日本と東アジアの大都市交通

――特に最近の自動車混雑渋滞問題――

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〔前注〕 一橋大学にて「第３回東アジア環境経済学シンポジウム」が 2008 年２月 21.22 日に中国，韓国，台湾や国連大学など多数の参加者を得て開催された。

招待記念講演を宇沢弘文名誉教授（東京大学）と柴田が行い，宇沢教授は「地球温暖化と持続可能な経済発展」の題目で，市場経済と利潤追求を前提とする既存経済学では現状に対処できず，先進国に対しその生産活動に伴う「比例的炭素税」制度を立て，それを財源として「大気安定化国際基金」The International Fund for Atmospheric Stabilization を設け，発展途上国の同方向努力への援助にせよとの主張が述べられた。これに関連し，参加各国からも現状報告を含め活発な意見が交わされた。柴田の報告は以下のようである。すなわち最近における東アジア大都市の急速な発展と市民生活の向上から，以前の自転車・荷車中心の交通にたいし急速な自動車（そして２輪モーター・バイク）への代替が進んでいる。だがまだ公共交通機関（電車・地下鉄・モノレールなど）の未整備のため，上記自動車やバイクが町にあふれ，渋滞や交通事故，大気汚染・騒音など多くのマイナス現象を起こしている。他方日本の東京など巨大都市ではあるが，都民の通勤はほとんどマイカーにはよらず，電車や地下鉄あるいはバスに依存し，交通事故や道路工事を除き自動車の渋滞は上記よりは比較的少ないといえよう。この背景を，明治以来の都市交通の軌道レール依存できた経緯やその財源措置，1970 年代に入ってからの急激な道路建設・自動車普及とそれによる大気汚染などの自動車公害にたいする市民側の強い反対運動のあったことなどを紹介する。同時にこうした自動車氾濫・渋滞にたいする公共交通と市民生活を優先させる日本や西欧先進都市の経験例などを示した。本文は当日における柴田報告の全文である（なお本章の後半第２・３章については，さらに当「学会誌――経済学」257 号掲載の拙稿論文第３・４章あたりを参照して下されば幸いである。

なお大都市〔特に首都〕の交通混雑対策として，そこに集中する政治・経済・教育機能の地方分散（地方自治強化）を基本に問わねばなるまい。この点で，関東大震災後に都心の皇居近くから現在地まで転出した当一橋大学の英断は，時代の先端を示したものとしたい（現在なら山梨県の西部あたりへの移転に当たろう）。移転当初教職員学生は，現在の国分寺駅から徒歩で通学したと聞くが，便宜上「国」分寺と「立」川の中間に両駅の頭字をとる「国立」駅がつくられ，かくして現在当大学は国立市に位置する結果となる。当一橋大学が大変意義

の深い先鞭をつけたことに注目したい（東京経済大学多摩学研究会編「多摩学のすすめ　Ⅰ巻」（けやき出版）の第Ⅴ章　一橋大学増田四郎元学長と柴田との対談の項でも参照されたい）。

Controlling Traffic Congestion in East Asian Metropolises

By　Tokue Shibata

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Chapter 1. Transportation in Japan and Tokyo

1. Prewar Period（1868 - 1945）

Japan is a volcanic island country with limited resources. It produces neither oil, gold nor other metals（bauxite, uranium, nickel and manganese - to name a few）. Its only mineral resources are poor-quality coal, iron ore and limestone. Japan is located in a temperate zone that too cool to support rubber tree cultivation.

On the other hand, Japan is mountainous and enjoys an abundant rainfall. More than two-thirds of the country is covered in forest. Agricultural land occupies only 11% of the nation. Inhabitable land is mostly urbanized. There are few orchards and meadows.

These natural conditions should be noted when we examine the modern development of transportation in Japan.

a）Steam locomotives and the national railway network

During the Edo Period, transportation, both intra-city and long-distance, was mostly by foot or by palanquin carried by two bearers. Commoners did not use horses. Horse-drawn carriages were not used. Cart men（not horses）pulled heavy loads along narrow, unpaved, muddy roads. At the close of the feudal regime, the Tokugawa feudal government was alarmed by Commodore Perry's Black Ship cannons（1853）, and hurriedly built blast furnaces that could produce pig iron（1857）, but this effort could not rescue the country from crisis, and Japan was forced to open up to the outside world.

