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The Ability to Restore Railway Traffic on the Route of Jelenia Góra–Karpacz/Kowary

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This article discusses the reason for the suspension of railway traffic on the Jelenia Góra - Karpacz route. The possibility of reactivating the transport on this route was indicated. Based on the equation of the train movement, calculations of the theoretical travel were carried out, as a result of which the technical and total travel time were determined. A rational interval of train runs was determined and a timetable was proposed, taking into account relations going beyond Jelenia Góra. The article justifies the need to introduce supplementary connection operated by electric buses. The concept of reactivating traffic in this area should be supplemented with the construction of a P + R car park. The possibility of further development of the transport system in the discussed area was also proposed.

1. INTRODUCTION

The turn of the millennium was a difficult period for railways in Poland. Local railway lines - due to the shortage of light rail buses and, consequently, the high operating costs of trains consisting of a diesel locomotive and carriages, and also - due to the deteriorating technical condition of the infrastructure, determining the reduction of permissible speeds - were subject to the process of degradation and, consequently, the traffic on them was mounted. The transport tasks were taken over by road transport which is particularly harmful to the natural environment. Fortunately, however, after the closure of the railway line No. 308 and the railway line No. 340, serving the Karpacz area, the railway lane was not developed in such a way that it would not be able to be accessible, so it is possible to restore railway traffic on the route in question. Moreover, modern, light, energy-saving multiple units have appeared on the market, easily overcoming significant hills on the analysed route.

In addition to restoring traffic on the above-mentioned railway lines, this article also proposes the electrification of the route (by 1945 the line had already been electrified [1]) and the launch of supplementary transport based on electric buses between the Karpacz railway station and Karpacz Górny (Bierutowice) and between Mysłakowice and Kowary. Such pro-ecological activities find their justification in the sustainable development policy pursued by the European Union and its members, and are also desirable in the era of electromobility. The situation in Zakopane also speaks in favour of the electromobility of passenger transport in this region, the effects of smog contradict the idea of tourism development and proper rest. The Jelenia Góra Valley should do everything to avoid a similar situation.

In the area of the analysed lines No. 308 and No. 340, tourist traffic is intensively developing, hotel and leisure facilities are being built. Karpacz - like Zakopane - suffers from inefficiencies in the road system, and its peripheral location (on the country border) makes it a transport excluded centre. The restoration of passenger rail traffic would allow for a change in this negative state and would attract Polish and German tourists to the area of Karpacz, both for one-day or weekend stays, and for longer trips.

The transport system of Karpacz struggles with considerable overload during the holiday periods, cars parked in narrow streets make it difficult to move around and do not allow you to enjoy the charm of the resort. Karpacz's further development as a holiday resort is hampered by the shortage of parking spaces. The arrangement of the P + R car park in the immediate vicinity of the railway stop on the initial section of the Jelenia Góra - Karpacz line will allow to reduce the number of cars entering the town, allow access to the Jelenia Góra Valley by private means of transport, leaving it and continuing the journey by train.

Moreover, it is indicated that the new Mysłakowice Dolne stop is justified in km. 7 + 360. The above-mentioned action is desirable due to the urban development of the areas located along the railway line and, consequently, the necessity to extend the influence of rail transport to new buildings.

Ultimately, the possibility of restoring railway traffic to Kowary is also indicated, and - in order to improve transport services in the area - it is proposed to consider the construction of a new, four-kilometre railway line from Kowary to Karpacz.

In the era of electromobility and the implementation of the assumptions of the sustainable development policy - especially in areas with high recreational and tourist values - it would be advisable to base passenger traffic on environmentally friendly means of transport. For this reason, the project of revalorization combined with the electrification of the line and the construction of the *Park & Ride* car park seems to be justified.

2. THEORETICAL RIDE

The basis for the development of transport solutions, especially the timetable, are traction calculations based on the equation of vehicle motion.

These calculations, the so-called a theoretical or minimal-time trip, allow to determine the course of changes in vehicle speed as a function of its traction properties and external conditions. On its basis, it is possible to determine the technical travel times of individual sections, which are necessary to propose the timetable, and also to determine the energy consumption and estimate the possibilities of its recovery in the case of using electrodynamic braking.

