NATIONAL COLLEGE OF ART AND DESIGN

Faculty of Design

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European Truck Cab Design from 1980 to 1993

by

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Submitted to the Faculty of History of Art and Design and Complementary Studies in Candidacy for the Degree of B.Des. in Industrial Design

1993

Acknowledgements

Prof. W. Kraus
Lars Hagstrom, *Product Planning, Scania Trucks and Buses*
Paul Caffrey, *HADCOM, N.C.A.D.*
Mark M^{c}Cague
MAN Nutzfahrzeuge GmbH,
Raymond Byrne
Paul Clerkin
DAF BV, *Geldropseweg, Netherlands*
Mercedes-Benz, Daimler-Benz AG. *Stuttgert - Unterturkheim, Germany*
Paul Fortune, *Dept. of Industrial Design, N.C.A.D.*

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INTRODUCTION

The thesis will address the question of design and its implications on contemporary European trucks. It is an area of design which has often been considered of lesser importance in the motor industry. A brief outline of the history of the truck, its origins and what the main issues in truck design today will be given. It will address the question: what is a contemporary European truck? with a look at the various models on the European market, giving an explanatory view of them, and what they represent within the truck industry. The tasks of such a truck from the point of the needs and requirements of the European transport industry and how they are addressed by the truck industry. It will look at what is on the market, particularly the main contenders such as DAF, Scania, M.A.N., Renault, Volvo and Mercedes-Benz. The impact of these vehicles on our environment will be analysed to see how we, as a society rely on the truck for our transport needs, and the direct effect of this on our roads and towns etc.

The thesis will analyse pre-1970 trucks with a look at the early box cabs of the turn of the century, and those purely rugged cabs of the '50s. The emergence of the cab-over truck, with the change from having the engine in front of the cab, to having it under the cab, and how this improved the drivers comfort. From this it will look at the progression to the cab of the '70s. With the introduction of driver comforts, and longer distance travel, and how this, going through the comforts of the '80s, with the new style and higher level of trim in the '80s cabs, gave birth to cabs of today, the third generation. These being the new cabs of the '90s, such as the Scania 3 series, the Renault Magnum, and how they relate to their predecessors

The thesis will look at the fleet operators versus owner drivers, and how the requirements of the large fleet operators, compared to those of the owner driver, and how they have influenced the truck industry. It will take into consideration, the local delivery.vehicle such as the smaller short distance multi stop DAF 45, and 75 / 85 series, and the long distance vehicle with the higher

powered truck, such as the Scania 143.500 Topliner, and it's requirements, compared to those of the short distance truck. Drawn from this will be an analysis of current trends from the drivers point of view, i.e. visibility, location of controls, and ease of operation. It will ask which should take priority, function or comfort? Should modern truck cabs be designed to be more functional, in that they are more rugged, like that of the military, and so be cheaper, easier to keep clean, and withstand the harsh treatment better, or should the driver's comfort be the main concern?

The Scania 143 will be analysed in depth. to see where the truck fits into the range, the power output, and what this truck is normally used for. It will be taken from the point of view of the driver, involving the ergonomics, layout of the cab, specification and standard of trim etc. From this the advantages and disadvantages of cab, in relation to others of this type on the market can be noted. It will draw a comparison to it's competitors on the market at present. It will look at the manufacturing and design of the cab. How the it is manufactured and produced. How the design of this truck compares to that of others, and how it relates to the needs of the transport industry. Drawing a conclusion,with the view to the overall truck, and the findings in relation to its competitors.

The current trends in cab design with the introduction of new ideas, such as computer aided design, the reduction of the number of cab panels, better visibility etc. will be examined to see whether are they moving in the right direction? It examines the controversial idea of putting the sleeper unit on top of the cab, rather than behind it, thus gaining extra payload space at the expense of the driver. While looking at the use of cab space, cross cab access is analysed, with the movement of the driver around the interior of the cabs such as the new Scania Topliner and the Renault Magnum. From the interior space to how good the ride is with total air suspension. Are three forms of air suspension necessary? with chassis, cab, and seating, using air suspension. With the advancement of electronics, it looks at electronic governing in the form of speed restrictors, A.B.S. self levelling suspension, and electronic gear shift, with the Volvo, Mercedes Benz EPS (electronic power shift) and how this assists the driver.

Away from the driver, it looks at manufacturing, cab assembly and new design methods, which reduce the number of panels required to produce the cab, and gives better flexibility to the production of the cabs. Aerodynamics falls into this area as to how the new exterior shape of the cab is reflected on the interior area, and accessibility to the cab. Computer mapping and communications are examined. How satellite navigation assists the driver, and the new level of communications available to him with such devices as mobile phones, and fax machines.

The thesis will look towards the future to find where is the industry going? with cab sharing development such as Cabtec, and the use of this company between DAF, Pegaso, and Seddon Atkinson. How they produced one basic cab to be used by each of the three companies, and look distinctive from each other. Size increase, with the so called 'super trucks' e.g. the Scania 143 500 etc. and their influence on the transport industry. As technology advances, what about onboard electronics? Are the modern trucks relying to much on electronic technology or should there be more use of made of these devises? With the environment being an issue of the future, new laws to make trucks friendlier to the environment, e.g. noise output and exhaust emissions, and how they effect the driver, e.g. quieter cabs. From this, it looks at concept trucks. What the future holds for the truck industry, with the onset of a single market, new legislation and new technology.

Fig. 1. The Lady Deborah

CHAPTER I : THE TRUCK

Trucks have been around for as long as the motor car. Some historians who specialise in motor vehicles regard the Cugnot steam vehicle of 1792 as the world's first mechanically propelled vehicle for burden (Ingram, 1979, p. 6.). This was a lumbering three wheeled tractor for carrying cannons, which might have been further improved had it put up a better performance than that of the 3 to 5 mph achieved during early trials. It is more likely however, that the contemporary heavy truck has its origins in the steam road-coaches of the 1820s, for without the intervention of railways, we could have enjoyed advanced steam road transport well before the nineteenth century. Instead it was limited to agricultural vehicles.

Fig. 2 A 1916 Seddon Atkinson steam powered truck

Strictly speaking it was the early petrol motor vehicle of the 1890s, which spawned the commercial vehicle, as we know it today, which with the later development of the diesel engine, has formed the basis of the worlds' transport operations. In the US the Rapid motor truck was launched in 1902 and became the foundation stone of General Motors. Fig.3 With liquid fuel reserves rapidly dwindling, there are now projects looking at the feasibility of electricity as a future form of power. Another parent of today's commercial vehicle is the horse drawn buggy. In the early days of trucks, it was this mode of transport which was constantly referred to when questions of cost, speed, and reliability were at issue.

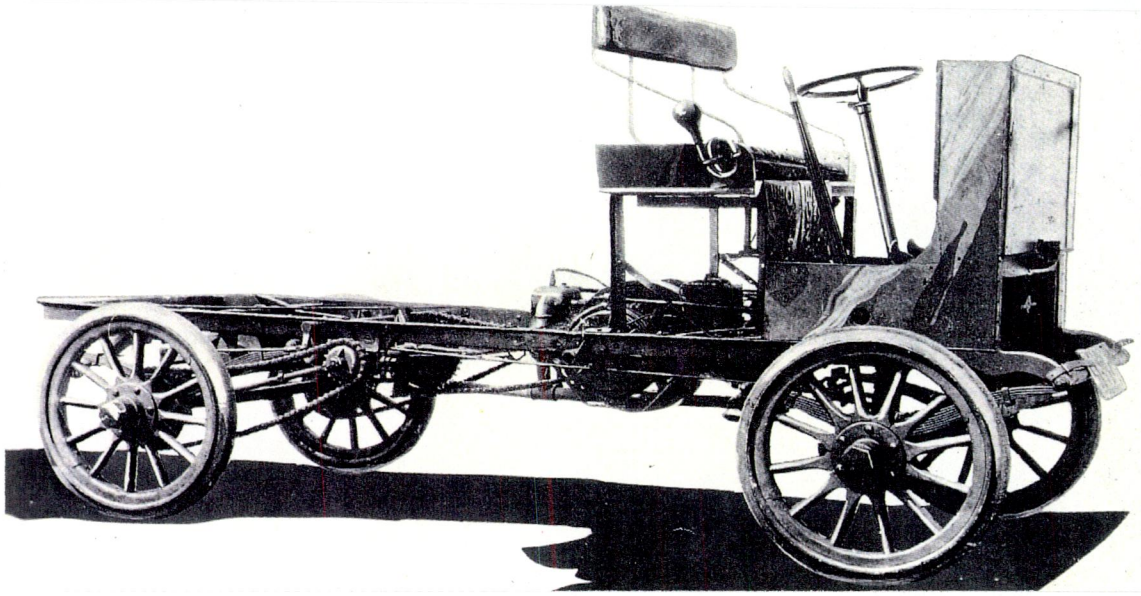


Fig. 3. The 1902 Rapid motor truck

Today the truck has to compete with the ship more than anything else. The long runs from Europe to such places as the Persian Gulf, Pakistan, the Far East and even war torn areas such as Kuwait are commonplace. Fig. 4. It is because of these routes, along with the long distance European work, as well as local haulage that the design of the truck is so important. Over 90% of all goods are transported by road today. (Boulton, Nov 1989, p.54.). The cab of the truck is not only a place of work, but also an environment in which the driver has to live. A driver may spend in excess of 120 hours a week in his truck. Because of this, much time and money is invested in both the interior, and exterior design of the truck.

Fig. 4 A long distance Volvo F12 globetrotter in Kuwait.

This chapter will address the question as to what a contemporary European truck is, its tasks, and impact on our environment. The evolution of such a truck from the early '70s, to the new third generation of trucks. The requirements of the driver for both long and short distance work with function and comfort in mind. The Scania 143 will be analysed later, from the points of its history, usage, the drivers point of view, the advantages and disadvantages of the truck, a comparison to its competitors and the design and manufacture. It will look at the current trends within the industry and see how this relates to what is on the market and look to see where the industry is going

What exactly are the requirements for a contemporary 1990s European truck? To explain this we need to take a look at the various models on the European market today. This will show the variety and diversion of trucks, and manufacturers that vary throughout Europe. To look at such a vast spectrum would be fruitless unless we take a single view point from which to start. So we ask the question, what is the common factors to this quest ? The operator and the driver. For the purpose of examining the question, what is a contemporary

European truck ? the operator shall be taken as the common factor as it is he who in the end holds the purchasing power over the manufacturer.

So what is the operator looking for when he is purchasing a new truck? This depends on what type of operation he specialises in. If it is long distance 40 tonne work he will want a vehicle which is powerful, lets say between 400 and 500 bhp. depending on wether it is domestic or international haulage. Higher powered trucks are now becoming more and more accepted for their reliability and fuel efficiency as they incur less effort to pull their payload. For example the Scania 143.500 with its 14 litre turbo intercooled engine and the Renault Magnum 500 AE with its 17 litre turbo intercooled engine were only a few years ago thought to be unnecessary and a total waist fuel. However it is now found that not only are they far easier to drive with less gear changes, reducing the stress on the driver, but they are giving as good as and in many cases better fuel returns while completing better journey times over their predecessors.

However not all haulage work is so demanding, much of it is local short distance lightweight. This type of work does not require the same power output from the engine, nor the same high level of interior comfort as the driver spends far less time in the truck. Sleeper cabs are not usually found on this type of truck examples of which are the Ford Cargo, the DAF 45 Series and the new and larger 75 and 85 Series. These vehicles may cover less distances than larger ones, but much of their time is spent in city traffic and so they need to be highly manoeuvrable, with excellent visibility from the driver seat.

From this brief outline of the requirements, it is clear there is a large variation in the needs of the transport industry, but the basic operator requirements are the same. Reliability, economical, functional while still offering a good level of comfort. From the outset the working principals are the same. As both the drivers working and living conditions are to be discussed, it is best that the larger trucks take precedence, from the point that these offer a more informative view of the industry and can offer a better insight into the contemporary truck.

Some of the main contenders in this area are Scania, DAF, M.A.N. Renault, Volvo, Mercedes Benz and this years winner of European truck of the year Iveco. Each have their own market strong points such as the new high-cab Mercedes with its electronic gear shift. Fig. 5. This unlike normal automatic transmissions has a manual clutch but the gear is selected automatically. This means that the driver does not have to wrestle with the gear lever to select the correct gear, he only needs to depress the clutch when the indicator tells him. It adds to the efficiency of the truck while reducing the work load on the driver. Such trucks as the Scania 143 and the Volvo F16 are renowned for their high power coupled to a high level of comfort, even though the Volvo in now rather dated compared to the others.

These trucks have been designed with long distance heavy haulage in mind. It is noted that the Scania is the regular choice with owner drivers for transcontinental work, despite its high price. DAF are well known in the middle weight section of the market for the domestic runs. These trucks would have been considered super trucks ten or fifteen years ago. This is when the top of the range DAF had a maximum power output of 280 bhp.on its 2800 range. It is now 430 bhp. on the 95 series, while still using the same basic 11.6 litre engine. But it is not only the power output that has changed, the cab has under gone a major transformation, not just the exterior but also the interior.

Everything from the dash to the seating to the trim has been improved. Renault on the other hand, have taken a different approach with their Magnum. This truck looks like nothing else on the roads of Europe today, as it towers above it's competitors. The truck was not redesigned, but designed from scratch in the mid '80s. Unlike normal cab-overs which have the engine protruding up into the cab, restricting cross cab access, the Magnum's engine compartment is totally sealed beneath the cab floor. Because of this the cab is higher than the normal cabs, but is far quieter, and enables the driver to walk freely around the cab.

Fig. 5. The Mercedes Eurocab and the Daf 95 Spacecab.

Many of these improvements may appear only to serve the the transport industry, but in turn this has a dramatic effect on our environment. Trucks are a part of our every day life, just as the horse and cart was, not so long ago. We see them on our roads and in our towns and cities every day. Almost everything we possess has at some stage been carried by such a vehicle. Without them society and the economy as we know it today, would fail to operate in it's current form. Our lives have become dependent on these gigantic beasts. But can we survive their presence? In these days of pollution and traffic congestion, the truck, towering above the family saloon car, comes under great scrutiny from those wishing to see a cleaner environment in which to live in.

In many areas large commercial vehicles need special licenses to enter towns and cities, other than in the day-time, such as London for example. This is because of their size and noise emissions. Many countries are introducing new legislation to curb pollution from trucks. Austria now has the strictest laws in Europe on noise emissions, giving not only silent trucks, but also lower exhaust emissions. Sweden, Denmark and Germany are close behind. Another serious problem is the conditions of the roads. The weight limit of these vehicles has increased over the years. The Netherlands permits a maximum weight of 56 tonnes, Ireland however only permits 38 tonnes maximum and Britain 40 tonnes which is the norm for Europe.

These are the issues concerning the contemporary European truck which reveal the most, in the way of offering a defined description as to what it is

CHAPTER II : HISTORY OF TRUCK CABS

Fig. 6. A 1928 diesel Mercedes-Benz 8 tonner.

TRUCKS

The mechanically propelled truck began life as a converted horse drawn cart with an engine. It followed that the cab changed very little in the transition from cart to truck. These were crude and uncomfortable, open to the elements with a bench style seat and no suspension. This style was common place in the late 19th. and early 20th. century. At this point it was regarded that reliability and engineering was the most important factor in the development of the truck.

With the declaration of the first world war in Europe saw a great demand for mechanical military transport. Much of this came at the time from America, who had foreseen the need for such vehicles. In realising the need they introduced what was known as the 'subsidy' scheme. This was where a grant was offered to an operator to purchase a truck followed by a subsidy for the following years. The trucks were then to be released to the government on mobilisation. In many cases this grant was only offered on specific trucks. One of the most advanced British 'subsidy' trucks was the 3.5 ton Dennis 'A' -type, although the 'L' or 'RAF'-Type Leyland was the best known.

The Dennis had considerable influence on the truck design after the war, but this was mainly in the field of engineering. It was not until the '30s. that the cab took on a new look. It was enclosed with the familiar 'long nose' bonnet style. (Millar, 1988, p.32.). The bonnet layout was the norm for heavy commercials but forward control was beginning to appear for smaller vehicles. This allowed extra load-carrying space. However a general conservative attitude insured that the bonneted arrangement would continue for some time. They were still very basic and uncomfortable. Fig. 7.

Fig. 7. A typical cab interior of the 1930s.

The immediate post-war period was the heyday of the American truck industry. It was at this time that the American manufactures began to set the trend for heavy 'cabover' tractors for long distance haulage. These cabs provided the driver with new comforts, better visibility and a quieter cab as the engine was under the driver rather than in front of him. Europe in the '60s. saw many new routes open up to road transport. This was due to two main factors. One, the construction on new motorways and better roads and two, better reliability from the commercial vehicles. Many European manufactures were offering special 'Middle East' packages, which offered more comfort for the driver. It was now, for the first time that the driver was considered with any importance in relation to the design, due to the longer distances the trucks were now able to cover. Along with this came new developments in technology. With the higher speeds which the trucks were capable of, new breaking systems were developed, the use of air breaks became popular along with engine breaks as a form of retarder.

THE EMERGENCE OF THE CAB-OVER TRUCK

As mentioned earlier there are two formats of cab design, the conventional 'long nose' bonneted type and the cabover type. Even though the bonneted cab still exists, particularly in America, the cab-over is by far the most popular. It has many advantages over the conventional with better visibility, quieter interior, better ride, gives extended pay-load space and allows freer movement around the cab.

