

9 FRICTION MATERIALS

Friction materials are used in the manufacturing of brake and clutch products that are used in a number of different on and off highway applications.

Chrysotile asbestos fibres have traditionally been a key raw material input in the manufacturing of friction materials. In most instances, the component elements that make up the friction material formula are mixed in dry powder form, and are then compressed and baked as the key steps in manufacturing friction materials.

The major applications for friction materials in the South African economy occur in the following application environments:

A. On Highway Applications

- Brake and clutch products for passenger, light commercial and heavy-duty vehicles

B. Off Highway Applications

- Brake products for trains
- Brake and clutch products for earth moving and agricultural equipment

C. Industrial and Mining Applications

- Brake and clutch products for headgears, conveyor belts, forklift trucks, etc.

9.1 ON HIGHWAY APPLICATIONS

There are approximately 6.8 million registered vehicles in South Africa. Of these, approximately 6.5 million are passenger and light commercial vehicles, with the remaining 320,000 being heavy-duty trucks and trailers. Table 36 reflects an estimate of the number of registered vehicles in South Africa as at the end of December 2000.

TABLE 36: REGISTERED VEHICLES IN SOUTH AFRICA

TYPE OF VEHICLE	REGISTERED NUMBER	PERCENTAGE
Heavy Load Vehicles	320, 785	4.7%
Light Load Vehicles	1, 804, 139	26.6%
Passenger Vehicles	3, 943, 279	58.2%
Minibus Taxis	248, 970	3.7%
Special Vehicles	318, 862	4.7%
Motorcycles	159, 917	2.4%
Other/Unknown	22, 580	0.33%
TOTAL NUMBER OF REGISTERED VEHICLES	6, 774, 501	

The key friction material products used in this application environment include disc brake pads, brake shoe linings and clutch plates. Table 37 on the following page reflects an estimate of the total market (local manufacturing and imports) for these products, expressed in annual units produced/imported.

TABLE 37: ON HIGHWAY FRICTION MATERIAL MARKET

	PASSENGER AND LIGHT COMMERCIAL VEHICLES	HEAVY DUTY TRUCKS AND TRAILERS
Brake Disc Pads	14 million	< 100 thousand
Brake Linings	2.8 million	2.5 million
Clutch Kits/Plates	800 thousand	300 thousand

9.1.1 Disc Brake Pads and Brake Shoe Linings

Approximately 90% of passenger and light commercial vehicles use disc brake pads on the front wheels, and brake shoes with friction material linings on the rear wheels (the remaining 10% use disc brake pads on both the front and rear wheels).

There are 6 local manufacturers of disc brake pads that produce approximately 70% of the brake pads used in RSA – 90% of which is made from non-asbestos materials. In addition, there are at least 5 importers that import the remaining 30% of the disc brake pads used in South Africa - at least 70% of which is asbestos containing.

Approximately 70% of the disc brake pads manufactured and imported into South Africa are made from non-asbestos formulations. The most popular formulations are based on steel wool and iron filing combinations – both of these elements are available from local South African suppliers.

Table 38 reflects a comparison of prices across the various price segments in this sector.

TABLE 38: DISC BRAKE PAD PRICING (END USER/CUSTOMER PURCHASE PRICE PER SET)

	ASBESTOS-CONTAINING PADS	NON-ASBESTOS PADS
Low Priced Segment (1.3million sets)	R160 – R260	R240 – R480
Mid-Priced Segment (1.45million sets)		R600 – R640
Premium Priced Segment (0.8million sets)		R660 – R840

Most disc brake pads are sold via a distribution channel that includes a wholesaler (that adds a 25% to 33% mark up) and a retailer that adds a further 25% to 33% mark up. Finally, the service workshop/fitment centre that fits the pads to the vehicle adds a final 17.5% to 25% mark up.

All of the local manufacturers have already undertaken the R&D necessary to develop non-asbestos formulations and are producing products that conform to SABS specifications. They report that these products perform as well as (if not better than) asbestos-containing brake pads in terms of their vehicle-stopping capabilities and are not any harsher wearing with regard to their impact on brake discs and brake drums.

