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New passenger rolling stock in Poland

Rail passenger transport in Poland has been bad luck over 20 years. Their decline was caused by insufficient investment both passenger rolling stock and rail infrastructure. As a result, railway offer has become uncompetitive in relation to road transport to the extent that part of the railway sector fell to 4%. Last years, mainly thanks to EU aid funds, condition of railway in Poland has changed for the better. In details, modernization of railway lines have begun, new modern rolling stock have been purchased, which can improve the rail travel quality. However, average age of the fleet has already begun closer to 30 years.

Passenger rail market

It is observed a stabilization in passengers numbers in Poland carried by railway for 10 years. Polish operators transported 270.4 million passengers in 2013, for comparison there were 271.2 million in 2004. However, there has been a large decline in transport volume from 67.5 billion to 62.1 billion passenger-kilometers. During this time, passenger transport in all modes of transport, including increased on average from 5 to 10% per year which had an effect on the dynamic growth of road transport and aviation (especially low cost airlines). As a result, rail market share fell to 4.4% in 2012.

The largest decreases were recorded in long-distance transport, this kind of transport are falling at a rate of about 20% per year last times. Without a doubt, it has an impact on the loss of competitiveness of rail traffic to road transport as a result of large investments in new roads and highways at the same time small rail investment and it is only in the modernization of existing lines. In addition,

these investments as a result of delays caused trouble in operation and the lack of opportunities to improve the services offered.

The best economic condition (relative high stability) are observed for two operators in the Warsaw region: Mazovia Railways (Koleje Mazowieckie – commuter traffic) and Warsaw Agglomeration Railway (Szybka Kolej Miejska SKM – suburban and agglomeration traffic) record annual growth of passengers after a few percent. They also carry out ambitious investment programs in purchases of new rolling stock and Mazovia Railways also thorough modernization of its fleet. SKM is based in mostly on new rolling stock purchased in recent years and still planning new purchases.

Passenger transport market in Poland almost entirely is the subject of contracts Public Service Contract (PSC) of operators with local authorities for regional transport and agglomeration and the Ministry of Infrastructure and Development to interregional transport. In addition to futures is a small group of Intercity Express trains (EIC) between Warsaw and the biggest cities in Poland and a lower category trains like TLK in used on the route Warsaw – Lodz. According to the UTK (Urząd Transportu Kolejowego, Eng. Office for Railway Transport; as at 30 June 2014) licenses to conduct passenger, issued by the President of UTK, had 17 operators, but the passenger rail market is determined actually by 12 main operators with a market share of 99.99%. The liberalization of passenger transport market began in Poland in 2001. Together, forming the basis of PKP two companies: PKP Intercity operating on a commercial basis and PKP Przewozy Regionalne on the basis of contracts signed with local governments (voivodeships). In 2008. PKP

Table 1. Classification of the main passenger operators in the transport market in Poland

Operator	Shares in market* (June 2014)	Holder	Specialization
State			
PKP Intercity	8,92%	PKP S.A. (PKP group), State Fisc	long distance and international traffic
Przewozy Regionalne	29,61%	local governments (16)	regional, long distance, cross border regional
Arriva RP	1,73%	DB Ltd.	regional
Regional			
Koleje Mazowieckie	23,56%	Mazovia voivodeship, Ltd.	regional
Koleje Dolnośląskie	1,27%	Lower Silesia voivodeship, Ltd.	regional
Koleje Wielkopolskie	2,71%	Great Poland voivodeship, Ltd.	regional
Koleje Śląskie	6,01%	Silesia voivodeship, Ltd.	regional
UBB	0,16%	DB Ltd.	regional
Koleje Małopolskie	in preparation	Small Poland voivodeship, Ltd.	regional
Urban			
SKM Warsaw		Warsaw city, Ltd.	urban
PKP SKM Tri-city		PKP SKM Tri-city Ltd, (the PKP group), State of Poland (fisc), Pomerania voivodeship, local authorities	urban
WKD		WKD Ltd. Mazovia voivodeship and local authorities	urban
Łódzka Kolej Aglomeracyjna		Lodz voivodeship, Ltd.	urban

* in terms of number of passengers.



ED250-001 Pendolino PKP IC high-speed train tested on the CMK (17.11.2013); photo: G. Koclega

Przewozy Regionalne were transferred to the local governments in shares proportionate to the size and scale of provinces passenger in them. Some local governments involved in creating their own transport companies. This established operators: Mazovia, Great Poland, Upper Silesia, Lower Silesia, Railways. Small Poland Railways are in preparation now.

A separate category create new rail operators (agglomeration traffic) and new companies have been created since 2001:

- ◆ PKP SKM in Tricity (Gdansk, Gdynia and Sopot); as rail operator in the metropolitan area of the Gulf of Gdansk,
- ◆ Warsaw Light Rail, operated on route Warsaw – Grodzisk Maz, with separated line and rolling stock.

SKM Warszawa formed in 2005 and its trains are used on routes like Pruszków – Warsaw – Otwock, Warsaw West Station – Sulejowek Milosna. The company started to operate a new relationship, including the Okęcie in Warsaw and Modlin airports and to Legionowo in subsequent years. The Lodz Metropolitan Railway (Lodzka Kolej Aglomeracyjna, LKA) was created in June 2014. The intention of the local government of Lodz is the program of creation an integrated transport system in the metropolitan area in Lodz.

Preparations for similar projects in Krakow and Szczecin agglomeration have also been undertaken.

