

Swiss Section

Consolidating control in the Port of Switzerland

Report by George Raymond

Some 1000 river-kilometres south of Rotterdam, the Swiss city of Basel and its Port of Switzerland (PoS) mark the end of the navigable Rhine. The river's waterway network is part of the Rotterdam-Basel-Genoa freight corridor, Europe's busiest. PoS is a major import gateway for Switzerland whose backbone is its railway.

The Swiss Port Railway (SPR) serves PoS's three Basel-area riverside zones in Kleinhüningen, Birsfelden and Auhafen. In 2018, SPR finished replacing four aging interlockings and centralised control. On 8 March 2019, an IRSE Swiss Section event attended by 36 members and guests reviewed the project. Our main host was port director Hans-Peter Hadorn. Bruno Huber of Projekthaus Herisau, chief project manager for SPR's resignalling, organised the event.

In the photo below Jan Riemek presents the Port of Switzerland's Kleinhüningen zone to IRSE members from atop a grain elevator. We are looking south towards the city of Basel. The 13-track hump yard (centre, behind building) was a focus of the port railway's resignalling programme.
(Photo George Raymond.)

Full spectrum of traffic

PoS's three zones constitute Switzerland's only international port. Its traffic thus reflects the full spectrum of countries and products involved in Swiss foreign trade.

At PoS, imports heavily outweigh exports. PoS data for 2014-2018 show that the import tonnage share for each of these product groups exceeded 81%, reaching 92% for petroleum products. The only exceptions were chemical products (58% import), and vehicles and machinery (67% export).

Tonnage vs value

But freight tonnage only tells half the story. Freight value is often just as important. A 2016 study of Swiss customs data analysed PoS traffic in terms of both tonnage and its value in Swiss francs (CHF).

The table on the next page shows that in 2015, PoS imported and exported 5.7 million tonnes of freight worth CHF 7.1 billion by barge. (As of mid-October 2019, CHF 100 were worth €91 or £78.) This was 8% of total Swiss foreign-trade tonnage.



Tonnage and value of Swiss and PoS foreign trade, 2015.
Port of Switzerland traffic study.

	Millions of tonnes	Freight value in CHF billion	Freight value in CHF per tonne
Switzerland, total	70.3	523	7440
Switzerland, containerised	3.1	13.5	4355
Port of Switzerland barge traffic	5.7	7.1	1246
% of Switzerland	8	1	
PoS barge traffic, containerised	0.61	2.0	3279
% of Switzerland, containerised	20	15	
% of PoS	11	28	

Imports dominate at PoS by weight, but not by value. In 2015, imports were 88% of total barge tonnage at PoS, but only 44% of this same freight's value. The rest were exports. This reflects the Swiss economy's specialisation in the export of higher-value goods. Of the PoS barge tonnage, imports were worth CHF 630 per tonne, but exports nine times that at CHF 5760 per tonne.

Container traffic

In 2015, PoS's four container terminals handled barges containing 102,916 TEUs (twenty-foot equivalent units) of containers holding 610,000 tonnes of goods worth CHF 2.0 billion. Of the freight PoS handled in barges, 11% of the tonnage and 28% of the value thus moved in containers. Barges serving PoS carried 20% of all containerised tonnage in Swiss foreign trade and 15% of its value.

In barged containers, PoS handled freight worth CHF 3279 per tonne. For comparison, all 2015 Swiss foreign trade was worth CHF 7440 per tonne. Imports in 2015 accounted for 42% of PoS containerised tonnage, 44% of its value, and 54% of TEUs; the rest were exports.

In 2015, PoS handled barged containers carrying 5.93 tonnes per TEU. But this figure includes empty containers. In 2018, 42% of the barged containers were 20-foot, the rest 40-foot. Some 33% of outbound and 23% of inbound barged containers were empty due to short-term repositioning between cities.

Port traffic fluctuations and long-term trends

PoS's traffic depends on both total foreign trade and the port's share. Port traffic thus fluctuates with commodity prices, exchange rates, customs tariffs and major infrastructure outages. Examples are the seven-week closure of the main Rhine Valley railway route in 2017 after the tunnel collapse at Rastatt, Germany; periods of high and low Rhine water; refinery shutdowns for upkeep (or bankruptcy in one 2012 episode); and the economic fortunes of the non-European countries on which high-value Swiss exports are particularly dependent. PoS storage facilities serve as buffers that give the Swiss economy extra months to bridge or adjust to foreseen or unplanned closure of major infrastructure.