However, the perspective from the vehicle servicing level is that "newer brake pads" last only 30,000 to 40,000 kilometres versus 60,000 to 70,000 kilometres for asbestos brake pads. Also, brake discs now need to be replaced after every 60,000 to 90,000 kilometres as apposed to every 150,000 to 160,000 kilometres – a set of brake discs retails at between R1,000 and R2,000. "Some customers" are aware of these differences and complain that "things are not lasting like they used to".

9.1.2 Brake Shoe Linings

The brake shoes fitted to the rear wheels of most passenger and light commercial vehicles incorporate a brake lining of friction material cut from "moulded roll". There are 2 local manufacturers and 4 importers of this moulded roll product.

90% of the 200,000 10-meter rolls sold in South Africa annually are locally manufactured, with the remaining 10% being imported. Currently, 80% of the market is made from asbestos-containing formulations.

One 10-meter roll can make up linings for 4 vehicles (4 sets of brake shoes per vehicle) and is sold by manufacturers/importers for R110 per roll. Asbestos-containing and non-asbestos formulations are sold for about the same price. Moulded rolls are sold to the Brake Bonders, who add a 50% to 100% mark up plus bonding costs.

9.1.3 Heavy Duty Brake Linings

99% of heavy-duty vehicles use lined brake shoes on the front and rear wheels of the trucks, and all of the wheels on trailers. There are 4 local manufacturers and 5 major importers of brake linings (plus another 5 or 6 smaller importers).

Brake linings are mostly fitted to heavy-duty vehicles, of which there are approximately 300,000 registered vehicles in South Africa. Currently, 80% of the heavy-duty brake linings manufactured and imported into South Africa are made from asbestos-containing formulations. Approximately 60% of brake linings are made locally, with the remaining 40% being imported.

Table 39 reflects a comparison of asbestos-containing and non-asbestos heavy-duty brake lining prices.

TABLE 39: HEAVY DUTY BRAKE LININGS (END USER/CUSTOMER PURCHASE PRICE PER UNIT)

	ASBESTOS-CONTAINING LININGS	NON-ASBESTOS LININGS
Local Manufacture	R48 – R63	R53 – R75
Imported	R17 - R20	

Generally, brake linings are sold by the manufacturers/importers to "Brake Bonders" (350 to 500 individual businesses) who add a 50% to 100% mark up (plus fitment costs) when they fit and sell linings to vehicle owners.

9.1.3.1 Heavy-Duty Vehicle Owners

There are approximately 1,750 truck operators, operating more than 300,000 vehicles and trailers on South Africa's roads. Table 40 reflects a break down of truck operators and vehicles.

TABLE 40: HEAVY-DUTY VEHICLES

	NUMBER OF OPERATORS	NUMBER OF VEHICLES
Large Fleet Operators	20	100,000
Medium Sized Operators	250	140,000
Small Operators	1,400+	65,000

Good quality non-asbestos brake linings provide a "far superior" performance as regards stopping ability, tyre wear and impact on brake drums.

They can provide as much as a 40% reduction in Cost per Kilometre (CPK) costs associated with brake maintenance, which "more that off-sets their higher price".

Road Freight Association costings indicate that brake linings make up less that 1% of the total maintenance costs associated with operating a heavy vehicle. Therefore, it is anticipated that most truck operators will absorb the additional cost of non-asbestos brake linings and will not increase their freight charges to compensate for this cost increase.

9.1.4 Clutch Plates

A clutch kit for a vehicle with a manual gearbox is made up of three components: a metal "cover assembly" (or pressure plate), the "clutch driven plate" – a metal plate that incorporates 2 clutch facings made from friction material, and a "release bearing".

When repairing an existing, broken clutch, the vehicle owner has two options: either install a complete new clutch kit, or "refurbish" the existing clutch. Table 41 reflects a breakdown of the clutch facings market.

