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PLANNING FOR CHANGE

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ABSTRACT: *The motor vehicle is an integral aid in the life of most Australians and its role in the conduct of our daily lives is largely unrecognised until we have to do without it. Expediency and urbanisation will make the motor car even more essential in the future.*

The motive for buying a motor car, freedom in transportation, never changes but the car does because the limitations on our freedom are ever being pushed further away.

This paper examines the procedures followed by a manufacturer and some of the problems he faces in attempting to plan vehicles that will be compatible with the economic and social environment and physical needs and expectations of the community they will have to serve.

1. THE MOTOR CAR IN TODAY'S SOCIETY

Of all the products of modern technology the motor vehicle has had the greatest economic and social impact on man's life style. The mobility and variety of uses to which the motor car in its various derivative forms can be put have lead to it playing an indispensable role in the functioning of economically developed societies.

Underdeveloped countries are also discovering the benefits of motor vehicles in raising living standards. Car populations in the Philippines, Thailand and Korea are steadily increasing but, through economic necessity, they are heavily biased to revenue producing goods transport and mass transit with personal transport a secondary consideration. All of these functions are performed in many instances by the same vehicle.

In Western society individuals have acquired unrivalled mobility in their business and social activities to satisfy their demands for urgency, freedom of choice and relaxation. The motor vehicle has also become a visual extension of man's personality and aspirations and, in some quarters, a symbol of his station in society.

Rising standards of living and the potential for decentralisation and escape are only possible because of the mobility offered by the motor car

The present world car population is about 300 million and 35-40 million new cars are sold annually, demonstrating the essential role we see for motor cars in our daily lives.

A car is normally the highest investment made by an individual, next to a home, and on the evidence of continually increasing car ownership this investment is vindicated by the resultant increase in freedom and pleasure. In recent, more affluent times the car has had to compete for the disposable dollar with other pleasure giving items such as caravans, boats, holiday houses, recreational vehicles etc. Redirection of this disposable income away from cars has not had a marked effect on total car sales for reason that any of the competing pursuits can only be enjoyed in combination with a motor car. It may however, along with inflation, have encouraged a trend to lower cost vehicles and to a longer period of ownership.

In this modern world we all have time demands both in business and in leisure. Transit time is expendable and it is this time that the population at large has elected to forego. In fact today the second family car cannot be

regarded entirely as a luxury. Children are driven to school, picked up and ferried to sporting events, music lessons, birthday parties and the like; mothers attend meetings, take on part time jobs, shop over a wider area, go bargain hunting, take up hobbies etc. To satisfy this desire for a full life a car is an essential ingredient.

The motor car is now inextricably woven into the fabric of our lifestyle and can no longer be regarded as a luxury. Who of you here today cannot visualise the constraints that would be imposed on him if he did not own or have access to a motor car?

The task of the manufacturers is to design to satisfy the wide variety of business and social uses to which cars are put, for a price and cost of ownership which will bring cars within the financial reach of the population at large.

At the same time the design, styling and package must be contemporary and appealing to the senses of sight, hearing and touch.

In consideration of the wide spectrum of consumer demand for cars for business, for a vast range of leisure activities, for all age groups, how then does a manufacturer develop the parameters for future product.

2. PLANNING FOR THE FUTURE

2.1 OVERALL CONSIDERATIONS

In planning future product the manufacturer is faced with a paradox. The design concept must provide a small external package for city use yet a spacious interior and adequate luggage space for recreational use; city manoeuvrability is a primary consideration yet on-highway handling under all road and weather conditions must be safe and not unduly demanding; the engine must return good fuel economy yet offer adequate performance, shortest passing time and towing ability. The body and interior must be aesthetically pleasing to most people but practical, the location of controls and seating package must be dimensionally suited to the whole driver population; the vehicle must remain operational and be comfortable and safe for occupants over a wide range of temperatures and climatic conditions. The manufacturer must also consider how best to serve specialised low volume markets. Our affluent society has tilted disposable income towards the younger generation. Hence we have witnessed a 'rapid' growth in the recreational vehicle market which takes in

'surfie' vans, camper vans, four wheel drive and personalised vehicles. One of our popular models today is the one ton F100 truck which can often be seen complete with curtains, body striping, vertical twin chrome silencers, extra lights etc. There are of course, and always will be, pockets of the market which high volume manufacturers cannot supply, in part because volume sometimes lessens the appeal. Hence we have Lamborghini's, Ferrari's etc. No single vehicle can be all things to all people. The ultimate design must always be a compromise. We endeavour to overcome this problem in Australia by different series of car models to which most options can be fitted to further tailor a car to an individual's personal requirement.

2.2 CHANGE TIMING

Regardless of the specific causal factors giving rise to a desire for change, there are important differences between executing a change in the automotive industry and most other consumer orientated industries.

Firstly the long time span from concept to fruition and the length of the product life. Major new product concepts are developed up to 4 years before they appear on the road and are expected to survive competitively in a consumer orientated market for possibly a further 5 to 6 years. Car companies are in effect trying to gauge consumer needs and wants for up to 10 years hence when evaluating new product. Figure 1 shows a typical timing plan for an all new model program and indicates timing objectives for some of the activities to be covered.

A second factor placing car companies in a unique situation is the complexity and cost of a new model program. These costs today are of the order of \$50 to \$150 million depending on the extent to which new plant, machines, and equipment, in addition to new tooling is necessary. Needs in this area are established very early in the new model program and once established are generally not readily open to change. Thus, product is being conceived far in advance of the market and once conceived brings into play a relatively inflexible support system, not very tolerant to change in direction. Initially approved concepts must then be well founded. Failure to read the market correctly can be costly and even lead to financial ruin. Changes must be finely gauged and in today's uncertain economic climate be more by evolution than revolution.

It is also a fact that the industry must operate within the bounds of Federal and State policies and regulations and any unanticipated abrupt changes in their intent can overnight destroy the most well considered plan,

particularly if timing provisions preclude the possibility of recovering a lost situation.

Why then do we change at all in the face of the high risks involved and how do we predict the market reaction to changes made?