About ten years later in 1868, the Shogun's feudal regime and its policy of isolation ended, and the new government under Emperor Meiji began to modernize Japan. One of its goals was to introduce Western technology and develop a steel industry to make rails and machinery necessary for the country's modern transportation infrastructure.

One such example was the coal-burning steam locomotive. In 1872 steam trains began running between Tokyo（Shinbashi Station）and Yokohama. This line, called the Tokaido Line, was extended west to Osaka and Kobe by 1889. Similarly, the north-bound Tohoku Line, connecting Tokyo（Ueno Station）with Aomori, was completed in 1899.

While Japan's railway network was expanding nationwide, the country experienced two wars: the Sino-Japanese（1894-95）and Russo-Japanese（1904-05）. Military leaders, rec-

ognizing the importance of military transport especially that by trunk railway lines (e.g., the Tokaido, Tohoku and Sanyo Lines), urged that they should be nationalized. It was completed in 1906. Private hands continue to hold the less-important local branch lines.

In 1914 the Tokyo Central Station was completed and became the starting point of the Tokaido Line (instead of Shinbashi Station). Tokyo Station was built as the front gate of the Imperial Palace and faces the Marunouchi business district - the nerve center of Japan's economy.

b) Electrification of street cars and trains

The Meiji government continued to introduce Western technology. In 1878 The Tokyo Institute of Technology (***Koubu Daigaku***) turned on Japan's first arc light at its auditorium. A little later, Baron Okura's group set up Tokyo Electric Company, and its thermal power plant supplied electricity to neighboring offices. More emphasis was placed on the development of hydropower stations to take advantage of the country's abundant rainfall. The first such station was built in Kyoto in 1891, and high-voltage cables supplied electricity to street cars in Kyoto City (1895).

Around the turn of the century, horse-drawn carriages (omnibuses) started running on rails in Tokyo. Following the Kyoto precedents, three companies started street car services, each operating different lines in Tokyo. By the end of the Meiji period (1911), these three private lines were unified and put under the control of the Tokyo City Government (***Tokyo Shiden***). A network of city street cars was expanded within the national railway's ***Yamanote*** loop line.

The First World War (1914-18) made the Japanese economy so prosperous that the number of white-collar workers employed in the newly developing industries swelled in the capital. In the aftermath of the Great Kanto Earthquake of 1923, even more workers came to live in the suburbs outside the ***Yamanote*** loop line. In other words, the number of Tokyo suburban residents increased dramatically. Private railway companies were established to transport these suburban residents to the CBD (central business districts around Tokyo Central Station). Some of the major lines carrying these commuters from the suburbs to the ***Yamanote*** loop line stations. Inside the loop line, the national Chuo Line and street cars carried commuters to the CBD.

These railway companies were actually "developers" of the suburban areas. At first they would buy up large areas of farming and forest land then develop residential areas. Then they increased the value of the land by constructing rail lines and stations. To make

the area around and along the railway lines even more attractive, these companies often invited famous colleges to set campuses to attract education-minded parents. The companies also built sports ground or commercial centers around major stations, and built department stores at the terminal stations.

c）Dreaming of cars

Around the same period, the automobile made its brilliant debut in the West. It is said that its real birthday was January 29th 1886 when Karl Benz obtained official recognition by building the first automobile powered by an internal combustion engine. Mercedes-Benz later attracted the wealthy with its cars. In 1908 in the United States, the mass-produced Ford Model T enabled ordinary people in North America to achieve the dream of car ownership. Over 15 million were sold before the model was discontinued in 1928. In the meantime, the Japanese paid little attention to this big trend. Japan had no domestic supply of either gasoline or rubber; moreover, its foreign currency reserves were too limited to spend on the importation of these commodities.

