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VOLUME MEASURES OF RAILWAY TRANSPORTATION

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Introduction

There are many service activities where it is very difficult to find appropriate measures for volume output. Transportation and particularly freight transportation, is not one of them. Measurement based on quantities (number of tons or ton-kilometers) transported is a widely accepted method.

This does not mean that the alternative, the basing of the measurement on deflation of output at current prices, should be rejected. The choice in favour of quantity indicators is purely practical. Satisfactory data of transportation tariffs are rarely available and even when available it is not simple to apply them for compiling reliable price indices for the changing field. The transportation output consists of unique services - types of goods differ as well as quantities transported and distances the goods are carried.

This paper deals with the measurement of volume output of freight transportation by rail on the basis of the Finnish data of 1980-1989. The question raised is whether the number of ton-kilometers (or ton-miles) really is the best indicator for the volume output. After that, it is briefly dealt with the the importance of the classification of transportation services for the measurement of the volume output.

Number of ton-kilometers as a volume indicator?

Transportation service can in principle be separated into two parts. The first part consists of the loading and unloading of goods, and the second part the carriage of goods from one place to an other. An appropriate measure for the loading and unloading is the number of tons, and for the carriage the number of ton-kilometers.

When using the number of ton-kilometers as an indicator for the volume output, it is implicitely assumed that the quantity of goods and the distance carried have equal importance. But maybe the number of tons carried should have more weight in the calculation.

The problem can be highlighted with an example. Let's assume that 1 ton of goods is carried a distance of 200 kilometers, and in another case 1 ton of goods is carried twice 100 kilometers. The volume in ton-kilometers is the same in these two cases.

However, it is easy to accept that the "real" volume output in the latter case is higher. Probably also the transportation costs are higher resulting higher output at current prices.

The higher volume should also be reflected in the volume output. If it does not, as in case ton-kilometers are used as a volume indicator, the implicite price index change even if the transportation tariffs are unchanged.

The question of the importance of the average length of haul for the volume output is treated below. The analysis is based on Finnish freight data from the year 1989. The material used in the tests consists wagonload freights only - transportation of express parcels has been taken into account when summarizing numerical results.

The data consist of 240 categories of goods. (See annex tables 1 and 2 where the classification has been presented in an aggregated form consisting 55 categories.). For each category, data of number of tons and ton-kilometers were available as well as the corresponding freight receipts. The average length of haul for each category is calculated by dividing the number of ton-kilometers by the number of tons.

Dependency of freight receipts on the number of tons carried and on the number of ton-kilometers

For getting a general view, a regression model was first applied for examining the dependency of freight receipts on the number of tons on one hand, and on the number of ton-kilometers on the other hand. The coefficients of determination were calculated for all data and separately for 8 main categories:

Categories	Number of subcategories
Vegetable and animal products	33
Minerals	46
Wood and wood products	23
Paper industry products	13
Metal industry products	31
Machines and equipment	23
Chemical industry products	50
Other products	21
TOTAL	240

In addition, the tests were repeated by dividing each main category (and total) into two groups with equal

number of categories, on the basis of the number of tons carried.

The results gave a small surprise. As expected, the R-squares were high, and for ton-kilometers higher than the corresponding R-squares for tons but at aggregated level only. When each of the 8 categories were divided into two subgroups and the tests repeated, the adjusted R-squares produced by the model, were for tons as often higher as vice versa. The results clearly indicated that the average length of haul has not too much importance for the freight receipts.

Dependency of freigt receipts on the number of tons and the average length of haul

For looking more closely the importance of the length of haul, the tests were continued by applying multiple regression model for examining the dependency of freight receipts on the number of tons and on the average length of haul. The model was applied without constant. (In fact, the R-squares were lower in the model with constant.).

The model was again applied for all data and for each of the 8 x 2 subcategories. In each test the column of tons was linearly adjusted in such a way that the average of tons equalled the average of kilometers. Thus the regression model produced directly comparable weights for the number of tons and the average length of haul.

The main results were as follows:

1. Model fitting results for: FREIGHT RECEIPTS, all categories

Independent variable	regr.coeff.	std. error	t-value
Number of tons	17.938625	0.375509	47.7715
Average length of haul	4.600565	1.024137	4.4921

R-SQ.(ADJ.) = 0.9134

240 observations fitted.

