WORLD BANK GROUP

UKRAINE: UKRZALIZNYTSIA (UZ) MODERNIZATION STRATEGY

Policy Note 2: Managing loss-making mainline passenger services

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Acknowledgments

The Policy Note was prepared by a World Bank team led by Baher El-Hifnawi (Program Leader for Infrastructure and Sustainable Development) and Paul Amos (Senior Railway Advisor) and a team consisting of Yevhen Bulakh (Transport Specialist) and Anton Hagen. The primary author of this Note is Richard Bullock (Senior Railway Advisor).

The Note benefitted from comments of the Peer Reviewers: Jean-Francois Marteau (Lead Transport Specialist) and Piers Vickers (Deputy Economic Adviser, European Investment Bank). The team is grateful for guidance received from Satu Kahkonen (Country Director), Karla Gonzalez (Europe Transport Practice Manager), Ross Pavis (Senor Operations Officer) and Fiona Collins (Lead Transport Specialist).

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Contents

Preface

This Policy Note is one of a series of individual papers originating in a request from Ukraine's Ministry of Infrastructure (MoI) and JSC Ukrzaliznytsia (UZ) to the World Bank to address specific topics concerning Ukraine's railway sector. The Policy Notes address the following topics.

1. **Railway market opening for cargo services:** progress in the meeting rail commitments in the EU-Ukraine Association Agreement, reorganization of UZ, Ukraine's readiness for and implications of market opening, pre-requisites to avoid leaving UZ in an unfavorable situation.
2. **Loss-making long-distance passenger services:** service costing, institutional and financial options for providing sustainable transport passenger services for long distance travel.
3. **Selected Freight Business Issues**: specific matters on which Bank advice has been sought including cargo tariffs, customer service and perceptions, and operating efficiency.
4. **Debt management**: options for UZ to restructure its debt and reach a financially stable situation.
5. **Infrastructure asset management and prioritization of investment.** Asset management strategy and life-cycle costing in the renewal and reconstruction of UZ's railway infrastructure network.

This Policy Note is for **Topic 2: Managing Loss-Making Long-Distance Passenger Services**.

Ukraine runs a wide range of passenger services. They form two main groups, regional (called primiiski or prigorodne) and long-distance. The World Bank developed a methodology in 2015 for costing the services which could be used as the basis for a Public Service Obligation (PSO) payment from the local or central government and used this as the basis for analyzing the regional services within Lviv oblast. This work is now being further developed by consultants working under EIB.

This Policy Note is concerned with long-distance services. Within this group there are both conventional loco-hauled services and express InterCity services using multiple-units. The express services are considered by UZ to cover their attributable costs and this note concentrates on the conventional loco-hauled services. Some of these recover their costs from fare revenue and some do not, with one class of fare (Platzkart) regulated by the Government (GoU). Currently losses are covered by internal cross-subsidy within UZ, but this will become progressively more difficult with market opening. This note focusses on testing whether, as suggested by UZ, compensation for the regulated Platzkart fares is a valid and practical approach to defining PSOs in the long-distance market.

Glossary of terms and acronyms

CURRENCY EQUIVALENTS

Exchange Rate (May 2019)

Currency Unit: Ukrainian Hryvnia (UAH)

USD 1 = UAH 26.4

ACRONYMS

FSU	Former Soviet Union
GoU	Government of Ukraine
gtkm	Gross tonne-km
MoF	Ministry of Finance
MoI	Ministry of Infrastructure
pkm	Passenger-km
PSO	Public Service Obligation
TAC	Track access charges (charges levied for use of railway infrastructure)
ntkm	Net tonne-km
TOC	Train operating company (‘Carrier’ in Ukrainian Law)
UAH	Ukrainian Hryvnia
USD	United States Dollar
UZ	Joint Stock Company, JSC Ukrzaliznytsia (registered October 2015)

Summary of Findings

Background

1. Ukraine runs a wide range of main-line passenger services. Some recover their costs from fare revenue and some do not, with fares for one class of travel (Platzkart) regulated by the Government of Ukraine (GoU). Currently losses are covered by internal cross-subsidy within UZ, but this will become progressively more difficult with market opening. This Policy Note examines whether, as suggested by UZ, compensation for the regulated Platzkart fares is a valid and practical approach to defining PSOs in the long-distance market.

Key findings

2. The conventional mainline passenger services carry two main classes of passenger service: Kupe and Platzkart. Kupe fares are more than double those for Platzkart and generally recover their 'above-rail' operating and capital costs i.e. the cost of operating the service and of renewing the rollingstock when it falls due. Platzkart services generally do not.

Policy options for Platzkart services

3. The normal response to improving the financial recovery of Platzkart services is simply to increase the fares. However, Platzcart fares in Ukraine are heavily regulated by the government for social reasons and that policy seems unlikely to change in the short and medium term. The main options available to UZ to improve the financial performance of the Platzkart service form three groups:
    - Reduce the unit cost of the inputs provided for these trains (e.g. locomotive maintenance cost, vehicle maintenance and so on). However, while some reduction is attainable, the Bank team's conclusion is that any reduction from this source is likely to be modest in the long-term.
    - Reduce the volume of inputs required. UZ is already reviewing the on-board train crew requirements which can reduce the total cost by 15-20 percent. Another option is to review the train composition to better align capacity with demand; this is particularly relevant where there are sections of heavy demand while other sections are relatively lightly loaded.
    - Obtain financial compensation from the government for providing Platzkart accommodation at the current tariff (assuming fare increases are not available). If this were to be done, it should be implemented on a simple contract basis, with the GoU receiving all Platzkart revenue and UZ being paid a standard rate per Platzkart vehicle-km provided, plus a commission for collecting fares on GoU behalf (a gross cost contract). Alternatively, a net-cost contract could be considered whereby the Government is paying the shortfall in cost.

1. The Services

1.1 Service classification

Passenger services in Ukraine, as in all ex-FSU railways, form two groups – long-distance services and primiiiski[1] (prigorodne in Russian) which are local and regional services. Few primiiski services have any prospect of ever being commercial (recovering the costs of their operation) in their own right and under the draft new Railway Law of Ukraine they are likely to eventually be tendered by the relevant local governments as happens in many countries in Europe. They were analysed by the World Bank in 2015 and are now being studied in more detail by EIB consultants.

The long-distance services form eight groups (Table 1.1), operated by two separate units within UZ. The High-Speed Company services are generally considered by UZ to be covering their attributable costs and this report, at the request of UZ, is concerned with those operated by the Passenger Company.

Table 1.1: UZ passenger service classification

Train type	Characteristics
Passenger company:	
Night Express	Services with a mixture of accommodation: • SW (two-berth sleeping car) • Kupe (typically four-berth compartments) • Platzkart (open berths, two high) Most of these services operate over long distances and transit times thus include (despite their name) substantial periods of day travel. They are nearly all locomotive-hauled with many carriages
Night Firm	
Night	
International trains	Cross-border services which operate under a range of agreements, some of which carry domestic Ukraine passengers. Includes both long-distance services (e.g. Kiev – Moscow) and short-distance (e.g. Ukraine – Slovakia)
Regional trains	Medium-distance service with sitting accommodation
Day trains	Also called Intercity, sometimes with carriages that convert from berths to sitting accommodation during the day
High-speed Company	

[1] These are normally translated as 'suburban' but they are essentially regional trains, stopping at all stations, with low fares and basic accommodation. They are not confined to the immediate vicinity of large cities and some go considerable distances of 200 km or more.

InterCity (IC)	Express (90 km/hr). Offers two classes: First (unregulated fares) and second (regulated)
InterCity Plus (IC+)	Express (110-120 km/hr). Offers two classes: First (unregulated fares) and second (regulated)

The three Passenger Company 'night services' will shortly be rebadged as Comfort, Standard and Economy, with more consistent rollingstock standards. All three types will continue to carry Kupe and Platzkart carriages but sleeping cars will only be available on Comfort and Standard services.

The Platzkart and second-class fares are regulated in all the types of train in Table 1.1. The fares on the Express services are around double those of the Passenger Company and their revenue is comfortably recovering their operating costs. However, many of the Passenger Company services have difficulty covering their costs. For some services, average revenue does not even cover short-run marginal costs and the more passengers they carry, the greater is the loss. The paper analyses the current cost structure and identifies areas where economies could be made (and are being already made by UZ). It also discusses the possibility of restructuring some of the services and possible ways of implementing any payment from GoU to compensate for the regulated Platzkart fares.

1.2 Basic Service Characteristics

Table 1.2 summarises the basic characteristics of the long-distance services operated by the Passenger Company (i.e. excluding the Regional Trains and Day trains in Table 1.1).

Table 1.2 Summary characteristics of long-distance Passenger Services 2018

	Sleeping	Kupe	Platzkart(1)	Total
Number of services	-	-	-	110
Train-km p.a. (million)	-	-	-	53
Carriage-km (million)	45	365	419	829
Passengers (million)	0.9	12.2	21.4	34.5
Passenger-km (million)	608	8061	11453	20123
Revenue (UAH million)	730	5723	3436	9889
Average distance (km)	647	659	536	582
Yield (UAH/pkm)	1.20	0.71	0.30	0.49

(1) includes a small number (0.1 million) of sitting passengers

1.3 Sample selected for analysis

A sample of 94 trains (out of the total of 110 operated) was selected for analysis. These cover a wide range of routes and range from 41 km (on the UZ network) to 1657 km. UZ has a wide range of detailed passenger service data available (e.g static and dynamic occupancies by carriage type by service) and the data used in this report has drawn on datasets covering passengers, revenue and operating statistics in routine use within UZ.

