

Why some airport-rail links get built and others do not: the role of institutions, equity and financing

by

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Abstract

The thesis seeks to provide an understanding of reasons for different outcomes of airport ground access projects. Five in-depth case studies (Hongkong, Tokyo-Narita, London- Heathrow, Chicago- O'Hare and Paris-Charles de Gaulle) and eight smaller case studies (Kuala Lumpur, Seoul, Shanghai-Pudong, Bangkok, Beijing, Rome- Fiumicino, Istanbul-Atatürk and Munich- Franz Josef Strauss) are conducted. The thesis builds on existing literature that compares airport-rail links by explicitly considering the influence of the institutional environment of an airport on its ground access situation and by paying special attention to recently opened dedicated airport expresses in Asia.

It is found that sustained government support and a sense of urgency for better airport access are the main motivating forces that need to be present if a dedicated airport express is to be constructed. For these reasons a number of dedicated airport express systems were constructed in Asia (Hong Kong, Tokyo, Kuala Lumpur, Seoul, Shanghai, Bangkok), where they were conceived simultaneously with the airports they serve. In cases with less focused objectives (Chicago, Paris, Chicago) lengthy planning periods have not yet led to the construction of an airport-rail link. London was the first airport-rail link in the Western world and exhibited strong government support for rail investments during a period of generally favorable conditions, which jointly led to the construction of the Heathrow Express.

Five of eight dedicated systems that are studied exhibit underestimation of ridership and underestimation of delivery time. The finding replicates for Asian examples (Hong Kong, Seoul, Bangkok, Shanghai) Flyvbjerg's (2009) observations on UK and US examples that transportation projects tend to systematically overestimate project benefits. The enduring and systematic overestimates of ridership hint at deliberate strategic misrepresentation rather than psychological optimism bias or technical error as reason for the erroneous estimates. Planners are advised to be aware of incentives for strategic misrepresentation among public and private agencies that prepare technical studies as basis for decision making.

In a number of systems that have dedicated rail service to an airport and are generally considered successful, fierce competition from buses has emerged recently (Hong Kong, Tokyo, London). It is recommended to planners of airport-rail links today to consider realization through bus rapid transit on dedicated rights-of-way in addition to airport-rail links because of their lower cost, wider scope in drop-off and pick-up destinations and easier scalability of capacity in times of low demand.

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Chapter 1 Introduction

1.1 Motivation

With the growing demand for air travel, airports grow, traffic at airports grows, and the time people spend at airports grows. Today, some authors refer to airports as “cities” to denote the functions that they have come to play in addition to safe and secure access to the airfield for passengers (Givoni and Rietveld 2008). Airports are significant generators of transportation demand that ground access systems have to satisfy. Located at the intersection of different modes of transportation- air, rail and road- integrated and sustainable access planning is a challenge. The involved institutions were traditionally only responsible for their clearly-bounded system and often do not look further. At many airports around the world a situation emerged that relies heavily on car travel, either through personal car, taxis, or hotel and airport shuttles. Associated problems are congestion, noise, emissions, and the required space for parking and road capacity. Some airports already experience these problems, whereas they do not yet seem urgent at others. Airports seem predestined for access by public transportation, especially in an age of increasing environmental consciousness and worsening congestion among many major highways that serve airports far away from city centers: a large number of people are traveling to the same destination, many of whom will not return until in a few days, weeks or months, making driving a personal vehicle unpractical. Some airport-rail links function fairly well today, for example the airport express in Hong Kong and the two express services in Tokyo. Examples of idling and failed projects exist as well, however. While the problem of ground access is common to all airports, especially those located far outside the city center, outcomes around the world in terms of successful implementation of ground access systems vary.

Planning and engineering research has been concerned for a long time with the question of how to deliver successful transportation projects. “Success” with regards to an airport-rail link is understood for this thesis as a combination of the factors mode share, time to implementation and prognosis for sustainable operation. In this thesis, the question is asked from a political angle: How do different fates of airport-rail links relate to their surrounding institutions and political environment? The thesis seeks to provide an

understanding of reasons for different outcomes of airport ground access projects. An understanding of the impact of institutional background will help research that seeks to provide guidance on how to implement successful large-scale infrastructure projects, and airport-rail links in particular. The initial interest in the topic was sparked by the author's work experience at the Chicago Transit Authority on plans for an airport express.

1.2 **Reasons for emphasis on airport-rail links**

For a number of reasons, airport-rail links are assumed to play a key role in sustainable airport access. "There is a consensus building that this (airport-rail links) is a desirable piece of overall strategy to deal with ground transportation challenges," according to Matthew Coogan, director of the New England Transportation Institute who has written extensively about the subject (Yu 2009). Rail is the public transportation mode with the highest capacity and highest possible running speed. Welded tracks allow for a more energy-efficient transport per passenger, lower emissions and a lower noise-level compared to road-based travel. Rail services to airports can provide a high-level of comfort to the traveler (air-conditioning, power outlets, in-train information screens, increased reliability through dedicated rights-of-way), that may be superior even to taxis. All of the points mentioned for comfort however can also be available on a bus. Anecdotally, trains are "more exciting" to the traveler and are preferred to a bus when given a choice. The potential for integration into regional and local rail transportation systems, where available, provides the "main justification" (Givoni and Rietveld 2008, p. 281) for an airport-rail link rather than a bus link to integrate those systems with the airport and allow travelers to continue their travels seamlessly to their final destination. It is for these reasons that airport-rail links are the focus of attention in this thesis.

Airport rail links have long been popular in Europe and Asia. In 1998, 62 rail connections to airports existed in the world and 116 were planned (in Europe, 40 existing and 49 planned, in North America, 14 existing and 32 planned, in the rest of the world, 8 existing and 35 planned (IARO 1998, cited after Givoni and Rietveld 2008). Based on 2008, only eight of the 20 largest US airports had rail service that

dropped passengers off within walking distance of the terminals: Atlanta, Chicago-O'Hare, New York-John F. Kennedy, San Francisco, Newark, Minneapolis, Boston and Philadelphia (Yu 2009). Not only are there less airport-rail links in the US, their mode mode-share is very low. According to Andrew Sharp, director general of the U.K.-based International Air Rail Organisation, in the US ridership typically ranges from 2% to 5% (Yu 2009). Because of the rather slow development of airport-rail links in the US, the more detailed case studies in this thesis focus on systems in Europe and Asia. Chicago O'Hare serves as example for a detailed case study from the US.

1.3 **Research design**

This thesis is an empirical one that compares case studies of airport-rail links to explain outcome patterns. All airport-rail links chosen for this thesis are summarized by key data points in a table in chapter 2. A selection of cases is then studied in more detail in Chapter 3. The questions this research seeks to answer are the following:

- 1) What patterns can be observed by looking at key data and background information across case studies?
- 2) How can these patterns be explained?
- 3) What advice can be given to developers of airport express services today?
- 4) What prognoses can be made for how new projects will fare?

The research design to answer those questions is presented in

Table 1-1.

Table 1-1: Thesis structure

Chapter 1	1. Literature research on comparative studies of airport-rail links and observations on the influence of institutions on different outcomes in transportation project delivery. 2. Derivation of conditions for a hypothetical sustainable state for airport ground access, adapted to a concrete situation from four general criteria for sustainability. These conditions are later validated through the case studies and help to formulate advice to planners and prognoses for current projects.
Chapter 2	3. Cross-sectional comparison of case studies and first attempt at explanation of observed patterns.
Chapter 3	4. Detailed case studies to explain patterns that remained unexplained in the previous section and to validate conditions for sustainability. 5. Additional smaller case studies for further validation and explanation of patterns.
Chapter 4	6. Summary of patterns and explanations. Comparison of outcomes in case studies and relationship to sustainability criteria. 7. Conclusion, final recommendation and prognosis for systems today.

1.4 Transportation background

This section provides background on common problems in transportation planning, particularly airport-rail links, and presents terminology and concepts used in the case studies.

1.4.1 Challenges in transportation planning

Airport-rail links are interfaces in a global multi-modal transportation system. Large-scale infrastructure systems, such as transportation or energy transmission systems, provide vital services without which society would be in danger of complete or partial collapse. At the same time, infrastructure systems leave heavy negative footprints on ecosystems. In the immediate surroundings of infrastructure systems, the

quality of life for humans and wildlife is almost always impaired due to noise, emissions, vibration, visual impairment, increased risk of accidents (e.g., from living close to roads, airports), and others.

Infrastructure systems are messy in that they are necessary for society, but due to their large initial investments and long lifecycles often do not pay for themselves. Financing therefore often is controversial. The process of designing infrastructure systems requires the (re)distribution of costs and benefits to different interest groups and requires moral decisions on equity, which may but typically do not have technical solutions. Infrastructure planning, and transportation as a subfield, is a domain that is characterized by trade-offs and the need to balance competing interests.

A number of institutions are involved in planning, constructing and managing of airport-rail links. Municipal, state and national policy makers administer funds and give more or less detailed directives as to how a system should be built. Airports, transit operators, and municipal and regional planning bodies typically also act in a planning capacity and dispose of more or less big budgets to initiate studies or even the construction of those links, subject to approval by policy makers or the responsible bureaucracies. Private sector concessionaires play important roles in the financing, construction and operation of ground access systems at many airports worldwide. The level of responsibility for more or less detailed planning varies among different countries from the national to the municipal level, and between politicians and more technically skilled planners at transit companies or special planning bodies. Planning is a multi-actor problem among different institutions, often remaining below the level of sovereign national states. Recently, transportation literature has come to distinguish between the concepts of mobility (ability to move physically) and accessibility (ability to fulfill the purpose of a trip), stressing that the true public good is accessibility of services and not mere mobility of people. While recognizing the importance of this distinction, a discussion of possible substitution of travel through communication is beyond the scope of this thesis.

1.4.2 Project delivery strategies

The traditional method of project delivery is Design-Bid-Build, meaning that detailed design is finished before a contractor is hired for construction. The government designs, finances and operates the system.

Alternative delivery strategies exist, including (adapted from Kay 2009):

Design-Build: The contractor provides both design and construction. Time savings are associated with combining final design and construction.

Design-Build-Operate-Maintain: The private sector contractor operates and maintains the project for a limited time after construction. The asset is later returned to the government. Usually the government assumes some of the operating risk to incentivize the contractor. Advantages of this strategy are the assessment of full life-cycle value by the constructor and assuring that proper attention is given to provisions for effective maintenance. A disadvantage is the potential loss of government support.

Design-Build-Finance-Operate-Maintain: In this arrangement, a private investor generally provides covers 10%-30% of total project cost and finances the balance through debt (Levy 1996, p. 17). This arrangement does not necessarily imply that all project financing, from debt or equity, is provided by the private sector. Partial financing may come from the government. This is commonly the case on rail transit projects, since revenues are usually insufficient to cover operating expenses, let alone capital costs. Advantages of this option are the attraction of (some) private sector funding, risk spreading between public and private sector, and filtering out of bad projects by the private sector partner, who will do its own internal assessment and not accept a bad project.

1.4.3 Rail terminology

Rail transportation can be classified according to four areas. The differences between the four areas are not clear cut and hybrids between two systems can exist. There are also some regional differences for how these systems are called, e.g. between the US and the UK. The following terminology is used in this thesis.

Light-rail is a form of public transportation that usually uses electric rail cars and operates on private rights-of-way, but is mixed with other traffic when necessary (e.g., MBTA Green Line).

Rapid transit (subway or elevated railway system) provides high-frequency passenger transportation in urban areas. It is grade-separated from other modes of transportation (e.g., MBTA “T” except Green and Silver Lines). Rapid transit systems can be realized using buses.

Commuter rail or suburban rail provides a connection between a city center and suburbs or commuter towns. They are larger and have more capacity than light-rail or rapid transit and may share rights-of-way with intercity or freight trains (e.g. MBTA commuter rail around Boston)

Heavy rail is a transportation system that can handle large volumes of people or freight. It is used for regional or national rail service or service in urban areas where high capacity is needed (e.g., L in Chicago).

Dedicated service: The service is targeted only at airport travelers and typically has special provisions, e.g. more space for bags or in-car screens.

Shared service: Several groups of people are serviced on the same line, e.g. commuters and airport travelers.

1.5 Literature research

Intermodality and airport-rail links in particular have increasingly received attention in recent years, as a number of comparative studies demonstrate. The focus of comparative studies on different airport-rail links has been to explain why some attract higher mode share than others and to derive best practices from those observations. The following section presents the most important comparative work and their findings. A clear picture emerges of what a successful airport-rail link would need to look like to attract significant mode share.

1.5.1 State and best practice of airport-rail links worldwide

While airport-rail links have enjoyed popularity in Europe and Asia for some time, they have not gained a strong foothold in the US. A notable amount of research in the US tries to explain this different outcome and make suggestions for airport-rail links in the pipeline at American airports.

Kouwenhoven (2008) gives an idea of the state of airport-rail links worldwide today (Table 1-2, Table 1-3).

Table 1-2: Airport-rail links (top 150 airports by passenger numbers), (Source: Kouwenhoven 2008)

Continent	Existing		Proposed		No. of Airports	
Oceania	2	(40.0%)	0	(0.0%)	5	(3.3%)
Asia	14	(40.0%)	8	(22.9%)	35	(23.3%)
Europe	29	(64.4%)	4	(8.9%)	45	(30.0%)
North America	12	(20.3%)	6	(10.2%)	59	(39.3%)
South America	0	(0.0%)	0	(0.0%)	4	(2.7%)
Africa	0	(0.0%)	0	(0.0%)	2	(1.3%)
Total	58	(38.7%)	18	(12.0%)	150	(100.0%)

Source: Data collected in 2006 from airport and rail authority websites by the author and colleagues

It is apparent that North America is lagging behind Europe in terms of delivered projects and behind both Asia and Europe in terms of percentage of big airports that have airport-rail links.

Table 1-3: Breakdown of rail links by type and continent (Source: Kouwenhoven 2008)

Continent	Fast dedicated		Regional		Metro	
Oceania	0	(0.0%)	2	(5.6%)	0	(0.0%)
Asia	2	(28.6%)	6	(16.7%)	5	(35.7%)
Europe	5	(71.4%)	20	(55.6%)	5	(35.7%)
North America	0	(0.0%)	8	(22.2%)	4	(28.6%)
South America	0	(0.0%)	0	(0.0%)	0	(0.0%)
Africa	0	(0.0%)	0	(0.0%)	0	(0.0%)
Total	7	(100.0%)	36	(100.0%)	14	(100.0%)

Source: Data collected in 2006 from airport and rail authority websites by the author and colleagues

In terms of quality of available airport-rail links, North America is lagging even further behind Europe and Asia. All examples for fast, dedicated airport-rail links can be found in those countries. The majority of connections in all continents is however delivered through integration into regional rail transportation systems.

The data in the table has changed since 2006. The case studies in this paper include 6 examples for fast dedicated airport-rail links, already outnumbering the two that are cited in the study. The US still does not have a dedicated rail-link to any of its airports, even though several large airports brought plans underway for dedicated service (e.g., Chicago O’Hare) or extending their regional transportation network.

In light of a number of planned projects in the US, several American research efforts seek to distill best practices for implementation in the US. A major study was conducted by the Transportation Research Board in 2000 within their so-called Transit Cooperative Research Program (TCRP), funded by the Federal Transportation Administration (2000). The goal was to identify success factors for airport ground access for American systems by looking at 14 case studies which they deemed to be the most successful ones worldwide. The report includes two appendices providing data for 38 of the 40 largest US airports and descriptions of access systems at selected US airports.

The 40 studied American airports have relatively low public transportation mode shares. If public transportation is used, buses and shared-ride vans dominate mode share. Only two of eight airports in 2000 with direct rail service had mode shares over 9%, Reagan National Airport in DC and Midway Airport in Chicago. Table 1-4 shows how the 14 best-in-class systems compare with regard to mode share. The 14 example systems show that sizable mode share on trains is possible. Interestingly however, the TCRP noticed that the use of public transportation at five of the 16 largest American airports that do not have rail service exceeded the share of users of public transportation overall at airports that did have rail service (excluding Reagan National). The five airports were New Orleans (16%), Denver (14%), Las Vegas McCarran (12.6%), Seattle-Tacoma (12%) and Orlando (11.5%) (Transportation Research Board 2000, p. 30). This observation raises the question whether an airport-rail link is truly always the best option for an airport in need of better transit access.

Table 1-4: Ranking of rail system performance of airports studied by TCRP (Source: Transportation Research Board 2000)

Rank in sample	City/airport	Rail mode share (percent)	Airport distance (miles)
1	Oslo	43	30
2	Narita	36	42
3	Geneva	35	3
4	Zurich	34	8
5	Munich	31	18
6	Frankfurt	27	6
7	Stansted	27	34
8	Amsterdam	25	9
9	Heathrow	25	15
10	Hong Kong	24	21
11	Gatwick	20	28
12	de Gaulle	20	15
13	Brussels	16	10
14	Orly	14	8

TCRP's review indicated that four key elements explained the success, as measured in mode share, of the different system (Transportation Research Board 2000). At a closer look, point four of the identified keys to success does not seem to play a major role or can be compensated.

1. *Type of service to downtown*- Successful systems appear to either focus on line speed between the airport and downtown (i.e. provide dedicated service) or focus on the quality of the distribution service and headway minimization that results from joint operation with regularly scheduled services. Analyses indicate that an emphasis on door-to-door travel time to a single point may be unproductive because of the typical broad distribution of airline passenger trip ends. [...]
2. *Availability of service to national destinations beyond the metropolitan area*- At several of the most successful airports, the rail connection is designed to link to a full national network [...], rather than to link to just the immediate downtown and surrounding metropolitan area. [...]
3. *The quality of the rail connections at the airport*-[...] Most of the airports with the highest rail mode shares have a direct rail connection to a single, centralized point of transfer to a compact landside terminal building. [...]
4. *Baggage handling strategies and services, and availability of off-site facilities* – [...] The successful airport-rail systems exhibit a variety of responses to this challenge, ranging from doing nothing to developing elaborate, full-service off-site check-in facilities. [...] While the availability of off-site baggage check-in facilities is a positive attribute, many of the successful systems have achieved high market shares without providing expensive full-service downtown check-in counters or elaborate strategies. [...]

In a special chapter market characteristics of airport travelers are described, importantly the difference between air travelers and employees. This important distinction does not bear on the subject of this thesis and is therefore not herein discussed.

Kouwenhoven (2008) finds the following factors for success from his look at 150 airport-rail links worldwide:

- Journey time advantage over other modes
- Direct access to the city center

- Size of the catchment area with direct rail access
- Product positioning (active marketing of airport-rail link)
- Composition of airport passengers (proportion of business travelers)
- Fare
- Terminal access
- Information provision

The availability of downtown baggage check-in facilities did not appear to be important to passengers.

Regarding the question of why existing airport-rail links in the US systematically attract lower mode shares than their European counterparts, Coogan (1995) argued that American airport travelers usually require a car at some point in their journey and are hence more likely to use it for the entire trip. European airport-rail links are integrated into a generally greater transportation network and therefore garner a higher mode share. The authors of the TCRP study remark along those lines that given the level of road investment in the US, it will be very difficult to make transit times not only comparable, but significantly better than travel time by car for most airports.

Schank (1999) studied in his Master's thesis at MIT 7 American airport-rail links in detail (John F. Kennedy, Philadelphia, Boston Logan, Washington National, Chicago O'Hare, Chicago Midway and San Jose) and 6 others to a lesser extent (Atlanta, Cleveland, St. Louis, Baltimore-Washington, Miami and Oakland). He sought to derive best practices from American examples in his thesis entitled "Airport Access via Rail Transit: What Works and What Doesn't". He looked for statistically significant relationships between rail links and their mode shares. The strongest findings are that a lower time difference between rail and car travel correlates with a higher mode share (meaning that rail not be slower), and that effectively serving population and employment centers is likely to increase mode share.

These findings have been replicated since in the previously cited studies on Asian and European examples.

All in all, a clear picture emerges of what a “good” airport-rail link would look like that were likely to attract a high mode share. What the best practices do not explain is the question of different outcomes in project delivery once a city has- or claim to have- made a decision that an airport-rail link should be built. Some scholars of planning and public policy have made observations regarding institutions and project delivers, which are presented in the next section.

1.5.2 Observations on transportation project delivery and institutions

Givoni and Rietveld (2008) compare integration of airport-rail links into regional and national rail transportation systems with their institutional framework. Based on three case studies, they find that there is a sweet spot between organizational independence and public oversight that allows transit companies the level of cooperation needed for integration. The three case studies they look at are Amsterdam-Schiphol, London- Heathrow and Paris- Charles de Gaulle. Schiphol is well-integrated into the Dutch national rail network, Charles de Gaulle used to be not well-integrated but concerted efforts were made recently and it is today, and Heathrow is not well-integrated into the British national rail system at all. Givoni and Rietveld consider the situation at Schiphol and Charles de Gaulle presently as one where there is “sufficient balance between public authority and organizational independence to allow coordination between organisations without the bureaucracy trap” (Givoni and Rietveld 2008, p.297). Previously, too much public oversight impeded organizational collaboration in France. On the other hand, intermodality is low on the agenda of the completely privatized actors in the UK. The emerging picture at Heathrow is one of isolation between airport and rail network development, with no appreciation of possible mutual benefits. The UK has seen a series of privatizations in the transport sector, which has shifted the focus towards more short-term thinking. The Department for Transportation is being lobbied by individual industries who advocate for their own short term narrow interests and needs, pushing the Department of Transportation into uni-modal thinking.

Givoni and Rietveld conclude that

The evidence from Heathrow, Schiphol and CDG point to the importance of institutional settings within which the industries operate, and here the level and form of privatization seem to be crucial while the institutional settings of the government body responsible for transport (e.g. the ministries of transport) seem to be of less importance in determining the extent to which air-rail opportunities are explored. The effect of the competitive environment in which the air and rail industries operate is not clear.

(Givoni and Rietveld 2008, p.300)

Flyvbjerg (2009) compares ex-ante estimates of costs and benefits of transportation projects and the actual ex-post costs and benefits. He finds that for his case studies in Europe and North America costs are systematically underestimated and benefits are systematically overestimated. He concludes that perverse incentives exist for developers to make projects look good on paper. He bases his conclusions on an extensive database of 258 transportation projects in 20 nations on five continents. Table 1-5 and Table 1-6 present the statistically significant overruns in cost and ridership estimates that he encountered.

Table 1-5: Inaccuracy of transportation project cost estimates by type of project, in constant prices

(Source: Flyvbjerg 2009, p. 346)

Type of project	No. of cases	Avg. cost overrun %	Standard deviation
Rail	58	44.7	38.4
Bridges and tunnels	33	33.8	62.4
Road	167	20.4	29.9

Table 1-6: Inaccuracy in forecasts of rail passenger and road vehicle travel (Source: Flyvbjerg 2009, p. 347)

Type of project	No. of cases	Avg. inaccuracy %	Standard deviation
Rail	25	-51.4	28.1
Road	183	9.5	44.3

He also finds that inaccuracies in both cost and ridership forecasts are constant over 70 and 30 years, respectively. Forecasts do not improve over time. It is for this reason that he suspects strategic misrepresentation (i.e. lying) in cost-benefit analyses and project estimates as reason for the wrong forecasts, rather than technical error or psychological bias. Strategic misrepresentation can be traced back to “agency problems and political and organizational pressures- for instance, competition for scarce funds and organizational pressures- and it is rational in this sense” (Flyvbjerg 2009, p. 350).

In establishing whether strategic misrepresentation has taken place, the researcher needs to know about the intentions of the planners. While this data is hard to gather in research, two studies exist and are cited by Flyvbjerg in which forecasters and managers did talk about strategic misrepresentation. Those studies are (Flyvbjerg and COWI 2004), based on UK data, and (Wachs 1990), based on US data. Interviewees in the UK study admitted that the system forced people to focus on the benefits and demonstrate all of them, whereas it was hard to pass on knowledge about a too low budget to a politician who is trying to obtain funding, and that such knowledge is therefore held back. Interviewees found that private consultants, while showing high professional standards and integrity, focused on justifying projects rather than critically scrutinizing them. One typical interviewee said that at the stage of project approval, it was important to show the project at its best. Wachs (1990) found similar incentives to emphasize benefits and de-emphasize costs in the US. Both studies together support the view that in situations with high political and organizational pressure the underestimation of costs and overestimation of benefits is due to intentional misrepresentation.

Koppenjan (2008) draws conclusions about experiences in the infrastructure sector with Public Private Partnerships (PPPs) to date. PPPs have drawn increasing attention as a third way to deliver infrastructure projects in addition to privatization and public management. While public decision-making is associated

with pork-barrel politics and inefficient decision making, privatization raises concerns about society's falling victim to market failures, such as failure to deliver essential but unprofitable services or lack of concern for the environment. High expectations are tied to PPPs: They are expected to avoid both inefficiencies and market failures and bring innovation and additional funding to the private sector. In a meta-literature review, Koppenjan draws the following picture in light of numerous problems that PPPs encounter all over the world:

In PPPs a large number of parties are involved, contract negotiations and renegotiations are erratic and lengthy, transaction costs are high, uncertainties about technologies, developments and forecasts are huge, transparency is lacking, and both public and private actors behave strategically, trying to create beneficial advantages by the way costs, benefits and risks are allocated. Parties often have unrealistic expectations of each other and are not very professional in playing the PPP game both in the phase of formation and in the implementation of PPP schemes. [...]

So the day-to-day reality of the marriage between public and private parties can hardly be described as heavenly. PPP imposes stringent requirements on both parties. In order to make this relationship work, it is not enough to develop proper contract forms and schemes, investments have to be made in the institutional condition for governing these working methods: the development of skills and expertise, improvement of the role performance by governments as professional procurers and process managers, and private parties as contractors, and the redesign of organisations to support these new roles.

