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JAPAN - NATIONAL REPORT

STRATEGIC THEME "A": SUSTAINABILITY OF THE ROAD TRANSPORT SYSTEM

MITIGATING THE IMPACT OF THE ROAD SYSTEM ON CLIMATE CHANGE

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1. INTRODUCTION

Regarding greenhouse gases emissions by developed countries under the Kyoto Protocol, which went into effect in February 2005, binding numerical targets are set for each Annex I country of UNFCCC. According to these numerical targets, Japan has an international obligation to cut greenhouse gas emissions by 6 percent from 1990 levels during the period from 2008 to 2012. In light of this obligation, Japan set the goal of restricting CO_2 emissions originating from energy in the transportation sector to an increase of about 10–12 percent from the 1990 level during the same period. As for medium- and long-term CO_2 reduction targets, Japan set the goal of reducing greenhouse gases emissions by 25 percent from 1990 levels by 2020. That target, however, is being debated. Internationally, discussion of a new framework for restricting greenhouse gas emissions from 2013 on is accelerating.

Looking at the social and economic situations in countries around the world, economic growth is expected to continue in developed nations, but dramatic growth is expected in emerging and developing nations. Global CO_2 emissions are projected to rise annually in conjunction with economic growth in each country unless special countermeasures are taken. Japan considers balancing economic growth with reducing CO_2 emissions to be a vital issue. It must be tackled on a global scale.

Against this background, in recent years Japan has been one of the few developed countries to successfully maintain economic growth while cutting CO_2 emissions in the transportation sector. Japan hopes that using international venues to transmit information about its initiatives can provide suggestions on what measures to take in order to grow economically while developing a low-carbon society.

2. THE STATUS OF CO_2 EMISSIONS IN JAPAN'S TRANSPORTATION SECTOR AND ITS RELATIONSHIP TO ECONOMIC GROWTH

Japan's total CO_2 emissions during FY 2008 were 1,214 million tons. Of this, the transportation sector emitted about 235 million tons, or 19.4 percent. Within this amount, vehicle traffic (passenger cars, buses, taxis, and personal and commercial trucks) accounted for about 90 percent of transportation sector emissions and roughly 17 percent of all emissions. Because CO_2 emissions from vehicle traffic constitute a significant share of total national emissions, emissions reduction must be strategically addressed over the medium and long term. (See Figure 2.1.)

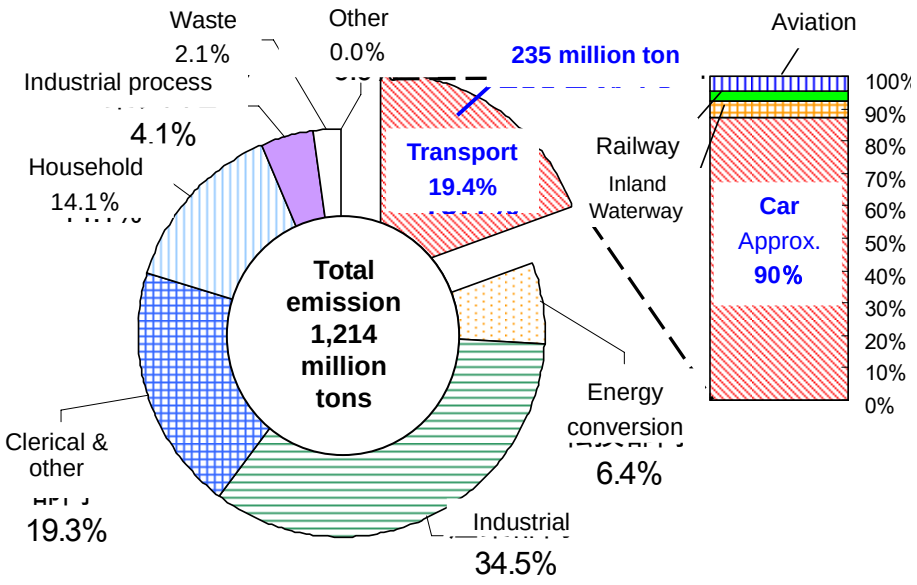
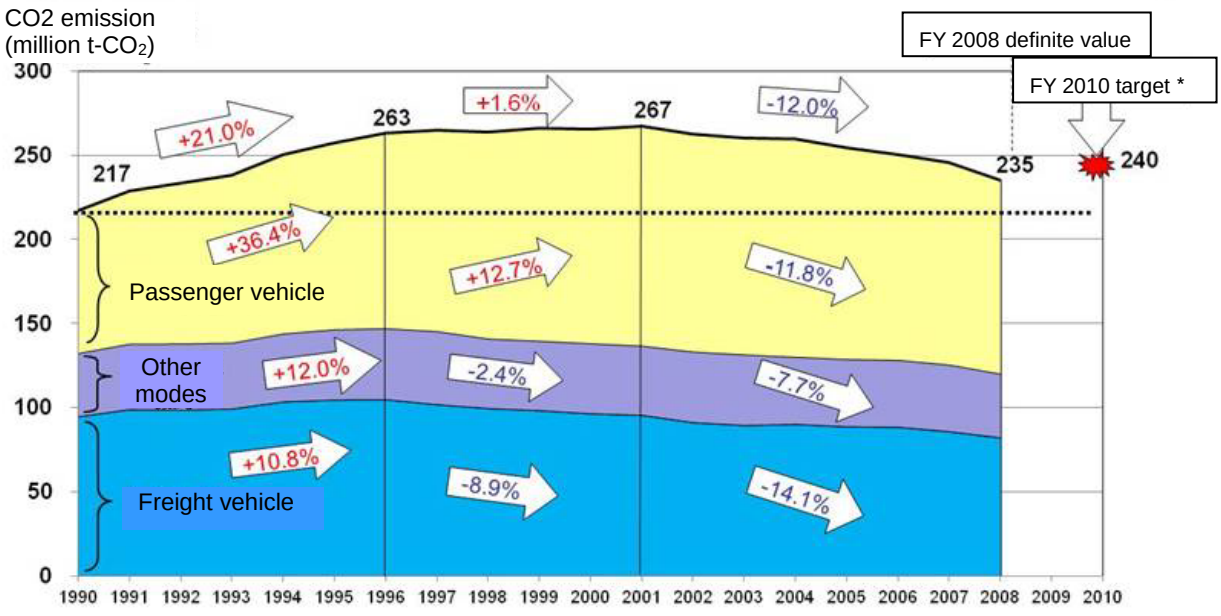


