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A COMPILATION OF ROAD TRACK COSTS*

by

Yatarō Fujii

1. *Purpose and Scope of Compilation*

In order that the investments in transport sector might be effectively allocated among various transport modes and that the facilities thus obtained be fully utilized, it is required to have information on the costs of providing and using the services. This also applies to the services of a particular mode in different time, location, etc.

Within the sector of inland transport, road has been falling behind railway in the cost analysis. This has resulted *inter alia* from difficulties in compiling road track costs. Although in Japan there have been several attempts of computation on the value of road assets and also some examples of cost estimation on hypothetical roads of particular routes and standards, our knowledge on the actual road costs remains limited. This paper intends to get some ideas on costs of providing road service, particularly cost relationships (1) between urban and rural roads and (2) between trunk and local roads. The former may concern cost differences especially with the volume of traffic, and the latter with the characteristics of service provided by each road group.

As regards the items of cost required for the supply and consumption of road service, a report by the British Ministry of Transport summarizes them into three categories; user costs, public costs and community costs.[1] User costs involve no problem on their incidence (apart from congestion costs to each other). This makes it essential that the charges on users be closely related to costs other than user costs. Community costs comprise items especially impor-

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1) Ministry of Transport: *Road Track Costs*, 1968, ch. 2.

tant in urban roads today. A difficulty lies, however, in the lack of any widely-accepted method of computing them. And if such community costs were assessed and included into cost accounting solely in one particular mode, then there would be brought about some distortions in traffic distribution among modes.

In this paper our concerns are confined to the road track costs, that is, capital and maintenance costs of road service in the category of public costs. Other items under this category are neglected because relevant data are not available or because further examination is necessary on the bases to be employed for identifying those portions attributable to the supply of road service. This omission might not lead to substantial errors since the importance of these items is conceived to be relatively minor compared with the costs of construction, improvement and maintenance of road, although the policing cost may be fairly important as regards urban or trunk roads.

The backwardness of road cost analysis is due to two obstacles. The one lies in the limitation of available data comparable with railway. In the case of road, the necessity of cost compilation is originally not so urgent since profit-and-loss accounting has not been required, and therefore explicit financial data have not been prepared. Moreover, the system of road administration is complicated, which makes data collection more difficult. Another obstacle is of conceptual one. Railways cannot offer a whole process of trip without complementary road services, except such case as traffic of which both origin and destination are on private sidings. The function of railways essentially consists in the service for through traffic, as is the case with expressways. On the other hand, roads have the function of access service, together with the service for through traffic. This dual function of road makes cost assignment to particular services very complex. In fact, the first-mentioned obstacle of data collection has been brought about by the purposive cut-off of direct connection between cost and revenue and the decentralized system of administration, both of which have originally resulted from such dual function of road.

Let's consider this in conjunction with the processes of analysis on road costs. For the assignment of road costs from the view of keeping close relation between costs and charges on users, four steps would be necessary; (1) ascertainment of total costs, (2) assignment of costs to users and non-users, (3) assignment of costs charged on users to various groups among them (by time, location, road class, vehicle type, etc.) and (4) assignment among individual users within each group. These steps would more or less arise in any cost analysis, yet in the case of roads, especially general-purpose roads on local level, there remarkably increases complexity in the second-step problem because the expected function of road involves the supply of access service. One of the purposes of this paper, that is, relative costs between trunk and local roads, is an attempt of fact finding for approaching the second-step problem. Another purpose, i.e., relative costs between urban and rural roads, is a trial of approach to one aspect of the third-step problem which has been left relatively untouched in contrast to a large pile-up of analyses based on vehicle

types. The supply of road facilities in urban area is so expensive that it has been argued that the use of vehicle therein has been charging on the economy an amount of costs larger than the burden actually borne by users, apart from the cost of congestion. However, we have not always definite evidence enough to verify such an argument.

2. *Procedure of Compilation*

When one attempts to find road costs for a particular year per unit of road length or traffic volume, a first problem is what items of cost should be taken into account. In this paper, discussion is confined to the costs directly required for road construction, improvement and maintenance. As to the running costs for maintenance, there are few problems about their assignment to a given year. The main difficulty lies with the assignment of capital costs.