These were first seen in the '30s. with small rigid trucks in Britain with such trucks as the Leyland 12 tone 'Hippo' of 1930, and the Guy 'Goliath' of 1931. It was not until 1963 that the first cab-over Scania appeared with the LB76. Scania's other Swedish competitor, Volvo had already produced a cab-over in the form of the L420 and L430. It was the late '50s before Mercedes-Benz took to the forward control configuration despite the fact that they had produced forward control buses since 1935.

It was 1950 when DAF introduced a forward control truck using mainly Leyland parts. So it can be seen that cab-over, forward control was no new idea when it became popular in the late '50s. But it was not until this point that the larger articulated trucks changed cab configuration. It was these trucks which gained the real advantages from the cabs. Previously cabs of this type suffered from the same problems as the conventional cab, they were very cramped to work in, and the engine protruded into it. This continues today, but it is better insulated, and so less noise and fumes penetrate the cab. It was not only the configuration which benefited the driver, but technological development with the production of the vehicles.

If we look across Europe today at the variety of trucks on the roads, it becomes very difficult to find one with a conventional cab. Only those purpose built for large scale construction work or military purposes are to be found. The reason for finding them in this area is often to do with their weight distribution and heaver chassis, which are better for heavier loads. These trucks spend a lot of their time in 'off road' conditions and so their drivers don't spend as much of their time in the cab as those on long distance haulage work.

THE CAB OF THE 1970s.

Along with the new technology and changes in working conditions came a new type of truck. One of high power, reliability, comfort, and an appreciation for the person who had to live in this environment - the driver. This truck came in many forms, from the Volvo F88 and F89, the Scania 111 and 141, the Ford Transcontinental, and the Daf 2800 and many more. It was these trucks which in many ways gave birth to the generation of trucks of to day. The 1970s was termed the technological age as far as commercial vehicles are concerned. (Miller, 1988, p.52.). However, this may be disputed today as electronics had not then taken a grip on the industry.

It was during this decade, with the fuel crisis, that other alternatives were looked at for the purpose of economics. Battery-electric power was looked into, but there was a problem with weight and distance which the vehicles could travel.

It also saw an increasing interest into the safe keeping on the environment which has frequently backfired on the transport industry in the form of restrictions on where they were allowed and at what times.

The EC began introducing new legislation on both manufactures and operators. One such piece of legislation was the tachograph ('the spy in the cab') This recorded the vehicles movements in both time and speed travelled. It led to strict laws on the number of hours a driver can work, and all drivers must produce this information when required. It now means that the driver must plan the journey well, but also that they may spend more time in their trucks on 'rest periods' than before, because rather than driving for long periods of time at a go they must stop, and take breaks to rest. This often requires pulling into a lay-by for a hour or so during a trip, in order to keep within the legislation.

Fig. 8 Scania 141 4 x 6

This in turn has given rise to new demands in driver comforts in the truck. The legendary Scania 141 with its 14-litre V8 first appeared in 1969. Fig. 8. This gave rise to the 142 and later the 143. The 141 competed directly along side its Swedish counter part the Volvo F89 which was introduced in 1968. This was an older style truck which appealed to the conservative operator, with its curves and a split wind screen. The interior was very strong, but had many of the hallmarks of the earlier trucks. The Scania on the other hand was square in design, with good access to the cab. It had a larger windscreen and side windows, giving better visibility all round. Both vehicles utilised the ideals of Scandinavian design, with their strong conveyance of function and comfort, coupled with reliability.

In 1974 Volvo introduced the F12 range. This was a superior truck at the time. In fact the current model, although somewhat dated at this stage, has changed very little. The exterior, along with the interior of the cab under went an upgrading in 1984, when it won the International Truck of the Year award. Daf on the other hand, a Dutch company launched a new tilt cab in 1970, with an 11.6 litre engine. This was to replace the older '50s. style cabs in the form of the 2800 and 3300. Fig 9.

Fig. 9 A Daf 3300 Ati with legendary cab

In 1973 the F2800 was launched, probably the most famous of the Daf range. This truck was to spend a further fifteen years in production. Despite the narrow windscreen, which posed problems for any driver over 6" it gave excellent visibility all round as there was double glazed windows all the way around the cab. Cross cab access was still a problem though. There was space at the rear for two sleeping bunks, which was excellent for long distance operations. However this truck spent much of its time on domestic operations, even though it was no stranger to international work either. It was at this time that through the technology and design of the truck, the driver's work load was becoming lighter. A trip to the Middle East not only look less time, but required less effort from the driver. This was the basis on which the cabs of today were built.

It was in 1977 that the first Dennisons appeared. These Irish trucks were designed with the idea of giving a basic, but functional truck. The striking angular cab gives the Dennison its unmistakable looks, and a harsh aesthetic feel. Visibility is excellent to the front, with the deep flat screens, and the mirrors give no problem down the sides. Fig. 10. They were never intended to offer the driver luxuries, instead they offered him reliability and functionality, which in turn gave him a sense of security. As Tommy Hussy, driver of a '79 Dennison explains,

> The Dennison is a good truck, basic, but straightforward. You can see there are no rattles, not even from the gear lever, and all the instruments are easy to spot. Everything is at your fingertips, you don't have to reach for anything. (Hussey, Oct. 1987, p.37.).

THE COMFORTS OF THE '80s.

Along with the boom of the early '80s. came the increase in the volume of goods being transported by road. This led to an increase in manufacturing, and increased profits. It was not to last. Towards the end of the decade the economy of Europe took on a downward trend. This affected the transport industry in many ways, with decreasing sales, higher costs and for the manufactures, a worry of being taken over by a competitor. This was reflected in the trucks of this time

Fig. 10 A '79 Dennison 290

by being more competitive. Each manufacturer tried to fulfil the market requirements to the upmost, which led to an increase in the standard of the trucks being produced.

Leyland introduced the T45 at the beginning of the '80s. Although well streamlined for aerodynamics, it had a rather 'plastic' interior. It sold well in Britain, but not elsewhere in Europe. They were then taken over by Daf in 1987. This saw a major development in the range. Daf continued to manufacture the Leyland range, but also improved it. Systematically they introduced new Daf engines, along with new cab trim to the Leyland range. When Daf introduced the 95 Series to replace the by now aged 2800, 3300 and 3600 range, Fig 11. they continued to produce the T45.

Fig. 11. Daf 3300 Ati Spacecab and 95 Series Shortcab.

The 95 series won the International Truck of the Year award in 1988. This cab was designed in association with Pegaso of Spain and Seddon Atkinson of Britain. The shell of the cab was the same, but the interior and the outer panels were unique to each. This joint venture, under the name Cabtec, insured that cost of research and development would be kept to a minimum. The result was three individual cabs with high standards of design features. The 95 was well noted for its improved forward visibility over its predecessor, along with a more luxurious interior and better allocation of space for storage. One feature of note was the

fold down tray in the steering wheel to form a writing board. The dash however came in for much discussion as the dials were recessed into it and so were hard to clean. Many complained of the limited choice of trim colour. This was a light shade, attractive when new, but not so after a life of fleet service. These were some of the issues which were much debated on launch of the 95 series, and since then improvements have been made in these areas.

Objectives had changed from the days when only the engine specification and the gross weight of the truck were the concern of the potential purchaser. The environment of the cab was a major selling point for the manufacturer. Luxuries of the '70s. were now being fitted as standard such as air suspended seats, night heaters, heated mirrors etc. It can be argued that air suspended seats were no longer necessary, as now with both the air suspended cab and chassis the ride was so smooth the suspension of the seat had become redundant, but it was expected from the driver to be there. The cabs were becoming much lighter, while becoming quieter inside due to the better insulation from the engine. This was not only a sales point to entice the owner driver, but the fleet operator as well, as it was now considered that if a driver was given a better environment to work in, then he would preform better for the operator, thus present a better image to the customer, and respect the vehicle so as to keep running costs down.

THE THIRD GENERATION.

As we entered the '90s. it could be seen how technology was changing how we lived and worked. This was evident everywhere, in all aspects of our lives. The truck industry was no exception. Everything from the method of manufacture to the style, to the performance of the vehicle had changed. This was not a sudden revolution, but one which had taken place over decades, and many models. They started out as a vehicle for the carriage of goods, then became a well engineered machine and now to a highly stylised, well designed, high performance vehicle for the carriage of goods. These new models were to be known as the third generation.

Scania portrayed this with their own third generation truck, the 143. Fig. 12. However this cheated somewhat on principle, as the original only appeared in 1968, in the form of the 141. Scania has however, been producing trucks since the turn of the century. Much of the technology comes directly from their sister company, Saab's aircraft division. Influences in truck design are are turning more from the aeronautics industries recently as can be been with Pegaso in chapter VI. One company to deviate from the previous trend in cab design was Renault. The Magnum AE is a new breed of truck design. Totally different to anything else on the market. It won the 1991 International Truck of the Year award. If not the most elegant of vehicles, it points the way towards the design of the 21st. Century.

Fig. 12 Scania 143 Topline, with all the trimmings.

Like most European trucks, it is a cab-over format. However with most trucks, the engine protrudes somewhat into the centre of the cab, but with the Magnum AE, the cab floor is positioned much higher, so as the engine compartment is completely sealed out, and allowing the driver free access across the cab. The high roof which is standard, unlike most other trucks which have it as optional, allows the driver to stand upright in the cab. The deep windscreen

gives excellent visibility all-round, and access to the cab is by way of steps behind the front wheel rather than the conventional way, in front of the wheel. One point of interest here is that if we look at the trucks of the '40s. and '50s. we see that the driver entered the cab in the same way. The only difference here being that instead of having steps for the purpose of climbing up, the driver would have to scramble over the wheel studs to gain entry, which could be hazardous in wet conditions.

In some ways it could be said that driving a contemporary truck is rather like driving a car. Gone are the days of cold cabs, heavy steering, difficult gear shifts, uncomfortable seats, and the ability to feel every bump on the road. The contemporary vehicle is a credit to its producers, with its efficient air conditioning, more complete instrumentation, 70 degree tilting of the cab, plastic insulation, double glazing, fully adjustable air seating, and wall to wall stereo! Now truck drivers look cleaner, less anxious, and much better turned out. This goes some way towards showing the tremendous progress that has been made in recent years, not only in design, safety, and comfort of trucks, but also the gradual acceptance that the truck driver is someone to be considered. He is the end user, and like any design, if it is to be successful, it is the end user whose needs should be addressed. He deserves a safe comfortable environment in which to work, not just a little tin box stuck up in front of the load.

CHAPTER III : DRIVER REQUIREMENTS

FLEET OPERATORS VERSUS OWNER DRIVERS

Despite the high number of owner-drivers, much of the transport industry is controlled by large fleet operators, some of whom operate up to two hundred trucks. A high percentage of fleet operators however run around ten trucks, small family businesses. This means that much of the spending power is not controlled by a minority, but by people who never physically drive the vehicles themselves. This can give a false impression to the manufacturer as to what the end user, the driver wants. When large fleet operators approach dealers to make a purchase, they receive a lot of attention from the dealer, as it usually implies the the operator will purchase a number of vehicles. Because of this the dealer will not only give a discount, but also try to facilitate the operator in any customising of the design of the truck. For example it is quite normal for the operator to 'mix and match' the vehicle i.e. to order a different engine or cab trim than is normally standard on the specification. This is a luxury very few owner-drivers can afford, or even offered in the first place. In many cases this has little effect on the owner-driver, but it does on the driver who has to drive the truck. Some companies look only at profit margins when it becomes time to replace part of their fleet. Of course this makes sense, it would be foolish not to look in some degree.

However, one of the main cost cutting areas lies in the driver comforts. Not luxuries, but comforts, those items which make life that little bit easier for the person who has to spend time in the truck. Cheaper seats, which cause back trouble. Less locker space, so everything is thrown around the cab etc. Another area is the technical side of the truck. It is proven by operators, that with a larger engine a truck can use less fuel, while giving longer engine life, and is less stressful for the driver. The problem with this type of truck is that the driver has to act responsibly, as it he who controls the vehicle and the efficiency of it. This is fine for the owner driver, because if he drives uneconomically he has to pay the fuel bill, so it is in his own interest to drive sensibly. But the fleet driver does not have the same constraint. This is why many fleets shy away from the high

powered vehicles, and in doing so purchase the basic truck within that range. As this is the larger sales area for the manufacturer they spend more time developing it and so neglecting the area of advanced development. The end result is that instead of improving the cab for the driver, it has become somewhat stagnant. Even though this may result in cheaper trucks, the purchaser is not gaining the benefits of what could evolve. This is particularly true in the case of the owner driver.

LOCAL DELIVERY

Throughout Europe drivers have to work under different conditions. These vary from country to country, They are changing somewhat now as we proceed to a single market. But taking these differences into account, are their requirements from the cab any different? In many ways this depends on the type of operation they are involved with, light or heavy haulage, short or long distance.

It can not be said that the light haulage driver does not cover a vast distance, nor can it be said that the heavy haulage driver only works solely on long distance routes. For example, a 40 tonne truck used on tipper operations may only cover a distance of 20 km in a day, where as a 7.5 tonne truck may travel up to, or over 500 km in a day. The normal use for a light weight truck is however for local deliveries, around towns and cities. These need to be small to be manoeuvrable.

One such truck is the revised DAF 45 series. Fig. 13. This, formerly the Leyland Roadrunner before DAF took over the company, ranges in size from 6.2 to 10 tonnes. This represents the lower end of the truck market. It is being presented as a small truck with big truck features. The 45 series' cab has been the subject of extensive detail work to improve the drivers workplace, recognising the fact that many lightweight trucks cover huge mileage in their lifetime. The cab has been changed in many ways, one of the most distinctive is the loss of the 'dog window'. This was a very low kerbside window on the front, which helped kerb visibility, but proved troublesome in service.(Truck - Leyland DAF, 1991, p.3.) In its place there has been fitted a useful document pocket, while keeping the

large space in front of the passenger seat. This gives the 45 series the best cross-cab access in its class (Truck - Leyland DAF, 1991, p.3.) This is particularly useful, as the driver this type of truck makes many short stops on a normal run.

Fig. 13. Leyland Daf 45 Series

The dash controls are as on the previous Leyland, clear and well laid out. Fig. 14. The cab trim is more luxurious, the thick carpet and the extra underfloor insulation around the engine means that the interior of the cab is very quite. Fig. 15. The seating in this truck is of a fully-adjustable rubber-suspended Isringhausen seat as standard, or an optional air suspended seat. The passenger has a bench style two-man seat. It may appear rather simplistic at first, but it hides a clever design feature. The back of this seat folds down to form a table,

Fig. 14. Dash of Daf 45

Fig. 15. Interior trim of the Daf 45

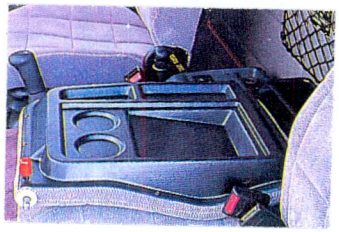


Fig. 16. Folding centre seat.

and has a large storage bin under the same seat. Fig. 16. This optimises the space within the cab to the full extent

The standard cab is a day-cab, but a two-man sleeper is also available. An additional air kit is available for the cab. The stylish and well finished fibreglass aerodynamic spoiler and under bumper air dam were designed at the Leyland technical centre

> Tests with a similarly equipped Leyland Freighter produced spectacular results, with fuel savings of up to 20 percent. Leyland Daf says that the already frugal 45 series Roadrunner will be unbeatable for economy with the air kit.(Truck - Leyland DAF, 1991, p.4.).

This is an extremely well designed, small truck, resulting in a design which gives excellent quality for both the driver and the operator.

This thinking continues through to the next in line in this Daf range, the 75 and 85 series. Fig. 17. These are a mid range of trucks which attracted a lot of attention when unveiled at the Hanover truck show in June of '92.

Fig. 17. The Daf 75 and 85 Series

"The 85 series is designed for top-weight local distribution and medium distance operations" (Bennett, Oct. 1992, p.34.) Cab access is excellent. The door opens to a full 90deg, and the steps are secure, staggered, and moulded to guide your feet onto the grips. Good deep grab handles on either side suit drivers of any height.

Once inside the driver gets a feeling of spaciousness. This feels a more roomy design than say the Scania 93, and its much more habitable than the Volvo FL10. Daf has achieved a good compromise between low floor height, for multi-drop distribution, and engine intrusion to the cab, a problem with most trucks of this size. Recesses on either side of the cover make the engine tunnel feel lower than it is and help cross-cab movement. On the road the view forward is very good. The dash is set low relative to the driver's eyeline, so you can see the ground ahead quite close to the front of the truck. One poor feature is the "boomerang' glazing bar in the door windows, Fig. 18. which come just in the line of sight of a tall driver. Daf points out that they are necessary (as Volvo found on the FLs) if you want to have the combination of a large window, and one that can be opened fully. (Bennett, Oct. 1992, p.35.)

Fig. 18. Interior of Daf 75 Series with boomerang glazing bar.

The dash is an improvement on the 95's, particularly in the warning light strip across the top of the dash, which is recessed to reduce glare, but visible from any angle. Fig. 19. The neat angled facia to the right of the driver (to his left on rhd models) is tilted up, rather than back into the cab, Fig. 20. which makes it less intrusive than in some designs, while putting the heating control within easy reach. This panel also houses the comprehensive IWS (Internal warning system) warning display. But it remains a bit of a stretch to reach the light switches to the left of the dash. The central facia consists of a neatly moulded panel which includes a pen tray, oddments bin and ashtray. Over the screen there are wide, deep stowage bins.