Traffic at PoS is also subject to longer-term trends such as shifts to road transport, to higher-value goods and to lower energy use from different sources. In 2014-2018, total barged tonnage at PoS was down 27% but barged TEUs up 137% from the same period 20 years earlier.

Future growth

PoS is Switzerland's water-borne connection to the world's oceans. At the other end of the Rhine's waterway network, the ports of Rotterdam and Antwerp have committed to shifting

their hinterland traffic from trucks to barge and rail for better capacity use and sustainability.

Switzerland's exports to developing, emerging and industrialised countries outside Europe are expected to grow faster than its exports to Europe. One customer with particularly high-value export goods is Basel-based Novartis, which ships its pharmaceuticals in refrigerated containers throughout the world.

Such exports, which typically travel by ship or plane, are more likely to leave Switzerland by barge than exports for European countries reachable by train or truck. However, rail transport of containers between Europe and the Far East is becoming an attractive alternative to slower ships and costlier planes.

Two-week round trip for barges

A barge's upstream trip from Rotterdam to Basel requires four days and the return downstream trip three. Loading and unloading requires another week, so a barge can typically start a round trip every two weeks.

Along the Rhine, channels undergo continuous dredging to minimise episodes of low water that force barges to reduce loads or stop.

In Basel, buoys separate Rhine ships from the thousands of locals who put their clothes in watertight bags and float down the river and through the city during heat waves.

Most hinterland transport by rail

Over the period 2014-2018, 60% of the net freight tonnes moving on land to or from PoS did so by rail and the rest by truck, an increase from the 57% rail share in the same period 20 years earlier. Reflecting the much lower value and thus shorter hinterland haul distance of imports, the 2014-2018 rail share of tonnage was 55% for import freight headed to the hinterland and 80% for export freight arriving from the hinterland. Trucks handled the rest.

Given Swiss Port Railway's importance, the Swiss Federation contributed CHF 100 million to improve SPR infrastructure between 2017 and 2020. This includes 30 million for resignalling and 35 million for an additional access line.

SPR only operates the port's rail infrastructure; it has granted 20 network access permits to train operators. Most just run trains into and out of the port; the Swiss Federal Railways' freight division, SBB Cargo, performs most shunting. But other train operators have the trained personnel and approved locomotives to shunt in part or all of the port. One operator can even run over SBB Infrastructure's tracks between Kleinhüningen and Birsfelden/Auhafen. Freight customers have 25 contracts for rail spurs within PoS.



The port and thus SPR operate in three zones: Kleinhüningen on the Rhine's east bank just north of Basel's city centre and the twin zones of Birsfelden and Auhafen on the Rhine's west bank in Basel's southeastern suburbs. *Image Port of Switzerland*

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Kleinhüningen zone

Of the 2.8 million net tonnes of freight that SPR handled in 2018, 29% was at Kleinhüningen, which saw 58 loaded trains in or out a week averaging 13 wagons plus 49 light locomotive movements. In addition to oil products, Kleinhüningen also handles recycling and metals, and hosts three container terminals.

Kleinhüningen also hosted a terminal of intermodal operator Hupac, which runs rolling motorway trains carrying complete lorries – tractor, trailer and driver – between Kleinhüningen and Lugano in southern Switzerland. Four to five pairs of such trains ran each week in 2018, removing 19 trucks a day from Swiss roads. A reduction in subsidies ended the service in 2019.

The Kleinhüningen zone connects via a 2.1-km line to infrastructure of German Railway (DB) near Basel Badischer station, which lies in Basel and thus Switzerland but is operated by DB.

Birsfelden and Auhafen zones

The other 71% of SPR's 2018 tonnage was at the Birsfelden and Auhafen zones. They currently share a 3-km access track from the west end of Basel's big Muttenz marshalling yard. Together, in 2018 the two zones saw 88 loaded trains a week in and out averaging 16 wagons, plus 61 light locomotive movements.

Both zones handle oil products. Auhafen handles fertiliser, alumina, grain and particularly dangerous goods. Like Kleinhüningen, Birsfelden handles recycling and metals. It offers space for production and logistics and hosts a container terminal. A problem for both Auhafen and Birsfelden is the presence of German residential neighbourhoods just across the Rhine due to a lack of planning coordination in the past.

