International Transport Forum

Sustainable and Inclusive Transport

Proceedings of a Joint Seminar held in Seoul, Korea on 3 November 2015

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KOTI THE KOREA TRANSPORT INSTITUTE

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The International Transport Forum

The International Transport Forum is an intergovernmental organisation with 57 member countries. It acts as a think tank for transport policy and organises the Annual Summit of transport ministers. ITF is the only global body that covers all transport modes. The ITF is politically autonomous and administratively integrated with the OECD.

The ITF works for transport policies that improve peoples' lives. Our mission is to foster a deeper understanding of the role of transport in economic growth, environmental sustainability and social inclusion and to raise the public profile of transport policy.

The ITF organises global dialogue for better transport. We act as a platform for discussion and pre-negotiation of policy issues across all transport modes. We analyse trends, share knowledge and promote exchange among transport decision-makers and civil society. The ITF's Annual Summit is the world's largest gathering of transport ministers and the leading global platform for dialogue on transport policy.

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International Transport Forum
2, rue André Pascal
F-75775 Paris Cedex 16
contact@itf-oecd.org
www.itf-oecd.org

KOTI-ITF Seminars

The ITF and KOTI organise regular joint seminars designed to review the results of recent research relevant to the annual ITF Summit.

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- Dr. Young-In Kwon and Jaehak Oh, Korean Transport Institute
- Mr. Stephen Perkins, International Transport Forum
- Dr. Sangjune Park and Geunwon Ahn, Korean Transport Institute
- Dr. Fabio Croccolo, Ministry of Infrastructures and Transport, Italy

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Executive Summary

Introduction

The Korean Transport Institute (KOTI) and the International Transport Forum (ITF) have held joint seminars since 2010 to share knowledge and experience on topics of mutual interest as well as to strengthen mutual cooperation. The first seminar examined green growth in transportation. In 2011, the focus was on critical evaluation of promotion policies for electric vehicles. The 2012 seminar explored seamless public transport. In 2013 the joint seminar theme was funding transport which aligned with the theme of the 2013 Leipzig Forum. In 2014 the joint seminar dealt with the issues of urban transport in a changing world. The main theme of the last seminar was transport and trade in accordance with the 2015 ITF Ministerial theme and the second 2015 seminar contributed to preparations for the 2016 ITF Summit on Green and Equitable Transport.

Findings

The second 2015 KOTI-ITF Joint Seminar addressed two different but closely related topics. The first theme is sustainable surface access to airports. Air transport is becoming increasingly important as economies develop and peoples' travel patterns change in the region in response to falling prices for air travel and rising incomes. The best practice case of Incheon international Airport is be discussed along with cases from other nations. The second theme is country specific policy cases for sustainable and inclusive transport. Issues related to the development of sustainable and inclusive transport indicators are also discussed.

Enhancing the sustainability of transport systems has been one of the highest priorities for the sector in the 21st century. However, transport is also notoriously dependent on fossil fuel and thus it is difficult to increase carbon efficiency in the sector to ensure environmental sustainability. As East Asia has become one of the most economically vibrant regions of the world, environmental sustainability has been compromised due to ever-increasing passenger and freight traffic. Another salient characteristic of the region is rapid urbanisation and aging population. Providing equitable access to the elderly and to the disadvantaged has emerged as a very important agenda in the region.

The paper is organised as follows. The first section looks at the research work at ITF on sustainable and inclusive transport. The second and third sections examine sustainable surface access to Incheon International Airport and in relation to London Heathrow Airport's expansion plans. The forth section presents Korea's sustainable transport policy measures. The final section is a case study of sustainability indicators in Italian cities.

Sustainable and inclusive transport research at the ITF

On inclusive transport

We are all aware of the challenges posed by mobility impairments and ageing, and of the scale at which they are present in society today. We also know that much of our cities have been built – in the public space, in transport systems, in buildings – as if assuming that all their users always enjoy rather good levels of mechanical and sensory fitness. The legacy costs of this situation, implicit script and associated design are huge.

We should act preventively. A significant number of people with severely mobility impairments have their condition as a result of road accidents/crashes. No reliable statistics on this could be found. Reducing fatalities and serious injuries requires major progress to reduce the number of people suffering from these impairments. The political weight of this cause in more developed countries seems to be diminishing, possibly associated with significant reductions of fatalities. A stronger focus on the suffering and costs associated with the seriously injured is necessary.

Access is the strategic objective

Focus on mobility has led to a concern mostly with time savings (and travel speeds) in most cities. This must change. Good access for all citizens is the strategic policy objective. Transport and mobility are instruments, but so is land-use. Density and functional diversity are essential to offer easy access, based on active modes (walking & cycling). Access to transport is necessary, but not sufficient. In the end it depends on where that transport could take you.

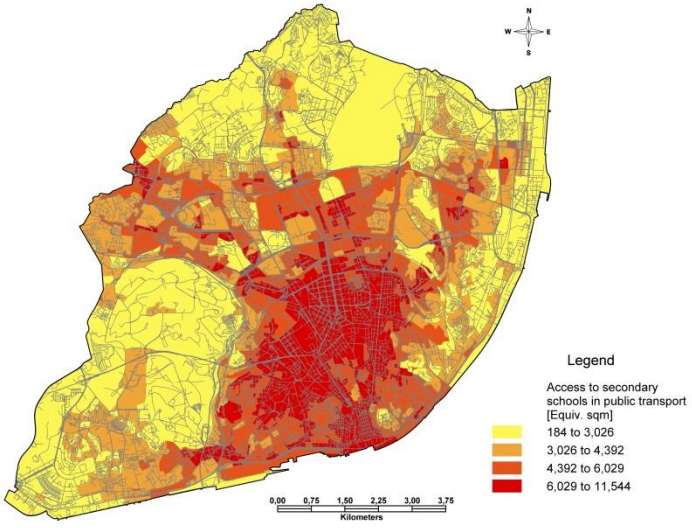
Based on translation of "near" and "far" into minutes of travel, these perceptions change according to target function, mode of travel and vitality condition of the citizen. With a GIS-system (data and software) calculations are quite easy and results can be communicated quite effectively. Results are presented as the area of a target function equivalent to the same level of attraction if all were located in the near range. The results are often stunning, showing huge discrepancies as represented in Figure 1.