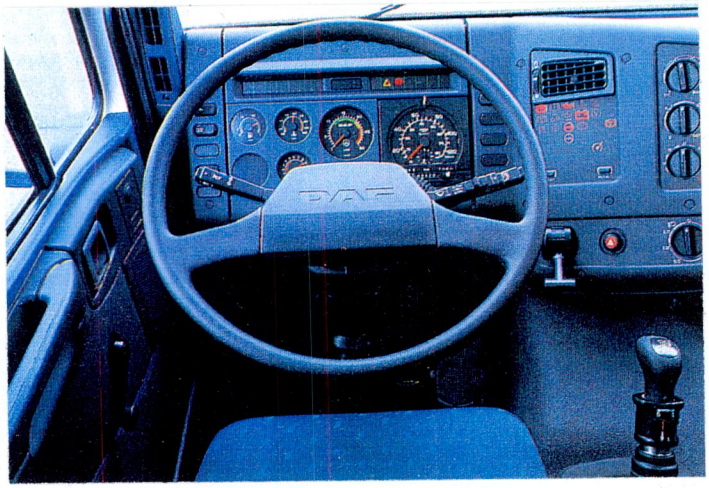


Fig. 19. Dash layout on Daf 75 Series.

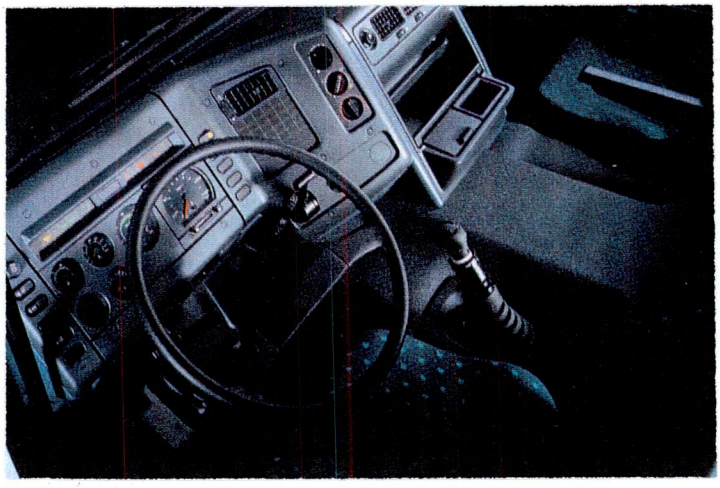


Fig. 20. Easy to read dash and facia on 85 Series.

Day cabs have a stowage bin on the back wall, while the sleeper-cab have good stowage (for a truck of this class) beneath the bunk. On either side of the engine there is a plastic lidded box, which helps keep things tidy, though they will only take a small overnight case. There is plenty of space in the single-bunk sleeper for national work, but it is suspected that some operators will send the 85 on long distance work. A full sleeper would be better for these operations.

Other good details include a panel switch to control the passenger door lock, and an optional version of the ITC (Internal temperature control). This is calibrated in degrees, unlike the 95 series, and maintained automatically. Early versions of the 75/85 had glass sunroofs, but these are being swapped for steel roof hatches because Daf had difficulties in making the glass ones wind-tight. Two unique and very distinctive styling features on the 75/85 series are the flared door panel over the wheel arch, and the large, highly visible indicators. Fig. 21. While the inside of the cab is excellent in almost every respect, the daily checks and fluid fillers are not so clever. The dipstick is accessible behind the lower grille, but the oil and water fillers are behind the panel above the grille, under the screen. "It's hard for a tall driver to reach them and shorter drivers will be looking for a ladder. It's a pity that in a truck where so much is just right for the driver, this isn't." (Bennett, Truck, Oct. 1992, p.37.)

Fig. 21. The flared door panel and large indicators on the 75 Series

Over all the Daf 45,75 and 85 cover the local, national and light, middle weight area of the transport industry. They also cater for the drivers, involved in this area. It can be seen from these two cabs that the requirements of the drivers of each are similar, but what about the international driver?

LONG DISTANCE DRIVERS

There is no clear-cut line between local, and long distance trucks. It depends on the type of work-load the vehicle undertakes. However it is usually considered that for long distance operations, large vehicles are used. Such trucks as the Daf 95 series, the Scania 143, and the Renault Magnum.

Having previously looked at the Daf range for the lighter vehicles, we shall begin here with the top of the range 95 series. Fig. 22. This was first introduced in September '87, and went on to win the International Truck of the Year award. The cab was designed in conjunction with Cabtec, but the interior was designed totally by Daf.

> There has never been an ergonomic study into a truck cab more thorough or more complete than that undertaken by the concept 95 development program. A study that now established not only how a driver works within his cab, but also how he rests. (DAF, 1987, p.5.)

Every aspect of the drivers requirements were to be taken into consideration.

> Out of the study came Felix 212 Fig. 23, representing every type of truck driver, in terms of height, weight, male or female. He played a vital role in the design and construction of the new cab, one that tries to provide the driver with the perfect working and living environment. Daf also interviewed more than 1700 operators and drivers through out Europe. A process that established what they needed in the next generation, and what they would like to see in it. A new approach was taken to the design of the 95 cab, it was built from the driving position outwards. (DAF, 1987, p.6.)

Fig. 22. The Daf 95 Series.

From this point the designers took everything from eyeline, movement, Fig. 24. instruments, stowage, even the colour of the trim into consideration. All the gauges and warning indicators on the dash are displayed in order of priority within the drivers immediate field of vision. Analogue instrument displays are used rather than digital as analogue allows for any change in status to be detected more easily. Fig. 25. The steering wheel is adjustable for rake and, unique to the 95 when launched, is also adjustable to a height of 80mm.

One major area of improvement over it's predecessor, the 3600, is the windscreen. This is larger and offers an uninterrupted view of the road ahead.

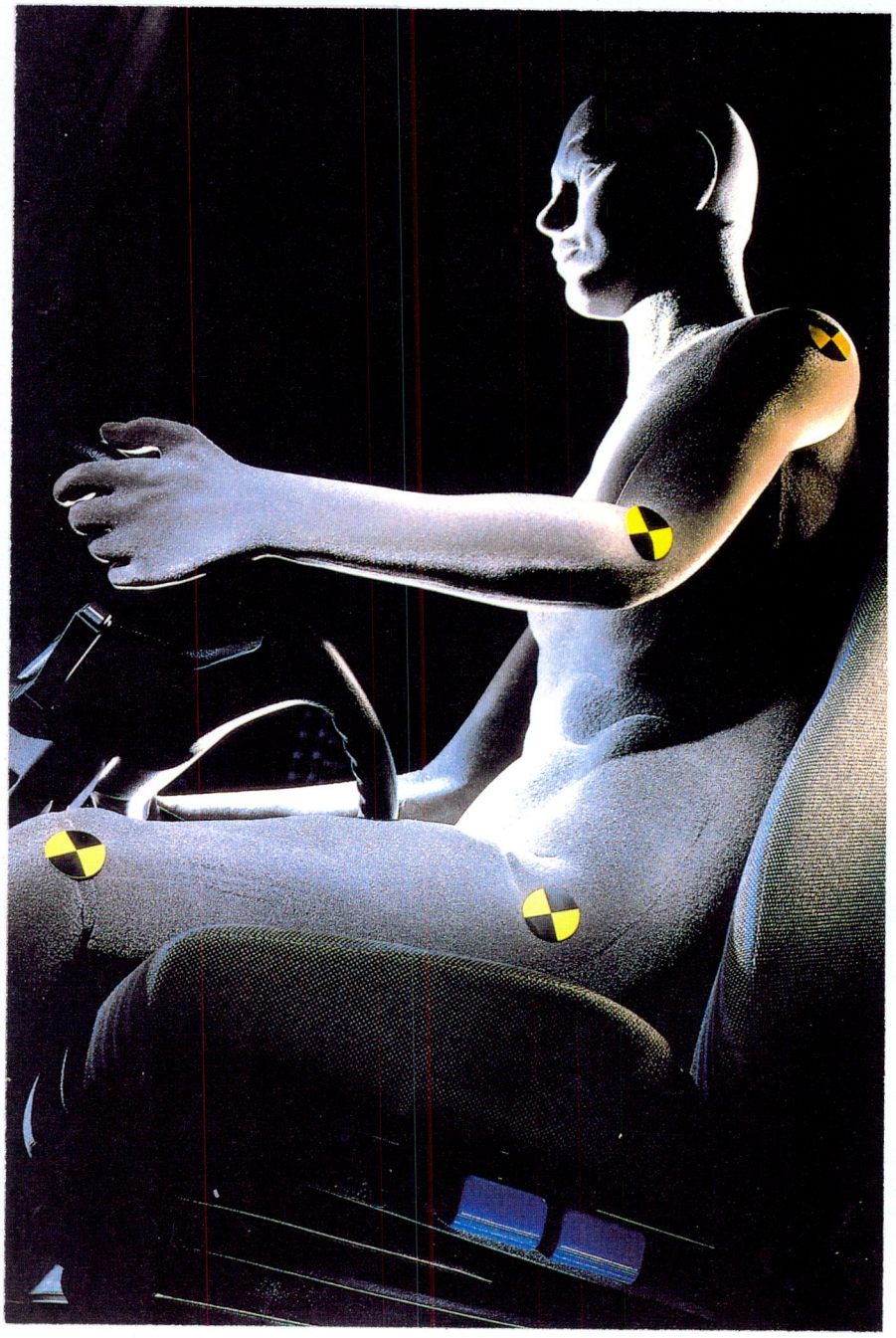


Fig. 23. Felix 212.

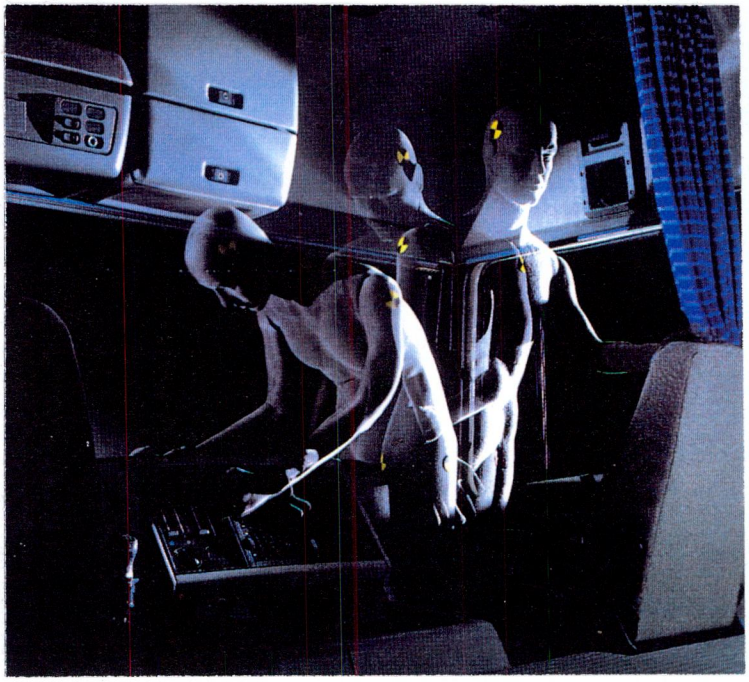


Fig. 24. Study of movement in the Daf 95 Series cab.

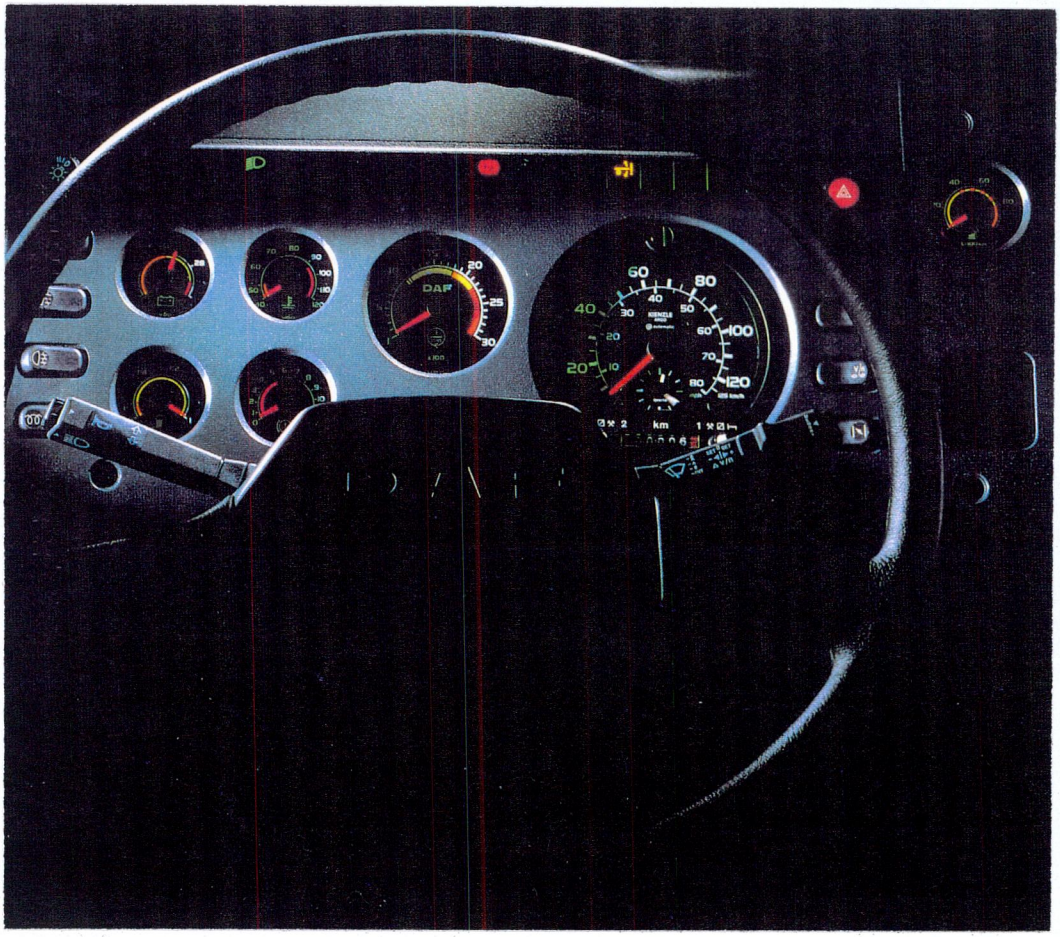


Fig. 25. Dash of the 95 Series.

Fig. 26. Pedals in the 95 Series.

Fig. 27. Daf 95 Series cab trim.

Another area given a lot of attention, to which there was previously much complaint, is the foot pedals. Fig. 26. An ergonomic study was under taken to establish the optimum angle and position for the pedals to be set to reduce the likelihood of fatigue. The flag ship of the Daf range is the 95.430. The 430 standing for the bhp output. This cab has been been updated recently, with a darker trim and new facia, both of which are easier to keep clean, Fig. 27. a problem with a vehicle which is in continuous use. Even though this truck is well proven for long distance operation, it is not in the 'super-class' league.

This is for Europe's most powerful and prestigious trucks, the Scania 143.500, and the Renault Magnum AE.500, Fig. 28. This is where the manufactures go it alone. These trucks are for prestige, not logic. It is where the manufactures get to show off their goods to the best effect. They are not an essential requirement for either the drivers or the operators, but rather 'a nice' vehicle to have. "The 450bhp-plus sector makes up a tiny slice of the total UK truck sales, 250 trucks a year at most."(Anon, Sep. 1992, p.46.) It is a market led by the manufactures. However it is worth looking at these trucks, if for nothing else but to see what the manufactures regard as important for the drivers of the '90s.

"The Scania 143.500 is market leader in this area"(Anon, Sept.1992, p. 46.) The 3 series Scania has always been very popular with owner-drivers, but some have reservations about this model, mainly the price tag. The standard chassis price in September '92 was stg£81,960, with air kit and other optional extras as seen in fig. 29, the price rises to stg.£93,877, compared to the standard chassis price of the Magnum, fig. 30, at stg.£76,790. (Anon, Sept.1992, p. 51.) These are expensive trucks! So what do you get for your money? The Magnum has been causing a stir ever since its launch in the summer of 1990, and the reason is obvious, there has never been a truck quite like it. Its massive stature, towering over every cab in Europe, provides a cab that is years ahead of the competition in terms of design and aesthetics. Some of the major changes are the separation of the engine and cab, giving a flat floored cab which is better insulated against noise.

Fig. 28. The Scania 143 and the Renault Magnum AE.

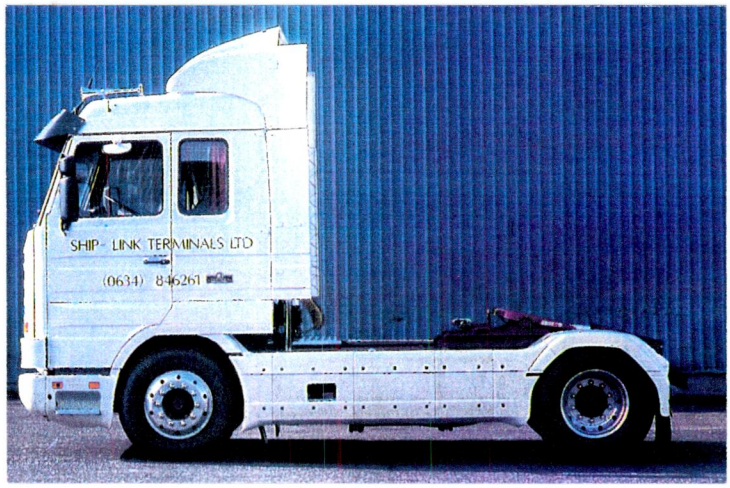


Fig. 29. The Scania 143 Centurion with Streamline Kit.