2.3 NEED FOR CHANGE

Change has always been a characteristic of the motor vehicle industry. The original Henry Ford philosophy was to give the public a reliable and serviceable car at a price the mass of them could afford. Despite popular belief, Henry did in fact update the Model T quite frequently to take advantage of new technology and satisfy customer requirements.

The same situation prevails today - except the pressures for change are much greater. Changes may be mandatory to meet the State's laws on equipment and performance levels. Often they are discretionary but in essence mandatory for competitive reasons, for instance fuel economy improvements by aerodynamic redesign to reduce drag coefficients or by adopting alternate materials to reduce weight. New features or designs to improve the functional characteristics of the car and add to occupant comfort, although discretionary, are necessary to satisfy the expectations of our customers.

The advent of plastic materials has brought with it a new technology which finds ready application to the motor car, but at the same time forces new design concepts and new manufacturing processes. Developments in the field of electronics have revolutionised packaging in instrument panels and the vehicle electrical systems generally - electronic ignition, electronic gauges etc. Manufacturers take maximum advantage of these developments to redesign package efficient interiors and improve reliability.

No changes today are made for the sake of change. Changes are directed to savings in cost and weight, ease of after sales service, improved quality, improved packaging or other such desirable characteristics to reduce ownership costs and improve comfort and safety.

This perhaps contrasts with the practice of the industry in earlier years when the motor car was viewed more as a status symbol and changes had to be more frequent and more cosmetic in character. The car was an article of fashion much the same as clothing, refrigerators or whatever. This is still true today but not to the same degree. We have entered an era in which customers are becoming more appreciative of the value and quality of goods and changes in vehicle appearance need to be less frequent and attuned to society's current values.

2.4 EVALUATING THE CHANGES CONTEMPLATED

To help us define and project the market environment, we rely on historical trends in vehicle size and market shares and analysis of the sales performance of ourselves and our major competitors, coupled with market research covering the consumer body.

Market Segments

Projected sales by vehicle sizes are based on historical sales patterns such as that depicted on figure 2 modified to reflect likely changes in the economic climate generally, disposable income, scrappage rates, ownership costs, population growth and age distribution, ownership rates, second car and many other factors. Trends are not necessarily straight line as evident from figure 2. Similarly projections may not simply be a proration of recent past trends.

Projections of these base market segments are then further broken down to reflect likely trends in body styles, powertrain components, features, options etc. To assist in this exercise market surveys are conducted.

Market Research

Each year a major survey of car buyers is carried out. A major portion of all of one months new car buyers are asked amongst other questions why they bought the car they did; their age; how much they earn; what car they traded; their satisfaction with the car? From these surveys, not only can the present buyer profile be determined but the nature and extent of changes in buying behaviour are made evident. Are customers trading up or down, in what age group are the buying pressures changing and in which direction, who participates in the buying decision (the reasons for buying and the uses to which the vehicles will be put?). Tables 1 to 7 are representative extracts from such a buyer survey and are included to indicate the detailed nature of the information compiled from customers.

This material assists us in determining where and how we should change our cars to appeal to the various market demands. We can tell you for instance that the average buyer of a specific car earns say \$12,000 a year, has 2.1 children, is 0.85 married, has 6 months of tertiary education and is 90% male. However like most averages in relating to people, no one person probably ever conforms exactly to the average.

As well as this major National New Car Buyers Survey, smaller surveys are conducted on our own products and at the time of introduction of major new models by our competitors. From this background of market research the parameters for new vehicle concepts are established.

3. VEHICLE DEVELOPMENT

For the body, dimensional limits which we call 'hard points' are determined. These are points which are fixed after analysis of passenger compartment requirements such as leg room, head room, hip width, ingress and egress, and luggage capacity, and consideration of packaging requirements of the engine and drive train components determined to be necessary. Figures 3A to 3D are representative of some of the areas of the vehicle for which hard points are established.

Legal and safety requirements are also recognized at this early stage. Within the dictates of these hardpoints, designers establish various possible styling layouts and renderings for appraisal. These are finally translated into full size clay models with fully detailed exterior. The vehicle interior package is developed simultaneously by means of separate bucks which are full size replicas of the intended styles.

Throughout this process the various engineering and production departments are called in to confirm production and design feasibility. The vehicle design is also being costed and alternative approaches evaluated.

After sign off, the clay model (there may be several) serves as the pattern for full size fibreglass models. These are again detailed to the point of being completely representative of the intended vehicle and submitted for appraisal by the final arbiters, the public.

These fibreglass models and a carefully selected range of competitive vehicles are exhibited to selected members of the public who are chosen from a body of potential buyers of the class of car under appraisal. These people are naturally screened to ensure employees of our competitors and members of the press have been excluded and that the respondents are as representative as possible.

To maintain anonymity, names, badges and identification are removed from the vehicles and the name of the convenor of the clinic withheld.

The various vehicles are rated for styling, package size, value for money etc, in absolute terms and compared to each other. We place great store in the results of these clinics and action is taken as necessary on the basis of the findings.

4 EXTERNAL CONSTRAINTS ON MANUFACTURERS

4.1 MARKET SIZE

The Australian market is small by other world markets - only 600,000 new vehicles are sold annually versus:

- (a) the U.S.A. - About 12 millions
- (b) Japan - About 4 millions
- (c) the U.K. - About 1.5 millions
- (d) Germany - About 2 millions
- (e) Italy - About 1.5 millions
- (f) France - About 2 millions

Unlike most other manufacturing countries we also have virtually no export market to support domestic sales. Yet the highly industrialised and sophisticated Australian market demands at least as diverse a range of product, componentry and equipment as other industrialised societies.

We have endeavoured to fulfil this fragmented low volume demand within the constraints of high local content, plans, investment limitations etc., by adopting common engines, power trains and body/chassis component in a limited number of base body shells to establish the necessary succession of models to meet the market wants. This has contrasted with past European and American practice where each model line was essentially an entity in itself with little commonality one with the other. Thus in the U.K. we had a Cortina with its unique U.K. components and in Germany a Taunus with its own separate set of unique components. Today the European scene is changing due to a need to more efficiently combine corporate resources and minimise investment from design through production to sales and service.

