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**Urban Mass
Transportation
Administration**

Small Bus Manufacturing Industry

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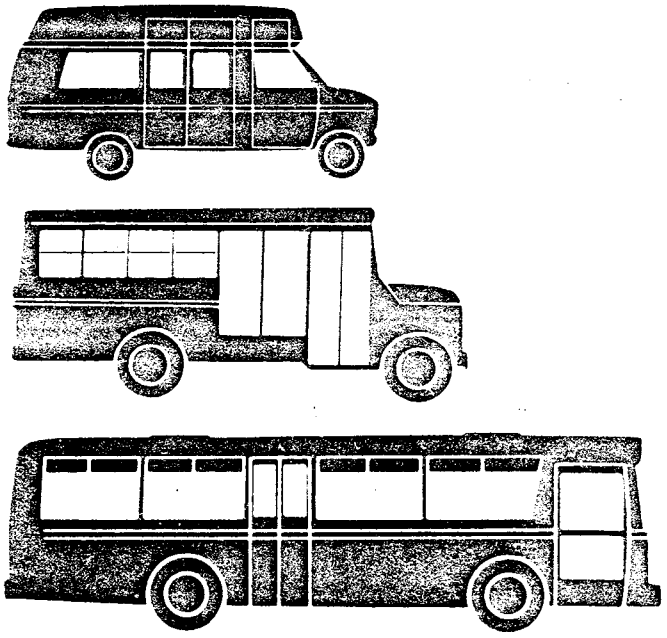
Transportation Systems Center

January 1985



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16. Abstract

This report is an examination of the small bus manufacturing industry with the objectives of: 1) providing a systematic understanding of the diversity of vehicle types and manufacturers and 2) identifying important economic trends in the industry that have implications on public transit. This study identified five broad categories of small vehicles which have been adapted to transit applications. These categories are: school buses; step vans; motor homes; vans and van cutaways; and purpose-built buses. The report discusses the development of the standard bus and small transit bus and gives a history and discussion of the five categories of small vehicles. Some of the findings of the study are that in recent years, there are signs that the industry is maturing with a trend toward fewer, larger, more committed manufacturers of purpose-built vehicles.

Appendix A in the report is: Small Transit Vehicle Manufacturing Profile and Appendix B is: Federal Agencies and Industry Associations.

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PREFACE

This report is an examination of the small bus manufacturing industry. The study identifies four vehicle categories which have been adapted to transit vehicle application and the modernization process which introduced a new set of companies in the transit market.

The work was sponsored by the U.S. Department of Transportation, Urban Mass Transportation Administration, Office of Technical Assistance, Washington, DC.

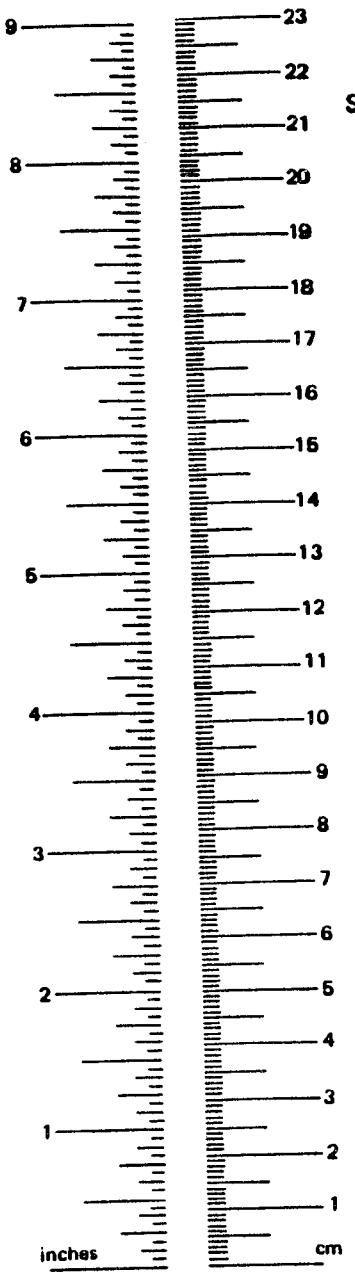
The study was performed by the U.S. Department of Transportation, Research and Special Programs Administration, Transportation Systems Center, Cambridge, MA.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

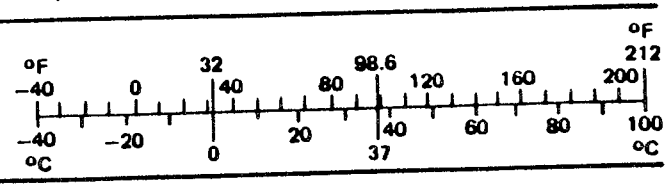
Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 In. = 2.54 cm (exactly). For other exact conversions and more detail tables see NBS Misc. Publ. 286, Units of Weight and Measures. Price $2.25 SD Catalog No. C13 10 286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	36	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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EXECUTIVE SUMMARY

Small transit buses are essential to many public transportation services and form an essential element in the nation's system of public transportation. For decades, small transit buses have served as the workhorses of many small city and rural transit systems and are used in many large urbanized areas for paratransit services. The operational capabilities of small vehicles fill a definite void between fixed-route transit coaches and the private auto or taxi service. To a much greater extent than standard-size transit buses, small transit buses are used by public service agencies and by private businesses, including church groups and airport shuttle services.

This study examined the small bus manufacturing industry with the dual objectives of providing a systematic understanding of the diversity of vehicle types and manufacturers and of identifying important economic trends in the industry that have implications on public transit.

Despite the many disparate and highly visible uses of small transit buses, the industry which manufactures them has remained obscure. No industry association exists; no reliable statistics concerning small bus production or use are produced. Even the identification of current manufacturers and vehicle design can be a difficult problem.

The reasons for the diverse nature of this industry appear to be both historical and related to the market for small buses. The relatively short history of transit bus development shows that modern small buses have evolved, in a large measure, from other vehicle types, such as vans and recreational vehicles. The necessity for a small transit bus was not recognized until well after standard transit buses had evolved to their present dimensions. To meet

the wide variety of needs, small vehicles, originally developed for other purposes, had to be modified and developed as transit vehicles.

The study identified five broad categories of vehicles which have been adapted to transit applications. Four derivative vehicles are school buses, forward control chassis delivery trucks or step vans, motor homes, and vans (including van cutaways). In the process of modernization, a new set of companies were introduced into the transit bus market. Declines in motor home, recreational vehicle (van) and school bus sales during the 1970s motivated the entrance of those industrial manufacturers into the transit market. This resulted in a large number of manufacturers offering a variety of vehicle concepts. In the mid-1970s, the developers of derivative vehicles were joined by an increasing number of builders of purpose-built small buses. Offering superior durability, builders of purpose-built buses added a fifth category of buses and manufacturers to the market.

The diversity of vehicles is maintained by a small bus market which demands buses with a wide range of special features and durability. In contrast to standard transit buses, which are designed primarily for a single, specific type of service (fixed-route urban transit service), and a single category of users (urban transit systems), small buses are designed for disparate services and users. There appears to be little effective competition by small buses with standard transit buses for the most common transit services. Where the service carries a high peak load and involves a duty cycle requiring heavy duty design (e.g., a duty cycle requiring high mileage, many stops, and slow speeds), then standard transit buses have a decisive advantage over small buses. On the other hand, the smaller size, lower price or special features (i.e., low floors,

wheelchair accommodations) of small buses are decisive advantages for certain transit services and operations.

Studying the diversity in the small transit bus manufacturing industry has uncovered a number of important trends, in this relatively young industry. Events in the "parent" industries of many of these manufacturers have sometimes had a large impact on the small bus industry. Steep declines in recreational vehicle demand, twice in the 1970s, caused many recreational vechicle builders first to try to manufacture buses to offset lagging sales in their main market, and then, forced many of those same builders out of business entirely, creating a good deal of instability in the small bus market. There are signs that the industry is maturing with a trend toward involvement by fewer, larger and more committed manufacturers. Several companies have invested in manufacturing facilities especially to produce buses for transit use. Purpose-built buses are now offered by several manufacturers and in several sizes and service configurations.

There is likely to be increasing pressure from bus and busbody manufacturers for component designs which will be more durable in commercial and transit duty cycles. This may result in experimentation with more foreign-built chassis and components, since there are only two or three domestic suppliers of the most commonly used chassis and a similarly limited number of suppliers for major components, such as engines, transmissions and axles.

Because of diversity in vehicle types and durabilities, the need to establish industrial standards for small buses is acute at this stage of development. Lengthy and elaborate bid specifications, prepared without reference to technical standards, are a problem to both manufacutrers and operators. As a result, manufacturers are likely to consider joining together

to establish transit standards. The orderly and professional development of standards would assist the manufacturers in marketing their products and in defending a market position established on the basis of good practice. Transit operators would benefit from simplified procurement procedures, improved quality and safety assurances.

Despite the maturing of the industry into a collection of more stable firms, the size of the transit market relative to other markets for small vehicles is likely to remain small. The annual demand for small buses for transit applications appears to be under 3000, compared to an annual demand for 25,000 school buses, 18,000 recreational van cutaways and 19,000 motor homes. The subordinate position of transit buses among small vehicles will continue to adversely affect the development of small transit buses. The strategies and resources of firms entering or participating in the transit market will also continue to be influenced, and perhaps determined by events in the other, larger markets for vehicles of similar size.

1. INTRODUCTION

1.1 OVERVIEW OF THE INDUSTRY

Buses manufactured in the United States have traditionally fallen into three broad classifications relating to their operation and design. These categories are transit, intercity and school bus. Although inadequate for describing the industry in detail, these categories have served to convey certain broad generalizations. Intercity and transit buses, generally, have been thought of as large (up to 40 feet in length) and heavy-duty, while school buses have been viewed as smaller, medium-duty vehicles. Intercity and transit buses have been the products of one group of manufacturers lead by such companies as General Motors and Greyhound, all of whom built complete vehicles. School buses, on the other hand, have often been viewed as the joint products of a group of truck manufacturers who supply chassis and another group of school bus body builders who complete the vehicles.

This traditional overview of the industry, forms a useful starting framework by introducing the idea that there are separate groups of companies in bus manufacturing, each group with a specialized product. It is also useful for introducing the concept that building a bus body on a purchased chassis (body-on-chassis construction) is an alternative to building a complete vehicle from the ground up (integral construction). Finally, it may be noted that this traditional view underlies the understanding which many in the bus manufacturing industry and the transit community have of the structure of the bus manufacturing industry. However, the subject of this report - the small bus manufacturing industry - does not exactly match any of the three categories previously described. After careful examination of the small bus manufacturing industry, it was found that nearly every assumption of the traditional view

would be a force fit in this discussion. The diverse structure of the small bus manufacturing industry confounds to the tidiness of the traditional view. Therefore, this report is deliberately focused on this diversity, and a major analytical effort is made to explain it in a way that will make possible a new, rationalized view of the bus manufacturing industry - one that includes small buses.

Individual manufacturers are not extensively discussed in the main body of the report, but brief profiles of companies are presented in Appendix A.

1.2 CLASSIFICATION OF SMALL BUSES

The term "small bus" is used very broadly in this report to mean all passenger highway conveyances appropriate for commercial or transit use which are larger than vans and smaller than standard transit buses. This range encompasses several varieties of buses differing widely in appearance and application.

The task of dividing the small bus market into segments reflecting the various vehicle types and market niches has been attempted in several previous studies and papers, but no single system has yet gained widespread acceptance in the industry and the transit community. The inability to settle on a classification scheme reflects both the complexity and the evolving, changing character of the industry.

Two bases for classification are readily appealing. One would be based on market niches and a reference to some characteristic of the bus related to a particular type of service. The other would be based on vehicle type and an examination of physical characteristics of the vehicle. The latter basis of classification is the one used in this report, modified to reflect the historical development of small buses as they evolved from a variety of different small vehicle "parents."

The former classification would be similar to the way market segments for cars are identified, with references, perhaps, to size and cost, as in"economy subcompact" or "mid-priced luxury car." The trouble with developing such a system is that market niches are not well defined; more might yet be developed, and many bus models appear able to satisfy the requirements of several market areas.

Table 1 displays the classification scheme used in this report. It is a scheme based on vehicle characteristics and origins rather than market niches, and it includes vehicle categories in which the buses are not necessarily "small" in the sense of being between a standard van and a standard transit bus in size. This approach to classifying the buses currently being produced is more realistic and complete than one which tried to segregate buses arbitrarily by length or some other size criteria. The modified van, van cutaway, small forward control chassis, and various purpose-built manufacturers are the ones which produce most buses for transit uses and are the ones on which discussion in this report will concentrate. However, brief comments will be made on the others.

The listing of models and chassis in Table 1 should not be considered complete. Due to the numerous companies willing to fabricate custom bus chassis or to supply them from abroad makes it impossible to be complete in the chassis manufacturing category. The list of complete bus models is also deficient. The very large number of local companies, including garages and body shops, which can modify a van makes it impossible to do more than list a few representative names which may be known nationally. Other categories also may not be complete. Importers have been omitted throughout as not a significant factor, although there have always been a few companies active in that field and, of course, many more with the potential.

TABLE 1. SMALL BUS CLASSES

VEHICLE TYPE	CHASSIS MANUFACTURER[1]	COMPLETE BUS (Manufacturer and Model Name)[1]	
VAN			
Standard Van	N/A	G.M. Ford Dodge	
Modified (converted) Van	General Motors Ford Dodge	Fortivan Ward Minuteman	National Coach Escort Turtle Top Terra National Custom Van
Van Cutaway Chassis	G.M. Ford Dodge	Fortibus Thomas Minotaur Wayne Chaperone Collins Omni/Bus	Bluebird Microbird Ward Vanguard El Dorado People Mover Champion Bus
TRUCK CHASSIS			
Forward Control Chassis Small	Wolverine Western General Motors	Coach and Equipment CL series Flxette Bluebird Minibird	Thomas Mighty Mite
Large	International Harvester *	Carpenter Cavalier Bluebird All American	Ward Patriot
Medium Truck Chassis (conventional school bus)	General Motors Ford International Harvester	Bluebird Conventional Thomas Conventional Wayne Lifeguard	Ward Volunteer Carpenter Conventional
Rear Engine Bus Chassis	*	Bluebird All American RE Thomas Transit Liner ER	Carpenter Corsair
PURPOSE-BUILT			
25'	N/A	Chance RT 50	
26' low floor	N/A	Orion II Neoplan Lit'l Bus Skillcraft	
30'	N/A	Gillig Phantom Bluebird Citibus Carpenter CBW 300	Thomas Citiliner

*Bus body builders commonly build their own chassis
N/A - not applicable.
[1] List is not exhaustive.

The categories used in Table 1 are formed into three groups, labeled van, truck chassis and purpose-built. This grouping reflects historical origins discussed in Chapter 2. It should be noted that the chassis grouped under the term, truck chassis, have been modified, in some cases extensively, from truck chassis for use in buses. Rear engine bus chassis may have no relationship to any current production truck chassis other than the use of a beam frame and some similar componentry.

Medium truck chassis are used to produce conventional school buses. (Conventional school buses are by far the most common type and can be identified by their characteristic truck nose.) Large forward control chassis and rear engine bus chassis buses are commonly built for use as large capacity school buses and "medium-duty" transit buses. They can be built in length up to 40 feet and thus can equal or exceed standard transit buses in seated passenger capacity. The armed services are often cited as a major market for these buses.

The scheme in Table 1 highlights different bus chassis configurations. Vans are probably most familiar and require little discussion. "Van cutaway" simply means that the van chassis is sold without a body behind the front door to another manufacuturer who completes the vehicle by constructing a body. "Forward control" means that the engine and driver's controls are located above or in front of the front axle. Forward control designs help to increase the passenger capacity within a given length vehicle by eliminating the long front hood seen on conventional vehicles (e.g., most trucks) and make it easier to design a vehicle with a low, flat floor. Rear engine designs, with the engine located beneath the floor, are another way of maximizing passenger capacity within a given vehicle length.

The term, purpose-built, is used in Table 1 to indicate buses which are not derivative in design from other vehicles. It is used instead of another, older term - integral construction - which is laden with connotations liable to

provoke argument. In the traditional view referred to earlier, buses could be divided neatly between body-on-chassis and integral construction. A body-on-chassis bus was a bus body bolted on a truck chassis whose frame is centered on two heavy beams running the length of the vehicle. The chassis could be built by one manufacturer and the body another in what was referred as a two-stage manufacturing process. The integral construction bus, by contrast, was built by one manufacturer alone. Heavy beams were not used in the frame. Instead, the whole body of the bus was strengthened and the frames supporting the chassis components were simply extended from the bus body. A key distinguishing feature between a body-on-chassis and integral construction was that the body of a body-on-chassis bus could be unbolted and removed and the remaining chassis could still be driven away as a unit. An integral construction bus, however, was a unit and could not be disassembled in this way.

