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Outline of APM in Japan and Current Tasks

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Introduction

The rapid motorization and use of private cars that accompanied the steady concentration of Japan's population in urban areas during the country's long period of high economic growth from the 1960s through the 1980s has led to chronic traffic jams and environmental problems. Since the 1990s, the opening of large numbers of retail outlets along suburban roads nationwide has contributed to an ongoing urban sprawl and a significant thinning out of commerce and residents in city centers.
The Ministry of Land, Infrastructure, and Transport has encouraged development of APM, mainly in large cities, as one way to resolve urban traffic problems. Four urban monorails and 9 new transportation systems were in operation as of January 2003. The total extension of these 13 lines is 140 kilometers, and 0.22 million people use them daily.
It is expected that Japan's population will begin to decrease from a peak in 2006, and that the percentage of senior citizens in the population will remarkably increase. An aging population with fewer children indicates a need to revitalize city centers by developing compact urban areas.
This paper discusses issues in developing APM in Japan. Coordinated with town planning, APM systems can effectively contribute to the creation of compact and attractive urban areas.

1. Development of Urban Transportation in Japan

(1) Population concentration in cities and expanding urban areas

During the period of high economic growth that started in the 1960s, about 40 million people, 45% of the population, were living in cities (DID). By 1995, this figure had doubled to about 80 million or 65% of the total population.
The rapid concentration of population in the cities (DID) was steadily accompanied by an overall expansion of urbanization in terms of area. This had the effect of creating lower population densities in central city districts.

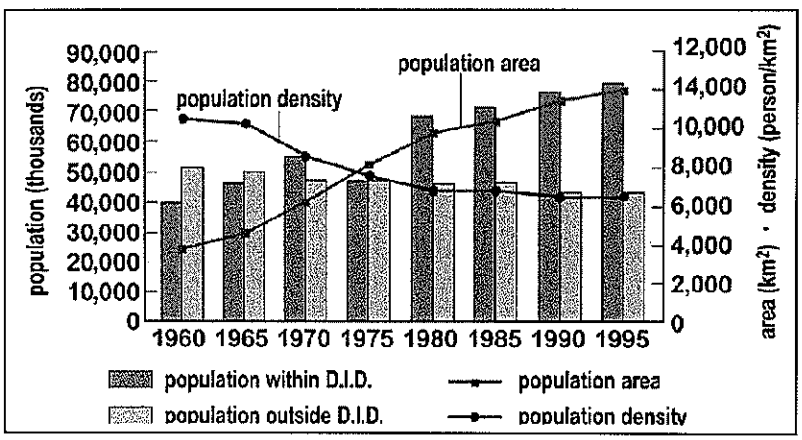


Figure 1. Development of DID areas and population

(2) Increased motorization and chronic traffic jams in cities

Car ownership rapidly increased, especially after the 1970s, during the high growth period in Japan. As shown in Figure 2, while the population increased 1.2 times during the 23 years from 1974 to 1997, car ownership increased 2.5 times.

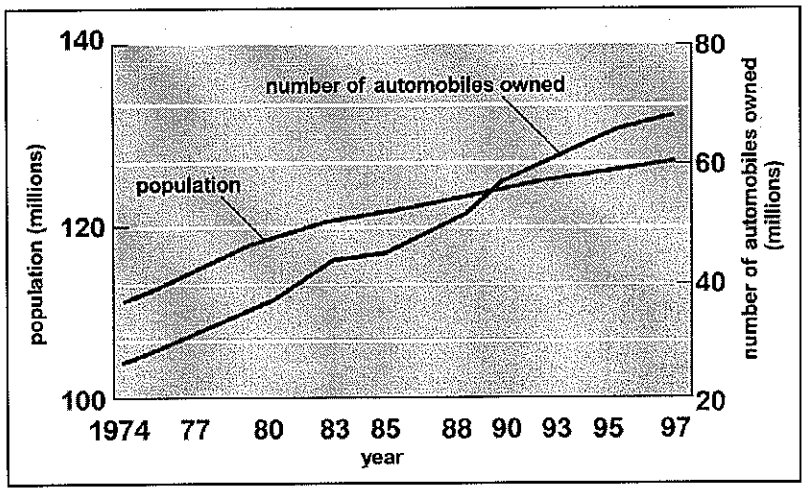


Figure 2. Car ownership and population

Road development could not keep pace with the rapidly increasing car ownership, resulting in chronic traffic jams, mainly in the cities. As a result, the travel speed of cars in cities has continuously declined, year after year.

