

Supporting the planning and dissemination of aviation policy

1. Outline of Studies and Activities

Year	Event	Main Research Activities and Results			
		Demand forecasting methodology	Market trend analysis	Evaluation methodology	Introduction of advanced technology
2000	Business deregulation under the revised Civil Aeronautics Act	Development of aviation demand forecasting models		Cost Benefit Analysis of Airport Improvement Projects Manual Ver. 4	
2003	Start of the “Visit Japan Campaign”				
2005	Opening of Chubu International Airport	Updating the aviation demand forecasting models • Regional segmentation subdivision • Reflection of the number of passengers per flight • Reflection of the latest data	Analysis of international air network		
2007	Kansai International Airport’s second runway to be put into service				
2008	Global financial crisis				
2010	Re-internationalization of Haneda Airport		Analysis of prevailing airfares		
2011	Great East Japan Earthquake	Updating the aviation demand forecasting models • Reflection of the LCC and tourism policy • Reflection of the latest data			
2012	LCCs begin domestic air service Visa relaxation policy		Impact analysis of LCCs and airport privatization		
2013	The number of foreign visitors to Japan reaches 10 million				
2015	Civil Airport Operation Law promulgated				
2016	Commencement of outsourcing of airport operations at government-managed airports				
2018	Promotion of aviation innovation		Trend analysis of foreign visitors to Japan		Development of GSE automatic driving simulation
2019	The number of foreign visitors to Japan reaches 30 million.				
2020	Outbreak of COVID-19				

- In the midst of increasing aviation demand and intensifying competition among major Asian airports, aviation policies are being implemented to strengthen the functions of Japan’s airports, including airports in the Tokyo metropolitan area, and to improve airline services. In particular, the environment surrounding the aviation market has changed dramatically since 2000, with the liberalization of airfares, the launch of low-cost carriers (LCCs), the rapid increase in the number of foreign visitors to Japan, and the privatization of airports.
- In order to support the planning and dissemination of aviation policies promoted by the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), we have analyzed the changes in the aviation market environment and social conditions, developed methods for aviation demand forecasting, developed project evaluation

methods, and conducted ongoing research on the introduction of advanced technologies.

Research Theme 1: Development of aviation demand forecasting models (2003-)

[Background/Issues] As competition among major Asian airports intensifies, Japan's airports, including those in the Tokyo metropolitan area, are being enhanced. In advancing the aviation policies, including the development of airport infrastructure and the provision of appropriate aviation services, it is necessary to calculate the scale and effectiveness of necessary project investments with an eye to future medium- and long-term aviation demand. There is a need to develop forecasting models that can estimate aviation demand according to various future scenarios based on recent changes in socioeconomic conditions surrounding the aviation market and the impact of competing transportation systems.

[Research Outline and Results Implementation] As forecast models for estimating medium- and long-term future aviation demand, we have constructed and updated a domestic air passenger forecast model, an international air passenger forecast model, a domestic air cargo forecast model, and an international air cargo forecast model, and we have published technical documents showing the details of the model equations. The models are widely used by the Civil Aviation Bureau as basic data for aviation policy planning, including studies of measures to strengthen the functions of airports in the Tokyo metropolitan area and the evaluation of airport development projects at individual airports.

Research Theme 2: Analysis of aviation market trends (2001-)

[Background/Issues] The recent trends in the aviation market, such as the liberalization of domestic airfares, the entry of LCCs into the aviation market, the rapid increase in the number of foreign visitors to Japan, and the privatization of airports, must be analyzed in detail to accurately grasp the events that need to be considered in aviation policy making.

[Research Outline and Results Implementation] The technical material obtained from the detailed analysis are compiled in the NILIM Technical Notes as needed, and disseminated externally through lectures and research presentations at academic conferences. The material is also used as basic information for the development and improvement of aviation demand forecasting methods and other related research themes.

Research Theme 3: Study on the advancement of evaluation methods for airport development (2001-)

[Background/Issues] The manual for evaluation methods to be referred to by each project implementer in the evaluation of airport development projects needs to be reviewed and upgraded in light of the overall policy of the MLIT and changes in the aviation market environment.