The Cortina and Taunus are now virtually identical in design with differences in only some minor appearance items. The full range of body styles, features and optional equipment previously offered still remained a viable proposition and was retained.

Thus not only was the European market at the outset larger than ours but further opportunity existed through the aegis of the Common Market for a total realignment and rationalisation of models to indirectly expand this market as inflation and cost pressures reduced profitability.

Similar opportunity is non-existent in Australia. Whereas in Europe the cost of meeting Government regulations and environmental controls is able to be amortised over a steadily increasing production volume we in Australia are locked into implementing these on substantially a constant market. We lack the same opportunities for cost reduction based on economy of scale.

Australian car manufacturers can only plan to compete in those segments of the Australian market where a viable volume is available, limited to two, perhaps three base car lines with restricted body styling offerings. In general we cannot afford to consider locally manufactured products for specialty markets (convertibles, four wheel drive vehicles etc.)

The volume constraints will be magnified when Toyota and Nissan commence local production and the available market has to be shared by 5 manufacturers.

4.2 LOCAL CONTENT

The concept of a local car manufacturing industry was initially promoted by the Chifley Government at the time World War II was drawing to a close. Car manufacturers responded to this and subsequent Government initiatives, and today have many millions of dollars invested in plants and machines to produce bodies, chassis and engines. They are supported by a vast network of parts manufacturers such that within the framework of Government Tariff Policies a technically advanced Australian car manufacturing industry has evolved.

Government protection policies have been restated over the years but presently require manufacturers to achieve an average of 85% based on value across all his car lines in order to obtain tariff concessions. The components which make up this local content are initially at the discretion of the manufacturer but, once becoming local, there have been constraints on later resourcing to import. These policies often limit the freedom a manufacturer can exercise in contemplating changes. Instead of being able to avail himself of technically more advanced overseas components with no investment he is constrained by content policy to invest to produce an equivalent, part locally.

For technical or financial reasons this may not always be a viable proposition. Also, for the local manufacture of many parts huge investment in plant and facilities has been made and these carry with them huge employment related decisions and problems and create further constraint. It will usually be more financially attractive in the short term to attempt to continue full utilization of this investment, restricting the extent to which change can be made.

4.3 LEGISLATION

Prior to registration, motor cars must comply with a vast body of State legal requirements. Many of these are Design Rules endorsed by the Australian Transport Advisory Council, subsequently incorporated into State Laws. 40 such rules to date have been endorsed. These all affect and constrain vehicle design in many areas and pose problems to the manufacturer but I will only touch on two of the most significant in terms of constraint, namely ADR 27A Vehicle Emission Control and ADR 28 Motor Vehicle Noise.

Vehicle Emission Control

Present legislation parallels the emission legislation effective in 1973 in the U.S.A. Control is exercised over emissions of carbon monoxide, hydrocarbons and nitrogen oxides from motor vehicle exhausts.

Manufacturers face a dilemma in endeavouring to reduce emissions while designing to maintain or improve fuel economy. The two actions are in direct conflict, redesign to reduce emissions lowers fuel economy, redesign to improve fuel economy increases emissions. Both objectives must be met to align with what appear to be the community wants. A solution to the problem is being pursued both here and overseas through engine development, weight reduction programs and more aerodynamic styling themes. Attacking the problem in these directions however generally lead us into ever increasing cost penalties and a decision as to when to cut off further development must be made.

The more we plan for a cleaner environment the greater disproportionately is the community cost. It is a matter of record now that manufacturers have certified their vehicles to the Rule but in prospect 2 years ago the engine development program on which we were about to embark was enormous. Millions of dollars had to be invested in computerised laboratory facilities, new techniques and the training of people. A tight timing schedule had to be met despite the possibility of failure and directional changes throughout the program. The equipment finally fitted

to limit engine emissions proved relatively expensive resulting in high costs to the community for in return a cleaner environment.

While in agreement with the intent behind the legislation we believe that in order to gain maximum overall cost benefit for the consumer, we see it necessary for traffic authorities to further a cleaner environment by considering the deleterious effects of stop start motoring and idling on ambient pollutants when formulating urban traffic control plans. Emission levels of carbon monoxide and hydrocarbons fall dramatically as average speed increases. Consideration could also be given to modifying traffic patterns in areas of high pollution.

Noise Control

Legislation to control vehicle noise has already been gazetted and more restrictive laws are pending. The same comments apply to noise as for exhaust emission in that action by the legislators will succeed only to the extent to which traffic flow in urban areas, where paradoxically noise levels are the highest, can be improved.

Overall Consideration

The Australian manufacturer is already constrained in many directions by the small competitive market, low volume, local content requirements, rules and regulations, high fixed costs, high labour rates, and the compounding effect of any further restrictions in the future must be carefully considered. One important contribution Governmental planners and rule makers can make is to ensure all States legislation is uniform and in line with A.T.A.C. recommendations, this being the only body where all the implications of feasibility, cost/benefit and timing are thoroughly aired and the opportunity presented for considered comment from all the parties involved. The ultimate decision may be a compromise but anything less than this form of consensus ultimately reflects in additional cost to the consumer.

5. WHERE IS THE MARKET HEADING

We have witnessed marked changes in the pattern of customer demand in the last 10 years.

Rapid growth has taken place in the small vehicle segment of the market, vehicles of the Escort, Cortina size. This was to be expected as the post war baby boom moved up the population/age histogram. This coupled with our bouyant post war economy produced an abnormally high proportion

of unmarried 20 year olds with money in their pockets, eager to acquire personalised transport. A small car met their immediate needs.

Today, several years later, this bulge in the population age distribution has moved upwards, and, as might be expected, growth in the market bias to small cars has slowed markedly.

One major factor which must weigh heavily in an assessment of future market trends is the cost of fuel, and the need to conserve energy, specifically crude oil imports. It is readily apparent that the price of fuel will escalate more rapidly than the overall cost of living, to what extent is difficult to gauge. It can be said with certainty however that fuel economy will become a greater consideration in the buying decision.

Higher fuel costs, reinforced by the effects of inflation on total cost of ownership might perhaps be expected to induce buyers to accept smaller or more economical engines and vehicles.