In order to assign capital costs to a particular year, there could be four approaches; (1) expenditures for maintenance only, as the short-run marginal costs; (2) current out-of-pocket expenditures, as approximates to the long-run marginal costs; (3) annual costs of assets on activity basis, i.e., replacement prices; and (4) annual costs of assets on inventory basis, i.e., original prices. We do not concern here in detail which approach be adopted. The most suitable approach should be selected according to the purpose of analysis, while the choice would be constrained by available data. For this paper, the replacement cost approach would be relevant. When, as in Japan, road investments are rapidly increasing year after year and are being undertaken selectively (in terms of road classes) under the relatively short-term plannings, the replacement cost approach could reflect the long-run opportunity costs more closely than the current out-of-pocket expenditure approach. Furthermore, for our aim such data are necessary that allow separations between urban and rural roads as well as between trunk and local roads. With the available data for us, full separations are not possible except by replacement costs. However, to the extent possible and with proviso of simplification, we will also show the results by maintenance expenditures together with ones by current out-of-pocket expenditures. The original cost approach is not employed, not only because the said separations are impossible, but also because it refers only to sunk costs.

The compilation relates to a specific year, that is, 1965. Major data sources are; *Survey of Road Traffic Volume, 1965* which gives details about traffic volume by road classes (former Class I and II National Highways, Principal Local Roads and Ordinary Prefectural Roads),[2] and *Road Assets* which shows

2) In Japan, roads are classified into National Highways, Prefectural Roads and Town Roads according to the authority responsible for construction and administration of the road in question, that is, the central government and the local governments of prefectures and of cities or towns, respectively. Until a couple of years ago, National Highways had been further divided into Class I and II. And Prefectural Roads are now sub-divided into Principal Local Roads and Ordinary Prefectural Roads according to the importance of the road concerned on the national network.

the current unit prices of construction and improvement of road facilities.[3)]

For sample areas, the followings were selected according to the size of average traffic volume (Table 1).

(1) from the group of prefectures with largest traffic—Tokyo (Rank 1 among all of 46 prefectures), Osaka (2) and Aichi (4);
(2) from the group of prefectures with medium traffic—Shizuoka (9), Toyama (21), Mie (24) and Okayama (31);
(3) from the group of prefectures with smallest traffic—Iwate (44) and Shimane (46);
(4) from the group of big cities—Osaka City and Nagoya City; and
(5) a case of an overall trunk line—National Highway No. 1.

The Inner Region of Tokyo Metropolis could not be isolated. The three prefectures other than Toyama under the medium group, which correspond roughly every tenth-odd rank, are situated along the busiest routes of Japan (NHys. No. 1 and 2). Toyama was added in order to show the case of non-corridor area.

The roads under examination consist of Ordinary Prefectural Roads and

Table 1. Volume of Traffic, by Prefectures and Big Cities
(total traffic volume (car-km)/total length of roads (km), 12-hours-a-day)

(car)

1	Tokyo	12,828	18	Yamanashi	1,401	35	Aomori	961
2	Osaka*	10,317	19	Nagano	1,398	36	Tokushima	952
3	Kanagawa*	7,565	20	Yamaguchi	1,388	37	Fukushima	921
4	Aichi*	4,494	21	Toyama	1,362	38	Akita	834
5	Saitama	3,006	22	Wakayama	1,339	39	Oita	826
6	Fukuoka	2,755	23	Tochigi	1,309	40	Kagoshima	817
7	Hyōgo*	2,691	24	Mie	1,290	41	Yamagata	812
8	Chiba	2,123	25	Hiroshima	1,242	42	Tottori	798
9	Shizuoka	2,085	26	Nara	1,189	43	Miyazaki	693
10	Kyōto*	2,054	27	Miyagi	1,182	44	Iwate	659
11	Shiga	1,632	28	Ibaragi	1,145	45	Kōchi	633
12	Ishikawa	1,605	29	Nagasaki	1,137	46	Shimane	549
13	Gumma	1,513	30	Niigata	1,084		Osaka City	29,054
14	Saga	1,442	31	Okayama	1,082		Yokohama City	15,829
15	Fukui	1,431	32	Kumamoto	994		Nagoya City	15,070
16	Gifu	1,414	33	Ehime	970		Kōbe City	8,810
17	Kagawa	1,403	34	Hokkaido	966		Kyōto City	8,415

