



FACTS ABOUT ARTICULATED BUSES

Over the past twenty years, there has been a steep rise in operating costs and personnel costs for bus traffic services. Another influential factor has been the shortage of personnel. Demands for better public transport are escalating due to increase in the number of traffic jams in city areas and increasing cost of fuel. Developments will soon make it impossible for people to drive to work in their own cars.

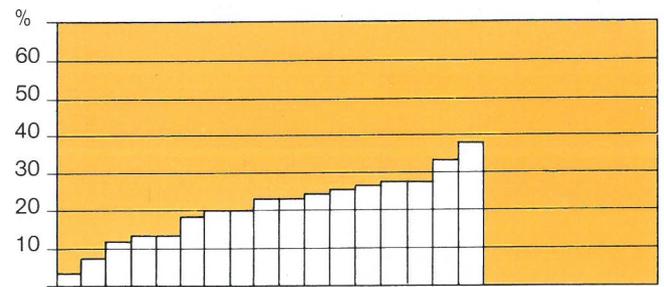
The difference between heavy and light traffic has also been emphasized. During peak hours, it is often necessary to have twice the capacity needed for light traffic. And in this context, the shortage of personnel is becoming an increasingly difficult problem.

One way of increasing transportation capacity is the use of larger vehicles which is a good solution, especially during peak hours. This is where articulated buses give a practical solution. Using the same number of personnel, having almost the same operating costs as two-axle buses, the passenger carrying capacity can be increased by 50% to 75%.

The information referred to in the following diagrams has been extracted from UITP's (International Union of Public Transport) report "Technical and economic aspects of articulated buses", which was given at the International Congress in Helsinki, Finland 1979.

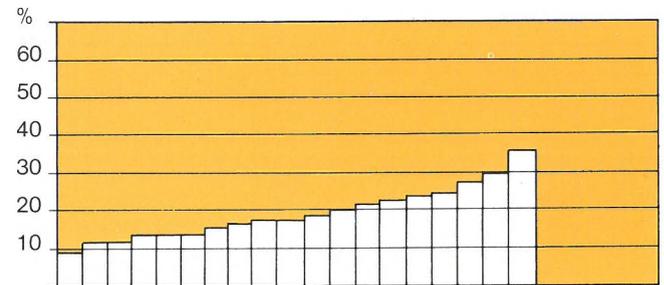
The diagrams indicate the savings that can be achieved by use of articulated buses, as compared to standard, 11 m, buses, costs per passenger have been used as comparative units. The costs have been obtained from 17 to 27 transport authorities throughout the world.

Savings in total kilometre costs.



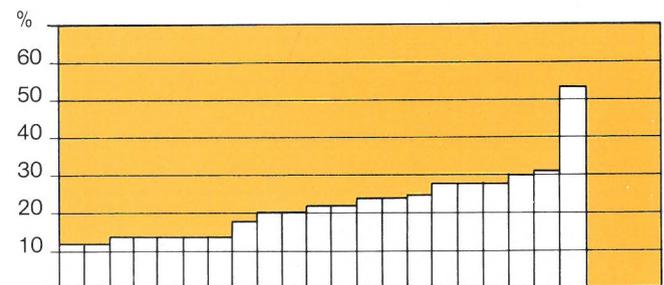
Each column represents a different network.

Savings in costs for service personnel.



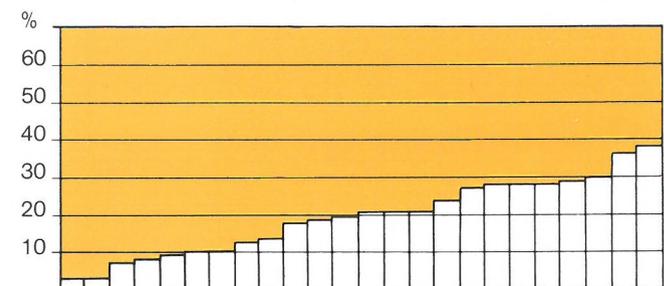
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Savings in costs for technical maintenance.



