Konferencja Naukowo-Techniczna
”Rozwój Kolei Dużych Prędkości w Polsce”

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Koleje dużych prędkości – trendy światowe i perspektywa polska

Fundusze Europejskie Inteligentny Rozwój
Rzeczpospolita Polska
Narodowe Centrum Badań i Rozwoju
Unia Europejska Europejski Fundusz Rozwoju Regionalnego

1. Najszybsze pociągi 2022/23
2. Historia i teraźniejszość
3. Perspektywy w Polsce
4. Podsumowanie

12. Eurostar e320: 200 mph, United Kingdom
322 km/h

11. Korail KTX: 205 mph, South Korea 330 km/h

11. Deutsche Bahn ICE: 205 mph, Germany
330 km/h

10. Talgo 350, 217 mph, Spain

349 km/h also known as the RENFE AVE Class 102

10. Haramain Western Railway: 217 mph, Saudia Arabia
349 km/h

9. Shinkansen H5 and E5: 224 mph, Japan
361 km/h

in 1964 that the Hikari high-speed train launched service between Tokyo and Osaka

9. AGV Italo, 224 mph, Italy 361 km/h

Alstom AGV. Italo from NTV in Napoli Centrale railway station.

8. Siemens Velaro, 250 mph, Spain 402 km/h

Siemens Velaro

Velaro E, Velaro RUS, Velaro e320, Velaro D, and Velaro CRH3

7. Frecciarosa 1000, 250 mph, Italy 402 km/h

The high-speed train, Frecciarossa 1000 (also known as ETR 1000) at Venezia Santa Lucia (Venice main station) in Italy.

Bombardier built Red Arrow

6. Fuxing Hao CR 400AF/BF, 260 mph, China 419 km/h

G123 CR400AF/BF

high-speed train in 2007, which runs on the Beijing Shanghai high-speed railway line and can travel from Beijing south to Shanghai Hongqiao in just four hours.

5. HEMU-430X, 267 mph, South Korea 429 km/h

HEMU-430X Mockup at Busan Logistics Fair 2013

4. Shanghai Maglev, 268 mph, China 431 km/h

Model of Shanghai Maglev Train in the Train Station; in commercial use since 2003

3. Harmony CRH 380A, 302 mph, China 486 km/h

CRH380A at Shanghai Hongqiao Station

operates regularly between Shanghai and Nanjing

2. TGV POS, 357.2 mph, France 574,7 km/h

SNCF TGV 4417

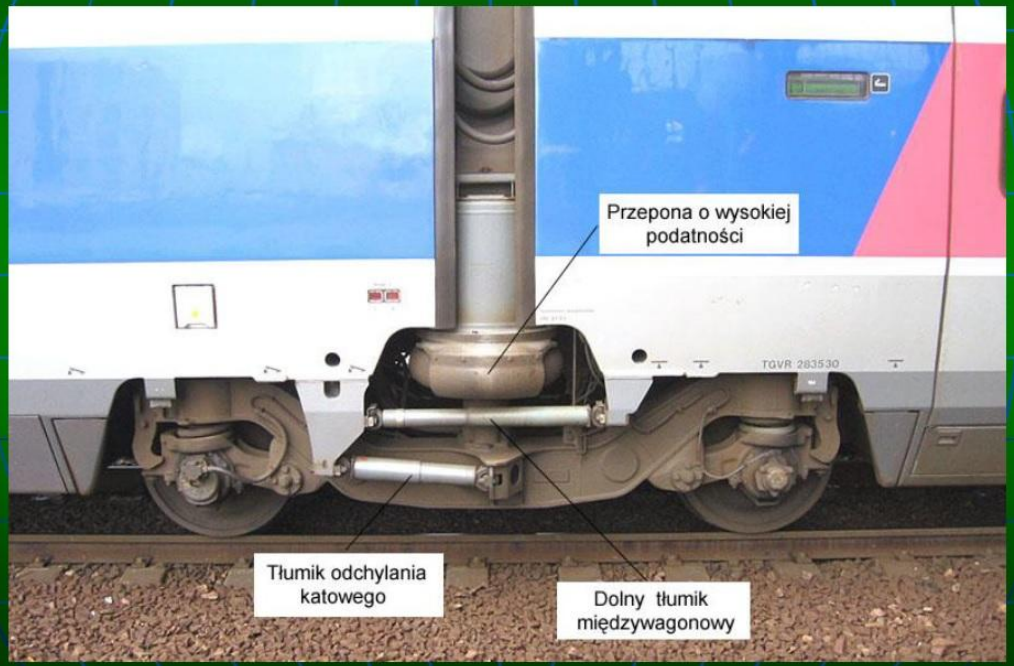
POS 4402, set a new world speed record on April 3, 2007, reaching a top speed of 357.2mph.

