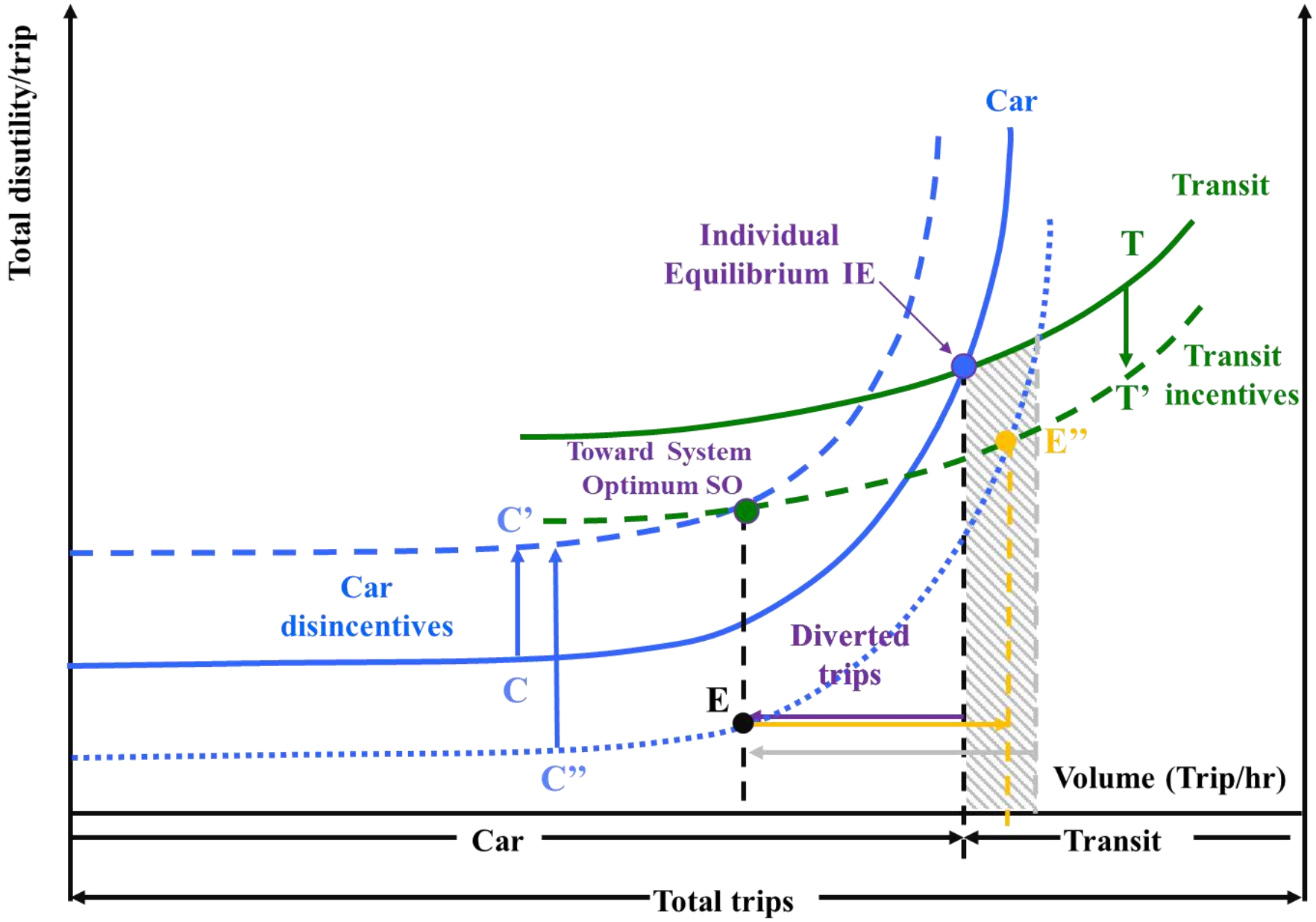
Travel distribution between cars and transit



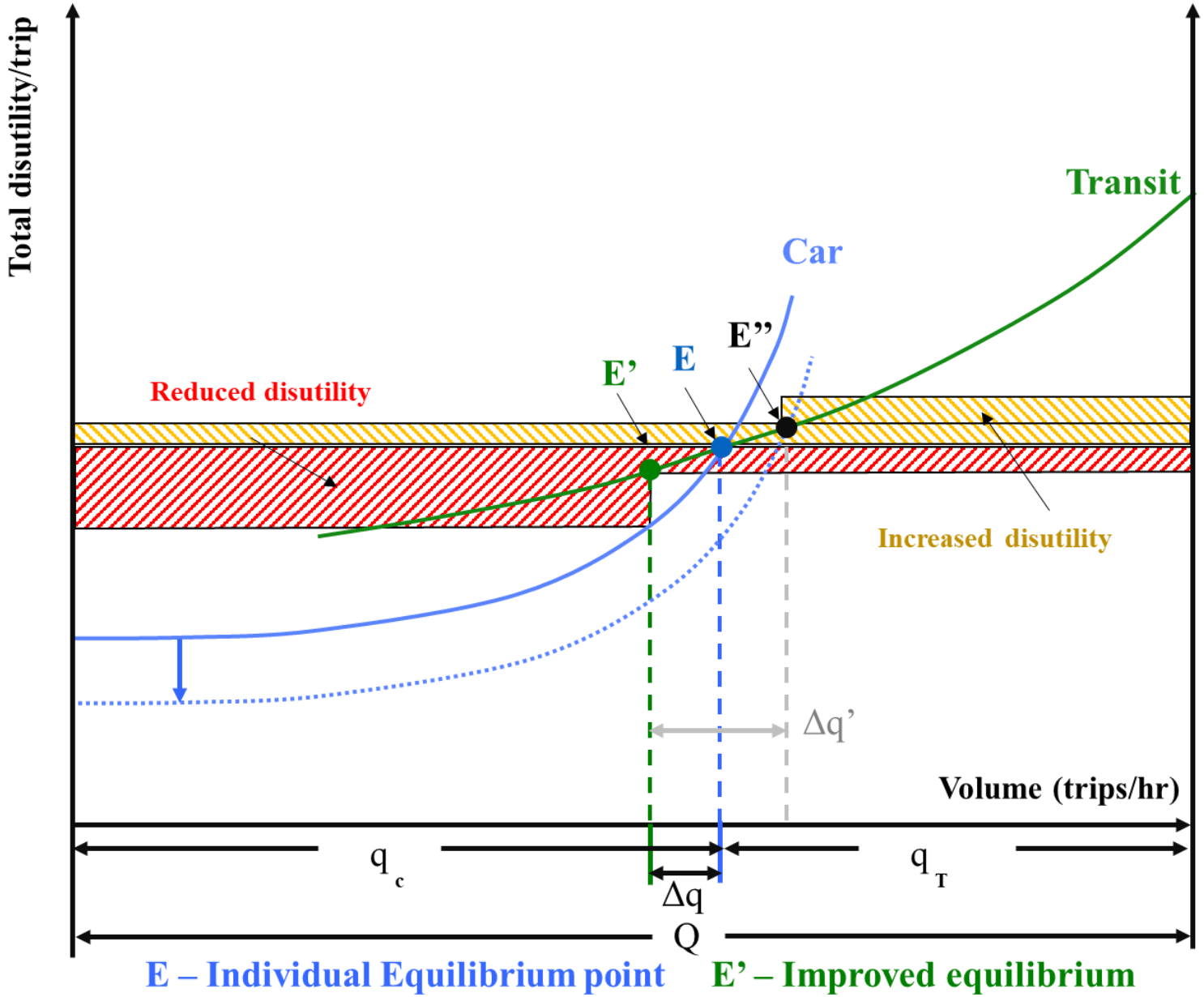
Transportation policies for shifting the individual equilibrium point toward system optimum



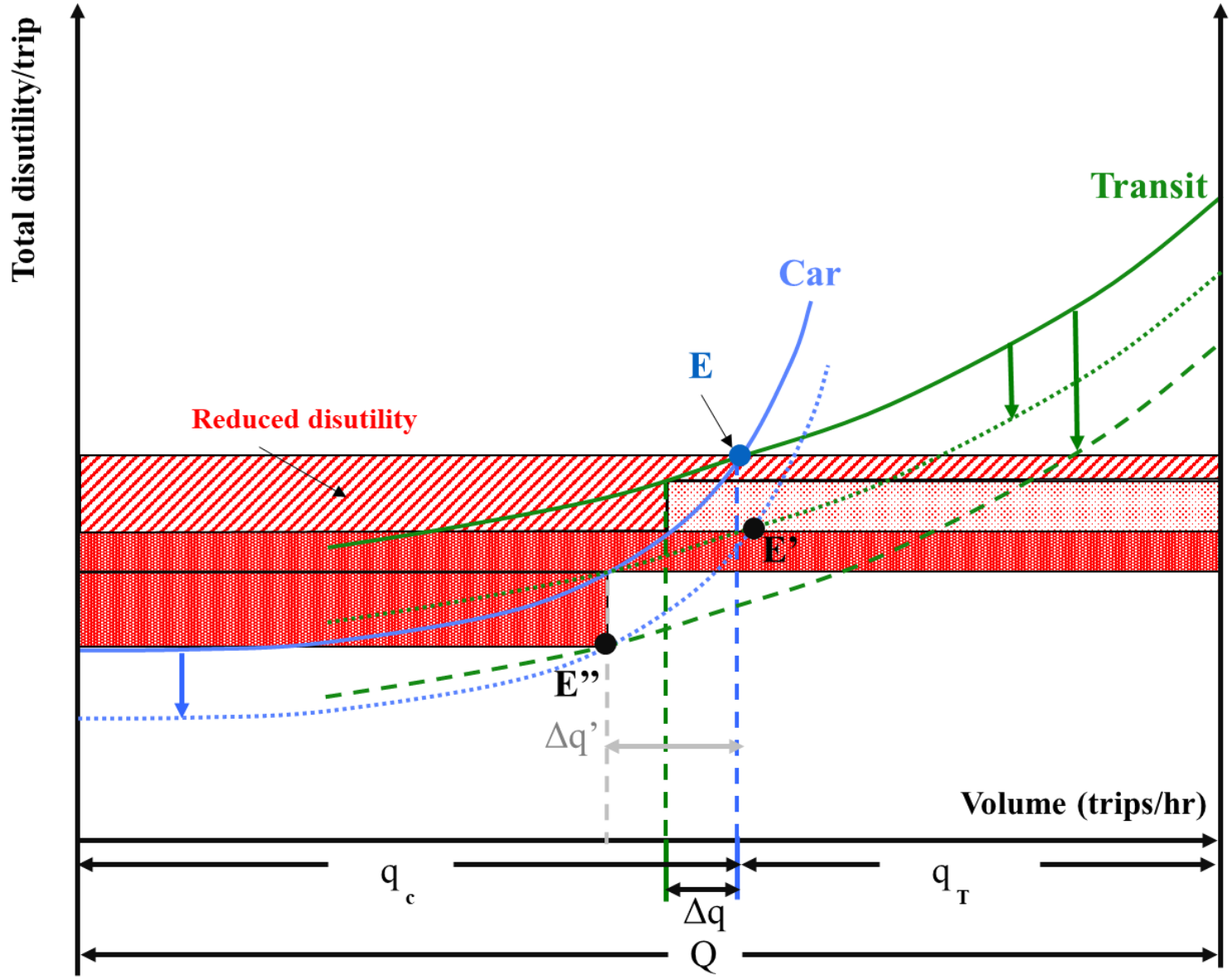
Investment offset: investing the equal amount of capital in transit and car-based infrastructure



Negative consequence of ONLY investing in car-related infrastructure

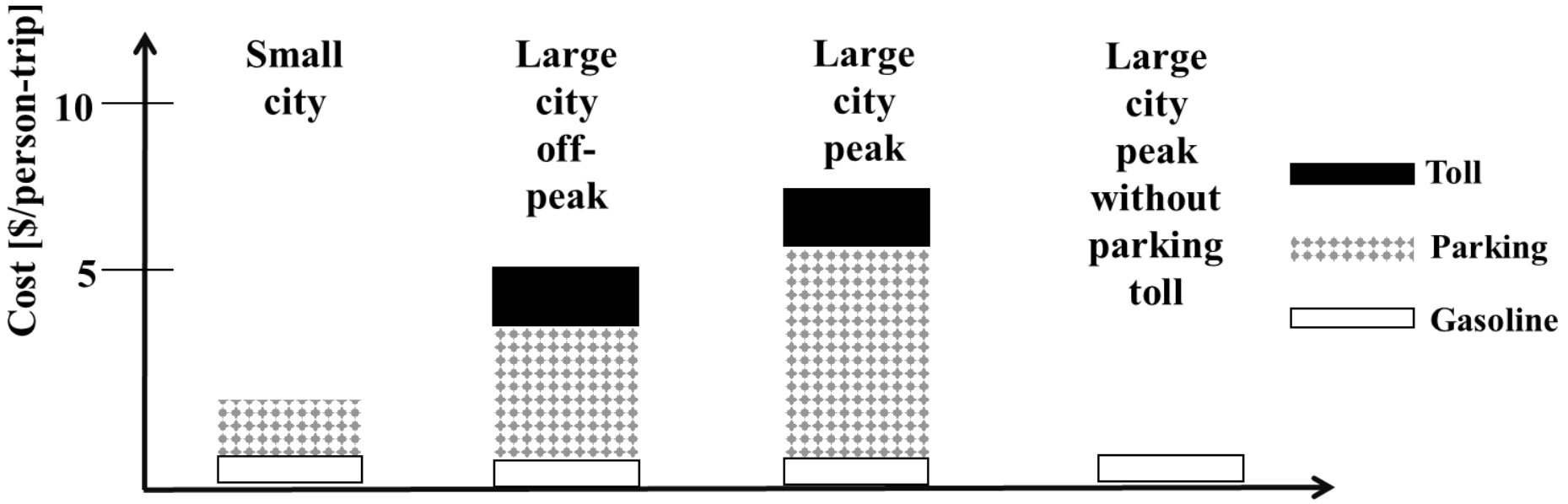


Positive return on investment: capital put into transit > car-related infrastructure

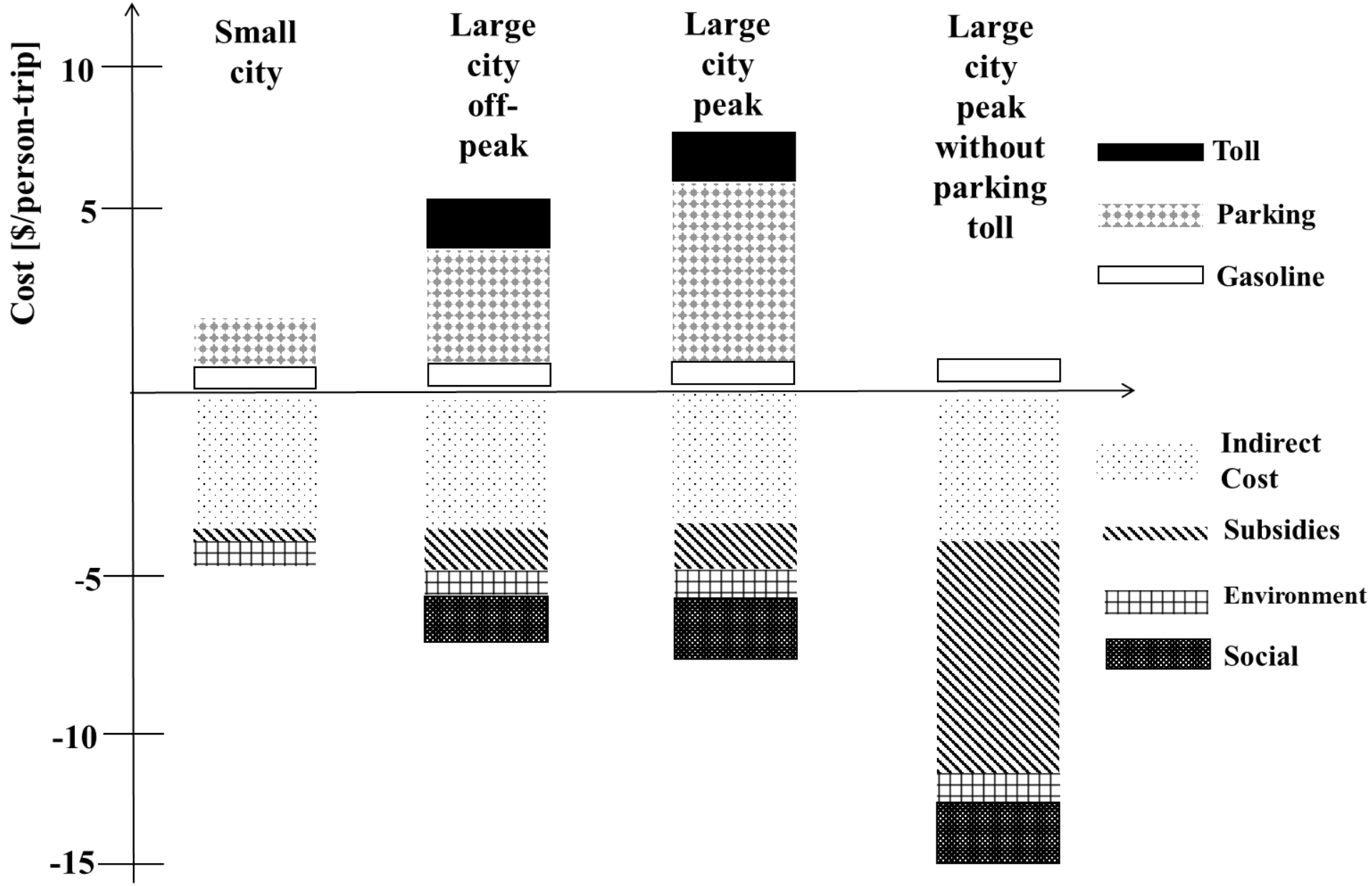


E – Individual Equilibrium point E' – Improved equilibrium

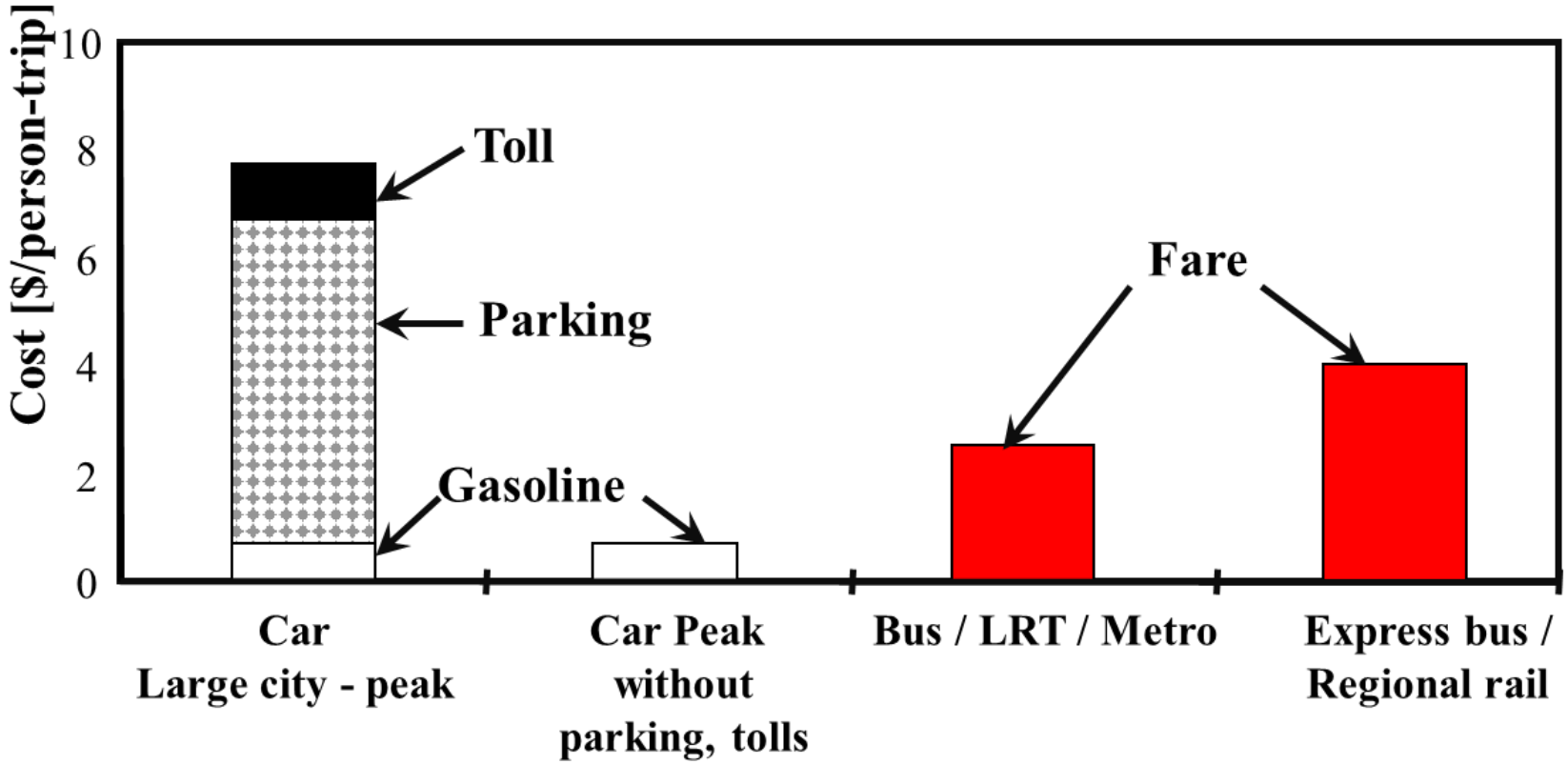
Direct cost of car travel under different scenarios in cities



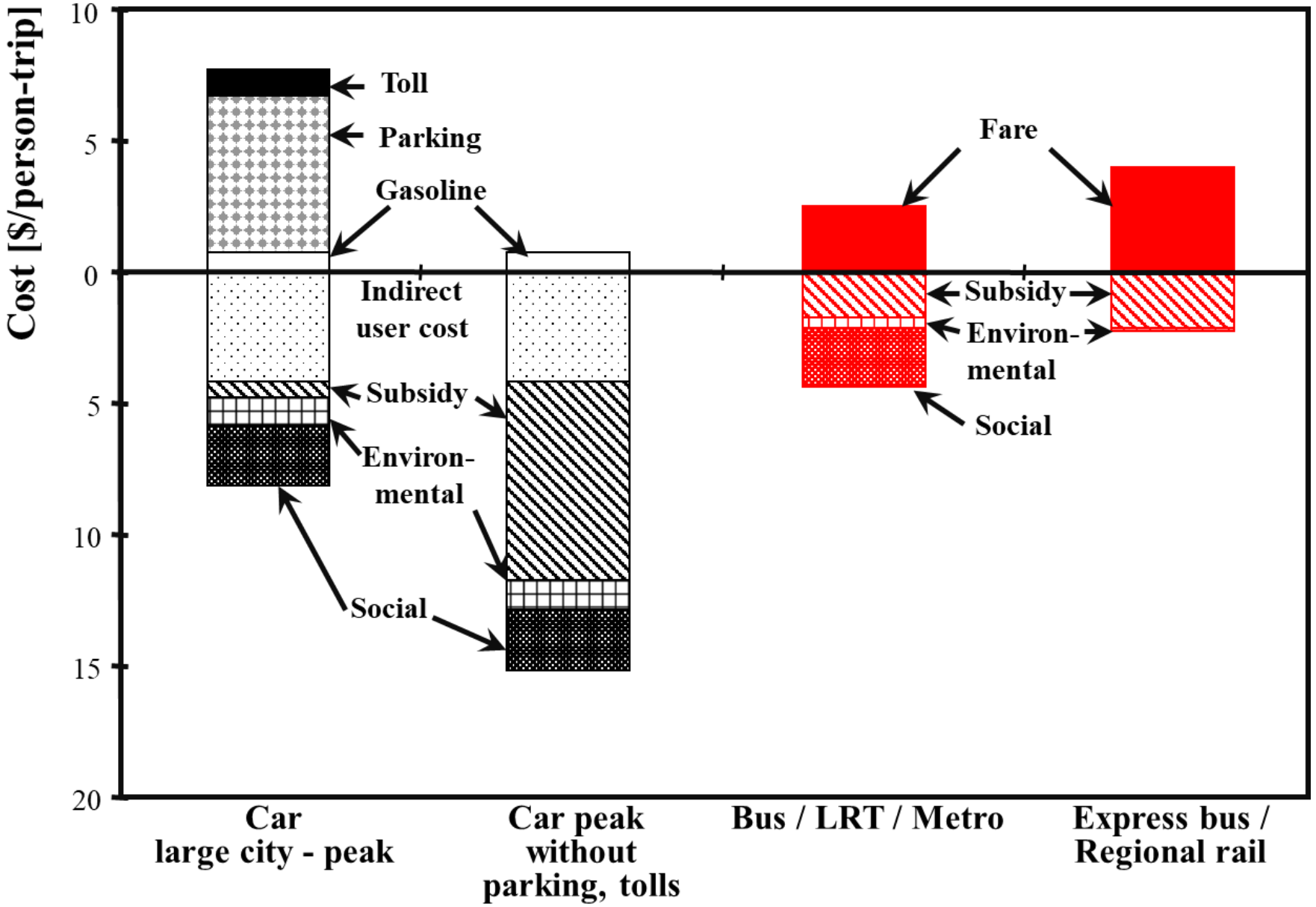
Total cost of car travel under different scenarios in cities



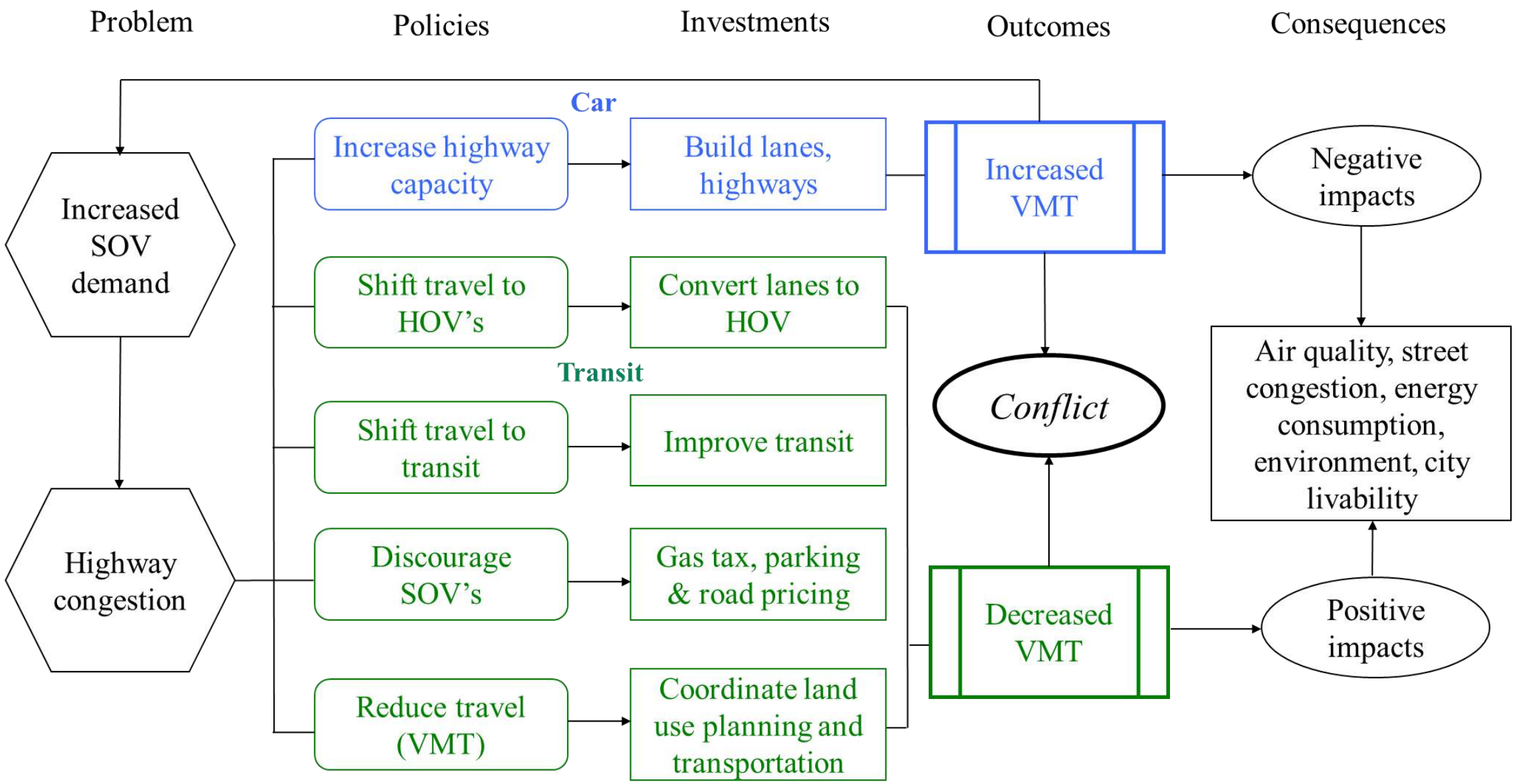
Direct costs of urban travel by different modes



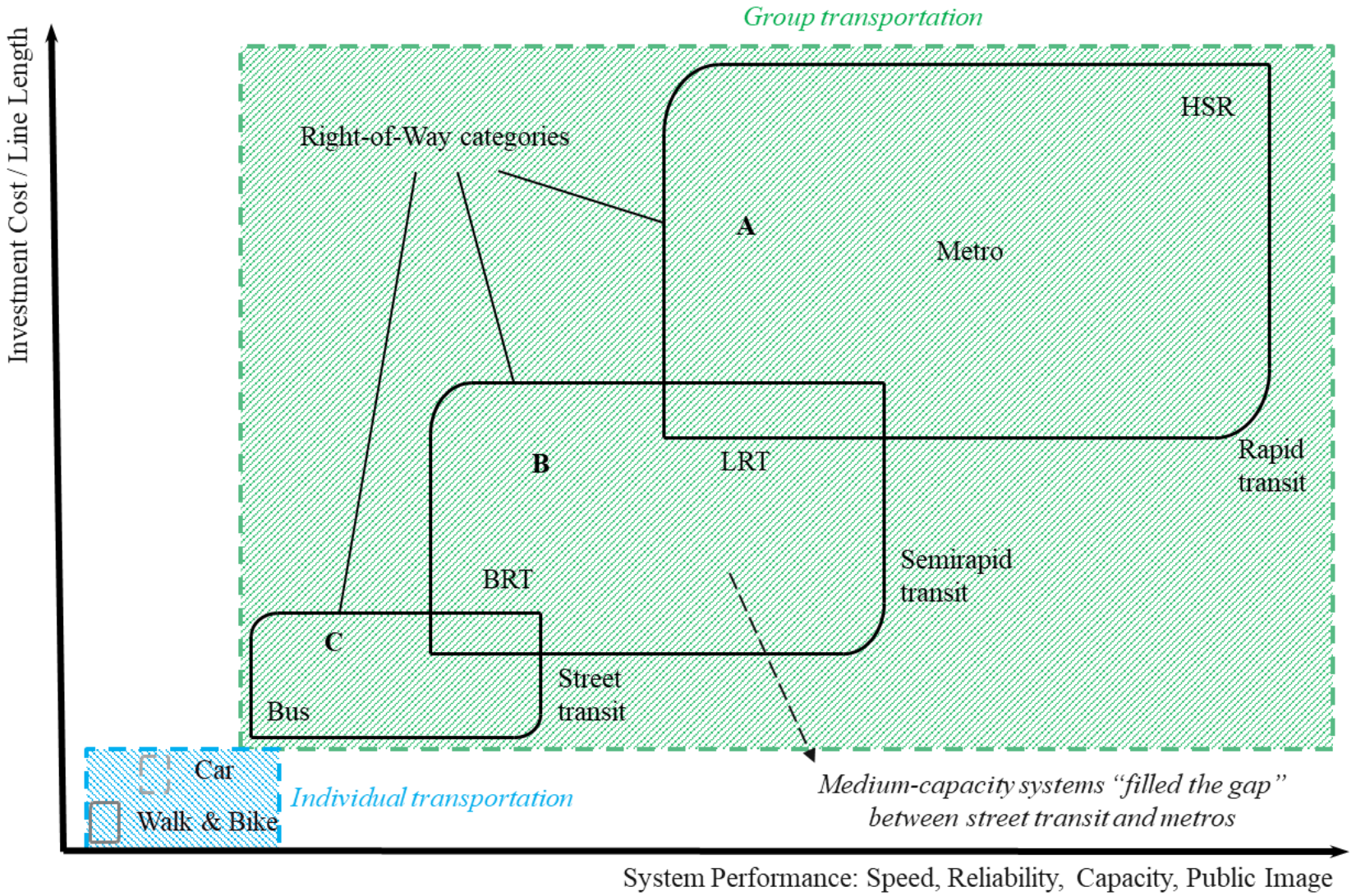
Total costs of urban travel by different modes



Offsetting consequences of conflicting policies and investments: car vs. transit



Multimodal Transport: Balance System



Investment Selection Criteria

1. ***System performance*** major elements:

- **Service frequency f**, number of Transit Unit departures per hour [TU/h]. It is inverse of headway h [min/TU];
- **Operating speed Vo [km/h],** speed on the line which passengers experience;
- **Reliability**, expressed as a percentage of TU arrivals with 0, 4 min delay;
- **Safety –** measured by the number of accidents per 100 million passenger-km.
- **Line capacity C [sps/h];** passengers do not observe it directly, but it influences most elements of systems performance and service quality.