New interlockings and central control

Bruno Huber of Projekthaus Herisau received a first inquiry in 2013 about replacing the interlockings in SPR's Kleinhüningen and Birsfelden/Auhafen zones. At the time, SPR relied on a "biotope" of electro-mechanical interlockings from makers

Bruchsal, Halske, Integra and Siemens that were 60-70 years old and whose technology was up to a century old.

Like most aging interlockings, SPR suffered from disappearing spare parts and expertise and were very hard to adapt to new track layouts. SPR therefore decided to replace the interlockings and associated field equipment and to create a control centre. Field work required digging in brownfield soil contaminated by heavy metals bought by long-ago floods from early industrial sites. The components of the new control system entered service in 2017 and 2018. It and related infrastructure changes cost about CHF 30 million.

SPR's new control system, based on a Siemens ILTIS system and two Simis W interlockings, features LED signals, four gated level crossings, and both the ETCS Level 1 and German PZB automatic train control systems, which stop a train that passes a signal at danger. This allows locomotives equipped to run on either the Swiss or German network to run into and out of the port without a locomotive change.

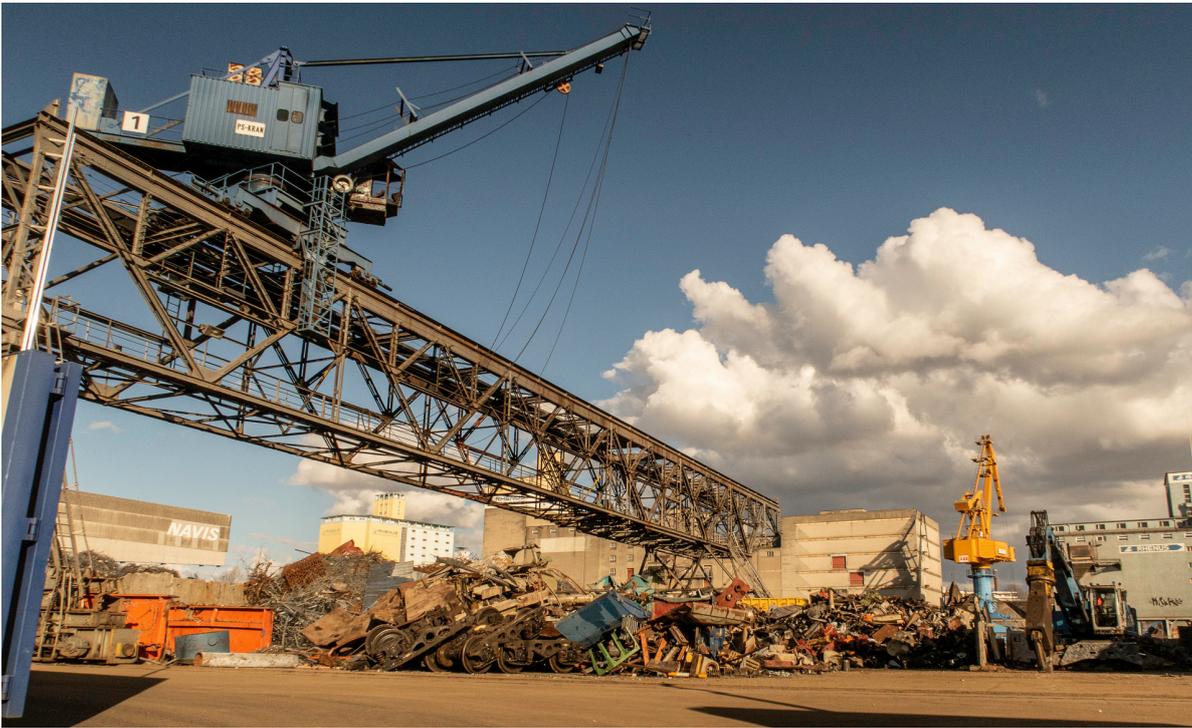
Shunting-friendly axle counters

SPR's old interlockings used track circuits to detect incoming trains. The new signalling uses axle counters on all track sections. A key issue was slow-moving axles that oscillate back and forth over an axle counter during shunting. Such situations created five to ten disturbances a day at first, but an "oscillating tolerance" function has reduced these to five to eight a month.

