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Transit Bus Manufacturer Profiles

B. Weiers
M. Rossetti

Transportation Systems Center
Urban Systems Division
Cambridge MA 02142

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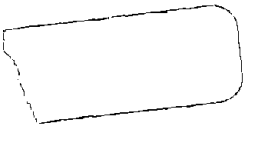

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16. Abstract

This report is intended as a reference work on individual companies, their products, history, facilities, and finance. A companion paper: Entry and Competition in the United States Transit Bus Manufacturing Industry, is an analytic paper addressing the apparent trend toward entry into the U.S. transit bus market by new foreign manufacturers. Responsibility for the manufacture of transit buses rests with the transit bus manufacturing industry. The quality, cost, and variety of buses available to transit operators depends on the firms in this industry. Structure and competition are changing radically in the U.S. transit bus manufacturing industry. The causes of these changes are analyzed in the above-mentioned companion report.

The purpose of this report is to present information on the structure and history of the U.S. transit bus manufacturing industry with a minimum of analysis. How buses are categorized and the relationship of transit buses to other types of buses are described. The structure of the transit bus industry and its relationship to the larger motor vehicle industry is also described. The history of the transit bus manufacturing industry is presented from production of the first buses at the turn of the century to the present day. The entry and exit of firms from the industry, the development of the Urban Mass Transportation Administration, and the introduction of the advanced design buses are highlighted. This document also discusses profiles of individual manufacturers. The United States and Canadian builders of standard and articulated transit buses are each profiled. Several foreign and domestic companies which have expressed an interest in the industry have also been included.

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FOREWORD

This document was prepared by the Transportation Industry Analysis Branch, Office of Energy and Environment, of the Transportation Systems Center (TSC).

It is a result of the Bus and Paratransit Systems Program, which is managed by the Urban Systems Division at TSC and sponsored by the Office of Bus and Paratransit Systems, Urban Mass Transportation Administration.

Transit Bus Manufacturer Profiles is intended as a reference work on individual companies, their products, history, facilities, and finance. A companion paper, Entry and Competition in the U.S. Transit Bus Manufacturing Industry is, in essence, an analytic paper addressing the apparent trend toward entry into the U.S. transit bus market by new foreign manufacturers.

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1. INTRODUCTION

The motorbus occupies a central position in mass transit in the United States. Two-thirds of all trips taken on public transit in the U.S. are taken on buses. For the majority of transit systems operating in the U.S., the bus is the primary mode of service. For all but about 25 systems, buses are the only type of vehicle in use. The quality and availability of transit, therefore, is nearly synonymous with the transit bus.

Responsibility for the manufacture of transit buses rests with the transit bus manufacturing industry. The quality, cost and variety of buses available to transit operators depends on the firms in this industry.

For many years, the transit-bus manufacturing industry in the U.S. lay dormant. The decline of transit bus sales in the U.S. after the Second World War combined with technological innovations and other factors to reduce the number of major U.S. transit bus manufacturers from five in 1951 to two in 1961. These two, producing nearly identical "New Look" buses, continued undisturbed by additional competition for ten years.

In the last ten years, however, the pace of competition and innovation has quickened considerably, seeming almost to accelerate. AM General came into the industry in the early 1970s, but left after producing for only five years. GMC and Flxible introduced new advanced design buses (ADBs) in 1975 and 1976. M.A.N.-AM General sold nearly 400 articulated buses in 1976 and 1977. Canadian bus manufacturers began selling larger numbers of buses in the U.S. after 1978.

In 1980, the number of manufacturers, actual and potential, began to grow. Gillig, a California school-bus builder, announced a standard-size transit bus. Crown Coach, a Los Angeles intercity and school-bus builder, announced that it would produce an articulated transit bus design by Ikarus of Hungary. Neoplan and M.A.N., West German firms, both announced plans to build plants in the U.S. to build transit buses. Mack Truck announced

that it was considering building Renault transit buses. Since then, Hino (Japan), Scania (Sweden) and Volvo (Sweden) have joined those expressing an interest in the U.S. transit bus market.

Structure and competition are changing radically in the U.S. transit-but manufacturing industry. The causes of these changes are analyzed in Entry and Competition in the U.S. Transit Bus Manufacturing Industry.

This report is intended as a companion document to that study. The purpose of this report is to present information on the structure and history of the U.S. transit bus manufacturing industry with a minimum of analysis.

Chapter 2 describes how buses are categorized and the relation of transit buses to other types of buses. The structure of the transit bus industry and its relation to the larger motor vehicle industry is also described.

Chapter 3 narrates the history of the transit bus manufacturing industry from production of the first buses at the turn of the century to the present day. The entry and exit of firms from the industry, the development of UMTA and the introduction of the advanced design buses (ADBs) are highlighted.

Chapter 4 presents profiles of individual manufacturers. The U.S. and Canadian builders of standard and articulated transit buses are each profiled. Several foreign and domestic companies which have expressed an interest in the industry have also been included.

2. TYPES OF BUSES AND THE STRUCTURE OF THE INDUSTRY

This chapter introduces some terms of classification associated with buses and the industries which manufacture them.

There are several types of transit buses --- and the transit bus is only one of several types of buses. Although transit buses are manufactured in North America by only a limited number of companies, there are many more firms involved in the manufacture of other types of buses, in the manufacture of other types of motor vehicles, and in the manufacture of components for buses and other vehicles. To some extent, these companies can be grouped by the types of buses or other vehicles manufactured.

The purpose of this chapter is to identify the different types of buses, show how the manufacture of buses fits in generically with the whole motor vehicle industry, and identify the major bus manufacturers.

Although all types of buses will be referenced in the classification, this chapter is focused narrowly on articulated and standard transit buses.

Buses can be categorized conveniently by four criteria:

1. Use (either intercity, transit, or school);
2. Method of manufacture (either integral construction or body-on-chassis);
3. Size (for transit buses, the terms in common use are Large capacity [meaning either articulated or double-deck]), Standard [either 35 or 40 feet in length], Medium [meaning 27 to 34 feet in length], or Small [less than 27 feet in length]);
4. Quality or degree of luxury (either premium, standard or utility) for transit buses. The "advanced design bus"

(ADB) can be treated as a premium designation, and the term, "New Look" can be used to designate a utility bus.*

All four criteria may be necessary to characterize and distinguish a bus model, although the quality or degree-of-luxury category may be superfluous in some cases. Figure 2-1 illustrates several different buses within category segments.

2.1 USE

Use has a profound impact on bus design.

Intercity buses, designed for lengthy trips, generally have high floors to allow for luggage compartments, narrow aisles, full-backed seats, luggage racks and a toilet.

Transit buses are generally designed for urban service at low speeds with frequent stops. Seating comfort and luggage space are sacrificed for the greater accessibility of lower floors and wider aisles. Transit buses do not have toilets and luggage racks, but usually have a second side door to permit faster loading and unloading of passengers.

A hybrid between transit and intercity is the suburban bus. A suburban bus is used generally to transport commuters between city center and remote suburbs. The suburban bus may not have the extra side door of the transit bus. The suburban bus usually has luggage racks, but may lack luggage compartments and other attributes of the intercity bus.

School buses have as their purpose the daily transport of school children, usually to and from school. School buses are notable for their extremely utilitarian design. Since they carry children, they can generally be smaller than transit buses, yet carry the same number of passengers.

*It is not suggested that the terms, "ADB" and "New Look" were necessarily coined to have the meanings "premium" and "utility" respectively, only that the terms sometimes are used that way.

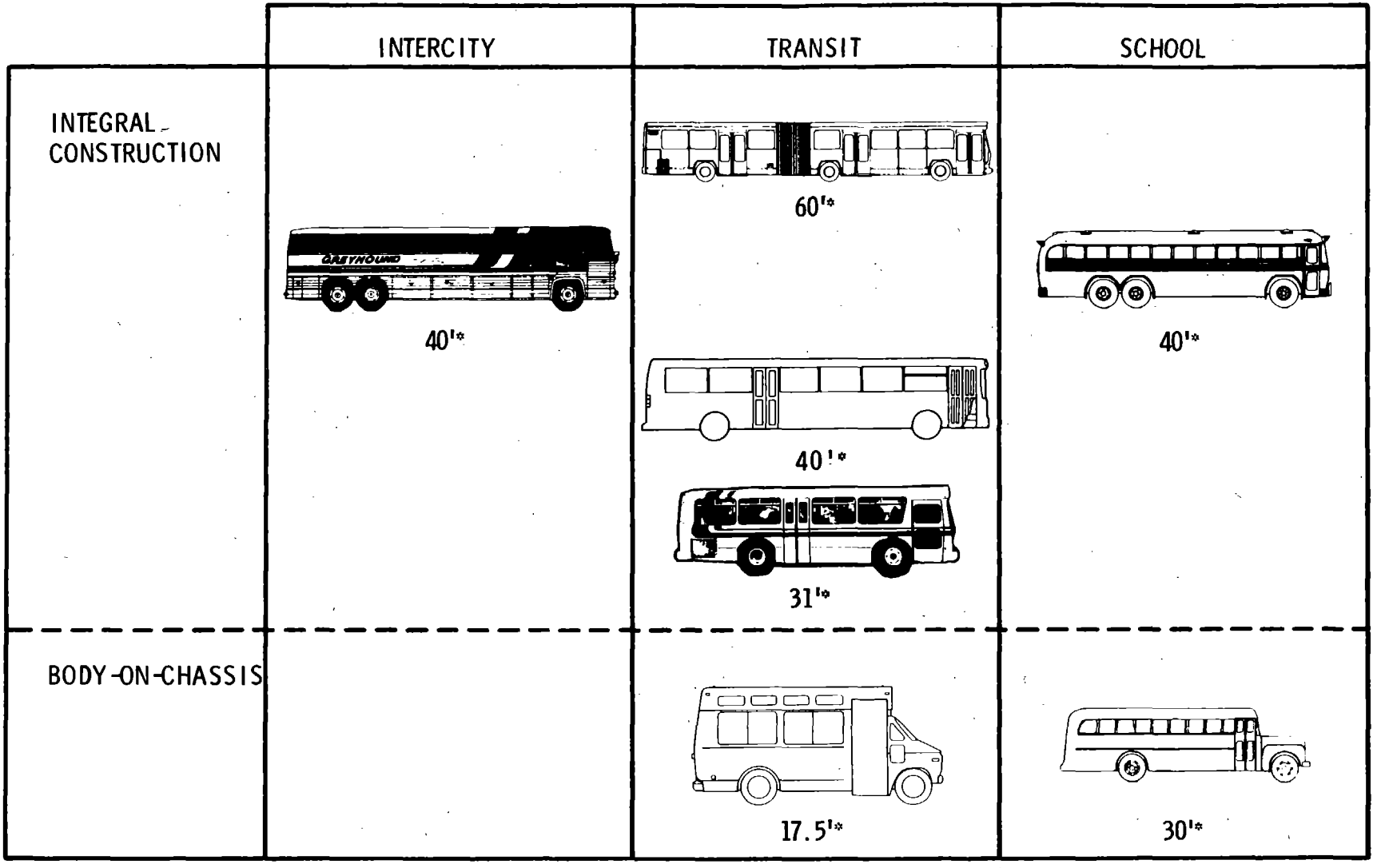


FIGURE 2-1. REPRESENTATIVE BUSES BY CATEGORY SEGMENT

Approximately two thousand intercity buses, four thousand integral-construction transit buses, seven hundred integral-construction school buses, and thirty thousand body-on-chassis school buses are built in the U.S. each year. It is not possible to determine the number of buses built on van chassis.

2.2 METHOD OF MANUFACTURE

Method of manufacture is a less commonly used criteria for categorization of buses. In general, integral construction is used for larger buses, especially those over thirty feet in length. Integral construction thus is used for most Medium and all Standard transit buses. It is also used for intercity buses and large-capacity or transit-type school buses which are usually at least thirty-five feet long. The manufacturer of an integral-construction bus assembles both the chassis and body of the bus, while the manufacture of body-on-chassis buses is divided between firms building the bus chassis and firms which buy the chassis and then build the bus body on them.

This difference in manufacturing approach is reflected in bus design. The chassis sold to the body-on-chassis bus producer is in running condition. It has all the necessary components to be driven down the highway, except, in some cases, a driver's seat. The chassis includes a heavy frame which is designed to have the bus body mounted on it and to take the structural stress of the complete vehicle.

The integral-construction bus is usually designed so that structural stress is borne by the bus body itself and the chassis components are mounted to the body.

Body-on-chassis buses usually have front-mounted engines. Integral-construction buses usually have engines in the rear, or sometimes, engines mounted amidships under the floor.

2.3 SIZE

The length of buses is limited by the practical problem of turning corners and commonly is regulated by law. To obtain the high passenger capacity within length limitations, designers have taken two approaches. The first is to have two floors, or decks, on the bus. Double-decker transit buses have been used for many years in the United Kingdom and, in the past, in some U.S. cities (currently in Los Angeles). The second approach is to make the bus flexible by "hinging" the bus in the middle. These buses, called articulated (or "artics"), may be half again as long as a standard (40') transit bus and carry proportionately more passengers. Such large capacity designs have also been used for intercity buses. Although both articulated and double-deck intercity buses were introduced in the U.S. in the 1950s, their use has dropped more recently.

Standard transit buses, by convention, can be either 35' or 40' long. Most transit bus models are designed to be manufactured in both 40' and 35' versions. The standard intercity bus is 40' long. Large capacity, integral construction school buses are commonly 35' and 40' in length.

The medium transit bus is about 30' in length. Historically, 30' versions of the standard transit bus models were available, but this practice ended in the mid-1970s. Since then, distinct medium transit bus models have been offered by manufacturers other than those building standard transit buses. Thus, the medium transit bus has come to be seen as representing a separate market segment and product.

A large number of different types of vehicles under thirty feet in length which might be called buses are available. Body-on-chassis school buses are one example. Vehicles derived from compact vans are also commonly used as buses.

2.4 QUALITY OR DEGREE OF LUXURY

This criteria is possibly the most difficult to conceptualize. Quality, or degree of luxury, as it is used here is not meant to connote choosing between good and bad. Rather the choice is between luxury or premium design and utility or utilitarian design. A good analogy might be the choice between an economy car and a luxury car. The luxury car may be more stylish, faster, and more comfortable, but likely to be more expensive to purchase and to operate.

Just such a choice confronts the bus purchaser choosing between the kind of premium buses offered by GMC and Flxible and the kind of utility buses offered by some other companies.

Historically, from the introduction by GMC of the "New Look" bus model in 1959 until the mid-1970s, only one quality level of transit bus was offered in the U.S. That level might be characterized as utilitarian. With the introduction of advanced design bus (ADB) models, however, premium transit buses have been offered for sale. These buses feature a more stylish appearance and a number of other improvements, although some operators have complained that they are more expensive to operate.

Intercity buses have long been available in utility, standard, premium, and specialty configurations. School buses are pretty uniformly utilitarian.

2.5 THE TRANSIT BUS MANUFACTURING INDUSTRY

The transit bus manufacturing industry is <u>one</u> sector of the motor vehicle manufacturing industry. The industry also includes the manufacture of passenger cars, trucks and other types of buses. The relationship of the transit bus to other categories of motor vehicles is diagrammed in Figure 2-2.

Transit buses (of which there are three basic sizes) are one type of integral-construction buses. Large capacity (or transit-type) school buses and intercity buses are also usually of the integral-construction type.

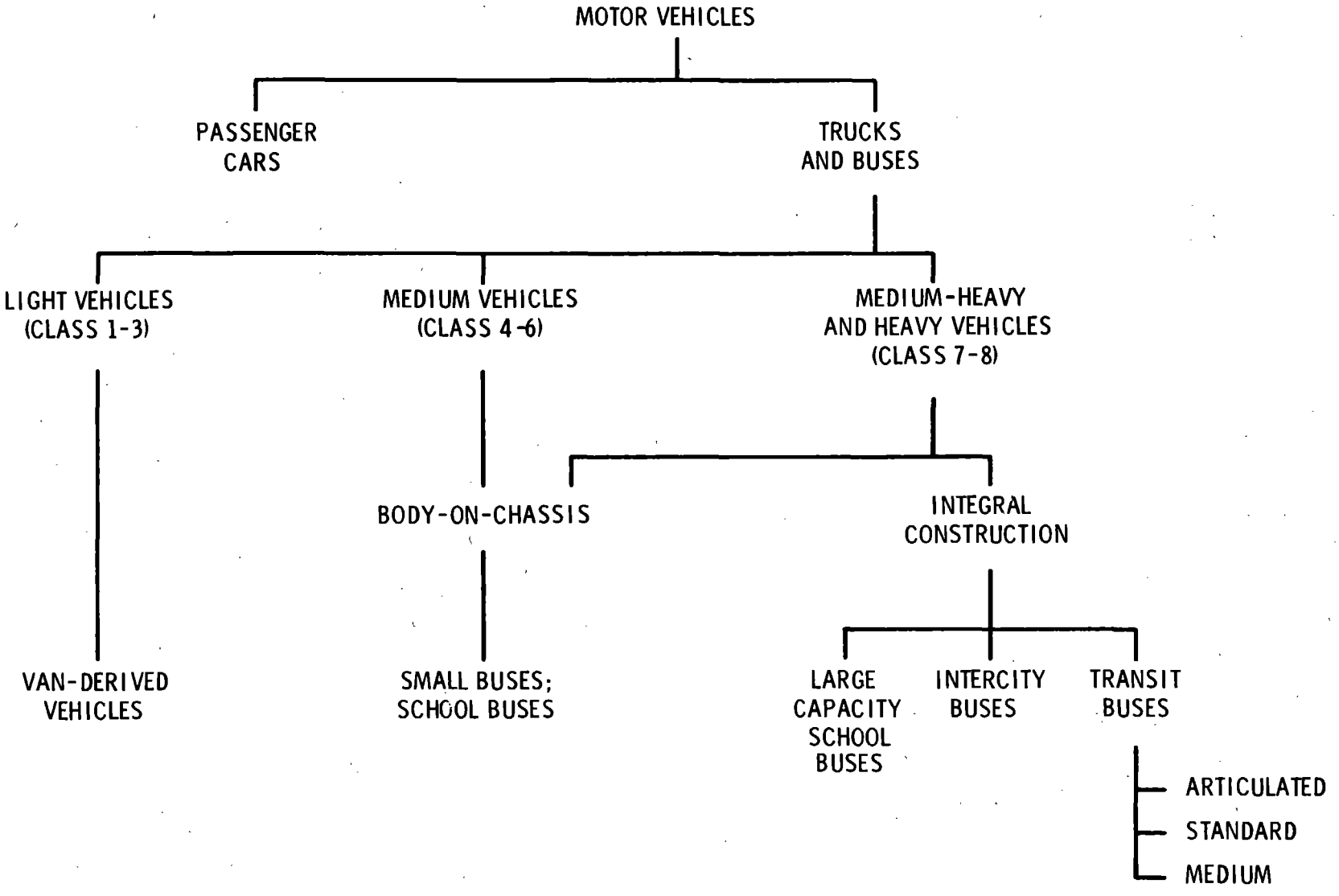


FIGURE 2-2. RELATIONSHIP OF TRANSIT BUS TO OTHER CATEGORIES OF MOTOR VEHICLES

Integral construction is usually reserved for larger buses, thus putting these buses in the same category as medium-heavy and heavy trucks. Body-on-chassis buses, by contrast, usually fall into the same category as medium trucks, although some may be classed as medium-heavy. Body-on-chassis construction is reserved principally for school buses in the U.S., although it also may be used for small buses in transit or intercity applications.

In the class of light vehicles (which include the pick-up truck and compact van), it is common to build special vehicles for paratransit use or for use as small buses on van chassis. The builders of these vehicles purchase a van chassis and complete manufacture with a special body.

Making these distinctions among types of buses is important because firms in the motor vehicle industry tend to specialize in individual types or sizes of vehicle or in certain phases of their manufacture. Five broad divisions of the truck and bus industry can be used to group companies according to phases of manufacture. These categories, which are listed in the first column in Table 2-1, are the truck chassis; engines and components; integral-construction vehicles; special vehicle bodies; and trailer bodies.

There is an interdependence among these categories. The truck chassis builders must buy their engines and components from the companies manufacturing them, and they sell their chassis to other companies which complete the vehicle by building on the special bodies. Integral-construction builders do not buy a separate chassis, but they still purchase engines and other components.

The size of the vehicle, measured in terms of the weight of the vehicle plus its maximum payload (gross vehicle weight), can be used to make further broad distinctions among groups of companies in the truck industry. From Table 2-1, it can be seen that at the light end, truck manufacture becomes virtually identical with passenger car manufacture. The same companies are involved, and there is much sharing of components and manufacturing techniques. A different group of companies, however, is involved at the other

TABLE 2-1. TRUCK AND BUS INDUSTRY

	SIZE		
	LIGHT VEHICLES CLASS 1-3	MEDIUM VEHICLES CLASS 4-6	MEDIUM-HEAVY AND HEAVY VEHICLES CLASS 7-8
TRUCK CHASSIS	CHEVROLET FORD G.M.C. CHRYSLER A.M.C. I.H.	FORD CHEVROLET I.H. G.M.C. CHRYSLER	I.H. FORD MACK G.M.C. KENWORTH FREIGHTLINER WHITE ETC.
ENGINES AND COMPONENTS	G.M. FORD CHRYSLER A.M.C. I.H. BENDIX BORG-WARNER BUDD ETC.	G.M. FORD CHRYSLER ETC.	D.D.A. (G.M.) CUMMINS CATERPILLAR ROCKWELL DANA EATON ETC.
INTEGRAL CONSTRUCTION VEHICLES	(SAME AS FOR TRUCK CHASSIS IN THESE WEIGHT CLASSES)	VARIOUS PRODUCERS OF TRANSIT AND INTERCITY BUSES, AND OF FIRETRUCKS	
SPECIAL VEHICLE BODIES	OVER 700 FIRMS IN THE U.S., INCLUDES PRODUCERS OF COMMERCIAL TRUCKS AND VANS, PARATRANSIT VEHICLES, GARBAGE TRUCKS, DUMP TRUCKS, SCHOOL BUSES, MOTORHOMES, ETC.		
TRAILER BODIES			OVER 300 FIRMS IN THE U.S., INCLUDES PRODUCERS OF TRAILERS AND DETACHABLE CONTAINERS.

end of the spectrum in building heavy trucks. This difference extends from the chassis builders to the suppliers of engines and components.