2. Model fitting results for: FREIGHT RECEIPTS, categories with large number of tons carried

Independent variable	reggr.coeff.	std. error	t-value
Number of tons	36.545557	1.092426	33.4536
Average length of haul	10.943727	2.165554	5.0535

R-SQ.(ADJ.) = 0.9225

120 observations fitted.

3. Model fitting results for: FREIGHT RECEIPTS, categories with a small number of tons carried

Independent variable	regr.coeff.	std. error	t-value
Number of tons	0.493865	0.041627	11.8641
Average length of haul	0.136246	0.055347	2.4617

R-SQ.(ADJ.) = 0.6813

120 observations fitted.

The percentage ratio of the regression coefficient between the number of tons and the average length of haul are in these three cases 80/20, 77/23 and 78/22.

When carrying out the test for each 8 x 2 subcategories, the ratio of the regression coefficient of the average length of haul was in most cases very low as well as the corresponding t-value. Such a category was e.g. the transportation of chemical products where the importance of the length of haul seems to have especially little importance. In some categories like the transportation of wood and wood products and the transportation of minerals, the t-value was relatively high (above 2) but also in these cases the regression coefficient of the average length of haul was much lower than the coefficient of the tons.

Weights of the number of tons and ton-kilometers

Considering the data normally available for the national accounting, a practical method to calculate the volume output for freight transport by rail, could base on the compiling the volume index by weighting together the index series of tons and ton-kilometers. For this possibility, the same multiple regression model, as applied above, was used for solving the weights. The freight receipts was the dependent variable in the model

and the tons and ton-kilometers (adjusted on the level of tons) the independent variables.

The main results were as follows:

1. Model fitting results for: FREIGHT RECEIPTS, all categories

Independent variable	regr.coeff.	std. error	t-value
Number of tons	17.517507	1.679303	10.4314
Number of ton-kilometers	27.953503	1.846477	15.1388

R-SQ. (ADJ.) = 0.9521

240 observations fitted.

2. Model fitting results for: FREIGHT RECEIPTS, categories with a large number of tons carried

Independent variable	regr.coeff.	std. error	t-value
Number of tons	17.519559	2.383051	7.3517
Number of ton-kilometers	27.897169	2.615374	10.6666

R-SQ. (ADJ.) = 0.9520

120 observations fitted.

3. Model fitting results for: FREIGHT RECEIPTS, categories with a small number of tons carried

Independent variable	regr.coeff.	std. error	t-value
Number of tons	70.179363	13.577078	5.1690
Number of ton-kilometers	36.464981	12.419254	2.9362

R-SQ. (ADJ.) = 0.6878

120 observations fitted.

The percentage ratio of the regression coefficient between the number of tons and the number of ton-kilometers is 39/61 for all categories and for categories with large number of tons carried (tables 1 and 2). Categories with small number of tons, the ratio is 66/34.

When carried out the tests by main categories, the

general tendency of results were the same as above. The regression coefficient was mostly higher in categories with large number of tons carried, and in categories with small number of tons the number of tons was more important.

Conclusions

In the draft international quidelines on volume measures for services, it is proposed to use the number of ton-kilometers as an single indicator for volume output of freight transportation by train. If only data of number of tons carried are available, it is proposed to use them but to make an estimated adjustment for taking into account annual changes in distances carried.

The tests above do not base on homogeneous categories of goods, and thus any final conclusions can not be made. However, the results gave strong evidence that it is not satisfactory to use only the number of ton-kilometers for calculating volume output for freight by rail. If the average length of haul is changing, more correct results can be gained by weighting together the series of tons and ton-kilometers.

Classification of transport services

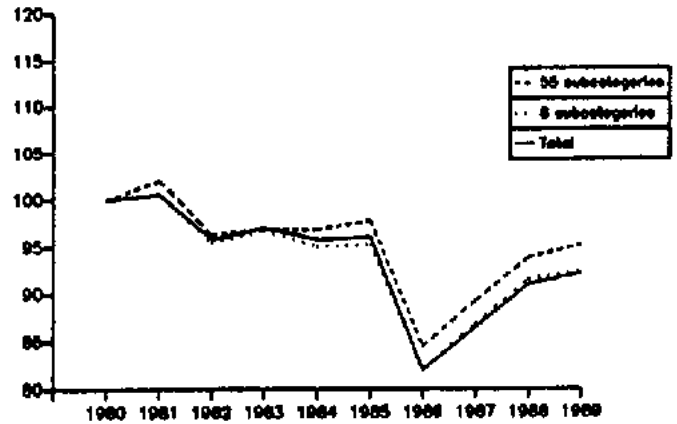
An interesting question is what is the influence of the classification of goods transported on the results. This was tested by producing volume indicators of wagonload transportation (1) at the total level, (2) by the same 8 main categories as used above, and (3) by 55 sub-categories (see the annex tables 1 and 2). The weights of the series based on freight receipts of 1989.