* Special-administration cities (listed at the end of Table) are not included.
Source: *Tabulation.*

3) Kensetsu Shō (Ministry of Construction): *Shōwa 40-nendo Zenkoku Dōro Kōtsūryō Jōsei Chōsa (Survey of Road Traffic Volume over the Country, 1965)*, 1966; *Ippan Kōtsūryō Chōsa Shūkeihyō (Tabulation Tables of General Survey on Traffic Volume)*, 1966; *Dōro Shisan (Road Assets)*, 1965.

upper-class ones. Informations about lower-class roads were not available. The *Survey* covers all of National Highways and Principal Local Roads. But as for Ordinary Prefectural Roads it includes only the results of about a ½ sample survey, so the figures are adjusted to the population.

(1) Costs

As noted above, in this paper the road track costs are confined to followings;

costs = capital costs (depreciation and interest) + maintenance costs

The assets included in compilation comprise four items of land, improved road, bridge and pavement.

Depreciation and Interest. In road cost analyses, one of controversial problems is whether the land costs should be included or not. Although usually land is not taken as a depreciable asset, it may be conceivable that, even in the case of road, economic obsolescence due to change in the demand pattern should be taken into consideration. It would be especially so where an acquisition of land is enforced at a price which does not represent its opportunity cost, as is the case with Japan (referred below). Again as regards interest, the sacrifice of putting the available fund into the acquisition of road facilities should be included in cost compilation whether the fund is borrowed or self-financed.

The economic life time of depreciable assets is rather a problem of judgement. Various proposals on the depreciation of land have been made, ranging

Table 2-a. Unit Price of Land

(yen/m²)

	Urban Area	Rural Area	
		Plain Terrain	Mountainous Terrain
Tokyo	59,185	21,712	3,753
Osaka*	30,150	13,671	3,217
Aichi*	17,690	2,144	536
Shizuoka	6,535	536	1,608
Toyama	4,709	536	804
Mie	4,410	804	536
Okayama	3,901	536	536
Iwate	3,413	1,340	804
Shimane	5,020	1,608	536
Osaka City	57,581	14,475	—
Nagoya City	41,949	6,969	—

	Urban Area	Rural Area	
		Plain Terrain	Mountainous Terrain
[NHy. No. 1]			
Tokyo	59,185	—	—
Kanagawa*	14,330	4,577	2,681
Yokohama City	21,464	15,011	—
Shizuoka	6,535	536	1,608
Aichi*	17,690	2,144	—
Nagoya City	41,939	6,969	—
Mie	4,410	804	536
Shiga	3,838	509	—
Kyōto*	—	2,144	—
Kyōto City	40,211	9,650	—
Osaka*	30,150	13,671	—
Osaka City	57,581	—	—

* Special-administration cities are not included. —: No relevant groups.

Table 2-b. Unit Costs of Non-

	Improved Road (million yen/km)			Bridge (million yen/km)			Pavement (thousand yen/m²)		
	Former Class I NHys.	Former Class II NHys.	Prefectural Rds.	Former Class I NHys.	Former Class II NHys.	Prefectural Rds.	Former Class I NHys.	Former Class II NHys.	Principal Local Rds.
Tokyo	140	108	76	1,512	1,512	1,512	3.8	4.1	3.5
Osaka*	76	76	76	702	702	702	4.3	3.8	3.8
Aichi*	108	43	38	702	594	486	3.8	2.7	2.7
Shizuoka	108	43	27	702	594	486	3.0	2.4	2.7
Toyama	76	70	27	702	594	486	3.0	2.4	2.4
Mie	76	32	27	702	594	486	2.4	2.4	2.4
Okayama	76	32	27	702	594	486	2.7	2.4	2.4
Iwate	43	32	22	702	594	486	3.0	2.7	3.0
Shimane	59	59	27	702	594	486	3.0	2.4	2.4
Osaka C.	140	108	76	1,512	1,512	1,512	3.8	3.0	3.0
Nagoya C.	140	108	38	1,080	1,080	1,080	3.5	3.0	3.0

* Special-administration cities are not included.

from 20 to 50 years.[4] We arbitrarily assume 40 years. On other facilities, we set the term of 40 years for improved road and bridge, and 10 years for pavement, assuming that the existing provisions of tax legislation have been based on common consents. For convenience in computation, possible residual values are ignored and the straight-line depreciation is used. The interest rate has also been subject to much controversies, but tentatively we take two rates; 7% and 3.5%. The dual function of road might make the direct application of commercial rate to it not equitable.

