Prototype container wagons for loading and unloading of ISO containers in rail sidings

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PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
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Involved partners / Version control

Following project partners have been involved in the elaboration of this document:

Partner N°	Organisation short name	Involved experts
1	HaCon	Eckhard Riebe, Niklas Galonske, Sascha Nerger
8	SBB Cargo	Katharina Litwin, Thomas Fuchs, Patrik Dober
10	Wascosa AG	Torben Kempf, Irmhild Saabel

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Cm	Centimetre
ft	Foot
kg	Kilogramme
K(s)	Two-axle flat wagon
mm	Millimetre
Re(s)	four-axle/bogie flat wagon
SBB	Schweizerische Bundesbahnen (federal Swiss railway company)
Sgns	Conventional container wagon type
s.r.o.	Czech company with limited liability
t	Tonne
UIC	International Union of Railways

1 Background and objectives

1.1 Containers in railway sidings / Swiss Split

With "Swiss Split", SBB Cargo currently offers the distribution of containers on the single-wagonload network in Switzerland directly into the sidings of the final recipients. The containers mostly come from the northern seaports either by shuttle trains (operators of combined transport) or by barge through existing hinterland terminals in Switzerland. There, the containers are then transferred from the shuttle trains by cranes or reach stackers to wagons of the single wagonload network of SBB Cargo. The Swiss Split integrates combined transport into the single wagonload traffic, thus ensuring a basic workload of the whole single wagonload network. Currently, up to 10% of the transported wagons in SWL network of SBB Cargo are related to Swiss Split. This means, Swiss Split is one of the largest market segments in the Swiss single wagonload traffic.

In the sidings, unloading of the containers is conducted by conventional industrial trucks (e.g. forklifts). These forklifts get access to the containers by driving from the side ramp over an appropriate compensation plate onto the wagon and then directly into the container.

1.2 Current technologies

Currently, SBB Cargo mainly uses flat wagons (type Re(s) and K(s)) for the Swiss Split operations. Because these types of wagons are not equipped with spigots, terminal employees have to nail wooden blocks around the container into the wagon floor to secure the containers on the wagon. This procedure is very time consuming and the maintenance of wooden floors is quite costly in comparison to wagons with steel floors. The wagons have now reached the limits of their economic life. In the near future, SBB Cargo therefore intends to use conventional container wagons (Sgns) for Swiss Split, primarily with spigots to easily secure the containers. This approach allows SBB Cargo to use one single type of wagon in both product segments of the Swiss Split – for transports into sidings as well as for transports between two regional terminals.

Figure 1: Current wooden floor wagon for container transports into sidings

Source: SBB Cargo

1.3 Objectives and development concepts

Requirements for an optimised Swiss Split wagon are firstly given by the logistics processes of the customers in the sidings. Secondly, the wagon has to be perfectly integrated into the Swiss Split operations.

In order to understand the requirements of its customers, SBB Cargo and ETH Zurich have visited ten sidings with Swiss Split traffic in advance and interviewed the responsible logistics staff. Important requirements from shippers arise primarily from the charging process, the infrastructural conditions of the existing loading equipment and last but not least from the work safety regulations in place. As a result of the customer consultation and the internal evaluation by SBB Cargo following aspects need to be considered when developing a new technology:

- The gap between the ramp and the wagon should be easily bridgeable;
- Forklifts need to be prevented from falling down to the tracks;
- Additional weight of a converted Swiss Split wagon should be as low as possible;
- As mentioned before, an optimised wagon has to be equipped with spigots and has to be drivable by forklifts for loading and unloading of containers;
- Due to heavy goods to be loaded to the floor an axle load of up to 5.5 tonnes must be guaranteed.

Since container wagons are narrower than conventional flat wagons, the resulting gap between the car floor and loading ramp has to be reduced or bridged by additional arrangements. Furthermore, the cargo floor should be suitable for all potential container charging schemes (20ft, 40ft, 45ft). At the same time the container doors have to be opened completely, which means nearly 270 degrees.