The results are presented below in graphics where the main alternatives for the volume output appear in quadrants I and IV. In the I quadrant the volume output is based on the number of ton-kilometers, and in the IV quadrant on the weighted average of the number of tons and ton-kilometers (the test results of all categories, 40/60, are here applied for each category).

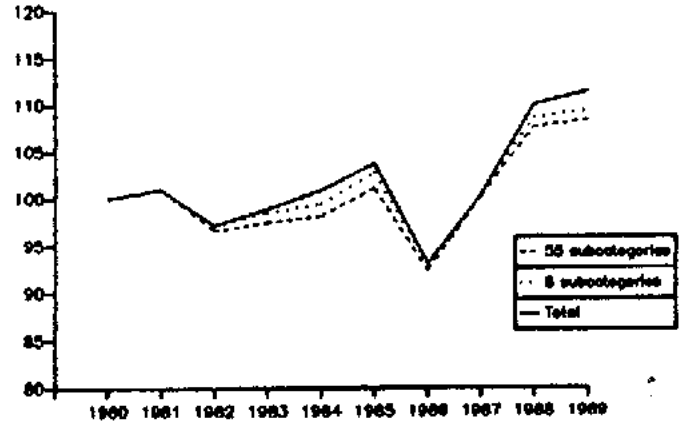
It is not possible to make any strong generalizations on the basis of these tests, but it seems that there is no need to calculate the volume output by very detailed classification. The results in quadrant IV are even almost identical - differences between the aggregation levels in the ton series are cancelled out by the differences within the ton-kilometer series.

Volume indicators of freight transport by different aggregation levels. The weights base on freight receipts, 1989.

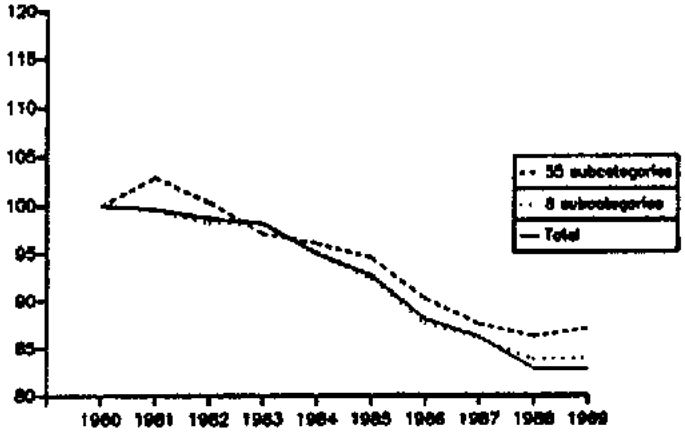
Number of tonkilometers



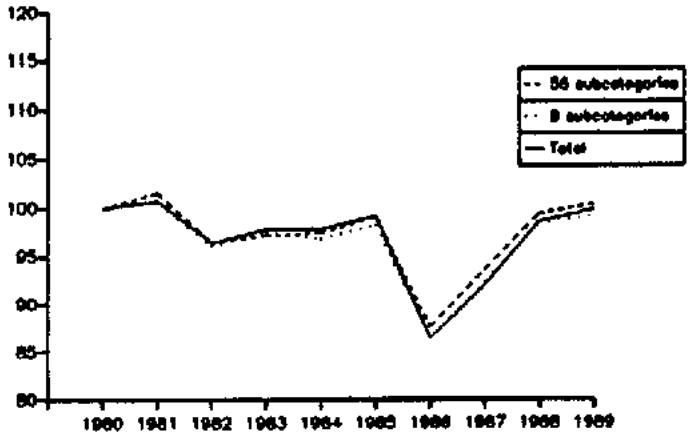
Number of tons



Average lenght of haul



Weightened avarage of the number of tons and the number of ton-kilometers



Summary of the numerical results

The following table summarizes the numerical results. The output includes also the transportation of express parcels, the importance of which has increased very fast:

VOLUME INDICES OF FREIGHT TRANSPORTATION BY RAIL.
THE WEIGHTS BASE ON FREIGHT RECEIPTS, 1985.

