EXECUTIVE SUMMARY

0.1 HISTORICAL DEVELOPMENT OF SHOCK ABSORBERS

The first primitive shock absorber was used as early as 1900 in the larger and faster racing cars. Even though, several designs were available, its use was very limited as most of early automobile designers categorised shock absorbers as unnecessary. 1920's saw gradual adoption of shock absorbers. Although early dampers were mostly friction devices, it was soon realised, that they were not suitable primarily due to their high initial stiction and damping force being independent of velocity. In comparison, the damping force in viscose damping is independent of velocity, and it also has a minimal stiction.

0.2 ADOPTION OF HYDRAULIC TELESCOPIC DAMPERS

In the post- world war II years, the trend to coil springs and softer rides favoured shock absorbers of telescopic form. This form of dampers are now used in a wide range of damping applications; everything from automobiles to tanks, locomotives and even bridges. Most commonly used configuration is still non-pressurised twin tube hydraulic type. However, recently pressurised type is making rapid inroads specially in the passenger car market.

0.3 NON-PRESSURISED TWIN TUBE TELESCOPIC HYDRAULIC DAMPERS

A twin tube telescopic non-pressurised hydraulic damper consists of a cylinder with a piston moving inside it. The piston has various designed orifices to allow fluid to flow between the compression and rebound chambers. To store the displaced oil by the piston rod movement, a storage tube is provided. The mechanical energy absorbed by the damper is converted into heat. Heat so produced is dissipated to the atmosphere through the storage tube. A bottom valve which fits into the bottom end of the cylinder is provided to allow the oil to flow back to the cylinder tube from storage tube during rebound.

To avoid mechanical damage to the piston rod due to stones and dust that are thrown up during the travel of the vehicle at a high velocity, a protection tube is provided on the shock absorbers.

A number of types of non-pressurised twin tube hydraulic shock absorbers with minor refinements are available. Basic refinements offered can be classified into :

- Adjustable damping co-efficient, and

- Variable damping co-efficient type.

0.4 GAS CHARGED SHOCK ABSORBERS

Gas charged shock absorbers are essentially hydraulic dampers with the addition of gas under pressure to improve the working efficiency. They are sometime also called 'gas shock absorber'. Only gas cannot be used as damping medium. Oil is a must. Pressurising the shock absorber oil allows elimination of cavitation (foaming of oil) a problem inherent in hydraulic dampers. Elimination of cavitation allows better control at all piston speeds and movements. This leads to better vehicle control, improved ride quality and quicker operation. Gas charged dampers are two types, namely: Mono-Tube, and Double Tube types.

i. Mono-tube Shock Absorbers :

The original gas pressurised shock absorbers were of the single or mono-tube construction. In the mono-tube shock absorber, the usual arrangement is to close the bottom end of the working space by a floating piston held in contact with the fluid by gas (usually nitrogen) under pressure below. The movement of the floating piston is confined to that necessary to absorb the rod volume. All of the valving function is handled by only the working piston as mono-tube unit has no bottom valve, so it must run at very high gas pressure in order to maintain proper control during the operation.

ii. Twin Tube Pressurised Shock Absorbers :

A much later development, its construction is similar to twin tube non-pressurized shock absorber. It uses lower gas pressure than a mono-tube unit. This is possible, because control of the oil flow is provided by the bottom valve. Low pressure of the twin tube unit also allows the use of a larger diameter piston rod. In twin tube nitrogen gas is sealed in the reservoir can be maintained at 0.5 to 1.5 MPa, compared to 2.0 to 3.00 MPa in a mono-tube type. Length required in pressurised twin tube is smaller than mono-tube type. This ensures the best fitment and performance characteristics. These can be fitted without any problem in the same manner as fitting of conventional non-pressurised hydraulic shock absorber.

0.5 SPRING ASSISTED DAMPERS

Primary purpose of a damper to its dampen the oscillations. They cannot carry any load. Dampers with spring across it are available for the front and rear suspensions to carry load. They resemble a conventional shock absorber with a coil spring fitted on to it.

Spring assisted dampers are normally of two basic types, namely MacPherson strut and spring damper. MacPherson is used normally on a 4-wheel passenger car and spring dampers on two- wheelers.