TABLE 41: THE CLUTCH MARKET

	PASSENGER AND LIGHT COMMERCIAL VEHICLES	HEAVY-DUTY TRUCKS
Clutch Kits	360,000 (720,000 facings) 100% non-asbestos Manufacturers Selling Price: R550	240,000 (480,00 facings) 100% non-asbestos Manufacturers Selling Price: R2,500 to R16,000
Lose Clutch Plates	200,000 to 400,000 (400,000 to 800,000 facings) 40% non-asbestos, 60% asbestos-containing Manufacturers Selling Price: - Non-asbestos: R85 – R130 - Asbestos-containing: R65 – R110	30,000 (60,000 facings) 40% non-asbestos, 60% asbestos-containing Manufacturers Selling Price: R300 to R1,400
Refurbished Clutches	200,000 to 400,000 (400,000 to 800,000 facings) 10% non-asbestos, 90% asbestos-containing Manufacturers Selling Price: - Non-asbestos: R45 to R60 - Asbestos-containing: R40 – R42	30,000 (60,000 facings) 10% non-asbestos, 90% asbestos-containing

The distribution chain for clutches includes a wholesale distributor (20% to 25% gross profit), a retailer (30% gross profit) and the workshop (30% gross profit) that fits/refurbishes the clutch.

There are no local manufacturers of clutch facing material in South Africa. As a result, all clutch facings used in South Africa are imported. There are 4 companies that manufacture and assemble clutch kits in South Africa. In addition, there are a further 20+ businesses that import lose clutch plates and clutch facing material into South Africa.

9.2 THE SABS ECE R90 SPECIFICATIONS

The South African Bureau of Standards (SABS) has established a working group comprising of members of the "Friction Material Fraternity" (which includes both local manufacturers and importers of disc brake pads, brake linings and moulded roll).

This group is currently developing an implementation plan for the new SABS ECE R90 specification⁸⁶.

This specification, which is based on a United Nations agreement concerning the adoption of uniform conditions of approval and reciprocal recognition of approval for motor vehicle equipment and parts, provides "uniform provisions concerning the approval of replacement brake lining assemblies and drum brake linings for power-driven vehicles and trailers". In an amendment to clause 5.1, dealing with specifications and tests, this United Nations agreement specifically states that, "brake linings shall not contain asbestos". It should be noted that this specification applies to on highway braking products but not clutches.

The Friction Material Fraternity has taken a unanimous decision that "no friction material containing asbestos will be imported or manufactured locally after the 1st of January 2004. The SABS will arrange for this to become a legal requirement". It is anticipated that it will require approximately 6 to 8 months for new SABS Component Specifications to be gazetted. As such, it is anticipated that the process of phasing out asbestos-containing brake products (i.e. disc pads, brake linings and moulded roll) will begin during the second half of 2003.

9.2.1 The Impact of Implementing the SABS ECE R90 Specification

Discussions with a number of friction material manufacturers, distributors and end-users indicate that these companies do not anticipate any negative impacts on their businesses as a result of replacing asbestos fibres with alternative man-made fibres.

Specifically, these companies do not anticipate any changes to:

- Basic friction material manufacturing processes
- The equipment required to manufacture and install non-asbestos friction materials
- The number of people employed
- The skills levels of people employed

In certain instances, friction material manufacturers anticipate that their overall production costs could decline as a result of not having to comply with the occupational health and safety regulations related to the use of asbestos materials, as well as from rationalised production and stock keeping practises.

9.3 OFF HIGHWAY APPLICATIONS

9.3.1 Rail Brake Blocks

There are two local manufacturers of rail brake blocks in South Africa. Table 42 on the following page reflects the market size for this product.

TABLE 42: RAIL BRAKE BLOCK MARKET

	ANNUAL UNITS	GROWTH RATE
South Africa	360,000	Static
Exports to Africa, Australasia and USA	60,000 – 80,000	Africa: declining Australasia/US A: 20% to 50% growth

In South Africa, the only customer for this product is the Transnet group (i.e. Spoornet, Metrorail, Main Line Passenger Services, etc.). This customer purchases brake blocks on tender, and typically shares the tender between the two existing local manufacturers. Transnet has specified in its most recent tender that all brake blocks must not contain asbestos.

Currently, approximately 90% of the brake blocks manufactured in South Africa are non-asbestos and are sold to both South African and overseas countries (i.e. Australasia and the USA). The remaining 10% of asbestos-containing brake blocks are sold to African countries (i.e. Botswana, Malawi, Namibia, Zambia and Zimbabwe), as they are generally less expensive.