The basis for these calculations is the train motion equation (1).

$$m \cdot k \cdot \frac{dv}{dt} = p(v,S) \cdot Q \qquad (1)$$

where: k - rotating mass coefficient, for a loaded train, $k = 1.06$, m - train mass [*kg*] (m = 172,000 kg), Q - train weight [*kN*], p - unit acceleration force [*N/kN*], which consists of a combination of unit forces: driving *f (v)*, braking *b (v),* train resistance in *(v)* and resistances resulting from the reduction of the railway line $i_m(S)$.

The considerations assume that passenger traffic will be based on 31WE newag impuls electric multiple units. These are modern units operated by Koleje Dolnośląskie S.A. in the amount of several dozen. in Legnica.

2.1 DRIVING FORCE

Driving force *F* is the driving tractive force of a traction unit. Its value is variable as a function of speed, it is called the traction characteristic (Fig. 1).

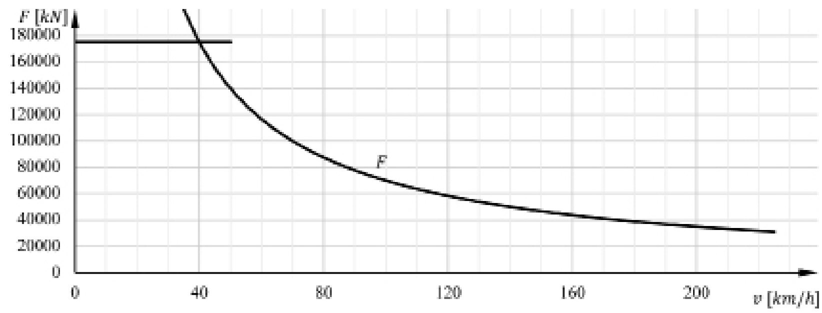

Fig.1. Traction characteristics of the 31WE Electric Multiple Unit / Diagram of tractive effort for a electric multiple unit 31WE

Source: Own study based on the data provided by Koleje Dolnośląskie S.A. in Legnica

In traction calculations we use the unit driving force (2) expressing the tractive force related to the weight of the unit expressed in [*kN*] [3].

$$f = \frac{F}{Q} \left[\frac{N}{kN}\right] \quad (2)$$

2.2 BRAKING FORCE

The calculations assume that the braking force is given by the formula (3).

$$B = \mu_i \cdot m \cdot N_i \ [kN] \quad (3)$$

where: μ_i- friction coefficient between the friction lining and the brake disc, m - number of brake linings in the vehicle, for 31WE m = 40, N_i - pressure of the friction lining on the brake discs

After Sawczuk and Jüngst, the dependence of the friction coefficient μ_i as a function of speed for a disc brake was assumed [4]. This dependence is illustrated in Fig. 2.

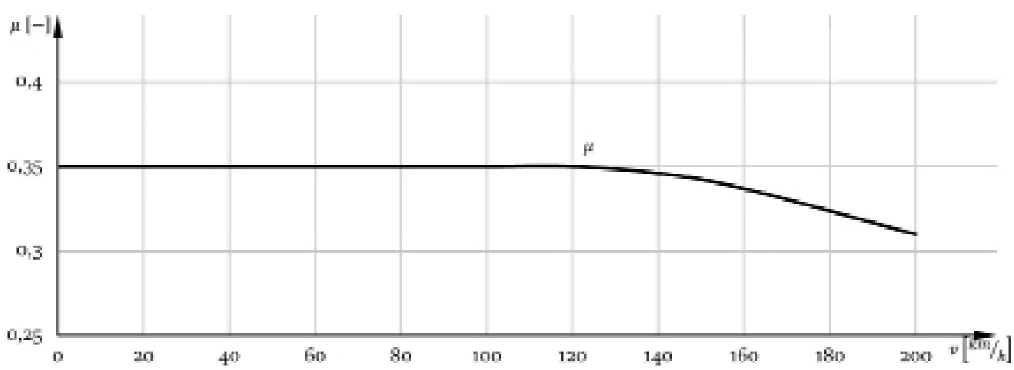

Fig. 2. The value of the coefficient of friction between the friction lining of a disc brake and the disc as a function of speed /

Source: [4]

The pressure of the friction lining on the brake discs is determined from the formula (4).

$$N_i = N_{nom} \cdot \xi_i [kN] \tag{4}$$

where: N_{nom}- nominal pressure on the lining, N_{nom}= 17.16 [kN], ξ_i- pressure drop coefficient for a given braking stage.