(Koppenjan 2008, p. 208)

The three papers in this section convey important insights about the inner workings of transportation project delivery and the importance of institutional cooperation for intermodal integration. The work presented in this thesis adds to the literature in two ways. First, the original question of this thesis, how

different outcomes in airport-rail link project delivery and performance can be explained, has not been addressed in the literature yet. Second, this thesis puts an emphasis on recent Asian case studies, which have not been subject of the referenced papers. The research will explore to what extent the observations and theories in the papers can be observed in the Asian case studies.

1.6 Conditions for a hypothetical sustainable state of airport-rail links

While focusing on explaining outcomes, the thesis assumes that developers of airport-rail links are interested in a long and useful life for their investment projects. Therefore four generic sustainability criteria are used to derive hypotheses for criteria that an airport-rail link would need to fulfill to endure over a lifespan of a few decades. Sustainability as understood in this thesis centers on human activity within the natural environment. A definition for sustainability expanded from (Bruntland 1987), and cited after lecture slides from MIT course 17.182, “Sustainability”, is “The *process* of *meeting* the needs of current and future *generations* without undermining the *resilience* of the life-supporting properties of nature and the *integrity* (or cohesion) of social systems”. This definition is broader than the typical focus on activity that merely preserves the natural environment.

Four areas of tension need to be managed in a sustainable system:

- Balance and resilience of ecological systems;
- Equity and efficiency of economic production and consumption;
- Participation and responsiveness of governance and politics;
- Adaption and feedback of institutional performance.

(Cited after 17.182 lecture slides)

Based on the general conditions for sustainability, conditions specifically related to airport-rail links are derived. The resulting list contains conditions for a hypothetical state of sustainability for airport-rail links. Those criteria apply to varying degrees during the three phases of a transportation project: planning, construction, and operation/maintenance.

Conditions for sustainable airport-rail links

- Balance and resilience of ecological systems
 - Low emissions
 - Management of adverse environmental effects
- Equity and efficiency of economic production and consumption
 - Funding system for airport access system in place (self-contained or not)
 - Regular maintenance to maintain cost-effectiveness (sustained funding)
 - No worsening of other modes of transportation (no delays or worsened congestion)
 - Scalability in both directions (to react to population growth, preferences)
 - Connectedness of airport express to other modes of transportation for efficient transfers
 - Equitable funding to other parts of the network
- Participation and responsiveness of governance and politics
 - Sustained political support and prioritization of project
 - Possibility for constituencies to voice their concerns and be heard
- Adaptation and feedback of institutional performance
 - Cooperation of involved institutions
 - Adaptability in political system to monitor and respond to change
 - Adaptability in operating institutions to monitor and respond to change

The next chapter introduces the case studies.

Chapter 2 Cross-sectional analysis

2.1 Selection of detailed case studies

Since Chicago O'Hare's unfortunate history with airport ground access sparked the original interest in this research, the case studies were selected to resemble the O'Hare case. Five case studies are treated in detail: Chicago O'Hare, Hong Kong, Tokyo-Narita, London-Heathrow and Paris- Charles de Gaulle.

Those airports share a number of similarities with O'Hare and, in addition, have successful airport-rail links (Hong Kong, Tokyo, London) or are making good progress towards construction of one (Paris).

The four big case studies that are compared to O'Hare share the following characteristics:

- location greater than 15 miles outside of the central business district they serve
- more than 35 million passengers in 2009 and major significance as hub airports
- availability of and connection to heavily-used city-wide transit system
- access to the airport by commuter rail with intermediate stops,
- high mode shares of > 20% for airport access by either dedicated or shared service (except for Chicago).

The last point ensures that systems that are typically considered successful are compared to O'Hare. The case studies trace the history of ground access from the opening of the airport to the present day. The data points of interest in the case studies are financing, involved institutions and relationship among each other, stakeholder issues and how they were countered, and motivation for the project. Table 2-1 presents key data points about the chosen airports for a high-level comparison and reference throughout the detailed case studies. Tokyo has two competing rapid rail services. The columns in light blue for Charles de Gaulle and Chicago indicate projects that are in the planning phase. Therefore, the current commuter service is included in the table for those two airports as reference for the current level of service. Commas in the table indicate a period in American notation. N/d denotes "no data" was available.

Table 2-1: Key data of big case studies (Sources: various)¹

	Hong Kong	Tokyo-Narita		London Heathrow	Paris Charles de Gaulle		Chicago O'Hare	
	Express	Narita Express	Skyliner	Heathrow Express	RER B	CDG Express	Blue Line	Express
Mode	Heavy Rail	Heavy Rail	Heavy Rail	Rapid transit	Rapid transit	n/d	Heavy rail	n/d
Dedicated/ shared	Dedicated	Dedicated	Dedicated	Dedicated	Shared	Dedicated	Shared	Dedicated
Distance to CBD (mi)	22	35.7	35.7	15	16	16	17	17
Constr cost	HK\$ 33.5 bn (1997)	\$ 214 mn (1991)	¥126 bn (2004)	£ 440mn (2000)	n/d	€ 760mn (2010)	n/d	\$700mn (2008)
Constr cost (\$ 2010)	\$4.56 bn	\$343 mn	\$1.3 bn	\$787 mn	n/d	\$1.024bn	n/d	\$709.8mn
Opening airport	1998	1978	1978	1946	1974	1974	1955	1955
Opening express	1998	1991	1991	1998	1981	(2015)	1984	(?)
Track length (mi)	21,2	32	32	16,5	10	19,9	14,6	16
\$mn/ mile of track	215,09	10,72	40,63	47,70	n/d	51,46	n/d	44,36
Time to completion	9 years	13 years	13 years	5 years	4 years	> 7 years	25 years	> 21 years
Construction time	4 years	n/d	5 years	5 years	n/d		5 years	
Delay	1 year	n/d	no	9 months	n/d		4 years	
Pax (airport 2009)	45,5mn	36mn	36 mn	66 mn	58mn	58mn	64mn	64mn
Fastest travel time	28 min	55 min	36 -40 min	15min	35 min	20 min	40min	25 min
Aver Speed (Min/mile)	1,27	1,54	1,12	1,07	2,19	1,25	2,35	1,47
Mode share	23%	14.9%	8.1%	9.3%	20%		4%	
Mode share other trans	47%	35%	35%	26.8%	11%		9%	
What is other transit?	Bus	Bus, local trains	Bus, local trains	Bus, local train	Bus	Hotel/Airport Van		
Financing	public & private	mostly private	private	private	public		public	
Ridership	below exp	n/d	n/d	below exp.	n/d		n/d	

2.2 Selection of small case studies

In addition to the big case studies, 8 smaller case studies from Europe and Asia are studied. The airports in those cases studies are located farther than 15 miles outside the city center they serve, have an airport-

¹ Data sources: Hong Kong: Distance to CBD, construction cost, airport and airport express opening, track length, time to completion counted from first plans for airport in 1989, construction time, fastest travel time (Ming 2001), Pax (Airports Council International), Mode share (Tam and Lam 2005); Narita Express: Distance to CBD, opening airport (Transportation Research Board 2000), Construction cost, opening express, fastest travel time (New York Times 1991), Opening express (Kensei Skyliner Official website), Pax (Airports Council Internationaional), Mode share (Horita 2004), Time to completion counted from opening of airport express in 1978 and opening of Narita Express in 1991; Narita Skyliner: Distance from CBD, opening airport (Transportation Research Board 2000), Construction cost, construction time, mode share (Hitora 2004), opening airport, opening airport express (Kensei Skyliner Official Website), travel time (Narita Rapid Rail Access Co. Website), time to completion counted from opening of airport in 1978 and opening of first airport express “Skyliner” in 1991, Heathrow: Construction cost (Vickermann 2000), Opening airport, opening airport express (Raco and Henderson 2009), distance to CBD, travel time (Transportation Research Board 2000), construction time, time to completion as measured in construction time plus delay, delay (Bary et al 2009), pax (Airports Council International), mode share (CAA 2006). Paris: RER B: opening, construction time, travel time, mode share (Transportation Research Board 2000), pax (Airports Council International), time to completion measured from first opening of RER B line, which was later extended to Charles de Gaulle; CDG Express: Distance to CBD, track length, time to completion to date, travel time, construction cost (CDG Express Official Website), opening airport (Transportation Research Board 2000), opening airport express (CDG Airport Express link), pax (Airports Council International). Chicago O’Hare Express: Distance from CBD, construction cost, opening airport, travel time, track length (Trans Systems Corp 1999), construction delay (several CTA planning docs), pax (Airport Council International), mode share (Wilbur Smith Associates 2004); Blue Line: same data sources as O’Hare express, plus opening Blue Line, construction delay (Schmidt 2010), travel time (Freemark 2009), time to completion measured from time of construction of Kennedy Expressway, which left space in the median for construction of the Blue Line.

Table 2-2: Key data of smaller case studies (Asia). (Sources: various)²

	Kuala Lumpur	Seoul Incheon	Shanghai Pudong	Bangkok	Beijing
Mode	LRT	Heavy Rail	Maglev	Rapid transit	LRT
Dedicated/ shared	Dedicated	Dedicated	Dedicated	Dedicated	Shared
Distance to CBD (mi)	31	43	20	16	20
Constr cost	2.5bn RM (2002)	3949 bn won (2007)	1.33 bn (2002)	baht 25.9 bn (2010)	5.4bn (2008)
Constr cost (\$ 2010)	\$7.89 bn	\$3.51 bn	\$1.61 bn	\$ 0.8547 bn	\$0.7398 bn
Opening airport	1998	2001	1999	2006	1958
Opening express	2002	2007	2004	2010	2008
Track length (mi)	35.5 mi	25 mi	19 mi	17.8 mi	17.5 mi
\$mn/ mile of track	222,25	140,40	84,74	48,02	42,27
Time to completion	12	10	3	6	no
Construction time	5	6	2.5	3	4
Delays	minor	1 year +	no	1.5	no
Pax (airport 2009)	30mn	44mn	50mn	40.5mn	65mn
Fastest travel time	28 min	28min	7min	15min	16-20min
Aver Speed (Min/mile)	0,79	1,12	0,37	0,84	1,03
Ridership	good	far below exp	far below exp	below exp	n/d
Financing	mostly private	mostly private	public	predom. private	PPP
Operating finances	profitable	deficient	deficient	too early to tell	n/d

rail link and are major airports (> 30 million passengers served in 2009). The Asian airport expresses are all very new (since 2000) and are often cited as examples why the state-of-the-art for a modern airport is to have an airport-rail link. A number of additional European airports with well-functioning airport rail

² Kuala Lumpur: distance to CBD, time to completion measured since first mention of planning (kiat.net), pax (Airports Council International), construction cost, opening airport, opening express, track length, travel time (Mohamad 2003), construction time (Wikipedia “KLIA Ekspres”). Seoul: pax (Korea heute), delay (Heojongsik 2009), travel time, distance from CBD, opening airport, track length (Wikipedia “AREX”), opening airport express, construction time, construction cost (Jackson 2007), time to completion measured since planning started (Korail Airport Railroad); Shanghai: pax (China Hospitality News 08-12-2010), distance from CBD, opening airport (Wikipedia “Shanghai Maglev Train”), construction cost, construction time, track length, opening airport express, travel time (Maass 2008), time to completion measured since of start of planning in 2001 (‘Erling 2009); Bangkok: opening airport express (MCOT.net), construction cost, time to completion, delay, construction time, track length (Briginshaw 2005), travel time (Airport Rail link), distance to CBD, opening airport, pax (Wikipedia “Suvornabhumi Airport”); Beijing: pax (Airports Council International), construction time, (Official Website of the Beijing 2008 Olympic Games), distance CBD, travel time (Wikipedia “Airport Express (Beijing Subway)”, opening airport (Wikipedia “Beijing Capital International Airport”), construction cost, construction time, opening express, track length (Railway technology).

links come to mind. They were excluded from this study because they are not located farther than 15 miles outside the city center (e.g., Amsterdam- Schiphol, Frankfurt) or served less than 30 million passengers in 2009 (e.g., Oslo).

Table 2-2 and Table 2-3 summarize key data points from the smaller case studies.

Table 2-3: Key data of smaller case studies (Europe). (Sources: Various)³

	Rome	Ataturk Istanbul	Munich
Mode	Heavy Rail	LRT	LRT
Dedicated/ shared	Dedicated	Shared	Shared
Distance to CBD (mi)	22	15	18
Constr cost	n/d	~ \$400 mn (2010)	121 mn (2000)
Constr cost (\$ 2010)	n/d	~ \$400 mn	\$153.4 mn
Opening airport	1961	1924	1992
Opening express	1990	2002	1992
Track length (mi)	n/d	12.2 mi	4 mi
\$mn/ mile of track	n/d	32,79	38,35
Pax (airport 2009)	35mn	30mn	35mn
Fastest travel time	30 min	30-35min	40 min
Mode share			31%

2.3 Comparison of key data points of case studies

The following outcomes can be observed from the tables:

Technology. The Asian systems have dedicated airport-rail links, except for Beijing. The European systems, except for London, have shared service that is an extension of the regular city transit system.

³ Sources: Rome: distance to CBD, opening airport, pax (Wikipedia “Leonardo da Vinci – Fiumicino Airport”), opening airport express, fastest travel time (Fabretti 2004); Istanbul: construction cost, track length, opening express, (Wikipedia, “Istanbul Light Rail System”), fastest travel time ([Hafif raylı sistem](#)), distance to CBD, opening airport, pax airport, (Wikipedia “Atatürk International Airport”); Munich: opening airport, pax airport, distance to CBD (Wikipedia “Munich Airport”), opening express, track length, fastest travel time, construction cost, mode share (Transportation Research Board 2000).

Service on the Asian airport-rail links commenced within 6 years or less after opening of the airport (except Narita), whereas rail service was added much later after opening of the older European airports.

Schedule overruns and underestimation of ridership. Even within the limited data sample, a pattern of schedule overruns and underestimated ridership can be observed. Five of the 8 dedicated rail systems were delivered with delay (Hong Kong, London, Bangkok, Seoul, Kuala Lumpur). Schedule overruns however were minor compared to typical public works projects in the transportation domain, on the order of +/- 1 year. Bangkok had the greatest schedule overrun with 1.5 years. Of 8 dedicated rail systems, 5 saw ridership far below expectations (Figure 2-1).

Hong Kong	Tokyo-Skyliner	Tokyo-Narita Express	London	Kuala Lumpur	Seoul	Shanghai	Bangkok	Dedicated expresses
1 year	n/d	n/d	9 months	minor	> 1 year	no	1.5 years	Delay
	n/d	n/d						Ridership overestimate

Figure 2-1: Delays and cost overestimates for dedicated systems

Construction cost. Hong Kong, Seoul and Kuala Lumpur were extremely expensive to construct, whereas the Narita Express was extremely cheap. The other projects are within the same general range of cost per mile of construction. A number of the cheaper systems reused existing infrastructure. The maglev train in Shanghai was one of the more expensive projects in costs per mile, but surprisingly it was by orders of magnitude cheaper than the systems in Kuala Lumpur, Seoul and Hong Kong. For the three shared systems whose construction cost is known (Munich, Istanbul, Beijing), construction cost was slightly lower than for dedicated service.

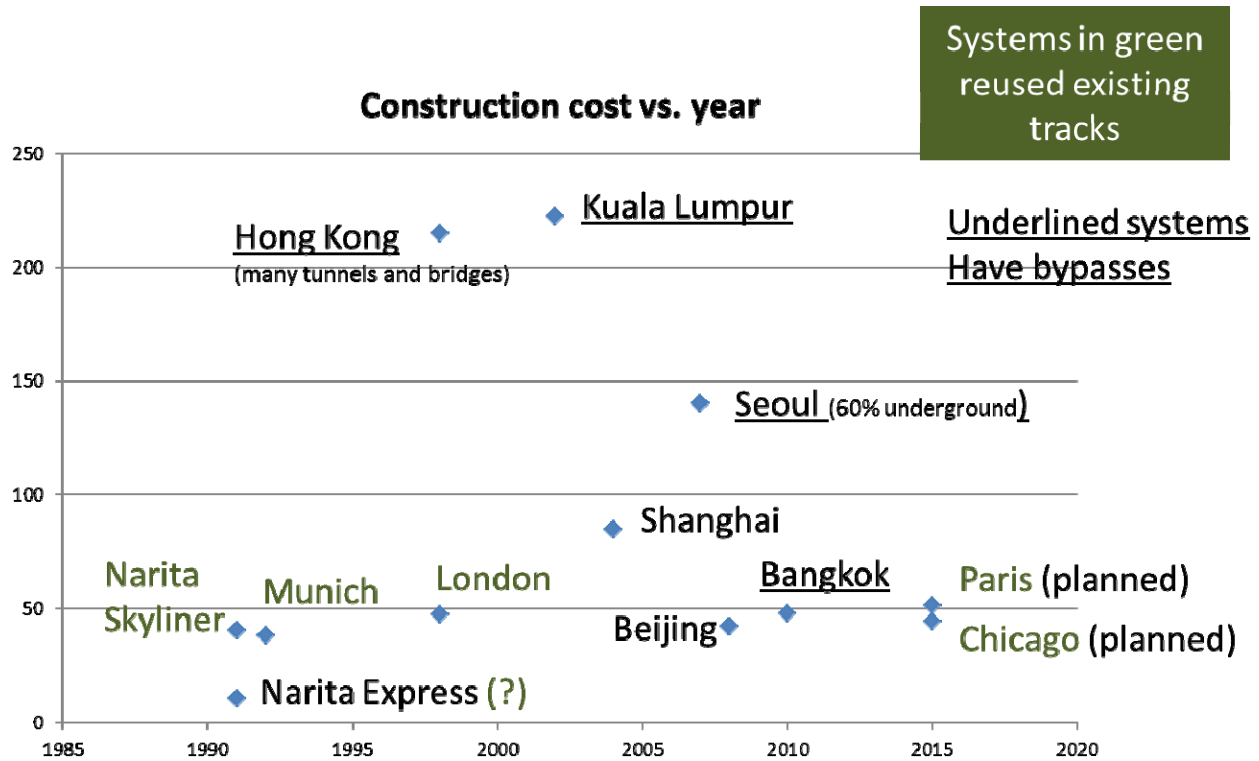
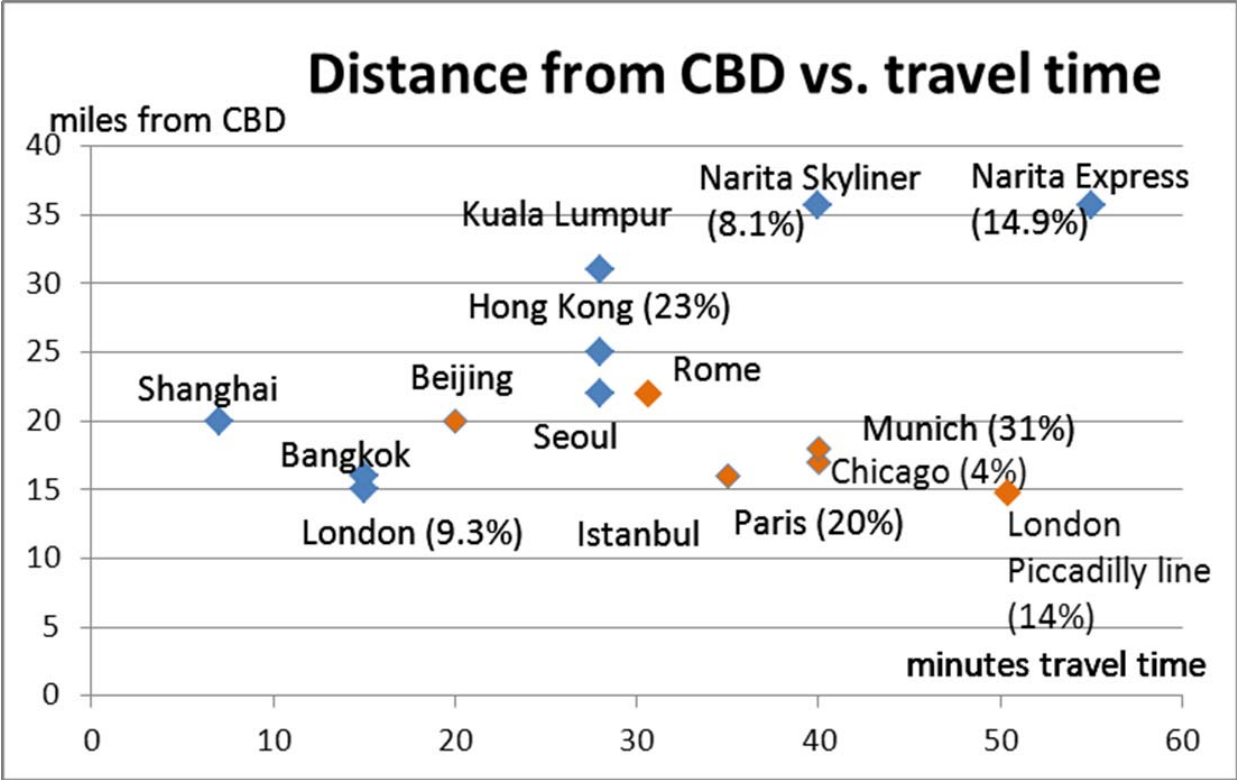


Figure 2-2: Construction cost vs. year for dedicated systems

Mode share. Hong Kong’s and Narita’s airport expresses have a higher mode share of public transportation than the three other systems of which mode shares are known (Charles de Gaulle, Heathrow and Chicago) and are substantially farther away from the city center. The Chicago Blue Line’s mode share is tiny, even though it is the only available public transportation option and a high mode share on a commuter line is possible, as Charles de Gaulle shows.

Travel time. For dedicated services, travel time corresponds more or less linearly to distance from the Central Business District (CBD). The longer dedicated systems (Hong Kong, Narita Skyliner, Kuala Lumpur, Seoul) have a travel time on the order of 28- 40 min The Narita Express is an outlier to the upper end with a travel time of 55 minutes. The shared transit systems (extensions of city transit systems) are in line with the slower dedicated systems with travel times between 30-40 minutes (Munich, Istanbul, Rome, Chicago, Paris). An outlier to the lower end is the Beijing Airport line with a travel time of 16-20 minutes (Figure 2-3).



Dedicated service

Shared service

Figure 2-3: Distance from CBD vs. travel time for all airport-rail links

Financing. Most of the dedicated systems were financed with varying degrees of private sector participation. It makes sense that shared service is publicly funded, as are most city transit systems. No improvement in ridership or construction time estimates can be noted for public private partnerships, a concept in which the private party responsible for the estimates assumes a significant share of project risk.

Hong Kong, Tokyo and London had a finance-build-operate arrangement with their private sector developers. Schedule underestimates and ridership overestimates are known for Hong Kong and London, and no information in that regard could be found for Tokyo. Kuala Lumpur and Seoul had finance-build-operate-transfer arrangements. Both projects were delivered behind schedule, and Seoul had severe ridership overestimates. Beijing and Bangkok were mostly publicly financed. Shanghai and all shared service systems were completely privately financed. Schedule delays are known for Bangkok, and

ridership overestimates are known for Shanghai and Bangkok. It follows that private financing in the case studies did not protect from schedule delays and ridership overestimates.

Outcomes that could not be explained easily from information in the tables were the following:

- Why was an airport-rail link constructed in London, but not in Chicago or Paris? The cities are of comparable importance and their well-used transit systems extend to their airports. Travel times for cities around 15-20 miles away from their airports are comparable with the Asian high-speed rail links that are often cited as state-of-the-art. Why did London construct one already in 1998, whereas Chicago and Paris have been busy planning one for years with no results to date (especially Chicago)?
- Why were airport expresses constructed in Hong Kong, Tokyo and London when bus mode shares are so high? Why are bus mode shares higher than train mode shares?
- Why did the two systems at Narita take over a decade to be built, when all other Asian airports built a high-speed rail link within 6 years of airport opening?
- What were reasons for delays, and why were delays relatively short for Asian systems and Heathrow? Why did those places built airport-rail links, while Chicago is trying and doesn't get the job done?
- What are reasons for ridership underestimates during construction of the Asian high-speed rail links?
- Why were Hong Kong, Kuala Lumpur and Seoul so expensive to construct, and the Narita Express so cheap? Why is the system in Kuala Lumpur profitable?

Chapter 3 Case studies

The following case studies are intended to shed light on the questions that remained unanswered in the cross-sectional analysis.

3.1 Detailed case studies

3.1.1 *Chicago- O'Hare*

Chicago is the enfant terrible of the case studies. Opened in 1955, it took until 1981 for people to be able to access the airport by rail, and even then they had to transfer to a bus to get to the terminal. Even though a continuous rail link was eventually built, little has changed in terms of the heavy mode share of motorized travel to the airport. These days the main artery from downtown Chicago to O'Hare, the Kennedy Expressway, is frequently congested (Travel Midwest Stats 2010) and quite expensive by taxi, which makes for an unsatisfactory travel experience. Studies for a direct train to the airport have been conducted about for over 21 years, but not much has come out of them other than an unfinished and unused \$300mn downtown station. With the state of Illinois facing one of the worst budget crises in the nation (Keefe 2010), the airport express project is dead for the next couple of years and it remains unclear when and if at all the downtown station and planning efforts to date will eventually be used.

Chicago's main airport, O'Hare International, is located 17 miles outside of downtown Chicago, an area called the "Loop". It serves as a hub for United Airlines and American Airlines. O'Hare is the fourth busiest airport in the world with 64mn passengers served in 2009 (Airports Council International). Although O'Hare is Chicago's primary airport, Chicago Midway (the city's second airport) is about 10 miles closer to the Loop.