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Full wagonloads:	tonkm	100.0	100.6	95.6	97.1	95.6	95.6	82.3	88.1	93.0	94.4
	ton+tonkm	100.0	100.8	96.2	97.6	97.1	98.2	86.3	92.8	99.1	100.6
Express parcels:	tonkm	100.0	105.4	103.1	97.9	94.6	130.0	155.6	207.2	231.1	2[illegible].6
	ton+tonkm	100.0	106.1	102.2	96.9	94.0	131.1	155.1	205.8	231.3	265.7
TOTAL:	tonkm	100.0	101.3	96.7	97.2	95.3	100.4	92.8	105.2	112.7	118.1
	ton+tonkm	100.0	101.4	97.1	97.5	96.7	103.0	96.3	109.3	118.4	124.5

ANNUAL CHANGES, %		1981	1982	1983	1984	1985	1986	1987	1988	1989	AVERAGE
Full wagonloads:	tonkm	0.6	-5.0	1.5	-1.7	0.0	-13.8	7.1	5.5	1.5	-.6
	ton+tonkm	0.8	-4.5	1.4	-.5	1.1	-12.1	7.6	6.8	1.3	0.1
Express parcels:	tonkm	5.4	-2.1	-5.1	-3.5	37.5	19.7	33.2	11.5	12.7	11.2
	ton+tonkm	5.1	-2.8	-5.2	-3.0	39.5	18.3	32.7	12.4	14.9	11.5
TOTAL:	tonkm	1.3	-4.5	0.5	-1.9	5.3	-7.6	13.4	7.2	4.8	1.9
	ton+tonkm	1.4	-4.3	0.4	-.9	6.5	-6.5	13.4	8.3	5.2	2.5

The annual growth rate of the indicator based on the weighted average of the ton serie and the ton-kilometer serie (weights 40/60) is in average 0.6 per cent higher than the indicator based on ton-kilometers only. The range of the differences between the annual growth rates is less than 2 per cent.

ANNEX 1.