Rolling stock of polish passenger operators at the end of 2012:

- ❖ Electric locomotives – 412,
- ❖ Diesel locomotives – 244,
- ❖ Electric Multiple Units – 1216,
- ❖ Diesel Multiple Units – 206,
- ❖ Passenger couches – 3170,

The average age of cars and electric multiple units in 2013 was about 28 years.

Rolling stock for the long-distance trains

Operator PKP Intercity assumes that by 2020 in its own a train restructuring strategy every train (locos, couches) will be new or upgraded. The strategy assumes that at first, new and modernized rolling stock will be directed to upgraded to a speed of

160 km/h railway lines. Currently operated by PKP Intercity fleet is primarily electric locomotives with a top speed of 125 km/h and couches with a maximum speed of 160 km/h but produced mainly in the years 1970–1992. Number of electric locomotives with a maximum speed of 160 km/h is small and amounts to 49 pieces. 10 locomotives Siemens – built new generation, multi-voltage (3 kV DC; 15 and 25 kV AC) have a top speed of 200 km/h. Also couches with a maximum speed of 200 km/h are used in rather small amount – about 50 ones.

With increasing length of the line with a maximum speed of 160 km/h time of need has become acquisition of vehicles likely to use their technical parameters.

One of them is the route Przemyśl – Cracow – Katowice – Wroclaw – Poznan – Szczecin, which is currently in modernization phase. For this line will be upgraded

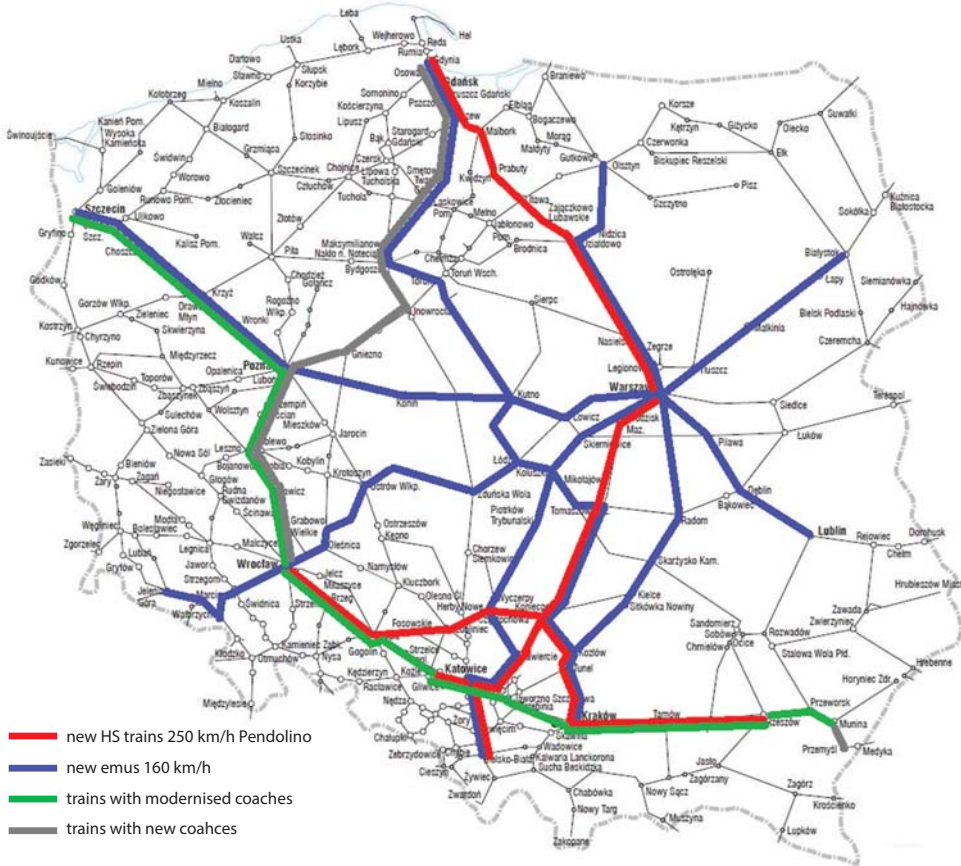
218 couches by the end of 2015, which will be compiled about 23 trains. Typical their summary of the wagons 1 and 2 class compartments and no-compartments, bar and night trains sleepings and couchettes. The first cars came into operation in 2014. Implementation of the project will enable the launch target connections on this route hour cycle.

Delivery of 25 passenger couches Z type, manufactured by Cegielski Poznan, will be completed in 2014. These couches, combined 4 trains, will be used on route Wroclaw – Poznan – Bydgoszcz – Gdynia.

PKP Intercity flagship investment is the purchase of 20 high-speed trains based on the Pendolino ETR610 class made by Alstom. Purchased vehicles have been not equipped in a mechanism for tilting the body because they will run the lines on flat ground. Speed (250 km/h) of these trains will allow the full use of the technical possibilities of Central Railway (CMK), now modernized. In the first stage, the maximum speed of 200 km/h will be achieved from 2015. Trains will run on routes Cracow / Katowice / Wroclaw – Warsaw – Gdynia. Delivery of these trains is currently in progress and they will be exploited from the new timetable from December 2014. Pendolino trains will be the first high-speed



Modernized PKP IC couches in fast train Przemyśl – Cracow at Jaroslaw station (17.08.2014); photo: M. Graff



Routes planned for the new PKP Intercity rolling stock
 Source: data from PKP Intercity presentation PŚ, Dec 2013.

trains in Poland. Manufacturer will maintain these trains under contract for 17 years, pursuant to the contract.