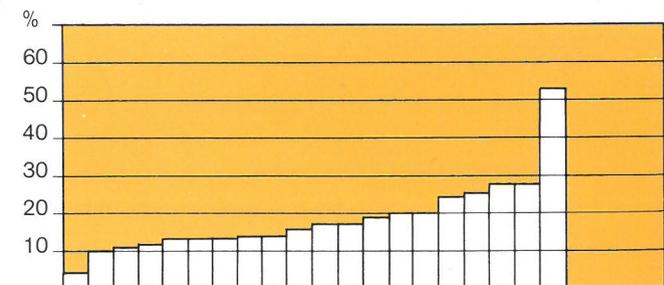
Each column represents a different network.

Savings in fuel costs.



Each column represents a different network.

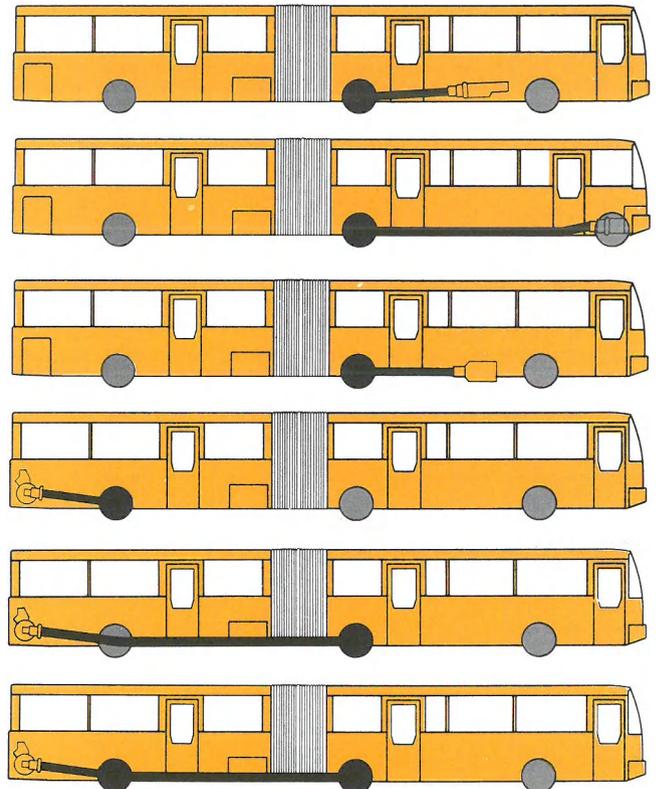
Savings in costs for tyres.



Each column represents a different network.

Different types of articulated buses have been developed over the years. Here, you can see 6 different types (UITP report):

- A. *Front end horizontal under floor axial engine with the second axle powered.*
- B1. *Vertical front engine with second axle powered.*
- B2. *Side mounted engine with second axle powered.*
- C. *Rear engine with third axle powered.*
- D. *Rear engine with second axle powered.*
- E. *Engine immaterial, with hydrostatic or electric transmission.*