Figure 2.1 - Japanese CO2 emissions by sector, with breakdown of the transportation sector (FY 2008)
Compiled based on figures by the Greenhouse Gas Inventory Office of Japan

Looking at changes in CO_2 emissions in the transportation sector, they were on an upward trend since FY 1990, peaking in FY 2001. Since then, through FY 2008, they have been decreasing. Falling emissions from passenger cars since FY 2001 are the main reason for the decline from the peak. Emissions from freight vehicles began falling in FY 1996, before those from personal passenger cars did. (See Figure 2.2.)



Other modes: bus, taxi, railway, ship, aviation

* FY 2010 target, the best-case figure under the Kyoto Protocol Target Achievement Plan (March 28, 2008 by cabinet resolution).

Figure 2.2 - Changes in CO2 emissions in Japan's transport sector (1990–2008)
Source: Ministry of Land, Infrastructure, Transport and Tourism (MLIT) website

Looking at the relationship between GDP and CO_2 emissions in the transportation sector in OECD countries other than the US (1990–2005), overall, emissions grew along with GDP. This indicates that economic growth tends to lead to increased CO_2 emissions. In Germany, France, and Japan, however, GDP grew, but CO_2 emissions in the transportation sector decreased. Those countries successfully cut CO_2 emissions in the transportation sector while growing economically. Turning to the relationship between per capita GDP and CO_2 emissions in the transportation sector, Japan has among the lowest emissions of countries with high GDPs. China and India, where future economic development is expected, currently have low per capita CO_2 emissions. If per capita CO_2 emissions increase in the future as traffic volume grows, their large populations mean that this change will have a major impact on the level of global CO_2 emissions. (See Figures 2.3 and 2.4.)

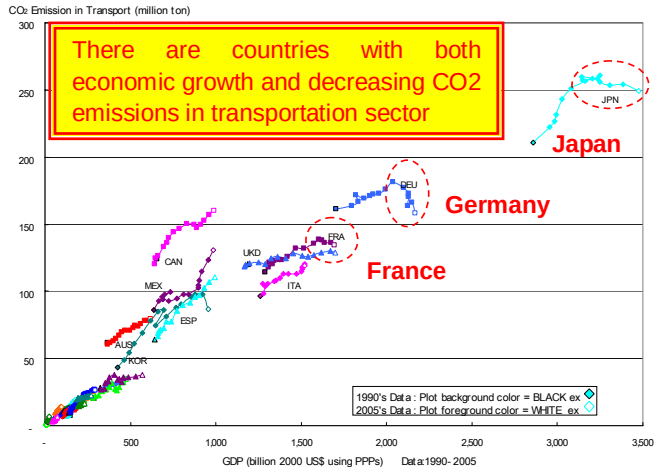


Figure 2.3 - Relationship between GDP growth and CO2 emission in various countries (1990–2005)

Sources: Created from IEA, "CO2 Emissions from Fuel Combustion 2007" and OECD, "OECD Environmental Data 2006-2007."

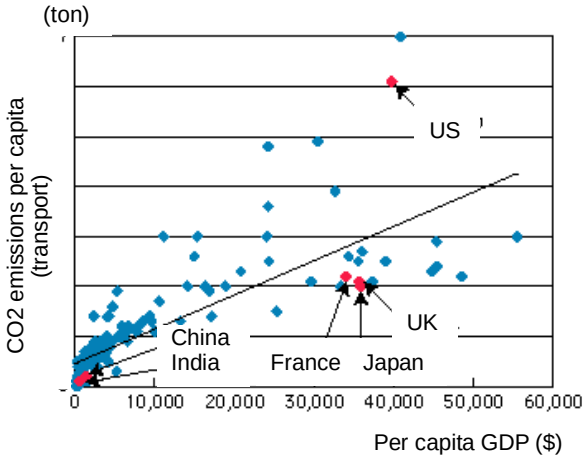


Figure 2.4 - Relationship between per capita GDP and CO2 emission (transport sector) in various countries (2004)

Source: White Paper on Land, Infrastructure Transport and Tourism in Japan, 2007

3. FRAMEWORK FOR POLICIES TO REDUCE CO_2 EMISSIONS IN JAPAN

At the 3rd Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3), held in Japan in 1997, the Kyoto Protocol was adopted. In light of this, in October 1998, Japan passed the Law Concerning the Promotion of Measures to Cope with Global Warming. The law set forth a framework for the national government, local governments, businesses, and the public to work together on measures to cope with global warming. The law also called for the setting of a Kyoto Protocol Goal Achievement Plan. The plan was set in July 2005 by Cabinet resolution. The Kyoto Protocol

Target Achievement Plan sets reduction targets for FY 2010 emissions for each sector and type of gas. It also incorporates diverse measures to reduce greenhouse gas emissions in each sector, including the industrial sector, clerical and other sector, household sector, and transportation sector.

For the transportation sector, the plan promotes measures regarding individual vehicles, traffic flow, use of environmentally-friendly cars, utilization of public transportation, development and adoption of energy-efficient railways, ships, and aircraft, replacing travel through information and telecommunications technology, e.g., telecommuting, cooperation between shippers and logistics businesses to reduce CO_2 emissions, and modal shifts and more efficient truck transport. Advancement of these measures is projected to decrease overall CO_2 emissions in the transportation sector by 14–17 million tons in FY 2010 compared with the FY 2005 level.

Japan thus takes a comprehensive approach to reducing CO_2 emissions in the transportation sector. This approach does not simply implement road-related measures. Instead, it undertakes measures in various fields, including the technical development of automobiles, ideas for ways for individual members of the public to use their automobiles, more efficient logistics, and transport planning. The following section will describe some of these initiatives.