Lack of locomotives with a maximum speed of at least 160 km/h was the cause of the decision of a wide introduction the EMUs instead current long-distance trains (locomotives+couches). It was developed a concept of low cost trainset for 350 passengers, including 60 in first class and 150 m long. Trains would be combined in double traction as required. Every new EMUs comfortably furnished for the journey no longer than 6 hours, will be equipped in a bar and adapted for journeys for people with limited mobility. Trains will operate the route with an average attendance of passengers between major cities in Poland and as complement the high-speed train Pendolino (ETR610).

The first 20 EMUs will be delivered the end of 2015 by the consortium of Stadler and Newag (j.v.) and they will be used on the routes:

- Cracow – Lodz – Poznan – Szczecin,
- Katowice – Lodz – Bydgoszcz – Gdynia,
- Cracow – Kielce – Warsaw – Olsztyn,
- Warsaw – Bydgoszcz,

The second batch of 20 EMUs will be provided by Pesa and used on the routes:

- ❖ Jelenia Gora – Wrocław – Lodz – Warszawa – Białystok / Lublin,
- ❖ Bielsko-Biala – Katowice – Warsaw – Białystok / Lublin.

Both manufacturers also received contracts for the maintenance of these units for 15 years.

PKP Intercity is also investing in the diesel locomotives fleet. Trains hauling by diesel locomotives represent a small part but many of them go to the tourist resorts in the mountains and the

sea. For these trains has ordered new 10 locomotives with a power of about 2 MW and a maximum speed of 140 km/h. They will be delivered by Pesa in 2015.

Moreover 20 shunting locomotives will be modernized in three versions:

- ◆ 10 locomotives will be reconstructed for a 2-motor with a total power of 1 MW and equipped with a heating unit of couched. These locomotives will be used to carry light trains on secondary lines, especially in the tourist season. It will serve also as shunting locomotives, in addition.
- ◆ 5 locomotives will be converted into a hybrid with the ability to ride on the battery with the engine off combustion. They will be used in largest rolling stock maintenance facility in Warsaw Grochow.
- ◆ 5 locomotives will get new engines and will be used as shunting ones.

Purchasing of 10 double deck EMUs (trains of high capacity) for the most congested routes Warsaw – Lodz in Poland is also planned in the years 2016–2020. In addition, upgrading 250 passenger cars, 10 multi-voltage locomotives with maximal speed of 200 km/h for international traffic and the subsequent modernization of shunting locomotives.

Electric multiple units used as regional and agglomeration

Purchases of new electric multiple units for regional traffic are carried out by regional governments. EU aid funds are used for the finance of them, mainly at regional level. Since 2006 he has ordered circa 300 new multiple units, of which the producers have already provided circa 180 units. Local governments transferred the purchased fleet in the use of operators, like a national company PR (Przewozy Regionalne) according the signed contracts or their own created operators (Table 1). Polish rail market is dominated by three manufacturers: Pesa Bydgoszcz, Newag Nowy Sacz and Stadler (plant in Siedlce near Warsaw).

The first modern vehicles made by Pesa were combustion-powered vehicles, intended for local traffic. It was a high demand there for similar vehicles: in the early 90s the number of light vehicles for was determined to be about 200 units. Local lines were operated by diesel locomotives and couches, previously used in long-distance traffic, and it was rather a temporary solution. Pesa designed motor cars equipped with a hydraulic transmission, and in the construction of similar vehicles this manufacturer had no experience (as well as other Polish producers). Alternately experimenting and producing, and learning from their mistakes, Pesa has gained experience in the manufacture of rolling stock combustion, which was later used in the production of electric rolling stock, hitherto dominated by old-fashioned and ubiquitous EN57. The first Pesa-built vehicles electric appeared a few years after the debut of diesel motor car (2001). They were a series of PKP PR EN59 and EN95 for WKD (Warsaw Light Rail, Warszawska Kolej Dojazdowa), both ordered as one copy. New vehicles passed the children disease, but the ven-

dor experience in the construction of both series, used in the design of the next series of vehicles – ED74 class, purchased by the PKP PR in the number of 14 units, with financial support of EU. Series ED74 was originally used Warsaw – Łódź trains, but quickly found out that the characteristics of the vehicles do not fully correspond to overcome the distance over 130 km in the time over 1.5 h. Pesa also designed electric railcars series EN81, as alternative for EN57 class, especially on lines with less traffic. However, the number of vehicles sold EN81 series did not exceed 10 units.

Successive Pesa-built vehicles offered to operators, became vehicles from Elf family, or electric-low-floor (vehicle). As mentioned earlier, similar ones were built for circa half the voivodeships, to new operators established by local governments with the participation of PKP PR. The operators like Mazovia, Upper Silesia, Great Poland, Lower Silesia, Metropolitan Railway of Lodz, Warsaw Agglomeration Railway (SKM Warszawa) are working now, but Small Poland Railway is in preparation. Creation of similar operators in others voivodeships in Poland, like Podkarpackie, Lublin, Warmia-Mazury, Podlasie, Świętokrzyskie or Lubusz is difficult, due to the lack of a strong central site in the region, as well as significantly less favorable economic situation in comparison with the previous group of provinces. These companies took over most of the new rolling stock, or otherwise resources allocated by governments for the purchase of rolling stock. The specific situation occurs in Warsaw, where due to the favorable economic situation of local authorities and the capital to invest in park-and-ride project, which encourage people to leave their private cars at parking at stations located in the satellite cities of Warsaw and using of rail transport (KM, SKM). Such a system allows the additional possibility of cheaper rail vehicle leasing and not just a purchase. Advantage is a good availability of each of the districts of Warsaw, the use of rail transport (railways plus underground). The advantage in turn begins to be the fact that an increasing number of private cars causes rapid depletion of the capacity of roads and new highways. Additionally, renovation and modernization of railway infrastructure, cause picking up speed, and thus the capacity of railway lines and modern fleet is an additional argument in favor of rail. Versatility Elf vehicles family can show an example of this family of vehicles ordered by SKM and KM, respectively, six – four section. The first of them well