Other differences between integral construction and body-on-chassis were also thought to be readily apparent. Because integral construction buses had stronger bodies and heavier-duty components, they were recognized as superior in durability. Body-on-chassis buses, taking advantage of the economies of scale in truck (chassis) production and cheaper components and production methods, could claim economy in price.

Unfortunately, in recent years the distinctions between body-on-chassis and integral construction have blurred. Bus body builders have chosen to build their own chassis and chassis for integral construction buses have been sold. Neither manufacturer has been willing to concede claims of durability and the term, integral construction, has been applied to virtually every conceivable design by ardent salesmen.

Calling some bus models "integrally constructed" in this report could easily be misconstrued as an assertion about durability or about design

approach. Therefore, the term, purpose-built, has been substituted. Even this term does result in sufficiently fine distinctions. In Table 1, it could be argued that the category, rear engine bus chassis buses, fit in the purpose-built group. The producers of these vehicles do not usually purchase chassis; they build their own. Their rear engine buses are not directly a derivative of a truck or other vehicle. Still, it is apparent that this category is distinct from categories in the purpose-built. Use of a beam frame and historical associations with trucks from days when truck builders supplied the rear engine chassis was enough to put them in the truck chassis group.

1.3 ESTIMATING VEHICLE DEMAND

Today, there are no comprehensive national statistics published indicating either the production or sales of small transit vehicles, nor is there any generally accepted method for arriving at an estimate of sales or production.

The problems inherent in making an estimate of the vehicle population, sales or production are compounded by several circumstances. First, the market is fractionated, as indicated by the large number of different types of users. No association of users comprises a large enough fraction of the market to provide any statistics useful for estimating the whole. (This is in contrast to transit buses, school buses and intercity buses, the primary users of which are organized to develop and exchange information on their vehicles.) Second, the category, "small bus" spans a wide variety of vehicle types, and includes both manufacturers of incomplete chassis and complete vehicles. Thus, there is more than ample opportunity in any estimating procedure to confuse types and to double-count between chassis and vehicles.*

*An attempt was made in this study to assemble a count based on information volunteered by manufacturers, but it had to be abandoned when it became clear that only a tightly-administered survey could produce reliable data, and it was determined that a survey would be beyond the scope of the project.

The information which is available on small transit vehicle demand is fairly limited in scope. The American Public Transit Association (APTA) reports on the number of new buses delivered to transit systems and the total transit fleet in the U.S. APTA distinguishes bus size by the number of seats. In 1981, 153 new buses were delivered with 29 seats or less. This number is clearly only a portion of the number of small buses being built, and serves more to indicate how few are being purchased by city transit systems than to measure total demand.

The Federal government's information is similarly limited. The Urban Mass Transportation Administration (UMTA) collects information from transit authorities on their fleets through their Section 15 reporting system. In FY82, the total of vehicles in demand response services (which may be assumed to be almost all small buses) and transit buses with fewer than 35 seats was approximately 5500.

There are UMTA programs outside the general purview of Section 15 reporting system which are of interest in relation to small buses. They are the Section 16(b)2 grant program, which aids local transportation for the elderly and handicapped through the states and Section 18 grant program, which aids rural transit. UMTA, unfortunately, keeps no statistics on vehicle purchases under these programs. Inquiries to state 16(b)2 coordinators in 1983 yielded some information from 31 states. The total 16(b)2 fleet in those 31 states was about 4300 vehicles, of which 60 percent were standard or modified vans and about 5 percent were standard transit buses. The remainder were mostly small buses.

Information on Section 18 is still incomplete. Inquiries made in 1983 to individual states for information generated replies from 11 states. Most Section 18 funds are apparently spent for operating and administrative expenses;

the proportion expended in capital purchases varied widely among the states responding. Nothing positive could be concluded about the number of vehicles in "Section 18 fleets" or the number purchased annually.

The bottom line on estimating small bus demand or production appears to be that any estimate is likely to be little better than a guess. Orders of magnitude can be given, based on very limited hard data and somewhat uncertain definitions. Based on limited information about some individual manufacturer's production, it appears that production of small, purpose-built buses in the U.S. is between 500 and 1000 annually. Combining these with body on truck or van chassis (but excluding modified vans) yields an order of magnitude estimate of annual small bus production of 1800 to 3000 units. Of course, these numbers would include many buses not sold as <u>transit</u> vehicles, per se.

2. HISTORY

2.1 DEVELOPMENT OF THE STANDARD TRANSIT BUS

The motor bus is a descendant of the automobile. Although self-propelled vehicles were invented as early as the eighteenth century, it was not until the late nineteenth century that serious development of the automobile began. In Germany, 1895, Karl Benz built an eight passenger, gasoline-powered vehicle. This vehicle is cited in the Encyclopedia Brittanica as the first motor bus.

In 1900, the Mack Brothers produced a 12 passenger vehicle which is claimed to be the first bus in the United States. The primacy of these vehicles has been greatly enhanced by the subsequent, historic, commercial success of their makers; and doubtless, other more obscure examples of early motorbuses, even some antedating these, could be found. From this, it can be noted that motorbuses were among the earliest motor vehicles developed.

Automotive pioneers developed buses because they were seeking commercial applications for their inventions. One of their models was the horse-drawn omnibus which rode on rails in most cities before the turn of the century. (The term "bus" is a derivative of omnibus.) Omnibuses were being replaced in many cities by electric streetcars at the turn of the century. It was in relation to streetrail systems that early transit applications of buses were developed. Motorbuses were first used as experiments for feeder service to the streetrail systems, and as a more economical means of extending the lines. Because of poor service and numerous traction strikes, motorbuses replaced the streetcars in many cities before the first World War. Privately operated jitney buses were more dominant than regularly scheduled transit buses before 1920.

Early buses, like the jitney, were small; the technology to build large, but still practical, road vehicles was slow to develop. In all important

technical respects, passenger cars remained indistinguishable from trucks or buses until World War I. The development of steel wheels (1906) and large pneumatic tires (1916) propelled the development of heavier vehicles (trucks and buses) for commercial purposes.

Air brakes were first demonstrated on an experimental motor coach in 1921 and had been widely adopted on buses by the mid-1920's.

Fageol Safety Coach is most usually credited with the first chassis specially designed for bus use. It was lower, had a longer wheelbase and a wider tread than an ordinary truck chassis (1922). Fageol can also be credited with the first integral construction bus (1927).

Yellow Coach (later, GMC Truck and Coach Division of General Motors) introduced an aluminum monocoque body bus in 1931, which was over two tons lighter than previous designs. Aluminum monocoque design, exemplified in the "New Look" (c. 1959), was the standard of the industry for over 40 years.

Diesel engines were first used in commercial trucks in 1932. In the same year, Clessie Cummins drove across the country in a diesel-powered bus to demonstrate its practicality. Use of diesels in commercial buses began around 1936. Yellow Coach (General Motors) adopted diesels as a regular production option in 1938. 1938 was also the first year for the transverse-mounted engine and the automatic transmission.

Throughout the 1930s, the bus manufacturing industry had many firms competing with a diversity of models. Among the leading firms, in addition to General Motors (Yellow Coach), were Mack Trucks, White Motor, Fageol Twin Coach, ACF Brill, and Ford Motor Co. A large number of smaller firms also competed.

Although the technology of larger buses was developing, there was no inexorable trend in that direction. Without an interstate highway system, intercity buses were still largely rural feeders to the railroads; and

streetcars were still used along the most heavily-traveled urban routes. The necessity of a transporting school children led many smaller companies to specialize in building school buses, marketing their products at first locally or regionally.

Standardization of transit buses, accompanied by a marked reduction of the number of firms, occured in the late 1940s and 1950s. Immediately after the Second World War, demand for new transit buses reached unprecendented levels as bus operators sought to replace buses worn-out during the war when production for civilian demand had been curtailed. The shutdown of many streetcar systems furthered this demand. Deliveries of new transit buses exceeded 12,000 in 1947. By 1950, this demand had been satiated and sales volume for the industry reached record low levels.

Transit and intercity bus production in the 1950s in the U.S. averaged about 3500 units with transit accounting for about 70 percent of the total. (School bus production, although growing, was by the 1950's the exclusive province of a separate group of manufacturers.) Ford Motor Co. pulled out of the industry in 1950. In 1953, General Motors introduced air suspension, a major innovation. Rather than match G.M., White Motor and ACF Brill elected to leave the transit industry; Fageol Twin Coach sold its bus manufacturing operation to the Flxible Company, then a builder of small intercity coaches.

The consolidation of the industry continued after 1959 when G.M. introduced its "New Look" model. Mack, after a brief attempt to market an intercity model, elected to withdraw rather than match G.M. with a new transit bus. Flxible decided to stay in, and by 1961 had introduced his own "New Look" model, nearly identical to the G.M. Model.

The "New Look" models brought the industry to the extreme of a trend toward standardization which had begun in the late 1940s. In 1948, G.M. introduced

the first 40-foot transit coach. About the same time, 35 feet was being considered as a standard length for a transit bus. It was also about this time that G.M. began building 30-foot versions of their 35-foot buses.

The introduction of the "New Look" a decade later further strengthened the concept that the same bus body design would be produced in 30-, 35-, and 40-foot versions. The 35- and 40-foot buses used common powertrains; special lighter components were required for the 30-foot version.

2.2 DEVELOPMENT OF THE SMALL TRANSIT BUS

The events of the 1950's established the 35- and 40-foot transit bus as standard and had reduced the number of major competitors in the marketplace to two. In the process, small transit buses had virtually disappeared. In 1947, the peak year for transit bus production, nearly 6000 of the 12,000 new buses delivered to transit systems were small (i.e., had fewer than 40 seats). In fact, almost 2000 of these small buses had fewer than 30 seats. But, by 1960, according to the American Public Transit Association, only 173 of the 2806 buses delivered to transit systems in that year, had fewer than 40 seats; none had fewer than 30 seats.

For a number of reasons, large transit buses were naturally to be preferred for the bulk of transit operations. Their components had been specially designed for durability in transit service and a high degree of design and component standardization enhanced efficient maintenance. Their size and passenger capacity had been pushed to practical limits to maximize driver productivity. Nevertheless, the concentration on the production of large, standard transit buses had created a void where smaller vehicles were concerned.

The evolution of transit buses had led away from small vehicles. When demand for small transit buses was again felt in the 1960s, it was necessary to look beyond virtually defunct small bus sector of the transit bus manufacturing industry for a source of supply.

Several other small specialty vehicles had been developed during the 1930s and '40s, and several more were to be introduced during the 1950s -70s. The manufacturers involved in the development of these vehicles acquired the expertise and resources to design new small buses.

In 1960, there were several manfacturing groups who would qualify as candidates for the small transit bus industry. First, there was the transit (and intercity) bus manufacturing industry, consisting primarily of the Flxible Company and the GMC Truck and Coach Division of General Motors. Both of these offered small transit vehicles at various times during the 1960s and 1970s. Second, there were the major automobile and truck manufacturers. In addition to General Motors, there were Ford, Chrysler, International Harvester, Mack, White Motor and Studebaker (later AM General). G.M., Ford, Chrysler and International Harvester have all been active builders of chassis for school buses and other small buses. The other companies have demonstrated little interest in small transit buses.

A third group of candidate small transit bus manufacturers was represented by the truck and bus body building industry. Two sectors of that industry had particular experience which increased their potential as small bus builders. The builders of multi-stop delivery vans (step vans) were familiar with building custom bodies on small forward control chassis. These chassis were a good size for a small bus and were designed for an urban environment and "stop and go" driving. Primarily, these chassis were used for parcel delivery trucks, home milk delivery trucks, etc. Grumman Olson and Boyertown were among the prominent

firms in this industry which demonstrated an interest in manufacturing buses in the 1960s and 1970s.

School bus (body) manufacturers also had relevant experience constructing transit vehicles. Bluebird, Carpenter, Superior, Ward and Wayne, and several additional school bus manufacturers, produced and marketed small buses for adult transportation during the 1960s and '70s.

The recreational vehicle manufacturing industry, the makers of motor homes and trailers, was still in its infancy in 1960. In the succeeding two decades, its growth gave rise to a large number of firms with a capability for and interest in manufacturing small buses. Companies like Winnebago, Rico and Champion can be mentioned, representing many others less prominent.

These groups of potential small bus manufacturers (automobile manufacturers, truck makers, truck and bus body builders, recreational vehicle builders) are not exclusive of the numerous companies interested in entering the industry. Many others, as diverse as engineering consultants and arms manufacturers, might acquire the fundamentals to design new small buses and might consider entering the industry. There were, even, of course, a number of foreign motor vehicle manufacturers with the potential to enter the industry.

It is not possible to review in detail the history of every firm which participated in the small transit vehicle manufacturing industry from 1960 on. The discussion here will be limited to five groups. These groups are the school bus manufacturers, the step van producers, the motor home producers, the van converters and van cutaway-based bus producers and, finally, the builders of purpose-built buses. Each of these groups had its own technological basis and approach to producing a small bus.

2.2.1 School Buses

School buses are the third oldest class of bus, following transit and intercity buses. They were manufactured during the 1930s as the states and local communities sought inexpensive motor vehicle transportation for school children, especially in rural areas.

The first school bus bodies were wood-frame structures fitted onto truck chassis, usually by local craftsman. Riveted steel construction eventually replaced wood structures. A few producers dominated the market regionally and then nationally. The major truck manufacturers adapted their medium-duty truck chassis for use as school bus chassis. The medium-duty truck chassis, used by all the school bus body manufacturers, became the basis for the conventional school bus with its characteristic truck hood and cowl. Conventional school buses, the standard of the industry, are still the largest volume product of school bus manufacturers.

Conventional school buses, with modifications to accommodate adult passengers, were built and sold for use as light and medium-duty buses. One inconvenience of the conventional school bus design is that its long truck nose limits maximum passenger capacity. School bus seats can comfortably accommodate three children but only two adults. Therefore, this design which limits the number of passengers, poses more of an inconvenience to adult transportation.

Redesigning the school bus model to increase passenger capacity requires the elimination of the truck nose, and the use of a different chassis. A forward control chassis, in which the engine and driver are situated either in front of or over the front axle, is one method. Another alternative is a rear engine bus chassis.

In the Far West, large capacity school buses became standard perhaps because their larger capacity was needed along the longer routes common in the West. Gillig (Hayward CA.) and Crown Coach (Los Angeles CA) were particularly successful in marketing large capacity school buses. Both companies designed and built their buses using their own integral chassis, in the manner of the transit and intercity buses. Neither company built conventional school buses.

The development of large capacity school buses was somewhat slower in the South and Midwest, where conventional school buses became standard, and the use of a separate chassis was more common.

Bluebird developed a forward control chassis bus in 1948 and Thomas-built followed in the early 1950s. By the late 1960s, General Motors and International Harvester were manufacturing rear-engine chassis. International Harvester also developed a forward control chassis. The major school bus manufacturers in the South and Midwest built large capacity buses using these chassis as well as their own and custom-built chassis.

Although the production volume of large capacity school buses was much smaller than the volume of conventional school buses, they were significant to the development of a capability to build a small transit bus. First, these large capacity buses resembled transit buses in configuration. Second, they were often built for adult transportation. Third, the forward control and rear engine chassis, built by G.M., I.H., and the custom chassis builders, were not direct derivatives of truck chassis (as were conventional school bus chassis). The absence of scale economies was reflected in a premium price. Therefore, it was economically feasible for a bus body manufacturer to produce his own chassis which some builders did, furthering their technical potential to become transit bus manufacturers.

In the late 1950s and 1960s, some of the major producers of conventional school buses in the U.S. began developing a substantial market abroad for their buses. Modified conventional school bus designs were exported for use as adult transportation vehicles to many developing countries around the world, but particularly to Central and South America.

School bus manufacturers increased their level of committment to the U.S. transit market in the 1970s, developing both purpose-built transit buses and other chassis-based vehicles for transit.

Gillig, after an unsuccessful venture with a small Neoplan design, introduced its heavy-duty Phantom transit bus in 1981. The Phantom was produced in 30-, 35- and 40-foot versions. Gillig used this model in competition with standard transit buses produced by G.M., Flxible and Neoplan.

Bluebird, which built its own chassis, entered the small transit bus market with a 30-foot rear engine bus in 1976. Thomas-built began building its own rear engine chassis in 1977. Carpenter, after introducing a 30-foot transit bus on a Gillig chassis in 1982, began building its own chassis in 1983.