Fig. 30. The Renault Magnum AE.

The positioning of the front axle towards the front of the cab means that the driver climbs in from behind the front wheel, Fig.31, which allows a wider step than usual. Once inside there's enough headroom to stand up and walk across the cab. It has vast stowage, electrical blinds instead of curtains, and a low knee-level dash, Fig. 32, with the tachograph placed to one side allowing a small instrument panel housing a conventional rev counter and speedometer. Fig. 33. This helps to give excellent forward visibility combined with a massive deep screen and side windows.

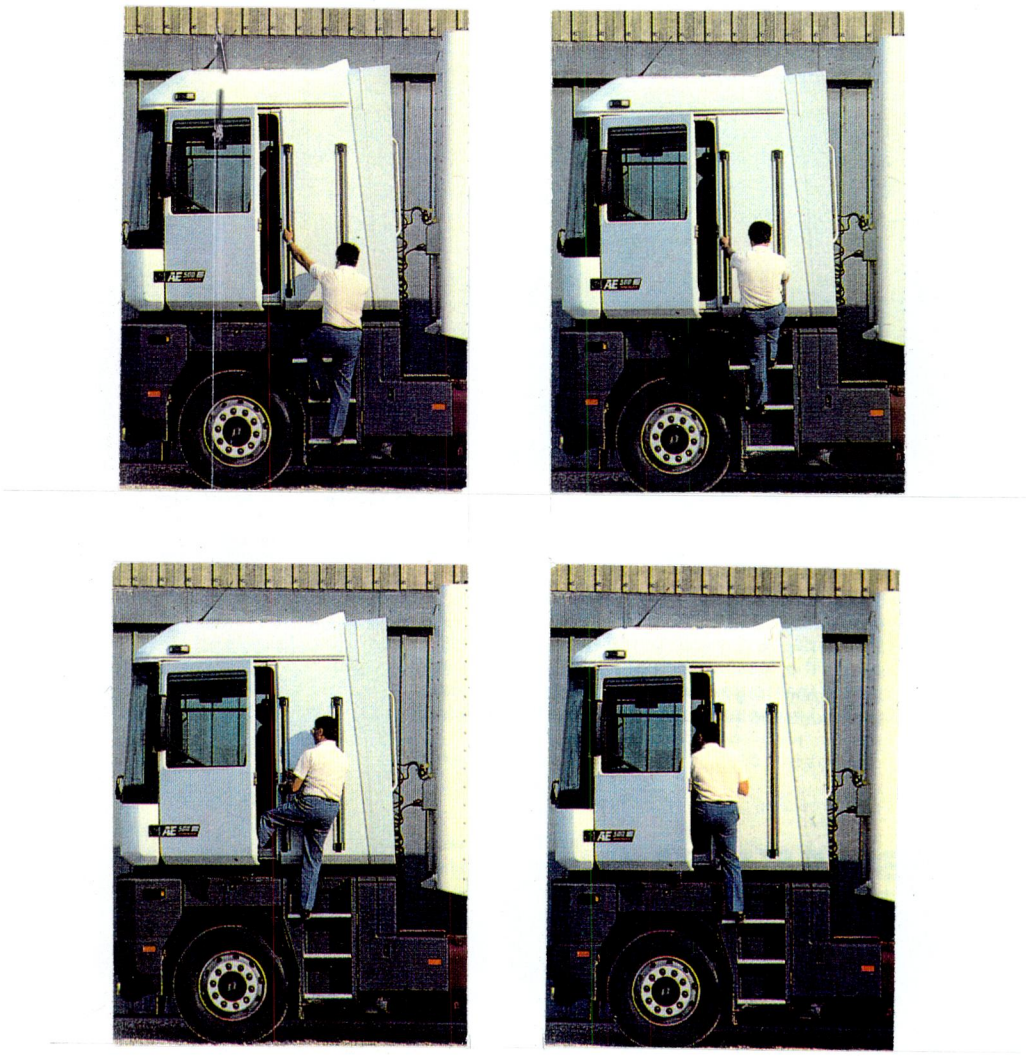


Fig. 31. Entry to the Renault Magnum

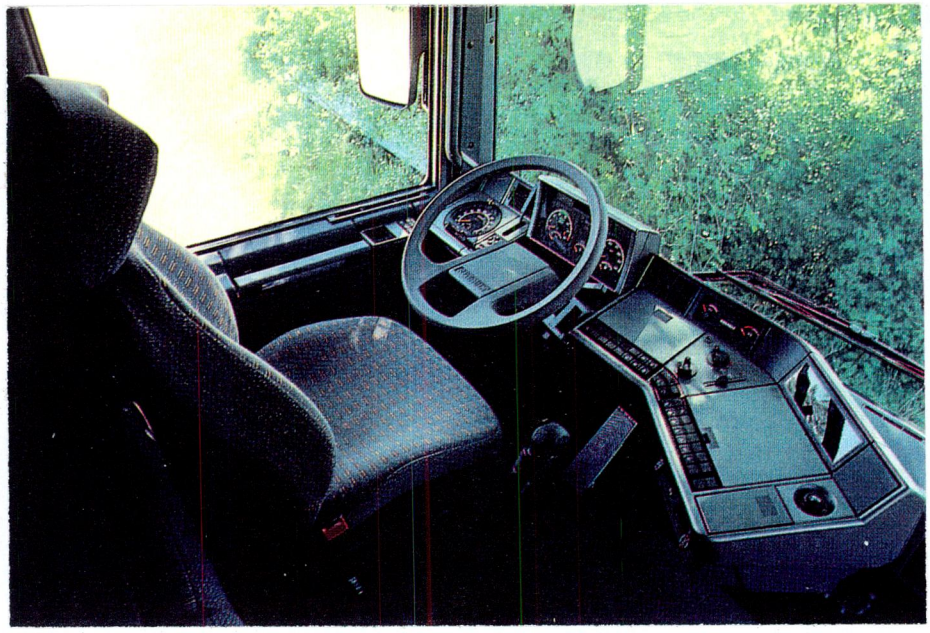


Fig. 32. Low-level dash, similar to those on Renault buses

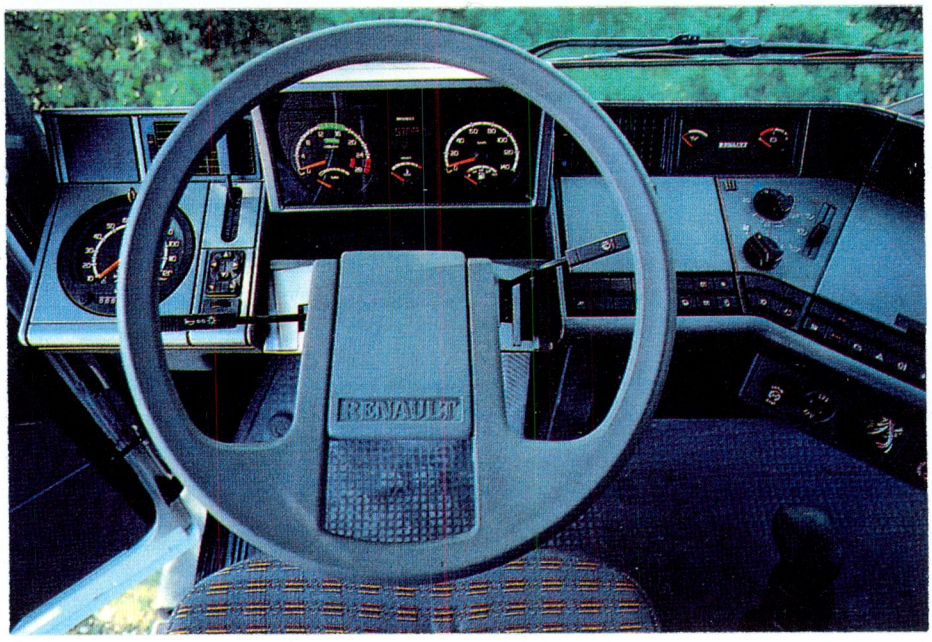


Fig. 33. Instruments on Magnum are clear to read.

According to Freddy Balle, now head of product planning and development at RVI (Renault Vehicles Industriels), and the man in charge of engineering the AE project through its final phase:

> Giving the driver something really special as the Renault design brief,. "The main idea was to have something really different at the top of the range. The design was centred on the idea of living in the truck. We looked at what was important and decided that we needed a flat floor, and enough headroom for a tall man to stand up straight. That decided the basic structure. It's true that Renault's car designers were in some way involved in the AE, because the styling department is common to both RVI and Renault's car division. The shape of the dash, and also the way some of the interior panels are designed shows some car influences. We wanted to keep some of the ruggedness of a truck, but a car like quality. The Virages trucks (original concept) was a laboratory for a lot of different ideas. (Fig. 34.) A little of the AE cab comes form the Virages, (Fig. 35), but we also wanted to make a cab that we could build to a high quality, and that affected the final design. Once we started comparing the traditional approach to the truck design, we could see all sorts of advantages. Ideas such as low noise levels, safety, because you can see further etc. and all the ideas were thoroughly tested. The giant cab is made of plastic panels on a steel frame and built to ECE 29 standards on impact resistance, which requires that the roof is able to withstand a crushing force at lest as much as the front axle (up to 7100kg) and the rear panel a force of 200kg of payload. We had a debate about whether to build in steel, or in steel and plastic, and in terms of quality of the end product we decided that plastic was better because if doesn't corrode, and it's lighter (Bennett, Jan. 1991, p.30.)

Life is very different in the Magnum. The Scania on the other hand is an extravagant conventional designed truck. Overall however, they offer an unprecedented level of comfort and reliability to the long distance driver through out Europe. As these vast trucks have to operate in many different countries in the course of a single trip, they each face many of the same problems, irrespective of their nationality. This leads to a standardisation of the vehicle internationally, to suit the drivers requirements which are becoming the same in each country in Europe.

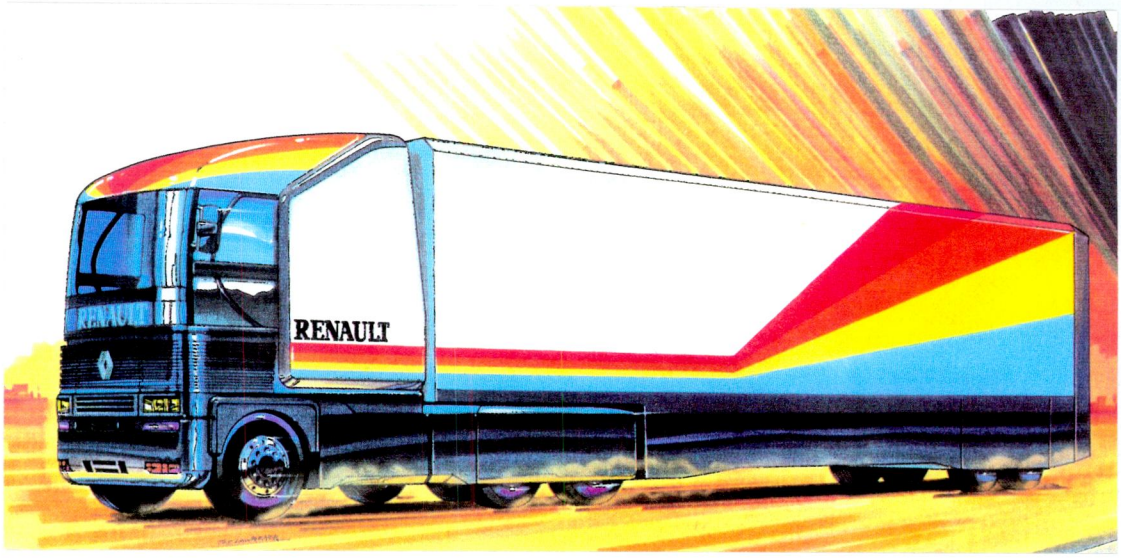


Fig. 34. The Virages concept

Fig. 35. The Virages concept on the road.

FROM THE DRIVER'S SEAT

From what has just been discussed we get a idea of what the driver prefers in a truck, from the point of view of the driving position, and space organisation within the cab. In general it is to make their work that bit easier. This has larger implications however. Visibility is a major factor which manufactures are improving on. This is a major safety point, as to manoeuver something as large a as twenty-two-wheeled articulated truck safely, requires that the driver is aware of his surroundings and the activities occurring there. It also reduces fatigue and stress. This leads on to the location of the controls, and their ease of operation. As previously mentioned, Daf have studied the foot control arrangement in great detail. This is an area, where, if poor ergonomic design is employed, could give rise to preventable accidents occurring, due to driver fatigue, or just an inability to react to the controls fast enough. The easier it is to operate the controls, the faster the reaction time, and the better the end result.

These points are most important for the driver, as it is he who has constantly use them. It should be noted that in many large fleets, drivers may drive a different truck each day. Because of this a general standard for the location of important and regularly used controls should be adopted. After all, the accelerator peddle is always to the right of the break peddle. To change this format would lead to huge increase in road accidents.

FUNCTION OR COMFORT

Having looked briefly at the range of DAF trucks, and two of the most prestigious trucks on the market, we come to the question. should contemporary truck cabs be designed to be more functional, in that they are more rugged like that of the military, and so be cheaper, easier to keep clean and withstand the harsh treatment they receive, Fig. 36. Or should the drivers comfort be the main concern? If we take the word 'comfort' in relation to relief, not pleasure, even though this sometimes is part of it, and look at its implications in the area of cab design it will help to answer this question.

Fig. 36. Leyland Daf 8x6 military vehicle.

From the safety aspect, much is being done to improve this area. Vehicles of this size can turn into lethal weapons if they lose control. The one person whose responsibility it is avoid this, when the vehicle is on the road, is the driver. In order for him carry this out he needs to be alert, have a fast reaction time to the situation. If the environment in which he has to work leaves him in a state where, he is unable to preform to his best, and so decrease his ability to control the vehicle under adverse conditions, then the safety factor of the cab is less than what it should be.

Of course there is the problem of functionality, in that the carpet and trim get dirty in the course of the everyday life. Or that the driver's window should not be electrically operated, as if the mechanism fails it creates problems, whereas the advantages of such a mechanism are very small, unlike the passenger window, which the driver is unable to reach. As from the point of being cheaper. To produce a more durable cab in many cases would cost even more, as the materials and tooling would cost more.

As we have seen, the driver's comfort is important for a truck's success, not only from a sales aspect, but also in the performance of the vehicle. The ergonomic features of the design should not fall into second place behind cost cutting factors. In many ways the driver is the most valuable feature of the vehicle, and should be considered in such a fashion. In turn, true functionality in the design should assist him, rather than appear as a cost reduction on the manufacturer's behalf. This is to say that if the design is to be considered as good, then it should incorporate both function and comfort, so as to provide the best solution to the situation, improve the drivers working environment, and his performance.

Fig. 37. A 1903 Vabis truck

A HISTORY OF SCANIA

Scania is one of the oldest existing truck manufactures today. Scania celebrated its one hundredth birthday in 1991, but the company did not start life as a truck builder. Its roots lie in a business set up in 1891 at Sodertalje, south west of Stockholm, to manufacture railway rolling stock under the name Vabis. It built Sweden's first internal combustion engined car in 1898. In 1939 a plan for the future was drawn up, which is still in operation to day.

> The architect of this plan was Carl-Bertel Nathhorst, who was appointed assistant managing director in 1939, and managing director the following year. In 1940, Nathhorst decided that Scania-Vabis should concentrate on the heavy truck and bus markets. It should standardise its use of components, aim at high quality standards, acquire its own research and development capability, build its own major components, and pursue a determined export drive.
> At this time exports were at 10 percent of production. By 1957

they were up to 50 percent, reaching 88 percent in 1979. It was in 1962 that the company dropped the name Vabis. They are now the world's third largest exporter of heavy vehicles, the fourth largest heavy truck manufacturer and the seventh largest bus manufacturer. Two-thirds of assembly in now outside Sweden, this overcomes the import barriers. (Millar, 1991, p. 3.)

Scania merged with the Saab car and aerospace business to form Saab-Scania. In 1972 their operations were separated within the group.

TYPE, SIZE AND USE.

In 1968 Scania introduced a new forward control tilt cab designed by Englishman Lionel Sherrow. This catered more than ever before to the drivers needs, not just with the interior, but also by having easier access steps in front of the front axle instead of expecting the driver to scramble up over the wheel nuts. This LB 80,85, and 110 range was joined in 1969 by the 140, then the most powerful truck in Europe. Its 14-litre, DS 114 turbocharged V8 engine developed 350 bhp. That was soon passed by the legendary 141. Fig. 38.

Fig. 38. The Scania 141 V8

The Scania 141 when it first appeared in 1969, developed 375 bhp, the ultimate king of the road in its time. From 1980 a new Italian designed cab, still in production today, replaced the previous ranges, and a modular construction programme allowed a wide choice of individual models to be built from a comparatively narrow range. This method was to become popular throughout the industry in the '80s. Four cab variants G, P, R and T were available on three grades of chassis M, H, and E, Fig. 39. In 1989 Scania launched it's new 3 series, which went on to win the International Truck of The Year award. The 3 series comprises of three main ranges, the 93, 113 and 143. The 143 is the top of the range in the Scania line, in the 'super truck' bracket. .The 143 ranges in out-put from 435 to 503 bhp. The most powerful of these is the 143.500, with its 14litre, V8 engine churning out over 500 bhp. The obvious application for this high-powered truck is on tasks where getting the trip done on schedule is of paramount priority, and fuel costs are of little consequence. The 143 can be made to cruise economically, but that is not why you buy a truck with a '500' badge on the grille. Scheduled, 'just-in-time' deliveries are what it is good for, regardless of the weather conditions. As mentioned earlier, it is typically a long distance truck.