4. INITIATIVES ON REDUCING CO_2 EMISSIONS IN THE TRANSPORTATION SECTOR THROUGH A COMPREHENSIVE APPROACH

In order to reduce CO_2 emissions in the transportation sector, Japan undertakes a comprehensive approach in the transportation sector that develops measures to reduce CO_2 emissions through fields such as automobile technologies, public transportation, road structure, and urban planning. This will be discussed in detail below. (See Figure 4.1.)

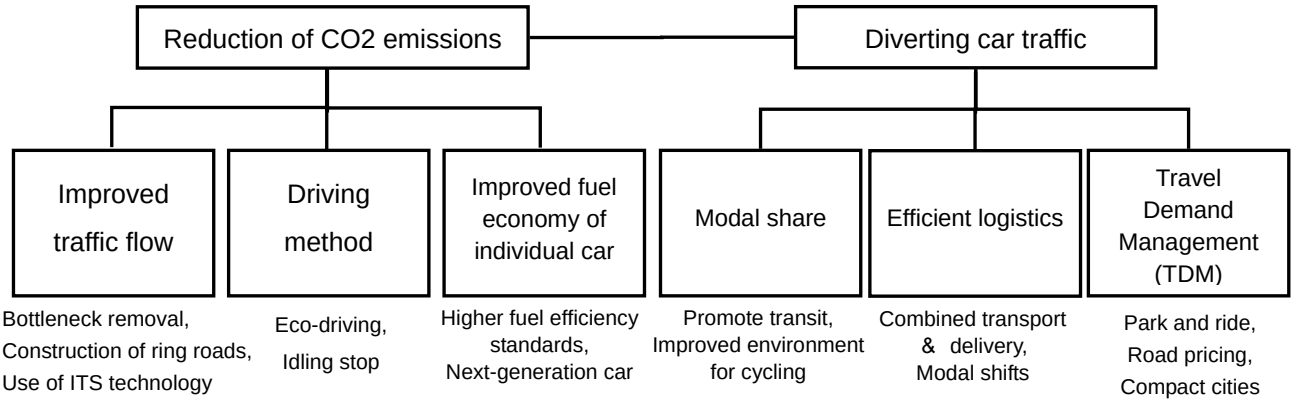


Figure 4.1 - System of measures to reduce automobile-source CO2 emissions

4.1. Improved Traffic Flow

When road traffic is congested and does not move smoothly, unnecessary CO_2 emissions are generated. After explaining the relationship between travel speed and CO_2 emissions, various road-related measures Japan is taking to optimize travel speed will be discussed.

4.1.1. The Relationship between Travel Speed and CO_2 Emissions

The relationship between automobile travel speed and CO_2 emissions is as follows. CO_2 emissions are higher in low-speed zones and decrease as travel speed increases. They are lowest at speeds of 60–80 km/h. Thus, CO_2 emissions from road traffic can be suppressed by promoting measures to eliminate traffic congestion that causes low travel speed and routing traffic to high-speed zones with greater fuel efficiency. Japan is tackling measures for reducing CO2 emissions based on this thinking. (See Figure 4.1.1.)

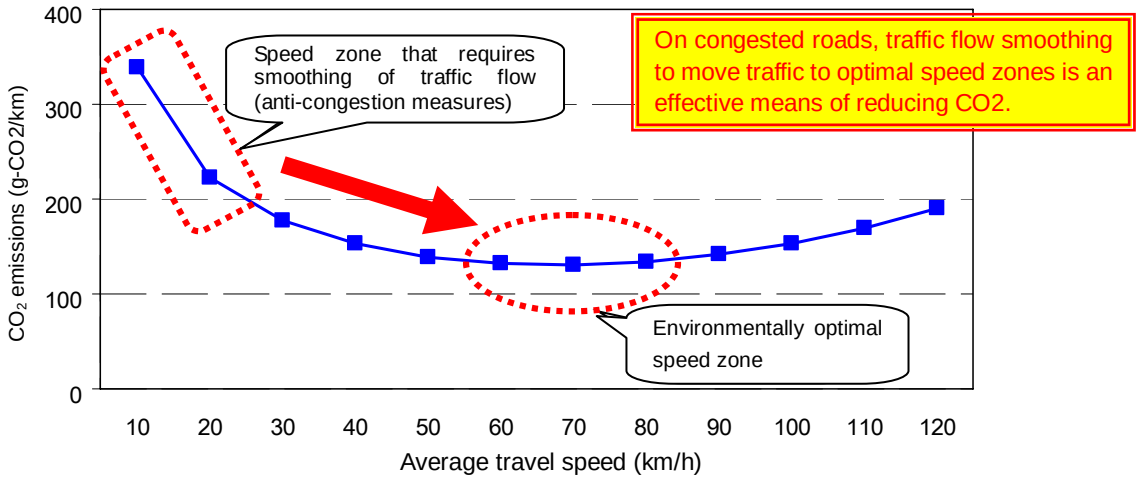


Figure 4.1.1 - The relationship between travel speed and CO_2 emissions

4.1.2. Elimination of Bottlenecks

Major traffic congestion points such as heavily congested intersections and "perpetually closed" crossings cause large-scale congestion. They also have serious impacts on surrounding road networks and generate unnecessary CO_2 emissions. Because there are still many such locations in Japan, mainly in urban areas, prioritized and strategic measures to eliminate them are being taken. In concrete terms, this means selecting sections with high priority by analyzing time lost from traffic congestion in each section of road and designating those with greater time loss as high-priority sections. For sites with high regional traffic demand, bypasses may be constructed or roads widened. For sites with intersections with heavy traffic on both roads, intersection grade separation may be implemented. Eliminating traffic congestion also results in suppressing CO_2 emissions.

Additionally, Japan is working to eliminate railroad crossings where roads and railways intersect on the same grade. The government is cooperating with railway companies on a continuous grade separation project. (See Figures 4.1.2 through 4.14.)