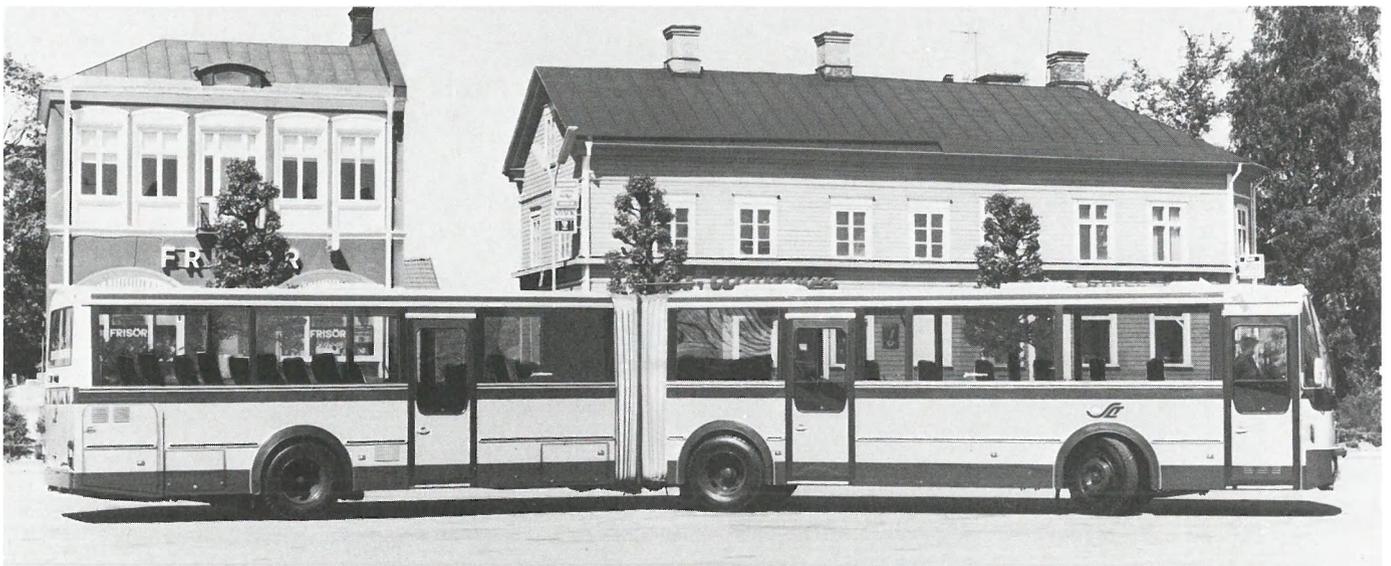


All these different types have their advantages and drawbacks. Scania-Bussar have chosen method C, i.e. an articulated bus with a rear engine, and with the third axle powered. This type is known as a “pusher” bus.

Scania-Bussar already understood the advantages of rear engine buses at an early stage, because with the engine at the rear, the bus can be built to meet individual body design requirements.

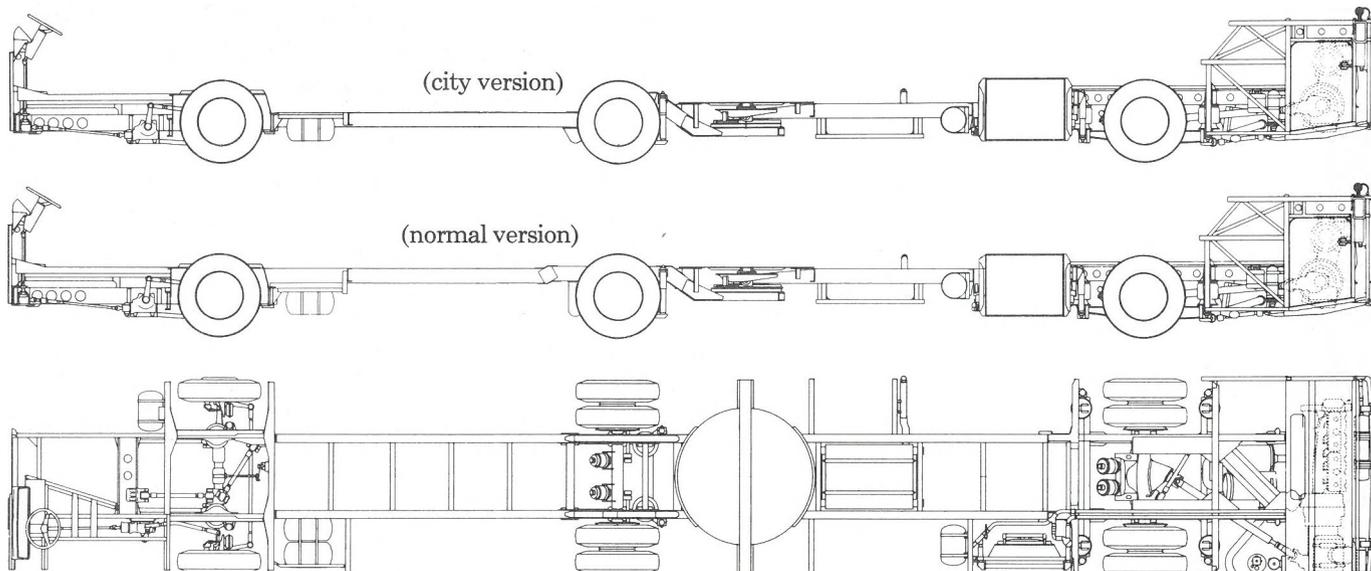
This has also been confirmed by bus owners. Sales of Scania rear engine chassis have soared.