Elf of SKM Warszawa 27WE-011 at Legionowo station (19.05.2012); photo: M. Graff



Impuls of Upper Silesia Railway (Koleje Slaskie) 35WE-007 at Katowice station (21.04.2013); photo: M. Graff



Flirt 3 of LKA as regional train to Sieradz, leaving Lodz Olechow station (29.06.2014); photo: M. Jerczynski



Flirt of Upper Silesia Railway (Koleje Śląskie) EN75-003 leaving Katowice station (12.07.2013); photo: M. Graff

suitable for use lines within the cities and towns located within the Warsaw agglomeration, and the second – when traveling longer distances. Elfs of SKM and KM dominate the service lines running to the airports in Warsaw – Okęcie and Modlin, last one modernized with the help of funds and proceeds from the EU. Both KM and SKM direct new vehicles to service lines that have been upgraded – for example, the domain of Flirt is the line service to Siedlce and Elfs – to Ciechanów (section modernized line Warsaw – Gdansk).

Operator with most modern rolling stock is Warsaw SKM, which operates both vehicles manufactured by Pesa (Elf) and Newag (19WE, 35WE) plus upgraded EN57 to form 14WE. These vehicles are exploited on several lines – S1 (Pruszków – Warsaw – Otwock), S2 (Warsaw – Chopin Airport – Warsaw Downtown (Śródmieście) – Sulejówek Miłosna), S3 (Warsaw – Chopin Airport – Warsaw – Central – Legionowo) and S9 (Warszawa Zachodnia (West) – Warszawa Gdanska – Weliszew). Operation of new vehicles on upgraded lines – Warszawa Wschodnia – Sulejówek / Legionowo allows fuller advantage of the new vehicles compared to when the service would be conducted EN57 – the higher the power of new vehicles, resulting in a more favorable acceleration, can significantly reduce the travel time.

A similar situation is present in Great Poland voivodeship, which decided to purchase 22 Elfs, four section, adapted to handle regional traffic. All vehicles were passed to Great Poland Railways. The preferred location of Poznań – on the line Warsaw – Berlin, upgraded to a speed of 160 km/h already in the 90s, and recently the line to Bydgoszcz by Inowrocław (for the same speed), causes the higher the speed of the Elfs in comparison with EN57 can be easily seen. Elfs go until stations like Zbaszynek (west of Poznań), Gniezno (northeast) and Kutno (east). Although the number of 22 vehicles seem to be significant, the regional government seriously consider the possibility of buying or upgrading next vehicles: Noteworthy modernization was carried out of the railway in the Poznań agglomeration including main station and local lines to Wagrowiec (completed) and Wolsztyn (not completed yet).

An interesting project seems to launch suburban railway network between Bydgoszcz and Toruń (BiT project). Since the

distance between the two cities is approximately 50 km, and to provide connections in fact half an hour, enough for the purchase of about 5 vehicles Elf, four section (now delivered 2). In addition, the line between the two cities has been revitalized to a speed of 120 km/h (upgrading to a speed of 160 km/h is planned later). BiT trains run between stations Bydgoszcz Główna (west station), and Toruń Wschodni (east station).

The Silesian government has purchased a significant number of Elfs emu, six and four section, plus Flirts manufactured by Stadler, single copies of Impus or SA138 (combustion motor unit) and acquired second-hand combustion-powered vehicles in the Netherlands and Germany. Newly created Silesian Railways hired their own

Elfs mainly to service main line Gliwice – Katowice – Zawiercie – Częstochowa, as well as on the side lines – to Wisła or Żwardon. The specificity of the Silesian agglomeration is that most of the railways has run the parallel, therefore, relatively easy for traveling east – west, and moving in a north–south requires longer transfers. In addition, the low speed on each line (except for Gliwice – Częstochowa) caused not only by years of under-investment in infrastructure, but also by mining causes that the railways have difficulty in being competitive to the private car or bus.

Small Poland government decided to buy the Acatus 2 vehicles, a budget version of Elf, and ordered Acatus Plus and Impuls emus, differing among others lack of compliance with the standards of the collision. These units are used on Oswiecim – Cracow – Wieliczka line, and Cracow – Tarnów / Nowy Sącz / Zakopane. However, unsatisfactory state of infrastructure within the Cracow agglomeration does not allow advantage of new rolling stock, and in addition, contributes to the shortening of periods two next repairing. Line, where you can freely move with the speed of 100–120 km/h, is the line of Cracow – Tunnel (– Warsaw / Kielce). Lines like Cracow – Tarnów – Rzeszów or Cracow – Sosnowiec (–Katowice) are currently in phase modernization, with scheduled completion in late 2015., and circa 2020. modernization requires a railway network in Cracow agglomeration, to form performed similarly as in the case of a railway network in Poznań one.