2. Level of service **-** overall measure of all service characteristics that affect users. It consists of:

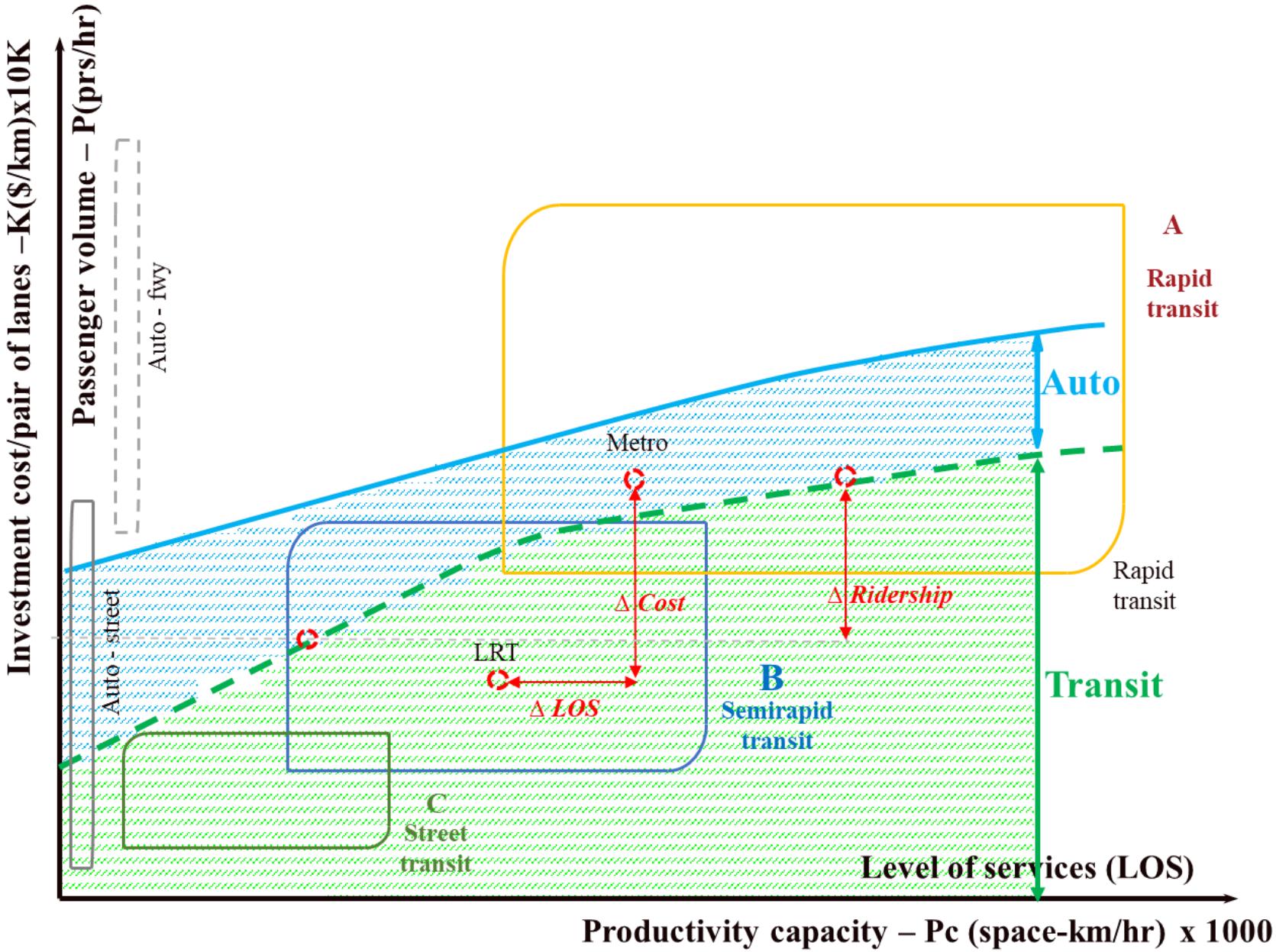
- **Performance elements that affect users (speed, reliability, safety);**
- **Service quality –** qualitative elements of service;
- **Transit fare.**

3. Impacts of transit service on its served area

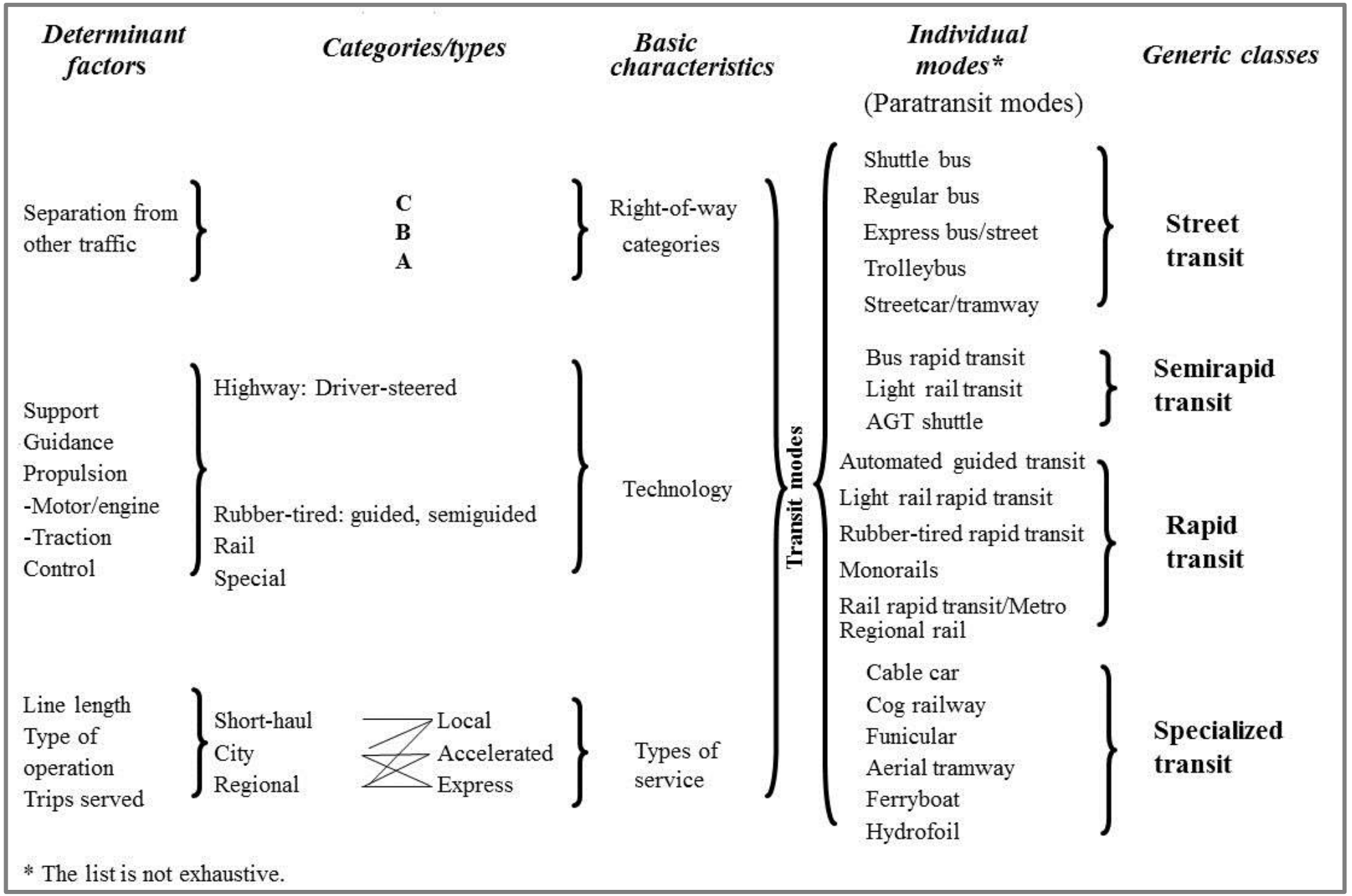
- Short- and long-term
- Positive and negative
- Quantitative and qualitative

4. System costs - usually divided into investment and operating costs

Investment trade-off: Family of urban transit modes



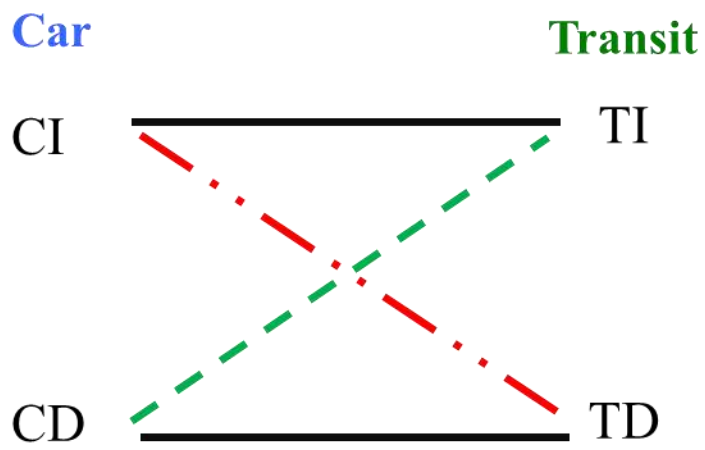
Summary table of multimodal transport



Technical, operational, and system characteristics of multimodal transport modes

Generic class		*Private*		*Street Transit*		*Semirapid Transit*		*Rapid Transit*	
Characteristics	**Mode / Unit**	**Auto on Street**	**Auto on Freeway**	**RB**	**SCR**	**BRT**	**LRT**	**RRT**	**RGR**
Vehicle Capacity, C_v	sps/veh	4-6, total.	1.2-2.0 usable	40-120	100-180	40-120	110-250	140-280	140-210
Vehicles/Transit Unit	veh/TU	1	1	1	1-3	1	1-4	1-10	1-10
Transit Unit Capacity	sps/TU	4-6, total.	1.2-2.0 usable	40-120	100-300	40-120	100-600	140-2000	140-1800
Max. Technical Speed, V	km/h	40-80	89-90	40-80	60-70	70-90	60-100	80-100	80-130
Max. Frequency, f_{max}	TU/h	600-800	1500-2000	60-120	60-120	60-90	40-90	20-40	10-30
Line Capacity, C	sps/h	720-1050[b,d]	1800-2600[d]	2400-8000	4000-15,000	4000-8000	6000-20,000	10,000-40,000	8000-35,000
Normal Operating Speed, V_o	km/h	20-50	60-90	15-25	12-20	20-40	20-45	25-60	40-70
Operating Speed at Capacity, V^c_o	km/h	10-30	20-60	6-15	5-13	15-30	15-40	24-55	38-65
Productive Capacity, P_c	10^3 sp-km/h	10-25[b]	50-120	20-90	30-150	75-200	120-600	400-1800	500-2000
Lane Width (One-way)	m	3.00-3.65	3.65-3.75	3.00-3.65	3.00-3.50	3.65-3.75	3.40-3.75	3.70-4.30	4.00-4.75
Vehicle Control	-	Man./vis.	Man./vis.	Man./vis.	Man./vis.	Man./vis.	Man./vis.-sig.	Man.-auto./sig.	Man./vis.-sig.
Reliability	-	Low-med.	Med-high	Low-med	Low-med	High	High	Very high	Very high
Safety	-	Low	Low-med	Med	Med	High	High	Very high	Very high
Station Spacing	m	-	-	200-500	250-500	350-800	350-800	500-2000	1200-4500

Investment mechanism: car and transit toward positive outcome

Policy Type	Investment	Mobility	Modes and Policies
Incentives	High	Increased	
Disincentives	Low or Negative	Decreased	

Legend for Policies

- Leads to balanced intermodal system
- May not influence intermodal relations
- Increases imbalance favoring car

CI: Car Incentive
TI: Transit Incentive
CD: Car Disincentive
TD: Transit Disincentive

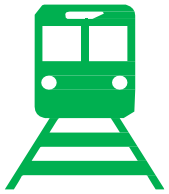
3. Infrastructure Investment Decision Making and Investment Concepts

Versatility of Government Initiative - Stalwart activism

United Arab Emirates

- Market access, establishment, stability
- Policy formation, guidance
- Managerial strategy

- City development
- Real estate



- Infrastructure Investment

- Deal structure, endorsement
- Macroprudential engagement
- Multilateral collaboration, barrier removal

- Large scale, big picture
- Trade-off, offset, conflict & countermeasure
- Resource allocation, opportunity cost, control mechanism

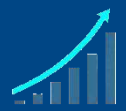
Source: https://www.government.ae/en/information-and-services/infrastructure/infrastructure-and-vision-2021

Infrastructure Investment sine qua non!!!

What is the minimum we need to earn on an investment to be willing to comeback and do it again?

What scale and magnitude of government spending are enough to achieve an intended outcome? How much capital do we need to invest in order to keep the economic growth? [Scale]

VS.



How much can we grow without destroying value? Growth at what cost? Growth, but how long can it be sustained? What is the [quality] of growth?

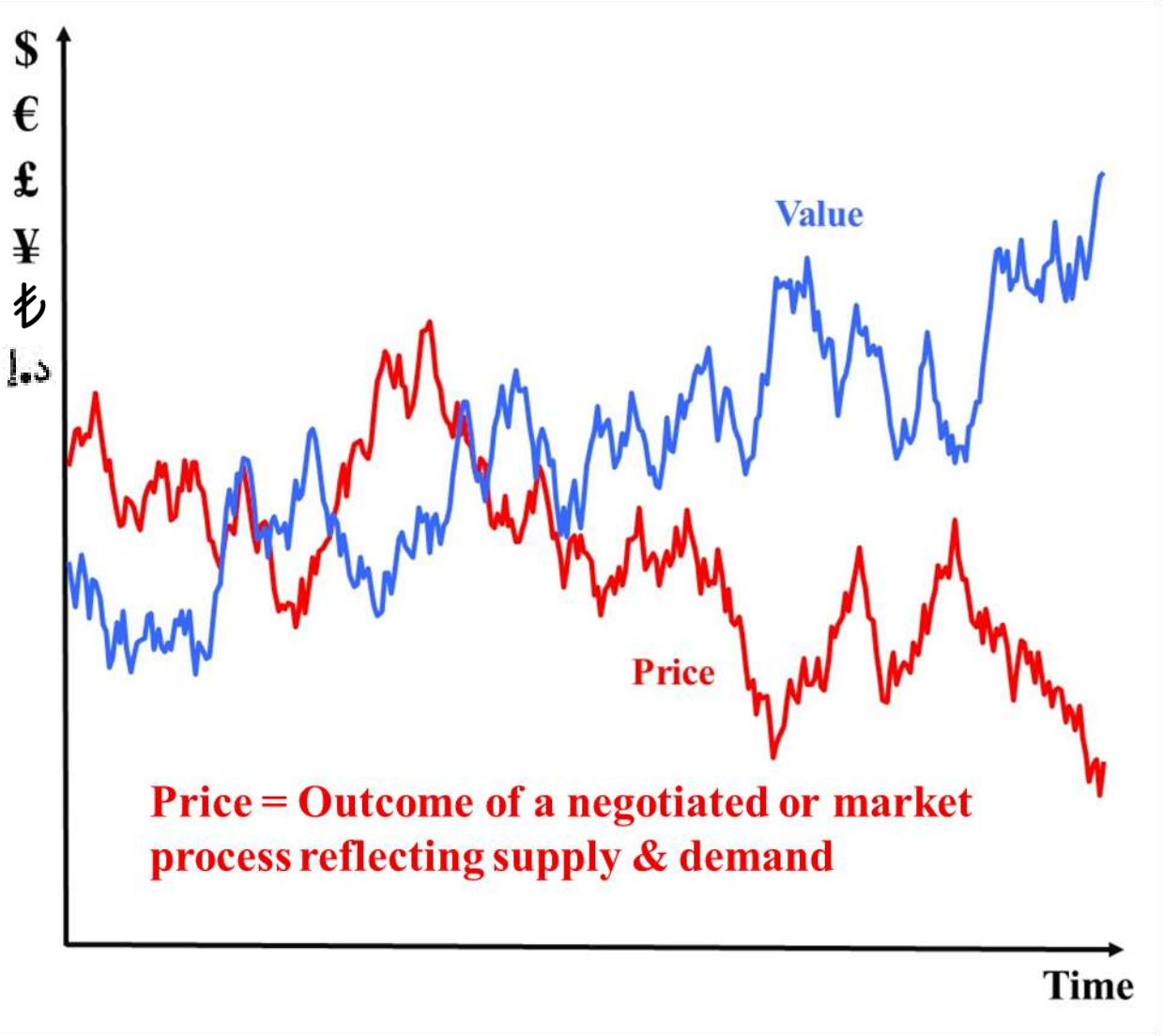
Which investment will create the most value? What is the countermeasure for value destruction?

What drives the return? What are the definitive investment process and control mechanism?

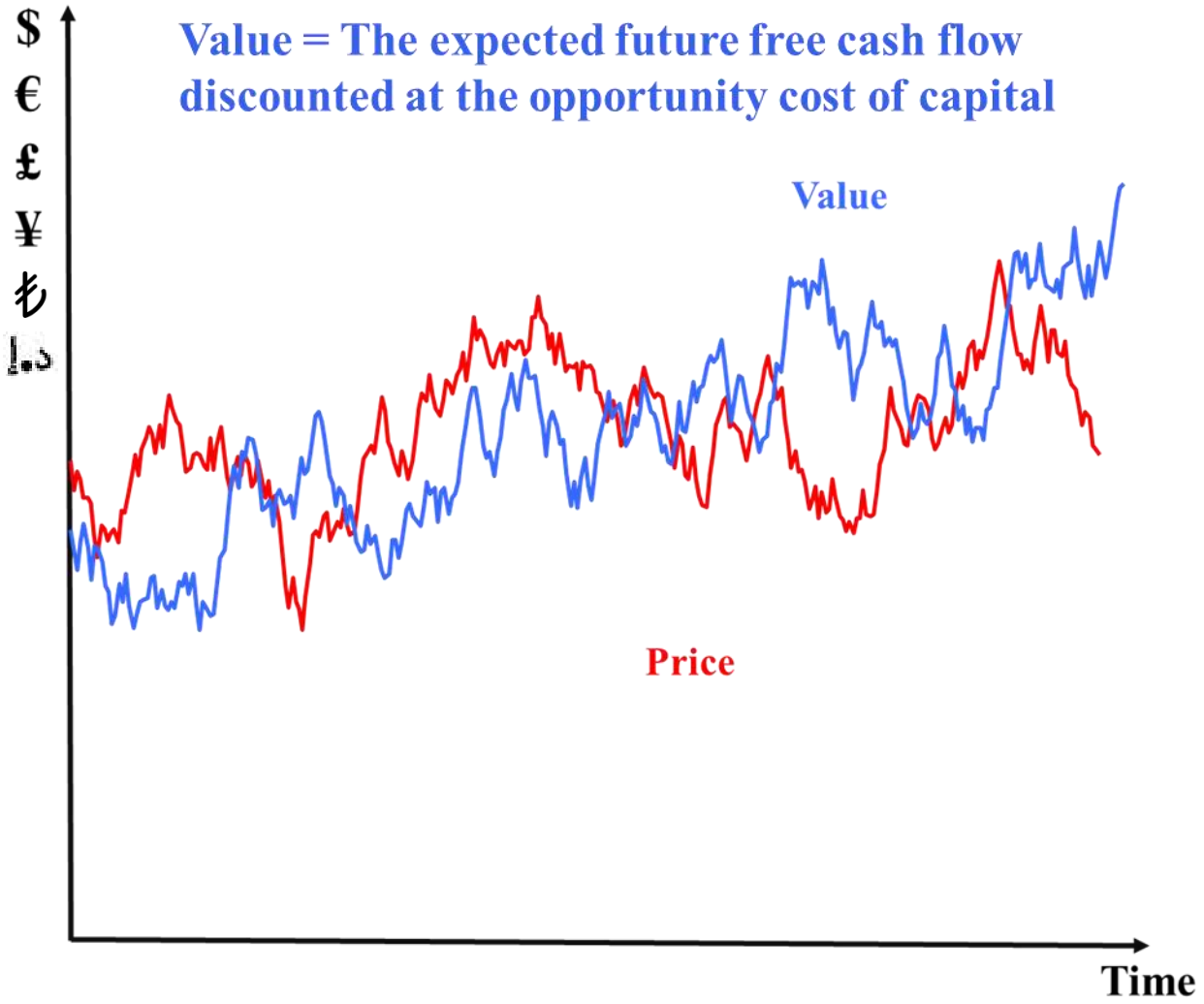
Patience, timing (e.g. J-curve or perpetuity funds), Increase return on scale or α or β?

Distinguishment of price vs. value in infrastructure investment

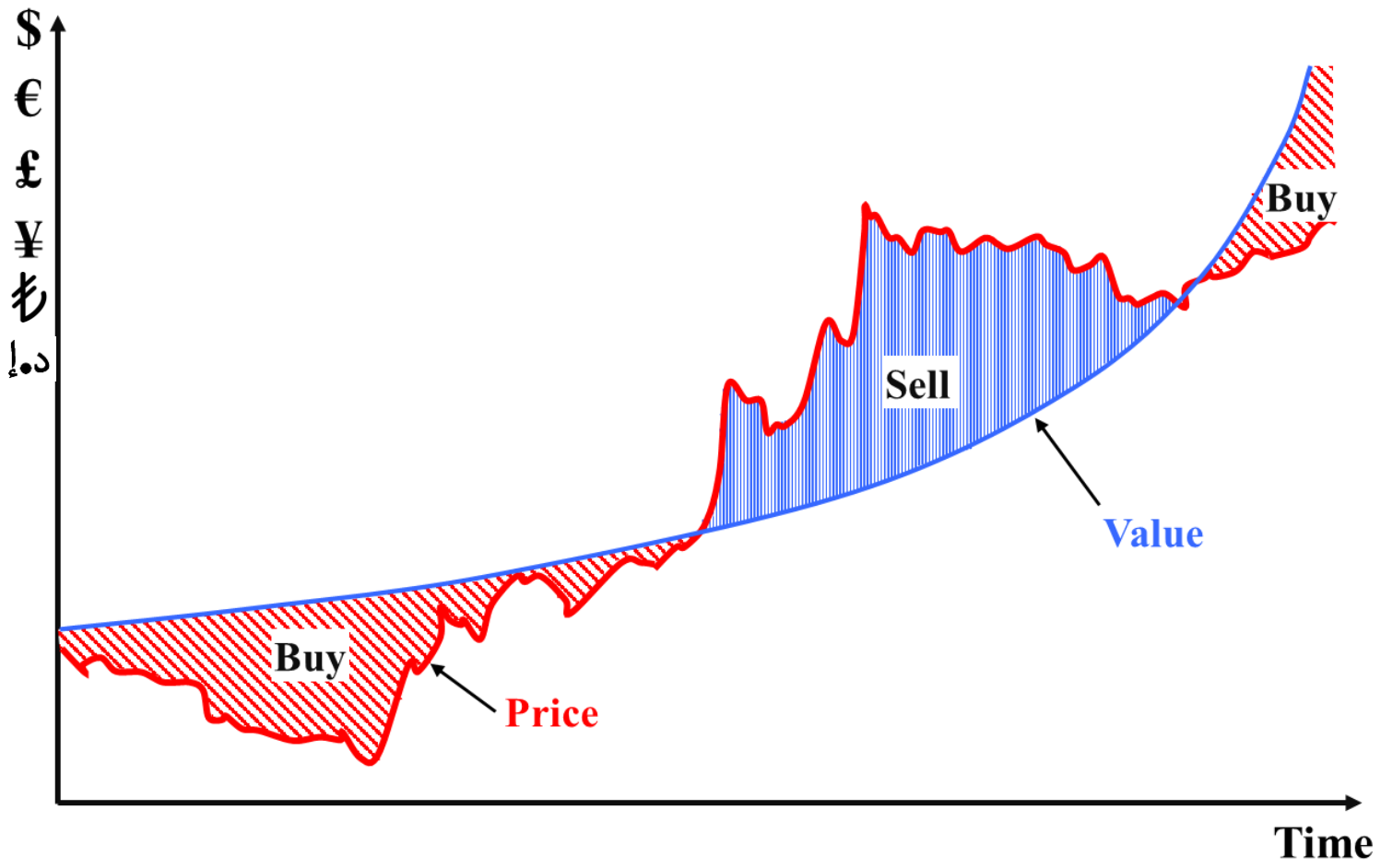
Price and value fluctuated around each other, then diverged



Price and value fluctuated around each other



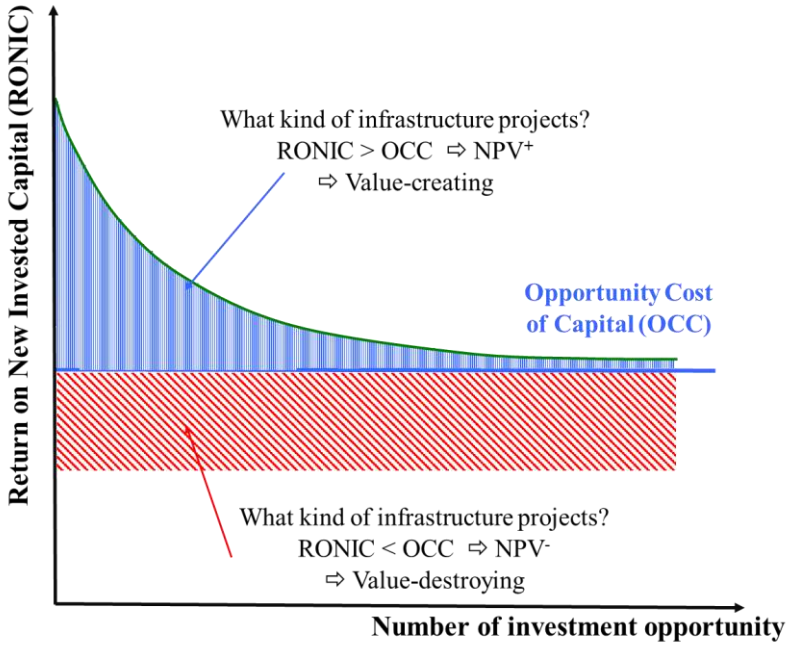
Asset ownership and entrepreneurial mindset

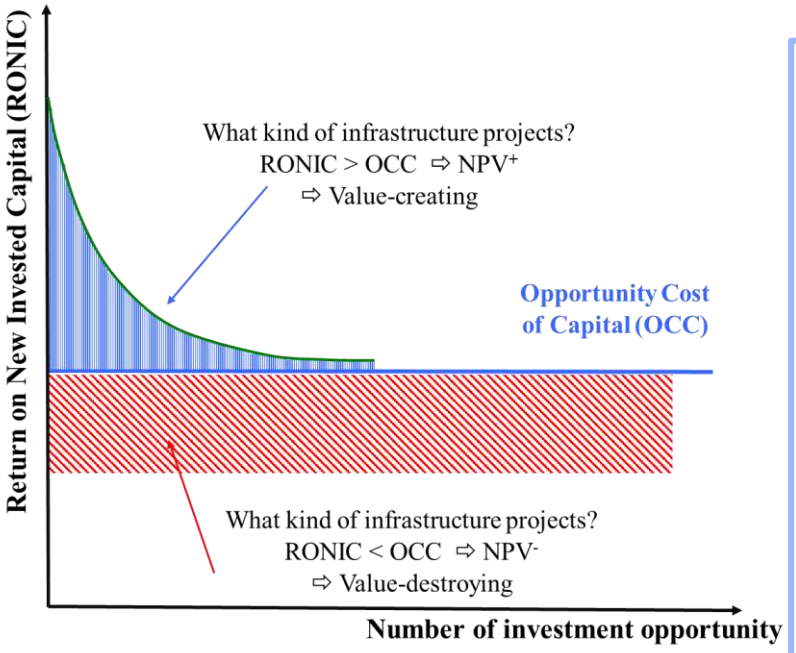


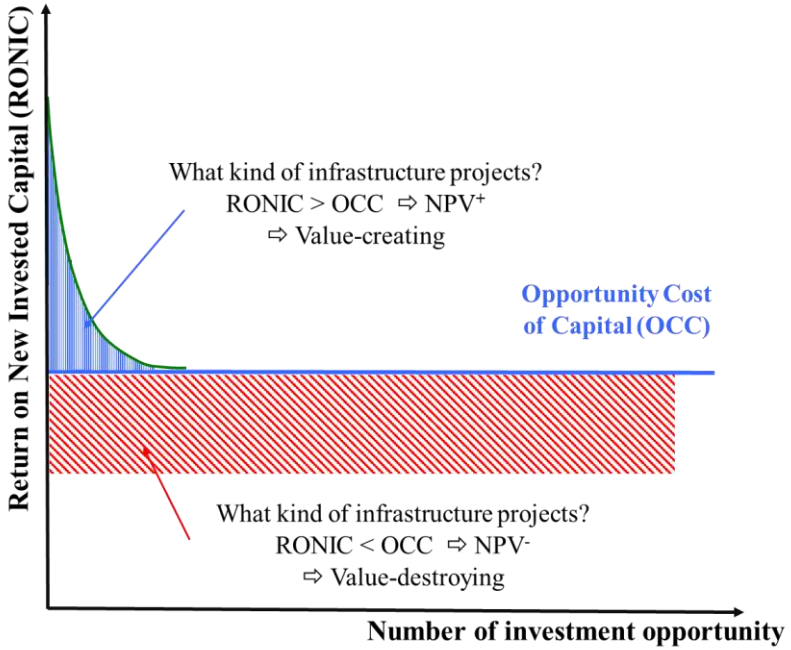
Asset ownership is not static, and an asset's best owner could at different times be a conglomerate, a private-equity firm, a government, a sovereign wealth fund, a family, etc. Having a concept of best ownership helps the economy to **redirect resource for productive uses** and **precipitates efficient allocation** to the **highest return** activities at a much lower cost. Ownership transition is neither good nor bad. It depends on whether the current owner creates more value than any prospective owner.

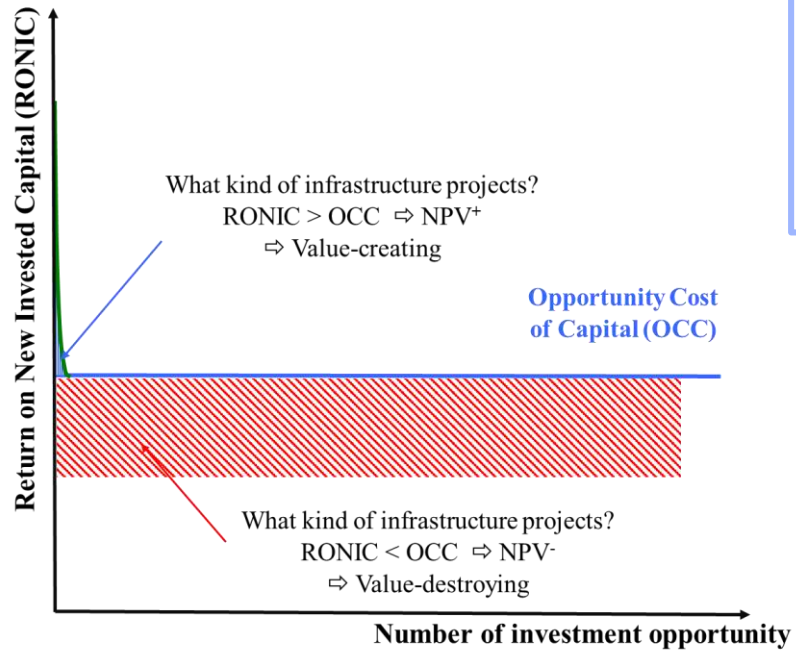
Divestitures are not just for underperforming assets. The most successful divestitures are those that are high-quality businesses, but are **underappreciated** within a portfolio.

Investing in value creation vs. destruction projects over economic competitiveness









1. If RONIC < the OCC, growth destroys value;
2. If RONIC > OCC, growth creates value;
3. If RONIC = OCC, growth has a neutral impact on value since all investments are NPV=0;
4. If growth = 0, there is no return on new investment. The investment impact on value is none.

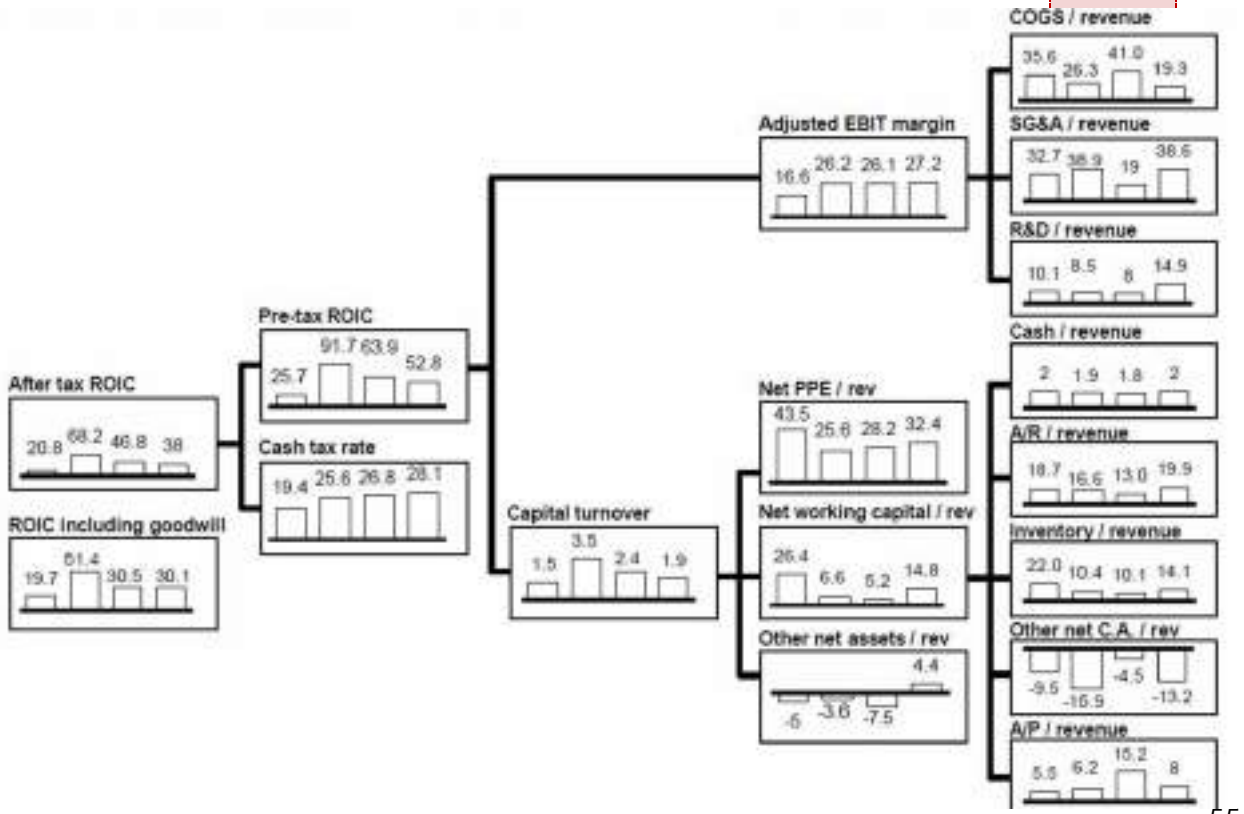
When a government fails to invest in positive NPV projects and simultaneously increases the overall liability, it is destroying value for its nation.

Source: The Blue Line Imperative – What Managing for Value really Means - Chapter 7 by Kevin Kaiser and David Young

Value creation levers – a

- Where has value been created?

	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	CAGR/AVG
Ridership	*Million Trips*	195.3	214	230.4	239	252.1	281.1	306.9	323.6	339.9	348.1	359.9	371.8	383.6	395.5	407.4	421.7	436	418.2	4.6%
Average fare per trip	*THB / trip*	24.7	26	25.9	27.4	27.4	29.1	28.8	30.2	30.2	32	32.8	33.6	34.4	35.1	35.7	37.2	38.7	40	2.9%
Farebox Revenue	*THB MM*	**4,824**	**5,564**	**5,967**	**6,549**	**6,908**	**8,180**	**8,839**	**9,773**	**10,265**	**11,139**	**11,805**	**12,492**	**13,196**	**13,882**	**14,544**	**15,687**	**16,873**	**16,728**	7.6%
Maintenance costs		744	766	789	813	837	862	888	915	942	970	999	1,029	1,060	1,092	1,125	1,158	1,193	1,229	3.0%
Direct staff costs		468	482	497	512	527	543	559	576	593	611	629	648	668	688	708	729	751	774	3.0%
Indirect staff costs		220	227	234	241	248	255	263	271	279	287	296	305	314	324	333	343	354	364	3.0%
Energy costs		386	403	421	440	460	480	502	525	548	573	599	626	654	683	714	746	780	815	4.5%
Other Operating costs		936	983	1,032	1,084	1,138	1,195	1,255	1,318	1,383	1,453	1,525	1,601	1,682	1,766	1,854	1,947	2,044	2,146	5.0%
Operating expenses		**2,754**	**2,861**	**2,973**	**3,089**	**3,210**	**3,336**	**3,467**	**3,604**	**3,746**	**3,894**	**4,049**	**4,210**	**4,377**	**4,552**	**4,734**	**4,924**	**5,122**	**5,328**	4.0%
	% of Revenue	*57.1%*	*51.4%*	*49.8%*	*47.2%*	*46.5%*	*40.8%*	*39.2%*	*36.9%*	*36.5%*	*35.0%*	*34.3%*	*33.7%*	*33.2%*	*32.8%*	*32.5%*	*31.4%*	*30.4%*	*31.9%*	38.9%
EBIT	*THB MM*	**2,070**	**2,703**	**2,995**	**3,460**	**3,698**	**4,844**	**5**												
	Margin (%)	*42.9%*	*48.6%*	*50.2%*	*52.8%*	*53.5%*	*59.2%*	*60*												
D&A and prov. for LT employee benefits	*THB MM*	1,255	1,255	1,255	1,267	1,220	1,307	1												
	% of Revenue	*26.0%*	*22.6%*	*21.0%*	*19.3%*	*17.7%*	*16.0%*	*14*												
Adjusted EBITDA	*THB MM*	**3,325**	**3,958**	**4,250**	**4,726**	**4,918**	**6,151**	**6**												
	Margin (%)	*68.9%*	*71.1%*	*71.2%*	*72.2%*	*71.2%*	*75.2%*	*75*												
CapEx	*THB MM*	60.3	69.6	74.6	81.9	86.3	333.7	26												
Net Farebox Revenue	*THB MM*	**2,010**	**2,633**	**2,920**	**3,378**	**3,611**	**4,511**	**5**												
	% of Revenue	*41.7%*	*47.3%*	*48.9%*	*51.6%*	*52.3%*	*55.1%*	*57*												
Other Fees (Fund Mgmt, Trustee, Others)	*THB MM*	154	178	191	210	221	262	*2*												
	% of Revenue	*3.2%*	*3.2%*	*3.2%*	*3.2%*	*3.2%*	*3.2%*	*3*												
Free Cash Flow (ECF in this project)	*THB MM*	**3,110**	**3,710**	**3,984**	**4,435**	**4,610**	**5,556**	**6**												
	% of Revenue	*64.5%*	*66.7%*	*66.8%*	*67.7%*	*66.7%*	*67.9%*	*68*												
Invested Capital (beginning)	*THB MM*	43,580	42,394	41,214	40,029	38,895	37,922	36,												
	% of Revenue	*903.4%*	*761.9%*	*690.7%*	*611.3%*	*563.1%*	*463.6%*	*417*												
ROIC	%	4.7%	6.4%	7.3%	8.6%	9.5%	12.8%	1												



FNCE 811 Infra Investment Course Material
Case study: BTS Skytrain Carve Out
MBA 2019: John Tiernan

Selected managerial strategy of increasing an infrastructure asset's competitive advantage

- What drives future value creation?