WAGONLOAD TRANSPORTATION BY RAIL. TON

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1. VEGETABLE AND ANIMAL PRODUCTS	611	738	693	521	506	441	394	367	407	453
Grain	181	198	264	102	147	126	101	108	142	235
Grain products	33	55	40	30	27	16	7	13	16	17
Root plants and vegetables	108	80	77	107	97	73	12	8	3	0
Dairy products	39	41	29	39	43	43	41	37	28	22
Meat and fish: refined and non-refined	29	34	28	24	20	25	3	1	0	0
Berries, fruit, vegetable fat and oil	17	36	28	29	14	12	9	5	2	3
Beverages, other food substance & stimulants	80	129	63	50	46	31	19	28	34	29
Cattle feed	118	160	160	135	107	106	194	161	176	146
Other vegetable and animal products	6	5	4	5	5	9	8	6	6	1
2. MINERALS	7046	7294	6881	6880	6749	7326	7110	6788	7500	7420
Unprepared stones	80	112	35	54	41	29	47	62	70	81
Talc etc	233	240	251	234	233	197	148	193	207	207
Liquid fuels	1546	1555	1420	1017	888	985	1146	1009	1183	1397
Coal and coke	723	683	602	697	613	650	678	588	624	516
Ore and ore concentrations	2875	2860	2801	2803	2783	2769	2666	2793	2955	2611
Peat	711	708	677	725	814	980	754	675	578	166
Lime	46	47	35	21	14	10	7	7	6	3
Cement	372	361	343	351	277	217	176	151	234	286
Asbestos, plaster,cement & synth.stone works	92	112	90	85	70	61	50	112	98	59
Clay and graphite works	76	60	50	49	38	40	36	29	25	29
Glass and glassware	41	26	28	27	16	12	14	39	34	21
Other minerals	251	530	549	817	962	1376	1388	1130	1486	2044
3. WOOD AND WOOD PRODUCTS	8483	8651	8456	8687	9166	8924	7456	8346	9858	10354
Logs and pillars	1085	1065	959	1184	1050	878	699	775	866	847
Piled wood	3908	4459	4302	4333	4986	4997	4104	4882	6202	6889
Sawn timber	1722	1444	1358	1412	1482	1459	1141	1292	1310	1170
Chip	1357	1282	1473	1434	1305	1273	1168	1096	1192	1149
Board products	354	340	271	253	256	231	210	228	247	265
Joiner works and other wood products	57	61	93	71	87	86	134	73	41	34
4. PAPER INDUSTRY PRODUCTS	5155	5073	4731	5056	5613	5718	5112	5915	6402	6543
Cellulose and mechanical wood pulp	1416	1450	1245	1261	1347	1427	1134	1345	1447	1378
Newsprint and printing paper	1201	1071	1003	1037	1264	1430	657	573	518	420
Kraft paper	239	187	170	145	143	141	102	116	137	199
Cardboard and paperboard	886	955	958	1012	1080	1080	1077	1198	1235	1258
Pulp, board and paper products	218	200	159	188	171	157	40	46	30	28
Other paper industry products	1195	1210	1196	1413	1608	1483	2102	2637	3035	3260
5. METAL INDUSTRY PRODUCTS	3575	3391	3483	3428	3144	3551	2871	3024	2741	2767
Iron and steel	188	207	178	201	193	173	452	519	412	452
Metals excl. iron and steel	77	75	76	72	62	88	42	62	55	30
Iron and steel substance	2615	2386	2463	2425	2226	2515	1684	1751	1658	1594
Iron and steel scrap	413	369	403	395	360	435	359	327	318	369
Wire and plate works	41	51	38	47	58	44	7	8	4	6
Other iron and metal works	241	303	325	288	245	296	327	357	294	316
6. MACHINES AND EQUIPMENT	226	235	231	216	209	249	265	323	354	387
Agricultural and dairy appliances	33	31	28	28	29	26	27	19	15	33
Industrial and working machines	80	85	85	70	63	91	63	64	73	63
Electrical machines and appliances	16	20	21	21	18	21	15	17	21	22
Transportation facilities	91	91	87	87	92	100	97	141	153	154
Other machines and equipment	6	8	10	10	7	11	63	82	92	115
7. CHEMICAL INDUSTRY PRODUCTS	3316	3307	3090	3256	3153	3128	3142	3578	3800	3555
Elements and acids	174	178	209	189	140	165	175	260	279	282
Gases, carbides and metal oxides	514	482	402	454	498	427	541	812	933	753
Halogen compounds and hydroxides	52	63	30	30	16	16	18	18	10	116
Salts	218	229	193	149	116	127	99	147	192	182
Alcohols, phenols and ethers	111	142	75	78	96	114	321	411	441	317
Fertilizers	1098	727	882	937	736	630	553	476	438	360
Tanning materials, albumins and glues	12	17	8	8	12	14	6	8	5	4
Dyestuff	85	116	99	98	124	155	141	101	109	134
Plastics, caoutchoucs and synthetic resins	721	904	948	806	937	925	778	927	1018	1193
Other chemical industry products	331	449	244	507	478	555	510	418	375	214
8. OTHER PRODUCTS	511	508	536	557	632	651	573	653	704	709
TOTAL	28923	29197	28101	28601	29172	29988	26923	28994	31766	32188

ANNEX 2.