Manufacturers can be expected to take action to offset this potential increase in cost of ownership, not only by producing more efficient engines but by reducing weight and drag coefficients. We can look forward to wider use of light weight metals, plastics and cars which offer the same interior package size as today within a smaller exterior.

Conventional engines will continue to be used with perhaps some bias towards diesel application in the longer term. Prospects for electrically driven vehicles are poor except for special purposes, other engine alternatives such as the gas turbine and the stirling engine are not likely to appear in useable form for some decades even in the U.S.

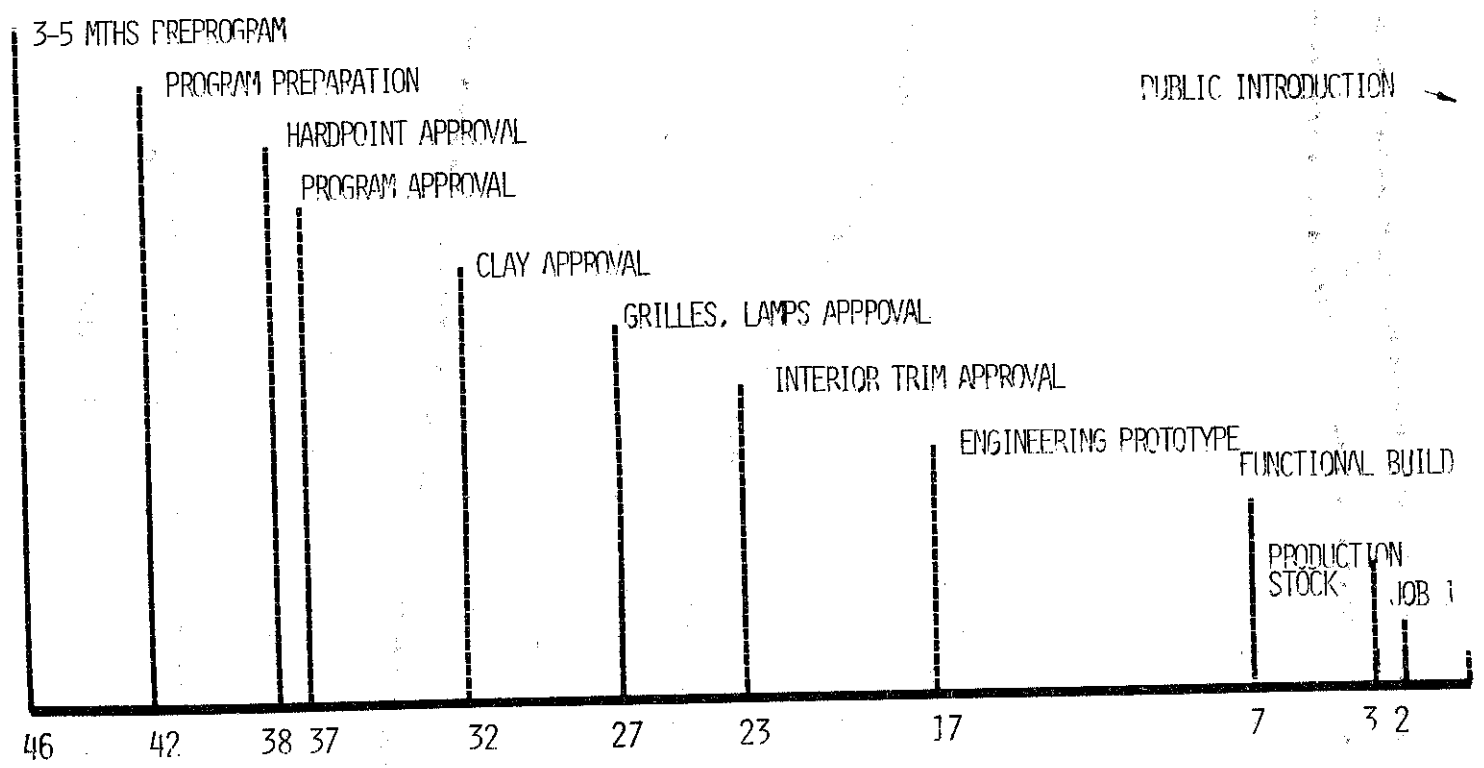
Another important but unpredictable factor bearing on the shape of the car of the future is Government policy. Any changes in content rules, tariff policy, exchange rates, sales tax, import quotas, export/import policies or income tax policies may cause rapid changes/reversals in historical trends. The industry is often consulted and therefore often forewarned of impending changes in these areas. Nevertheless the effects, because of long turnaround times, could cut disastrously across a Company's long range plan and upset a previously stable set of planning criteria.

Other difficult to predict areas are the rate of urban sprawl and the degree to which public transport systems can be developed to meet the personal transport want and compete or combine with cars for comfort, elapsed time and flexibility; the rate at which freeways, roads and other

traffic control measures can be implemented; the extent to which decentralisation of industry and community centres take place. All these changes will affect patterns of usage and hence the type and feature content of vehicles purchased. As an industry we appreciate early advice on any planned changes in urban transport policies likely to distort the current transport pattern in order that it may be included in our forward year planning assumptions.

Overall we will see a continuing reduction in the number of unique low volume models around the world as energies of the major manufacturers are concentrated on production of lighter, more efficient vehicles that must respond to economic and governmental requirements rather than just meet the wants of the buyer. There will be a growing trend to "world cars" to spread development costs over larger volume bases, increase cost efficiency via larger production runs, and avail the latest technology to the maximum number of manufacturing affiliates. However high local content in certain countries with investment in unique local design facilities will be a major determinant in forward planning and the ability to adopt or adapt world cars.