Unit costs. As regards the unit costs, the price of land again presents some problems. Continuous use, as a road, of a certain space of land for a certain period is obviously accompanied by some opportunity costs to the economy. Under the present procedures of land acquisition in Japan (that is, acquisition at the outset of construction work and at the current price long after the announcement of the plan), such price should involve the benefits to be brought about from the plan, accordingly does not represent the real cost for putting the land into road. Similarly the current prices of lands along the road are also formed on presuming the existence of the road itself. It may be, therefore, improper to apply such price to cost compilation in this paper. However, as no other data

4) Professor Winch proposed 20-25 years (D. M. Winch: *Economics of Highway Planning*, 1962, p. 100), and Mr. Foster 50 years (C. D. Foster: *Transport Problem*, 1963, p. 205). The 50-years is also employed in a computation of capital stock by the Keizai Kikaku Chō (Economic Planning Authority): *Sōgōteki Kōtsū Taikei* (*Synthetic Transport System*), 1961.

land Facilities and Maintenance

Maintenance (million yen/km)								
General Prefec. Rds.	Former Class I NHys.	Former Class II NHys.	Principal Local Rds.	General Prefec. Rds.		Impro. Rd. (million yen/km)	Bridge (million yen/km)	Pavement (thousand yen/m²)	Maintenance (million yen/km)
3.0	7.9	9.3	2.6	2.2	(NHys. No. 1)				
3.2	5.0	2.0	0.9	0.7	Tokyo	140	1,512	3.8	7.9
2.7	2.8	0.7	0.6	0.5	Kanagawa*	108	702	3.8	6.5
2.7	2.7	0.4	0.1	0.4	Yokohama C.	108	702	3.2	5.9
2.4	1.2	0.6	0.2	0.2	Shizuoka	108	702	3.0	2.7
2.4	0.8	0.6	0.2	0.2	Aichi*	108	702	3.8	2.8
2.4	1.0	0.5	0.4	0.1	Nagoya C.	140	1,080	3.5	7.5
2.7	0.6	0.8	0.4	0.2	Mie	76	702	2.4	0.8
2.4	0.7	0.3	0.2	0.1	Shiga	76	702	3.5	3.0
2.7	10.0	1.0	1.1	0.6	Kyōto*	43	702	3.8	1.6
2.4	7.5	0.5	2.0	0.3	Kyōto C.	86	1,080	3.2	3.7
					Osaka*	76	702	4.3	5.0
					Osaka C.	140	1,512	3.8	10.0

are easy to avail, we have to use the acquisition prices shown in the *Assets*.[5] The *Assets* also gives the unit prices of other facilities for each prefecture by road classes and roadside conditions, but since figures indicated are for 1963 then they are inflated by the index of land values and road construction costs. These unit costs are shown in Table 2.

Maintenance and other out-of-pocket costs. In respect of the maintenance and other out-of-pocket expenditures, the *Annual Statistics of Roads* shows them for each prefecture by road classes.[6] Since data by roadside conditions are unavailable, these expenditures are applied regardless of roadside conditions.

Amounts of Road Facilities. The amounts of road facilities are, according to the terms of unit costs, defined as follows;

land = (road length − bridge length) × (average width of carriageway + shoulders 0.5m × 2)

improved road = road length − bridge length

bridge = bridge length

pavement = road length × average width of carriageway × pavement ratio.

5) The land costs in this paper include compensation payments in addition to nominal prices. Whatever the titles are, an amount covering all payments is the real price to make the owner part with his land. For the rate of compensation payment to nominal price, 78.8% (indicated in the *Assets*) is uniformly applied.