Several school bus manufacturers also introduced small forward control chassis (stepvan) and van cutaway-based small buses for adults. The introduction of these vehicles, in some cases, paralleled their introduction of small school buses using the same kind of chassis. The Thomas-built Mighty Mite, originally introduced on a short truck chassis in 1970 and later reintroduced on G.M. small forward control chassis (the P-30 stepvan chassis), and Wayne Transette are examples.

The motivation behind school bus manufacturers moving into the transit bus market during the 1970s could be related in part to the decline of school bus sales. The demand for school buses is related to the size of the school age population. Decline in this population led to a decreased demand for school

buses in the late 1970s and early 1980s. School bus manufacturers experienced financial difficulty, and several companies were forced out of business. Thus, school bus manufacturers sought other markets. One of the largest alternative markets is the transit market.

2.2.2 Step Vans

Step vans or multi-stop delivery trucks were first developed in the late 1930s. Chevrolet introduced the Step Van in 1937, followed in 1938 by the International Metro Multi-stop, a product of International Harvester and a small truck body manufacturer. These two vehicles and many imitators were used as urban delivery trucks, delivering milk, bread and packages door to door.

Step vans or multi-stop trucks were designed with low, unobstructed floors for easier driver and cargo accessability. To maximize the available cubic cargo space in a small, maneuverable vehicle, the manufacturers used a small forward control chassis (i.e., a chassis in which the engine and driver's controls are placed forward of or above the front axle). For the most part, major truck manufacturers (General Motors, I.H., and later, Ford) produced the small forward control chassis and sold them to body manufacturers (Metropolitan, Union Truck Body, Boyertown, Grumman Olson, and others) who completed the vehicle production.

The small forward control chassis has several characteristics which make it appealing for transit bus use. Unlike most truck chassis, it is used on city streets, at slow speeds, and for stop and go duty cycles. Moreover, its forward control, relatively low-floor design is a good bus configuration for the market served, emphasizing passenger capacity and accessibility.

It is unknown when small forward control step van chassis were first used for buses. The Flxette, one of the most popular buses to use a small forward control chassis, was introduced in 1965, and is still in production today, having survived several changes in the ownership of the firm which makes it.

Grumman Olson, which specializes in producing lightweight aluminum step vans, introduced an aluminum bus seating 17 to 24 passengers in 1974, thus emphasizing the fuel economy of its light weight. The Olson bus remained in production for several years. Boyertown, another step van body producer, has built small buses using forward control chassis for several years. School bus manufacturers, as mentioned earlier, have also built buses using the small forward control chassis.

The popularity of small forward control chassis for their principal use - stepvans - began to decline in the 1950s and early 1960s as the custom of daily milk and bread deliveries faded.

In the early 1970s, some chassis manufacturers promoted their use in building motor homes, but the oil crisis largely destroyed this market. The oil crisis also had direct impact on delivery truck sales. The unavailability of an appropriate diesel engine for this size vehicle further handicapped sales in an era of increased fuel prices. International Harvester ended production of its chassis and the International Metro Multistop series stepvan in 1975. Ford ended its production of its P-series forward control chassis in 1980, leaving only General Motors to produce a small forward control chassis.

Ford, since dropping its P-series, has re-entered the competition with G.M. by producing a stripped van chassis (i.e., one without any cowl or hood) with a

relatively high gross vehicle rating. Several bus producers use this stripped van chassis to produce a small forward control bus.

IVECO, a European truck and bus producer, which has been marketing a small forward control chassis diesel truck in the U.S. started promoting its chassis for use as a bus in 1983. The IVECO chassis, however, is significantly smaller than the G.M. chassis. The buses built using this chassis more closely resemble van cutaway buses.

A small independent manufacturer, Wolverine, began marketing a small forward control chassis in direct competition with G.M. in 1983.

2.2.3 Motor Homes

Modern motor home vehicles were developed and produced during the 1950's, although it should be mentioned that predecessors of these models did appear as early as the 1930s. The first motor home vehicles were custom conversions of trucks and buses. Dodge is credited with producing the first motor home chassis in 1958. The chassis was then delivered to one of the early motor home manufacturers for completion. Dodge continued to dominate the market for motor chassis for more than ten years. In 1965, Ford entered the market with a converted truck chassis, and G.M. followed somewhat later.

The popularity of the recreational vehicle in the early 1970s led to the decision of several companies to enter the recreational vehicle industry and resulted in the development of several motor home chassis. Five thousand conventional motor home units were produced in 1965. By 1970, that figure had reached 30,000 units; and in 1972 and 1973, the number of motor homes produced exceeded 60,000.

Ford introduced a new motor home chassis in 1971. International Harvester introduced a rear engine motor home chassis in 1973. General Motors also introduced its front-drive Transmode motor home chassis in 1973. G.M. and I.H., by innovating in motor home chassis design, hoped to capture the growing market for luxury motor homes.

In 1973-74, increased fuel prices and curtailed recreational travel caused a decrease in the demand for motor homes. Decreased sales during 1974-75 forced several motor home manufacturers to seek relief in the transit bus market. In 1973, Winnebago introduced the Series 19 bus, an adaptation of its motor home model with a Dodge motor home chassis. At the same time, General Motors demonstrated its Transmode chassis in transit service. In 1975, Rico, a recreational vehicle manufacturer, developed a transit bus that used the Transmode chassis.

From 1975-78, sales of recreational vehicles increased; but in 1978, the market once again collapsed and the number of recreational vehicles produced drastically decreased to the production levels fell to the levels of the late 1960s.

From 1976-1978, an average of 45,000 conventional motor home units was produced. In 1979, the number of units fell to 21,000 and by 1980 under 10,000 units were being produced. The downturn in the market forced many motor home manufacturers out of business. Production of motor home chassis was terminated by G.M., International Harvester, Ford and Dodge.

Motor home chassis were not ideal for demanding applications of transit service. Although certain features, such as low floors, appealed to those requiring accessible vehicles, the chassis did not prove reliable or durable.

The instability of the motor home market had a negative impact on the small transit bus manufacturing industry in general. Recreational vehicle

manufacturers, who may have improved their product in time, were forced out of the transit market by the need to retrench or by outright bankruptcy and liquidation. The reputation which the small bus manufacturing industry gained for extreme instability may be traced in large part to the effect of the roller coaster market for recreational vehicles.

A recreational vehicle manufacturer detecting a slow in growth in recreational vehicle sales, might introduce a transit bus as a diversification and then be forced out of business a year or two later, dragged down by the unexpected and nearly total collapse of his recreational vehicle sales. This scenario was played out at a number of companies in 1974 and again in 1979. It was a scenario which affected not only producers of conventional motor homes, but also, companies which built recreational vehicle van conversions and van cutaway vehicles. (The history of vans and van cutaways is discussed in the next section.)

Even after the difficulties of the 1970s, recreational vehicle manufacturers remained a group with potential as small bus manufacturers. In 1980, Champion Motor Homes, one of the oldest and largest recreational vehicle producers, introduced a small bus on a van cutaway chassis. It should be noted that this vehicle was in no sense a converted motor home and it did not use a motor home chassis as such.

2.2.4 Vans and Van Cutaways

The modern van originated with the Volkswagen Microbus and, in the late 1950s, along with the Volkswagen Beetle was very successful in the U.S. market. To compete with the foreign vehicles, American manufacturers developed

comparable vehicles. In 1960, Chevolet produced the Corvair (equivalent to the Beetle) and the Corvair Greenbriar (equivalent to the Microbus).

The Corvair Greenbriar, smaller than later van models, was manufactured with only a 90-inch wheelbase and had a very low floor since it had a rear engine drive. Instead of replacing the Microbus, the Greenbriar and other van models replaced the panel truck. The sizes of vans increased through yearly model changes. Dodge introduced a 108-inch wheelbase van in 1967, and in so doing, took the lead among the automakers in converting the van from a compact car derivative to a pickup truck derivative.

During the 1960s, vans were adopted by the counter-culture. First, the VW Microbus became the favorite vehicle of hippies. Their colorful modifications of the paint and trim led others to be inventive with their vans. Soon, in California and then across the country, people began to install carpet, furniture, windows and appliances. A cottage industry of recreational van converters spontaneously grew in response. Van converters found a market not only among recreational users, but also among handicapped individuals, seeking to improve their personal mobility.

In 1971, Dodge, still leader in producing larger, heavier vans, developed the first van cutaway. The van cutaway or chopped van was a van without a cargo body. The van is enclosed completely to the rear of the front door and beyond that, the chassis is exposed. Van converters now could construct their own van bodies, instead of modifying them. A year later, Dodge developed dual rear wheels which increased the carrying capacity of van cutaways. This development was fundamental to bus construction as seen in 1974 by the manufacture of the Wayne Transette which became one of the most popular and widely imitated small buses.

Van conversion is less expensive than any other method of producing a bus. Building a body on a van cutaway involves considerable construction. Van cutaway body construction can be accomplished with less investment than is required for fabrication of a school bus body or a step van.

The growth of van conversion and the recreational vehicle market provided an opportunity for a large number of firms to expand their capabilities and accumulate capital. The development of vans opened the small bus industry to a very large number of firms which could enter or leave the industry easily.

2.2.5 Purpose-Built Buses

The purpose-built bus is constructed by entirely one manufacturer. Unlike a van conversion manufacturer, a purpose-built bus builder does not rely on another company to supply a chassis. Purpose-built buses are usually constructed as single units without separate chassis.

Standard transit buses are purpose-built buses. Purpose-built buses are expensive, but they can be designed with characteristics (i.e., greater durability) that are more appropriate to transit service than the characteristics available with a derivative vehicle.

The first purpose-built small transit buses were shortened versions of standard transit buses. GM began offering a 30-foot version of its standard transit bus in the late 1940s. The powertrain and chassis components used on GM's 35- and 40-foot models could not be used on the smaller model. Lighter-duty components were substituted, thereby limiting the durability of their 30-foot model. GM manufactured the 30-foot bus until 1973.

In the late 1960s, a small Ohio-based company, Highway Products, designed and manufactured a purpose-built, 30-foot transit bus. Highway Products was founded in 1957 to assume control over the Fageol Twin Coach engine plant.

Fageol Twin Coach had been a leading bus builder in the 1920s-30s, but had transferred its bus-building operation to Flexible in the early 1950s. Highway Products built and supplied spare parts for Fageol's line of gasoline and propane engines. It also manufactured postal vehicles and guided missile launchers. In 1968, a 31 passenger bus was introduced, using the Twin Coach name. A 25-foot, 25 passenger version was offered shortly thereafter.

Although the Highway Products 30-foot bus was not generally considered to be a good design, it was less expensive than GM's 30-foot version. Eventually GM withdrew its 30-foot bus from the market. Serious complaints were made against the Highway Products bus by some operators. The parent company, Alco-Standard, sold Highway Products in 1973, and the company later filed for bankruptcy.

In 1974, Flxible introduced a 30-foot version of its New Look bus. Flxible decided to withdraw this bus, which was similar to GM's 30-foot model, in 1976. Following Flxible's departure from the market, several other firms introduced purpose-built small buses. In 1976, Bluebird introduced the Citybird, a 30-foot, purpose-built transit bus. The Chance Minibus RT-50, a 22-foot purpose-built bus was introduced in the same year. In 1977, TMC, a subsidiary of Greyhound Bus, bought the rights to the design of the Orion, a 30-foot bus built in Canada by Ontario Bus Industries.

The purpose-built bus sector of the small bus manufacturing industry has continued to expand since 1977. TMC stopped production in 1982, selling its license back to Ontario Bus Industries. Ontario Bus subsequently invested in a U.S. production plant and continued manufacturing the Orion. As previously mentioned, Gillig, Thomas-built and Carpenter have all introduced 30-foot purpose-built buses. Carpenter reportedly invested $7.5 million in a new plant to produce its transit bus. Neoplan, a manufacturer of standard and articulated

buses, introduced a 26-foot, low-floor, purpose-built bus in 1983. Bus Industries of America, the U.S. arm of Ontario Bus Industries, began marketing the Orion II, also a 26-foot, low-floor bus.

The purpose-built sector of the small bus manufacturing industry is important because the companies involved represent the most committed firms in the industry. These companies first and foremost regard themselves as transit bus builders. Their products are not derivative ones. Although these manufacturers can and do use their purpose-built buses as the basis for other vehicles (e.g., luxury motor homes, emergency vehicles), the purpose-built, small transit bus remains primarily a transit bus. The design and manufacture of the vehicle "from the ground up" involves a major commitment of millions of dollars.

3.0 MARKET DEMAND

The diversity evident in the small transit bus market is not merely the result of the diverse, historical circumstances in which manufacturers developed small buses and entered the industry. Contemporary circumstances and factors inherent in the market also contribute to the diversity of this market and encourage a multiplication of vehicle features and concepts. This chapter discusses the nature of the market and its impact on the diversity of vehicle types. The market for small buses is an extension of the market for standard transit buses, but small buses are not simply compact economical versions of standard buses. The market for small buses, in large part, is directly related to unique features that small buses do not share with standard transit buses. These unique features are not necessarily common to all small buses. Different small buses occupy different niches in the market, with each niche related to one or a combination of special features. Thus, diversity is encouraged to the extent "new" unique and special features are created.

3.1 BACKGROUND

Buses are pieces of capital equipment purchased by an organization which intends to operate them to produce a service. To this extent, they are exactly analogous to the machinery purchased by a factory to produce a product. Just as the factory chooses only equipment specifically designed to produce its particular product efficiently, a bus operator must match its equipment with the requirements of the service to be provided. To select buses which were not designed to produce the kind of service the operator intends to provide could be very costly and inefficient.

All bus operators do not, of course, provide exactly the same service, and consequently, they do not all require buses with identical characteristics. One combination of characteristics may be ideal for providing a certain sort of service, while a different combination would be better for another service. The determination of what combination of price, durability, passenger capacity, appearance, accessibility, fuel economy, performance and so on is best has to made on a case-by-case basis. This is done when the transit operator making a purchase decision tries to match his requirements with bus models offered by manufacturers.

Manufacturers of buses generally try to form some understanding of the requirements of operators before designing and marketing a bus model. Armed with this understanding, they will try to give their model a combination of features which will be viewed as optimal for certain types of service by at least some operators. To the extent the manufacturer succeeds, his bus will be preferred over others by at least some operators for certain types of service. When a manufacturer is targeting a well-defined group of operators or type of service, he may be said to be seeking a special niche in the market.

Please note that the establishment of this special niche may be based upon making appeals both objective and subjective. The bus may be designed to meet the physical requirements of a type of service and it may be marketed to satisfy an operator's particular circumstances. A highly durable bus could be targeted to types of service with high daily mileage. An inexpensive bus might be targeted to operate with limited capital. A quiet, inconspicuous bus might appeal to operators with suburban, residential routes. A sleek look might be important to an image-conscious transit operator.

3.2 THE MARKET FOR STANDARD-SIZE TRANSIT BUSES

The market for small buses is by no means limited to urban transit, but the main interest of this report is small buses as transit vehicles. In addition, transit is a convenient point to begin an analysis of the market for small buses because of its visibility and familarity to many people. Moreover, the counterpoint with standard-size transit buses may provide useful comparisons.

The primary market niche for new standard-size transit buses is fixed-route, urban transit. The duty cycle associated with this type of service is characterized by slow speed operation, frequent stops, high mileage and variations in load. It is a difficult duty cycle. Nevertheless, because this one type of service predominates, all manufacturers of standard transit buses try to design their standard transit bus models to satisfy the physical requirements of this type of service and duty cycle. Designing for a different duty cycle is not considered feasible. To establish a special niche in the market, a manufacturer must focus his design and marketing efforts instead on features of his bus which will satisfy the special circumstances or preferences of some operators. Some standard transit bus manufacturers emphasize the utilitarian or traditional character of their bus models; others emphasize the advanced design character of their models; some try to do a little of both, promoting both traditional features and advanced design appearance. The differences among models, although they may be significant to some potential purchasers, are not radical and a frank appraisal must acknolwedge that much of the design and marketing effort is focused on relatively trivial features of the vehicle.

The transit market for small buses can be viewed as an extension of the market for standard-size transit buses. The analogy between transit buses and personal automobiles suggests that because small cars are preferred by some

people to big cars for economy of operation and lower price, then small buses should be preferred by some transit operators for the same reasons.

The substantially lower purchase price of most small transit buses and the obvious difference in passenger capacity might further suggest to some that particularly large economies might be available to a transit operator serving a route with a low passenger volume. "Why run a big bus half empty when a small, economical bus could do the job at a fraction of the cost?" Careful study, however, has found that in common, mainstream transit applications, small buses do not offer decisive economies in comparison to standard-size transit buses, even on routes with low average passenger loads.