Integral-construction transit buses fall into the categories of medium-heavy, or heavy vehicles. Many of the same companies which supply engines and components for medium-heavy and heavy trucks also do so for transit buses.

Over time, it has been common for companies to diversify within the truck industry by entering the production of another type or size of vehicle or phase of manufacture. There are significant barriers to this kind of entry mobility within the truck industry, but these barriers are lower in many cases than for a company trying to enter from outside the truck industry.

Individual corporations, especially the large multidivisional ones which may be viewed as operating several firms, may have chosen to participate in several of the niches identified by the simple matrix illustrated in Table 2-1. General Motors, the most broadly based company in the motor vehicle industry, participates across the whole size range and in every phase except the manufacture of special vehicle bodies and trailer bodies. Examining only the heavy vehicle segments, GM, through its GMC Truck and Coach Division, is a builder of both truck chassis and integral-construction transit buses. GM, through Detroit Diesel Allison Division, is also a major supplier of engines and transmissions to all truck chassis builders.

A second example is Grumman Allied Industries, the subsidiary of Grumman Corporation, which owns and operates Flxible and has several motor vehicle ventures. In addition to integral-construction transit bus production, Grumman Allied Industries also is involved in building aluminum delivery van bodies and fire trucks.

Prime candidates for entering the transit bus manufacturing industry are firms producing integral-construction buses of other types. These would include producers of intercity buses and large-

capacity school buses. Secondary candidates might include producers of body-on-chassis school buses and producers of truck chassis. These firms already have the requisite engineering and manufacturing skills to choose their own chassis components and assemble them into a bus.

In North America, each of the companies involved in bus production have specialized in a limited number of bus types. The principal manufacturers and their products are listed in Table 2-2. It can be readily observed that most companies have a narrow product range in regard to buses.

Historically, the U.S. producers of transit buses also manufactured intercity buses, but this is no longer true. Flxible ended intercity production in 1969 and GMC in 1979.

The North American builders of intercity, standard and articulated transit buses are listed in Table 2-3, together with their plant locations and approximate employment. Figure 2-3 maps the location of transit and intercity bus assembly plants in North America.

TABLE 2-2. PRODUCT RANGES OF NORTH AMERICAN BUS MANUFACTURERS

FIRM	INTEGRAL CONSTRUCTION BUS						BODY-ON-CHASSIS BUS		TRUCK CHASSIS
	TRANSIT				INTERCITY	LARGE SCHOOL	COMPLETE SCHOOL BUS	SCHOOL BUS CHASSIS ONLY	
	ADB	NEW LOOK	ARTIC	MEDIUM					
GMC	X		P					X	X
FLXIBLE	X								
GM-CANADA		X	X						
FLYER		X							
NEOPLAN	X	X	X						
M.A.N.			X						
CROWN COACH			X		X	X			
GILLIG		X				X			
TMC/MCI (GREYHOUND)				X	X				
EAGLE (TRAILWAYS)					X				
PREVOST					X				
BLUEBIRD				X			X		
CARPENTER							X		
THOMAS BUILT							X		
WARD							X		
WAYNE							X		
SKILLCRAFT				X					
FORD								X	X
CHRYSLER								X	X
I.H.								X	X
CHEVROLET								X	X

X - In production or planned for production within one year.

P - Planned for production, but not within one year.

TABLE 2-3. NORTH AMERICAN TRANSIT AND INTERCITY BUS MANUFACTURERS

ESTABLISHED TRANSIT BUS BUILDERS	PLANT LOCATIONS	APPROXIMATE EMPLOYMENT
GMC TRUCK AND COACH	PONTIAC, MICH.	1400
GRUMMAN FLXIBLE	DELAWARE, OHIO	1200
DIESEL DIV., GM OF CANADA	ST. EUSTACHE, QUEBEC	700
FLYER INDUSTRIES	WINNIPEG, MANITOBA	500
NEW TRANSIT BUS BUILDERS		
M.A.N. TRUCK AND BUS	CLEVELAND, N.C.	600
NEOPLAN	LAMAR, COLO.	500
GILLIG	HAYWARD, CALIF.	230
CROWN-IKARUS	LOS ANGELES, CALIF.	120
INTERCITY BUS BUILDERS		
MCI (GREYHOUND)	WINNIPEG, MANITOBA PEMBINA, N.D.	1780
TMC (GREYHOUND)	ROSWELL, N.M.	900
EAGLE (TRAILWAYS)	BROWNSVILLE, TEXAS	740
	HARLINGEN, TEXAS	*
PREVOST	STE. CLAIRE, QUEBEC	250

*Plant is scheduled to open in the summer of 1982. Employment is projected to reach 650 at full production.

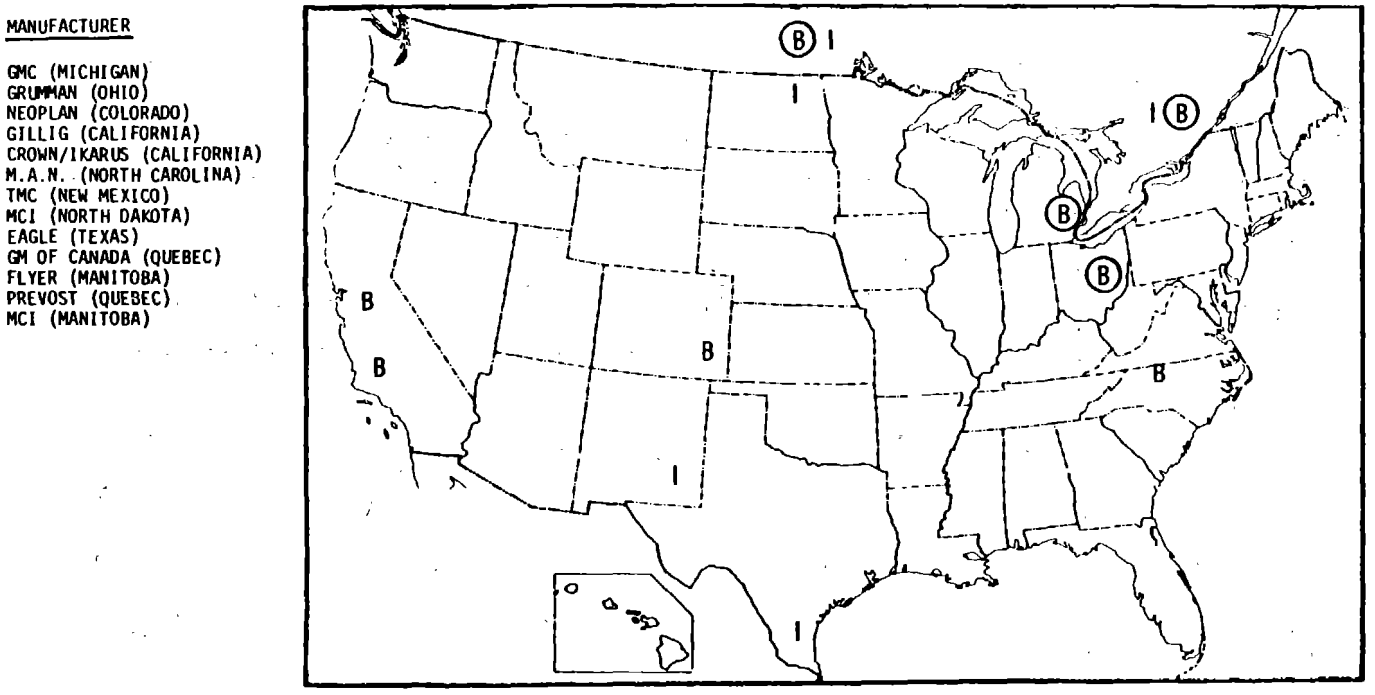


FIGURE 2-3. LOCATION OF TRANSIT AND INTERCITY BUS ASSEMBLY PLANTS IN NORTH AMERICA

3. HISTORY OF BUS MANUFACTURING

3.1 EARLY HISTORY

The history of bus manufacturing stretches back to the early development of the automobile. The first bus generally is thought to have been an eight-passenger vehicle built by Karl Benz in 1895. Most of the first buses were built on passenger car or truck chassis. In 1922, however, Fageol Safety Coach Co. (founded the year before) built a bus on a chassis especially designed for use with a bus (its chassis was lower than a regular truck chassis, had a longer wheelbase and a wider tread). This marked the first step in the development of the bus as a special vehicle quite separate and distinct from a truck.

The technological development of the motorbus continued throughout the 1920s and 1930s with most important developments originating in the United States. Advancing from the special chassis bus, Fageol completed the first integral-construction bus in 1926. General Motors introduced "monocoque" aluminum body construction in 1931. Powertrains were also improved with the introduction of automatic transmissions and two-cycle diesel engines in the 1930s.

During the 1930s, a large number of companies built motor buses, but the industry came to be dominated by five major manufacturers: General Motors, Fageol Twin Coach, Mack Trucks, A.C.F. Brill, and White Motor Co. G.M., Mack, and White were also major truck builders. Fageol specialized in buses, while A.C.F. Brill was also a streetcar manufacturer. A wide variety of models were produced for both the intercity and transit markets. About 6000 to 8000 buses a year were sold in the U.S. in the late 1930s and early 1940s.

Buses continued to be produced during the Second World War for the Armed Services, but at a somewhat reduced rate. After the war, bus sales soared as bus operating companies replaced buses which had been worn out during the war, when replacements

were unavailable. As a result of this surge in demand, bus sales reached their twentieth century peak in 1947-49. During the 1950s, however, bus sales plummeted as the personal automobile became the predominant mode of transportation. Annual sales of transit and intercity buses reached an annual rate of 3500 in the early 1950s, with transit buses accounting for approximately 70 percent of the total.

The sudden decline in bus sales put a good deal of pressure on the bus manufacturing industry and during the 1950s the number of manufacturere were reduced to two: General Motors and Flxible.

The first shakeout among the major producers occured in 1953. This shakeout coincided with the introduction of air suspension, a major technological innovation, by General Motors. A.C.F. Brill and White Motors elected to simply end bus production. Fageol transferred its bus manufacturing operation to a small company called Flxible. Flxible had been producing a small, intercity bus, but was not considered a major manufacturer.

Complaints about certain General Motors business practices in the bus industry, including the provision of credit to bus purchasers, the refusal to supply engines to competitors, and exclusionary contracts with some major bus purchasers, led to scrutiny by the Federal government in the mid-1950s. In 1956, the Justice Department filed a civil suit against General Motors on antitrust grounds. That suit, however, was not settled until 1965.

Following the shakeout of 1953, General Motors dominated the U.S. transit and intercity bus manufacturing industry, taking 80 percent or more of the market. In 1959, GM introduced the "New Look" transit bus replacing its earlier models. Mack Trucks elected to end transit bus production rather than to try to introduce a competitve model. Flxible, however, decided to stay in the market, and was able, by 1961, to introduce a bus model very similar to GM's.

3.2 THE EARLY DEVELOPMENT OF URBAN MASS TRANSPORTATION ADMINISTRATION (UMTA)

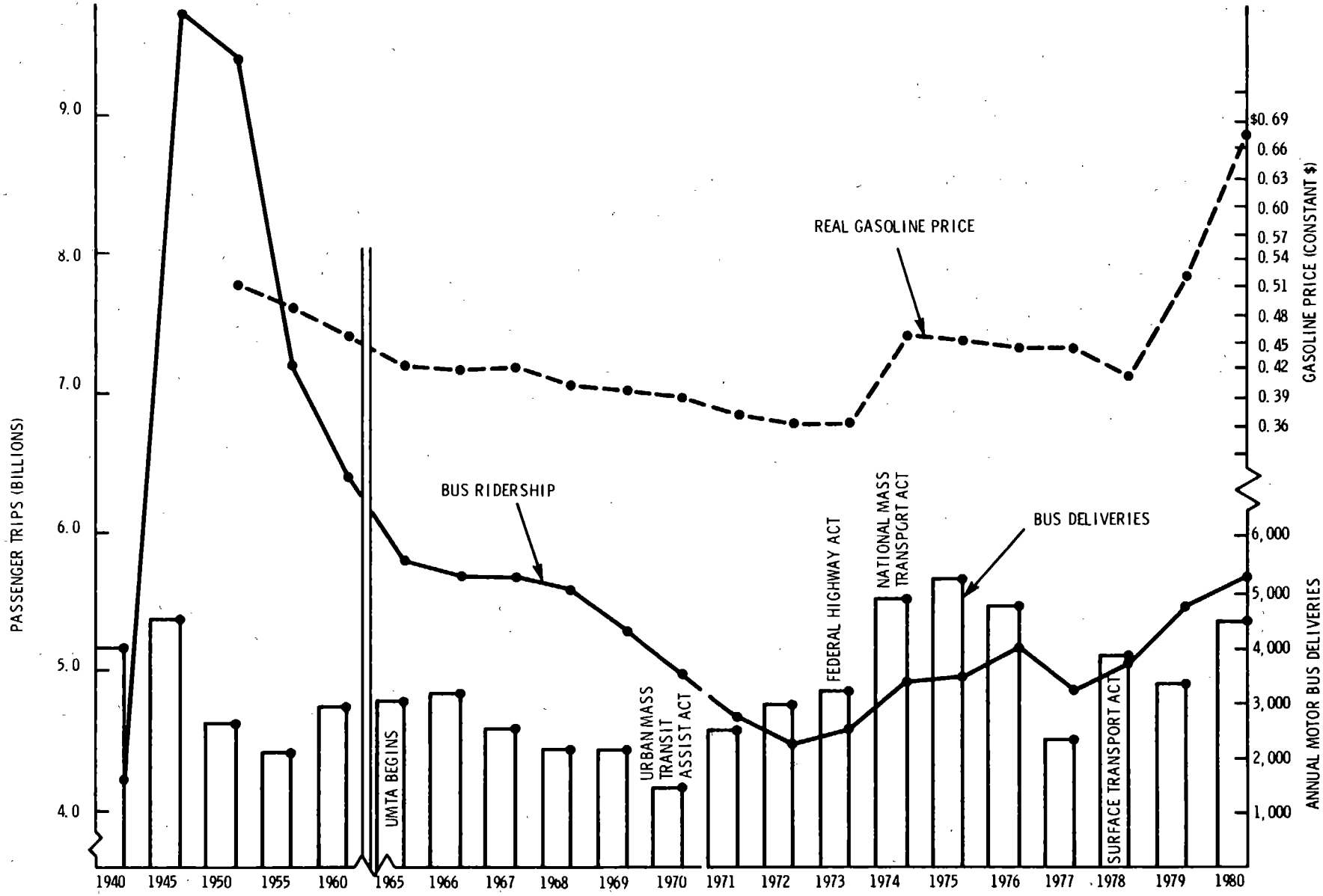
During the 1960s the decline in public transit that characterized the 1950s continued. As shown in Figure 3-1, bus ridership declined fairly steadily until 1972. As a result, deliveries of buses to public transit organizations continued at the low levels evidenced in the 1950s.

The decline in public transit ridership was a part of broad national changes in transportation patterns and social structure. The nation's population was using its new source of mobility, the private automobile, to move to the suburbs. The major part of the interstate highway system was under construction, suburban shopping malls were being developed, and new industry was heading for the beltways of major cities.

The move to the suburbs left behind aging inner cities, and urban decay was perceived in the 1960s as a major national problem. The decline of public transit was seen in this context as part of the urban problem. Consequently, as a Federal response to the national decline in public transit developed, that response was part of an urban policy.

The Housing Act of 1961 marked the first venture of the Federal Government into public transit. That act established the Federal Office of Transportation in the Housing and Home Finance Agency (HHFA) and provided $50 million for loans to state and local governments and $25 million for mass transit demonstration grants. The office evolved into the Urban Mass Transportation Administration (UMTA) and HHFA became the Department of Housing and Urban Development (HUD).

In 1964, the Urban Mass Transportation Act (the original enabling act for Federal assistance to transit) was passed, authorizing $375 million over three years including $30 million for research and development. Later legislation extended the spending authorization at comparable levels through 1969.



Sources: APTA FACT BOOK
DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION, 1980 ANNUAL REPORT TO CONGRESS, VOL. 2.

FIGURE 3-1. TRENDS IN BUS RIDERSHIP, BUS DELIVERIES AND REAL GASOLINE PRICES, 1940-1980

Although there was no important additional authorizing legislation in the late 1960s, important organizational changes in the administration of mass transit policy did take place. In 1965, HUD was created, absorbing HHFA, with an Urban Transportation Administration (UTA) as one of its operating agencies. In 1968, the UTA was renamed UMTA and moved to the then two-year-old Department of Transportation (DOT). By means of these changes, aid to public transit had evolved from a part of Federal urban policy into a part of Federal transportation policy. As an instrument of Federal transportation policy, the scope and scale of UMTA's activities expanded greatly, and authorizations for mass transportation spending increasingly were tied to spending for highways, another transportation mode experiencing heavy Federal involvement.

The transit bus manufacturing industry was not much affected by the early Federal involvement in transit funding. Much of the early Federal effort was aimed at helping local and state governments form regional public transportation authorities to absorb the private bus operating companies which were failing financially. Although some grants were made to purchase new buses, they accounted for only a fraction of all the transit buses purchased nationwide. Despite the Federal effort, bus ridership and transit bus deliveries continued to decline in the late 1960s.

3.3 THE CONSENT DECREE

Transit bus production in the decade was in the hands of GMC and Flxible, with GMC controlling the lion's share of production. In 1965, General Motors signed a consent decree with the Justice Department settling the civil antitrust suit started in 1956.

The decree sought to promote competition by requiring GM to sell its buses to all customers without discrimination; make available for sale to other bus makers all of its engines, transmissions, and bus parts; open its financing facilities to bus

buyers even if those buyers used GM financing to buy competitors' buses; and permit other bus makers to use all of GM's bus patents, owned at the time the decree was entered, without payment of royalties.

The decree is in effect until 1990, except for a reopener provision and a requirement that GM furnish bus parts other than engines through 1975.

3.4 EVOLUTION OF THE INTERCITY BUS MANUFACTURING INDUSTRY

The consent decree applied equally to transit and intercity bus production. Although there was no immediate change in the structure of transit bus production, the structure of intercity bus production was already changing radically at the time the decree was signed. Both GMC and Flxible produced intercity buses at the time of the decree and had done so for many years. The largest U.S. intercity carrier, Greyhound, had purchased its buses from GMC over an extended period. Trailways (then, Continental Trailways) had undertaken, in the late 1950s, to import buses from Europe. These were manufactured originally by Kassboher, a German firm also known by its tradename, Setra. Unlike Greyhound, however, Trailways is an association of independent carriers and not all the members chose to purchase the Setra buses.

In 1963, Greyhound began purchasing buses built by a Canadian bus manufacturer called Motor Coach Industries (MCI). MCI was owned by Greyhound Lines of Canada which is controlled by Greyhound, Inc. in the U.S. Greyhound proceeded to phase GMC out and in 1967 took delivery of its last GMC bus. The end of the relationship between GMC and Greyhound appears to have taken place independent of the consent decree, but it is clear that the provisions of the decree might have been interpreted in such a way as to prohibit GMC from entering into the kind of exclusive seller agreement that it had with Greyhound.

Greyhound has since expanded its bus manufacturing operations. MCI established an assembly plant in Pembina, North Dakota, where it builds buses, mostly for non-Greyhound customers. Greyhound, Inc. established a second bus manufacturing subsidiary called TMC in a plant in Roswell, New Mexico in 1974. The Roswell plant produces most of the buses used by Greyhound itself. In 1979, TMC began production of a medium transit bus called the City Cruiser. The design for the City Cruiser was licensed from Ontario Bus Industries, which sells a similar bus, which it calls the Orion.

Trailways' importing venture gradually evolved toward manufacturing, first with a plant in Belgium and then with the founding of the independent Eagle Manufacturing Co. in Brownsville, Texas. Eagle began building buses for Trailways in 1974 in Brownsville. Trailways has since taken control of Eagle, and Eagle is now a wholly owned subsidiary of New Trails, Inc., the Trailways parent corporation.

The entry of the two major intercity carriers into the bus manufacturing business has served to displace GMC and Flxible. Flxible, which had two intercity bus models, discontinued production of the first in 1967 and the second in 1969. GMC was able to continue in the intercity market after the end of its Greyhound business by selling to independent carriers, but seeing its business decline gradually, GMC elected to end production in 1979 rather than introduce a new model.

3.5 GROWTH IN UMTA SPENDING

Major increases in UMTA funding began with the Urban Mass Transportation Assistance Act of 1970, which provided $10 billion over twelve years for mass transit. This act was supplemented by some provisions of the Federal Aid Highway Act of 1970 which provided additional assistance for public transportation, bus and parking projects. The Federal Aid Highway Act of 1973 went much further by making possible the transfer of interstate highway funds. The 1973 Act also increased the Federal share in mass transit projects to four-fifths (80 percent) from two-thirds (67 percent).

The National Mass Transportation Assistance Act of 1974 also provided substantial funds, and permitted, for the first time, direct grant subsidies for operations. The surge in mass transportation funding culminated in the 1978 Surface Transportation Act which authorized $15.1 billion in appropriations plus up to $2.8 billion in interstate transfers for public transportation.