New paradigm focuses on access of all social groups to jobs, public services, and social interaction opportunities. Some diversity of preferred services and places of social interaction for different social groups by age, income, and culture are necessary. By measuring level of access with a GIS-system, we can find the distortions, which are generally quite big, across urban spaces. Targeted corrections by urban area and social groups can then be developed. Mobility impaired people living in those low accessibility areas have an additional barrier. Action plans must consider both territorial and individual dimensions.

"Larger than life" barriers for the elderly

Public transport with easy physical entry/exit is essential to encourage the mobility of elderly people, but there are a few elements that still constitute barriers felt as especially severe by them. Public transport infrastructure, rolling stock and services remain inaccessible to older and disabled people in many parts of the world. Navigation or route planning in a complex public transport network should be provided particularly for those who were car drivers most of their active life. Continuous progress must be made on these fronts, for all citizens, but targeted action is needed for the elderly.

Figure 1. **Level of access, GIS evaluation example**



Source: Martinez and Viegas, 2016.

Digital connectivity, easy customisation

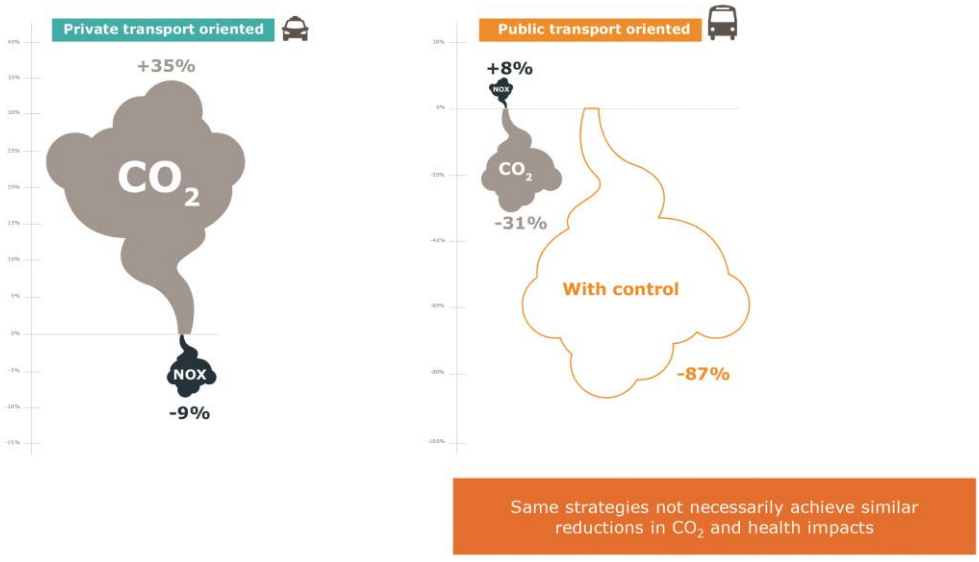
Strong social penetration of digital connectivity facilitates new kinds of services with the right combination of available to all but tailored to each one. Customised information about the best options to move in complex public transport networks lowers information barriers. Innovative and collective door-to-door transport services, for example shared taxis, responds to demand in real-time. Multiple personal logistics trips are no longer needed thanks to telecommunications (telemedicine, health monitoring, online shopping, etc.), which make physical mobility mostly optional based on the pleasure of personal interactions.

On sustainable transport

ITF Outlook

The policies for the long-term transition to sustainable transport and adaptation to severe weather and climate change are assessed. ITF Outlook includes extended scenarios for COP21. It is a scenario tool to examine the development of global transport volumes, related CO_2 emissions, and health impacts. It is also a strategic tool to support policy makers in shaping the future of transport policies. It analyses how the world could change if we choose different policies, focusing on scenarios illustrating potential upper and lower pathways. Figure 2 presents an Outlook modelling example that shows the simplistic public transport policies may increase NO_x emissions but that if accompanied by strict emission controls they can reduce CO_2 and NO_x emissions at the same time.

Figure 2. **CO_2 and NO_x emissions in alternative policy scenarios (Latin America example)**



Source: Viegas, 2015.

Infrastructure adaptation to extreme weather and climate change

Transport asset managers face a fundamentally uncertain future with respect to infrastructure and network vulnerability to climate change and future extreme weather events. Climate change will have an impact on many hazards that affect transport assets and alter transport system performance. Transport asset owners and network managers will have to make decisions on the basis of uncertain, incomplete or inadequate data regarding key climate stressors. ITF's working group on Infrastructure Adaptation to Extreme Weather and Climate Change has recommended the following actions:

- Transportation asset owners and network managers must act now to preserve asset value and system performance.
- Fully funded maintenance is a key hedging strategy in light of climate uncertainty.
- We must prepare for more frequent and unexpected asset failures.
- Asset management strategies must assess infrastructure and network vulnerability.
- Adaptation must focus on system resilience, not just on designing robust infrastructure.
- Transport authorities must re-evaluate their stance regarding redundant infrastructure.
- Authorities should no longer rely solely on cost-benefit assessment for appraisal in light of deep uncertainty regarding climate impacts on transport assets and networks.
- Incorporating deep uncertainty into asset appraisal requires a new set of decision-making support tools.

Cycling impacts on safety, air pollution and health

Bicycles are a fast, flexible, efficient, and environmentally friendly transport mode. However, cycling is not necessarily safe in the current traffic system. Cyclists are vulnerable road users. The relative risk of death or serious injury is several times higher (14 times in the UK, 11 times in Switzerland, 6 times in Norway and Netherland) for cyclists per km travelled than it is for cars. The relative risk is less per hour spent travelling, but cyclists are still more vulnerable. This higher relative risk is largely due to the fact that the road traffic system has not been designed for cyclists, more precisely for mixing fast and heavy vehicles with slower, lighter and unprotected road traffic users. Simple treatments are effective to reduce the risk like in Copenhagen where the use of blue bands to highlight the major cross-junction bicycle movements has successfully reduced serious and fatal crashes .