Push-pull double decker coaches of Mazovia Railway at Warsaw West; station (6.05.2012); photo: M. Graff

Table 2. Modern electric and diesel motor units purchased by rail operators in Poland in 2004–2013*

Operator	Producer	Type / Model**	Trade mark	Number of section in EMU	Class	Number of emus contracted	Number of emus delivered	Years of delivery or putting in operation
Koleje Dolnośląskie	Newag	31WE	Impuls	4	31WE–001÷005	5	5	2013
		36WE		3	31WEa–011	6	1	2014
Koleje Mazowieckie	Stadler	Flirt**	Flirt	4	ER75–001÷014	10	10	2008
	Pesa	22WEe	Elf	4	EN76–010÷025	16	16	2011
Koleje Śląskie	Stadler	Flirt**	Flirt	4	EN75–001÷004	4	4	2008
	Newag	35WE	Impuls	6	35WE–007	1	1	2012
	Newag	36WE	Impuls	3	36WEa–008÷010	6	3	2014–2015
	Pesa	22WE	Elf	4	EN76–001÷008	8	8	2011
	Pesa	22WEb	Elf	4	EN76–009	1	1	2011
	Pesa	27WEb	Elf	6	27WEb–001÷006	6	6	2013
Koleje Wielkopolskie	Pesa	22WEa	Elf	4	EN76–026÷047	22	22	2012–2014
Łódzka Kolej Aglomeracyjna***	Stadler	Flirt 3**	Flirt	2 (3)	no data	20+10	6	2014–2015
PKP IC	Pesa	ED74	Bydgoskia	4	ED74–001÷014	14	14	2007–2008
	Alstom	Pendolino**	Pendolino	7	ED250–001÷020	20	13	2013–2014
	Stadler+Newag	Flirt 3**	Flirt 3	8	no data	20	0	2015
	Pesa	Dart	Dart	8	no data	20	0	2015
PR (Zakład Łódzki)	Pesa	15WE/16WE	Acatius	3	EN59–01	1	1	2006
PR (Zakład Małopolski)	Pesa	308B	–	1	EN81–001,002, 005÷008	6	6	2005, 2007
PR (Zakład Świętokrzyski)	Pesa	308B	–	1	EN81–003, 004	2	2	2005
	Pesa	34WE	Elf	2	EN96–001÷004	4	4	2005
PR (Zakład Warmińsko–Mazurski)	Pesa	21WE	Elf	3	EN62–001	1	1	2012
	Newag	37WE	Impuls	2	no data	1	0	2015
Szybka Kolej Miejska w Warszawie	Newag	19WE	–	4	19WE–01÷04	4	4	2008–2010
	Pesa	27WE	Elf	6	27WE–001÷013	13	13	2011
	Newag	35WE	Impuls	6	35WE–001÷006	6	6	2012
	Newag	35WE	Impuls	6	35WE–008÷010	3	3	2013
województwo lubuskie	Newag	31WE	Impuls	4	no data	2	0	2014–2015
województwo małopolskie	Pesa	32WE	Acatius 2	4	EN77–001÷005	5	5	2010–2011
	Newag	36WEa	Impuls	3	EN94–001÷004	6	4	2014–2015
	Pesa	40WE	Acatius Plus	3	no data	6	0	2014
	Pesa	41WE	Acatius Plus	2	no data	4	0	2014–2015
województwo podkarpackie	Newag	36WE	Impuls	3	EN63–001	2	1	2013, 2015
	Newag	37WE	Impuls	2	EN98–001÷002	2	2	2014
	Pesa	40WE	Acatius Plus	3	EN62	2	0	2014
województwo świętokrzyskie	Newag	36WE	Impuls	3	EN64–005÷007	6	3	2014–2015
województwo kujawsko–pomorskie	Pesa	22WE	Elf	4	EN76–048÷052	5	2	2014
województwo zachodniopomorskie	Newag	31WE	Impuls	4	ED78–001÷008	12	8	2013–2015
Warszawska Kolej Dojazdowa	Pesa	13WE	Mazovia	4	EN95–01	1	1	2004
	Pesa	33WE	–	3+3	EN97–001÷014	14	14	2011–2012
	Newag	no data	no data	3+3	no data	6	0	2015–2016
Total	–	–	–	–	–	298	190	–

* modern rail vehicles are defined as equipped in asynchron traction motors and maximal speed above 120 kph;

*** 20 two-section EMUs have been ordered by LKA, with possibility elongation to three section, and increasing of vehicle number to summaric 30 ones;

The Impuls emus of Lower Silesia Railway – 5 ones purchased and 6 next ordered, are exploited on the line E30 (Zgorzelec –) Węglińiec – Legnica – Wrocław (– Opole), upgraded line to the speed of 160 km/h, and travel time has been shorten in consequence. In addition, the modernized line Wrocław – Walbrzych – Jelenia Góra is also a place of the Impuls exploitation, and it will be in near future also the line Wrocław – Leszno – Poznań. At the moment, the whole of modern rolling stock (electric and combustion) purchased by local authorities has been transferred to the carrier

