
Photo: Chili Foto, Aarhus Letbane

of part of Phase One of the Letbane is scheduled for May 2017, the remainder to be inaugurated in autumn 2017. The lower right-hand photo on the previous page, taken on 19 January 2017, shows **1104/1204**, the fourth of the Letbane Variobahn trams, covered with blue vinyls promoting Aarhus as the European Capital of Culture 2017, on the test track between Hennigsdorf-Nord and Velten.

The inaugural European Cultural Capital ceremony took place in Aarhus on 21 January, and one of the Variobahns was exhibited adjacent to the **Dokk1** public library and cultural centre. This was the first time one of the new trams had actually ventured onto the new urban tramway line, which is still under construction, as can be seen in the upper photo. By 17 February 2017 six Tangos and five Variobahns had been delivered to Aarhus, the latest Variobahn reaching the city that same day.

During press conferences at InnoTrans 2016 **Stadler and Solaris** announced that they would be forming a partnership for light rail vehicle production. This new **joint venture** was founded on 1 January 2017, and is known as **Solaris Tram Sp. z o. o.**, a Polish-registered company. It will take over the Solaris factory at Środa Wielkopolska (at Brodowska street). Here tram bodyshells will be built and painted. For tenders originating in Poland and the rest of central Europe, Stadler Polska and Solaris Tram will offer joint bids as a Stadler-led consortium, thus enabling them to strengthen their position within these markets. Assembly activities will take place in the various Solaris factories in the Poznań area, and also at Stadler Polska's Siedlce factory, and the formation of the joint venture will result in a doubling of the amount of space available for bodyshell manufacturing and assembly.

The use of Stadler's Siedlce plant results in the involvement of a workforce of up to 800 in tram production. The factory also has numerous Polish suppliers and partners, with combined workforces of over 2,000. Since its establishment in 2006 the Siedlce works has become Poland's largest exporter of railway rolling stock. Solaris, founded in 2001 as the successor to Neoplan Polska, is able to contribute to the joint venture its teams of engineers and specialists in sales, purchase and after-sales service, and over two decades of bus and coach building experience. The consortium has already tendered bids for new trams for Kraków and Poznań, and will be involved in building and assembling the trams ordered in late 2016 by Ostrava DPO (see p. 64).

Solaris **Tramino 3013**, one of the batch of 15 built for the new 1,435 mm gauge network in **Olsztyn**, a capital of Województwo Warmińsko-Mazurskie (Warmia-Mazury province), was exhibited. Olsztyn (population 173,600) originally had a metre gauge tramway network, which survived from 1905 to 1965. On 1 March 2012 construction of the new three-line, 11 km 19-stop network, linking the city centre and railway station, in the north of the urban area with the southern suburbs, began.

On 21 September that year the contract for 15 Traminos was signed with Solaris Bus & Coach, the first tram being presented in Olsztyn on 19 June 2015, with the new tramway being inaugurated on 19 December that year (see R 6/15, p. 74). Olsztyn is the second Polish city to acquire a Tramino fleet. The first was Poznań, which acquired 45 in 2009.

Services require 12 trams, with three being held in reserve. The tramway is proving popular, with an average of 130,500 passengers being carried on an average weekday - around 3.3 million per month. The trams have also exhibited a high level of technical availability, the fleet having covered over 850,000 km in its first year in service.

Olsztyn's Traminos are bi-directional, 100 % low-floor, three section vehicles, 29,300 mm long, 2,500 mm wide and 3,800 mm high above rail top with pantograph lowered. Each section is mounted on one fully pivoting bogie, giving an axle arrangement of Bo'2'Bo'. Each powered axle is fitted with a 120 kW asynchronous traction motor giving a total power rating of 480 kW. Wheel diameter is 682 mm when new and 602 mm when worn.

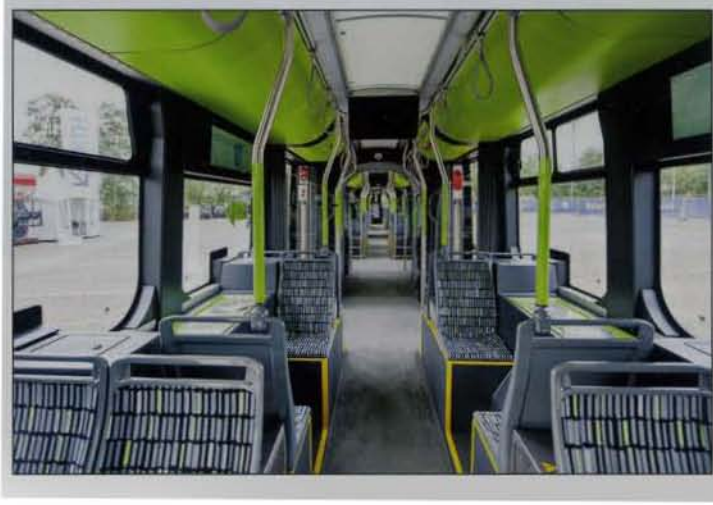
The support nodes for the bodyshells on the bogies are equipped with an automatic levelling device, partly to maintain the distribution of loads at a constant level, and thus ensure that wheel wear is equalised, and to ensure that the tram floor remains at a constant height regardless of the varying weight of the passenger load. The device measures floor height when the entrance doors open, and as passengers board and alight it checks floor height and rectifies tilt if necessary. Should the floor height be too low or too high, hydraulic actuators, which are not part of the bogie suspension, raise or lower the bodyshell to the correct height for the platform.