The pressure drop factor for a given braking stage is calculated from the formula (5).

$$\xi_i = \frac{\Delta p_i}{\Delta p_{maks}} \tag{5}$$

where: Δp_{maks}- pressure drop in the main line during emergency braking, Δp_{maks}= 0.5 [MPa], Δp_i - pressure drop in the main line for individual braking stages, braking was applied in the case of the theoretical run full (2nd degree) - Δp_2= 0.22 [*MPa*].

In order to be able to take the braking weight into account, the concept of the unit braking force defined by the formula (6) is introduced.

$$b = \frac{B \cdot \delta}{Q} [N/kN] \tag{6}$$

where: δ - percentage of braking weight, Q - train weight [*kN]*

The braking weight percentage is determined using the formula (7).

$$T = \sum_{i=1}^{n} (t_j + \tau_j), \tag{7}$$

where: ε - braking weight [*kN*] expressed by the formula: $\varepsilon = m_h \cdot Q$, braking weight of the train 31WE is $m_h = 281[t]$

2.3 BASIC MOVEMENT RESISTANCES

Calculations of the traction resistance of the multiple unit were based on the recommendations developed at the Railway Institute in Warsaw (formerly CNTK) given in [5]. They determine the resistance to motion as a square function (8) of velocity (Fig. 3).

$$W = 0{,}67 \cdot v^2 + 25{,}8 \cdot v + 2618[k \tag{8}$$

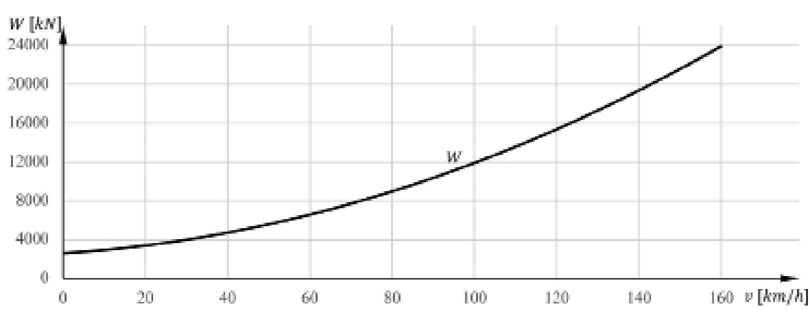

Fig.3. Graph of the resistance to motion of the vehicle 31WE as a function of speed

Source: own elaboration

2.4 ADDITIONAL MOVEMENT (PROFILE) RESISTANCES

In order to perform the calculations, the profile of the analysed railway line was reduced by reducing the rise and fall as well as the curves of the tracks. The so-called profile resistance [6].

For the reduction of resistance to motion in curves, the relationship (9) [3] was adopted.

$$i_ł = \frac{\sum l_ł \frac{690}{r_ł}}{\Delta l} [‰] lub \left[\frac{N}{kN}\right] \quad (9)$$

where: $l_ł$- arc length at a given reduction step $[m]$, $r_ł$- arc radius $[m]$, Δl - reduction step value $[m]$.

The reduction of a railway line consists in adding up the values of all local resistances occurring at a given step of the route reduction (10). Figure 4 shows the profile of the analysed line.

