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National integrated cycle timetable (KZCRJ)

Abstract: The article discusses the role of the timetable as part of the commercial offer in public transport in comparison with broadly understood concept of the commercial offer in the economy. The influence of deficiencies of transportation offer on the perception of rail transport and the development of competing services was described. Article describes the idea of a stable, integrated timetables and features that make the timetable may be classified as a cyclic and integrated. The potential benefits of the transport system, which brings stabilization of the timetable were shown.

Keywords: railway operations, integrated timetable, passenger rail service.

Introduction

The transport service in regular public transport is characterized by the fact that it can only be consumed by the customer at the same time as its execution. This feature puts the public at a competitive disadvantage compared to private transport and taxi services. Especially in the case of a one-off occurrence of an unforeseen need for transportation, the transport service is carried out, adjusted in time and in relation to satisfying this need in the best possible way. On the other hand, in the case of public transport, unfortunately, the way of realizing the customer's transport needs has to be adapted to the existing offer on the market. So if you do not have the time and the desired train/bus/tram/ferry... etc., then the transport needs or is not met - the potential customer will give up the journey or his transport needs will be met by the individual transport - take a taxi or ask someone to pick up the car.

The timetable describing the connections, hours and frequency of the journey is therefore what characterizes the transport offer in public transport. Local government entities organizing public transport and ordering services in the area are often not aware of the link between a well-structured timetable and the perception of public transport by local communities, including the popularity of this transport. Popularity is directly attributable to the costs of its organization: the more passengers there will be, the greater will be the coverage of the cost of organizing ticket sales.

A timetable is a commercial offer available to potential customers. The term "sales offer" is understood as "an offer for the sale or purchase of goods or services, specifying the material terms of the future purchase contract" [4]. In the case of a transport service, the offer is for a transport service, described by publicly available timetable and ticket price. However, it is possible to find common characteristics characterizing the commercial offer, both in transport and, for example, in the retail trade. Both the timetable and the assortment of goods can be characterized by the features that make up the analogy between seemingly distant segments of the economy such as public transport and retail. The following table summarizes the features of the transport offer and the commercial offer, together with a brief explanation of their significance for the customer.

Tab.1. Characteristics of the transport offer and the trade offer

Feature of the transport offer	Feature of the trade offer	Meaning for customer
The frequency	Variety of goods and brands in the assortment	There are several products on the shopping list that decide on having to visit another store, the lack of connections at the right time decides to use another means of transport.
Hours of operation	Opening hours of the shop	Availability of the offer. In the closed shop we do not do shopping, from the closed train station, which in the given hours do not leave, we will not make a trip.
Punctuality and reliability of the transport service	Quality of goods	Quality of the offer. The customer will not buy again the poor quality, just as he/she will not want to go by unpunished and unreliable means of collective transport.
connections directness	Sales of piece, trays or by weight	Availability of the offer tailored to individual needs of particular customer groups. People waiting for convenience or reduced mobility prefer direct connections. Just like in a store they prefer to buy a product once a week, rather than buying one every day.
Stability of the transport offer	Rozmieszczenie grup towarów na terenie sklepu	A store that does refurbishments on the shelves every few weeks, cause irritation and vice versa by regular customers. Similarly, frequent changes to the timetables do not serve the customer to make regular trips

Having a good trade offer, both in transport and in retail, meets the needs of our customers. The shortages in this offer cause a retreat from services and the creation of a complimentary offer. As in the 1980s, the response of the emerging free market to the shortages in the retail trade was the boom of the market, so in the 1990s, in response to the deteriorating public transport (PKP, PKS) transport, small transport companies, that filled the niche after the withdrawn trains and buses.

Where there is a good rail offer and an acceptable travel time for entrepreneurs wishing to earn on road passenger transport, they have nothing to look for. An example is Zwardoń, which reaches 12 pairs of trains during the day and only two bus routes of a local, private carrier in the day. Similarly, on the route Katowice - Czechowice Dziedzice, where the travelers have at their disposal as many as 22 pairs of regional trains, there are no direct bus connections. However, where the train runs 2-3 times a day and its journey time does not encourage travel - you can see a rich offer of bus carriers. For comparison: Strzyżów in the Podkarpackie Province: 2.5 pairs of trains, and 42 (forty-two!) bus connections in the day, of which 10 accelerated. Zakopane: 4 pairs of regional trains per day and over 60 (yes, sixty!) Bus routes of several carriers together in the same relation.

Desired passenger characteristic of the timetable is its stability. The client is accustomed to the fact that the train which he commutes to work daily commutes to the city 20 minutes before the start of the train, and the train, by which he visits the family every year at the other end of the country, set off in the same way for years, e.g. in the morning.