[Research Outline and Results Implementation] In cooperation with the Civil Aviation Bureau of MLIT, we are developing and updating the "Manual for Cost Benefit Analysis of Airport Development Projects." This manual is utilized in the evaluation of new projects at the time of adoption, the re-evaluation, and the ex-post evaluation of airport development projects nationwide.

Research Theme 4: Study on promoting the introduction of advanced technology into airport operations (2018-)

[Background/Issues] The Civil Aviation Bureau of MLIT is committed to promoting innovation in Japan's air transportation industry by utilizing advanced technologies and systems such as automation, robotics, biometrics, AI, IOT, and big data in order to realize the world's highest standard of passenger service from the user's perspective while addressing these issues. In

order to introduce advanced technologies to be promoted as part of this “aviation innovation,” it is necessary to verify the effects of introduction and identify technical issues.

[Research Outline and Results Implementation] The project evaluated the impact on the airport restricted area, verified the project effect, and examined the feasibility of introducing automated driving technology to aircraft ground support equipment (GSE) that travels within the restricted area of the airport. The results are being used as technical material for the MLIT Civil Aviation Bureau’s GSE (towing tractors, minibuses, snow removal vehicles, etc.) demonstration tests and actual operations.

2. Main Research Results

◆ Research results on the development of aviation demand forecasting models

- A forecasting model was developed to estimate the medium- to long-term future aviation demand values (number of passengers and number of departures and arrivals) for Japanese airports under various future scenarios based on economic and social conditions and transportation service levels.¹⁾ The model is based on a four-stage estimation method that divides passenger travel behavior into ① traffic generation, ② traffic OD distribution, ③ transportation choice, and ④ route (airport) choice, with each stage estimated by a submodel.
- The aviation demand values projected by the model in 2013 were used as basic material by the MLIT when considering measures to enhance the future functions of airports in the Tokyo metropolitan area and to expand the traffic control processing capacity.²⁾

◆ Research results on the analysis of aviation market trends

- Since the liberalization of airfares in 2000, various discount fares have been sold by various airlines, making it difficult to determine the actual fares, which serve as a guide to the level of air traffic service, and we developed a method to estimate this for each route.³⁾

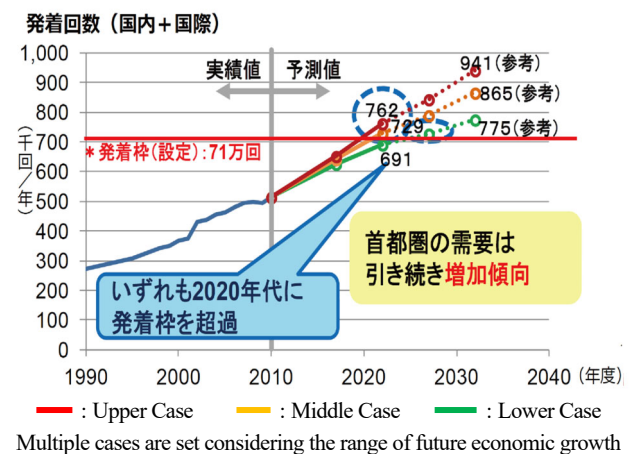
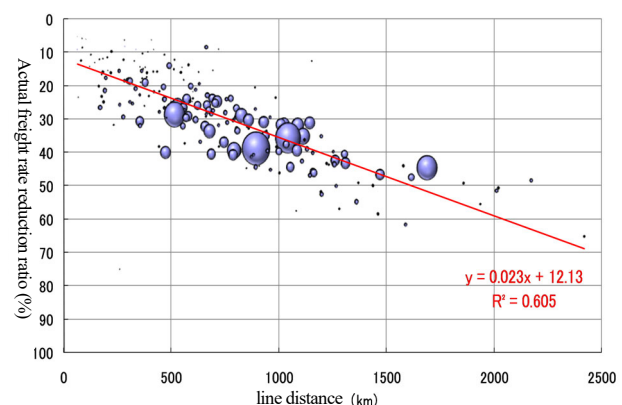