Intrinsic Value	External Growth
Innovative products and services: Non-duplicable or patented products, or technologies to maximize network effect	**Innovative business method:** Product or service integration to capture new catchment markets and maximize synergy
Quality: Users willing to pay a higher premium for better produces and services to save travel time or increase comfort, etc.	**Unique circumstance:** Unparalleled or favorable access to scarce resource, knowledge, or development right, etc.
Brand: Users willing to pay a higher premium without an actual difference on product, service or tangible benefits	**Economies of scale:** Balancing return of scale vs. earnings quality, growth, and sustainable competitive advantage
User retention: Users willing to stay loyal with definitive advantages on quality, travel time saving, etc.	**Operating efficiency:** Standardized lean process and control procedure
Elasticity of demand: Attention to react price fluctuation and corresponding effects without compromising return	**Barrier elimination:** Reduction of agency cost, administrative burden, and permitting process, etc.

Source: Valuation – Measuring and managing the value of companies – Chapter 6 by David Wessels et.al, European PPP Expertise Centre, and author insights

Selected managerial strategy of increasing an infrastructure asset's competitive advantage

- What drives investment discipline?

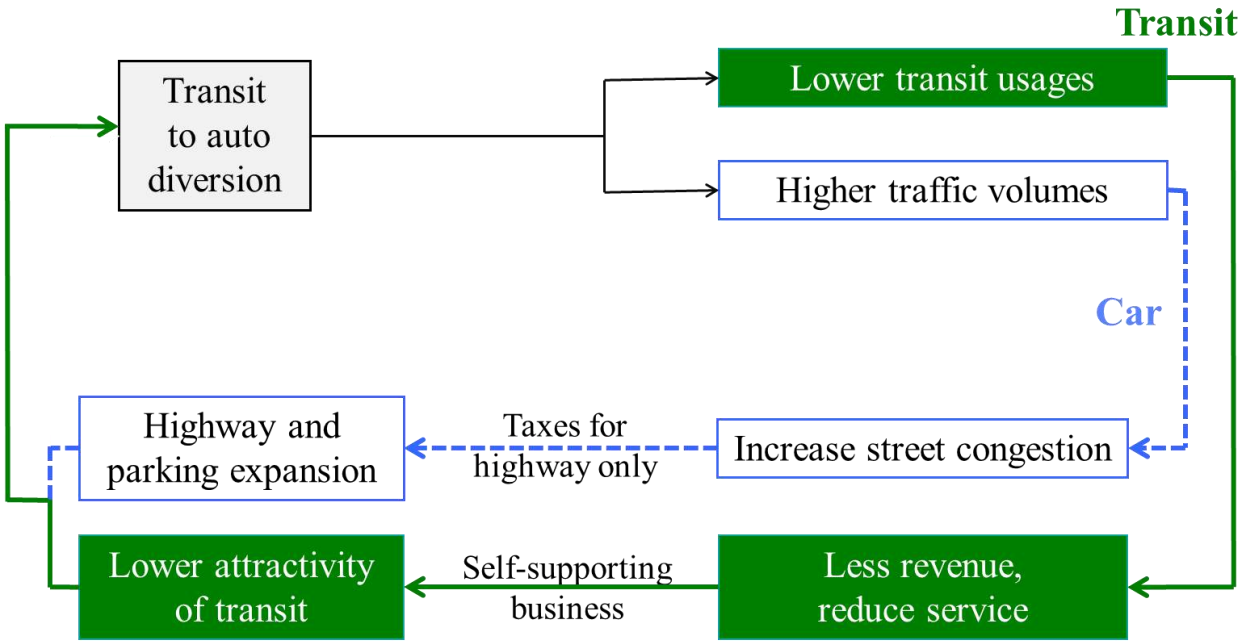
Define an Investment Thesis	Performance Measure
Plan: Have a short-to-long term plan	**Metrics:** Map out essential metrics
Path: Stress 2-3 key value creation levers	**Value:** Focus on cash and value, not price
Growth: Focus on genuine growth, not just scale or cost reductions	**Efficiency:** Link incentives to productivity and unit performance

Balance Sheet	Strategic Execution
Control: Redeploy or eliminate unproductive capital - both fixed assets and working capital	**Optimization:** Focus on optimizing each business; consolidation whenever opportunities for value creation
Equity: Treat equity as scarce	**Ownership:** Don't hesitate to sell when price is right
Debt: Use debt to gain leverage and operation focus, but match risk with return	**Unsentimental:** Be unsentimental in making investment decisions and portfolio executive hirings

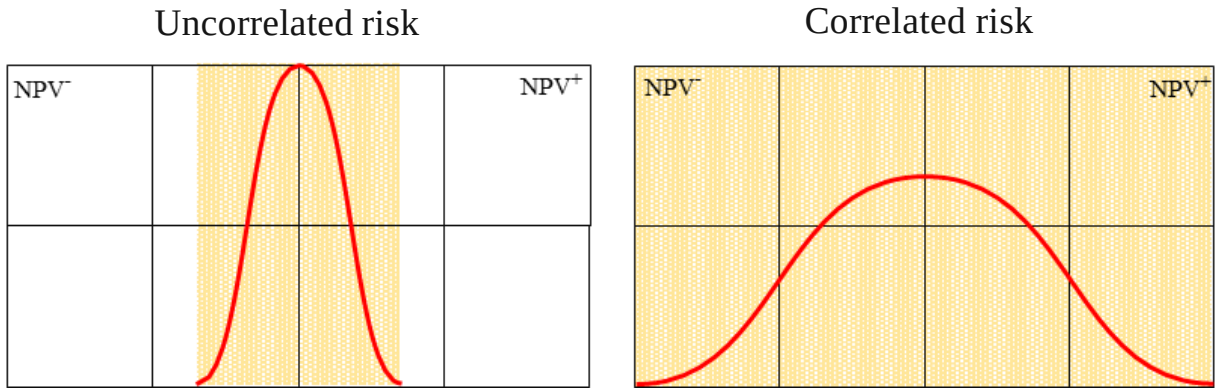
Source HBS Lessons from Private-Equity Masters, and author insights

Calibration risk – β (particular in emerging markets)

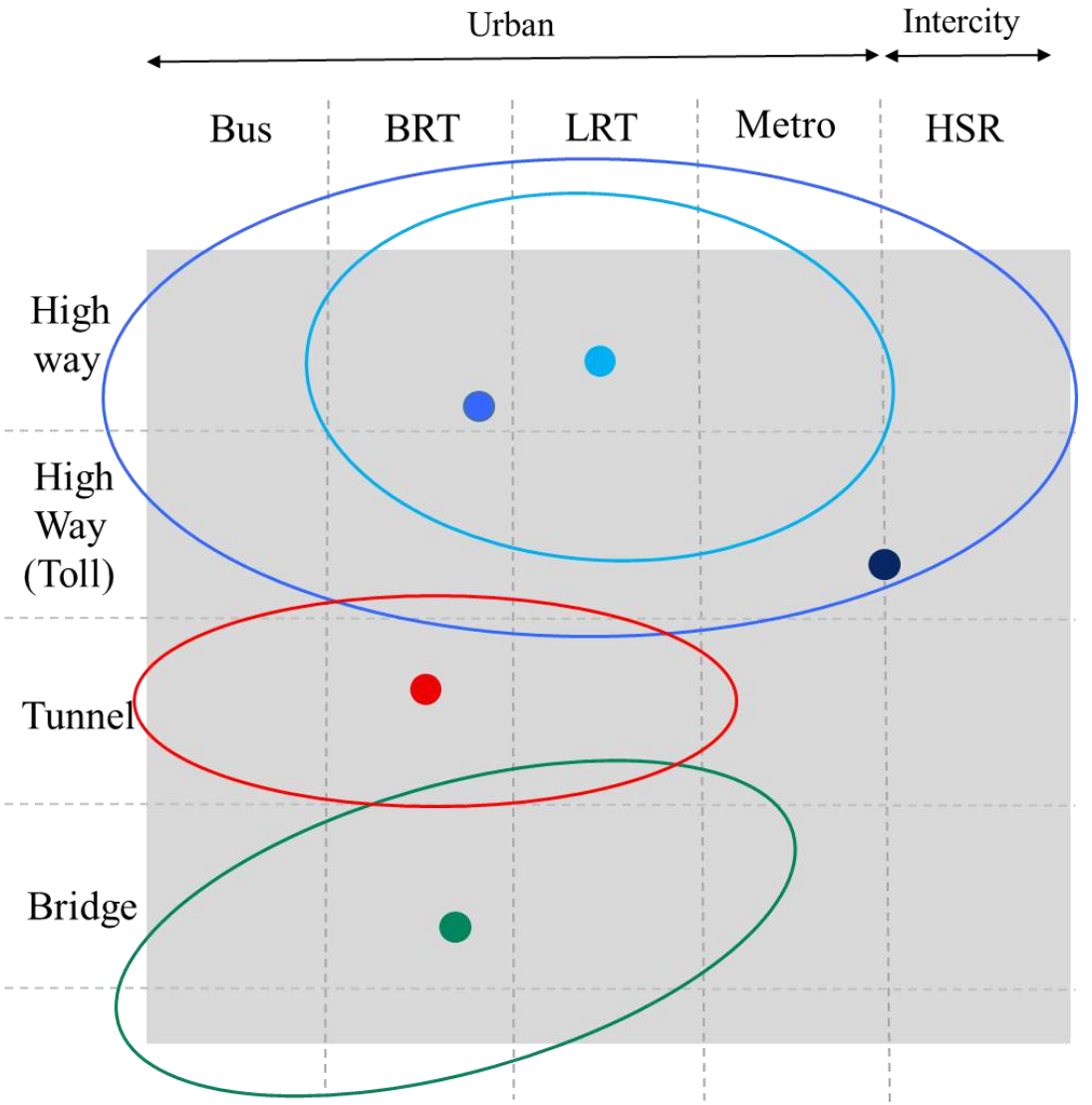
- Jeopardizing returns in the portfolio assembly?



Distribution of return profile: Uncorrelated vs. Correlated Risk



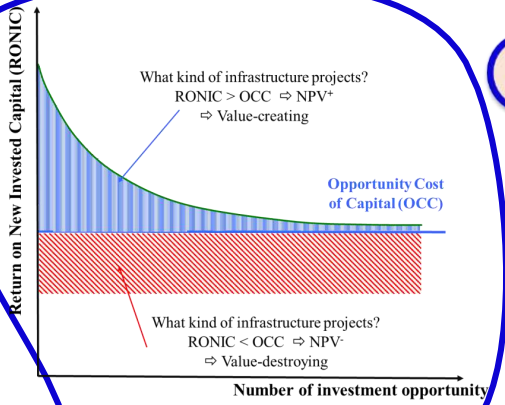
Example of calibration risk within infrastructure assets



Value destruction vs. countermeasure

1 Eliminate inefficient use of assets and improve poor working capital conditions, allowing for rapid reductions and driving cash unleashed from the lax investing process.

2 Continue to encourage use of underutilized assets and effective managerial strategy with a value creation mindset; differentiate which strategy drives price and which drives value; focus on increasing long-term competitive advantage rather than short-term spike.



4 Better strategic execution on:

1. performance incentive scheme; 2. capital structuring; 3. Aggregated realization

1

INVESTED CAPITAL

DEBT

4

EQUITY

REVENUES

EXPENSES

2

NET PROFIT

3b

INVESTED CAPITAL

DEBT

4

EQUITY

3a Optimize cash extraction procedure and examine the opportunity cost of the best use of earnings.

RETAINED VS. DISTRIBUTED EARNINGS



4. International Case Studies: Common Mistakes and Lessons



Wharton ALTERNATIVE INVESTMENTS Initiative
UNIVERSITY of PENNSYLVANIA

Moskva / Sept 2018 – Policy Governance

Wharton ALTERNATIVE INVESTMENTS Initiative
UNIVERSITY of PENNSYLVANIA

Invitation of Moscow International Transportation Expert Council since 2013

THE GOVERNMENT OF MOSCOW
DEPARTMENT FOR EXTERNAL ECONOMIC AND INTERNATIONAL RELATIONS

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Tel.: +7 (495) 633-68-66, fax.: +7 (495) 633-68-65
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08.07.2013 № 15-07-11850/3

To Vukan R. Vuchic
UPS Foundation Professor of Transportation Engineering
Department of Electrical and Systems Engineering
School of Engineering and Applied Science
Professor of City and Regional Planning
University of Pennsylvania

Dear Mr. Vukan R. Vuchic,

On behalf of the Moscow City Government I have the honour to invite you to participate in the first sitting of the Moscow International Transport Expert Council, which will be founded in the capital city of Russia.

As I have already written to you, the mission of this Council is the regular discussion and expert evaluation of the city of Moscow transport policies as a whole and working out of the plans of concrete measures for realization of the key Moscow transportation projects.

While designing the large-scale plans to develop the Moscow transport infrastructure, the Moscow City Government plans to create such a panel of experts in order to take into consideration the actual experience of the leading cities of the world and recommendations of the world top transport specialists. Among the people invited to participate in the work of the council we have the Vice-Mayor of Beijing Mr. Chen Gang, the Head of the Public Transport of Toronto Ms. Karen Stintz, the Deputy Head of Berlin City Department of Urban Development and Environment Mr. Christian Gebler, the Head of the Department of the Surface transport of Singapore Mr. Chu Hok Jong, the Head of the Department of Transport of Istanbul Mr. Jacup Demirhan and other leading experts responsible for the development of the transport infrastructure of the large cities of the world.

The first sitting of the Moscow International Transport Expert Council will be held in Moscow on August 29-30, 2013.

The subject matter of the first sitting in Moscow will be the discussion of the issues of improvement and modernization of the public transportation system.

To work out the final suggestions and recommendations the participants of this sitting will be able to visit the elements of the transport infrastructure of the capital of Russia and have meetings with your colleagues from the transport services of Moscow and other world's large cities.

The first sitting of the Moscow International Transport Expert Council will be opened by the Mayor of Moscow Mr. S. Sobyanin. Actively participating in the sitting of the Council will be the Deputy Mayor of Moscow, the Head of the Department of Transport and the Development of Road-Transport Infrastructure of Moscow Mr. M. Liksutov.

This event will get a wide media coverage. We intend to make it into a notable international event in the sphere of practical cooperation between the cities of the world.

The Moscow City Government is ready to undertake all the expenses related to the visit to Moscow of the two representatives of each city (visa support, flight, hotel accommodation, transfers within the city, etc.)

In case of you positive decision to become the member of the International Transport Expert Council at the Moscow City Government, please confirm your participation by July 26, 2013, and please also consider the possibility of making a report on the strategy of the development of public transport in your city.

You will find a brief description of the transport situation in Moscow in the presentation attached to this letter. The detailed information for the first sitting of the Council will be forwarded for your consideration by August 1, 2013.

I hope to have the pleasure to welcome you in the city of Moscow on August 29-30, 2013 and am thankful in advance for your reply.

Moscow Government Minister,
Head of the Department **S. Cheryomin**

Svetlana Bulgakova
BulgakovaSD@mos.ru or sdb707@gmail.com +7(903) 181-53-26

Aug 2013 - Present

Signing books to Mayor Sergey Sobyanin

Sept 2018

Dr. Vuchic and Deputy Mayor of Moscow
Mr. Maksim Liksutov

HE Liksutov and HE Mattar Al Tayer, Director-General and Chairman of RTA
Monthly Magazine of Dubai's RTA
Issue No. 118 April 2018

Private Equity Infrastructure Investor 10th Annual Summit in NYC

Russia Federation Broadcast Interview

ЗАМЕСТИТЕЛЬ МЭРА МОСКВЫ
В ПРАВИТЕЛЬСТВЕ МОСКВЫ

Профессору университета штата Пенсильвания (США)
эксперту по вопросам транспорта и городского планирования
В. Вучику

Уважаемый г-н Вучик!

От лица Правительства Москвы и от себя лично этим письмом я хотел бы выразить Вам свою благодарность за нашу встречу и сотрудничество в рамках делового визита в сентябре 2018 года с целью изучения последних достижений транспортной системы города Москвы. Уверен, что состоявшаяся встреча выведет наше сотрудничество на качественно новый уровень.

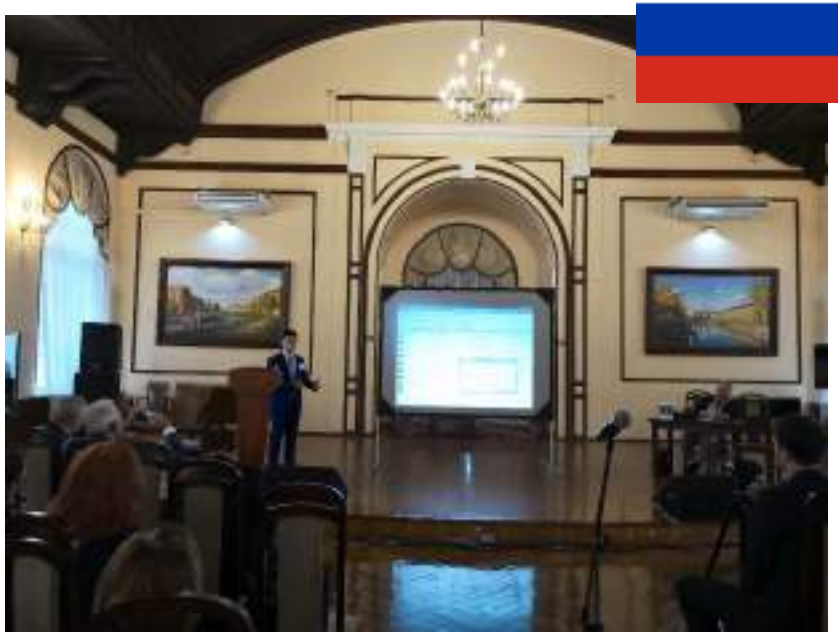
Для нас было очень важно познакомиться друг с другом лично, обменяться мнениями о важных аспектах транспортной политики и укрепить деловые и дружественные связи между Москвой и международным экспертным сообществом.

Пользуясь случаем, я хотел бы еще раз поблагодарить Вас за высокую экспертную оценку о развитии транспортной системы города Москвы и интересную дискуссию, посвященную решениям в сфере транспорта. Я уверен, что открытое обсуждение и обмен опытом приведет к совершенствованию московского транспорта и станет ключом к будущему успеху.

Надеюсь на расширение сотрудничества в решении транспортных задач, а также налаживание эффективного взаимодействия в разработке и реализации совместных проектов.

М. С. Ликсутов

Appreciation Letter from Russia Government



Presenting & meeting with Dean of St. Petersburg State University Dept. of Transport (Sept 2018)

Structure of Government programs – Russian Federation

Key directions of the Government of the RF

- Key document of strategic planning in RF
- Aimed at achieving the goals, stated in the President decree "on national aims and strategic goals of RF development"

State programs

1. **New quality of life**
   - Health care, education, social sphere, pensions, culture, environment, sports, employment
2. **Innovative development and modernization of the economy**
   - Science and technology, economic development, industry, aviation, etc …. transport system development
3. **National security and safety**
   - Armed forces, personal safety, extraordinary events
4. **Balanced regional development**
   - Regional finance and budget system, socio-economic development of several regions
5. **Effective government**
   - Financial markets, justice, foreign relations

National projects

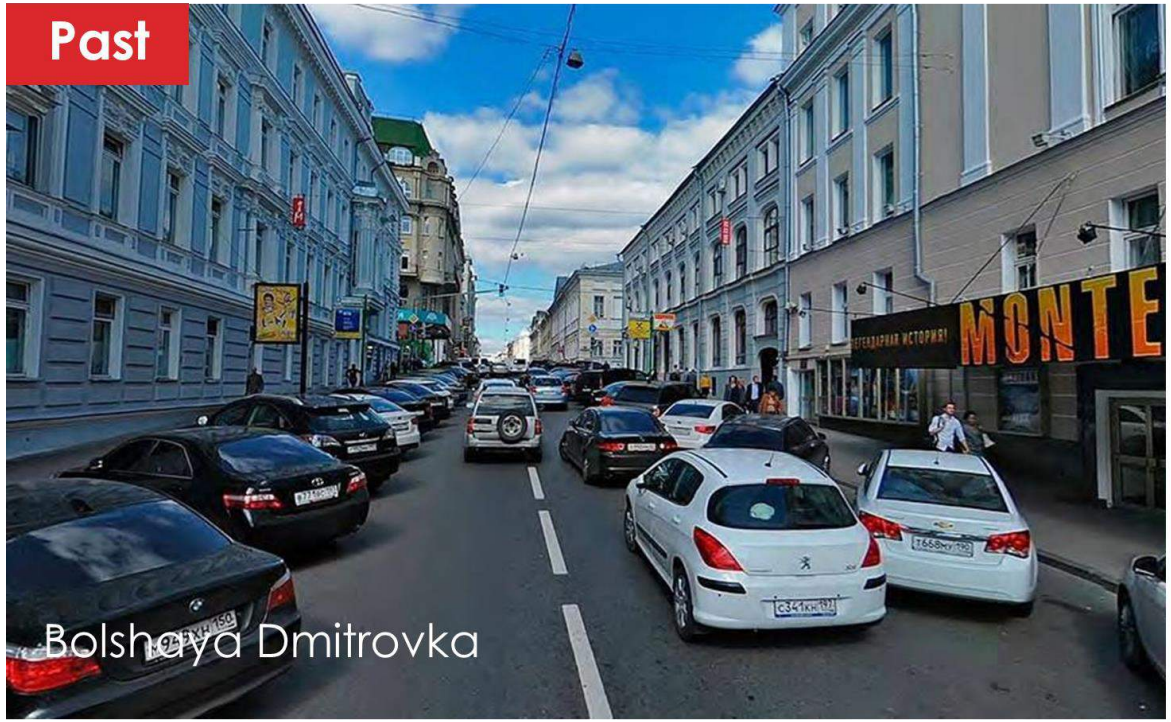
- **Health care**
- **education**
- **demography**
- **culture**
- **Safe and high-quality motorways**
- **Housing and city environment**
- **science**
- **ecology**
- **entrepreneurship**
- **Capacity / productivity**
- **International cooperation**
- **Digital economy**

Complex Plan of modernization and expansion of transit infrastructure

Travel situation in Russia in the early 2010 and the transition

Change of traffic flow on the adoption of auto-disincentive policy: Example of Moskva garden ring

The transition and putting & investing “transit” as the priority



Moscow Central Circle

High speed rail in Russia

«SAPSAN» (eng. «Sapsan»)
Moscow – St. Petersburg

- Type: **Siemens** Velaro
- Operation **since 2009**
- Average speed – **180 km/h**
- **15** times a day
- **2-3 stops**

635 km	3h40	32.2 mln
distance	Travel time	total passengers since its launch

«ALLEGRO»
St. Petersburg - Helsinki

- Type: **Alstom**
- Operation **since 2010**
- Average speed – **120 km/h**
- **8** times per day
- **5-7 stops**

407 km	3h27	2.3 mln
distance	Travel time	total passengers since its launch

«STRIZH» (eng. «Martin»)
Moscow – Nizhniy Novgorod

- Type: **Talgo** TransMashHolding
- Operation **since 2015**
- Average speed – **130 km/h**
- **5 times a days**
- **5-7 stops**

442 km	3h35	1.9 mln
distance	Travel time	total passengers since its launch

«LASTOCHKA» (eng. «Swallow»)

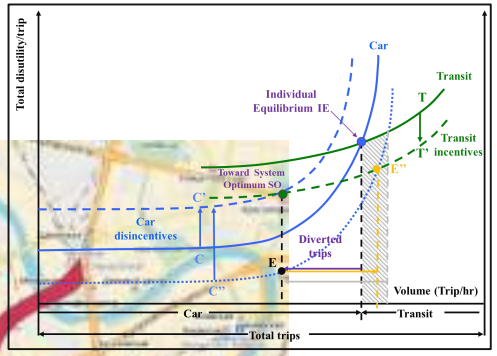
Connects cities Moscow, St Petersburg, Sochi, Krasnodar, Yekaterinburg, Kaliningrad, Rostov-on-Don with other regional towns

- Type: **Siemens Desiro**
- Operation **since 2013**
- More than **170 trains** on different routes
- 5-7 times a day
- 2-10 stops

100-500 km	25 min – 6h	9.2 mln
distance	Travel time	total passengers since its launch

Source: Russian Railways

Moscow Metro vs. Kutuzovsky Prospekt Highway PPP



The statement is not meant to advocate for divestment in car-based infrastructure, but rather advise caution regarding the dynamic movement between the individual equilibrium and system optimum. If the increase of car travel causes economic leakage and lower productivity due to congestion and externalities, policy and investment decisions need to take place to alleviate the offset.

PRESIDENCY OF THE REPUBLIC OF TURKEY
INVESTMENT OFFICE

Türkiye / July 2019 – Problem Diagnosis

Wharton ALTERNATIVE INVESTMENTS
UNIVERSITY of PENNSYLVANIA Initiative

Cities struggle with finding a balance between transit and highway investments

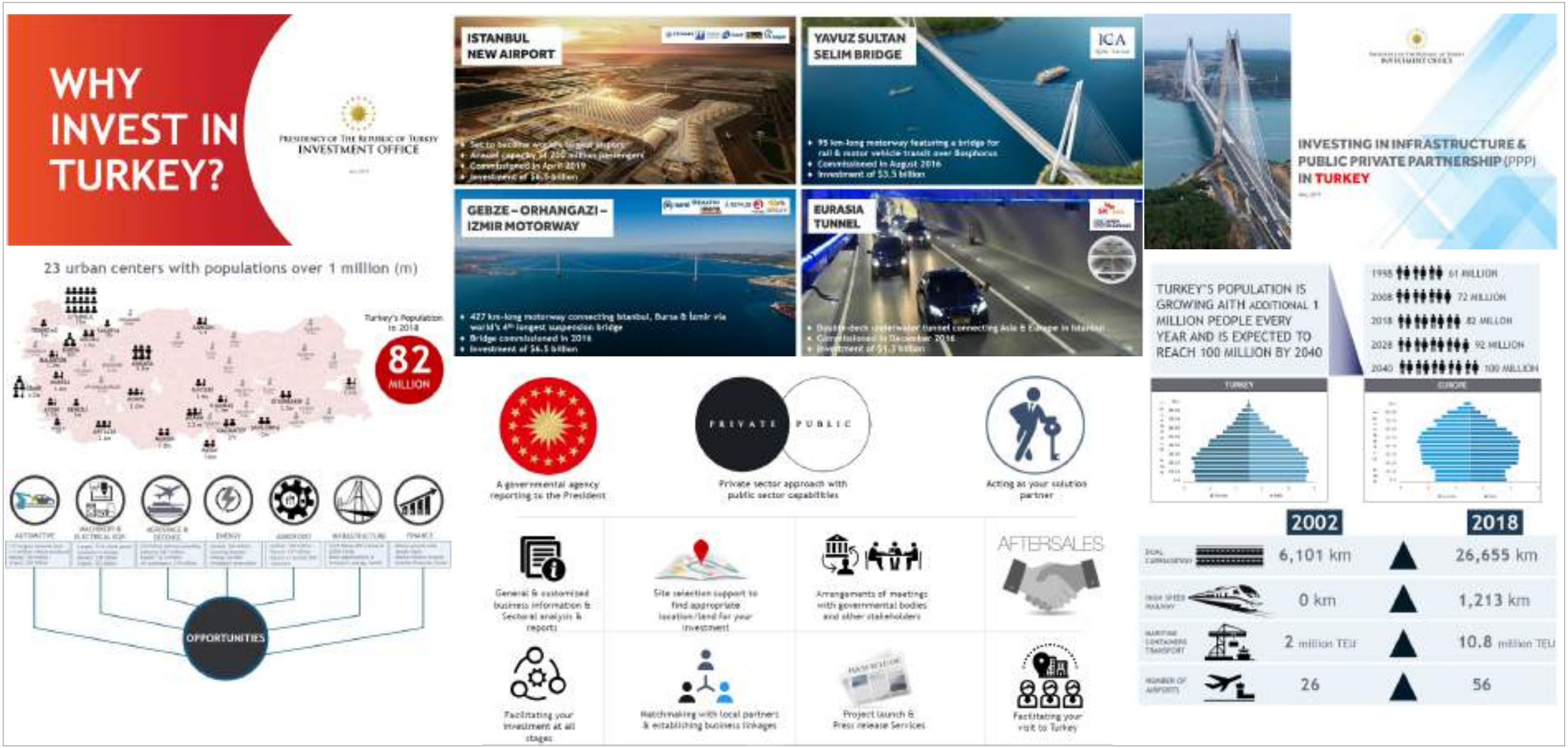
2hr 20 min meeting (includes 30 min lecture) with CIO and Secretary

BRT and Metro in İstanbul

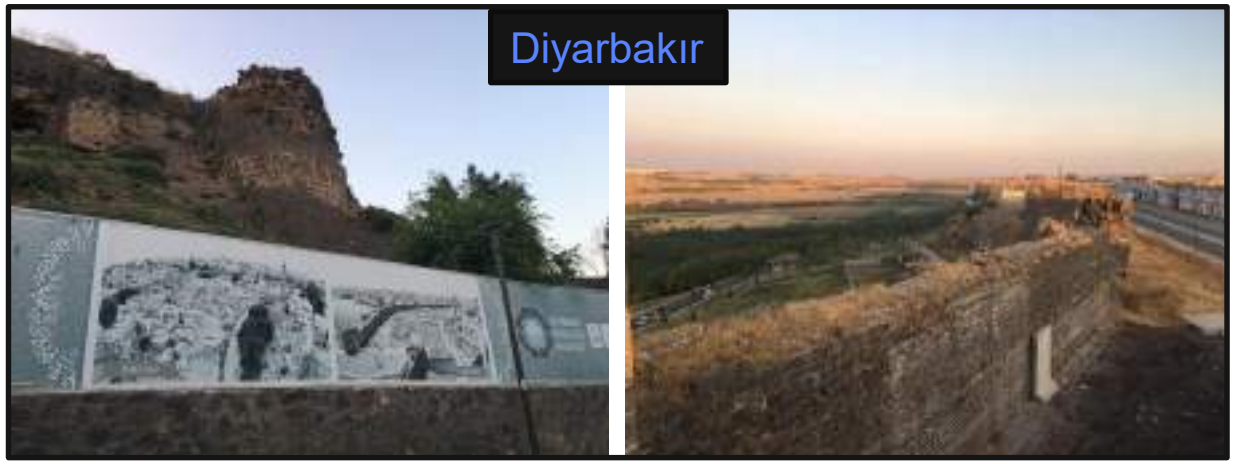
İSTANBUL BÜYÜKŞEHİR BELEDİYESİ

METRO İSTANBUL

Review of Turkish Infrastructure Investment and P3



Turkish Infrastructure Investment Scheme

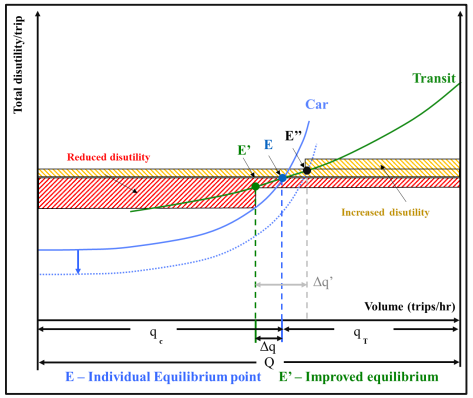


Major transportation challenges in Turkish cities

High density minibus (dolmuşlari) occupied urban areas in Ankara

An overcapacity BRT in parallel with a congested highway in İstanbul

Consequences of busway conversion into a HOV roadway



Opening busway to HOV's

Busway: increased volume

Freeway: lanes less congested

HOV/ paratransit users

Reduced travel time for HOV passengers

Bus users

Decreased performance (reliability, speed, safety)

Auto users

Some reduction of travel time for other auto users

Steeling of passengers by HOV's

Loss of bus passengers

Encouragement of HOV's

Deterioration of bus service

Attraction of more SOV's

Benefit

Loss

HOV – High-occupancy vehicle
SOV – Single-occupancy vehicle

European Investment Bank
The EU bank

Luxembourg / July 2019 – Decision scenario

Wharton ALTERNATIVE INVESTMENTS Initiative
UNIVERSITY of PENNSYLVANIA

Decision scenario case

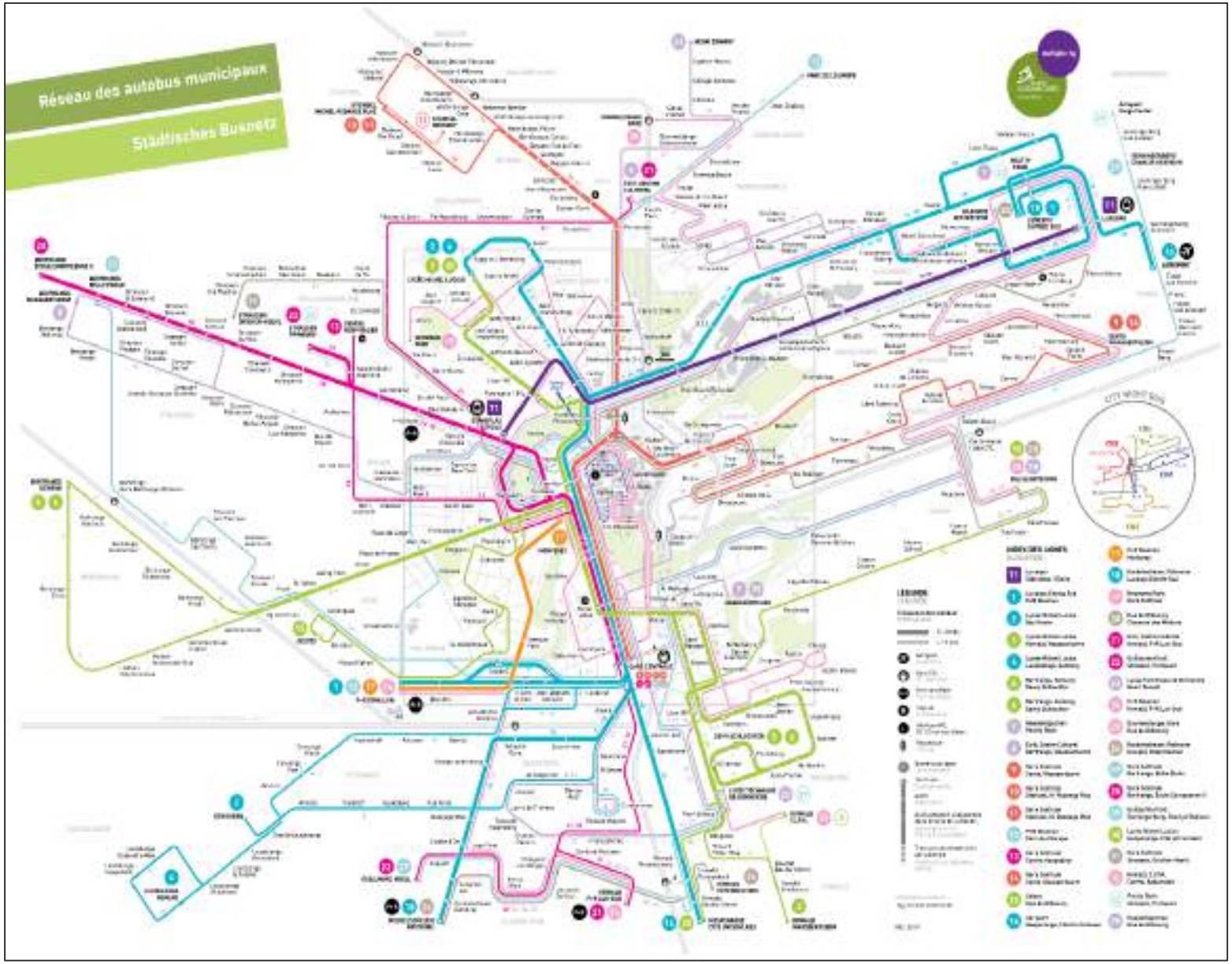
CNN travel Luxembourg makes all public transport free

Although a policy is formed in good intention, it could jeopardize return no matter how valuable the value creation project is. The case demonstrates the important elements of return on "policy" and showcases a sequential consequence of mutual conflicting policies and investment decisions.