If we are concerned about bicycle crashes, it is because of the negative impact these have on cyclists' health. For transport authorities, this is a key area of concern. However, crashes are not the only health-related concern for cyclists, nor even the most important one. On the one hand, there is air pollution. Cyclists are exposed to health-reducing levels of air pollution – particularly fine particles and ozone. Because they inhale more frequently and deeper than other traffic participants, they register higher doses and incur more severe consequences. In some cities, like in Paris, the health impact from air pollution for cyclists is greater than the health burden from bicycle crashes and related injuries and death. Accounting for ventilator effort, cyclists register two to eight times more pollutant intake than car occupants.

The most important health impact from cycling is a significantly positive one. Consistent and robust evidence indicates that by far the greatest health impact related to cycling is the positive health impact derived from physical exercise. Cycling, as a moderate physical activity, can significantly reduce mortality and morbidity due to cardiovascular disease, type-2 diabetes, cancer (colon, breast), osteoporosis, and depression. The health benefits are greatest for new cyclists who previously were relatively inactive. Policies must focus on this population whose needs, expectations and preferences may be different than regular and experienced cyclists. What attracts these users to everyday cycling is a key policy question.

Evidence on the scale and size of the health benefits from bicycle-related physical exercise are robust. The monetised benefits from improved health are nearly 20 times greater than the combined health impacts of crashes and exposure to air pollution. This impact is greatest for those switching to cycling from a more sedentary lifestyle – eg those otherwise inactive people switching from passive forms of transport (car, public transport though there is more walking already) to cycling. It is imperative to preserve or increase cycling from a whole-of-government perspective but transport authorities typically only account for crash disbenefits. A key policy challenge is addressing the disconnect between transport policy which focuses on cyclist safety in traffic and the whole-of-government perspective that seeks to optimise all benefits, including the very important health benefits of cycling. Governments that do not address this challenge misdiagnose, misunderstand and miss out on the real societal benefits of cycling in the best of cases and actually make society worse off in the worst case.

Safe System approach

The road transport system should accommodate human errors. The Safe System approach should incorporate strategies for better management of crash forces and aims at reducing or eliminating crash risk by avoiding latent errors and dangerous actions throughout the traffic system. The Safe System approach is built around four principles: functionality in that road design matches desired usage, homogeneity by speed management and separation, predictability to avoid unexpected situations, and forgivingness to minimise crash outcomes.

Potential of shared rides to reduce congestion and emissions

Urban Mobility System Upgrade is a project started by the ITF and the Corporate Partnership Board in 2014. A shift to public transport has not done enough up until now for the decarbonisation of transportation. Shift to public transport is seen as essential, but mostly it is not happening. There are two main reasons. Misalignment of policies in urban areas helps explain, but it is not enough. Public transportation quality of service is poor, especially for those requiring transfers and/or requiring service in periods or areas of low demand. Digital connectivity allows strong quality improvement.

The key concept is to combine quality of service with good load factors. The quality of service is critical for good acceptance. Two new modes of public transport are assessed: Shared Taxi services combine passengers going in the same direction and Taxi-Buses, small buses organised in (quasi) real-time response to demand. Very strict constraints on quality of service for both the modes were applied as shown in Table 1.

Table 1. **Service condition of Shared Taxi and Taxi-Bus**

Shared Taxi	Taxi-Bus
- Door-to-door service - Max waiting time: from 5 minutes (<=3km), up to 10 minutes (>= 12 km) - Max lost time (waiting + detour): from 7 minutes (<=3 km), up to 15 minutes (>=12 km) - Minivan configuration to facilitate entry/exit, capacity 6 passengers	- 30 minutes advance notice (most users with regular reservation) - Deviation to desired boarding time <= 10 minutes - Walk to boarding point <= 500 m - Direct ride for all passengers - Small vehicles (capacity 8 to 16 passengers, few stops, good speed)

Using real data (trips, network) from a mid-size European city (Lisbon), very detailed simulation with all motorised trips on road modes (cars, taxis, buses) were performed by Shared Taxi and Taxi-Buses. Metro services were kept. The results showed that public spaces for parking are released. All parking spaces at surface and 80% and more of built-up are released, allowing great improvement of conditions for active modes and requalification of public spaces. Much more intensive use of these vehicles leads to much faster fleet renewal, making quicker integration of cleaner technologies.

Table 2. **Shared mobility simulation results**

		Average number of passengers on board
Shared Taxi	All day	2.0
	Peak	2.0
Taxi-Bus	All day	4.1(cap 8)/9.4(cap 16)
	Peak	5.1(cap 8)/12.1(cap 16)
Fleet size (Shared Taxi + Taxi-Bus)		4.3% of base case
Vehicle-kilometre travelled (VKT)	All day	71% of base case
	Peak	66% of base case
CO_2 emission		70% of base case

With very affordable prices with non-subsidised operation, including ownership and operational costs + 25% for back-office and profit, the cost of shared taxis is at 28% of current taxis cost, and that of Taxi-Buses is at 37% of the current cost of public transport including the subsidy. If the cost of Shared Taxis

is compared with owning a car and operating, even for the low cost (EUR 15K) new cars; Shared Taxis cost less for daily distances <=45 km.

From all these results with current technologies and drivers under contract, very significant decarbonisation can be achieved (30% less), and significantly less congestion occurs (34% less VKM at peak hours), meaning that much better and safer conditions for active modes are achieved. This is a radical configuration, with no private cars, but maintaining all current mobility, with improved quality (no transfers, no congestion) and much lower emissions. The main conclusion is that a paradigm shift for public transport is needed and holds great potential, recognising that careful calibration to each city's conditions, as well as necessary arrangements for the transition.

Sustainable surface access to airports: Incheon International Airport best practices

Brief history, current conditions and achievement

The site of Incheon International Airport (IIA) was agreed upon in 1992 and Terminal 1 together with the surface transport centre opened in 2001. The highway access link, the Airport Expressway including Youngjong Grand Bridge opened in 2000. The first stage rail connection from the new airport to the existing Kimpo International Airport was completed in 2007 and the remaining section from Kimpo to the main Seoul Station was completed in 2010. A second highway link to the airport, located 15 km south of the first link opened in 2009. In 2017 Terminal 2 will be completed. The airport is located 60 km west of the centre of Seoul on an area of 56.2 km^2 over two islands: Youngjong Island and Yongyoo Island (Figure 3). The access distances from the other major cities in Korea are 200 km from Daejeon, 430 km from Busan, 330 km from Daegu, and 340 km from Gwangju.