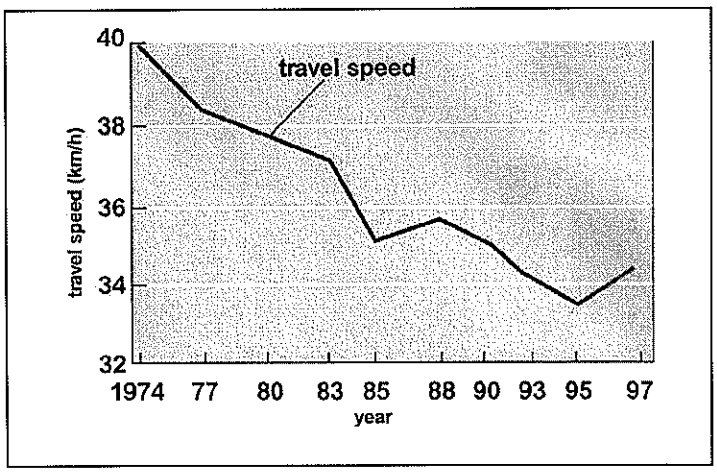


Figure 3. Declining travel speed of cars

2. Development of APM in Japan

(1) Summary of APM development

APM's have been developed mainly in large cities. Four urban monorails and 9 new transportation systems were in operation as of January 2003. The total extension of these 13 lines is 140 kilometers, and 0.22 million people use them daily.

(2) Profitability

APM's and other forms of public transportation in Japan are developed to operate on the basis of sound profitability as transportation services.

However, seven of the thirteen APM lines are operating in the red.

Table 1. Operating profit/loss of operating lines

	Line	Length (km)	Type	Passengers 1,000 persons	Revenue 1,000 yen	Operating costs 1,000 yen	Depreciation 1,000 yen	Taxes 1,000 yen	Operating profit (%)	
									Before depreciation	After depreciation
1	Port Island (Kobe City)	6.4	New transportation	24,323	4,416,179	2,455,260	1,258,871	183,237	59.7	88.3
2	Rokko Island (Kobe City)	4.5	New transportation							
3	Nanko Port Town (Osaka City)	6.9	New transportation	24,083	2,797,851	2,347,101	1,268,560	15	83.8	129.2
4	Kanazawa Seaside (Yokohama City)	10.6	New transportation	16,761	3,438,792	1,897,105	1,434,370	52,174	56.7	98.4
5	Tokadai (Komaki City)	7.7	New transportation	826	229,196	500,255	18,345	4,979	220.4	228.4
6	Hiroshima Shinkotsu (Hiroshima City)	18.4	New transportation	19,344	4,610,569	2,695,723	1,911,774	78,034	60.2	101.6
7	Yurikamome (Tokyo)	12.1	New transportation	38,062	9,436,268	3,990,504	3,098,118	223,413	44.7	77.5
8	Nanko-Minatoku (Osaka City)	1.3	New transportation	11,345	2,088,795	2,124,205	984,633	99,924	106.5	153.6
9	Shidami (Nagoya City)	6.8	Guideway Bus	55	15,574	55,489	34,871	2,777	374.1	598.0
10	Kitakyushu Monorail (Kitakyushu)	9.1	Urban Monorail	12,148	2,390,886	1,465,395	595,512	62,363	63.9	88.8
11	Osaka Monorail (Osaka City)	24.3	Urban Monorail	28,499	6,594,459	2,769,348	2,976,267	298,252	46.5	91.7
12	Tama Urban Monorail (Tachikawa City, etc.)	16.2	Urban Monorail	29,132	5,201,574	3,188,676	3,586,458	125,766	63.7	132.7
13	Chiba Urban Monorail (Chiba City)	15.4	Urban Monorail	16,432	3,231,015	1,964,317	2,243,338	145,118	65.3	134.7
		139.7		221,010						

Note ┌ The operating profit figures for the Port Island and Rokko Island Lines are combined figures of the two lines.
┌ The operating profit figures for the Nanko-Minatoku Linecorrespond to the total operating length (3.1km) of the operator (OsakaTransport System Co.).
┌ The operating profit figures in [redacted] than 100%) indicate negative management performance.

Source: FY 2000 Annual Rail Statistics (supervised by the Railway Bureau, the Ministry of Land, Infrastructure and Transport

3. City development issues in Japan

(1) Hollowing out of residential areas in city centers

In the 1990s, many large retail outlets opened nationwide along suburban roads in the expectation that customers would drive there to shop.

Urban public facilities, such as those for welfare, medical care, and education, were dispersed throughout the suburbs, due to the difficulty of securing land in urban areas. Housing also developed in the suburbs, due to people's desire to own their own home. This resulted in a suburban sprawl, and fewer residents in city centers.