- With a population of 602,000, Luxembourg is one of Europe's smallest countries suffering from major traffic jams. **But that could be about to change**. Last month, it announced plans to make all public transport -- trains, trams and buses -- free from March 2020.
- The government hopes the move **will alleviate heavy congestion** and **bring environmental benefits**, according to Dany Frank, a spokesperson for the Ministry of Mobility and Public Works.
- "**Luxembourg is a very attractive place for jobs**," explains Geoffrey Caruso, a professor at the University of Luxembourg and the Luxembourg Institute of Socio-Economic Research specializing in land use and transportation.
- But its "**booming economy**" and high concentration of jobs have led to congestion issues, he says.
- **In 2016, Luxembourg had 662 cars per 1,000 people**, and driving is a "primary means of transportation" for commuters, according to a 2017 report by the Ministry of Sustainable Development and Infrastructure.
- That year, drivers in Luxembourg City spent **an average of 33 hours in traffic jams**. It fared worse than European cities Copenhagen and Helsinki, which have comparable population sizes to all of Luxembourg -- yet drivers in both only spent an average of 24 hours in traffic.

Source: https://www.cnn.com/travel/article/luxembourg-free-public-transport/index.html

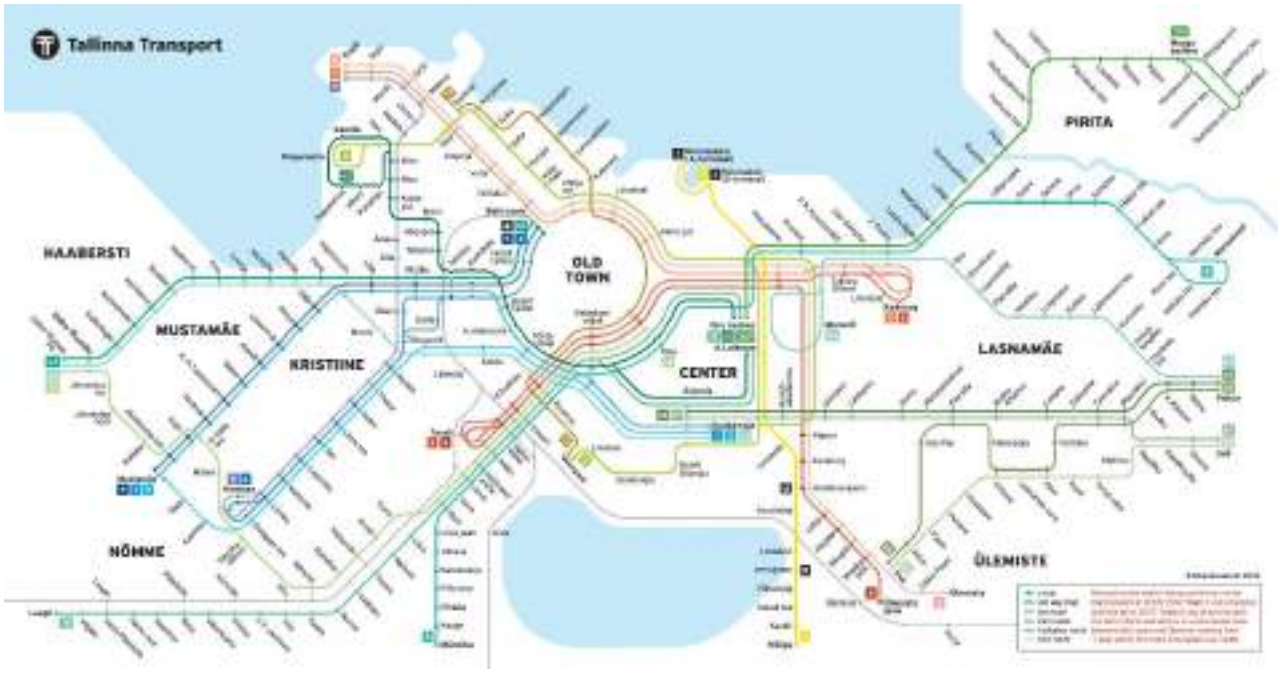
City built around cars *Transitioning* to transit



The Economist

Free public transport in Estonia

May 9th 2019 | TALLINN

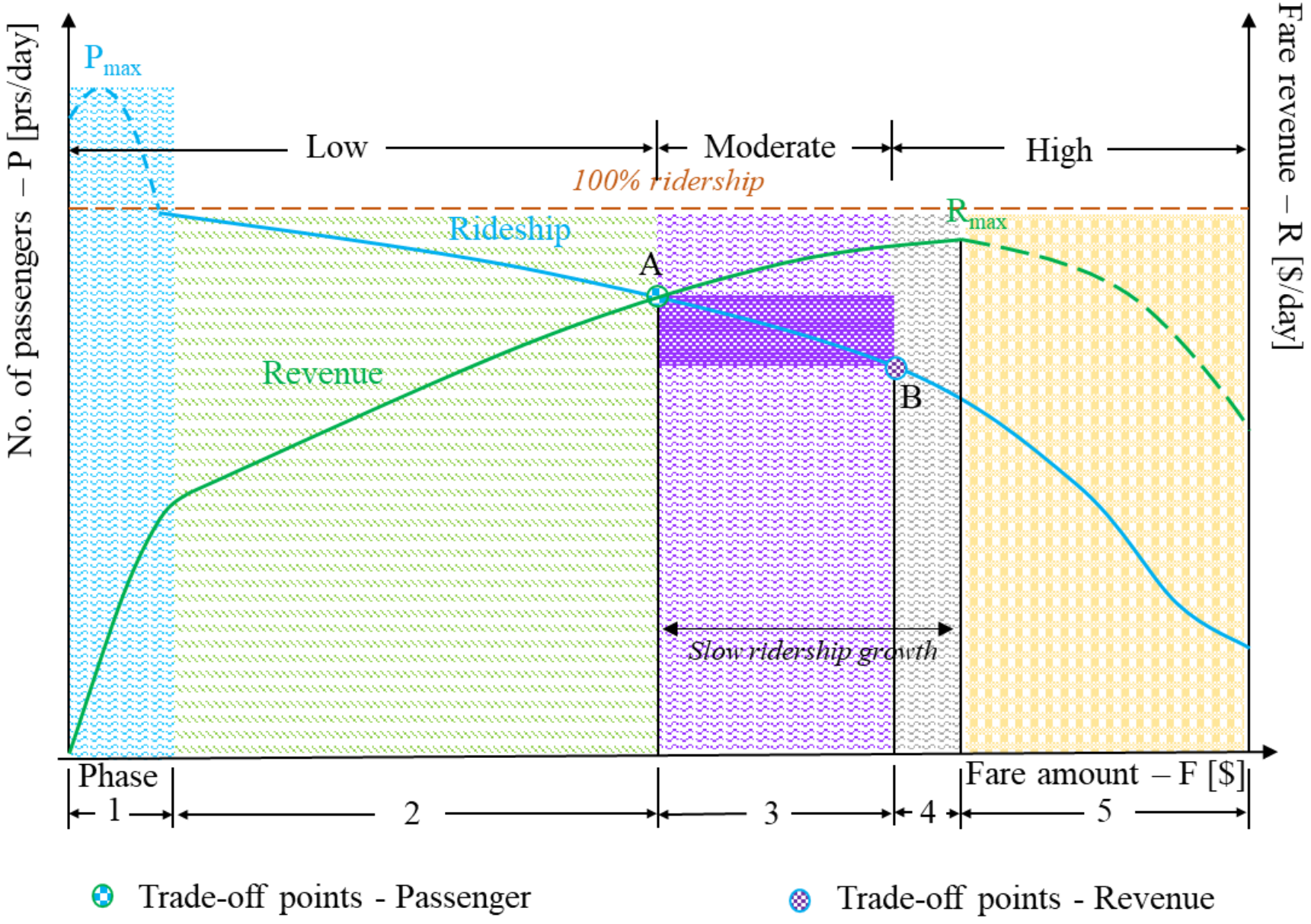


The size of city could be a decision factor of whether making free public transit would successfully alleviate congestion.

- Free public transport also **enables people with lower income** consume goods and services at the entire territory of the city, as they do not need to worry about transportation costs. The increase of use of public transport in the evenings and at weekends, however, refers to the changed behaviour of people with an average income and also bigger than average income – **instead of a private car they often prefer public transport** for visiting entertainment establishments and family events.
- Although the city paid more than 70% of public-transport costs, ticket prices were still too high for poorer residents. **Congestion had also become a problem.**

Source: https://www.economist.com/europe/2019/05/09/free-public-transport-in-estonia

Analyzing the Free Transport case

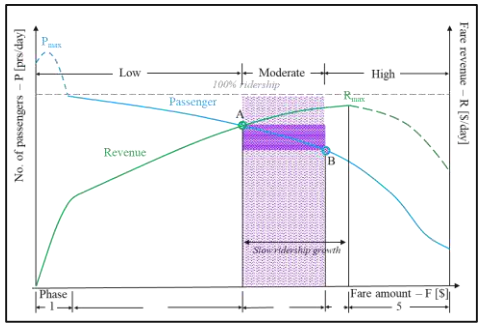


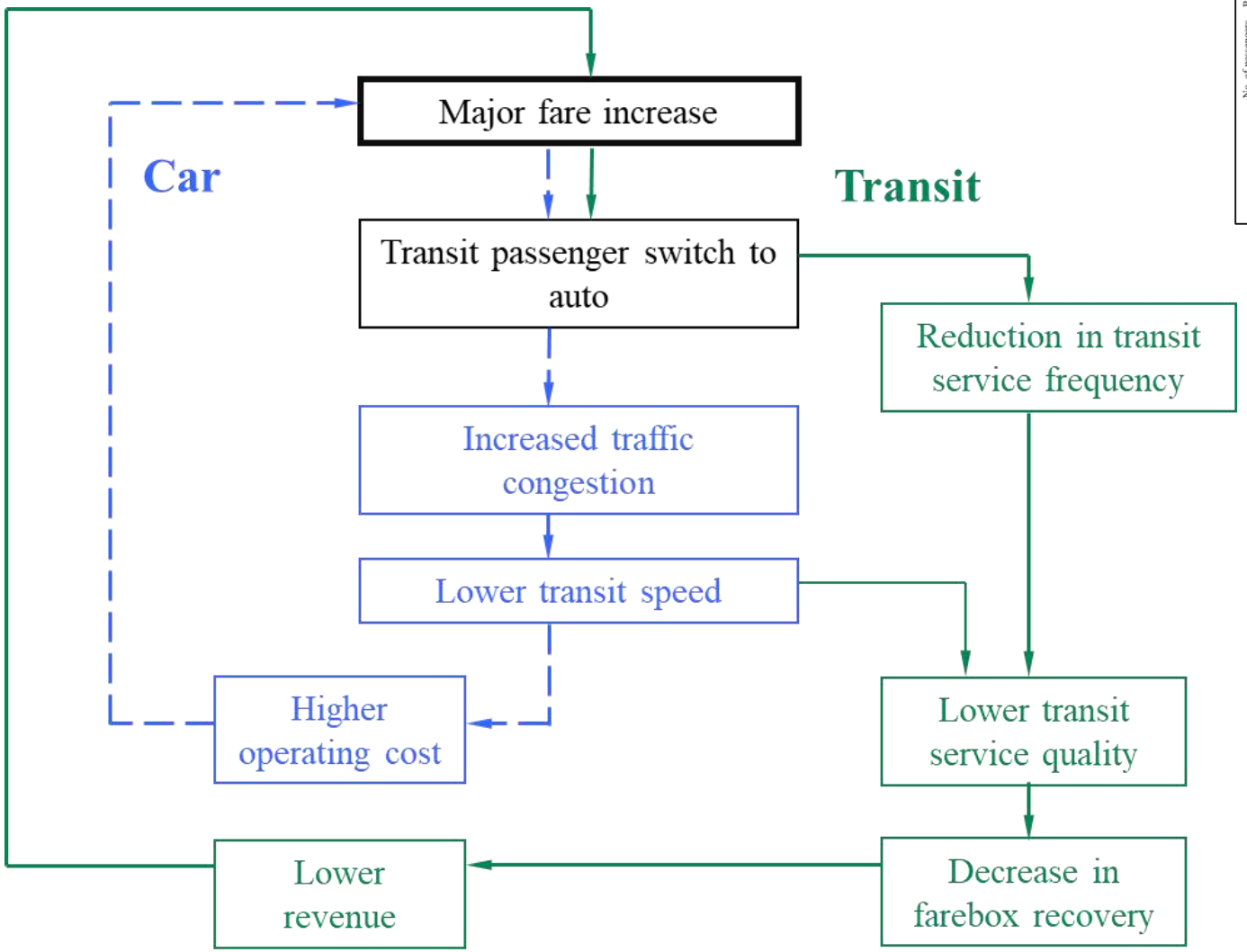
In phase 3 & 4, passengers start making alternative travel decisions. Growth of asset usage rate becomes slower or diminishes.

If the goal is to maximum ridership, the trade-off point should be at Point A. Whereas it is to maximum revenue, then the tradeoff point should be at Point B. For the asset owner or operator, the square between Point A and B (**dark purple box**) is the "daylight" that the asset can still gain ridership and revenue by interchangeably adjusting it based on demand elasticity.

Sequential rounds of investing:

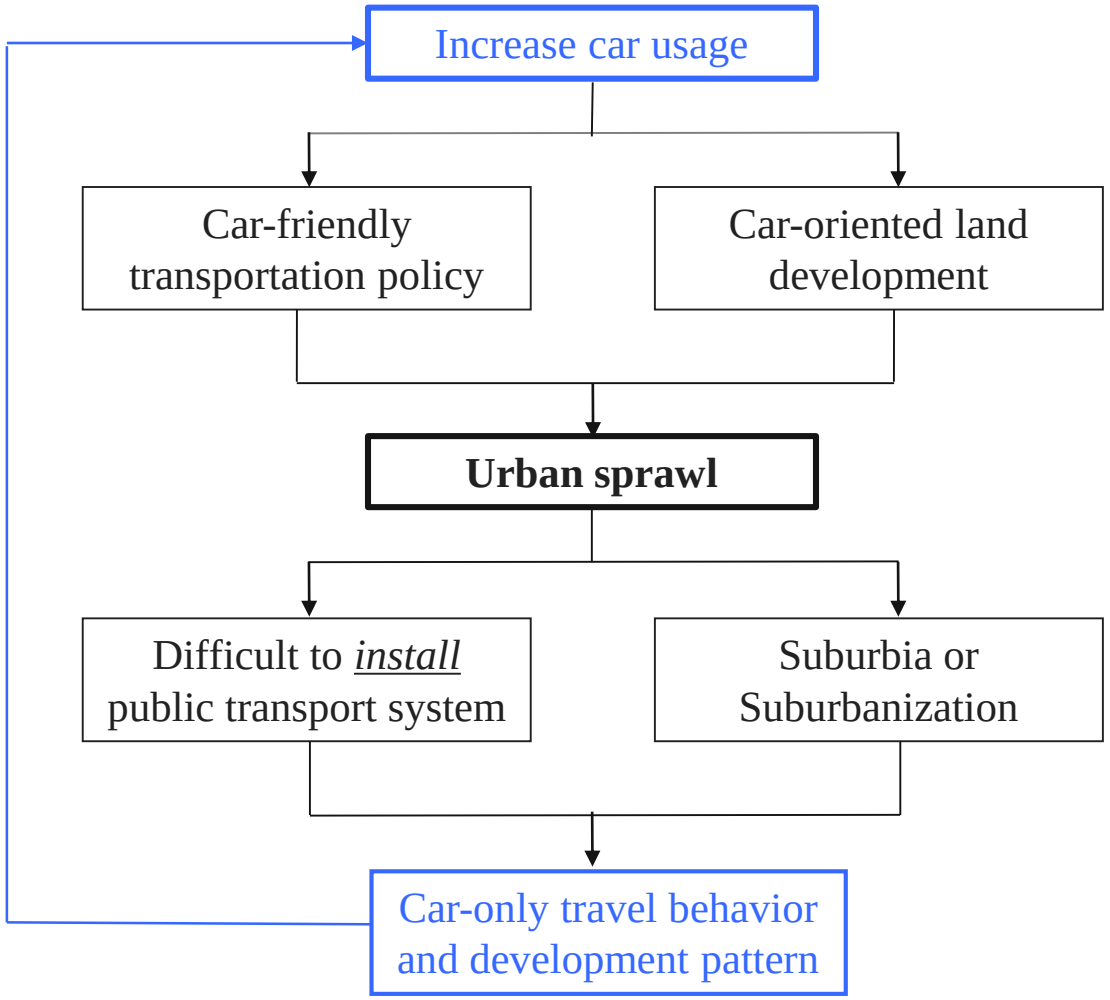
Starting phase 3, public transit starts losing its leading position in the range of city commute options and unable to outperform the utility of car offers.



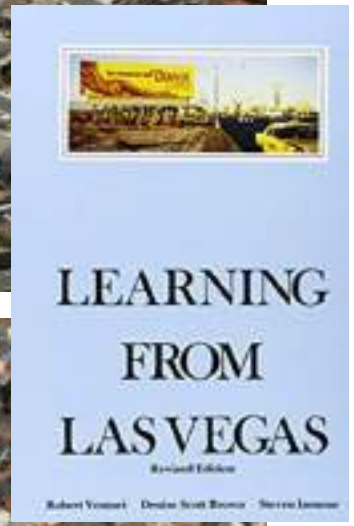


Two vicious circles of fare increase

Sequential consequences of car usage increase



Suburbia in Las Vegas with major arterial roads

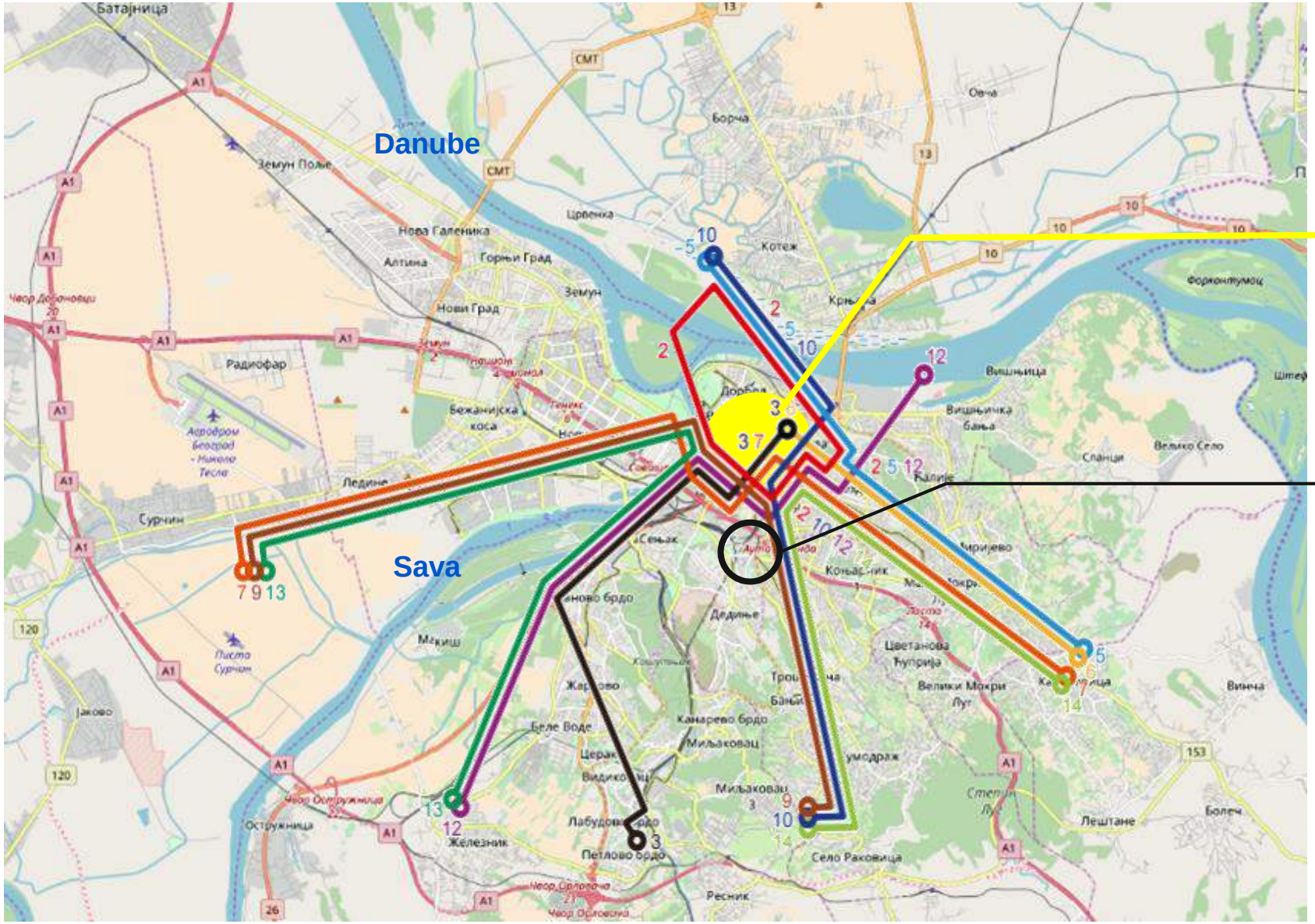


Suburbia with a major highway

Belgrade / March 2018 – Activism Engagement

Wharton ALTERNATIVE INVESTMENTS Initiative
UNIVERSITY of PENNSYLVANIA

Belgrade city development and waterfront serenity



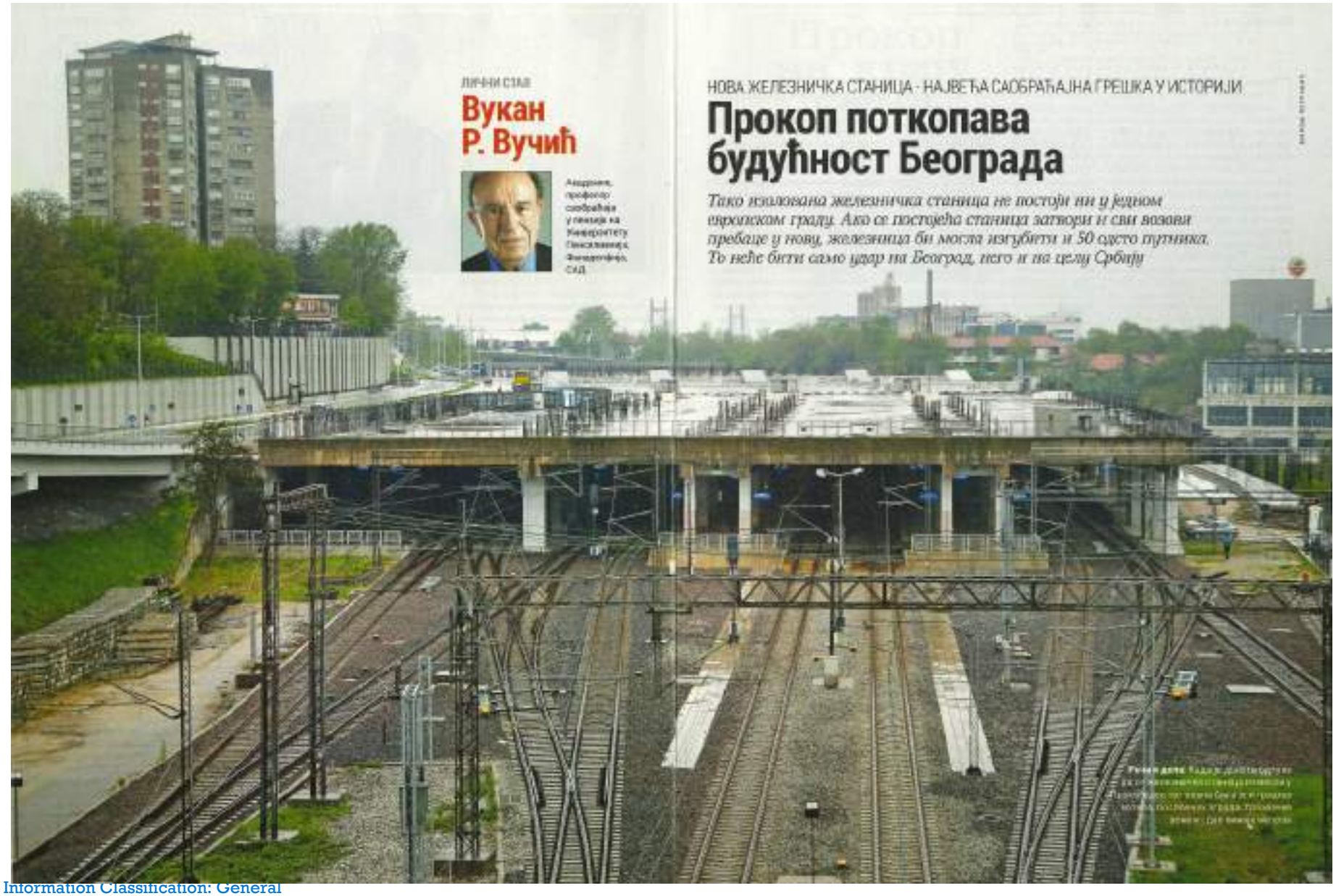
Project summary:

- Over 1 million square meters of residential space on a 177-hectare area
- 750,000 square meters of commercial space
- 62,000 square meters of public facilities
- 242,000 square meters of green space.

Source: https://www.constructionweekonline.com/article-33433-eagle-hills-inks-3bn-belgrade-waterfront-deal

Belgrade tram network served by an integrated range of overlapping routes

Challenge No.1 Beograd Center railway station (Prokop): Relocation to nowhere?



Challenge No.2 Pseudo New Beograd Center railway station (Prokop) and Investment mindset

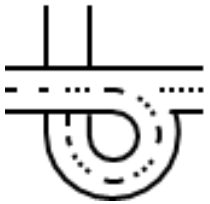
Source: http://beobuild.rs/#

Value creation

- Make the world in a better place or
- Do wealth transfer
- Balanced growth / Gentrification

Asset utilization

- Network consolidation
- Who are the users? **Not the investor!**
- Duration / Investment horizon

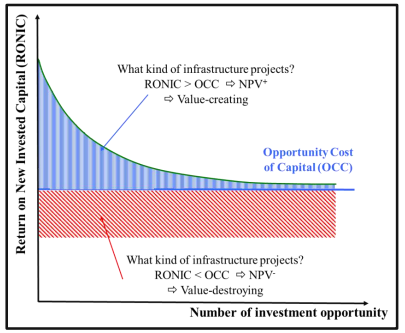


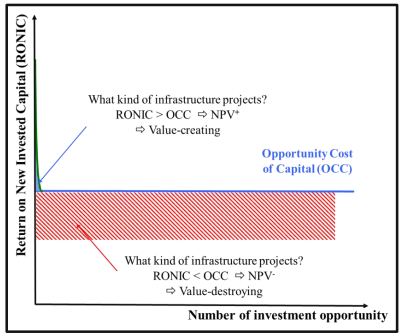
Land recapitalization

- Best use of the land
- Flip the assets
- Separate the landmass

Waterfront eco-management

- Storm water management
- Old vs. New city scene compatibility and cohesive
- Livable city





Source: http://www.politika.rs/sr/clanak/402152/Plan-za-metro-u-interesu-putnika-a-ne-investitora?fbclid=IwAR0uNjlELn7RzCgIo1JFc5JOGxpwQ52aRqycxTGfmeLgI0bEBoh8lkEuz94
https://www.danas.rs/beograd/prokop-najkatastrofalnija-greska-saobracaja-u-beogradu/?fbclid=IwAR3gsqiE_WXhod5Q4-SU53CSXgByUHBD5U-SH7FjEorGNJv_BGe4RVjckqw

THE BIGGER APPLE

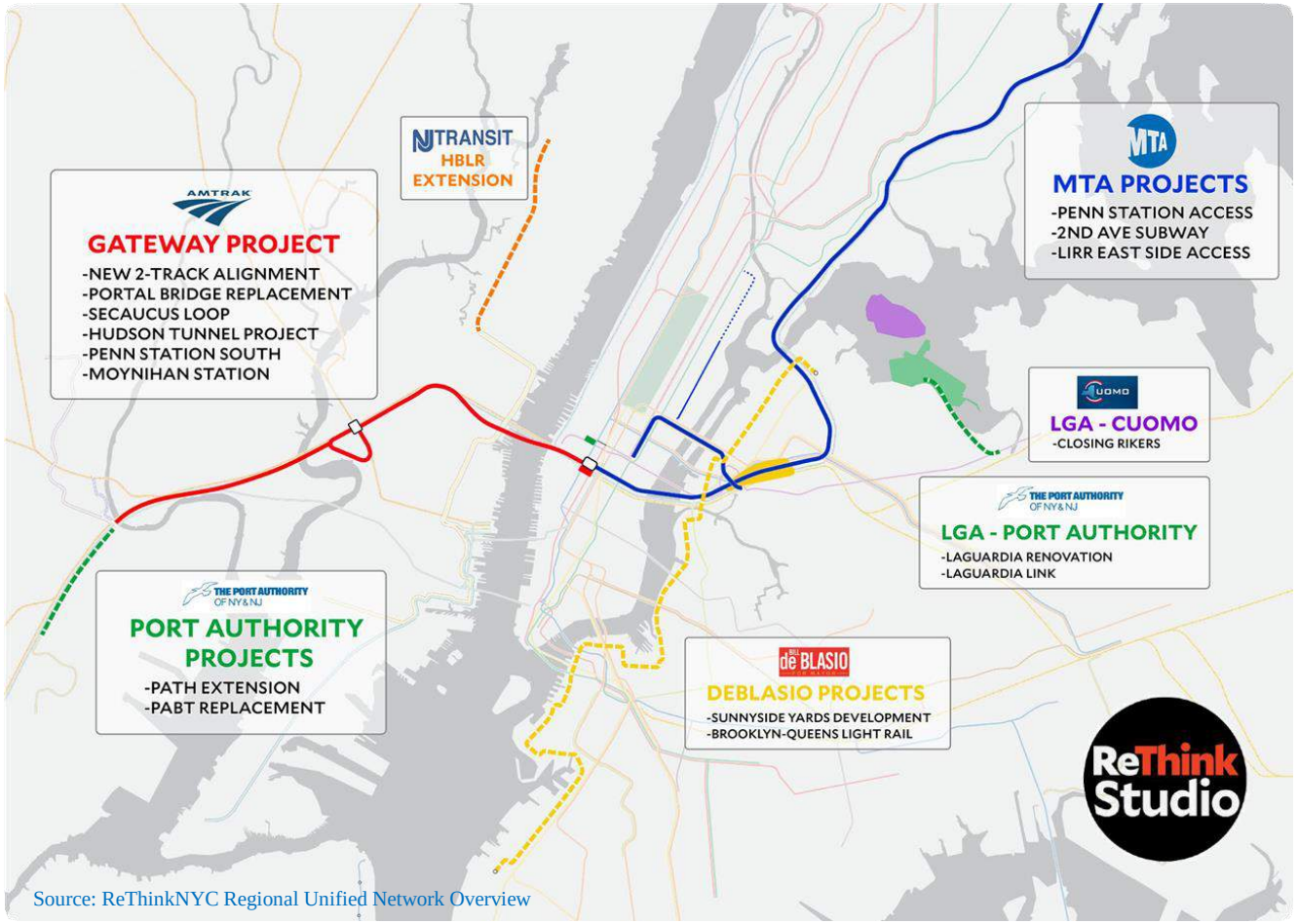
ReThinkNYC PLAN 2050

New York City – Managerial Barrier

Wharton ALTERNATIVE INVESTMENTS Initiative
UNIVERSITY of PENNSYLVANIA

Managerial challenges

Democratic vs. communist infrastructure investment scheme contrasts the two different countries' managerial procedure of making public transportation investment decisions. Distilling the two iconic cities: New York vs. Moskva growth regimes, a differentiated investment attitudes at the administrative level discloses the **unnecessary administrative burden** and **hazardous agency cost** resulted in two separated growth regimes and aggregated return at both fund and ESG levels.



Source: ReThinkNYC Regional Unified Network Overview

Major transit agencies in the New York region

Institutional autonomy:

1. An overlapping spending on a same project
2. Investing so much on the regional transits, but the travel situation is still worse
3. Whichever makes a louder voice would get a bigger portion of the government fund

Independent governance:

1. Different agendas and priorities
2. Information delays, biased decision-making due to imbalanced information
3. A discrepant process of capital allocation arising from interagency competition

Historical U.S. fund distribution across common intercity modes

THE WALL STREET JOURNAL.