6) Kensetsu Shō (Ministry of Construction): *Dōro Tōkei Nenpō* (*Annual Statistics of Roads*), *1965*, 1966.

The amount of facilities thus computed are shown in Table 3.

Table 3. Amounts of Road Facilities

	Road Length (km)	Bridge Length (km)	Land Space (1,000m²)	Paved Space (1,000m²)
Tokyo	2,070	42	25,669	23,034
Osaka*	1,455	19	13,632	11,235
Aichi*	4,212	55	30,643	18,499
Shizuoka	3,467	58	24,726	9,702
Toyama	2,223	41	14,029	5,210
Mie	3,119	55	17,840	4,181
Okayama	3,889	53	24,367	7,690
Iwate	3,771	41	20,579	3,750
Shimane	3,255	32	18,314	4,091
Osaka City	249	10	4,799	4,754
Nagoya City	413	10	7,154	6,722
NHy. No. 1	581	25	6,640	6,247

* Special-administration cities are not included.

(2) Traffic volume

The annual traffic volume is estimated as;

annual traffic = 12-hours-a-day traffic × daytime/all-day ratio × 365

The traffic refers only to motorcars, excluding motorcycles and others. The *Survey* gives 12-hour traffic for each prefecture, road class, vehicle type and roadside condition. As to daytime/all-day ratio, the *Survey* includes the results

Table 4. Traffic Volume

	Estimated Annual Traffic (million car-km)	Congestion ratio (12-hours)
Tokyo	11,113	1.49
Osaka*	6,721	1.41
Aichi*	6,779	0.97
Shizuoka	3,444	1.05
Toyama	1,008	0.77
Mie	1,572	1.12
Okayama	1,522	0.67
Iwate	1,051	0.67
Shimane	641	0.60
Osaka City*	3,170	1.51
Nagoya City	2,760	0.95
NHy. No. 1	5,258	1.92

* Special-administration cities are included in the relevant prefectures respectively.

of 24-hour observations at several spots. The results from relevant spots in respect of area, road class and roadside condition are applied respectively. Table 4 presents the traffic volume estimated.

3. *Summary of Results*

The costs of road facilities compiled thereby are shown in Table 5. The costs are remarkably high in the industrial areas and big cities, ranging from 42 million yen per kilometer of road length in Iwate to 753 million yen in Tokyo, nearby 20 times as large. Such high costs in the industrial and urban areas are mainly caused by expensive land costs, which reflect the high values of lands in those areas, as well as the widening road space required for large volume of traffic. The proportion of land costs to total facility costs constitutes as high as 80% in Tokyo compared with a low figure of 10% in Mie. In general, between costs per road length and traffic volume there is a proportional relationship, yet below a certain level of traffic the costs cease to show further appreciable decline.

Table 5. Replacement Costs of Facilities

	Replacement costs (billion yen)	(of which land costs) (%)	Replacement costs per/km (million yen)
Tokyo	1,559	80	753
Osaka*	700	70	411
Aichi*	698	57	151
Shizuoka	224	23	65
Toyama	121	14	54
Mie	157	10	50
Okayama	183	12	47
Iwate	158	18	42
Shimane	155	16	48
Osaka City*	322	84	1,297
Nagoya City*	297	82	720
NHy. No. 1	184	47	317

* Special-administration cities are included in the relevant prefectures respectively.

In the last section, we have referred to the approaches proposed for the computation of annual road track costs. Series of figures in the columns (1)-(3) of Table 6-a correspond to the approaches (1)-(3) respectively; that is, (1) maintenance expenditures only, (2) out-of-pocket expenditures, (3) annual costs based on replacement prices. In column (3), sub-column (a) shows the case where the facilities other than land are put under depreciation and an interest rate of 3.5% is applied, while sub-column (b) assumes depreciation on all facilities including land and a 7% rate of interest.