0.6 STRUCTURE OF INDUSTRY, OWNERSHIP PATTERN & INSTALLED CAPACITY

The shock absorbers industry in India is about 35 years old, with Hydraulic Ltd., Madras, being the earliest entrant. Shortly thereafter, Escorts, Faridabad and Gabrial, Bombay entered the field. It was only recently that seven others joined the fray. The names of the companies presently operating are shown on the next page :

Name of Units	Installed Capacity (Lakh Nos./Annum)
A. Organised Sector	
1. D.H. Woodhead Ltd., Gurgaon	12.50
2. Escorts Ltd., Faridabad	28.97
3. Gabrial India Ltd., Bombay; Masik; Parwanoo & Gurgaon	39.00
4. Hydraulic Ltd., Madras	10.50
5. Munjal Showa Ltd., Gurgaon	13.00
6. Rank Suspension Pvt. Ltd., Faridabad	6.00
7. Renowned Auto Products & Sachs Ltd., Hosur	10.00
8. Sirmour Sudburg Ltd., Parwanoo	12.00
9. Stallion Shocks Ltd., Ghaziabad	15.00
10. Super Shock Absorbers Ltd., Madak	10.00
Total	**153.07**
B. Unorganised Sector	
1. Duro Shox Ltd.	4.80
2. Shox India Ltd.	3.00
3. Himtough Shock Absorbers Ltd.	1.50
Total	**9.30**

0.7 GEOGRAPHICAL DISTRIBUTION OF SHOCK ABSORBER MANUFACTURERS

The largest capacity of shock absorbers is installed in the state of Haryana (41.32%) followed by Maharashtra (15.19%), Tamil Nadu (12.55%), Himachal Pradesh (10.41%), Uttar Pradesh (10.12%), Andhra Pradesh (6.12%), Madhya Pradesh (2.45%) and Punjab (1.84%).

0.8 RAW MATERIALS, SEMI-FINISHED COMPONENTS USED & THEIR SOURCES OF SUPPLY

Raw-materials, semi-finished components used and their sources of supply is outlined below :

Material/Component	Used for	Sources of Supply
A. Raw-materials		
- CRW Tube	Cylinder, Casing Tube & Protection Covers	Tube Products of India, Madras, TISCO, Jamshedpur Steel Tubes of India, Dewas
- EMB Bright Bar	Piston Rod	Mukand Steels, Super Bright Steels, Bangalore
- Sheet Metal	Cage, Washers, Flappers.	
B. Semi-finished Components		
- Piston Guide (Sintered)		Mahindra Sintered Products, Pune Aerotrex, Nasik
- Piston Guide (Sintered)		Aerotrex, Nasik
- Bottom Valve Body		Aerotrex, Nasik

(Contd.)

Material/Component	Used for	Sources of Supply
C. Finished Components		
- Oil Seals		Fenner, Madurai Swastic Rubber, Bombay
- Rubber Bushes		Sundaram Inds., Madurai Meenakshi Moulding, Madurai
- Nut/Bolts		Many in small scale.
- Springs		Stumpp, Scheule & Somappa, Bangalore
- Washers		Sharadha Confab Ltd., Faridabad
- Piston Ring		In small scale

0.9 MAJOR IMPORTS OF RAW-MATERIALS TO SUSTAIN INDIGENOUS PRODUCTION

Most of the organised sector units used imported materials valued at 4 per cent of the total cost of raw-materials and components. The units in the small scale sector mostly do not use any imported materials directly.

0.10. MANUFACTURING PROCESSES & MACHINES GENERALLY USED

Starting material and manufacturing process normally used for production of non-pressurised twin tube hydraulic shock absorber which are only produced in the country is given on the next page :

Component	Starting Material	Process Performed to get the Finished Component	Machines Used
1. Casing Tube	ERW Tube	Parting, chamfering, engraving pressing of cap in casing tube, seam welding of cap with the tube, projection welding of eye with the cap.	Turn-o-mat, engraing machine, welding machine,
2. Storage Tube	ERW Tube	Parting, chemfering, engraving pressing of cap in casing tube, seam welding of cap with the tube, projection welding of eye with the cap.	Turn-o-mat, engraing machine, welding machine.
3. Working Cylinder	CRW Tube	Parting, chamfering, calibration, drilling and deburring.	Turn-o-mat, hydraulic press, drilling machines.
4. Piston Rod	ENB Bright bar of dia 10 mm to 20 mm	Turning, parting, drilling and deburring, induction hardening, grinding, thread rolling hard chromeplating	Travb, drilling grinding machine thread rolling m and chromeplating m/c.
5. Piston	Semi-finished Piston	Lapping and machining to improve geometical accuracy.	Lapping machine
6. Valves	Disk Valve	Spring steel.	Punching, Anneali & Shaping.