By Ted Mann and Alejandro Lazo

Updated May 16, 2019 7:01 p.m. ET

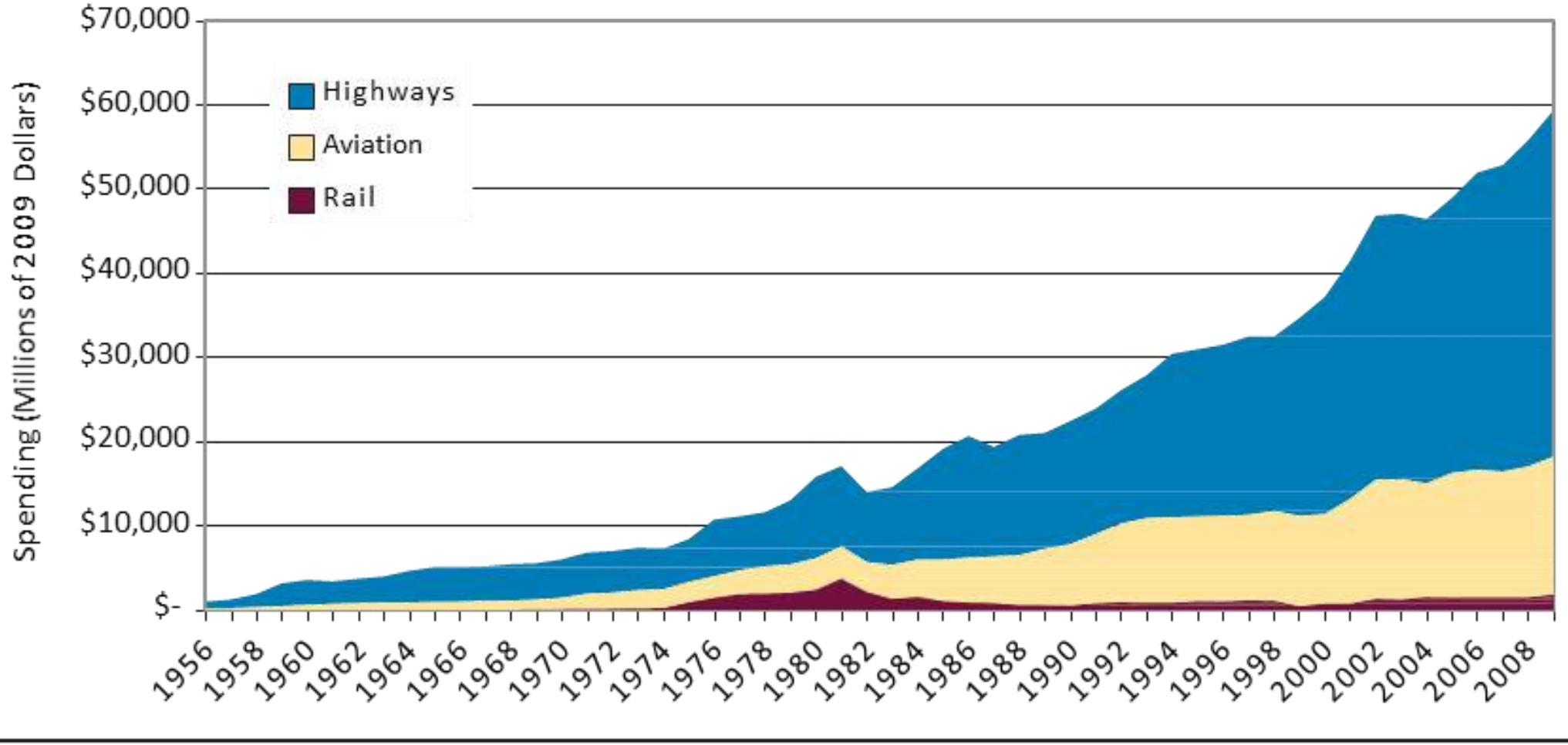
U.S.

Trump Administration Revokes $929 Million for California High-Speed Rail

Transportation Department follows through on threat after state scaled back plans for troubled project

FIGURE 1

Total Federal Spending on Highways, Aviation, and Rail, 1956–2009



Data Source: Congressional Budget Office (2010).

Source: High-Speed Rail International Lessons for U.S. Policy Makers, Lincoln Institute of Land Policy, 2018
https://www.lincolninst.edu/sites/default/files/pubfiles/high-speed-rail-full_0.pdf

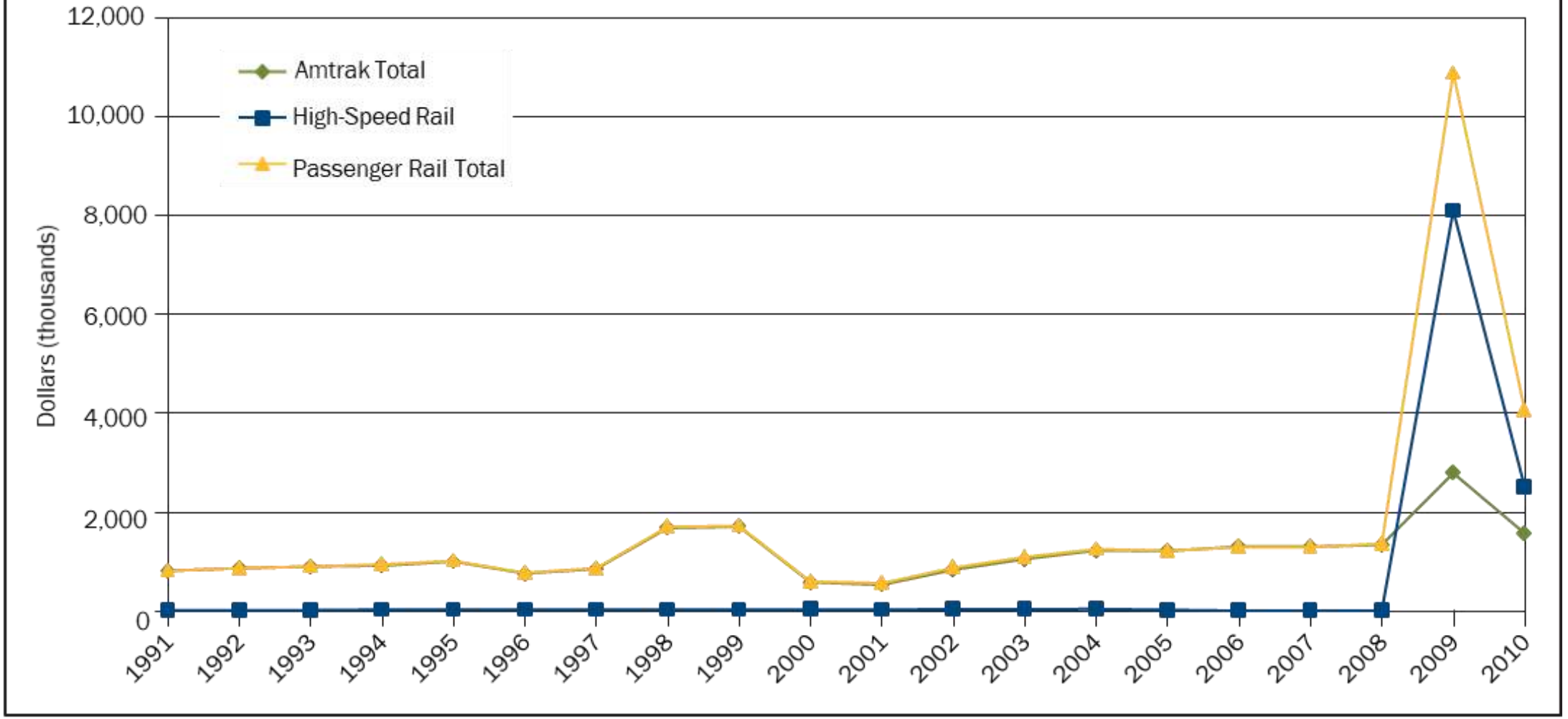
Historical U.S. rail fund distribution

REUTERS U.S. MARCH 21, 2018 / 11:06 AM / A YEAR AGO

U.S. budget plan cuts proposed funds for N.Y.-New Jersey tunnel: sources

FIGURE 8

U.S. Funding of Passenger and High-Speed Rail, 1991–2010



Note: Dollars not adjusted for inflation.

Source: National Association of Railroad Passengers (2008).

Source: High-Speed Rail International Lessons for U.S. Policy Makers, Lincoln Institute of Land Policy, 2018
https://www.lincolninst.edu/sites/default/files/pubfiles/high-speed-rail-full_0.pdf

U.S. funding mechanism? - Using tolls to fund public transit

The Philadelphia Inquirer

Lawsuit challenging Pennsylvania's transit funding dismissed

by Jason Laughlin, Updated: April 4, 2019

The suit filed in March 2018 complained that Pennsylvania Turnpike tolls were so onerous they inhibited interstate commerce and travel. It challenged the use of toll money — about $450 million a year — to fund public transportation. The suit contended that the cost of tolls was in part driven by the turnpike's obligation to provide money to public transportation, and that turnpike users were paying for projects beyond the highway itself.

"This lawsuit is far from over," Spencer said. "And win or lose on appeal, the turnpike's debt crisis and the Commonwealth's transportation emergency aren't going away either. This is a crisis created by the legislature's decisions, not our lawsuit."

In its own statement, PennDot agreed that the cost of tolls had become untenable, and the decision Thursday didn't resolve the state's larger problems funding transportation.

"Turnpike tolls are too high," said Erin Waters-Trasatt, a spokesperson for PennDot, "and current funding levels will not allow us to develop new projects or address the full portfolio of needed repairs."

Taxes and fees recommended as solution to Pennsylvania's $450 million transit problem

by Jason Laughlin, Updated: April 2, 2019

Almost 40 SEPTA projects stalled over Pa. Turnpike lawsuit

by Jason Laughlin, Updated: February 25, 2019

SEPTA

Dr. Vuchic and SEPTA GM Jeffrey Knueppel

The Vicious Circle of the underfunded U.S. HSR - Amtrak

Lack of legislative support

Competing interest among states and political parties

Lack of coordination at administrative levels

Special interest groups and lobbyists

Self-liquidate & Underfunded situation

Maximize revenue

Insolvency

Accumulated pension liability

Reduce performance and low/ aging asset utilization

Astronomical fare

Reduce O& M, training, services

Cut services / No expansion

Less operating ability to generate revenue

Negative spillover

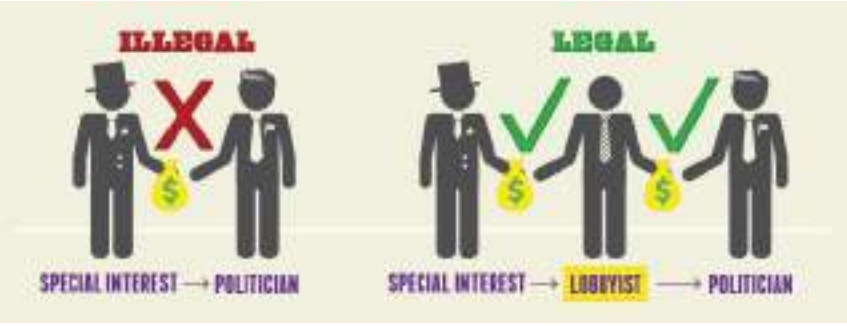
Elastic demand to low-cost operator (i.e. bus)

Congestion on intercity highway and regional corridor

Low-cost airline demand increase with low quality services

More funding supports to highway and airport expansion

Lobbyists



Source: GAO analysis of the Lobbying Disclosure Act of 1995, as amended. | GAO-18-388

*Narrative, but not exclusive

Reduce O&M, training, services led to massive catastrophe

Harvesting vs. market mechanism

New York Region Commuter Rail & Waterfront Terminals, 1910. Penn Station and eight waterfront terminals provided many ways between Manhattan and New Jersey.

New York Region Commuter Rail, 2018. Penn station is the primary means of access between New Jersey and Manhattan.

Reduction of rail network and service between Manhattan and New Jersey in 1910 – 2018

Turnaround management and learning from the international best practices

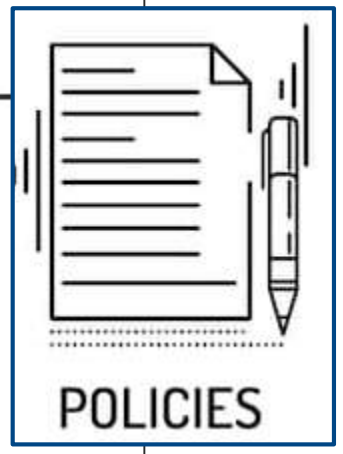
REPORT BY THE

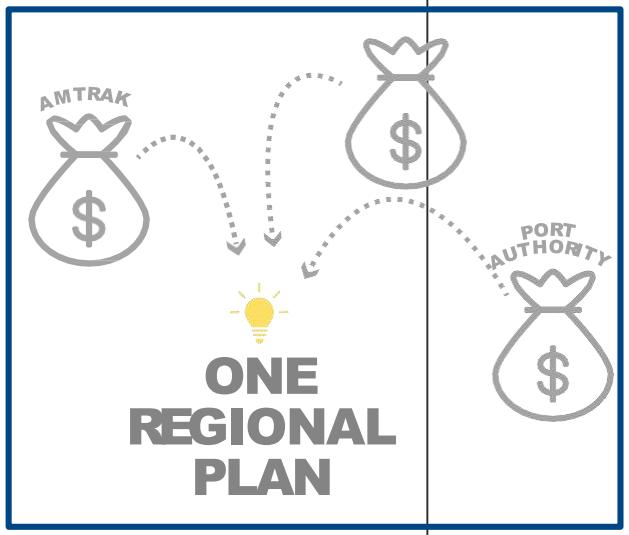
Comptroller General

OF THE UNITED STATES

Should AMTRAK's Highly Unprofitable Routes Be Discontinued?

Despite new equipment, improved stations and tracks, changes to schedules, and additional intermediate stops, some routes operated by the National Railroad Passenger Corporation continue to be highly unprofitable and to waste energy. However, they are still operating. Procedures developed for deciding which routes, if any, should be discontinued are not effective.





CED-79-3

NOVEMBER 27, 1978

Managing unprofitable passenger rail operations in Japan - Lessons from the experience in Sweden

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ARTICLE INFO

Keywords:
Railway reform
Vertical separation
Public finance
JEL classification:
R14
L3
L33
L92
L98

ABSTRACT

Japan implemented a ground-breaking reform in the railway sector in 1987 when it broke up the Japanese National Railways (JNR) into six vertically integrated railway companies. Mainly because of the recent population decrease in local areas, many local rail lines face severe declines in passenger numbers. When it comes to upholding unprofitable public transport, Sweden implemented a radical reform in 1988 by means of vertical separation and decentralisation, and then gradually introduced competitive tendering to procure unprofitable passenger rail services. In this paper, the situation in Japan, and primarily Hokkaido, is presented in some more detail, as well as the situation in Sweden. The study of railway operation and management in the two countries leads to a couple of lessons and implications for sustaining unprofitable but socially beneficial passenger railways. Among the addressed key issues are: 1) establishing the appropriate governance structure that facilitates reaching a better, agreed balance between national government and regional governments; 2) stipulating a standard to select the appropriate transport mode; 3) bearing of the financial responsibility for sustaining specific lines based on an analysis of the benefitting parties.

1. Background to the study and aim of research

In April 1987, the Japanese National Railways (JNR) underwent a major reform. JNR was divided into six vertically integrated companies, and a single vertically separated freight railway company. This case is considered to be a successful reform of a public enterprise in Japan as transport volumes and productivity of railways, as a whole, have increased substantially. However, mainly because of the recent population decrease in some parts of Japan, many local rail lines now face severe declines in passenger numbers. For JR Hokkaido (HJR), where the average passenger traffic density is lower than most other JR companies, managing the railways has been particularly difficult. In November 2016, the company announced that 1,237 km of lines cannot be sustained only through the revenues from the businesses and the interest payments of the Management Stabilisation Funds (MSF). Consequently, it has become necessary to take certain measures if these unprofitable lines should be kept in the future. As this status shows, despite the overall success of the 1987 JNR reform, the current railway management in Japan requires some measures in order to uphold operation of local lines.

In Sweden, a major reform of the Swedish State Railways was initiated in 1988, in which rail infrastructure was vertically separated from train operations, and responsibility for many unprofitable passenger lines was decentralised to regional governments. This was later followed by the introduction of procurement of rail services by competitive tendering. Today, both the national government and regional governments allocate funds to the railway sector to sustain unprofitable passenger railway services when they are socially beneficial.

Based on a study of the experiences and schemes to allocate public spending to unprofitable passenger railway services in Sweden, this paper seeks to address the key issues necessary to sustain such railway services in Japan. The underlying idea is that, although there may be many differences between Japan and Sweden, there could still be sufficient similarities in the conditions for rail passenger services if we focus our analysis on the island of Hokkaido, making it relevant to consider some of the lessons from Sweden.

Table 1 provides a very basic comparison, in terms of geography and population, between the three Japanese islands Hokkaido, Shikoku and Kyushu, as well as a comparison with Sweden, divided as traditional into its three parts Götaland, Svealand and Norrland (for a map,

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E-mail addresses: [redacted] (F. Kurosaki), [redacted] (G. Alexandersson).

https://doi.org/10.1016/j.retrec.2018.07.019
Received 30 November 2017; Received in revised form 25 May 2018; Accepted 17 July 2018

NY-NJ Gateway Tunnel Project

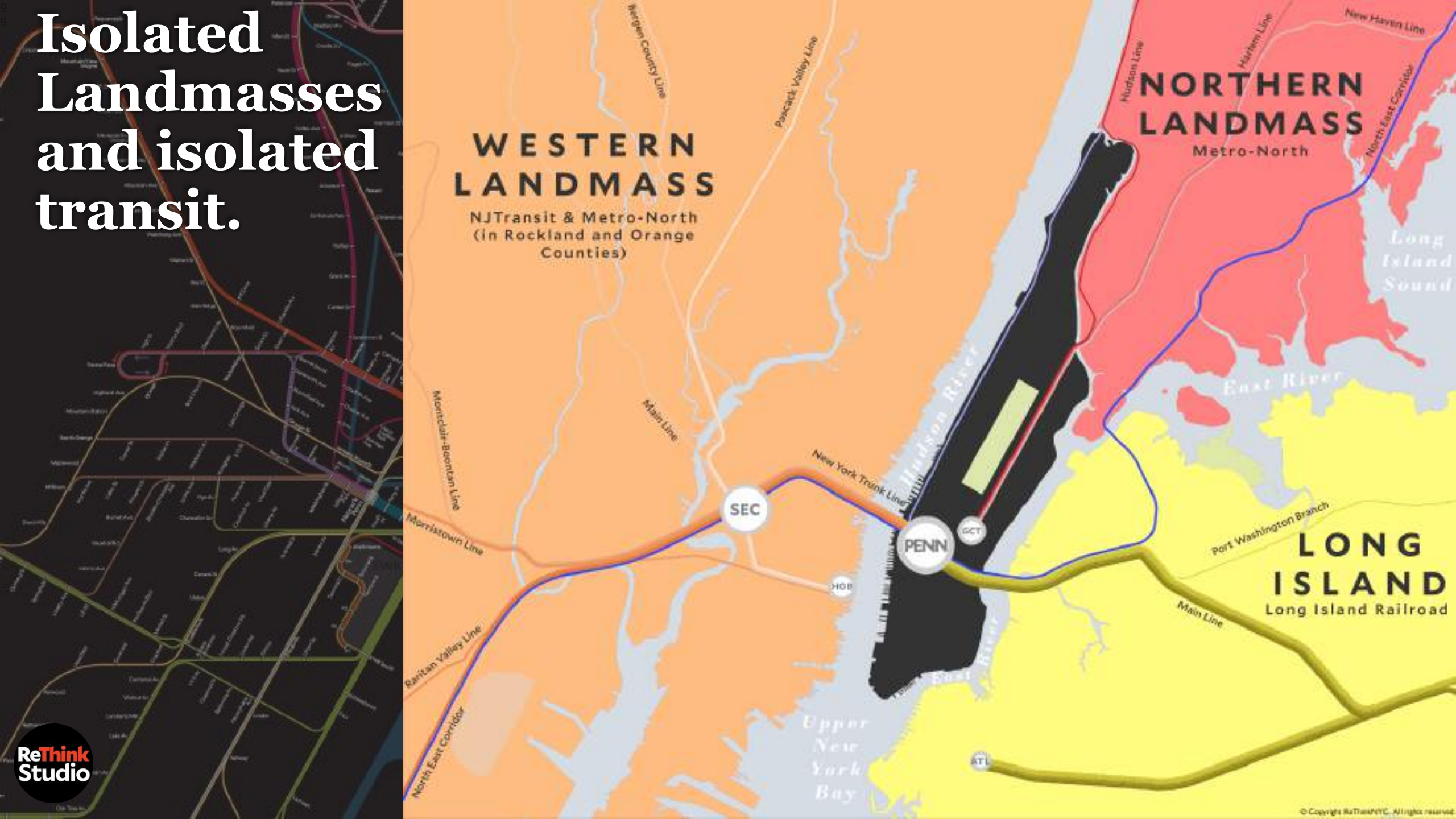
- New York Pennsylvania Station: Existing challenges and corresponding engineering measures

Source: RPA 2012

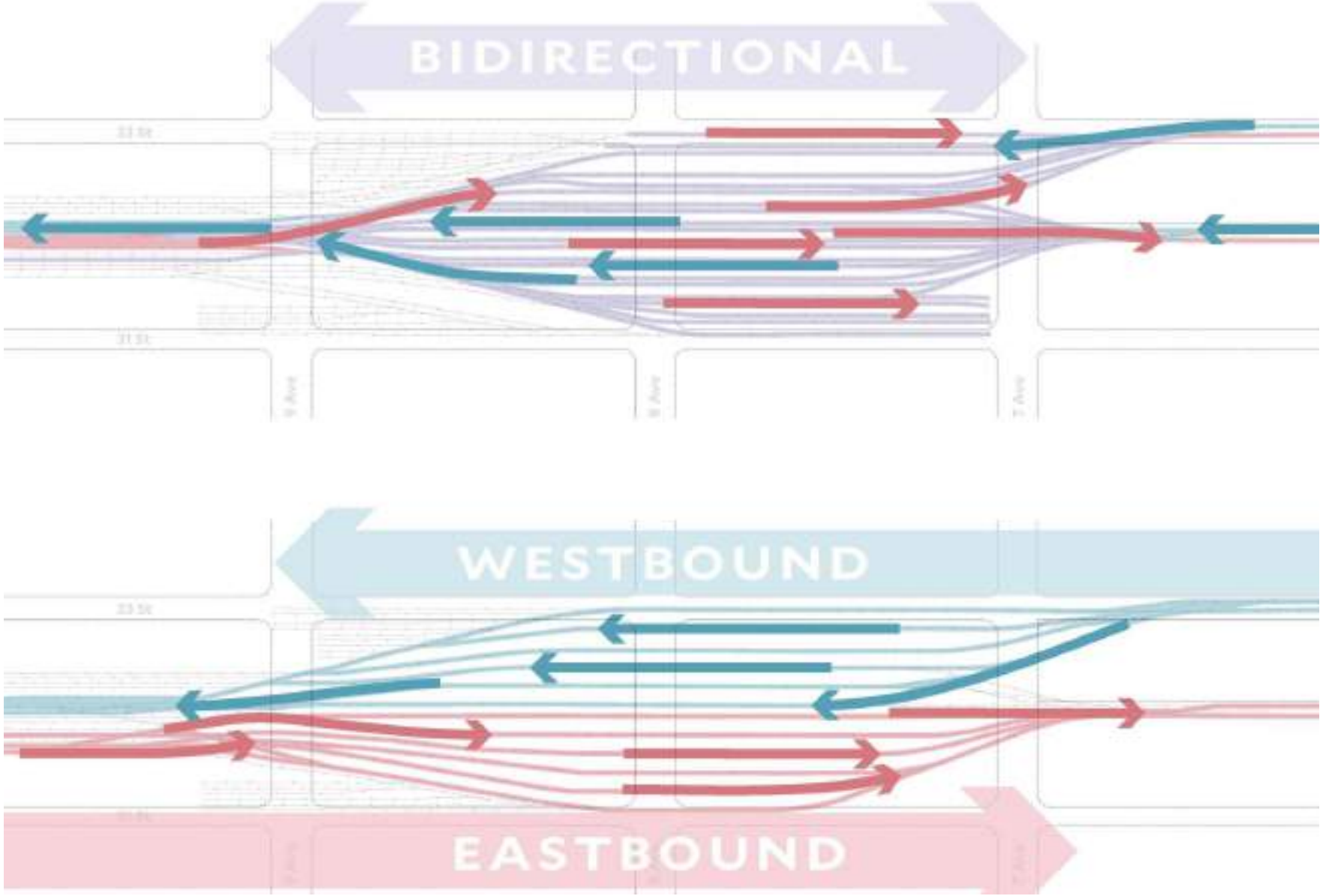
Aerial footage on Lincoln tunnel (inbound) to New York

Source: Wikipedia, The Business Journal, CBS, NBC New York

Isolated Landmasses and isolated transit.



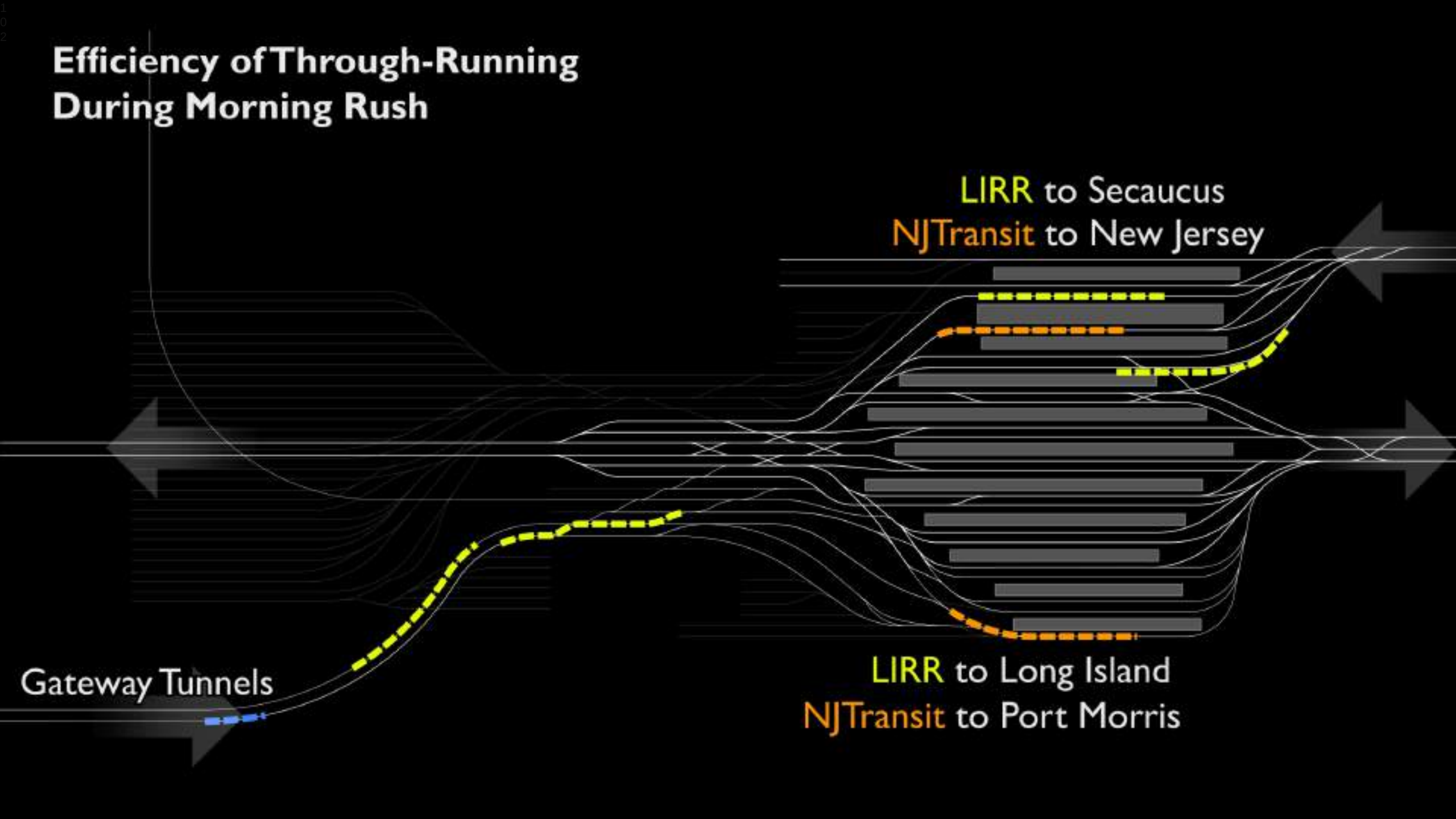
1. Low network capacity (Up) vs. Flexible track alignment for higher efficiency (Down)



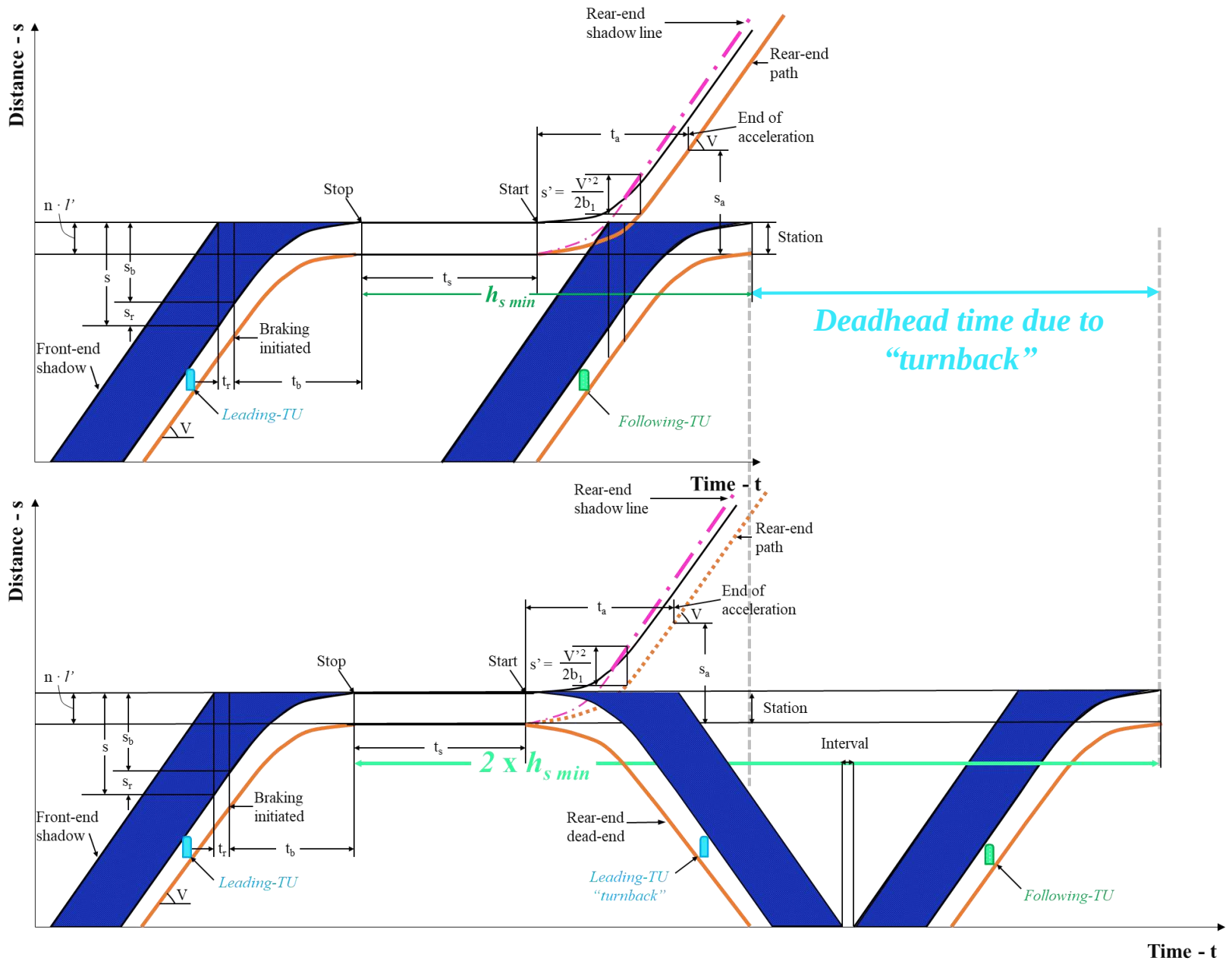
NY Pennsylvania station Dead-end conflict (Up) vs. Through-running flow (Down)


EMPIRE CONNECTION
TO ALBANY
EXISTING TUNNEL
TO NEW JERSEY
NEW GATEWAY
TUNNEL
EXISTING
TUNNELS TO QUEENS
EXISTING
TUNNELS TO QUEENS
PENN
STATION
SOUTH

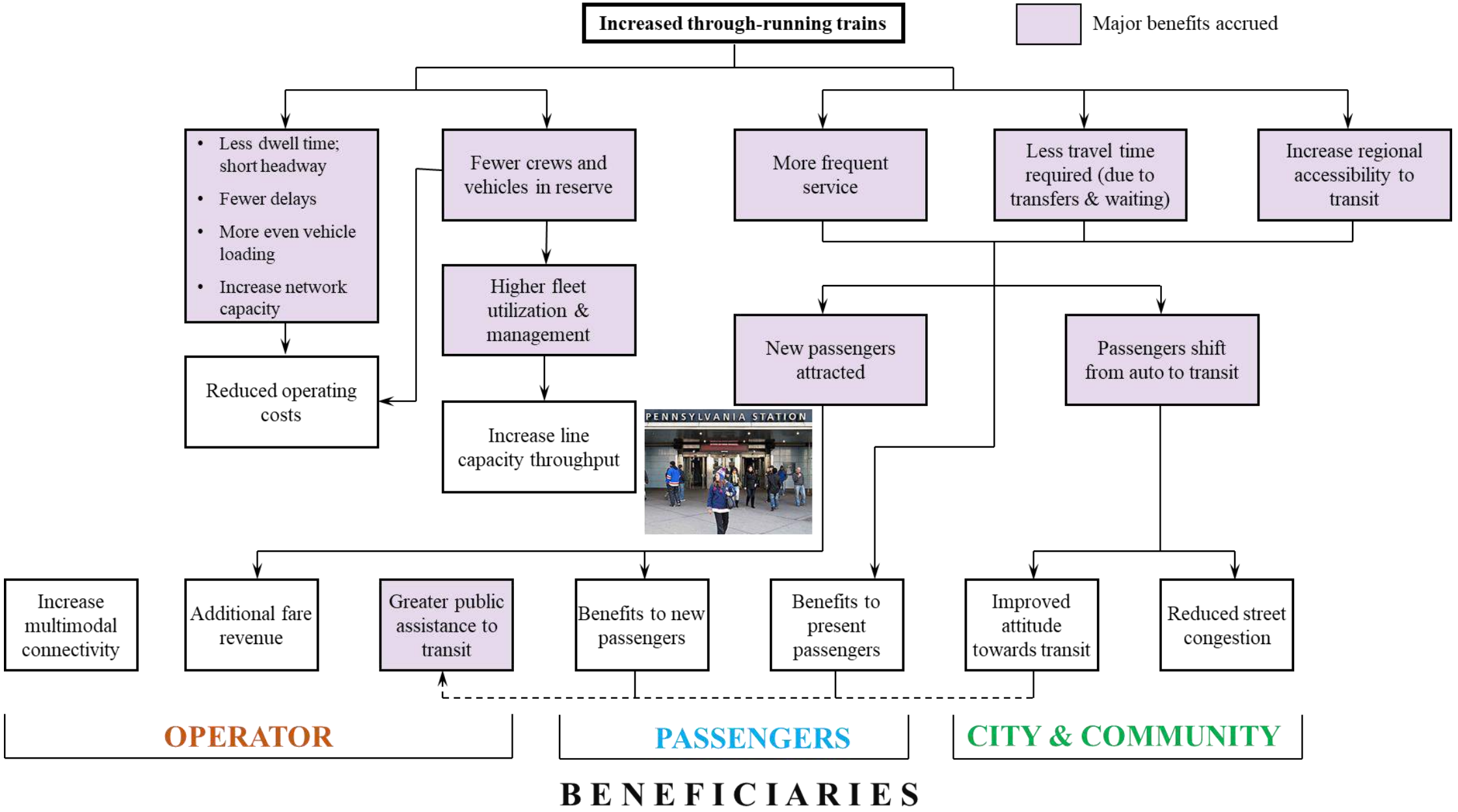
Efficiency of Through-Running During Morning Rush