Historically speaking, Japan's textile industry developed from the early Meiji Period. Sakichi Toyota set up a spinning company in 1918 and developed automatic looms. His son, Kiichiro, was so interested in newly imported Ford and GM automobiles that he founded *Toyota Jidousha Kogyo*（Toyota Automobile Manufacturing Co.）Utliliaing the spinning precision machine technology in 1937. This was the year of the Sino-Japanese Incident. The Japanese army marching on China's vast plain found that automobiles, especially trucks, were essential for efficient military transport and logistics. The government's war mobilization policy encouraged its automobile industry to boost production. To achieve this goal, after attacking Pearl Harbor（1941）and entering WWII, the Japanese Imperial Army marched into the Malay Peninsula, Borneo（Kalimantan）and Sumatra islands（with a parachute troop）to secure oil and rubber resources. However, after Japan's defeat at Midway its weakened navy was unable to transport these resources to Japan. Table 1 shows the number of automobiles produced in wartime Japan. Lack of oil and rubber, plus heavy bombing of the mainland by the US B29s destroyed the fledgling Japanese car industry.

2. Postwar Period I（1945 - early 1960s）

a）From ruins to reconstruction

By the time Japan surrendered on August 15, 1945, all Japanese cities（except Kyoto）

Table 1 Number of Automobiles Produced in Wartime Japan（1937 - 1945）

	Toyota			Nissan			Isuzu	Total
	Passenger cars	Buses	Total	Passenger Cars	Buses	Total	Trucks & buses	
1937	577	3,436	4,013	4,068	6,159	10,227	600	14,840
1938	539	4,076	4,615	4,151	12,440	16,591	1,695	22,901
1939	107	11,874	11,981	1,370	16,411	17,781	4,180	33,942
1940	268	14,519	14,787	1,162	14,763	15,925	7,066	37,778
1941	208	14,403	14,611	1,587	18,101	19,688	7,797	42,096
1942	41	16,261	16,302	871	16,563	17,434	5,265	39,001
1943	53	9,774	9,827	566	10,187	10,753	5,365	25,945
1944	19	12,701	12,720	9	7,074	7,083	3,486	23,289
1945	--	3,275	3,275	---	2,001	2,001	600	5,876

Notes :

1）Isuzu produced diesel trucks and buses.

2）Source: Toyota,“*Motarizeishon to Tomoni*（Together with Motorization）”1970, p. 55,

had been destroyed by allied air raids or bombardment by warships. Industrial activities were almost completely paralyzed. When the war ended, many people were homeless and starving. In addition to these difficulties, hyperinflation affected day-to-day life so seriously that business leaders could not seize the opportunity to resuscitate the Japanese economy.

We must admit that the outbreak of the Korean War in June 1950 was an unexpected boon for the Japanese economy. The US Army in Korea made special requests from Japan（for Japan it was ***tokuju*** or a special demand）for the materials they needed for their military operations - this resuscitated Japan's lifeless economy.

It should also be noted that a few years before the Korean War, Japan instituted large-scale agricultural land reforms under the guidance of the US occupation forces. Land owned by absentee landlords was redistributed among the landless tenant farmers who worked the soil. The tenant farmers were overjoyed to own their own farmland, and along with the diffusion of labor saving-devices such as agricultural chemicals, pesticides and tractors, agricultural productivity improved remarkably. The amount of rice production soared. Agricultural mechanization eventually led to a labor surplus in the countryside.

Many ex-soldiers returned home from Asia and started working on the land and in factories. By 1951 the country's food supply problem was largely solved. Most people no longer had to worry about starvation. The economic recovery and development effort was in full-swing.

b) Drastic changes in energy sources: from hydro- to thermal power, the rise of the *Kombinat* and the beginning of motorization

As the Japanese economy developed, the national government switched its energy source from hydro to thermal power - possibly at the suggestion of the US. In 1955 the government decided to construct a large oil refinery in a former naval yard. At the same time the government launched its *Kombinat* construction plan. *Kombinat* is a Russian word meaning "industrial complex". The plan combines the following three projects:

i) Reclamation of land from the sea for use as an industrial zone with port facilities. Strategic locations, with a good access to metropolises, were selected and designated as coastal industrial zones;

ii) Construction of ports near or in these industrial zones and the construction of huge oil tankers to bring in crude petroleum from the Middle and Near East and other oil-producing countries; and

iii) The refining of this imported crude oil to produce gasoline, diesel oil, kerosene and other products for supply to thermal power plants, iron and steel works, petrochemical plants, etc.