Fig. 39. A Scania 142H Drawbar unit

FROM THE DRIVER'S SEAT

Scania has always offered a very high level of luxury to the driver. This is continued in this truck, as we have seen in chapter III. It offers an excellent driving position, with well located controls, Fig. 40. As a living environment, it is excellent, particularly the high roofed Topline, Fig. 41. It is excellent for overnights. The bunk is wide and long enough for a six foot person to sleep comfortably. The only problem is the potentially useful stowage box in the centre of the cab makes it awkward to get into bed.

Fig. 40. Dash and facia of Scania 143.

Fig. 41. Interior of Scania 143 Topline cab.

MANUFACTURE AND DESIGN

Scania was very proud of their new interior and exterior changes, which include the high roof, Topline. Until now they only offered normal height roofs. Although cab design comes under Kaj Holmeluis, in all over chassis development. The chief engineer for cab design was until '88 Axle Peterson. He's in no doubt that "the best job in the company is in cab development" (Anon, Jan 1989, p.61). His enthusiasm shared by the 26 member cab development team, which divided into groups of three or four, to work on areas like the dash, the seating, the exterior aerodynamics, etc. Some of the exterior details include the extensive use of sound-deadening material under the cab floor and behind the solid areas of the front flap. Aerodynamic fairings are designed for the topline and standard cabs, and the front 'sun visor' is actually an aerodynamic aid, improving the airflow over the cab to the tune of a 3 to 5 % benefit in fuel combustion (Millar, 1991, p. 12.)

The new interior was developed by an Italian design house, 'Open Design', from a complex Scania brief that included results of research into ergonomics, cab, dash and seat lay-out, etc, Fig 42. It was the first time that Scania had brought in a design team from outside Scania at the start. They used to do all the engineering, and then bring in the design team at the end, but by that point the designers could do only a limited amount of detailing.

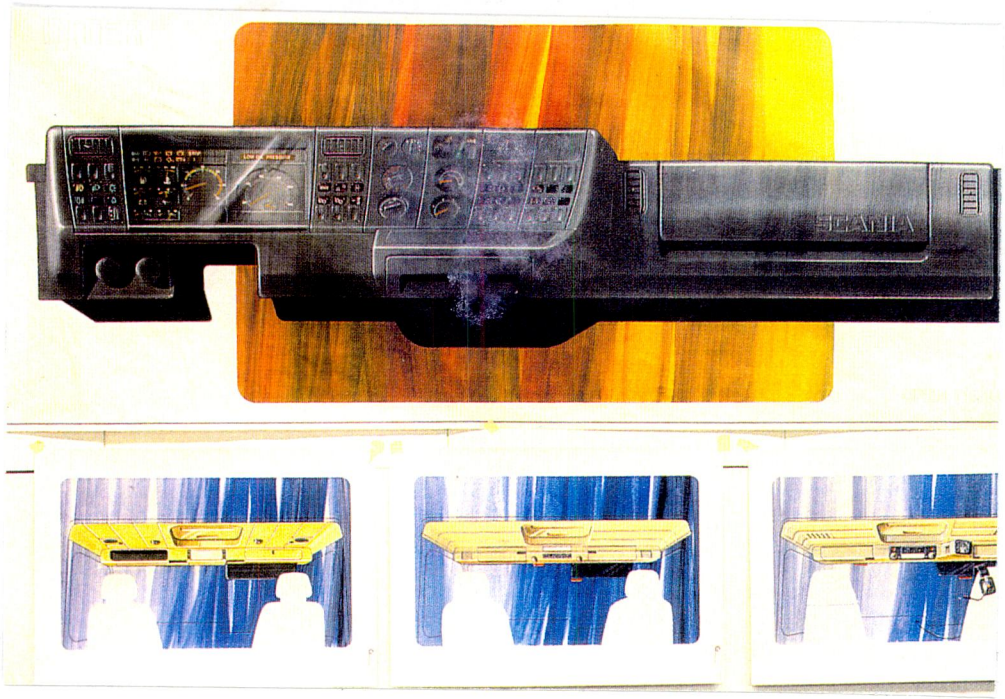


Fig. 42. Early design sketches for the facia of the Scania 3 Series

One would wonder why, with Scandinavian design holding such a high reputation throughout Europe, that Scania would bring in British and Italian designers to develop their most successful trucks. Scania believe that the best way to develop a truck for the European market, is to design it from that same market. Scandinavian designers are renowned for their ability to work with other designers in groups, while holding an individual content to the end product. "What is remarkable in Scandinavian design is the way individual artistic development is widely linked to industrial methods to produce quality goods" (Heskett, 1980, p.118.)

It is Scania's intention to give to the customer what they require, not just what Scania themselves can offer. In a lecture at N.C.A.D. Denise Hagstromer who was involved in setting up the Scandinavian Design Exhibition in The Design Museum London in answer to this theory, replied,

> Scandinavian Design has always looked at design trends outside Scandinavia. Then by taking note of these trends, they could produce high quality goods, geared towards those markets, while retaining the hallmarks of Scandinavian design. (Hagstromer, Feb. 93.)

This is in no way copying other designs, but rather improving on the those trends in order to provide the best solution for that market.

Giving a ten page specification to the design company kept the engineering need in mind, while allowing 'Open Design' in Turin to come up with an integrated curved dash concept, in which the separate switch panels are made up from four basic modules, with the same exterior dimensions so they can fit in any order in the panel. This dash panel can also be used in both left and right hand drive models, and is used on all Scania's. The dash and facia are completely pre-assembled and tested, even including the Tachograph calibration, since the spec of the chassis,which the cab is destined for, is known when the cab is trimmed.

Since 1984, cabs have been galvanised before trimming, to cure the former rust problems. Although the dash is curved, it is still possible to walk across the cab, particularly with the topline option. A great deal of thought has gone into the living arrangements for the long haul drivers. This has proven fruitful. An ingenious sliding passenger seat is fitted in the topline, allowing the seat to be moved to the back of the cab, once a portion of the lower bunk is lifted. The seats incorporate safety belts, which remain in the same position, relative to the driver. The interior design gives the Scania one of the best working environments in the business, and helps to maintain the strong driver image.

Apart from driver comforts, Scania is also concerned about the environment. They are introducing a range of revised 'environmental' engines, that meet the strict new European emission regulations, which came into force in 1993. The new engines in the 8.5, 11, and 14-litre versions all meet the Euro 1 requirements. (Millar, 1991, p. 13.) This has been achieved by new turbochargers to increase low-rev torque, and intercooling to lower combustion temperatures. The changes reduce oxides of nitrogen (NOx), carbon monoxide (CO), hydrocarbons (HC), and particle emissions. Noise levels are another concern. These too are being reduced by better panelling, lower engine revs, and the use of catalytic converters.

> The overall interior design gives the Scania one of the best working environments in the business, and helps to maintain its traditional strong driver image. Its part which goes with being *Truck of the Year.* (Anon. Jan. 1989, p.62.)

Along with this, the quality of the vehicle it self, in the level of detailing, engineering, and manufacture, make it stand out compared to the other trucks on the market.

Fig. 43. A Scania Vabis 1927 truck with the latest R143.400

CHAPTER V: CURRENT TRENDS IN CAB DESIGN

INTRODUCTION OF NEW IDEAS

The development of the truck in recent years has come about by the introduction of new ideas. Creativity from the designers, engineers, management, and even the owners of the trucks, has given rise to new ideas. Some of these ideas benefit everyone, others only those who conceived them. Not all ideas are good for the industry, but a compromise is often difficult to arrive at. So some are implemented despite their low level of merit. On average most contain enough merit to warrant their introduction. Computer aided design, the advancement of electronics, manufacturing processes, and safety standards are areas where much development is taking place at the moment, but is it moving in the right direction?

Fig. 44. A Renault G290 with topsleeper cab

TOP SLEEPER CABS

One area of major debate at present with truck design is the sleeper cab, Fig. 44. Previously all long distance trucks had one or two bunks at the rear of the cab, behind the seats. In European trucks however this was confined, unlike U.S. trucks, which have sleeper units attached to the rear of the cab, the European ones were only allowed the confined space of the cab itself. This is to maximise

the payload area of the truck, while keeping within the maximum legal limit, which is different to that of the U.S.

Then in the late '70s, Volvo introduced the Globetrotter. This was unique in the fact that it had a higher roof than normal, which gave an additional space above the driver, for stowage space, it also allowed the driver to stand upright in the cab, and also gave the driver a new level of comfort, Fig. 45. DAF then followed with their Spacecab, on the 3600. This was fine with the normal articulated vehicles, however operators soon realised the advantage of this idea on their drawbar units. A drawbar truck is one which is a ridged with a trailer, both with payload space. These trucks are 1.5 meters longer than an articulated truck, thus giving more payload space. If they were to replace the normal sleeper cab with a shorter day cab, and then place the sleeper on top of the cab, then they could gain extra payload area. For the case of the operator, this is a useful development, but the same is not said by the occupant of the cab. This is much more awkward for the driver to gain access to the bunk, provides less stowage space, and does not allow him to stand upright in the cab. Because of this, the concept has received much resistance from drivers as it does nothing to improve their level of comfort, but rather retract what comfort they had.

Fig. 45. Volvo F16 Globetrotter

CROSS CAB ACCESS

The driver needs space, but he must be able to move easily within this space. The greatest obstruction to this movement is the engine cover protruding into the centre of the cab. The manufactures have now realised this, and are attempting to reduce the intrusion. The most successful are Renault, with their Magnum AE. Fig. 46. However in order to do so, they had to approach the problem from a different angle.

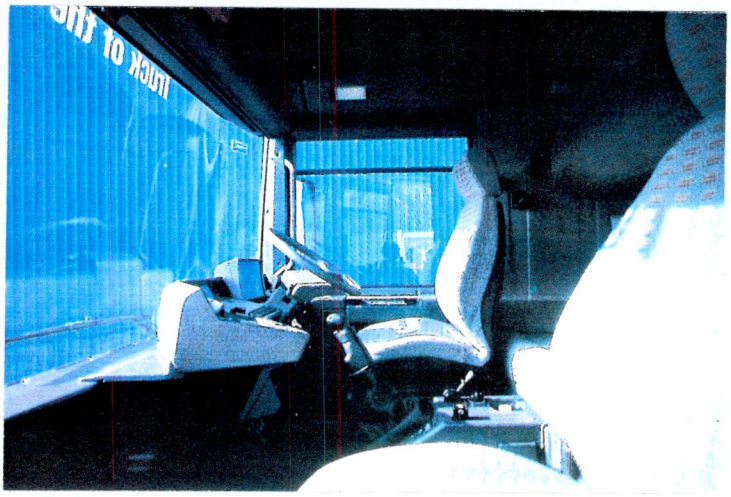


Fig. 46. Flat floor of the Magnum AE.

Previously, it was the engine which was either located lower on the chassis, or designed differently. Instead Renault raised the level of the cab floor. This resulted in a much taller cab, but one with a flat floor allowing the driver to walk freely across the cab. Not all design changes assist movement in this way. 'Wrap-round' dashes for example, have began to appear on some of the larger trucks, such as the Scania 143. Fig.47. These serve their purpose very well, in that the ergonomics from the point of the layout and accessibility of instruments and controls to the driver is much easier. However, as the dash curves round the driver, it restricts his movement across the cab. In most cases this is only a slight infringement.

Fig. 47. Italian designed wrap-round dash of the Scania 143.

TOTAL AIR SUSPENSION

In most current trucks there are three forms of suspension, the chassis, the cab and the seating. All of these join to provide a stable vehicle and comfortable ride for the driver. Previously the cab was bolted to the chassis with no shock absorbency. The chassis was suspended by leaf-springs, which were hard and unforgiving, and the drivers seat was fixed to the cab with, in some cases, a spring to help absorb some of the shocks. This often resulted in the driver being catapulted into the air upon encountering a bumpy stretch of road. This proved quite dangerous at times. This has been improved with the introduction of air suspension. Most of the cabs are now air suspended with air suspended seats, which can easily be set to respond to the individual drivers weight.

The chassis suspension comes in different specifications. For example, MAN trucks, depending on their intended use, the F90 can be fitted with leaf springs, combined leaf/air suspension of full air suspension. Fig.48. The MAN modular system allows for optimised suspension systems to match any transport task. In the case of full air suspension, it is particularly comfortable and ideal for transporting fragile goods. It is also self levelling, so the vehicle remains at the same height off the road regardless of the load. But with such an active system, is three forms of suspension justified? Is it necessary for the driver's seat to use this method as well? Would it not be more advantageous to the driver to keep a fixed position relative to the controls, while using only the cab and chassis suspension

to provide the necessary shock absorbency form the terrine below. This would give the driver a better sense of control over the vehicle, as he would no longer be moving independently to his environment.

Fig.48. MAN with leaf spring suspension.

ELECTRONIC GOVERNING

In this age of electronics it is not surprising that we see them entering the world of commercial vehicles. However this is a slow entry as they make the vehicle more expensive, are not yet proven to the industry, and operators are slow to accept them. Change is however taking place. The latest introduction to trucks is the 'drive-by-wire' technology. What this means is that instead of a mechanical linkage attached to the drivers' controls, an electrical or electronic connection translates the drivers' wishes, as applied to the pedals, levers etc. into the appropriate reaction by the engine or transmission.

The first of these systems was perhaps the electronic power shift (EPS) introduced by Mercedes in 1986.

> The engineers insist that future legislation on all manner of things from emission levels, to breaking performances, can only be met by using electronics, so it seems as if we have 'drive-by-wire' whether we like it or not. (Kennett, Apr. 1992, p.29.)

Looking at 'drive-by-wire', what are the reservations? Three questions have to be addressed: Firstly, does it do the job properly? Secondly, does it do it reliably? Thirdly, can it be repaired easily if any thing goes wrong? European experience, at least, indicates that there is a reasonable expectancy that electronic systems such as ABS (Advanced Breaking System), electronic diesel control, speed control etc. not only work properly but are reasonably dependable too.

> In Nordic conditions, Scania admits to still not having entirely solved the problem of damp or ice interfering with cable joints in ABS and ASR circuits between truck and trailer. 'We are still seeking the ideal solution,. (Kennett, Apr. 1992, p.29.)

The week points are where circuit or loom joints occur, such as between the tractor and trailer, or between the cab and chassis. It can be a problem if the ABS fails, but not necessarily a disaster, however if the engine management control system, or gearbox control system fails, then it is quite serious. Almost invariably this will mean recovery to a workshop for repair, and this is costly in terms of time and cash. At present, the repair and maintenance of 'drive-by-wire' systems is an embryonic science. Despite this, the engineers are forging ahead with new ideas. The designer must now incorporate these ideas into the concepts of future trucks. In order for the design to benefit most from these ideas, they should be looked at to see how they can change and improve the current design, not regarded as an upgrade to it. This result of this will be a truck totally unlike the current model. There is now a truck which has 'drive-by-wire' breaks. (Kennett, Apr. 1992, p.29.) This has not yet been accepted as legal in any country, but it points the way in which the industry is moving. The breaks are applied by an electronic signal to each wheel by means of electropneumatics. The main advantage of this system is you get simultaneous break application on all wheels, no matter how long the vehicle is, which overcomes the the major criticism of air breaks.

ELECTRONIC GEAR SHIFT

Part of the 'drive-by-wire', high tech components being introduced to large trucks, is in the form of automatic transmission. This has a number of advantages from easing the work load on the driver to better fuel efficiency. The most widespread use of the is to be found on the Mercedes-Benz Powerliners. Mercedes made a courageous decision when they settled on its own EPS (Electronic Power Shift) semi automatic shift system. There are no manual options in the range.

> According to Erust Gohring, M B's truck development engineer, the way ahead is through engineering enterprise. Electronics will play an increasingly large part in all trucks by the mid - '90s, and a gradual introduction to on-board electronics is not merely desirable but it is also essential. (Kennett, Nov 1987, p.83.).

EPS is based on a wholly conventional gearbox, in the case of the Powerliners, a 16 speed Ecosplit, splitter from ZF. It is a very much simpler system than that of Eaton's SMAT.

Where the Mercedes design is unique is in its electronic command system. It reads signals provided by the drivers selection lever, a sender on the clutch pedal, speed sensors on the gearbox output shaft, and the valve block which engages the gears via the pneumatic servo on the side of the gearbox itself. Weighing up all this information it will normally signal a gear shift according to what the driver has selected, as soon as the clutch is dipped. However if the drivers signal is erroneous,- for example, asking for a down-shift when the engine is running at high revs, then the electronics will reject the command, sound a bleeper to warn the driver of his error, and remain in the gear already held. Providing the command is legitimate the shift goes through as the clutch is dipped, and the control unit alters the dash display according to the new gear. The display shows the gear held, next gear selected by the driver, and the optimum gear for the speed the truck is travelling at. This relieves the driver of all the laborious selection and engaging of gears, as on full manual gearbox's. He is also guarantied engagement on each selection and not ending up in the wrong gear, or in neutral.