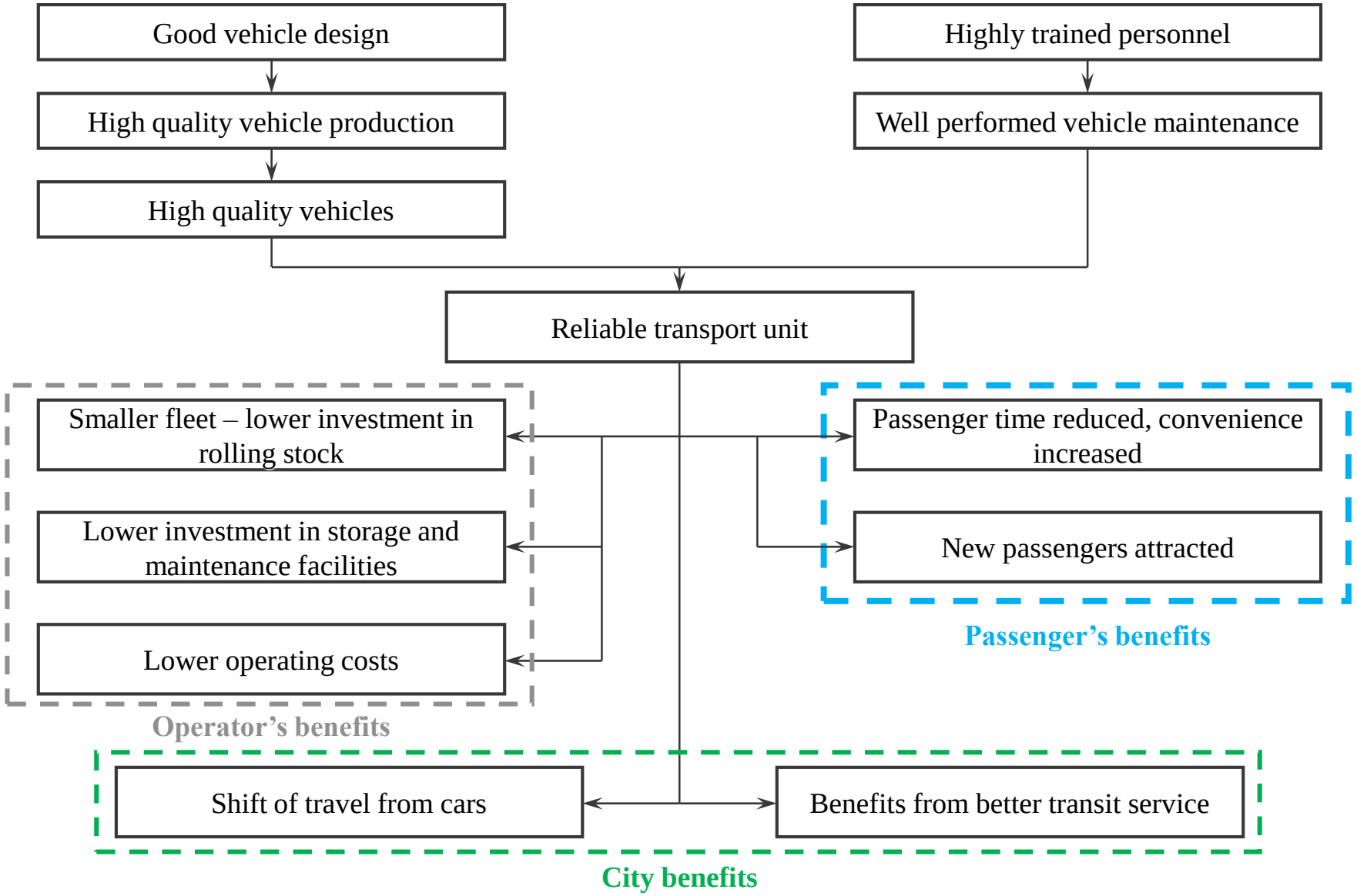
2. Increase throughputs and capacity: Through-running vs. Dead-end station



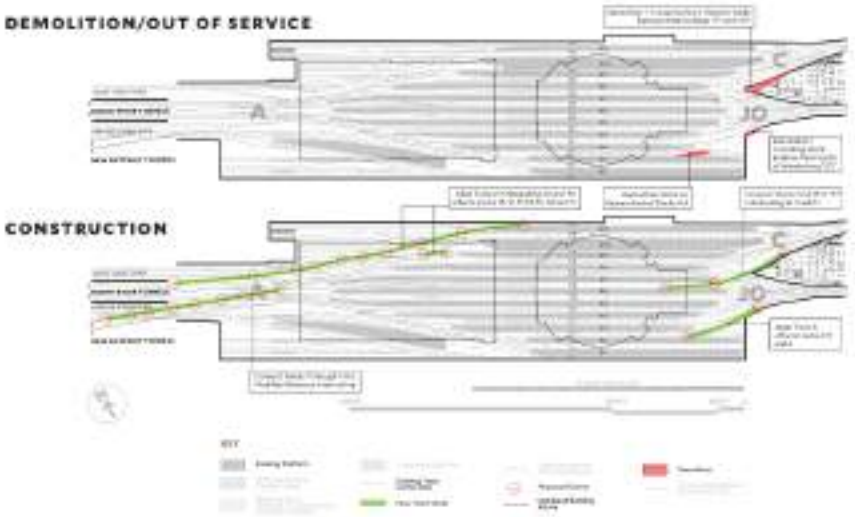
Increase network efficiency on through-running operations

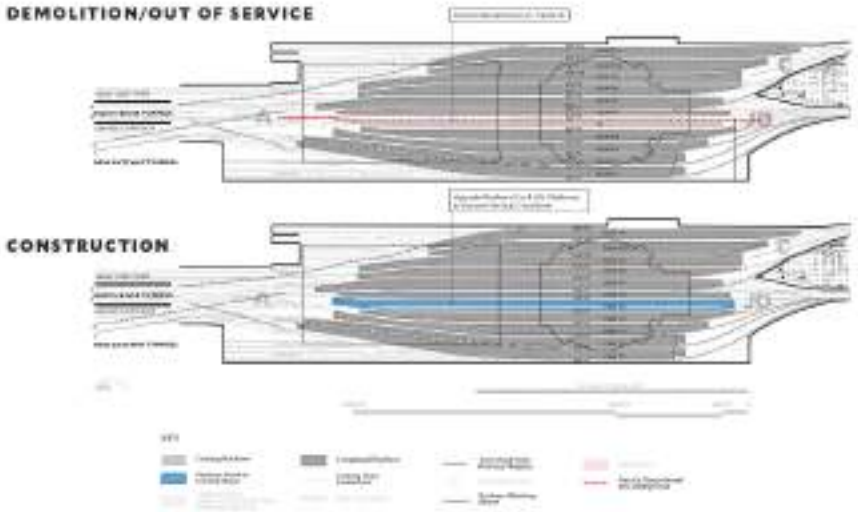


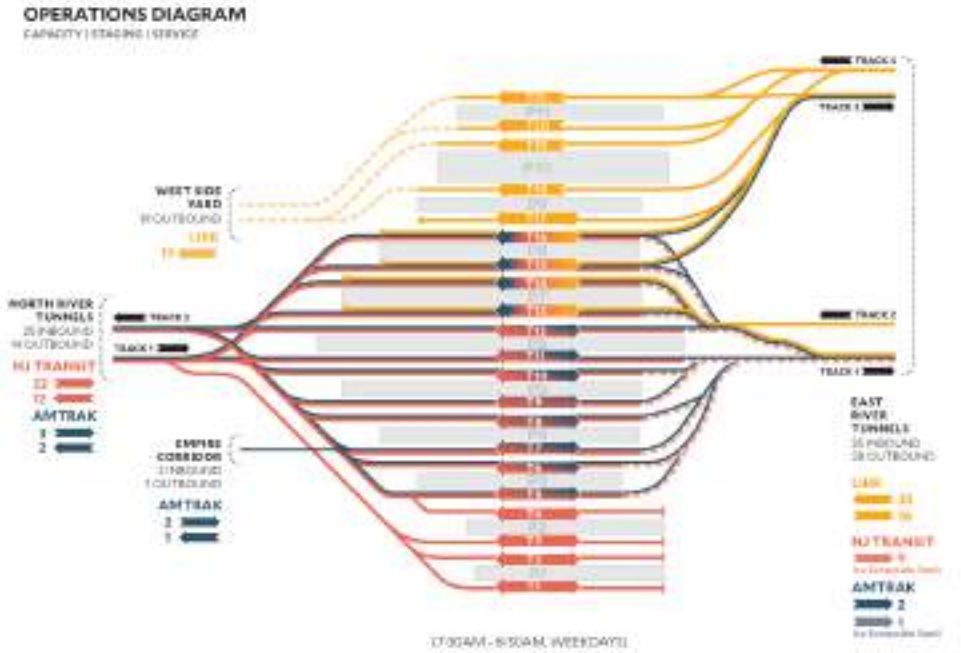
Steps for Achieving Higher Reliability & Benefits

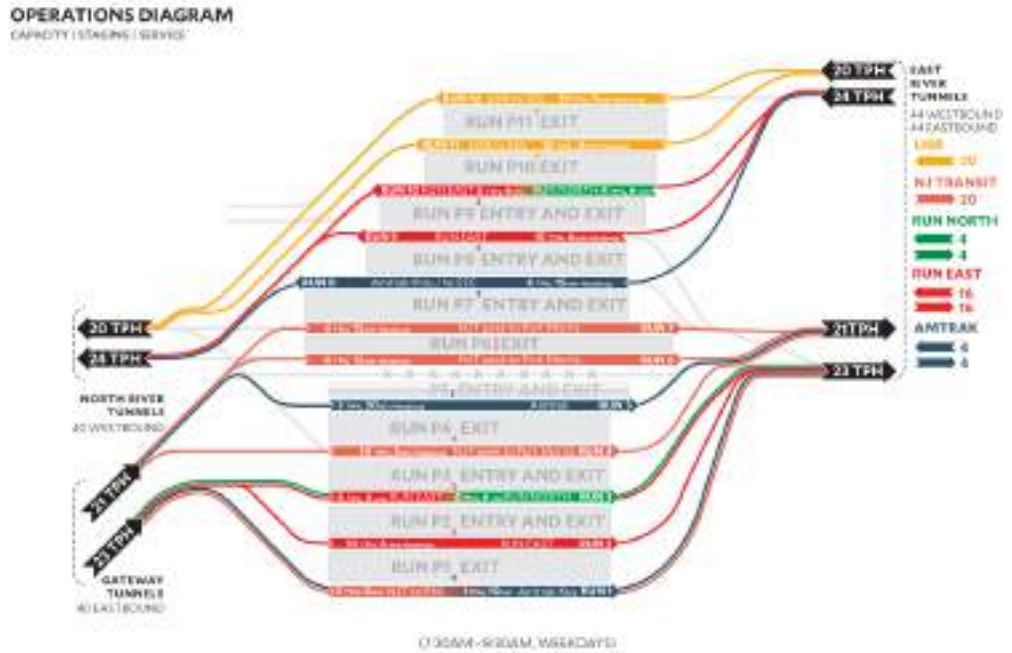


3. Operation efficiency: increase of tunnel and track utilization



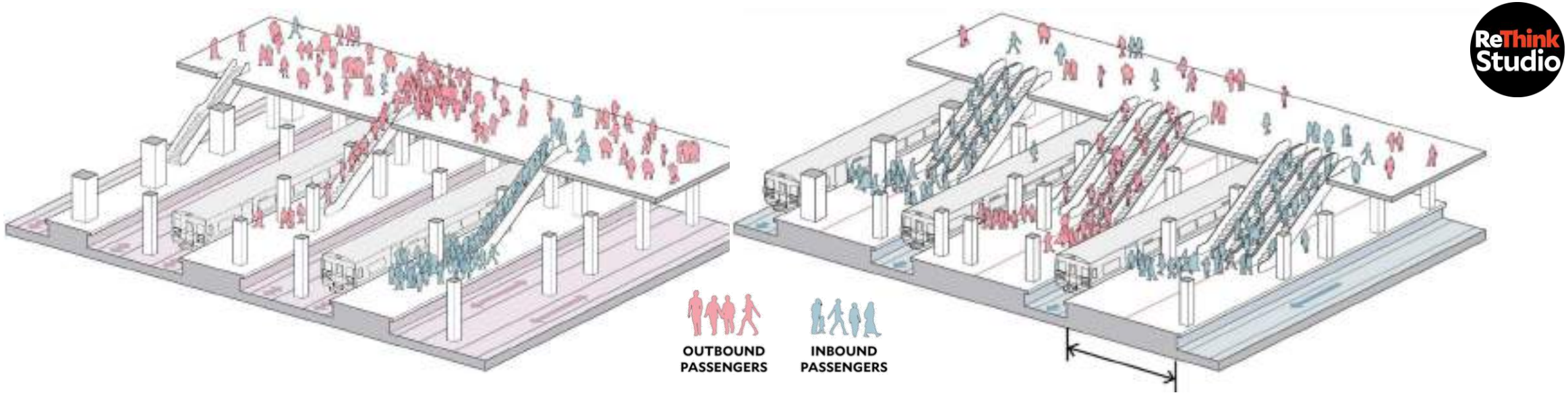






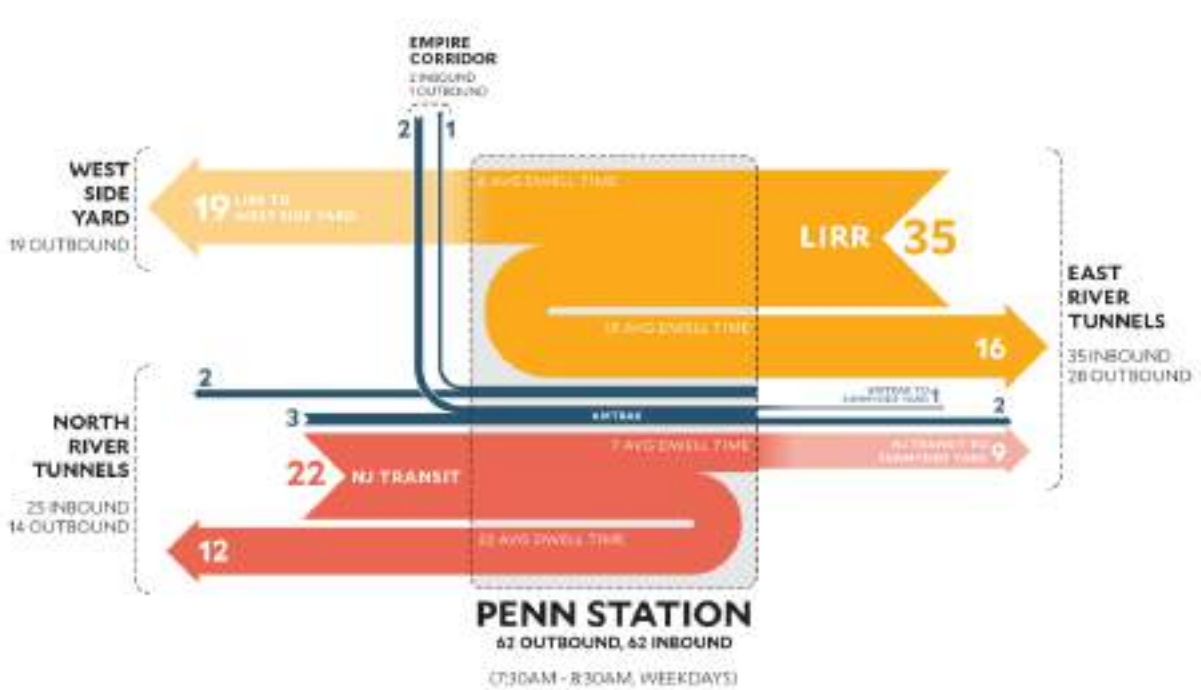
Selected schematic design on track reengineering, network realignment (up) and counter operation strategy (Down) within the Penn station construction phasing Plan

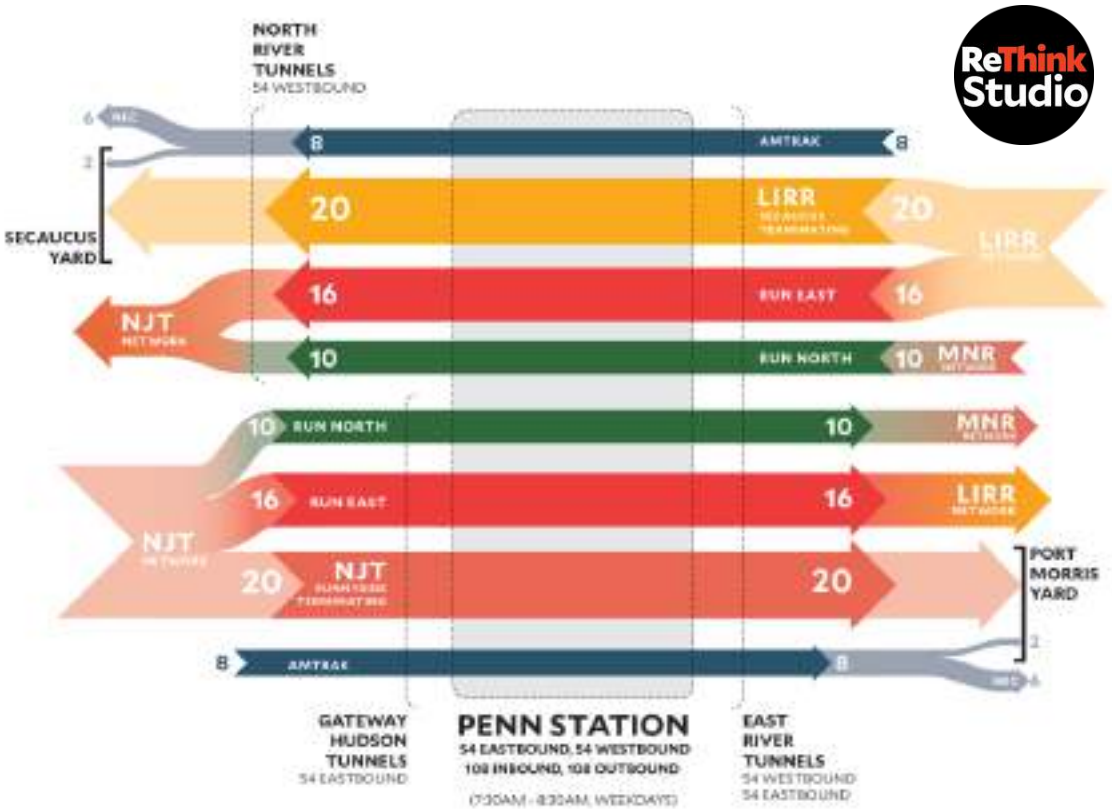
4. Limited passenger circulation vs. Platform expansion to expedite boarding and alighting process

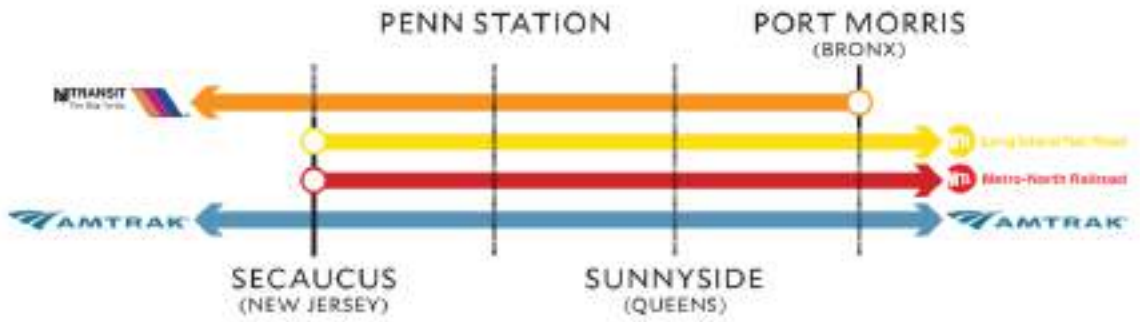


Penn Station existing platform condition (Upper-left and lower two) vs. Engineering improvement on vertical circulation (Upper-right).

5. Disconnected network services vs. Regional unified network (RUN)

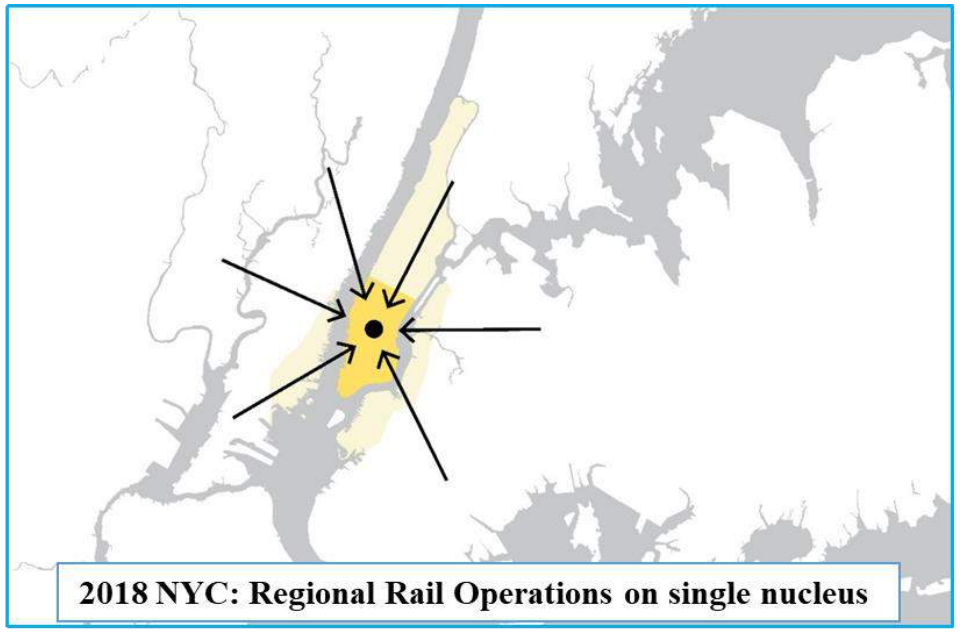




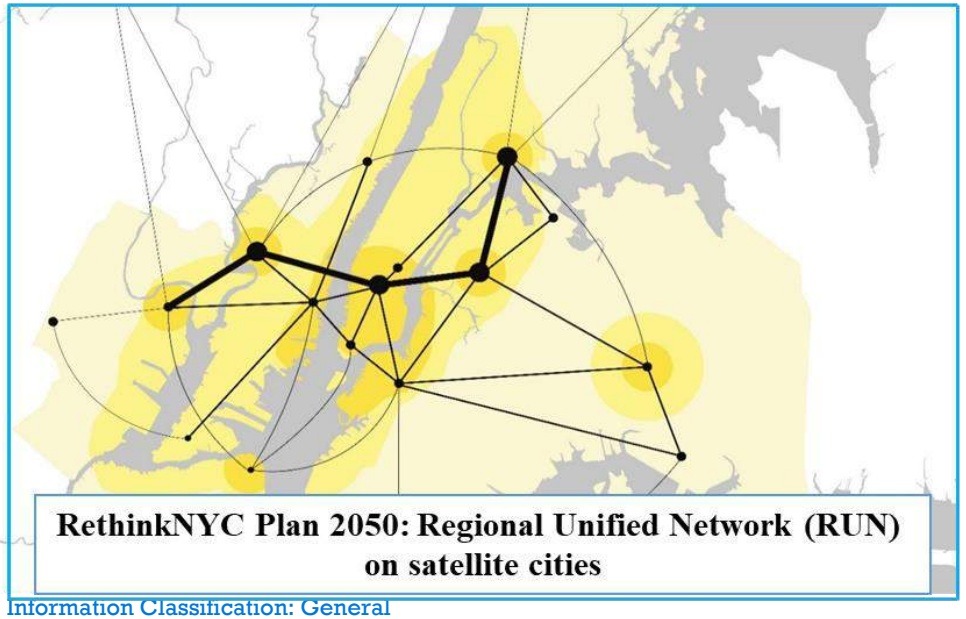


Comparative analyses of dead-end (Left) vs. through-running (Right) network capacity at the New York Pennsylvania Station

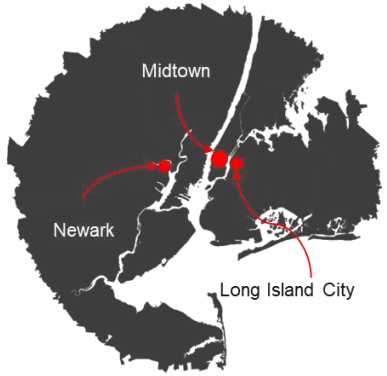
Urban land recapitalization and asset utilization

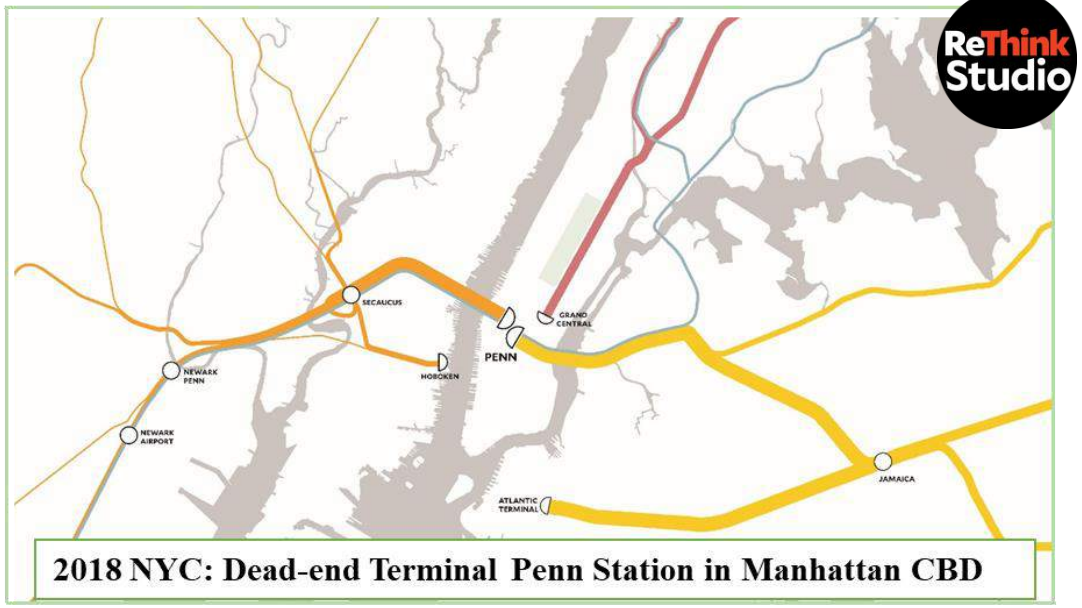


2018 NYC: Regional Rail Operations on single nucleus



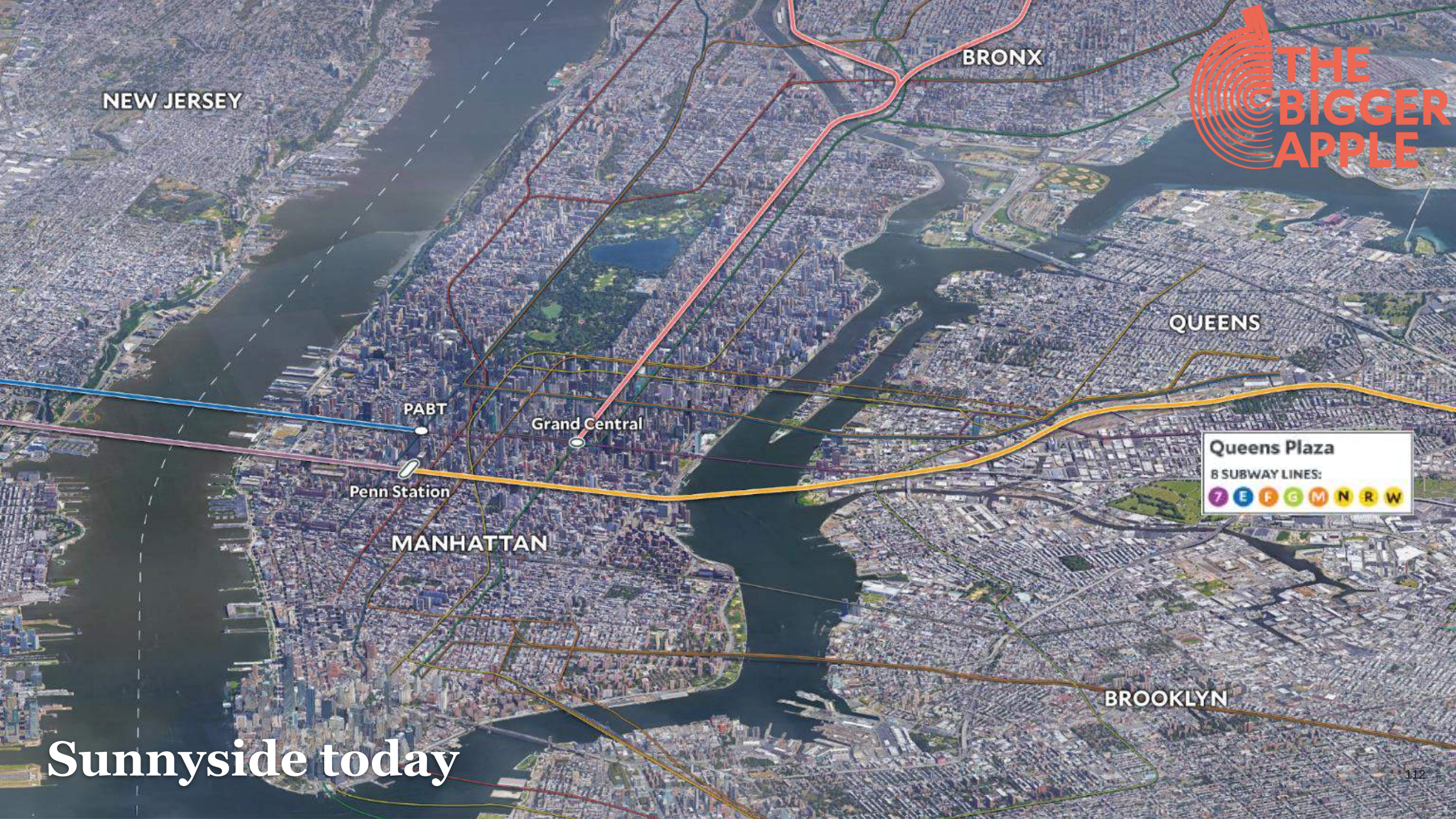
RethinkNYC Plan 2050: Regional Unified Network (RUN) on satellite cities





2018 NYC: Dead-end Terminal Penn Station in Manhattan CBD

RethinkNYC Plan 2050: Through-running Penn Station in Manhattan CBD and New Transit Hubs



Sunnyside today

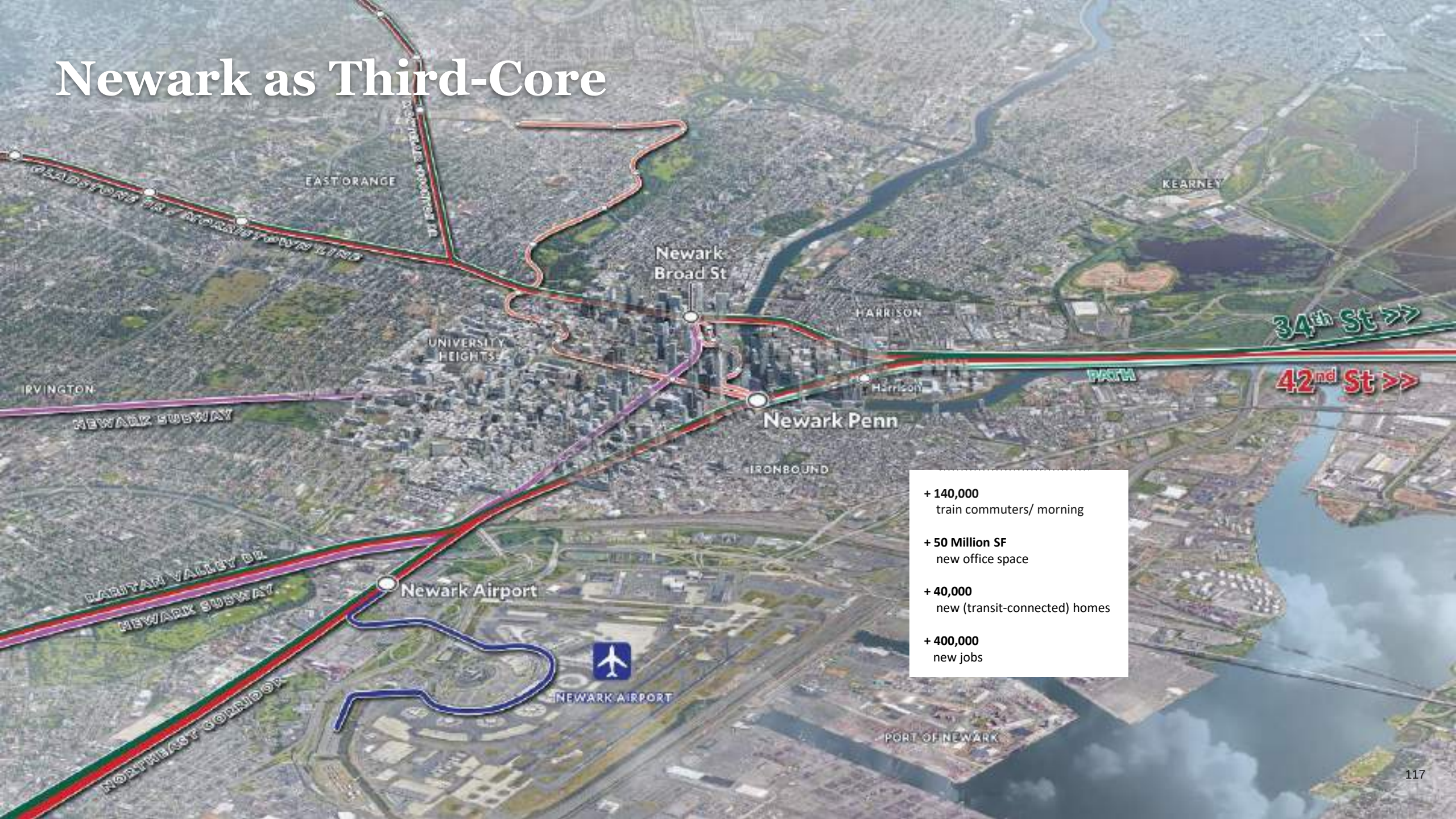
Critical Interventions

Sunnyside as Second-Core

Newark today

Critical Interventions

Newark as Third-Core



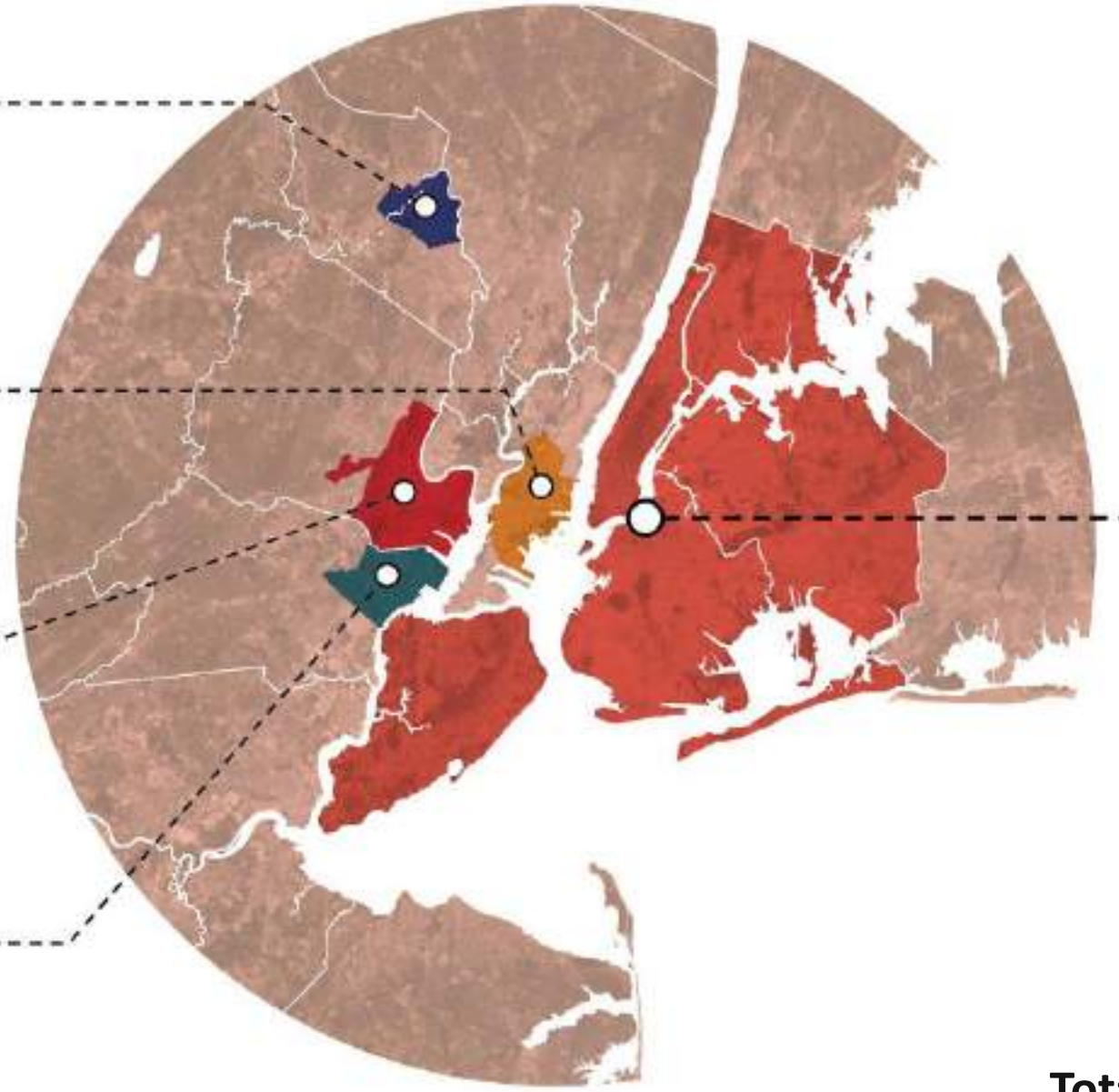
+ 140,000
train commuters/ morning

+ 50 Million SF
new office space

+ 40,000
new (transit-connected) homes

+ 400,000
new jobs

THE BIGGER APPLE



Total revenue (2016)

How much can we grow without destroying value? Growth at what cost? Growth, but how long can it be sustained? What is the [quality] of growth? vs. the cost of inaction?

