Scania Transportlaboratorium – Evaluation of transports with duo-trailer combination 2019-10-28

Content:

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1. Summary

Scania has within Scania Transportlaboratorium AB's operations, for 5 years operated a duo-trailer combination, 2-axle tractor-semitrailer-dolly-semitrailer. The transports, which run between Södertälje and Malmö, are run around the clock seven days a week. In total, this vehicle combination has been driven approximately 4 million km in all seasons.

With the vehicle combination we have saved about 25% CO_2 emissions and the same amount of fuel, which also means a cost saving of about 30%.
In addition, other traffic environment impacts have decreased as we have used one tractor less.

Scania has chosen the above vehicle combination to provide maximum benefit without changing the European basic concept with two-axle tractor and three-axle semi-trailer. To be able to achieve maximum climate benefit with HCT vehicles here and now, we must focus on the fact that the existing fleet of vehicles, trucks and trailers, easily could be used.
This also favours opportunities for multimodality and cross-border traffic. If special solutions are required, the climate benefit will be significantly delayed and diminished. The vehicle combination has during the test period always consisted of a 4x2 tractor, two mega trailers (of which the first equipped with a tow coupling) and a dolly with custom tow bar length. Tractors with engine power between 410 and 580 hp has been used.

The only adaptation of the tractors has been signs about long vehicle, warning lights (only for a speed-reduced bridge south of Jönköping) and speed limitation to 80 km/h. The trailers have been supplemented with tow coupling.

We have had one traffic accident during the period. The vehicle combination then drove into the side of a turning plow truck. Our assessment is that the accident had nothing to do with the vehicle combination and should therefore not be included in the evaluation.

We have no negative experiences to report, however, there are some difficulties to consider
- dependence on good road maintenance (plowing, sanding, salting) for starting in the winter
- the pairing of dolly and trailer takes time the first time and requires space for maneuvering the vehicles
- parking space at service areas/rest places
- In some cases, limitations in following traffic diversion

2. Driven km per year

The special permit was first obtained in 2014-06 with “TSFS 2014: 32/TSV 2013-2758” and the operation started 2014-08.
An initial "Technical Report" was written 2015-08-25 and the technical data reported there are also considered valid for the continued operation.
The first permit expired in 2017-12. A renewed permit was obtained in May 2018 “TSV 2018-1031/TSV 2018-1661” and traffic was restarted in 2018-05.
This current permit is valid until 2019-12-31.

Tractor	2014	2015	2016	2017	2018	2019	Km*1000
DTO782	180	180					360
DSD872	180	400	140				720
EOK271		220	400	50			670
ROH037			260	190			450
XKZ551				190			190
YEM195				340	200	20	560
ESE492				30	40		70
ZKH555					180	180	360
YCL912						140	140
	360	800	800	800	420	340	3 580

3. Fuel and CO2 reduction

Over time, the fuel consumption has been around 36 liters/100 km. In comparison the average fuel consumption for tractors with single trailers is about 24 liters/100 km. This gives a fuel and CO_2 saving of 25%.
Since 2018-03, all tractors are run on HVO. We can’t detect any differences in fuel consumption, but the fuel gives a CO_2 reduction of about 90% compared to diesel.

4. Technical testing in operation according to § 6 och 7 in the special permit application

ITK 74 Intelligent Access Control
The Transportlaboratory's duo-trailer vehicle combination was used in the FFI-funded project ITK Demo, which was finalized in 2018-09. The project has continued in a work with geo-fencing, Scania Zone, but it has not particularly affected the duo-trailer vehicle combination.

More testing on winter roads
During the test period 2018/2019 there were real winter conditions with a lot of snow on the roads.
We have improved drivability by choosing best possible winter tires and the tractors are equipped with easy to use snow chains. Towards the end of the winter we tried On-spot, which automatically throws chain links under the

tires, so that the driver doesn't need to stop the vehicle. The result was very good and has reduced the need for using snow chains.

Platooning

We have tested a new software in one of the vehicles that has always passed as tractor no. 2 in a column run. The experiences from this are evaluated by Scania's development department.

Other tyre profiles

We have switched to 70-profile tires and with it gained access to newly developed designs and rubber blends that are better suited for winter conditions. Together with Michelin we have chosen their 315/70 R22.5 XFN for summer and 315/70 R22.5 XDW ICE-GRIP for winter time. The latter has provided good winter driveability and a life span of just under 200,000 km from October 15 to March 15.