And consequently, it was natural for Scania to develop the new articulated bus on a rear engine chassis. Scania’s articulated, pusher bus was presented in conjunction with the UITP-Congress in Helsinki, 1979. The bus was a Jonckheere Trans City, built on a Scania BR 112 A chassis.



Scania's articulated bus chassis became a branch topic, right from the start. And a large number of chassis were sold merely on the basis of the

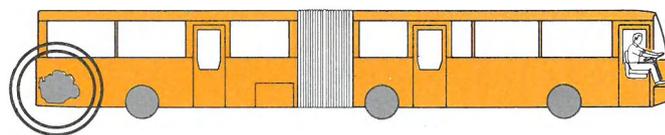
prototype, even though all constructions had not yet been tested. Today, they have.



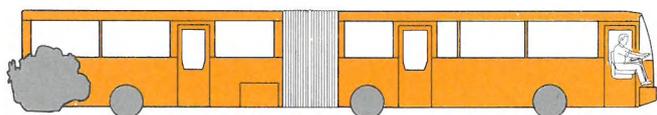
OPERATING FLEXIBILITY.

Articulated buses can operate in practically all types of traffic conditions. Scania BR 112 A makes it feasible to build a bus with a low floor for city traffic (city version). And for suburban services and route services, or route services and private coach services, there is BR 112 A with a normal floor and with space for a luggage compartment under the floor (normal version).

Scania BR 112 A is built for silent running. Noiseless for the driver and the surroundings. That's why there is a tachometer on the instrument panel; the driver can't hear the engine.



PERFORMANCE AND ENVIRONMENTAL FEATURES.

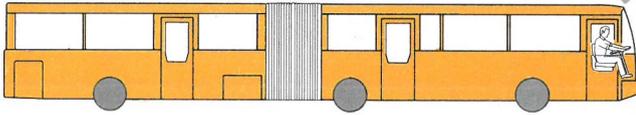
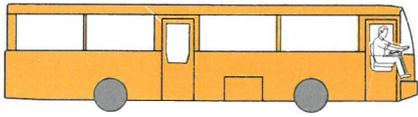


Bearing in mind that the total weight may exceed 26 tons, the drive line components must satisfy the demands for good acceleration, as well as for high speed. Scania BR 112 A is delivered with a turbocharged, 191 kW (260 hp ISO), DS 11 engine for maximum fuel economy. The automatic gearboxes, 3-shift or 4-shift, live up to engine performance. The Scania BR 112 A accelerates swiftly, smoothly and can be driven at high speeds.

Thanks to the rear mounted engine, it's easy to sound-proof the engine compartment. Consequently, Scania BR 112 A is delivered with a completely sound-insulated engine room, and with instructions for the coach makers regarding the completion of the sound-insulating work, so that a bus with no more than around 77 dB (A) noise level is obtained.

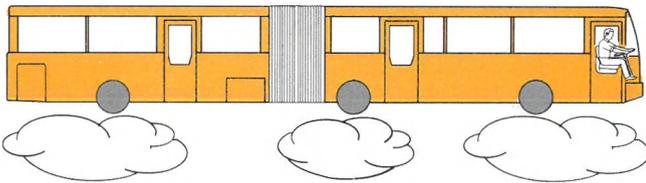
STANDARDIZATION IN RELATION TO TWO-AXLED BUSES.

Bus companies require as much uniformity as possible in respect of parts supply, servicing methods and of course good public image. There will then be no need for the retraining of drivers. They can switch from a two-axled bus and straight away take over a three-axled articulated bus.



An articulated bus is of course longer, so the driver has to take this into consideration in certain situations during a run, but other operating characteristics, such as instrumentation, fittings, controls etc., should be more or less the same for an entire fleet.

RIDING AND DRIVING COMFORT.



Naturally, riding and driving comfort should be equal to that of two-axle buses. It's important to passengers that access step height is low and convenient. The bus must also be well suspended have excellent stability and road holding so that it doesn't sway when cornering or wander at high speeds.