New York City regional transit plan 2050

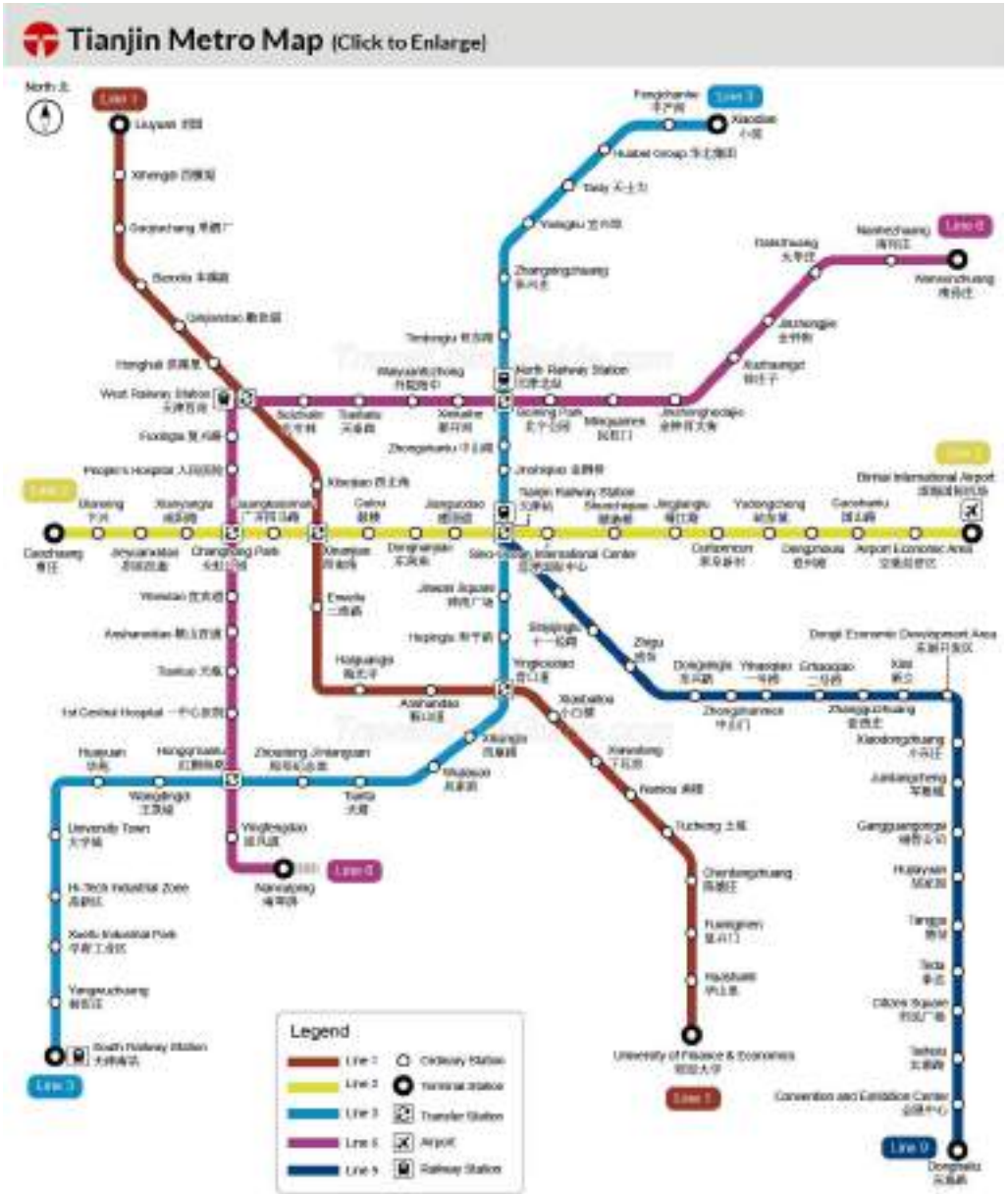
NY-NJ-CT Tristate transit plan 2050

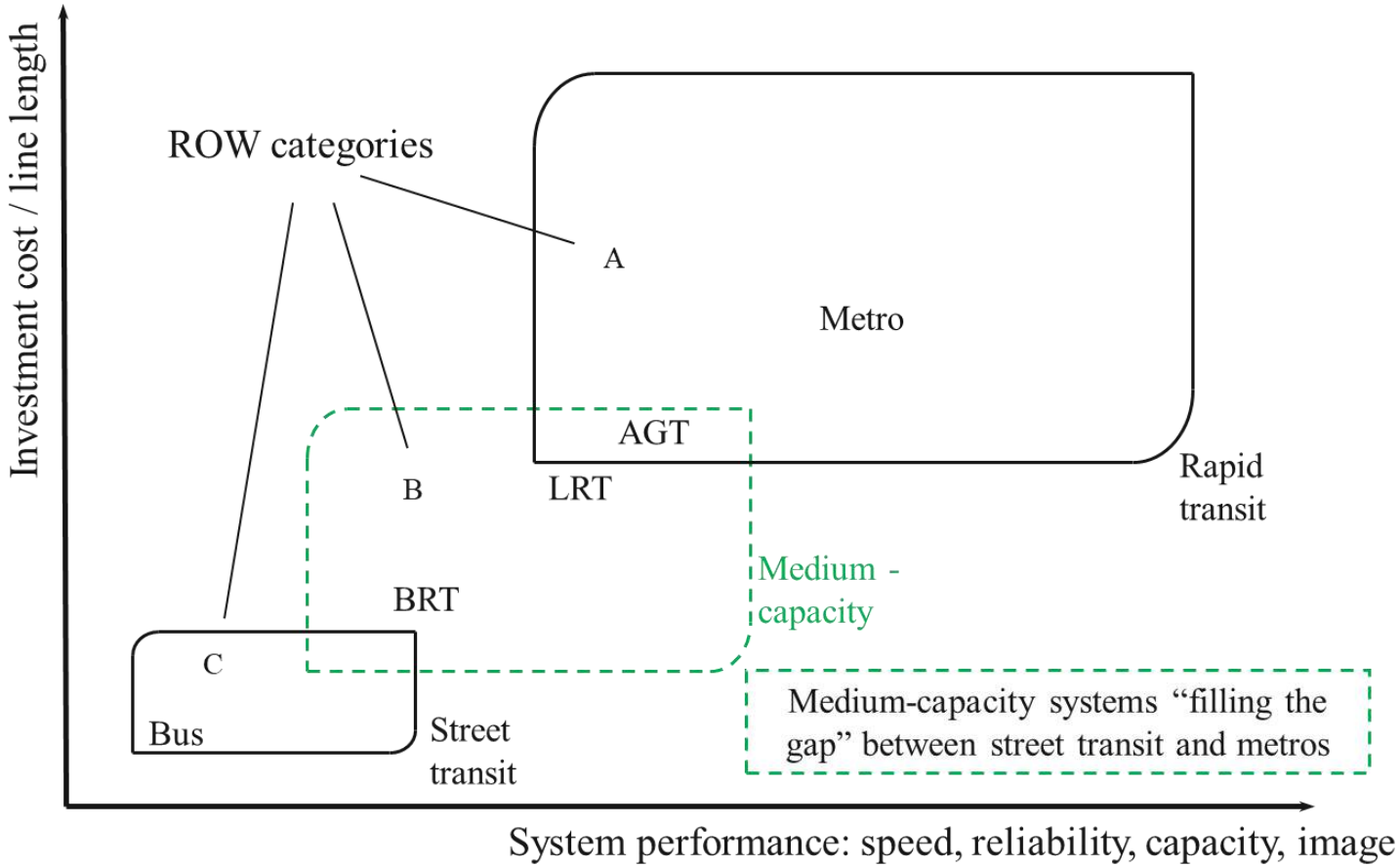
THE WORLD BANK

Tianjin / Oct 2016 – Evaluation Methodology

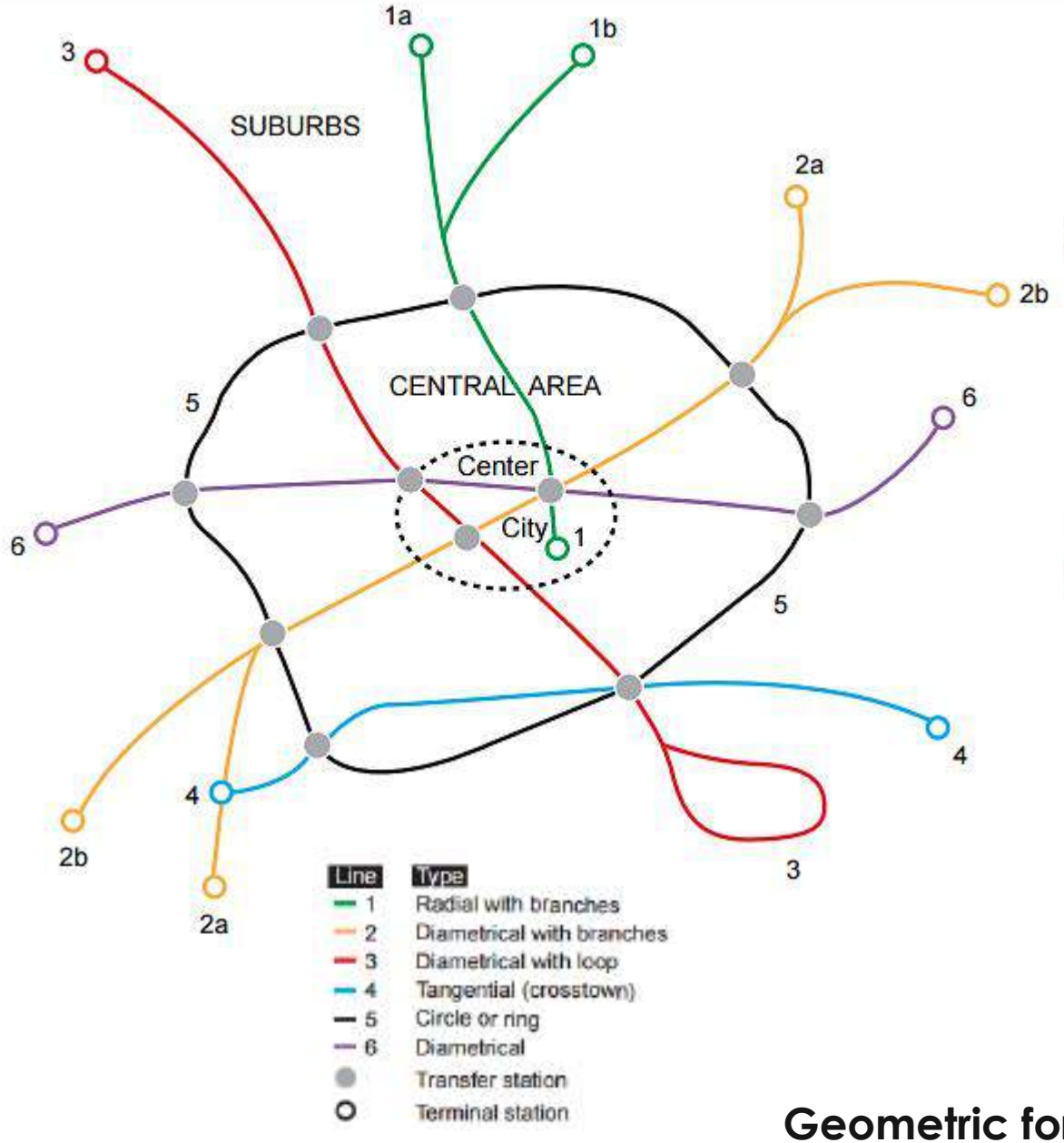
Wharton ALTERNATIVE INVESTMENTS Initiative
UNIVERSITY of PENNSYLVANIA

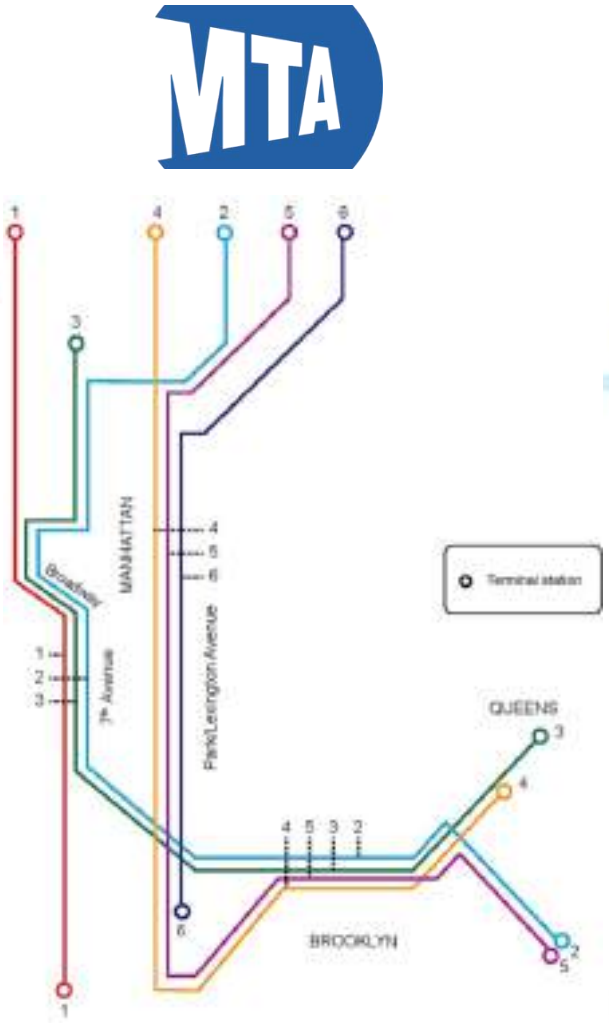
Challenge No.1 Bipolarized investment scheme: lack of medium-capacity transit modes

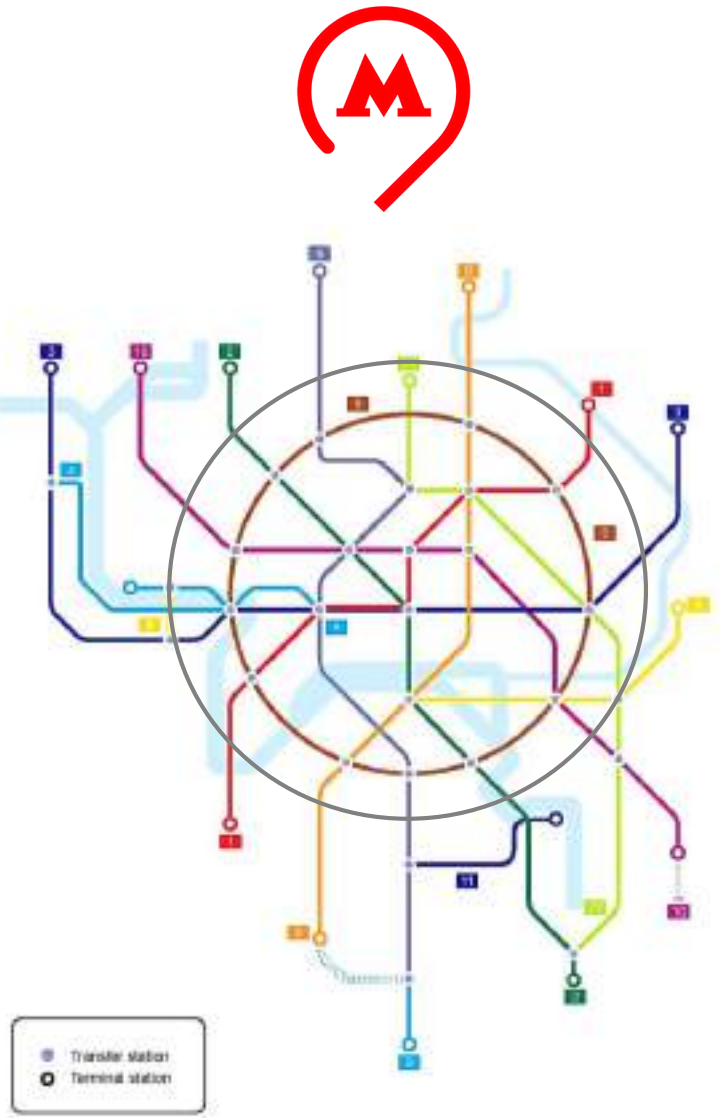




Geometric forms of transit lines





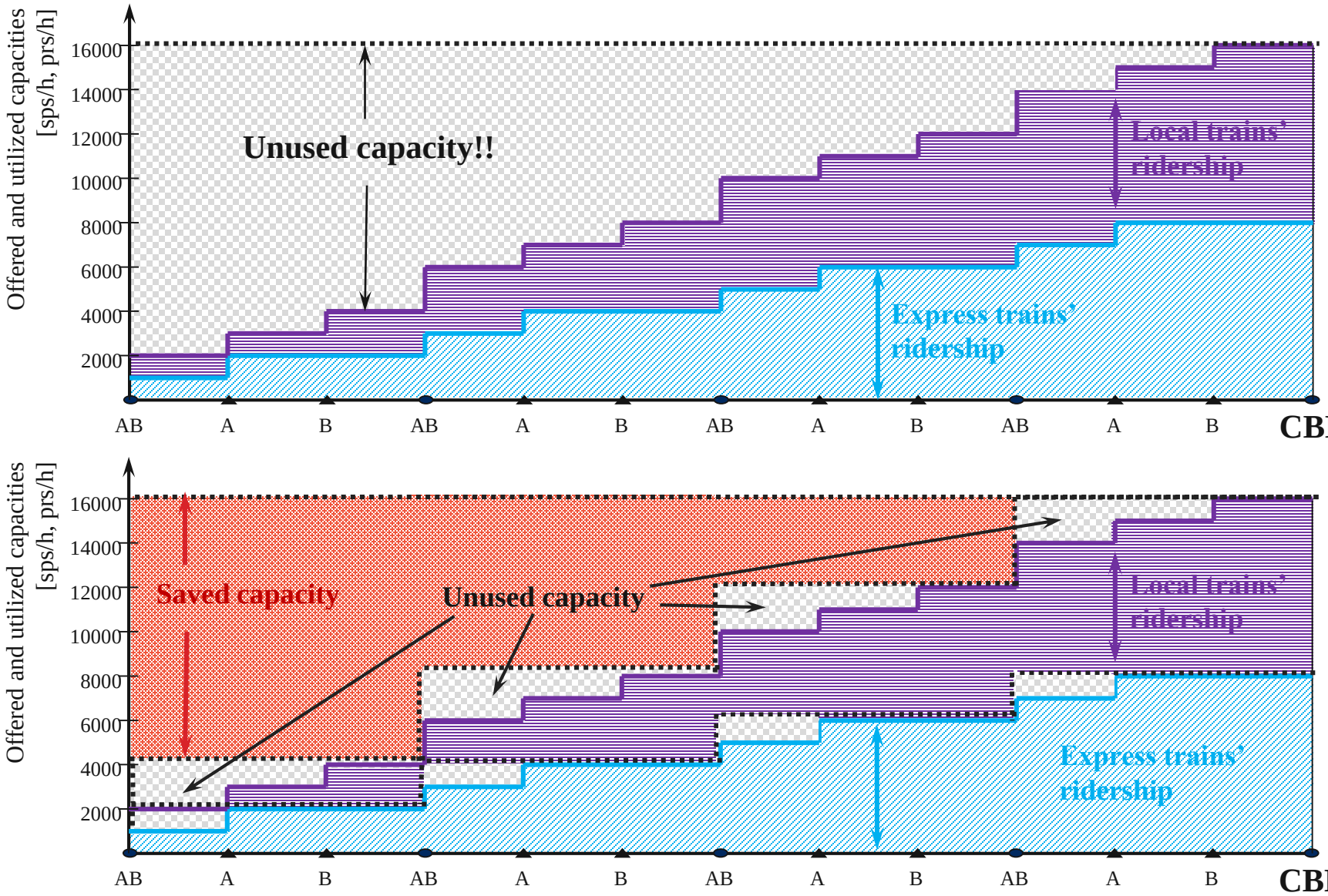


Geometric forms of transit lines

Comparison of offered vs. utilized capacity for local and skip-stop operations

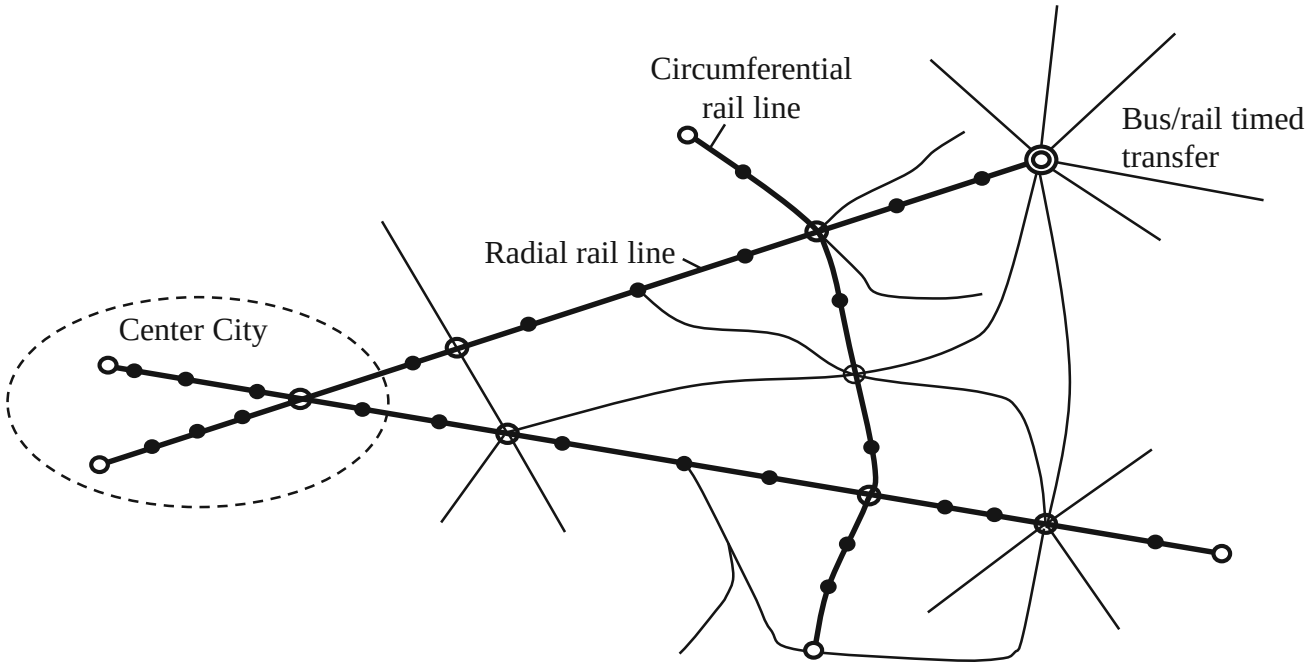
Offered capacities [sps/h, prs/h]

Suburb



Center city/ CBD

Multimodal strategies: Network expansion, operation efficiency, mode coordination



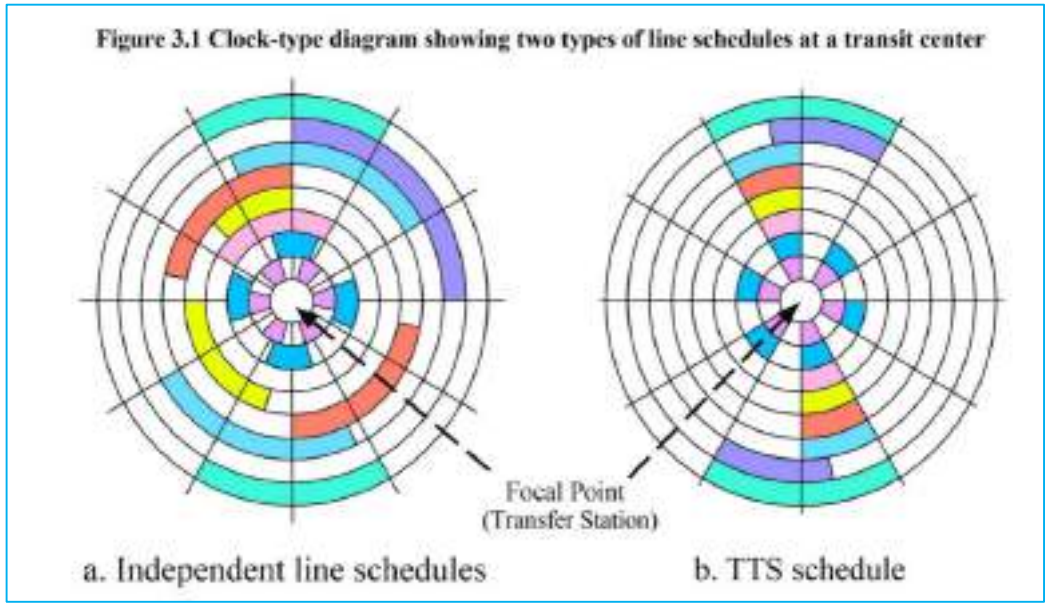


Table 4.1 Use of different transit modes in large cities

Benchmark	City	Street transit: Bus	Street transit: Trolleybus	Street transit: Tram	Medium capacity (MC): BRT	Medium capacity (MC): LRT	Rapid transit: Metro	Rapid transit: Regional Rail	Others
	Beijing	✓	✓		✓		✓		
	Boston	✓	✓	✓	✓	✓	✓	✓	Ferries
●	Copenhagen	✓						✓	ALRT, Ferries
	Dalian	✓		✓	✓		✓		Ferries
	Guangzhou	✓		✓	✓		✓		AGT
●	Hong Kong	✓		✓		✓	✓	✓	Ferries
●	London	✓				✓	✓	✓	ALRT
	Los Angeles	✓			✓	✓	✓	✓	Funicular
	Moscow	✓	✓	✓		✓	✓	✓	Monorail
	Nanjing	✓		✓			✓		
●	New York	✓				✓	✓	✓	Ferries, Aerial tram
●	Paris	✓				✓	✓	✓	
	Philadelphia	✓	✓	✓		✓		✓	LRRT
	San Francisco	✓	✓	✓		✓	✓	✓	Cable car, Ferries
●	Seoul	✓			✓		✓	✓	
	Shanghai	✓			✓	✓ (Rubber-tired)	✓		MagLev
●	Singapore	✓					✓		AGT
	Tianjin	✓		✓ (Rubber-tired)			✓		
●	Tokyo	✓		✓			✓	✓	Monorail
	Toronto	✓		✓		✓	✓	✓	
	Vancouver	✓	✓		✓	✓	✓	✓	Ferries
	Vienna	✓		✓		✓	✓	✓	

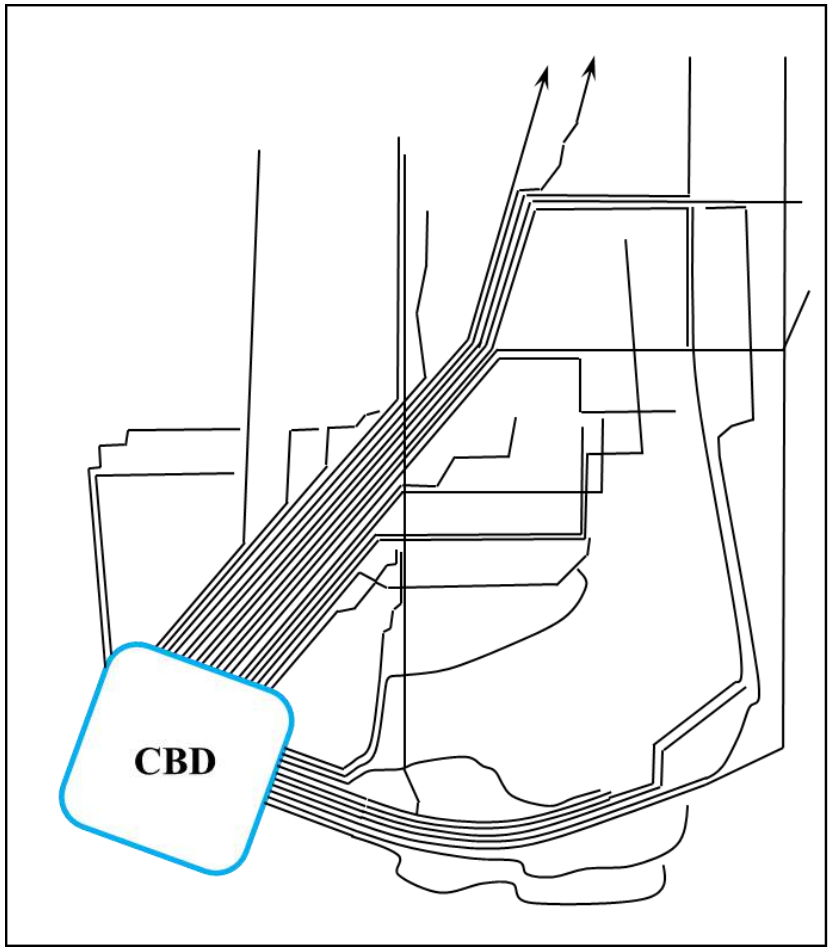
Legend: ✓ – Heavily used; LRRT - Light Rail Rapid Transit; AGT/PMS - Automated Guided Transit /People Mover System; ALRT - Automated Light Rail Transit

4

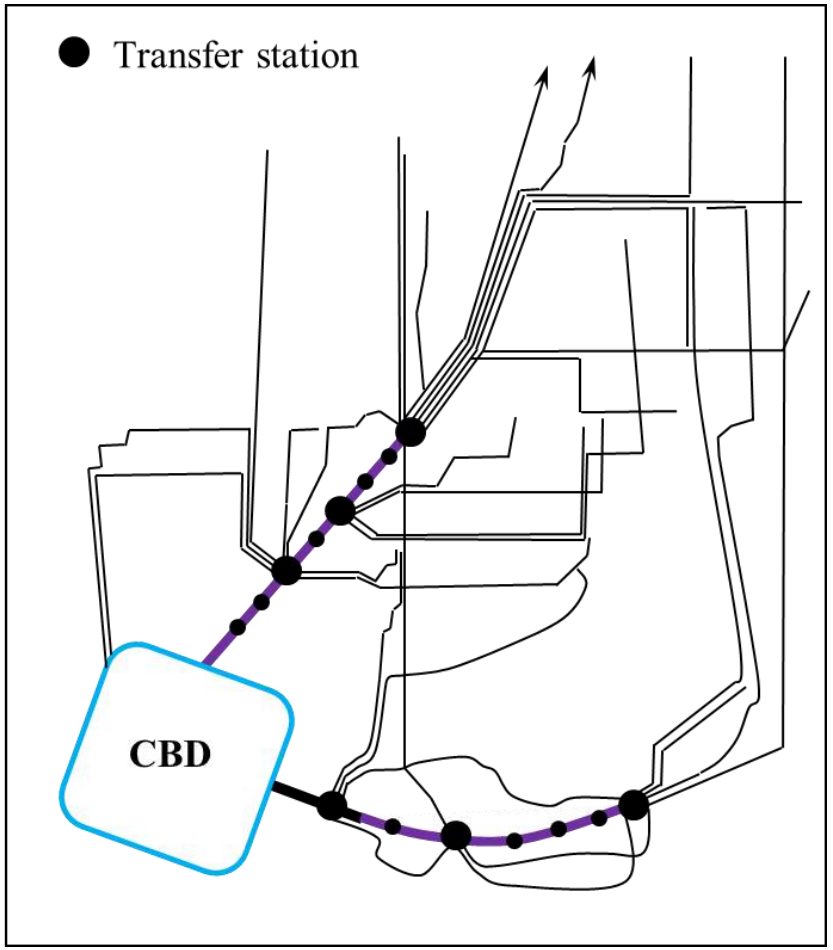
No.2 Growth Management: Bus route consolidation and coordination

Elevated crossway at a bus stop – 6 buses

Congestion on the main street (peak hr)