0.11 ENERGY CONSUMPTION PER UNIT PRODUCTION

All the production units use diesel oil and electricity. Diesel is used mainly for operation of standby generator. Power consumption varies between 1 to 2 Kwh per unit production. Units using work hardening process consume around 1 Kwh and those using induction hardening process use around 2 Kwh per unit production.

0.12 POLLUTION CONTROL MEASURES USED

Hard chromeplating process is the major cause of liquid effluent. In most of the units, liquid effluents generated is neutralised before discharging into captive soaking pits.

0.13 PERFORMANCE OF INDIGENOUS SHOCK ABSORBERS

Expected life of a shock absorber is generally specified in number of cycles of operation. The main input for shock absorber to operate is road roughness. Estimation of average cycles faced by different types of road surface prevailing in India is presented below :

Surface Type	Roughness (mm/km)	Size of Bump (mm)	Cycles[1] (per km)
Asphaltic concrete	3,000	5	600
Premix concrete	5,000	5-10	620
Surface dressing	6,000	10-15	600
Good-water bond Mecadam	8,000	15	600
Poor-water bond Mecadam	12,000	15-20	800-600
Gravel & earth	15,000	20-25	750-600

Note : Number of cycles indicated above is true for a vehicle having a wheel diameter of 700 mm. Cycles faced by vehicles fitted with a larger diameter will be less and vehicle with smaller wheel diameter will be more. No precise data on exact quantum of reduction or increase of number of cycles/km on actual road condition is available.

Average life of shock absorber actually obtained in India on different types of vehicles is presented below :

Type of Vehicle	Life of Shock Absorbers	
	Kilometers (Th.)	Cycle (Million)
- Passenger Cars	30.0 - 37.5	18.0 - 22.5
- Motorcycles	25.0 - 30.0	15.0 - 18.0
- Scooters	22.5 - 26.3	13.5 - 15.75
- Mopeds	20.0 - 22.5	12.0 - 13.5

Relevant Indian, Japanese and other standard stipulates that a shock absorber should not show any marked deterioration in damping co-efficient when subjected to one million cycles under accelerated test conditions. Life of any product under normal operating conditions, is generally taken as ten times that stipulated under accelerated test conditions. Thus, the average life actually obtained for indigenous shock absorber, under actual road running condition, more than satisfies the standard stipulations.

Most of the vehicles used on road are using hot retread tyres, in case the shock absorber were used under developed country environment i.e.

- less road roughness;
- newer tyres; and
- without over-loading.

Actual life of Indian made shock absorber in kilometer/ cycles, in developed country environment, is expected to be much higher.

0.14 COMMON CAUSES FOR FAILURE OF SHOCK ABSORBERS

Shock absorbers are situated near the wheels, thus considerable amount of dust are thrown up during the travel of the vehicle at a high velocity. Dust thus thrown up has a tendency of travelling through the passage between the protection cover and reservoir

tube and getting deposited on the piston rod, which has always a fine layer of oil. During the up and down movement of the piston rod dust on it, damages the oil seal, which in turn causes leakage of oil, leading to failure of shock absorbers. Ingress of dust in the oil seal and natural hardening of rubber can be attributed to be the main cause of failure of shock absorbers.

0.15 AVERAGE REJECTION RATES

Average rejection rate experienced by the industry at the quality control stage is between 0.2 to 1.5 per cent of the production.

016 STATUS OF INDIGENOUS TECHNOLOGY

All shock absorbers produced in the country are based on imported designs of respective foreign collaborators. Imported designs are being continuously updated by individual manufacturers. Although each company makes the shock absorbers as per the designs of their respective collaborator, the basic design concept of all the manufacturers are the same. Common features of indigenously produced shock absorbers are:

- All produce only non-pressurised twin tube hydraulic typs shock absorbers.
- All of them use disc valves.
- All of them use same shock absorber oil produced in the country.

Performance and longivity of above type of shock absorbers produced in the country, compare very well with similar ones produced in advanced countries.