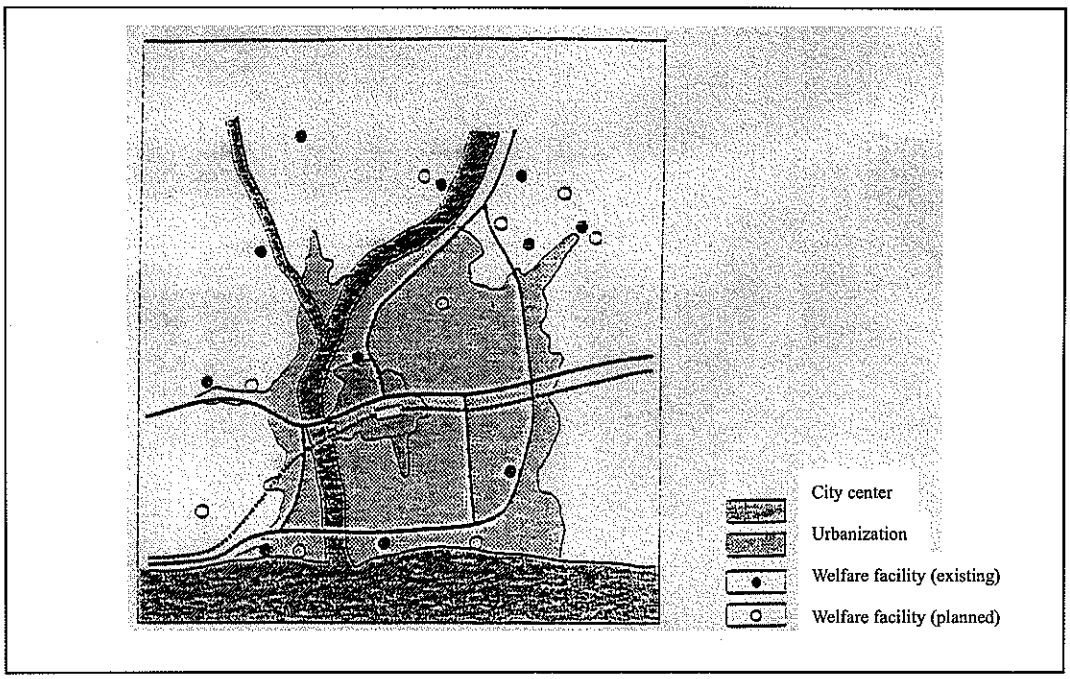


Figure 4 Location of welfare facilities

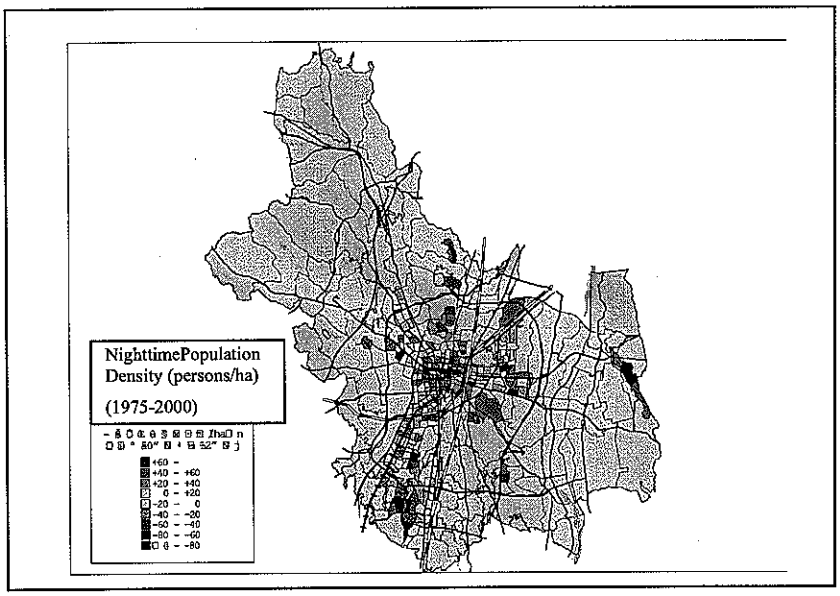


Figure 5. Population decline in city centers

(2) Aging population with fewer children

It is expected that the population will decrease after peaking in 2006, and Japan will become a society with an aging population—with a lower percentage of youth. In such a society, older drivers pose a problem in traffic safety. Development of public transportation is needed to reduce their dependence on cars for transportation.

The resulting decrease in the working population will also lead to financial limitations on the development of infrastructure.