Table 1.3 Sample long-distance services selected for analysis

	From	To	Pass-km (mill)		Revenue (UAH mill)		Dist-ance (km)	Time (mins)	Speed (km/hr)	Cars	
			K(1)	PK(1)	K(1)	PK(1)				K	KP
1/2	Ів Франківськ	Костянт	131	0	94	0	1453	1230	71	10	0
3/4	Запоріжжя	Ужгород	96	0	69	0	1440	1240	70	10	0
6/5	Київ	Москва	65	54	46	16	354	292	73	12	5
8/7	Одеса	Харків	79	0	56	0	762	555	82	10	0
7/8	Київ	Івано-Франківськ	112	0	80	0	712	681	63	8	0
7/8	Харків	Одеса	79	0	56	0	762	555	82	10	0
12/11	Львів	Одеса	150	0	107	0	745	608	74	10	0
12/11*	Київ	Новоолексіївка	263	97	187	29	861	737	70	15	3
13/14	Київ	Солотвино	152	197	108	59	1017	1205	51	9	6
15/16	Харків	Рахів	116	14	82	4	1336	1155	69	9	1
17/18	Харків	Ужгород	114	15	81	4	1342	1160	69	9	1
19/20	Харків	Москва	2	1	2	0	41	40	61	4	1
20/19	Київ	Лисичанськ	64	0	46	0	737	725	61	10	0
24/23	Одеса	Москва	89	174	63	53	1008	930	65	7	6
26/25	Одеса	Яремче (Рахів)	139	158	99	48	1024	1170	53	7	5
29/30	Київ	Ужгород	158	0	113	0	853	732	70	10	0
31/32	Київ	Рига	9	0	6	0	240	142	101	10	0
36/35	Одеса	Пшемисль	34	0	24	0	828	985	50	4	0
37/38	Київ	Запоріжжя	114	0	81	0	657	1185	33	8	0
41/42	Дніпро	Трускавець	263	353	187	107	1198	1245	58	10	9
43/44	Ів Франківськ	Київ	158	220	113	66	712	1210	35	11	9
45/46	Ужгород	Лисичанськ	222	348	158	105	1657	1880	53	7	7
49/50	Київ	Трускавець	222	78	158	24	756	704	64	15	3
54/53	Київ	Санкт-Пет.	9	5	6	1	293	229	77	7	1
55/56	Хмельницький	Москва	38	106	27	32	720	1195	36	7	6
57/58	Ковель	Одеса	96	170	68	51	889	977	55	8	8
59/60	Одеса	Харків	109	246	78	74	762	780	59	7	10
62/61	Миколаїв	Москва	14	72	10	22	740	495	90	3	7
63/64	Харків	Київ	200	0	143	0	485	418	70	18	0
63/64	Дніпро	Одеса	111	126	79	38	631	664	57	8	6
70/69	Маріуполь	Львов	210	373	149	113	1585	1720	55	7	8
72/71	Запоріжжя	Київ	72	89	51	27	633	699	54	10	8
74/73	Львів	Москва	35	104	25	31	976	1400	42	3	4
74/73	Кривий Ріг	Москва	34	52	25	16	552	696	48	5	3
79/80	Дніпро	Київ	221	19	158	6	532	447	71	18	1
81/82	Київ	Ужгород	333	0	238	0	910	950	57	18	0
81/82	Харків	Новоалексіївка	49	105	35	32	530	468	68	6	7
83/84	Київ	Маріуполь	151	287	108	87	1032	1073	58	7	10
86/85	Львів	Новоолексіївка	78	117	56	35	1415	1440	59	5	5
87/88	Ковель	Новоолексіївка	55	91	39	27	1342	1342	60	5	5
91/92	Костянтинівка	Одеса	42	160	30	48	940	990	57	4	11
92/91	Львів	Київ	205	0	146	0	572	990	35	16	0
92/91	Одеса	Константинівка	102	309	72	93	940	990	57	5	11
95/96	Харків	Маріуполь	13	20	9	6	702	765	55	2	2
96/95	Маріуполь	Бахмут	38	51	27	15	942	1070	53	5	4
97/98	Ковель	Київ	87	138	62	42	552	600	55	8	8
101/102	Київ	Херсон	174	137	124	41	642	720	54	12	6

	From	To	Pass-km (mill)		Revenue (UAH mill)		Dist-ance (km)	Time (mins)	Speed (km/hr)	Cars	
			K(1)	PK(1)	K(1)	PK(1)				K	KP
104/103	Жмеринка	Маріуполь	186	497	132	150	1299	1280	61	7	13
106/105	Одеса	Київ	258	0	184	0	654	525	75	17	0
106/105	Дніпро	Москва	12	30	8	9	350	350	60	4	3
108/107	Одеса	Ужгород	158	246	113	74	1032	1150	54	8	8
110/109	Львів	Херсон	276	190	197	57	1135	1170	58	12	5
111/112	Харків	Львів	262	146	187	44	1110	1200	56	12	4
116/136-115/135	Київ	Покровськ	102	199	73	60	880	1008	52	6	8
117/118	Чернівці	Київ	115	123	82	37	573	1206	29	10	6
120/119	Запоріжжя	Львів	124	185	88	56	1243	1482	50	5	5
122/121	Миколаїв	Ровно	138	366	98	110	973	985	59	7	12
123/124	Київ	Костінтинівка	181	239	129	72	800	885	54	11	9
125/126	Київ	Костінтинівка	102	232	73	70	680	715	57	7	10
127/128	Ковель	Харків	63	107	45	32	1143	1328	52	8	8
129/130, 127/128	Суми	Зернове	1	5	1	2	262	314	50	1	1
134/133	Миколаїв	Івано- Франківськ	115	320	82	97	1339	1490	54	5	9
135/136	Чернівці	Дністр	0	405	0	122	1096	1230	53	0	12
137/138	Хмельницький	Лисичанськ	119	369	85	111	1104	2390	28	6	12
139/140	Київ	Кам.-Под.	24	54	17	16	458	778	35	6	8
139/140	Дніпро	Лисичанськ	45	114	32	34	657	777	51	7	8
141/142	Одеса	Маріуполь	26	58	18	17	558	1755	19	6	9
142/141	Львів	Бахмут	247	245	176	74	1467	1250	70	11	5
143/144	Харків	Санкт-Пітер	5	8	3	2	578	631	55	2	1
143/144	Запоріжжя	Івано-Франківськ	81	104	58	31	852	940	54	10	8
145/146	Київ	Ізмаїл	94	244	67	74	934	1005	56	5	9
145/146	Львів	Ужгород	17	15	12	4	287	1010	17	4	2
148/147	Одеса	Київ	100	185	72	56	669	800	50	8	8
149/150	Кременчук	Ів.Фран, Ворохта	73	129	52	39	1190	1340	53	8	8
317/318/ 617/618	Запоріжжя	Одеса	35	38	25	12	639	906	42	6	4
357/358	Київ	Рахів	85	131	60	40	835	1125	45	6	6
375/376	Харків	Херсон	136	132	97	40	763	1080	42	11	6
601/602	Львів	Солотвино	36	48	26	15	447	738	36	5	4
606/605	Львів	Рахів	8	41	6	13	279	480	35	2	6
668/667	Ковель	Чернівці	17	75	12	23	525	851	37	2	6
737/738	Київ	Запоріжжя	88	0	62	0	657	489	81	8	0
749/750	Київ	Івано-Франківськ	111	0	79	0	712	489	87	8	0
757/758-769/770	Київ	Мог.Под.Кам.Под.	8	171	6	52	478	418	69	1	13
76/75	Кривий Ріг	Київ	80	114	57	35	491	501	59	9	8
77/78	Ковель	Москва	10	80	7	24	553	603	55	1	5
771/772	Хмельницький	Київ	3	78	2	24	366	317	69	1	7
775/776, 766/765	Харків	Херсон	34	262	24	79	1127	1040	65	1	6
779/780	Суми	Київ	6	100	4	30	352	465	45	1	9
782/781/ 774/773	Черкаси	Шостка	6	61	4	18	550	459	72	1	5
785/786	Київ	Шостка	8	71	6	21	303	238	76	1	7

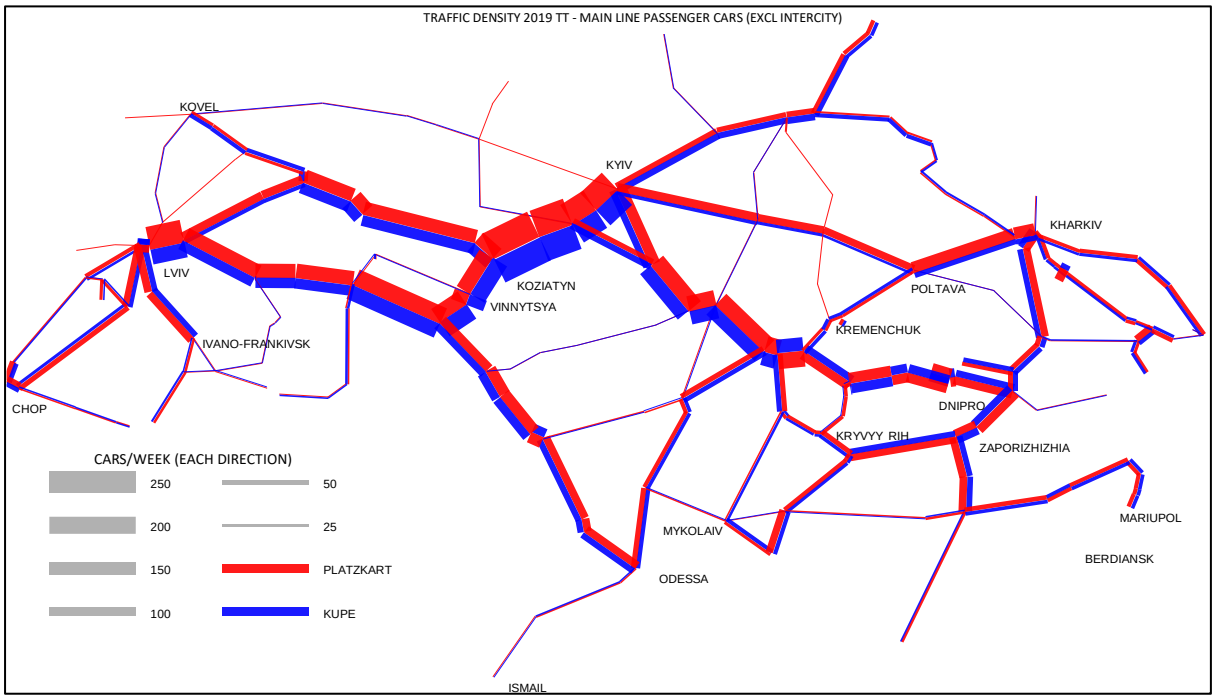
	From	To	Pass-km (mill)		Revenue (UAH mill)		Dist-ance (km)	Time (mins)	Speed (km/hr)	Cars	
			K(1)	PK(1)	K(1)	PK(1)				K	KP
789/790	Київ	Кропиквницький	8	47	6	14	362	303	72	1	3
791/792	Кременчук	Київ	7	49	5	15	401	302	80	1	3
797/798	Харків	Запоріжжя	0	60	0	18	327	267	73	0	6
798/797	Одеса	Вінниця	8	91	5	27	434	495	53	1	8
Average			95	116	68	35	784	810	58	7	5

(1) K = Kupe. For the purposes of this analysis they include sleeping cars, as the average yield per car-km is similar ; PK = Platzkart

(2) Trains with numbers above 700 carry first and second class rather than Kupe and Platzkart.

An average train in the sample of 94 consisted of seven Kupe carriages and five Platzcart carriages, although there are a significant number which are effectively all one or the other. The average distance is 784 km, taking over 13 hours. The average commercial (end-to-end) speed is relatively low at 58 km/hr, although this is often not an important consideration for passengers travelling overnight. In addition, many services, especially on low-frequency routes, make many intermediate stops. Figure 1.1 shows the sections of the network covered by these services.

Figure 1.1 Network coverage of sampled services



Because of the electronic ticketing system installed by UZ, demand (passenger numbers) and revenue can be directly attributed to individual services. However, as is the case in almost all large railways, it is impractical to record more than a few cost items directly to each individual service in the general ledger (financial accounting) system. These costs have therefore to be estimated by management accounting methods as described in the following two chapters.

2 Passenger Service Costing Framework

2.1 Introduction

Few railways automatically record the cost of individual train services through their general ledger system. However, most railways record the cost, to a greater or lesser degree, of each of the main technical functions that create services, and then use broadly similar approaches to deriving the cost of the passenger sector as a whole and of individual services. This process consists of estimating a set of unit costs (i.e. cost per unit of output) for a set of outputs associated with passenger services (e.g. locomotive-km, car-kilometre and so on) and then applying them to the resources consumed in creating a particular service or set of services.