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MONTHS AHEAD OF PUBLIC INTRODUCTION
 FIG. 1 - TYPICAL NEW MODEL TIMING PLAN

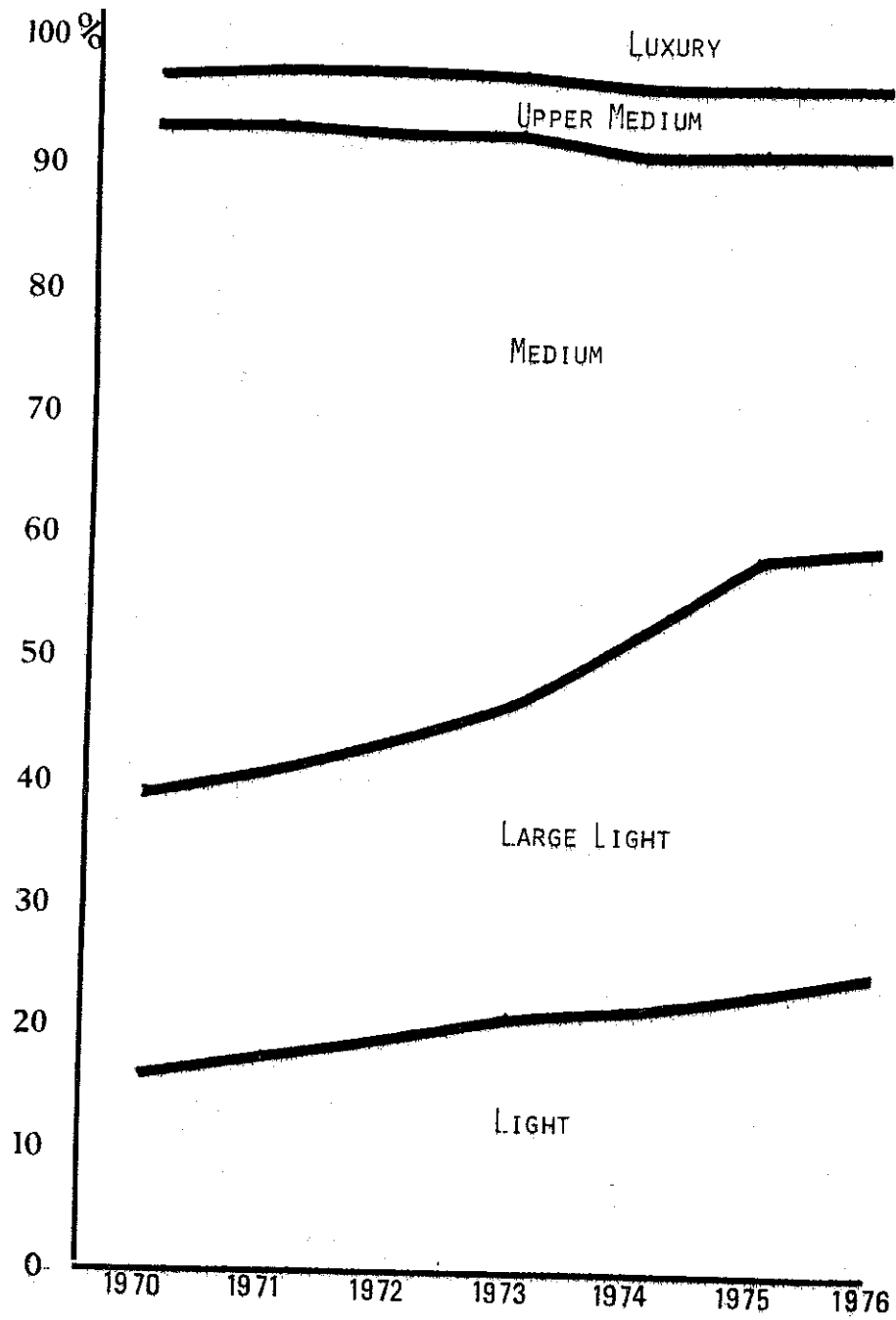


FIG. 2 - PASSENGER MARKET SEGMENTATION - PERCENT

	PERCENT OF OWNERS			
	CAR SIZE			
	A	B	C	D
OVERALL APPEARANCE	29%	33%	34%	23%
WANTED LARGER CAR	6	10	21	5
WANTED SMALLER CAR	24	25	2	7
PERFORMANCE/ENGINE RESPONSE	14	26	26	25
ROAD HOLDING/HANDLING	14	18	23	45
RIDING AND DRIVING COMFORT	25	33	41	52
MANOEUVRABILITY	22	10	2	8
ECONOMY OF OPERATION	63	44	8	7
PRICE	44	22	23	3
EXTRAS INCLUDED IN PRICE	18	19	12	4
THE DEAL/TRADE-IN VALUATION	10	15	27	5
FURTHER RESALE VALUE	6	7	13	11
QUALITY OF WORKMANSHIP	22	26	6	43
RELIABILITY	20	18	23	25
PRIOR FAVOURABLE EXPERIENCE	7	10	23	8
ADVICE OF FRIENDS/RELATIVES	7	6	3	2
REPUTATION OF MAKE/CAR	17	19	15	24
DEALER SERVICES	4	6	9	4
AVAILABILITY OF SPARE PARTS	7	9	24	2
PRESTIGE	-	1	1	7
WARRANTY COVERAGE	1	1	4	1
SAFETY FEATURES	2	5	6	36
AVAILABILITY	14	12	16	4
SAMPLE :	(1762)	(2746)	(2353)	(423)

TABLE I - REASONS FOR BUYING - SEGMENT

PERCENT OF OWNERSCAR SIZE

	A	B	C	D
A) <u>VEHICLE USE</u>				
NO ONE USE MORE IMPORTANT THAN OTHERS	33%	42%	33%	43%
DRIVING TO AND FROM WORK	27	16	10	7
SHOPPING AND RUNNING AROUND TOWN	18	11	3	4
LONG TRIPS	5	12	20	29
HOLIDAYING	2	3	5	1
TOWING A VAN OR BOAT ETC.	-	2	9	3
SOMETHING ELSE	6	6	9	6
NOT ESTABLISHED	9	8	11	7
TOTAL	100%	100%	100%	100%
B) <u>MOTORIST TYPE</u>				
CAR ORIENTATED	9%	13%	13%	28%
DRIVING ORIENTATED	58	62	58	57
A MEANS OF GETTING FROM A TO B	25	19	20	11
MOTORING IS HAZARDOUS & FRUSTRATING	4	3	3	2
NOT ESTABLISHED	4	3	6	2
TOTAL	100%	100%	100%	100%

SAMPLE : (1762) (2746) (2353) (423)

QUESTION: (A) WHICH ONE OF THE FOLLOWING USES, IF ANY, WAS THE MOST IMPORTANT TO YOU WHEN CHOOSING YOUR CAR?