Table 6-a. Annual Costs: Total and per Traffic

	Annual Costs (million yen)				Costs per Traffic (yen/car-km)			
	Maintenance Ex. (1)	Current Out-of-Pocket Ex. (2)	Replacement Cost (3) (a)	Replacement Cost (3) (b)	(1)	(2)	(3a)	(3b)
Tokyo	6,082	58,181	73,987	159,881	0.5	5.2	6.7	14.4
Osaka*	2,296	26,409	36,222	72,862	0.3	3.9	5.4	10.8
Aichi*	3,428	17,210	40,677	75,032	0.5	2.5	6.0	11.1
Shizuoka	1,599	8,651	15,708	24,873	0.5	2.5	4.6	7.2
Toyama	629	4,524	8,463	13,097	0.6	4.5	8.4	13.0
Mie	959	11,341	10,764	16,671	0.6	7.2	6.8	10.6
Okayama	960	5,333	12,863	19,825	0.6	3.5	8.5	13.0
Iwate	1,317	6,096	10,920	17,196	1.3	5.8	10.4	16.4
Shimane	633	7,605	10,142	16,192	1.0	11.9	15.8	25.3
Osaka City*	590	10,253	14,212	32,289	0.2	3.2	4.5	10.2
Nagoya City*	806	5,169	13,935	30,444	0.3	1.9	5.0	11.0
NHy. No. 1	2,219	—	12,698	21,287	0.4	—	2.4	4.0

* Special-administration cities are included in the relevant prefectures respectively. —: Unavailable.

Table 6-b. Costs per Traffic, by Road Classes

(yen/car-km)

	Former Class I NHys.	Former Class II NHys.	Principal Local Rds.	Ordinary Prefectural Rds.
Tokyo	4.3	4.4	6.9	8.2
Osaka*	3.5	4.7	5.2	7.7
Aichi*	3.1	5.5	6.0	8.5
Shizuoka	2.0	4.1	6.8	10.3
Toyama	4.8	7.0	7.4	14.8
Mie	3.7	8.2	7.3	14.6
Okayama	4.0	8.3	8.1	14.0
Iwate	8.1	14.6	12.6	11.1
Shimane	10.8	25.0	12.7	22.0
Osaka City*	3.7	4.8	4.7	4.7
Nagoya City*	4.1	5.0	5.1	5.8
NHy. No. 1	2.4			

* Special-administration cities are included in the relefant prefectures respectively. Estimates by the basis (3 a).

Table 6-c. Costs per Traffic, by Roadside Conditions

(yen/car-km)

	Urban Area	Rural Area	
		Plain Terrain	Mountainous Terrain
Tokyo	6.1	10.7	26.6
Osaka*	4.5	6.3	23.5
Aichi*	5.6	5.4	33.8
Shizuoka	3.6	3.7	11.4
Toyama	5.1	8.4	26.1
Mie	2.5	5.3	18.1
Okayama	4.1	7.0	23.0
Iwate	7.0	7.6	19.3
Shimane	11.8	11.0	24.6
Osaka City	4.5	4.0	—
Nagoya City	5.1	4.7	—
NHy. No. 1	2.6	2.2	3.4

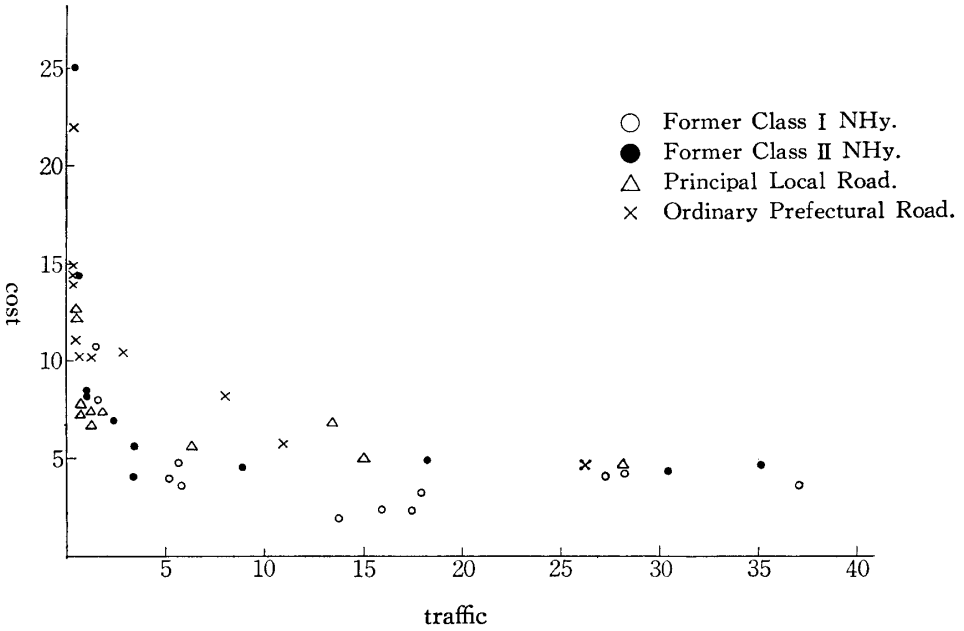
* Special-administration cities are included in the relevant prefectures respectively. —: No relevant groups. Estimates by the basis (3 a).