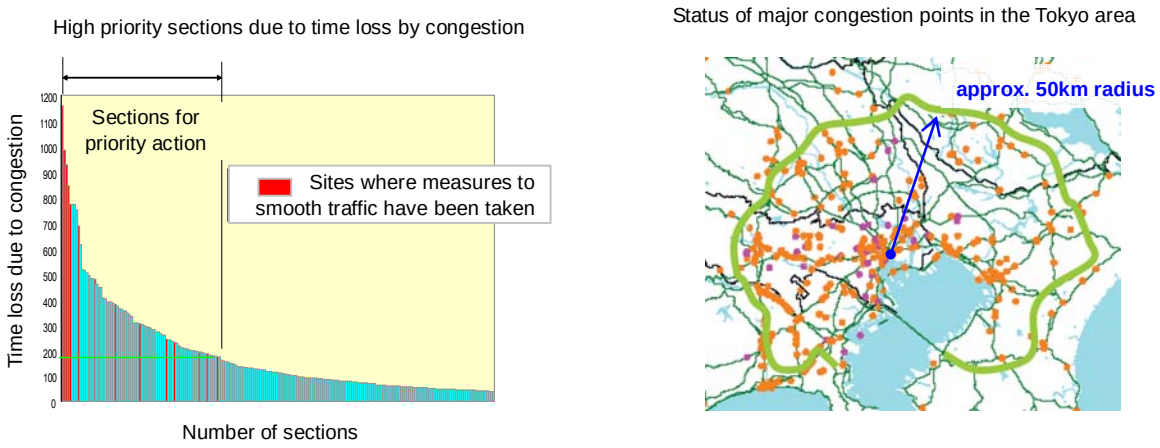
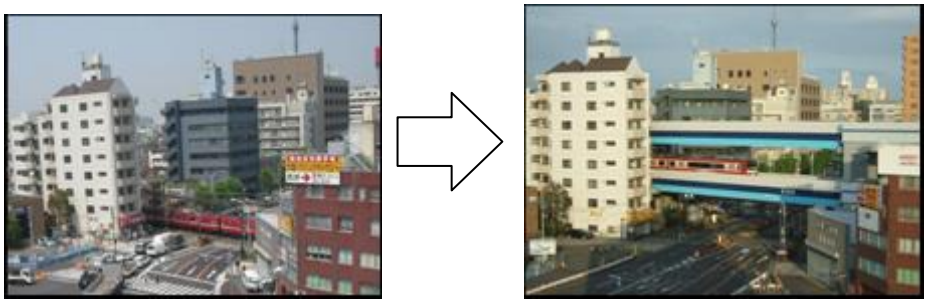


Figure 4.1.2 - Japan's thinking on major traffic congestion points

Before intersection grade separation After intersection grade separation

Figure 4.1.3 - Grade separation project of intersection
(Ordinary National Highway 17, Kakinuma-Koizuka grading [Kumagaya, Saitama])



Before elevated railway bridge After elevated railway bridge

Figure 4.1.4 - Measures for bottleneck railroad crossings
(Keikyu Main Line/Airport Line grade separation project)

Easing of traffic congestion through road development can increase automobile travel speed, resulting in improved fuel efficiency and lower CO_2 emissions. On the other hand, road development may invite greater automobile traffic, increasing CO_2 emissions. Data measuring the impact of new road development such as bypass construction, lane

widening, and intersection grade separation on traffic and CO_2 emissions show that even when there are short-term increases in traffic, over the long term, easing traffic congestion increases speed, leading to reduced CO_2 emissions. CO_2 emissions increased at sites in some areas, but decreased markedly in urban areas. (See Figure 4.1.5.)

Note: dates in parentheses indicate: (Research before opening – Opened date–Research after opening).

Figure 4.1.5 - Changes in CO2 emissions due to bypass construction, lane widening, and intersection grade separation

Source: Report by Council on Road Measures to Prevent Global Warming

4.1.3. Construction of Ring Roads in Urban Areas

Through traffic with no business in the city center is a major cause of congestion in urban areas. Ring roads contribute to the rerouting of such traffic. Since they are developed as expressways, they can be constructed for low CO_2 emissions per vehicle kilometer traveled. Based on these two perspectives of easing traffic congestion and constructing roads with low CO_2 emissions, Japan is rapidly advancing the construction of ring roads using expressways in major urban areas, especially the three ring roads in Tokyo Capital Region Although ring roads have some effect as they open partially, only when all the radial roads are connected and missing links are complete, significant impacts could be expected by diverted traffic. It is therefore important to proceed with construction while always keeping the road network in mind. The opening of the Yamate Tunnel (between Shibuya and Shinjuku) on the Central Circular Route, one of the three metropolitan inner circular routes, provides a route around a traffic congestion point in the city center. It thus promotes the dispersal of traffic that has no purpose in the city center itself. During peak traffic congestion, it shortens the time between the Tomei and Joban Expressways by 15 minutes. The tunnel's opening has improved flow and eased congestion on the Metropolitan Expressway as a whole. Length of congestion (sections with speeds of 20 km/h or less)

during the peak period (between 11:00 a.m. and noon on weekdays) on the Metropolitan Expressway and all Tokyo routes has decreased about 30 percent since the tunnel opened. This is expected to reduce CO_2 emissions from car traffic on expressways and ordinary roads in the Tokyo area by about 34,000 tons annually. (See Figures 4.1.6 and 4.1.7.)