$$i_m = i_w + i_ł [‰] \quad (10)$$

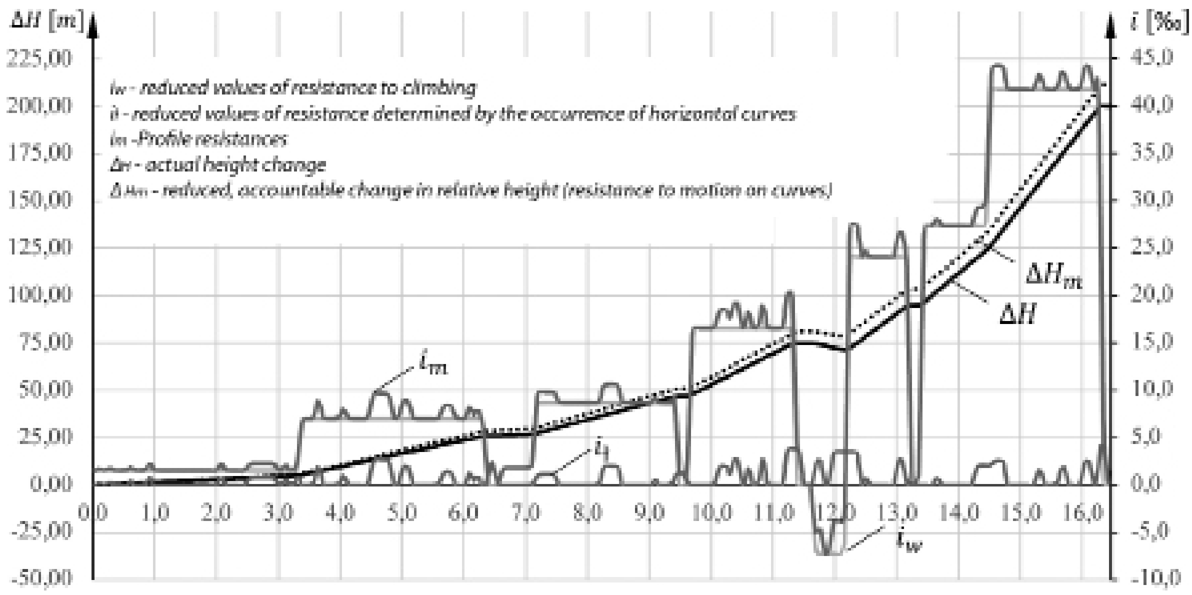

Fig. 4. Reduction of railway line Jelenia Góra – Karpacz
Source: own elaboration

2.5 CALCULATIONS OF A THEORETICAL RIDE

The calculations assume that the train will move with the maximum speed v = 60 [km / h]. A fragment of the calculation results is shown in Fig. 2.5. The calculations were made for the entire route Jelenia Góra - Karpacz there and back.

The performed calculations showed that the time needed by the traction unit to cover the route to Karpacz (without stopping time, but taking into account the stops and acceleration) was 18.77 [min], the return journey: 18.80 [min].

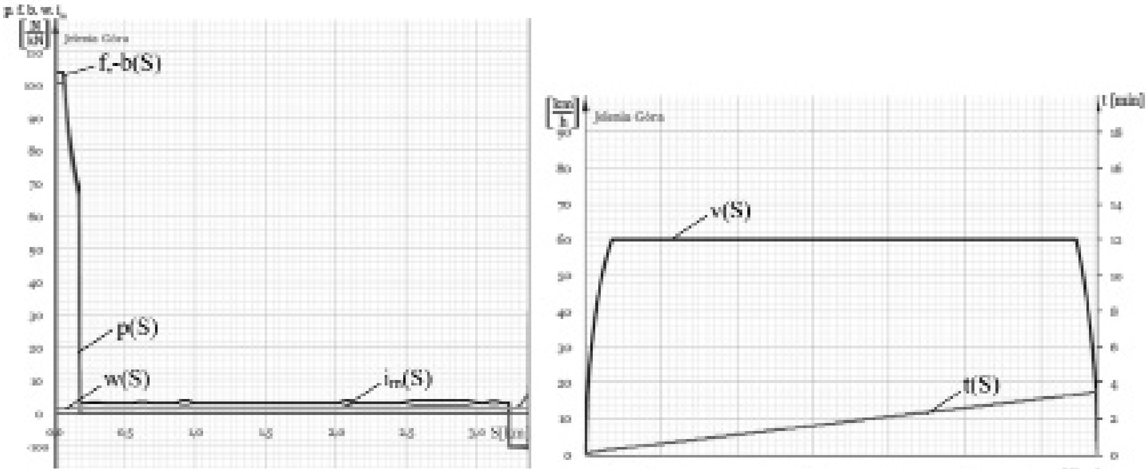

Fig. 5. Portion of theoretical ride 31WE emu from Jelenia Góra to Łomnica Średnia