Industrial facilities within a *Kombinat* zone were strategically located to achieve maximum production efficiency. By the late 1950s, Kombinats had been built in Yokkaichi (close to Nagoya), Kawasaki and Chiba (along the Tokyo Bay), Sakai-Senboku (close to Osaka) and several other places.

c) Underdeveloped roads hindering motorization

As mentioned earlier, the automobile had seduced consumers throughout the West, but had been largely out of the reach of the masses in Japan due to the lack of domestic natural resources. Finally in the mid 1950s, the time had come to enable the car to make inroads into Japanese society. Several factors made this possible: i) oil refineries in *Kombinats* that could supply enough of gasoline; ii) steel works (there were 28 blast furnaces in operation by the 1950s) which refined imported iron ore and produced high-quality steel for making automobile bodies, engines and other components; and iii) petrochemical plants in the *Kombinats* that manufactured the synthetic rubber for car tires.

During the Second World War, Great Britain had an effective monopoly over the cultivation of rubber trees. Both the US and Germany tried hard to develop synthetic substitutes. Needless to say, in 1957 the Japanese government stipulated a special law to financially support research into synthetic rubber. A short while later the Japan Synthetic

Rubber Co. at the ***Yokkaichi Kombinat*** succeeded in manufacturing this vital material.

d) Improvement of the underdeveloped road network

The Japanese auto industry, now supplied with the oil, steel and synthetic rubber it needed, began automobile production. In 1960 the number of automobiles produced in Japan reached 482 thousand. However, as the industry grew and more cars appeared throughout Japan, a bottleneck appeared: incredibly poor road conditions.

After the Meiji Restoration, Japan depended on its railways for transportation but neglected its roads. Road travel was mostly by foot or by rickshaw - or by bicycle from the 1900s onwards. People (not horses) pulled heavy loads in carts. Accordingly only 0.9% out of a total 906 thousand kilometers of roads were paved by 1936 and only 1.2% by 1945. On rainy days, pedestrians often stepped into mires, and large hand-pulled two-wheeled carts got stuck in the mud. In addition, many roads were too narrow for automobiles.

In 1958 "The Emergency Law for Road Improvement" was promulgated. It made the appeal "to strengthen Japan's economic base is our national supreme order, and the only way to achieve this is to make quick improvement of roads. This is to enable automobile to run in smooth and safe conditions." Based on the Emergency Law, automobile taxes (including gasoline tax, local road tax, diesel-oil delivery tax, petroleum gas tax, automobile acquisition tax and motor vehicle tonnage tax) were introduced. All of these tax revenues were earmarked for the construction and maintenance of roads. To build expressways, the Japan Highway Public Corporation was established in 1956, then the Metropolitan Expressway Public Corporation in 1959.

Fortunately, Japanese mountains were rich in the limestone needed to manufacture the cement required to make concrete. Since Japan was already able to produce high-quality steel, conditions were set for the construction of paved roads and long-span bridges. The next problem was how to secure enough money at a time when Japan was still strapped for cash.

e) Financial resources for road construction: taxes and the FILP

For road construction Japan used three types of financial sources: i) automobile related taxes, ii) general taxes and iii) low-interest and long-term loans from the government. The first two were in the forms of national tax and local tax. The third, "the Fiscal Investment and Loan Program" (or FILP) was a mechanism to utilize interest-bearing funds to implement government projects. The FLIP played a key role in road development

Table 2　Financial Sources for Road Construction（unit: billion yen）

	Central government			Local governments			FILP	Total
	ART	GT	Total	ART	GT	Total		
1960	96	3	99	36	57	93	19	211
1970	519	71	590	323	426	750	258	1,597
1980	1,868	70	1,938	1,137	1,487	2,625	1,266	5,829
1990	2,564	158	2,722	2,033	3,557	5,590	2,421	10,733
2000	3,516	769	4,285	2,265	4,266	6,531	1,953	12,769
2005	3,624	156	3,780	2,242	2,197	4,439	1,349	9,568

Notes :

(1) ART: Automobile Related Taxes　GT: General Taxes
FILP: Fiscal Investment and Loan Program

(2) ART values are a little different from those in Table 2 due to the difference in the definition of the fiscal year.