3.6 REACTION IN THE TRANSIT BUS MANUFACTURING INDUSTRY

The seemingly massive commitment of 1970 inspired a great deal of interest in the, until then, dormant transit equipment manufacturing industry. Rohr, an aerospace manufacturer anticipating declining NASA budgets, was one of those interested. In 1970, Rohr bought the Flxible Company, which, until then, had been independent, and proceeded to finance its rapid expansion.

Another interested company was AM General, a subsidiary of American Motors Corporation (AMC). AM General built vehicles for direct sale to the Federal government. These were mostly tactical military vehicles - army trucks and jeeps - and postal delivery trucks. In 1971, AM General bought the rights to produce a transit bus design from a Canadian bus manufacturer called Flyer Industries, and announced its intention to enter the transit bus manufacturing industry. AM General actually began production in 1974.

These new manufacturers were not disappointed. As a result of Federal subsidies, bus purchases increased substantially. Deliveries of new transit buses increased substantially in the early 1970s, from their post-World War II low in 1970 to a peak in 1975 of over 5000. The three transit bus manufacturers shared approximately equally in bus sales, with each company accounting for about one-third of deliveries in the 1974-1975 period. For AM General, this was new business. For Flxible, it represented a substantial gain in both unit sales and market share. For GMC, there was a loss of market share and no significant gain in unit sales.

Under the Superbus project, initiated in 1972, UMTA sponsored an examination of articulated bus technology by a group of ten cities. In 1973, this examination included a European tour in which representatives of the group visited manufacturers and transit operations. In 1974, M.A.N., a West German firm, and Volvo, a Swedish firm, demonstrated articulated transit buses in the United States under the sponsorship of the program.

The Superbus project* helped prepare cities to purchase articulated transit buses. In 1975, Seattle Metro issued the first solicitation for these buses. That first solicitation was not bid by manufacturers. However, in 1976, two solicitations (one by Seattle Metro, the second by a consortium) did result in contracts. Both contracts were won by the sole bidder, a joint venture by AM General and M.A.N.

The introduction of a new generation of transit buses to replace the "New Look" models which have been introduced in 1959-1961, caused a great deal of controversey. A large part of this controversy revolved around the Transbus program, which was aimed at developing this new generation of transit bus, but the decision to introduce advanced design buses was one made by the industry independent of Federal direction.

The Transbus program found its origin in a study published in 1968 by the National Academy of Engineering which called for the development of a new transit bus to replace the 1959 "New Look". UMTA initiated the Transbus program in 1971, aiming at the development of a bus which would replace the "New Look" as the standard of the industry. In 1972, UMTA signed contracts with three bus manufacturers,** each of whom was to develop a prototype.

*For further information, see the California Department of Transportation Report, The Development and Operation of High Capacity Buses in the United States.

**GMC Truck and Coach Division, General Motors Corp.; Flxible Company, Rohr Industries; AM General, American Motors Corporation.

Following the development and testing of prototypes, it was hoped that it would be possible to put a new generation of buses into production, replacing the "New Look" generation of buses.

After the prototypes had been produced and tested, an attempt was made to induce regular production of buses meeting Transbus specifications. This attempt, which will be described later, was unsuccessful.

3.7 THE ADVANCED DESIGN BUS

Although the Federal Government's attempt to mandate a specific replacement for the "New Look" was unsuccessful, the Transbus prototype development did contribute to the development of a new generation of buses. This new generation was called Advanced Design Bus (ADB). The ADBs were developed independently by GMC and Flxible, but both companies acknowledged the importance of the Transbus program in underwriting engineering research and development.

GMC Truck and Coach began pursuing its own path toward a new generation of transit buses very early. General Motors demonstrated an experimental bus which it called the RTX in 1968, the same year in which the National Academy of Engineering published the study which led to Transbus.

General Motors announced as early as 1971 its willingness to produce an advanced design bus based on its experience developing the RTS prototype. The company publicly committed itself to producing an advanced design bus in 1973. Introduction of the RTS II advanced design bus came in 1975 when GMC presented a prototype to the transit industry and began to solicit orders.

In April, 1976, a consortium of transit properties moved to procure the new GMC advanced design bus. The consortium submitted a proposed bid package, including a set of proposed specifications, to UMTA. UMTA modified and concurred with the specifications, which were advertised for bid in June, 1976.

In August 1976, AM General filed a suit against the Department of Transportation, challenging the legality of permitting procurement of ADBs using specifications which effectively excluded AM General from bidding with its "New Look" type bus. AM General lost its suit, and subsequently left the market rather than invest in an ADB of its own.

Flxible, which had begun work on its own ADB in 1971 with the help of its parent company, Rohr, introduced its own ADB in 1976. Between introduction and actual production, Flxible was sold by Rohr to Grumman, another aerospace manufacturer. Grumman proceeded with actual production in 1978.

GMC and Flxible pursued similar strategies in their introduction of ADBs. Although their buses were dissimilar in structural design, both companies aimed for a premium product. The two buses shared such features as standard air-conditioning, sealed windows and cantilevered seats. Both buses were designed with fewer parts with the objective of lowering manufacturing cost. Both companies spent tens of millions of dollars on new tooling and equipment. GMC, which reportedly spent $50 million, built a highly automated facility, using welding robots and other sophisticated equipment.

3.8 THE FAILURE OF TRANSBUS

Meanwhile, although the introduction of the ADBs was complete, the Department of Transportation continued to press for the production of the Transbus. In May, 1977, the Secretary of Transportation stated that after September 30, 1979, all buses purchased with Federal funds would have to meet the specifications developed for Transbus. The ADBs would not be eligible for purchase with Federal funds. The first Transbus bids were requested by transit properties in January, 1979. However, no bids were received in response to these solitications by the May bidding deadline. The U.S. manufacturers, refusing to bid, cited both technical and business reasons.

The September 30, 1979 deadline was suspended in August, 1979. Procurement of ADBs and "New Look" buses remained possible.

The extensive publicity surrounding the unsuccessful attempt to induce manufacturers to build a Transbus attracted the attention of entrepreneurs at home and many companies abroad. For example, the DeLorean Motor Co. demonstrated a couple of German-built buses developed under a technology improvement and standardization program in West Germany, claiming that these buses could meet the objectives of Transbus. M.A.N. and Volvo also examined the specifications and seriously considered bidding.

3.9 WHITE BOOK

With the introduction of the Flxible "870", the problem of writing solicitation specifications in a way that preserved competition, but still permitted procurement of the ADB over the "New Look", became acute. Since the ADBs were premium products, adherence to a low bid, open specification, philosophy would result in contract awards always going to companies offering the most utilitarian (and therefore cheapest) bus, rather than the bus which was actually desired---the ADB. This problem was compounded by the fact that the two ADBs were very different in their structural design. Consequently, the traditional practice of writing specifications by tightly describing dimensions, components, materials and design would automatically result in the exclusion of one ADB or the other in any solicitation.

These problems never had to be confronted when the "New Look" buses were being procured, because the "New Look" buses were uniformily utilitarian. Moreover, the GMC and Flxible buses were very nearly identical, except for relatively minor details.

To solve this problem, UMTA developed and circulated a model bus procurement solicitation with a full set of functionally defined specifications. Included in these specifications were a set of price offsets for the evaluation of bids which included certain specific, desired features. A manufacturer offering the specified feature would have his bid "reduced" by the price offset

before it was compared to the bid of a manufacturer not offering the feature. Thus, the offerer of a premium bus could realize a premium price, while the inability to offer a specified design feature would not exclude a company from bidding. This model procurement document has been commonly referred to as the White Book. UMTA issued the Withe Book in April, 1977, and the White Book was first used in a procurement in August, 1977. Issuance of the White Book did not require transit properties to use it without modification. The White Book was issued as, and has remained, a set of specification guidelines. The practical incentive for using it was that it facilitated gaining a favorable UMTA review and avoided the considerable cost of developing acceptable alternative specifications.

Transit properties which wished to continue to procure "New Look" buses could do so by preparing their own specifications in the traditional manner.* Since the established U.S. builders had stopped building "New Look" buses by 1978, transit properties wanting "New Look" buses had to turn to other builders. At first, principally Canadian manufacturers, and more recently, Neoplan and Gillig in the U.S. have been the main suppliers. Procurement from the Canadian builders was possible under the Buy America rule because their bus was viewed as being a kind of bus not available from U.S. builders.

Following the introduction of the ADBs, the great majority of standard-size transit buses purchased were of the ADB-type. "New Look" purchases continued, however. An estimated 16 percent of bus procurements in fiscal year 1980 were for "New Look" buses produced by Canadian firms.

*It is unclear whether the majority of transit properties understood they still had the option of buying "New Look" buses even after issuance of the White Book. A 1981 GAO report found that some transit officials were under the impression that only ADBs could be purchased with Federal funds either because of the White Book or Buy America. The Urban Mass Transportation Administration's Involvement in Bus Specifications and Testing, Government Accounting Office, June 5, 1981 pp. 5-6.

In the period since the introduction of the ADBs and the collapse of Transbus, four new manufacturers have established plants in the United States and have begun producing transit buses. These four manufacturers are representative of a much larger body of companies which are interested in the U.S. transit bus market. Their story is examined in the next chapter which looks at the recent strategies and activities of bus manufacturers in relation to the U.S. transit bus market.

4. MANUFACTURERS' PROFILES

4.1 GMC TRUCK AND COACH DIVISION

4.1.1 Summary

GMC Truck and Coach Division of General Motors Corporation is by far the largest producer of transit buses in the U.S. Existing transit bus production capacity approximates 5000 buses per year.* Current employment in transit bus manufacturing at the GMC Truck and Coach Division stands at about 1400. Other products of the Division include: chassis for school buses; cabs; truck chassis; motor-home chassis; vans; pickups; and utility vehicles. Plant operations and company headquarters are located in Pontiac, MI. A large distribution and sales network is an integral part of the companys' operations. Table 4-1 summarizes some basic company reference information.

4.1.2 Corporate Overview

Transit buses are built by two divisions of the General Motors Corporation in North America. In the United States, the GMC Truck and Coach Division builds the RTS 04 advanced design bus in Pontiac, Michigan. In Canada, the Diesel Division, General Motors of Canada, produces "New Look" transit buses in St. Eustache, Quebec. (The Diesel Division and its transit bus activities are described in Section 4.3.)

General Motors is also the principal supplier of diesel engines, automatic transmissions, starters, alternators, and batteries for transit buses built by other bus manufacturers. The Detroit Diesel Allison Division builds the diesel engines and automatic transmissions. Delco Remy Division produces the electrical components and batteries.

*Two-shift operation; 250 days per year.

Despite participation in the transit bus manufacturing industry as both a bus builder and bus component supplier, General Motors' revenues from U.S. transit bus sales are still less than 2 percent of its total worldwide revenues.

General Motors Corporation is the largest automobile manufacturer, and one of the largest industrial corporations in the world. Its activities are primarily in the automobile industry. Less than ten percent of its U.S. sales are non-automotive. Nevertheless, its high degree of vertical integration - much greater than that of most other automakers - has involved the company in the wide variety of businesses, ranging from iron casting, to electronics manufacture, to making bearings, to fabricating plastic parts. The sheer volume of its requirements for automobile manufacture has often enabled the company to undertake these diverse activities at scales rivaling that of the largest independent firm in these industries.

To manage such a huge and diverse enterprise, GM has adopted a divisional system of organization, with the divisions reporting through a group vice-president or executive vice-president to the president of the corporation. Subject to the board, these divisions manage their individual businesses. This organizational system is diagrammed in Figure 4-1. Only the line organization is shown here. The staff organizations report to the chairman of the board.

The divisions, in most cases, are vestiges of one or more of the companies which William Durant brought together to form General Motors in the early part of this century. ALthough there has been an observable tendency for given divisions to assume functional identities--casting division, radiator division, wiring division, etc.--this evolution is by no means complete, and individual divisions may themselves be engaged in a number of businesses. Moreover, two or more divisions may frequently find themselves in "competition" with each other.

Traditionally, the GMC Truck and Coach Division of General Motors was one of six divisions in the Car and Truck Group, making it one of six "auto companies" within GM selling automobiles.

In July, 1981, General Motors began a series of organizational changes which are expected to result in the formation of a Truck and Bus Group. GM's Japanese affiliate, Isuzu and GM's British truckmaking subsidiary, Bedford, will also report through this structure.

GMC's product line (itemized in Table 4-2) includes a full range of trucks, vans, and chassis as well as integral construction of the city bus. Part of this line, especially at the lighter end, is identical with products marketed by the Chevrolet Division.

Although the Division has a major manufacturing complex of its own in Pontiac, Michigan with facilities for vehicle assembly and body fabrication, other divisions of the corporation carry a large part of the responsibility for manufacturing the Division's products. Final assembly of many of the light trucks marketed by both GMC and Chevrolet, for example, is by the GM Assembly Division. GMC is the only one of the seven divisions in the Car and Truck Group not to have engine manufacturing operations of its own. The car divisions supply the engines for its light vehicles. Detroit Diesel Allison and independent suppliers supply the engines and transmissions for its medium and heavy-duty vehicles.

General Motors, one of the largest industrial corporations in the world, reported sales in 1981 of 62.7 billion dollars, down six percent from 1979. The decline in sales reflected a drop in unit motor vehicle sales from nearly 9 million in 1979 to 6.8 million in 1981. This decline in the company's unit volume can be attributed to the general slackening of automobile demand in the company's major markets and a dramatic shift in consumer demand toward smaller, more fuel-efficient cars, particularly in the U.S.

GMC Truck and Coach Division transit bus sales are not reported by the company. However, they can be estimated to be approximately $250 million, based on deliveries of 1900 transit buses at prices ranging from $125,000 to $140,000 per bus.

The deterioration in sales and the market shift which changed the GM product mix can be cited as the primary factors responsible for the corporation reporting a loss in 1980 of $762.5 million. This was the first such loss since 1921 in the corporation's history. The downward trend in earnings was further affected by depreciation and tool amortization increases reflecting increased capital expenditures. The loss was primarily attributable to the company's automotive operations, and these operations continued to show a loss in 1981.

GMC Truck and Coach Division has consistently quoted its break-even volume for transit bus production at 2200 buses per year. When volume is less than that amount, the company loses money or makes a very small profit on transit bus production. Production volume exceeded 2200 units in 1980 for the first time since the existing plant started operation in 1977. Volume in 1981, at 1900 units, was again below the break-even target.

Table 4-3 provides statistics on GM sales and income for six years. It also shows the recent movements in production volume for GM's motor vehicle businesses, including buses.

Responding to changes in the automotive market because of increased energy prices and also to opportunities presented by growth and changes in overseas markets, GM has embarked on a program of greatly increased capital expenditure. These expenditures for new models and new or modernized plants are expected by GM to exceed $40 billion over the 1980 to 1984 period. Capital outlays in 1980 were $7.8 billion,* representing an increase of 44 percent over the previous year. Substantial increases occurred in 1978 and 1979 as well. Expenditures in 1981 exceeded $8.7 billion dollars.

*Figures include expenditures for special tools. These were $2.60 billion and $3.18 billion in 1980 and 1981, respectively.

GM's capital spending is concentrated in the U.S. and Canada, but the precentage going to North America has been declining as expenditures have risen, --- falling from 86 percent in 1978 to 57 percent in 1981.

GM has traditionally been regarded as one of the most financially conservative of major industrial corporations. It has carried relatively little debt and has usually financed its dividends and capital spending from current operations.

However increases in capital expenditures, combined with falling sales and a loss, forced the company to borrow $1.3 billion in long-term debt in 1980 and $2.2 billion in 1981.

Some 93 percent of GM's worldwide sales in 1981 were attributable to automotive products with 96 percent of the company's U.S. sales similarly attributable to automotive products.

GM has reported to the press that its initial investment in plant, equipment and tooling to produce the RTS series of transit buses was approximately $50 million.

4.1.3 Company History

GM has its origin in the entrepreneurship of William C. Durant, a Flint, Michigan businessman. Starting in 1885 in the carriage business, Durant had become a millionaire by 1900. In 1904, looking for new worlds to conquer, he acquired control of a bankrupt automaker named Buick, and embarked on a course of rapid expansion. In 1908, he formed the General Motors Company to facilitate his strategy of expansion by acquiring other automobile manufacturers and automobile suppliers.

In the course of this acquisition policy, GM acquired the Rapid Motor Vehicle Company, a Detroit truckmaker, forming the basis of what is now the GMC Truck and Coach Division. Two years later, in 1911, the General Motors Truck Company was formed to handle sales of Rapid and another truck maker named Reliance.

General Motors participation in the bus manufacturing industry began in 1925 when it acquired an interest in the manufacturing subsidiary of the Omnibus Company (later the Hertz Corporation). That subsidiary, known as the Yellow Coach Manufacturing Co., was the largest bus manfuacturer in the U.S. at the time. In a complex arrangement, GM merged its General Motors Truck Company with the Yellow Coach Manufacturing Co. to form the Yellow Truck and Coach Co. Yellow Truck and Coach continued until 1943, when GM acquired the remaining minority interests and formed the present GMC Truck and Coach Division.

After the Second World War, GM came to dominate the transit and intercity bus manufacturing industry. Yellow Coach was producing about 20 percent of all buses in the U.S. when GM acquired its interest in 1925. By the late 1940s, GM had increased its market share to over 40 percent, and by 1955, was producing over 80 percent of all transit and intercity buses. GM was accused by the other bus manufacturers of anti-competitive practices, and in 1956, the Justice Department filed a civil antitrust suit against the company.

This suit finally was settled in 1965 by a consent decree. The decree sought to promote competition by requiring GM to sell its buses to all customers without discrimination; make available for sale to other bus makers all of its engines, transmissions and other bus parts; open its financing facilities to bus buyers even if those buyers used GMC financing to buy competitor's buses; permit other bus makers to use of all of GM's bus patents owned at the time of the decree without payment of royalties; and to make available to competitors all new patents it developed over the period to 1975. A reopener clause and the provision of the decree which required GM to furnish bus parts other than engines to other bus makers expired in 1975, but the other provisions of the decree extend to 1990.

As the leading bus manufacturer, GM was responsible for a number of technological advances in bus design. Experiments with diesel engines led GM to offer two-cycle diesel engines in buses for the first time in 1938. Allison automatic transmissions were offered in GM buses for the first time in 1948. Air suspension was introduced by GM in 1953. In more recent years, GM has experimented with turbine engines for buses.

The GMC transit coach has evolved gradually over time through a series of infrequent, new-model introductions and, more frequently, minor improvements. Monocoque body construction was introduced in 1931. In 1938, GMC adopted a rear engine design for its integral-construction transit coaches. In 1948, GM offered a forty-foot transit bus for the first time. In 1959, the company introduced the "New Look" bus which was to be the standard of the transit industry for nearly twenty years.

Work on a replacement for the "New Look" bus began in 1964, culminating in 1968 with demonstration of an experimental prototype dubbed the RTX. In 1971, GM announced its willingness to produce a new model bus, the RTS, whose design had derived from experience with the RTX, if the Federal government would permit purchase of the new model with Federal assistance. Also in 1971, GM, along with AM General and Rohr (Flxible), agreed to participate in the Department of Transportation's Transbus development program.

In 1973, GM announced its intention to tool up to produce its RTS transit bus. GM's 1973 Annual Report estimated the cost of tooling and equipment to introduce the new bus to be $36 million and projected a 1976 introduction.

In September, 1975, GM introduced a prototype RTS coach and began to solicit orders. A consortium of six cities led by Houston, Texas placed the first order, with DOT approving the consortium's bid in August, 1976. A suit by AM General, another bus builder, against the Department of Transportation (DOT) stopped the sale. AM General challenged DOT's approval on the

grounds that the bid specifications, written to assure procurement of a bus with the advanced features offered by the GM RTS, were exclusionary. After nearly a year's delay, the court upheld the DOT. Actual production of the RTS began in the Summer of 1977, and the first deliveries were made in October, 1977. At the time of introduction, GM estimated the total cost of facilities, tooling and equipment for the RTS to be $50 million. The initial RTS model was designated the RTS II. Deliveries of a modified design, called the RTS 04, began in August, 1980, thus replacing the initial design. The RTS 04 incorporated several improvements, most notably the use of the '92' series Detroit Diesel engine in place of the older '71' series, and also the relocation of the air conditioning unit.

A chronology of events is given in Table 4-4.

4.1.4 Product Line of Buses

At present, GMC Truck and Coach Division's sole transit coach product is its "advanced design" bus--the RTS 04 series. Along with Grumman and new-entrant Neoplan, it is one of the few sellers of these vehicles in the U.S. The RTS-04 bus is factory-equipped with a Detroit diesel engine and Allison transmission. Its design employs unitized construction with an integral body structure. A rear entry/exit wheelchair lift comes as standard equipment. Independent front suspension, extensive use of stainless steel in the body, and a kneeling feature are other significant aspects of the bus design. The RTS series has been manufactured by GMC since 1977 and is available in 35- and 40-foot lengths.

GMC also produces a line of unit construction school bus chassis. These chassis are delivered to independent body-on-chassis school bus manufacturers for final assembly as school buses. GMC formerly produced a line of intercity buses, but has withdrawn from that market. Recently, GMC announced its future intentions to produce a high-capacity articulated transit bus by 1984.

The principal subsystems and components with technical specifications and supplier are detailed in Table 4-5 for the RTS-04 advanced design bus. The RTS series basic construction technique is of modular construction, composed of five-foot individual modules. The RTS-04 is available with a full range of premium, performance, and safety options. Overall exterior dimensions of the bus may be found in Figure 4-2.

GM maintains production facilities for buses at its Pontiac, MI location. The plant is part of the larger ring of the company's plant structure in that city. Some essential characteristics of the plant are listed in Table 4-6.

GM's bus manufacturing plant is heavily automated relative to most other bus production facilities. Because of this, it is able to operate more efficiently and cost-effectively at higher output relative to its competitors. The company estimates its break-even production volume to be at a level of 2200 motor buses per year. This is roughly 50 percent of its capacity on an annual basis. Production has been sluggish in the past couple of years, reflecting conservative purchasing decisions by transit properties, the influence of new entrants, and a general fall-off in the underlying demand for new buses. Business activity is illustrated by the six-year production trends presented in Table 4-7.