Aerodynamical improvements

We have used so called boat tails to achieve lower fuel consumption. The experience is that we were able to achieve some percent improvement. At the same time, we have experienced large maintenance costs as the components are sensitive to external impact and are not sufficiently robust. Continued development is required and a legislative amendment is also needed that allows the extra vehicle length when the boat tails are folded.

New vehicle generation with even lower CO_2 values

We have driven about 2200,000 km with the new vehicle generation and achieved fuel savings. However, it is difficult to account for these quantified as the winter season became the most difficult to date. Therefore no direct comparisons can be made.

5. Vehicle combination

Throughout the trial period, we have operated 2-axle tractors, 3-axle mega semitrailers and 2-axle dollies. We have operated tractors with engine power of 410-520 hp and the optimal balance for us between fuel consumption and average speed is with engine power 450-500 hp.
We have chosen to only operate with 2-axle tractors to achieve the best economy and because this is the standard configuration in Europe. We are aware of that there are proponents for three-axle tractors but we have not seen it as an advantage as the loading of a Euro trailer adapted for a two-axle tractor gives a low bogie load.

6. Adaptation of vehicles

Tractor
The tractors has the same specification as we use for 40 tonnes, except for a slightly higher engine power. The cruise control is locked to maximum GPS speed 80 km/h and the vehicle has a “32 m sign” on the front grille. The tractors are equipped with tires with priority winter driveability and quick-fitting snow chains.
During the current special permit period we have also had flashlights in the front corners synchronized with remote control of magnet mounted flashlights on the rear corner of the last trailer. The flashlights are only used to mark the speed reduction of 50 km/h on the E4 bridge over road F846 when we have a GTW over 64 tonnes. We have also tried dynamic snow chains, On-spot, with very good results. The On-spots reduces the risk of accidents when installing/removing snow chains along the road.

Trailer
The major adaptation of the trailers has to do with the installation of tow coupling on the first trailer. We have 90 trailers in operation and, in conjunction with the replacement of the fleet, have ensured that an increasing proportion have tow coupling. From the start there were 30 out of 90 and now 68 out of 90. Until we have the tow coupling on all trailers the transport manager needs to make sure that at least one trailer every departure is equipped with tow coupling. The second trailer is fitted with a 32 m sign with magnetic brackets and remote controlled flash lights in the corners.

Dolly
We operate two duo-trailer combinations but already from the start we have had three dollys in order to constantly have one in reserve for repair and maintenance. The dollys have been given more frequent maintenance because they have a very high utilization. They are built from standard components but with custom drawbar length.

7. Traffic accidents

We have had one traffic accident. 2018-01-17, on the E4 northbound just after the departure of Vagnhärad, our vehicle combination drove into the side of a turning plow truck. Our driver lay in the outer lane and planned overtaking the plow truck plowing in the inner lane. Then the plow truck turned left to change plowing direction. The situation arose suddenly and unexpectedly and our driver could not stop before the vehicles collided. There were major material damages to the vehicles involved but no personal injury. According to the police report none of the parties were considered to be causing accident, therefore our assessment is that the accident would have been exactly the same if it had happened with a single

trailer combination and should not be included in the experience evaluation of the duo trailer.

8. Handling of difficulties

Roadholding
Dependence on good road maintenance is increasing to enable driveability in winter roads. It is difficult to get started in connection with a lot of snow. Most often, the drivers have solved this by mounting snow chains before starting and moving to a better starting position. With the On-spot this is facilitated.

Coupling of dolly and trailer
Drivers experience only minor difficulties while driving. The second trailer follows the first trailer and the tractor in a good way, it requires that the driver take out a little more through intersections and roundabouts but it has been considered as easy. The challenge is the space required for pairing up and meeting right with the trailer against the dolly, and the dolly under the second trailer. It does not involve any traffic safety risks but it's only a matter of time efficiency, where training provides skill.

Parking space at rest/service areas
The resting places that we have planned to use have plenty of space for long vehicles. Difficulties can arise in connection with delays where the driver needs to take rests in places other than the pre-selected ones. Therefore, in the most recent special permit application, we have increased the number of planned resting places.

Diversion in connection with a closed off main route
In most cases, there are no accessibility problems on the diversion routes. We strive to allow a single-trailer combination to go ahead and explore accessibility. The general assumption that applies to our drivers is that, if the selected diversion is possible to use with a 25.25 link trailer then our duo-trailer combination can use it as well.