3.1.1.1 History of O'Hare and the Blue Line

O'Hare was constructed between 1942 and 1943 as a military manufacturing plant during World War II and opened for civil use in 1955 to replace the overcrowded Midway Airport, Chicago's secondary airport. The CTA Blue Line was opened in 1899 and extended to the airport in 1984. The Chicago Transit

Authority (CTA) is the operator of Chicago's mass transit system, which centers around the Loop but extends into some of its suburbs. The CTA is financially supported by the Regional Transportation Authority (RTA) of the northeastern Illinois region. When the Kennedy Expressway was built in 1959 an empty strip was left in the middle so the Blue Line, constructed in 1899, could eventually be extended to the airport. For a long time however nothing happened. Insiders speculated that the Chicago and North Western Railroad (now merged with Union Pacific Railroad) was holding things up because they feared damage to their commuter business (Schmidt 2010). In 1979 the CTA was able to extend the Blue Line to Jefferson Park, 8 miles short of the airport and requiring airport travelers to transfer to a bus. That arrangement appeared to be the deal they had worked out with the railroad. Only later, when the commuter railroads were taken over by Metra could the line be extended to O'Hare, obliterating the bus transfer. Construction started in 1981 and service commenced in 1984 (Schmidt 2010). The Blue line is the CTA's second busiest rail line, with an average weekday ridership of 154,012 as of October 2009 (CTA official website). At present the Blue Line has no room to expand: it runs in the media of the Kennedy Expressway, on elevated structures or underground, always with dwelling units in close proximity. The Blue line took 55 minutes for the 17 miles to the airport in 2008, and has since been renovated and is able to make the trip in about 40 minutes. Even so, 15 stops between the Loop and the airport, turnstiles and staircases without elevators in some stations inconvenience travelers with luggage.

A second transit operator, Metra, runs a commuter train that stops a few miles north at the O'Hare Transfer station and is connected to the airport via a shuttle bus. The Metra train has a reported mode share of 0% and the Blue Line of 4% (Table 3-1, Wilbur Smith Associates 2004). O'Hare is accessed by 67% of travelers by personal car, car drop-off, taxis or rental car (Wilbur Smith Associates 2004). A third transit system exists in the Chicago region, the bus operator PACE, who has no relevance for airport access. The three transit providers are fairly segregated, as is evidenced by the absence of a joint ticketing system even though coverage areas overlap widely. The author knows from personal experience through an internship in 2008 that Metra is not very interested in closer integration and collaboration with the

much bigger CTA, e.g. by establishing joint ticketing. At present, CTA, Metra and PACE are completely segregated organizations.

The Kennedy Expressway, the main artery from Chicago to the airport, is frequently and highly variably congested (Travel Midwest Stats 2010). Travel times range from as short as 25 minutes to over one hour for the 16-mile trip from the Loop to the airport. O’Hare’s ground access has received criticism, since both slow, cumbersome transit and expensive individual travel by car or taxi are unsatisfactory for passengers.

Figure 3-1 shows ways to access O’Hare.



Figure 3-1: Airport access via Kennedy Expressway and CTA Blue Line (Source: Google Maps)

Table 3-1: Access mode to O’Hare (Source: Wilbur Smith Associates 2004)

	From entire Region	From downtown
Car parked	15%	11%
Dropped off	22%	12%
Rental Car	12%	7%
Taxi	18%	33%
Limo	14%	8%
Hotel or Airport van	9%	13%
Blue Line	4%	12%
Total	100%	100%

3.1.1.2 History of Airport Express plans

Anecdotally, it has long been recognized by planners at the CTA and the Mayor's office that a better way to access the airport would be desirable. Several studies have been carried out since 1999 (Trans Systems Corporation 1999) and identified feasible options to construct an airport rail-link. The proposals focused exclusively on expensive, non-stop rail connections. During her work at the Chicago Transit Authority in 2008, the author received the answer that buses options had purposefully not been considered because of concerns that "dirty" buses would fail to attract the coveted premium segment of the airport traveler market. O'Hare International and airlines have been excluded from the City's technical studies, presumably because no funding is expected from them. An agreement with O'Hare is mentioned stating that the airport will allow modifications to its underground terminal should an express be constructed.

Three basic concepts were presented by Trans Systems Corporation in 1999.

The so-called *Route 1* would share existing Blue Line tracks. The faster dedicated train would need to overtake slower local trains with its multiple stops a few times on its way to the airport. To achieve the targeted running time of 30 minutes, 2-4 trains would need to be overtaken per run. Several sub-options of Route 1 exist that suggest different ways to build a number of bypasses. Bypasses along the existing lines would have been very expensive and intrusive since the Blue Line runs in the media of the Kennedy Expressway and completely fills its allotted right of way. Tight enclosure by dwelling units, a tunnel and an elevated structure close to downtown leave almost no room to expand. A larger number of bypasses is needed for reliable operation of both service types on one set of tracks. On the other hand, the more bypasses, the more disruptive the project becomes for local residents. The trade-off here is between reliability and cost/disruption. Because of the prohibitive price for an acceptably reliable option with three bypasses, severe neighborhood disruptions, and implementation time of over a decade, this option was not further considered. Other Route 1 options were ruled out because they did not meet reliability expectations.

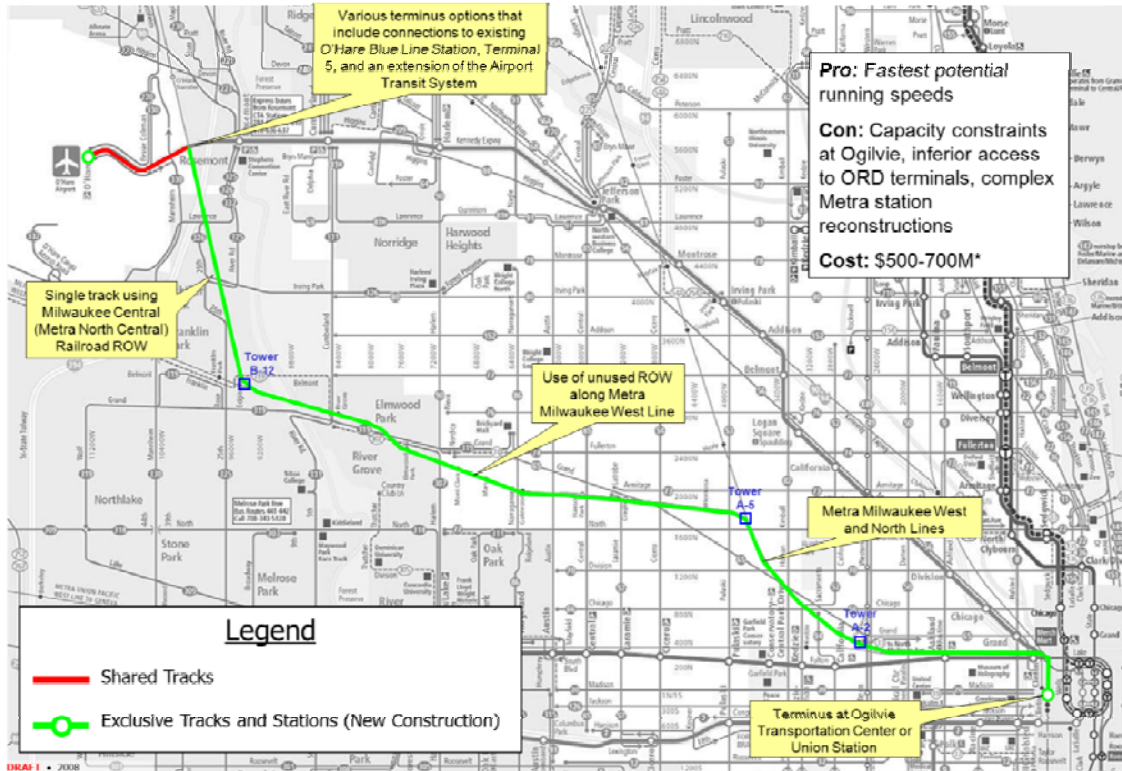


Figure 3-2: Express service Route 2 (Source: CTA)

Route 2 (Figure 3-2) would utilize an unused fourth track on the existing Metra North Central Line to provide express service on its own dedicated right-of-way. Metra currently only uses three of the four tracks. During the last part of the route, the airport express would have to merge with existing traffic onto three tracks. This route could be operated reliably, and be built within two years. It makes possible fast running speeds because of the separate right-of-way for the airport express. Different sub-options offer different possibilities for how to connect the tracks to O’Hare, demonstrating a trade-off between cost and interfering with potential future expansion of O’Hare. The options range between \$500mn and \$700mn in 2008 dollars. Route 2 was favored in 1999 because it offered a separate right-of-way for the airport express and reliable operation at lowest cost. The favored sub-option was budgeted at \$363 in 1999 and would connect to O’Hare through a new subway station. It is generally referred to as “the plan” for the Chicago Airport Express in this thesis.

Route 3 offers an alternative for a separate right-of-way for the airport express, sharing the Wisconsin Central freight line. This option would have cost considerably more than Route 2 at no added advantage.

A business study by Parsons Brinckerhoff Consult in 2006 suggested a fourth route reusing existing Metra and Union Pacific tracks, labeled the “Kennedy Express Union-Pacific Alignment”. The Kennedy UP Alignment was more expensive than Route 2 but offered no new advantages, and was therefore ruled out for the same reasons as Route 2. As a more important contribution, the business plan acknowledges funding shortfalls for either Route 2 or the new UP Alignment option and recommends partnering with a private concessionaire, who would hopefully contribute to funding. PB states that “premium fare single market services are not the CTA’s traditional business” (Parsons Brinckerhoff 2006, p.5) and that the city should therefore partner with a private sector concessionaire, who would be the “face” of the new service. The business plan claimed optimistically that the investment for either the new option or Route 2 would be profitable for a private investor at a ticket price of \$10 per ride. In 2008 the investment bank J.P. Morgan recommended tasking a private-sector concessionaire with designing, financing, building and operating the project for a time span of 30-50 years. They advised however that even through a Design-Finance-Build-Transfer arrangement the City was realistically looking for subsidy minimization (not 100% private funding), and that transportation was an industry that always needed to be subsidized (J.P. Morgan 2008). During the same time, finance staff at the CTA came to the same conclusion that the project was not attractive for a private sector concessionaire with the ridership projected at the time, an assumption that had been held for years. The author had several personal conversations about the planned airport express during her internship at the CTA in the summer of 2008. A senior member of the Planning staff expressed that bus options had purposefully not been considered because of concerns that “dirty” buses would fail to attract the targeted premium segment of the airport traveler market.

In the summer of 2008 a task force was formed at the CTA to drive plans on the airport express forward. The task force was short-lived, since the economic downturn that hit Chicago with full force in the fall of 2008 brought about a whole range of more pressing problems. Around the same time, the Finance

department at the CTA cast severe doubt on the idea that the airport express could be lucrative investment for a private sector concessionaire, and that subsidies had to come from somewhere. The project was handed over to and disappeared in the Mayor's Office, where currently no directly responsible person exists (Personal communication 2010).

An interview with a Planner at the Mayor's office revealed in a semi-structured utility interview that the major expectations/ criteria for success that the city related to the project were an increase in property tax revenue, employment generation, attraction of outside project funding, attraction of visitors to Chicago and preserving equitable investment into other parts of the system to secure public support (Interview partners 2008). While attraction of visitors was project-specific, the other criteria are generically applicable to any good public project. Typical expectations of airport rail links were not mentioned at all, such as environmental improvement, congestion reduction and providing passengers with a better experience. The overarching theme of the expectations is clearly that of inducing economic growth and less that of providing non-monetary public goods.

A report by the National Conference of State Legislatures was published in July 2010 (cited by Keefe 2010), reporting that the Illinois budget crisis was the worst in the nation. Illinois is one of two states expecting a gaping budget shortfall at the end of fiscal year 2010. In light of Chicago's and Illinois' current budget crisis, the project can be considered as tabled for the intermediate future.

The Transport Politic, a website dedicated to following transportation projects in the US, reports the following about the current state of plans on Chicago's airport express on August 20, 2010:

This week, Mr. Daley formed a 17-member exploratory committee to study options, arguing that private investors from around the world had suggested to him that they might be available to help finance the [airport express] project. The Mayor promised that the municipal government would provide none of the funds for either construction or operation of the program, though he did not rule out the possibility of demanding state or federal dollars to aid in the investment. The new chair of the Regional Transportation Authority is likely on board, being a big supporter of public-private partnerships. [...]

The superstation, located under the Block 37 project, has been partially constructed after a \$250 million public investment. But the station is not completed and does not include track connections between the Red and Blue rapid transit lines, one of the primary goals of the project. [...]

Mr. Daley's impulse — to promote a new transportation project specifically without committing the public sector to financing its completion — certainly makes sense considering the city's limited fiscal reserves and its other priorities, but it may also be unrealistic.

For one, reason puts in question the assumption that private investors would be willing to fund the capital costs of the airport line, no matter the cost customers may be asked to pay to ride along it. There are significant obstacles to putting the project into play, including the purchase of new train sets; the construction of bypass tracks along an elevated line in dense urban neighborhoods; the expansion of an underground station downtown; and the possible need to create a new terminus station at O'Hare Airport. In other words, airport service of the type that's been discussed before for Chicago would require several hundred million dollars — of somebody's money.

Freemark (2010)

In a different article, the Transport Politic criticizes the abandoned superstation on the so-called block 37 and the entire planning process around the airport express sharply.

[...] the failure of Block 37 and the affiliated superstation is no matter of fate — it is a reflection of misplaced priorities at Chicago City Hall and a poor response to the market. Mayor Richard Daley encouraged the developer to move forward with the dual objectives of building a tower on the city's last major available downtown parcel and of linking the city center more quickly to airports. The first idea will come to partial realization later this year, though its stature has been dimmed significantly by the failure of the real estate market in Chicago, like almost everywhere.

The airport connection, however, never seemed fully thought out. Today, commuters can travel from the Clark/Lake Station downtown to O'Hare Airport in 40 minutes on the Blue Line or to Midway Airport in 30 minutes on the Orange Line; either trip costs just \$2.25. Though the city's connections between its

airport rail stations and passenger terminals are not ideal, service is reliable and well-used. By 2008, the city was proposing that a private entity operate the new express link from Block 37 to O'Hare and Midway; the trip would take just 15 minutes less than existing service, but cost an outrageous \$17. Check-in counters would be available in the basement of the Block 37 facility, allowing commuters to rid themselves of their bags downtown. The airport express trains would travel along existing heavy rail tracks shared with the Blue and Orange Lines.

Even if the idea had some validity — Chicago's airports attract a number of business travelers who might be interested in the faster service — CTA was never prepared to provide the tracks for express trains. There was some discussion a few years back about adding tracks along the Blue Line that would allow express trains to bypass locals, but no money was ever provided. Carole Brown's vision of using the airport link as a motivator to attract more funding to aid CTA operate more banal services fell flat. As happens with many airport-connector projects, the project morphed from a "money-maker" to a strain on the rest of the system, \$100 million over initial cost estimates, too expensive for the city to continue construction. [...]

What private operator would agree to run a subway from the Loop to one of the airports if it had to run behind regular Blue Line trains and operate on their schedule?

There were other alternatives if airport access was one of the city's main priorities: existing Metra commuter rail tracks run directly from downtown; buying DMU rail cars and building surface-level stations near the airports would have cost a lot less than the halfhearted attempt to construct a massive underground terminal in the heart of the city. Those trains would have probably been faster than even the dead-on-arrival express service using existing CTA tracks.

Why was the airport link considered so important by the city's planners? Was the new facility worth \$300 million in construction costs, even if it had become operational? The money certainly could have gone elsewhere. CTA has a number of other projects in construction and planning, including the elimination of slow zones throughout the system, the Circle Line, and three extensions of existing lines. Chicago may well have lost out on its attempt to win the 2016 Olympics because of the deficiencies in its local transit offerings, not necessarily its airport access, which is acceptable.

Before it can invest in under-performing extravagances like better links to O'Hare and Midway, CTA demands an infusion of cash to fulfill basic needs. The ill-conceived superstation that will not be used for years should have never been a priority.

Freemark (2009)

Just like the interview with the planner in the Mayor's office, the article begs the question of the initial value proposition for the airport express. Why did the City ever initiate planning on this project? If the main interest had truly been to bring travelers faster to the airport, it is unclear why more cost-effective options had not been seriously considered in times of tight finances, such as a dedicated Bus Rapid Transit Line along the Kennedy Expressway or using existing Metra commuter tracks north of the Kennedy Expressway, like Freemark suggests. A senior planner at the CTA (the successor of the planner referenced earlier, who has since left the CTA) expressed in May of 2010 that the idea of a dedicated lane on the Kennedy Expressway for bus rapid transit, together with high-occupancy vehicle priority policy, did indeed have merit and should be considered at a time when the project might seriously be reconsidered (Personal communication 2010).

The history of airport express planning in Chicago leaves the impression of a never fully-thought out project that would have been nice to have, but that was never a priority. In addition, a solution of an airport-rail link was favored early on, whereas other options were not comprehensively explored. An illusion was maintained that a private operator could magically make the project happen, until financial advisors pointed out that the city would have to contribute something in order to structure an attractive deal for a private investor. Accessibility to the airport is suboptimal but not a problem that requires urgent attention, as was evidenced by the fact that when money was not available, no-one turned to cheaper options.

3.1.2 *Hong Kong- Chek Lap Kok*

Unlike Chicago, Hong Kong's airport express was recognized as a necessity by the city government when Hong Kong International airport was planned in 1989. Located on an island far outside the city center for minimal disruption of residents, access is a challenge. Despite heavy competition from bus services and a commuter rail line to the nearby village of Tung Chung, the express sees one of the highest mode shares of any airport-rail link worldwide.

3.1.2.1 Ground access to Hong Kong International

Hong Kong International opened in 1998 on the Island of Chek Lap Kok. It is one of the busiest airports worldwide today, registering 45.5mn passengers between May of 2009 and 2010 (Airports Council International). The airport is operated by the Airport Authority Hong Kong and serves as hub for Cathay Pacific Airways, Dragonair, Hong Kong Express Airways, Hong Kong Airlines, and Air Hong Kong (cargo). Hong Kong International shares the story of many major Asian airports: a previous airport had become too congested and a new one was built far outside the city center. In the case of Hong Kong, the small Kai Tak Airport was closed once Hong Kong International was opened.

Airport access was designed simultaneously with the airport itself. The result offers seamless integration of modes and serves as a role model for a well-designed airport-rail link worldwide. The airport is served by both a direct Airport Express and a commuter line with intermediate stops, the Tung Chung line. Both services started in 1998 around the time of the airport's opening. Travel time from Hong Kong Island to the airport is 24 minutes on the express. The airport-rail link is integrated into Mass Transit Railway, Hong Kong's city transit system and major mode to get around. As of the first half of 2009, MTR had 42% market share of the franchised public transport market (MTR Corporation Interim Report 2009). Major transfer functions exist at Tsing Yi station on the way to downtown, from which destinations in the northerly part of the system can be reached. High-quality transfers to taxis at both Central and Kowloon

stations. MTRC developed the world's first downtown check-in system for use by all airlines. Bags can be checked in at both Central Station and Kowloon stations. All check-in functions, including the issuance of boarding passes, are undertaken at the downtown facilities staffed by airline personnel. Free shuttle service to hotels in the area is available at Central and Kowloon stations, and free porter service is available at all stations except at Asia WorldExpo.

Only the Airport Express allows direct access to the airport's terminal area. Riders on the cheaper Tung Chung line are dropped off in the nearby town Tung Chung and can take a bus to various areas of the airport. Despite a significant difference in comfort and price, the Tung Chung Line uses the same tracks as the airport express for most of the way. Superimposed "skip stops" on the track infrastructure allow express trains to bypass the Tung Chung line trains at each of the local stations. Although the bypass tracks are in operation at local stations, the fundamental infrastructure—particularly in expensive tunnel and bridge segments—is that of a two-track railroad. In effect, two complete systems must be dispatched simultaneously, resulting in a precisely managed rail operation. Little tolerance exists in either system for failure or delay in the other system (Transportation Research Board 2000). The express railway consists of 21.2 miles of track, 5 of which are underground, 12.5 miles at grade and the remaining 3.7 miles are on elevated structures (Ming 2001). South of the channel between Lantau Island and Chek Lap Kok Island the commuter line splits off to Tung Chung.

3.1.2.2 History of construction of the airport express

When the decision was made to construct the new airport in 1989, the Hong Kong government invited the then-fully government-owned MTRC (MTR Corporation) to build a train line to Chek Lap Kok Island, where the new airport would be located. MTRC was privatized in 2000 and today is no longer wholly-owned by the government. In 1992, the Chinese Government and the Government of the United Kingdom signed a Memorandum of Understanding on the construction of the new airport in Hong Kong. One of the so-called Airport Core programs, for which the government previewed financing, was an airport-rail link. In light of the airport's remote location and Hong Kong's transit dependence, high-quality transit

access seemed like a necessity in order for the airport to work. In 1993 the board of the MTRC announced their decision to finance, construct and operate the airport railway. Chinese and British government conflicts about financial and land disagreements delayed construction until late 1994. The provision made for the airport railway in the airport budget was HK \$33.5 bn (1989, equal to \$4.5 in 2010), based upon the target opening date of June 1997. The initial railway was called the Lantau Airport Railway, but was later split into the Tung Chung Line and the Airport Express. Both were inaugurated a few weeks apart in 1998, after four years of construction.

MTRC took over responsibility for the construction and financing in 1993, with substantial support by the Hong Kong government. MTRC borrowed from international capital markets, with borrowing peaking on the order of \$10bn per year (Ming 2001). Even though the Asian financial crisis struck in 1997, the express was completed only one year behind schedule in 1998. The Hong Kong government supported MTRC in a number of ways in their efforts to raise capital, while maintaining MTRC's credit ratings and keeping interest rates at acceptable levels. Ming (2001) summarizes these efforts:

- The Hong Kong Government forwent dividends from the MTRC for a number of years until 2001;
- The Hong Kong Government permitted the MTRC to develop properties on the five sites;
- The Hong Kong Government contributed additional equity of \$3.7 billion in 1993, which included the balance of 2.5 billion payable in respect of the 50,000 partly paid shares issued at 31 December 1991;
- The Hong Kong Government committed to a callable equity of \$12.5 billion to be drawn down in specific adverse circumstances.

The Hong Kong Government undertook the completion of all Airport Core Program projects required for the operation of the Airport Railway. If for reasons outside the control of the MTRC but resided under the responsibility of the Hong Kong Government, certain parts of the Airport Core Program projects were delayed; the Hong Kong Government would, subject to a grace period of two months and for no more than two years, reimburse 80% of revenue lost to the MTRC (MTRC Airport Railway -Information Guide 1992).

Ming (2001), p. 55-56

Unlike many of its European and North American counter parts, MTR is a profitable transit provider. From MTRs financial statement (MTR Corporation Summary Financial Report 2009) it is apparent that retail business in train stations and property development play a significant role for the private company's profitability.

At present, only one transit provider exists in Hong Kong, MTR. At the time of the construction of the airport express however, two railway companies served Hong Kong, MTRC and KCRC (Kowloon-Canton Railway Corporation). In 2007 KCRC granted a 50-year service concession (which may be extended) of the KCR network to MTRC, in return for making annual payments to KCRC, thereby merging the railway operations of the two corporations under MTRC's management (Yeung 2008). KCRC remains fully government-owned.

3.1.2.3 Reception

The high mode share of rail of 23% (Tam and Lam 2005) is routinely cited in discussions of airport rail links. However, this has drastically declined from a peak of 32% in 1999 (Yeung 2008). Mode share among different ground access modes for the airport is displayed in Table 3-2.

Table 3-2: Mode share at Hong Kong International (Tam and Lam 2005)

Mode	Share
Car (private and rental)	7.5%
Taxi	12.9%
Rail	23.4%
Bus	47.4%
Other	8.8%
Total	100%

The Tung Chung line and a subsequent bus connection is a cheaper alternative and partly cannibalizes the airport express. The most popular means of transportation to the airport however is bus service all the way from downtown. Travelers can board buses closer to their origin, whereas a trip with the airport express requires travelers to access the downtown terminal, which might be out of their way. Competition was increased in recent years through drastic improvements in bus service, e.g. in terms of speed through

opening of Western Harbour Tunnel for quick cross-harbor trips, reliability, and comfort, through air-conditioning. Between 1998 and 2000 eight special Airport bus routes have been introduced and 13 external Airport bus routes from Tung Chung were opened (Ming 2001, Chapter 5). Ming sees this change as the reason for a drop in market share of the Airport Express Railway from 31.8% in 1999 to 27.9% in 2000 (Ming 2001, p. 45).

One of the original architects of the Hong Kong Airport Express writes:

It is apparent that even with a good design and well/integrated railway service, the Airport Express does not have inherent advantages over more direct single mode bus travel. In other words, the speed advantage of rail versus single mode road competitors when traveling over distances of only up to 34 km [21 mi] do not result in significant enough time savings to compensate for the necessary transfer.

(Noble and MTRC 1998, cited after Transportation Research Board 2000, p. 86)

Despite the relative success of the airport-rail link with customers, ridership expectations remain unfulfilled to this day. Ming (2001, p. 45) reports that about 39,000 passengers (estimated in 1992) were expected to ride the express on a busy day when service commenced in 1998. Actual ridership in 1999 was 28,000 passengers per. For the Tung Chung line, 266,000 passengers were estimated in 1999 Ming (2001, p. 45). In 1999, actual ridership was 72,000 per day (MTRC Airport Railway -Information Guide 1992). While MRT overall is profitable, the airport express itself is not an overall profitable operation due to too low ridership (Ming 2001, Chapter 6). It should be noted that the comparison here was a full-cost one, which is very rarely fulfilled for infrastructure projects, even though original patronage estimates projected a break-even. In terms of positive non-monetary effects, Ming (2001) points out that airport rail service has had a lower accident rate in Hong Kong than road-based travel to the airport. Environmental impacts are mentioned qualitatively, but are not quantified and did not seem to play a prominent role when the airport express was conceived.

It is remarkable in what a short time the express was finished despite the strong setback from the Asian financial crisis. Even before competition from buses emerged, ridership was below expectations. It is unclear to what extent this is due to uncertain events, notably, the Asian financial crisis (but then why

didn't ridership increase in the years after?), or due to strategic misrepresentation (Flyvbjerg 2009). It is unclear who would need to be convinced by strategic misrepresentation of ridership estimates, since the MTR and the Hong Kong government agreed on the construction and no reports of substantial resistance are known. Looking forward, the threat from buses is real and their ability to scale capacity down in times of slow demand puts them at a strategic advantage.