Employment in transit bus production at the current production rate of eight buses per day numbers some 1400 of which 1100 are in bus assembly and an additional 300 are involved in fabricating bus body parts. These numbers do not include the engineering, service, or sales staffs.

4.1.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment effort.

Reference Sources - As considered here, reference sources (although useful and credible data and information) do not have the formal, publication-referenceable quality of the articles and publications appearing in the open literature and cited in the bibliography which follows. Reference sources, nevertheless, are compiled and presented here for completeness sake and as evidence of the interaction and dynamics of the industry analyses conducted with the cooperation of the various companies.

The Transportation Industry Analysis Branch has developed (and maintains and refines) a broad motor vehicle industry reference collection which encompasses, in broad categories, a gamut from mini-cars; to light trucks and vans; to buses; to heavy trucks. This reference collection served as a significant research tool in support of the analyses.

In addition, staff members of the Transportation Industry Analyses Branch visited and conducted extensive interviews at the GMC Truck and Coach Division's plant and headquarters in Pontiac, Michigan in September, 1981. The visit and interviews were complemented by a series of telephone conversations with company officials.

GMC Truck and Coach Division press releases and photographic coverage of their product line buses also were used as reference sources.

The following additional company literature was used in support of the analysis and assessment:

- "Shape of Things to Come" (1981), Articulated Bus Description.
- "RTS 04 Series," (1981).
- General Motors, Annual Report, 1981, 1980 and 1973.
- "RTS 04 Series: The Advanced Design Transit Coach for the 80's and Beyond" (1980).
- "RTS Concept and Reality" (1979).
- "Public Transportation For the Cities," (1977-78).

- o GMC Truck and Coach Division Press Releases, August 13, 1980 and September 23, 1977.
- o "RTS Viewpoints," (no date).
- o "The Most Corrosion Resistant Coach We've Ever Built", (no date).
- o "This is GMC, The Truck People From General Motors," (no date).
- o General Motors, Public Interest Report, 1977-78, and 1979.

Bibliography - The following significant publications were used in support of the analyses and assessments:

- o "GMC May Suspend or Reduce Transit Bus Operations in January," American Metal Market (October 5, 1981), p. 33.
- o "GM Forms World Truck Group," Ward's Automotive Reports, (6/29/81), p. 204.
- o "American Bus Manufacturers," Metropolitan, (March/April 1981), p. 32.
- o "General Motors Corporation," Moody's Industrials, (1980), p. 1182+.
- o "Busing," Forbes, (8/1/79).
- o "GM Decision Not to Bid May Dash Hopes for Transbus Plan to Aid Handicapped," Wall Street Journal, (4/30/79).
- o "GMC Ends Intercity Bus Production," Bus Ride, (August 1979).
- o "GMC's Truxell and Stokel," Metropolitan, (November/December 1978) pp. 13-20.
- o "RTS-IIs Finally Make It," Mass Transit (12/77), pp. 53-53.
- o "Advanced Design Transit Bus Goes Into Production at GM," Metropolitan, September/October (1977), p. 24.
- o "Bus Upgrading Blocked," Washington Post, (5/4/76), p. B15
- o "Life Begins at 50," Mass Transit, (5/76), pp. 29-35.

- "GMC Truck and Coach Division," Metropolitan, (May/June 1974), p. 6.
- "GM Domination of Bus Output to be Studied in Light of '65 Decree, Antitrust Chief Says," Wall Street Journal (2/27/74), p. 2.
- "GM Designs New Coach," Metropolitan, (July/August 1973) p. 22.
- "United States of America v. General Motors Corporation" Court Decision, Case No. 1297, Commerce Clearing House, (1966) 71,624. pp. 81,802-81,810.
- United States of America, Plaintiff v. General Motors Corporation, Defendant, Stipulation, Civil Action No. 15816, (November 30, 1965), In the United States District Court for the Eastern District of Michigan.
- "A Study of the Antitrust Laws," Hearings Before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, United States Senate, Part 6, November 8, 9, 10, 15, 16, 17, 18, 21 and 22, 1955, U.S. Government Printing Office, (1956).
- "United States of America, Plaintiff v. General Motors Corporation, Defendant," Complaint, Civil Action No. 15816, (July 6, 1956). In the United States District Court for the Eastern District of Michigan.
- A Study of the Antitrust Laws, Report of the Committee on the Judiciary, United States Senate, Containing the Staff Report of the Subcommittee on Antitrust and Monopoly Pursuant to S. Res. 61, entitled "Bigness and Concentration of Economic Power. A Case Study of General Motors Corporation," U.S. Government Printing Office, (1956).

TABLE 4-1. COMPANY DIGEST - GMC TRUCK AND COACH DIVISION

Name of Company:	General Motors Truck and Coach
Address:	General Motors Corp. GMC Truck & Coach Division 660 South Blvd., E. Pontiac, Michigan 48053
Telephone:	(313) 857-5000
Transit Bus:	RTS-04 Advanced Design Bus (35' and 40'); Articulated Planned.

TABLE 4-2. PRODUCT LINES - GMC TRUCK AND COACH DIVISION

- Vans and Utility Vehicles (4500 to 10,000*)
- Pickups (4700 to 10,000)
- Forward Control Chassis (6800 to 14,500)
- Motor Home Chassis (10,500 to 14,500)
- Chassis Cab (Truck and Tractor) Series (8600 to 66,000)
- School Bus Chassis
- Advanced Design Transit Bus

*Pounds, Gross Vehicle Weight

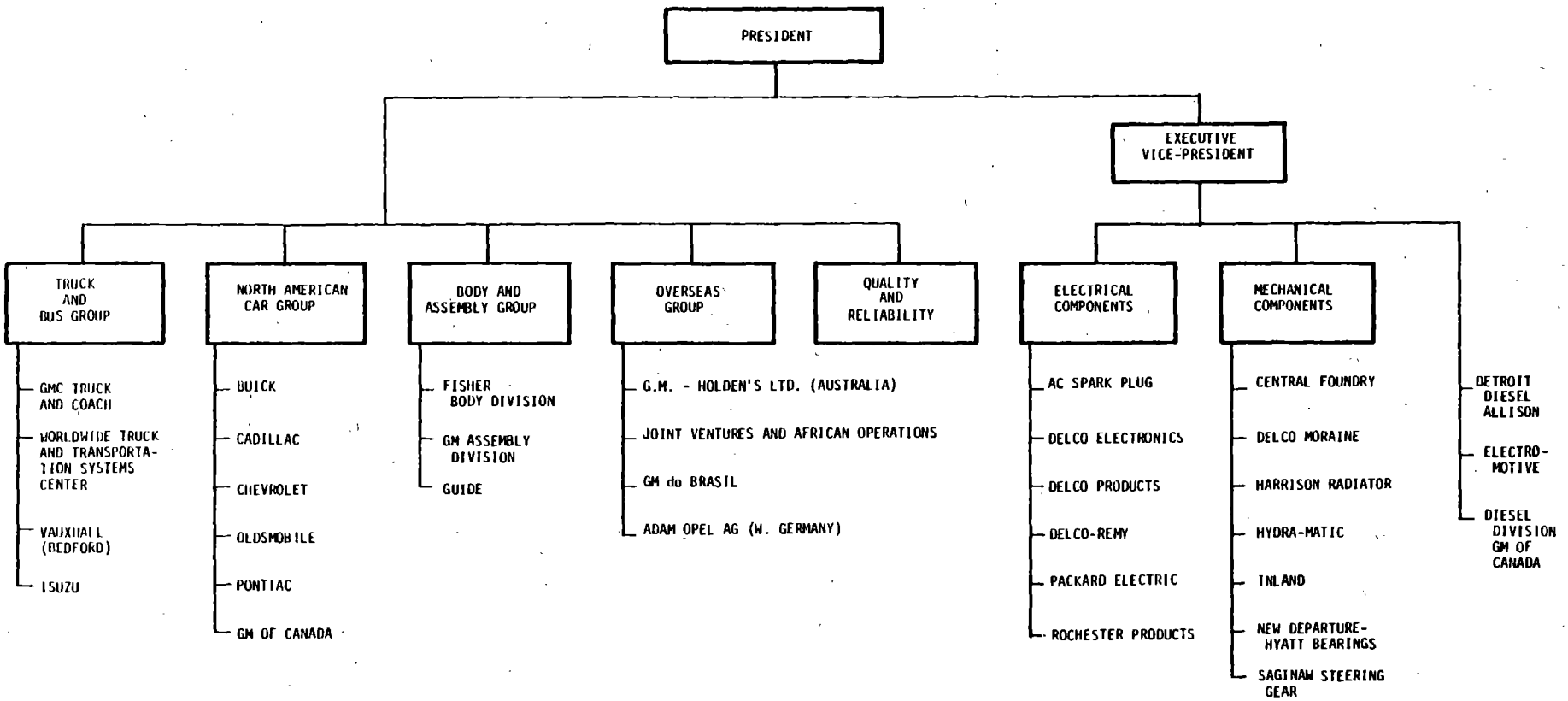


FIGURE 4-1. GENERAL MOTORS CORPORATE STRUCTURE

TABLE 4-3. FINANCIAL STATISTICS - GENERAL MOTORS

GM (worldwide)	1976	1977	1978 ($ MILLION)	1979	1980	1981
NET SALES	$47,181	54,961	63,221	66,311	57,729	62,699
NET INCOME (loss)	2,903	3,338	3,508	2,893	(763)	333
CAPITAL EXPENDITURES (excluding special tools)	999	1,871	2,738	3,372	5,162	6,563
GM (U.S.)						
NET SALES	39,785	47,551	53,499	55,015	46,925	52,754
NET INCOME (loss)	2,903	2,976	3,073	2,321	(72)	693
CAPITAL EXPENDITURES (% of worldwide)	80%	87%	86%	74%	64%	57%
PRODUCTION VOLUME (U.S.)						
CARS	4,883,273	5,258,583	5,291,680	5,084,400	4,072,000	3,894,000
TRUCKS AND BUSES	1,335,336	1,436,220	1,586,439	1,361,064	699,000	717,000
GMC DIVISION	290,736	319,161	375,039	388,088	173,702	175,210
TRANSIT BUS	1,500	250	1,100	1,580	2,300	1,900
EMPLOYEES						
WORLDWIDE	748,000	797,000	839,000	853,000	746,000	741,000
U.S.	603,760	654,711	680,399	633,269	577,635	480,000

TABLE 4-4. CHRONOLOGY OF EVENTS -- GMC TRUCK AND COACH DIVISION

1902	First Rapid truck is sold. Rapid Motor Vehicle Company is formed in Detroit.
	Reliance Motor Company formed in Detroit as a passenger car and truck manufacturer.
1908	General Motors Company is organized (September 16).
1909	Rapid Motor Vehicle Company joins General Motors.
1911	General Motors Truck Company organized to handle sales of GM's Rapid and Reliance products.
1916	General Motors organized as a corporation under Delaware law (October 13) to acquire all stock of the General Motors Company.
1925	General Motors Truck Company is merged with the Yellow Cab Manufacturing Company of Chicago to form the Yellow Truck and Coach Manufacturing Company, in which GM holds a large interest. General Motors Truck Company is the sales subsidiary of the new company and General Motors Truck Corporation is the manufacturing subsidiary. Products of the new company include Yellow Coach buses.
1928	Yellow Truck and Coach manufacturing operations, including bus building, are consolidated at a new plant in Pontiac, Michigan.
1929	Allison Engineering Company joins General Motors.
1936	Yellow Truck and Coach Manufacturing Company continues as the manufacturer of all GMC trucks, tractors, trailers, taxicabs and Yellow coaches, but sales activities are transferred to the General Motors Truck and Coach Division of General Motors.
	First diesel engine used in a GM bus.
1937	Detroit Diesel Engine Division organized.
1938	First use of two-cycle diesel engine in a bus.
1943	General Motors purchases the property and assets of Yellow Truck and Coach, and forms the GMC Truck and Coach Division.
1947 -48	Peak production of GM buses; a total of 10,868 are produced in these two years.
1948	First use of an Allison automatic transmission in a GM bus.
1953	GM introduces air suspension on its transit bus, becoming first manufacturer to do so.

TABLE 4-4. CHRONOLOGY OF EVENTS--GMC TRUCK AND COACH DIVISION (Cont.)

1956	Justice Department institutes a civil antitrust suit charging GM with monopolization of the manufacture and sale of transit and intercity buses.
1959	GM introduces its "New Look" transit bus.
1965	GM signs a consent decree with the Justice Department, settling the antitrust suit.
1968	GM demonstrates its experimental RTX bus.
1973	GM announces its intention to build the RTS advanced design bus.
1975	GM introduces a prototype RTS and solicits orders.
1977	GM begins production of the RTS.
1979	GM ends production of intercity buses.
1981	GM announces reorganization of its group vice-president corporate structure.
1981	GM announces its intentions to build an articulated transit bus by 1984.

TABLE 4-5. SPECIFICATION PROFILES - GMC TRUCK AND COACH DIVISION

COMPONENT	TECHNICAL DESCRIPTION	SUPPLIER
Engine - Standard	6V9A, Turbocharged, 253 B HP	Detroit Diesel Allison
Engine - Optional	6V71 200 SAE HP	Detroit Diesel Allison
Engine - Optional	6V92TAC (CA) 236 SAE HP	Detroit Diesel Allison
Transmission	V-730, Automatic 3-speed	Detroit Diesel Allison
Axles - Front	Independent Design, 13,000 lb. Rating	Rockwell
- Rear	Heavy Duty Spiral Bevel Drive	Rockwell
- Propeller Shaft	1700 Series, 3½" Diameter Universal Joints	Spicer

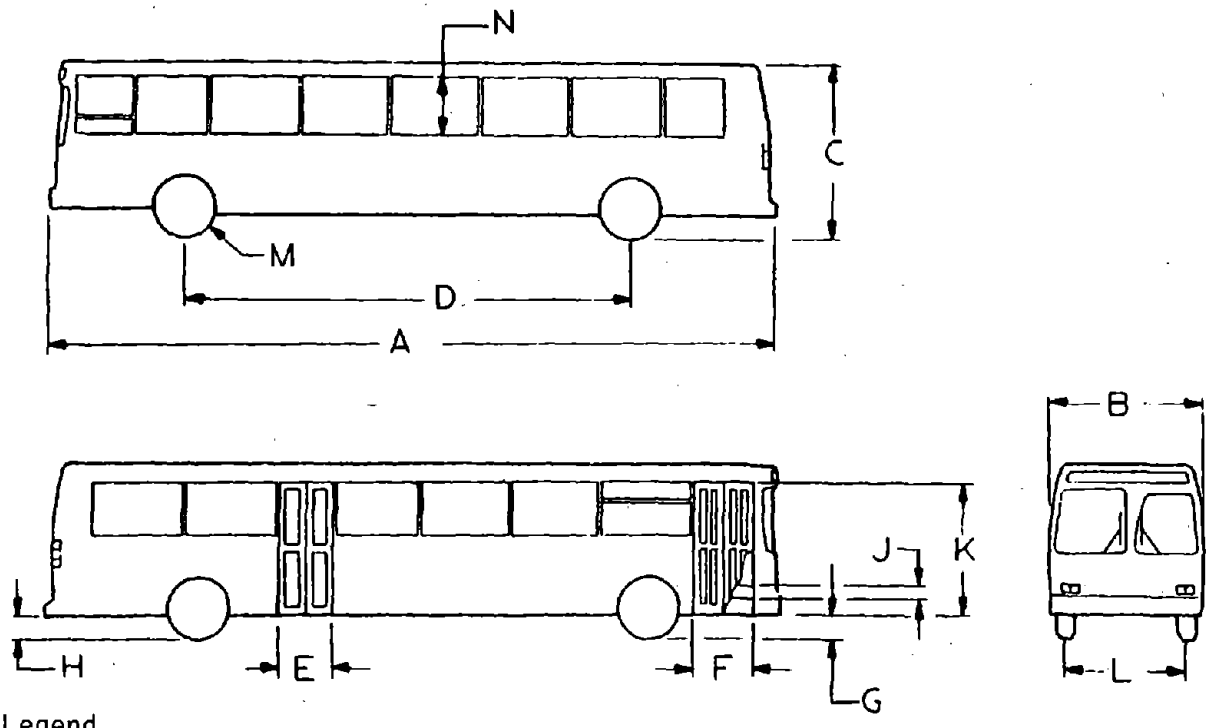
TABLE 4-6. PLANT INFORMATION - GMC TRUCK AND COACH DIVISION

Location:	660 East South Blvd. Pontiac Michigan
Employment:	1400
Investment:	$50 million
Size:	1,6000,000 Square feet
Products:	RTS-04 Bus; Motor Homes
Capacity:	5000 annually (20 buses/day @2 shifts) [Currently operating at one shift, producing 8 buses/day]

TABLE 4-7. PRODUCTION TRENDS - GMC TRUCK AND COACH DIVISION

YEAR	PRODUCTION
1976	1500
1977	250
1978	1100
1979	1580
1980	2300
1981	1900

Source: General Motors



Legend

A.	length----------	35' or 40'
B.	width----------	96" or 102"
C.	height----------	118.5"
D.	wheelbase----------	35'=238.7" 40'=298.7"
E.	rear door opening width--------- clear opening---------	 44"
	front door opening width--------- clear opening---------	 30"
G.	first step height front---------- kneeling-------- rear---------- kneeling--------	 13" 7" 15.75" 12.75"
H.	ground clearance--------	
J.	interior steps--front--- rear----	2 steps w/9.6" riser
K.	door height-----front--- rear----	
L.	track----------front--- rear----	96"=80.8" 102"=86.8" 4 dual wheels 96"=70.5" 102"=76.5"
M.	tires dimension----------	14 ply-rated tubeless 35'=12.0" x 22.5" 40'=12.5" x 22.5"
N.	windows height---------- thickness---------- total area----------	 1/2" (tinted acrylic) 2000 in^2 viewing area (each window)

FIGURE 4-2. EXTERIOR TRANSIT BUS DIMENSIONS - GMC TRUCK AND COACH DIVISION

4.2 GRUMMAN FLXIBLE CORPORATION

4.2.1 Summary

Grumman Flxible is the second largest producer of transit buses in the U.S. Existing two-shift capacity is approximately 4000 buses per year. Actual production in 1981 was about 1100 units. Including its parts distribution and sales network, Flxible employs 2600 people. Plant operations are located in Delaware, OH.

Flxible introduced its current transit bus model, the 870, in 1976, and began production in 1978. In 1981, the company modified this basic model to include a wider range of options, including options usually associated with the "New Look"-type bus such as pedestal-mounted seats and openable windows. The company calls this modification of the 870, the Metro.

In December, 1980, cracks were discovered in the undercarriage of Flxible buses in service in New York City and several other locations. The cost of repairing buses in service has resulted in very large losses for the company in 1981.

Grumman Flxible is a subsidiary of the Grumman Corporation, a major aerospace company and defense contractor. Grumman acquired Flxible in 1978 from Rohr Industries, another aerospace manufacturer. Rohr had acquired Flxible in 1970.

Some salient company data is contained in Table 4-8.

4.2.2 Corporate Overview

The Grumman Corporation is a large aerospace manufacturer primarily producing military aircraft, but the corporation diversified into many other industries. (See Figure 4-3.)

To manage the complex operations, Grumman groups its product lines into four categories: aircraft and space; special vehicles, energy systems; services and other.

Product lines by categories are detailed in Table 4-9.

By far, the most important in terms of revenue and profits are the aircraft and space products, which represent the company's original business. Organizationally, these products are managed by the Grumman Aerospace Corporation, a subsidiary of the Grumman Corporation. This subsidiary and other subsidiaries are shown in relation to the parent company in Figure 4-3.

Responsibility for Grumman's commercial activities, including the manufacture and sale of transit buses, rests with Grumman Allied Industries. The businesses managed by Grumman Allied Industries include two other special vehicle assembly operations -- the making of aluminum truck bodies and fire trucks.

The businesses of Grumman Allied Industries represent a diversification away from the traditional aerospace and military aircraft business in which Grumman began. Several of these ventures are speculative in nature, based on new product developments. Others, including buses, can be considered to have growth potential in light of reduced energy supplies and the high cost of personal transportation.

In 1981, Grumman reorgnized Grumman Allied Industries, so that the president of Grumman Flxible reports directly to the president of Grumman Corp. The rest of Grumman Allied's business has been grouped into two operating divisions which also report to the Grumman president.

When Grumman acquired the Flxible operations from Rohr, the company expressed optimism about the growth potential of the company, stating that:

> "The annual market for transit buses is expected to reach 5000 in 1978 and continue to grow in the years to follow."

In 1980, Grumman Corporation recorded total revenue of nearly $1.3 billion. This resulted in a company-wide profit, before taxes, of $81 million. This was a good year financially for the company relative to the previous four years. Comparative data for the period 1976 through 1980 illustrate this trend. (See Table 4-10.)

The Grumman Special Vehicles Group, which includes the Flxible bus operations, had 1980 sales of $285 million. However, due in part to the undercarriage crack repairs on the "870" buses, the division experienced a net operating loss of $11 million in 1980.

Bus sales individually accounted for $214 million in sales revenue in 1980 versus $97 million in 1979. Deliveries of new buses rose to 1549 units in 1980. The company estimates that its breakeven volume is approximately 1600 buses per year. Except for the loss attributed to the cracking problem, 1980 would have been marginally profitable. With substantially lower volumes, 1981 and 1982 are expected to result in operating losses.

The Grumman Corporation employs 28,000 workers altogether, a figure which has remained relatively stable during recent years. Bus related employment is less than 10 percent of this total. Capital investment in 1980 amounted to $34 million, a 31 percent increase over 1979. Grumman Flxible Corporation captured 61.5 percent of all procurements for advanced design buses in the U.S. during 1980.