Railways Lower Silesia. Region such as Podkarpackie, West Pomerania, Świętokrzyskie, Lubusz, Warmia–Mazury also purchased a number of modern electric multiple units. Accordingly, the Podkarpackie the line Rzeszów – Przemyśl has been revitalized on the stretch Rzeszów – Przeworsk – Munina (adapting to the speed of 120 km/h) and a line Przeworsk – SW Rozwadów, the latter is expected to revitalize. A similar situation occurs in the West Pomerania province: local government bought 12 four sections emus (now delivered 8), which run from Szczecin to Słupsk, Poznań and Swino-

ujscie. The condition of these lines can be described as satisfactory, but speeds above 100–120 km/h is currently not possible. It should be noted that Impuls' ordered by the province Lubusz will overcome similar route compared with the Impuls' of West Pomerania – from Poznan to Krzyz. Similarly, rolling stock purchased by the province Swietokrzyskie, because of the condition of infrastructure around Kielce, requiring repair (lines Kielce – Sedziszow / Skarzysko Kamienna – Ostrowiec Swietokrzyski), is unlikely to affect the reduction of the current travel time. Modest procurement by province Warmia and Mazury only one enus has been purchased, and the next one ordered, can be treated only as a prelude to further orders.

Least favorable to the state contracts for modern electrical units ordering in the provinces Opolskie, Podlasie and Lubelskie, which is not even ordered one copy of new vehicles for regional traffic. Similarly, in the Pomeranian province – where of the modernization of the Warsaw – Gdansk (adapting to the speed of 160–200 km/h) is in the final phase, and this line would be ideal place of exploitation of modern vehicles in regional traffic, complementing prepared courses of Pendolino high speed trains (planned inauguration in December 2014.) on route Gdynia – Warsaw – Cracow / Katowice. The only currently implemented plans to modernize the rolling stock in the Pomeranian province is a deep modernization of the rolling stock SKM (light railway in Tricity), Gdansk – Sopot – Gdynia – Reda – Wejherowo, with some train courses elongated to Slupsk or Tczew (plus purchase of combustion rolling stock for the Pomeranian Metropolitan Railway).

Very ambitious plan to modernize its own railway infrastructure was developed in Lodz after many years of neglect, railways within the Lodz agglomeration are upgraded (to a speed of 120 km/h), to the level of the line Lodz Kaliska – Koluszki – Warsaw, modernized a few years ago to maximum speed of 140 km/h. At the same time a of new generation fleet has been purchased – offered by Swiss Stadler Flirt emus, two section, with future elongation until three section ones. Vehicles will be transferred to the operator the Lodz Agglomeration Railway, and a service center is under construction near the station Lodz Widzew. Emus of LKA will be exploited on lines within the Lodz agglomeration – to Sieradz, Koluszki, Zgierz and Kutno. It should be added that at present, a new station Lodz Fabryczna, located completely underground (the old station was demolished), which will be



SA133-006 as regional train to Kostrzyn at Krzyz station (29.03.2008); photo: M. Graff



SA136-005 at Szczecin Gl. station (5.04.2014); photo: M. Graff



SA138-005 as regional train to Zawiercie (28.02.2014); photo: G. Koclega

come – plans – part of the communications center of Lodz. First 6 emus the Flirt 3 were officially presented on Lodz Kaliska station and inaugurated their own exploitation in parallel with EN57 of PR – on the line Kaliska – Zduńska Wola – Sieradz route in June 2014.

Vehicles with combustion engines for regional traffic in Poland

Currently, around 200 vehicles known as diesel motorcars and diesel multiple units and the least number of rail cars are operated railway network. The first vehicles diesel motorcars Poland-built were manufactured in the late 80s – it was SN81 class produced by the Kolzam Raciborz. In addition, in the early 90s ZNTK Poznan produced several prototype vehicles SA101 and SA102 class, equipped with combustion engines and transmissions made in Poland. However, the then prevalent nationwide economic crisis – lack of orders from PKP and the lack of capital in the Polish rolling stock manufacturers, led the these series the only remaining prototypes. The deficit of financial resources to acquire modern vehicles for PKP also did the Polish rail vehicles market unattractive for foreign carriers producers (their vehicles offered include Stadler in the mid 90s). the reform of local government carried out on the beginning of the XXI century did gradual improvements of the financial situation of the provinces, which were obliged for purchasing vehicles with combustion engines at Polish producers, has caused a chance for domestic manufacturers for receiving contracts for delivering new vehicles. However, they were not existing producers, yet providing for railway rolling stock – H. Cegielski Poznan (diesel and electric locomotives, passenger cars' producer) and Pafawag Wroclaw (electric locomotives producer), only completely new companies – the current ZNTK Bydgoszcz converted in August 2001 r. to Pesa Rail Vehicles in Bydgoszcz Holding SA (Pol. Pesa Pojazdy Szybowe), ZNTK Poznan, dealing with, like the sister company of Pesa – only repairs of rolling stock. Pesa took over ZNTK Minsk Mazowiecki to form the Pesa group in August 2008. One of the existing rolling stock for railway suppliers – Pafawag was taken over by the German company Adtranz (now Bombardier) in 1997, and now this company produces bodies of locomotives, and Cegielski after restructuring, its business profile is the production or repairing of passenger cars.

Another domestic manufacturer Kolzam Raciborz in the 90s based on the trolley WOA–29 vehicles SPA–66 (series SN81) and 208M (SA104 series) as the first modern rail cars designed with families RegioVan (SA107 and SA109 series), which, unlike the originals were already low floor vehicles. The new vehicles by Kolzam used imported: combustion motor and hydromechanical transmission. Soon, power units manufactured vehicles revealed factory defect. Additionally, in 2005. Manufacturer of non-technical reasons disbanded, which complicated maintenance SA107 and SA109 series by operators. Since 2007. Kolzam was took over Hungarian company MAVEX–Record KFT.