The number of airlines using the airport has increased from 47 at the time of opening to 88 in 2014. The number of destination airports has increased from 109 to 184 during the same time span. The number of international passengers has grown from 14.5 million to 45.5 million, making Incheon the 8th ranked airport in the world in terms of passenger service. Cargo tonnage has increased from 1.2-2.6 million tonnes, making it the 2nd ranked airport in the world in terms of cargo service. The Best Airport Worldwide Award has been awarded to Incheon International Airport 10 years in a row, recognising the quality of the infrastructure and the service provided.

Figure 3. **Location of Incheon International Airport and its connection to the mainland**

Source: Incheon Airport.

Airport access: Highway, rail and bus

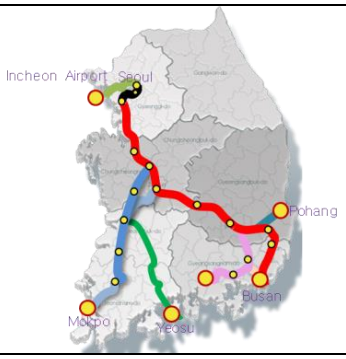
The first highway link, Incheon International Airport Expressway including Young Grand Bridge, opened in 2000. The construction was funded by a public-private partnership (PPP). The second link also funded by a PPP, including Incheon Bridge, opened in 2010. Korea's national highway system is a grid of 9×7 routes (Figure 4, centre). A high occupancy vehicle (HOV) lane was installed in 1994 on a 141 km stretch of the highway from Seoul to Sintanjin (Figure 4, right), which is the most heavily used section of the highway network, and this greatly facilitates access to Incheon airport by public transport from major cities in the south.

Figure 4. **Location of Incheon International Airport and major metropolitan cities (left), national highway grid (centre) with Seoul-Sintanjin HOV link highlighted, operation of HOV lane (right)**

Source: Hwang and Kim, 2014.

The first stage, 37.6 km of Airport Railway opened in 2007 from the airport to Kimpo International Airport. The second stage of 20.4 km from Kimpo International Airport to Seoul Station opened in 2010. The travel time of the express service from Seoul Station to the airport is 43 minutes and that of the all-station-stopping service is 56 minutes. From outside Seoul Metropolitan Area, the national high speed rail (KTX) network connects Korea's major cities to the airport via Seoul Station, with transfer to the express airport train, and through services on KTX trains operate several times a day.

Table 3. **Travel time to IIA from southern cities on through trains**

From	To	Travel time	Frequency per day	
Incheon International Airport	Busan	3h 50m	6	
	Jinju	4h 10m	1	
	Pohang	3h 20m	1	
	Mokpo	3h 30m	2	
	Yeosu	4h	1	

Source: Based on Kwon and Oh, 2015.

There are 69 bus lines that provide access to the airport from Seoul Metropolitan Area, including 24 bus lines from cities outside the metropolitan area. For quick access, bus stops are located on arrival and departure area curb-sides. Taxi drop-off and pick-up is located across the bus way at a second curb and cars are required to use the parking area for drop-off. Bus fare level is KRW 8 000-15 000 (USD 7-13) for passengers from the Seoul Metropolitan Area and KRW 20 000-40 000 (USD 17-34) for other regions. The competitiveness of the bus access is represented in the bus access share of 53%, which is the highest among all airports in the world.

Figure 5. **Bus stop layout on arrival curb-side and bus stop operation**

Source: Incheon Airport; Kwon and Oh, 2015.

City airport terminals are located in Seoul Station and Samsung Metro Station, where check-in counters and customs immigration and quarantine services are provided. Passengers on Metro no 9 transfer to the Airport Railway at Kimpo International Airport station without changing platforms. Seoul Station is a major transfer point where Metro no 1, no 4, High Speed Rail and many bus lines are connected to the Airport Railway.

Best practice analysis

Public transport mode share

The public transport access mode share was 67% as of 2014 at Incheon International Airport, which is the highest among all airports in the world. This high share of sustainable access modes is due to the convenient and complete public transport networks provided, including bus and rail. Especially the bus share is extremely high, at 53%, which is due to well-connected bus networks across the country.

Integrated fare and exclusive bus lane

Within Seoul Metropolitan Area (also within most metropolitan cities in Korea) the public transport fare is integrated, with one card covering all routes and modes. Passengers use a credit card or dedicated public transport fare card and the fare is calculated based on the information of from/to station or bus stop. Along 14 major bus corridors express bus or BRT systems with exclusive median bus lanes have been installed since 2004. The bus connection to Incheon International Airport was not explicitly considered when selecting the corridors. However, as the new system increases the speed of buses accessing major expressways connecting Seoul with Youngjong Grand Bridge and the 2nd Bridge (Figure 3), it benefits access to IIA. At major metro stations BRT transfer centres have been built (Figure 6) to facilitate connections between bus and rail networks.

Figure 6. **BRT transfer centre at Cheongryangni Station, Seoul**

Source: Kwon and Oh, 2015.

Timely investment by public-private partnerships

During the project period of the airport, the Korean government experienced financial diffuculty following the Asian financial crisis. To reduce the financial burden the access highway and railroad were

funded by PPPs, the first in Korea. Previously it took seven to eight years to complete an expressway project of this nature, but the PPP project took five years to complete the highway as a result of the incentives provided by structuring the project as a PPP. Following the airport expressway project, 24 expressways have been funded by PPPs elsewhere in the country.

Reliability and competetiveness of public trtansport access

Airport access travel time and cost comparisons are presented in Table 4. From Seoul the car access is shortest in time but in terms of cost, that of bus and rail is much less. The frequent congestion on road networks in Seoul makes the public transport modes even more attractive. From cities from the far south, access time is shortest by rail service. Bus and car show a similar level of access time. Again in terms of cost, using public transport modes is advantageous. The airport bus service is in general cheapest and is a direct service. This makes bus the most popular mode of access to the airport. Recall that the mode share is the highest, at 53%, among all modes.