The Flxible bus business has not yet proven profitable for Grumman. The stress-crack problem which was discovered in late 1980 resulted in a $7 million write-off as a provision against the repair of the buses in the field. In 1981, Grumman lost $69 million as a result of the cost of repairing the buses in service and as a result of a decline in sales.

4.2.3 Company History

The history of Flxible Corporation spans almost 70 years. Back in 1913, Hugo Young had a novel idea for stabilizing the sidecars then so commonly seen on motorcycles. His invention consisted of a tilted axle pivot for the connection from the sidecar to motorcycle, which eliminated the inflexibility that had previously caused sidecars to become airborne on turns. With an investment of $25,000, White and his partner, Carl Dudte, formed the Flexible Side Car Company in 1914. The name, "Flexible" referred to the functioning of that invention. By 1919, a factory was constructed to handle the increasing popularity of the sidecar. This stimulated new capital investment of $500,000. Also at that time, the company made a decision to drop the first letter "e", from its trademark, giving it the unique spelling of its name, "Flxible."

In 1924, after the sidecar market had collapsed following the introduction of inexpensive Ford Roadsters, Flxible sold its first bus. This was a Studebaker 12-passenger sedan. The dependability and longevity of that first bus helped Flxible's business and public image immensely. The bus lasted three years and 275,000 miles --- an impressive tour de force in that time period.

The company diversified further in 1925. At that time, Flxible introduced more product lines consisting of funeral hearses and ambulances. This enterprise proved to be a stabilizing and profitable undertaking for Flxible, with the production continuing for over 30 years.

Meanwhile production of buses was continuing at Flxible primarily with special purpose applications. A relationship with the Buick Motor Company began with the use of the Buick passenger car chassis for mounting under Flxible bus bodies. In that period these bodies were adorned with various wood and metal interior ornaments and paneling.

An early mainstay of Flxible's bus business was its "Airway Coach" introduced in 1936 and placed into widespread service. Chevrolet chassis were used for the undercarriage. Two years later

the Flxible Clipper, a 25-passenger vehicle, was also well-received by the riding public. Equipped with an integral-construction design and utilized on all major U.S. highways, this bus can now be identified as the forerunner of the latter-day line of Flxible intercity coaches. In 1940, Flxible unveiled its popular 29-passenger intercity coach. Five thousand of these vehicles were in service during the period of peak interest in these buses.

With the outbreak of World War II, Flxible's commercial operations ground to a halt. The firm began concentrating on military procurement opportunities and requirements. The company also worked closely with Goodyear leading to the production of the blimp air vehicles for the war effort.

In 1951, Flxible entered into a business agreement with Fageol Twin Coach Company which led eventually to Flxible acquiring all interest in the bus manufacturing operations of Twin Coach. By 1954, after modifying the original Twin Coach design for city-type buses, Flxible delivered 300 units to Chicago. These buses were produced in its Loudonville, Ohio plant. In this same year, Flxible introduced its first two-level intercity coach, embodied with several advanced technological features.

In the late 1950s, Flxible reemphasized its hearse and ambulance production activities in order to supplement its bus manufacturing. The building of hearses and ambulances had been abandoned when Flxible began manufacturing Twin Coach buses.

In 1961, Flxible introduced its "New Look" transit coach. Closely resembling the GM "New Look" bus introduced in 1959, the Flxible bus became a familiar feature on U.S. city streets. This style of bus continued in production for almost two decades.

During the 1960s, Flxible began to specialize in transit buses, abandoning its other lines of business. In 1964 production of hearses and ambulances was halted once again. In 1967, the company made its last intercity coach, and two years later withdrew entirely from the intercity market by ending production of its two-level

intercity bus. During the same period, the company added the Flxette, a small bus, to its transit line.

The decade of the 1970s was marked by growth and changes in ownership. Rohr Industries, a California company based in the aerospace industry, acquired Flxible in 1970. During the period of control by Rohr, Flxible participated in the Transbus program and developed the model '870' advanced design bus. Production of the Flxible "New Look" transit bus was expanded rapidly as Rohr sought to gain shares in an expanding market. From an annual production level of 400 to 600 in the late 1960s, Flxible expanded to a level of 1100 to 1600 in the mid-1970s.

When Rohr encountered financial difficulty in 1976-77, it decided to divest itself of Flxible. Rohr sought a buyer while committing itself to continue development of the ADB. In 1978, the present owner Grumman, bought Flxible for $55 million from Rohr.

For Grumman, the purchase of Flxible was part of a continuing long-term diversification strategy. Grumman, through its non-aerospace subsidiary, Grumman Allied Industries, already had interests in other lines of special vehicles, including aluminum truck bodies and fire trucks. For a time in the early and mid-1970s, Grumman Allied Industries had even produced a small (23-passenger) bus, though this product line had been discontinued by the time of the Flxible purchase.

In 1978, Grumman Flxible, as it is now known, introduced its model '870' ADB, and discontinued production of the traditional "New Look" bus. The introduction program appeared to be going reasonably well, despite some early production quality problems, until December, 1980, when cracks were discovered developing in the frames of buses in operation. In several cities, and amid wide publicity, Grumman Flxible buses were withdrawn from service by transit authorities pending repairs. Grumman committed itself to full repair of the cracking frames and the reinforcement of the frames of all the buses in use. Most of this repair work was completed in 1981.

Table 4-11 presents a chronology of events.

4.2.4 Product Line of Buses

Up until October of 1981, when Grumman announced that it would begin to produce a new utility bus called the "Metro," the product line of motor buses was limited to the model '870'. The '870' is Grumman's advanced design bus introduced in 1978 to compete with GMC's RTS for the premium vehicle market. Like the RTS, the '870' is a stylish, streamlined, modernistic bus with product features and sub-componentry which are reflective of the combination of company plans and national goals during the 1970's.

Up until its acquisition by the Grumman Corporation, Flxible had produced a "New Look" bus model. The '870' had been developed and introduced to the public before Grumman acquired Flxible but production began under Grumman.

The Grumman Model '870 advanced design bus system and component specifications and suppliers are listed in Table 4-12. The body structure is a semi-monocoque design. The sidewalls consist of heavy-duty aluminum extrusions running the full length of the bus and joined permanently at all interlocking points. The roof and floor use a sandwich construction of one piece aluminum skins surrounding a plastic foam core.

The Model '870' is also equipped with a kneeling feature, eight-inch steps, cantilevered seats, and a wheelchair lift. It is available in widths of 96 inches and 102 inches and in lengths of thirty-five and forty feet. These and other dimensions of the bus are more clearly illustrated in Figure 4-4. Among other equipment suppliers are American Seating (seats), Goodyear (tires and wheels), RCA (floors), and Hammil (bumpers).

The primary assembly plant for the bus-making operations of Grumman is located in Delaware, Ohio, a small city located to the northwest of Columbus. Grumman also operates a plant in Loudonville, Ohio which produces parts and subassemblies for the '870.' Up until 1974, the Loundonville facility was the main assembly

plant for Flxible motor buses. The Delaware plant was opened in that year to permit expended production.

Annual motor bus production capacity at the Grumman plant is 4000 units. This represents about 40 percent of all U.S. capacity.

Employment of 2600 includes those working in Flxible's large parts distribution network. (Table 4-13)

Recent Flxible bus production activity is detailed in Table 4-14.

4.2.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment effort. The definitions of Reference Sources and Bibliography are the same as defined previously in Section 4.1.5.

In addition, staff members of the Transportation Industry Analysis Branch were visited by and interviewed George Prytula, Vice-President, Government Affairs, Grumman Flxible Corporation. The visit and interview were complemented by a series of telephone conversations with company officials and additional correspondence with Mr. Prytula.

Flxible Corporation press releases and photographic coverage of their product line buses were used as reference sources.

The following additional company literature was used in support of the analyses and assessment:

- "The New Grumman Metro," (1981) Includes Specifications Data.
- "LTV Seeks Control of Grumman," New York Times, (9/24/81), p. D1, D4.
- "Statement of the Grumman Flxible Corporation," Presented to Committee on Public Works and Transportation, Subcommittee on Surface Transportation, (4/21/80).

- "Statement of the Grumman Flxible Corporation," Before the Housing and Urban Affairs Subcommittee, Committee on Banking, Housing and Urban Affairs, U.S. Senate, (3/19/80).
- Grumman Corporation, Annual Report, (1980).
- Rohr Industries, Annual Reports, (1975, 1976, 1977).
- "870 Bus Presentation," Grumman Flxible, Manufacturing Engineering Department, Loundonville, Ohio (no date).
- "Flxible 870 General Specifications," (no date).
- "The Grumman Flxible 870," (no date).
- "Grumman Flxible 870 - A New Dimension in Transportation," (Reprinted from Glassic.)
- "The Grumman 20 Passenger Bus," (no date).
- "The Grumman Buses Are Making a Comeback," (no date).
- "New 1961 Flxible Transit Models," (no date).
- "Grumman Flxible, Historical Synopsis," (no date).
- "Letter from G. Prytula, Vice-President Government Affairs, Grumman Flxible Corporation, to Arthur E. Teele, Jr.," Office of the President Elect, Transition Team Headquarters.

Bibliography - The following publications were used in support of the analyses and assessment:

- "Grumman Lagging in Getting Buses Back to New York," New York Times, (11/9/81), p. 1, 18-20.
- "Grumman Profit Fell in 1st Period, but Net from Operations Rose," Wall Street Journal, (5/6/81), p. 24.
- "Putting the 870 Back Together," Mass Transit, (May 1981) pp. 12-16.
- "Grumman Sees Clear Road Ahead for 870," Metropolitan, (March/April 1981), pp. 45-50.
- "The Darkness Before the Dawn," Forbes, (March 16, 1981), pp. 82-83.

- "The Bogged Down Bus Business," Fortune, (March 9, 1981), pp. 58-66.
- "Big Apple to Grumman: The Bus Stops Here," Washington Post, (2/11/81) p. A-12.
- "Grumman to Fix Cracks in Flxible Buses Removed from Service in Several Cities," Wall Street Journal, (12/16/80), p. 20.
- "Transit Officials Refuse to Accept 200 New Busses, " New York Times, (12/10/80), p. B1.
- "Aluminum Utilization Loan Growing with Advanced Buses," American Metal Market News, (5/26/80), p. 24.
- "It's Flxible," American Metal Market News, (1/5/80), p. 38.
- Moody's Industrial Manual, (1980), p. 1249-1252.
- "Grumman Flxible's New Way to Build Buses," Reprint, Assembly Engineering, (11/78).
- "How to Build a Better Bus," Reprint, Materials Engineering, (10/78).
- "Firm Declines to Bid on Bus Accessible to the Handicapped," Wall Street Journal, (March 13, 1978), p. A-2, p. B-6.
- "Grumman Buys Flxible From Rohr," Mass Transit, (12/77), p. 49.
- "Flxible Unveils New City Transit Bus," Metropolitan, (September/October 1976).
- "Rohr May Sell Three of its Units," Washington Star, (April 12, 1976).
- "Grumman Buses Rolling Out for Mass Transportation Uses," Metropolitan, (November/December 1974), p. 20.
- "How to Make a Bus," Mass Transit.

TABLE 4-8. COMPANY DIGEST - GRUMMAN FLXIBLE CORPORATION

Name of Company:	Grumman Flxible Corporation
Address:	970 Pittsburgh Drive Delaware, Ohio 43015
Telephone:	(202) 659-5151 (Washington Office)
Contact:	George Prytula Vice President, Government Affairs
Transit Bus:	Model '870' Advanced Design Bus (also called the Metro)

TABLE 4-9. PRODUCT LINES GRUMMAN CORPORATION

Aircraft and Space	Special Vehicles	Energy Systems	Services and Others
Military Aircraft - F-14 - E-2C - EA-6B - A-6E - EF-111 Aerospace Subcontract Sales Aircraft Modification and Maintenance Military Aircraft Development and Demonstration	'870' Transit Buses Fire Trucks Aluminum Truck Bodies Dormavac, a Hypoboric Storage System	Solar Hot Water Systems Windmill Development Contract Research in Fusion Energy	Aluminum Canoes Pearson Yachts Hydrofoil Boats Specialized Equipment for Oil Exploration Computer Services Data Processing Training Gray Iron Castings

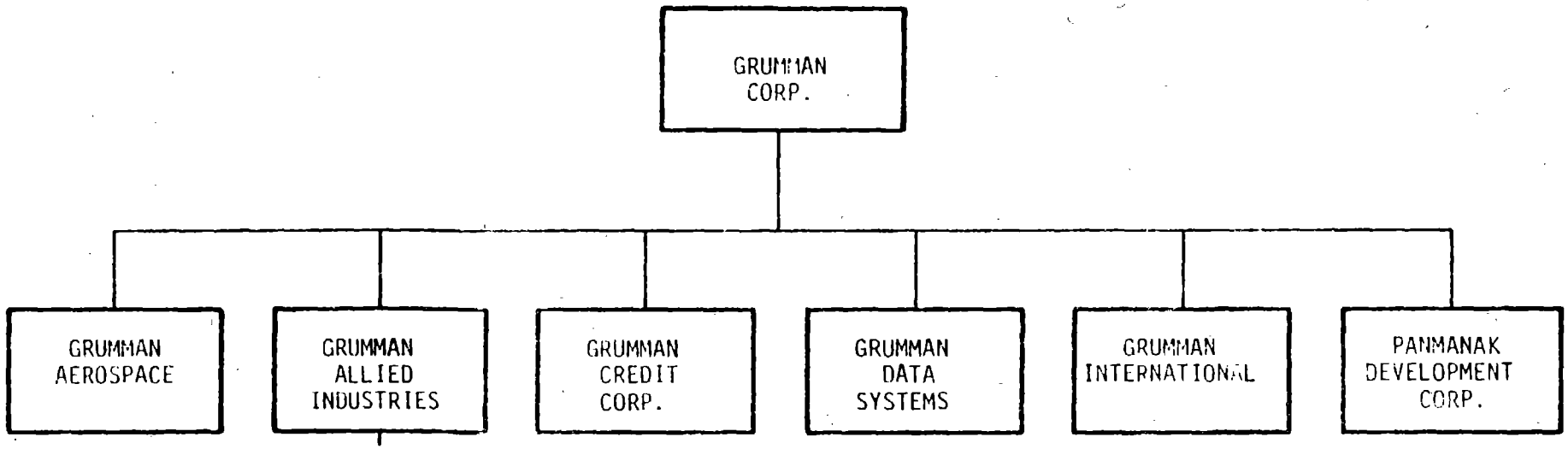


FIGURE 4-3. GRUMMAN CORPORATION CORPORATE STRUCTURE

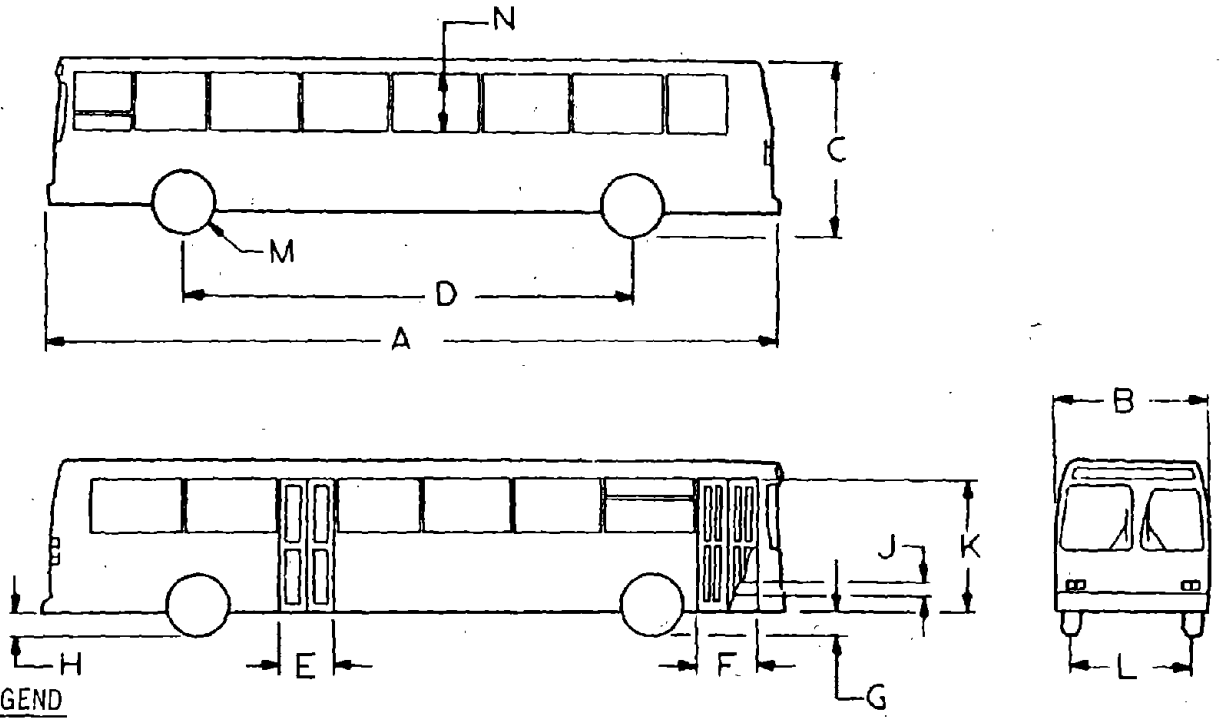
TABLE 4-10. FINANCIAL STATISTICS - GRUMMAN CORPORATION

	1976	1977	1978 ($ MILLION)	1979	1980	1981
Grumman Corporation						
Revenue	1,394	1,410	1,468	1,493	1,759	1,949
Operating Profit (before taxes and interest)	57	61	54	60	81	86
Net Income	24	32	20	20	31	20
Capital Expenditures			29	26	34	50
Grumman Special Vehicles						
Sales	57	59	149	204	285	259
Operating (loss)	1	(3)	(10)	(20)	(11)	(77)
Capital Expenditure			3.5	2.4	3.7	6.3
Buses						
Sales	-	-		97	214	197
Operating Profit (loss)	-	-	(3.5)	(16.1)	(7.6)	(69)
Unit Deliveries						
Buses	-	-	803	994	1,549	1,044
Number of Employees						
Total Grumman Corporation	27,900	27,000	26,400	27,900	27,800	28,600

Source: Grumman Fifty-First Annual Report, 1980

TABLE 4-11. CHRONOLOGY OF EVENTS - GRUMMAN FLXIBLE CORPORATION

1913	Flxible founded to produce motorcycle sidecars.
1924	Ford Motor Co. destroys the sidecar market by pricing the Ford Roadster at $360 less than the cost of a motorcycle and sidecar.
	The first Flxible Bus, a Studebaker 12-passenger sedan, delivered. Flxible began manufacturing hearses and ambulances one year later.
1936	Flxible produces its first intercity coach, the Flxible Airway Coach, based on a Chevrolet truck chassis.
1938	Flxible produces its first intergral-construction bus, the 25-passenger, rear engine Flxible Clipper, for intercity use. Capacity later increased to 29 passengers.
1951	Flxible cooperates with Fageol Twin Coach Co. to produce coaches for the army.
1952	Flxible agrees with Twin Coach to produce the Twin Coach city transit bus. Flxible ends hearse and ambulance production.
1954	The 37-41 passenger, Two-level Intercity Coach introduced.
	Delivery on a 300-unit order from the Chicago Transit Authority begins; Flxible's first big city bus order.
1959	Hearse and ambulance production revived to supplement bus production.
1961	The Flxible "New Look" transit coach is introduced.
1963	Ambulance production is discontinued.
1964	Hearse production is discontinued.
	Flxible acquires Southern Coach (Evergreen, Ala.) to produce small buses and vans. Introduces the Flxette, a small bus built on a Ford chassis.
1967	Production of the 29-passenger intercity coach ends.
1969	Production of the Two-level Intercity Coach discontinued.
1970	Rohr Industries acquires Flxible (September).
1974	Flxible corporate headquarters and final assembly line are transferred to Delaware, Ohio.
1975	Rohr decides to sell Southern Coach; Flxette production ends one year later
1978	Rohr sells Flxible to Grumman Allied Industries (a subsidiary of Grumman Corp.) for $55 million.
1978	The '870' advanced design bus is introduced. Production of "New Look" coaches is discontinued.
1980	Cracks are discovered developing in the frames of Grumman Flxible '870' buses. Amid wide publicity, several transit systems withdraw the buses from service, pending repair.
1981	Grumman announces production of the "Metro," a city transit bus similar to the '870,' but with a wider range of options.



LEGEND

A. length----------35' or 40'

B. width----------96" or 102"

C. height----------not to exceed 121"

D. wheelbase----------35'=239" 40'=299"

E. rear door
opening width----------32"
clear opening----------25.75"

front door
opening width----------36.2"
clear opening----------31.2"

G. first step height
front----------14" max
kneeling----------10 1/2"
rear----------15" max
kneeling----------

H. ground clearance----------10" min between front and rear wheels

J. interior steps--front--------2 steps w/8" riser
rear---------2 steps w/10.2" riser

K. door height-----front--------85.12" clear opening
rear---------88.75 clear opening

L. track----------front--------7.1'
rear---------4 dual wheels 6.3'

M. tires
dimension----------c12:75R/22.5 radial tubeless

N. windows
height----------36"
thickness----------1/2" (tinted acrylic)
total area----------

FIGURE 4-4. EXTERIOR TRANSIT BUS DIMENSIONS - GRUMMAN FLXIBLE CORPORATION

TABLE 4-12. SPECIFICATION PROFILES - '870' ADVANCED DESIGN BUS

COMPONENT	TECHNICAL DESCRIPTION	SUPPLIER
Engine		
Standard	6V-71N Naturally Aspirated	Detroit Diesel
Optional	6V92TA Turbocharged	Detroit Diesel
Optional	6V92TA(c) Turbocharged	Detroit Diesel
Transmission	V-730, automatic 3-speed	Detroit Diesel
Axles		
Front	Heavy Duty 13,340 lb rating	Rockwell
Rear	Heavy Duty 25,000 lb rating	Rockwell
Propeller Shaft	1710 Series, Heavy Duty	Spicer

TABLE 4-13. PLANT INFORMATION - GRUMMAN FLXIBLE CORPORATION

Location:	Delaware, Ohio/Loundonville, Ohio
Employment:	2600 (production & salaried workers)
Investment:	N/A
Size:	340,000 square feet
Products:	'870' Advanced Design Bus
Capacity:	4000

TABLE 4-14. PRODUCTION TRENDS - GRUMMAN FLXIBLE CORPORATION

YEAR	PRODUCTION
1976	1,581
1977	1,165
1978	803
1979	994
1980	1,549
1981	1,100

Source: Correspondence with Grumman Flxible.