This chapter discusses the cost structure generally employed and the factors (or 'cost drivers') which are the principal influences on the various cost components.

2.2 Passenger Service Cost Structure

Table 2.1 shows a functional classification of passenger service costs that is in general use in railways worldwide. The majority of these cost types can be categorised in one of two ways:

- whether they are directly variable with the volume of train operations or are fixed (at least until changes are made overall organisational scale or capacity);
- whether they are associated with train operations (sometimes called 'above-rail' costs) or with infrastructure maintenance and operations (sometimes called 'below-rail' costs).

Each of the costs includes an administrative component (depot managers, crew supervisors etc). There is also generally a central administration function covering such areas as finance, personnel, legal and corporate management. Finally, many railways have capital charges associated with the initial construction of facilities which are unlikely to be renewed in the foreseeable future; these costs have been included for completeness but are independent of either current or future traffic volumes.

Table 2.1 also shows the most common basis adopted for the allocation of costs to particular segments or services. 'Above-rail' costs and variable 'below-rail' costs can generally either be specifically identified or else allocated using standard operating statistics, such as locomotive-km or gross tonne-km. However, where the cost is 'fixed' no such relationships exist and instead costs are allocated using a variety of principles. In recent years, the development of rail track access charges in railways offering third-party access, has seen these principles formalised, although with wide variations of systems and detail. In most railways, the 'below-rail' costs have been allocated to passenger services using the bases given in Table 2.1; however, for the fixed costs, these are essentially an allocative mechanism rather than a causal relationship.

Table 2.1 Functional Cost Categories and Basis of Allocation to Services

Cost category	Basis of cost allocation
Variable costs	
Above-rail:	
Fuel and energy	Gross tonne-km
Train crew (driver and assistant)	Train-hours
On-train crew (conductors, attendants)	Crew-hours (or weighted train-hours)
Passenger handling and station operations	Passenger
Catering	Passenger-km
Rollingstock maintenance and servicing	Vehicle-km (with vehicle-hour component)
Rollingstock renewal capital	Vehicle-hour
Below-rail:	
Traffic-related track maintenance	Gross tonne-km
Train planning	Train-km
Infrastructure renewal capital (traffic-related)	Gross tonne-km
Fixed costs	
Below-rail:	
Traffic-unrelated track maintenance	Gross tonne-km
Structures maintenance	Gross tonne-km
Overhead line equipment maintenance	Gross tonne-km (electric-hauled)
Signals and communications maintenance	Train-km
Signalling operations, train despatching and control	Train-km
Infrastructure renewal capital (time-related)	Gross tonne-km
Administrative overheads	Percent mark-up
Non-renewable infrastructure capital	Omitted

The functional areas included under the heading 'variable' are largely the 'above rail' operating costs. Although in the very short term most of these costs (other than fuel) are fixed, all these costs can be varied in the medium term[2]. However, the speed with which individual cost areas respond to changes in the level of activity naturally depends on management's ability to modify resource supply, which

[2] Short-, medium- and long- term and their cousins short-run and long-run can be elusive concepts which mean different things to different people. In this paper, the long-run/long-term means that period of time during which both operations and capacity have adjusted to changes in demand, be it an increase or decrease. A long-run cost thus includes the capital cost or saving from the marginal change in capacity. Short-term, on the other hand, means the period of time before any such adjustments have been made; during this period, cost savings will generally only be those costs which are consumable (such as fuel) or the subject of short-term contracts. In railways, increases in infrastructure are often slow to eventuate and it is convenient to consider a third concept, the medium-term, during which adjustments have been made to operational capacity (crew, maintenance, and rollingstock capacity) but changes in the capacity of the infrastructure have not yet taken place. From a practical point of view, the short term for a railway is probably up to 18 months, while the long-term is rarely less than five years.

depends as much on institutional arrangements as on technical factors. So the cost of train crews, who can be redeployed to alternative services, generally responds faster than rollingstock maintenance costs, which have a substantial workshop component for overhauls which are only carried out at intervals of four years or more.

A large part of the costs of routine infrastructure maintenance are independent of the level of traffic and can be considered fixed, until traffic levels change dramatically, or additions or subtractions are made to the network. Relative scale is always an important factor when considering the 'fixity' of any cost as the addition of a new traffic of sufficient volume requires additional infrastructure with its associated costs. Similarly, removing all traffic on a particular line, even if it is a comparatively small volume, would make all costs on that line avoidable if it were to facilitate closure.

The third group of costs are administration-related[3]. They are fixed in the sense that they are largely insensitive to the removal or addition of an individual train service but are more related to the overall scale of the railway. Even then, they generally react only sluggishly. A typical pattern is for these costs to remain more or less fixed (or slowly but steadily increasing) for several years punctuated by periodic management 'restructurings' during which a chunk of the overhead is taken out. As long as operations continue at around an existing general level of activity, central administrative costs can generally be treated as independent of traffic volume, although there would be the ability to make a step reduction if passenger services were more dramatically curtailed or withdrawn.

The treatment of capital costs also depends on the decisions to be made. The cost of operating an on-going service should include an allowance for renewable capital items such as rollingstock and track excluding only the non-renewable component of infrastructure capital costs[4]. However, an accounting income statement would include depreciation and interest charges for all assets, usually based on historical costs (and often of doubtful use). In general, the avoidable capital cost is based on either the replacement cost of the asset, for an on-going service, or is zero where the service is unlikely to be replaced when the rollingstock becomes obsolete.

2.3 Cost Components

The raw financial data available in most railways with conventional financial accounting systems is broadly consistent with the categorisation of Table 2.. In some cases, labour on-costs, such as pensions, are included as general administration and need to be extracted and, in the absence of specific causal information, allocated to functional areas in proportion to wages and salaries.[5] Functional overheads can then be distributed to the relevant functional area. For example, administrative costs relating to track maintenance (supervisors, district engineers etc) are included in track related direct expenditure and are then allocated on the same basis as the direct expenditure

[3] These administration costs do not include **all** costs incurred at Divisions and HQ. The administrative costs of branches such as Engineering and Electrical are generally treated as overheads to the relevant direct costs, leaving only the accounting and general administration branches such as General Management and Finance.

[4] This assumes that the rollingstock can be redeployed elsewhere and that the renewable component of the infrastructure can be salvaged and re-used. The costs of the initial construction of the line, such as earthworks and some structures and buildings, are unlikely to be recovered and the associated capital charges generally continue to be incurred indefinitely until they are written off.

[5] Many modern accounting systems allocate on-costs directly.

they are supporting. However, general administration overheads, such as general and financial management, are not directly related to a particular function and remain separate.

The augmented functional costs (including the labour on-costs and supervision costs) for those components in Table 2.1 which are 'variable' can then be allocated to services based on the appropriate causal relationship.

2.3.1 Operating costs

Fuel and Traction Electricity

Fuel and energy costs are normally booked to system-wide accounts but may sometimes then be allocated to passenger and freight based on estimated consumption rates. Very few railways have on-train meters. The simplest basis to distribute fuel and traction electricity costs to services is in proportion to gross tonne-kilometres; however, more accurate estimates are possible for individual routes if the average grade of the route, the speed of the train and the train size are taken into account.

Train Crews

On some railways, drivers are booked under separate accounts for freight and passenger work, and sometimes also for multiple-units and locomotives; on other railways all train crew is booked to a common account. Allocation to services is best done in proportion to train-hours; on railways where this statistic is not available, train-km is a second-best alternative. Adjustments need to be made for the number of train-crew used – some railways use single-manning for some types of locomotive and multiple-unit trains.

Guards are no longer used on all railways but where this is so, they are normally allocated on the basis of train-hours.

On-train crew

The cost of on-train crew varies sharply from railway to railway as well as by type of train. At one extreme are sleeper cars with two attendants per carriage on some railways; at the other is a single conductor/inspector – or sometimes none. Some railways also have on-board security staff (or railway police), typically two or three per train. Where no detailed data is available, the only practical basis for allocation is to use weighted train-hours, with the train-hours weighted by the estimated number of on-board crew for each train type.

Passenger handling and station operations

These are often difficult costs to identify for the typical integrated railway. The major costs are labour-related and therefore can only be identified by analysing (or using a management assessment) of the time spent by staff on passenger-related activities. Staff employed at stations for train despatching and train-working should be included under signalling operations but are often included in general station costs.

There are variations in ticket selling and terminal costs depending on the fare/ticketing systems and facilities (some railways have very basic passenger facilities or provide a low level of service for ticket-selling, with long queues) as well as management practices. Some railways have out-sourced ticket sales on a commission basis (and others have set up special internal cost centres which effectively 'in-source' this activity).

Station maintenance costs are generally only available in aggregate but can be allocated in proportion to staff numbers. Although the connection between station maintenance and staff numbers is more tenuous than for operations costs, the number of staff does give an indication of size and complexity of stations and therefore the level of maintenance effort.

The aggregate passenger-related costs are best allocated to services on a per passenger basis. In practice, the high-fare and long-distance passengers have higher costs than commuters and low-fare passengers, so an acceptable alternative is to distribute costs in proportion to revenue.

Catering

Catering costs should be directly available from the financial accounts. However, such costs generally only include the cost of food and catering staff; they exclude the costs associated with maintaining and hauling any restaurant and buffet cars. Catering revenue and expenditure should be allocated in the same manner; depending on the system, weighted passenger-kilometres is a reasonable basis, with weights reflecting the relative use of these facilities by the different classes of passengers.

Rollingstock Maintenance

Maintenance cost of passenger rollingstock is generally available by broad type (locomotive, carriages and multiple-units) but is rarely available by class of carriage and not always by type of locomotive. There are arguments for and against differentiating between classes of locomotive, as the locomotives used on any particular service often reflect management discretion rather than being based on specific technical characteristics; in addition, very often the most powerful locomotives are the newest and hence have the lowest unit maintenance costs. It is therefore often best to use a fleet average maintenance cost for locomotives; analysis has shown this can be allocated on the basis of locomotive-km and locomotive-hours, typically 50:50.

Similar results hold true for multiple units, although here it is often worth distinguishing between modern 3 and 4-car sets used for main-line services and the life-expired one or two-car units often used for branch-line services. Carriage maintenance costs should also distinguish between the higher-class carriages, often with air-conditioning and generally with much higher interior standards, and the lower-class carriages, for which interior maintenance is minimal on many railways. A reasonable basis for allocating carriage maintenance costs between services is 70 percent on the basis of vehicle-km and 30 percent on the basis of vehicle-hours; however, if costs by class of carriage are available, vehicle-km alone can be a reasonable basis, as most trains with similar types of carriage operate at similar commercial speeds

Cost is also a function of the level of service being provided. For example, vehicles for main-line premium services will generally have a higher standard of interior fittings and maintenance than those used on the cheapest branch-line services; cheaper unit costs in such circumstances therefore do not necessarily reflect greater efficiency.