Figure 3-3: Map of the MTR Airport Express and Tung Chung Line. Adapted from: Wikipedia, “Airport Express (MTR)”

3.1.3 Tokyo- Narita

Narita International and its airport expresses look back on a long and troubled history of severe stakeholder protests against both the airport and the airport rail link. It took a long time of heightened security at Narita, resembling a “military fortress” (Sterngold 1989), and poor accessibility before the airport transitioned into its current form and an airport rail-link was built to the airport. Narita’s history shows both strong government support and violent stakeholder opposition to a project, which led to abandonment of an airport-rail link, years of poor accessibility, and only recently to the construction of a new one.

3.1.3.1 History of Narita airport and the airport express

Narita International is the main airport serving Japan's capital Tokyo. It serves as a hub for Japan Airlines, All Nippon Airways and Nippon Cargo Airlines. It serves as an Asian hub for Delta Airlines. Narita served 35 mn passengers in 2007, and lesser numbers in 2008 and 2009 (Airports Council International). In the early 1960s, Tokyo International (Haneda Airport) was becoming congested and the Japanese government began the planning of a new airport. The rapid post-war development of Tokyo led to a shortage of available land for new development, pushing the location for the airport 35.7 miles outside of the city. First protest against the new airport developed in 1966 with a group of student activists, local residents and farmers who did not want to give up their land, and left-wing political parties, all of whom formed the Sanrizuka- Shibayama Union to Oppose the Airport. The Union remained active until 1983 (Apter and Sawa 1984). The Union sent formal protests to the mayor of Narita and set up roadblocks against surveying the perimeter of the airport in 1967.

The protests delayed construction of the airport. Some residents went as far as threatening to burn the new homes after relocation of anyone who would voluntarily move away. Since peaceful relocation was not possible, the Japanese government began forceful expropriation in 1971 under eminent domain power. 291 protesters were arrested and more than 1,000 police, villagers and student militants were injured in a series of riots, notably on 16 September 1971 when three policemen were killed in a riot involving thousands (Apter and Sawa 1984). Some protesters chained themselves to their homes and refused to leave. As provided under Japanese law, compensation had to be paid to expropriated homeowners.

This however did still leave an extremely tense situation. Construction of the airport began in 1971, but was delayed by ongoing protests. Opponents occupied pieces of land necessary for the first runway and built large towers in the runway's path (McCargo 2000). The runway was completed and the airport scheduled to open in 1978, but a group armed with Molotov cocktails drove into the airport in a burning car, breaking into the control tower and destroying much of its equipment. The incident delayed opening by two months (Crabbe 1978). When the airport finally opened later in 1978, protesters again disrupted

operations at the new airport by cutting the power supply to an air traffic control facility and throwing rocks and firebombs (Crabbe 1978). The airport operated subsequently under unprecedented security measures to keep protesters outside of the terminal buildings.

The original master plan had called for a high-speed rail line, the Narita Shinkansen to run from Tokyo Station to the airport. Construction started in 1974 for completion by the airport's opening in 1976, but the project was canceled because of expropriation issues, with only part of the necessary land obtained between central Tokyo and Narita (Apter and Sawa 1984). Due to the opposition, only a 5.6 miles stretch of trackbed and the airport station shell had been constructed before the project was halted. Those abandoned pieces would later be used by Keisei's Narita Skyliner express.

Along with the high-speed rail line, plans for three additional runways were abandoned because of the tense political situation. By 1986 Japan's growing economy caused a surge in business and leisure travel, which made capacity shortfalls more pressing. The Japanese government chose to forego the expropriation of slightly less than 53 acres of land from eight Japanese families that would have been needed to complete additional runways (Sterngold 1989). At the time, Narita was operating at 40% over capacity and resembled a "military fortress" (Sterngold) because of sustained protests and violence against airport expansion. A second runway finally opened in 2002, in time for the World Cup events held in Japan and Korea that year.

Throughout the 1980s, Narita was very hard to access. While construction of the Shinkansen link was on hold, the private Tokyo rail operator Keisei had constructed an ordinary rail link to the vicinity of the airport, which it began to operate in 1978. However, services had to terminate outside airport grounds because the station inside the airport and the track connecting to it was owned by then state operator Japanese National Railways. As a consequence, Keisei could not legally use the in-terminal station and Keisei's Narita station was located far away from the terminal, requiring a lengthy walk or a transfer to a shuttle bus, subject to an additional charge and random security screenings. This inconvenience caused

many passengers to use direct city-to-terminal limousine buses rather than Keisei's train, which was already called "Skyliner". JNR was privatized in 1987. Following growing criticism of Narita's ground access in the late 1980's, Transport Minister Ishihara pressed airport train operators JR East (one of Japan National Railway's successors after privatization) and Keisei Railway to connect their lines directly to the airport's terminals and opened up the underground station that was originally built for the Shinkansen service. After the passing of the Railway Business Act in 1986, Keisei could acquire rights to lease tracks from JR and operate direct service to the airport. In 1991, twelve years after the airport opened, the direct rail service "Skyliner" to the airport began (New York Times 1-27-1991). In the same year JR East opened its own competing service, the Narita Express. Until then, the Skyliner had been the only direct transit access route to the airport. Both services operate from the underground station "Narita Airport" under Terminal 1. On July 17, 2010 the Skyliner was transferred from the so-called Keisei Main route to a new route, the Narita Sky Access route, which partially reuses old Narita Shinkansen tracks. The new route represents the fastest way to reach Tokyo from Narita, in 36 minutes (Keisei Skyliner Official website). The Narita Sky Access route is operated by Keisei, but some parts of the line are operated by other companies as well. Figure 3-4 illustrates the location of different rail tracks between Tokyo and Narita International.

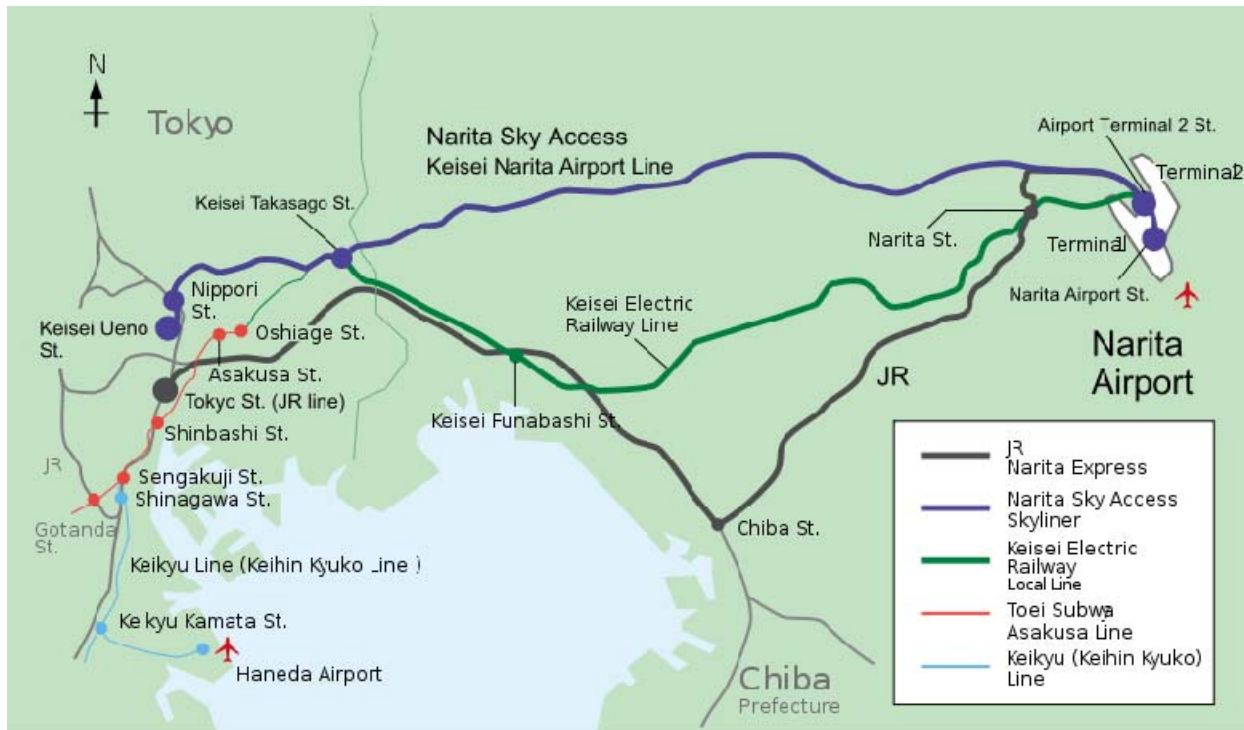


Figure 3-4: Narita Airport (Source: Narita Airport Official Website)

3.1.3.2 Financing and reception

The construction of the Sky Access route involved the refurbishment of 20.1 miles of existing track on the Hokusō Line, as well as the construction of 11.8 miles of new track to Narita Airport. The total cost according to Narita Rapid Rail Access' website was ¥126 billion, or about US\$1.3 billion (Narita Rapid Rail Access Co., Ltd). Local governments pledged ¥46 bn of that amount in subsidies (Hirota 2004). To reduce noise and vibration, soundproofing walls, direct track sleepers and continuous welded rail were used (Narita Rapid Railway Access Co. Ltd). Mode share at Narita is summarized in Table 3-3.

Table 3-3: Mode share at Narita (Source: Hirota 2004)

Mode	Share
Car (Taxi, private and rental)	15%
Rail	40.3%
<i>Skyliner</i>	8.1%
<i>Narita Express</i>	14.9%
<i>Local trains</i>	17.3%
Bus	41.6%
Other	3.1%
Total	100%

Although JR East enjoyed the advantage with regard to express services, the situation was reversed for rapid and local services (13.0% for Keisei and just 4.3% for JR East). In 1990, before the airport-rail links were fully established, rail had a share of only 17% and buses of 54% (Hirota 2004). In 1993, rail had a share of 36% (Narita Express 14%, Skyliner 10%, local trains of 12%) and bus service of 23% (Narita Airport Authority in communication to BAA, 1993, cited by Transportation Research Board 2000). Since the establishment of the new airport-rail links, rail mode share has steadily increased and bus service first plummeted to 23%, but then increased again to over 41.6%. Overall transit use increased from 71% to about 82%. The 10% increase is most likely due to the better airport-rail links.

In the case of Narita, delays were due to massive and violent stakeholder protests, not due to unwillingness of airport operators or the government to invest or cooperate. Even though the Japanese government tried to achieve peaceful relocation and later provided reimbursement for forced relocation, the situation remained so tense that an extra terminal and the Shinkansen express projects were foregone. After years of highly unsatisfactory service Narita is today served by a wide offer of public transportation that together has an overall mode share of 59%. Buses enjoy the greatest mode share of all transit modes despite very good train connectivity to national and metropolitan destinations and cheap local trains. The two high-speed rail links are run by JR East and Keisei, two profitable companies (Japanese Transit Profitability 2003 and public financial statements on company websites).

3.1.4 London- Heathrow

Heathrow's construction is a story of exemplary project delivery. It is particularly interesting because its fragmented planning bodies do not set it up for efficient planning and delivery. The completely private financing and construction of an airport express, the dream of Chicago, not only materialized but worked out well. In line with a number of other projects, ridership on the Heathrow Express remains below expectations.

The major European metropolis and largest city in the United Kingdom, London, is served by a system of seven airports. The largest of those is London-Heathrow, located in the London borough of Hillingdon, 13 miles outside of the city center. London-Heathrow is one of the major airports in Europe, handling 66 million passengers in 2009 (Civil Aviation Authority 2009) and serving as a hub for the carriers BMI, British Airways and Virgin Atlantic Airways. The other six airports in the London Metropolitan Region are Biggin Hill, Gatwick, Stansted, Luton, Southend and City Airport.

London is served by the Heathrow Express, a dedicated airport-rail link, as well as the shared service Heathrow Connect, London Underground's Picadilly Line and a variety of buses.

3.1.4.1 Overview of public transportation access modes to Heathrow

The *Heathrow Express* is a dedicated heavy rail service connecting London Heathrow and Paddington Station in London. The service operates every 15 minutes and takes 15 minutes from Paddington to Heathrow Central. Heathrow Express is equipped with video monitors for news and weather broadcasting and mobile signal reinforcement, allowing phone calls to be made even from within tunnels. Construction started in 1993 and consisted of extending the rail line from Paddington to Heathrow. The service opened in 1998. Generally, the Heathrow express is oriented towards Central London and is not integrated with the UK's national rail service. National rail service is accessible via a number of specialized shuttle buses.

Heathrow Connect uses largely the same track infrastructure as Heathrow Express, but serves intermediate stations. Being slower and cheaper than the Heathrow Express, Heathrow Connect was intended to serve airport employees. It has a running time of 25 minutes and departs every 30 minutes. Unlike Heathrow Express and London Underground, Heathrow Connect does not serve all of the airport's terminals. Heathrow Connect serves Heathrow Central station (Terminals 1, 2, 3) and terminates at Terminal 4. Terminal 5 is only accessible by Heathrow Express or London Underground's Piccadilly Line.

The subway *Piccadilly line* takes about 40-50 minutes from the airport to downtown. However, it serves many popular destinations directly and within an hour which gives it an advantage over the Heathrow Express. Examination by the authors of the TCRP report (Transportation Research Board 2000) shows that there are only a small number of Underground stations (the immediately adjacent stations on lines connecting from Paddington) at which the total travel times for the Heathrow Express plus Underground are faster than Underground plus Underground travel times (this excludes time penalties to account for transfer and waiting times, as typical practice when comparing travel times).

Heathrow is served by a wide variety of *buses* that are operated from Heathrow airport. In addition to locally oriented buses, larger ones are used by airport employees and specialized bus service has developed to downtown hotel areas. The hotel service is marketed as the Airbus and serves a number of common shared bus stops downtown (Transportation Research Board 2000). Ridership on the many bus services is increasing (Transportation Research Board 2000).

3.1.4.2 Mode share of different transit modes to Heathrow

Table 3-4 compares mode shares of public transit modes to Heathrow between 1996 and 2004. A big gap exists between forecast and actual ridership for 2003. It appears that planners overestimated time sensitivity and underestimated cost sensitivity of the prospective Heathrow Express patrons (Kouwenhoven 2008). There was a strong expectation that the Heathrow Express would capture a good part of the taxi market, which it did not. Kouwenhoven (2008) suggests that the latter effect indicates that taxi users are not overly price or time sensitive, but rather value the convenience of a direct service over connecting in London. In addition, for groups of 2 – 3 people the taxi can be more cost effective as well. Between 1999 and 2004, after opening of the Heathrow express, public transportation mode share remained mostly constant. The most notable change is a small decrease in ridership on the Heathrow Express (- 1.7%) and a small increase in taxis trips (+ 1.9%).

Table 3-4: Mode share to O'Hare (Sources: various)

Mode	1996	1999	2001	2002	2003 Forecast	2003 Actual	2004
Private Car	43%	n/d	35%	36%	44%	35.9%	35%
Rental Car			3.2%	3.2%		3.1%	2.8%
Taxi	24%	24%	26.5%	26.1%	16%	25.3%	25.9%
Underground	16%	14%	13.1%	13.3%	10%	14%	14.2%
Heathrow Ex.	-	11%	8.4%	8.8%	19%	8.9%	9.3%
Bus/ coach	17%	15%	13.1%	12.3%	11%	12.6%	12.4%
Other	-	36%	0.7%	0.3%		0.2%	0.4%
Total	100%		100%	100%	100%	100%	100%

The 1996 data is taken from (LeBlond 1999) and the 1999 data from unofficial estimates from BAA staff from summer 1999, cited after (Transportation Research Board 2000). The mode shares 2001-2004 have been compiled by Kouwenhoven (2008) from CAA (Civil Aviation Authority) data. The CAA is the UK's aviation regulator. According to the CAA website, the 2004 mode shares that Kouwenhoven cites still appear to be the most recent data collection. The forecast for 2003 is based on BAA estimations made prior to the opening of the Heathrow express in 1998.

3.1.4.3 Construction and operation of the Heathrow Express

The private company BAA Ltd, formerly British Airports Authority, financed the complete construction for the Heathrow Express (valued at 440mn GBP in 2000), while Railtrack was responsible for improvements to existing track infrastructure (Vickermann 2000). Railtrack was a group of companies that owned the track, signaling, tunnels, bridges, level crossings and all but a handful of the stations of the British railway system from its formation in April 1994 until 2002, when it was sold to Network Rail, the government-created owner and operator of most of the rail infrastructure in Great Britain. Heathrow Express' construction cost was relatively low. According to (de Neufville 2006), the main reason is the reuse of long portions of existing track infrastructure. The main construction activities for the Heathrow Express were the digging of a 5-mile tunnel, construction of underground stations at Heathrow, and electrifying part of the Great Western Main Line between Paddington and a station called Airport

Junction. The Great Western Main Line is a main line railway that runs westwards from London's Paddington station to the west of England and South Wales, with its core running between London and Bristol. The Heathrow line runs from Paddington to Airport Junction. Up until Airport Junction, tracks are owned by Network Rail. The line from Airport Junction to the airport terminals is owned by BAA but maintained on their behalf by Network Rail. The Heathrow Express is operated by the Heathrow Express Operating Authority, which itself is fully owned by BAA Ltd. After the presentation of facts in this section, the story of the Heathrow Express is told in the remainder of this case study.

3.1.4.1 History of Heathrow and the Heathrow Express

The parcel of land that today is Heathrow has been used as a military airfield since 1930 and throughout most of World War II, until 1943. In 1946 control of the airport was turned over to the Ministry of Civil Aviation and, later within the same year, fully opened for civilian use. The originally three runways (1947) have been reduced to two parallel ones today. Terminals 2, 3, and 1 opened in 1955, 1961, and 1968, respectively. Located in the center of the airport, the cluster of terminals has since become an obstacle to further expansion. Their placement dates from a time when only the wealthy could afford to fly and would be dropped off and picked up from the airport by private chauffeurs. Extensive parking facilities did not seem necessary for air travelers at the time. By 1968, Heathrow was handling 14 million passengers annually. Inner London had a population of around 7.5 mn at the time, and the outer boroughs contributed another 4.4 mn people to the metropolitan area population (Demographia 2010). Greater London's population declined steadily in the decades after World War II until the late 1980s, when it started to increase again, encouraged by a strong economy and an increasingly positive image of London as a city. The rapid increase in population from the mid-80s onwards exposed the dire condition of much of the subway (Underground) and commuter rail infrastructure and stimulated lobbies both for their improvement and for new lines (Travers 2009). It took until 2000 however, after construction of the Heathrow Express, until reinvestment in the Underground took place (Travers 2009).

In 1977 the London Underground Piccadilly line was extended to Heathrow and made it accessible by transit in just under an hour. By the early 1980s terminal space needed to be expanded to accommodate the then 30 million passengers Heathrow was handling annually. In 1986 the M25 motorway (London Orbital Motorway) was completed and connected Heathrow directly to much of the rest of the country.

Due to political disputes in the early 1980's between London Mayor Ken Livingstone and the Conservative government under the leadership of Margaret Thatcher, London's central municipal government was abolished and only reinstated in 2000 under Prime Minister Tony Blair. Along with a number of other transportation privatization initiatives under the Thatcher government, the British Airports Authority was privatized in 1987 and became BAA Ltd. BAA today is the owner of Heathrow, six other UK airports and the Heathrow Express. A political review in 1983 of the future of Heathrow determined that the further growth of the airport should be contingent on the creation of a high-speed rail link (Transportation Research Board 2000). In a policy document published in 1996 (Government Office for London and Department of Transport, 1996, pp. 17–18), a number of reasons were given for investments in new rail infrastructure. These reasons were: improving London's competitiveness; the stimulation of regeneration; and achieving the government's environmental goals. Congestion was far less important in this 1996 document than it is today, presumably because the deep recession that took place between 1990 and 1992 had cut traffic (Travers 2009). The UK enjoyed a prolonged period of economic growth from 1992 to 2008 (Transportation Research Board 2000). All those reasons taken together-economic growth, call for investment in rail and perception as necessity of a high-speed rail link for Heathrow's future expansion- led to the decision to construct the Heathrow Express. The Express opened in 1998 after five years of construction.

Today, Heathrow serves 66 million passengers annually and possesses five terminals and two parallel runways. Passenger numbers are increasing rapidly and Heathrow suffers from severe landside and airside congestion. Road congestion results in travel time of over an hour, compared to just over 40 min in free-flow condition for the 14 miles from London's city center (Eddington 2006). The London Plan (Greater

London Authority 2008), published by then-Mayor Ken Livingstone in 2004 and since edited, estimated that the population would reach 8.1 million by 2016, and continue to rise thereafter, putting pressure on London's ground and air transportation system.

Even though the Heathrow Express was delivered without delay and mostly successfully (with the exception of a tunnel collapse that is detailed in the next section), different critics of London's transit systems make somber prognoses about London's ability to deal with the increasing road-side congestion around Heathrow.

Railway services to destinations outside London are very limited from Heathrow, and those that are available have to be accessed by a shuttle bus. Givoni and Rietveld (2008) view Heathrow's stronger integration into the national rail network as a promising measure to combat road-side congestion. They observe however that the benefits of rail do not seem to be recognized in the UK at airports such as Heathrow. The White Paper that is mentioned in the following quote is White Paper on The Future of Air Transport (DfT 2003b) that contains the UK air transport policy for the next 30 years.

The debate on the future of air transport, as reflected mainly in the consultation leading to the White Paper, gives the impression that the rail and air transport industries seek to minimize the interaction between them. [...]In the UK air transport policy debate, much focus is placed on runway and terminal developments at Heathrow's main hub rivals (DfT 2003a, 2003b, Vandermeer 2001), but their rail developments are overlooked.

(Givoni and Rietveld 2008, p. 290)

Travers (2009) seconds their doubts as to London's ability or willingness to plan intermodal airport access. He describes land-use and transport planning in London as fragmented, even though the creation of the Greater London Authority and Mayor's "London Plan" created a little more cohesion than was previously the case. While plans are regularly produced, resources have never been consistently available to act on those long-term projects in a consistent way. Analysis techniques such as cost-benefit analysis

and environmental-impact assessments are widely used and yet decisions are often made in such a way as to suggest they are political or pragmatic rather than as part of a thorough rational process (Travers 2009). Against such as background it is surprising that the Heathrow Express was constructed at all, and constructed fast. The complete private financing and construction of Heathrow Express by BAA Ltd. seems to play a large role in explaining this outcome. The following sections talk about the “inner life” of the project during planning and construction of the Heathrow Express.

3.1.4.2 Tunnel collapse and impact on project management at BAA

Construction of the Heathrow Express took place from 1993 to 1998. It is worth noting that like the Hong Kong express, the Heathrow Express was completed nearly on time despite a major setback. In 1994, one partially constructed tunnel collapsed, destroying an office building and a car park. Harper recounts in an article in *The Guardian* how a results- oriented mindset led to slips in safety precautions.

A report by the health and safety executive concluded that warning signs that all was not well had not been recognised. It [the report] said the problem would not have occurred if safety had been put before results. [...] Kevin Myers, the executive's chief inspector of construction, said: "The collapses could have been prevented but for a cultural mindset which focused attention on the apparent economies and the need for production rather than the particular risks." [...] He said large projects carried out close to the public required particular attention, and production pressures had to be balanced by precautionary safety systems.

(Harper 2000)

The tunnel collapse had far-reaching repercussions on how project management was done at BAA. Brady et al (2006) recount that instead of “going down the litigation route”, BAA decided to work together as partners with the contractor Balfour Beatty and quickly move on to reconstruction. At one point the Heathrow Express was 24 months behind schedule, but thanks to integrated team work (Brady et al 2006) the Heathrow express commenced service 9 months behind the projected date. Balfour Beatty was

eventually litigated after the Heathrow Express was finished, found guilty of negligence, and fined GBP 1.2 million (Harper 2000).

3.1.4.3 Expectations

Similarly to Chicago, the construction of the Heathrow Express served two larger strategic goals, in addition to bringing passengers to the airport. It signaled London's competitiveness as a global city on the one hand, and was part of a larger project to regenerate Paddington Basin in London on the other.

According to Raco and Henderson (2009), development pressures emerged from several places within London, but Paddington ticked

all the necessary boxes of a 'sustainable' urban regeneration project. It provided brownfield, inner urban sites for new employment-oriented land uses adjacent to an existing public transportation hub. At the same time it solved a local political problem for politicians and planners in Westminster by diverting development pressures away from affluent, conservative neighborhoods.

(Raco and Henderson 2009, p. 307)

Therefore, Paddington was chosen as the location for a larger urban regeneration project in London, of which the construction of the Heathrow Express was an important part. It encouraged national and international companies to move in to the canal basin surrounding Paddington. A key catalyst for the first development phase was the designation of the Paddington Special Policy Area (PSPA) by the Westminster City Council (WCC) in 1988 (Raco and Henderson 2009, p. 306). In that sense, the airport express did receive important city government support even though it was completely privately financed. One of the "boxes" that Paddington ticked was the absence of local communities who might be opposed to major construction or possible displacement. Raco and Henderson (2009) conducted several interviews regarding the Paddington regeneration project over the course of three years. A number of their interviewees noted that,

one of the reasons for investing in the area has been the explicit absence of local communities and the de-politicised nature of the development in a context where “the community doesn’t yet exist”. The boundaries of the PSPA were specifically drawn to exclude residential communities. As a WCC planner noted:

“in the local context we’ve never actually had to argue our case . . . Paddington has never been to a public inquiry, our policies have never been challenged by anyone at the UDP [Urban Development Plan] level . . . so we’ve never been tested!”

This partly reflects the local geographical imaginations of development that exist in Paddington with much of the new investment being made in relatively ‘invisible’, marginal and ‘un-owned’ (in community terms) sites between the railway lines and the Westway Motorway.