(3) US$1.00 = 110 to 120 yen in 2005
Source: National Road Users Council（2007）

in the latter half of the 20th century and was based on the government's extensive network of post offices（24,768 in 2005 throughout the country）with their deposit accounts for people's savings. Through postal savings and postal insurance annuities the central government was able to amass a gigantic monetary fund（356 trillion yen in 2005）which was used mainly for financing public works through long-term lending at low interest rates.（The post offices were privatized in 2007.）

Since the promulgation of the Emergency Law in 1958, a vast sum of money has been spent on road construction through the FILP mechanism. Table 2 shows the sources of finance for road construction between central and local governments.

As the improvement of national and local roads continued, the number of cars increased, further stimulating the Japanese auto industry. Fed by funds from automobile related taxes, both the length of roads and the number of automobiles increased.

The heralded debut of the Nissan Bluebird and Toyota Publica in 1959 is regarded as the start of Japan's motorization（known as "My Car Zero Year"）. Just a month before the Tokyo Olympic Games opened in October 1964, the Meishin Expressway（connecting Nagoya with Kobe）was inaugurated, followed by the Tomei Expressway（Tokyo-Nagoya）in 1969. Table 3 shows how the Japanese auto industry boomed between 1960 and 1980.

Table 3 Production of Automobiles by Country (1960-2005)

(unit: 1000)

Year	Japan	US	Germany	France	UK	Italy
1960	482	7,905	2,055	1,349	1,810	644
1965	1,875	11,138	2,976	1,616	2,177	1,175
1970	5,289	8,283	3,842	2,503	2,098	1,854
1975	6,941	8,986	3,186	2,859	1,648	1,458
1980	11,043	8,009	3,878	3,378	1,312	1,610
1985	12,271	11,649	4,446	3,016	1,314	1,572
1990	13,487	9,780	4,977	3,769	1,566	2,121
1995	10,196	11,975	4,667	3,475	1,765	1,667
2000	10,141	12,800	5,527	3,348	1,814	1,738
2005	10,799	11,981	5,758	3,549	1,803	1,038

Notes : Figures for Germany before the unification are those of West Germany.
Source : "Jidousha Nenkan 2006-07," "Nissan Handbook 1991."

3. Postwar Period II (Late 1960s-)

a) The financial battle between the two "R"s - Railways (Trains) and Roads (Automobiles)

The Japanese have supported their railway network for more than 135 years. The success of the train in Japan is symbolized by the ***Shinkansen*** bullet train (whose service began between Tokyo and Osaka exactly one month before the Tokyo Olympic Games). Private railway lines played a remarkable role in the development of suburban metropolises. Japanese passenger lines use a complex system of expresses and local passenger trains sharing the same tracks to maximize transportation capacity and efficiency. Local trains switch tracks and wait on one side of a station allowing the faster express to pass through on the main line.

Streetcars, which were the main means of urban transportation in the prewar days, were mostly abolished by the late 1960s as the number of automobiles increased. However, government sectors managing streetcars survived by constructing subways as in several metropolises. For example in Tokyo the Metropolitan Subway Public Corporation opened the underground Marunouchi Line in 1962, replacing the above-ground street car system (abolished the following year in 1963).