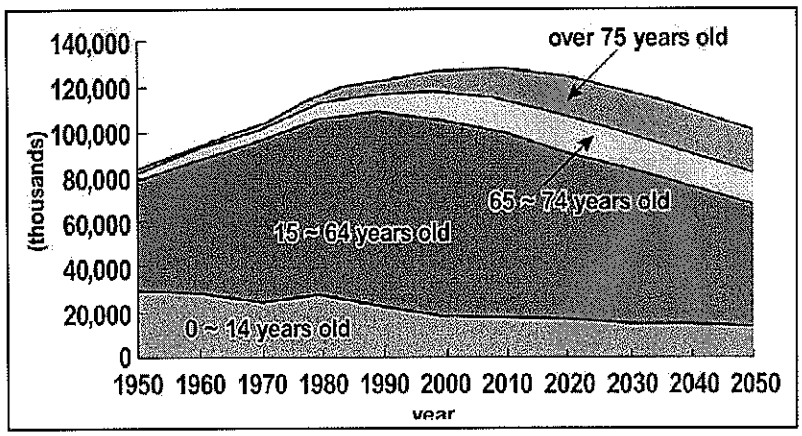


Figure 6. Estimated population development

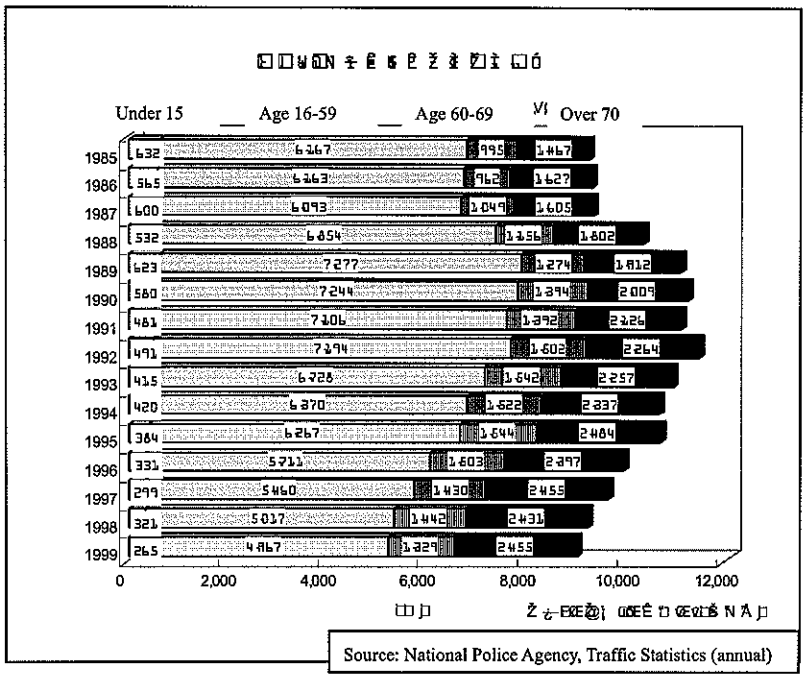


Figure 7. Traffic accident victims by age

（3） Development of compact urban areas

The development of "compact urban areas" is needed to remedy the situation in which urban areas are expanding; yet the population and commercial activity in city centers is declining at the same time the population is aging. This type of development is based on the following three basic concepts:

1) Reduced expansion of urban areas by higher density

In revitalizing and reconstructing Japanese cities, we need to create compact urban areas by creating sites with integrated functions in the city center, rearranging town blocks, constructing midrise and highrise buildings, securing open spaces with rich greenery, and forming rich and spacious city environments.