Thanks to active stability control system, Traminos are able to negotiate curves in a smooth manner which offers considerably greater comfort to passengers. Once the front end of the tram enters a curve a hydraulic signal from the leading bogie is passed to the other bogies, which modify their positioning accordingly. The front ends of the trams are fitted with two shock absorbers.

The Olsztyn Traminos have a maximum design speed of 75 km/h, a maximum service speed of 70 km/h, and the entire network is electrified at 600 V DC. The Traminos are also fitted with 540 Ah batteries which eventually can be used also for no-catenary operation. Tests indicate that a range of over 1 km is possible using battery power alone. The traction equipment also enables the option of fitting supercapacitors to store energy recuperated from braking and reuse it during acceleration.

Six pairs of 1,300 mm wide double-leaf doors with a threshold height of 360 mm above rail top access the air conditioned, LED-illuminated **passenger accommodation**, which has seats for 43 passengers, wheelchair harness points behind the cabs, and space for up to 200 standees at a density of five per m². The cabs are not fitted with rear-view mirrors. Instead the driver's rear view is provided by two CCTV cameras, one monitoring the doors immediately behind the cab, the other providing a view along the whole length of the tram. These cameras are heated, to


Photo: Jürg D. Lüthard



Siemens exhibited a model of a proposed high speed intercity train, with high quality accommodation, for potential use in the countries surrounding the Persian Gulf. This is branded **„Hesan Alkhaleej"** (Horse of the Gulf). With many of these countries, whose resident populations are expanding rapidly, and which are experiencing steady socio-economic growth and development, this including the construction of new rail networks, many of these designed essentially for heavy freight traffic, the „Hesan Alkhaleej" is regarded as a safe, comfortable and reliable alternative to road and air travel, and will incorporate tried and tested components from Siemens Mobility's product range.


Photo: Jürg D. Lüthard

It will be designed to cope with ambient temperatures in excess of 55 °C, and will incorporate sand filtering technology, for reliable operation in desert areas. The air conditioning systems and power supply will all incorporate exceptionally high redundancy levels, so that should multiple on-board failures occur, the train will still be able to continue to its destination, with the passengers travelling in air conditioned comfort. The 200 km/h „Hesan Alkhaleejs" will be fitted with between 200 and 800 seats, depending on length, and will be designed for use not only on lines dedicated to passenger services, but also on those built primarily for heavy freight traffic.

ContiTech also exhibited its new, recently developed **pantograph air actuators**, manufactured using an ultra-fire-resistant material and meeting the strict requirements of the new EN 45545 European fire protection norm at the very highest safety level, Hazard Level 3 (HL3), thus setting new standards for the industry.

The material used for ContiTech's new **folding bellows** for inter-car gangways are subject to extremely strict requirements, since they are flexible and constantly in motion. They also have to withstand the impact of ballast, UV rays, rain and snow, and also meet fire protection standards, having been tested for compliance with the EN 45545-2. The materials are available in thicknesses of 0.8 to 3.0 mm, in different designs such as CSM or silicone rubber, and in a range of different colours.


Photo: ContiTech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Riyadh Metro Project's Metropolis EMUs

The evolving six-line Riyadh metro network is at present the world's largest metro construction project in realisation, designed to cater for the rapidly expanding resident and working population of the Saudi Arabian capital. By early 2017 the metro network was 47 % complete, with inauguration now scheduled for 2019. A batch of Metropolis EMUs is being built by Alstom at Chorzów for Lines 4, 5 and 6.

The Metro Project

Riyadh's population is growing rapidly, from 5.4 million in 2010 to 6.5 million by 2016, and predictions indicate that it will increase to 8.5 million by 2030. The city's residents make an average of 10 million journeys per day. Of these around 8.9 million (89 %) are by private car. 6 % of all journeys are made using collective non-public transport, 3 % by taxi and only 2 % by public transport.

Fuel for road vehicles is incredibly cheap, a litre of **petrol** costing just 0.22 EUR in February 2017, having risen from 0.15 EUR in 2015. Only Venezuela has lower fuel prices than does Saudi Arabia. The result is clearly unsustainable as the population continues to rise, the consequences being growing road congestion and increasing pollution, with consequent negative effects on business efficiency, quality of life, and quality of health - unless radical action is taken. An efficient and attractive network of road and rail public transport is therefore essential, to encouraged people to leave their cars at home.

All six metro **lines** are 1,435 mm gauge, are electrified at 750 V DC third rail, and are designed for driverless operation. Of the entire network 87.4 km (49.6 %) will be elevated, with 31 stations, 18.9 km (10.7 %) will be surface level, with four stations, and 69.8 km (39.7 %) will be subterranean, with 50 stations. Five interchange stations between metro lines will be provided. There will be seven depots, and 25 stations will be provided with Park & Ride facilities.

At stations the use of **photovoltaic panels** will mean that around 20 % of the energy required for air conditioning and lighting will be generated by this means. It is estimated that the metro network will be used by around 1.16 million passengers per day when inaugurated, this figure eventually rising to the design capacity of 3.6 million per day. An urban bus network is also being developed, with a design capacity of 900,000 passengers per day.


In November 2016 Chorzów factory embarked upon the final assembly stage of the batch of Metropolises for Riyadh metro. This is car MC2 of the seventh train, this one destined for the Purple Line (6), in Hall 8 on 7 February 2016.