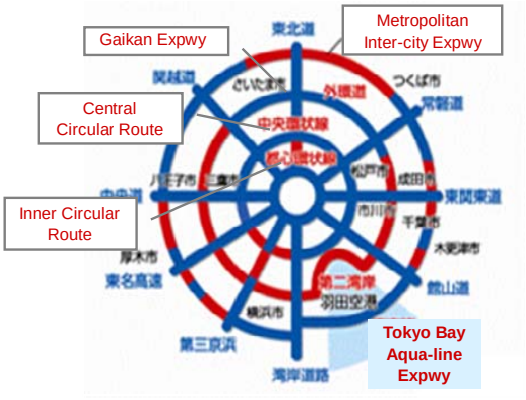


Figure 4.1.6 - Status of construction of the three ring roads in Tokyo metropolitan area (Blue: as of April 2010; Red: not yet completed)

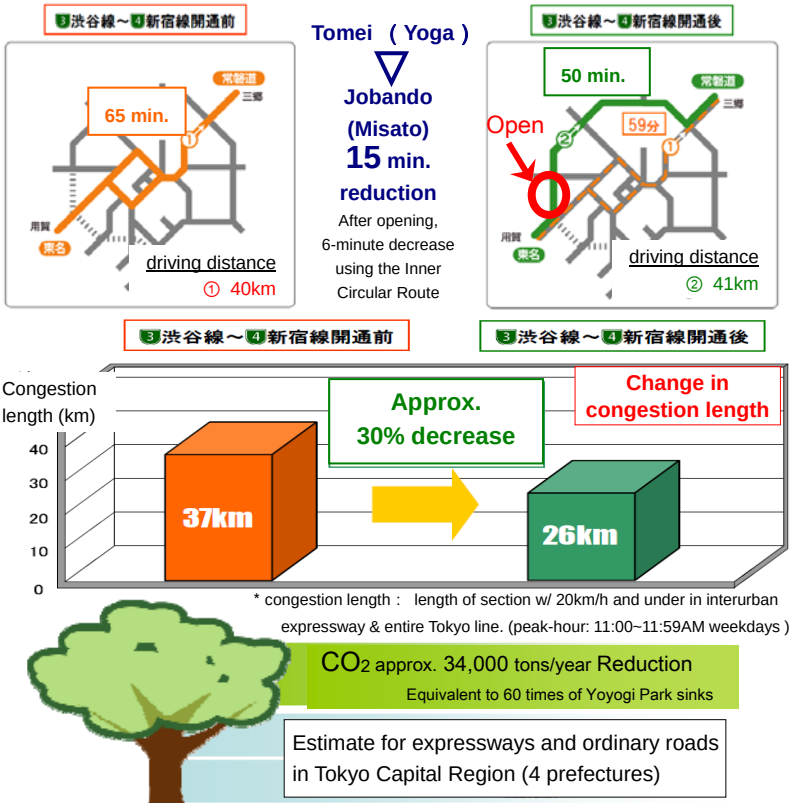


Figure 4.1.7 - Effects of constructing the three metropolitan inner circular routes (Central Circular Route [btw. Shibuya & Shinjuku])
Source: Metropolitan Expressway Co., Ltd.,
URL：http://www.shutoko.jp/company/press/h21/prl2sv0000009qwa-att/prl2sv0000009qzm.pdf

4.1.4. Utilization of ITS Technology

Providing information on road traffic so that drivers obtain information regarding traffic congestion and can avoid congested areas is expected to result in reduced overall CO_2 emissions from traffic. It is necessary to continue disseminating VICS (Vehicle Information and Communication System) as the core means of providing road traffic information. In addition, ETC (Electronic Toll Collection System) eliminates the temporary closing of tollgates, resulting in the elimination of traffic congestion around tollgates. These technologies are also effective means of suppressing CO_2 emissions. Adoption of ETC on the Metropolitan Expressway has almost eliminated traffic congestion at tollgates on the main route. Even during the busy year-end and New Year's period, the number of sites with traffic congestion of five kilometers or more have been drastically reduced. (See Figures 4.1.8 and 4.1.9.)