There are three main reasons for this situation. First, the largest cost of operating a bus is the driver, and a small bus does nothing to reduce this cost, while it does limit the driver's potential productivity. Most transit service experience peak load periods at the beginning and end of the workday as people travel between their homes and their places of employment. During these periods, the full capacity of a standard-size transit bus will be needed. The cost of providing additional peak load capacity with many extra small buses would outweigh the cost of running the larger standard-size transit buses half empty during slack periods.

Second, there is a "hidden" tradeoff in vehicle life and maintenance cost. This "hidden" tradeoff is the determining factor for many transit operators. While a standard-size transit bus might have an expected life of 8-20 years with a capability to travel over one million miles, the life of most small buses is much less than this. The van-based small buses are only somewhat more durable than a passenger automobile, capable of traveling one-fourth to one-tenth the life mileage of standard-size transit bus. The cost of frequent replacement of a van-based bus running in transit service could quickly outrun the price of a

standard-size transit bus. Some purpose-built small buses approach standard transit buses in durability and expected vehicle life, but these small buses also approach standard transit buses in price. Most small buses are expensive in the same degree as they are durable.

Third, even on the routes which are not heavily travelled, the choice for most transit systems is not between a new small bus and a new standard transit bus: it is between a new small bus and an old, used standard transit bus. It is a common practice for many transit systems to concentrate their newest equipment on the most difficult, most heavily-travelled routes, and to transfer their equipment to less demanding service as it grows older. This is a sensible policy economically from two perspectives. First, it simplifies the task of maintenance. Unless the system was very large, it would be expensive and difficult to maintain different-size buses on different routes. More parts would need to be kept in inventory, mechanics would require broader training and the substitution of one vehicle for another when repairs were needed could be awkward since it might not always be possible to get the proper size match.

Second, using a older bus on a low ridership service reduces the opportunity cost of the equipment "invested" in services where it earns a lower "return" in terms of passenger miles travelled. Returning to the analogy between buses and personal automobiles, the choice can be very much like that faced by the man on a tight budget who must choose between a new subcompact economy car and an older, used full-size model, except that in the case of a bus, not only is the "price" of the full-size model lower, but there is a good chance that the operating and maintenance costs will be lower too. In addition, the full-size vehicle may even last longer.

The foregoing discussion is not intended to convince anyone that small transit buses ought never to be preferred to standard transit buses. It is

intended to clear away the belief that the principal demand for small buses is as compact, economic alternatives to standard transit buses in the most common transit services. With this understanding, it is possible to begin examining the cases in which small buses are to be preferred, and analyzing what aspects of small buses make them preferable in these cases.

3.3 SPECIAL FEATURES AND SMALL BUSES

Although small buses may not be well suited as an economical alternative to standard transit buses in most common urban transit services, there are niches which they have filled successfully. For the most part, these niches can be defined in terms of a feature of a small bus which distinguishes it either from standard transit buses or from other small buses. Smaller size and lower price are features of small buses which distinguish them from standard transit buses. Special equipment such as wheelchair lifts to provide handicapped access and novelty outfitting to create special bodies such as imitation trolleys are other distinguishing features.

Size - The common, distinguishing feature of small buses, by definition, is their size. Smaller size can be an advantage, because it affords greater maneuverability, because it offers a less intrusive presence, or because the service provided does not require a larger vehicle. Services to which the arguments about regular transit service might not apply include door to door demand/response services, paratransit services for the handicapped, and rural services. For these services, in some cases, peak travel periods may not be a major problem and meeting minimum service standards (e.g., minimum headway on scheduled routes or minimum response times) may mean very low passenger loads at almost all times.

The problem of intrusive presence is one which may be very important to a service in residential neighborhoods. The noise, diesel exhaust and intimidating size of standard transit buses may make them unacceptable in such settings. Road surfaces and bridge structures may not be adequate to handle the weight of a standard transit bus on a regular basis. Maneuverability, which is related to size, may also be a concern.

Passenger Capacity - All "small" buses are not small in the same degree and the smaller a bus is the greater the restriction placed on passenger capacity. Standard production vans represent one extreme in size. The seating capacity of vans ranges from line or the smaller version up to fourteen or fifteen in the extended length models. In addition to seating limitations, vans are also notable for their low headroom (about 54 inches from floor to roof). Passengers can not stand erect when alighting, and the headroom available in the rear or side entrances (about 48 inches) is not enough to allow wheelchair passengers to enter using a mechanical lift.

Vans are commonly modified to relieve the restrictions on headroom and seating capacity. The most common modification is a raised roof to increase interior headroom. This is done by removing the standard roof at or below the roof line and replacing with a steel, aluminum or fiberglass raised roof. With a raised roof, a van's headroom may be increased to 74 inches.

At least one company (Wide One Corporation) modifies vans to increase their overall width. This is done by widening the frame and extending the axles on a standard van. The increase in width may be up to 14 inches, affording the option of either an aisle or additional seating capacity.

The next step up in passenger capacity and accessibility are buses built on van cutaway chassis. The manufacturers of these buses typically build a body around a steel frame added to the chassis of a van cutaway. Less impeded by the original design of the van body, the bus body can be higher and wider. The exterior width of these vehicles varies from around 80" up to around 92". Passenger capacities have generally fallen into two categories: 12 to 16 passenger vehicles and 16 to 25 passenger vehicles.

Buses built on small forward control chassis mark another small increase in passenger capacity. In this case, the bus manufacturer is building the entire body of the bus and he is working with a somewhat larger chassis to begin with. These vehicles vary in width from 84 inches up to 96 inches and are generally a little longer than typical van cutaway vehicles. Passenger capacities range generally from 18 to 31.

Purpose-built buses do not generally improve much on the passenger capacity of small forward control chassis vehicles of similar dimensions.

Maneuverability - In the same way that all small buses do not lay claim to the same passenger capacity, neither can they claim the same maneuverability. In the case of maneuverability, the number of demarcations are not so numerous, but they are significant. At one extreme, a standard van, without lengthening, has the maneuverability comparable tc that of an automobile. At the other extreme, a standard 40-foot transit bus is a fairly ponderous vehicle, with a turning radius of 40 feet or more. A bus generally has a turning radius roughly equal to its length. Thus, a 30-foot bus has a turning radius, usually, of just under 30 feet. For purposes of maneuverability, the classes of small buses can be defined in terms of vehicle length. This is done for easy reference, although length is an imperfect substitute for turning radius.

Twenty-two feet and below appear to constitute one class, including most of the vans and van-based vehicles. Twenty-six foot and 30-foot buses constitute two additional classes, and include most of the purpose-built and small forward control chassis vehicles. There is evidently a sufficient difference between 26-foot and 30-foot vehicles that the 26 footers have a significant competitive advantage in some circumstances. Some manufacturers have sought to produce 26-foot vehicles (as well as 30-foot ones) in order to be able to offer more maneuverability.

Maneuverability is at a premium for services which must be provided in constricted areaas, along narrow streets, etc. Shuttle services provided in downtown areas, malls, and airports are prime examples.

Handicapped access - One of the largest niches filled by small buses has been been the one for vehicles equipped with features to aid the transportation of handicapped persons. Equipping converted vans with wheelchair lifts is one of the most prominent examples of how small buses have acquired these features.

Wheelchair lifts are not the sole point of development of features to enhance accessibility by the handicapped. Also notable are low-floor designs. Several manufacturers have attempted to develop durable, purpose-built designs which would have very low floors, making them easier to enter for the elderly and, in some cases, wheelchair-accessible by means of simple ramps rather than complex and expensive lifts. Recently, Neoplan Skillcraft, and Bus Industries of America have begun promoting purpose-built, low-floor, 26-foot bus models. The Neoplan "Lit'l Bus" and the Bus Industries "Orion II" appear to be aimed at similar market for heavy-duty, manueverable, highly-accessible vehicles. The Orion II with a kneeling feature offers a single step and wheelchair access with a simple ramp at the rear.

The handicapped access niche is a favorable one for small buses not just because they can be designed with necessary features such as low floors and wheelchair lifts, (standard tansit buses can have such features, too) but because transportation services for the handicapped often have characteristics favorable to small buses. For example, they may not have the periodic high peak loads of many regular transit services, average number of passengers may be low, annual mileage may be lower, the service may have to be provided along residential side streets, etc. It is the combination of necessary features and favorable service characteristics which creates this important niche for small buses.

Novelty bodies - One often overlooked niche for small buses has been in the area of novelty outfitting. Sometimes a community or a business will determine that it needs a bus that will also be something of an amusement ride. The bus may be needed as part of a tourist attraction or to promote some similar enterprise. One of the most common examples of novelty outfitting is to design a bus body to resemble an old trolley. This can be done with a special paint scheme and special seats, handrails, and entrance doors.

Several small bus builders have produced and promoted their "trolley" buses in recent years. These include Chance, Bogertown and LTP (Flxette).

Summary - This discussion of special features has necessarily been incomplete. It is in the nature of special features that they can be developed in endless degrees of significance and that the creation of new ones is limited only by the inventiveness of manufacturers. In fact, the most important point made in this chapter is that because small bus demand is so closely linked to special features, great variety among small bus models is inevitable and desirable. Standard transit buses tend to resemble each other in most respects because they are all aimed to fulfill the same or similar service requirements

of capacity and durability. Because very different conditions prevail in the small bus market, small buses vary greatly among themselves in all their characteristics.

3.4 DURABILITY AND SMALL BUSES

In Section 3.2, it was argued that small transit buses generally do not make good substitutes for standard transit buses in common urban transit services for two reasons:

1) insufficient passenger capacity to handle peak load conditions; and
2) insufficient durability in heavy duty transit service.

These two reasons are the barriers which a small bus manufacturer wishing to capture a share of the transit market must confront. The builder of a small transit bus cannot sell his bus to most of his potential transit customers because his bus is not big enough and his bus is not durable enough. Of course, there are many non-transit customers which may not require so large and durable a bus, but the obstacles to the largest and most visible market for buses are size and durability.

These circumstances naturally lead small transit bus manufacturers to seek to overcome these two obstacles. The only obvious way to increase passenger capacity is to build a larger bus. Indeed, it is not uncommon for makers of purpose-built 30-foot buses to eventually build 35- and even 40-foot versions of their bus, in order to compete in the standard transit bus market. Bus Industries of America, building the 30-foot Orion, is only the most recent example of a company doing this. (Bus Industries of America is building 40-foot Orions for Albany NY) Several builders of 30-foot small buses offer 35-foot versions currently. Among the current major builders of standard transit bus,

it may be noted that Gillig made its entry into the industry based, in part, on marketing 30-foot purpose-built buses.

Chance, a manufacturer of 25-foot purpose-built vehicles, has a novel solution to the problem of size. It offers an "Articulated Modular Transit Vehicle" which combines two of its vehicles, one powered and the other, an unpowered trailer. This solution to the problem of size has not been imitated, however, and it appears clear that a small bus manufacturer cannot pursue the most obvious method of overcoming size barrier (i.e., building a standard-size bus) without ceasing to be an exclusively small bus builder.

It is not so clear, however, that the small bus builder cannot increase the durability of his bus while remaining a small bus builder. Increased durability would increase the appeal of his vehicle for those applications in which passenger capacity was not the crucial reason for favoring a standard transit bus. Moreover, increased durability is an inherent competitive advantage in the market since it is equivalent to a price reduction for the operator who will realize lower maintenance costs or a longer vehicle life. Increased durability is a highly desirable quality in the competition both with standard transit buses and with other small buses.

The obvious conclusion to draw from this analysis is that small bus builders are motivated to persistently seek after increased durability in their vehicle designs. This seeking is not easily satisfied, since there are significant technical and economic obstacles to increasing small bus durability, but the seeking gives rise to one of the more remarkable and predictable trends in the small bus industry.

Small bus builders may be observed to be constantly emphasizing the durability of their vehicles in their advertising and marketing. All are apparently aware of the importance of durability to their customers.

Many manufacturers also seek to improve the durability of their vehicles through better design and better choice of purchased components. The increasing number of manufacturers offering purpose-built buses is part of the evidence for a tendency to seek to build more durable small buses.

There are significant obstacles, however, to achieving great durability in a small bus. Durability is a quality of the vehicle system and not of a single element in the system. Durability can not be purchased for the price of a larger brake or a heavy-duty diesel engine. Each component is part of the system. A larger brake may require a larger wheel or axle. A heavy-duty diesel engine will be heavier, and may require a larger starter, greater axle capacity, etc. Durability is often achieved in design by adding material and surplus capacity. Thus, designing for durability tends to lead in the direction of greater size and weight with attendant loss in fuel economy and a harder ride unless compensated in suspension. And, of course, cost increases, as well.

A second obstacle to producing a more durable vehicle is the limited availability of components. For a bus of a given size, the choices of complete chassis or key components such as engines or transmissions may be very limited. For producers of small forward control chassis buses or van cutaway chassis buses, there is a very limited selection of chassis available. General Motors is the only major producer of small forward control chassis, and there are only three major producers of van cutaway chassis. For a manufacturer of small, purpose-built buses, there is a limited selection of diesel engines available, and only one choice in domestic automatic transmissions.

The limited availability of domestic componentry and chassis has led some bus manufacturers seeking greater durability and other features to explore using foreign-built chassis or components. IVECO, a subsidiary at the Italian company, Fiat, has actively promoted the use of its Z-van chassis as a

substitute for U.S. van cutaway and small forward control chassis. Isuzu, a Japanese automo-bile and truck builder, has been trying to market bus chassis in the U.S. as well. Several bus manufacturers have been seriously considering using Isuzu 26-foot forward control chassis or Isuzu 31-foot rear engine chassis as a basis for their buses. Some have built prototypes, although none have announced production at this time.

The desire of U.S. small bus producers for greater durability is likely to continue to lead them to seek collaboration with overseas chassis and component producers promising durability. Whether they can gain significant improvement by this means is beyond the scope of this paper to determine. There is no evidence on whether more durable, heavier-duty chassis for small buses are, in fact, available abroad. Nevertheless, the acute and persistent need for durability will lead to experimentation and clearly offers opportunity for foreign manufacturers.

4.0 TRENDS IN THE SMALL BUS INDUSTRY

Viewing the small bus industry as a young, but maturing industry can lead to the identification of several important trends. By applying the model of the development of other, now older industries, the direction of these trends can be deduced.

Mature industries have several common features. It is interesting to try to discern whether the small bus manufacturing industry is headed toward developing similar features. Many mature manufacturing industries are dominated by a group of long-established firms whose relative positions and identities in the market are slow to change. The major U.S. automobile manufacturers, for example, have had the same rank in terms of market share for decades, and reputations and product ranges are well-known in the market. Similar statements could be made about industries as diverse as the breakfast cereal industry, electric motor industry, the school bus industry, and home appliance industry. Such stability is a common characteristic of mature industries because the long-established firms possess experience, the necessary assets (e.g., plant, engineering resources, etc.) and institutional supporting structures (e.g., dealers, a service network, etc.), which give them an overwhelming advantage compared to any potential newcomer.

Another common feature of mature industries is a standard product typology, to which all the firms tend to adhere. The typology, which categorizes the range of industry products according to one or more dimensions may be informal and casual or it may be extremely formal and even codified in a set of industry standards. The division of automobiles into categories like subcompact, compact, full-size is an example of an informal system. The electric motor industry's definition of various frame sizes and levels of insulation is an

example of an extremely formal typology, supported by a code of standards. The degree of formality is usually a function of the need of product purchasers to specify a desired type with technical precision.

Typologies become possible only after experimentation with various product configurations has led to a somewhat settled acceptance of certain configurations as standard.

A third common feature of mature industries is the existence of an industry association in which the leading firms cooperate in matters of public interest concerning their industry. Industry associations vary in their functions. Most collect statistics on production, sales and employment in their industry, in cooperation with the Bureau of the Census, or similar government agency. Most represent their industry before the Congress and regulatory agencies. Some coordinate the development of product standards, in cooperation with technical societies. Some conduct market research or coordinate technical research programs for the common use of their members. An industry association forms when an industry has achieved a certain level of self-consciousness. There have to be a number of companies in the industry which identify themselves primarily with that industry. A major motivating force behind the formation of an industry association is usually the desire for more accurate production statistics and marketing information. As companies commit increasing amounts as investment in an industry, the value of accurate marketing information on which to base financial plans increases accordingly.

Recent developments in the small bus manufacturing industry indicate that it is maturing, and from this maturing trend, it may be deduced that there is or will be a tendency for the industry to become more like other mature industries in several respects. Several companies in the industry have recently made major

committments in terms of plant investment and design engineering for small buses. These companies may well represent a growing, committed and self-conscious core for the industry. Certain vehicle types have emerged as standard for the industry, with several manufacturers producing similar vehicles. The industry does not have an industry association to gather production and sales statistics, but the need for one is becoming clearer. Nor, are there industrial standards specific to this industry, although again, it is clear that the need exists.