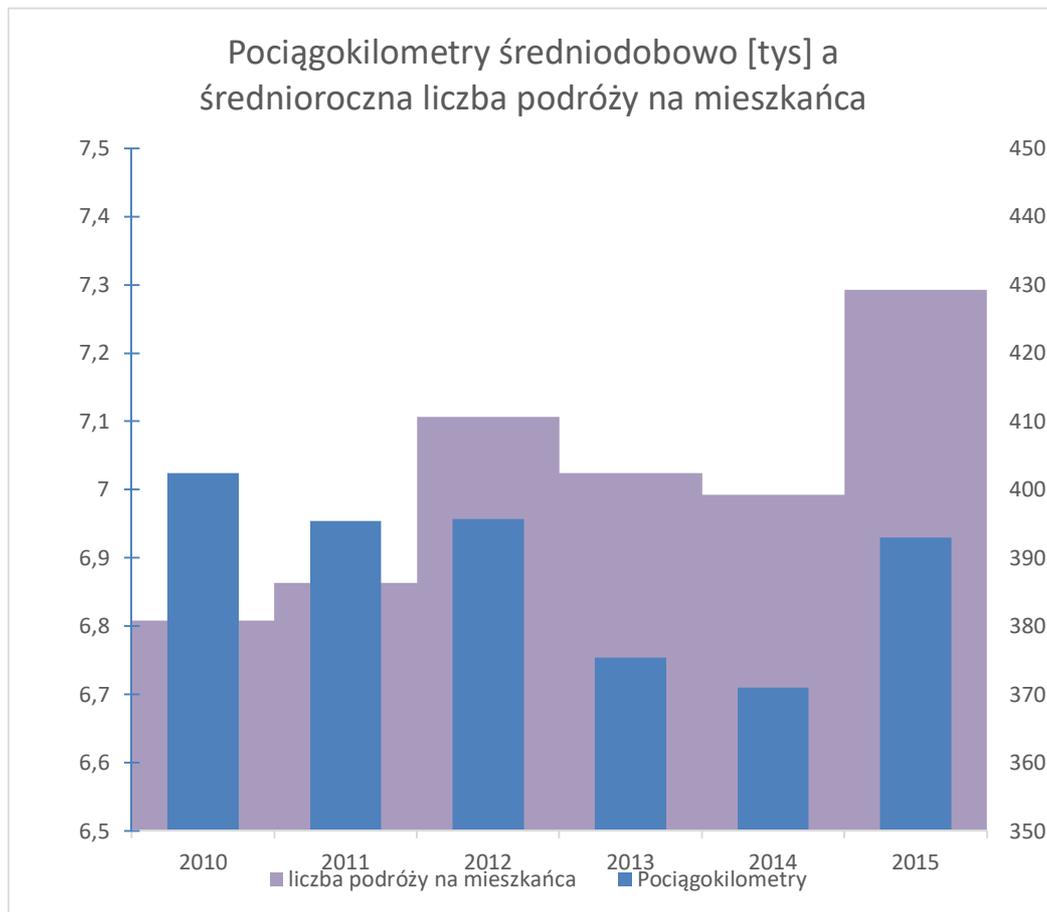
Meanwhile, based on observations of variability station, nationwide timetable could also be drawn such conclusions:

- every year in Poland 7 new cities are established,
- about 3 million people migrate between provinces,

- Residents of some provinces never spend their holidays on the Polish seaside, and the mountains are visited only by the inhabitants of certain provinces,
- every year disappears 35 deserted villages from the map,
- about one million people leave Poland permanently.

Of course, these are not true statements. However, by following up the views of the annual train timetable and changing the schedules during the year, you can start wondering whether you are sure. For many years, the annual train timetable was published in book form, with minor changes throughout the year, but now we have come to such a state that the operation of a national timetable resembles a kaleidoscope, and a single train can perform in a yearly schedule in a dozen or so, and sometimes even dozens of different variants of running and not running [5].

Quantitatively the offer can be characterized by the number of train-kilometers. This is not a very reliable indicator as the quality of the transport offer may vary, but the comparison of operating variability in subsequent years according to the UTK data [8] with the average number of rail journeys per passenger allows to track the convergence during the worsening of the transport offer. in 2012-2014 with a decrease in the average number of trips per capita. The comparison is shown in the graph:



1. Comparison of operating work with average annual travel per capita

In the years 2010-2012 we observe an increase in the average number of rail journeys by a Polish resident, despite a noticeable drop in operating activity. The significant decline in operating activity in 2013 and 2014 relative to 2012 is accompanied by a much lower decrease in interest in rail. The year 2012 cannot be decisive, because due to the European

Football Championship, which took place in Poland, with a slight increase in operating work, transport increased. 2015 is a breakthrough, it can be seen that with the increase and improvement of the transport offer, the number of trips per capita is growing.