0.17 STATUS OF COLLABORATION, AND TECHNOLOGY ABSORPTION

Shock absorber is a mechanical assembly item made by using bought out and in-house produced components. The technology of shock absorber consists of following elements :

Design of shock absorbers;

- Detailed drawings and material specification of each component;
- Production technology and quality control methods; and
- assembly and testing of final product.

In nearly all cases, two or three persons were sent out for training in collaborators works for training and absorption of technology. In most cases, the plant were designed by collaborators, they also helped in selection of plant equipment, tools and dies required for production. One or two experts from collaborators works comeover to India to commission the plant and initiate the production in active cooperation with technical staff of the unit. Normally time taken to absorb 90-95 per cent was found to be limited to 9-12 months from the start of production. Absorption time for balance of technology was around 2 to 3 years. All the units felt the technology transfer was quite smooth and could not recall any major hardle faced by them.

0.18 IMPORT OF TECHNOLOGY

The technology for conventional i.e. non-pressurised twin tube hydraulic shock absorbers is well established in the country and no further imports seem to be necessary. Presently, the demand of gas filled and variable damping co-efficient shock absorbers are very small. Technology for both type will have to be imported, when their production is initiated in the country.

0.19 INTERNATIONAL COMPETITIVENESS

India only produces non-pressurised twin tube hydraulic shock absorber. From the point of view of price, above type of indigenous shock absorbers are quite competitive. All the shock absorbers made in the country is based on imported design, the quality of this type of shock absorbers produced in the country, is at par with those produced in developed countries. However, due to limited installed capacity of Indian manufacturers, they are only able to cater for export for the replacement segment.

0.20 STATUS OF INDIGENOUS R & D

In developed countries, all newer designs of shock absorber and/or shock absorber, or of improved/modified specification

are introduced first in the replacement market and are subsequently adopted by OEMs, only if, found to have wider actual users acceptance. In India, due to limited demand from replacement sector, none of the indigenous manufacturers have found this approach attractive. Thus, neither indigenous manufacturers nor any R & D organisation have initiated basic R & D activities in the field of shock absorbers. Most R & D divisions of *shock absorber* units are primarily geared to adaptation of technology, quality control and vendor development. By and large captive R & D unit are not recognised by Department of Scientific and Industrial Research, Government of India.

R & D expenditure incurred by the larger units is around 0.5 per cent of turnover and that of smaller units varies from 0.1 to 0.2 per cent of turnover.

0.21 TRENDS IN USAGE OF DIFFERENT TYPES OF SUSPENSION SYSTEMS AND SHOCK ABSORBERS IN DEVELOPED COUNTRIES & THEIR RELEVANCE TO INDIAN SCENARIO

Analysis of international trade journels reveals :

- Interconnected suspension systems which does away with shock absorbers has made in road in a small way in passenger car market in developed countries.

- Active suspension systems have not yet made any in roads anywhere in the world.

- More than 98 per cent of shock absorbers used are of telescopic type.

- Market share of non-pressurised twin tube hydraulic shock absorbers during 1989-90 was around 80 per cent in the developed countries, and around 100 per cent in other countries.

- Usage of non-pressurised gas shock absorbers during 1989-90 in passenger cars was around 20 per cent in developed

countries in monetary terms. This is expected to increase to 40 per cent by 1994-95.

- Pressurised shock absorbers have not yet made any inroads in two-wheeler and heavy commercial vehicle markets.

- The variable damping damper has not yet been accepted. However, most of the manufacturers are confident that it will ultimately capture the total market of two-wheelers, cheaper cars and heavy commercial vehicles.

As on date, suspension systems of all vehicles produced in the country except Gypsy (produced by Maruti Udyog Ltd.) are designed to accept on only non-pressurised hydraulic twin tube shock absorbers. Both the Zen and Gypsy use twin-tube pressurised (gas) shock absorbers. Apart from Maruti, detailed discussions held with vehicle manufacturers indicated that none of them earlier plans to change their suspension systems or introduce pressurised shock absorbers. Maruti has already introduced gas filled shock absorbers for Gypsy and Zen. The other OEMs felt, gas shock absorbers should be tried out first in the replacement market, only if they are found successful, OEMs may consider offering these as an alternative to discriminating customers at extra costs. Shock absorber manufacturers on the other hand, feel it will not be economically viable for them to launch newer or improved shock absorbers in the local replacement market due to its limited size and poor paying capacity. Thus, it is felt, there is little scope for introduction of latest type of shock absorbers in the country by the indigenous manufacturers.