Table 4. **Bus, rail, car airport access time and cost comparison**

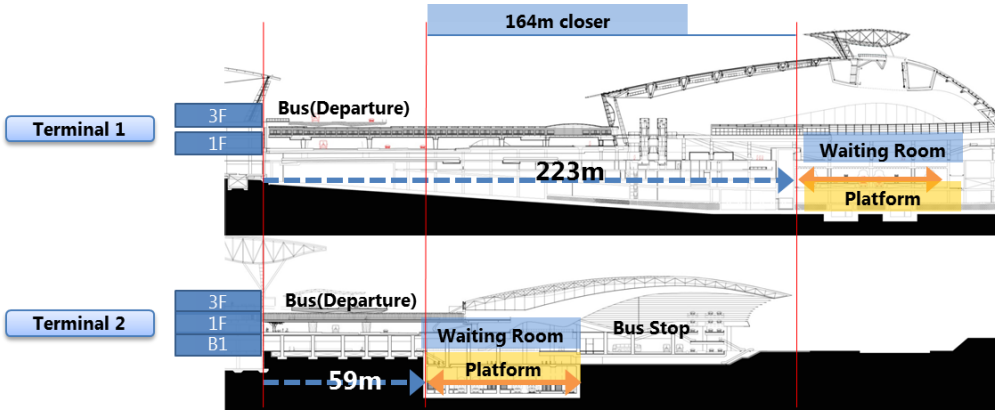
Destination	Airport bus		Airport rail		Passenger car	
	Time*	Fare (KRW)	Time**	Fare (KRW)	Time	Cost*** (KRW)
Seoul	1h 20-50m	10 000	1h 30-45m	4 250-8 000	1h	47 000
Busan	5h 30m	41 800	3h 55m	72 100	5h	114 000
Gwangju	3h 50m	32 300	3h 5m	59 400	4h	98 000

* access/waiting time 30m, ** access/waiting time 45m, *** toll, petrol, and 3 day parking

Airport improvement plans: Terminals, parking and railway access

The new passenger terminal (located at the bottom of Figure 10) will further improve public transport accessibility. In the current layout, the passengers using the Airport Railway walk 223 metres to reach Terminal 1. To improve access, the layout of the new Terminal 2 (opening in 2017) situates the rail platform just 59 metres from the check-in area (Figure 7).

Figure 7. **Walking distance from rail platform to passenger Terminal 1 and 2**



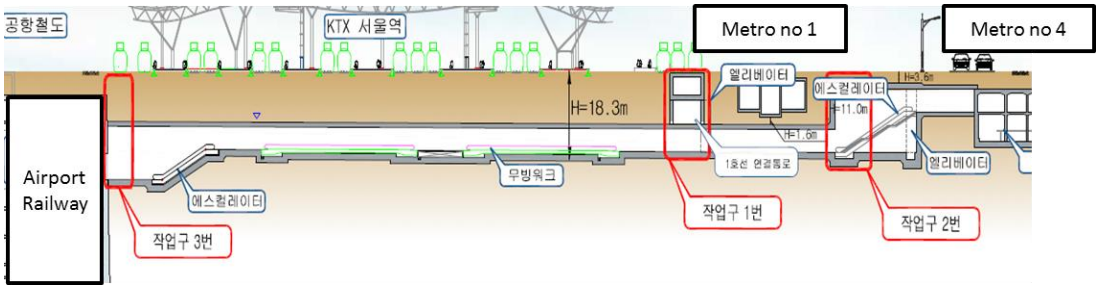
Source: Kwon and Oh, 2015.

The small area of the curb-side reserved for cars is highly congested and short-term parking spaces are insufficient to meet the demand. Responding to these issues, Incheon International Airport Corporation is planning to increase the parking fee from KRW 12 000 to KRW 24 000 per day.

At Gwangmyeong KTX Station located at the southwest border of Seoul, a new city air terminal will be added where passengers can check-in ticket/baggage and clear the security check before KTX boarding. Because 74% of KTX inter-city trains stop at this station, this convenient feature will attract IIA passengers from outside Seoul.

The rail access mode share is relatively low at Incheon International Airport and the patronage of the city air terminal at Seoul Station is also low. This is in part due to poor station platform and concourse layout, and impeding connection to the Airport Railway at the station. In the current layout of the station, the passengers from Metro no 1 and 4 walk 700 metres around KTX station. To resolve this, a direct underground path is being planned (Figure 8).

Figure 8. **Airport railway access improvement plan at Seoul Station**



Source: Kwon and Oh, 2015.

Sustainable surface access to airport: London Heathrow case study

Planning framework for infrastructure projects in the UK

The framework is designed to ensure that proposed developments are compatible with community expectations and current and planned land use allocation and transport system capabilities. Projects are subject to agreement by local government planning authorities and, if they have major environmental impacts, national support in form of a bill in Parliament. The requirements of European Union directives including air quality standards and strategic environmental impact appraisal are important parts of planning considerations. Planning inquiries are held for controversial projects.

Requirements and approval process for airport development: Two planning routes

In the UK, airports are mostly in private ownership, but central government has a crucial role to play in the planning process whenever there are significant noise or air quality impacts and implications for land use and the transport system beyond the scope of the local planning authority. To reach a planning consent for major airport developments there are two alternative routes: a National Policy Statement from government, and a so-called Hybrid Bill in Parliament.

If the NPS route is followed, the government publishes a National Policy Statement that describes the need of Nationally Significant Infrastructure Projects. Parliament and the public must be consulted. Individual promoters can develop their proposals and submit them to the Planning Inspectorate. When they develop the proposal, local people and interested groups must be consulted. Then, the Planning Inspectorate must make a recommendation to the relevant Secretary of State within nine months of the beginning of the examination. The Secretary of State must then decide whether to grant a Development Consent Order within three months.

If the Hybrid Bill is chosen for the consent of a planning, the government publishes a strategy document, setting out its assessment of need for the project. Then, the government secures detailed scheme designs with a private sector promoter. These government actions are made with public consultation. The government drafts a bill to grant consent and introduces it to parliament. The bill is subject to public petitioning at a committee stage. The permission to proceed is granted through Royal Assent to an Act of Parliament.