(Raco and Henderson 2009, p.308)

They further observed that:

Institutional respondents also noted that it has proved almost impossible to establish coherent engagement mechanisms in the Paddington area owing to its social diversity and complexity. According to WCC’s leader it is filled with “terminally hard to reach communities” as is a “reception area for people newly arriving in the country or in to London, so what you get is a turnover of people who will always start at the bottom”. In addition, it has an extremely high social and linguistic mix. In 2001 71 per cent of Westminster’s BME (black and minority ethnic) communities were located around Paddington, a significant proportion of whom were ‘refugee and asylum seekers’ (Westminster Primary Care Trust, 2004). The political consequence of this mix, it is argued, is a lack of engagement and/or interest in local development politics amongst local communities and, more significantly, a disparity between the bureaucratic– institutional mechanisms of community engagement that WCC and local developers have tried to establish and the life-worlds of people living in the Paddington area. Marrying these up in a simple way has proved to be a major challenge.

(Raco and Henderson 2009, p. 308)

It needs to be noted that long-standing community groups did exist in the Paddington area that have campaigned for particular outcomes. Significant community politics have arisen and heated discussions were led around the local benefits from the regeneration of the Paddington Basin. Local residents reported

in focus groups disengagement from the developments that had taken place in the Paddington area.

Criticisms were advanced that little had been done to tackle drug-related crime in the area and to improve the quality of urban environments in the northern parts of Paddington. An increasing sense of polarization developed between the security-patrolled PSPA and a newly formed Business Improvement District to its south, and the uncontrolled and unregulated spaces surrounding it (Raco and Henderson 2009).

3.1.4.4 Reception of the Heathrow Express

According to the corresponding Wikipedia article, the express has been

generally well received, not least because steps were taken to reduce the environmental impact of the train line. Measures included disguising ventilation shafts as barns. The service has received some criticism, however, particularly of its high fares and the poor air quality at Paddington station due to the fact that all main-line trains there are diesel-hauled.

(Wikipedia, “Heathrow Express”)

In terms of mode share (9.6%) and general public perception, the Heathrow Express can be considered a moderate success, despite overly optimistic projections that remained unfulfilled. Planners in Westminster achieved their goal of signaling London’s global city status and the Express attracted lots of investments from global and national companies. The question of whether the impoverished areas surrounding Paddington were improved sustainably is however unclear at this point. Despite undeniably positive outcomes, socio-economic conditions in the neighborhoods surrounding Queen’s Park to the north of the development remain among the poorest in England:

with more than 60 per cent of its children living in families receiving benefit (Westminster Primary Care Trust, 2004b). The Harrow Road and Bayswater wards are also amongst the 100 most ‘housing deprived’ wards in the country and in 2008 the former was still within the most 25 per cent of deprived wards in England, with one neighbourhood ranked amongst the poorest 5 per cent (WCC, 2008). Just under a third of the working population in the area is classed as ‘economically inactive’ and despite the regeneration project, by 2002, official unemployment rates in adjacent neighbourhoods was 10.5 per cent, well above the

London average and not including those on incapacity benefits and others excluded from the claimant counts (Select Committee on ODPM, 2002, paragraph 239). It is impossible not to contrast these ongoing problems with the wider perception that the regeneration has been ‘successful’ in policy terms. Its most significant economic benefits have been accrued by in-migrating companies and property investors, whilst WCC’s broader political credibility and reputation have also been significantly enhanced.

(Raco and Henderson 2009, p. 310)

Finally, Raco and Henderson caution against too high expectations for urban development from flagship projects, as are often held by developers of airport-rail links. While the agenda of urban regeneration and development of a deprived area has fostered the implementation of the Paddington regeneration project with the Heathrow Express as a core component,

the capacity of urban regeneration policies to deliver on these promises remains a source of contention.

Research has consistently shown that even though major projects are often located in the poorest urban areas, they do not necessarily lead to the development of those areas (Massey, 2007; Jones & Evans, 2008).

(Raco and Henderson 2009, p. 302)

3.1.5 *Paris- Charles de Gaulle*

Charles de Gaulle is in the same situation as Chicago when it comes to ground access to the city center. A suburban rail line, the RER B, serves the airport express as well as the surrounding suburbs. A high-speed connection to downtown is in planning. The high-speed connection has already seen a delay of a few years during which plans were revised, due to strong opposition by residents to the express. While the projected express is extremely unpopular with adjacent communities, opposition so far has been civilized, peaceful and well-informed.

3.1.5.1 History of the shared service RER B at Charles de Gaulle

Paris Charles de Gaulle, also known as Roissy Airport, is the main airport serving the Paris Metropolitan region and one of the main airports in Europe. The airport serves as a hub for Air France. Charles de Gaulle handled 57.9mn passengers in 2009 (Airports Council International).

Charles de Gaulle is connected to Paris by the RER, Paris' suburban rail network, and to all of France by the TGV, France's national high-speed rail network. The RER B was inaugurated in 1977 and extended to station Aéroport Charles de Gaulle 1 in 1981, in 1994 to Charles de Gaulle 2-TGV. In 1994 the RER B line was also connected to Paris' second airport, Orly, via the automatic OrlyVAL metro line that runs between RER B's Antony station and Orly. RER B serves a number of stations between downtown Paris and Charles de Gaulle, including many connections to Paris' city transit system. Service runs every 15 minutes and takes 35 minutes between Charles de Gaulle to downtown. The southern part of the RER B line (south of Gare du Nord) is operated by RATP (major transit operator in Paris and surroundings), the northern part by SNCF (French National Railway Corporation). Trains are owned by either company. Bus service to downtown is provided by Air France and RATP.

Unlike Chicago, Charles de Gaulle is also connected to France's regional high-speed TGV network and other national trains. Integration of Charles de Gaulle into the national rail system has been a major focus

over the last decade. Originally, the traveler needed to travel to downtown to connect to the TGVs or regional trains. With the creation of a new TGV loop line around Paris that connects to the airport, trains with long-distance destinations such as Lyon (2hr) and Brussel (1.5 hr) can be boarded directly at the airport. In 1994 the RER B line was also connected to Paris' second airport, Orly, via the automatic OrlyVAL metro line. Ridership on that line has been far below expectations and hopes of sustained private operation did not materialize. The line was turned over to the state after a few years of losses. RER B makes a number of intermediate stops on its way to downtown Paris, including downtown stations that offer good connections to Paris' transit system. Bus service to downtown exists as well and is provided by Air France and RATP, the major transit operator in Paris and surroundings. According to (Transportation Research Board 2000), mode share at Charles de Gaulle breaks down as summarized in Table 3-5 (Aéroports de Paris, 1999 interview with Leigh Fisher Associates, cited in Transportation Research Board 2000).

Table 3-5: Mode share at Charles de Gaulle (Source: Transportation Research Board 2000)

Mode	Share
Rail (RER B and TGV)	20%
Bus	11%
Taxi	33%
Other	26%
Total	100%

3.1.5.2 Plans for CDG express

Plans for the new express service, the Charles de Gaulle (CDG) Express, are much further underway than those in Chicago. The concession contract was awarded and signed in 2008, even though the concessionaire is not named on any of the websites pertaining to the project. Opening of the CDG express is slated for a time between late 2012 and 2015 (Charles de Gaulle Express link). The projected journey time is 20 minutes, and the new express would depart from Gare de l'Est station in Paris. The total cost of the project is estimated at €760 million (Charles de Gaulle Airport Express Link). One reason for support of the project was Paris' candidacy for the 2012 Olympics, which however is not relevant anymore.

The CDG Express' official website provides the image of a tightly integrated project between Aéroports de Paris (ADP), SNCF (the French national rail company) and RFF, a publicly-owned industrial and commercial company (CDG Express official website). Those companies will each assume different tasks during construction. RFF will guarantee the availability of the required train paths throughout the duration of the contract. SNCF, through a contract with the concessionaire, will maintain the tracks and provide the safety license and certification. ADP will supervise all construction work carried out in airport areas, particularly those relating to the under pass beneath Runway 4 of Paris-Charles-de-Gaulle Airport.

RFF, SNCF and Paris Airports kicked off the project in 2000 by establishing an Economic Interest Group to propose a public service solution that would be capable of meeting demand for a direct airport rail link. Several stakeholder meetings were held in 2006 in communities adjacent to the proposed tracks. These meetings were an extension of the public debate that the project caused in 2003.

The concessionaire will be responsible for financing, designing, constructing and operating the new infrastructure for the rail link, as well as supplying and maintaining rolling stock and operating passenger service. Being a full concession according to the official website, the private concessionaire will not receive any government money and has to recuperate investments through fares (CDG Express official website).

The route currently under discussion for the CDG Express, called the “Virgule”, emerged in the course of a public debate held in 2003 and in reaction to severe local protest. With a total length of 32 km, new plans for the CDG Express will make use of existing infrastructure of the RER B. Current plans call for the dedication of two of four tracks along the CDG corridor to local commuter trains, and for the CDG express to share the other two tracks with regional and freight trains.

3.1.5.3 Stakeholder meetings

Several stakeholder meetings were held in 2006 in communities adjacent to the proposed tracks. Brief summaries of transcripts of four stakeholder meetings in late 2006 are provided below. The atmosphere

during those meetings was still one of strong opposition and animosity, as is evidenced by the meeting transcripts (in French) from the communities Sevrans, Bourget, Mitry-Mory, Aulnais-sous-Bois and Villepinte (2006). The meetings transcripts are available on the official website of the CDG Express link.

All meetings commenced with a briefing over what had happened since 2003. Following public protests in 2003, the project had been handed over from the Paris city planning authority to the French national Ministry of Transportation, which decided upon the new route “La Virgule” and financing of the project in form of a full concession, charging complete construction cost to a concessionaire. The tender for a concessionaire was launched in July of 2006, prior to the meetings for stakeholder engagements in late 2006. The project was believed to have been made more palatable through the fact that no public money would be spent and a changed, shortened route.

The main point of critique is that money will be invested in an “elite” airport express when local commuters are stuck in an overheated, overcrowded and unreliable commuter train (RER B). They argue that these conditions prompt commuters to drive to work by car, and that a higher improvement in air quality and public benefit could be achieved by providing a much better service for the local population who far outnumber airport travelers. The French government quickly proposed a parallel project in 2006 in reaction to those claims, called RER B Nord+, intending to improve the elderly RER B line. The state agreed to finance 50% of the project cost instead of the usual 30% for infrastructure projects. The opposition appears to be well-organized, well informed and articulate in the meetings.

Sevrans community (250 participants, Réunion publique de Sevrans 11-13-2006): A main argument is that the RER B line is in much more dire need of improvement. The Mayor of Sevrans demands that the RER B improvement project, called project B Nord+ be financed entirely by the national government.

Investment costs for project RER B Nord + are estimated at Euro 500mn. A speaker for Paris’ regional planning authority, Francis Rol-Tanguy, explains that infrastructure projects are generally only funded by the national government at 30% and that the government’s willingness to fund 50% of RER B Nord+ is

an accommodation of the commuter suburbs along the planned CDG Express. He expects the RER B Nord+ to be completed by 2011.

Other objections voiced include annoyance through the construction work, fear that the banlieue area (commuter suburbs) will not receive any benefits from the project, since the CDG Express will only run through but not stop at intermediate stops, and a feeling of injustice that airport travelers receive a new train while commuters are stuck in the crowded, unreliable, hot RER B line. It is mentioned that 2,000 petitions against construction of the CDG Express and for the modernization of the RER B line were signed.

Aulnay-sous-Bois (85 participants, Réunion publique de Aulnay-sous-bois 11-29-2006): Protest from participants concerns questions of equity because of the “elitist beneficiaries” of the project and the need for improvement of the RER B trains. A spokesperson of a neighborhood association demands to have RER B train put on omnibus. He also expresses fear that the CDG Express will be turned over for public financing as has happened with the failed OrlyVal people mover. OrlyVal was initially operated by a private concessionaire, but became a public project after a few years and much lower ridership than expected. Another participant suspects that Paris city officials want to keep airport travelers and the local populace separate. The president of the organization “Vivre sans CDG Express” (“Living without the CDG Express”) expresses both doubt as to profitability of the planned express if 6 mn riders per year would not be achieved , as well as significant environmental benefits if ridership won’t be high enough. Both of those arguments have been used as main selling points in this and the other meetings. Noise concerns are expressed with regards to nightly freight trains sharing the CDG Express tracks.

Mitry-Mory (100 participants, Réunion publique de Mitry-Mory 12-06-2006): Concerns about equity and noise are expressed again. A speaker for Paris’ regional planning authority, Francis Rol-Tanguy, mentions improved air quality as one of the benefits of the project. The argument is countered by the

theory that in order to improve air quality it would be advisable to improve the local RER B train, so that local inhabitants wouldn't drive their cars to work in the inner city.

Villepinte (9 participants, Réunion publique de Villepinte 11-15-2006): Little attendance and opposition. The Mayor of Villepinte wishes to have a stop at Parc d'Expositions de Villepinte.

3.1.5.4 Institutional cooperation

From a broader perspective, the way planning of the CDG Express progresses is evidence for a remarkable turnaround in inter-agency collaboration in Paris. After years of poor integration between different transport modes, transport policy surrounding CDG changed in the 1990s, “transforming CDG airport from a buffer between transportation modes into a facility serving linked intermodal travel” (Perl 1998, p. 189). CDG transformed from a “buffer between transportation modes” (Perl 1998, p. 189) to an exemplarily integrated intermodal hub, “second only to Frankfurt” (Givoni and Rietveld 2008, p. 293). Perl recounts the silo thinking of both ADP and SNCF, neither of whom viewed it as their job to integrate CDG into the national rail network, “because this task fell outside their logic of appropriate action” (Perl 1998, p. 190). Those agencies have come a long way since the close collaboration that is demonstrated during planning for the CDG Express. During a time of increased competition from high-speed rail and other European hub airports, ADP and SNCF joined forces because both were engaged in new forms of infrastructure development that generated mutually advantageous opportunities for collaboration.

Parallel organizational thinking was a necessary but not sufficient condition for formalizing inter-organisational collaboration between ADP and SNCF. To progress beyond informal interaction, a forum in which the organisations could negotiate was needed, one that would allow them to avoid the exposure to government bureaucracy. France's traditional use of high-level working groups to initiate new policy options offered that. In 1985, the Funel commission laid the foundations for a TGV interconnection that would encircle Paris. [...]

In 1994, an HST station opened at CDG, directly under Terminal 2 (and to be linked to Terminal 1 by a people mover). The station became the sole point at which all branches of France's high-speed rail network intersect.

(Givoni and Rietveld 2008, p. 295-296)

This close level of collaboration is a significant difference to Chicago, where agencies still operate in fairly segregated ways.

3.2 **Small case studies**

3.2.1 *Kuala Lumpur*

Kuala Lumpur is a success story of airport express planning and construction. In a number of ways, it seems like Hong Kong's little brother because it shares many similar characteristics. An old airport became congested, a location for a new airport had to be found suitably far away from the city center to minimize adverse effects and because of the distance, a dedicated rail connection seemed like a necessity to the initiating national government. The Asian financial crisis delayed the project briefly, but strong government support carried the project through to completion. Kuala Lumpur is notable for its construction and operation by consortia of private sector companies. These arrangements speak for a high level of communication and interaction between the different members.

Kuala Lumpur International, located in Malaysia, is one of Southeast Asia's major aviation hubs, serving 26 mn passengers in 2006 (Airports Council International). The airport serves as a hub for Malaysia Airlines, MASkargo, AirAsia and AirAsia X. The planning of Kuala Lumpur International began in 1990, due to congestion of Subang International Airport. The airport site 35 miles outside of Kuala Lumpur was partially chosen to minimize social and environmental disruption from its construction ([www. kiat.net](http://www.kiat.net)). A village of aboriginal inhabitants, the Organg-Asli, however had to be relocated. They were offered new farmland as compensation for their relocation (www. kiat.net). Due to the airport's conception as major

hub airport and location far outside the city center, a rail link appeared necessary for successful operation of the new airport (Mohamad 2003).

Another parallel to Hong Kong is the fact that two price-segregated services are operated on the same tracks: the KLIA Express, a dedicated express, and the KLIA Transit train, a commuter service making three intermediate stops. The KLIA Express commenced service in 2002 and takes 28 minutes from the Kuala Lumpur City Air Terminal at the airport to central Kuala Lumpur. KLIA Transit makes the trip in 35 minutes (Mohamad 2003, Wikipedia “KLIA Ekspres”).

In 1997, the Malaysian government granted a 30-year concession to the company Express Link Sdn. Bhd. to finance, construct, operate and regulate the rail services connecting Kuala Lumpur and the airport. Construction of the Express Rail link began in 1997 and was completed 5 years later (Wikipedia “KLIA Express”). Express Rail Link Sdn. Bhd. is a joint venture company between the Malaysian companies YTL Corporation Bhd., Lembaga Tabung Haji and Trisilco Equity Sdn. Bhd., with each partner holding 50%, 40% and 10% of the company respectively (Mohamad 2003). After construction was finished, the Express Rail link was handed over to SYZ consortium, a joint relations consortium between German and Malaysian companies consisting of Siemens AG, Siemens Electric Engineering Sdn. Bhd and Syarikat Pembinaan Yeoh Tiong Lay Sdn. Bhd (SPYTL), a wholly owned subsidiary of YTL Corporation Bhd (Mohamad 2003).

ERL Maintenance Support Sdn. Bhd. was established in 1999 to operate and maintain the rail link. It started out as a joint venture between the Express Rail Link Sdn. Bhd. and Siemens AG, but is now fully owned by the Express Rail Link Sdn. Bhd. (Wikipedia “KLIA Ekspres”).

The Asian financial crisis starting in 1997 delayed the project briefly, but strong government support for the airport rail link continued. The overall project cost RM 2.4 bn and was funded through a combination of equity (RM 500 mn), loans of RM 940 mn from the Development and Infrastructure Bank of Malaysia, and the remaining balance by credit export facilities from four financial institutions of Germany. Express

Rail Link Sdn Bhd achieved a profit in 2003 after only one year of operation (Mohamad 2003). Almost certainly, Mohamad denotes an operating profit.

3.2.2 Seoul- Incheon

At first, Seoul seems to retell the story of Hong Kong and Kuala Lumpur of the new airport located outside of the city center which needs to be connected to the airport by a dedicated rail link. Seoul also demonstrates a vinculated set of consortia of private sector companies that financed and constructed the express, similar again to Kuala Lumpur. However, planners were not able to build the complete tracks at once. Currently, two airports are connected with each other, but not with the city center. Ridership is far below expectations on this relatively useless link and the heavily deficient operations on the AREX airport express are criticized harshly by some. The government is obliged to make up for 90% of the operator's operating losses. At present, Seoul is an example for a build-operate-transfer agreement gone wrong.

Incheon International Airport in Seoul was opened in 2001, replacing the older and congested Gimpo Airport as main airport for the Seoul metropolitan area. Incheon is located 43 miles outside of Seoul and serves as hub for Korean Air, Asiana Airlines and Polar Air Cargo. The airport currently handles 44mn passengers annually (Korea heute).

An airport rail link, AREX, exists between Incheon and Gimpo airports. Both express and commuter trains are operated, taking 28 and 33 minutes from Incheon to Gimpo airport, respectively. The commuter service has six intermediate stops. About 60% of the line is underground. A rail extension from Gimpo to Seoul station in downtown Seoul was due for completion in 2010 (Heojongsik 2009), however that date has been taken off of AREX' official website (Korail Airport Railroad). A future extension to Seoul station would integrate the current connection between two airports with Seoul's public transit system. AREX is operated by the Korail Airport Railroad Co., Ltd., whose largest shareholder is Korail (88.8%), South Korea's national railroad operator. The airport express is the first railway concession project in Korea. The Korail Airport Railroad Co., Ltd. is the successor of the Incheon International Airport

Railroad Company (Iiarco), a special purpose company incorporated in March 2001. Iiarco has a 30-year operating concession starting from the end of construction. In March 2009 Korail acquired 88.8% of Iiarco for 1.2 trillion won (Korean Times) and changed its name to Korail Airport Railroad (Heojongsik 2009). Iiarco (Incheon International Airport Railroad Company) was held by 11 shareholders, including Hyundai (27%), Daelim (18%), POSCO Engineering and Construction (12%), Daelim Industrial (10%), Dongbu Corporation (10%), Korea Rail Network Authority (10%), and six other Korean companies.

Phase 1 of the airport link project, the connection between Incheon and Gimpo airports, opened in 2007 after 6 years of construction (Jackson 2007) and 10 years after planning started (Korail Airport Railroad). Construction cost is put at roughly 3.9 bn won, of which 3.1 bn has been raised by a private-sector consortium led by Hyundai Engineering & Construction (Jackson 2007). Phase 1 was constructed by IKFC (Incheon Korean French Consortium), a consortium headed by Eukorail. Eukorail includes as partners the French company Alstom and the South Korean company Hyundai Rotem. Total investments amount to 3,949 bn won (2002), comprising 931 bn of equity, 845.8 bn of public capital subsidy, and 2,172.2 bn of debt financing underwritten by Korea Development (Korail Airport Railroad). The investment split has been roughly 25% public and 75% private.

Knutton (2004) reports that the project is considered a priority by the Korean regional and national governments: “The project is strongly supported by national and regional government as a means of linking the Incheon hub to Seoul and the recently-opened KTX high-speed railway, which runs from Seoul Central station to Busan.”

Ridership has been far below expectations to date and AREX’ operating losses are a major political problem (Korean Times, Heojongsik 2009). Operating losses were 740bn won in 2008, according to the Korean Times. The purchase of Iiarco by Korail was intended to help reduce the state’s burden on the loss-making railway. The Korean Times claims in an article that this was “just a ploy to share the burden with Korail without any plan to scale down the astronomical operating losses” (Korean Times).

The airport railroad is Korea's first railway to be built and operated by private capital under a "build, operate and transfer" contract. Under this contract Iliarco (now Korail Airport Railroad) builds the railroad and operates it until 2040, at which point it will be turned over to the Korean government. The government is obliged to make up for 90% of the railway's operating losses. In 2007 and 2008, the shortfall the government had to cover was 104 bn won and 166 bn won, respectively (Korean Times).

The Korean Times accuses the government of "recklessly pushing the project without making a correct estimation about the potential number of railway passengers." Iliarco had predicted a number of 210,000 daily passengers in 2007, the first year of operation, and 490,000 daily passengers when the airport railroad would have a direct link to Seoul Station. However, average daily ridership in 2008 has only been around 16,000, thus remaining far below expectations. The Korean Times concludes that "This means that the private builders played a hoax to get compensation for operational losses from state coffers. Taxpayers are forced to shoulder the burden on the unprofitable railway because of policymakers' negligence and poor preparation for the project."

It is expected that ridership will pick up with the opening of the connection between Gimpo Airport and Seoul.

3.2.3 Shanghai- Pudong

Another airport that replaces a congested legacy airport is located far outside the city center. An ambitious government decides to make a statement with its rail link: the first magnetic levitation airport connector worldwide is constructed, but it drops people off on the outskirts of the city center and as a result, ridership has remained far below expectations. Proposals to extend the line to Beijing to make are met with massive stakeholder protests. "Relocation motivation workshops" and changed plans to construct part of the tracks to Beijing underground have not been able to tame protests to date.

Shanghai Pudong airport is the major airport serving the metropolis Shanghai, handling 50 mn passengers between July of 2009 and 2010 (China Hospitality News 08-12-2010). It is the main hub for China

Eastern Airlines and Shanghai Airlines, as well as a major hub for Air China. Pudong was constructed to supplement the congested Hongqiao airport, which remains in operation to date.

Located 19 miles outside of the city, Pudong is served by the first commercial high-speed magnetic levitation (maglev) train. Construction of the maglev line began in March 2001 and public service commenced on January 1, 2004. The so-called Shanghai Transrapid project took ¥10 billion (US\$1.33bn) and two and a half years to complete (Maass 2008). The maglev train is able to make the 19 mile-trip in around 7 minutes depending on the time of day. It ends in the outer parts of Shanghai and requires a longer subway or cab ride for a traveler to reach his actual destination within Shanghai. Pudong is also connected to Shanghai's city subway via line 2 from Pudong airport to Longyang Metro station.

Ridership on the maglev train has remained far below expectations and the project is highly deficient. The Asia Times (Zhong 2007) called the project an image project that was built to show off "correct leadership and performance of officials in charge". Because of the express' unique technology, the service is not integrated with Shanghai's massive underground transit system, "and as such virtually goes nowhere" (Zhong 2007). The vast majority of travelers are not dropped off where they need to go, but need to transfer to the subway system or cabs to reach their destination. In addition, the maglev train is expensive at 50 yuan (\$ 5.40) for a one-way ticket. Zhong reports that the trains are 80% empty, making the service commercially non-viable. When planning began in 2001 10mn annual passengers were expected. At the end of 2007, actual ridership was around 4mn. Between 2004 and 2007, the maglev train had an operating loss of 100 bn Euro according to the China Business Journal, as quoted by (Erling 2009).

Several proposals have been brought up to extend the maglev train to make it more viable through a wider scope of destinations. A proposal to link Beijing and Shanghai was strongly opposed by the Ministry of Railway, citing impracticality, high costs and high risks. The proposal has been vetoed since by the central government. In early 2004, Chinese president Hu and premier Wen started to impose

macroeconomic controls on China's economy, putting a brake on the construction of impractical, unneeded "image" projects.