At present, Tokyo has 14 subway lines in service with 274 stations mainly within the Yamanote Loop Line area. Rail and subway have a great economic and political influence

Table 4　Trends of Automobile Ownership and Traffic Accidents in Tokyo

Year	No. of automobiles registered (thousand)	No. of accidents	No. of killed and injured
1955	240	16,050	11,909
1960	608	150,919	64,839
1965	1,181	77,471	57,460
1970	2,197	65,178	88,406
1975	2,655	35,337	44,444
1980	3,090	32,074	33,907
1985	3,746	35,296	41,974
1990	4,529	49,863	59,144
1995	4,617	58,412	68,185
2000	4,623	90,012	103,631
2005	4,638	80,633	91,561

Source : "Statistical Year Book 2006," Tokyo Metropolitan Government.

on urban life.

Table 4 shows the rise in number of accidents in Tokyo as the number of cars increased.

In the midst of the so-called the "traffic war" during the years of rapid motorization, Kakuei Tanaka, a leading politician of the ruling party LDP, proposed the imposition of a new tax on automobiles. Public opinion supported such a move. Mr. Tanaka, after becoming a prime minister 1972, introduced a new "Motor Vehicle Tonnage Tax" and arbitrated between the "Road" and "Rail" groups of politicians and bureaucrats insisting that the new tax revenue should be shared between the two. Both groups agreed and thanks to this arrangement, the Rail group was able to extend the Shinkansen network nationwide, and the Road group could extend its expressway network all over Japan. The improvement of the road networks has done much to alleviate traffic jams and accidents in Tokyo and other Japanese metropolises.

b) Unparalleled public transportation convenience in Tokyo

In Tokyo, suburban private railway lines now share tracks with subways to allow suburban commuters easy access to the CBD. These interlinking projects were 40% covered by grants from central and local governments, with the remaining 60% from FILP loans.

If you either live or work in Tokyo's built-up "ward" area (roughly within a radius of 13 km or 8 miles and with a population of more than 8 million people), you can enjoy excellent public transportation services. Within a 10-minute walk you might be able to find a bus stop; moreover, you can expect a bus to come along almost every 5 to 10 minutes. If you walk or ride a bicycle for 10 minutes, you can get to a railway station where there will be a train every 3 to 5 minutes during the rush hour. Though the trains and buses are always very crowded during rush hours, they run on schedule down to the second. Thus almost all workers in Tokyo and other Japanese metropolises commute via this efficient and accurately run public transportation system. Only high-ranking government officials and corporate executives commute to their office by car with chauffeur.

This situation may be compared favorably with that of the US. In America, after the intercontinental railway was opened in 1869, a nationwide railway network developed in the latter half of the 19th century. However, from the beginning of the 20th century, motorization proceeded so rapidly by taking advantage of cheap gasoline interstate highways and freeways, that the number of railway passengers decreased year after year. To cover their financial deficit, Amtrak (the National Railroad Passenger Corporation) was established in 1970, but was unable to revive the nationwide railway services. Apart from several exceptional cases such as the Metroliner running between Washington DC and New York City, and BART covering the San Francisco Bay Area, public transportation services in smaller cities and rural areas are very limited. Local residents have to rely solely on their cars. As the price of gasoline soars, the poor and the disabled citizens in particular are facing tough times.

c) Environmental impact of automobile gas emission

Post-war reconstruction in Japan continued until the early 1970s and focused on industrial development. There were almost 20 thousand chimneys in Tokyo at this time, each discharged black smoke from coal fires. Air pollution in these industrial areas worsened. Scenic views of Mt. Fuji (located 100 kilometers to the west of Tokyo) were only possible during the New Year holidays when all the factories stopped operation. Sulfur dioxide discharged into the air led to many cases of bronchial asthma.

The Tokyo Metropolitan Government (TMG) set out to control air pollution by giving financial aid to companies that introduced sulfur dioxide removal systems in their factories or relocating their factories outside Tokyo. Thanks to these arrangements, the number of chimneys decreased remarkably (now, the only ones you can see are those of garbage

incinerators and public bath houses). Tokyo residents regained relatively clean air. However, as Table 4 shows the number of automobiles in Tokyo increased rapidly in the late 1960s and in turn became the source of a new kind of air pollution.