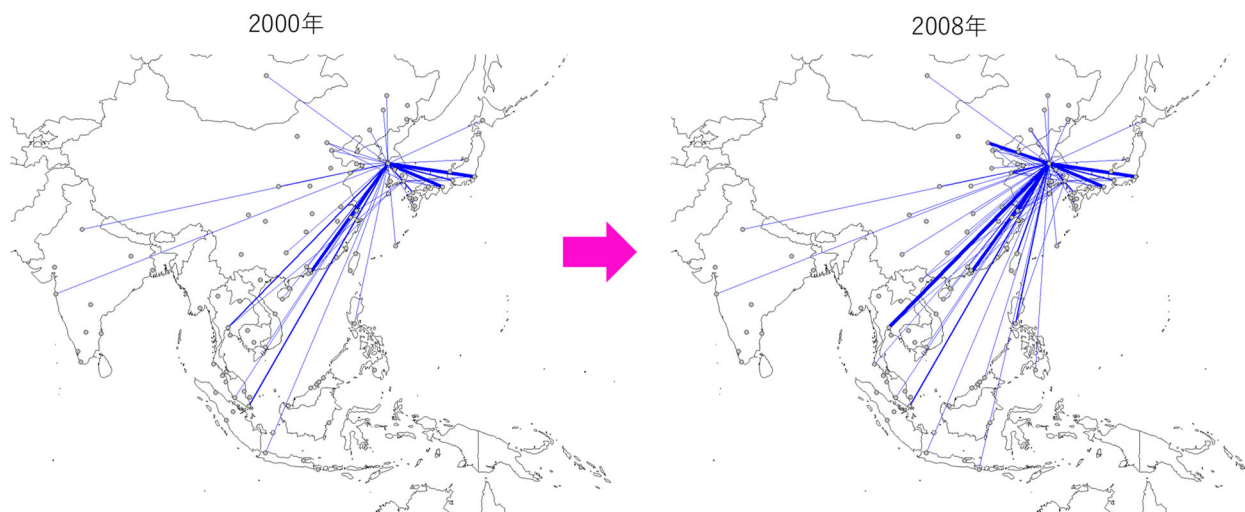
Figure-1 Aviation demand forecasts for airports in the Tokyo metropolitan area (number of arrivals and departures)²⁾



The relationship between the actual fare reduction rate for each route and the distance of the route is plotted. The size of the circle indicates the size of the 2007 annual passenger volume for each route. Actual fare reduction rate: The rate of decrease in the actual fare relative to the normal fare, estimated from the average unit purchase price.

Figure-2 Route distance and actual fare reduction rate

- With an eye on aviation demand in the rapidly growing Asia-Pacific region, we analyzed international air passenger flows in the Asian region in order to understand the development of overseas hub airports competing with Japan's and the resulting changes in the aviation market trends and their impact on Japan's aviation policy.³⁾



*Extra heavy lines: routes with more than 1 million passengers per year; heavy lines: routes with more than 500,000 passengers per year; and thin lines: routes with more than 10,000 passengers per year.

Figure-3 Transition of intra-Asia international air route network (Example of routes to/from Korea)³⁾

◆ Research results on the advancement of evaluation methods for airport development

- In cooperation with the Civil Aviation Bureau of MLIT, we developed the “Manual for Cost Benefit Analysis of Airport Improvement Projects,” which explains the methods for measuring various benefits (user benefits, supplier benefits) and the intensity of benefits generated by airport improvement projects.⁴⁾
- We also provide technical guidance on how to apply the manual and past evaluation cases as needed at the request of the Regional Development Bureau of the MLIT and local governments, which are the entities responsible for airport development.