In terms of the maturing of the industry, one of the most encouraging trends has been the growth of the purpose-built sector. The number of firms making the committment to design and build a small vehicle especially as a bus has been increasing steadily. Since the failure of Highway Products, the pioneer in the field, the Chance RT-50, Orion, Bluebird Citibus, Thomas Citiliner, Skillcraft, Carpenter CBW 300, Neoplan Lit'l Bus and Orion II have been introduced to the market. At least four of the companies behind these buses have been in the market now for over five years with a purpose-built vehicle, an indication of the stability of these companies. The only major manufacturer to withdraw from the market recently - TMC, builder under license of the Orion - was quickly replaced in the U.S. by its licensor. Substantial investments in new plants have been made recently to build the Orion in Utica NY and the Carpenter CBW 300 in Indiana.

This trend is important because of the committment it implies. Modifying vans is a relatively simple business, requiring little investment. The statement, "anyone with a blow torch can do it," is only a slight exaggeration. It is easy to get into and easy to leave behind, and a firm modifying vans need

not commit itself to product development or substantial customer support. Building body-on-chassis vehicles is a somewhat more demanding manufacturing process and business than modifying vans. More engineering expertise and equipment is required to fabricate a complete body, although the chassis can still be purchased complete. The scope for product development is limited because the bus builder has limited control of chassis. Although the body-on-chassis bus builder has somewhat greater investment in his manufacturing process, his committment to the bus market is still fairly limited. If his transit bus is not a complete success, he can perhaps build a school bus or a recreational vehicle using the same methods and tools.

The builder of purpose-built buses, however, has committed greater investment in engineering design to put together his own chassis. The investment in fabrication methods is likely to be substantially greater due to the chassis building task and a greater reliance in the body building task on welding and riveting steel over bolting steel and glueing fiberglass. Having committed itself to a purpose-built design, a firm has also committed itself to the transit market. The purpose-built transit bus is also likely to be unnecessarily durable and prohibitively expensive for most school bus and recreational vehicle applications.

There are indications of increasing stability as well in the body-on-chassis sectors where the appears to be increaasingly settled agreement on certain vehicle types. Although there is still great diversity, manufacturers have begun to imitate each other in producing rival models in certain categories. Producers of van cutaway chassis buses, for example, have often imitated the Wayne Transette, producing vehicles with similar specifications, dimensions and appearance.

Contributing to this gradual establishment of vehicle type categories has been the pre-existing rivalry among the major school bus builders. These companies, closely matched in size and competing against one another in the school bus market for many years, have entered the transit market with an acute awareness of the activities of each other. Through a combination of having similar resources and motivations and a consciousness of each other, these companies have tended to introduce similar ranges of bus models aimed at the transit market. Although not every company has matched the others in every niche, there has been enough similarity to establish a pattern for the whole small transit bus market. Van cutaway buses, small forward control buses and 30-foot rear engine purpose-built buses have been introduced to the transit market by several or all of the five major conventional school bus manufacturers.

The growth of a committed core of companies who think of themselves as small transit bus manufacturers and an increasing awareness of being rivals with others producing similar vehicles are significant events which may be leading toward some forms of coordinated action in the small bus manufacturing industry. There are two areas where there is an apparent need for coordinated action. The first is in the matter of statistics and the second in the matter of industrial standards. No reliable statistical information exists on the small bus market or on industry production. This information, which is vital for planning, would be extremely valuable to a company considering major investments. As more companies face these decisions, this becomes more acute.

The matter of standards has an unfortunate history. In the mid-1970s, there were many urging whole-vehicle standardization on the new small bus

manufacturing industry. Standardizing on one vehicle (or one chassis), produced by several companies, would permit great economies of scale, it was argued: It would be possible, to use a more specialized and durable design in a standard small bus than was available using designs derived from vans or school buses or motor homes. The analysis of the market in this report indicates that the market for small buses is fragmented into many niches, a fact which has become more apparent since the mid-1970s. This fragmentation works against whole-vehicle standardization.

The same fragmentation, however, makes the need for standards of another sort more acute. Industrial standards exist in many industries to serve various functions. One of the most important functions is communication. Standards can be defined in precise and elaborate terms and then referred to in an easy shorthand that simply names the standard. Standards are most useful in industries where there is great product variety, especially when the products vary in qualities that are difficult to define, such as durability. At the present time in the small bus manufacturing industry, there are no standards to define differences in durability. There are no standards to define common contract terms, e.g., aisle width, which may be subject to different measuring procedures. There are no standards for color-coding or routing electrical wiring, even though there may be significant maintenance cost impacts. The need for standards is reflected in the efforts of transit operators to develop ever-more specific and elaborate bid specifications and procurement procedures.

The increasing length and technical complexity of contract specifications are likely to lead small transit bus manufacturers to consider cooperating to establish industrial standards. The increasing cost of coping with idiosyncratic approaches to problems of technical specification is likely to

lead to cooperative efforts to establish standard approaches in the form of industrial standards.

Although formation of some sort of industry association to deal with developing statistics and standards seems likely, the exact form of this association can not be determined. Given the small size of the industry, establishment of an association as an offshoot of a larger organization appears plausible. An association might be formed with the producers of standard transit buses, whose numbers have increased substantially in recent years. An already existing association which includes many of the companies in question might form a conference of small bus builders. The Truck and Bus Body Builders Association or the Recreational Vehicle Manufacturers Association, for example, already number quite a few small bus builders in their memberships. A combination user and manufacturer organization might be formed, particularly if the primary focus was to be on developing standards. Such an organization could be independent or could be an offshoot of a larger organization such as APTA or the American Association of State Highway Transportation Officials (AASHTO). (Brief profiles of existing industry associations with an interest in transit are included in Appendix B.)

Despite the trend toward establishment of an industry consciousness, the increasing number of purpose-built buses and the prospects for an industry association, it would be wise to keep in mind that small transit buses manufacturing is still very small relative to other sectors of the small vehicle manufacturing industry. A reasonable order of magnitude estimate of small bus production excluding modified vans, but including 30-foot and smaller purpose-built units and body on truck or van chassis units would be 1800 to 3000

TABLE 2. COMPARATIVE VEHICLE PRODUCTION STATISTICS

	1982
RECREATIONAL VAN CUTAWAYS[1]	18,000
RECREATIONAL VAN CONVERSIONS[1]	111,300
CONVENTIONAL MOTOR HOMES[1]	19,300
SCHOOL BUSES[2]	25,000
SMALL TRANSIT VEHICLES[3]	1,800-3,000

[1]RECREATIONAL VEHICLE ASSOCIATION

[2]MOTOR VEHICLE MANUFACTURERS ASSOCIATION

[3]TRANSPORTATION SYSTEMS CENTER ESTIMATE

vehicles annually. As can be seen in Table 2, this compares with production of 25,000 school buses in 1982 and nearly 150,000 recreational vehicles and motor homes. For the many companies in the small transit bus manufacturing industry who are also in these other industries, transit buses are not going to be their primary interest. This is an important perspective to maintain.

5.0 SUMMARY OF FINDINGS

The problems originally addressed by this study were to explain and understand the diversity in the small bus manufacturing industry, and to identify trends. There are, it was observed, a large number of manufacturers and a confusing array of different types of vehicles. The explanation developed was partly historical and partly a matter of market demand.

Historically, the industry is a relatively young one. Small buses are, in some ways, a new idea and when a demand for small buses was felt in the 1960s and 1970s, a large number of firms producing other kinds of small vehicles possessed at least some of the prerequisites for building small buses. Declines in the recreational vehicle and school bus market impelled many firms building recreational vehicles and school buses into the small bus market. The history of the development of the small bus industry helps to explain why there are so many different small bus designs because it shows the connection between small bus technology and van, motor home, small delivery truck and school bus technology. It also helps to explain how so many firms came to attempt small bus production.

An examination of the market demand for small buses extends understanding of the diversity by identifying a number of factors which tend to preserve diversity in the present and encourage future diversity. The market for small transit buses is very different from the market for standard transit buses. While the market for new standard transit buses is sharply focused on the requirements of urban transit systems operating fixed route services, the small bus market is itself very diverse. Small bus manufacturers are responding to the requirements of a wide variety of services: demand-response, paratransit,

shuttle, and others. Special features to satisfy the particular needs of one or more services are a key element in the product design and marketing strategies of many small bus manufacturers. Examples of such features include: vans modified to have a raised roof to facilitate entry by the elderly or handicapped; wheelchair lifts; low-floor vehicles; and novelty outfitting (e.g., imitation antique trolleys). Several levels of durability and price are featured, as well.

This examination of diversity leads to a new view of the small bus industry and some observations which have important implications for the future and for transit operators who may consider using small buses. To put this new view into perspective, it may be useful to recall an older view of the small bus manufacturing industry. In the past, the diversity and youth of the industry have been interpreted by some as signs of instability and disorder. Small buses have been seen as needed economical alternatives to standard transit buses in regular transit services. Based on this view, standardization of vehicle design to permit manufacturing economies of scale has been advocated to solve the problem of combining low initial price and durability.

The view put forth in this study is that diversity is the natural result of both historical circumstances and current market forces. The apparent instability of the industry can be laid to its relative youth and the dependence of firms in the small bus market on other unrelated markets. The great diversity of vehicle types can be understood, at least in part, as a natural response to a market which demands small buses with widely disparate characteristics. Whole-vehicle standardization would clearly be considered counterproductive in the small bus market, in this view.

This view of the small bus manufacturers as a relatively young industry also leads to the identification of some important trends associated with the inevitable maturing of the industry. It was noted that:

- The number of firms building purpose-built vehicles is increasing.
- Several companies have invested substantial sums in bus design and new manufacturing plants.
- Definite vehicle types are beginning to emerge as rival companies deliberately produce similar ranges of bus models.

Based on the established trend toward greater maturity, and apparent need, the formation of an industry association to develop market statistics and industrial standards appears likely.

APPENDIX A

SMALL TRANSIT VEHICLE MANUFACTURER PROFILES

COMPANY: Adaptive Driving Systems
ADDRESS: 21011 Itasca, Unit G, Chatworth, CA 91311
PHONE: (213) 998-1026
CONTACT: Mr. Chuck Kutz

Adaptive Driving Systems produces custom vans, modified vans for handicapped use, and converted vans for a variety of uses. The company was started as a van conversion company in 1977. Production is approximately 300 vans per year with about 75 vans per year modified for handicapped use. The company has built vehicles for the Federal Government, hospitals, insurance companies, and hotels, as well as for individual use.

COMPANY: Advanced Mobility, Inc.
ADDRESS: 12555 Sherman Way, North Hollywood, CA 91605
PHONE: (213) 982-1004
CONTACT: Mr. Scott Deacon

The company modifies stock vans and cars to transport, or be driven by, the physically disabled. Conversions range from six wheelchair capacity, extended headroom transporter vans to quadraplegic driver vans, to a low floor front wheel drive mini van incorporating ramps instead of lifts.

Founded in 1975, Advanced Mobility, Inc. modifies vehicles to order, with a production rate of 150 vehicles per year. The company manufactures and distributes wheelchair restraints and other handicapped equipment to installers nationwide.

COMPANY: American Transportation Corporation
ADDRESS: Highway 65 South, Conway, AR 72032
PHONE: (501) 327-7761 x 106
CONTACT: Mr. Joe Clark

American Transportation Corporation (AmTran) is a privately owned company that has been building buses for 50 years. The company's main product line is school, military and commercial buses. Recent orders for buses came from various school districts, the U.S. Army and the U.S. Air Force. About 75 percent of AmTran's sales are for school buses.

Before February 1981, AmTran was called MBH, Inc. MBH, Inc. was formed in 1980 by a group of investors, including some Ward bus distributors, to take over the then-bankrupt Ward Industries, Inc. The takeover was completed in November 1980.

Ward Industries was started in 1933 when D.H. Ward, a blacksmith, was asked to put a bus body on a Ford truck chassis. The company grew to be one of the major bus body builders in 1960's and 1970's. Late in the 1970's, the company attempted to expand, based in part on sales of buses to Middle Eastern countries, and an expectation that large numbers of commuter buses could be sold domestically. This expansion led to the company's bankruptcy.

In the early '60's, the company produced not only its regular line of school buses, but also entered the small school bus market due to the demand for small school buses and for small transit vehicles. Although sales of small buses has been rising, 85 percent of AmTran's sales are for large buses.

Today, AmTran manufactures a variety of school buses. The vehicles are body on chassis construction and built to order with General Motors, Ford & International chassis available.

In 1981, the company introduced a small school bus model built on a van cutaway chassis, called the Vanguard. A year later, a more sophisticated version of the Vanguard, called the Vanguard VCS, was brought out for commercial applications as a shuttle.

Recently, AmTran introduced the Ward "Patriot", which has a semi-forward control design that provides increased seating capacity of up to 78 passengers, allows for easy maintenance and is less expensive than full forward control designs. The company also produces a conventional school bus model (called the Volunteer) and a van conversion vehicle (called the Minuteman).

AmTran's main plant, first built by Ward Industries, Inc., is located in Conway, Arkansas. The Conway plant currently has two assembly lines and has increased its summer payroll from 800 to 1200. The newer of the two assembly lines builds two small buses, the Minuteman and Vanguard. Production capacity for the main plant is 32 buses per day. The small bus line capacity is approximately 5 buses per day. Total annual production for 1982 was approximately 5000 vehicles.

COMPANY: Armbruster/Stageway, Inc.
ADDRESS: P.O. Box 1178, 7300 South 28th St., Fort Smith, AR 72902
PHONE: (501) 738-3121
CONTACT: Mr. Ross Barrows, Pres.; Mr. Milt Earnheart, Vice-Pres.

Armbruster/Stageway, Inc. was founded as Armbruster and Company in 1887 to build and repair horse-drawn vehicles. By the early 1920's, the business had expanded to include automobile repair work. In 1923, Armbruster first stretched an automobile into a small bus. Stageway Coaches, Inc. was incorporated in 1962 to handle sales for the Armbruster Company manufacturing firm. The two corporations were combined as Armbruster/Stageway, Inc. in 1966. The firm currently produces over 1000 units per year in limousine conversions, convertibles, crew cabs, and suburbans. Armbruster/Stageway operates in three facilities in Fort Smith, occupying a total of 140,000 square feet and employing 180 people. Its customers include limousine operators, funeral directors, oil and gas companies, governmental agencies, and celebrities and heads of State in the United States, Europe, and the Middle East.

COMPANY: Blue Bird Body Co.
ADDRESS: P.O. Box 937, Fort Valley, GA 31030
PHONE: (912) 825-2021
CONTACT: Mr. George; Albert L., Jr.; Joseph Luce, Presidents

Blue Bird Body Company, a builder of school and other type buses, has been in business under the Luce family for over 60 years. Mr. Albert L. Luce, Sr. was the founder of the company. His sons, George, Albert, Jr., and Joseph now own the Blue Bird Body Co. business. Their product lines are school buses, transit buses, and motor coaches.

In 1975, Blue Bird entered the transit bus business because of GMC's and Flxible's exit from the small bus market and also because of a decline in the school bus market. Currently, Blue Bird offers a 26 foot and 30-foot version of the City Bird for the transit bus market. The advantage of the City Bird is a shorter turning radius and a clearer driver perception in city driving. Blue Bird now has buses operating in over 60 different city transit properties. Blue Bird's manufacturing plants are in Fort Valley, Georgia; Brantford, Ontario; Mt. Pleasant, Iowa; and Buena Vista, Virginia. City transit buses are built in the main plant at Fort Valley.

COMPANY: Boyertown Auto Body Works, Inc.
ADDRESS: P.O. Box 418, Boyertown, PA 19512-0418
PHONE: (215) 367-2091
CONTACT: Mr. Harry Yoder

Boyertown Auto Body Works, Inc. was formed in 1872. The first vehicle produced was a doctor's buggy. In 1890 the company produced its first transit stagecoach. The main product line of the company became trucks and medium size buses during the 1920's and '30's. The company produces 16 to 44 passenger trackless trolley buses and other small buses. Average annual production is 2000 vehicles of all types, including 100 small buses and 70 trolleys. The company has four plants with its main offices in Boyertown. Recent customers include the Lowell National Park; Anheuser Bush, Inc.; and the University of Oklahoma; Fort Worth, Texas; Grand Rapids, Michigan; and Bethlehem, Pennsylvania.