In addition, new manufacturers proposed for national operators of family vehicles like Partner type 214M (Pesa) and RegioTramp (ZNTK Poznań). As local governments seek to the maximum cost reduction, manufacturers also only gained experience, and the PKP also not widely exploited in the past similar so many vehicles, so that the all learned from the mistakes.

Unlucky was ZNTK Poznan: after production of several vehicles has dropped their production. With time Pesa expanded range of products for diesel multiple units, two and three-section, experimenting by mounting to vehicles more powerful engines – 500 kW (SA106) or weaker – 350–390 kW (SA103, SA135) and transmission hydraulic or hydro. The youngest Pesa product is diesel multiple units known as Link, first officially presented at the Innotrans in Berlin in 2012, and delivered for rail operators from Germany and the Czech Republic, and the authorities ordered Western Pomerania (2 vehicles) and Lubuskie (4 vehicles), for planned rail service to Germany. For now, Links are tested in Germany, needed for a receiving certificate on network DB (planned at the end of 2014). Seems to be a source of Pesa success to obtain quality certificates in the field of not only production, but also the management of the company, although the Polish legislation does not require explicitly that rail operators from Germany tied to technical discipline, really pay attention to it. Success in Germany, otherwise challenging market, can create for Pesa the way to obtain new contracts in Europe and beyond. Another manufacturer – Newag has also appeared as new rail vehicles manufacturer in Poland (Newag is converted ZNTK Nowy Sacz), dealing with previously renovation of passenger cars, electric multiple units and locomotives. Despite the difficult beginnings, after the acquisition by a private investor in 2003 Newag soon began to gain the contract to vehicles manufacturing: first combustion, and later on electric, too. Newag provided several diesel for the Pomeranian, Opole, Silesia and Lubuskie provinces, from 2010 onwards, and 4 ones for operator Przewozy Regionalne. Newag became the majority owner of shares ZNLE Gliwice in 2008.

The liberalization of rail transport in Poland as the implementation of EU directives resulted in admission and other rail operators to PKP network. One of them was Arriva RP, realizing the transport in several EU countries, for instance, Germany, Denmark, and others. Originally Arriva (Arriva PCC) was a joint-venture company of the German-Polish PCC Rail and Arriva UK. The Arriva was acquired by DB in 2010. Arriva RP won the tender to operate local lines in the province Kuyavian–Pomeranian in the first half of 2013, for 2013–2015, and to this end has acquired vehicles SA106 and SA123 series owned by the government of the Kuyavian–Pomeranian, and additionally purchased diesel multiple units two SA134 class and later 4 vehicles SA133 class. Sometimes motor cars SA106 class are exploited coupled with passive cars (acquired from Ger-



SA139-003 as regional train Gorzow Wlkp. – Zielona Gora at Przylep station (29.03.2014); photo: M. Graff

many), equipped with its own heating source. Arriva RP for a short time (late 2013 and 2014) used on PKP network also two vehicles borrowed from DB Regio Nord-Ost VT 646 class (Stadler; GTW 2/6). Similarly, vehicles GTW 2/6 VT 646 class of German operator UBB (Usedomer Baederbahn) has gone to Poland via built in 2008 1.5 km stretch and reach the end station Swinoujście Centre.

With the Poland accession to EU and the appearance of low cost airlines, many airports have been thoroughly modernized in Poland, and also built new ones (Warsaw-Modlin, Lawica, Gdansk-Rebiechowo, Pyrzowice, Cracow-Balice, Szczecin-Goleniow Lublin-Swidnik and others). Rail connection have been built to some ones, and new railway stations was built at airports. However, Cracow-Balice airport, due to the high popularity of tourist Cracow, and thus a large number of passengers and flights, the rail operator

can provide high frequency of trains, in the case of Szczecin-Goleniow the Lublin-Swidnik, where the number of passengers of the airport / train to the airport is much smaller, the carrier rail is forced to limit the number of courses.

Another situation is present in Gdansk / Tri-City, which decided to build Pomeranian Metropolitan Railway (POM), which is a kind of ring road connecting Gdansk and Gdynia, Sopot without. The line will branch from the main line between stations Gdansk Zaspka and Gdansk Przymorze-Uniwersytet, running to the west, and then connect to the line Bydgoszcz - Kościerzyna - Gdynia (rise 17 km double-track line + 1,4 km single one). One of the POM station is located near the airport Gdansk-Lech Walesa, and the entire railway line will be operated by diesel multiple units. Planned date of inauguration of the traffic on the POM is July 2015.

Table 3. Statistical data of diesel motor units exploited by rail operators in Poland