2 Container wagon with accessible floor (Wascosa)

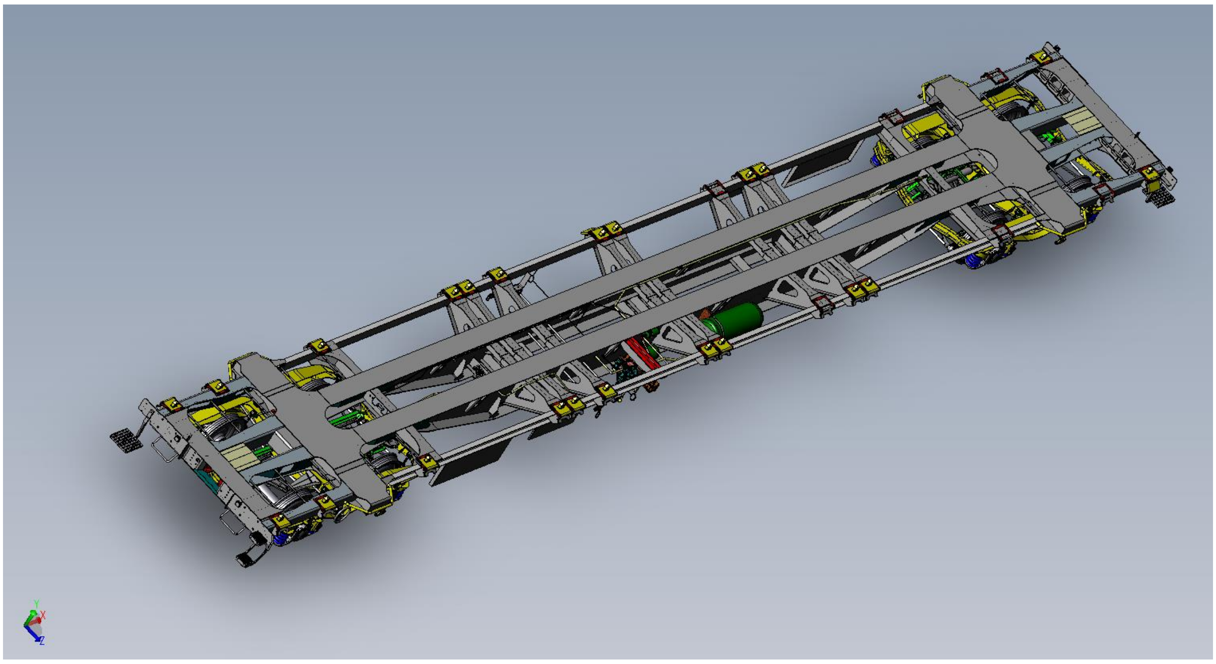
2.1 Concept

The Wascosa flex freight wagon is with a tare weight of 17.4 tonnes the lightest 60’ container flat in Europe. Standard European container flats have the main longitudinal beams outside, carrying the container spigots. On the Wascosa flex freight wagon, these beams were moved to the middle of the wagon structure, similar to North American container flats, so-called “spine cars”.

This wagon design allows the integration of a “plug-in” floor which makes the wagon fully accessible with forklift, without restricting the possibilities to load containers/swap bodies in any way, see Figure 2 and 3.

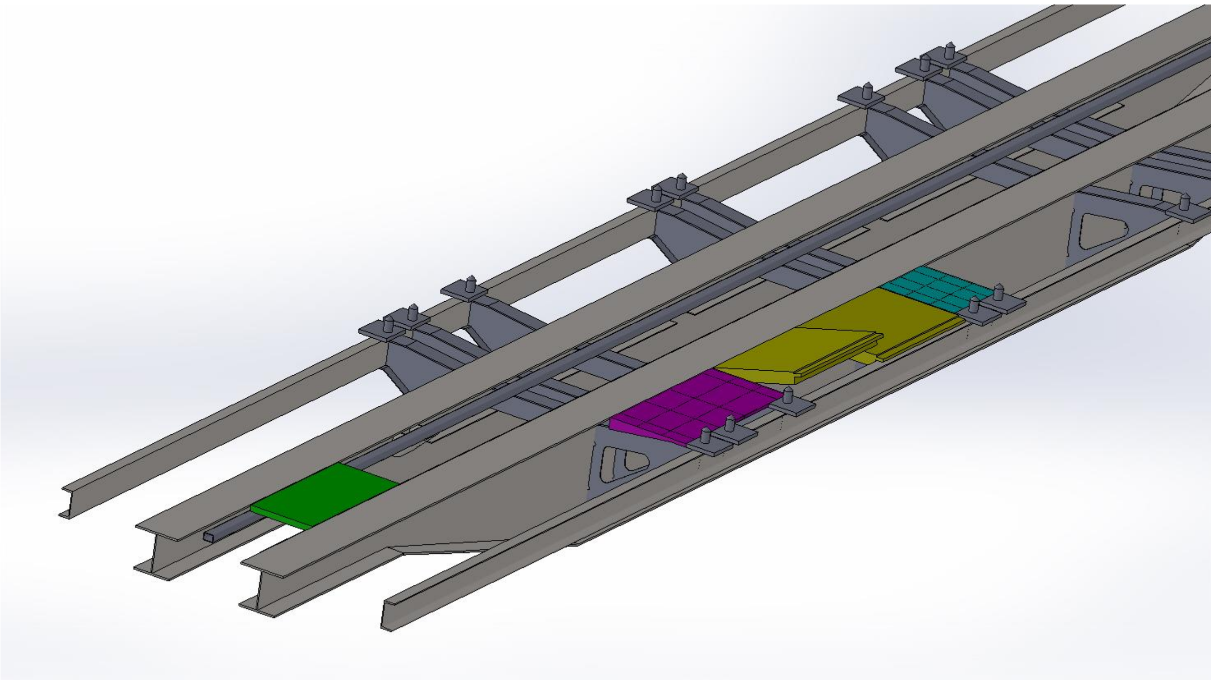
Because of the extremely low tare weight of the wagon, there will be also no load restrictions compared to standard 60’ container flats with a tare of 20 tonnes, even when the wagon is equipped with the additional floor.