Zarys historyczny

- Program TGV zapoczątkowany został już w późnych latach 60-tych.
- Pierwszy prototyp, pociąg TGV 001, rozpoczął testy we wczesnych latach 70-tych. Napędzany był turbiną gazową, 8 grudnia 1972, ustanowił on rekord prędkości 318 km/h.
- 27 września 1981 została otwarta pierwsza linia wysokich prędkości z Paryża do Lyonu.
- 18 maja 1990 TGV ustanowił światowy rekord prędkości 515,3 km/h.
- 3 kwietnia 2007 TGV ustanowił nowy światowy rekord prędkości 574,8 km/h.

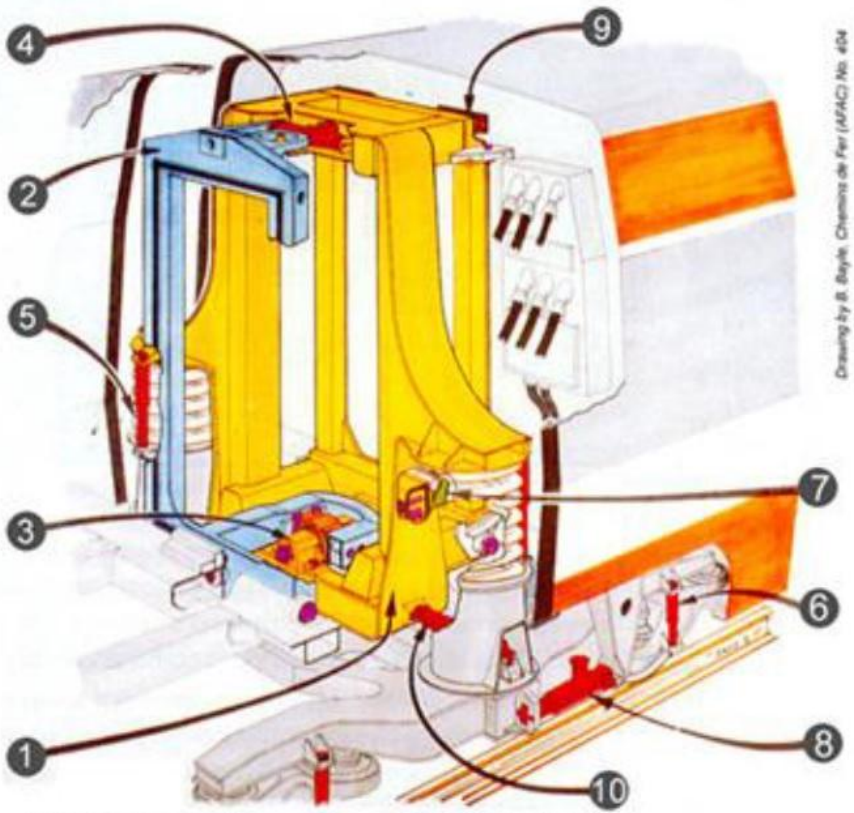
Zestawienie składów

Wózki są umieszczone między wagonami w taki sposób, że każdy z nich przenosi ciężar dwóch sąsiednich wagonów.