Source: own elaboration

3. SUGGESTED TRANSPORT OFFER

3.1 SCHEDULED TIME OF A RIDE

The implementation of the theoretical journey leads to the determination of the technical travel time of the train, determining the timetable to the greatest extent. According to the Instruction [7], it constitutes the A component of the train's travel time. The operational reserve is component B (for a passenger train it is 5 [min] for every 100 [km] of travel). Component D, on the other hand, is the sum of stopping times at stops and intermediate stations, however the minimum commercial stopping time for an electric multiple unit is 0 ^ 3 [min]. The total, scheduled travel time of a train in the Jelenia Góra - Karpacz and Karpacz - Jelenia Góra directions is presented in Table1

Table 1 Travel time for route Jelenia Góra – Karpacz

Line section		Travel to Karpacz				Travel to J. Góra			
		A	B	A+B	D	A	B	A+B	D
		[min]	[min]	[min]	[min]	[min]	[min]	[min]	[min]
Jelenia Góra	Łomnica Średnia	3^{7}	0^{1}	3^{8}	0^{3}	3^{7}	0^{2}	3^{9}	-
Łomnica Średnia	Łomnica Dolna	1^{7}	0^{1}	1^{8}	0^{3}	1^{8}	0^{1}	1^{9}	0^{3}
Łomnica Dolna	Łomnica	2^{0}	0^{1}	2^{1}	0^{3}	2^{0}	0^{1}	2^{1}	0^{3}
Łomnica	Mysłakowice Dolne	1^{6}	0^{1}	1^{7}	0^{3}	1^{6}	0^{1}	1^{7}	0^{3}
Mysłakowice Dolne	Mysłakowice	2^{3}	0^{1}	2^{4}	0^{5}	2^{3}	0^{1}	2^{4}	0^{3}
Mysłakowice	Mysłakowice Orzeł	1^{4}	0^{1}	1^{5}	0^{3}	1^{4}	0^{1}	1^{5}	0^{5}
Mysłakowice Orzeł	Miłków	3^{0}	0^{1}	3^{1}	0^{3}	3^{0}	0^{1}	3^{1}	0^{3}
Miłków	Karpacz	3^{5}	0^{2}	3^{7}	-	3^{4}	0^{1}	3^{5}	0^{3}
	Σ	19^{2}	0^{9}	20^{1}	2^{3}	19^{2}	0^{9}	20^{1}	2^{3}
	Σ	-	-	22^{4}		-	-	22^{4}	

Source: own elaboration

The analysis showed that the scheduled minimum travel time for a train in the Jelenia Góra - Karpacz route is $t_T = 22{,}4[min]$ and it coincides with the time needed to cover the return route.

3.2 ROUTE CAPACITY

The minimum time needed to make the trip back and forth is equal to the value given by the formula (11).

$$t_m = \sum t_{j_i} + \sum t_{j_j} + \sum_{k=1}^{n} t_{p_{1k}} + \sum_{k=1}^{n} t_{p_{2k}} + \sum_{l=1}^{n} t_{z_l} + t_r[min] \quad (11)$$

where: n - number of intermediate commercial stops, t_{j_i}- travel time between stops on the way there [min], t_{j_j}- travel time between stops on the way back [min], $t_{p_{1k}}$- time of stops between stops on the way there [min], $t_{p_{2k}}$ - time of stops between stops on the way back [min], t_z - duration of train front changes [min], t_r- time reserve compliant with the guidelines contained in [7] [min].

In the considered case of the route from Jelenia Góra to Karpacz, the minimum time needed to travel there and back, after inserting the designated data into formula (2.11) and taking into account the six-minute time needed to change the train front, is t_m= 56.8 [min]. This means that it is possible to run trains cyclically in a sixty-minute cycle.

In the event of an increase in traffic on the analysed route, a half-hour cycle can be introduced - this solution would require reconstruction of the so-called road in Mysłakowice. a passing loop, enabling trains to pass on a single track.

3.3 ASSUMPTIONS FOR THE TIMETABLE

The basic route is the shuttle route Jelenia Góra - Karpacz - Jelenia Góra. Moreover, during periods of increased tourist traffic (holidays, holidays, long weekends) it is planned to run trains on the route extending beyond Karpacz - to Wrocław. Launching connections also with Węgliniec should be considered at a later stage.