The Powerliner range represents a new generation of advanced technological trucks, however the cab is showing its age,- now nearly 18 years old as a basic design. More recently Volvo, Scania and Renault have also introduced automated gear shifts into their range. Volvo's 'Geartronic' system goes much further than the Mercedes EPS. It is based on a standard 14 speed gearbox, but with a fully automated clutch and gearshift. Fig. 49. It works directly with the electronically controlled diesel pump, which controls the engine speed. The driver can override the system by pre-selecting a starting gear, holding a gear or selecting a gear manually in the lower range. There is no need to lift the foot off the accelerator pedal when changing gear, the EDC controls that. There is a choice between economy and power changes. Standard' is a cruise control, this returns to the original speed even after gear changes. For example, on approaching a hill, the truck will automatically change down to the required gear, then once reaching the top will return to top gear and resume the original speed to give optimum performance and economy, without the driver having to lift a finger.

Fig. 49. The Volvo Geartronic shift.

This goes a long way to making life much easier for the driver of the truck, but will he accept it. Many drivers frown on this type of technology, saying that it takes the control of the truck out of their hands, that they can no longer react instinctively to a situation, but rather have to depend on a microprocessor to do so. This is the one advantage Mercedes had, that they retained the clutch peddle. Volvo on the other hand say that by giving the driver access to the gear changes, will result in poor fuel economy.

CAB ASSEMBLY

Along with the shape of the cab, the methods of design and production have also changed. As with all other aspects of design, computer aided design now features highly in the design of contemporary cabs. On the CAD side, stress levels are determined much more analytically than in days gone by. Finite element analysis methods enable stress concentrations to be identified in a proposed cab, or its individual panels, or sections where weaknesses are likely to occur, and the design can then be modified accordingly. So its possible, as in any other truck component being designed, to provide enough strength in the cab structure to ensure durability for the whole of the chassis life, while avoiding the cost and weight penalty of over specifying. Excessive strength margins being dead weight - which eats into payload and costs money, simply because of the superfluous material used. A comparison can be drawn here to that of aircraft design, however, the margins here are far narrower

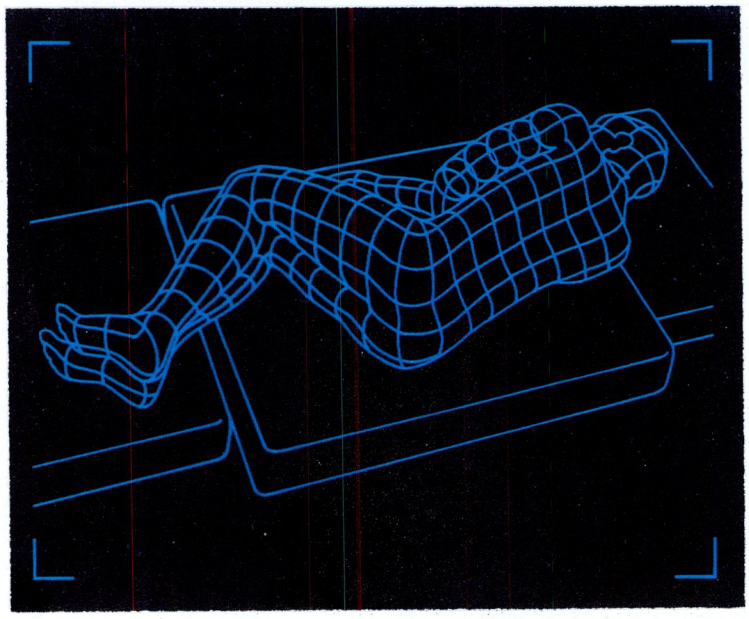


Fig. 50. CAD analysis of interior space.

One way of cutting weight and at the same time, the cost of manufacture, is to have fewer joints in the cab shell. For most cabs, those fabricated largely from steel pressings, a reduced number of joins means less welding, and less risk of eventual corrosion. However one result of fewer structural joins is the need for individual panels to be larger. That implies larger, heavier, and more expensive

presses, which could mean hefty new investment for the vehicle, or proprietary cab producer. Another deterrent in designing larger and fewer pressings in a new-generation cab, is the matter of subsequent repair procedures and costs. When a truck has an accident, the cab invariably suffers the worst of the impact. It is usually the forward structure which has to absorb the energy of the impact, by deforming in the controlled way envisaged today by safety-motivated vehicle designers.

A special extra consideration for those making truck cab strength calculations is the formidable rear corner impact of a violently jackknifing semi-trailer. Today the outer visible panels at the front of the cab, below windscreen level at least, are often non load-bearing, bolt on items. On vehicles currently in production, they are frequently moulded from one of the increasingly wide family of plastic, non-corrodible materials, such as ABS. In other instances they are galvanised steel, able to sustain stone chip damage, without rusting afterwards. Plastic specification for cab parts is chosen for the required balance of deformability, and out right strength. (Kraus, 1993, p.6.) Thermoplastics offer little impact resistance, and can some times be pulled back into shape after being deformed in a mild shunt. But those used typically for radiator grille's will often crack. Glass reinforced plastics (grps), Of the type used by ERF and Foden for their entire cab shells are stronger, but will ultimately fail by cracking or shattering.

One of the first manufactures to go down this road of reducing the number of panels was MAN - VW, with the introduction of the F90 in 1986, whose cab typifies the weight saving, cost cutting, corrosion reducing, shell which is philosophically now accepted by all makers. The shell of the F90 cab in sleeper form, as fitted on the tractor models like the 17.362, is fabricated from a total of just 36 pressings. The out going MAN F8 cab shell (a 20 year old design) is made from 45 pressed steel parts. Though the new cab structure, Fig. 51a and 51b. with its CAD / CAM (Computer Aided Machining) input, is lighter and essentially simpler than its predecessors, the MAN parts list price for a replacement shell is higher, at £5180, against £4296 (1986 prices). This reflects

the need to recoup the formidable cost of tooling for the F90 cab which arguably represented the boldest new cab investment for years, considering MAN's production volumes, and the company's go it alone policy, without co-operative cost-sharing deals, such as Cabtec, which designed the cab for the DAF 95 series, the Seddon Atkinson Strato, and the Pegaso Troner.

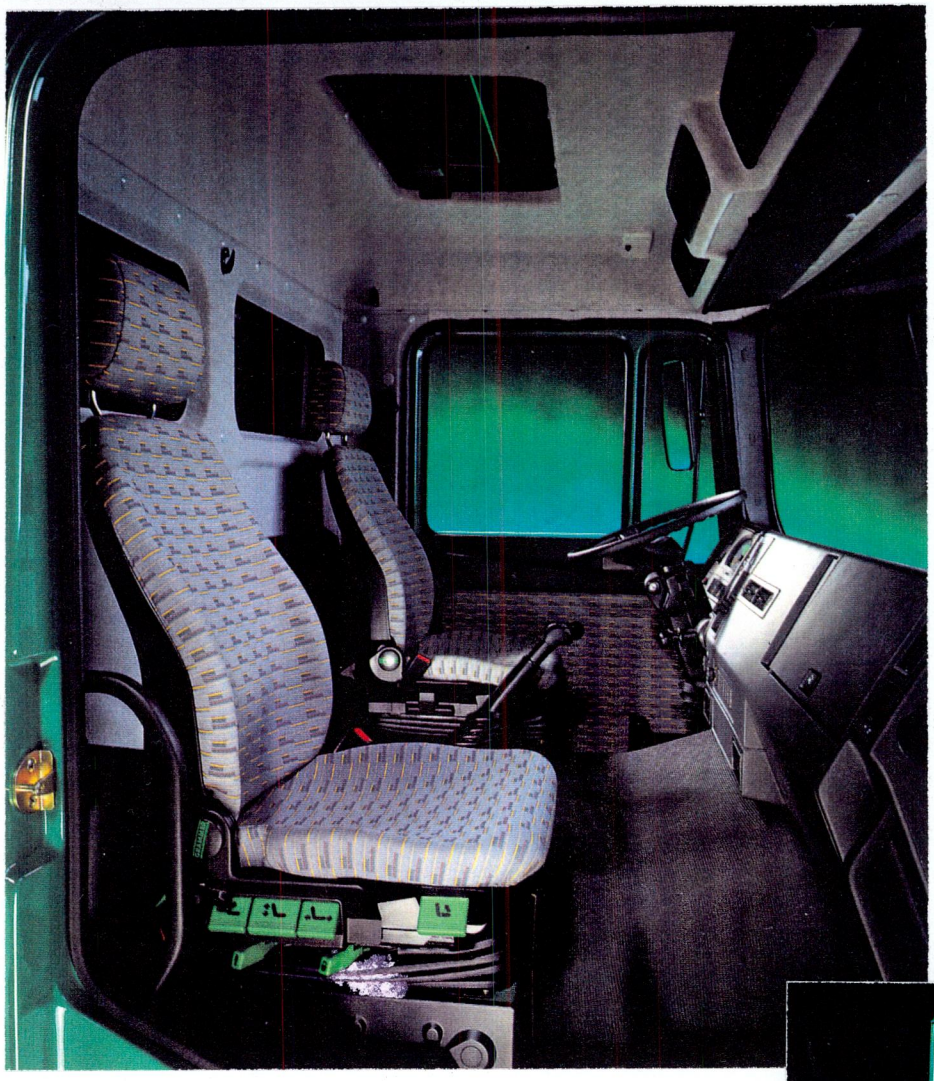


Fig. 51a. MAN Short-haul cab.

Fig. 51b. MAN long-haul cab.

AERODYNAMICS

One of the main areas of concern to the designer, when developing the external form, are the aerodynamic factors. Fuel efficiency is a priority on the larger trucks, so the drag-coefficient must be as low as possible. When first launched, the Cabtec cab was one of the most aerodynamic in production, despite its 'cube' appearance.

The concept of form prevailing in the '80s was strongly influenced by aerodynamic aspects, and this is apparent from two details. Firstly, the curving of the cab panels to assist air flow, and secondly, the addition of air dams, incorporating the side steps to the lower bumper, lateral side deflectors, which help keep the side windows free of dirt, and roof spoiler, which assists the flow of air between the cab and trailer. Some parts of these wind cheater's are only offered as optional, but as more and more become standard, so the demand rises. A full kit may increase the efficiency of the truck by 5%. This amounts to a large saving annually, The main effect on the interior of the cab is the reduction in the noise level produced by the wind resistance when travelling at speed, plus the spray and dust is deflected away from the cab, improving visibility to the sides and rear of the vehicle, Fig. 52.

Fig. 52. MAN 19.422 with aero kit.

Fig. 53. Interior of MAN 19.422.

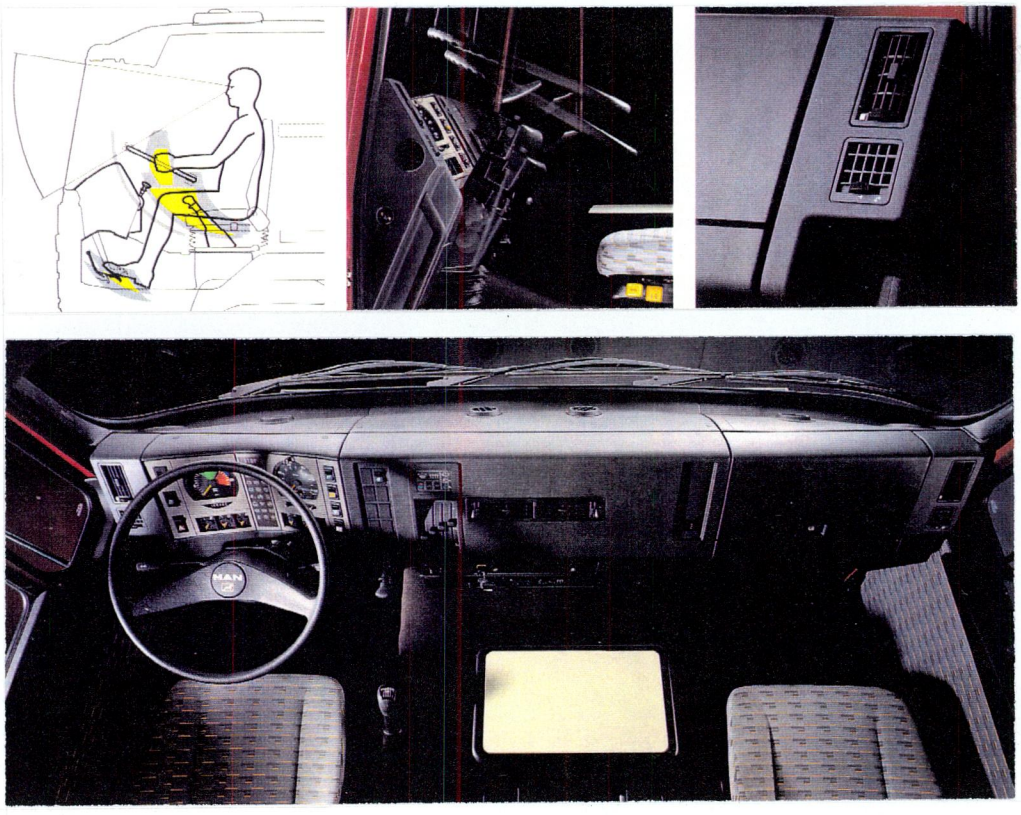


Fig. 54. Layout of MAN 19.422 cab.

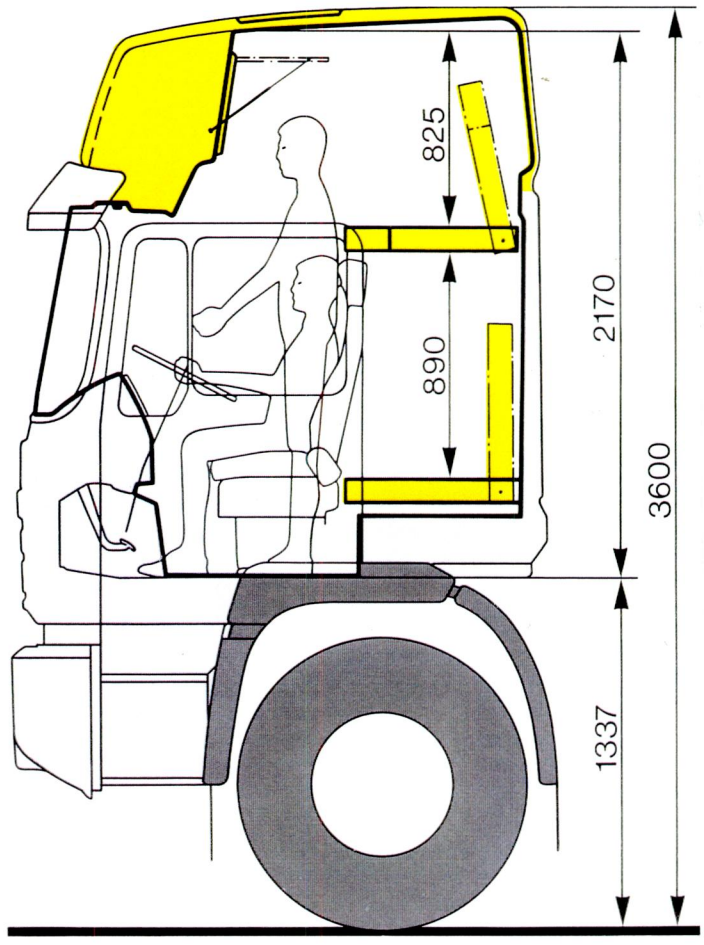


Fig. 55. Dimensions of interior of MAN 19.422 cab.

COMPUTER MAPPING / COMMUNICATIONS

"Satellites are going to play a key role in two of the buzz concepts of the '90s in Europe: just-in-time and cabotage." according to Jim Lamont, ex general manager of Volvo, now commercial director of Locstar, one of a small group of new communications companies specialising in this field. (Anon, Feb, 1990 p.44.) He believes they will speed up deregulation of transport:

> I don't think any operator is going to be able to survive without the use of satellite communications. By the end of the decade, trucks without satellite communication as part and parcel of the truck will be in the minority. If you allow your imagination to run riot, you will find applications which we will offer economic improvements. (Anon, Feb. 1990, p.44.)

In the US, satellite communications have taken off dramatically. By November '89, almost 10,000 trucks had been equipped with the satellite communications equipment, and this number is growing rapidly. (Anon, Feb. 1990, p.44.) The system which Locstar is introducing, offers two-way communication between the truck and its base, by using a keyboard, printer and transmitter onboard the truck, and a receiver unit at the base. The vehicle will then be able to be tracked to a few meters anywhere in Europe. It is also intended that this system will incorporate a navigation system, similar to those on trial in Germany and France at present. This technology will run along side the mobile phone, and portable fax machine, which is becoming common place in the cab of today's driver. In order to be competitive, these communications devices are employed to help increase the efficiency of the vehicle, while out on the road. It is now easier for the driver to be kept informed by the base, and for the owner driver, he is able to compete with the larger fleets as he can now use the cab as his base.

CHAPTER VI : WHERE IS THE INDUSTRY GOING ?

CAB SHARING DEVELOPMENT

Previously each manufacturer designed its own cabs, incorporating their own corporate style. However, in these days of increasing costs in development, and the need to produce a cab which surpasses its competitors, manufacturers are joining forces, to develop the bulk of the design. It also involves greater interaction between designers of different companies, resulting in a fresh approach to the design. In 1984, DAF, Pegaso, and Seddon Atkinson got together to share the costs of developing a cab shell, the Cabtec shell. The first of these cabs to appear on the European roads was that of the Pegaso Troner. Fig. 56.

Fig. 56. The Pegaso Troner.