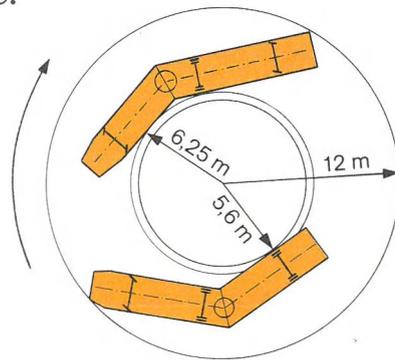
From the driver's viewpoint, it's important that the bus has good road holding characteristics, and that it performs in traffic like a two-axle bus in most situations. Neither should the driver have any cause to be uncertain about what happens, when he brakes heavily on icy roads, or when he has to drive up a slippery slope for instance.

STEERING GEOMETRY CHARACTERISTICS.

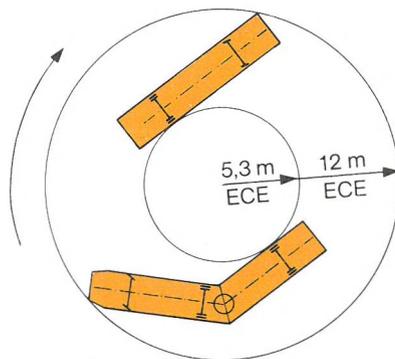
Drivers, depot and workshop personnel prefer a type of articulated bus that can be driven in the same places, and use the same stops, as two-axle buses. This should be feasible,

without any difficulties about supervising bus movements. Safety wise, it's also important that the sweep area is the least possible when cornering, changing lanes, pulling in or out of bus stops, bearing in mind surrounding traffic and pedestrians.

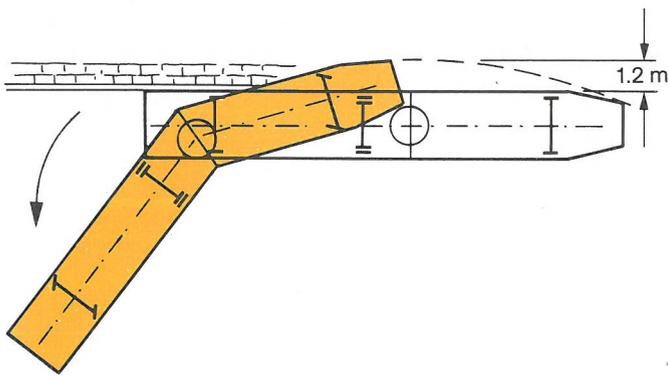
In a steering geometrical sense, it's possible to differentiate between articulated buses with a steered rear axle and those with a rigid rear axle. Utilizing a rear engine and the third axle powered, you are in practice forced to use a rigid rear axle. And consequently, Scania BR 112 A has this feature.



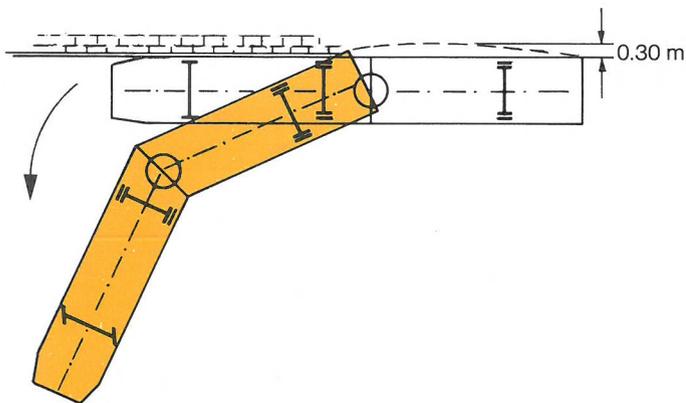
The advantage offered by an articulated bus with a steered rear axle is a smaller sweep width (distance between outer and inner turning circle). But the difference is rather modest, around 0.7 m, when compared to Scania's new articulated bus.



Scania's new articulated bus satisfies the EEC-regulations, which stipulate that in stabilized cornering, it must be possible to drive a bus between two circles with radii of 12 m and 5.3 m, whether the bus has two axles or several axles. These regulations regarding sweep width will be adopted by an increasing number of countries.



An articulated bus with a steered rear axle has a drawback, since the rear section sweeps over the kerb when the bus pulls out from the bus stop. The maximum permissible oversweep is 1.2 m according to EEC-regulations.