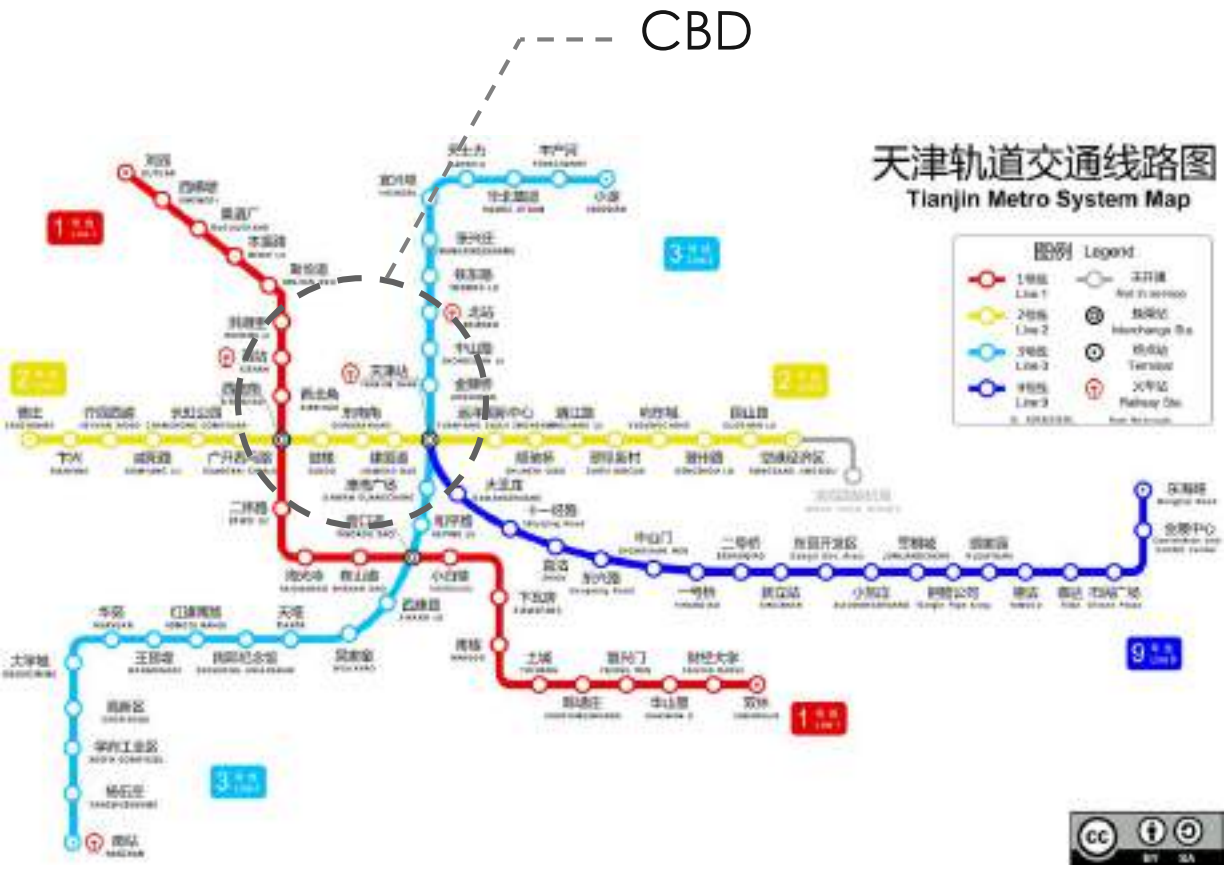


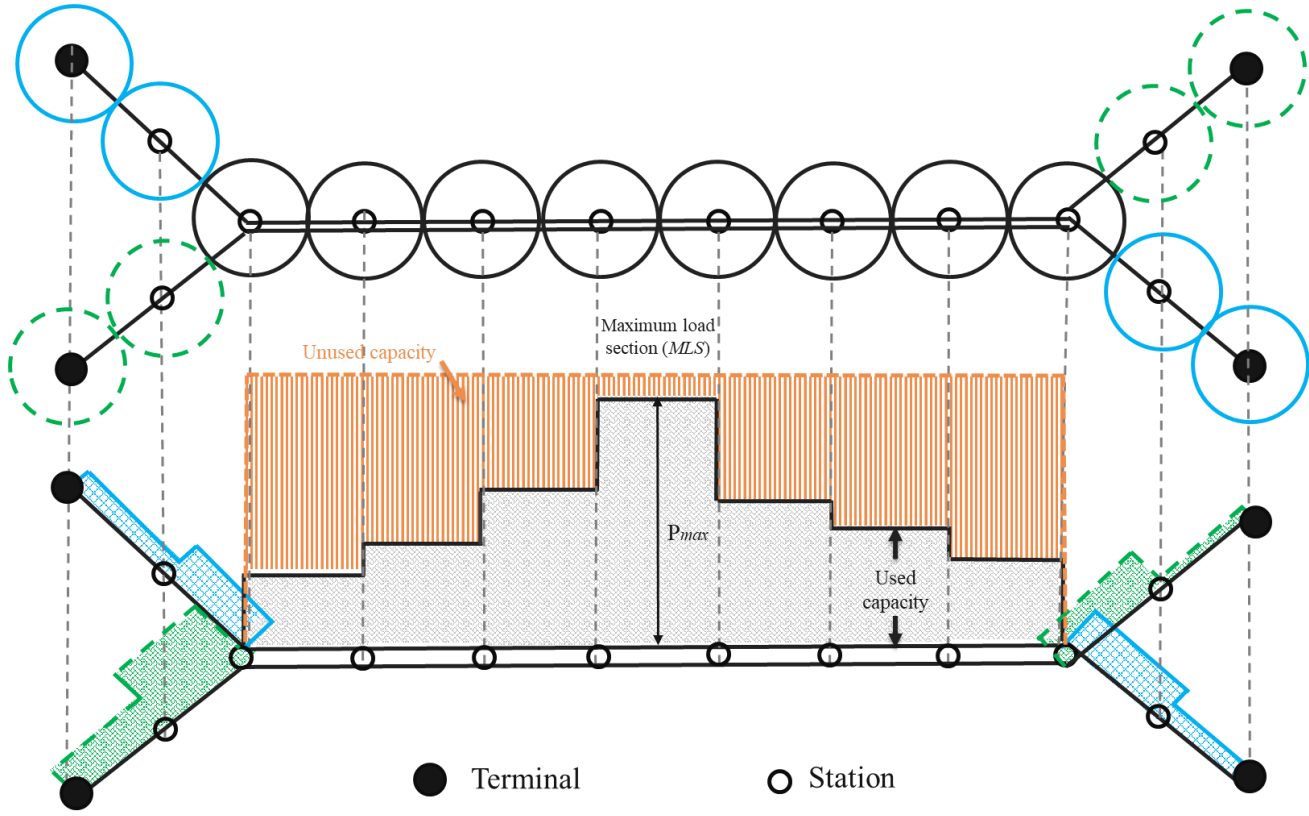
Existing: Independent bus lines compete on the main street



Proposed: **Trunk LRT** with feeders – balanced and synergistic value

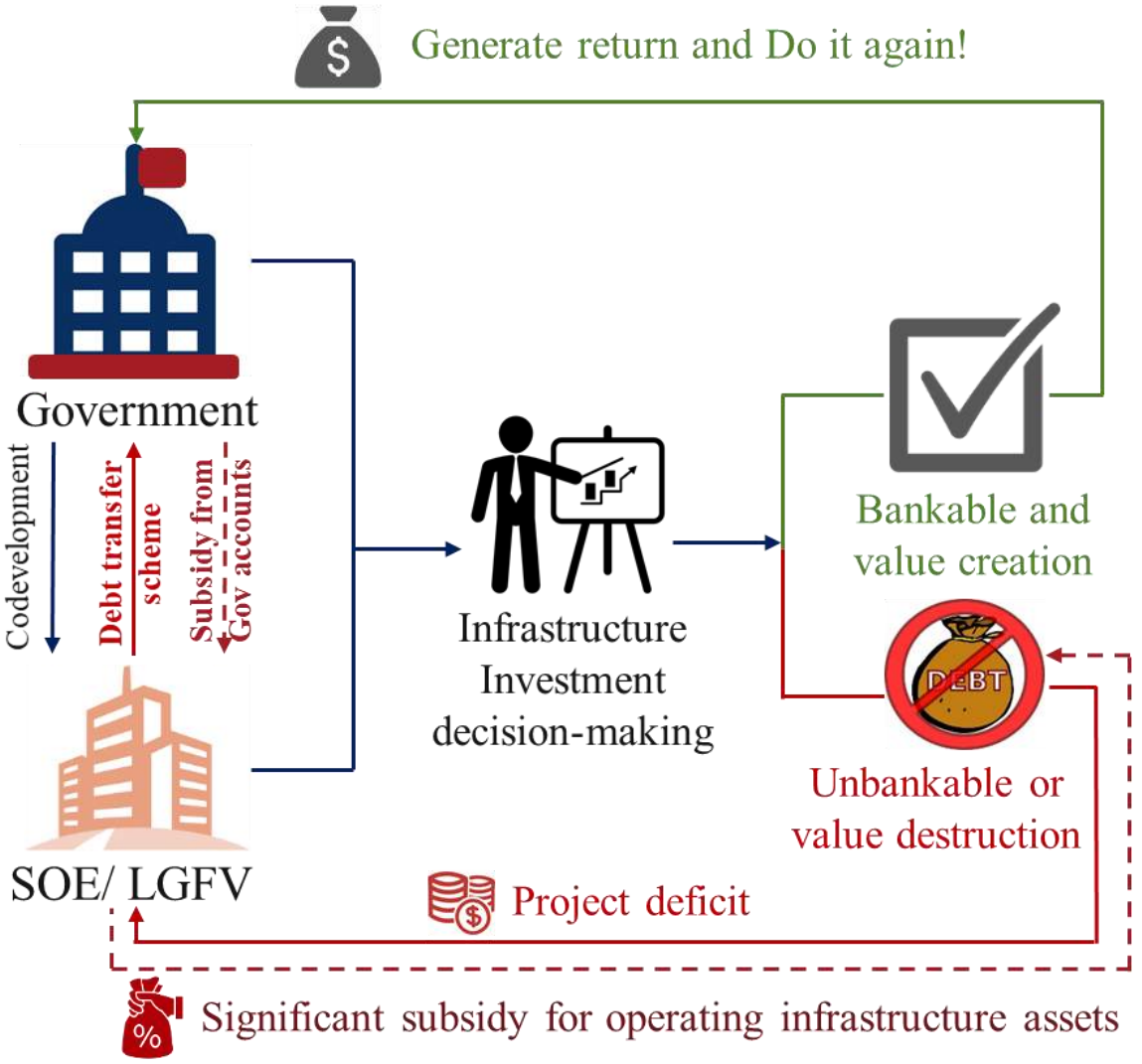
No.3 Tianjin Metro: Hyperextended independent lines vs. Trunk Line with Branches





Increase area coverage & passenger profile: Trunk line with 2 branches

No.4 Debt transfer scheme in unbankable or value destruction projects



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No.5 Interpreting the motivation of the debt transfer scheme

Dialogue Box

Government decision-maker (G): Five years from now, I won't be here! I need to show people how many metro lines and bridges are going to open during my tenure as soon as possible. Let's build them first and wait for the ridership to grow.

Consultant (C): Underutilized infrastructure assets would be a waste of investment. Do you have a way to boost the asset utilization rate?

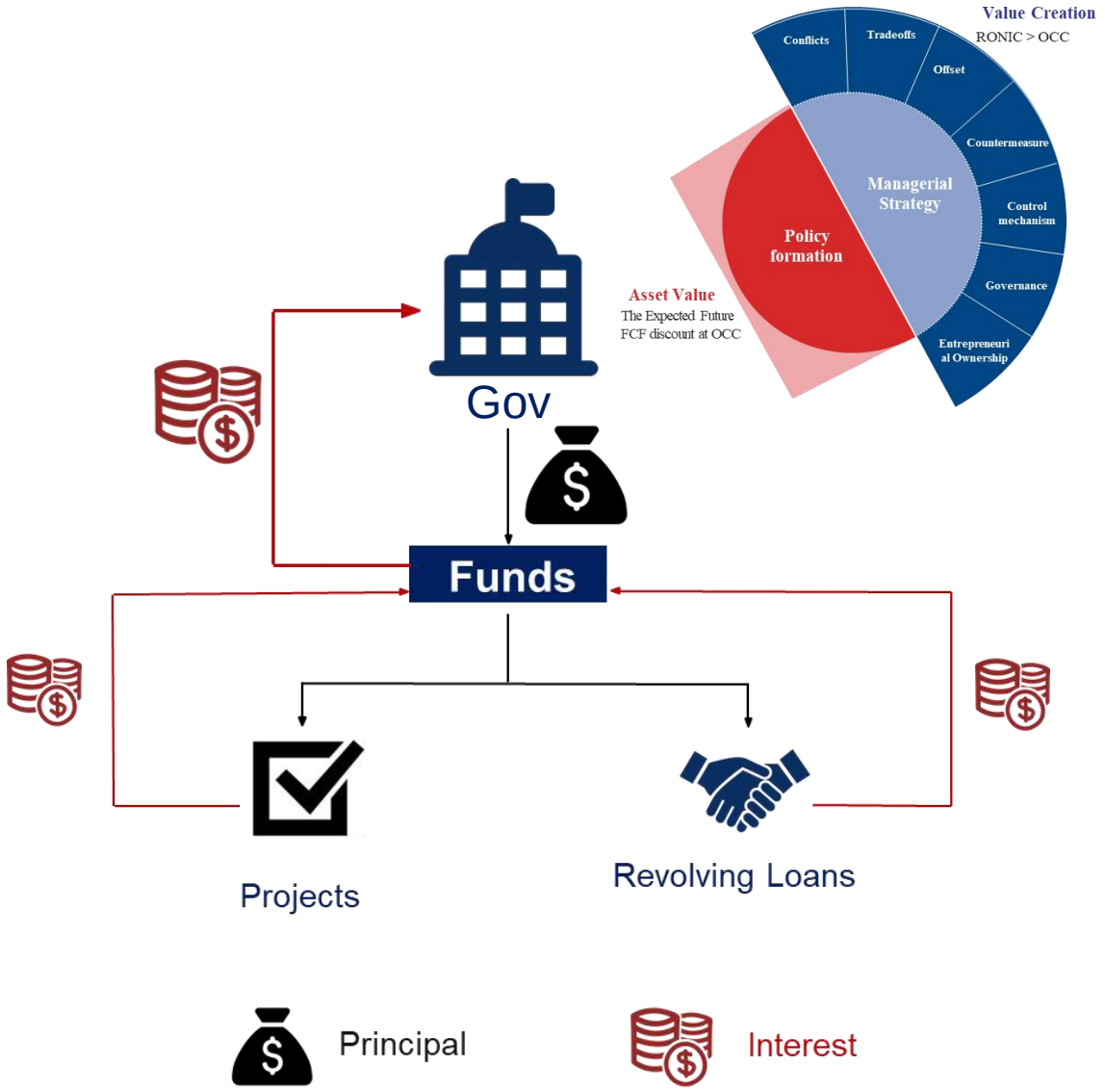
G: No, we don't!

C: Would you like to have one?

G: Well, it sounds complicated. Why not simply focus on how many lines and new systems we can open during my five-year term?

What scale and magnitude of government spending are enough to achieve an intended outcome? How much capital do we need to invest in order to keep the economic growth? [Scale]

5. Conclusion and Executive Pitch



Investment is a mean to accelerate growth, but growth itself is not the goal. The goal is to identify what kind of city or country do people want?

Focus on investing in value creation projects with a **positive-NPV** while alleviating the investment offset and externality.

OCC is the non-negotiable dichotomy. Be mindful of investing in value destruction projects and recovery of countermeasures and effects

Growth ≠ value creation. Differentiate external growth factor vs. internal driven managerial strategy and execution. **PLAN | PATH | VALUE**

Value is not price. The fluctuation of asset price due to the interrelation between demand and supply vs. The growth of asset intrinsic value driven by the process of value creation via managerial strategy and policy formation. Individual equilibrium (**IE**) vs. System optimal (**SO**)

Investment mindset: Make the world in a better place (The incumbent) vs. Fool some people all of the time | Too busy to make $ (The barbarian)

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URBAN LAND RECAPITALIZATION AND ASSET UTILIZATION: REGIONAL UNIFIED TRANSIT NETWORK

E Chao [2], J.C. Venturi [1] and C. Calvin[1]*

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Rethink Studio, New York, USA[1]
[2]*Finance Department, Waseda University, Tokyo, Japan*
** Corresponding author*

ABSTRACT Public transport is an asset with national significance and a dominant engine for economic productivity. Urban areas are the centers of economic, industrial, governmental, and cultural activities, their developments belong to the national level. Many global cities are either at the transition stage of repositioning cities' long-term competitiveness or in the development stage of large-scale metropolitan planning. In the United States, the New York City (NYC) and the Tristates (New York, New Jersey, and Connecticut) are simultaneously facing these two dimensional challenges. Common flaws have been found in these two settings: the outstanding commitment on the modernization of efficient urban transit systems and the transformative mindset to recapitalize city's assets: both developable and underutilized lands within the central business districts (CBDs) and surroundings. The article marries both economic perspective and engineering discipline. The analyses on urban formation reach the following discussions. First the definitions, reviews, and evaluation of growth obstacles represent that the necessities to turn independent line operation into a cohesive unified trunk networks are feasible and well-thought out. Second, an introduction and comparative analyses across independent lines vs. integrated network, trunk vs. branch lines operation, single nucleus vs. multi-satellite cities associated with regional rail systems are presented. Third, architectural and engineering uplifts on station design, platform expansion, track reengineering, and network realignment at the underperforming Pennsylvania Station are comprehensively studied. It is, now, time to pay a systematic attention to the transformative process of repositioning the NYC long-term competitiveness.

1. Introduction

The opinions on a large-scale rail transit network planning, design and operation vary the transit systems geometric shape and service strategies, which influence future patterns of urban development and city functionality. Studying the evolution of rail transit network in cities can provide valuable lessons for new projects, including the choice of appropriate transit modes and the design of network efficiency. Digesting the historical land use theories from distinguished experts, a critical topic has not yet been discussed. That is, how could a through-running station and a regional unified network (RUN) generate long-term sustainable growth for a city and overall region. The article presents a surgical diagnosis of the recent NYC' economy stagnation and proposes a series of countermeasures to unlock the economic values by recapitalizing underutilized land and creating a regional unified network (RUN) to further increase service coverage, regional connectivity, and economic productivity. The process is a transformative measure to increase urban land and asset utilization, which is an imperative action for the NYC and Tristates' long-term competitiveness.

First, the definitions, reviews, and evaluation of growth obstacles represent that the necessities to turn independent line operation into a cohesive unified trunk networks are feasible and well-thought out. Second, a series of NYC' case studies and international comparative analyses across independent lines vs. integrated network, trunk vs. branch lines operation, single nucleus vs. multi-satellite cities associated with regional rail systems are presented. Third, architectural and engineering uplifts on station design, platform expansion, track reengineering, and network realignment at the underperforming Pennsylvania Station are comprehensively studied. It is, now, time to pay a systematic attention to the transformative process of repositioning the NYC long-term competitiveness.

2. Existing conditions and growth obstacles of the NYC and regions

2.1 Overloaded capacity on a single nucleus

The regional rail network is currently operating on a single nucleus, rather than ratifying an entire region. When a single nucleus starts to reach its system capacity, it is intuitively to divert and redistribute the rapid growing demand. To ensure the demand would be successfully distributed, a development of trunk and branch lines used to be planned and efficiently operated. Instead, the NYC and Tristate regional rail systems are not only operating on a single nucleus point, but disconnecting one from another as shown in Figure 1. For example, for passengers wish to commute from the Northern part of the Manhattan to Long Island, they would have to encounter an overcrowded Grand Central station, and either walk 8 blocks down or take a clogging subway to the inefficient Pennsylvania Station located in the core of the Manhattan CBD, and then ride on the Long Island Rail Road (LIRR). This fragmented region is unable to provide

Comparative Analyses of Through-running vs. Dead-end Tunnel to Urban Transit Network Efficiency and Design of Through-running Tunnel in the New York Pennsylvania Station

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Rethink Studio, New York, USA

E. Chao
The Wharton Business School Department of Finance, Pennsylvania, USA

C. Nicolescu
Columbia University Department of Architect, New York, USA

ABSTRACT: Opinions on urban transit network vary the geometric shape, tunnel efficiency, and operation strategies, which influence the future scale of urban growth. Studying historical urban transit tunnel operations has revealed a critical topic that has not yet been discussed: how could a through-running tunnel and a regional unified network (RUN) increase network efficiency? The article focuses on the comparison of through-running vs. dead-end tunnel operations within the central business district (CBD) and elements of transit network design in the tunnel environment. First, the definition, measures, and decision-making trade-offs are well-interpreted. Second, the time-distance measure shows two independent concepts of static and dynamic transport units on a common variable, allowing tunnel and network designers to precisely define the minimal headway of leading and following trains. The reduced headway decreases the deadhead non-revenue operating time to further increase tunnel efficiency and fleet utilization. Comparative regional rail case studies are presented. Third, schematic station design on platform expension, track reengineering, and network realignment at the underperforming New York Pennsylvania Station are comprehensively studied. These serial breakdowns enable the establishment of through-running tunnel operation. It is now critical to pay systematic attention to the planning, design, and operation of the interrelation between tunnel efficiency and network throughputs.

1. Definition and Measures of Network Efficiency

Network efficiency, representing a system's performance as a whole and the cost of transit operations, is a major concern for operators or transit agencies (Musso & Vuchic, 1988; Vuchic & Musso, 1991). There are five outstanding determinants of network efficiency:

Operating flexibility is increased through connections between lines at which Transit Units (TUs) can be switched among lines for scheduled or unforeseen changes in service. More extensive networks and track connections among lines also increases operating flexibility. Turnback tracks (Case I.), usually center dead-end tracks connected with both through tracks, allow short turn operations, i.e. use of intermediate stations as terminals. Storage or pocket tracks can be used for holding reserve trains and storing of disabled trains and maintenance equipment. Frequent crossover (Case II.) tracks between the two main tracks make single track operations easy, facilitating maintenance. Through station (Case III.) connects both end of cities with a much operating pattern. All these types of tracks increase the reliability and efficiency of network operations.

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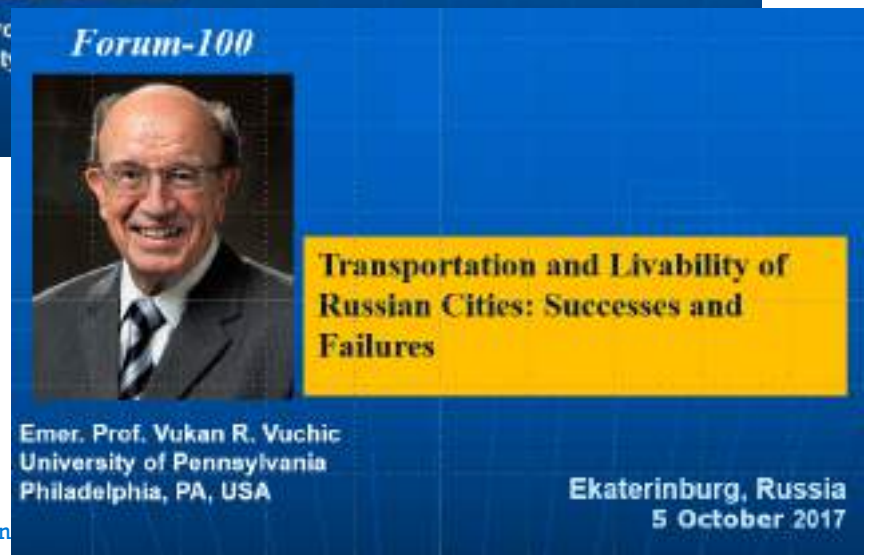

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Urban Transit for Livable Cities

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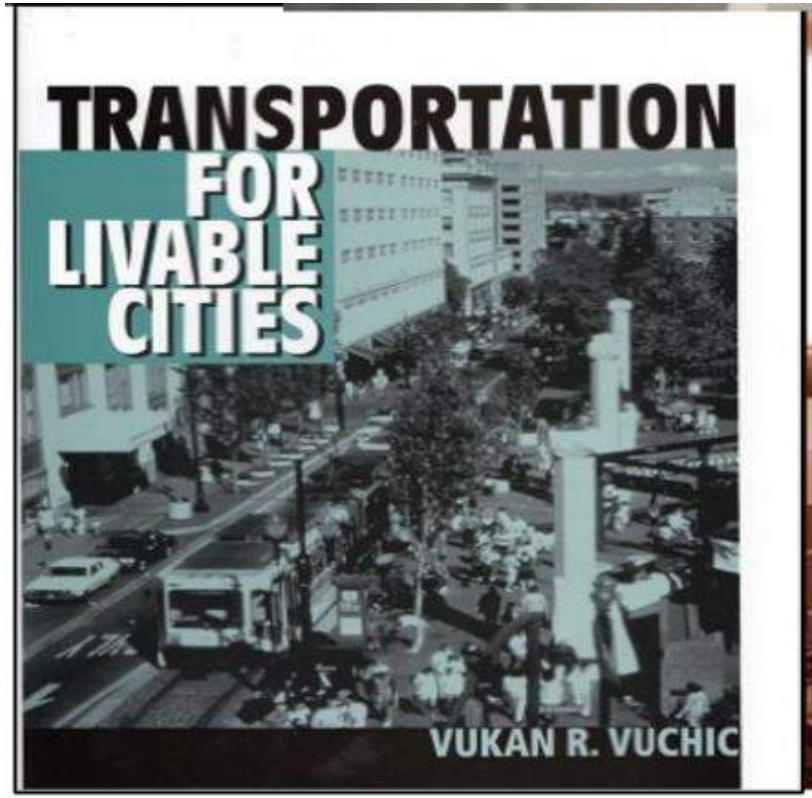
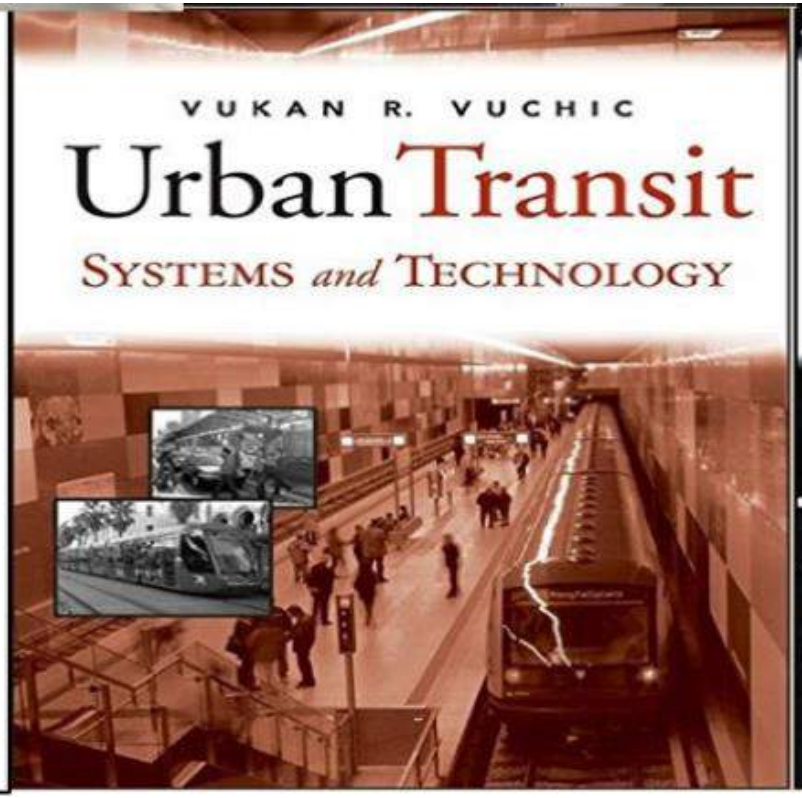
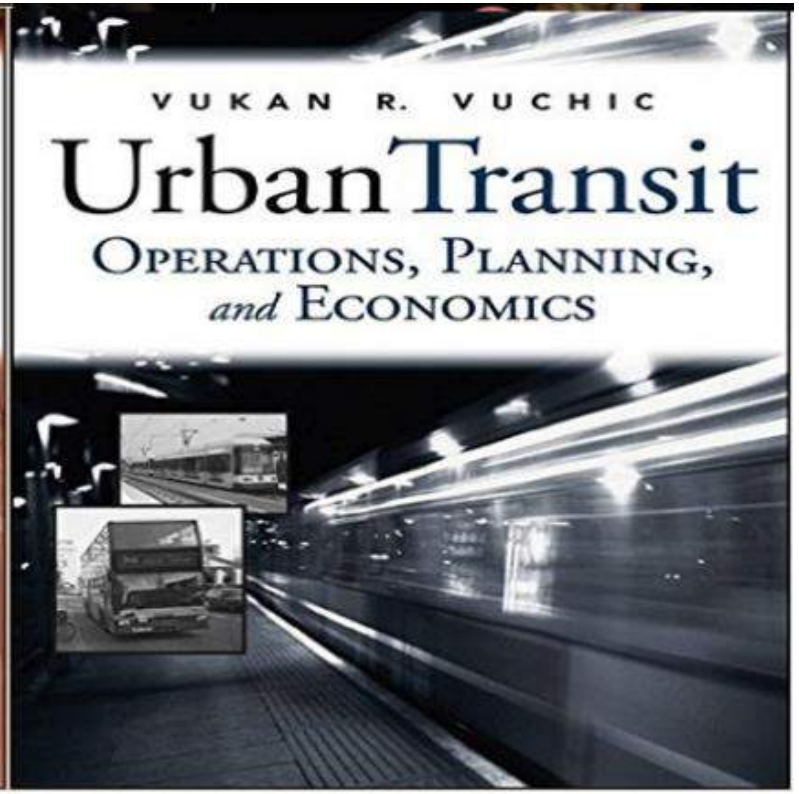
Urban Transit Trilogy







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Urban Transit for Livable Cities

Session / Module	1. Cities and Transportation: Evolution of Transport Modes	2. Highways, Transit Buses, Trolleybuses, BRT and Paratransit	3. Rail Transit: Tramways, Streetcars, LRT, Metro, Regional Rail	4. Rail Transit Characteristics, Operations and Roles	5. Rail Transit Networks, Scheduling and Performance	6. Fare, Financing, Ownership and Regulation	7. Transit Planning, Mode Selection and Design	8. Transportation for Livable Cities: Policies and Implementation Measures
1.	Impacts of Transportation on Cities	Definitions and Characteristics	Characteristics of Rail Transit Modes	Rail Transit Stops and Stations	Network Planning Objectives	Objectives in Fares Determination	Short-and Long-Range Transit Planning	City Sizes and Roles of Different Transport Modes
2.	Evolution of Transport Modes with City's Growth	The Vehicles	Tramways/Streetcars and Light Rail Transit - LRT	Transfer and Integrated Stations	Network Types: Independent vs. Integrated Lines	Structure of Fares and Their Characteristics	Planning Procedure	Short-Term Solutions vs. Long-Term Optimum System
3.	Definitions of Transit Modes	Trolleybus System and Vehicles	Metro/Rail Rapid Transit	Intermodal Rail Stations and Feeder Modes	Geometric Forms of Transit Lines	Fare Collection and Payment Control	Travel Demand Forecasting	Defining of Balanced Intermodal Urban Transportation
4.	Three Categories of Transit Modes	Bus Ways, Lanes and Stops	Regional (Commuter) Transit - RRR	Train Travel Control: ATP, ATO, and ATS	Transit Line Scheduling: Input Information and Operating Standards	Types and Levels of Fares	Modal Split and Trip Assignment	Structure of Travel Cost by Different Modes
5.	Technologies of Transit Modes	Bus Lines, Networks and Transfer Stations	Review of the Family of Rail Transit Modes	Crewless Train Operation - CTO or UTO	Transit Scheduling Computations	Principles and Trends in Financing Transit Systems	Design of Alternative Plans	Policies and Measures for Achieving Balanced Transportation
6.	Classification and Characteristics of Transit Modes	Intermodal Bus-Rail Transfer Stations	Rolling Stock	Automated Medium-Capacity Transit Modes	Schedule Presentations	Government Agencies and Professional Organizations for Transit	Comparative Analysis, Evaluation and Selection of Plans	Transit Use Incentives
7.	Elements of Transit System Operations	Bus Rapid Transit – BRT	Geometric Elements of Line Alignments and Cross-Sections	Monorail and Low-Speed Maglev	Crew Scheduling or Run Cutting	Transit System Development and Regulation	Preliminary Transit System Design	Auto Use Disincentives
8.	Performance Attributes of Transit Operation and Service	BRT in Developing and/or Industrialized Countries	Rail Transit Right-of-Way: Surface, Aerial and Tunnel	Specialized Technology Systems	Timed Transfer Systems - TTS	Purposes and Types of Transit Regulation	Integrated Regional Rail Network of SEPTA in Philadelphia, PA, USA	Cities with Rapid Increase of Auto Ownership
9.	Transit Line Capacity	Paratransit: Definition and Classification	Construction Methods of Shallow and Deep Tunnels	Rail Transit Performance and Costs	Accelerated Services	Regulated and Deregulated "Free Market Transit"	Planning Further Modernization of SEPTA's Regional Rail	Present Problems and Prospects in Different Cities
10.	Vehicle Motion, Regimes of Travel and Station-to-Station Travel Time	Paratransit: Characteristics and Roles	Rubber-Tired Metros	Present and Future Role of Rail Transit Modes	Modeling and Systems Analyses in Transit	Functionally Integrated Intermodal Transit System	Upgrading "Subway-Surface Trolleys" in Philadelphia into Light Rail Transit	Leading Livable Cities with Balanced Transportation System

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Online course structure

Course Instructor: Emer. Prof. Vukan R. Vuchic
Project/Technical Manager: Eugene Chan, PMP

February 1th 2017

Regional Unified Network and The Bigger Apple

Thank you!

Q/A

1. Within the management authority, how would you respond this common managerial challenges?

What scale and magnitude of government spending are enough to achieve an intended outcome? How much capital do we need to invest in order to keep the economic growth? [Scale]

VS.

How much can we grow without destroying value? Growth at what cost? Growth, but how long can it be sustained? What is the [quality] of growth?

2. What are the investment challenges (i.e. with PE, within PPP, etc.) and ongoing development, expansion, and investment plans? What are the top priority projects?

3. Are there specific projects funded by foreign investors? How does funding and financing mechanisms work (i.e. project finance, loan, etc)? Is there a procedure chart?

4. Are there foreign Private Equity investors currently invest in infra? Who are they and what are they investing? How would the government balance the gain of domestic vs. foreign investors?

5. Any controversial infrastructure deals? Any awareness of incumbent vs. scavenger investors? What is the return on investment (ROI) does the government usually allow?

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Ans:

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Ans:

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Ans:

Appendix

Radial lines go from center city radially outward to suburban areas. They are often the heaviest travelled corridors in urban areas. Their loads are highest where lines leave central city, then decrease outward toward suburbs.

Diametrical lines connect different suburbs through center city. They provide better distribution and more transfers with other lines in center city than radials.
Many cities have upgraded radial lines into diametrical. Ideally, diametricals connect suburbs between which there is considerable travel demand and which have similar volumes on each side of central city.

Tangential and circumferential lines are often operated in major cities with grid street patterns, such as Toronto, Philadelphia and Washington, DC. They serve major tangential corridors around center city and they distribute or interconnect radial lines. Their volumes tend to be lower than on radial lines, but they are less peaked in distance and time, and therefore more uniformly utilized.

Circle or ring lines are avoided by some cities because of difficult recovery of delays. However, many cities have solved maintaining reliability and utilize extremely important functions of circle lines: first, they serve large travel volumes around central city. And second, they interconnect all radial lines, thus integrating metro network and shortening many non-center oriented trips.

In Tokyo, Seoul, Berlin, Moscow and Beijing circle (or “ring”) lines have very important roles in their metro and RGR networks.

Trunk lines with branches represent a very logical solution to greatly increase efficiency of radial networks by splitting their trunk sections into two or more branches. As the utilization of the capacity on the trunk line decreases toward suburbs, it is divided into several branches, each one receiving a fraction of offered capacity and using it for new passengers from additional served areas.