Infrastructure costs

Even when a common methodology is adopted, infrastructure costs often vary widely, reflecting not only variations in accounting procedures for periodic maintenance, as discussed above, but also the very different infrastructure standards on the different railways. The absolute cost of infrastructure maintenance increases as volume increases not only because of the costs associated with the incremental volume but also because of the higher standards required to provide the required

capacity and because higher traffic volumes restrict the time available each day for access to the track, thus increasing the unit cost of maintenance activities.

Treatment of major periodic maintenance, both for rollingstock and infrastructure, can also cause distortions. More financially robust railways carry out such work routinely and include the costs as part of operating expenses. However, many smaller railways with low traffic densities can often only do such work when they receive specific funds through loans and grants. In these cases, the work is almost always capitalised; periodic maintenance can represent 50 percent or more of the long-run maintenance cost and its capitalisation creates significantly deflated unit operating costs. The converse arises when rollingstock items, particularly locomotives, continue to be operated much longer than their normal lives as the railway does not want to (or cannot) purchase replacements; the life-expired locomotives can require extensive routine maintenance to keep them operating, leading to comparatively high unit operating costs.

Train despatching and control

Train control (signalling) and train-working costs are often very difficult to establish with any precision because station staff involved in typical railways are generally multi-tasking; these costs are also heavily influenced by policy decisions on station manning.

Headquarters Administration

Analysis of these costs on different railways has shown that they are within a fairly close range (5 percent-12 percent) of total working expenditure (i.e. excluding capital charges). In the long run, therefore, they should vary in line with other expenditure and can be included in service costs as a percentage mark-up.

2.3.2 Capital costs

Rollingstock

The capital cost of rollingstock and infrastructure is reasonably consistent across all railways. Rollingstock manufactured in Europe is generally more expensive on a vehicle-for-vehicle basis but generally has more features and ancillary equipment e.g. air conditioning, more sophisticated toilets, centrally operated doors etc. Given the unit costs and life of an asset, this can be converted into equivalent annual costs, using an assumed real interest rate. The capital cost per unit of use then depends on the asset utilisation; higher utilisation, whether from the type of service being offered (e.g. long-distance overnight services or daytime medium-distance shuttle services) or from the efficiency of timetabling and operation, generates lower per unit capital costs.

The appropriate approach to the measurement and allocation of capital costs depends upon the purpose for which it is being estimated. For the purposes of financial accounting statements, assets are generally valued using accounting standards which assume that the railway is a going concern, values are related to historic costs and normal commercial relationships between risk and return prevail.

From an operating railway's perspective, many assets are impossible to value in the accepted commercial sense. Land for the permanent way may have a significant alternative use value but if it is unavailable for that alternative use, its value is a function of the level of income that it can generate. This Policy Note assumes the on-going operation of the railway so the only capital costs included are replacement costs for renewable items.

The capital costs are represented as an annual charge equivalent to the depreciation and interest costs that would be incurred if the replaceable assets were replaced at current new costs with a loan over the life of the asset. The interest rate used (i.e. the return to the investor) is set at 7 percent real (i.e. the return excluding the effects of inflation) and asset lives are 25 years (100,000 hours) for diesel locomotives, 30 years for diesel multiple-units and 40 years for electric locomotives, electric multiple units and hauled carriages.

Infrastructure

In most FSU countries, the periodic replacement of infrastructure is known as 'kapital remont' and is treated as an operating cost. No additional cost therefore needs to be included for this activity.

3 UZ Passenger Service Costs

3.1 2017 Financial Accounts

UZ is a vast organization with many wholly and partly-owned subsidiaries. Some of these do significant work for organizations outside UZ but many work only for the railway departments of UZ, for which they receive income. The best starting point for an analysis of the costs of UZ services is the segment analysis provided in Section 8 of the audited Annual Financial Statements (Table 3.1). This gives the cost in 2017[6] of each three main market segments: mainline passenger, suburban passenger and cargo.

Table 3.1 Segment results 2017 (UAH million)(1)

	Cargo	Long-distance	Suburban passenger	Auxiliary activity	All other segments	Unallocated	Eliminations	Adjustments	Total
Sales to third parties	60,991	6,745	589	6,498	9	–	(894)	–	73,938
Inter-segment sales	–	–	–	7,409	1,777	–	(9,186)	–	–
Total revenue	60,991	6,745	589	13908	1,785	–	(10,080)	–	73,938
Staff costs	(17,409)	(5,318)	(2,585)	(4,636)	(617)	(607)	585	(1,388)	(31,974)
Depreciation	(10,714)	(1,633)	(870)	(1,274)	(36)	(168)	34	–	(14,662)
Electricity	(5,306)	(1,236)	(722)	(7,952)	(56)	-	7,428	(3)	(7,866)
Fuel	(4,971)	(955)	(605)	(769)	(47)	(5)	44	–	(7,308)
Maintenance	(3,758)	(837)	(528)	(367)	(1,106)	-	1,447	(661)	(5,810)
Other expenses	(4,756)	(1,423)	(556)	(1,363)	(11)	(1,717)	7,572	4,827	(1,061)
Inter-segment	–	–	–	3,398	–	–	(3,398)	–	–
Total cost	(46,914)	(11,420)	(5,866)	(12,963)	(1,874)	(2,499)	10,080	2,775	(68,681)
Segment result	14,077	(4,675)	(5,277)	945	(89)	(2,499)	–	2,775	5,257

(1) As given in 2018 financial statements

A good explanation of what the various headings mean is given in the notes to the 2018 accounts and is reproduced below.

For management purposes, the Group is organized into business units based on their services, and has five reportable operating segments:

- *Cargo segment includes cargo transport services provided by the Group.*
- *Long-distance passenger transport segment comprises cross-regional passenger transport services provided by the Group.*
- *Suburban passenger transport segment includes intraregional rail passenger transport services.*
- *Auxiliary operations segment mainly includes activities of certain structural units of Regional branches and branches of the Company that produce industrial products and provide services for internal consumption within the Company and for sale to third parties outside of the Group. Auxiliary operations segment produces industrial products and provides services related to cargo transport and suburban passenger transport, construction, reconstruction and modernisation of railway tracks and railway infrastructure, repair and maintenance of various railway-related equipment etc. The transfer of products (works, services) between the structural units of one branch and between branches within the Company is considered as internal turnover and is reflected as a reallocation of expenses ("Inter-segment expenses" line) with no revenues recognised (except for certain types of transactions). A segment that receives reallocated expenses includes them in the "Other Costs" category.*

[6] Much of the analysis reported in this paper was undertaken before the 2018 statements and supporting documentation had been finalised. Updating will be completed when this data becomes available.

None of Auxiliary segment operations are individually of sufficient size to be reported as separate segment. None of these operations can be aggregated with reportable operating segments described above due to dissimilar economic characteristics.

- *All other segments include repair and maintenance of rolling stock and other services provided by the Company's subsidiaries.*

The operating segments results do not include the effects of some adjustments that may be considered necessary to reconcile the management accounts to IFRS consolidated financial statements.

Segment revenue is revenue that is directly attributable to a segment, whether from sales to external customers or from transactions with other segments. Segment revenue does not include:

- *Interest income;*
- *Foreign exchange gains;*
- *Gain on disposal, change in fair value and reversal of impairment of financial assets;*
- *Gain on disposal of property, plant and equipment;*
- *Other income.*

Segment expenses are expenses resulting from the operating activities of a segment that is directly attributable to the segment and the relevant portion of an expense that can be allocated on a reasonable basis to the segment, including expenses relating to sales to external customers and expenses relating to transactions with other segments.

The segment result is calculated as the difference between segment revenue and segment expenses. Transfer prices between operating segments are on an arm's length basis in a manner similar to transactions with third parties, except for operations of electricity transfer.

The costs presented in Table 3.1 include both train operating costs (the 'above-rail' costs) and the costs of maintaining and operating (train control and related activities) the infrastructure (the 'below-rail' costs. As the below-rail costs include a significant element of joint costs, this component of the segment costs includes allocation on a general basis rather than a causal one, as discussed in section 2.

3.2 Form 10

It was impractical for the many rail-related organisations making up the rail sector in the FSU to have a single chart of accounts, given the vast geographical scope and the wide range of activities. Instead, a uniform set of accounts (known as Form 69) was developed into which all organisations converted their data to create a consistent basis for subsequent management accounting. It was used extensively for tariff-setting and for allocating expenditure between passenger and freight traffic.

Many FSU railways, including UZ, still use this form (now known as Form 10 in Ukraine), although it has been frequently revised to deal with changing operational circumstances. The Ukraine version now has around 900 accounts, arranged into 13 main groups broadly corresponding to the main functional groups (passenger operations, freight operations, traction, civil engineering etc) for each of which expenditure is divided by type: labour, staff benefits, electricity, diesel, materials, depreciation and other (Table 3.2). 'Other' includes what in some charts of accounts is termed 'sundries' e.g. external services, travel, stationery etc

Each operating unit completes its own Form 10 and these are consolidated centrally into one covering the whole of UZ. In many cases units are providing services for other units and in these cases the cost is cross-charged. These are shown in the last two columns of Table 3.2 and included as debits (and corresponding credits) in the 'other' costs. The individual costs in Form 10, in aggregate, exactly match the segment costs in the audited financial statement shown in Figure 3.1. Whilst there may be, as in all large organisations, occasional miscodings of costs, detailed analysis of Form 10 by the World Bank

did not uncover any significant instances where costs seemed unreasonable and there is no reason to question the reliability of these costs.

Within Form 10, each cost is allocated to one of three segments, cargo, long-distance passenger and suburban passenger, corresponding to the three segments in Table 3.1. In most cases, other than infrastructure, the allocation is straightforward because of the structure of the individual accounts, which have developed over time to record the expenditure to these segments at as detailed a level in the organisation as possible. Where costs do have to be allocated to more than one segment,this is done on the basis of a suitable physical measure, similar to the procedures described in the previous chapter.

Table 3.2 Typical Form 10 cost records (UAH 000)

Article	Activity		Including							Total	Transferred	
			Payroll	Benefits	Material costs			Deprec-iation	Other		From	To
					Materials	Diesel	Energy					
1001	Sale of domestic tickets	7703	135,722	30,061	7,952	1	1,008	17	9,620	184,381	1	573
1003	Domestic baggage	7705	7,240	1,363	162	11	3		465	9,244	49	44
1008	On-board equipment and services	7708	57,014	12,749	6,895	29,316	2,932	4,139	13,274	126,319	1,598	2,303
1009	Maintenance of domestic and international cars	7709	1,063,682	242,922	13,852	9,693	56,075	9,485	102,687	1,498,396	45,929	21,877

In any unit, there are a number of cost heads that are of a support nature and cannot be directly related to a specific activity undertaken by that unit. Examples include management costs, employee sick leave and training or the maintenance of buildings in a workshop. These costs (known, for example, as 'shop overheads' in workshop costing) are included as a separate item which can then be subsequently distributed over the relevant direct costs.

Table 3.3 summarises the costs for the three market segments by the 15 main Form 10 cost groups.