COMPANY: Braun Corporation
ADDRESS: 1014 S. Monticello, P.O. Box 310, Winamac, IN 46996
PHONE: (219) 946-6157
CONTACT: Mr. Michael Bruno

The Braun Corporation was founded in 1964 by Ralph W. Braun, himself a handicapped individual, as a producer of wheelchair lifts and converted vans for the handicapped. When the 16 (b) 2 program was started these two programs were combined and the company currently modifies stock 15 passenger vans with paratransit interiors, semi-automatic and fully automatic wheelchair lifts, wheelchair restraint systems, and a reinforced roof that meets Federal Motor Vehicle Standard #220. Wheelchair lifts are still the company's main product. Total annual paratransit production is over 100 vehicles. Major customers include 16 (b) 2 programs, nursing homes, hospitals, and individuals.

COMPANY: Broughman Industries, Inc.
ADDRESS: 14320 Romona Ave., Chino, CA 91710
PHONE: (714) 597-1893
CONTACT: O.J. Hawkins, Pres.; Lee Moses, V.P. Engineering

The company began building converted and modified van type vehicles 14 years ago. Their primary product line is motor homes. Annual production of small transit vehicles is currently low since the company is concentrating on RV and special executive vehicle construction. Recent small transit vehicle customers include Northrop Aircraft Co., Hawthorne Co., Southern California Edison, and Bacthel Power Co. Broughman has abandoned all aspects of the bus market except fleet orders and/or ride-sharing customers.

COMPANY: Bud Industries, Inc.
ADDRESS: 100 Pulaski Street, West Warwick, RI 02893
PHONE: (401) 822-2352
CONTACT: Mr. Edward Viggiano, Mr. Edward Weygand

This company was founded in 1971 and started building its own small transit vehicles in 1973. The main product line is evenly divided between light transit vehicles, elderly and handicapped vehicles, and small school buses. Other product lines include the manufacture of a full line of fiberglass components used in the transit industry. Bud Industries, Inc. also offers a line of glass windows made for small bus application. Total annual production is approximately 500 vehicles. Major recent customers included 16 (b) 2 programs in Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, West Virginia, and Ohio.

COMPANY: Bus Industries of America, Inc.
ADDRESS: Base Road R.D.I., Oriskany, NY 13424
PHONE: (315) 768-8101
CONTACT: Gord Nevison, Sales Manager

Bus Industries of America is the U.S. subsidary of Ontario Bus Industries, Inc., a Canadian firm headquartered in Mississauga, Ontario. Ontario Bus Industries, Inc. is descended from another company, Ontario Bus and Truck, which had been in the business of repairing and rebuilding buses and trucks for many years. In 1976-1977, this company developed a prototype purpose-built bus and went into actual production in 1978. In 1979, Ontario Bus Industries sold a license to manufacture and sell the bus in the U.S. to TMC, a manufacturing subsidiary of Greyhound located in Roswell, N.M. The TMC Citycruiser, produced from 1979 to 1981, was the result. Ontario Bus Industries repurchased the license in late 1981 and resumed selling in the U.S. Bus Industries of America was established with a plant near Utica, N.Y. and began production in 1982.

The principal product of Bus Industries of America is a purpose-built transit bus, called the Orion, available in 30-foot, 35-foot and 40-foot lengths. Including approximately 950 TMC-produced Citycruisers, over 1400 Orions have been produced. In late 1983, the company began marketing the Orion II, a low-floor transit bus designed to also be appropriate for handicapped services by virtue of its high degree of accessibility. Several prototypes are being tested and production is planned for late 1984.

Two production plants are in operation, with the Mississauga, Onatrio plant producing approximately one and one-half Orions per week and the Bus Industries of America plant in Orishrang, N.Y. turning out about five per week. About 80 people are employed at the Orishrang plant.

COMPANY: California Custom Design
ADDRESS: Fabric Engineering Space Center Building 831A, Mira Loma, CA 91752
PHONE: (714) 685-0151
CONTACT: Mrs. Sherley Kowalke, Administrative Secretary

The company was founded in 1966 to convert and customize vans. The main activity is van conversion. The company converts approximately 150 vehicles per year. They have built commuter van vehicles for the Fluer Corporation and Xerox's southern California operation.

COMPANY: Carpenter Body Works, Inc.
ADDRESS: 1500 W. Main St., P.O. Box 128, Mitchell, IN 47446
PHONE: (812) 849-3131
CONTACT: Mr. Mike Mayden

Carpenter Body Works has been a leading bus manufacturer in the U.S. for 60 years. Currently, it produces two types of buses for the transit market: the midsize Carpenter CBW 300 and the small Carpenter Cadet. The 30-foot CBW 300, seats 35 passengers and is designed for long-life, heavy-duty service. The CBW 300 is produced at Carpenter's $7.5 million facility in North Vernon, Indiana. The smaller Cadet is available in capacities up to 27 passengers with an interior height of 6 feet 7 inches and width of 90 inches.

COMPANY: Champion Home Builders, Co., Commercial Vehicles Division
ADDRESS: P.O. Box 158, 331 Graham Road, Imlay City, MI 48444
PHONE: (313) 724-6474
CONTACT: Robert Maison

Champion was founded in 1953 to produce mobile homes. In 1968 the company produced its first Class A recreational vehicle, and in 1971 produced its first Class C RV. In 1981, the company started producing medium-duty buses at the Imlay City Plant. In 1982, the company produced 559 Class A and 680 Class C RV's, and 175 medium-duty buses. The company produced 284 Class A and 370 Class C RV's and 151 medium-duty buses from January to June of 1983. The company has 28 plants in the U.S., with its home office in Dryden, Michigan.

COMPANY: Chance Manufacturing Co., Inc.
ADDRESS: 4219 Irving, Wichita, KS 67277
PHONE: Sales Office: (214) 742-3802 Factory: (316) 942-7411
CONTACT: Mr. Joe Diehl, Sales Manager, Coach Division

The company traces its history to the Ottaway Amusement Co., founded in 1945. In 1950, R. Harold Chance decided to establish a separate manufacturing operation to build miniature steam trains and other amusement park rides. The manufacturing operations were situated on their present site in west Witchita in 1960. Chance remains today a leading producer of amusement park rides.

In 1976 Chance purchased Minibus Co., a Los Angeles-based subsidiary of MCA, Inc., the entertainment conglomerate which owns Universal Studies. Minibus Co. produced small buses which were used for Universal Studio tours and which had been marketed to transit operations since the mid-1960's. Shortly before the sale, Minibus introduced a new, more heavy-duty model, the RT-50, replacing the body-on-chassis bus which it had been building for several years. In 1981, the company introduced its Articulated Modular Transit Vehicle (AMTV). The AMTV consists of an RT-50 pulling an unpowered, but nearly-identical-looking "trailing module." Both axles of the trailing module steer. The RT-50 25-foot bus seats 25; the AMTV seats 55. The RT-50 features an extra-wide side door which can be equipped with a wheelchair lift. Chance also produces a trolley-replica bus using the RT-50 running gear.

Chance produces about 50 vehicles a year.

COMPANY: Coach & Equipment Manufacturing Corp.
ADDRESS: P.O. Box 36, Penn Yan, NY 14527
PHONE: (315) 536-2321
CONTACT: Richard L. Kreutziger

The company is an outgrowth of a carriage/wagon building company which moved to bus building in the 1920's. Currently, the company builds small to medium size transit buses, tram units, specialty vehicles and small school buses. Total annual production is approximately 250 transit type vehicles and 500 school buses. The vehicles are built to order. Recent sales have been made to Chicago RTA, UPTRAN in Michigan, and New York State 16 (b) 2 Programs.

COMPANY: Collins Industries Inc.
ADDRESS: P.O. Box 58, Hutchinson, KS 67504-0058
PHONE: (316) 663-4441
CONTACT: Mr. Ron Peters

Collins Industries, Inc. started producing Type II school buses in 1972, and added small transit buses in 1979. Production of school buses and transit buses totals nearly 1000 per year, with transit buses representing approximately 150 of this total. Collins' main product lines, in addition to buses, are ambulances, electro-hydraulic wheelchair lifts for handicapped transportation, fire trucks and funeral coaches and limousines. This mix of specialty vehicles is built to order, and is sold to distributors across the country who deal with the vehicle's owners. Collins Industries buses are marketed in Canada by Girardin Vehicles Industries, Ltd.

COMPANY: Continental Co.
ADDRESS: 16951 Murphy Ave., Irvine, CA 92714
PHONE: (714) 863-0511
CONTACT: Mr. Miles Mallard

In 1980, Continental Co. started producing a medium-sized 32 passenger transit bus. The company's main product line is transit buses. The two models it produces are the Midtrans 830, a 30 foot bus, and the Midtrans 825, a 25 foot bus. Twelve buses are produced annually and there are 15 employees. Customers include Dollar Rent-a-Car, Budget Rent-a-Car, and Dupont.

COMPANY: Coons Manufacturing (Diamond People Movers)
ADDRESS: 2300 West Fourth St., Box 489, Oswego, KS 67356
PHONE: (316) 795-2191
CONTACT: Mr. Bud Coons

Coons Manufacturing began as an innovative producer of RV's in the 1950's. In 1978, the company expanded its production with converted van type small buses. The main product line is now evenly split between RV's and small transit vehicles, with total annual output between 850 and 1020 vehicles. The company supplies its buses mainly to tour operators.

COMPANY: Dutcher Industries
ADDRESS: 7644 Trade Street, San Diego, CA 92121
PHONE: (619) 578-5502
CONTACT: Mr. Ian Stevenson

Dutcher Industries was formed in January 1970 in response to the "Caltrans Clean Car Project," a program to develop a steam engine car. Later, the company built a prototype taxi for an UMTA demonstration in New York. The company has worked closely with the taxi industry. In 1983, the company was building a production prototype small transit vehicle and marketing it to several cities.

COMPANY: Flxette, Inc.
ADDRESS: P.O. Box 410, Evergreen, AL 36401
PHONE: (205) 578-1820
CONTACT: Mr. Wayne Bell

Flxette, Inc. was founded in 1940 as the Southern Coach & Body Company, and produced its first vehicle, a school bus, in the same year. Until 1964, Southern Coach & Body Company produced a variety of transit vehicles, primarily for the military. In 1964 Southern Coach & Body was bought by the Flxible Corporation. In the same year, the Flxette was introduced as a small body on chassis version of Flxible's large transit bus. In 1970 Rohr acquired Flxible and in 1975 production at the Southern plant ceased. In 1976 the plant, equipment, and rights to the Flxette were acquired by Leisure Time Products, Inc. The Flxette was returned to production in August 1980, and is currently being built in five versions from 19 to 35 passenger capacities. Total annual production for 1982 was approximately 52 vehicles and 1983 production is estimated at 100 vehicles. There are 74 people employed by the company. The company currently produces a step van (Flexvan), a small bus (Flxette), and high cube cargo body van conversions. The company is planning to introduce a trolley-body style bus in the near future and has an order for five from the city of Birmingham's Transportation Authority.

COMPANY: Funcraft Vehicles Lt. (Canada)
ADDRESS: 165 Shedon Drive, Cambridge, ONT. CANADA NIR 6T8
PHONE: (519) 621-9310 (FTS: 970-6200)
CONTACT: Mr. Rodger Pascoe

Funcraft Vehicles, which originated as an ambulance manufacturer, began building small transit vehicles from ambulance bodies. The company's main products are RV's and specialty vehicles, such as ambulances. Annual production of STV's is very small.

COMPANY: General Mobility
ADDRESS: 265 Rte 10, East Hanover, NH 07936
PHONE: (201) 887-7500
CONTACT: Mr. Barry Colton

General Mobility, founded in 1978, is involved solely in the conversion of vans and buildings for use by the handicapped. Van production is currently 24-36 units per year. The company's employment, currently six, has varied between five and fifteen people. General Mobility's customers, who are primarily in the New Jersey area, include NJ Association of Retarded Citizens, Westchester City Medical Service, and similar organizations.

COMPANY: A. Girardin, Inc.
ADDRESS: 33 Highridge Court, Cambridge, ONT., CANADA NIR 7L3
PHONE: (519) 622-0666
CONTACT: Mr. Jean-Marc Girardin

A Girardin, Inc. has 25 years of experience in the bus industry. The company produces school buses and commercial buses with a seating capacity up to 20 passengers. It specializes in vehicles for the physically disabled, saf-t-lifts, and the Queen restraint system for wheelchairs. Girardin is also the Canadian distributor for Collins Industries buses.

COMPANY: Gresham Driving Aids
ADDRESS: 30800 Wixon Road, Wixom, MI 48096
PHONE: (313) 624-1533
CONTACT: Ms. Carol Gresham

The company was formed in 1958. Its original business was the production of hand controls for motor vehicles. The founder was a handicapped person. The company was first incorporated in 1971 and began van conversions in 1974. VA and FDA-approved hand controls continue to be produced. Van conversions, including both 16(b)2 and personal vehicles, number about 250 per year.

COMPANY: Hames Bus Sales
ADDRESS: 5602 East Belmont, Fresno, CA 93727
PHONE: (209) 251-8332
CONTACT: Mr. Kent Hames

The company was formed in 1960 as Superior Bus Sales, a business that sold Thomas and Superior buses. In 1965, the name of the business changed to Hames Bus Sales. In 1967-68, Hames began to modify vans into class II school buses. Hames is also involved in leasing school buses, with 90 percent of its buses being leased to "political subdivisions." Total annual production has been decreasing with the entry of large manufacturers in the market. In 1972-75 Hames produced 300-400 buses per year, compared to its current production of 50 buses per year. Customers include individuals, companies, senior citizen villages and hospitals.

COMPANY: HCI (Handicapped Conversions, Inc.)
ADDRESS: 2516 W. Pennway, Kansas City, MO 64108
PHONE: (816) 471-0305
CONTACT: Mr. Larry Wanger

HCI/HANDICAP CONVERSIONS, INC. began operation in February 1980 by converting standard vans into private vehicles for the handicap individual. The vehicles built by HCI has expanded to include mini-buses and multi-purpose vehicles for state and private agencies for the aged and handicapped, retirement communities, transit companies and car-rental companies. Vehicles built HCI range from mini-buses seating of 8-14 passengers to small buses seating up to 25 passengers.

COMPANY: Landmark
(Note: see National Coach)

COMPANY: Mid Continent Conversion Company
ADDRESS: MAILING: P.O. Box 10649
PLANT: 700 N.E., 76th Street, Gladstone, MO 64118
PHONE: (816) 436-7550
CONTACT: Mr. Jim Olson

The company was founded in 1972. Their main product line is specialty vehicles, ambulances, converted vans and 16(b) vehicles. In 1979 the company expanded into STV production from ambulances. Current total annual production is 50-75 units per year, which is much less than its production of 100 vehicles per year before 1981. The decrease in production is attributed to the recession. The company employs 20 people.

COMPANY: Mid West Handicap Equipment (Mike's Mobil)
ADDRESS: 510 W. 5th St., St. Charles, MO 63301
PHONE: (314) 946-5310
CONTACT: Mr. Michael Gilbert

The company went into business when another company in the van coversion business went under and sold its equipment. The company's main product line is converted vans. Total annual production is approximately 20 to 25 vehicles per year. A recent customer has been the City of St. Louis.

COMPANY: Mobility Dynamics
(see Adaptive Driving Systems)

COMPANY: National Coach Corporation
ADDRESS: P.O. Box 2309, Gardena, CA 90247
PHONE: (213) 538-3122
CONTACT: Roger Hess

The company's main product line includes small and mid-size transit and paratransit vehicles. The commercial bus division is some ten years old. The total corporation annual sales approach $50 million.

The company has expanded its product line to include van pool units, high head room mini-buses, body on chassis mid-size units (with and without rear storage) and a million mile 30-foot transit bus.

COMPANY: Matthews Buses, Inc.
ADDRESS: P.O. Box 369, Danville, NY 14437
PHONE: (716) 335-6091
CONTACT: Mr. Matthews

The company was incorporated in 1971. Currently, the company produces specialty vehicles; police cars, fire trucks, and mobile libraries. Matthew Buses distribute Thomas & Braun buses.

In 1967 Matthews buses started converting buses. Thomas buses are modified for 16(b) 2 programs. The main product line of the company is air suspensions for Thomas buses.

COMPANY: MCR Technology
ADDRESS: 55 Depot Road, Goleta, CA 93117
PHONE: (805) 964-0671
CONTACT: Mr. Romano

MCR Technology is descended from Minicars, Inc., an engineering consultancy which was involved in producing prototype safety vehicles for the National Highway Traffic Safety Administration in the 1970's. In 1980, the company, in a joint venture with the West German firm, Walter Velter GmbH, sold some specialized 40-foot electric shuttle buses to Denver. The company continues to promote standard and articulated Velter buses in the U.S., having delivered 19 buses in 1982. In 1983, the company introduced the MCR 8200 DL Diesel, a 28-foot bus capable of accomodating 22 seated passengers and 17 standees.