Among the four series of costs per car-km of traffic, naturally (1) < (3a) < (3b). In column (2) (current out-of-pocket expenditures), the costs per traffic vary from 2.5 yen in Aichi and Shizuoka to 11.9 yen in Shimane. Generally (2) is smaller than (3), but any correspondence is not observed between them. Again no proportional relationship is found between current out-of-pocket expenditures and traffic volume. Since road investments have to be done in a short span of time with lumpiness and the expenditures in each year are selective in terms of road classes, cost compilation by the current out-of-pocket expenditures is not relevant at least at the prefectural level, although it may be at the national level.

In every series of costs other than that by the current out-of-pocket expenditures, the costs per traffic tend to decline as the traffic volume increases. They range from 0.3 yen in Osaka to 1.3 yen in Iwate on the maintenance expenditure basis; from 4.6 yen in Shizuoka to 15.8 yen in Shimane on the replacement cost (a) basis; and similarly from 7.2 yen in Shizuoka to 25.5 yen in Shimane on the replacement cost (b) basis. It seems, however, after the traffic reaches a certain level, the costs come to show no further appreciable reduction. This corresponds to the counterpart findings as against the costs per road length stated above. This tendency would be more clearly observed in Tables 6-b and 6-c which represent the costs per traffic by road classes and by roadside conditions respectively, and in Figures 1 and 2 which depict these relations between cost and traffic. By Figures it can be seen that the costs per traffic are highest at roads with small traffic, and sharply decline as the traffic grows larger; yet, after the traffic volume reaches a level of about 10 to 15

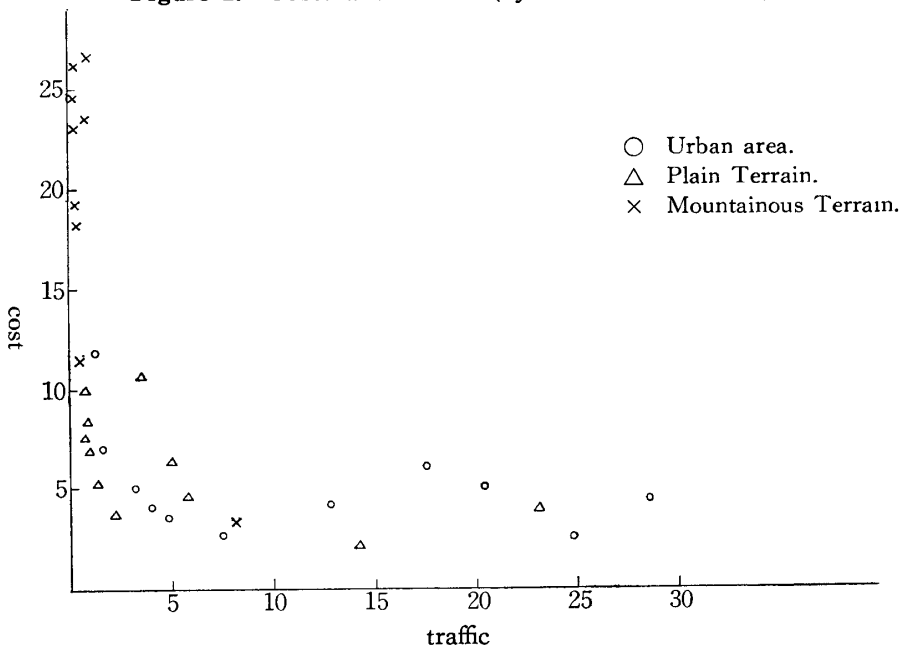
thousand cars a day (12-hours, overall-line average), the decline of costs becomes insignificant. The similar tendency has been also observed by an analysis in America.[7] In the case of Japan, however, in those roads with extremely

Figure 1. Costs and Traffic (by road classes)



cost: yen/car-km, (3a) basis.
traffic: 1,000 cars, 12-hours-a-day, overall-line average

Figure 2. Costs and Traffic (by roadside conditions)



See footnote in Figure 1.