The timetable determines the availability and quality of the transport offer. The available and good transport offer makes the customers have more opportunities to meet their transport needs by means of collective transport. The national, integrated cyclical timetable is a response to passengers' expectations to ensure that the transport offer is good and available.

Defining a national integrated cycle timetable

National - that is, throughout the country, all carriers who carry out transport on the basis of the transport plan of the appropriate level.

Integrated - that is, covering all rail carriers and other means of communal, county and regional transport, linked in integration nodes with rail transport through guaranteed interconnections. The integrated cyclic timetable usually has symmetry, which means that if arrivals of trains depart from a certain direction n minutes before full hour, trains depart in the same direction n minutes after full hour [1].

Cyclical - that is, in which departures of means of transport are carried out at equal intervals, which are either a multiple of multiples or an hour multiplier (which means that the timetable for the bus running every 27 minutes, even though the flight takes place at equal intervals, will not be cyclical). Pursuant to §2 (1) of the Regulation on conditions for access and use of railway infrastructure [2], the cyclic timetable is characterized by the following characteristics:

- at least 4 trains in one day from at least one station depart at hours with a fixed minute tip
- the distance between the given train and the previous or next train running in the cycle is no more than 4 hours
- train parameters allow for the development of a timetable of approximately the same time.

Why "domestic"? It is often mentioned in the media that passengers did not arrive for the purpose of their journeys due to broken communications, canceled train or lack of cooperation between carriers in the event of a disturbance on the railway network. Arranging and integrating the timetable at a national level can greatly reduce such extremely unpleasant situations. This also undoubtedly has other advantages - the skeleton of a nationwide timetable provides a solid basis for linking bus timetables for regional carriers and even for public transport.

An integrated and cyclical schedule is one in which trains at nodes meet at a full hour and 30 minutes after the full hour and at selected nodes at 15 and 45 minutes after a full hour [7]. The introduction of such a scheme for regional and long-distance connections in Europe was Switzerland. A cyclically integrated timetable at a national level was introduced in 1982 [6]. It is also no accident that in Switzerland the average number of rail journeys per capita is highest in Europe and the second in the world.

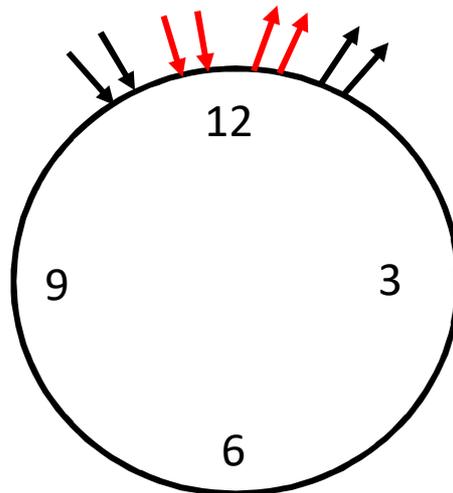
An integral part of the cyclic, integrated timetable is that the driving times between the nodes of the network are, as far as possible, multiples of 30 minutes [3]. Then the synchronization of trains on nodes is possible.

An integrated (but not cyclical) distribution system where trains from all directions meet at a single stop so that after a few minutes of traveling, providing a replacement for

travelers, it has a much longer tradition. In the most minimalist case, trains from all directions met at the local node station (e.g. Pruszcz Bagienica) three times in a day, already in the 60s of the last century [9]. At that time, no one had ever thought of motor simulators and computer systems to compile a timetable.

Taking into account the findings of the study of the motivation of travel, it can be stated that in the case of regional and agglomeration transports, commuting to school and work may exceed 50% of the total passenger flow [9]. With this in mind, the thesis on the superiority of qualified traffic over daily commutes to school and work should be overturned. Therefore, by creating a national, integrated cyclical timetable, the skeleton of the cycle should be transported and repatriated to regional centers of employment and education. Their priority over a long haul and even qualified transport can be justified not only by the cost of social benefits but also by the comprehensive understanding of the importance of rail transport as a whole for the national economy. The situation when the high-speed trains traveling twice a day interfere with the cycle of trains should be avoided. That bring daily masses to work and school. With a properly structured, cyclic timetable, the upper-class train route will be able to run at any hour without disturbing the operation of regional connections.