Przekrój przegubu i zawieszenia wagonu TGV Sud Est

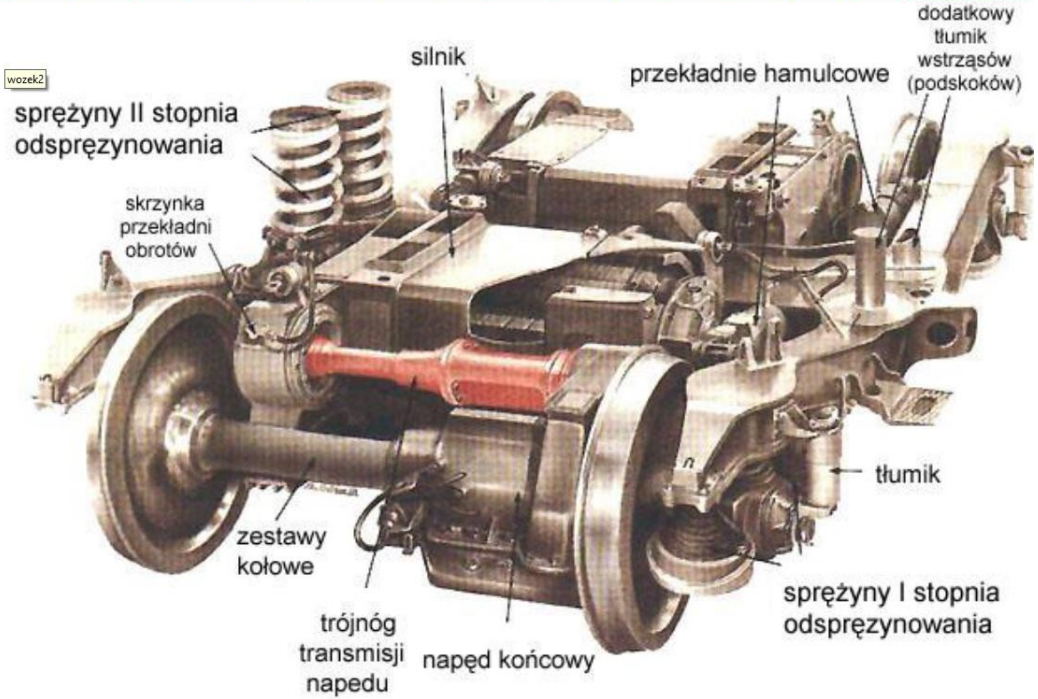
(przed modyfikacją w roku 1983)



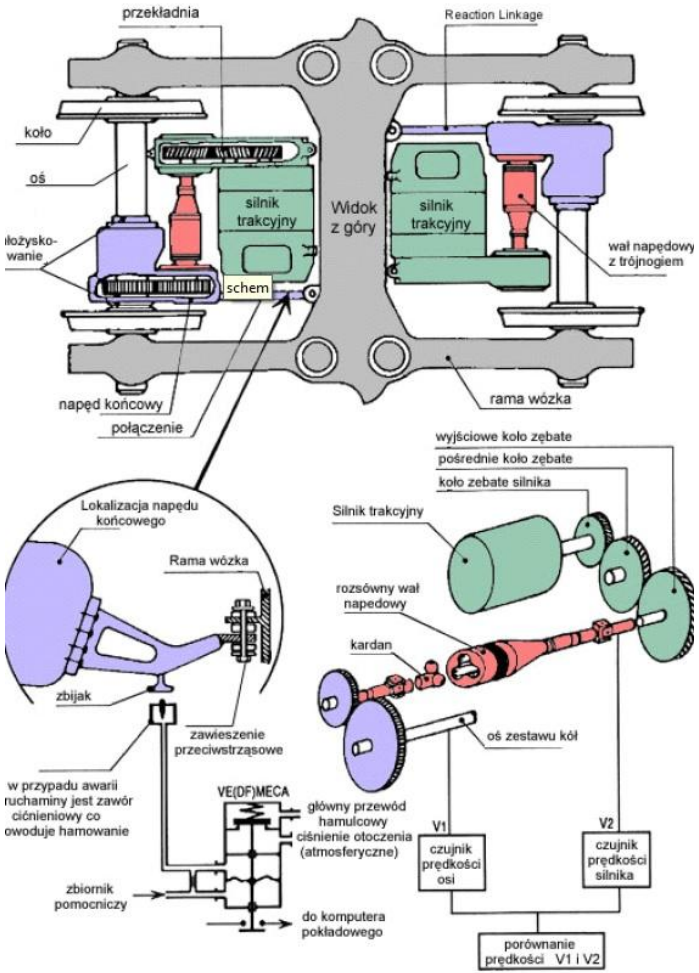
1. Rama nośna (żółta)
2. Rama stała (niebieska)
3. Połączenie kulowe
4. Tłumik
5. Sprężyny amortyzatora
6. Amortyzator osi
7. Zaczep
8. Amortyzator momentu ochyleniowego
9. Amortyzatory gumowe
10. Amortyzator poprzeczny