Table 3.3 Segment costs by department 2017 (UAH million)

Departments	Cargo	Long-distance	Suburban passenger	Other	Total
Mainline passenger		5547	176		5723
Suburban passenger		172	3472		3645
Cargo	2173				2173
Operations	2579	375	281		3234
Locomotive	14906	3231	263	94	18493
Wagon	5460	10		3	5474
Track	14827	746	480		16054
Buildings and structures	805	259	382	43	1490
Signalling and communications	1744	750	541		3036
Electrical	1168	174	205		1547
Supply	159	16	4		180
Recovery trains	1086	81	58		1225
Management				74	74
IT/security	728	31	21		780

Central management				1071	1071
Total cost	45635	11393	5886	1285	64200

The first six departments broadly constitute the above-rail costs (UAH 38.7 billion in 2017, about half the total costs). The next four (UAH 22.1 billion) broadly constitute the below-rail costs while the last five (UAH 3.3 billion) are various services which are provided on a system-wide basis.

The Passenger and Suburban Passenger departments maintain and crew the self-propelled trains they operate. The costs incurred for passenger services from the Locomotive Department are thus only those for loco-hauled services (the majority for main line passenger services but very few for suburban passenger services).

Wagon costs are almost exclusively for freight. Locomotive-hauled passenger vehicles are maintained by the Passenger department itself.

As the track costs in Form 10 are currently distributed on the basis of gross tonne-km, the majority are allocated to freight, while suburban passenger attracts comparatively little.

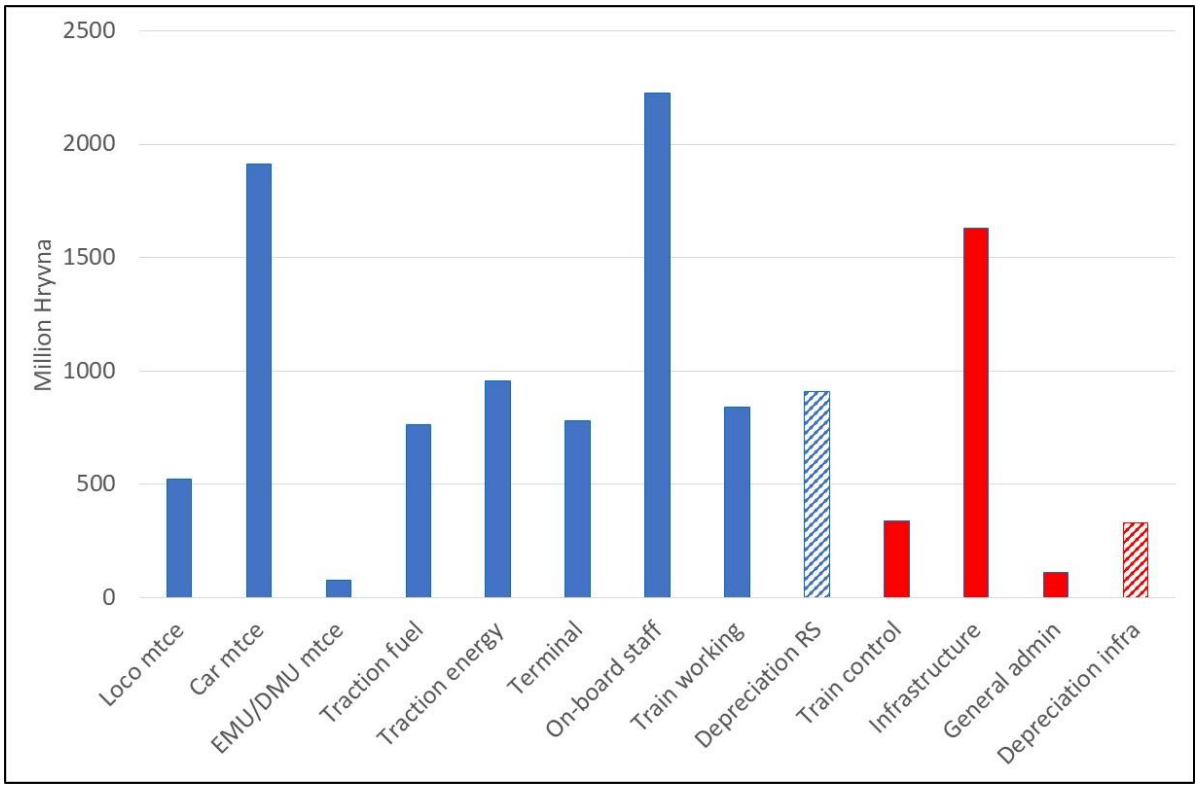
3.3 Analysis of Form 10 costs to generate aggregate costs by activity

For the purposes of passenger train costing, each of the Form 10 accounts was reclassified into one of 13 activities corresponding to the cost structure given in Table 2.1 and shown in Figure 3.1:

Table 3.4 Segment costs by activity 2017 (UAH million)

	Mainline passenger	Suburban passenger
Diesel fuel	762	476
Traction energy	957	589
Loco maintenance	524	18
Car maintenance	1912	91
EMU maintenance	43	689
DMU/RB maintenance	34	326
Shunting locos maintenance	38	8
Station	975	522
Train crew	840	1029
On-train crew	2226	-
Shunting crew	105	
Infrastructure	1629	1323
General admin	110	78
Depreciation	1238	728
Total	**11393**	**5885**

Figure 3.1 Mainline passenger costs as summarised in Form 10 2017



3.4 Derivation of unit costs

3.4.1 Unit operating costs

The aggregate costs in Table 3.4 can be related to the relevant cost drivers to derive a set of unit costs (table 3.5). Most railways keep records of the operating statistics which are the key cost drivers (train-km, locomotive-km and so on) by broad category, in the case of UZ for cargo, mainline passenger and suburban passenger.

Table 3.5 Derivation of unit operating costs for mainline passenger services (UAH 2017)

	Cost (UAH mill)	Cost driver	Activity 2017	Unit cost
Diesel fuel	762	Diesel gtkm (000)	5764	132
Traction energy	957	Electric gtkm (000)	33361	29
Loco maintenance	524	Loco-km	54469	10
Car maintenance	1912	Car-km	625532	3
EMU maintenance	43	EMU km	22698	2
DMU/RB maintenance	34	DMU km	5829	6
Station/shunting	1118	Passenger	49000000	22
Train crew	840	Train hour	967000	868
On-train crew	2226	Car-hour	11362000	197

Few railways maintain detailed records of shunting activities and these costs (fortunately relatively small) have been combined with station costs to provide a composite passenger handling cost.

UZ do not keep separate maintenance costs for electric and diesel locomotives, nor for the different types of passenger carriage, and in particular not for kupe and platzkart. The maintenance cost of electric locomotives is typically about two-thirds that of corresponding diesel locomotives and this was used to develop costs for each type consistent with the overall average. The same approach was adopted for the platzkart and kupe carriages; kupe carriages are maintained to a higher standard and were given a maintenance cost 40 per cent higher than the platzkart cars after discussion with UZ staff.

3.4.2 Unit capital costs

The capital cost of rollingstock and infrastructure is reasonably consistent across all railways, although it naturally depends on the features provided e.g. air conditioning, more sophisticated toilets, centrally-operated doors etc. Capital cost can be converted into equivalent annual costs, using an assumed asset life and real interest rate. The capital cost per unit of use then depends on the asset utilisation (Table 3.6). Higher utilisation, whether from the type of service being offered (e.g. long-distance overnight services or daytime medium-distance shuttle services) or from the efficiency of timetabling and operation, generates lower per unit capital costs.

Table 3.6 Derivation of unit capital costs for mainline passenger services (UAH 2017)

	Cost	Life	Depr.	ROI/Int	Total	Util. P.a..	Cost per unit ($)		
	USD ($000)	YRS	$000	$000	$000		Depr	ROI	
Locos (1 section)	2500	25	100	115	215	4000	25.00	28.75	Hour
Carriage (K)	1000	40	25	50	75	4000	6.25	12.50	Hour
Carriage (PK)	800	40	20	40	60	4000	5.00	10.00	Hour

3.5 Application of unit costs to selected services

It would be possible to extract these for individual services from the operational database but UZ does not yet do this. Instead, the relevant statistics for individual services are normally calculated on a service-by-service basis, using standard operating information on train times and compositions.

Table 3.5 shows a sample of the information used in the service costing in this report.

Table 3.5 Service operating data

	From	To	Distance		Days/	Time	Carriages	
			Electric	Diesel	week	(mins)	Kupe	Platzkart
1/2	Ів Франківськ	Костянт	1312	141	3.5	1230	10	0
3/4	Запоріжжя	Ужгород	1440	0	3.5	1240	10	0
6/5	Київ	Москва	354	0	7	292	12	5
8/7	Одеса	Харків	762	0	3.5	555	10	0
7/8	Київ	Івано-Франк	572	140	7	681	8	0
7/8	Харків	Одеса	762	0	3.5	555	10	0
12/11	Львів	Одеса	745	0	7	608	10	0
12/11*	Київ	Новоолексіївка	861	0	7	737	15	3
13/14	Київ	Солотвино	862	155	7	1205	9	6

This data enables all the cost drivers to be defined, given the weights of the locomotive and rollingstock. The cost of each service can then be derived by combining them with the relevant unit costs.

4 Analysis of results

4.1 Introduction

There are two important financial thresholds that help establish the financial viability of rail passenger services:

- Is the revenue earned by the service greater than the above-rail operating costs (excluding capital)? If so, it is worth continuing to operate the service as it has a positive cash flow, as long as there is not a better use for the rollingstock used in the service
- Is the revenue earned by the service greater than the above-rail operating costs (including capital)? If so, it is worth reinvesting in the rollingstock for that service when it becomes life-expired.