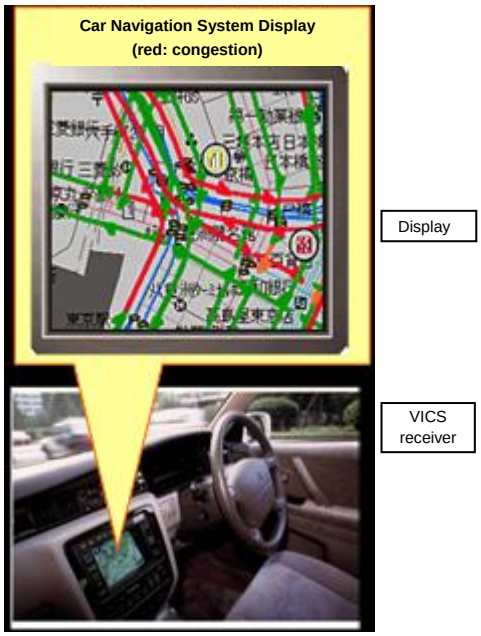


Figure 4.1.8 - Traffic congestion guidance using VICS

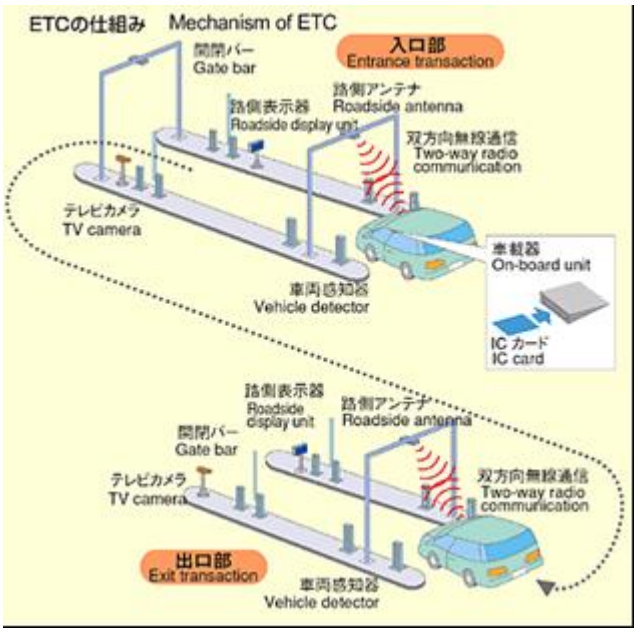


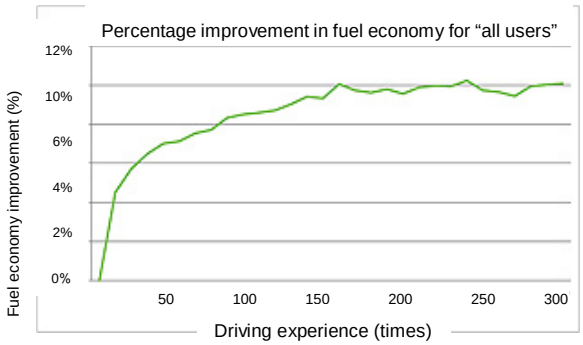
Figure 4.1.9 - ETC mechanism

4.2. Eco-driving and other driving methods

The amount of CO_2 emitted from automobiles changes because of the characteristics of driving on ordinary roads and the characteristics of acceleration and deceleration around traffic signals. Promotion of driving techniques for individual drivers that are effective in reducing fuel consumption has some effect from the perspectives of drivers and of suppressing CO_2 emissions. It is important to promote skillful driving in which drivers work to implement eco-driving techniques such as using their accelerators gently, avoiding unnecessary acceleration and deceleration, using engine braking, and employing idling stop, even if they drive no less than before. Relevant Japanese ministries and agencies are collaborating to promote the spread of eco-driving among drivers. (See Figure 4.2.1.)

Degree of eco-driving is analyzed by accelerator and brake operation. Speedometer's background color changes to feed back fuel consumption status in real-time.

< Display for the Eco Assist >



< Average fuel economy improvement for all drivers >

Figure 4.2.1 - Reduced fuel consumption through eco-driving

Source: Honda Motor Co., Ltd., website

URL: http://www.hondanews.info/news/ja/auto/4091005

4.3. Improving the Fuel Efficiency of Individual Vehicles

In order to reduce CO_2 emissions from vehicle traffic, it is necessary to increase the fuel efficiency of automobiles themselves. Since 1985, Japan's Law Concerning the Rational Use of Energy has promoted the adoption and enhancement of fuel efficiency standards for automobiles. In order to meet these requirements, each automaker develops various types of technology to improve fuel economy.

4.3.1. Enhanced fuel economy standards and technical development

The average fuel consumption of passenger cars sold in Japan has improved on a new car basis since FY 1996 and on a registered car basis since FY 1998. CO_2 emissions in Japan's transportation sector began declining in FY 2001. The increased fuel efficiency of individual vehicles is believed to have had an effect on this phenomenon. Japan employs a Top Runner approach, in which fuel economy standards for automobiles are set based on the level of the most efficient vehicles on the market. In order to meet the standards and their rises, each automaker has been involved in the development and dissemination of technologies that contribute to fuel efficiency. These include lean burn gasoline engines, direct gasoline-injection engines, variable valve timing, idling stop mechanisms, continuously variable transmissions (CVT), and common rail fuel injection equipment. Of these technologies, hybrid vehicles, which combine gasoline engines and electric motors that regenerate energy lost during deceleration and store it as electricity for use during acceleration, are rapidly spreading in Japan. (See Figures 4.3.1 and 4.3.2.)

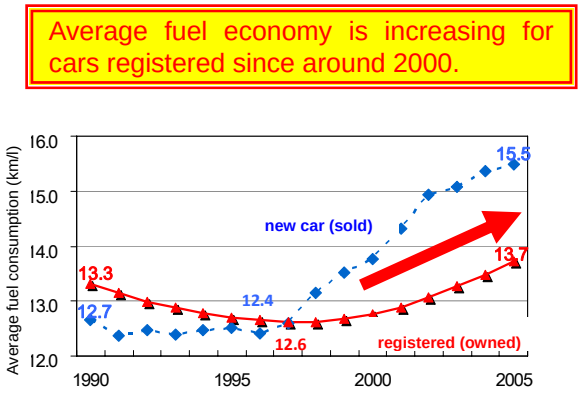


Figure 4.3.1 - Average fuel economy of Japanese automobiles (1990–2005)

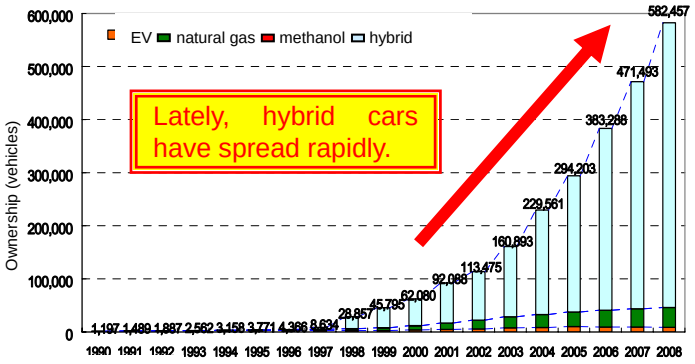


Figure 4.3.2 - Dissemination of low-emission vehicles in Japan
Source: Created based on "Environmental Statistical Summary," Ministry of the Environment

4.3.2. Development and Dissemination of Next-generation Automobiles

In order to greatly reduce CO_2 emissions from vehicle traffic over the long term, it will be necessary to convert the source of automobile energy from conventional fossil fuels to more energy-efficient electricity. As technical development for passenger cars, Japan is currently promoting technical development and dissemination of next-generation automobiles that are easy on the global environment. This involves technical development of electric cars and plug-in hybrid cars and trucks centered on fuel-cell vehicles. In addition, reduced dependence on fossil-fuel energy is also necessary. Japan is therefore advancing biofuel manufacturing and technical development on the local level. As these next-generation automobiles spread, CO_2 emissions in the transportation sector will be suppressed. Next-generation automobiles are therefore treated preferentially in Japan through tax breaks and subsidies in order to promote their dissemination. This is making ordinary drivers and transport businesses more eager to purchase them. These measures are used only when products initially come on the market, but they contribute to CO_2 emissions reduction.

4.4. Modal Share

It is possible to reduce CO_2 emissions in the transportation sector by enhancing the convenience of public transportation and upgrading environments for cycling in order to promote the shift of passenger travel from automobiles to public transportation and bicycles.