4.3 DIESEL DIVISION, GENERAL MOTORS OF CANADA, LIMITED

4.3.1 Summary

The Diesel Division, General Motors of Canada, is the largest producer of "New Look" transit coaches in North America. During the past two years, the company has expanded significantly its U.S. sales as transit operating companies showed renewed interest in the traditional bus style. Some salient company data is contained in Table 4-15.

The company recently expanded its bus product line with the announced introduction of a "New Look"-style, articulated transit coach.

4.3.2 Corporate Overview

The corporate organization of General Motors is discussed fully in Section 4.1 on GMC Truck and Coach Division. The General Motors Corporation is a very large, diversified, and vertically integrated multinational concern. Organizationally, it operates using a divisional system with group vice-presidents reporting directly to the President of the corporation. The divisions function as individual businesses. Each may be a multiproduct enterprise in its own right, and on occasion may find itself in competition with other divisions in certain market segments. For convenience, the diagram of the organizational structure is again shown in Figure 4-5.

General Motor's Canadian operations are closely integrated with those in the United States. The Diesel Division of General Motors of Canada has traditionally been grouped with Detroit Diesel Allison and the Electromotive Division. Formerly, these operations were grouped with Frigidaire and Terex (since sold) in the Power Products and Appliance Group. Now these three divisions report directly to the executive vice-president as shown in Figure 4-5.

As demonstrated in Table 4-16, the Diesel Division manufactures or sells products originating with Detroit Diesel Allison, Electromotive and Terex. The Diesel Division also manufactures several types of special automotive vehicles, including school bus chassis, armoured amphibious military vehicles, and transit buses. The Division's principal production facilities and headquarters are in London, Ontario. The transit bus manufacturing plant, however, is located in St. Eustache, Quebec.

The financial characteristics of General Motors Corporation were discussed at length previously under the GMC Truck and Coach section (4.1) of this report. Table 4-17 from that section is re-displayed here for convenience. To summarize, General Motors has experienced declines in sales revenues, volume and profitability since 1979, brought about chiefly by the shift in demand for automobiles and deterioration of overseas markets. The company has responded to these changing market conditions by greatly increasing its capital spending activity. In excess of $40 billion is expected to be expended during the 1980-1984 period.

General Motors, historically, has adopted a conservative approach in its capital structure. However, falling sales and operating losses recently have caused it to increase its borrowing through long-term debt.

GM sales in Canada amounted to almost $8.1 billion in 1980. Of this amount, transit bus sales in 1980 were only $98.6 million, but this represents almost a doubling of sales from 1979 when they were $52.7 million. Bookings for 1981 indicate that sales will continue to increase and are expected to reach $127.1 million.

The increased level of dollar sales reflects a rising volume of bus production, with sales to both the U.S. and Canada increasing. The proportion of unit sales going to the U.S. has increased from 15.2 percent (80 buses) in 1979 to 42 percent (440 buses) expected in 1981. Overall production has increased from 527 in 1979 to 721 in 1980 to an expected 1048 in 1981.

The total investment for transit bus production is reportedly $20 million.

4.3.3 Company History

General Motors of Canada, Ltd., and its bus-producing Diesel Division possess an extensive manufacturing history which is initially traceable to the establishment of the McLaughlin Carriage Company of Oshawa, Ontario in 1876. Some thirty years later, McLaughlin Motor Car Company, using Buick engines, commenced production of passenger cars. By 1915, the McLaughlin family formed the Chevrolet Motor Company of Canada, and three years later, in 1918, General Motors of Canada was born from the merger of the McLaughlin Motor Car Company and Chevrolet Motor Car Company of Canada.

The Diesel Division itself was not formed until 1949 when a facility for the manufacture of diesel-electric locomotives was constructed in London, Ontario. In subsequent years, the locomotive business grew and resulted in several additions to the existing production plant at London. Exports of the company's locomotives started in 1953. In 1961, GM of Canada began producing both suburban and city coaches, based on the GMC "New Look" design, introduced in the U.S. two years earlier. Diversification continued in 1965 when the company began manufacturing front-end loaders and off-highway haulers.

Expansion in the Diesel Division's business lines resulted in relocation and enlargement of the assembly plant in London during 1972. Continued growth in its bus products led to the company building a second assembly plant in 1974, located in Quebec. The acquisition (from GM of Canada in Oshawa) of responsibility for school bus chassis assembly led, in 1977, to the construction of expanded facilities at London to accommodate both that line and its Armoured Vehicle production program. Then, in 1978, in order to consolidate the company's coachmaking operations at a single point, Diesel Division's latest plant was constructed in St. Eustache, Quebec.

Table 4-18 presents a chronology of events.

4.3.4 Product Line of Buses

The Canadian-built General Motors' coach is similar to the "New Look" transit coaches introduced by General Motors in 1959. Assembly of the coach started in London, Ontario in 1961 and, to date, over 8500 have been delivered to Canadian and U.S. customers. Diesel Division, General Motors of Canada Limited, has assumed engineering and design responsibility for this coach and has the following models in active production:

Model	Length	Width
T6H4523N	35'	96"
T6H5307N	40'	102"
T8H5307A	40'	102"
T8H5308A	40'	96"
T8H5308N	40'	96"

Both transit and suburban configurations are available. In addition to these five models, an articulated coach seating 69 passengers was introduced in early 1981. This articulated coach shares basic components, appearance and body design with the other models.

During 1981, the appearance of the Diesel Division transit bus was redesigned. The company has applied the name "New Look" Classic to this redesigned bus. The redesign has resulted in a sleeker appearance more like the ADB's and the "New Look"-type buses introduced recently by Neoplan and Gillig in the U.S. Square headlamps and larger windows have been introduced.

A very high level of U.S. content is maintained as all major components (engines, transmission, axles, destination signs, seats, flooring, etc.) are purchased from U.S. based suppliers. A front door mounted Environmental Equipment Corporation (EEC) lift assembly is available as an option in order to comply with handicap mobility regulations.

System and component specifications and suppliers are detailed in Table 4-19. The basic design style is the "New Look".

The Diesel Division's buses are available in widths of 96 inches and 102 inches, and in lengths of thirty-five feet and forty feet. Further data on exterior dimensions for these buses is given in Figure 4-6.

The body construction is basically aluminum, reinforced with steel components. The bus is an integral construction type, with the body proper and underframing components forming a monocoque unit. Exterior side panels are fluted aluminum riveted to steel posts. Engine location for both the standard and articulated models is in the rear.

Data on the exterior articulated bus dimensions are contained in Figure 4-7.

The production plant for the Diesel Division's coachmaking operations is located in the town of St. Eustache, Quebec. It was built in 1978 in order to consolidate production at one central location. Headquarters and manufacturing facilities for other Diesel Division products are located in London, Ontario. Some highlights of these operations are presented in Table 4-20.

Total plant investment is around $20 million, with a capacity of five buses per day on a one-shift basis. A second shift would add two to three units per day to the output. The plant employs 525 production workers and 175 administrative personnel at its current production rate of four buses per day. Production activity for the Diesel Division is provided in Table 4-21.

4.3.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment effort. The definition of Reference Sources and Bibliography are the same as defined previously in Section 4.1.5.

In addition, staff members of the Transportation Industry Analyses Branch corresponded with Mr. S.I. Rodgers, Coach Sales Representative, Diesel Division, General Motors of Canada Limited, and complemented this correspondence with a series of telephone conversations.

Diesel Division, General Motors of Canada press releases and photographic coverage of their product line buses also were used as reference sources.

The following additional company literature was used in support of the analysis and assessment:

- "Standard Specification for GMC Coach Models," (April 1981).
- General Motors, Annual Report, (1980).
- "Transit Coach Warranty," (effective January 1, 1977).
- "Customer List - Diesel Division," (no date).
- "Diesel Division, General Motors of Canada Limited," (no date).
- "The New Look Classic By General Motors of Canada, Limited," (includes specifications), (no date).
- "Way Out Front -- GM's Transit Coaches," (no date).

Bibliography - The following significant publications were used in support of the analysis and assessment:

- "GM-Canada Introduces Articulated "New Look"," Metropolitan, (March/April 1981), pp. 34-38.
- "General Motors of Canada, Diesel Division," Metropolitan, (March/April 1981), p. 31.
- "Transit Fleets are Buying Older 'New Look' Buses from GM-Canada," Fleet Owner, (October 1980), pp. 54-55.
- "Diesel Division, General Motors of Canada, Ltd.," Bus Ride (11/78), p. 27.

TABLE 4-15. COMPANY DIGEST - DIESEL DIVISION, GM OF CANADA

Name of Company:	Diesel Division, General Motors of Canada, Ltd.
Address:	P.O. Box 5160 1991 Oxford St. East London, Ontario, Canada
Telephone:	(519) 452-5153
Transit Bus:	"Classic" New Look-type transit bus, 35', 40' and Articulated

TABLE 4-16. PRODUCT LINES - DIESEL DIVISION, GM OF CANADA

- Diesel-electric locomotives
- "New Look" transit coaches
- Sale of Detroit Diesel Allison engines
- Sale of Electro-motive diesel engines for industrial power generation and marine applications
- School bus chassis
- Armored vehicles for the Canadian armed forces

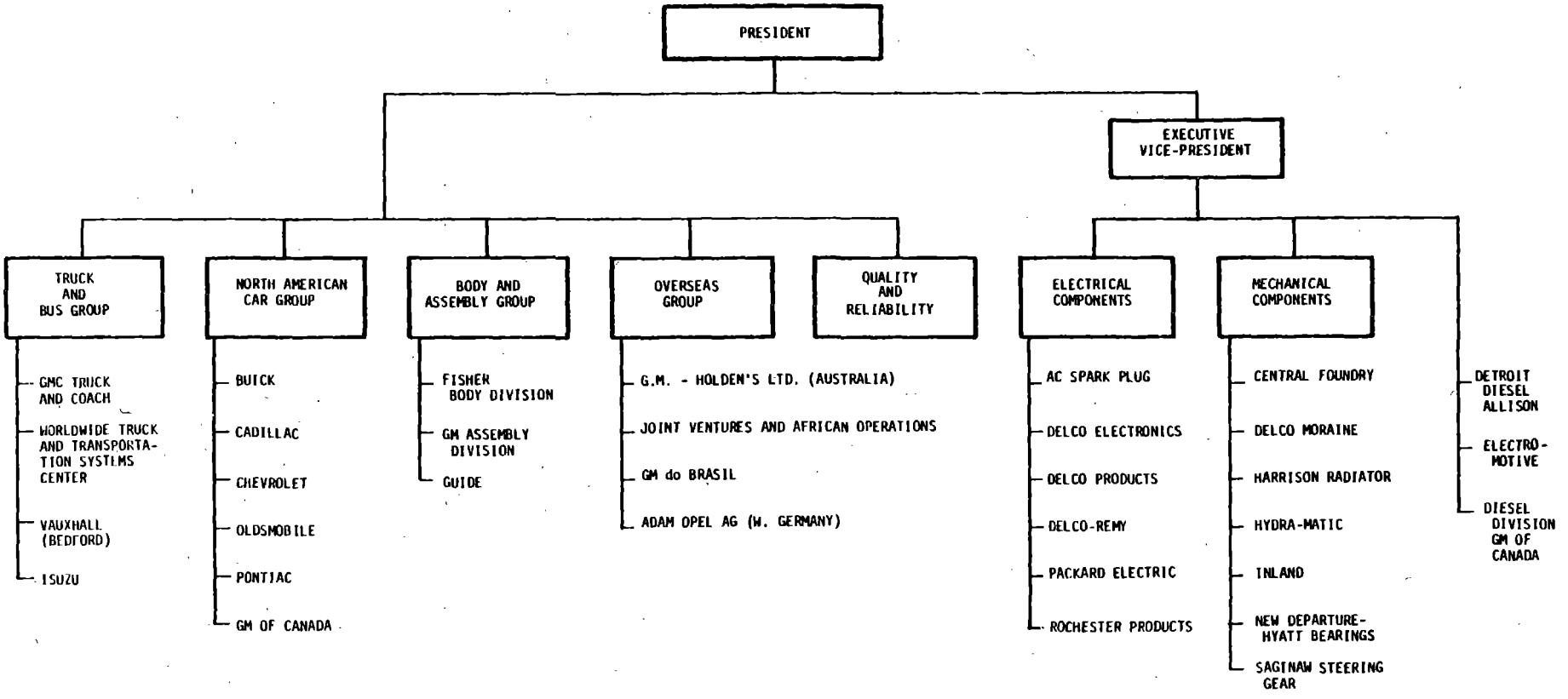


FIGURE 4-5. GENERAL MOTORS CORPORATE STRUCTURE

TABLE 4-17. FINANCIAL STATISTICS - GENERAL MOTORS

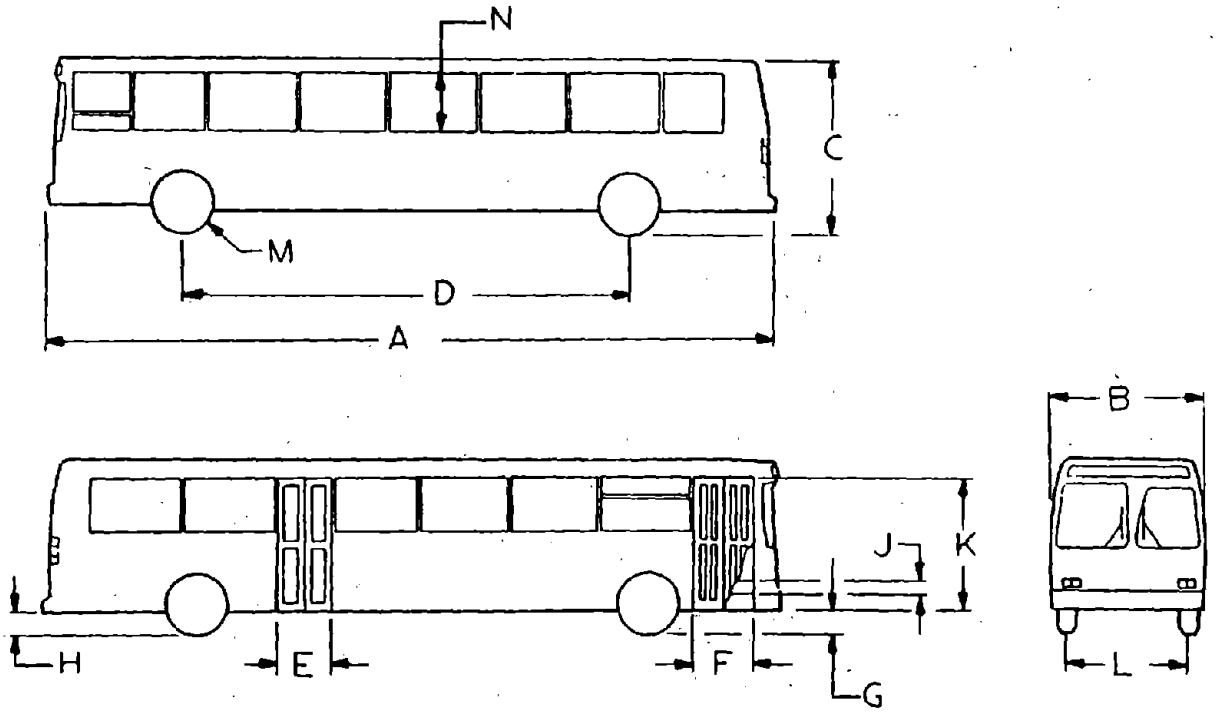
GM (worldwide)	1976	1977	1978 ($ MILLION)	1979	1980	1981
NET SALES	$47,181	54,961	63,221	66,311	57,729	62,699
NET INCOME (loss)	2,903	3,338	3,508	2,893	(763)	333
CAPITAL EXPENDITURES (excluding special tools)	999	1,871	2,738	3,372	5,162	6,563
GM (U.S.)						
NET SALES	39,785	47,551	53,499	55,015	46,925	52,754
NET INCOME (loss)	2,903	2,976	3,073	2,321	(72)	693
CAPITAL EXPENDITURES (% of worldwide)	80%	87%	86%	74%	64%	57%
PRODUCTION VOLUME (U.S.)						
CARS	4,883,273	5,258,583	5,291,680	5,084,400	4,072,000	3,894,000
TRUCKS AND BUSES	1,335,336	1,436,220	1,586,439	1,361,064	699,000	717,000
GMC DIVISION	290,736	319,161	375,039	388,088	173,702	175,210
TRANSIT BUS	1,500	250	1,100	1,580	2,300	1,900
EMPLOYEES						
WORLDWIDE	748,000	797,000	839,000	853,000	746,000	741,000
U.S.	603,760	654,711	680,399	633,269	577,635	480,000

TABLE 4-18. CHRONOLOGY OF EVENTS - DIESEL DIVISION, GM OF CANADA

1876	McLaughlin Carriage Co. established in Oshawa, Ontario.
1908	McLaughlin Motor Car Co. begins production of passenger cars using Buick engines.
	General Motors Company formed in the U.S., absorbing Buick Motor Company.
1911	Chevrolet Motor Company formed in the U.S.
1915	McLaughlin family forms the Chevrolet Motor Car Co. of Canada to produce the Chevrolet 490.
1918	Chevrolet merges with General Motors in the U.S.
	General Motors of Canada, Limited formed through the merger of McLaughlin Motor Car Co. and Chevrolet Motor Car Co. of Canada.
1949	General Motors Diesel, (later, the Diesel Division of General Motors of Canada Limited) established at London, Ontario to manufacture diesel-electric locomotives.
1961	General Motors Diesel begins production of GM "New Look" transit and suburban coaches.
1965	Canada-U.S. Auto Trade Pact signed.
1969	Major operating subsidiaries of the General Motors Corporation in Canada consolidated to form General Motors of Canada Limited.
1972	Bus assembly relocated in London, Ontario.
1974	A second bus assembly plant established in Quebec.
1977	School bus chassis assembly is transferred to the Diesel Division from GM of Canada in Oshawa.
1978	Transit coach assembly operations are consolidated in a new plant in St. Eustache, Quebec.
1981	Diesel Division introduces an articulated "New Look" bus.