(B) WHICH ONE OF THE FOLLOWING FOUR STATEMENTS BEST SUMMARISES YOUR OWN ATTITUDES TO CARS & DRIVING?

SOURCE : NATIONAL NEW CAR BUYER

ISSUED : MARKETING RESEARCH

TABLE II - A) VEHICLE USE AS PURCHASE INFLUENCE - SEGMENT,

B) MOTORIST TYPE

OWNERS

		TOTAL CAR RATED OVER/(UNDER)			
		CAR MAKE			
		A	B	C	D
2	D				
3%	43%	(0.4)	(0.2)	(0.6)	(0.4)
0	7	(0.7)	(0.6)	-	(0.3)
3	4				
0	20	0.3	0.3	(0.1)	(0.1)
5	1	0.9	0.6	(0.7)	(0.1)
9	3				
9	6	(1.0)	(1.5)	(2.0)	(1.2)
1	7	(1.3)	(1.1)	0.1	(0.4)
0%	100%	(2.9)	(2.5)	(0.3)	(1.1)
			0.1	(0.7)	0.1
3%	28%	(0.7)	(0.5)	(1.7)	(1.5)
8	57	(0.5)	(0.7)	(1.1)	(0.5)
0	11		(0.4)	(0.7)	(1.3)
3	2				
6	2	(3.4)	(2.6)	(2.6)	(2.1)
0%	100%	(1.5)	(1.1)	(2.0)	(1.7)
		(1.0)	(0.6)	(1.7)	(1.4)
3)	(423)	0.1	0.4	0.1	1.1
WAS THE CAR?		(1.1)	(1.0)	(1.4)	(1.1)
S BEST DRIVING?		(156)	(163)	(113)	(175)
CE -					

PERFORMANCE/ENGINE RESPONSE
ROAD HOLDING/HANDLING
EASE OF PARKING AND MANOEUVRABILITY
RIDING AND DRIVING COMFORT

QUALITY OF WORKMANSHIP
STANDARD OF ENGINEERING & DESIGN
SAFETY
AVAILABILITY OF PARTS & SERVICE

THE CAR OVERALL

SAMPLE :

NOTE : (1) DIFFERENCES OF 0.4 OR MORE ARE CONSIDERED STATISTICALLY SIGNIFICANT.

(2) AVERAGE RATING BASED ON SIMULATED 10 POINT SCALE (10, 8, ..., 2).

SOURCE : NATIONAL NEW CAR BUYER

ISSUED : MARKETING RESEARCH.

TABLE III - AVERAGE OWNER RATINGS
(CAR RATED OVER/(UNDER))

	PERCENT OF OWNERS				
	X	CAR MAKE			
		A	B	C	D
NONE	9%	31%	28%	20%	9%
BODY FIT AND FINISH	48	19	26	25	29
DOORS AND WINDOWS	34	18	14	23	35
INTERIOR TRIM	27	15	23	13	26
LEAKS	29	3	8	14	18
ENGINE SYSTEM	20	11	13	4	22
SUSPENSION	6	5	6	9	12
DRIVE LINE	4	1	2	4	8
BRAKES	12	2	3	16	3
TRANSMISSION	11	6	7	26	9
CLUTCH	2	1	4	7	1
EXHAUST	5	1	3	4	9
FUEL	5	3	3	4	7
STEERING	4	2	3	1	1
CLIMATE CONTROL	8	7	3	10	6
INSTRUMENTS	12	15	16	5	13
ELECTRICAL	25	18	20	17	25
GENERAL QUALITY	24	7	6	12	13
ALL OTHER	3	3	1	4	3
FAULTS PER 100 OWNERS	<u>289</u>	<u>137</u>	<u>161</u>	<u>192</u>	<u>259</u>
SAMPLE :	(408)	(320)	(305)	(113)	(175)
SOURCE :	NATIONAL NEW CAR BUYER				
ISSUED :	MARKETING RESEARCH				

TABLE IV - CAR FAULTS INCIDENCE
(THREE MONTHS AFTER DELIVERY)

INERS

D
9%
29
35
26
18
22
12
8
3
9
1
9
7
1
6
13
25
13
3

PERCENT OF OWNERS

CAR MAKE

	A	B	C	D
MALE	87%	86%	82%	86%
FEMALE	12	13	14	14
NOT ESTABLISHED	1	1	4	0
TOTAL	<u>100%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>
MALE HEAD OF HOUSEHOLD	74%	60%	72%	75%
FEMALE HEAD OF HOUSEHOLD	5	3	4	4
WIFE	6	6	7	9
SON	10	22	5	6
DAUGHTER	2	4	2	1
OTHER MALE/FEMALE	3	2	4	4
NOT ESTABLISHED	1	3	6	1
TOTAL	<u>100%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>
SAMPLE	(156)	(163)	(113)	(175)

SOURCE : NATIONAL NEW CAR BUYER

ISSUED : MARKETING RESEARCH

TABLE V - Sex/POSITION IN HOUSEHOLD

259

(175)

	PERCENT OF OWNERS				
	CAR SIZE				
	A	B	C	D	E
UNDER \$3,000	10%	5%	3%	1%	1%
\$ 3,000 - \$ 3,999	6	4	3	1	-
\$ 4,000 - \$ 4,999	8	7	5	3	1
\$ 5,000 - \$ 5,999	15	14	10	6	2
\$ 6,000 - \$ 6,999	11	11	8	6	2
\$ 7,000 - \$ 7,999	10	11	10	6	3
\$ 8,000 - \$ 8,999	7	10	9	7	3
\$ 9,000 - \$ 9,999	4	6	8	9	4
\$10,000 - \$12,499	7	11	13	16	12
\$12,500 - \$14,999	3	4	6	9	10
\$15,000 AND OVER	3	5	9	24	48
NOT ESTABLISHED	16	12	16	12	14
TOTAL	<u>100%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>

MEDIAN GROSS INCOME BEFORE TAX : \$6548 \$7459 \$8686 \$10931 \$13854

SAMPLE : (1762) (2746) (2353) (712) (423)