WAGONLOAD TRANSPORTATION BY RAIL. TONKM

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1. VEGETABLE AND ANIMAL PRODUCTS	187	241	232	175	161	145	122	118	131	124
Grain	39	48	74	29	36	37	23	29	39	54
Grain products	9	17	13	8	10	7	2	4	3	3
Root plants and vegetables	30	23	23	32	30	22	3	2	1	0
Dairy products	12	12	9	12	13	14	12	12	9	5
Meat and fish: refined and non-refined	9	10	8	4	4	5	1	0	0	0
Berries, fruit, vegetable fat and oil	7	13	11	11	5	4	2	2	1	1
Beverages, other food substance & stimulants	25	45	19	16	15	8	6	9	13	11
Cattle feed	54	72	74	61	47	45	70	58	63	50
Other vegetable and animal products	2	1	1	2	1	3	3	2	2	0
2. MINERALS	2214	2213	2074	2029	2046	2138	1851	1654	1771	1640
Unprepared stones	28	25	10	11	10	6	26	38	39	42
Talc etc	103	100	110	95	98	84	59	74	76	77
Liquid fuels	394	346	329	281	273	302	280	255	313	361
Coal and coke	343	320	273	300	282	304	252	185	188	128
Ore and ore concentrations	963	923	904	897	960	936	734	734	736	565
Peat	101	103	98	105	109	128	97	80	66	19
Lime	28	28	21	13	9	6	4	5	4	2
Cement	127	133	123	117	86	67	52	49	62	61
Asbestos, plaster,cement & synth.stone works	31	36	24	21	14	15	14	33	26	17
Clay and graphite works	25	23	18	16	11	15	17	9	7	7
Glass and glassware	14	9	11	10	6	4	4	10	9	6
Other minerals	57	167	153	163	188	271	312	182	245	355
3. WOOD AND WOOD PRODUCTS	2004	2073	1989	2072	1990	1945	1487	1611	1797	2043
Logs and pillars	261	254	225	455	281	194	168	193	216	204
Piled wood	734	892	810	712	816	890	617	687	873	1145
Sawn timber	538	470	459	454	464	477	366	412	401	360
Chip	333	337	375	348	316	273	233	223	221	249
Board products	118	102	87	79	72	69	66	74	75	76
Joiner works and other wood products	20	18	33	24	41	42	37	22	11	9
4. PAPER INDUSTRY PRODUCTS	1341	1339	1217	1284	1404	1355	1177	1387	1427	1449
Cellulose and mechanical wood pulp	376	409	340	355	378	372	291	359	350	329
Newsprint and printing paper	276	239	226	253	299	306	121	94	69	59
Kraft paper	71	59	55	44	43	42	31	34	37	52
Cardboard and paperboard	254	276	265	269	294	297	292	332	343	344
Pulp, board and paper products	79	70	56	65	63	56	11	14	9	9
Other paper industry products	285	286	275	298	327	282	431	554	619	656
5. METAL INDUSTRY PRODUCTS	1218	1179	1216	1194	1129	1192	1001	1100	1037	1026
Iron and steel	52	57	51	52	48	40	160	191	162	163
Metals excl. iron and steel	31	27	30	27	24	32	18	29	27	12
Iron and steel substance	922	869	882	879	848	898	615	675	659	638
Iron and steel scrap	140	138	169	161	145	151	135	125	125	148
Wire and plate works	16	14	10	14	18	13	2	3	2	2
Other iron and metal works	57	74	74	61	46	58	71	77	62	63
6. MACHINES AND EQUIPMENT	76	79	73	67	65	77	82	106	113	120
Agricultural and dairy appliances	13	13	11	11	11	11	11	7	6	14
Industrial and working machines	28	29	28	22	21	27	21	21	22	19
Electrical machines and appliances	5	7	6	6	5	6	4	6	6	6
Transportation facilities	28	29	26	26	26	30	32	55	59	57
Other machines and equipment	2	1	2	2	2	3	14	17	20	24
7. CHEMICAL INDUSTRY PRODUCTS	981	930	858	923	826	787	761	856	903	891
Elements and acids	53	52	62	60	53	62	80	126	131	139
Gases, carbides and metal oxides	199	180	138	170	171	131	123	192	203	171
Halogen compounds and hydroxides	17	21	11	10	5	5	8	7	4	58
Salts	41	40	31	26	24	23	15	21	26	23
Alcohols, phenols and ethers	18	31	18	19	26	27	67	82	89	76
Fertilizers	368	267	307	322	234	195	179	160	168	130
Tanning materials, albumins and glues	5	7	4	4	6	8	3	4	3	2
Dyestuff	26	36	30	32	42	57	45	25	25	29
Plastics, caoutchoucs and synthetic resins	155	174	173	165	167	164	137	155	182	217
Other chemical industry products	99	122	84	115	98	115	104	84	72	46
8. OTHER PRODUCTS	147	160	168	182	201	210	211	226	251	231
TOTAL	8168	8214	7827	7926	7822	7849	6692	7058	7430	7524

ANNEX 2.