Owner	class	Producer	Number of ordered dmus	Number of section in dmu	Years of delivery	Operator
Arriva RP	SA123	Pesa	5	1	2009	Arriva RP
	SA133	Pesa	4	2	2012	
	SA134	Pesa	2	2	2007	
	MR+MRD	Düwag/Scandia	7	2	2008-2009 (1978-1985)	
	Y	Waggonfabrik Uerdingen	1	3	2010 (1965-1984)	
	VT 646	Stadler Rail	2	3	2013-2014 (2001-2002)	
Dolnośląskie	SA106	Pesa	1	1	2005	Koleje Dolnośląskie
	SA109	Kolzam	2	2	2004	
	SA132	Pesa	1	2	2006	
	SA134	Pesa	8	2	2008-2011	
	SA135	Pesa	9	1	2010-2011	
Kujawsko-pomorskie	SA106	Pesa	13	1	2002-2007	Arriva RP
Lubuskie	SA105	ZNTK Poznań	4	1	2003-2005	Lubuski Zakład Przewozów Regionalnych
	SA108	ZNTK Poznań	1	2	2006	
	SA133	Pesa	4	2	2006-2008	
	SA134	Pesa	2	2	2011	
	SA137	Newag	1	3	2012	
	SA139	Pesa	4	2	2013	
Lubelskie	SA103	Pesa	3	1	2005-2006	Przewozy Regionalne Zakład w Lublinie
	SA107	Kolzam	2	1	2003-2004	
	SA134	Pesa	8	2	2010 2013	
Małopolskie	SA109	Kolzam	2	2	2004 2005	Przewozy Regionalne Zakład w Krakowie
	SA133	Pesa	2	2	2007	
Koleje Mazowieckie	VT627.0	LHB	2	1	2005-2006 (1974-1975)	Mazowiecka Spółka Taborowa
		MaK	1		2005-2006 (1974)	
	VT627.1	MaK	4	1	2005-2006 (1981)	Mazowiecka Spółka Taborowa
	VT628	Uerdingen, LHB	4	2	2005-2006 (1974)	Mazowiecka Spółka Taborowa
	SA135	Pesa	4	1	2010-2011	Koleje Mazowieckie
	222M	Newag	1	2	2013	Koleje Mazowieckie
Opolskie	SA103	Pesa	3	1	2005 2007	Przewozy Regionalne Zakład w Opolu
	SA109	Kolzam	1	2	2004	
	SA134	Pesa	5	2	2008-2009	
	SA137	Newag	2	2	2010-2011	

Table 3. continued

Owner	class	Producer	Number of ordered dmsus	Number of section in dmu	Years of delivery	Operator
Podkarpackie	SA109	Kolzam	2	2	2004	Przewozy Regionalne Zakład w Rzeszowie
	SA103	Pesa	2	1	2005	
	SA134	Pesa	2	2	2011 2014	
	SA135	Pesa	5	1	2010-2011	
Podlaskie	SA105	ZNTK Poznań	1	1	2004	Przewozy Regionalne Zakład w Białymstoku
	SA108	ZNTK Poznań	2	2	2005-2006	
	SA133	Pesa	8	2	2006 2009 2011	
Pomorskie	SA103	Pesa	2	1	2005	Przewozy Regionalne Zakład w Gdyni
	SA109	Kolzam	5	2	2004	
	SA131	Pesa	1	2	2005	
	SA132	Pesa	3	2	2006	
	SA133	Pesa	0 from 4	2	2015	
	SA137	Newag	2	2	2010	
	SA138	Newag	4	3	2010-2011	
Pomorska Kolej Metropolitalna	SA133	Pesa	0 from 3	2	2015	Pomorska Kolej Metropolitalna
	SA136	Pesa	0 from 7	3	2015	
Sigma Tabor	SN82 (DH1)	Düwag, Cummins, Voith, SIG	5	1	2009 (1983)	Koleje Śląskie
	SN83 (DH2)	Düwag, Cummins, Voith, SIG	3	2	2009 (1981-1982)	
Śląskie	SA109	Kolzam	2	1	2004 2012	Koleje Śląskie
	SA138	Newag	1	3	2012/2013	
	SN84	MAN, Düwag	2	3	2014 ?	
Warmińsko-mazurskie	SA106	Pesa	5	1	2005-2007	Przewozy Regionalne Zakład w Olsztynie
	SA133	Pesa	6	2	2009-2010	
Wielkopolskie	SA105	ZNTK Poznań	1	1	2002	Koleje Wielkopolskie
	SA105	ZNTK Poznań	1	1	2002	Przewozy Regionalne Zakład w Poznaniu
	SA108	ZNTK Poznań	4	2	2005-2007	Koleje Wielkopolskie
	SA108	ZNTK Poznań	3	2	2005-2007	Przewozy Regionalne Zakład w Poznaniu
	SA132	Pesa	11	2	2006-2008	Koleje Wielkopolskie
	SA134	Pesa	2	2	2005-2009	Koleje Wielkopolskie
Zachodniopomorskie	SA103	Pesa	3	1	2005	Przewozy Regionalne Zakład w Szczecinie
	SA109	Kolzam	1	2	2003	
	SA110 SA112	Uerdingen, MAN	14 5	3	2006 (1964-1968)	
	SA136	Pesa	12	3	2010-2011	
	SA139	Pesa	2	2	2012-2013	
	SA135	Pesa	2	2	2013	
Przewozy Regionalne	SN81	Kolzam	5	2	1988-1990	PR Zakład w Łodzi
	SN81*	Kolzam	1	2	1988-1990	LHS (1520 mm)
	SA101	ZNTK Poznań	3	2	1990-1996	Przewozy Regionalne
	SA102**	ZNTK Poznań	3	3	1990-1996	Przewozy Regionalne
	SA104	Kolzam	1	2	1995	Przewozy Regionalne
	SA135	Pesa	1 (2)	1	2013	PR Zakład w Łodzi
	220M	Newag	2 2	2	2014	PR Zakład w Gdyni PR Zakład w Lublinie

* SN81-005 with rail gauge of 1520 mm as inspection vehicle for LHS; SN81-006 written off as consequence of rail accident in October 2013;

** SA102A+SA111+SA102B.