In the morning of July 18 1970, the residents of Tokyo enjoyed a beautiful blue summer sky. No smog could be seen in the air. In the western residential area of Suginami-ku, about 40 junior high school girl students were running in their school field surrounded during PE class. Suddenly they experienced difficulty breathing and felt pain in their eyes and throat. Some had to be hospitalized. Everyone in the school panicked, as they did not know what had caused the problem. Parents with school-age children in Tokyo were terrified. Really it was a mystery.

Research officers of the TMG's Institute of Environmental Protection who had just returned from Los Angeles rushed to the school to identify whether a Los Angeles-type of smog was at work in Tokyo. This smog, called "photochemical" smog, occurs when nitrogen oxide and hydrogen chloride (mainly from automobile gas emissions) are exposed to the ultraviolet rays of strong sunlight.

In 1971 the US Clean Air Act (the "Muskie Act") set a goal to control automobile gas emissions by 1975, but even in 1974, the Japanese automakers paid no attention to this goal, stating that it was technically impossible, too expensive to achieve, would take more than 10 years to accomplish - among a myriad of other excuses.

Worrying about worsening pollution, leading officials of seven metropolises with the total population of 24 million (the Governor of Tokyo and the Mayors of Osaka, Kyoto, Yokohama, Kobe, Nagoya and Kawasaki) formed the "League of Automobile Gas Emission Control." They adopted a resolution on September 24, 1974 and appealed to the Japanese automakers to achieve the targets of the US Clean Air Act immediately. Consumers, especially mothers with school-age children, had a national conference and supported this resolution saying that any car failing to achieve the goal shall not enter in their neighborhoods. The citizens' movement gained momentum because of this national conference.

After heated discussion between citizens and automakers, new type of engines meeting the US Act were introduced to the market in late 1974, for example, the Honda CVCC, the Mazda rotary engine, and various other engines with catalytic converters. The Big Two (Toyota and Nissan) who said it would take "ten years" brought their new US Clean Act compliant car to the market without delay.

Later President Kawashima of Honda commented, "Citizens! The movement to achieve cleaner engines enabled us to develop unprecedented fuel-saving engines with

Table 5 The Annual Number of Automobiles Produced

(unit: 1000)

Year	China	India	Indonesia	Korea	Thailand	Taiwan
1970	87.2	85.5	4.4	28.8	22.1	8.9
1980	222.3	113.9	174.7	123.1	73.3	132.6
1990	473.5	364.2	270.5	1,321.6	242.7	351.6
2000	2,069.1	801.4	292.7	3,115.0	411.7	372.6
2005	5,707.7	1,626.8	494.6	3,699.4	1,125.3	446.3

Source : Same as Table 3

lower gas emissions."（Asahi Shimbun Sept. 4, 1976）

Under strong pressure from citizens demanding improvements to the living environment, the Japanese auto industry has continued to take the initiative in the development of fuel-efficient and environment-friendly cars such as petrol-electric hybrid cars and electric cars that get their power from internal fuel cells that consume hydrogen.

Chpter 2. Automobiles in East Asian Metropolises

1. High Rate of Economic Growth & Rapid Motorization

East Asian countries like China, India, Indonesia, Thailand are making striking achievement for their economic development especially for their automobile industry (some with foreign aid). Table 5 shows the annual number of their automobile production.

Let us compare this Table 5 with that of Table 3 showing the similar data of western well developed countries. Between 1970 and 2005, the number increased China 65.4 times, Korea 128.5 times, etc. Since these rapidly developing countries imported many foreign cars every year, total umber of automobiles hold（Table 6）is much larger than accumulated annual number of automobiles produced in each country. We must count in imported (or brought in as passengers accompanied goods) used cars. Auto Market Research Institute reports that the number of used cars exported from Japan was 1,13 million in 2006. It is impossible to know how many of them are included on the Table 6, and so the actual number must be much larger than Table 6 shows（except Japan）.