TABLE 4-19. NEW LOOK TRANSIT COACH SPECIFICATIONS PROFILE - DIESEL DIVISION, GM OF CANADA

Component	Turbine Description	Supplier
Engine: Standard	6V71N, Naturally Aspirated, 162-185 HP	Detroit Diesel
Optional	8V71N, Naturally Aspirated, 226-265 HP	Detroit Diesel
Optional	6V92TA, Turbocharged, 253-277 HP	Detroit Diesel
Optional	6V92TAC, Turbocharged, 240 HP	Detroit Diesel
Transmission	V730, 3 speed automatic	Detroit Diesel Allison
Axles - Front	Reverse Elliot Type	Rockwell
- Rear	Full Floating Heavy Duty	Rockwell
- Propeller Shaft	Series 1710, 3 1/2" diameter shaft	Spicer



Legend

A.	length----------	35' or 40'
B.	width----------	95.75" or 101.75"
C.	height----------	non-airconditioned -- 120 1/4" airconditioned 121 1/2"
D.	wheelbase----------	35' = 235" 40' = 284 3/4"
E.	rear door	
	clear opening-- ------	26 1/2"
F.	front door	
	clear opening---------	42"
G.	first step height	
	front----------	13.50"
	rear----------	15.69"
H.	ground clearance--------	15"
J.	interior steps--front---	(2) steps w/10" riser
	rear----	(2) steps w/9.63" riser
K.	door height-----front---	79.9" clear opening
	rear----	77.0" clear opening
L.	track----------front---	35'=79.25" 40'=85.25"
	rear----	35'=70.25" 40'=76.50"
M.	tires	
	dimension----------	35' --- 11.00 x 20 --- 12 ply Range F 11.00 40' --- 11.50 x 20 --- 14 Ply Range G
N.	windows	
	height----------	34.60"
	thickness----------	3/16" tinted safety glass
	total area----------	25,330 in^2

FIGURE 4-6. EXTERIOR DIMENSIONS, "NEW LOOK" TRANSIT COACH, DIESEL DIVISION, GM OF CANADA

Legend

A.	length----------	60'
B.	width----------	102"
C.	height----------	121.5 (maximum)
D.	wheelbase, tractor------	235"
E.	wheelbase, trailer------	281.7"
F.	front door	
	clear opening---------	42.3"
G.	center door	
	clear opening---------	45.1"
H.	rear door	
	clear opening---------	45.1"
J.	steps	
	first step	
	front----------	13.1"
	middle, rear--------	15.7"
	risers	
	front----------	10" (2)
	middle----------	9.6" (2)
	rear----------	10.6" (2)
K.	door height	
	front----------	79.8"
	center, rear---------	77.0"
L.	windows	
	height----------	34.6"
M.	ground clearnace	
N.	track	
	front	
	rear	
P.	tires	
	dimensions----------	

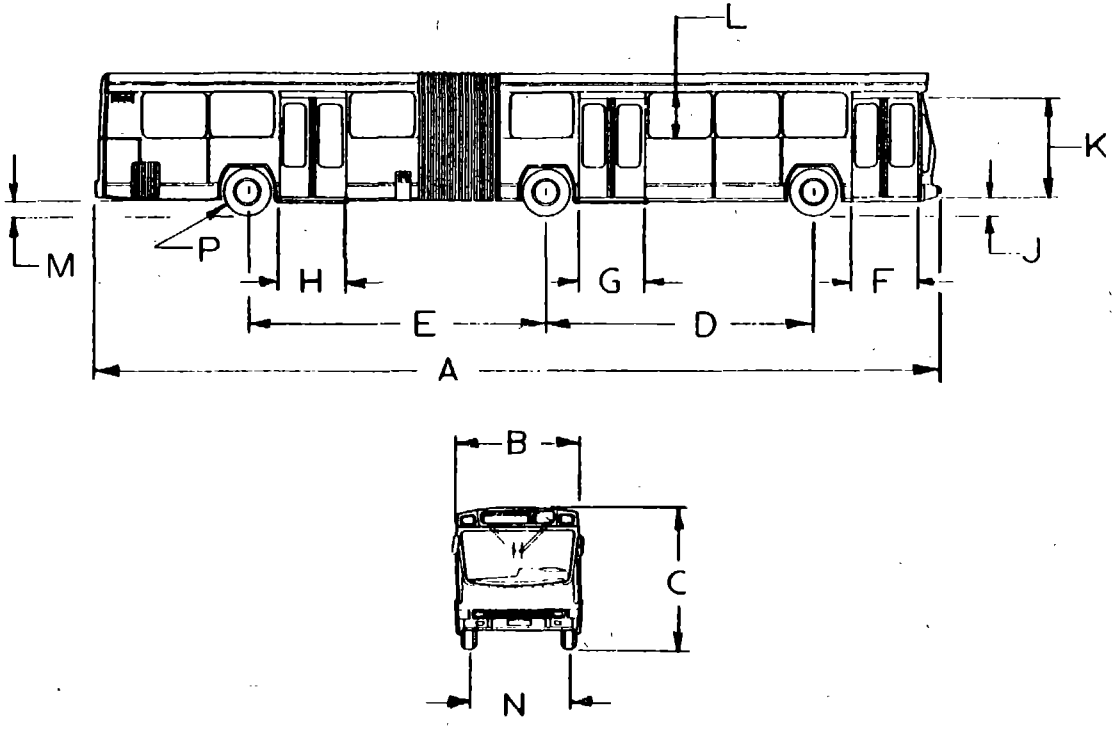


FIGURE 4-7. EXTERIOR DIMENSIONS, ARTICULATED BUS - DIESEL DIVISION, GM OF CANADA

TABLE 4-20. PLANT INFORMATION - DIESEL DIVISION, GM OF CANADA

Location:	St. Eustache, Quebec, CANADA
Employment:	700
Investment:	$20 million
Size:	138,000 square feet
Products:	Transit and Suburban Coaches
Capacity:	1750 buses per year (two shifts)

TABLE 4-21. PRODUCTION TRENDS - DIESEL DIVISION, GM OF CANADA

Year	Production
1976	823
1977	683
1978	601
1979	527
1980	721
1981	

Sources: Correspondence with company officials

4.4 FLYER INDUSTRIES

4.4.1 Summary

Flyer Industries is the second largest producer of standard transit buses in Canada. Its bus model is considered to be of the "New Look"-type. The company also builds a trolleybus version. The company's plant is located in Winnipeg, Manitoba, where the company currently employs about 500 people.

Transit motorbuses and trolley buses are the principal products. Flyer has been heavily dependent on U.S. sales for several years. The company is wholly owned by the Provincial Government of Manitoba. Some salient company data is contained in Table 4-22.

4.4.2 Corporate Overview

Flyer Industries, Limited is a Canadian company located in Winnipeg, Manitoba. Since 1970, the company has concentrated its activities on the production of urban transit buses and trolleybuses.

Flyer is 99.9 percent owned by the Manitoba Development Corporation (MDC), which is a funding arm and industrial development agency of the Provincial Government of Manitoba. The MDC currently has no other subsidiaries, although at one time it owned as many as six other Canadian companies. Figure 4-8 presents the organizational structure.

While the MDC owns Flyer, the company has a normal corporate structure with a president and vice-presidents. There is an independent Board of Directors appointed by the MDC. The Chairman of that Board also serves as the Chairman of the MDC.

The product line of Flyer Industries is limited to the manufacture of diesel and electric trolleybuses. These are marketed as its Urban Bus Series 901.

The company operates two major plants, both located in suburbs of Winnipeg. The Transcona plant, built in 1973, is the final

assembly plant. The Fort Garry plant fabricates components. Table 4-23 provides statistical trends on Flyer finances.

4.4.3 Company History

In 1930, what is now Flyer Industries was founded as the Western Auto and Truck Body Works, Limited. A major impetus to Western's early growth was a contract issued to it by the Canadian government during the World War II period. Under that contract, the company produced a substantial quantity of various trucks and buses. During the 1950s, the company put its main emphasis on the production of intercity buses. In 1967, the company, now known as Western Flyer began to turn to transit buses. Its first prototype was completed in 1968. The following year an electric trolleybus prototype was also built. In 1970, a decision was made by Flyer management to concentrate exclusively on transit bus and trolleybus production. (See Table 4-24 for a chronology of corporate history.)

In 1971, Flyer concluded an agreement with AM General, a subsidiary of American Motors Corporation, under which the two companies exchanged technological knowledge, and AM General acquired the right to use the Flyer bus shell design.

The MDC, a funding arm and industrial development agency of the Province of Manitoba, made two large loans to the company in 1969 and 1970. The MDC acquired ownership in 1971 changing the name of the company to Flyer Industries.

The company experienced periodic financial difficulties during the 1970s, along with frequent management changes and occasional labor unrest. After completing a new assembly plant in 1973, the company lost some $15 million in 1974, its worst year. The company regained profitability in 1975-1977, but again became unprofitable in 1978 and 1979.

In 1980, anticipating the impact of the "Buy America" rule in its largest market, Flyer filed papers to form a corporation in North Dakota. Although there were indications that an assembly

plant was under consideration, the company has not moved to create any kind of actual organization in North Dakota.

The company faces an obstacle similar to "Buy America" in Quebec, where the Province has a "Buy Quebec" policy. That policy favors GM of Canada which has its transit bus plant in Quebec.

With a change of political parties in Manitoba around 1977, the MDC began selling off its holdings in private companies, and also sought buyers for Flyer. A number of companies, including Grumman Flxible and Volvo, are known to have examined the company.

4.4.4 Product Line of Buses

Flyer Industries' product line consists entirely of its urban bus series 901 vehicles, which can be further broken down by its diesel buses and electric trolleybuses. The diesel transit coach (D901) is available in either a 35-foot or 40-foot version. The design has evolved from one similar to that produced in the U.S. by A.M. General. The resemblance in styling, however, disappeared with the introduction of the 900 series in 1979. The 900 series employs sleek lines and square headlamps to more closely resemble the advanced design buses introduced in the U.S. The 901, incorporating some additional minor modifications such as a redesigned windshield, went into production in 1981.

Flyer Industries model series 901 transit bus specifications and suppliers are listed in Table 4-25. Overall exterior transit-bus dimensions are detailed in Figure 4-9.

Flyer Industries' coachmaking activities take place at its Transcona assembly plant, located in Winnipeg, Manitoba. It additionally operates a component plant located in Winnipeg. Some basic information on the assembly is shown in Table 4-26.

The plant at Winnipeg was constructed in 1973. Production capacity, would be 800/1000 buses per year, using two shifts. Recent production trends for Flyer are given in Table 4-27.

4.4.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment efforts. The definition of Reference Sources and Bibliography are the same as defined in Section 4.1.5.

In addition, staff members of the Transportation Industry Analysis Branch conversed by telephone with Flyer Industry officials, the Manitoba Development Corporation, and the Toronto Transit Commission. Extensive correspondence was used as reference material and is listed as follows:

- Letter from M. Hafiz Khan, Director, Corporations Branch, Province of Manitoba, Department of Consumer and Corporate Affairs and Environment (11/5/81).
- Letter from H.J. Jones, Chairman, Manitoba Development Corporation (10/20/81).
- Letter from Lorna J. Prescott, Province of Manitoba, Department of Consumer and Corporate Affairs and Environment (9/8/81).
- Letter from P.A. Bridgens, Executive Vice-President, Flyer Industries Limited (5/21/81).
- Letter from H.J. Jones, Chairman and General Manager of the Manitoba Development Corporation, and Chairman, Flyer Industries Limited (5/21/81).
- Letter from E. T. Tumulty, Manager of Capital Procurement, MBTA (5/20/81).
- Letter from R.J. Biddell, Marketing Manager, Flyer Industries (5/14/81).
- Contract Proposal No. CAP-10-80, UMTA Projects Nos. MA-03-0093 and MA-05-0018, for delivery of 80 new, 40-foot diesel transit buses to the MBTA (1980).

The following additional company literature was used in support of the analyses and assessment:

- "Flyer Urban Bus Series 901," (1981).
- Flyer Industries Limited, Financial Statements, 1980, 1979, 1978, 1977 and 1976.
- "Manitoba Development Corporation," Annual Report, (1980).
- Flyer Industries, Auditors' Report, (5/6/80) (Dunwoody & Company).
- Flyer Industries, Auditors' Report, (4/24/79) (Dunwoody & Company).
- Flyer Industries, Auditors' Report, (4/21/78) (Dunwoody & Company).
- Flyer Industries, Financial Statements, (12/31/78) (Price Waterhouse).
- "Technical Specification, Flyer Model D901 Diesel Transit Type Bus," (8/79).
- "Flyer Corporate Background," (no date).
- "Flyer Delivers!," (D-900 Series)-(no date).
- "Flyer Electric Coaches," (no date).
- "Flyer Model 9635-6," and "Flyer Model E700 Electric Bus," (Vol. 1, No. 9, 1974) -- Description of Flyer-AM General Bus also Model 10240-6.
- "Introducing the New Flyer Transit Diesel," (no date).

Bibliography - The following significant publications were used in support of the analyses and assessments:

- TORONTO GLOBE AND MAIL

  "Flyer Rebounds," (4/25/81).

  "Bus Plant" (7/29/80).

  "Report on Canada," (7/24/80).

  "Flyer" (5/17/80).

"Flyer Industries Expecting Loss for the Year," (11/21/79).

"Manitoba May Keep Flyer Industries with Recent Upturn in Firm's Fortune's," (12/23/78).

"Manitoba Firm Wins Contract for Seattle Buses," (11/19/78).

"New Faith Seen with Bond Issue for Flyer Unit," (10/31/78).

"Prosperous Year Seen for Flyer Industries," (5/19/78).

"Flyer Sale," (11/4/77).

"Flyer Still Shows Loss on Orders for Buses," (9/22/76).

"Fighting Chance at Survival," (12/11/75).

"Flyer's Deficit for Year Set at $20.4 Million," (12/6/75).

"More Funds from Manitoba Going to Flyer," (11/6/75).

"Manitoba Determined to Resuscitate Flyer Despite Various Losses," (8/13/75).

- WINNEPEG FREE PRESS

  "Employees Blame Low Morale on 'Interference'" (3/21/81).

  "Flyer Workers Upset As Board" (3/18/81).

  [Title of Article obscured in available copy] (2/20/81).

- "Flyer's Killinger" (interview), Metropolitan, (May/June 1979). pp. 14-20.

- "Flyer," Bus Ride, 11/78), p. 29.

TABLE 4-22. COMPANY DIGEST-FLYER INDUSTRIES

Name of Company:	Flyer Industries, Ltd.
Address:	64 Hoka Street Box 245 Winnipeg, Manitoba CANADA RZC 3T4
Telephone:	(204) 224-1251
Transit Bus:	D901 ("New Look") Transit Bus (35' and 40') and E901 Trolleybus

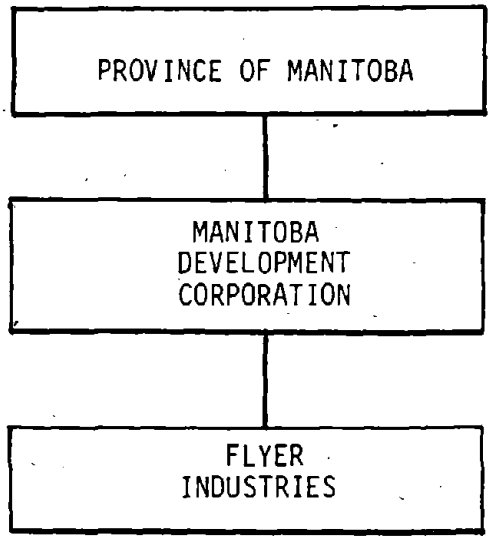


FIGURE 4-8. FLYER INDUSTRIES CORPORATE STRUCTURE

TABLE 4-23. FINANCIAL STATISTICS - FLYER INDUSTRIES

	1976	1977	1978	1979	1980
			(MILLIONS)		
Net Sales	$34.1	22.8	12.0	20.2	41.6
Net Income (loss)	$ 4.1	1.2	(1.0)	(4.5)	0.96
Production Volume	479	190	135	198	351
(U.S. volume)	376	80	0	132	328
Employees	NA	NA	350	550	575

TABLE 4-24. CHRONOLOGY OF EVENTS - FLYER INDUSTRIES

1930	Western Auto and Truck Body Works Limited founded in Winnipeg.
1940s	Builds trucks and buses under contract to the Canadian government.
1950s	The company builds intercity buses.
1964	Company name is changed to Western Flyer.
1968	Western Flyer builds a transit bus prototype.
1969	Western Flyer produces an electric trolleybus prototype.
1970	The company concentrates its resources on urban bus production.
1971	Manitoba Development Corporation (MDC) acquires Flyer Industries; Company name is shortened to Flyer.
1971	Agreement reached with A.M. General on design licensing agreement.
1973	Company opens new $2.5 million assembly plant in Winnipeg.
1974	Flyer reports a loss of over $15 million.
1980	Flyer forms a North Dakota corporation in contemplation of an U.S. assembly operation.

TABLE 4-25. SERIES 901 TRANSIT BUS SPECIFICATION PROFILE - FLYER INDUSTRIES

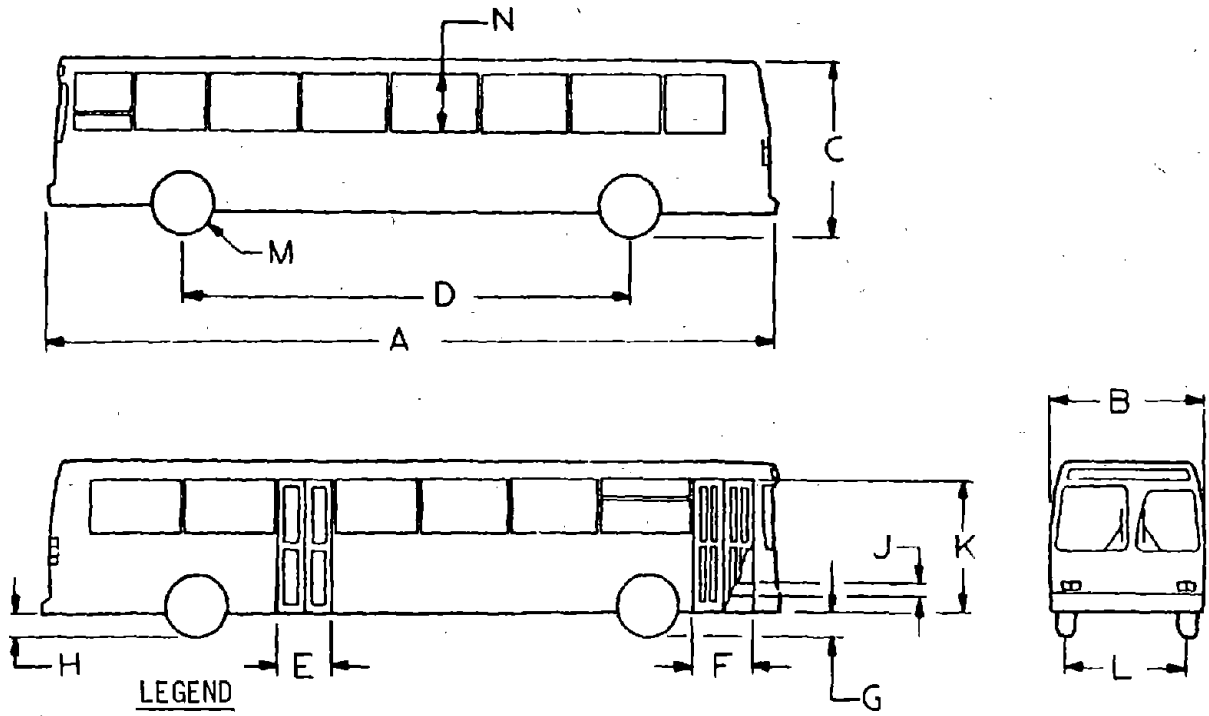
COMPONENT	TECHNICAL DESCRIPTION	SUPPLIER
Engine		
- Standard	6V71N, Naturally Aspirated	Detroit Diesel
- Optional	6V92TA/TAC Turbocharged	Detroit Diesel
- Optional	VTB903, Turbocharged	Cummins
Transmission	V-730	
Axles		
- Front	Reverse Elliot, 12,000 lb. rating	Rockwell
- Rear	Full Floating, 23,000 lb. rating	Rockwell
Propellar Shaft	4" diameter, 1710 Series	Spicer

TABLE 4-26. PLANT INFORMATION - FLYER INDUSTRIES

Location:	Winnipeg, Manitoba, Canada
Employment:	575
Investment:	$6 million
Size:	2,000,000 ft.^{2}
Products:	Diesel and Electric Transit Buses
Capacity:	1000/year

TABLE 4-27. PRODUCTION TRENDS - FLYER INDUSTRIES

YEAR	PRODUCTION
1976	479
1977	190
1978	135
1979	198
1980	351
1981	378



A.	length----------	35'or 40'
B.	width----------	102"
C.	height----------	120.5"
D.	wheelbase----------	35' = 225" 40' = 285"
E.	rear door opening width--------- clear opening-- ------	 26.5"
	front door opening width--------- clear opening---------	 38"
G.	first step height front---------- kneeling-------- rear---------- kneeling--------	 13.5" 10.0" 14.0"
H.	ground clearance--------	14.0" minimum road clearance -- center
J.	interior steps--front--- rear----	10.7" 10.7"
K.	door height-----front--- rear----	80.0" 78.5"
L.	track----------front--- rear----	85.2" 76.5"
M.	tires dimension----------	 22.5 x 8.25
N.	windows height---------- thickness---------- total area----------	 32.75" 1/4" tinted safety glass

FIGURE 4-9. EXTERIOR TRANSIT BUS DIMENSIONS - FLYER INDUSTRIES

4.5 CROWN COACH/IKARUS

4.5.1 Summary

Crown Coach is a Los Angeles company producing buses, intercity buses, firetrucks and articulated-transit buses. The company's articulated transit bus is based on a design developed by a Hungarian company called Ikarus. Crown Coach uses Ikarus as a subcontractor supplying parts in building the articulated transit bus.

Crown Coach is a small, privately-held company, Its single plant, located in Los Angeles, has a capacity to produce about 1200 vehicle per year with a full staff. The capacity to produce articulated-transit buses is about 160 units per year.

Ikarus is the largest producer of integral-construction buses in the world. The company builds over 13,000 transit and intercity buses per year, primarily for sale, to other Eastern European countries. Ikarus builds over 3000 articulated buses per year. Table 4-28 summarizes some basic company reference information.

4.5.2 Corporate Overview

The Crown Coach Corporation is a small, privately-held company headquartered in Los Angeles, California. Its product lines are limited to the four vehicle types listed in Table 4-29.

The school buses it produces are large-capacity, integral-construction buses, 35- or 40-feet in length. Considered by many to be the "Cadillac" of school buses, they are relatively expensive (~$90,000 apiece) and are sold in small numbers (averaging about 350 per year), mostly in the Western states.

Crown's special coach business centers around the building of custom vehicles resembling intercity buses, typically in 35- and 40-feet lengths for purposes such as mobile libraries, post offices, laboratories, and testing vehicles.

Crown also builds intercity-type buses of three types: standard intercity, sightseeing coaches, and utility coaches.

These last are intercity coaches without many of the expensive cosmetic and luxury features associated with intercity buses. In recent years, Crown has concentrated its attention in the intercity bus market on direct sales to the Federal government.

The production of the Ikarus Model 286 articulated bus is a new venture. Crown uses Ikarus as a subcontractor providing the bus design and some bus parts for assembly in the U.S. using U.S. chassis components.

Ikarus is a Hungarian bus builder headquartered in Badepest, Hungary. Ikarus is represented abroad by the Mogurt Trading Company, which has responsibility for the overseas sale of the products of the Hungarian motor industry.

The phenomenal size of Ikarus as a bus producer is the result of planned specialization in motor vehicle production among the Comecon countries of Eastern Europe. In 1964, it was agreed among the Soviet Bloc countries, excluding Romania, to permit Hungary to establish a virtual monopoly in production of large buses. The other countries in the region would undertake complementary specialization in other types of vehicles.

Ikarus is a bus specialist, building only the bus body. Major components are supplied by other firms.

Ikarus is very active in international trade through Mogart, the Hungarian trading company charged with trade in motor vehicles. Ikarus has helped establish assembly plants in Iraq, Madagascar, Cuba and Angola where its buses are assembled, usually from kits sent from Hungary. The largest of these plants is in Iraq where Ikarus buses are assembled using Scania and Saviem (Renault) chassis.