9.3.1.1 Alternative Fibres

In replacing asbestos, rail brake block manufacturers make use of a combination of expanded rock, iron particles and cellulose fibre in their formulations, all of which are sourced locally from South African suppliers.

Despite the fact that some of these components are more expensive than asbestos, (i.e. cellulose is far more expensive than asbestos: asbestos: R1, 950/ton, cellulose: R7, 000/ton), the actual cost per kilograms in the final brake block is actually lower than that of asbestos (i.e. asbestos: R9/kg, cellulose: R7/kg).

In addition to replacing asbestos, manufacturers have also improved the quality of their brake blocks and are now able to provide customers with far better performance:

- A significantly longer "wear life"(as much as three times longer)
- Less "friction fade" which makes stopping more predictable
- Fewer "wheel skids" which prolongs wheel life

In combination, these factors provide customers with far greater value for money, even though they are now paying a premium for a re-formulated, non-asbestos-containing brake block, i.e. asbestos: R60 per unit, non-asbestos: R75 – R85 per unit. Transnet estimates that it has spent R20 million on its involvement in the development of non-asbestos containing brake blocks over the past 3 to 4 years.

In addition, the South African manufacturers of non-asbestos-containing brake blocks are able to export these products to international markets whether they are able to obtain higher prices and improved margins (approximately 20% more). Australasia and the United States represent a significant opportunity for growth for these South African businesses.

Transnet is purchasing a portion of its brake block requirements from Australia. The reason for this is that the two local manufacturers have not yet been able to develop a non-asbestos containing brake block for use on certain locomotives that meets its performance requirements. Approximately 20,000 brake blocks are purchased from this Australian source per annum.

This figure is likely to increase to approximately 80,000 units over the next four years unless the local manufacturers are able to develop an acceptable non-asbestos block during this period.

The conversion to non-asbestos materials will not have any significant impact on the manufacturers of rail brake blocks. There will not be any significant change to production processes and no significant investment in new equipment will be required - nor will there be any significant dis-investment of existing equipment. Furthermore, there will be no change to the number and skills levels of people employed in this industry. The only potential negative impact that a phasing out of asbestos in South Africa could have on this industry will be the loss of African customers who do not see the value in converting to non-asbestos-containing brake blocks.

9.3.2 Earth Moving Equipment

Friction materials are used in the braking systems employed in heavy-duty earth moving equipment. Transmission systems employ power shift technology and, therefore, do not make use of conventional clutches that involve friction materials.

The market for friction material associated with earth moving equipment is worth approximately R90 million per annum. Less than 10% of this market is associated with asbestos-containing friction materials. The major reason for this is the fact that earth-moving equipment is traded on a global basis (i.e. Caterpillar, Komatsu, Hitachi, etc.) and many developed countries will not allow asbestos-containing materials into their markets. Furthermore, braking (and transmission) systems are advancing in technological directions that make friction materials obsolete. It is anticipated that this market will become asbestos-free within the next 12 to 24 months.

Despite the fact that non-asbestos-containing friction materials (and new, technologically advanced wet braking systems) are significantly more expensive than asbestos-containing friction materials (non-asbestos friction materials: plus 25% to 50% premium), the cost of friction materials is generally not an issue as they represent a very small proportion of overall operating and maintenance expenses in this application environment.

9.3.3 Industrial and Mining Applications

Friction materials are used as part of the speed control and braking systems associated with conveyors and lifts found in the mining industry, and in other continuous process, mass production industries (i.e. food processing, beverages, etc.). The individual products sold into this sector include moulded roll (40%), brake blocks (50%) and disc pads (20%).

The market for friction material in these industries is valued at approximately R30million per annum. Less than 10% of this is accounted for by asbestos-containing friction materials. Most mines and major industrial companies are increasingly insisting on non-asbestos-containing friction materials. It is anticipated that this industry will progressively moved towards an asbestos free status over the next 12 to 24 months.

Despite the fact that non-asbestos-containing friction materials are, in some cases, significantly more expensive than asbestos-containing friction materials (25% to 50% premium), the cost of friction materials is generally not an issue as they represent a very small proportion of overall operating and maintenance expenses in this application environment.