In this case, Scania's new articulated bus even satisfies EEC regulations for two-axle buses, for which the maximum permissible oversweep is 0.8 m. As a matter of fact, the oversweep of Scania's articulated bus is less than that of a two-axle bus.

A Scania BR 112 A has a larger sweep width. To compensate this, the first buses have been shortened by around 60 cm, to 17.4 m. On the other hand, a steered rear axle articulated bus has tapered coachwork corners to reduce the drawback of body over swing when cornering, changing lanes, pulling in or out at bus stops and in order to retain the maximum permissible length of 18 m.

Which drawbacks are the easiest to accept?

The wider sweep of a pusher articulated bus is more acceptable, in

our opinion, than that of a steered rear axle articulated bus. A driver always knows what is happening to the rear part of a pusher articulated bus. He can supervise everything with the help of the side mirrors, something he cannot do, however, on a steered rear axle articulated bus.

It's also a fact that a pusher articulated bus doesn't attain its full sweep until the bus has made about a half-turn. But long curves are few and far between. Therefore, under normal conditions, a pusher articulated bus can utilize the same manoeuvring areas as a common two-axle BR 112 bus.

It's even easier to reverse Scania BR 112 A, but on the other hand it requires more space for turns on straightening, than a steered rear axle articulated bus.

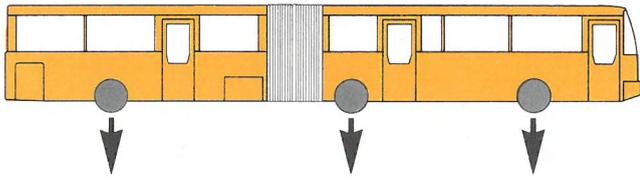
WEIGHT DISTRIBUTION.

The weight distribution on an articulated bus should be arranged so that the drive wheels always have sufficient tractive force. There should also be a good distribution of the braking force. It must be possible to use the retarder, without running the risk of jack-knifing on slippery roads.

It is a well known fact that articulated buses with the second axle powered often have starting problems on slippery road surfaces. In the case of Scania BR 112 A, however, you get sufficient pressure on the powered axle, even on an empty bus.

In addition, Scania BR 112 A has an adequate positive load, which is applied to the pivot by the rear coach. One manufacturer's articulated bus construction has actually resulted in a negative load on the pivot. And this has influenced the performance to such an extent, that it has been found necessary to limit the speed of that bus.

When braking, it is advantageous to have an axle load distribution at the rear, where the heaviest weight is and consequently, the highest braking force. Furthermore, there is an advan-



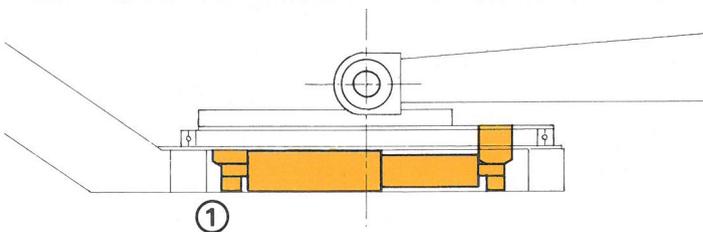
tage in that the gearbox retarder works on the right axle, i.e. the third axle. A retarder on the second axle increases the risk of jack-knifing on slippery roads.

Scania BR 112 A has a good basic stability, as a result of its advantageous weight distribution: 4,000 kg at the first axle 4,345 kg on the second axle and 7,750 kg on the third powered axle. These figures apply to the service weight of the first Jonckheere-body, which was built in a de luxe version for route and tourist traffic.

ROAD HOLDING STABILITY.

The running characteristics of an articulated bus must induce a feeling of safety in the passengers. They must feel that the bus is safe and stable, independent of speed or road conditions. Scania BR 112 A displays an excellent road holding stability, even at high speeds and in trials on skid pads.

SAFETY AGAINST UNCONTROLLED JACK-KNIFING.