It is also worth noting the synergy effect: well-functioning, tailored to the needs of everyday commuters, the train timetable also encourages them to take advantage of the extraordinary travel, tourist and business travel. Everyday commute to work and school by rail should be subordinated to the integration and cyclicity of all types of trains. Well-functioning regional transport provides travelers with long-haul and vice versa. The long-distance train is scheduled to depart from the junction station a few minutes after arriving at this station regional trains from all directions and bus services to the train station. Similarly, a few minutes after the arrival of a long-distance train, trains, and buses departing from the junction of the train depart for the arrivals of passengers to smaller towns. Layout of trains in KZCRJ at the junction station is shown below (color black regional trains, red trains long distance).



2. Timetable of train arrivals and departures in a cyclically integrated timetable

The transport schedule should be adapted to the size of the regional center. If this is a city that for 15 minutes you can walk on foot across and across, the arrival of a train to school classes a few minutes after seven is a misunderstanding. In such centers, it is advisable to seek a cycle of 15 and 45 minutes after the full hour. Like the arrival of the train 10 minutes before

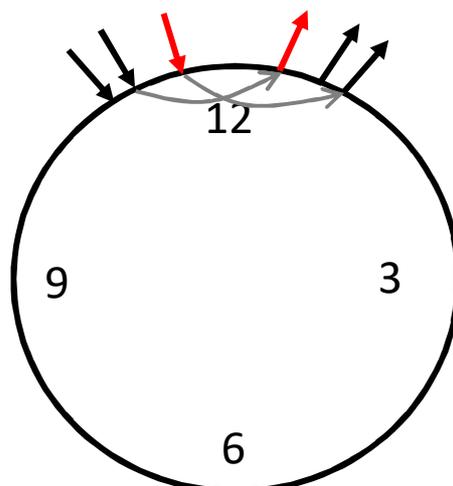
the sixth to the city, where from the train station to the factory district is 15 minutes by bus city. It is therefore advisable for larger centers to have a cycle organized around 30 minutes after full hour.

The implementation of the national, integrated cyclical timetable is conducive to the reduction of transit times resulting from the implementation of revitalization and modernization works, and it baffles paradoxically - the process of realization of these works. Therefore, the implementation of the integrated timetable should go hand in hand with the multi-annual planning of modernization works on the national railway network, and take into account these works in the annual timetable.

Integrated cyclic timetable and low crowded lines.

Does the "national integrated cyclic timetable" mean that every route must run at least every hour? Of course not. There are times in the day when the demand for transport falls in a noticeable way. You can assume that it is between 9 am and 1 pm, when all the working and learning people have already arrived at work/study places and have not started yet. During these hours of departing from the hourly rate for calls every 2 hours, it should not be considered as "empty shelves", and with a limited budget of the transport organizer, providing hourly tactics at peak morning and afternoon hours even at the expense of a four hour break in distribution is more favorable than the release the same money for six pairs of trains in the same day running every 2 hours. The definition of the cyclic timetable given in Regulation [2] extends even the maximum sequence of successive trains in a cycle of up to 4 hours.

On many railways, the regional traffic gap can be filled by long-haul trains, which will reach their target stations just in times of reduced regional traffic. This solution has been used for many, many years until the separation of trains from Regional Transports [3]. The integrated timetable allows for a very easy "jump" of the long-distance train into the regional route, as well as the other way - the promotion of the regional connection to long-distance at the junction. Passage of the long-distance train to the regional route and vice versa is shown in the illustration.



3. The opportunity to go on long-distance routes and regional vice versa in an integrated cyclic timetable

However, this requires a good cooperation between the carriers. Here we are talking about tariff integration, whose conditions and examples have been discussed in a separate paper.

Summary

The implementation of the national, integrated cyclic timetable on the railway network in Poland - not only on the PKP PLK network but also other traffic managers, will solve the most important problems faced by rail travelers and attract new customers who have used it very rarely or never. Establishing regional bus and bus timetables for national distribution, backed up by tariff synergies through synergies, will provide mutual "transfer" of passengers between transport subsystems, rather than as before - competition between rail and bus transport.

The most important social and image benefit for railways is that once the KZCR is developed and implemented, the media on "railroad change" will only say once. And they should never again scare away potential travelers, i.e. seasonal and annual changes to their timetables, often depriving travelers of a convenient connection that they have already become accustomed to. The ZCRJP skeleton should be set once in a long time and any changes resulting from planned closures should not affect the departure time of trains from the starting station to maintain the cycle at least during departure times.

Source materials

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