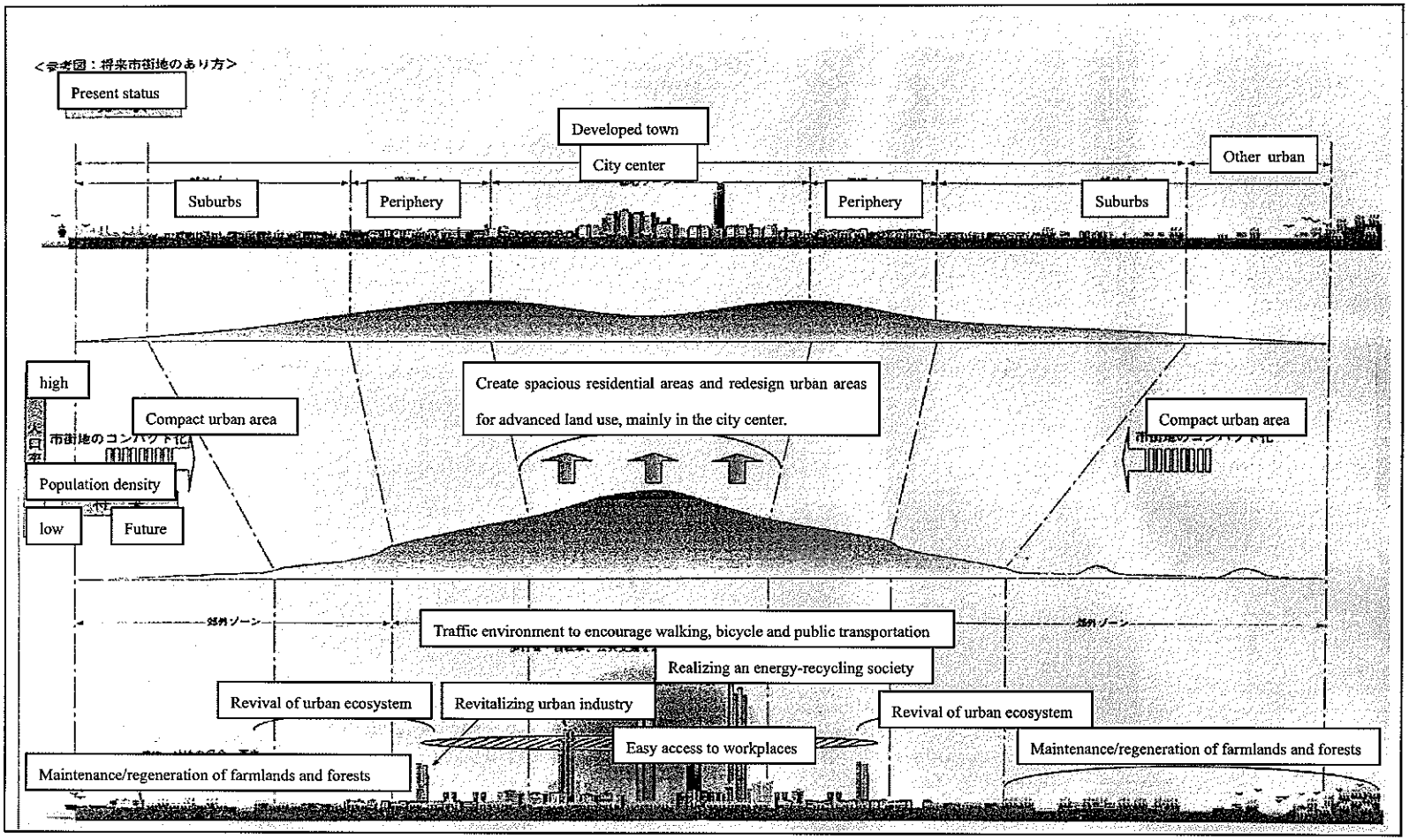
2) Multipurpose land use including workplaces closer to home

By realizing multifunction urban areas, we can shorten commutes between homes and offices. By reaching a balance in the daytime and nighttime population in cities, we can create high-quality city spaces where people can move by public transportation or walk. In this way, we will develop urban environments where people can choose from various lifestyles in terms of quality and quantity. The diversifying needs of a population with more elderly and fewer children will be met.

3) High-density urban areas with green open space

By forming compact urban areas for easier living and activities, we can maintain and utilize historical and cultural resources existing in urban areas, including city centers. By creating open city space through maintenance and regeneration of suburban farmlands and forests as well as advanced use of land for maintenance and generation of the natural environment in cities, we will maintain and create cities with unique local features.

Figure 8. Desirable urban areas in the future



(4) Expected effects of compact urban areas

We expect the following effects by developing new compact urban areas.

① Enhancing transportation of people and goods

In a traffic environment with reduced car traffic where people can easily move on foot, bicycle, or public transportation in conjunction with the development of compact urban areas, we will create city spaces that facilitate transportation of people and goods.

② Developing city environments for rich and active living

By maintaining and restoring population density in urban areas, we will enable maintenance and expansion of public transportation. By securing compact living spaces and diverse city functions in urban areas, we will create a city environment for active living, working, playing, meeting, and enjoyment of culture.

③ Developing low-cost cities

Since an increased elderly population with a decreased youth population will likely result in more financial limitations in infrastructure development, we will create cities with smaller management costs (facility development and operation/maintenance) by integrating city functions and infrastructure facilities.

④ Cities creating lower environmental burdens

It is an urgent task for us to reduce emission of greenhouse gas such as CO_2 while there is global warming. We will therefore reduce traffic arising from city activities by spatially compacting city functions and, by wider use of public transportation, we will reduce the burden on the environment caused by traffic.