COMPANY: Medical Coaches, Inc. (Medicoach)
ADDRESS: Box 129, Oneonta, NY 13820
PHONE: (607) 432-2444
CONTACT: Mr. Al Collins

Medicoach began producing mobile medical units for Mexico and Cuba in 1949. The main products of the company are specialty vehicles including ambulances, van conversions, wheelchair vans and 16(b) 2 type vehicles. The company produces an average of 300 vehicles per year with $5-6 million in sales. Medicoach has resumed production of ambulances after a four year lapse. The firm's customers include hospitals, nursing homes, and 16(b) 2 programs.

COMPANY: Neoplan (Rolf Ruppenthal & Assoc., Inc.)
ADDRESS: 825 S. Broadway, Boulder, CO 80303
PHONE: (303) 499-4040
CONTACT: Mr. Shelli Villano

Neoplan was founded in 1935 in Germany. The first vehicle produced was a bus, which was a wooden body placed on a truck chassis. The company produces a full-line of integrally-constructed buses. The first small bus produced by Neoplan was the 21-foot Lit'l Bus. Although brought to the U.S., the Lit'l bus was not sold here due to complications complying with EPA certifications. Since December 1982, Neoplan has demonstrated the prototype of a 26-foot bus in Pennsylvania. Hertz Rent-a-Car was their first customer. Neoplan has two plants in the USA: in Lamar Co., 30-35-foot buses are manufactured, in Montgomeryville, Penn buses are finished and serviced. Rolf Ruppenthal & Associates represents Neoplan in the U.S. as a marketing agent.

COMPANY: Premiere Bus Manufacturing
ADDRESS: 12450 Lakeland Rd, Santa Fe Springs, CA 90670
PHONE: (213) 538-3795 or (213) 946-6881
CONTACT: Ms. Nancy Munoz, Sales Manager

The company began producing buses in the mid-'70's. Its main product is a small bus on a van cutaway chassis. The company's total annual production is 200 to 300 vehicles. Recent customers include several hotel chains and city transit authorities.

COMPANY: Quality Coach (formerly Rec Vec)
ADDRESS: Stump Road & Commerce Drive, Montgomerville, PA 18936
PHONE: (215) 643-2211
CONTACT: Mr. Dick Boyd

The company was formed in 1969 to repair RV's. They began to do modification work and eventually began producing STV's. The main product line of the company is specialized vehicles. Total annual production is approximately 50 units. Recent customers include individuals and nursing homes.

COMPANY: REVCON
ADDRESS: 10870 Kalama River Road, Fountain Valley, CA 92708
PHONE: (714) 968-3346
CONTACT: Mr. Bob Mitchell

REVCON was started in 1969. Its main product line is RVs. It produces approximately 35 transit type vehicles per year. Recent customers include the Armed Forces and the White House.

COMPANY: RJ Mobility Systems
ADDRESS: 715 South 5th Avenue, Maywood, IL 60153
PHONE: (312) 344-2705
CONTACT: Mr. Tom Cosack

The company was started 15 years ago by an individual who had sustained a physical injury resulting in a handicap. The company's main product line is evenly split between wheelchair lifts and van conversions. The company also builds undercover police vehicles and designs and builds paratransit and wheelchair lift accessible buses and vans. Total annual production is between 75 and 100 units. Recent customers include nursing homes, hospitals, and private individuals.

COMPANY: Skillcraft
ADDRESS: 355 Center Court, Venice, FL 33595
PHONE: (813) 493-8804
CONTACT: Mr. T.L. Huston

Founded in 1969, Skillcraft has been primarily a manufacturer of low-floored, heavy-duty transit buses. The first vehicles produced by Skillcraft were 13 vans used in a government Elderly and Handicapped demonstration program in 1971-72. These vans are now used in a 16(b) 2 program. The Transmaster, the company's 32.5-foot transit bus, was introduced in 1979 and is available in 20, 23, 27, 31 passenger models. Their plant in Venice, Fla. has been expanding. Currently 40 workers are employed and production is one bus per week; with the new $28,000 sq. ft. building, production capacity will be three buses per week.

COMPANY: Steyr-City Bus (Transbus of America)
ADDRESS: P.O. Box 119, Portland, ME 04104
PHONE: (207) 797-8466 Telex: 944417
CONTACT: Mr. E. Robert Brown

Transbus of America is the national distributor of the Steyr City Bus manufactured by Steyr Daimler Puch AG, in Vienna, Austria. The 20-foot bus is a low floor, diesel powered, front wheel drive vehicle.

COMPANY: Target Industries, Inc.
ADDRESS: 55 Newbury Road, East Windsor, CT 06088
PHONE: (203) 627-9329
CONTACT: Mr. John Quandt, Vice Pres.-Marketing

Target Industries, Inc. manufactures lifts, steering systems, braking systems, and a substantial line of products for the disabled driver or passenger. Annual production is approximately 200 to 400 vehicles. End users include private non-profit agencies participating in the 16(b) 2 program, state rehabilitation commissions, Veterans administrations, school bus and ambulance services.

COMPANY: Thomas Built Buses, Inc.
ADDRESS: P.O. Box 2450, High Point, N.C. 27261
PHONE: (919) 889-4871
CONTACT: Mr. John W. Thomas, Jr., President

Thomas Built Buses, Inc. is managed and owned by the Thomas family. Perley A. Thomas founded Perley A. Thomas Car Works in 1916, after Southern Car Company curtailed operations. The company primarily manufacturers school buses.

Since the 1920's, Perley A. Thomas Car Works, now called Thomas Built Buses, Inc. has been expanding and developing its product lines and plants. Thomas began mass producing school bus bodies in 1935. During World War II, Thomas produced mobile arms shops used for supplying and repairing rifles, pistols and small compact weapons for the military. Following World War II Thomas returned to producing school bus bodies, and the company's first transit bus bodies. By 1960, Thomas also began penetrating foreign markets in North America, South America and Central America. The International Division also opened plants in Woodstock, Ontario (Canada); Quito, Ecuador; and Callao, Peru (S. America). In the last decade, Thomas has introduced the Mighty Mite, first with the conventional configuration mounted on the Dodge and International chassis, later as the present forward control configuration on the Chevrolet chassis. Recently, Thomas has introduced the Minotour, a small transit bus with a 20 passenger capacity. A wide body Mighty Mite with a 96 inch width permitting 2 to 2 adult seating is also available.

Production in the High Point headquarters in the past two years has been affected due to decreasing student enrollments and tight budget constraints. Problems with chassis deliveries and late state bids also affected production schedules. To help overcome some of these obstacles Thomas designed, tested and put into production their own chassis in the late '70's. This chassis has opened other markets for the company. Thomas has tripled its production in the last 20 years; sales since 1950 have increased 50 times. Currently Thomas provides jobs for over 1100 people.

COMPANY: Transit Bus Manufacturing Inc.
ADDRESS: 2437 Minnis Drive, Forth Worth, TX 76118
PHONE: (817) 838-6789
CONTACT: Mr. Hyden

The company originally modified vans. The company began to build converted vans for car rental companies and is now diversifying into building small buses using Isuzu chassis. The main product line of the company is buses and modified vans. Total annual capacity is approximately 50 large vehicles per year and between 60 and 72 small vehicles per year. Recent customers include church groups, car rental companies, beer companies, and several small city transit authorities.

COMPANY: Transportation Products Inc.
ADDRESS: P.O. Box 329, Suffer, NY 10901
PHONE: (914) 357-2510
CONTACT: Mr. Tony Appuzo

The company started producing van conversion school buses in 1976. Their entrance into the STV market was to offset the cycles in the school bus market. Recent customers include car rental companies, casinos and bus dealers. Production is an average of 300 buses annually.

COMPANY: Turtle Top/Independent Protection Co.
ADDRESS: 118 West Lafayette Street, P.O. Box 537, Goshen, IN 46526
PHONE: (210) 533-4116
CONTACT: Mr. Marion Carlin

In 1965, the company started purchasing vans from GM and Ford and converting them into recreational vehicles. The product lines expanded and the company also started manufacturing a small RV and a small transit vehicle. The main product line of the company is lightning protection. Total annual production is approximately: van conversion: 143; mini motor homes: 40; small transit vehicles: 150. Recent customers include universities, transit authorities, colleges and dealers.

COMPANY: Universal Coach Corporation
ADDRESS: 270 Route 109, West Babylon, NY 11704
PHONE: (516) 587-6680
CONTACT: Mr. Hank Fichtner

This company got into the small transit vehicle business in 1978 during the fuel crisis. Prior to 1978, the company manufactured custom vans. The main product line now is specialized vehicles. Total annual production is between 200 and 350 vehicles. These vehicles are used for airport transportation, local transit, and handicapped transportation.

COMPANY: Urban Transportation Development Corporation
ADDRESS: 2 St. Clair Ave. W., Toronto, Canada M4V-1L7
PHONE: (16) 961-9569 (FTS 457-4411)
CONTACT: Ms. Debra Bennett

The company was originally founded in 1973 by the province of Ontario. The company produced a small bus based on a motor home chassis during the mid-'70's but is now involved in production of an intermediate capacity fixed guideway transit system. The company's main product line is turn-key fixed guideway transit system construction and research. Currently, systems are on order from Detroit, San Jose, Toronto and Vancover, resulting in orders for 200 vehicles over the next two years.

COMPANY: Wayne Corporation
ADDRESS: P.O. Box 1447, Industries Road, Richmond, IN 47374
PHONE: (317) 962-7511
CONTACT: Mr. Curtis Atkisson, Jr., President
Ms. Carol Vanderpool, Product Manager

The company which is now known as Wayne Corporation was founded in Dublin, Indiana, in 1837 as a producer of agricultural equipment. In 1868, the firm expanded into the transportation equipment industry.

In 1875, the company moved its operations to Richmond and, around 1890 built one of the first horse-drawn "kid hacks" - forerunner of the motor-powered school bus. In 1914, Wayne built one of the earliest school bus bodies designed for mounting on a motor powered chassis. In 1930, it designed and built one of the first all steel school buses. During World War II, Wayne produced all the cross-country ambulances used by the Army, as well as signal corps radar van bodies, mobile machine shops, and other materials.

Wayne acquired Welles Corporation, Ltd., the Canadian division in 1963. In 1967, Wayne moved its Richmond operation to a new plant, which is one of the largest in the industry. In 1968, Wayne was purchased by Indian Head, a broadly diversified company in metal and automotive products, pumping systems, construction products, information technology, and containers. Indian Head has since been absorbed into the corporate structure of Thyssen-Bornemisza, Inc., a diversified international group of companies involved in agriculture, banking, shipbuilding, ship repair, and transport and trading.

In 1973, Wayne introduced the Lifeguard, a new school bus which employs a number of advanced concepts designed to increase strength and durability; reduce the possibility of injury in the event of accident; permit faster and easier escape, and increase driver visibility. The Lifeguard is constructed of one-piece, full-length exterior and interior panels that eliminate seams, resist penetration and increase safety.

In 1974, as the result of market studies indicating a growing need for a highly maneuverable, economical smaller bus, Wayne introduced the Busette. Bus operators requested a higher headroom version of this bus, so Wayne presented the Transette in 1976. These buses have accelerated Wayne's expansion into a broad spectrum of new commercial markets, including city bus lines, park and fly, employee pooling, industrial and hotel shuttles, tour services, taxis, rural transit, and church shuttles.

In 1983, Wayne introduced the Chaperone bus, which seats 22 students or 17 adults, for school and commercial applications. For 1984, the company is introducing a longer version, the Chaperone II, which can accommodate 21 adults.

All models are available specially equipped for transportation of the physically handicapped and elderly. Wayne buses are marketed throughout the U.S., Canada, and overseas.

COMPANY: Wide One Corporation
ADDRESS: 3051 E. LaPalma Ave., Anaheim, CA 92806
PHONE: (714) 630-7933
CONTACT: Mr. Dale Hanson

Wide One Corporation was formed in 1978 after having re-purchased the equipment and rights from their original company, Far West Coach, that was formed in 1972 by the present owners. The main product line is that of small transit buses, paratransit buses, ambulance shells, van limousines and commercial vans. The products are distributed generally in the Western States. The vehicles are based upon Dodge Maxivan chassis and are widened to an exterior width of 94½ inches to provide proper room for use in the specified category. Production annually is approximately 135 to 150 units.

APPENDIX B

FEDERAL AGENCIES AND INDUSTRY ASSOCIATIONS

American Association of State Highway
and Transportation Officials
444 N. Capital
Washington, D.C. 20001
(202) 624-5800
Francis B. Francois, Executive Director

Founded in 1914, ASHSTO has 63 members made up of highway and transportation departments of the 50 states, Puerto Rico, Guan the Virgin Islands, Marianas, the District of Columbia, the U.S. Department of Transportation and the highway departments of Manitoba, New Brunswich, Nova Scotia, the Northwest Territories, Alberta, Saskatchewan, and Ontario.

AASHTO's purpose is to develop and improve methods of administration, design, construction, operation and maintenance of a national integrated transportation system. The organization studies all problems connected with such a system; counceling Congress on transportation legislation; to develop technical, admininstrative, and highway operational standards and policies for all transportation modes; and to cooperate with other agencies in the consideration and solution of transportation problems.

American Bus Association
1025 Connecticut Ave., N.W.
Washongton, D.C. 20036
(202) 293-5890
Norman R. Sherlock, President

The American Bus Association is the national organization of the intercity bus industry. Nearly 700 private intercity carriers, including Greyhound and Trailways, are members of the ABA. Collectively, ABA operator members provide more than 90 percent of all intercity bus travel in the United States and Canada.

In addition to bus operator members, more than 1,500 organizations involved in travel and tourism are ABA members. More than 100 firms in allied industries, associations and 42 state travel officies hold membership in the Association.

The ABA Maintains a full-time research staff to collect and analyze data on the bus industry from a variety of sources. On a routine basis, the ABA shares the results of its analyses with government agencies, educational institutions, and private consultants, as well as members of the Association.

American Public Transit Association
1225 Connecticut Ave., N.W.
Suite 200
Washington, D.C. 20036
(202) 828-2800
Jack R. Gilstrap, Executive Vice-President

The American Public Transit Association is the national organization representing the urban transit industry APTA represents over 300 local bus and rail transit systems in the United States, Canada, and several foreign countries. APTA member transit systems carry 94 percent of all transit riders in the United States. In addition to transit systems, APTA members include manufacturers and suppliers of transit equipment, consultants, state and local departments of transportation and planning agencies, universities, and transit construction contractors.

Community Transportation Program
Extension Service, U.S. Department
of Agriculture
Washington, D.C. 20250
(202) 447-2602
Mr. Donald L. Nelson,
National Program Leader
Community Transportation

The Extension Service is the educational agency of the Department of Agriculture. It is one of three partners in the Cooperative Extension System. State governments, through their land-grant universities, and county governments are the other partners. All three share in financing, planning, and conducting the Extension's educational programs.

The Extension Service helps the public learn about and apply to everyday activities, the latest technology developed through research by land-grant universities, the Department of Agriculture,

and other sources. Major areas of assistance are agricultural production, marketing, natural resources, home economics and human nutrition, 4-H youth development, rural development, and related subjects including rural transportation improvement.

The Extension Service has a small staff that provides national level policy formulation, program leadership and management, organization, coordination and representation, and accountability and evaluation systems in support of the Cooperative Extension System.

Federal Highway Administration
Department of Transportation
400 Seventh Street, S.W.
Washington, D.C. 20
(202) 426-0537
Ray A. Barnhart, Federal Highway Administrator

The Federal Highway Administration (FHWA) became a component of the Department of Transportation pursuant to the Department of Transportation Act (80 Stat. 932). It carries out the highway transportation programs of the Department of Transportation under pertinent legislation or provisions of law cited in section 6(a) of the act.

The FHWA encompasses highway transportation in its broadest scope, seeking to coordinate highways with other modes of transportation to achieve the most effective balance of transportation systems and facilities under cohesive Federal transportation policies as contemplated by the act.

The FHWA is concerned with the total operation and environment of highway systems, including highway safety.

Motor Vehicle Manufacturers Association
of the United States, Inc.
Detroit, MI 48202
(313) 872-4311
V.J. Adducci, President and Chief Executive Officer

The Motor Vehicle Manufacturers Association of the United States, Inc. is the trade association for U.S. Car and Truck

manufacturers. Its nine members are American Motors Corporation, Chrysler Corporation, Ford Motor Company, General Motors Corporation, International Harvester Company, MAN Truck & Bus Corporation, PACCAR Inc., Volkswagen of America, Inc., and Volvo North America Corporation. These nine members produce over 99 percent of all domestic motor vehicles.