It is reasonable for trains to run from approx. 5.00 to approx. 22.30. These times - specific turning points - are determined by the working hours in the workplace. An important factor is also the need to ensure connections with Jelenia Góra for students.

From the point of view of tourist traffic, it is particularly desirable that it is possible to arrive at the place of rest in the late morning (around 10.00 a.m.) and return from there around 6.00 p.m. Setting the time frame as above allows the residents of Wrocław, located about 140 [km], to conveniently arrange one-day and weekend trips.

3.4 THE SUGGESTED TIMETABLE

On a working day, it is proposed to put into operation a total of 18 pairs of trains in the Jelenia Góra - Karpacz - Jelenia Góra shuttle route, which translates into operational work of 592.56 [km]. It is planned to carry out trips in one hour, the first connection would be made from the Jelenia Góra station before 5.00, the last arrival at the destination station is expected after 23.00.

On non-working days, 12 pairs of trains are expected to run on the Jelenia Góra - Karpacz - Jelenia Góra route and one pair of connections on the Wrocław Główny - Karpacz - Wrocław Główny route. The operational work will decrease in relation to the working day to the level of 427.96 [gpm].

The proposed timetable was presented in the form of Table 246 of the Network Train Timetable (Table 2).

Table 2: The proposed timetable in the form of Table 246 of the Network Train Timetable

246 JELENIA GÓRA - MYSŁAKOWICE - KARPACZ

Wrocław Główny	a.							§ X												
Jelenia Góra	p.							§ X												
termin kursowania		B	B		B		B	C										B		B
przewoźnik - kategoria		KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os
informacje dodatkowe																				
numer pociągu		60500/1	60502/3	60504/5	60506/7	60508/9	60510/1	60512/3	60514/5	60516/7	60518/9	60520/1	60522/3	60524/5	60526/7	60528/9	60530/1	60532/3	60534/5	60536/7
JELENIA GÓRA	o.	§ 04:42	§ 05:42	06:42	§ 07:42	08:42	§ 09:42	§ 09:42	10:42	11:42	12:42	13:42	14:42	15:42	16:42	17:42	18:42	§ 19:42	20:42	§ 22:17
Łomnica Średnia	|	§ 04:46	§ 05:46	06:46	§ 07:46	08:46	§ 09:46	§ 09:46	10:46	11:46	12:46	13:46	14:46	15:46	16:46	17:46	18:46	§ 19:46	20:46	§ 22:21
Łomnica Dolna	|	§ 04:48	§ 05:48	06:48	§ 07:48	08:48	§ 09:48	§ 09:48	10:48	11:48	12:48	13:48	14:48	15:48	16:48	17:48	18:48	§ 19:48	20:48	§ 22:23
Łomnica	|	§ 04:50	§ 05:50	06:50	§ 07:50	08:50	§ 09:50	§ 09:50	10:50	11:50	12:50	13:50	14:50	15:50	16:50	17:50	18:50	§ 19:50	20:50	§ 22:25
Mysłakowice Dolne	↓	§ 04:52	§ 05:52	06:52	§ 07:52	08:52	§ 09:52	§ 09:52	10:52	11:52	12:52	13:52	14:52	15:52	16:52	17:52	18:52	§ 19:52	20:52	§ 22:27
Mysłakowice	p.	§ 04:55	§ 05:55	06:55	§ 07:55	08:55	§ 09:55	§ 09:55	10:55	11:55	12:55	13:55	14:55	15:55	16:55	17:55	18:55	§ 19:55	20:55	§ 22:30
	o.	§ 04:55	§ 05:55	06:55	§ 07:55	08:55	§ 09:55	§ 09:55	10:55	11:55	12:55	13:55	14:55	15:55	16:55	17:55	18:55	§ 19:55	20:55	§ 22:30
Mysłakowice Orzeł	|	§ 04:57	§ 05:57	06:57	§ 07:57	08:57	§ 09:57	§ 09:57	10:57	11:57	12:57	13:57	14:57	15:57	16:57	17:57	18:57	§ 19:57	20:57	§ 22:32
Miłków	↓	§ 05:00	§ 06:00	07:00	§ 08:00	09:00	§ 10:00	§ 10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	§ 20:00	21:00	§ 22:35
Karpacz	p.	§ 05:04	§ 06:04	07:04	§ 08:04	09:04	§ 10:04	§ 10:04	11:04	12:04	13:04	14:04	15:04	16:04	17:04	18:04	19:04	§ 20:04	21:04	§ 22:39