Further considerations: Noise, air quality and surface access

No formal noise limits are imposed by EU or UK law. One of the main principles of planning is to avoid, mitigate, or reduce significant noise impacts on quality of life from any development. The Airports Commission established by the government to examine the scale and timing of airport expansion in London and the Southeast of England recommended a package of measures to address noise impacts for its recommended option, Heathrow 3rd runway to go ahead. Their recommendations included a ban on all night flights, a noise envelope, a commitment imposed on Heathrow Airport to spend over GBP 1 billion on community compensation measures, a noise levy to fund noise insulation and support for schools, establishment of a Community Engagement Board and an Independent Noise Authority.

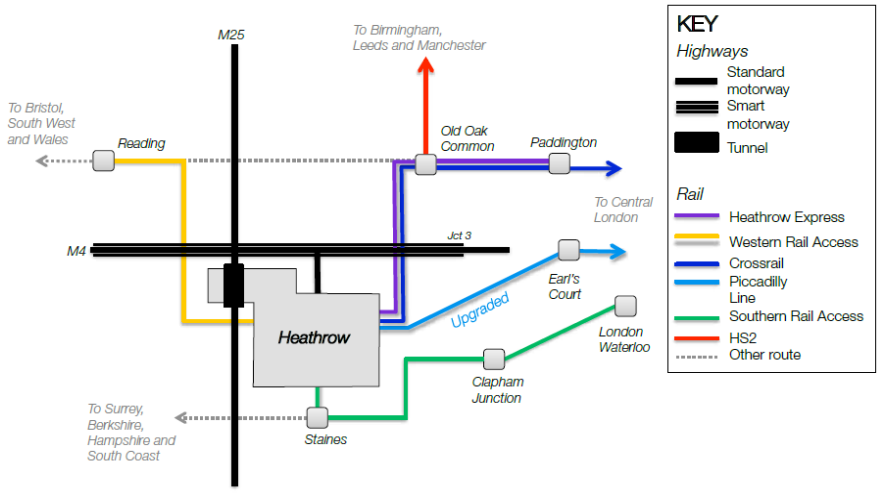
Infrastructure projects often create air quality challenges with respect to the European air quality standards. The Airport Commission recommended expansion contingent on acceptable air quality performance, and suggested potential demand regulation mechanisms to be applied to roads around the airport. This means that high public transport mode shares will need to be attained for the airport to be able to use its expanded capacity.

The Airports Commission scrutinised the surface access strategies submitted by scheme promoters against three objectives: maximising the number of passengers and workforce accessing the airport via sustainable modes of transport, accommodating the needs of other users of transport networks, such as commuters, intercity travellers and freight, and enabling access to the airport from a wide catchment area.

The surface access strategy for expansion of Heathrow comprises a number of upgrades to the existing networks (Figure 9). On top of the already planned works to increase capacity on the key motorway links serving the airport, for example the improvements needed to transform a section of the M4 into a "smart motorway" by 2021, the commission identified a number of road widening schemes. In addition, a range of works that would be needed to accommodate expansion was identified, including the tunnelling of a section of the M25.

As several significant surface transport schemes that will benefit Heathrow in the future have already been planned (Crossrail, HS2 and Western Rail Access), there is relatively little bespoke new infrastructure associated with airport expansion. The only new link that would be constructed specifically for expansion is Heathrow Southern Rail Access, which would provide links to Waterloo as well as areas of West London that are currently poorly connected to the airport by public transport (i.e. Richmond).

Figure 9. **Surface access strategy for expansion of Heathrow Airport**



Source: Airports Commission, 2015.

The enhanced transport offering resulting from Heathrow expansion was forecast to enable a shift in the airport's public mode share from around 41% in 2012 (28% rail, 13% bus/coach) to around 53% in 2030 (over 40% rail). These figures indicate that public transport, and rail in particular, is expected to take up a much greater volume of Heathrow's passengers in the future, in 2030 over 56 million passengers would be expected to travel by public transport compared to around 29 million in 2012

Appraisal of the Thames Estuary: Four modules

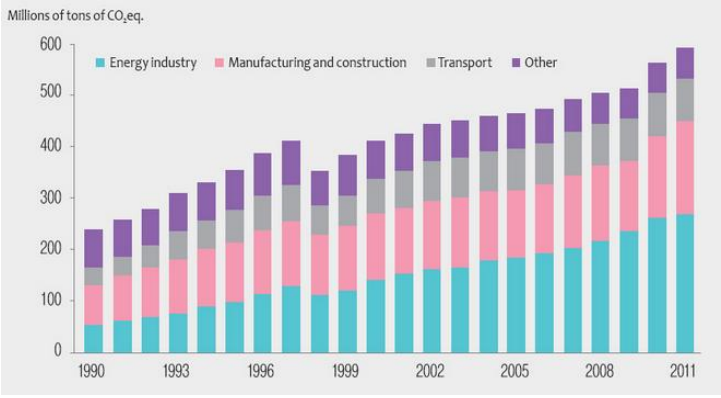
The Airports Commission decided not to shortlist the Thames Estuary project for detailed assessments due to: economic disruption and environmental hurdles, its high cost (GBP 70-90 billion with much greater public expenditure involved than in other options, GBP 30-60 billion), the cost of the surface access package to serve the long-term capacity needs was estimated at about GBP 26.9 billion.

Korea's sustainable transport-related policy measures

GHG emissions: Trends, composition and national reduction goals

Korea's GHG emission in 2011 is 697.7 million CO_2eq tonnes. The total GHG emissions have been continuously increasing since 1990. The amount from fuel combustion constitutes 45.5%, which is divided by manufacturing and construction industries sector (31.1%) and transport sector (14.4%).