Pegaso, has always been an engineering led company. Its origins go back to Hispano-Suiza, - surely one of the finest names in aeronautic history. This truck follows in this tradition, and the cab is a major feature of this. The Cabtec shell is largely common to that of the DAF 95 Series shell (DAF use a different floor), but all the trim, equipment, interior design, seating, control systems and everything else that bolts or sticks onto the shell is purely Pegaso. By any standards the cab is impressive. From its copy-book step arrangement, the superb seating and dash layout. Not only are the steps more than wide enough for the largest man, but when you look down you can see all the threads, each set a few centimetres from the one below. This is a major safety point, as entry and exiting the cab may often prove hazardous under some adverse weather conditions.

The interior space is utilised to the full, such good use the structure makes of the available space on the chassis. The corner pillars are slim, at least in the direction from which the driver sees them, which adds to his visibility. The dash is both impressively styled and functional in use. Fig. 57. From the drivers seat the screen looks huge, and the angled side windows have a very low waist-line. (Kennett, May, 1987, p.64.) The Troner without being radical in design in any way, pushes the boundaries of known technology that little bit further forward. Pegaso have been able to concentrate on the development of the interior for their cab, as the shell was being developed by Cabtec. Fig. 58.

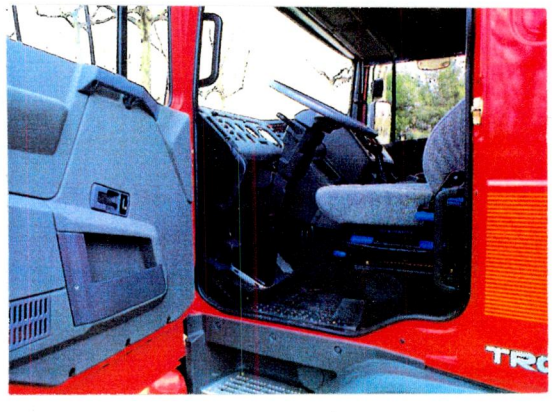


Fig. 58. Detailing of the Pegaso Troner

Fig. 57. Dash layout of the Pegaso Troner.

The British Seddon Atkinson (SA) which is owned by Pegaso's Spanish parent company, ENASA, also uses the same Cabtec shell on their Strato, launched in October '88. Fig. 59. The Strato has three of the four versions of the Cabtec shell, only the top sleeper is unavailable. The Strato version differs from that of the Troner, in having its own floor-pan. Not only was it designed for a narrower chassis, but right-hand drive versions are catered for by having a wider leg space on the right than on the left-hand drive Pegaso. Fig. 60. The only other changes is the blue / grey colour used on the trim which S A says hides the dirt better, Fig. 61. (Kennett, May, 1987, p.66.) a feature appreciated by most drivers. The other cab related feature is the front grille. The refinement level is the same as on the Pegaso and the DAF.

Fig. 59. Seddon Atkinson Strato

Fig. 60. Driving position of Seddon Atkinson Strato

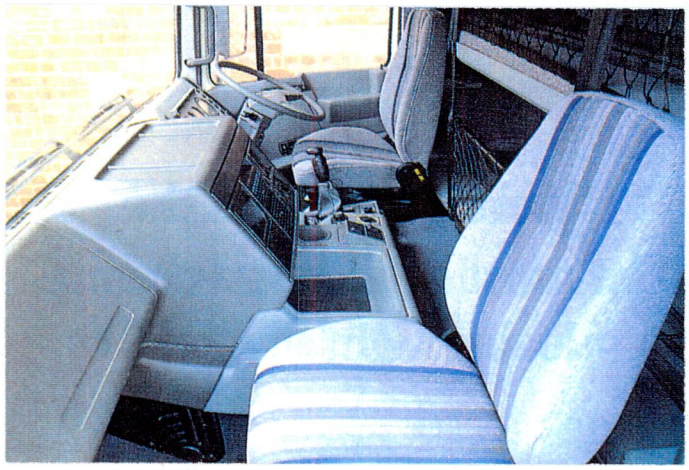


Fig. 61. Cab trim of Seddon Atkinson Strato

The most successful of the three Cabtec designs has to be the DAF 95 Series. Fig 62. This was introduced in October '87, to replace the fifteen year old 2800 series, and went on to win the International Truck of The Year award in 1988.

Fig. 62. Daf 95 series Spacecab

The DAF version (see chapter III) is very similar to the others. Different in appearance it may be, but once in side it feels very similar. The cabtec shell is of steel construction, meeting all regulations governing strength, including those for the Swedish market, which is extremely strict. It is extensively treated for corrosion protection. To help keep weight down almost all non-load bearing panels are made of hard plastic. Fig. 63. On the top-sleeper, and spacecab versions, the roof is made of fibreglass, bonded and rivetted in position. Each manufacturer has taken the cabtec shell and given it a distinctive identity. By sharing the shells development, it has meant that they have been able to concentrate on the detailing of the cab, to a high standard.

Fig. 63 . Interior trim of the 95 Series Daf.

SIZE INCREASE

Does big mean better? Most of the truck manufactures seem to think so. Ten years ago 400 bhp was accepted as adequate, today the manufactures are trying to improve on 500 bhp. There is the argument that the higher power output increases engine life, and reduces fuel consumption on long haulage. This is true, once the truck is driven correctly. From the drivers aspect, working with the higher power output means less gear changes, which on a sixteen speed truck, can be strenuous, and faster overall trip times. This is all very well, but the end result is faster trucks on the roads. Vehicles of this size can very easily turn into lethal weapons, when in the wrong hands, but so can any road vehicle.

The public often accuse the heavy goods vehicle of being the cause of the collision, in which it is involved. This is unfair, as EC road accident statistics prove otherwise. EC regulations are very strict when it comes to heavy goods vehicles, which as the power race continues, is good for the industry, from the safety aspect. It is not only the power output which is on the increase, but the gross vehicle weight, and the trailer lengths and width. Slowly the transport industry is increasing the overall size of the European truck!

ON BOARD ELECTRONICS

As discussed in chapter V, electronics are becoming more and more part of the transport industry. It follows that they are finding their way into the truck, in the form of engine management, automated transmissions, active suspension, drive-by-wire, and communications facilities such as mobile phones and tracking devices. Is the industry relying to strongly on this technology at present? The likelihood of the failure of such components is far beyond that of the old tried and tested mechanical methods, and these are usually easier to repair if anything should go wrong. The electronic component is often a throw away item, which is generally expensive. The fact is that they are continuously improving on this technology, so that in the future it will be as cheep and reliable as the existing mechanical systems, and will cost no more to maintain. These have all been introduced to improve the efficiency of the truck, and assist the driver.

The next ten years will see the introduction of even more technology into the cab. Those who resist this advancement shall be left behind to fend on their own, and inevitably, perish at the success of their competitors. This technology needs to be introduced slowly, so as not to frighten the user, but gradually familiarise him with it. This will in time benefit the industry.

CLEANER TRUCKS

In the '90s the environment has become a large issue, and will continue to grow. Green issues are going to have more and more impact on our lives, as all aspects of modern life are reassessed in terms of their environmental impact. For road transport this process has already begun, with the first environmentally-driven legislation, in the form of spray suppression noise and engine emissions, already in force. There are many more environmental regulations governing the design and operation of trucks to come into force over the next few years. Road vehicles are at the front of the queue for environmental scrutiny, in the pursuit of reduced greenhouse gases.

British trucks contribute three percent of UK CO^2 production, and just 0.1 percent of the global total, according to Iveco Ford (Barden, Mar, 1991, p.38.) The trucks use fuel that contains no lead and emits less carbon monoxide (CO) The impact of environmentally driven legislation on trucks is likely to be greater than on cars, simply because the public doesn't like the lorry! The EC are introducing new regulations. Stage two of which, was inforced on the 1st. of January 1993, and for the first time, particulate emissions will be regulated. The limit for type approval purposes is 0.36 grammes per kilowatt hour for over 150 bhp engines. Stage three is to be introduced in 1996, and will involve a reduction in the sulphur content of the diesel fuel. (Barden, Mar, 1991, p.38.)

These regulations mean the addition of catalytic converters, and possibly soot traps to the exhaust system of the truck. Fig. 64. The existing soot traps however need to be cleaned every nine hours on a long distance truck, and this involves burning off the deposits at 600degC 'regeneration' temperature.

Estimates of the cost of these soot traps vary between £3500 and £9000 per vehicle, and have a maximum filter life of only three years. As Graham Montgomerie, chief mechanical engineer of the FTA puts it,

> Do we really want trucks carrying red-hot, self igniting soot dustbins in our high streets?
>
> Exhaust emissions is only one part of the legislation, noise is another. At present, in order to meet the Austrian limit of 80dB(A) - the toughest in Europe, covers have to be fitted over the sump and bell housing, with extra insulation matting stuck to the chassis and the underside of the cab. The current EC limit is 84dB(A) for heavy trucks. Because of this Engines are being redesigned to reduce mechanical and combustion noise, while gearbox, and air flow noise is also being reduced. Air suspension is being specified, as it is quieter then steel springs, and kinder to the roads. There is little expectation of reducing the noise level below 80dB(A) as most of this noise below this level is caused by tyre contact with the road.
> (Barden, Mar, 1991, p.39.)

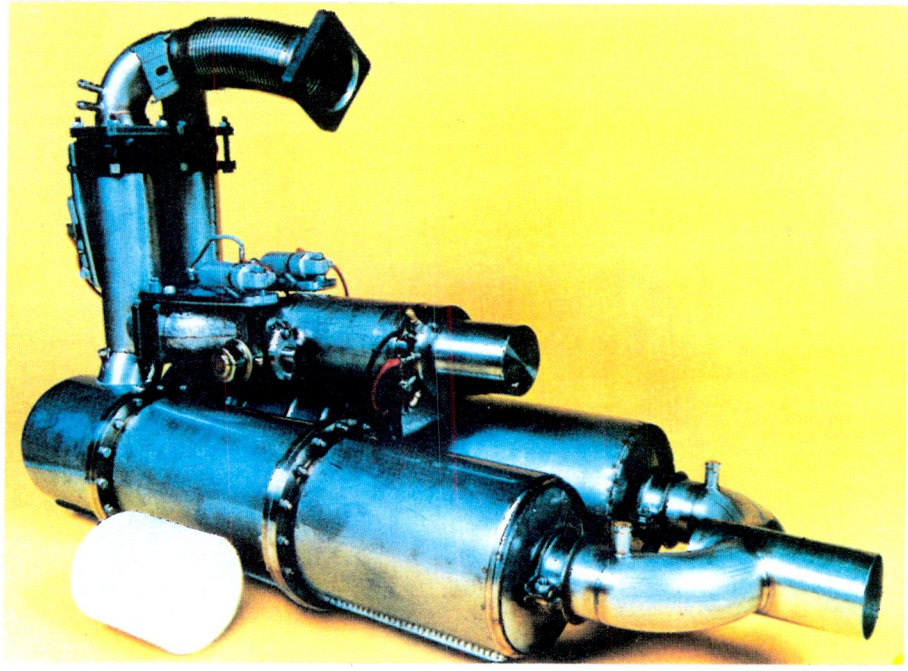


Fig. 64. A soot trap

YEAR 2000

The transport industry has been the subject of much change since the first vehicles appeared on the road. This will continue into the next century, with the advance of new technology, a single European market, and the introduction of new legislation. The idea of a plastic truck, made largely of glassfibre and assembled in a climatically controlled factory totally by robots is closer to realisation than it was ten years ago. The weight and cost of such a truck would be approximately two-thirds that of the current truck. The technology required is no more novel than that of the aerospace and aeronautical industries.

The Spanish truck manufacture, Pegaso, has decided to explore this area in full. They have formed a truck design team with a difference, which offers a new approach to the development of the truck. It comprises of four aerospace experts, who form the core of Pegaso's Advanced Technology Group. This group is in charge of the company's technological research. They deal with issues which are unrelated to the immediate development of existing models, they are researching the trucks of the future. From their knowledge of other areas of design, they can look at the truck with a different view than that of their counterparts within the truck industry. From this comes new concepts and ideas.

One product of this is the Solo concept truck. Fig. 65. This bares little resemblance in either aesthetics, or construction to that of the existing European truck. The materials used here offer to the designer, new ways to execute the problems faced with today's trucks. For example, the chassis on the Solo is of a glassfibre and Metal Matrix Composite material (MMC). According to Jose Manuel, a member of the group whose speciality is airframes.

> When materials change, so must design. Function and manufacture are all different when a new material is used. Steel is not best for all components. It is heavy, expensive and cannot by varied in thickness because of how it is shaped. (Coughlan, 1990, p.61.)

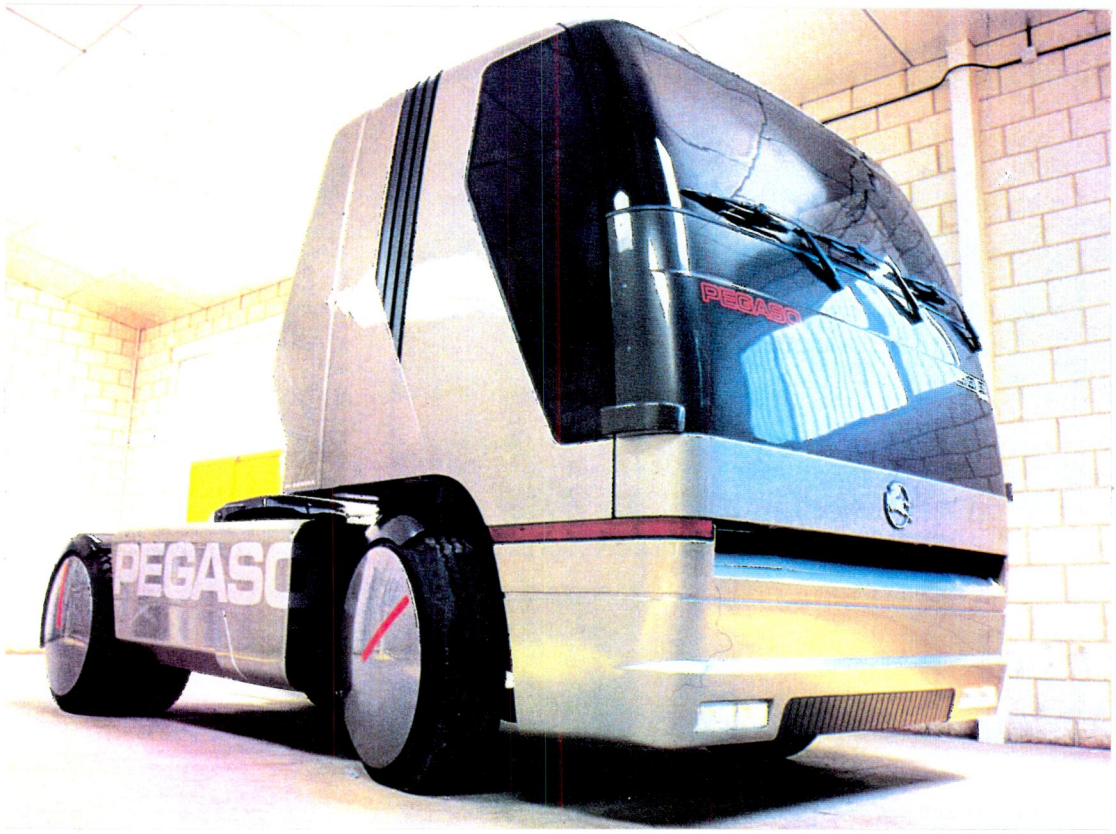


Fig. 65. The Pegaso Solo.

Manuel took the chassis rail and found it to be an inefficient use of material. The steel rail must support the engine, cab, and rear axle. To do so it needs to be strong in these regions, but the thickness of the rail is uniform along the rail due to the shaping process. This results in much of the rail being stronger, and so thicker than it needs to be, so resulting in a heavier and more expensive truck. By using MMC instead of steel, which is cheaper and lighter than steel, the thickness can be varied, and it can be compressed into a range of shapes, giving Manuel a very different form. Fig. 66. It is also both water and oil resistant, which makes it ideal for fuel tanks, similar to those made of carbon fibre/plastic composite material already used on the A330 Airbus. (Coughlan, 1990, p.61.)

Fig 66. The Pegaso Solo.

Electronics is another area development for the group, Rafael Guzman, who previously worked for Ceselsa Electronics, on military projects, mainly radar, believes that such tracking systems must be fitted to the vehicle, and that there is a lot of existing systems which could be of advantage to the truck, but he is primarily interested, not in the 'second generation, but the 'third generation' of electronics. This is where the mass of cabling is eliminated, and replaced with a single cable, known as a data bus. This gives the designer space for development which would other wise be used for the housing of the cables. The group believe that the driver should not by bombarded by information from a bank of instruments. They would do away with most of the instruments and instead, only show a warning indicator when there is a fault. Fig. 67.

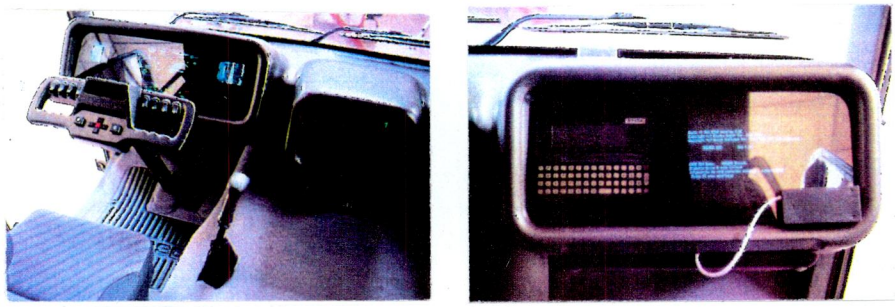


Fig. 67. Clear instrumentation of the Pegaso Solo.