In the diagram on page 29 tracks 46 and 47 on the left are still Auhafen's only connection with Basel's big Muttenz marshalling yard and the outside world. For more flexibility, efficiency and redundancy, SPR is spending CHF 35 million to build a second, 900-metre access track between Auhafen and Muttenz. Expected to enter service in May 2020, it will enter Auhafen on track 81 on the lower right.

The red gates protect a level crossing of tracks 81 to 86. Seven locally controlled swing gates protect the yard on weekends. The interlocking monitors the gate actuators.

A hump yard uses gravity to sort a string of wagons by destination. Access to Auhafen's nine sorting tracks is from both ends. System designers thus had to take account of the risk that an errant wagon could roll all the way from the hump to the turnouts at the far end of the yard.

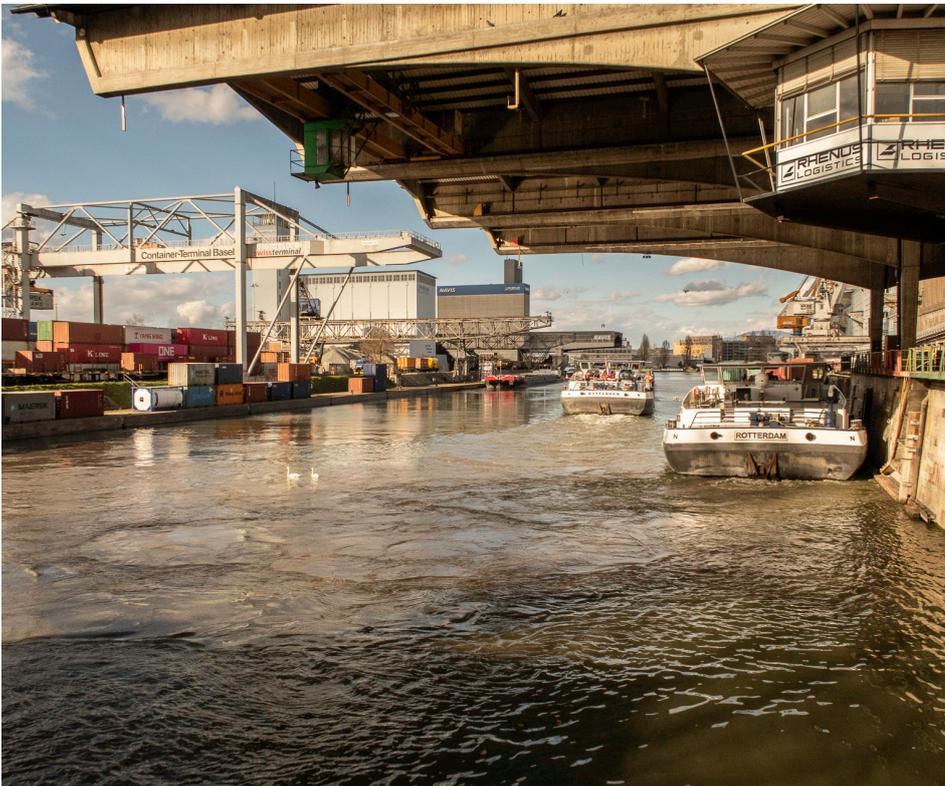


Left, recycled materials handled in PoS's Kleinhüningen zone include freight wagon parts.

Below left, looking north toward one of three container terminals in PoS's Kleinhüningen zone and, on the right, facilities that handle bulk freight.

Below, looking north into one of PoS's three container terminals in Kleinhüningen.

Photos Peter Hefti.



	Kleinhüningen	Birsfelden/ Auhafen
Kilometres of track under control of SPR interlockings/total kilometres of track	11/25	11/22
Powered turnouts / total turnouts	84/136	53/108
Tracks in hump yard	13	9
Axle-counter sections	126	59
Dwarf signals	82	47
Miniature home signals showing that the interlocking has set a route out of the port	15	17

Scope of SPR and its resignalling.

Marcel Weyermann shows us the new control centre, whose dispatcher monitors approaching trains in France, Germany and Switzerland and surveillance cameras, for example to check that security staff close gates across the Auhafen yard tracks after hours. Whereas the old, decentralised interlockings required four people, SPR's goal is to station just one dispatcher at the control centre.