In 2006, Beijing gave green light to build a Shanghai-Hangzhou maglev railway (towards Beijing), supposedly under pressure from the Shanghai clique. Since then, a series of public protests led to the repeated suspension of the Shanghai-Hangzhou line. Shanghai Daily reported in March 2010 that the Shanghai-Hangzhou extension had finally been approved, with construction to start in 2010 (Shanghai Daily online 3-14-2010). Shanghai residents protested because of concerns about radiation and noise. Zhong (2007) reported following the first project announcement that the Shanghai government had been “under huge pressure over the past months, with crowds of petitioners against the railway knocking on their doors every day and thousands of complaints being received online. The Minhang District government alone was besieged by more than 5,000 petitioners in a single day in March.” Lorenz (2008) talks of “hundreds, if not thousands” of protesters in 2008 who demonstrated against the Shanghai-Hangzhou extension. At that time, the Shanghai government was seriously preparing the extension. “Relocation motivation workshops” were held to prepare the 6000 families and numerous businesses that would have to be relocated.

It was believed in 2007 that the connection line would be operating by the time Shanghai hosted the world expo in 2010, which however has not materialized. When the Chinese government announced massive public investments (430 bn Euros) to help stabilize their economy following the world economic crisis, plans for the maglev extension were revisited (Erling 2009). In order to reduce the impact on local residents, the planned tracks were shortened and moved underground for large parts of the way (Lorenz 2008). Severe protests however continue.

3.2.4 Bangkok- Suvarnabhumi

Bangkok's brand new airport express opened commercial operations on August 23, 2010, 4 years after Bangkok's new airport commenced operations. Despite its short history, it is noteworthy how the project

was pushed to completion despite a series of setbacks, “only” 1.5 years behind schedule. The project had been delayed multiple times for a number of reasons, most notably the Asian financial crisis of 1997, a lengthy bidding process, a series of legal challenges of landowners who had encroached on State Railway of Thailand’s property, and technical problems. Construction costs remained within budget for the government, thanks to a contract structure that specified the exact amount a private contractor would be paid for delivery of the project. Initial ridership developed, at least during a ride-for-free trial, but remained below expectations.

Suvarnabhumi Airport is one of two airports serving Bangkok, Thailand. It opened in 2006 and replaced the congested Don Muang airport as the primary international airport. It serves as a hub for Thai Airways International, Bangkok Airways, Orient Thai Airlines, and Thai Air Asia.

Planning of a second airport for Bangkok started in the 1960s. The process was slow from the start. In 1973, the land that the airport was built on was acquired. Because of political and economic instabilities, notably the Asian economic crisis of 1997, civil construction was pushed back to start in 2002. The airport was completed 4 years later. The Suvarnabhumi Airport Link was opened on August 23, 2010 (MCOT.net). Service had been operating on a trial basis since June 1, attracting about 17,000 people a day traveling for free (Bangkok Post 08-23-2010). These numbers are far below expectations from 2005. The airport express operates non-stop and commuter service, the latter one including six stops. Traffic in 2005 was estimated at 4,000 passengers per hour per direction for non-stop service in 2008, increasing to 50,000 passengers per hour per direction by 2037. The commuter option was expected to be busier and carry 37,000 passengers per hour per direction in 2008, and 184,000 per hour per direction by 2037 (Briginshaw 2005). Promotional fares are offered until the end of the year 2010 to attract ridership. A number of set-backs delayed completion of the express. The so-called Hopewell debacle (abandoning of express project to Don Muang airport), an extended bidding process, and a series of legal challenges from property owners who had encroached on State Railway of Thailand’s land repeatedly held up the project (Wikipedia “Suvarnabhumi Airport Link”). Other reasons for the delay include flooding at the

construction site, the State Railway of Thailand's failure to deliver land to the contractor, and power supply problems (Bangkok Post 08-23-2010).

The line is built largely along the same alignment as the failed Bangkok Elevated Road and Train System (BERTS) project. The so-called Hopewell project was started by Hopewell but stopped in 1997, during the Asian financial crisis, when only 10-13% had been completed. The Hopewell project was a planned elevated connection to Don Muang Airport. Some BERTS pillars stood in the way of the new system, and after extensive debate on their suitability for reuse and demands for compensation from Hopewell, SRT decided to demolish the pillars and build new ones (2Bangkok.com).

In 2005, when the airport link contract was signed, total project cost was estimated at baht 25.9 billion, or \$675 million at the time (Briginshaw 2005). The cost was financed by a consortium of Thai banks. Only 30 months were budgeted until completion of the express, plus three months for commissioning and testing. The project took twice as long to complete and opened exactly 34 months after the initially projected opening. The airport express was built by a consortium consisting of B Grimm, Siemens, and Sino Thai Engineering & Construction (Stecon). The express is owned and operated by the State Railway of Thailand (SRT).

The project was able to stay within budget because of a so-called Maximum Guarantee Price, according to the airport express' official website. The price of baht 25.9 bn covers the whole construction work, regardless of the actual quantity of work. The contractor is responsible for performing specified works and acquiring his own source of capital. The State Railway of Thailand provides a bank account for the contractor to use during construction and covers interest rates (Airport Rail Link).

The present-day airport express is connected to Bangkok's transit system's Green and Blue Lines. Travel time from the city is 15 minutes by express service from Makkasan city air terminal, and 27 minutes by commuter service. The airport express is elevated for most of its length, running above existing railway right-of-way. The tracks measure 17.9 miles (Briginshaw 2005). At present, a single-trip journey costs 15

Baht (\$0.5) on the commuter option and will cost 100 Baht (\$3.33) on the Express Line after the end of the promotional fares.

3.2.5 Beijing- Capital

The airport express was constructed for an old airport when the Olympics required it. No major events are reported around its construction. Beijing Capital International Airport is the main international airport in Beijing, China. In 2009, Beijing Capital served 65 mn passengers, the third-most worldwide (Airports Council International). Air China, Hainan and China Southern Airlines use the airport as their hub. The airport was opened in 1958 with a single terminal. The second terminal was added in 1999 and the massive third one in 2008, in time for the 2008 Olympic Games.

The airport is located 20 miles outside of Beijing's city center. It is served by the Airport Express of the Beijing Subway. The express was opened in July of 2008, also in time for the Olympic Games.

Construction of the Airport Line began in 2005. Track-laying was completed by November 2007 (Official Website of the Beijing 2008 Olympic Games). The contractor was Bombardier Transportation for project management, vehicle systems engineering and integration, design and manufacturing of the bogies, as well as the propulsion and braking systems (Railway technology). The project received funds through a joint venture with the Hong Kong MTR (Railway technology).

The 17.4 mile trip takes 16-20 minutes. Morning News (Xinhua Zhang Shuo) reported that ridership in 2008 had been 2.17bn (Beijing Morning News 01-02-2009).

3.2.6 Rome- Leonardo da Vinci (Fiumicino)

Rome is an example for a city with an old airport and an old transit system, which was extended over time and connected to the airport. The same has happened in a number of other cities in Europe. While the resulting service is not perfect, headways for example are large, it is well accepted by airport travelers.

Rome's main airport is Leonardo da Vinci airport, located in the village of Fiumicino 22 miles outside of Rome's historic city center. Fiumicino served 35mn passengers in 2008 (Rome Airport Info) and

functions as hub for Alitalia. Fiumicino was opened in 1961, replacing the former Rome Ciampino airport. A first airport-rail link, opened in 1991, terminated in Rome's Ostiense station. In 1990 another connection to the airport was opened between Rome's main station, Termini station, and the airport, following the extension of Rome's public transportation system to the small village of Fiumicino (Scalese, personal blog). The connection from Fiumicino to the airport involved the construction of a 2.2km-long viaduct that takes the train into the airport station to a three-platform terminal. Both connections from Ostiense and Termini use the same tracks for most of the way. In 1993, the Ostiense downtown terminal was moved to the more central Rome Tiburtina station. The FR1 line from the airport to Tiburtina station was extended into the small commuter towns of Fara Sabina and Orte, making Tiburtina a truly central station on the FR1 line. After the extension, non-stop service between Rome's Termini station and Fiumicino Airport started in 1993, which became known as Leonardo Express in 2000. Shared service with a number of intermediate stops continues to be operated from Tiburtina station. Table 3-6 represents the regional network around the Leonardo Express. Each dash represents a travel time of one minute.

Termini station in Rome has two platforms that serve exclusively the Leonardo Express. All airport terminals are can be reached by foot via a system of escalators and walkways (Fabretti 2004). The Leonardo Express is operated by the primary Italian train operator, Trenitalia. Trenitalia is owned by *Ferrovie dello Stato* ("Railways of the State"), which itself is owned by the Italian Government.

The Leonardo Express takes 30 minutes to Termini Station, the main train station in Rome. While the trains for the Leonardo Express are quite luxuriously equipped, only two runs per hour are offered. Amenities include soundproofing, a sound-system providing trip information, air-conditioning and a first-class, fully renovated interior. The local trains leave every 15 minutes and stop at all stations in between (Aeroporti di Roma). Cars or taxis take 60-90 minutes, depending on traffic (Fabretti 2004).

According to Fabretti (2004), 9,000 passengers were using the Leonardo Express daily. He also mentions that “customer satisfaction surveys indicate the service is appreciated over taxi or private car due to its low cost, comfort, speed and safety.”

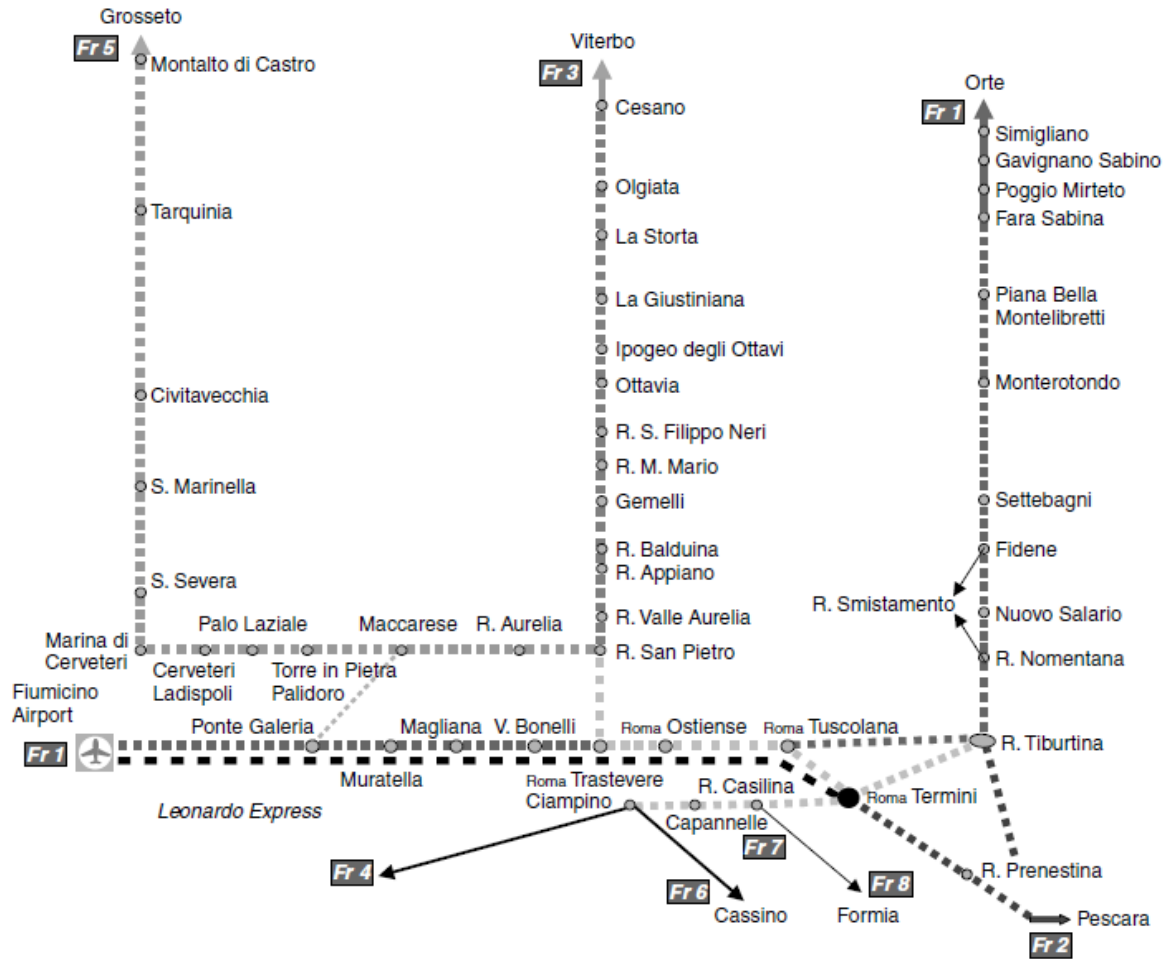


Table 3-6: Stations on FR1 line with connections to regional trains (Rome Fiumicino)

Source: Ferrovio dello Stato, cited after (Fabretti 2004)

3.2.7 *Istanbul- Atatürk*

Istanbul has one of the oldest public transportation systems in Europe and a relatively old airport (opened in 1924). It took until 1989 however for the first light rail line to be built, and until 2002 for it to be connected to the airport. Istanbul's principal airport, Atatürk International, is located in the neighborhood of Yeşilköy, on the European side of Istanbul, 15 miles west of the city center. Like Fiumicino, Paris, and Chicago, Atatürk International can be reached by public transportation via Istanbul's city transit system. One of two light rail connections in Istanbul (M1) extends from Aksaray to the airport, providing service from downtown to the airport in 30-35 minutes (Hafif raylı sistem). The transit terminal in the airport is located within the international terminal and somewhat remotely from the domestic terminal, but walking is aided by walkways. The M1 crosses some important destinations on the European side of the city, including the intercity bus terminal. The two light rail lines (M1 and T4) are completely segregated from other traffic without grade crossings. The investment cost for both light rail lines was US\$ 700 mn and their combined length is 20 miles, 6.5 miles of which are underground (split evenly between both lines). M1 has a length of 12.2 miles, suggesting a rough share of construction cost of US\$ 400mn (Wikipedia, "Istanbul Light Rail System") for the entire line.

Istanbul's public transportation system is old, even by European standards. Road-based public transport dates back to 1869. Since then it has been expanded by tram, buses, ferries, and light rail. The first light rail line M1 began service in 1989 between Aksaray and Kartaltepe. An extension to the intercity bus station in Otogar followed in 1994. Several other stations were opened in 1995 and 1999. In 2002, finally, the line was extended through the World Trade Center to Atatürk Airport, providing rail access to the airport.

Istanbul has seen rapid population growth in the last three decades. In 2008, the population counted roughly 13 million inhabitants (Türkiye İstatistik Kurumu 2008). Capacity issues at Atatürk International prompted the planning process for a third airport. The situation will resemble those in Asia, in which new airports are conceived simultaneously with an airport-rail link to access them.

3.2.8 *Munich- Franz Josef Strauss*

Munich is in the same position as Paris and Chicago. The location of the airport far outside the city center is perceived as hurting Munich's competitiveness. Before 2008, serious plans for a dedicated rail link were under discussion. While funding for original cost estimates from 2004 was available from public and private contributors, it turned out in 2008 that the original cost estimates were much too low. After years of negotiations and planning, the project was killed because nobody was prepared to pay the \$3 bn price tag. Despite being slow, Munich's shared light rail lines have a high mode share at 31% (Transportation Research Board 2000).

Munich is served by Franz Josef Strauss Airport, commonly referred to as just Munich Airport. It is located 17.7 miles outside of Munich and serves as hub for Lufthansa and its Star Alliance partners. The airport was opened in 1992, replacing a former airport at Munich-Riem. Before construction of the new airport started in 1980, a village named Franzheim had to be demolished and its 500 inhabitants had to be displaced (Wikipedia, "Flughafen München").

Munich downtown can be reached from the airport by public transportation in 45 minutes via light rail lines S1 and S8 of Munich's transit system. Connection to national main line rail is only available at Munich Main Station, about 40 minutes from the airport by either light rail line. Decided in 1965, Munich's public transit system opened in 1972 after only 6 years of construction. Construction was accelerated because of the 1972 Olympic Summer Games, for which it had to provide adequate public transportation. The extension from the village of Ismaning to Munich Airport was completed in 1992 and service commenced that same year, completing the rail connection to downtown Munich. Travel between Ismaning and the airport takes 20 minutes, travel to downtown 45 minutes. The airport station is located in an underground tunnel under the airport. A second tunnel beneath the airport terminals is unused and serves as space holder for a possible faster rail connection in the future. A serious plan for such a connection was a maglev train which would have shortened the trip to downtown Munich by 35 minutes to 5-10 minutes. The project was canceled in March 2008, citing cost escalation. The Maglev project was

initially projected to cost 1.85 bn euros (\$2.9bn). At a meeting with German Transportation Minister Tiefensee in 2008, industry representatives corrected their estimates to over 3 bn euros. German companies Siemens, ThyssenKrupp and Hochtief were contractors of the maglev project. Siemens and ThyssenKrupp attributed the construction underestimate to construction company Hochtief. Hochtief claimed not to have been involved in the 2004 estimate and this to be the first time for a proper cost overview to have been prepared (Deutsche Welle). The original financing had been agreed upon between the German government (50% of project cost, up to a maximum of Euro 925 mn), the state of Bavaria (Euro 500 mn), with German state railways Deutsche Bahn, Munich airport, the European Union and the two companies involved (Siemens and ThyssenKrupp) making up the remainder. After the federal government learned about the higher cost estimate it withdrew its commitment to the project, citing inability to increase its contribution (Deutsche Welle).

Chapter 4 Discussion

4.1 Revision of outcomes from cross-sectional analysis

The following patterns could be observed in the cross-sectional analysis in Chapter 2.

Technology. The Asian systems have dedicated airport-rail links, except for Beijing. The European systems, except for London, have shared service that is an extension of the regular city transit system. Service on the Asian airport-rail links commenced within 6 years or less after opening of the airport (except Narita), whereas rail service was added much later after opening of the older European airports.

Schedule overruns and underestimation of ridership. Even within the limited data sample, a pattern of schedule overruns and underestimated ridership can be observed. Five of the 8 dedicated rail systems were delivered with delay (Hong Kong, London, Bangkok, Seoul, Kuala Lumpur). Schedule overruns however were minor compared to typical public works projects in the transportation domain, on the order of +/- 1 year. Bangkok had the greatest schedule overrun with 1.5 years. Of 8 dedicated rail systems, 5 saw ridership far below expectations (Figure 4-1).

Hong Kong	Tokyo-Skyliner	Tokyo-Narita Express	London	Kuala Lumpur	Seoul	Shanghai	Bangkok	Dedicated expresses
1 year	n/d	n/d	9 months	minor	> 1 year	no	1.5 years	Delay
	n/d	n/d						Ridership overestimate

Figure 4-1: Delays and cost overestimates for dedicated systems

Construction cost. Hong Kong, Seoul and Kuala Lumpur were extremely expensive to construct, whereas the Narita Express was extremely cheap. The other projects are within the same general range of cost per mile of construction. A number of the cheaper systems reused existing infrastructure. The maglev train in

Shanghai was one of the more expensive projects in costs per mile, but surprisingly it was by orders of magnitude cheaper than the systems in Kuala Lumpur, Seoul and Hong Kong. For the three shared systems whose construction cost is known (Munich, Istanbul, Beijing), construction cost was slightly lower than for dedicated service (Figure 4-2).

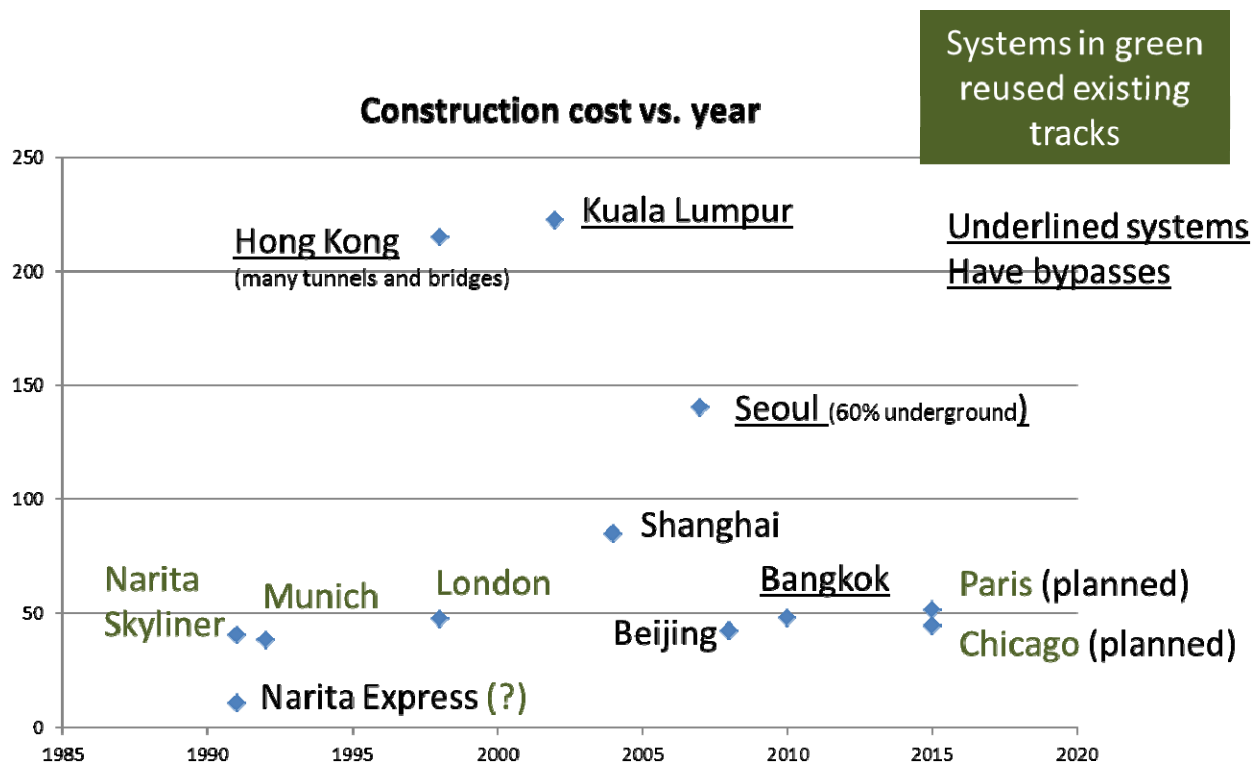


Figure 4-2: Construction cost vs. year for dedicated systems

Mode share. Hong Kong’s and Narita’s airport expresses have a higher mode share of public transportation than the three other systems of which mode shares are known (Charles de Gaulle, Heathrow and Chicago) and are substantially farther away from the city center. The Chicago Blue Line’s mode share is tiny, even though it is the only available public transportation option and a high mode share on a commuter line is possible, as Charles de Gaulle shows.

Travel time. For dedicated services, travel time corresponds more or less linearly to distance from the Central Business District (CBD). The longer dedicated systems (Hong Kong, Narita Skyliner, Kuala Lumpur, Seoul) have a travel time on the order of 28- 40 min. The Narita Express is an outlier to the

upper end with a travel time of 55 minutes. The shared transit systems (extensions of city transit systems) are in line with the slower dedicated systems with travel times between 30-40 minutes (Munich, Istanbul, Rome, Chicago, Paris). An outlier to the lower end is the Beijing Airport line with a travel time of 16-20 minutes (Figure 4-3).

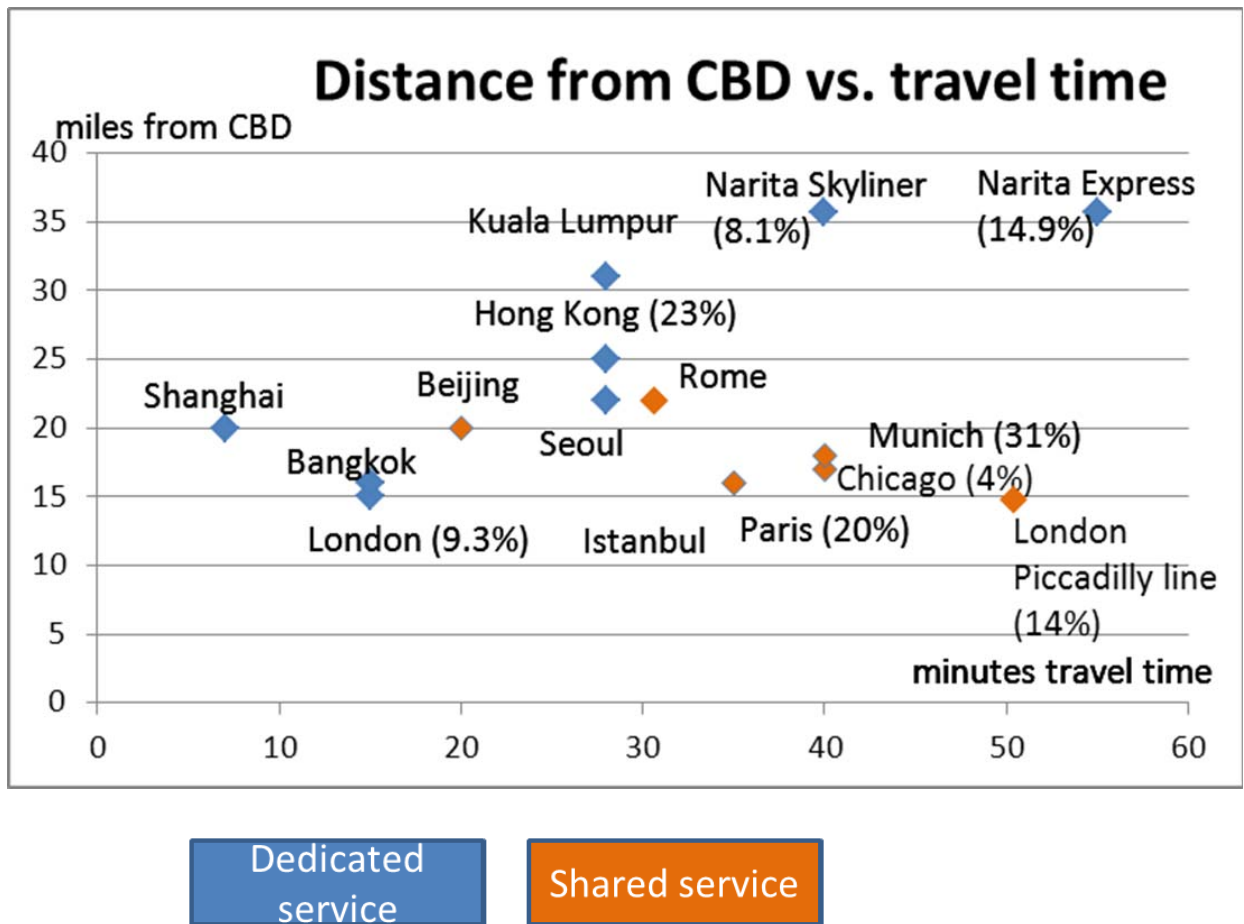


Figure 4-3: Distance from CBD vs. travel time for all airport-rail links

Financing. Most of the dedicated systems were financed with varying degrees of private sector participation. It makes sense that shared service is publicly funded, as are most city transit systems. No improvement in ridership or construction time estimates can be noted for public private partnerships, a concept in which the private party responsible for the estimates assumes a significant share of project risk.