7) *Final Report of the Highway Cost Allocation Study*, 87th Congress 1st Sess., H.C. No. 54, 1961 sec. IIIG.

large traffic the trend of costs seems to go toward some increases.

On the results by road classes, the costs per traffic of former Class I National Highways range from 2.0 yen in Shizuoka to 10.8 yen in Shimane ((3a) basis), being lower than in any other classes of road. The costs tend to increase as the road becomes more local. In Ordinary Prefectural Roads, the costs are highest among road classes in most areas, varying from 7.7 yen in Osaka to 22.5 yen in Shimane. In big cities, however, the variance of costs by road classes is narrow.

On the results by roadside conditions, the costs per traffic of urban areas are generally cheaper, ranging from 2.5 yen in Mie to 11.8 yen in Shimane, while in mountainous terrains they are remarkably high without exception, varying from 11.4 yen in Shizuoka to 33.8 yen in Aichi. In some prefectures the costs are lower in plain terrains of rural areas than in urban areas, but the differences are not so wide in all cases.

For the National Highway No. 1, which connects major cities of Japan and is the busiest route in a term of through traffic, the costs per traffic count 2.4 yen, cheapest among all illustrated cases. Since in such an inter-city trunk road the traffic volume is relatively large, and especially in corridor areas along it the unit costs of facilities are relatively small, then a lower costs per traffic are naturally conceivable. This may be reflected in the low figures of former Class I National Highways in Shizuoka, Mie or so. Again in certain cases of big-city suburbs the similar effect may be involved.

To summarize, according to the results either by road classes or by roadside conditions, the costs per traffic of providing road service are in general relatively high for areas or roads with small traffic. The larger the traffic, the smaller the costs per traffic. Yet this tendency loses its significance where the traffic volume exceeds 10 to 15 thousand cars a day (12-hours, overall-line average). There would be some danger, however, to put overmuch generalization on these findings—for example, putting together all of relations between cost and traffic in individual roads as ones subject to the same linear relationship—without taking account of the conditions of individual roads or areas, as is imaginable with case of corridor areas or city suburbs.

Most analyses of road costs have originally aimed at attaining equity of burdens on users. The actual payment of road users in Japan has been amounted as 367 thousand million yen—mainly in the form of fuel tax—while the traffic volume as 83 thousand million car-km, totaling up all types of motorcars over the country in 1965. The users' payment per traffic, therefore, counts 4.5 yen per car-km on average. Our compilation has omitted policing and other administrative expenditures in the supply of road service. But this may be at least in part offset by the exclusion from revenue of tax on vehicle ownership, as well as revenue from motorcycles and other vehicles. If the revenue from tax on ownership (which counts 68 thousand million yen in 1965) is included into users' payment, the burden on users will increase by 0.8 yen per traffic.

Since our compilation has been made on a specific concept of cost as well as on various assumptions and simplifications, the results are not comparable

directly with the actual payment of users. However, they might serve to assess the tendency of existing cost-burden relations diversified among road groups. That is to say, the costs per traffic for urban areas or trunk roads with large traffic may be relatively low, while users' payment may be relatively large in urban areas with increasing fuel consumption through severe congestion or on trunk roads with a large proportion of big-size vehicles. Therefore, although excessive generalization should be prevented, it seems that the relations between cost and users' payment are closer in such cases as corridor areas of trunk roads or city suburbs, next in big cities or trunk roads, and most remote in Ordinary Prefectural Roads or other rural and local roads with small traffic. However, it should be noted again that the cost compilation in this paper is confined to road track costs, only by reference to road classes and roadside conditions as groups.