WAGONLOAD TRANSPORTATION BY RAIL. TONEN

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1. VEGETABLE AND ANIMAL PRODUCTS	187	241	232	175	161	145	122	118	131	124
Grain	39	48	74	29	36	37	23	29	39	54
Grain products	9	17	13	8	10	7	2	4	3	3
Root plants and vegetables	30	23	23	32	30	22	3	2	1	0
Dairy products	12	12	9	12	13	14	12	12	9	5
Meat and fish: refined and non-refined	9	10	8	4	4	5	1	0	0	0
Berries, fruit, vegetable fat and oil	7	13	11	11	5	4	2	2	1	1
Beverages, other food substance & stimulants	25	45	19	16	15	8	6	9	13	11
Cattle feed	54	72	74	61	47	45	70	58	63	50
Other vegetable and animal products	2	1	1	2	1	3	3	2	2	0
2. MINERALS	2214	2213	2074	2029	2046	2138	1851	1654	1771	1640
Unprepared stones	28	25	10	11	10	6	26	38	39	42
Talc etc	103	100	110	95	98	84	59	74	76	77
Liquid fuels	394	346	329	281	273	302	280	255	313	361
Coal and coke	343	320	273	300	282	304	252	185	188	128
Ore and ore concentrations	963	923	904	897	960	936	734	734	736	565
Peat	101	103	98	105	109	128	97	80	66	19
Lime	28	28	21	13	9	6	4	5	4	2
Cement	127	133	123	117	86	67	52	49	62	61
Asbestos, plaster,cement & synth.stone works	31	36	24	21	14	15	14	33	26	17
Clay and graphite works	25	23	18	16	11	15	17	9	7	7
Glass and glassware	14	9	11	10	6	4	4	10	9	6
Other minerals	57	167	153	163	188	271	312	182	245	355
3. WOOD AND WOOD PRODUCTS	2004	2073	1989	2072	1990	1945	1487	1611	1797	2043
Logs and pillars	261	254	225	455	281	194	168	193	216	204
Piled wood	734	892	810	712	816	890	617	687	873	1145
Sawn timber	538	470	459	454	464	477	366	412	401	360
Chip	333	337	375	348	316	273	233	223	221	249
Board products	118	102	87	79	72	69	66	74	75	76
Joiner works and other wood products	20	18	33	24	41	42	37	22	11	9
4. PAPER INDUSTRY PRODUCTS	1341	1339	1217	1284	1404	1355	1177	1387	1427	1449
Cellulose and mechanical wood pulp	376	409	340	355	378	372	291	359	350	329
Newsprint and printing paper	276	239	226	253	299	306	121	94	69	59
Kraft paper	71	59	55	44	43	42	31	34	37	52
Cardboard and paperboard	254	276	265	269	294	297	292	332	343	344
Pulp, board and paper products	79	70	56	65	63	56	11	14	9	9
Other paper industry products	285	286	275	298	327	282	431	554	619	656
5. METAL INDUSTRY PRODUCTS	1218	1179	1216	1194	1129	1192	1001	1100	1037	1026
Iron and steel	52	57	51	52	48	40	160	191	162	163
Metals excl. iron and steel	31	27	30	27	24	32	18	29	27	12
Iron and steel substance	922	869	882	879	848	898	615	675	659	638
Iron and steel scrap	140	138	169	161	145	151	135	125	125	148
Wire and plate works	16	14	10	14	18	13	2	3	2	2
Other iron and metal works	57	74	74	61	46	58	71	77	62	63
6. MACHINES AND EQUIPMENT	76	79	73	67	65	77	82	106	113	120
Agricultural and dairy appliances	13	13	11	11	11	11	11	7	6	14
Industrial and working machines	28	29	28	22	21	27	21	21	22	19
Electrical machines and appliances	5	7	6	6	5	6	4	6	6	6
Transportation facilities	28	29	26	26	26	30	32	55	59	57
Other machines and equipment	2	1	2	2	2	3	14	17	20	24
7. CHEMICAL INDUSTRY PRODUCTS	981	930	858	923	826	787	761	856	903	891
Elements and acids	53	52	62	60	53	62	80	126	131	139
Gases, carbides and metal oxides	199	180	138	170	171	131	123	192	203	171
Halogen compounds and hydroxides	17	21	11	10	5	5	8	7	4	58
Salts	41	40	31	26	24	23	15	21	26	23
Alcohols, phenols and ethers	18	31	18	19	26	27	67	82	89	76
Fertilizers	368	267	307	322	234	195	179	160	168	130
Tanning materials, albumins and glues	5	7	4	4	6	8	3	4	3	2
Dyestuff	26	36	30	32	42	57	45	25	25	29
Plastics, caoutchouca and synthetic resins	155	174	173	165	167	164	137	155	182	217
Other chemical industry products	99	122	84	115	98	115	104	84	72	46
8. OTHER PRODUCTS	147	160	168	182	201	210	211	226	251	231
TOTAL	8168	8214	7827	7926	7822	7849	6692	7058	7430	7524