Hong Kong, Tokyo and London had a finance-build-operate arrangement with their private sector developers. Schedule underestimates and ridership overestimates are known for Hong Kong and London, and no information in that regard could be found for Tokyo. Kuala Lumpur and Seoul had finance-build-operate-transfer arrangements. Both projects were delivered behind schedule, and Seoul had severe ridership overestimates. Beijing and Bangkok were mostly publicly financed. Shanghai and all shared service systems were completely privately financed. Schedule delays are known for Bangkok, and ridership overestimates are known for Shanghai and Bangkok. It follows that private financing in the case studies did not protect from schedule delays and ridership overestimates.

Outcomes that could not be explained easily from information in the tables were the following:

- Why was an airport-rail link constructed in London, but not in Chicago or Paris? The cities are of comparable importance and their well-used transit systems extend to their airports. Travel times for cities around 15-20 miles away from their airports are comparable with the Asian high-speed rail links that are often cited as state-of-the-art. Why did London construct one already in 1998, whereas Chicago and Paris have been busy planning one for years with no results to date (especially Chicago)?
- Why were airport expresses constructed in Hong Kong, Tokyo and London when bus mode shares are so high? Why are bus mode shares higher than train mode shares?
- Why did the two systems at Narita take over a decade to be built, when all other Asian airports built a high-speed rail link within 6 years of airport opening?
- What were reasons for delays, and why were delays relatively short for Asian systems and Heathrow? Why did those places built airport-rail links, while Chicago is trying and doesn't get the job done?

- What are reasons for ridership underestimates during construction of the Asian high-speed rail links?
- Why were Hong Kong, Kuala Lumpur and Seoul so expensive to construct, and the Narita Express so cheap? Why is the system in Kuala Lumpur profitable?

The next section will discuss the importance of the conditions for sustainability that were established in Chapter 1, before section 4.3 offers explanations for the observed patterns drawing from the case studies, literature research and the sustainability discussion.

4.2 Evaluation of sustainability criteria for airport-rail links

The hypothesis in Chapter 1 was that conditions derived from generic sustainability conditions will help explain different outcomes by systematically thinking through issues that effect how a project turns out during construction and operation. The conditions identified in Chapter 1 are discussed individually in this section as they relate to the case studies.

4.2.1 *Balance and resilience of ecological systems*

4.2.1.1 Low emissions

While environmental protection is often cited as a reason for implementing rail and airport-rail links, emissions turned out to be minor motivators in all of the considered cases. It is ironic that in London's case a document published in 1996 (Government Office for London and Department of Transport, 1996, pp. 17–18) named “achieving the government's environmental goals” as one reason for investments in rail infrastructure. The Heathrow Express however uses Diesel-hauled trains that lead to significant air pollution at Paddington station and are one of the very few criticisms of the Heathrow Express. In this case one would draw the conclusion that in order to sell an airport-rail link as environmentally friendly alternative to car travel, it should at least not visibly pollute the

air around its terminals. Heathrow's experience is an isolated one and of the other services no complaints about air pollution have been reported.

Hong Kong and Narita have a sizeable transit share of 60-70% of airport travelers overall who use transit for airport access, around 25% of those on the high-speed airport-rail links. Those airports are most likely to receive environmental benefits from rail transport, but environmental preservation did not seem to be an important motivator for those projects.

The prospect of lower emissions was used in French stakeholder meetings to sell the project to opposed residents, but was countered with two arguments. First, a significant number of people would need to ride the express to gain any noticeable benefits, which is questionable. Second, if the city was serious about fighting emissions it would be a better idea to spend money on the commuter rail to get commuters off the road, which would have the larger impact by number of cars alleviated. Both Chicago and France seem to care about emissions savings more as a selling point to the public than as a serious goal to be achieved by the airport express.

4.2.1.2 Management of adverse environmental effects

Managing adverse environmental effects is important to not incite unhappy residents in proximity to the project even more. The developers of the Narita Skyliner seemed to have learned from the airport's rocky past and took a number of precautions to minimize the train's impact on adjacent villages. London's Heathrow Express is credited for its overall good reception with the good job it did in managing adverse environmental effects. This outcome is important since the Heathrow Express was completely privately financed and it is a common notion in privatization literature that a private developer will care less about the environment than a public one. It seems in this case that the developers were pragmatic enough to limit the impact of noise and visual impairment on residents so as to minimize opposition. Adverse environmental effects also play an important role in stakeholder opposition around the CDG Express. In all examples cases in which management of adverse environmental effects played a role, the main

concern was however to limit the immediate impact on people's quality of life and less to preserve the environment.

4.2.2 Equity and efficiency of economic production and consumption

For transportation, it needs to be defined first what the product is before a discussion about its equitable and efficient production can be started. The social good of mobility allows people to travel and fulfill any professional or personal needs that require physical relocation. Externalities and the large initial investments and long payback period usually render transportation unfit to be handled by the free market. Typically the government needs to jump in and help out with (equitable) transportation planning and transportation financing. In the case studies, it was evident that the wish for economic growth was underlying all projects to some extent, especially in the cases of Chicago and London. In a more traditional sense, it is usually assumed that mobility and measures like passenger-miles traveled or number of trips are the product that a transportation system produces.

4.2.2.1 Regular maintenance to maintain cost-effectiveness (sustained funding)

The problem did not appear in the case studies, however, literature warns against rent-seeking behavior in public-private partnerships in which the private operator might neglect maintenance towards the end of the concession. Similarly, a tradeoff exists usually between higher quality construction up-front and lower maintenance costs, or cheaper construction and higher maintenance cost. There is again an incentive for a constructor to save during construction at the expense of maintenance costs later on. Kuala Lumpur and Seoul circumvented this problem by some variation of (Design-) Finance-Construct-Operate (- Transfer) contracts with private investors. In other cases, the railways are operated by the agency that built them with no plans to transfer, which is also safeguarding (Heathrow Express, Hong Kong, Tokyo, Bangkok, Rome, Munich) against the mentioned rent-seeking behavior. A greater danger exists through neglect through deferred maintenance as systems age, which will result in increasing operating costs. This

problem becomes noticeable after 20 to 30 years of operation, and is therefore not yet an issue for most of the much younger systems in the case studies.

4.2.2.2 Equitable funding to other parts of the network

The lack of equitable funding in other parts of the network has been a problem for Charles de Gaulle and to a smaller extent for Chicago. Both were critiqued for planning an “elitist” airport express while other parts of the system are in urgent need of maintenance. In the case of Charles de Gaulle, stakeholder protests convinced the government to quickly launch a parallel program for renovation of the commuter line to the airport. London was in the same position in the 80s, when rapid population growth exposed the dire state of the Underground and commuter rail system. The Heathrow Express however was completed in 1998, whereas renovation of the Underground did not start until 2000. A possible reason is the fact that BAA Ltd. as private investor was not responsible for renovating the Underground and, being a private investor, the argument could not be made that it should invest in maintenance of the existing first. No similar arguments were reported for the Asian case studies in China, Thailand, Malaysia and South Korea. In the cases of the latter three, government participation was hidden within a complicated consortium structure, which makes the developing agglomerate less prone to criticism about its investment priorities.

4.2.2.3 Need not to worsen other modes of transportation

The need not to worsen other modes of transportation is a different take on the problem of intra-system equity and turned out to be a problem in some options of mixed operations that Chicago considered. The typical trajectory of a city’s connection to an airport in the past has been an extension of a city transit system (shared service) and later the implementation of a dedicated system either on entirely new tracks or sharing of the existing ones of the city transit system. Sharing tracks of a city transit system is attractive because it reuses existing infrastructure for a new service. Hong Kong has perfected this system by offering two services with a completely different look and feel (business class express and local train) on 90% of the same tracks. Other cities that use this model are Kuala Lumpur, Rome and Bangkok. The

model requires a number of bypasses for the faster train and accuracy in operation. If one train is delayed, the “meet train” will need to wait in the bypass tracks and experience the same amount of delay. Chicago’s local transit system, the Blue line, is located in a densely populated area and bypasses would have led to severe disruption, including relocation of people and demolition of houses. Since neither this level of disruption nor the potential for delays to the local Blue Line train were acceptable, this cheap option could not be considered. Paris has similar plans for having the airport express share tracks with regional and nightly freight trains. The model was criticized in stakeholder meetings because of fear of noise from nightly freight trains and questioning of the logic of running trains at different speeds on the same tracks. The set-up that Paris proposes is indeed a complicated one, since the CDG Express, freight trains and regional trains would be run by three different entities. While precise operations are a challenge already for a single operator in Hong Kong or Kuala Lumpur, the proposal becomes impractical if three different organizations need to integrate their operations to such a large extent. It seems likely that controversial discussions will be necessary about which service to disadvantage in cases of delays. The Paris case is different from Chicago since Chicago customers of the Blue Line are in close physical proximity, and residents as daily commuters feel strongly about the Blue Line, so that loud protests can be expected. Delays to regional trains, whose patrons are more geographically dispersed and only occasionally take the train, and less time-sensitive freight trains may be accepted more calmly. Generally, delays to existing modes of transport are an important issue and it seems that developers are well aware of it. In none of the systems in the case studies did an airport express get built that disadvantaged existing service. It remains to be seen if Paris chooses to move along with its proposal which in its current form will negatively impact current services.

4.2.2.4 Connectedness to other modes of transportation

The importance of connectedness of an airport-rail link to other modes of transportation has been established in previous comparative studies and is supported again by the case studies in this thesis. Specifically, travelers value service that will get them to their destination without or with minimal

transfers. Seoul and Shanghai Pudong lament low ridership, and it seems fairly clear that the main reason is the poor integration of their systems into the regional transit network. Riders on Pudong's maglev train are dropped off in the suburbs and left to find the way to their destination using a cab or local transit. Seoul only gets people halfway to the city (the old airport, where the airport express terminates, is located between the city and the new airport). On the other hand, Hong Kong and Tokyo have high mode shares on their airport-rail links, which are directly connected to the city transit system which will get them to any destination. Mode shares on the extension lines from the local transit systems in Munich, Paris and London are high- 31%, 20% and 14.2%. In London's case, ridership on the Piccadilly line even surpasses ridership on the Heathrow Express. The different price point of course is another explaining variable for this difference.

In terms of regional connectedness, all airports except for Charles de Gaulle could be improved. Charles de Gaulle is served directly by the TGV, whereas all other airports require passengers with destinations that require a regional train ride to first take a train downtown to a transfer station. Rietveld and Givoni (2008) suggest integrating Heathrow into Britain's regional rail network to achieve a larger mode share of people who access and depart from the airport by public transportation. The suggestion seems equally applicable to every other airport whose operators would prefer a higher transportation mode share. Japan deserves special mention in this context, since planners very early envisioned connecting the airport to the Shinkansen network. It was not because of lack of political will or integration of planning bodies, but because of expropriation issues, that these plans had to be abandoned.

4.2.2.5 Scalability

Sadly, scalability is mostly needed to scale projects down when ridership is below expectations. In theory, the highly cyclical airline industry has to deal with sudden increases and decreases in ridership, and so does service that serves airports. In practice, correct ridership estimation rarely takes place and if adjustments need to be made, they are to cut capacity. Buses have a strategic advantage due to their lower fixed costs when capacity needs to be cut. This is the reason why in several places (Tokyo, Hong Kong,

London) private bus operators can afford to compete with the often government-supported airport expresses.

4.2.3 Participation and responsiveness of governance and politics

4.2.3.1 Sustained political support and prioritization of the project

Political support of the project appears to be the key variable when explaining why some cities build airport expresses quickly and despite setbacks, and others plan for years without getting anything done (Chicago). The projects that were constructed fast (all Asian ones, except for Tokyo, and London) had a city and sometimes national government behind them (Bangkok) that saw a clear need for an airport express. In the Asian cases the reason was mostly that new airports far outside the city center were not assumed to work without dedicated service. In Beijing's case, the Olympics required an upgrade to the transportation system. In all of the Asian cases the airport express was seen as a necessity to access the airport, and not as a lever for a broader strategic goal to demonstrate the city's competitiveness or foster economic development (even though those side effects certainly existed, they were not the main motivators). Even in cases in which private investment paid for the airport express, government support was imperative to drive the project to completion. In the case of Hong Kong financial aid from the Hong Kong government pushed the project to completion despite the Asian financial crisis. In order for Tokyo's two transit operators to construct an airport express, new legislation was needed and given that allowed for various schemes to share rail infrastructure. In London, city planners helped BAA out a lot by declaring Paddington a special policy area and being deeply involved in project planning, for example through their efforts to reach out to local residents. In the cases of Shanghai and Beijing government support was evidenced through its willingness to fund the projects completely (Shanghai) or to a large extent (Beijing, Hong Kong's transit operator MTR contributed). Seoul's government guaranteed to make up 90% of operating losses of the airport express and in the case of Kuala Lumpur and Bangkok loans by state banks contributed substantially to the financing.

The projects in Hong Kong, Tokyo and London were initiated by their city governments, who reached out

to transit (Hong Kong, Tokyo) and airport operators (London). Charles de Gaulle shows the same pattern of city government initiative and targeted involvement of transit operators (ADP, SNCF, RFF). In Chicago on the other hand, the city initiated the project and handed it over to the CTA for a long time with the mandate to explore options. It appears that the project was bounced back and forth between them, but its real value proposition and a practical financing scheme were never seriously discussed. Strapped for cash, the CTA expressed already in 2008 that all it could contribute was expertise, whereas the latest announcement by the Mayor of Chicago assures that no municipal funds will be spent. Taken together, no willingness or ability to finance the project exists. In 2008, a city contribution to the project was not ruled out (at least until the fall of that year), but the expectation was that the project would be attractive as-is to a private investor. Considering the lack of commitment to financial support and the non-specific value proposition expressed in the interview with a planner from the Mayor's office, it becomes apparent that sense of urgency and city government support was a lot lower than in the Asian cases.

4.2.3.2 Possibility for constituencies to voice their concerns and be heard

The possibility for constituencies to voice their concerns and be heard is a key issue for success. Tokyo and Shanghai (maglev extension) show how much power local residents have to kill a project. No project can be completed against too strong stakeholder opposition, such as the violence around Narita. In order to react to stakeholder concerns, it is important to listen to them. In the case of Paris, planners are doing a good job at holding meetings and interacting with opposed residents. The interaction has already resulted in a changed route for the proposed express and the announcement of a project to modernize the commuter train RER B. Similarly, stakeholder protests in Shanghai led to changed plans for a shortened route with a majority of the tracks underground. In both cases however stakeholder protests continue, albeit in a much more civilized way than around Narita.

In the cases of stakeholder protests in the case studies (Tokyo, Paris, Shanghai) residents opposed diminished quality of life. The problem is especially urgent if expropriation is threatened, which happened a number of times for construction of airport-rail links (Munich, Kuala Lumpur, Tokyo). There

is no promising strategy that can be derived from the case studies for how to deal with diminishing stakeholders' quality of life or expropriation issues. In Kuala Lumpur a village of aboriginal inhabitants was demolished and the residents offered new farmland. Literature research does not result in findings about compensation payments to the people who were relocated for the construction of Munich airport, but (Reise-Katalog) mentions 5,724 filed lawsuits against construction of the airport, of which 40 example cases were admitted. Even if compensation was paid, there was still substantial opposition to construction of the airport. In the case of Tokyo the national government attempted peaceful relocation and compensation, but residents remained belligerent. Tokyo has the most violent reaction to government plans to relocate people, despite offered compensation. It is hard to give advice for what could have been done better in this situation, other than that trying harder to reach out to people and to increase compensation for relocation were the only promising courses of action available.

The case of Paris illustrates that stakeholder outreach can suggest options that the city government had not been aware of before to make a new undesired infrastructure project more palatable (upgrading of RER B route). Planners in London were smart and avoided stakeholder problems altogether by placing development into an area where people had other problems than oppose public works. The designation of Paddington as development area, knowing that little protest was to be expected, was another way by which government planners in London supported BAA in constructing the airport express. While the method may be controversial, it proved effective.

4.2.4 Adaptation and feedback of institutional performance

4.2.4.1 Cooperation

The case studies suggest that cooperation between institutions is a key factor for speedy project delivery, or project delivery at all. It was only after ADP's and SNCF's complete turnaround in attitude towards collaboration that Charles de Gaulle became a true intermodal hub and the present airport express project became possible. Even though the CDG Express does not seem fully thought through at this point, the commitment of various institutions to collaboration is credible from their presentation on the project's

website. Two main reasons delayed the construction of an airport-rail link in Tokyo, despite strong government support and a transit-oriented culture. One was stakeholder opposition and the other failure to cooperate between Kensei and JR East in Tokyo due to legal hurdles. After the legal barrier was eliminated by the passing of the Railway Business Act in 1986, both companies constructed airport expresses and began operation simultaneously in 1991. Chicago is another example for project delay because of a little war between organizations. It was because of the Chicago and North Western Railroad's fear of competition that it took 25 years to connect Chicago's city transportation system to O'Hare. All in all, the case studies support the general finding of Rietveld and Givoni (2008) that cooperation between institutions is required for the delivery of intermodal projects.

Authors sometimes applaud systems that have "healthy" competition, such as the Skyliner and Narita Express in Tokyo (Transportation Research Board 2000). The question is to what extent such competition is desirable since the pie to divide up is small. In Tokyo's situation two profitable transit operators in a heavily transit-dependent 35 million city are able to cross-subsidize their competing airport expresses. This situation is however not comparable to almost any other city. In the case of Hong Kong, which operates two competing services by a single operator, it is evident that the Tung Chung line is cannibalizing the dedicated express to some extent.

4.2.4.2 Adaptability in political system to monitor and respond to change

The condition is meant in a strategic sense. Anticipation of a changed future and proactive change in the political system around an airport-rail project has not been an issue in any of the case studies. However, unforeseen events happened in all case studies and the involved city governments had to respond. Except for Chicago, all governments reacted by continuing the project in some way or other. In cases of crises, such as the Asian financial crisis, the city government operates at a higher strategic level than transit operators or concessionaires and is therefore looked up to for direction. London is an exception to this rule, since the catastrophe of a tunnel collapse was an internal affair and dealt with internally. In the other cases, the city government had to reaffirm its support. Hong Kong's government reacted to the Asian

financial crisis by continuing to support the project financially in the amount of \$15bn, including setting aside an “emergency funds” for MTRC to draw on in specific situations. The Tokyo government appeared to be paralyzed after stakeholder protests in the 1960s. It was only under pressure from customers about the unsatisfactory situation at Narita (access, security measures) in the 1980s that the city government finally started acting again by reaching out to transit operators and passing needed legislation. France responded to opposition by passing responsibility for planning up from the city level to the national level, from where a directive came to continue with a changed project. That way, the city government could point to the national government that had already made a decision in stakeholder meetings. While this process may be controversial, being able to point to a decision that had already been made higher up proved effective and helpful in the actual stakeholder meetings.

4.2.4.3 Adaptability in operating institutions to monitor and respond to change

This one is the analog condition to government adaptability in the previous section. In the case studies, the condition has not played a role in the intended anticipatory sense. In a more direct sense, the ability of non-government actors to respond to new situations has been important. The most notable example is BAA in dealing pragmatically with the tunnel collapse and deciding to finish first, litigate later. Another example is the decision to collaborate between SNCF and ADP after stiffer competition from high-speed rail in other countries and low-cost airlines. It would be desirable in the interest of cooperation and intermodality if more non-government organizations came to cooperate closer by their own initiative. However, this initiative cannot be expected and it is therefore important for city governments planning desiring collaboration to reach out to individual transit operators.

4.3 Outcome explanation with information from case studies

The outcomes described in section 4.1 are explained in this section based on the case studies, literature research and discussion of sustainability criteria.

Technology. The new Asian airports were constructed far outside of city centers and designed from scratch, including ground access. Planners developed the airport express simultaneously and in an integrated way with the airport and chose dedicated service in every single case (except Beijing, which is an old airport). For this reason, the dedicated services were completed relatively fast (> 6 years) after opening of the airport. The older European airports are closer to the city center and have well-developed transit systems. Extending existing city transit service was the most natural and cost-effective way to create transit access. The shared services are mostly well-used (Munich, Paris, London). Of the European case studies, London is the first city to construct an additional line of dedicated service.

Schedule overruns and underestimation of ridership. Flyvbjerg (2009) mentions three possible reasons for overestimation of benefits: technical error, psychological bias, and strategic misrepresentation. Five of the 8 cases with dedicated airport express experienced lower ridership than expected (Hong Kong, London, Seoul, Shanghai, Bangkok). What was the reason? In Hong Kong's case, the operator MTR was the one who prepared the erroneous forecasts (MTRC Airport Railway -Information Guide 1992) a year before committing to financing and constructing the express. MTR did not prepare the forecasts for a third party. It is possible that incentives still existed to sway the forecasts, for example since the government was strongly committed to the project and willing to invest money into a link that would later belong to MTR. On the other hand, the Asian financial crisis struck in 1997, a year before opening of the airport express, and more recently unexpected competition from modern buses emerged. It is also possible that MTR did not foresee these events and therefore overestimated ridership.

The 2003 forecasts for the Heathrow Express were prepared by its private constructor BAA Ltd. BAA financed the airport from its own money and already had the city government's blessing. It is not clear what advantage strategic overestimation of ridership would have had. It is possible however that BAA anticipated to capture more taxi ridership, which did not happen. Taxi ridership remained almost constant between 1996 and 2004, hinting at price insensitivity of taxi riders and their appreciation of convenient door-to-door service. During the same time, ridership on the Picadilly Line has remained relatively

constant, despite BAA's forecasts that it would drop. There seems to have been the expectation that current cab and Piccadilly line users would switch to the Heathrow Express, which they have not. This finding cautions against high expectations to capture a large share of former taxi and transit riders on new systems.

In Seoul the system's lack of ridership is easily understandable: the airport express only goes from the new airport halfway towards the city. The plan to finish construction of the second piece in 2010 has been moved. It is unclear what caused high expectations of ridership while the express was yet unfinished. It is possible that riders' valuation of travel without transfers was underestimated. On the other hand, an incentive existed for the operator Korail Airport Railroad, the consortium that builds the airport express and operates it until 2040, to overestimate ridership. Korail Airport Railroad was responsible for the overestimates in 2007, the first year of operation. The South Korean government is responsible for making up 90% of the system's losses and was hit with steep bills of around \$100 and \$147mn in 2007 and 2008. It is possible that Korail Airport Railroad, a special purpose company to operate the airport express, sought to keep the government optimistic in 2007.

In the case of Shanghai, it appears that again travelers' aversion to transfers was underestimated. Since the Chinese government decided and financed the project it is less clear who should have been impressed by too optimistic ridership estimates. The estimates may have been used to make the project look better to the public.

In the case of Bangkok it is not known who was responsible for the outrageous ridership estimates of 4,000 passengers per hour in 2008 (Briginshaw 2005). The project was financed by a consortium of Thai banks and it is possible that those positive expectations were needed to convince them to finance the project.

All in all, incentives for strategic misrepresentation appear to have existed in Seoul and Bangkok, and they are possible in Hong Kong and London and possible but less obvious in Shanghai. Due to the

relative novelty of airport-rail links it is also possible that certain effects, such as the importance of not having to transfer or the strong competition by buses, the London Underground and taxis, were not known by the agencies preparing the estimates. At least in the cases of Seoul and Bangkok, constructed in 2007 and 2010, the novelty of airport-rail links must have worn off however, and precedents of ridership underestimation in Asia were available.

The dedicated airport-rail links that were completed behind schedule were London (1998), Hong Kong (1998), Kuala Lumpur (2002), Seoul (2007) and Bangkok (2010). London was hit by a tunnel collapse and Hong Kong and Kuala Lumpur were thrown back by the Asian financial crisis starting in 1997. This may explain the minor delays in their cases (9 months, one year and “minor” delays, respectively).

Bangkok’s optimism in planning (budget of 30 months to construct the airport express) after a lengthy planning process due to a plethora of earlier problems (e.g., Asian financial crisis, flooding, power supply issues) is harder to explain. The emerging picture from cost and ridership projections in Bangkok is one of extreme optimism in planning. The reason for Seoul’s delay in completing the project is unknown, but any problems are of recent nature since the opening date in 2010 was only recently removed from the airport express’ official website. All in all, incentives for underestimation of project delivery times are less clear than for ridership projections. It appears that most projects were hit with the “usual unusual” during construction that led to delays.