The MVMA has a legal and administrative staff as well as three operating units. These operating units include Public Affairs, Technical Affairs, and the Motor Truck Division. These divisions specialize in areas of law, energy and material, environment, vehicle and safety engineering, engineering research, trademark and patent records, statistics, education programs, public relations, Federal liason, State relations, International Affairs, personel and taxation, Motor truck technical services, and traffic and freight rates.

Recreational Vehicle Industry Association
14650 Lee Road
Chantilly, VA 22021
(703) 968-7722
David J. Hamphreys, President & General Council

The RVIA was founded in 1974. It has 281 members including recreation vehicle manufacturers (108), suppliers of accessories and equipment used by manufacturers (148), and associate members (25). The organization seeks to provide a unified recreational vehicle organization for manufacturers of motor homes, travel trailers, truck campers, folding camp trailers, park trailers, and multi-use vehicles. The purpose of the organization is to provide all elements of the industry with a single, active base from which to communicate with legislators, various federal and state government departments and agencies, the financial community, allied industries, the media and the general public. The RVIA also complies marketing statistics and presents awards for achievements in, and in support of, the industry.

School Bus Manufacturers Institute
Cherry Chase Building, Suite 1220
5530 Wisconsin Avenue
Washington, D.C. 20015
(202) 652-8004
Mr. Berkley Sweet, Secretary

The School Bus Manufacturers Institute was founded in 1949 and has 5 members; the American Transportation Company (Ward), Blue Bird Body Company, Carpenter Body Works, Thomas Built Buses, and the Wayne Transportation Division of the Wayne Company, all of these companies manufacture school bus bodies. The purpose of the SBMI is "To promote the best interests of the public in the manufacture of safe and qualified school bus bodies and to insure fair and competitive manufacturing practices within the industry." The Institute conducts research on crashes, minimum school bus safety standards and design and development. It is a division of the Truck Body and Equipment Association.

Transportation Research Board of the
National Research Council
2101 Constitution Avenue, N.W.
Washongton, D.C. 20418
(202) 334-2000
Lawrence D. Dahms, Chairman
Thomas B. Deen, Executive Director

The Transportation Research Board is an agency of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board's purpose is to stimulate research concerning the nature and performance of transportation systems, to disseminate information that the research produces, and to encourage the application of appropriate research findings. The Board's program is carried out by more than 150 committees and task forces composed of more than 1,800 administrators, engineers, social scientists, and educators who serve without compensation. The program is supported by state transportation and highway departments, the U.S. Department of Transportation, and other organizations interested in the development of transportation.

The Transportation Research Board operates within the Division of Engineering of the National Research Council. The Council was organized in 1916 at the request of President Woodrow Wilson as an agency of the National Academy of Sciences to enable the broad community of scientists and engineers to associate their efforts with those of the Academy membership. Members of the Council are appointed by the president of the Academy and are drawn from academic, industrial, and governmental organizations throughout the United States.

The National Academy of Sciences was established by a congressional act of incorporation signed by President Abraham Lincoln on March 3, 1863, to further science and its use for the general welfare by bringing together the most qualified individuals to deal with scientific and technological problems of broad significance. It is a private, honorary organization of more than 1,000 scientists elected on the basis of outstanding contributions to knowledge and is supported by private and public funds. Under the terms of its congressional charter, the Academy is called upon to act as an official—yet independent—advisor to the federal government in any matter of science and technology, although it is not a government agency and its activities are not limited to those on behalf of the government.

To share in the task of furthering science and engineering and of advising the federal government, the National Academy of Engineering was established on December 5, 1964, under the authority of the act of incorporation of the National Academy of Sciences. Its advisory activities are closely coordinated with those of the National Academy of Sciences, but it is independent and autonomous in its organization and election of members.

Urban Mass Transit Administration
Department of Transportation
400 Seventh Street, S.W.
Washington, D.C. 20590
(202) 426-4043
G. Kent Woodman, Acting Administrator

The Urban Mass Transportation Administration (UMTA) operates under the authority of the Urban Mass Transportation Act of 1964, as amended (49 U.S.C. 1601 et seq.). The Administration was established as a component of the Department of Transportation by section 3 of the President's Reorganization Plan No. 2 of 1968, effective July 1, 1968.

The missions of the Administration are: to assist in the development of improved mass transportation facilities, equipment, techniques, and methods; to encourage the planning and establishment of areawide urban mass transportation systems where they are cost effective; and to provide assistance to State and local governments in financing such systems; and to encourage private sector involvement in local mass transportation systems.

GLOSSARY

Average Cost per Passenger - The average total costs per vehicle-hour divided by the average number of passenger trips made per hour.

Average Ridership - The total number of passenger trips divided by the total number of service days (usually determined on an annual basis).

Axle Weight - The amount of weight carried by one axle.

Body - The part of the vehicle designed to carry passengers or payload.

Body-on-Chassis Construction - A vehicle design feature and a method of manufacture in which the chassis and body of the vehicle are built as separate units and joined together to form the completed vehicle. Chassis and body of the same vehicle are commonly built by different companies and in different plants. Criteria for denoting body-on-chassis vehicles vary, but by the most rigorous criteria, the chassis alone must be a "driveable" unit, except perhaps for the lack of a driver's seat and body-mounted lights and signals, and it must be possible to demount the body from one chassis and mount it again on a new chassis. Chassis for body-on=chassis construction generally have heavy frame rails to which the body is attached.

School buses, many small transit vehicles and most single-unit medium and heavy trucks are body-on-chassis vehicles. See also "integral construction."

Brokerage - A management technique which brings people in need of transportation (agencies or riders) together with a transportation provider. The broker coordinates the transportation services for clients and for providers.

Bus - A motor vehicle designed to carry a large number of passengers.

Cab - The part of the vehicle which encloses the driver and vehicle operating controls including the sheet metal housing, the power plant and the fenders. Vehicles without a separation between cab and load areas are not considered to have a cab.

Carpool - A group of people who share their automobile transportation to designated destinations, usually alternating drivers and vehicles.

Carrying Capacity - The payload or maximum weight the vehicle can accept, usually GVW minus curb weight.

CETA - The Comprehensive Employment and Training Act of 1973, as amended, provides job training and employment opportunities for economically disadvantaged, unemployed, or underemployed persons, and also funds for transportation to training centers, work sites, and educational and counseling centers.

Chassis - The frame and working parts of the vehicle such as the engine, transmission, suspension, axles, steering gear and brakes.

Checkpoints - In a point deviation system of paratransit, a set number of regularly scheduled stops distributed throughout a geographical area, with which a vehicle must touch base during each run.

Common Carrier - A provider of transportation which is open to the general public, and for which a fare is paid.

Conventional School Bus - A body-on-chassis school bus built on a long frame, front engine chassis derived from a medium-duty truck chassis. Conventional school buses are distinguished by the placing of the front axle and engine ahead of the driver creating a front silouette with a long nose.

Cowl - The portion of a motor vehicle forward of the front doors to which are attached the windshield and instrument panel. School bus chassis are often sold with a cowl in place of a full cab so that the bus body can be constructed in a way which includes the driver's area.

Curb Weight - Weight of the vehicle with all items of standard equipment, 150 pounds per passenger in each designated seating position, and maximum capacity of fuel, oil, and coolant.

Demand-Responsive Paratransit - A public transportation service characterized by the flexible routing and scheduling of relatively small vehicles to provide shared occupancy, door-to-door personalized transportation on demand for a modest fare.

Dial-A-Ride Services - A demand-responsive type of service whereby a person can telephone a dispatcher and arrange to be picked up by a vehicle either shortly after the call or at another specified time. Nearly all dial-a-ride systems in the country are operated by some type of public authority, whether the system serves the general public or only special groups.

Dispatch - The relaying of service instructions to drivers.

Door-To-Door Service - A demand-responsive transportation service whereby a person can be picked up at his door and delivered to his exact destination.

Doorstep Service - In a point deviation system, a delivery or pickup service to or from the exact point designated by a rider. Riders have the following service options: doorstep-to-doorstep (otherwise called "door-to-door" service); doorstep-to-checkpoint; and checkpoint-to-doorstep.

Drivetrain - The group of components used to transmit engine power to the wheels. The drivetrain includes the clutch, transmission, universal joints (U-joints), drive shafts, and drive axle gears and shafts.

Dynamic Routing - The process of modifying a vehicle route to accommodate service requests received after the vehicle has been dispatched.

Express Service - An operation designed to make a limited number of stops between relatively long distances along a given route.

FHWA - Federal Highway Administration.

Feeder Service - A local transportation service which provides connections with a major public transportation service.

Fixed-Route - A regularly scheduled transportation service operating over a set route.

Forward Control Chassis - A front engine chassis on which the driver's controls are placed above or in front of the front axle.

Gross Vehicle Weight (GVW) - The maximum allowable fully laden weight of the vehicle and its payload, it is the most common classification criteria used by manufacturers and by states, for trucks, tractors, and buses.

Headway - The time required for successive vehicles traveling at the same speed and direction to pass the same point (used to plan orderly dispatch of vehicles).

Horsepower - The unit of power used by the engine industry. The rate at which the twisting force (torque) is applied. If 802 lb-ft of torque is generated at a rate of 1900 revolutions per minute (rpm), the power generated is 290 horsepower.

Integral Construction - A vehicle design feature and a method of manufacture in which a single structure serves as both chassis and body of the vehicle. The most important advantage of integral construction is its greater rigidity-to-weight ratio which permits a strong body with a larger seating capacity for a given weight than body-on-chassis construction. Low floor height may also be easier to achieve, since the heavy chassis frame rails associated with body-on-chassis construction are not necessary. Large transit buses and intercity buses are usually integral construction vehicles. See also "body-on-chassis construction and "monocoque".

"Journey-To-Work" Zone - A geographical area subdivision which is used by the U.S. Census Bureau for locating residential and work sites.

Lift - A device which raises and lowers a platform to accommodate the entrance and exit of wheelchair users and others with disabilities.

Limited-Mobility Users - Those persons for whom access to either private automobiles or public transportation is limited: the elderly, the handicapped, the poor, the young, and the unemployed, for example.

Loop Configuration - A fixed, circuitous path along which a vehicle operates continuously, picking up and discharging passengers along the way.

"Many-To-Few" Service - A demand-responsive transportation service which picks up passengers at their homes or other logical starting points, but discharges passengers only at certain pre-established points, such as health centers, shopping centers, or regular transit stations.

"Many-To-Many" Service - A demand-responsive transportation service in which passengers are collected from multiple locations (origins) and transported to their individual destinations; generally, service offered between any combination of origin-destination points in the service area.

"Many-To-One" Service - A demand-responsive transportation service which picks up passengers from a variety of places, but has only one dropoff point.

Mass Transportation - Transportation by bus, or rail, or other conveyance publicly or privately owned, which provides general or special service (not including school buses or charter or sightseeing service) on a regular and continuing basis.

Monocoque - A type of integral construction in which the outer skin of the vehicle body carries all or a major part of the stress. Semi-monocoque differs from monocoque structure in that the skin is reinforced stringers.

"One-To-Many" Service - A demand-responsive transportation service having only one pickup point for passengers, but several delivery points scattered over the service area.

Paratransit - Flexible transportation services, operated publicly or privately. Typically, small scale operations using low-capacity vehicles closely related to public transportation, e.g., dial-a-ride, shared-ride taxi, carpools, vanpools, and subscription buses.

Passenger Trip - One person traveling one way from origin to destination.

Peak Hours - Specified time periods during which the volume of traffic and/or the number of passengers is greater than at other periods.

Prearranged Ridesharing - A paratransit service whereby riders sign up in advance and travel with a group of people on the same route every day. Services are provided mostly between a residential neighborhood and a particular employment area with some route deviation for minor collection and distribution patterns at either end of the trip. Examples include carpools, vanpools, and subscription buses.

Primary Transmission - Attached directly to the rear of the engine, the primary transmission contains a number of gears which, when a connection is made between a specific set, provides a specific reduction of power to the line axles.

Public Transportation - A common term for mass transportation.

Pulsed Schedule System - A dispatching technique in which local and regional transit routes arrive at the same point (transfer station) at the same time. It allows for quick and convenient transfers between vehicles, and it increases the number of destinations that can be reached.

Route-Deviation - A demand-responsive transportation service pattern in which a fixed-route bus will leave the route upon request to serve patrons not on the fixed route.

Section 3 - A section of the Urban Mass Transportation Act of 1964, as ammended, which authorizes UMTA to make discretionary grants or loans in response to individual applications for capital improvement

projects, including equipment. A fixed percentage of Section 3 appropriations are used to fund Section 16 and until 1982 were used to fund Section 8 of the Urban Mass Transportation Act of 1964, as amended. As of 1983 Section 3's match fund requirements change from 80% Federal/20 % State and Local to 75% Federal/25% State and Local.

Section 5 - The Section 5 formula grant program for urbanized areas divides its funding program into four tiers. The first two tiers base funding upon a population and population density formula. The third tier is devoted to rail and fixed guideway transit. The fourth tier funds bus capital grants which are also apportioned by population and population density. Federal funds available under Section 5 are expected to supplement rather than substitute for district transit income such as fare box receipts, advertising and concession revenues, property leases and state and local public funds.

NOTE: Section 5 ends in FY83. After FY83 funds will be carried forward until September 30, 1985 after which time the funds will be added to the Section 9 Block Grant program for reapportionment.

Section 8 - Section 8 of the Urban Mass Transportation Act of 1964, as amended, provides for contracts and grants to states and local public agencies for the planning, engineering, designing and evaluation of urban mass transportation projects; for the development of regional transportation plans and for various other technical studies. Activities under this heading may include (1) studies relating to management, operation, capital requirements and economic feasibility of transit projects; (2) preparation of engineering and architectural surveys, plans and specifications; (3) evaluation of previously funded projects; and (4) similar activities preliminary to the construction of an improved operation of mass transportation systems, facilities or equipment. Section 8 funds, generally available to regional and metropolitan planning agencies, provide an 80 percent federal share of the total project or study cost; the remaining 20 percent of project cost must be provided locally or by the state.

Section 9 - Section 9 (9A in FY83 only) is a block grant capital expense funding program with a formula apportionment of 80/20 percent Federal/Local share. It is funded from the Mass Transit Account of the Highway Trust Fund. This program allows a single application for a Program of Projects rather than individual applications for individual projects. Procedures under this Section are similar to those under Section 5.

Section 16(b)2 - Section 16 of the Urban Mass Transportation Act of 1964, as amended, authorizes UMTA to make grants and loans to states and local agencies specifically to provide mass transit services which meet the special needs of elderly and handicapped persons. The Act also authorizes UMTA to assist private nonprofit organizations in providing transit services for this group where transportation services provided are unavailable, insufficient or inappropriate for their use.

Subsection b, paragraph 2 of the Act is the specific section which regulates how the funding may be applied. 16(b)2 is a capital grants program for equipment purchase only.

Section 18 - The Federal Public Transportation Act of 1978 includes a $420 million program of capital assistance for exclusive use in nonurbanized areas (under 50,000 population) during the period from 1979 through 1982. Funds under this program are available for planning and program development activities, demonstration programs, vehicle acquisition and other capital investments in support of general or special transit services, including services provided for elederly, handicapped and other transit-dependent persons.

The Section 18 program has been continued by the Surface Transportation Assistance Act of 1982.

Service Area - The geographical area within which transportation service is offered.

Shared-Ride Taxis - A type of demand-responsive service in which taxis are allowed by the regulatory authorities to carry at any one time several unrelated passengers with different origins and destinations.

Shuttle Service - A transportation service operating exclusively between two fixed stops.

Subscription Bus Service - A service provided through advance reservations for regular trips over a specified period of time.

Tandem Axle - Two axles operated from a single suspension.

Torque - The twisting force of the engine crankshaft which is transmitted to the axles to turn the tires and move the vehicle. Torque is expressed in units of pound-feet (lb-ft).

Turbocharging - Using a turbocharger to increase engine performance, improve fuel economy, and reduce engine smoke and noise levels. The turbocharger uses the exhaust gas energy (in its turbine) to compress the engine intake air (in its compressor) and thus provides pressurized air in the intake manifold.

UMTA - Urban Mass Transportation Administration.

Urbanized Area - An area with a city of over 50,000 persons so designated by the Bureau of Census, within boundaries which shall be fixed by responsible state and local officials in cooperation with each other, subject to the approval by the Secretary of Transportation.

Van Cutaway Chassis - An automobile van which is sold without any body behind the front seats and doors.

Vanpool - Ride-sharing services by van for eight or more travelers with routes and schedules to meet their particular travel needs.

Wheelbase - The distance between the centerlines of the front and rear axles or, if tandem, the distance from the centerline of the front axle to a point midway between the two rear axles.

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