Odbierak prądu

Budowa wózka TGV



Wózek TGV - transmisja napędu

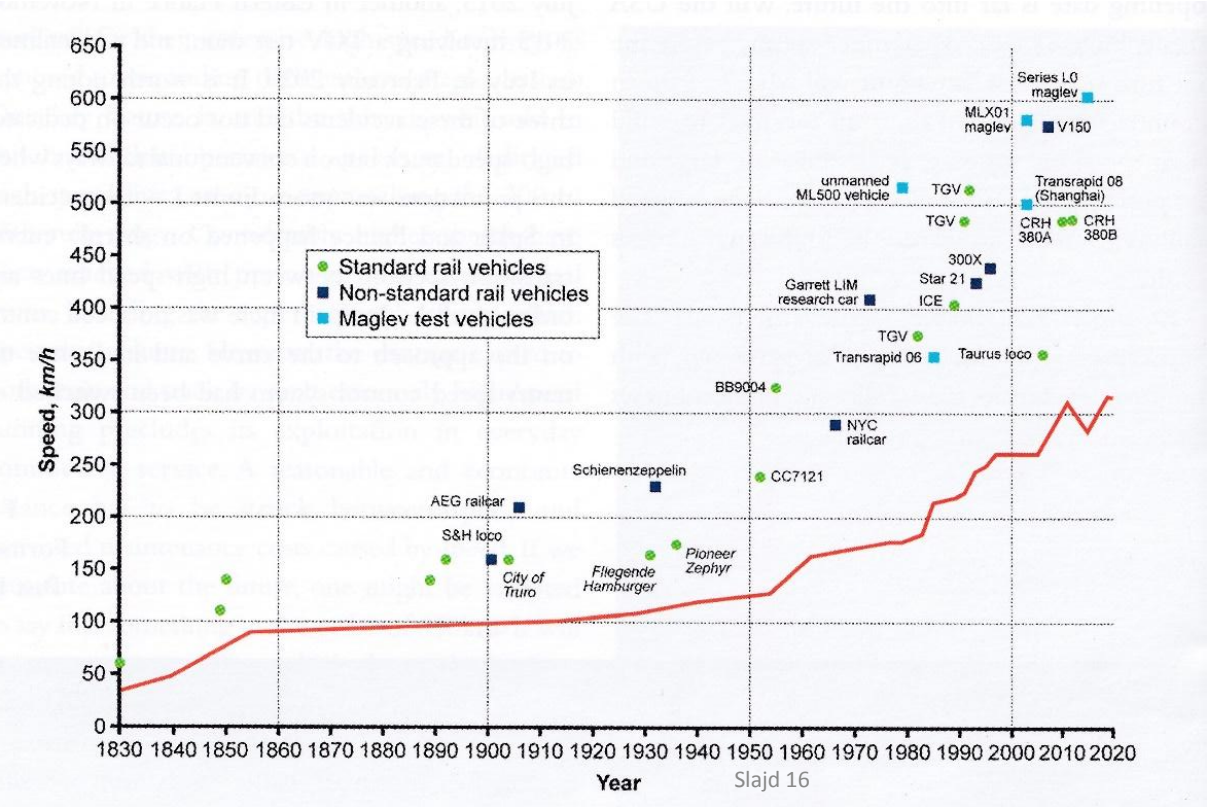


1. L0 Series Maglev, 375 mph, Japan 604 km/h

An L0 series maglev train undergoing testing on the Chuo Shinkansen test track in Yamanashi Prefecture, Japan

The L0 Series Maglev is one of the fastest trains expected to commence commercial operations in Tokyo and Osaka, covering 178 miles between Tokyo and Nagoya in just 40 minutes. The first section of the train is scheduled to be ready by 2027.