9.4 ANTICIPATED IMPACTS OF PHASING OUT ASBESTOS

9.4.1 Asbestos Fibre Consumption

Table 43 reflects the pattern of raw asbestos fibre purchases by the major manufacturers of friction material products for the past three years.

TABLE 43: ASBESTOS FIBRE PURCHASES

	2000	2001	2002	2003	2004
Chrysotile Asbestos Fibre (tons)	1,368	1,248	560	250	0

These figures reflect a significant decline in asbestos fibre consumption over the past three years. This has been brought about by the fact that a number of manufacturers have fully converted to non-asbestos friction material formulations, whilst the remaining manufacturers are still in the process of doing so.

If the SABS ECE R90 specification is implemented as planned, there will be no more local manufacturing or importing of asbestos-containing disc brake pads, brake shoes and brake shoe linings for passenger and light commercial vehicles, and heavy-duty brake pads from January 2004. The only asbestos-containing friction material that may continue to be manufactured and/or imported into South Africa will be in the form of moulded roll that will be used for remanufactured clutch plates, and certain industrial friction material requirements.

9.4.2 Alternative Fibres

The range of alternative fibres that can be used in friction materials as a replacement for asbestos include:

- Steel wool/iron powder combination
- Ceramics
- Rock wool fibres
- Wollastonite
- Kevlar
- Cellulose

These replacement fibres, and other raw material inputs, are used in a variety of different formulations for producing friction materials of varying qualities, performance characteristics and price levels. Union representatives are concerned that there may be negative occupational health and environmental impacts associated with the use of these replacement fibres.

9.4.2.1 Comparative Costs

In general, the alternative fibres that can be used in place of asbestos in the manufacturing of friction materials are more expensive, i.e. asbestos: R1.70/kg, steel wool/iron powder: R8.00/kg, rock wool: R6/kg, Kevlar: R80/kg.

In view of the fact that it is possible to use an infinite variety of different combinations of alternative fibres, it is almost impossible to make direct comparisons between the cost of asbestos-containing friction materials and non-asbestos containing materials.

The basic processes used for manufacturing friction materials will not be affected by a change from asbestos containing to non-asbestos formulations.

Therefore, costs associated with manufacturing will remain largely the same. As such, total production costs will only be affected by raw material cost changes, and these will vary according to the formulations used.

The possibility exists that non-asbestos-containing friction material products could be sold for the same price as a comparable asbestos-containing product. However, it is anticipated that the price of non-asbestos containing products will vary between being 25% and 50% more expensive, depending upon the application. Table 44 reflects an estimate of the price premium that end users can expect to pay for non-asbestos friction materials.

TABLE 44: END-USER PRICE COMPARISONS

APPLICATION ENVIRONMENT	ASBESTOS-CONTAINING FRICTION MATERIAL	NON-ASBESTOS-CONTAINING FRICTION MATERIAL
Passenger and Light Commercial Vehicle Brakes and clutches	Disc Brake Pads: R160 to R260 per set Brake Shoe Linings: R260 per set Clutch Kit: R600 to R700	25% premium
Heavy Duty Truck and Trailer Brakes and Clutches	Brake Linings: R20 – R65 per unit Clutch Kit: R4,250 – R27,000	25% - 50% premium
Rail Brake Blocks	R60 per unit	25% premium
Earth Moving Equipment	Various	50% premium
Industrial and Mining Operations	Various	25% to 50% premium

9.4.3 Exports

A number of local manufacturers of friction materials are exporting a percentage of their production to foreign markets. These exports include both asbestos-containing and non-asbestos friction materials.

There is a perception that, with the introduction of the SABS ECE R90 specification, there will be "enormous potential" for exports of asbestos-free disc brake pads (and, possibly, heavy-duty brake linings) to foreign markets – South Africa will have a significant cost advantage as a result of the local availability of certain raw materials and exchange rate benefits.

9.4.4 Investment

In view of the fact that converting from asbestos-containing friction material formulations to non-asbestos formulations will not require any significant changes to basic business processes, most companies do not envisage any need for extensive, expensive investment or dis-investment of capital equipment. Some businesses may use the phasing out of asbestos as an opportunity to upgrade and replace old equipment. However, this will not be a significant issue, and will be a discretionary rather than a consequential decision.