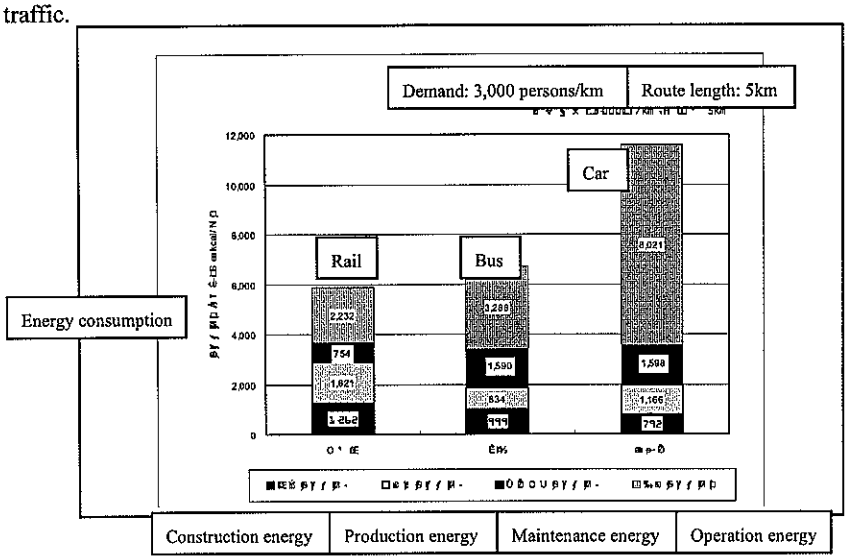


Figure 9. Energy properties by means

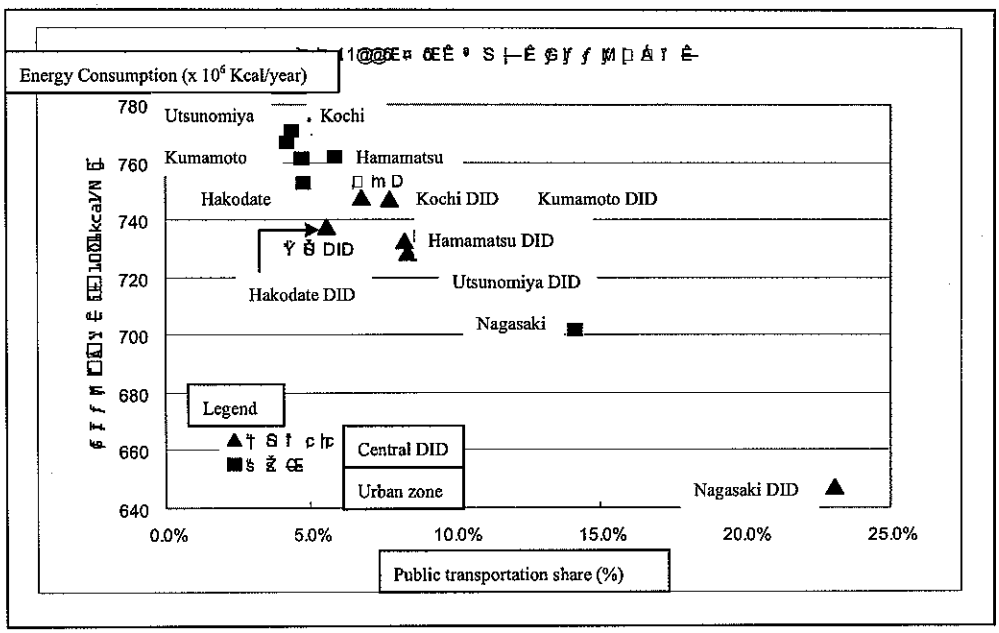


Figure 10. Energy consumption by public transportation

4. Current issues for APM development in Japan

Building APM's can effectively contribute to the development of compact urban areas and revitalization of cities in Japan.

APM's have been introduced mainly in large cities where they were highly needed. Further development will require aggressively dealing with the following issues:

① Reducing project costs

The existing APM's are primarily feeder services in large cities. Such systems cost more than 8 billion yen per kilometer for facility development and require demand of roughly 4,000 persons/day/km for profitable operation.

Future APM demand in regional cities outside the country's largest metropolitan areas is projected at 2,000-3,000 persons/day/km. These systems will have to be compact and less costly to suit this level of demand.

Since the government and municipalities offer subsidies for the development of APM infrastructure in Japan, it is important to reduce non-infrastructure costs to achieve profitability of newly developed systems. To achieve profitability with demand at 3,000 persons/day/km, the non-infrastructure project cost should be reduced to 1-2 billion yen/km from the current figure of 3 billion yen/km.