KDP – historia i teraźniejszość



Selected Rail Speed Records

Date	Speed *km/h*	Country	Location	Vehicle
27 Oct 1903	210.2	Germany	Marienfelde–Zossen	AEG electric railcar
9 May 1904	164.6	UK	Exeter–Taunton	City of Truro steam loco
21 June 1931	230.2	Germany	Ludwigslust–Wittenberge	Schienenzeppelin
19 Dec 1932	165.0	Germany	Berlin–Hamburg	VT877 diesel railcar
11 May 1936	201	Germany	Hamburg–Berlin	05-002 steam loco
3 July 1938	203	UK	Grantham–Peterborough	A4 Mallard steam loco
20 July 1939	203	Italy	Bologna–Milan	ETR232
28 Mar 1955	331*	France	Lamothe–Morcenx	CC7107
29 Mar 1955	331	France	Lamothe–Morcenx	BB9004
23/24 July 1966	295.8	USA	Bryan, Ohio	M-497 railcar
4 May 1978	230.0	Spain	Alcázar de San Juan–Rio Záncara	Class 353 Talgo loco
20 Dec 1979	257.5	UK	Beattock–Lockerbie	APT-P
26 Feb 1981	380.4	France	Moulins-en-Tonnerrois	TGV Set 16
1 May 1988	406.9	Germany	Hohe Wart–Mottgers	IC-Experimental
18 May 1990	515.3	France	Courtalain–Tours	TGV Set 325
24 May 1991	319.0	Italy	Rome–Florence	ETR500X
8 Aug 1992	350.4	Japan	Ogori–Shin Shimonoseki	WIN350
23 Apr 1993	356.8	Spain	Mora–Urda	S-100
3 June1993	220.0	Portugal	Espinho–Avanca	LE56 electric loco
21 July 1993	276.0	Sweden	Falkenberg–Varberg	X2000
5 Oct 1993	271.0	Russia	Shluze–Doroshikha	TEP80 diesel loco
21 Dec 1993	425	Japan	Tsubame-Sanjo–Niigata	STAR21
11 May 1994	251	Poland	Warsaw–Kattowice	ETR460
12 Nov 1995	360	Germany	Hannover–Göttingen	ICE power cars+Talgo set
26 July 1996	443.0	Japan	Kyoto–Maibara	JR Central 300X
6 Nov 1997	354	Belgium	Brussels–Antoing	PBKA set
24 June 1998	239.7	China	Zhengzhou–Wuhan	SS8 electric loco
9 July 2002	254	Spain	Bujaraloz–Vallmanya	Talgo XXI diesel