Larger percentage of these holding automobiles is concentrated in metropolitan area. Also we must keep in our mind that as bicycle riders' purchasing power improved, they often replace their bicycles with motorbikes. In Vietnam incredibly large number of motorbikes

Table 6　The Number of Automobiles Holding

(unit: 1000)

Year	Japan	China	India	Korea	Taiwan
1990	57,697.7	4,776.4	3,972.0	3,394.8	2,937.7
2000	72,649.1	16,089.1	7,430.0	11,164.3	5,599.5
2004	74,655.5	26,937.1	12,834.0	11,825.2	6,684.5

Source : same as Table 3

Table 7　The Number of Motorbikes Holding

(unit:1000)

Japan 13,369	China 51,028	India 28,342
Korea 1,949	Taiwan 12,367	Vietnam 11,419
Thailand 18,210	Indonesia 18,06	Malaysia 5,843

Notes : The data are based on 1996-2003

Source : Japan Environmental Council, "The State of the Environment in Asia 2006-07" (Japanese edition p.274) published by Toyo-Keizai.

are running in Hanoi and Ho Chi Minh City.. In Taipei, Taiwan also many people are riding motorbikes with their two or three family members. Table 7 shows the number of motor bikes in various countries.

In addition to the above 4-wheel cars and motor-bikes, large number of bicycles and cyclos, rickshaws are running or walking in East Asian metropolises. In a certain Indian cities, sacred cows are walking on the street without paying attention on traffic signals. When different kind of transport facilities mixed and move on the same street, traffic congestion gets worse and worse.

Here we will examine minus factors (social costs) caused by flood of automobiles (including other transport facilities).

2. Social Costs of Traffic Congestion

a) Air Pollution

Automobile (and Motor-bike) gas emission causes asthma and other respitory diseases, and releases carcinogenic particles.

b) Noise and Vibration: Noisy horns often overused in highly congested residential areas.

c) Traffic Accidents: large umber of deaths and injured

d) Traffic Jam causing economic losses

Chapter 3. The Way of Controlling Traffic Congestion

1. Controlling Automobiles Running in the Road

a) Limit the umber of automobiles running in the metropolises: Singapore case

Singapore: the government limits the total number of automobiles license plates and by adopting "Electronic Road Pricing" system to control traffic jam. Also developing MRT (Mass Rapid Transit) subway network in addition to good bus and taxi service.

b) Encourage the Bus Service

i) Fukuoka City, Japan: discounted bus fare (from 190 yen to 100 yen - one coin), car drivers visiting the city shopping center switched to use buses and the daily passengers increased from 29,948 to 56,990. Alleviating car congestion and illegal parking problems in the Fukuoka city central area.

ii) US Denver City case: free bus service along a shopping-lined street. Regular cars are not allowed to pass through this route. Sur-charge on real estate tax in the city central area financially enables the free bus service.

iii) US Seattle City shopping district: Surface roads are very congested. Only bus lane and keeping watch a regular passenger free charge bus could pass through the tunnel constructed under the shops lined street. Visitors get off at the under ground bus stop and an elevator brings them up to the surface shopping center. .Value added tax earmarked enables the operation of this free charge bus system.

iv) Seoul City, Korea: Set up bus lane and keeping watch a regular passenger car not making its way in to this lane.

c) Encourage Bicycle Riding

Netherlands, taking advantage of their flat land (with no mountain),. encourages bicycle riding. Many cities have set up bicycle lanes and parking facilities.

d) Encourage Public Transportation network and the way of financing the construction cost: Tokyo subway

e) Technical Innovation: Hybrid car, Plug in Hybrid Car, Electric Car, Bio Fuel, Fuel Saving Compact Car, Low cost car (Tata of India making), etc.

2) Decentralize the Metropolitan (Capital City) Functions

i) USA: Washington DC, New York City, Chicago City, Boston educational institutes, etc.

ii）Tokyo: Hitotubashi Universwity: Once located at the city center, but after the Kanto big earthquake〔on Sept. 1st, 1923〕, moved in western suburb called Kunitachi, locating between Koku（Kuni）bunji and Tachi-kawa. Good example to decentralize the high educational institutes. .

Conclusion: Toward Sustainable Cities

to be continued