◆ Research results on promoting the introduction of advanced technology into airport operations

- We developed a GSE automatic driving simulation model for Tokyo International Airport, which can estimate changes in the vehicle traffic flow at the airport when automatic driving GSE is introduced.⁵⁾ Using this model, the efficiency and safety of vehicle traffic flow within the airport can be verified. The model can also be used to evaluate the effectiveness of measures for airport facilities and operations that will be developed in conjunction with the introduction of automated GSE.
- The results of this research are reported to the “Study Committee for the Realization of Automatic Driving in Airport Restricted Areas” meetings held by the Civil Aviation Bureau and disseminated to those involved in airport business and other relevant parties.

Classification	Main effects (examples)	Treatment in cost benefit analysis
Effect on users (passengers and cargo)	time	◎
	Decrease in travel/transportation costs	◎
	Increase in timeliness and service rate	○
		○
Effect on suppliers		△
	Increase in revenue for airport managers	◎
	Increase in revenue for terminal building managers	(○)
	Increase in revenue, etc. for access transportation operators	(○)
Effect on local businesses and residents	Increase in revenue of airlines	(○)
	Increase in tourism visitors	△
	Increase in airport visitors	○
	Increase in employment opportunities	△
	Increase in local income	△
	Increase in business production	△
	Rise in corporate tax, income tax, land-related tax, and other tax revenues	△
	Promotion of land use around airports	△
	Effective use of former airport land	△
	Increase in property value	△
	Noise and other changes	○
	Contribution to a balanced national land formation (promotion of remote islands, etc.)	△
	Formation of regional symbols	△
	Improvement of regional safety (securing means of transportation during disasters)	△

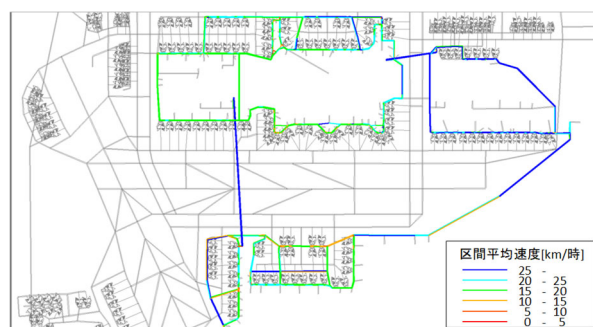


Figure-4 Results of simulation estimation⁵⁾

3. List of Related Reports and Technical Documents

- 1) About Aviation Demand Forecasting <https://www.y.sk.nilim.go.jp/kakubu/kukou/keikaku/juyou1.html>
- 2) Basic Policy Subcommittee, Aviation Subcommittee, Council for Transport Policy, First Meeting of the Subcommittee for Technical Study on Functional Enhancement of Airports in the Tokyo Metropolitan Area, Document 5: Study on the Functional Enhancement of Airports in the Tokyo Metropolitan Area <https://www.mlit.go.jp/common/001018977.pdf>
- 3) NILIM Technical Notes No. 612, No. 643 <https://www.y.sk.nilim.go.jp/kenkyuseika/kenkyusyosiryoku.html>
- 4) Manual for Cost Benefit Analysis of Airport Improvement Projects Ver. 4 <https://www.mlit.go.jp/common/000168996.pdf>
- 5) NILIM Technical Note No. 1136 <https://www.y.sk.nilim.go.jp/kenkyuseika/kenkyusyosiryoku.html>

4. Future Outlook

The environment surrounding the aviation market and technological developments are advancing rapidly, and these trends must

continue to be closely monitored. As more years pass, available statistical data will accumulate on events that have a significant impact on the aviation market, such as the increase in the number of foreign visitors to Japan, the entry of LCCs into the market, and the impact of the risk of infectious diseases such as the new coronavirus. Further analysis and research and development on improving and upgrading the aviation demand forecast models and airport project evaluation methods utilizing this data are expected. In addition, technological development will accelerate efforts toward the practical application of advanced technologies, such as automated driving, to airport operations, and further research and development related to the development of an environment for the introduction of advanced technologies, such as common infrastructure and operational rules at airports, is expected. We will continue to promote such research and development in cooperation with the Civil Aviation Bureau of MLIT.