SOURCE : NATIONAL NEW CAR BUYER

ISSUED : MARKETING RESEARCH

TABLE VI - INCOME - SEGMENT

OWNERS

		PERCENT OF OWNERS			
		CAR MAKE			
	E	A	B	C	D
%	1%	2%	-%	2%	-%
	-	8	14	9	1
	1	12	10	9	6
	2	3	6	6	3
	2	3	3	2	4
	3	2	3	1	2
	3	13	15	12	17
	4	16	15	22	18
	12	5	3	1	7
	10	3	4	2	6
	48	5	3	6	11
	14	5	4	7	5
		2	1	1	-
%	100%	1	1	2	1
		4	2	-	3
\$	\$13854	16	12	13	12
		-	4	5	4
	(423)	<u>100%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>
TOTAL	:	(156)	(163)	(113)	(175)
SAMPLE	:	NATIONAL NEW CAR BUYER			
SOURCE	:	MARKETING RESEARCH			
ISSUED	:				

TABLE VII - OCCUPATION

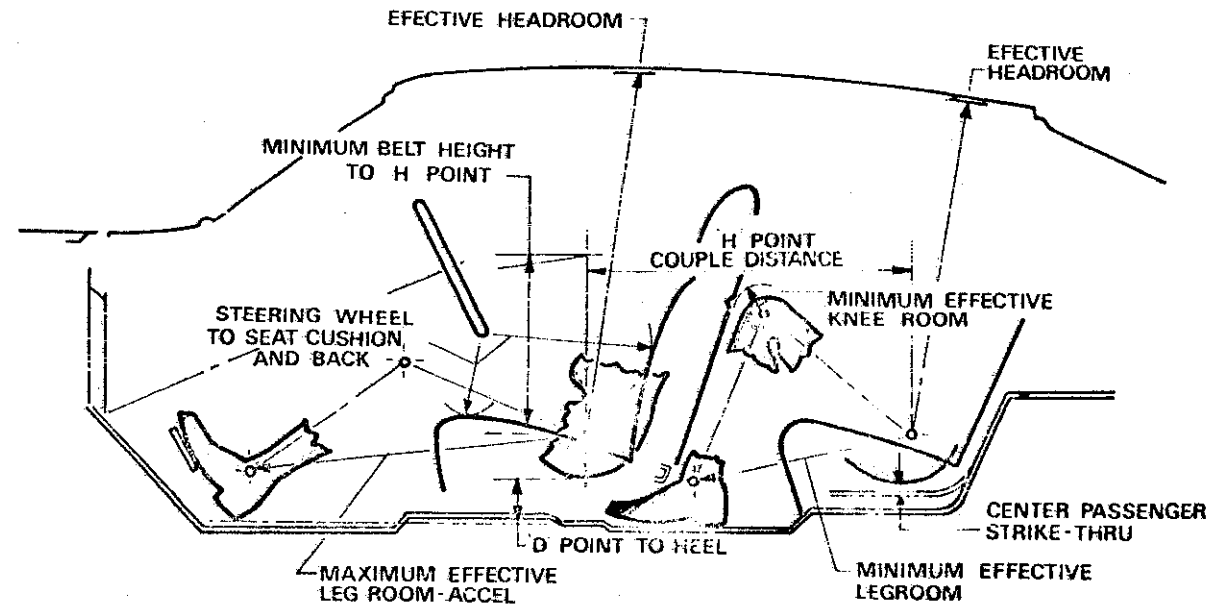


Fig 3A SEATING PACKAGE

Fig 3A SEATING PACKAGE

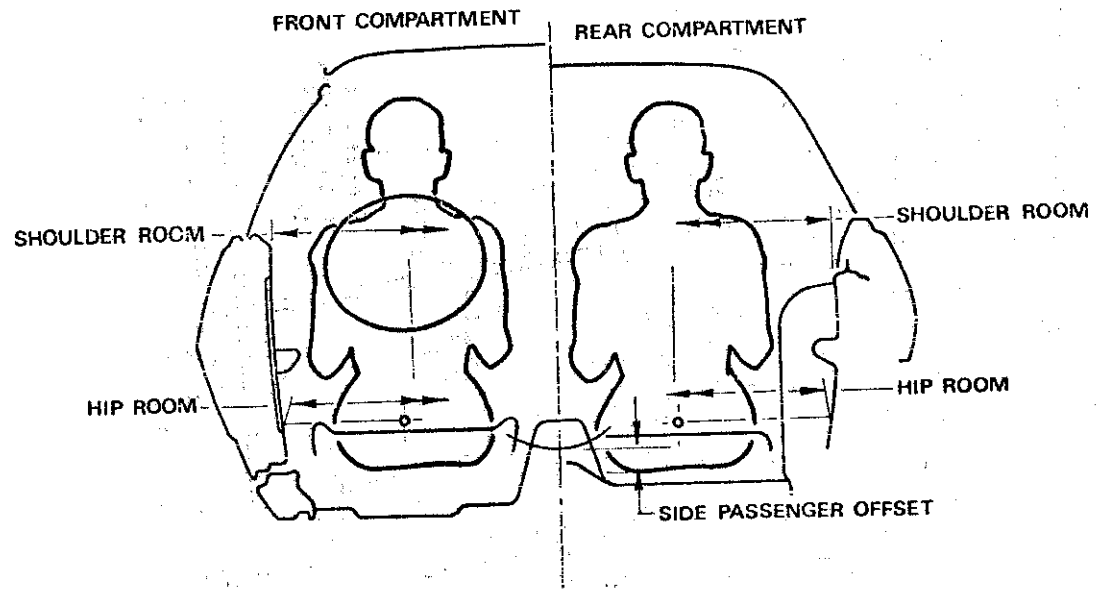


Fig. 3B SEATING PACKAGE

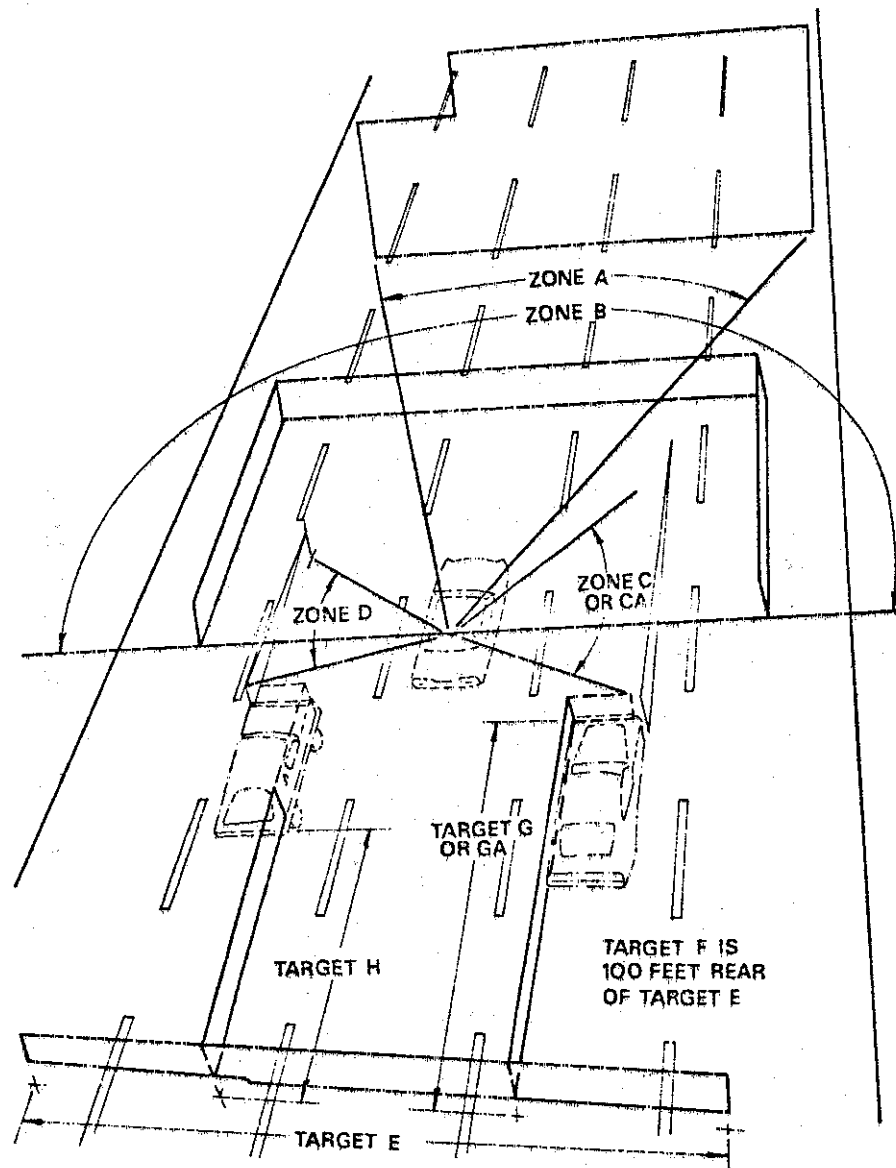


Fig 3C VISIBILITY ZONES & TARGETS

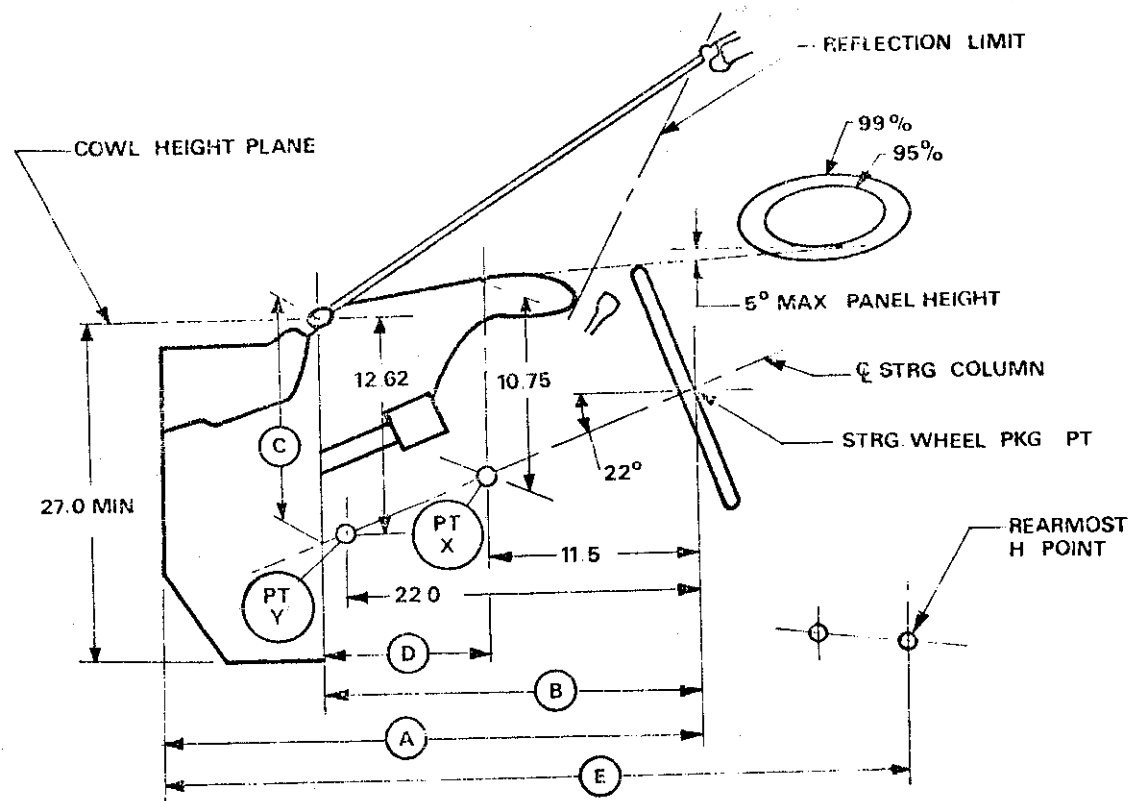


Fig 3D INSTRUMENT PANEL HARDPOINT PARAMETERS