0.22 FUTURE TRENDS IN SHOCK ABSORBER TECHNOLOGY IN DEVELOPED COUNTRIES

To analyse the future trends in shock absorber technology a search of world patent literature for the period 1981 to 1990 was carried out. The search revealed that hundreds of patents, have been granted on the subject during the above period. Analysis of

a representative sample of patents granted during 1987-91 revealed that, the main thrust of development during the period, in the field of twin tube hydraulic shock absorbers, both of pressurised and non-pressurised types were mainly in the areas of :

- Design and production of pre-loaded valves to obtain linear variation of damping force with velocity.
- Electrically adjustable shock absorbers, and
- Self-adjusting variable damping co-efficient shock absorbers.

Regarding components used in shock absorbers, the main thrust has been on development of better qualtiy of (i) Oil seals, (ii) Valves, (iii) Piston and piston rod assembly, and (iv) Rubber mountings.

0.23 SOURCES OF INDIGENOUS DEMAND FOR SHOCK ABSORBERS

Demand for shock absorbers in India, at present, is primarily limited to automobile sector only. Their demand arises from two segments namely, Original Equipment Manufacturers (OEMs) of vehicles, and Replacement market. Demand from OEM's depends on the past/current/envisaged production of vehicles. Demand arising from the replacement market, on the other hand, depends on users perception of the need, actual life obtained and other parameters. Front fork for motorcycles and shock absorbers used in rail road are repairable type. Replacement demand has been projected based on the following sectors :

- In most of the HCVs and LCVs used on Indian roads, additional leaf springs are added to guard against poor road surface and extra loads they have to carry. Addition of extra leaf springs significantly changes the damping characteristics required under different loading conditions. The normal shock absorbers mounted on the vehicles thus became ineffective and hence mostly removed by actual users. Thus, there is very little demand of shock absorbers for HCV and LCVs.

- Assumed life of shock absorbers is 3.5 years for cars, jeeps, 3-wheelers, motorcycles, and 4 years for scooters and mopeds.

- Most of actual users of newer passenger cars upto 7 years from the year of registration, generally prefer to use a new shock absorber for replacement.

- 10 per cent of owners of older (more than 7 years) passenger cars who are either affluent and/or knowledgeable prefer to use a new shock absorber for replacement.

- 90 per cent of owners of older (more than 7 years) passenger cars will prefer to use a reconditioned shock absorber due to constraints of disposable income and/or are not sufficiently enlightened regarding advantages of use of a new shock absorber.

- Only 37 per cent of owners of newer motorcycles upto 7 years prefer to use new shock absorbers for replacement.

- Only 40 per cent of owners of newer scooters upto 3 years prefer to use new shock absorbers for replacement.

- Only 18 per cent of owners of mopeds upto 8 years prefer to use new shock absorbers for replacement.

0.24 PRODUCTION AND DEMAND OF SHOCK ABSORBERS

Production of shock absorber from 1990-91 to 1993-94 is presented below alongwith demand for and 1994-95, 1995-96 and 1996-97.

PRODUCTION OF SHOCK ABSORBERS

Year	Production Quantity in Nos	Value in Rs. Lakhs
1990-91	6,213,084	7453.80
1991-92	5,488,974	10134.20
1992-93	6,095,237	1,393,5.34
1993-94	6,399,900	1,531,3.52

Source : ACMA Facts & Figures 1993-94

DEMAND OF SHOCK ABSORBERS.

Year	Total Demand in Nos
1994-95	12,281,000
1995-96	14,153,000
1996-97	15,341,000

Source : ACMA Facts Figures 1993-94

0.25 INDIGENOUS DEMAND OF RECONDITIONED SHOCK ABSORBERS

Difference between the prices of new shock absorbers as supplied to OEMs & replacement market alongwith the price (1991-92), a reconditioned shock absorber is given below :

Types	OEM Price (Rs.)	Replacement Market Retail Price (Rs.)	Repaired Shock Absorber (Rs.)
Rear shock absorber for Ambassador car	80-85	175	75
Front shock absorber for Bajaj Scooter	40-45	75	35

Source : Survey

Disposable income of most of the vehicle owners in the country is low. Thus most of them prefer to go for reconditioned shock absorbers (which are much cheaper) for replacement. Consolidated yearly demand from 1994-95 to 1996-97 for shock absorber is given on the next page :