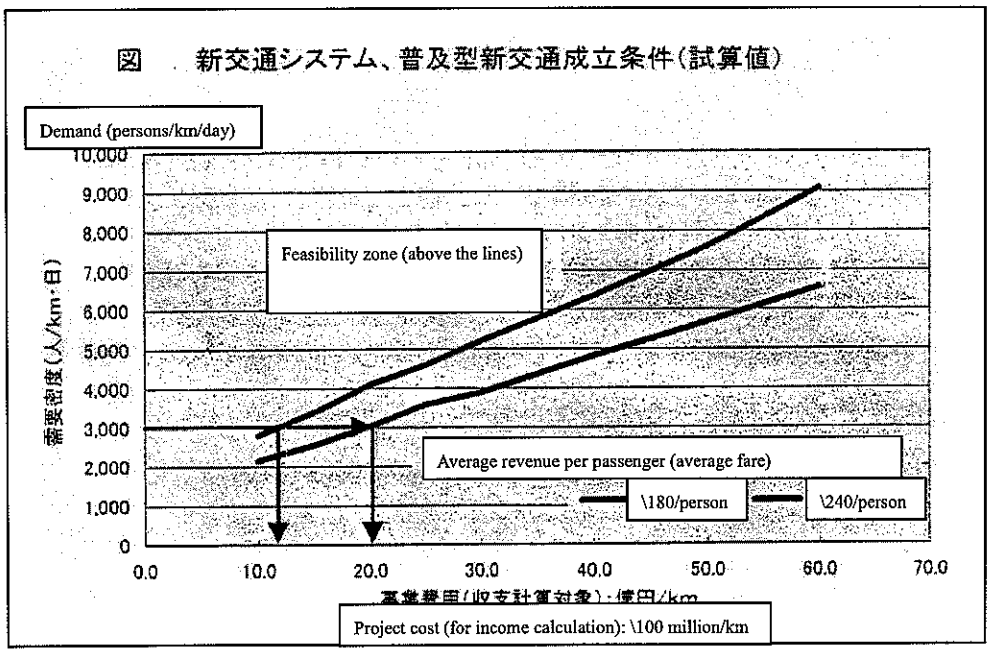


Figure 11. Data on popular new transportation system (estimates)

Conditions of estimation
Route length: 10km
Average transportation: 5km
Feasibility: Realize after-depreciation profitability in 15 years after opening
Cost estimation: Operation and maintenance cost was calculated by regression model based on the performance of existing systems.
Pricing: Average payment per passenger (fare) was set for an average trip of 5km on the basis of past performance (\180/person,\240/person).

② Space for introduction

The current standards for establishing APM's in Japan sets clearance limits and lateral clearance. We need 20.5 meters of street space in the regular sections of the lines and 33.0 meters in station part to introduce a new transportation system. As the street width in regional cities is often 20 meters or less, we need to consider changing lateral clearance for APM's, integrated development of station buildings and neighboring buildings, and the use of underground space.