4.4.1. Promotion of Public Transportation Use

Public transportation such as railways and buses emit less CO_2 per person transported than personal passenger cars do. Shifting passenger travel from passenger cars to public transportation can therefore suppress CO_2 emissions. This trend holds true internationally as well. According to data from countries around the world, the higher the percentage of people using public transportation, the lower CO_2 emissions in the transportation sector tend to be. In order to raise the modal split of public transportation, it must be made more convenient and attractive. Measures such as development of train station plazas and other transportation nodes and provision of information on bus connections are effective means of doing this. (See Figures 4.4.1 and 4.4.2.)

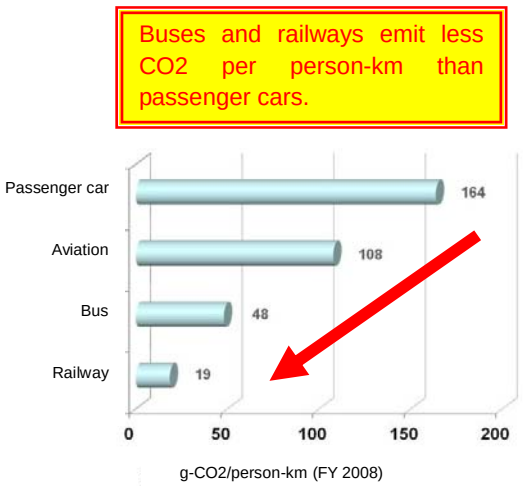


Figure 4.4.1 - CO2 emissions per person by transport mode
Source: MLIT website

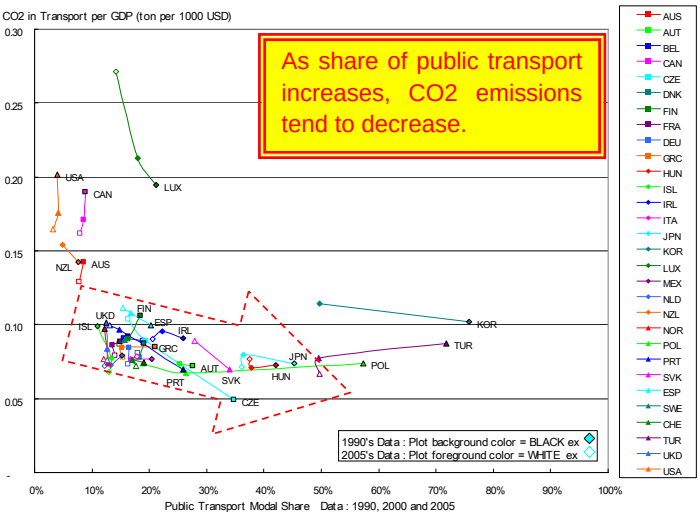


Figure 4.4.2 - Relationship between the share of public transportation and CO2 emissions in transportation sector (1990, 2000, 2005)
Sources: Created from IEA, "CO2 Emissions from Fuel Combustion 2007" and OECD, "OECD Environmental Data 2006-2007"

4.4.2. Improving Environments for Cycling

Bicycles are an efficient means of transportation. For urban travel over short distances of about five kilometers, bicycles take less time than other modes such as railways, buses, and automobiles. Improvement of bicycle roads and parking facilities around public transportation access points and preparing environments for the safe and smooth use of bicycles can therefore reduce car traffic by commuters and so on. Improvement of bicycle-related facilities is being actively promoted in Japan in recent years.

4.5. More Efficient Logistics

Effective means of suppressing CO_2 emissions from trucks include improving the efficiency of logistics systems so that truck traffic is reduced and shifting from trucks to transportation with lower CO_2 emissions.

In order to reduce truck traffic, it is important to improve logistics efficiency through joint delivery, a shift from private trucks to more efficient commercial ones and a shift to larger truck. These measures can further reduce CO_2 emissions. In addition, it is important to promote the greening of the overall logistics system and to encourage a shift from automobile transport to railways or coastal shipping, which emits less CO_2. These measures can further reduce CO_2 emissions. (See Figures 4.5.1 and 4.5.2.)

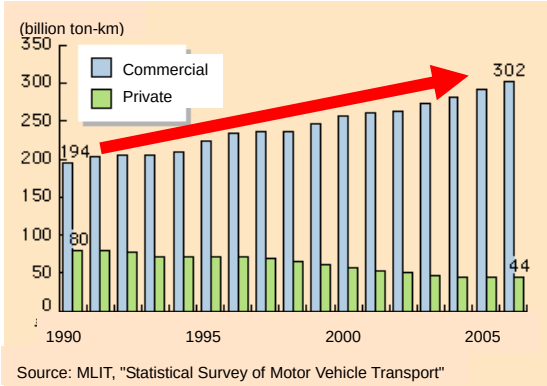


Figure 4.5.1 – Changes in independent conversion of trucks (1990–2006)
Source: White Paper on Land, Infrastructure Transport and Tourism in Japan, 2008

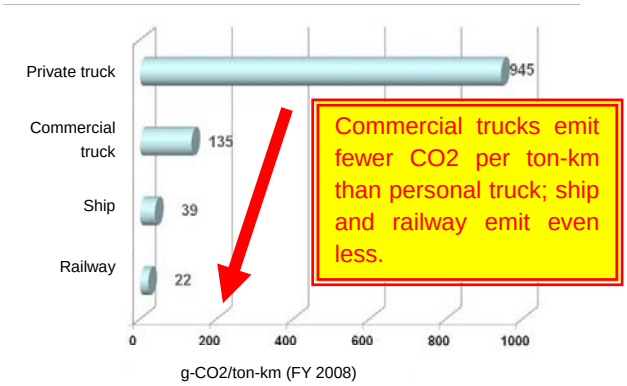


Figure 4.5.2 - CO2 emissions per cargo volume by transport mode
Source: MLIT website

4.6. Traffic Demand Management

4.6.1. Traffic Conversion Measures to Eliminate Congestion

Promotion of traffic demand management that disperses automobile usage times and routes and shifts automobile traffic to transportation modes such as buses and railways in order to eliminate the congestion that accompanies traffic concentration and increase travel speed is linked with reducing CO_2 emissions in the transportation sector.