Photo George Raymond.



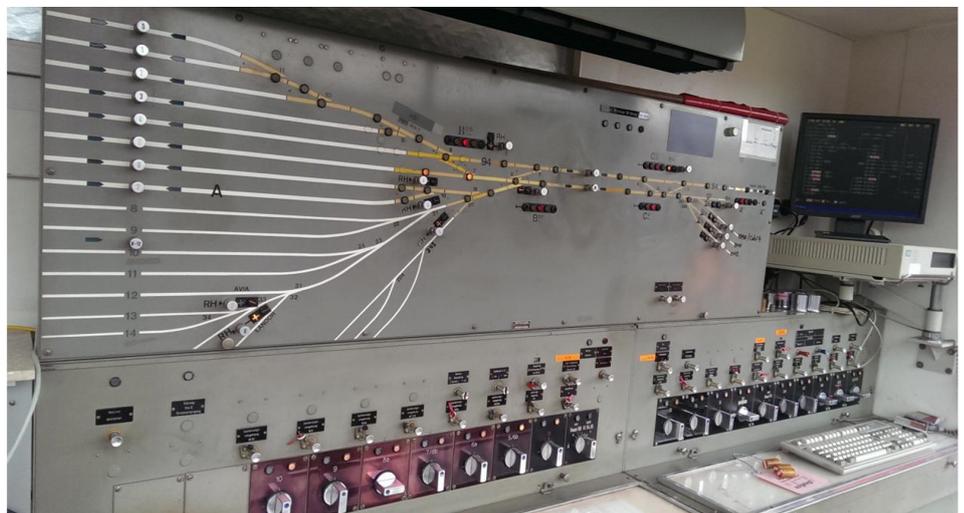
Standard Swiss dwarf signals in the Kleinhüningen arrival/departure yard topped by special miniature home signals indicating that the interlocking has set a route out of the port. Auhafen has similar signals.

Photo George Raymond.



Obsolete interlocking that controlled the northwest end of Auhafen's arrival/departure and hump yard. This area is on the left in the diagram on the next page.

Photo Port of Switzerland.



Local control of hump yard

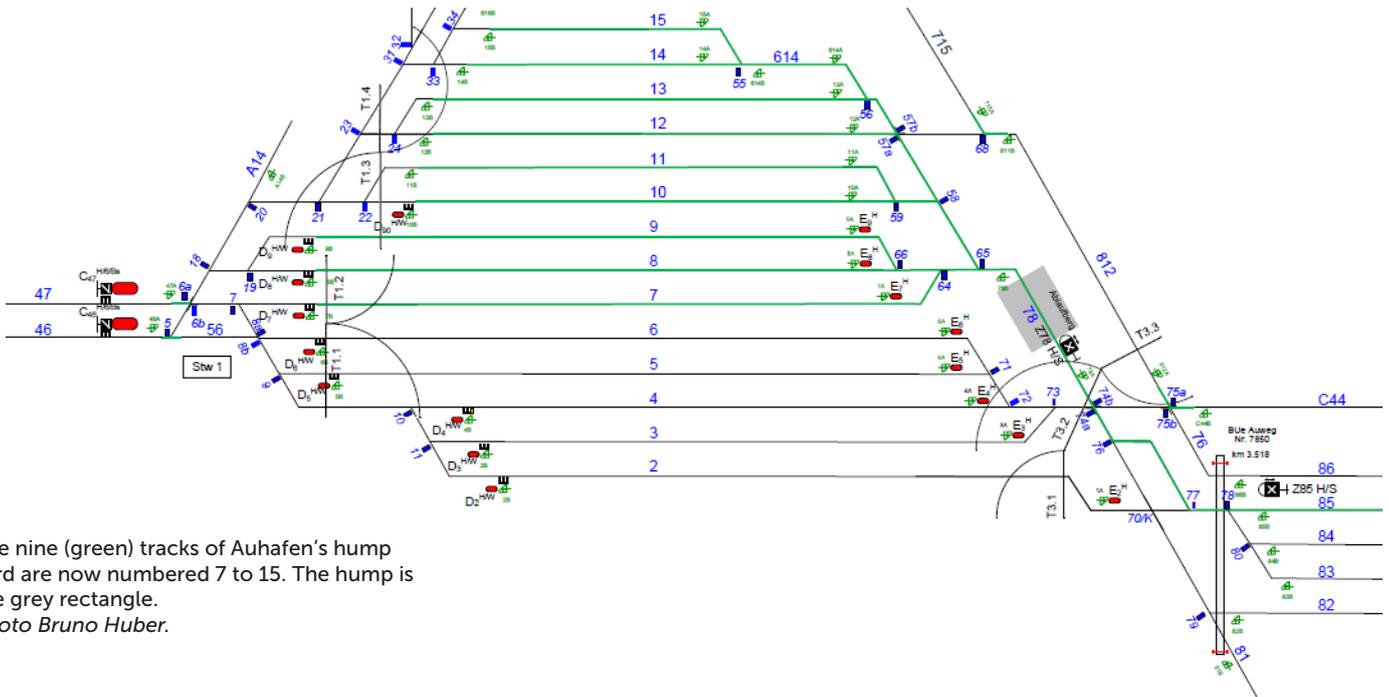
An important feature of SPR's new control system is the option of controlling the railway's Kleinhüningen and Auhafen hump yards either from the control centre or at the hump.