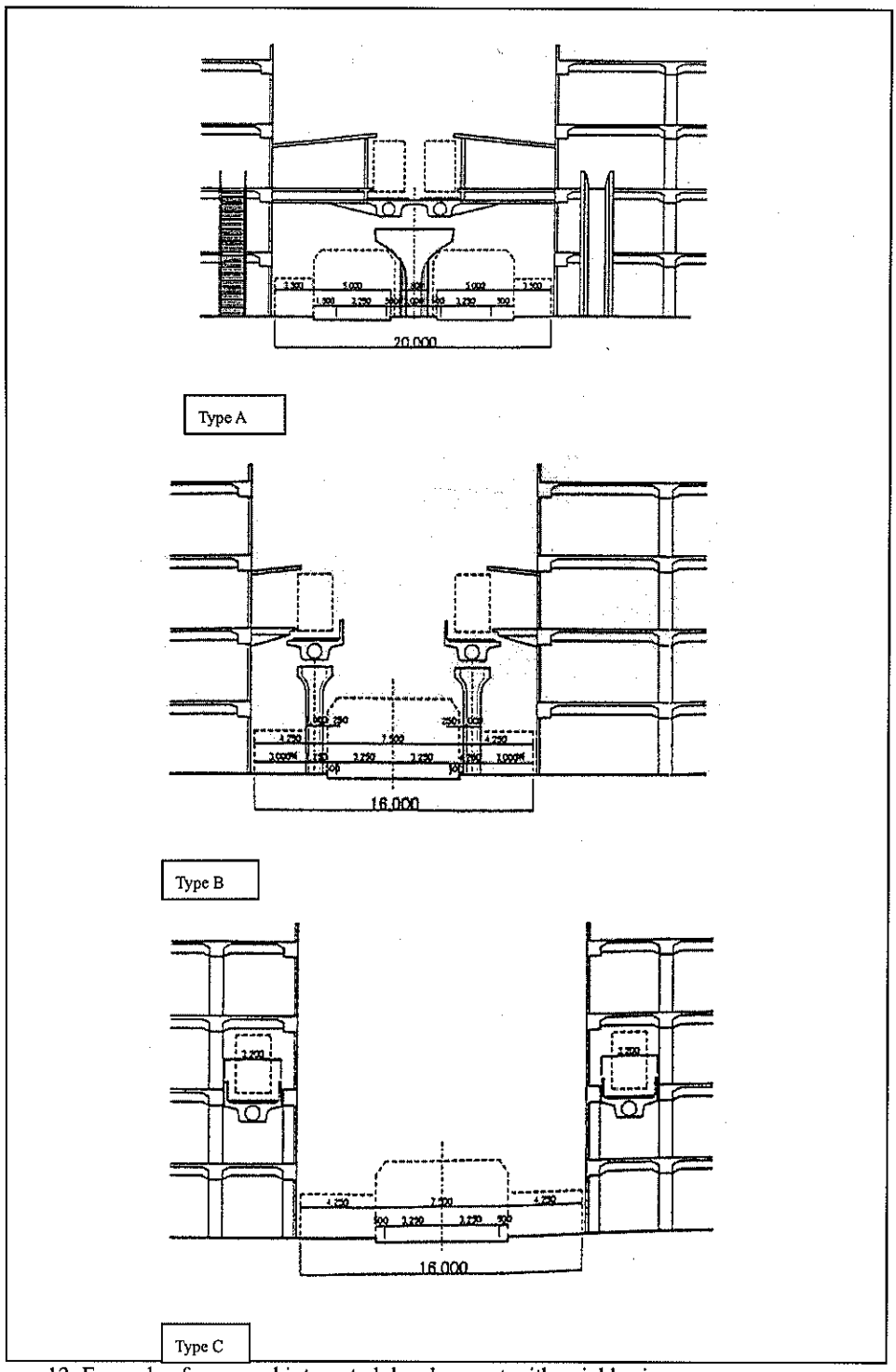


Figure 12. Example of proposed integrated development with neighboring buildings

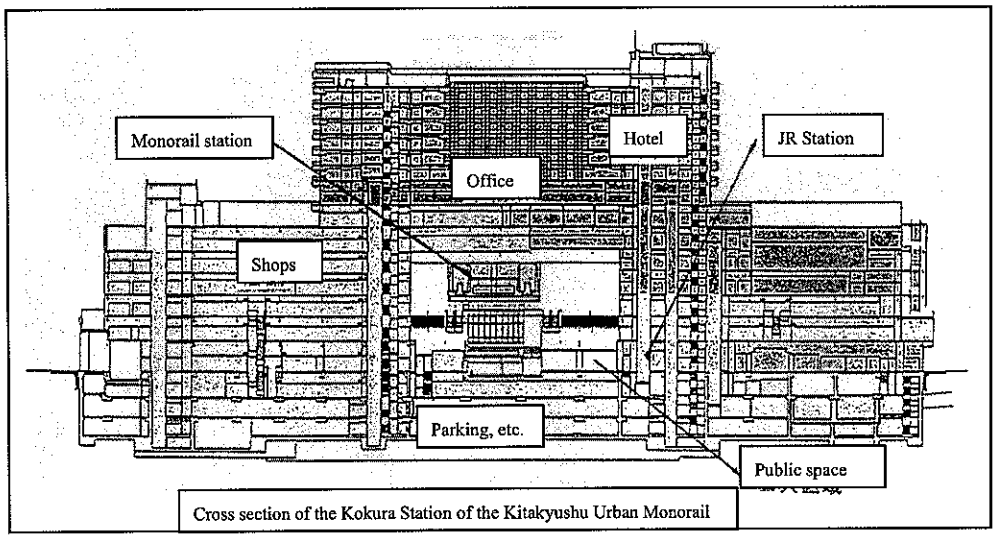
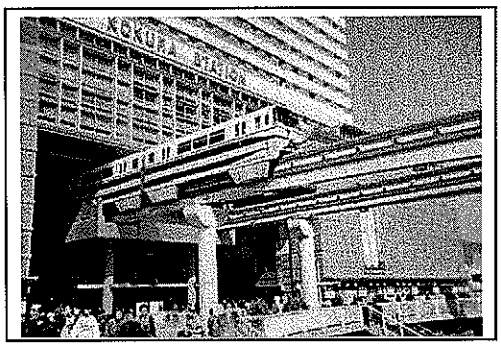


Figure 13. Integrated development at Kitakyushu Monorail StationFigure 14. Integrated development at Kitakyushu Monorail Station

■ South entrance of Kokura Station



■ Monorail Kokura Station near ticket barriers

③ Integrated land use

APM's in Japan should be developed in close coordination with the development of compact towns. Specifically, if a new APM line is developed through a city center, we should invite hospitals, schools, government agencies, and other public facilities to be built along the new line, especially in the city center. We should also encourage council estates, which are currently dispersed, to be rebuilt near new APM lines. It is important to increase daytime and nighttime population density in the city center to help achieve integrated development of compact towns with APM's as a source of major public transportation.

④ Deregulation

The Law for Promoting Development of City Monorails in Japan clearly defines the types of APM systems that will qualify for infrastructure subsidies.

We need to create urban transportation systems for our major regional cities that are based on new, cost-reducing technologies that can be used overseas as well as in Japan. To encourage this, public assistance for APM's should be based on performance certification rather than the currently applied specification certification.

Performance certification should be based on transportation capacity, safety, disaster prevention quality, environmental soundness and economic efficiency. The government should establish certain standards related to these issues. New systems of the required structure that meet these types of standards could be certified as APM's eligible for public finance.

An organization and a method for examining and certifying specific performance standards must be separately established.