DEMAND OF SHOCK ABSORBERS

(in lakh nos)

Year	Car & Jeeps	Shock Absorbers		Total
		Commercial Vehicles	2/3 Wheelers	
1994-95	32.70	6.86	83.25	122.81
1995-96	36.84	7.63	97.06	141.53
1996-97	42.13	8.95	102.33	153.41

Source : ACMA Facts & Figures 1993-94

0.26 IMPACT OF USAGE OF RECONDITIONED SHOCK ABSORBER ON THE SHOCK ABSORBER MANUFACTURING INDUSTRY

In India, shock absorber reconditioning is carried out in a very organised manner and on a very large scale. During 1990-91, around 78 lakh numbers of shock absorbers were reconditioned and made available for usage against 86 lakh numbers new shock absorbers produced. Although, most of the shock absorber manufacturers feel reconditioned shock absorbers are not effective. However, not much has been published to educate the public against its usage or highlighting low economics of usage of reconditioned shock absorbers has been or circulated by most of the manufacturers in the country.

0.27 EXPORT/IMPORTS OF SHOCK ABSORBERS

Export of shock absorbers started in 1985-86 with a modest number of around 7,000 nos. The growth rate of export has increased substantially thereafter, with a total export of 3.12 lakh nos. shock absorbers in 1989-90. The value of exports was Rs. 388.90 lakhs in 1992-93. By 1994-95, total exports are expected to be around 20 percent of the installed capacity, i.e. around 35 lakh numbers.

The imports of shock absorbers has increased from Rs. 23.96 lakh in 1987-88 to Rs. 105.76 lakh in 1992-93. The imports have been mainly of shock absorbers to meet the requirement of export of Maruti.

0.28 DEMAND AVAILABILITY BALANCE OF SHOCK ABSORBERS

In the past, although OEM demand was more or less completely met by indigenous manufacturers, the replacement demand was mostly met by reconditioned shock absorbers from the unorganised sector and indigenous shock absorber manufacturers. This scene is likely to continue in the future also.

0.29 RECOMMENDATIONS

0.29.1 An association of shock absorber manufacturers need to be formed. Formation of such an association will help in organising R&D activity, in addition, extend help to the industry in mounting major export promotion drive besides other matters for development of this sector of industry.

0.29.2 There is an urgent need for optimisation and standardisation of the components and raw materials taking into all aspects of installed plant and equipment at each of the unit. This will not only reduce the cost of production, but also help in identification of items which can be farmed out to improve quality and reduce incidental cost. However, this activity needs to be carried out in a phased manner with active cooperation of all units.

0.29.3 At present, little is being done to improve the customer awareness. Also there is a need for development on instrument for testing of shock absorber in situ. Detailed discussions held with different institutions and instrument manufacturers showed, that development of such instrument is very feasible. Action should be initiated to develop such an instrument. Also to improve customer awareness mass education media can be used by the shock absorber manufacturers, research institutions and others concerned.

0.29.4 Major cause of poor financial health of the industry can be ascribed due to poor utilisation of installed capacity. All manufacturers must initiate action to increase exports and convert the latent replacement demand of shock absorber into procurement.

0.29.5 Consistent quality of most of the shock absorbers produced is good. However, consistency of quality can be broadly said to be around 85 per cent. To improve the image and export, the consistancy of quality should be around 90 to 95 per cent. This calls for a detailed analysis of quality control measures at present being used alongwith the need for introduction of 'Quality Circle' concept in each production unit, as a tool for consistency in quality.

0.29.6 It is reported that there is little interaction amongst manufacturers, and between sub-suppliers and manufacturers. One of the methods of improving interaction between technical and commercial personnel of the manufacturers and sub-suppliers is to arrange an yearly congress, to which foreign experts and probable importers could also be invited.

0.29.7 There is need for a more comprehensive Indian standards on shock absorbers.

0.29.8 At present, services of ARAI is only used for testing the product to obtain approval of OEMs, thus the interaction is minimal. It is felt that ARAI may regularly test the shock absorber by procuring shock absorbers produced by different manufacturers from spare parts dealers and publish their findings in their journals. This will not only allow concerned persons to get an idea of the quality of shock absorbers being manufactured by different units, but also help the units themselves to keep a stricker control on their products.