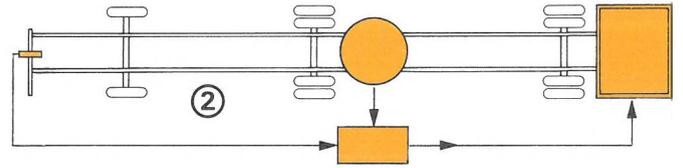
An articulated bus should be built in a way that makes it possible to avoid jack-knifing even if the driver makes obvious mistakes, or if road conditions are unfavourable.

Scania BR 112 A has a basic design that results in a steady running bus, well adapted to all traffic situations.

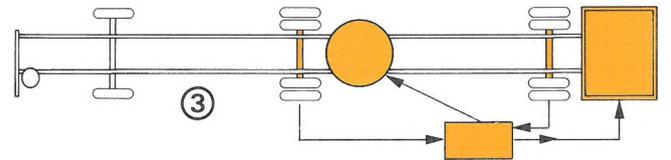
In addition, the following extra safety devices have been introduced on Scania BR 112 A, so that it can operate safely, even in extreme situations.

1. Horizontal fold-absorbers that counteract high folding (jack-knifing)

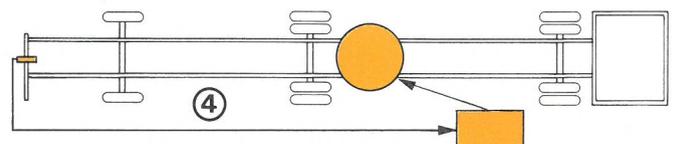
speeds are fitted at the pivot. The curve of the fold-absorbers allows them to follow closely at low folding speeds, but also to absorb and even lock at jack-knifing.



2. The throttle is electronic and is connected to a control box, which is also fed with data about the pivot-angle. Excessive acceleration is electronically blocked in conjunction with big pivot-angles. This electronic control cuts out at speeds of less than 7 km/h.



3. Another electronic system registers the revolutions of the third axle (powered) and compares them with those of second axle (using known techniques from locomotives and non-locking brakes). If the rate of revolution does not fall within the permissible ratio, the fuel is automatically cut off and a multi-disc, lamina brake in the pivot is engaged (the same type of brake employed on long-distance, semitrailer trucks). This makes it possible to avoid e.g. jack-knifing, when there are differences between the tyre grips under the second and third axles.



4. The pivot brake is activated also at high braking pressures. This means that when a driver brakes heavily, there is no risk of the rear being swung outwards.

These features ensure that Scania BR 112 A runs safely in all road conditions for all drivers.

SUMMARY. ARTICULATED BUS CHASSIS SCANIA BR 112A.