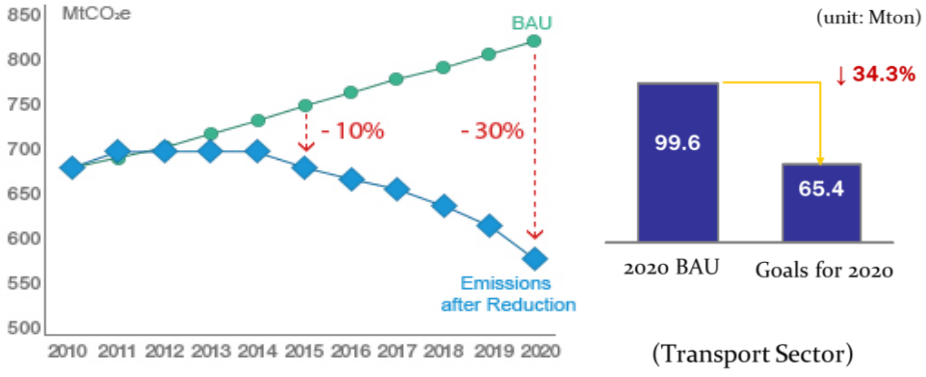
Figure 10. **Korea's GHG emission trend since 1990**



Source: Based on Greenhouse Gas Inventory and Research Center of Korea, Park and Ahn, 2015.

Korea set and announced a voluntary mid-term goal of reducing GHG emissions by 30% of the BAU level by 2020 (Figure 11). Taking the total amount reduction as 100%, the reduction target amount of transport sector is the highest, 34.3%, followed by building/ housing sector and power supply sector.

Figure 11. **Korea's GHG emission reduction target, national (left) and transport (right)**



Source: Based on Greenhouse Gas Inventory and Research Center of Korea, Park and Ahn, 2015.

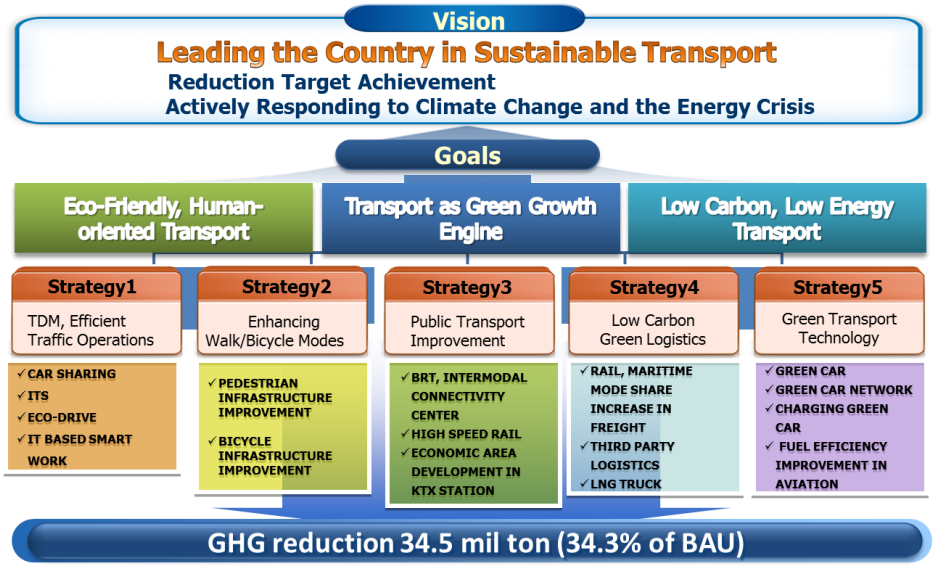
National sustainable transport policy framework

National Sustainable Transportation and Logistics Development Master Plan

The Low Carbon Green Growth Act was established in 2010 in order to respond to climate change, the energy crisis and environmental protection requirements. Under the act, the government should build Green Growth Master Plan every five years and sub-plan every year. Under the first plan, goals and targets are set regarding energy, transport, technology innovation, etc.

In the transport sector, the Sustainable Transportation and Logistics Development Act was established in 2009. Under the act, a National Sustainable Transportation and Logistics Development Master Plan should be set up every ten years. The first plan depicts goals and strategies to reduce GHG emissions in the transport sector. The details of strategies include transportation demand management and efficient traffic operation; walk and bicycle environment improvement, public transport improvement, green logistics and green technology development (Figure 12).

Figure 12. **National Sustainable Transportation and Logistics Development Master Plan**



Source: Based on Ministry of Land, Transport and Maritime Affairs, 2015.

GHG emission cap management

Under the Low Carbon Green Growth Act, heavy GHG emitters (with their emission level over predefined thresholds), such as car manufacturers, power plants and oil refineries, are managed by the government by capping their emission level and assessing the efforts to reduce it. The Ministry of Environment is in charge of this management and energy related public authorities provide guidelines and verify their emission reports. Based on the emission reports submitted, the organising committee decides if the emitters should be under the management regulation, and if they are, the committee set their cap levels. Then, the emitters under the cap management submit action plans. The actions plans and success of achieving the cap are assessed in the next three years. This cycle repeats (Figure 13).

Figure 13. **GHG cap management administration process**

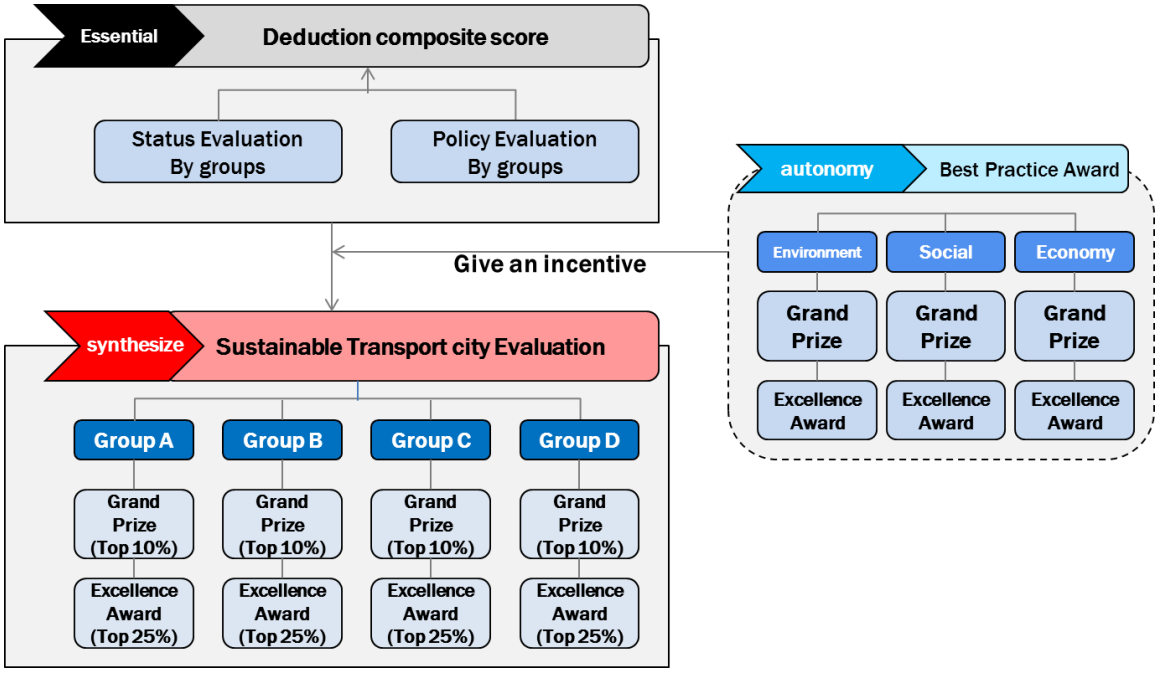
Source: Based on Greenhouse Gas Inventory and Research Center of Korea, Park and Ahn, 2015.