Fig. 68. Leyland TX 450.

Research and development in a project is a slow process. From the time when the technology is first conceived, to it being set into operation often takes years. Much of the technology is discarded, as it is found to be of little additional advantage, or superior technology is found. In 1987, Leyland unveiled their TX450. Fig. 68, 69. This was much more than a concept vehicle. This truck actually goes.

Pat Kenneth of Truck Magazine writes:

> The road is icy on this early winter morning shop delivery, and the chunky six-wheeled curtainsider is picking its way carefully over the slippery patches. The continuous variable transmission chooses a ratio which keeps moderate speed with gentle torque at mid-range revs. The micro computer which looks after the suspension senses that grip is a bit marginal at the drive wheels, so it adjusts the pressure balance in the air suspension to give a bit more traction weight on that pair of wheels The gradient steepens and the transmission computer adjusts itself to provide minium power to do the job, so trying to avoid spin. Even so, wheel spin begins to set in, the wheel on the icy crown of the road loses its grip, and the engine revs blip up. The engine's microcomputer checks with the transmission microcomputer to see what's going on. No answers there, so it checks elsewhere. The suspension microcomputer reveals that there is a traction problem, so the supervisory master computer calls up the brakes microcomputer for help. It reads the wheel spin on that off-side drive wheel, and gently applies the break to the spinning wheel, restricting it to normal speed. All is back in balance again, and the truck continues up the icy slope, safely and securely. Later in the morning's work, as deliveries are made the loss of weight from the back end increases the front axle load. The suspension microcomputer measures each wheel accurately, tells the driver that he's getting close to the front axle limit, and then adjusts the pressure in the three axle sets of air suspension to the best setting within the legal limits. Dropping pressure in the third axle effectively shifts the pressure base forwards to suit the changing load. All the time this is going on, the diagnostics microcomputer is keeping a careful eye on things. It monitors - electronically of course - the behaviour of the flywheel many times a revolution, and records te temperatures of oil, water, inlet and exhaust gases, among other items. The state of fluids and so gives an obvious report on the engine, but it is the flywheel monitoring that produces the real answers. One compression slightly down will show up as below-par acceleration of the flywheel on that firing stroke. By analysing these relative

accelerations and deceleration of the flywheel 150 times in every revolution, the diagnostic microcomputer can tell exactly what is going on, and report accordingly on the mechanical condition of the engine. (Kennett, Apr. 1987, p.59.)

Fig. 69. Leyland TX 450.

The electronic technology used by the systems that control the TX450 are highly advanced. It demonstrates highly advanced thinking in terms of driveline, suspension control, chassis and body hardware in a stylish and practical way. At the time most of the hardware was considered as futuristic, but as we can see today, many of the ideas, which have been tested and proven, are being introduced. One accepts, almost unnoticed, the slow introduction of technology, but when confronted by a truck like the TX450 it becomes clear that the future is not so far away. The designer must be fully aware of the technology available to him. An understanding is not always necessary, but a competent ability to deploy this technology is essential, if the design is to be succeed.

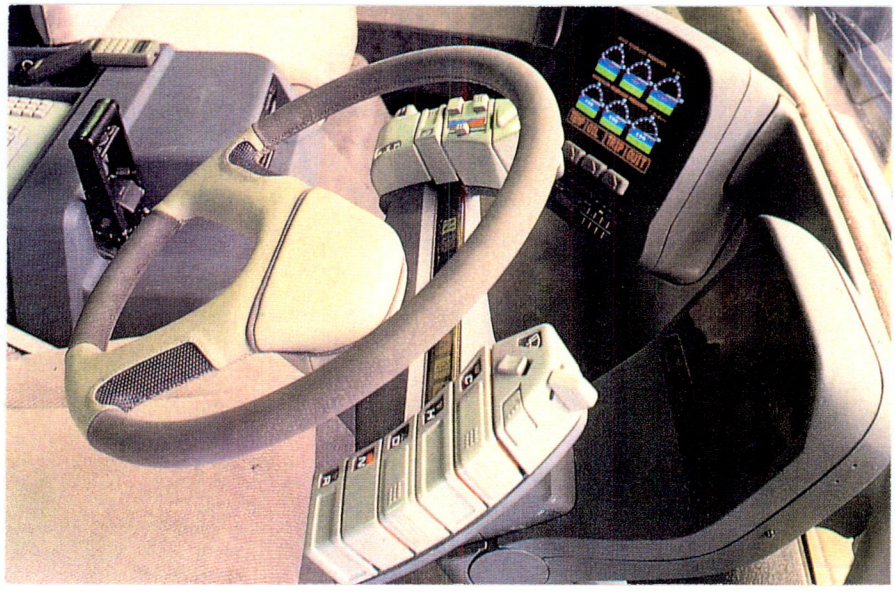


Fig. 70 Unconventional dash of the Leyland TX450.

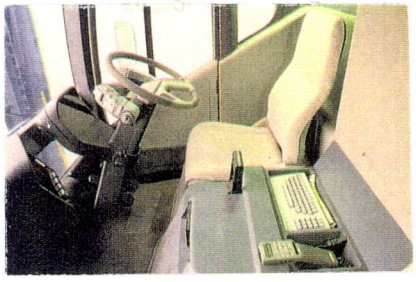
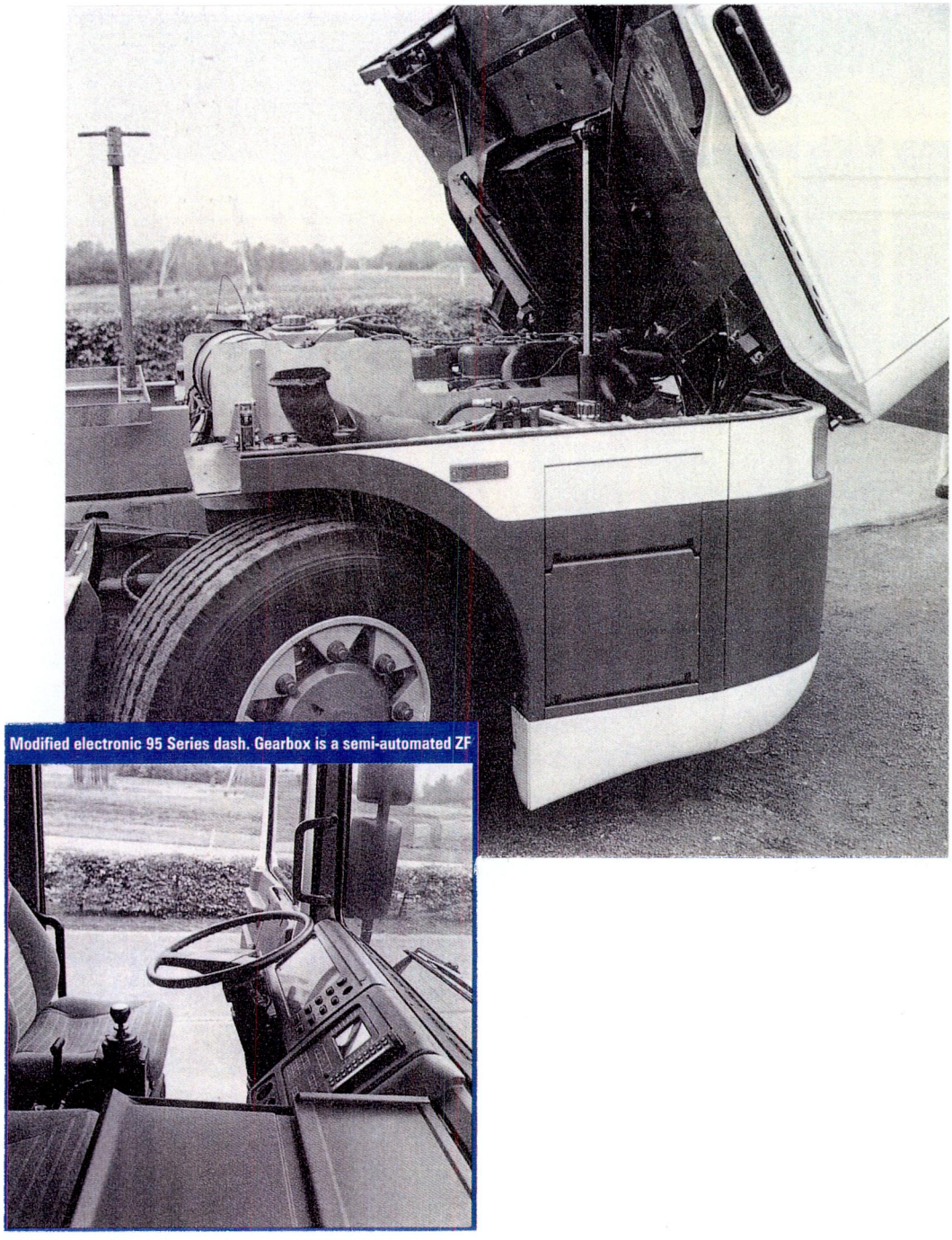


Fig. 71. Interior of the Leyland TX450.

In order to gain a competent ability to deploy the technology manufactures spend a lot of time studying, and testing new ideas. A good example of this in operation is the Daf FCV (future concept vehicle). The FCV uses the existing 95 series cab as a basis for the testing. Fig. 72. To this the new concepts are added, such as the entry steps which fold flush when the door is closed to aid the aerodynamics, and the dashboard. The dashboard uses a single transparent panel to cover all the instruments instead of the previous individual dials, which were extremely difficult to keep clean. At present however, this truck is a test-bed, more for the engineers than the designers, as transmission and driveline are at the forefront of this vehicle. The designers will work separately until at a later stage, when both groups have finished their preliminary testing, come together to develop the next range. This is not to say that there is is no

Fig. 72. Daf's FCV prototype.

correspondence between the two groups in the early stage of the project. There has to be in order for the two to merge later, each must know that the other is doing, so as to keep the development of each parallel.



Figs. 73 / 74. Detail of steps and dash panel of FCV.

Fig. 75. Colani concept tractor unit.

Probably the most unusual concept to go into limited operation in recent years is the Colani concept tractor unit. Fig. 75. Professor Luigi Colani, 'enfant terrible' of the industrial design world, caused a sensation when he revealed his first commercial vehicle, with its round screen and striking aerodynamics, at the Frankfurt Motor Show in 1975. Now this vehicle which was revealed at the Geneva Motor Show in 1990 has gone into with a major German fleet operator, Bardusch. The Colani concept tractor unit boasts an extremely low drag factor of 0.38, and offers fuel savings compared to conventional trucks of aproximitly 30% (Anon, Feb 93, p.19). It is very unlikely that we will see this truck in large scale production. despite its advantages to the operator. The styling of the cab contains a ' '70s space age' look, not what the contemporary truck driver is expecting. It is very much a curiosity piece with many good ideas incorporated into it, some of which we will see in the trucks of the future.

CONCLUSION

> In conversation I often get the impression that the approach of the year 2000 involves a kind of magic number and will bring about some drastic change in our habits. I equally often get the impression that we designers are supposed to have designed by then a vehicle which can fly or should at least look as if they can.. But I can not see this at all. (Kraus, 1993, p.6)

The contemporary truck has come a long way from the early days, it is not a large, slow, dirty vehicle. It is much more sophisticated and so is the design involved. We are now entering a design phase in the truck industry of exciting optimism. The new miniaturised technology is tending to liberalise designers from the dominance of form and function. In turn the appearance of the contemporary truck is undergoing a transformation. Everything from the method of manufacture, to the method of driving the vehicle, to how it treats the environment is changing.

No longer is the truck the forgotten part of the motor industry. As the image of the truck has improved over the years, so it has been realised that the truck is of vital importance to all industries. As part of this realisation, the truck manufactures now see the driver as an integral part of vehicle, and so has a more prominent position on their design brief. His working environment is changing, as so are his conditions. Inevitability, not all changes are for his benefit, but as development continues, all those concerned with the truck can avail of the improvements offered.

The appearance of the cab has changed dramaticly since the early days, the methods of design and production have also changed. As with all other aspects of design, Computer aided design now features highly in the design of contemporary cabs. CAD allows for the stress levels are determined much more analytically. Finite element analysis methods enable stress concentrations to be identified in a proposed cab, or its individual panels, or sections where weaknesses are likely to occur, and the design can then be modified accordingly.

This not only is better for the designer, but results on a more reliable cab for the user as potential problems can be foreseen and measures taken to eliminate them. CAD is particularly useful for aerodynamic improvements with trucks which is of major importance in the '90s.

Environmental issues are at the forefront of design in all forms of industry today. The truck which previously had a poor reputation in this area is now coming forward as a cleaner, and less destructive vehicle towards the environment. Many of the cab components are made of recyclable materials, and are assembled in a manner such that they can be easily disassembled to as to retrieve them for recycling. Unlike previous trucks, many of which were just left to rot in some yard somewhere, today's truck when it reaches the end of its service life, can be used to provide some of the raw materials needed for the production of new trucks.

One notable change of truck design, is the change in designers themselves. Not only has their numbers increased, but so has the variety. Designers who specialise in the area of aeronautics can now be found in the commercial vehicle industry. Despite the fact that the aeroplane and truck are two different products, they are both for the carriage of goods and passengers for reward. Even though one remains on land, while the other is reliant on air as a means of getting from A to B, they both share many of the same constraints. So it is a natural progression that they should share designers. Many other areas of design are also represented in the in the new style design studios of the truck manufactures.

The end result is one of a highly sophisticated product, designed with the end user in mind, and so fulfils the requirements of the operator and driver better than has ever before been achieved.

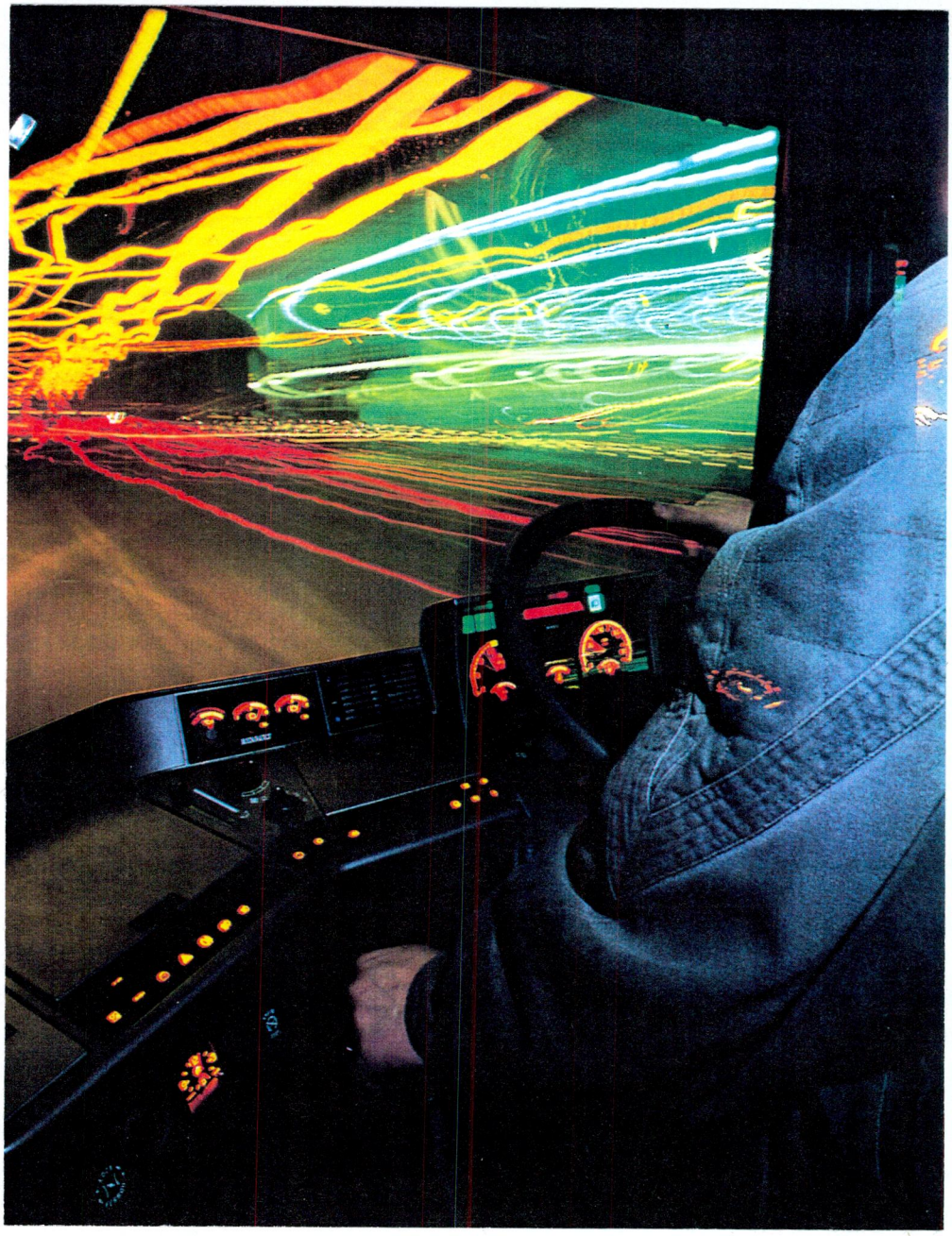


Fig. 76. A driver in control.

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