Selected rail speed records

27 Nov 2002	321.5	China	Shenyang–Qinhuangdao	China Star
6 Apr 2003	362	Japan	Urasa–Niigata	E2-1000
20 Aug 2004	305	Austria	Vienna–Linz	ICE-S
2 Mar 2006	336.2	Netherlands	Hazeldonk–Rotterdam	PBKA set
2 July 2006	390	Spain	Alcalá de Henares–Calatayud	S-103
30 July 2003	334.7	UK	Ashford–Ebbsfleet	Eurostar 373-313/14
16 July 2006	404	Spain	Madrid–Lleida	S-103
2 Sep 2006	357	Germany	Kinding–Allersberg	'Taurus' electric loco
3 Apr 2007	574.8	France	Vaires–Baudrecourt	V150
26 July 2007	281	Sweden	Stockholm–Göteborg	Regina EMU
14 Sep 2007	303	Turkey	Beylikova–Esenkt	ETR500Y2
8 Nov 2007	288	Switzerland	Ferden–Lötschen	ICE
1 Mar 2008	355	Italy	Milan–Bologna	ETR500Y1
24 June 2008	394.3	China	Tianjin–Beijing	CRH3
3 Feb 2009	362	Italy	Florence–Bologna	ETR500Y1
2 May 2009	281	Russia	Okulovka–Mstinskiy Most	Sapsan
29 May 2009	235	Poland	Psary–Gora Wlodowska	'Taurus' electric loco
28 Sep 2010	416.6	China	Shanghai–Hangzhou	CRH380A
3 Dec 2010	486.1	China	Beijing–Shanghai	CRH380A
10 Jan 2011	487.3	China	Beijing–Shanghai	CRH380BL
31 Mar 2013	421.4	South Korea	Seoul–Busan	HEMU-430X
2 Dec 2013	293	Poland	Gora Wlodowska–Psary	Pendolino
26 Feb 2016	393.8	Italy	Milan–Turin	Frecciarossa 1000 (ETR400)
18 June 2017	330	Saudi Arabia	KAEC–Madinah	Talgo T350
4 May 2018	357	Morocco	Tangiers–Kénitra	RGVM (TGV Duplex)

Pendolino w Polsce

Manufacturer	Alstom
Built at	Savigliano (ITA)
Constructed	2006 – present
Entered service	2008
Number built	93 sets
Formation	7 cars, 4 motors and 3 trailers
Capacity	430 + 2 wheel chairs
Specifications	
Train length	187.4 m (614 ft 10 in)
Car length	26.2 m (85 ft 11+1/2 in) (total length 28.2 m or 92 ft 6+1/4 in)
Width	2.83 m (9 ft 3+3/8 in)
Maximum speed	250 km/h (155 mph) (service) 293 km/h (182 mph) (maximum)
Weight	387 t (381 long tons; 427 short tons) 421 t (414 long tons; 464 short tons) (loaded)
Axle load	16.5 t (16.2 long tons; 18.2 short tons) (with passengers)
Power output	5,500 kW (7,376 hp)
Electric system(s)	3 kV DC – 25 kV 50 Hz AC (ETR 600) 3 kV DC – 25 kV 50 Hz AC – 15 kV 16⅔ Hz AC (ETR 610)
Track gauge	1,435 mm (4 ft 8+1/2 in) standard gauge