termin kursowania		B	B		B										B	C		B		B
przewoźnik - kategoria		KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os	KD - Os
informacje dodatkowe																				
numer pociągu		60600/1	60602/3	60604/5	60606/7	60608/9	60610/1	60612/3	60614/5	60616/7	60618/9	60620/1	60622/3	60624/5	60626/7	60628/9	60630/1	60632/3	60634/5	60636/7
Karpacz	o.	§ 05:11	§ 06:11	07:11	§ 08:11	09:11	10:11	11:11	12:11	13:11	14:11	15:11	16:11	17:11	§ 18:11	§ 18:11	19:11	§ 20:11	21:11	§ 22:46
Miłków	|	§ 05:14	§ 06:14	07:14	§ 08:14	09:14	10:14	11:14	12:14	13:14	14:14	15:14	16:14	17:14	§ 18:14	§ 18:14	19:14	§ 20:14	21:14	§ 22:49
Mysłakowice Orzeł	↓	§ 05:18	§ 06:18	07:18	§ 08:18	09:18	10:18	11:18	12:18	13:18	14:18	15:18	16:18	17:18	§ 18:18	§ 18:18	19:18	§ 20:18	21:18	§ 22:53
Mysłakowice	p.	§ 05:20	§ 06:20	07:20	§ 08:20	09:20	10:20	11:20	12:20	13:20	14:20	15:20	16:20	17:20	§ 18:20	§ 18:20	19:20	§ 20:20	21:20	§ 22:55
	o.	§ 05:20	§ 06:20	07:20	§ 08:20	09:20	10:20	11:20	12:20	13:20	14:20	15:20	16:20	17:20	§ 18:20	§ 18:20	19:20	§ 20:20	21:20	§ 22:55
Mysłakowice Dolne	|	§ 05:23	§ 06:23	07:23	§ 08:23	09:23	10:23	11:23	12:23	13:23	14:23	15:23	16:23	17:23	§ 18:23	§ 18:23	19:23	§ 20:23	21:23	§ 22:58
Łomnica	|	§ 05:25	§ 06:25	07:25	§ 08:25	09:25	10:25	11:25	12:25	13:25	14:25	15:25	16:25	17:25	§ 18:25	§ 18:25	19:25	§ 20:25	21:25	§ 23:00
Łomnica Dolna	|	§ 05:27	§ 06:27	07:27	§ 08:27	09:27	10:27	11:27	12:27	13:27	14:27	15:27	16:27	17:27	§ 18:27	§ 18:27	19:27	§ 20:27	21:27	§ 23:02
Łomnica Średnia	↓	§ 05:29	§ 06:29	07:29	§ 08:29	09:29	10:29	11:29	12:29	13:29	14:29	15:29	16:29	17:29	§ 18:29	§ 18:29	19:29	§ 20:29	21:29	§ 23:04
JELENIA GÓRA	p.	§ 05:33	§ 06:33	07:33	§ 08:33	09:33	10:33	11:33	12:33	13:33	14:33	15:33	16:33	17:33	§ 18:33	§ 18:33	19:33	§ 20:33	21:33	§ 23:08
Jelenia Góra	a.															§ X				
Wrocław Główny	p.															§ X				

Source: own elaboration

4. ORGANIZATION OF THE BUFFER PARKING LOT

The road system of the eastern Karkonosze resorts is struggling - especially during the tourist season - with considerable overload. Parked cars are especially difficult. In connection with the above, it becomes reasonable to arrange the Park & Ride car park located in the immediate vicinity of one of the initial access points to the Carpathian line. It is proposed to arrange parking spaces for 500 vehicles in the first stage. According to the norm provided by Mr Czarnecki in [8], such a car park would take up the area - depending on the used system of parking spaces and internal roads - about 1.2 [ha]. It has been shown by the spatial development analysis that the relevant area is located in the immediate vicinity of the Łomnica Średnia passenger stop.