Figure 2: Wascosa flex freight wagon with main longitudinal beams in the middle of the wagon structure



Source: Wascosa

Figure 3: "Plug-in" floor solution



Source: Wascosa

2.2 Technical data

The main technical characteristics are summarised as follows:

- Weight of plug-in floor ca. 2.4 tonnes;
- Tare weight of WASCOSA flex freight system® with "plug-in" floor ca. 19.8 tonnes;
- All loading possibilities of a 60' container flat;
- The entire wagon is accessible with forklift (6 tonnes axle load).

2.3 Documentation of prototype delivery

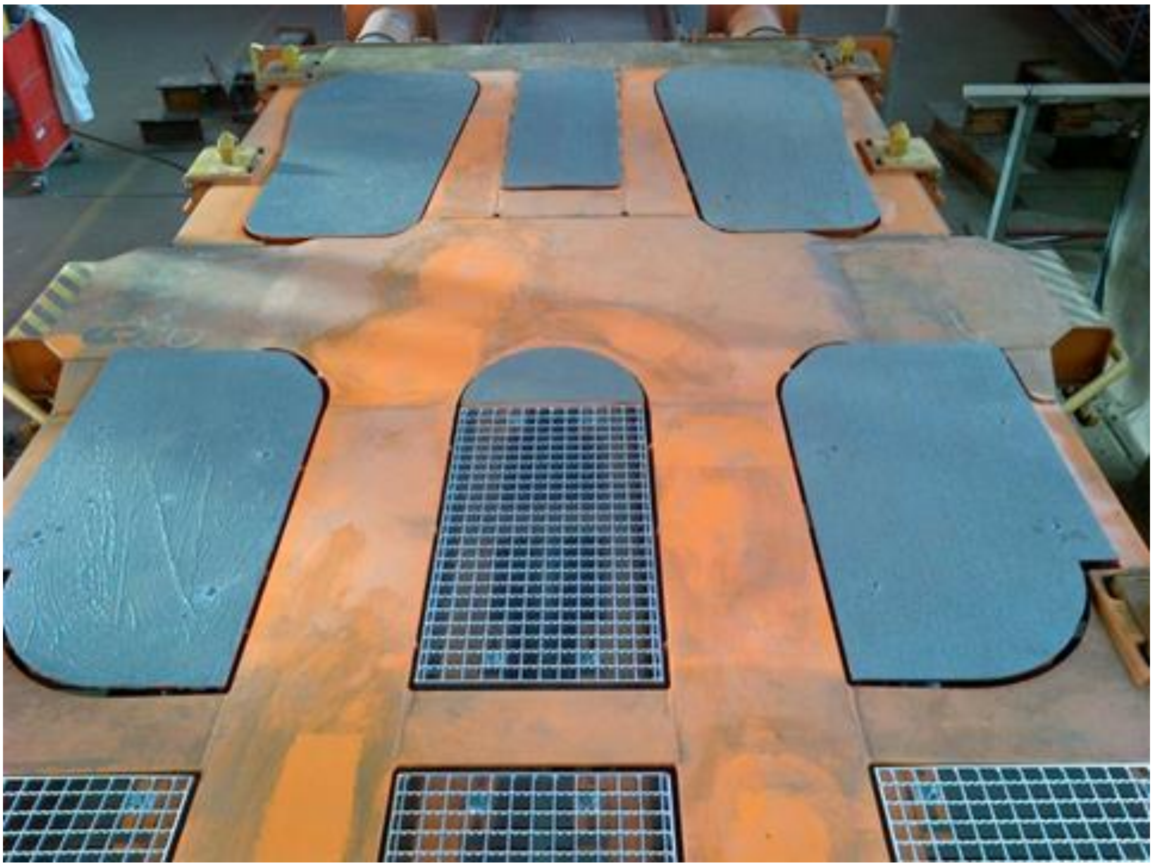
For the development of the prototype platform the following steps have been carried out:

July 2013:	Evaluation of different concepts (mobile platform vs wagon with accessible floor)
August 2013:	Technical concept finalised
September 2013:	Tender process started
October 2013:	Manufacturing company selected / Subcontract signed with: Fahrzeugwerke Miraustrasse GmbH (FWM), Berlin (Germany)
November 2013:	Technical details in collaboration with manufacturer specified
February/March 2014:	Prototype production at FWM
April 2014:	Prototype delivery to Wascosa
Dec. 2014 – January 2015:	Prototype in workshop for improvement of wagon floor (see figure 6)

Figure 4: Wascosa container wagon with accessible floor

Source: Wascosa

Figure 5: Accessible floor before modification



Source: Wascosa

Figure 6: Accessible floor after modification

Source: Wascosa

2.4 Outlook to training/demonstration

The tests of the first prototype wagon started in May 2014. Ongoing testing is performed at Swiss Split sidings with a modified prototype wagon (no more edges, whole floor painted with slip save coating). A detailed documentation on training and demonstration activities will be carried out within WP 9/10.

3 Drive-on platform (SBB Cargo)

3.1 Concept

Initial tests of the Wascosa wagon with an accessible floor at customers' sidings have brought up that the car cannot be used optimally in all sidings. In some cases, the gaps between the car floor and the loading ramp are too large for a smooth unloading. The crossing plates positioned at the customers' sidings are optimally dimensioned for the old wooden floor flat wagons and are sometimes too short to bridge the gap between ramp and the Wascosa wagon. In addition, the standard container wagon (Sgns) is not as high as a conventional wooden floor wagon, which means that, depending on the weight of the container, the container doors cannot be opened completely and sometimes even are blocked by the loading docks' edge.

Considering these findings, SBB Cargo has developed another solution, which reduces the above mentioned problems to a minimum. The concept is to equip the entire car with a platform able to be driven by forklifts. The platform is placed on the container spigots and is equipped with additional container spigots to be loaded with 20 feet, 40 feet and 45 feet containers. The platform has a height of about 13 cm, which compensates the lower overall height of the wagon. In order to reduce the gap between the underbody and the loading ramp, the platform is designed wider than the wagon itself on both sides. This ensures that the container wagons assumes the dimensions of the old wooden floor wagons and therefore fits perfectly into the sidings.

Figure 7: 60ft platform solution – 3D drawing

Source: SBB Cargo

3.2 Technical data

The main technical characteristics are summarised in Figure 8 below.

Figure 8: 60ft platform solution – technical data

Parameter	Dimension & Related standards
Width	(UIC 592 appendix A) 2,880 mm
Length	(SO 668) 6,056 mm +2mm /-4 mm
Loading height	122 mm
Loading height from track	1,277 mm
Difference between spigots (front/back)	5,853 mm +/- 3 mm
Difference between spigots (side/side)	2,259 mm +/- 2 mm
Difference between gripping edges	4,876 mm
Tare weight	1,870 kg
Max. floor load	(EN 12663-2) 588 kg

Source: SBB Cargo

3.3 Documentation of prototype delivery

There is no prototype produced yet. For the development of the prototype platform the following steps have been carried out:

June 2014:	First approaches to develop a drivable platform for Swiss Split
August 2014:	Technical concept finalised
September 2014:	Tender process started
November 2014:	Manufacturing company selected / Subcontract signed with: PVF Schienenfahrzeuge s.r.o., Česká Lípa (Czech Republic)
November 2014:	Definition of technical specifications in cooperation with SBB engineering and security department
December 2014:	Technical details in collaboration with manufacturer specified
February 2015:	Prototype production (of four 20 feet platforms) started
March 2015 (expected)	Prototype production concluded
March 2015 (expected)	Prototype delivery to SBB Cargo

3.4 Outlook to training/demonstration

Several tests are planned to take place from April to August 2015. SBB Cargo is going to test the platform in the same way it tested the Wascosa wagon with accessible floor. Most of the customers are already informed about the upcoming tests in their sidings. A detailed documentation on training and demonstration activities will be carried out within WP 9/10. In May 2015 the platform will be shown on the Transport Logistic exhibition as part of the presentation of ViWaS modular wagon technologies.