Pendolino ED-250

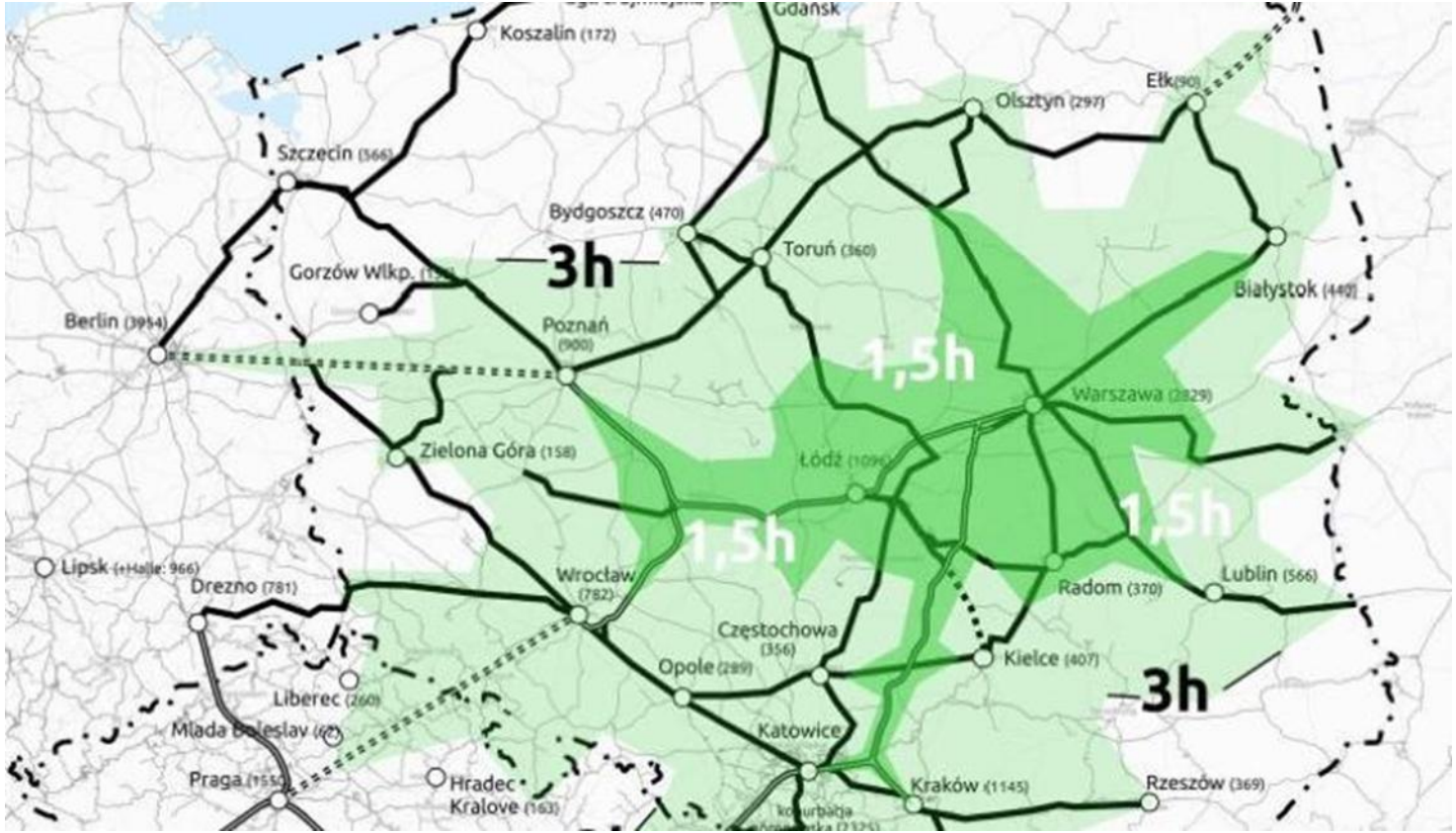
On 30 May 2011 the Polish state railways PKP signed an agreement with Alstom for 20 Pendolinos ETR 610.[5][6] These new trains, referred to as Pendolino ED250, were procured with the intent of operating them several major trunk routes, including between Gdynia and Warsaw, on the high-speed CMK Central Rail Line from Kraków/Katowice to Warsaw and Wrocław to Warsaw.[7] On 12 August 2013, the first ETR 610 was delivered.[8]

High speed tests involving the new trainset were largely conducted on the CMK Central Rail Line; on 16 November, the first day of testing, the Pendolino reached 242 km/h (150 mph).[9] On 17 November 2013, a new speed record for Polish railways was set when the Pendolino ED250 reached a speed of 291 km/h (181 mph),[10] breaking the previous record of 250.1 km/h (155.4 mph) set 19 years prior. On 24 November 2013, the final day of tests on the CMK Central Rail Line, the Pendolino reached 293 km/h (182 mph).[11]

The contract between the Polish operator PKP Intercity and Alstom called for the first eight Pendolino ED250 trainsets to be delivered on 6 May 2014, tested ('homologated') for operation at 250 km/h (155 mph) using ETCS L2 signalling. These tests had not been performed by May, and PKP announced that Alstom had failed to meet the contract terms and would be charged penalties as of May 6.[12] Alstom responded that homologation in Poland at 250 km/h (155 mph) using ETCS Level 2 was impossible, since ETCS Level 2 was not operational anywhere in Poland, and the Central Rail Line (where the first ED250 Pendolino had reached 293 km/h (182 mph) in testing) was equipped with ETCS Level 1, not Level 2.[13] On 26 June 2014, a compromise was reached between PKP and Alstom under which the Pendolinos would be delivered under a two-stage homologation, first homologated for operation using ETCS Level 1 and eventually to be homologated for ETCS Level 2. Hopes were expressed that the Pendolinos could be in service by 14 December 2014.[14][15]