“Park and Ride” is one of these measures. In order to control traffic congestion during peak commuting times or when events are held, parking lots should be prepared at the edges of areas where congestion is expected so that passenger travel within the area can be shifted from passenger cars to buses and other modes of transportation.

In areas where the air is polluted with NO_X and so on, particularly in sections where traffic congestion is remarkable, through truck traffic can be routed around by implementing environmental road pricing to lower tolls on detour routes. This can shift traffic and contribute to easing traffic congestion. (See Figures 4.6.1 and 4.6.2.)

4.6.2. Concentration of Urban Functions

When urban functions are scattered, reducing the density of the entire city, the distances that people and goods need to travel increase. This in turn increases CO_2 emissions. Comparison of data from Japanese cities shows that high population density generally reduces per capita CO_2 emissions. Achievement of concentrated urban structures that systematically concentrate urban functions and use public transportation as the core means

of transportation must be promoted. This will reduce the movement of people and goods and accompanying CO_2 emissions.

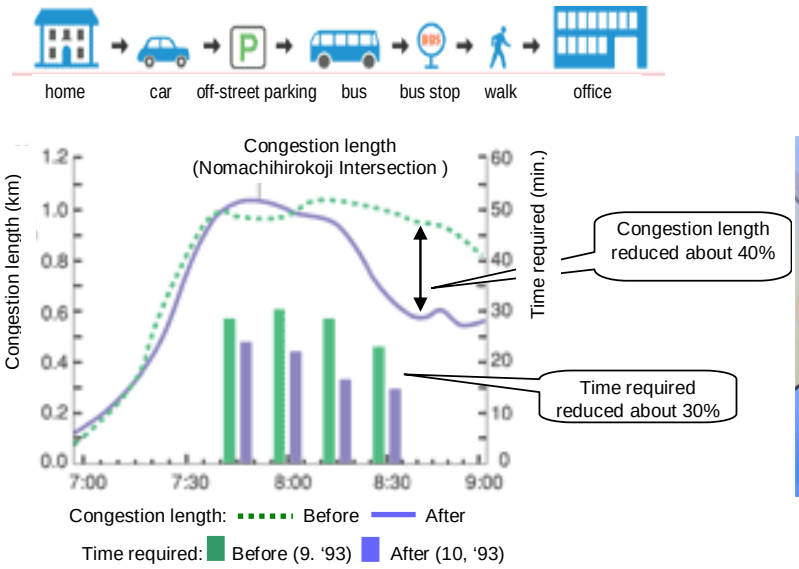


Figure 4.6.1 - Traffic congestion reduction effect by adoption of park and ride in Kanazawa City

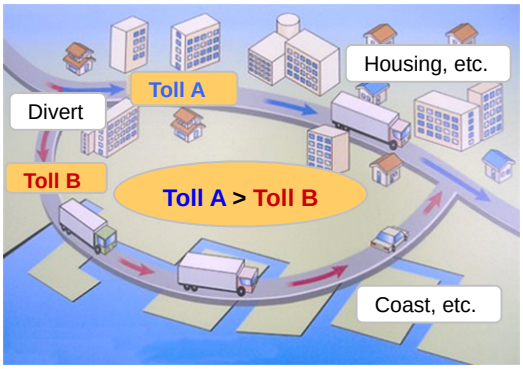


Figure 4.6.2 - Image of environmental road pricing
Source: Hanshin Expressway Company Limited website

4.7. Improving effective data for estimating CO_2 emissions

For decades, either annually or every five years, Japan has carried out national surveys of consumption of gasoline and other fuels, traffic volume on major roads, the status of road development, and stored these statistical data. Since the 1990s, when national and international discussion of preventing global warming began, Japan has used the data as a source of information. It has helped estimate the effects of policies and measures on CO_2 emissions reduction. Today, Japan uses truck counters and probe car data to obtain more accurate data regarding traffic volume and travel speed on major roads in terms of both time and space.

Some emerging and developing nations have not yet been able to move ahead with keeping up this type of statistical data on transportation. Because it contributes to predicting the effects and to understanding background conditions of measures to reduce CO_2 emissions, such data would be a valuable reference for future policy planning.

5. CONCLUSION

In recent years, Japan has been one of the few countries to post economic growth while successfully reducing CO_2 emissions in the transportation sector. Initiatives aimed at reducing CO_2 emissions are carried out with national goals set in every sector. National and local governments and businesses each work together to broadly implement policies in order to achieve these goals. Japan takes a comprehensive approach on CO_2 emissions reduction in the following varied fields in the transportation sector and in automobile traffic in particular.

- Traffic flow measures that eliminate road congestion and induce automobiles to use travel speeds that are easy on the environment
- Devising driving techniques that are easy on the environment for individual drivers
- Improvement of the fuel economy of individual vehicles through the development of elemental technologies and next-generation automobiles in response to higher fuel economy standards
- Modal shift from passenger cars to railways, buses, and bicycles
- More efficient and greener freight transportation
- Traffic demand management to transform automobile traffic

In light of Japan's situation, the following may be useful ideas for addressing reduction of CO_2 emissions in the transportation sector in the future.

(1) Balancing economic growth with reduction of CO_2 emissions in the transportation sector is possible. Japan has already implemented such measures.
(2) Promotion of road development in the form of smoothing traffic flow through measures against congestion is effective in reducing CO_2 emissions in the transportation sector.
(3) In order to reduce CO_2 emissions in the transportation sector, it is important to take a comprehensive approach in which various fields such as roads, automobiles, transport planning, logistics, and urban planning contribute to CO_2 emissions reduction.
(4) It is important for emerging and developing nations to refer to the experiences of countries that are successfully reducing CO_2 emissions in the transportation sector and to work toward full policy development and collection of traffic data.