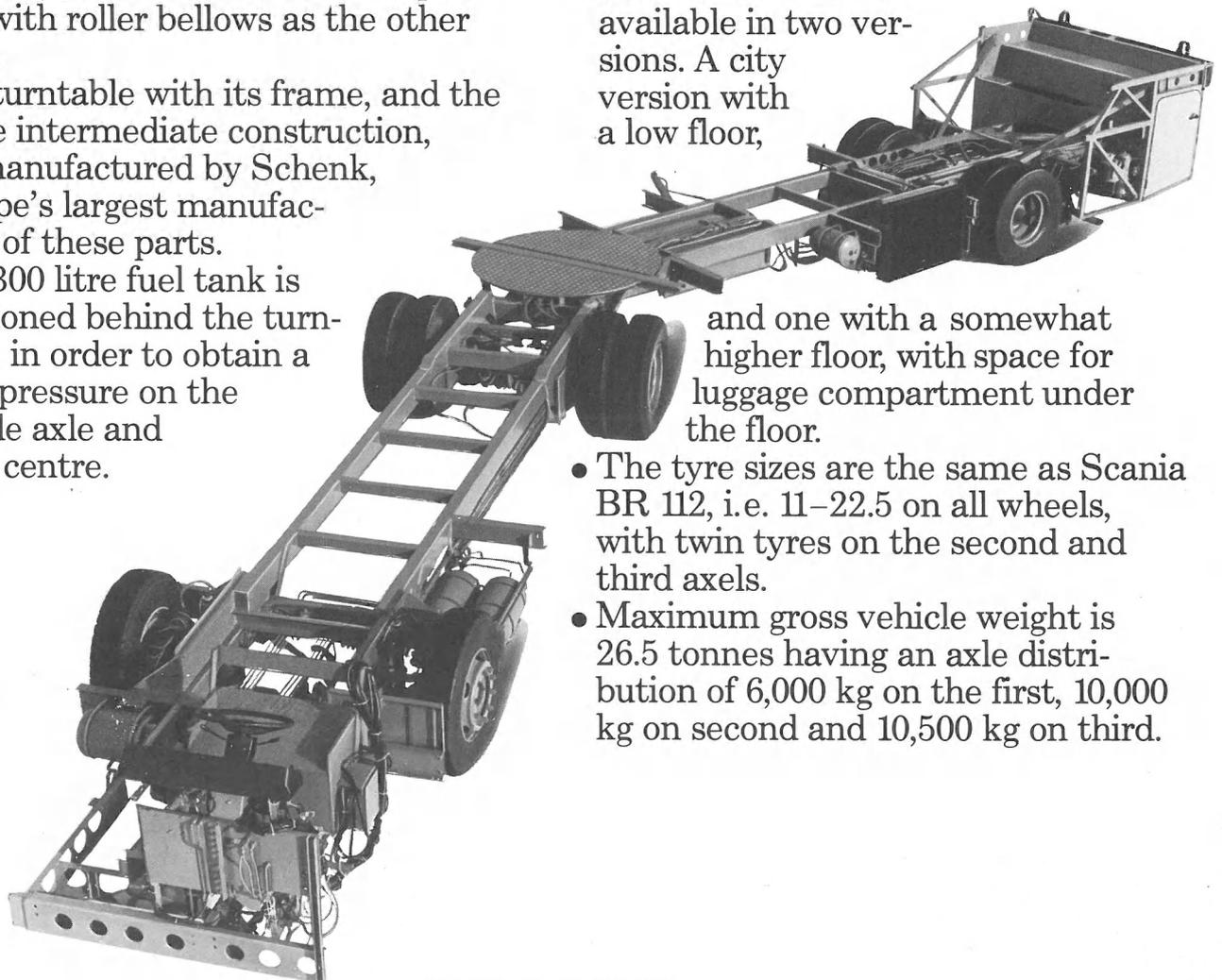
Scania BR 112 A has the same standard components as Scania BR 112, regarding steering parts and drive parts. Consequently it also has the same advantages as a common rear-engined bus:

- Weight concentration above drive wheels which results in even tractive force.
- Engine is easily accessible for service.
- Engine compartment is easy to sound proof and gives lower noise level.
- Low floor for city services, high floor for route services, when ample space for luggage is required, can be adapted due to rear mounted engine.
- The driver enjoys a quiet environment.
- It differs from a normal two-axle Scania BR 112 in that only a middle axle and a turntable are added. The middle axle is a Scania standard trailer axle of type AT 90. It has air suspension with roller bellows as the other axles.
- The turntable with its frame, and the entire intermediate construction, are manufactured by Schenk, Europe's largest manufacturer of these parts.
- The 300 litre fuel tank is positioned behind the turntable, in order to obtain a good pressure on the middle axle and pivot centre.

- Scania BR 112 A has an electronic throttle. Cables and tube extension kits are delivered for bus lengths of up to 18 m.
- The tachometer is standard, since the engine is so far away from the driver.
- The braking system is a two-circuit system. One circuit works on the first and third axles, and the other on the second and third axles.
- Brake linings on first, second and third axles are 7", 8" and 10" respectively.
- There is an extra compressed air tank for the extended braking system.
- High folding (jack-knifing) is counteracted by horizontal fold-absorbers, pivot-angle controlled throttle, lamina brake in the pivot and a sensor comparing the revolutions of the second and the third axle.
- Scania BR 112 A is available in two versions. A city version with a low floor,

and one with a somewhat higher floor, with space for luggage compartment under the floor.

- The tyre sizes are the same as Scania BR 112, i.e. 11-22.5 on all wheels, with twin tyres on the second and third axles.
- Maximum gross vehicle weight is 26.5 tonnes having an axle distribution of 6,000 kg on the first, 10,000 kg on second and 10,500 kg on third.



SCANIA

SCANIA-BUSSAR AB, KATRINEHOLM