9.4.5 Employment

None of the businesses involved in the manufacturing, importing, distribution and fitting of friction materials anticipate any change to their employment practises as a result of a phasing out of asbestos from this sector. Only one manufacturer of disc brake pads has had to retrench 15 employees (out of a total of 65 employees) as a result of converting from asbestos-containing to non-asbestos formulations – this business lost low-priced business to another local manufacturer of asbestos-containing brake pads.

However, looking to the future, businesses in this sector do not foresee the need to re-trench any existing employees, nor do they anticipate any need to employ new people as a direct result of a phasing out. In addition, converting from asbestos-containing friction material formulations to non-asbestos formulations will not require any significant changes to basic business processes. As such, there will be no need for significant retraining of existing employees.

Union representatives are concerned that management may use a phasing out of asbestos as an excuse for retrenching "illiterate workers" and replacing them with "Technikon trained students" – a universal trend that they have encountered in many manufacturing businesses across a broad variety of industries.

9.5 OCCUPATIONAL HEALTH AND SAFETY

All of the businesses interviewed and surveyed claim to be observing and implementing the requirements of the latest Occupational Health and Safety Act. In addition, regular medical checks are performed on staffs that are potentially exposed to asbestos. None of these businesses are aware of any staff members that have contracted an asbestos-related disease.

9.6 REHABILITATION OF FACILITIES

All of the businesses currently handling asbestos-containing products will have to "sell off" existing stocks of raw materials and finished products, and to rehabilitate their facilities to ensure that no traces of asbestos fibres remain.

Negotiations between the SABS and the "Friction Material Fraternity" indicate that businesses anticipate that existing stocks of raw asbestos fibres will have been used up in manufacturing processes by the end of 2003, and that 99% of finished products will have been sold through the distribution system within a further 12 months (i.e. by the end of 2004). Beyond this, it will require another 24 to 36 months for asbestos-containing products sold during the next 15 months (i.e. October 2004 to December 2005) to be "consumed" by end users – vehicle owners, industrial concerns, etc.

Most businesses, with the exception of the primary manufacturers of asbestos-containing friction materials, do not anticipate the need for extensive and expensive rehabilitation of their facilities. However, the primary manufacturers will need to undertake a comprehensive cleaning process in order to ensure that their premises are asbestos free. Union representatives require that businesses be given sufficient time to phase out the use of asbestos so that this exercise cannot be used as an opportunity to "rationalise" and/or retrench staff.

9.7 BUSINESS VIABILITY

Most people consider that the phasing out of asbestos-containing friction materials is necessary from an occupational health and environmental impact perspective. In addition, they perceive that this development will improve the overall viability of their businesses in that costs are likely to be reduced (i.e. working capital invested in duplicate raw material stocks and finished products, reduced Occupational Health and Safety requirements, less expensive waste material disposal, etc.) and efficiencies are improved as a result of fewer product changes in manufacturing processes.

Despite the fact that non-asbestos friction materials are more expensive, end-users (i.e. vehicle owners, industrial customers, etc.) do not perceive this as a significant issue. It is anticipated that the owners of private passenger vehicles will not be significantly adversely affected by the fact that they will be paying approximately 25% more for non-

asbestos disc brake pads, brake shoes and clutches.

In the case of the owners of light commercial and heavy-duty vehicles, and industrial businesses, friction materials represent a very small percentage of overall maintenance costs (i.e. less than 1% in most instances). Therefore, it is most likely that these businesses will absorb the additional costs associated with non-asbestos friction materials and will not attempt to pass this increase on to their customers in the form of higher transport charges and/or product price increases.

9.8 TRANSITIONAL MEASURES

There is some concern that an attempt may be made to illegally import asbestos-containing friction material products in order to exploit the significant price differential that will exist between certain asbestos-containing and non-asbestos friction materials.

This is most likely to occur in the heavy-duty brake lining and clutch plate market as a result of:

- The significant 30% to 50% price differential
- The "extreme" price sensitivity that exists amongst heavy-duty vehicle owners
- The relatively small number and easy accessibility of Brake Bonders and Clutch Manufacturers (i.e. 350 to 500 businesses)

Legitimate businesses in this sector are concerned that Customs do not have the capacity or the competence to police this possibility effectively.