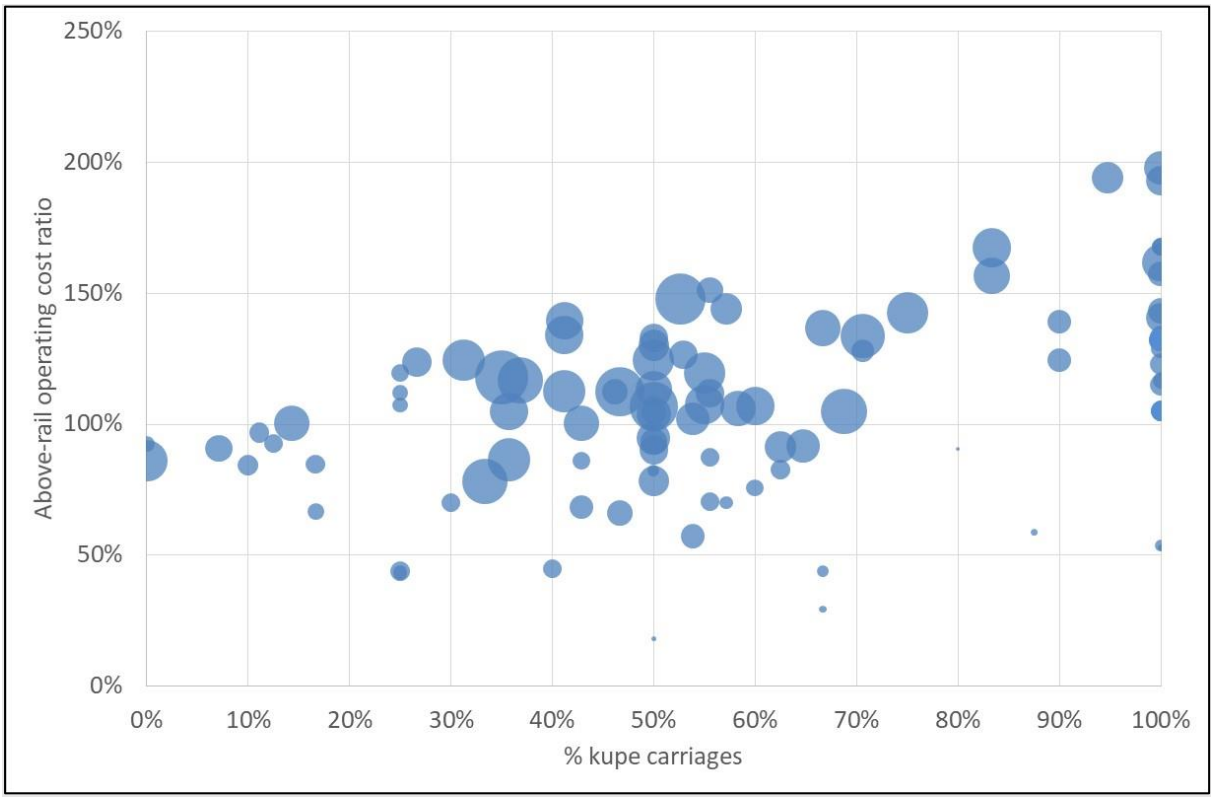
Both thresholds assume that there are other users of the infrastructure over which the service operates (a reasonable assumption in the case of mainline passenger services in UZ). If not, then either the service needs to generate sufficient financial surplus to cover the cost of the infrastructure or there needs to be external financial support to achieve this.

The next section presents the results of the analysis for 2017.

4.2 Overall Service Viability

Figure 4.1 addresses the first threshold above and shows the distribution of the above-rail operating cost ratio as a function of the proportion of kupe carriages. In both Figure 4.1 and 4.2, the size of the bubbles indicates the passenger-km on the service.

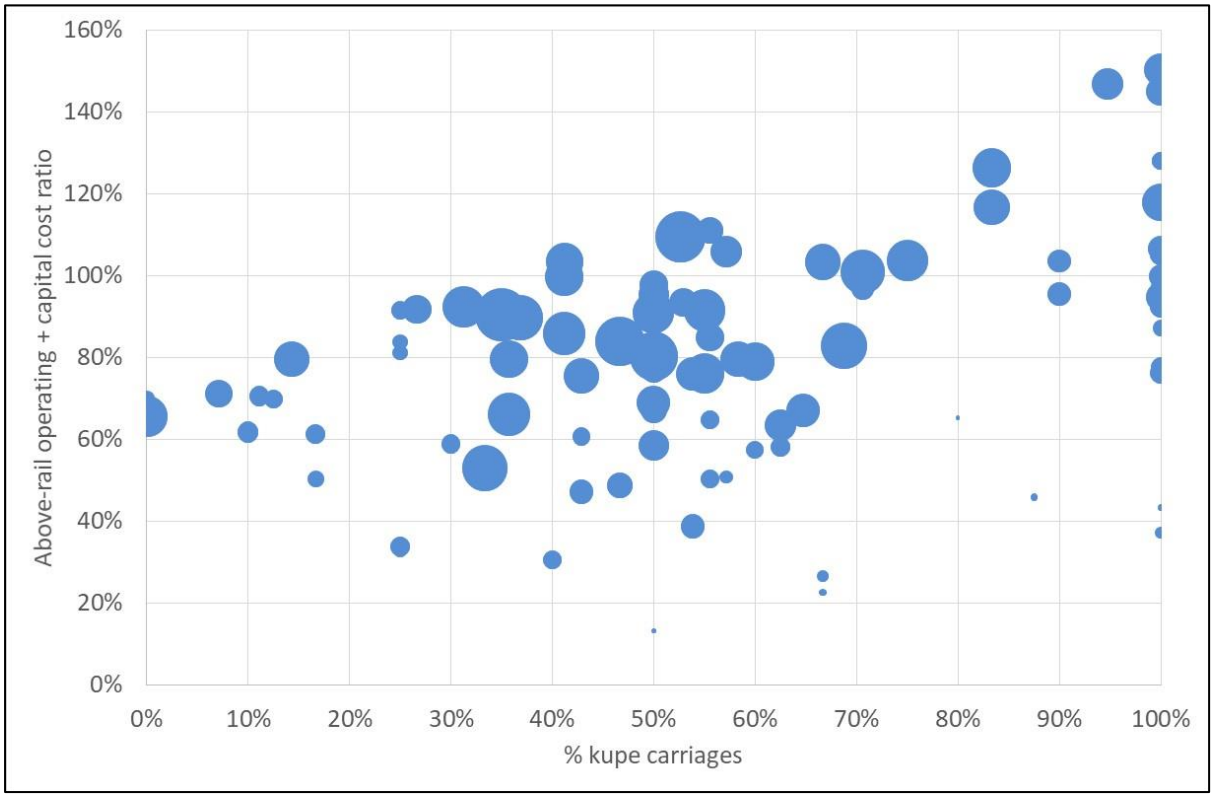
Figure 4.1 Above-rail operating cost ratio and proportion of kupe carriages in a train



Of the 94 services analysed, 57 had a ratio greater than 1 and were thus earning more on each trip than it was costing to operate them. Almost all services for which kupe cars were over 70 per cent of the train composition were over 100 percent, but none of those with under 20 percent kupe cars were.

When above-rail capital costs (locomotives and carriages) are included, only 20 out of the 94 services had a ratio greater than 1 and were thus earning enough to fund replacement rollingstock as it became due (Figure 4.2). Only services with 60 percent or more of kupe carriages are passing this test and even then it is by no means guaranteed.

Figure 4.2 Above-rail operating + capital cost ratio and proportion of kupe carriages in a train



An even smaller number of the sample would be able to contribute significantly to the cost of infrastructure. If the track access charge for mainline passenger were set at UAH 30 per 000 gross tonne-km, only 9 out of the 94 services analysed would be able to pay.

Given the revenue per passenger-km for a kupe passenger is more than twice what it is from a platzkart passenger, the mix of classes is clearly a critical element in determining the financial viability of a service. This is discussed in more detail in the next section.

4.3 Financial analysis by class

Figure 4.2 shows that almost all all-kupe train services are able to cover their reinvestment costs, while no all-platzkart train services are. Figures 4.3 and 4.4 show the cost per vehicle-km and per passenger-km.

Figure 4.3 Cost per vehicle-km of platzkart and kupe services

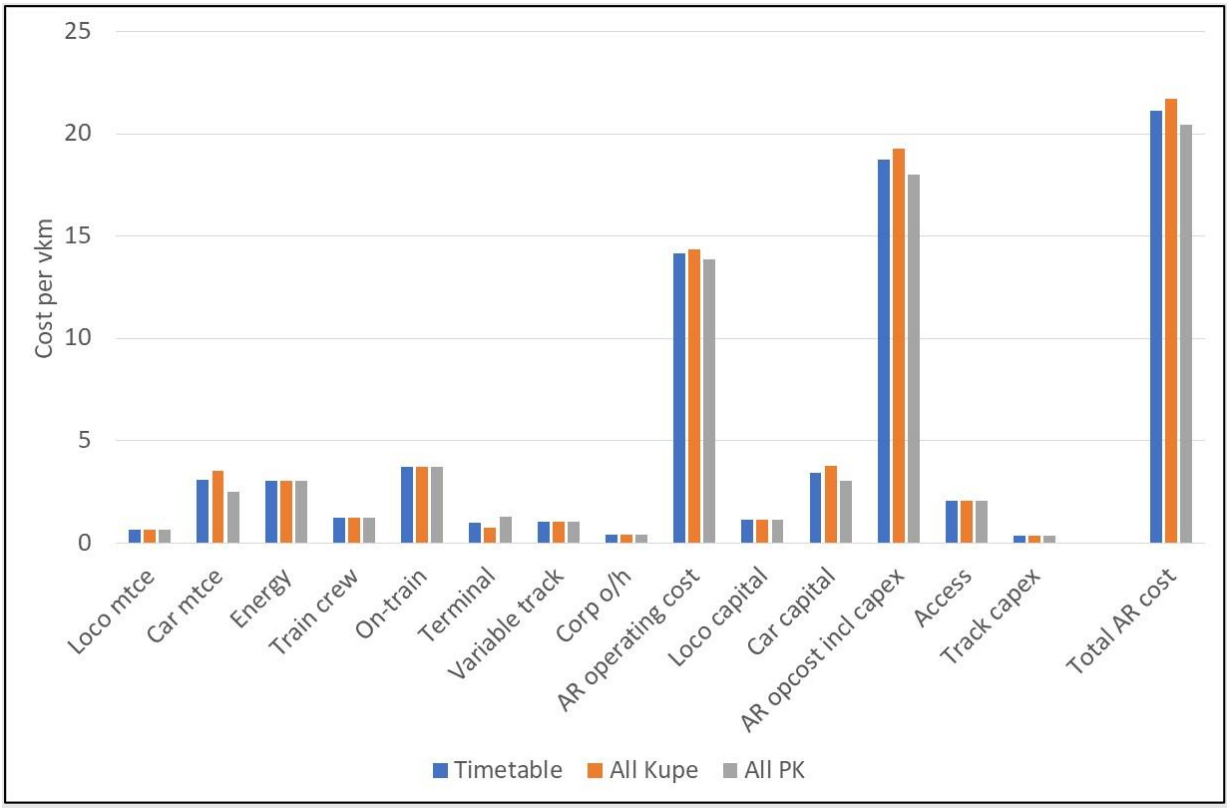
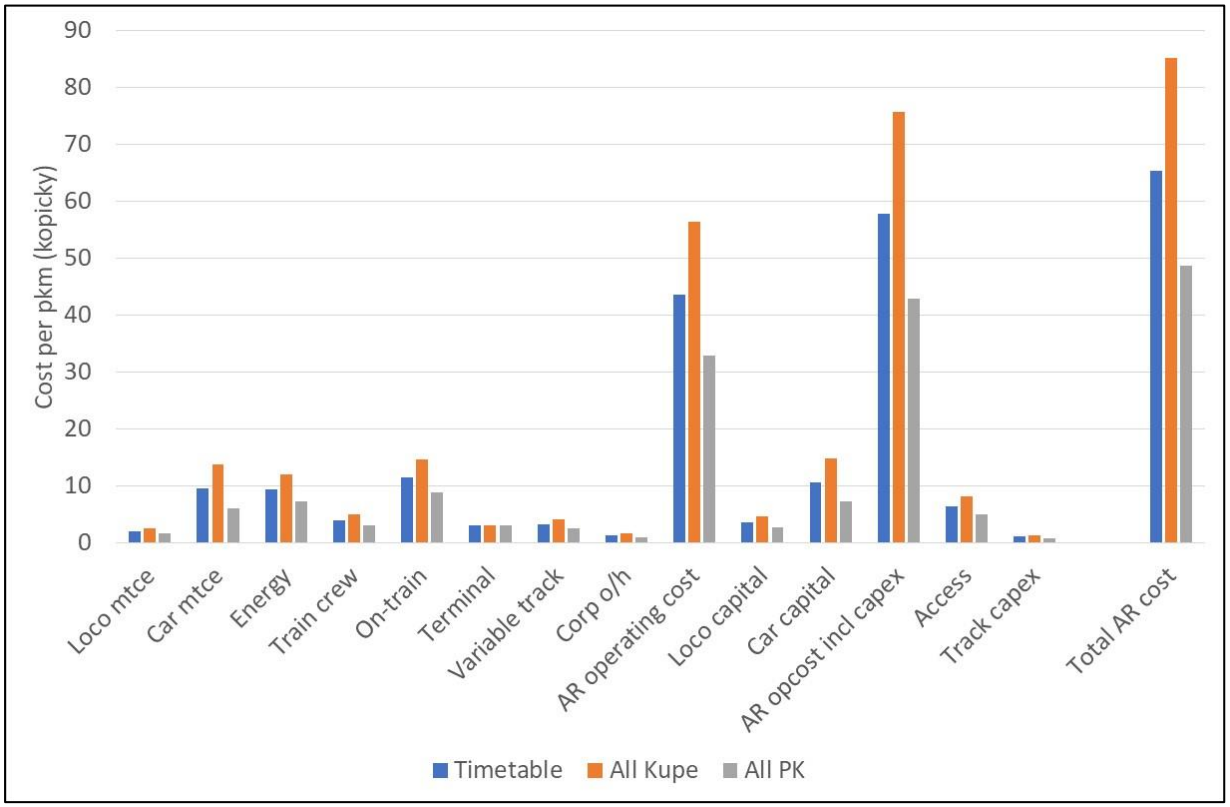