Sustainable transport: City evaluation

With the Sustainable Transportation and Logistics Development Act Article 15 (Investigation and evaluation of sustainability), the Minister of Land, Infrastructure and Transport (MOLIT) shall investigate and evaluate the sustainability of transportation system of cities on a regular basis. The MOLIT shall establish and operate databases, for systematic collection, analysis and provision of data used for the investigation and evaluation. The objectives of this evaluation are achieving a sustainable transport system on a city level, evaluating the current transport conditions and policies of local governments, and monitoring and supporting local governments' sustainable transport policies.

Cities are classified by four groups according to their population size. Cities with a population above 100 000 fall under the scope of the evaluation. The evaluation consists of the status evaluation using sustainability indicators (quantitative statistics) in social, economic, and environmental aspects, and the policy evaluation is based on the submitted set of policies to promote sustainability. In each group, based on the score of combining status and policy evaluation, Grand Prize and Excellence Award are given to well performing cities. Based on submitted policies evaluation, best policy practices are selected and the cities are awarded. Those with poor scores are also selected and they are given funds to make improvement plans. The overall evaluation and awarding framework are shown in Figure 14.

Figure 14. **Sustainable transport – city evaluation framework**



Source: Park and Ahn, 2015.

Transport systems sustainability indicators in Italian metropolitan cities

Evolution of transportation planning in European countries

As directed in Action Plan on Urban Mobility of European Commission (COM (2009) 490/5), transportation planning evolves from a traditional one, focusing on vehicular traffic, to a more sustainable urban mobility planning one, caring more about people, citizens and their activities. The Guidelines, Developing and Implementing a Sustainable Urban Mobility Plan (EC, 2013) nicely summarises the planning guidance. The primary objectives of the traditional planning are increasing road capacity and vehicular speed, but in SUMP, they are accessibility and quality of life, sustainability, economic viability, social equity, health and environmental quality. In the same context, modal split is weighed more on cleaner or sustainable modes, soft solutions are more sought after in terms of investment, and all stakeholders (i.e. citizens) participate in the planning process rather than only experts, as was the previously case. The evolution of the manner of transportation planning in the guidelines are summarised in Table 5.

Sustainable urban mobility indicators in Italy

Transport indicators are adopted to measure the performance of urban mobility. Traditionally pure transport indicators have been used for this purpose. For example, the number of vehicles, modal split, commercial speed, time of travel, number of parking slots, and length of transport infrastructures per mode are traditionally used. As the transport planning evolves toward valuing sustainable urban mobility, social (number of accidents and casualties, accessibility, modes, parking violations), environmental (air quality, GHG, noise, use of land, restricted traffic area), and economic (tolls, costs, time of return, NPV, IRR, CBA) indicators are also considered. Even among the traditional ones, there is more focus on soft mobility, like cycles and pedestrians, and elderly people. In the planning process more stakeholders are involved and procedural indicators, such as participation (e.g. number of meetings), communication and diffusion, and monitoring (e.g. number of updates), are evaluated. As this evolution goes on, data collection is also evolving from estimated data to real data, from historical data to updated data, and from static data to real-time data.

Table 5. **Move from traditional transport planning to sustainable urban mobility planning**

Traditional transport planning	Sustainable urban mobility planning
Focus on traffic	Focus on people
Primary objectives: Traffic flow capacity and speed	Primary objectives: Accessibility and quality of life, as well as sustainability, economic viability, social equity, health and environmental quality
Modal-focused	Balanced development of all relevant transport modes and shift towards cleaner and more sustainable transport modes
Infrastructure focus	Integrated set of actions to achieve cost-effective solutions
Sectorial planning document	Sectorial planning document that is consistent and complementary to related policy areas (such as land use and spatial planning, social services, health, enforcement and policing, etc.)
Short- and medium-term delivery plan	Short- and medium-term delivery plan embedded in a long-term vision and strategy
Related to an administrative area	Related to a functioning area based on travel-to-work patterns
Domain of traffic engineers	Interdisciplinary planning teams
Planning by experts	Planning with the involvement of stakeholders using a transparent and participatory approach
Limited impact assessment	Regular monitoring and evaluation of impacts to inform a structured learning and improvement process

Source: European Commission, 2013.

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International Transport Forum

Sustainable and Inclusive Transport

The Korean Transport Institute (KOTI) and the International Transport Forum (ITF) have held joint seminars since 2010 to share knowledge and experience on topics of mutual interest as well as to strengthen mutual co-operation. The joint seminar, held in November 2015, addressed two closely related topics. The first theme was sustainable surface access to airports, in which the best practice case of Incheon international Airport was discussed alongside cases from other nations. The second theme was the development of practical indicators for measuring progress towards more sustainable and inclusive transport. Experience was reviewed internationally covering not only the largest cities where the focus is on shifting passenger transport from cars to public transport but also smaller cities where public transport options are much more limited. The seminar contributed to preparations for the 2016 ITF Summit on Green and Inclusive Transport

International Transport Forum
2 rue André Pascal
75775 Paris Cedex 16
France
T +33 (0)1 45 24 97 10
F +33 (0)1 45 24 13 22
Email : contact@itf-oecd.org
Web: www.itf-oecd.org

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