Construction cost. Hong Kong, Kuala Lumpur and Seoul were extremely expensive to construct. 60% of Seoul’s system is underground, which is the likely cost driver. It operates dedicated and commuter service, meaning that it had to construct bypasses. Hong Kong’s system runs between five islands or peninsulas, requiring several expensive tunnel and bridge segments. In addition, bypasses had to be constructed to run two services along the same tracks. The high construction cost is harder to explain for Kuala Lumpur. The investment was a greenfield investment, no infrastructure could be reused and several bypasses were needed to run two competing services on the same tracks. The same situation however is true for Bangkok, which has construction cost per mile in line with London Heathrow and the Tokyo

Skyliner, and also operates both dedicated and commuter service along the same tracks, requiring bypasses. Both London Heathrow and the Tokyo Skyliner are known for their low construction cost due to reuse of existing structures, which did not apply to Bangkok. Against that background Bangkok stands out for its low construction cost, which can be explained by its contract structure that limited the amount the developer would be paid for delivery of the project. It is possible that true construction costs were higher than what was paid by the government, especially considering the delay of 50% over the initially budgeted construction time. Shanghai's maglev train is cheaper than might be expected for such novel technology. It is possible that Germany and the delivering company Siemens applied special pricing, since they had interests in demonstrating German engineering skill and the functioning of the Siemens-developed new technology with a possible larger application to a link between Shanghai and Beijing. Three of the most expensive systems, Hong Kong, Kuala Lumpur and Seoul, operate two services on the same line and had to construct bypasses. A fourth example locked in costs by contract (Bangkok) and it is unknown how much construction really cost. All in all, it appears that tracks that are able to operate two services at the same time are correlated with higher project cost, which is not surprising.

For the three shared systems for which construction cost is known (Munich, Istanbul, Beijing), construction cost was slightly lower per mile than for the cheapest airport-rail links London, Tokyo Skyliner and Bangkok. Construction cost per mile was much cheaper than dedicated airport-rail links in Hong Kong, Kuala Lumpur and Seoul. This outcome is not surprising, since extending city transit systems is cheaper than constructing a new dedicated service and the reasons for the low cost of London, the Tokyo-Skyliner and Bangkok have been discussed above.

The Narita Express is an outlier to the lower end because of its extremely low construction cost per mile, on the order of a fourth of cost per mile than the cheap systems in Hong Kong, London and Bangkok. Existing track infrastructure from the failed Shinkansen express was used for Kensei's Skyliner, not JR East's Narita Express, and hence does not account for the difference. The most likely explanation is that JR East's service from Tokyo to the city of Chiba existed before construction of the airport express and

the quoted construction amount applies to tracks from Chiba to the airport. In that case, construction costs increase by about 60% per mile, which leaves the Narita Express still very cheap in comparison. More information about any reused tracks is needed to explain construction cost for the Narita Express.

Mode share. Many previous comparative studies on airport-rail links focused on explaining different mode shares. The explanations discovered in earlier studies also help to explain mode share outcomes in the case studies in this thesis. Hong Kong's and Narita's high mode shares on the airport express and on transit in general (local train, buses) can be explained by a generally transit-oriented culture in those cities and the well-developed and well-used local transit system that allows travelers to reach almost any destination. London's relatively high mode share can be explained by the same reasons, but competition from taxis is stiffer due to the airport's closer proximity to the city center. Charles de Gaulle's and Munich's relatively high mode shares on no-frills local service shows demand for airport access by public transportation and speaks for the well-developed and cheap city-wide transit systems in those two cities. The Chicago Blue Line does not carry much ridership because Chicago is not well-accessible by its public transportation system except for the downtown area and some suburbs along outgoing rapid transit lines. A car is likely needed at some point, decreasing the likelihood that transit will be used due to people's dislike for transfers. While price is an important explaining variable, fares in all three cities are comparably low. A greater cultural preference for transit use in Paris and Munich may also help explain the greater mode shares in those cities, which of course suggests a more somber prognosis for Chicago's plan to build an airport express.

Travel time. No outliers exist for travel time. A general pattern that can be observed throughout all case studies is that shared service takes 30-40 minutes to cover 15-17 miles, depending on travel speed and number of stops. Dedicated service takes 30-55 minutes to travel a distance of 22 to 43 miles, depending on speed. Shanghai is an outlier to the lower end, covering 20 miles in 7 minutes. However, it is known that the service does not drop off passengers in a central location and actual travel time to their destination is much higher. The Beijing airport line is the fastest of the shared services, covering 20 miles in 16- 20

minutes. The character of the line is that of a hybrid between shared and dedicated service. The line only has four stops, two of which are at the airport. The categorization as shared service is due to its integration as the magnolia line into Beijing's subway system, which generally offers shared service to multiple destinations.

The two cities that are planning dedicated rail links, Chicago and Charles de Gaulle, already have comparable access times with most of the Asian systems that have dedicated service, to which Paris and Chicago seem to be looking as benchmarks.

Financing. Most of the dedicated systems were financed with varying degrees of private sector participation. Hong Kong, the two Narita systems and London were financed and are owned and operated today by former state-owned transportation operators (transit operators in the two Asian cases, airport operator in London's case). The three systems are commonly considered successful airport-rail links, maybe hinting at a good combination of operational expertise and risk share in those organizations. Paris, Istanbul, Rome, Munich, Beijing and Chicago follow the traditional model for investments into public transportation: public funds finance the extension of existing lines to the airport, while authorities under government supervision operate the service as one branch of general public transportation in the city. Shanghai falls into the same category with the only difference of being clearly dedicated service for travelers to the airport. Bangkok, Kuala Lumpur and Seoul are interesting cases because of their joint public-private financing structure. All were constructed by private firms, but construction was backed by the national government in some form or other. Seoul was constructed by a consortium of private companies, but financed to roughly 25% by public capital and is today operated by the South Korean national railway operator Korail, because its operating losses were a political problem for the national government, who had to make up for 90% of the losses. Seoul can be considered a public private partnership gone wrong. Kuala Lumpur was constructed and is maintained by a joint venture between Malaysian private companies, while being partially financed by the Infrastructure and Development Bank of Malaysia. Kuala Lumpur seems to have been a successful story so far in terms of ridership and project

delivery. Bangkok was constructed by a consortium of private companies, financed by loans from Thai state banks, and is owned and operated by the State Railway of Thailand.

In light of Koppenjan's cautions against PPPs gone wrong, it is worth noting that Kuala Lumpur seemed to have worked, but Seoul and Bangkok have had problems with on-time project delivery and ridership estimates. It is important to also consider these outcomes when holding up "the Asian examples" as general role models for airport-rail links, including their public-private financing structure.

Outcomes that could not be explained easily from information in Chapter 2 are repeated and explained in the following section.

- *Why was an airport-rail link constructed in London, but not in Chicago or Paris? The cities are of comparable importance and their well-used transit systems extend to their airports. Travel times for cities around 15-20 miles away from their airports are comparable with the Asian high-speed rail links that are often cited as state-of-the-art. Why did London construct one already in 1998, whereas Chicago and Paris have been busy planning one for years with no results to date (especially Chicago)?*

The reason is initiative by the city government, which strongly favored rail in the 1990s in London and believed further expansion of Heathrow was contingent upon having an airport express. In addition, London and the UK as a whole experienced a period of prolonged economic growth from 1992 onwards. In addition, tracks could be reused which made for an overall low construction cost of the project, that attracted a private investor. Having a private investor possibly circumvented typical discussions about the desirability of investments into an elite airport express versus investments into local rail lines that tend to accompany those projects. In addition, the private investor brought to the table a pragmatic mindset of getting the job done, which eventually benefitted the project even after the catastrophic tunnel collapse that was probably partially due to this mindset. While it seemed that the sun and the moon aligned in London in the 90s, the situation is different for Chicago and Paris. Both systems presently have expressed

an unwillingness to contribute city government funds to the project, indicating that the project is perceived as nice to have, but not urgent. In an interview with a planner in Chicago it was expressed that expectations for the airport express were tax revenue, employment generation and business development. It is neither clear that the airport express is the best way to achieve those economic goals, nor is the project attractive for a private investor without any support from city, state or federal governments. All in all, Chicago's expectations are not realistic as it stands. Paris' exhibits some of the half-hearted me-too-attitude that Chicago displays when it comes to project funding, but it has done a better job at aligning different involved organizations (ADP, SNCF, RFF) and it seems more committed in its planning, for example through organizing stakeholder workshops. All in all, one needs to wonder however why neither Chicago nor Paris explored cheaper bus options if better airport access truly had been a priority in times of tight finances. The failure to consider bus rapid transit may hint at prestige as a motivating factor. London is an example for a city in which airport accessibility does not seem to have been the main driver during construction of the airport express. The main drivers seem to have been regeneration of the Paddington Basin and signaling global city status (prestige). From the point of view of the planning body Westminster City Council, those goals were met, even if the poor in the area did not benefit, as announced as one of the goals of the project. A number of favorable circumstances came together in the case of London, and one should not generalize London's experience without acknowledging the overall favorable economic and political situation during the time.

Why were airport expresses constructed in Hong Kong, Tokyo and London when bus mode shares are so high? Why are bus mode shares higher than train mode shares?

When Narita airport was conceived, buses were no competition for rail services. Air-conditioning, downtown luggage check-in and dedicated bus-only lines emerged during the last decade. Narita was built with considerable delay, and so were its airport expresses. There has been however a long-term vision that Narita should have high-speed rail access, which was eventually constructed in the late 80s after stakeholder expropriation issues had cooled down enough. In the case of Hong Kong, planners did

not seem to be aware of competition from buses, as an overestimated mode share for transit use suggests. In London, bus mode share remained almost constant since 1999, with a slight decrease between 1996 and 2001. In all the considered cases, buses became more competitive recently, through a higher level of comfort and the fact that they drop passengers off closer to their final destination in the city area. Competition from buses became stiffer in all considered cases after airport-rail links were built. The question therefore is less why the airport-rail links were built in the first place, and more how to react to competition from buses, which tend to mimic comfort and speed at a lower price, wider spread of pick-up points downtown and higher scalability.

- *Why did the two systems at Narita take over a decade to be built, when all other Asian airports built a high-speed rail link within 6 years of airport opening*

Like the newer Asian case studies, Narita was planned with a clear vision for a rail-based airport express. The Narita case study explains how severe and violent stakeholder protests delayed opening of both the airport at Narita and its airport expresses. The degree of animosity and violence at Narita has not been repeated in any of the case studies, even when expropriation issues emerged (Munich, Bangkok, Shanghai). The more recent Asian airports were opened with occasional problems (Asian financial crisis), but nothing comparable to the degree of opposition shown at Narita.

- *What were reasons for delays, and why were delays relatively short for Asian systems and Heathrow? Why did those places built airport-rail links, while Chicago is trying and doesn't get the job done?*

The dedicated airport-rail links that were completed behind schedule were London (1998), Hong Kong (1998), Kuala Lumpur (2002), Seoul (2007) and Bangkok (2010). London was hit by a tunnel collapse and Hong Kong and Kuala Lumpur were thrown back by the Asian financial crisis starting in 1997. London overcame the setback because of the pragmatism of its private constructor BAA Ltd. Hong Kong and Kuala Lumpur had very strong city government support that pushed the project to completion despite

the setback of the Asian financial crisis in 1997. The reason for Seoul's delay in completing the project is unknown, but any problems are of recent nature since the opening date in 2010 was only recently removed from the airport express' official website. Bangkok displayed optimism in its planning, expecting the airport-rail link to be completed in 30 months following a series of problems including the Asian financial crisis, technical problems, and legal issues with people who had settled on unused land owned by State Railways of Thailand. While construction overrun was only 1.5 years, it was 50% over the initially budgeted time. The fact that the sizeable delays were not longer can be attributed to the fact that airport-rail access to the airport was considered important by the city government, as has been the case with predecessors Hong Kong and Kuala Lumpur.

- *What are reasons for ridership underestimates during construction of the Asian high-speed rail links?*

The section about ridership underestimates earlier in this section speculates that incentives for strategic misrepresentation appear to have existed in Seoul and Bangkok; that those incentives have possibly existed in Hong Kong and London, and possibly but less likely have existed in Shanghai. Due to the relative novelty of airport-rail links it is also possible that certain effects, such as the importance of not having to transfer or the strong competition by buses, the London Underground and taxis, were not known by the agencies preparing the estimates.

- *Why were Hong Kong, Kuala Lumpur and Seoul so expensive to construct, and the Narita Express so cheap? Why is the system in Kuala Lumpur profitable?*

Sixty percent of Seoul's system is underground and it had to construct bypasses for simultaneous operation of two services, which is the likely cost driver. Hong Kong's system runs between five islands or peninsulas, requiring several expensive tunnel and bridge segments. In addition, bypasses had to be constructed to run two services along the same tracks. Kuala Lumpur's investment was a greenfield investment, no infrastructure could be reused and several bypasses were needed to run two competing

services on the same tracks. While Bangkok shares the same characteristics with Kuala Lumpur, project cost to be billed to the developer was frozen in Bangkok and is therefore not known. Bangkok appears cheap on paper, but because of its contract structure true investment costs are not known. More information about potential reused tracks is needed to explain why construction cost for the Narita Express is so cheap. Similarly, the report that Kuala Lumpur is operating at a profit is surprising. While the project appears to have met expectations in terms of ridership, more information about accounting practices is needed to see what costs are billed against fare revenues.

4.4 Advice to planners and prognosis for systems in planning/ under construction today

4.4.1 Pieces of advice

The two systems that are not yet built (Chicago, Paris) seemed to have several, but unfocused objectives. Without an understanding of what is expected, it is difficult to deliver a successful system. The most important piece of advice to planners of airport ground access today is therefore to *formulate a problem statement* of what exactly the project is sought to achieve. It is important to discuss the problem statement with any institutions that may contribute funding or are otherwise involved in the realization of the project. That way, it can be distinguished if the main driver for the problem is in fact to make airport access better for passengers or if higher level, strategic goals play the most important role. There is nothing wrong per se with having strategic expectations of an airport-rail project, but planners need to be aware of the bad track record that infrastructure projects had in developing underdeveloped parts of the city (Raco and Henderson 2005) and generally that there has been a strong tendency to overestimate benefits for transportation projects, and ridership on airport-rail links in particular.

In places in which better ground access to airports is truly desired, a comprehensive problem statement should be formulated and a *large number of options* for how to react to the problem statement should be *evaluated*. This initiative will include a broad search for technical options for how to realize airport access. While rail systems have been lauded in the past as important pieces for airport ground access infrastructure, they need not be the best or cheapest option. Dedicated road lanes to bus rapid transit can

match performance of rail service these days in terms of convenience, speed and reliability. In addition, bus transport is easier to scale up or down in times of excess demand or crises. In order to avoid stakeholder protests, equitable funding to other parts of a city transit network is necessary. This is especially important if the developer of the airport-rail link is also the operator of the city transportation system (and assumed to have financing capacity for the system, even though this does not need to be the case). If a discussion about the desirability of investment into an elite airport express is to be avoided, it helps to clothe the executing agencies with a new name that does not make government, city government or city transit operator involvement apparent at first sight. While Paris was vulnerable in that regard, Asian examples show that project management by some obscure consortium of public and private members is correlated to the absence of stakeholder criticism, or none at least was reported. Stakeholder support can also be achieved by investing into transit infrastructure before plans of the airport express become known, to avoid a situation like in Paris, where residents had a valid point in pointing out that the commuter line to the airport was in dire need of maintenance. While it seems economic to run an airport express on the same lines as commuter rail options, developers need to be aware of the higher cost that is associated with construction of those options (Hong Kong, Kuala Lumpur, Seoul) and of the need for meticulous operation so as not to worsen existing service. When preparing ridership estimates, it is important to bear in mind that the unexpected will often happen during construction, as has happened in virtually all case studies, and second that riders value a ride to their destinations that does not necessitate transfers. The study of past airport-rail link performance and forecasts is recommended for preparers of future forecasts.

When options for ground access are compared, *total access time* needs to be taken into consideration, which proves extremely important for rider's mode choice. Especially in the cases of Heathrow and Shanghai travel time along the dedicated airport-rail link does not reflect the true time for people to get to their destinations. The case studies however have shown that time to destination (without transfer) is of utmost importance when predicting ridership. The London case cautions against overly optimistic

estimates to capture a large share of former taxi riders (convenient) or former transit riders (cheap, good accessibility of destinations).

Another important piece of advice is to make sure that the project enjoys government support and that a true value proposition for better airport access exists with the city government, or else the project is set up for failure. While the case of London has shown that when a good economic situation and government sympathy towards rail service align, an airport-rail link can be built, this situation should only be generalized with care.

Stakeholders that may be opposed to construction of better ground access need to be *involved in the process and compensated*, if their quality of life is diminished. A number of case studies that tell of delays because of stakeholder problems (Shanghai, Paris, Tokyo) illustrate that upset stakeholder have real power to influence project delivery, and second, that compensation payments may be the only course of action left to ensure a feeling of fair treatment.

Cooperation between different transit operators has been described by Givoni and Rietveld (2008) as crucial for the realization of intermodal transport projects. In their case, they referred to integration of airports into national main line rail systems. The case studies have shown that institutional cooperation between transit agencies, city government and airport operators is extremely important in order to realize an integrated, intermodal airport-public transportation link. This recommendation also applies to links that are realized using bus service. In addition, integration into main line national rail links is likely to promise a higher mode share. In cases in which cooperation between the airport operator and the city or national transportation operator is absent, the city government would be required to facilitate cooperation between those actors.

The case studies have shown that “*unexpected*” *crises happen regularly*, be that a tunnel collapse, an economic crisis, unexpected competition from buses or unexpected technical problems. Developers need to be aware of the fact that setbacks in some form or other will happen, and that they need to be reflected

in construction cost and scheduling estimates. At the same time, project developers need to be aware that a changed situation may *require adaptation* from both transit operating agencies and city government to push through during times of crises. Not only do unexpected situations require change on the side of operating and government institutions, there also needs to be a plan for how to deal with those situations, e.g. what to do in times of cash shortfalls. Unpopular emergency “rescue bills” by governments (as seen repeatedly in Chicago in recent years) can be avoided by acknowledging uncertainties early on. Solutions for how to deal with unexpected economic crises include setting up an emergency funds in advance, including several stopping points within a project during which construction can be interrupted more easily and which might still deliver partial value, and designing the project such that it can be stripped to a simpler one, possibly until later money permits expansion.

A project initiated today should be *prepared for future opportunity or pressure to be more environmentally-friendly*. While environmental concerns are not a main driver for public transportation yet, environmental arguments receive increasing attention and are expected to gain even more importance in the future. It would be wise to use technology that can be changed to cleaner sources of fuel or electricity when technology make those widely available, e.g. electric or hybrid powering, both for buses and trains. An advantage of bus service is that they can be replaced more easily when new technology is developed. While environmental concerns are not true motivators for projects in any of the case studies, they may become more urgent in the future and it will be wise to construct public ground access systems today that are able to switch to more environmentally-friendly modes when needed. London’s Diesel-hauled trains are an example of what not to do, since they already stir up opposition but will also be expensive to replace. Generally, concerns of emissions are a ticking time bomb and planners are well-advised to prepare for times when those issues become more important.

It is possible that a city government acknowledges the fact that its public transportation access to its airport is not sustainable currently, but also that the sense of urgency to change anything about that is not strong enough at the moment. Chicago and Paris might find themselves in that situation. The solution

here is to *acknowledge the degree of urgency and tailor planning efforts to that situation*. Planning efforts will look different if a problem is anticipated but no action is needed until later in the future (like in Chicago) versus a situation where the express needs to be up and running within a few years. If no action in short time is needed, the city government can still do a number of useful things to prepare successful construction and operation of the airport express in the future. Those actions include securing of land where the express should be constructed, reaching out to the airport and city transit operators to encourage cooperation, discussing expected benefits of the project and who should pay for them, and reaching out to adversely-affected residents to find out how they feel about the project and what might be done to make the project more palatable for them.

In cases in which rail service is truly deemed more appropriate than rapid bus service on dedicated, well-designed transfer stations and transfer stations that will accommodate buses when the need to scale up emerges would be a wise investment.

4.4.2 Prognosis for systems under construction

The following list of necessary conditions for a sustainable airport ground access project helps to formulate a prognosis for systems currently in planning or under construction:

- Equitable funding to other parts of the transit network
- No worsening of other modes of transportation
- Connectedness to other modes of transportation
- Sustained political support and prioritization of the project
- Possibility for constituencies to voice their concerns and be heard
- Cooperation between involved government and transit operating bodies
- Adaptability in political system to monitor and respond to change

- Adaptability in operating institutions to monitor and respond to change

Paris shows impressive commitment between different planning bodies, but its plan for financing the express does not seem fully thought through. While in London in times of economic prosperity a private investor could be found, the same seems doubtful in Paris in times of crisis. In addition, Paris' plan to run regional and freight trains on the same tracks as the airport express raises seems dangerous. The current set-up suggests delays in implementation since it is not clear how the project will be financed and how different trains will be run on the same tracks.

As for Chicago, the project is off the table and it seems doubtful that it will be resuscitated any time soon. While a predecessor of the current General Manager found buses to be an image problem, the current person in charge is more open to realizing airport access through bus rapid transit.

Hong Kong and Tokyo are examples for maybe the most successful airport-rail links today. Their weaknesses consist in their lack of scalability and possibly in the ability of the city government and operating institutions to anticipate and react to change. All three conditions are currently being tested by the fierce competition of modern buses that developed. London is in a slightly worse situation with a lower mode share and concerns being voiced already about air pollution from the airport express itself. The biggest threat is again steadily improving bus service. Every agency that is planning airport-rail links today needs to be aware of this danger and should seriously consider a high-quality, dedicated bus line with provisions to later change to cleaner propulsion technology, once it becomes available. Buses have the strategic advantage of higher scalability than trains and therefore burn less cash in times of slow demand. It is possible for bus service to be completely comparable to rail when it is seamlessly integrated into the local, regional and national rail networks at transfer stations.

4.5 Conclusion

The observations that different authors made in the literature relating to European and North American examples help to explain outcomes for the Asian examples.

Flyvbjerg (2009) demonstrates systematic cost underestimates and benefit overestimates. The case studies in this thesis replicate this finding by demonstrating a pattern of systematic overestimation of ridership and underestimation of construction time. While unusual events, like the Asian financial crisis, help explain these outcomes, the question needs to be asked why prior experiences of ridership and schedule underestimation are not taken into account when planning new systems. It can only be hoped that systems currently under construction, such as Chicago and Paris, learn from the track records of ridership and schedule underestimates of Asian systems. From a broader perspective, initiators of large-scale transportation projects such as airport-rail links need to be aware of possible incentives for preparers of forecasters to sway numbers in order to make a certain project look more promising on paper. These incentives are not automatically cured by risk allocation for wrong estimates to the preparer of forecasts, as is often done in private-public partnerships.

An important finding from the research in this thesis is that a number of new Asian systems were greenfield investments that were conceived jointly with its ground access systems (Hong Kong, Tokyo, Kuala Lumpur, Seoul, Bangkok, Shanghai). This fact explains the importance that was attached to constructing dedicated rail service and a general sense of urgency that rail service was needed in order for the new airport to function. Airports in Europe and the Chicago airport have worked for a while without dedicated systems (Heathrow, Paris, Munich, Istanbul, Rome, Chicago). Heathrow was the first airport in the Western world in the case studies to follow suit and construct dedicated service, prompting similar plans at other airports (Paris, Chicago, Munich). While the motivation for Asian system was clearly to enable better airport access, the recent plans at Paris, Munich and Chicago seem to be motivated mostly by a perceived need to signal global competitiveness. This suggestion is in line with the apparent lack to consider less elaborate, less expensive systems that would allow for faster airport access in those cities. While prestige is not a bad motivator per se, it needs to be noted that construction of large infrastructure projects is often hit by unexpected adverse effects, and that government determination will be needed to

push a project to completion in that situation. It is possible that prestige alone is not a strong enough motivator in times of crises.

Experiences with dedicated airport-rail links are mixed. A number of them are delivered behind schedule and fail to attract the targeted level of ridership. People place high importance on connectedness within a wider city transportation system. This level of connectedness can be achieved with simple extensions of an older city-wide transit systems. Heathrow's example shows that one needs to be modest in one's hopes to capture taxi ridership. Airport access is a tough market and competition from buses is stiff. Before investing into a billion-dollar project for dedicated airport access, like Chicago and Paris plan to do, it is important to explore a wide range of technical options, including service by bus rapid transit on dedicated lanes. Not only are buses cheaper, they can cover a wider area of drop-off and pick-up points for passengers, decreasing the need for the much-dreaded transfers.

The need for integration of planning bodies is evidenced by several case studies, including Narita and Paris. In addition, a number of smaller case studies demonstrated complex structures of financing and operating consortia (Kuala Lumpur, Seoul, Bangkok), that underline the need for cooperation of participating institutions. Givoni and Rietveld conclude that the level of privatization is crucial for explaining successful integration of transportation systems at airports. This finding is supported by the case studies in this thesis, since the cases in which an airport-rail link was constructed were overwhelmingly financed to at least some extent by the private sector (Hong Kong, Tokyo, Kuala Lumpur, Seoul, Bangkok). Little attention has been paid to integrating airports into national main line rail service and as a consequence, all airports in the case studies except for Paris form a sink from a broader transportation point of view and make it difficult to access regional and national trains. Where a higher mode share from public transportation is a true concern, it is advisable to consider investing into a better connection to national main line rail.

City governments need to develop and act on plans to encourage cooperation between involved transit institutions. The question is one of choice and determination. The UK developed a plan for stronger intermodalism, but so far has not acted on it (Givoni and Rietveld 2008). In addition, an honest discussion about the value proposition of an airport express and who should pay for what needs to be had, since public goods do not usually pay for themselves. While private investment contributed to financing of many airport expresses and completely financed London's system, it cannot be relied upon to completely finance any airport express as Chicago and Paris envision.

All conclusions in this thesis are generalizable to other infrastructure systems. The basic challenges identified for airport-rail links are due to a complex stakeholder structure, the provision of non-monetary benefits and the question of who should pay for them, large initial investments and long payback period for infrastructure, and the location of managing and regulating bodies between the public and private domains. Those challenges are shared with many infrastructure systems in general beyond transportation. A special challenge for airport-rail links arises from their connector function between different subsystems that were previously governed more or less autonomously. Connector functions develop in other infrastructure domains as well, for example between waste treatment and energy generation through burning of trash. Due to the need to create a sustainable interface between different systems, policy makers managing the process of institutional collaboration of connectors in other areas may also find this research of interest.

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