Figure 4.4 Cost per passenger-km of platzkart and kupe services

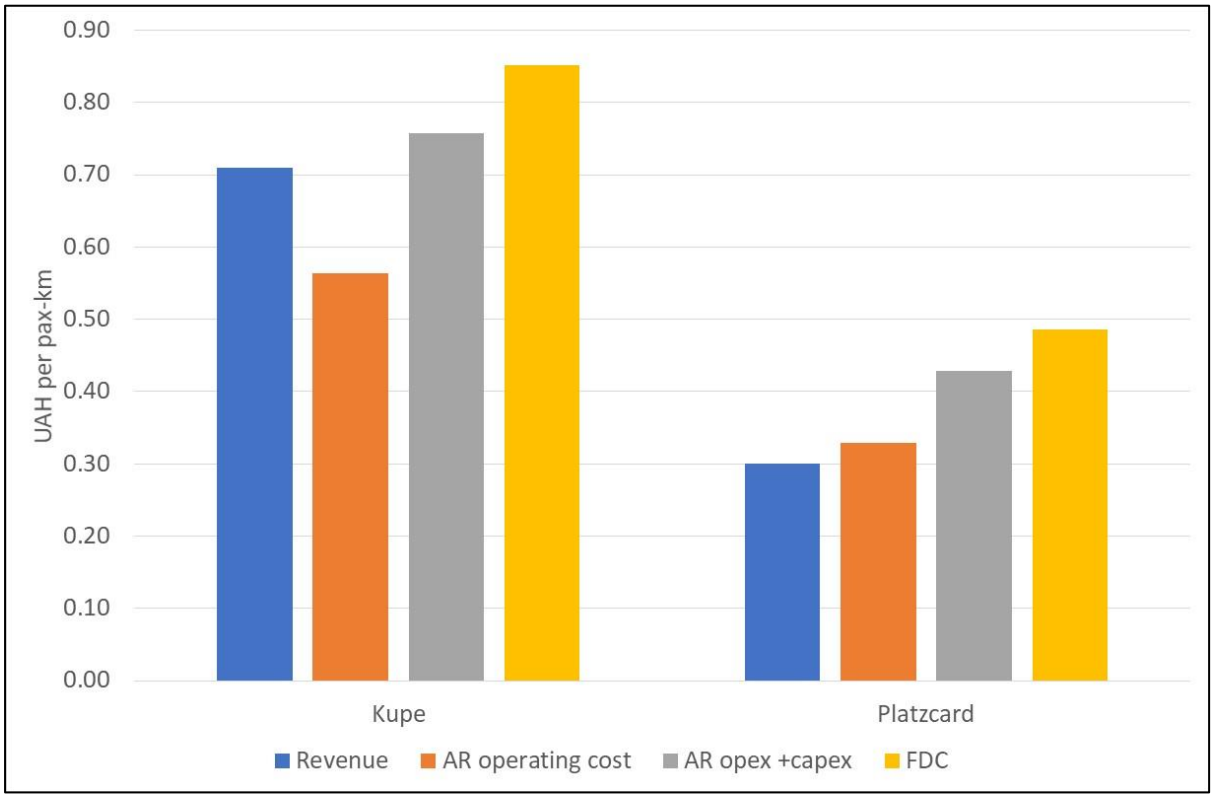


The cost of platzkart per vehicle-km is only slightly less than for kupe, because of the lower maintenance cost. Per passenger-km, however, the difference is more pronounced because of the higher occupancy rate for platzkart. Even so, however, this is not sufficient to generate comparable earnings per vehicle-km (Table 4.1) and platzkart will normally always fail to cover its full costs because of the lower regulated fares (Figure 4.5).

Table 4.1 Average revenue per vehicle-km

	Kupe	Platzkart
Average load (pkm/vkm)	26	41
Yield (UAH/pkm)	0.71	0.30
Revenue/pkm	19	12

Figure 4.5 Comparison of kupe and Platzkart revenue and operating cost[7]

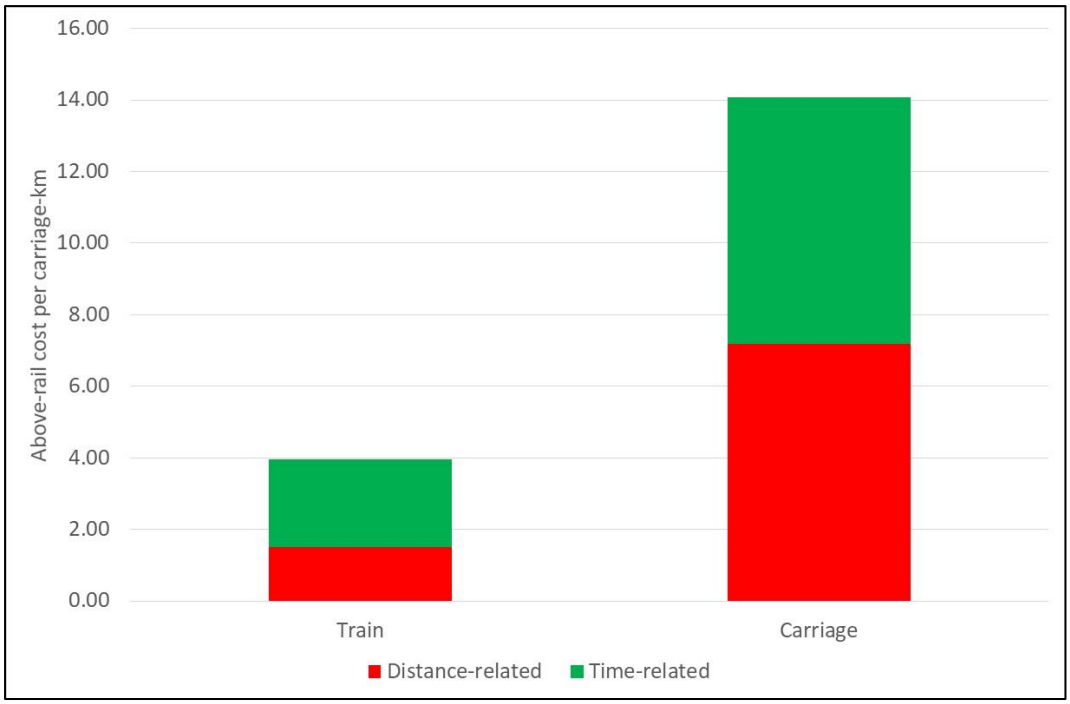


4.4 Impact of variations in train composition, speed and traction type

With UZ's current cost structure, the cost of passenger trains is dominated by the carriage-related costs (on-board attendants, maintenance and capital) rather than those associated with the locomotive. Some of these are variable with time while some primarily vary with distance.

[7] FDC is fully distributed costs.

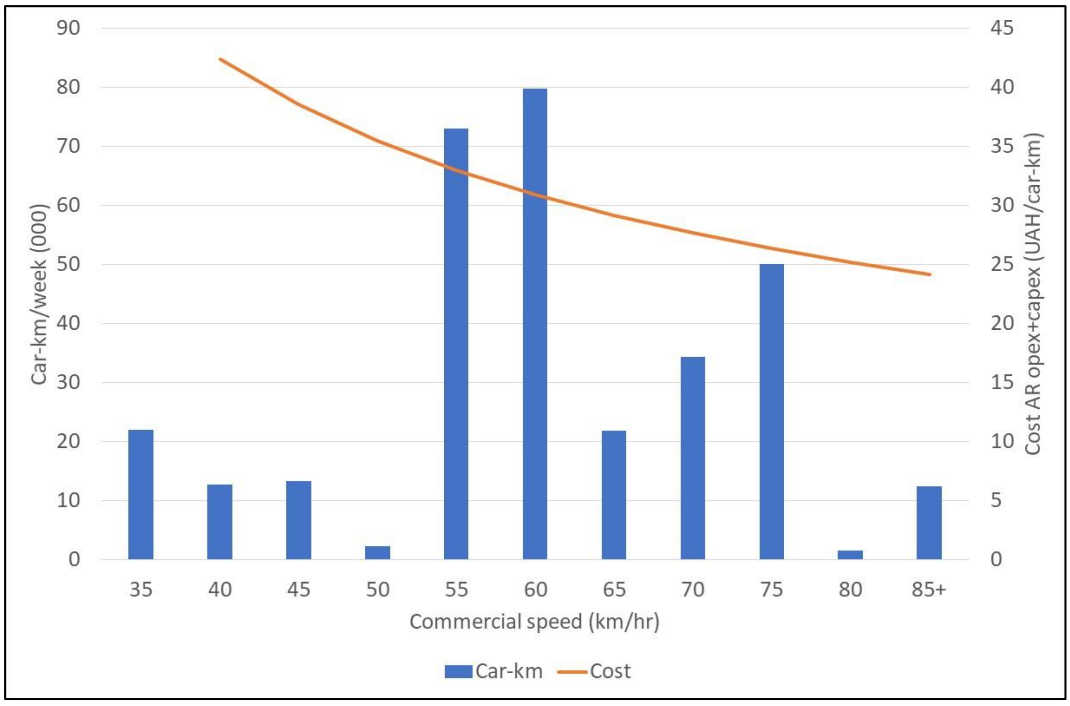
Figure 4.6 Train and vehicle-related costs



About 75 percent of the total costs are associated with carriages, with costs also dividing approximately equally between passenger and freight. This indicates that, while improving travel times should have a noticeable effect on overall cost, varying the size of the train will have comparatively little effect if average occupancies remain unchanged.