5. COMPLEMENTARY TRANSPORT

Historical and terrain conditions determined the route of the railway lines No. 308 and No. 340, preventing the railway from reaching all areas with significant population centers, so sometimes a passenger stop or station is located unfavorably, far away from traffic generators, and the access route - from the point of view of potential rail customers - it is excessively elongated.

In order to increase the accessibility to the Jelenia Góra-Karpacz railway connection, in the two cases described above, it is proposed to launch a supplementary bus service (connected with trains) on the following routes: Karpacz (railway station) - Bierutowice - travel time there and back is 32 minutes and Mysłakowice (railway station)) - Kostrzyca - Kowary - travel time back and forth is 26 minutes, so it is possible to extend some of the courses in the direction of the adit.

The use of non-emission electric vehicles (electric buses) should be used to service the above lines.

6. RESTORATION OF TRAFFIC ON THE MYSŁAKOWICE - KOWARY ROUTE AND CONSTRUCTION OF THE KOWARY - KARPACZ LINE

The launch - parallel to the Jelenia Góra - Karpacz connections - of a similar number of pairs of trains running on the Jelenia Góra - Kowary route could generate an oversupply of connections on the route between Jelenia Góra and Mysłakowice. However, arranging transfers at the station in Mysłakowice does not allow rational use of the rolling stock and would be unattractive for travellers. Therefore, one should consider the possibility - following the example of the existing bus network - routing the train route to Karpacz in such a way that it also passes through Kowary. This would require the construction of a single track section of almost four kilometres, connecting the curve in Kowary with the railway line No. 340 between Miłków and Karpacz. The location of the proposed switchgear (in five variants) has been presented graphically (Fig. 6).

Variants 1, 2, 3A and 3B connect Karpacz and Kowary in a traditional way, i.e. maintaining the head station in Karpacz (which is not a problem, as the rolling stock intended for servicing this connection is a two-sided rolling stock). They differ in the way they pass through the village of Ściegny and in the place where the proposed line is incorporated into the railway line No. 340 - the differences are determined by the terrain profile and the presence of population centres.

A different approach was used when developing variant 4. The Mysłakowice - Kowary - Karpacz - Mysłakowice loop was established. Such a solution, however, requires abandoning the resumption of traffic to the existing railway station in Karpacz and the construction of a completely new facility, located north-east of the current one. The decision to build a railway line following the fourth variant requires the construction of a tunnel under Kozi Grzbiet (approx. 160 meters long).

Fig. 6. *The concept of rail route Kowary – Karpacz*

Source: Own elaboration based on [9]

7. SUMMARY

traffic on many local railways. The difficult situation - apart from careless maintenance of the railway infrastructure - was worsened at the turn of the millennium by the shortage of light rolling stock, inexpensive to maintain and appropriate for passenger flows on lines of minor importance.

The travel time along the route which is the subject of this article, both to Karpacz and Jelenia Góra, will be 22 ^ 4 [min]. Thanks to this, it is possible to run trains in a 60-minute cycle.

The proposed timetable provides for the launching of 18 pairs of shuttle trains on a working day, on days off, it is planned to launch 12 pairs of routes on the Jelenia Góra - Karpacz - Jelenia Góra route and one pair of connections on the Wrocław - Karpacz - Wrocław route, arranged in such a way as to enable was even a one-day trip to Karpacz by the inhabitants of Wrocław.

The supplementary connection planned to be launched, based on low-floor, modern electric buses, increases the accessibility to railway services, generating additional passenger flows, especially tourist flows (in relation to Bierutowice) and those related to daily commuting (shuttle migrations) - mainly on the route to Kowary. This connection - due to the use of electric, non-emission rolling stock - will contribute to the improvement of the natural environment of the Karkonosze Mountains.

Ultimately, it seems reasonable to build a link between Kowary and Karpacz.

The restoration of railway traffic on the Jelenia Góra - Mysłakowice - Karpacz route will contribute to increasing the tourist and sightseeing attractiveness of this part of the Karkonosze Mountains, it will positively influence the activation and increase of the mobility of the local community. Revitalization combined with the electrification of the railway line will increase the number of tourists coming to Karpacz.

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