On 11 September 2014, Polands's Railway Transport Office (UTK) announced that the ED250 had been certified for operation at up to 250km/h in accordance with the relevant Technical Specifications for Interoperability (TSI).[16] In the 2020/21 timetable, ED250 routinely operated at a scheduled speed of up to 200 km/h (124 mph) along selected stretches of the Warszawa - Gdynia and Central Rail Line routes.[17] Polish Pendolino trainsets do not have tilting mechanism which precludes them from the main advantage of faster taking of curves. In 2020, one train did derail in Germany during an instrumented test run.[18]

Czas połączeń KDP



Opłacalność KDP

Opracowano model transportowy, który pozwala w łatwy sposób testować warianty nowych połączeń i ich efekt na system transportowy.

Wyznaczenie liczby podróży oparto na modelu Vomberga. Do kalibracji danych wykorzystano ponad 80 punktów w skali kraju. Podczas kalibracji model okazał się zgodny ze stanem rzeczywistym na poziomie powyżej 85 procent!

Analiza ekonomiczna wykazała, że realizacja projektu przynosi społeczno-ekonomiczną wartość dodaną a ekonomiczna stopa zwrotu ERR wynosi 6,3% Poniżej 2 procent inwestycja jest zbyt mało opłacalna, za to osiągnięcie wskaźnika powyżej 8 procent jest dla takich inwestycji raczej nierealne i wskazywałoby na źle przyjęte założenia

Według analiz ekonomicznych przepływ pieniężny netto to 48,8 miliarda złotych, a zdyskontowany wskaźnik zwrotu z projektu B/C ma wartość 1,2.

CPK … gwiaździsta topologia sieci

Podsumowanie

- Projekty KDP realizowane są na całym Świecie
- Afryka: superszybki pociąg – połączenie Casablanca-Tangier, które kursuje z prędkością prawie 200 mil na godzinę
- USA : jeszcze nie tak dawno bez KDP, teraz linia Washington – Boston, i inne projekt wg tzw. planu Obamy
- Indie: największa na świecie sieć kolejowa!, prestiżowy projekt KDP Mumbai-Ahmedabad
- **Czy KDP mają przyszłość?**
- Początkowa inwestycja w linie KDP jest niezwykle wysoka (ok 10 mln Euro/km) + nowoczesny tabor (specjalistyczna technologia)
- Ekonomiczna stopa zwrotu KDP: 2-6 % ???

Konkurencja > Rozwój tanich linii lotniczych EasyJet, Rayanair, Wizzair i innych w ciągu ostatniej dekady podniósł to pytanie

(-) limity bagażowe, niski komfort podróży

(+) szybko na znaczne odległości, podróże między-krajowe

High-Speed Rail Benefits

Explore the many advantages of high-speed trains, providing swift, cozy, and eco-friendly travel options below

1

Time Efficiency

High-speed trains can travel at speeds exceeding 300 km/h (186 mph), significantly cutting down travel durations and offering a quicker option for long-distance journeys.

2

Enhanced Comfort

High-speed trains offer a smooth, quiet ride with ample space, and on-board amenities like WiFi, power outlets, and catering.

3

Reliability

High-speed rail systems are known for their punctuality and reliability, as they operate on dedicated tracks that minimize the potential for delays and disruptions.

4

Safety

High-speed trains have an outstanding safety record, thanks to advanced safety features and dedicated tracks that minimize the risk of accidents and collisions.

5

Environmental Benefits

High-speed trains are eco-friendlier than cars or planes, emitting fewer greenhouse gases per passenger and using less energy, resulting in a smaller carbon footprint.

6

Economic Boost

High-speed rail networks promote economic growth by connecting cities, boosting trade, and attracting tourists, while also creating direct and indirect jobs in served regions.

Dziękuję za uwagę

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