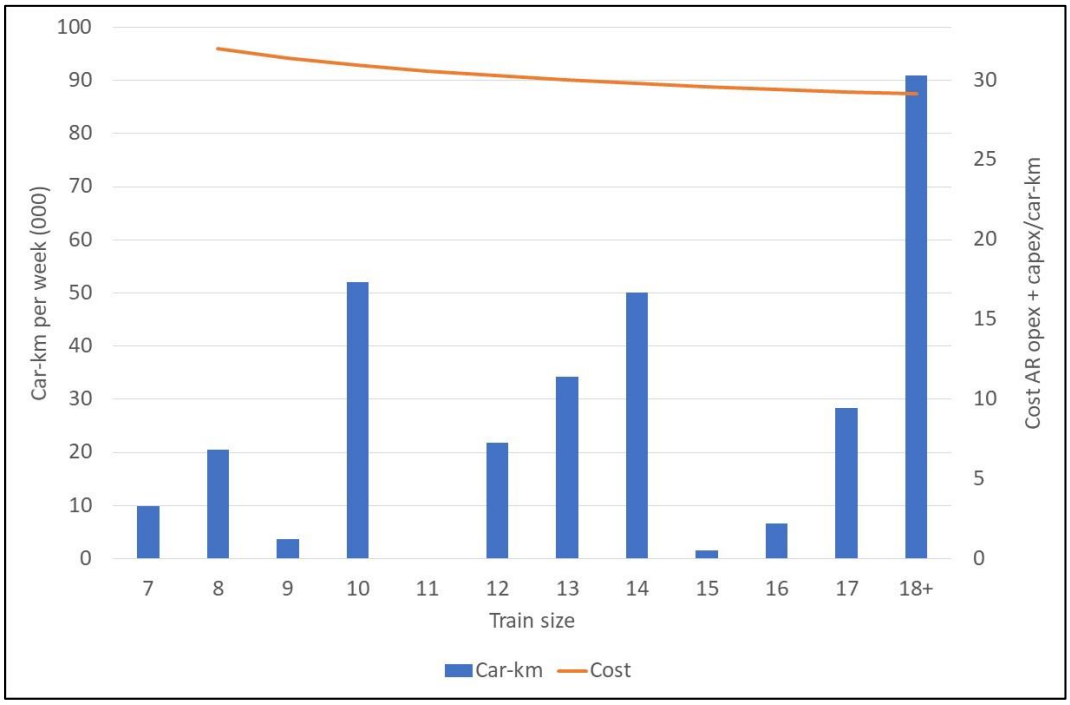
Figure 4.7 shows the variation of cost with speed for a 12-car Platzkart train. The blue columns show the distribution of the analysis sample by speed in terms of car-km per week. Doubling the commercial speed reduces the cost per vehicle-km by about 40 percent.

Figure 4.7 Cost variation by speed



The variation in cost with the size of the train is much less marked (Figure 4.8). Doubling the size of the train reduces the cost per vehicle-km by only about 10 percent.

Figure 4.8 Cost variation by size of train



Although train-related costs (which includes the locomotive) are relatively small, electric-hauled trains are cheaper than diesel-hauled ones by about 15 percent.

5 Possible strategies

While the Kupe services seem relatively secure financially, the Platzkart services are only surviving because of (effectively) cross-subsidy from the Kupe and freight services. However, this will become increasingly difficult and an alternative approach needs to be found. The normal response to improving the financial recovery of these services is simply to increase the fares. However, Platzkart fares in Ukraine are heavily regulated by the government for social reasons and that policy seems unlikely to change in the short medium term.

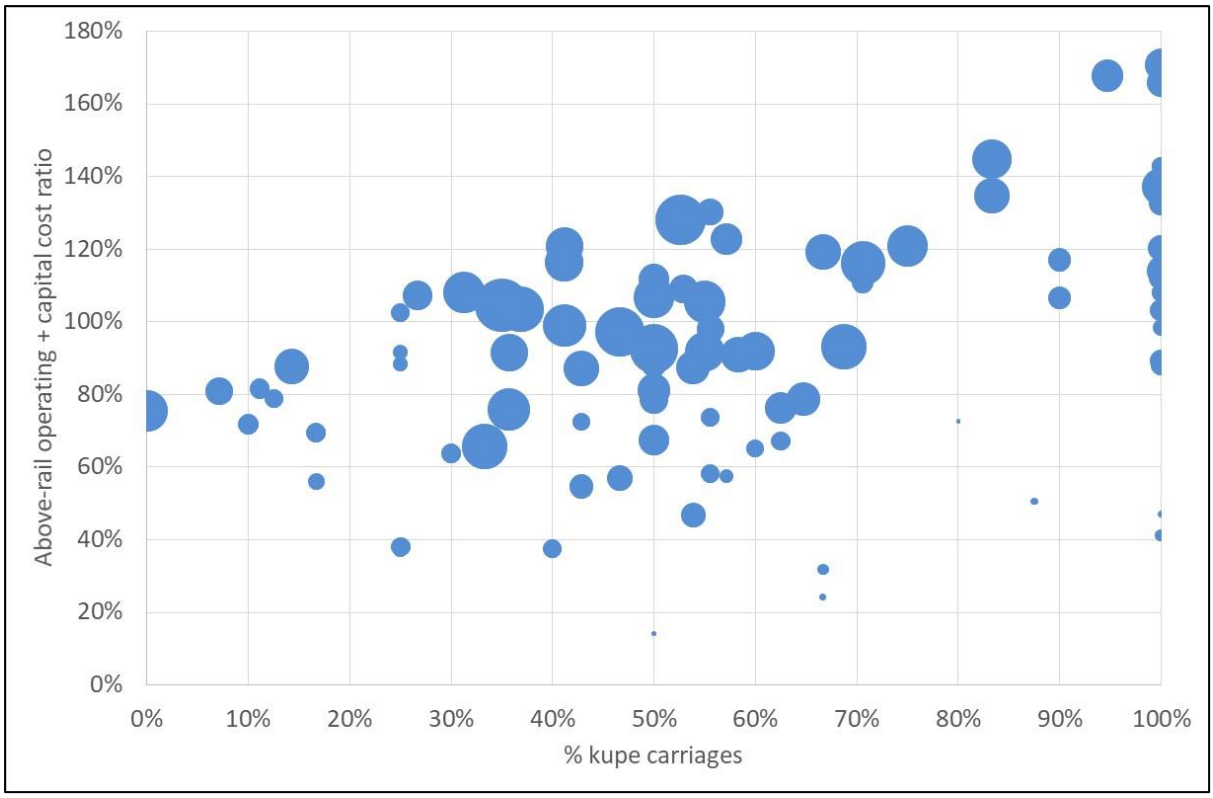
The other main options available to UZ to improve the financial performance of the Platzkart service form three groups:

- Reduction in the unit costs of the inputs to the services
- More efficient use of the inputs
- Compensation from the government

Whilst unit costs can almost always be reduced by reviewing methods and procedures, in many cases such reductions are not large and reviews sometimes show that costs should be increased rather than decreased in order to ensure maintenance is properly carried out. There is little evidence that the unit costs in UZ are unduly high compared to those in other countries, based on experience of railways in Eastern Europe that the World Bank has worked on in recent years. For example, locomotive maintenance in UZ averages UAH 10 per loco-km – (about US$ 0.40). Typical values elsewhere range from $0.7-$2 per loco-km, depending on the age of the locomotive and whether it is electric or diesel. Similarly, the maintenance cost of loco-hauled carriages, estimated at UAH 3/vehicle-km (US 0.10), is similar to a typical maintenance cost for a freight wagon on other railways. Reductions in unit cost will therefore help at the margin but will not be the long-term solution to losses.

UZ is already trialing a change in their inputs to these services. The traditional manning for the on-board attendants has traditionally been two people per carriage. A single train might therefore carry upwards of thirty on-board staff. UZ are now testing one person for two carriages, albeit with a 30 percent pay increase. This move represents a significant reduction in one of the largest cost components, reducing on-train crew costs by around two-thirds.

Figure 5.1 Above-rail operating + capital cost ratio – modified on-train crew



If this trial were extended to all services it would increase the number of services in the analysed sample covering their above-rail operating and capital costs from 20 to 36 and bring many others into an achievable distance of doing so.

Another option for UZ is to more closely tailor capacity to demand, especially on some of their very long-distance services. Although the average occupancy (measured as the dynamic load factor: passenger-km/seat-km) for the analysed services is 73 percent, this varies from 100 percent to 40 percent or less. Whilst load factors on services with many intermediate stops are much harder to manage than for services which are largely point-to-point(like airlines), this variability does suggest that capacity is being provided on some services to handle specific heavily-loaded sections which then goes unused for the rest of the journey. Addressing this problem is not easy, as modifying train consists en route can be expensive but there is a prima facie case for reviewing some of the service schedules and compositions.

It seems unlikely that the demand for Platzkart services will reduce significantly in the short-medium term. The average journey length is relatively long (536 km) and long-distance bus services are relatively few in Ukraine (e.g. five services daily between Kiev and Lviv), take as long as the train over indifferent roads and are unpopular because of both safety and travelling conditions in winter. Nevertheless, any reorganization and rescheduling of services should be accompanied by market surveys of both rail and competing modes to ensure the resulting services remain attractive to potential passengers.

UZ could also apply for financial compensation from the government for continuing to operate these services. As there is unlikely to be a significant problem with an all-Kupe service, this equates to compensation for operating Platzkart services at fares regulated to levels insufficient to cover costs. There are two main ways of doing this:

- UZ could keep the revenue from the Platzkart passengers and then be compensated for the difference between this revenue and the cost of operating the Platzkart vehicles
- UZ could operates the Platzkart vehicles under a supply contract with the government. The Government would then receive all Platzkart revenue and would pay UZ a fixed amount per Platzkart vehicle-kilometer

The first of these will create a large amount of work to cost individual services, many of which may change their composition on a regular basis (e.g. by day of week). In addition to the problem of data complexity, there are also conceptual problems in allocating part of the train-related costs (locomotive and driver) to the Platzkart vehicles. The second option seems far simpler to implement and administer, as well as providing greater certainty to both government and UZ. The only data required is the vehicle-kilometers performed by Platzkart carriages and this can be combined with a single unit cost per vehicle-kilometer applied to all trains to yield a compensation level..

In theory, such a cost would vary by train composition and train speed (see Figures 4.7 and 4.8) but adopting an average cost based on an average service should mean that any deviation from a service-by-service costing would be minimal.

In summary, the immediate priority for UZ is to find an approach to PSOs which is acceptable to all parties and compliant with the railway Law and the Accession Agreement. Strategies to improve passenger service and operating efficiency need to be longer-term and, in most cases, will require continuing investment in rollingstock and passenger facilities.