To use the hump control panel, a local operator first obtains control over the hump yard from the central dispatcher. According to the destinations of the wagons to be sorted, the operator then enters a sequence of up to 10 destination tracks. They appear on the panel's small screen. A destination track can appear in the list several times.

To conduct the sorting operation, the shunting manager works in cooperation with the locomotive driver, the people who uncouple the wagons and others who place track brakes on each target track. A signal indicates when the driver can push each group of wagons over the hump.

A Swiss interface to German Railway

Until July 2019, a mechanical semaphore signal of German Railway (DB) governed trains leaving the SPR access line and entering DB infrastructure near Basel Badischer Station. SPR's resignalling project provided a new interface between SPR's ETCS Level 1 and DB's Siemens PZS90 signalling, also known as



The nine (green) tracks of Auhausen's hump yard are now numbered 7 to 15. The hump is the grey rectangle.
 Photo Bruno Huber.



The nine-track Auhausen hump yard in 2013, before re-signalling. The project removed the connection between tracks 4 and 5 and renumbered all tracks. Photo Bruno Huber.



The re-signalled, nine-track Aufhafen hump in 2019 and its new local control panel, which an operator can use wearing gloves. Photo George Raymond.

Euro ZUB. To the interface designers, the only common points between the German and Swiss railways seemed to be catenary voltage and track gauge. German signals are on the right, Swiss on the left. The Germans and Swiss often use different German words for similar objects and vice versa. In Germany, an operator must tell the interlocking the direction of travel over a track section; Switzerland allows the interlocking to determine this itself.

Basel's disputed new tri-modal container terminal

Faced with projections of continued growth in container traffic, PoS, Swiss Federal Railways' freight division (SBB Cargo) and two other operators want to build a central tri-modal container terminal for Basel on the former site of a DB marshalling yard. Six tracks at Gateway Basel Nord (GBN) will receive 750-metre trains directly from the parallel north-south rail corridor connecting Rotterdam and Genoa. The terminal's cranes will also unload barges docked in a new, adjacent port basin and load trucks that can then depart on the parallel A2 motorway. GBN's promoters point to the ongoing growth of the ports

of Hamburg, Antwerp and Rotterdam and to the Rhine's abundant capacity.

GBN is to become a central gateway for Swiss imports and exports. Its promoters say that GBN will be more efficient in this role than the current network of smaller Swiss terminals in the Basel area and elsewhere. GBN's efficiency should also discourage shippers from placing containers on trains that arrive at points outside Switzerland, then move to their final destinations in Switzerland by road. The goal is for 50% of loading units arriving at GBN by rail or barge to continue their trip into Switzerland by rail.

The current plan is to start GBN's construction in 2020, complete the rail part of the terminal in 2021 and open the port basin in 2024. But Swissterminal, the private operator of two of PoS's four existing container terminals, is challenging GBN in court, saying that the Swiss Federation's CHF 83 million contribution to GBN is unfair. Although GBN's backers point out that Swissterminal's facilities have also benefited from federal funds, Swissterminal may seek compensation before allowing GBN to proceed.