4.5.3 Company History

Crown Coach traces its history to 1905 with the founding of the Crown Carriage Company. The company's bus business commenced in 1915 when it produced its first special coaches. It entered the school bus business in 1932 when it build the first transit-

type school bus in the U.S. Crown specialized, for a time, in transit-type school buses, diversifying in 1951 to produce fire-trucks. In 1955 Crown began building intercity coaches.

Ikarus traces its beginning to a coach-building factory founded in Budapest in 1897. That factory was nationalized in 1948. The company's growth since then has been the result of the government's emphasis on developing its motor industry in successive five year plans. In 1964, Hungary, the Soviet Union, Czechoslovakia, Poland, East Germany and Bulgaria, made an agreement concerning how each would specialize in the motor vehicle industry. The objective was to enhance efficiency and trade among the agreeing nations. As part of the agreement, Hungary was to phase out of car and truck production, concentrating instead on buses and certain truck components. Hungary, later, also withdrew from building farm tractors. As a result of the agreement, Ikarus gained exclusive responsibility for building large transit and intercity buses for most of Eastern Europe. Consequently, Ikarus was able to greatly increase its scale of production.

The design which forms the basis for all of Ikarus "200" series bus models (including the 280 series articulated models), was introduced in 1966.

Ikarus became involved in the U.S. transit-bus market at the instigation of the McDonnell-Douglas Co., a manufacturer of commercial aircraft. McDonnell-Douglas has been attempting to sell commercial aircraft in Eastern Europe for a number of years. Such sales would require: 1) political influence, and 2) a means by which the planes could be paid for, such as offsetting trade. McDonnell-Douglas actively sought a market for Ikarus buses in the U.S. under an informal agreement with Mogurt by which Mogurt would support McDonnell-Douglas' efforts to sell planes and the Hungarians would credit the sale of Ikarus buses in the U.S. in any trade offset agreement involving the purchase of McDonnell-Douglas planes.

McDonnell-Douglas identified the articulated-bus market as having potential, and Ikarus began designing a U.S. prototype in 1975. McDonnell-Douglas found a U.S. partner for Ikarus in Crown Coach, a Los Angeles bus builder. Crown Coach and Ikarus (represented by Mogurt) began their association in 1977.

In 1978, Crown and Mogurt jointly toured the U.S. with a prototype bus. This bus was one of the Ikarsu 280 series articulated buses, modified to use U.S. chassis and powertrain components. This bus was evaluated by the two companies, and the design was further refined to meet U.S. operating requirements.

Crown Coach subsequently entered the U.S. transit-bus market with the articulated bus, bidding on and winning several small contracts. The first sale occurred in 1979, and deliveries on that order began in 1981.

Crown Coach assembles the bus in Los Angeles, subcontracting to Ikarus for bus body parts. The major chassis parts (engine, transmission, brakes, etc.) are purchased from U.S. makers.

On the first buses built, the U.S. powertrain components were shipped to Hungary for installation, and only finish work was done by Crown Coach. On later orders, Crown Coach plans to do more assembly work, including component installation. The Crown Coach/Ikarus chronology of events is presented in Table 4-30.

4.5.4 Product Line of Buses

Crown Coach builds a line of transit-type school buses, intercity and special coaches. These products were described previously in Table 4-29. The company also builds an articulated-transit bus, the Ikarus 286, available in both fifty-five and sixty-foot models. The bus weighs about 25 tons. Crown Coach final assembles the partially finished bodies exported from Hungary. Ikarus production statistics are presented in Table 4-31.

The Crown/Ikarus model 286 articulated-transit bus major components, specifications, and suppliers are detailed in Table 4-32.

A multi-tube space frame construction techniques is used by Crown/Ikarus on the model 286. The overall exterior dimensions are shown in Figure 4-10.

The Crown Coach final assembly plant, where it produces its entire product line of buses, is located at Los Angeles, California. The plant was constructed in 1935. Some basic plant information is shown in Table 4-33.

There is no indication that Crown will produce any transit bus other than the model 286 articulated, using Ikarus as a subcontractor.

Ikarus has five plants in Hungary. Two are in Matyasfold, a suburb of Budapest.

Crown Coach's production of articulated buses totalled 67 in 1981. Statistics for other Crown Coach products are not available.

4.5.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment efforts. The definition of Reference Sources and Bibliography are the same as defined previously in Section 4.1.5.

In addition, staff members of the Transportation Industry Analyses Branch have corresponded with the Hungarian Trading Company, Mogurt, and with Sandor Aranyi, Commercial Counselor, Embassy of the Hungarian People's Republic, New York and Washington.

Crown Coach and Ikarus press releases and photographic coverage of their product line buses were used as reference sources.

The following additional company literature was used in support of the analysis and assessment:

- "City Bus 260," (1981).
- "Export Distinctions of Ikarus Made Buses and Coaches," (1981).
- "Production of Buses and Coaches by Type," (1981).
- "The Crown-Ikarus 286 Articulated: The 1980s Transit Bus," (1981).
- "Coach de-Luxe 250," (1980).
- "City Bus Ikarus 1980."
- "Ikarus 222," (1979).
- "Long-Distance Coach 256," (1979).
- "Pioneer Los Angeles Firm Thrives on Excellence and Versatility, Press Release, Crown Coach Corp. (January 1978).
- "Ikarus Coach and Vehicle Works - Background Information," News from Mogurt Hungarian Trading Company for Motor Vehicles, Budapest, Hungary (January 1978).
- "Articulated City Bus 280," (1978).
- "City and Suburban Coach, Ikarus 266," (no date).
- "City Bus, Ikarus 261," (no date).
- "Crown Custom Built Utility Coaches," (no date).
- "Crown Custom Built Security Coaches," (no date).
- "Crown-Ikarus 286 Articulated City Bus, Technical Description," (no date).
- "Crown Supercoach." (no date).
- "Custom Coaches by Crown." (no date).
- "Intercity Bus, Ikarus 255," (no date).
- "Ikarus 280 T3, Trolleybus Article," (no date).
- "Ikarus-286, The First Hungary-American Bus - Background Information," News from Mogurt Hungarian Trading Company for Motor Vehicles, Budapest, Hungary (no date)

- "Ikarus 280 Articulated Bus," (no date).
- "Motor Coach DeLuxe, Ikarus-Scania," (no date).
- "Technical Data of Bus Type Series Ikarus 200," (no date).
- "The Hungarian Bus Industry," (no date).
- "The Ikarus 286 By Crown Coach Corp." (no date).
- "Tourist Coach Ikarus 212," (no date).
- "Traveling Coach, Ikarus 256," (no date).

Bibliography - The following publications were used in support of the analyses and assessment:

- "Hungary as a Trading Partner," Wall Street Journal (large advertisement), (10/2/81), p. 33.
- "Articulated Transit Vehicle Arrives in Los Angeles," Metropolitan, (3/4/81).
- "Crown/Ikarus," Metropolitan, (3/4/81), p. 31.
- "Budapest and Transit: Preparing for Tomorrow's Urban Survival," Mass Transit, (2/81), pp. 12-14.
- "Crown Tests U.S. Market with Articulated Ikarus 286," Metropolitan, (3/4/81), p. 51.
- "Don't Miss Our Bus -- Ikarus!" Wall Street Journal, (adv.), (10/2/80).
- Mass Transit, (4/80), p. 13.
- "Bus Imports Build Momentum," Business Week, (1980).
- "Hungarians Produce No Cars, Thrive on Heavy Equipment," Automotive News, (8/28/79), pp. 10-12.
- "Mogurt in Hungarian Foreign Trade of Motor Vehicles," Hungarian Machinery, (3rd Quarter 1979), pp. 2-5.
- "Road Vehicle Manufacturing in Hungary," Hungarian Machinery, (3rd Quarter 1979), pp. 7-13.
- "Special Products of Hungarian Road Vehicle Manufacturing," Hungarian Machinery, (3rd Quarter 1979), pp. 41-45.

- "Passengers Ride Anna's 'Baby Bus'," Long Beach Independent (A.M.), Press-Telegram, (11/21/78), p. A10+.
- "Hungarian Volvo a Success on the Trial Course," Hungarian Heavy Industries, (2nd Quarter 1977), p. 40.
- "The Role and Importance of Vehicle Industry in Hungary's National Economy," Hungarian Heavy Industries, (2nd Quarter 1977), pp. 1-10.
- "Hungary-Production Exports," MVMA, (1974-1977).
- "From Carriages to Coaches," Automotive News (3/16/70).

TABLE 4-28. COMPANY DIGEST - CROWN COACH/IKARUS

Name of Company:	Crown Coach Corp.	Ikarus Karosserie-U
Address	2428 W. 12th Street Los Angeles, CA 90021	Fharze Ugwerke Susanne Holup/A. Lazlow 1630 Budapest Marget UZ - Hungary
Telephone:	(213) 627-4021	
Transit Bus:	Articulated Bus, Model 286	

TABLE 4-29. PRODUCT LINES - CROWN COACH/IKARUS

- Ikarus Articulated Transit Buses
- Firetrucks
- Transit-Type School Buses
- Intercity Coaches

TABLE 4-30. CHRONOLOGY OF EVENTS - CROWN COACH/IKARUS

Ikarus

1897 Coach building factory established.
1948 All factories in Hungary nationalized.
1975 Began designing an articulated bus for the U.S.
1981 Fills first order for the Crown Ikarus bus.

Crown Coach

1905 Founded as Crown Carriage Company.
1915 Began production of special coaches.
1932 Built the first integrally-constructed transit-type school bus.
1951 Introduced a fire truck into production.
1978 Demonstrated an Ikarus articulated bus in the U.S.
1981 Fills first order for the Crown/Ikarus bus.

TABLE 4-31. IKARUS PRODUCTION STATISTICS

	1976	1977	1978	1979	1980
Intercity Buses (250 series)	4,079	3,680	3,154	2,640	2,791
City buses (260 series)	4,867	5,187	5,502	5,410	5,299
Articulated (280 series)	1,679	1,732	1,978	2,449	3,042
Miscellaneous[1]	1,282	1,601	2,383	3,124	2,423
Total	11,907	12,200	13,107	13,623	13,555

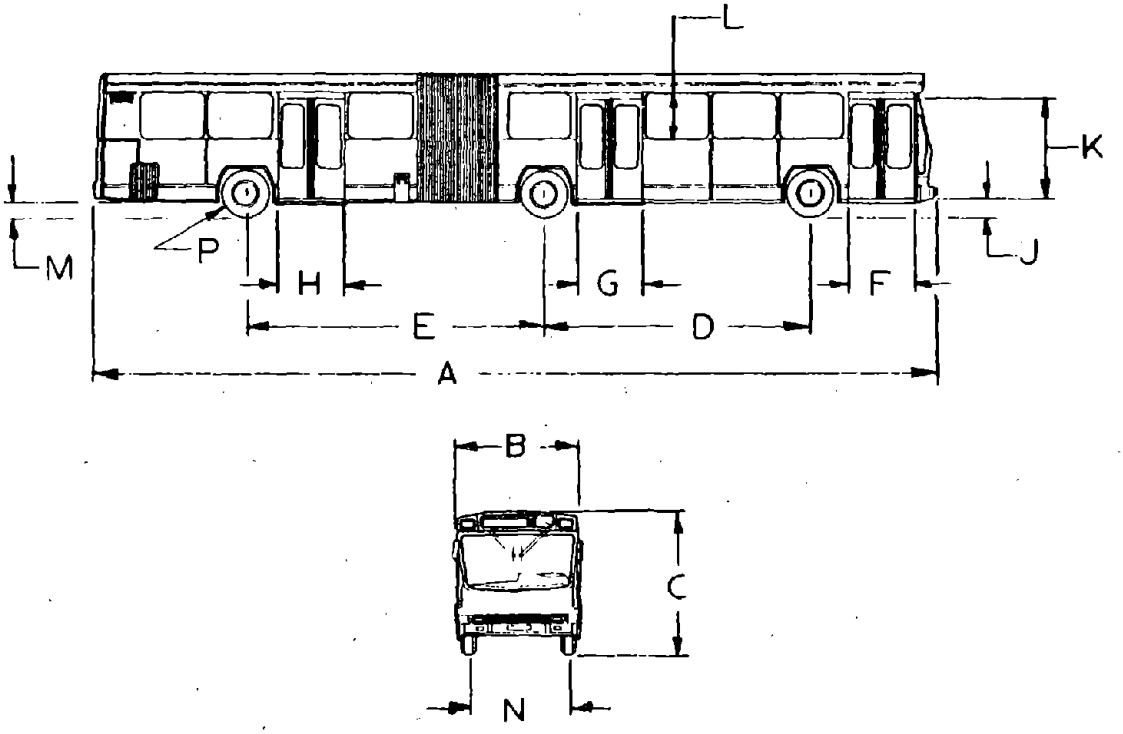
[1] Includes units which could not be identified as to type in available production statistics

TABLE 4-32. MODEL 286 ARTICULATED BUS SPECIFICATIONS PROFILE - CROWN/IKARUS

COMPONENT	TECHNICAL DESCRIPTION		SUPPLIER
Engine (under floor, behind front axle)			
- Standard	NHHTCC-290, Turbocharged		Cummins
- Optional	NHHTCC-350, Turbocharged After Cooled		Cummins
Transmission	HT-740, 4-Speed Automatic		Allison
Axles			
- Front	FL931	18,000 lb. rating	Rockwell
- Drive	59742	23,000 lb. rating	Rockwell
- Trailer	FL931	18,000 lb. rating	Rockwell
Propeller Shaft	Series 18.0		Spicer

TABLE 4-33. PLANT INFORMATION - CROWN COACH

Location:	Los Angeles, California
Employment:	400
Investment:	N/A
Size:	400,000 ft.^{2}
Products:	Ikarus 286 Artic, School Buses, Special Coaches, Firetrucks
Capacity:	1200 per year, including 160 articulated buses



LEGEND

A.	length	55' 2 door 60' - 2 door 60' - 3 door
B.	width	102"
C.	height	124"
D.	wheelbase, tractor	224"
E.	wheelbase, trailer	280"
F.	front door	
	opening width	
	clear opening	48"
C.	center door	
	opening width	
	clear opening	48"
H.	rear door	
	opening width	
	clear opening	48"
J.	steps	
	first step above ground	14.75"
	inside steps-Front	11.0" 7 1/2" (optional)
	-Rear	
K.	door height	
	front	
	center	
	rear	
L.	windows	
	height	
	thickness	
	total area	
M.	ground clearance	8.0"
N.	track	
	front	
	rear	
P.	tires	
	dimensions	Michelin 13/80 R22.5 x tubeless PR 18

FIGURE 4-10. EXTERIOR ARTICULATED BUS DIMENSIONS - CROWN/IKARUS

4.6 GILLIG CORPORATION

4.6.1 Summary

Gillig is a small bus builder located near San Francisco, California. Historically, a builder of integral-construction school buses, Gillig introduced a standard-size transit bus in 1980. The company plant has a capacity with two-shift operation to produce 800 buses per year. Planned production for 1982 is about 350. Gillig is a subsidiary of Herrick, a fabricator of structural steel. Table 4-34 summarizes some basic company reference information

4.6.2 Corporate Overview

Gillig is a wholly-owned subsidiary of the privately-held Herrick Corporation. Herrick is one of the largest fabricators and erectors of structural steel in the United States. Both Herrick and Gillig have their headquarters on the same site in Hayward, California.

Historically, Gillig has been primarily a builder of integral-construction school buses. Its market for these buses has been the Western United States. Since 1980, Gillig has also been a producer of transit buses. Gillig's transit bus model, the Phantom, is unrelated in its design to the school-bus model. Gillig's product line is limited to these two buses.

Financial information is not available for either Gillig or Herrick. Gillig's total revenues in 1981 were probably in the range of $30 to $45 million. Herrick's revenues, other than for Gillig, are probably in the range of $50 to $100 million. The Corporate organizational structure is shown in Figure 4-11.

4.6.3 Company History

The present-day Gillig Corporation traces its history to Jacob Gillig opening up a shop around 1880 in San Francisco to repair and build buggies and carriages. Following the 1906

earthquake, the business re-opened as the Leo Gillig Automotive Works, building automobile bodies and early model buses. Expansion in the 1920s and 1930s led the company to become involved in the production of recreational boats and truck bodies. The company built its first school bus in 1932. In 1937, Gillig built its first integral-construction school bus. Shortly thereafter, Gillig acquired the Patchett company, another bus builder located in Newman, California and began building underfloor engine buses using Hall-Scott powerplants.

Following World War II, Gillig began building rear-engine buses. In 1958, Cummins diesels were introduced. A new plant was opened in Hayward, California in 1968. Herrick, whose main plant was on an adjacent site in Hayward, acquired Gillig in 1973.

Gillig began its first modern venture in the transit bus market in 1976 when it acquired the right to produce a Neoplan-designed medium (30') transit bus. First deliveries of these buses were made in 1977. The Neoplan-designed bus did not prove successful, in part because of problems encountered in service by one of the first customers. Production was discontinued.

After the Neoplan bus venture, a new management team led by former Peterbilt executives was brought in by Herrick. A new transit bus of Gillig's own design was developed and introduced in 1980.

A chronology of events is given in Table 4-35.

4.6.4 Product Line of Buses

Gillig Corporation's major transit product is its "Phantom" heavy-duty transit coach, introduced in 1980. The Phantom is available in thirty-foot (33 passenger), thirty-five foot (40 passenger) models and forty-foot (47 passenger) configurations.

The bus has been marketed primarily as an especially heavy-duty medium-transit bus and as a "New Look" or utility-standard-size transit bus. Gillig has bid successfully on the

advanced-design bus ("White Book") solicitations in a few cases as well.

Gillig claims for the Phantom excellent fuel economy, and offers the largest brakes in the industry (16.5 x 6, front and 16.5 x 10, rear. This compares with 14.5 x 6 and 14.5 x 10 for competitive buses). The powertrain is an in-line configuration using an HT-740 transmission.

Gillig's strategy calls for it to market its bus primarily to private operators such as Hertz and Avis airport shuttle services and to small transit properties with fleets of less than 100.

The Gillig Corporation's "Phantom" model transit bus has the major subcomponents, specifications, and suppliers detailed in Table 4-36.

The Phantom is also available with a kneeling feature, and wheelchair lifts. Overall exterior dimensions are shown in Figure 4-12. The assembly plant used by Gillig for its transit and bus production is located in Harward, California. Some basic plant information is shown in Table 4-37.

The Hayward plant was constructed in 1968, replacing an older facility in the same city. Gillig is planning a slow, steady build-up in its production of transit buses.

Recent production statistics for Gillig's transit bus are detailed in Table 4-38.

4.6.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment efforts. The definitions of Reference Sources and Bibliography are the same as defined in Section 4.1.5.

In addition, staff members of the Transportation Industry Analysis Branch conversed by telephone with Gillig Corporation officials.

Gillig Corporation press releases and photographic coverage of their product line buses also were used as reference sources.

The following additional company literature was used in support of the analysis and assessments:

- "Phantom, Heavy Duty Transit Coach - Technical Specifications City-Suburban," (August 1981).
- "Phantom, Heavy Duty Transit Coach - Technical Specifications," (July 1981).
- "The Phantom Arrives," (no date).
- "Gillig Phantom - Classic Simplicity," (no date).
- "Largest and Most Modern Bus Manufacturing Facility in the West," (no date).
- "For Over Three Quarters of a Century - Dedicated to Excellence," (no date).
- Herrick Corporation - (Information Book).

Bibliography - The following significant publications were used in support of the analyses and assessment:

- "Executive Dialogue: Gillig's Oliveira," (interview with John Oliveira, Vice-President of Gillig) Metropolitan, Jan-Feb, 1982, p. 13-19.
- "Gillig Producing New Bus Model," Metropolitan, (September/October 1981). p. 21.
- "Does 'Phantom' Have a Ghost of a Chance?," Hayward Daily Review, (1/30/81), (California).
- "Gillig Corp. Debuts 'Phantom' Transit Coach," Metropolitan, (November/December 1980).
- "Gillig-Neoplan," Bus Ride, (11/78), p. 34.
- "Going After the 'Small Bus' Market," Mass Transit, (October 1978), pp. 46-48.

TABLE 4-34. COMPANY DIGEST - GILLIG CORPORATION

Name of Company:	Gillig
Address:	25800 Clawiter Road Hayward, California 94545
Telephone:	(415) 785-1500
Transit Bus:	"Phanton" transit bus (30', 35', 40')

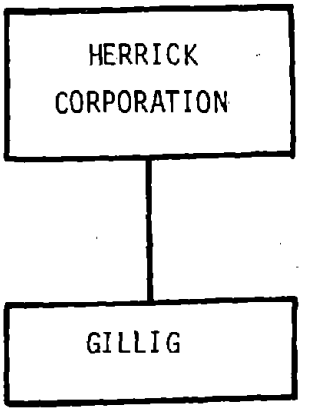


FIGURE 4-11. HERRICK CORPORATION CORPORATE STRUCTURE

TABLE 4-35. CHRONOLOGY OF EVENTS - GILLIG CORPORATION

1880	Jacob Gillig, a carriage builder, arrives in San Francisco, California, from New York.
1906	The Gillig plant is burned in the fire which followed the Great Earthquake. The plant reopens as the "Leo Gillig Automotive Works."
1932	Gillig builds its first school bus.
1937	Gillig produces its first "transit-type" school bus.
1938	Gillig moves to Hayward, California and also acquires Patchett, another bus builder.
1954	Gillig's bus production is 100 percent diesel-powered for the first time.
1968	A new factory is completed in Hayward.
1973	Gillig is acquired by Herrick Corp., a California structural steel firm.
1976	Gillig enters the transit bus market with a Neoplan-design bus. The standard Gillig-Neoplan is 31' in length, but a 35' version is sold.
1980	Gillig introduces the Phantom, a transit-bus of its own design.

TABLE 4-36. SPECIFICATIONS PROFILE - "PHANTOM" TRANSIT BUS

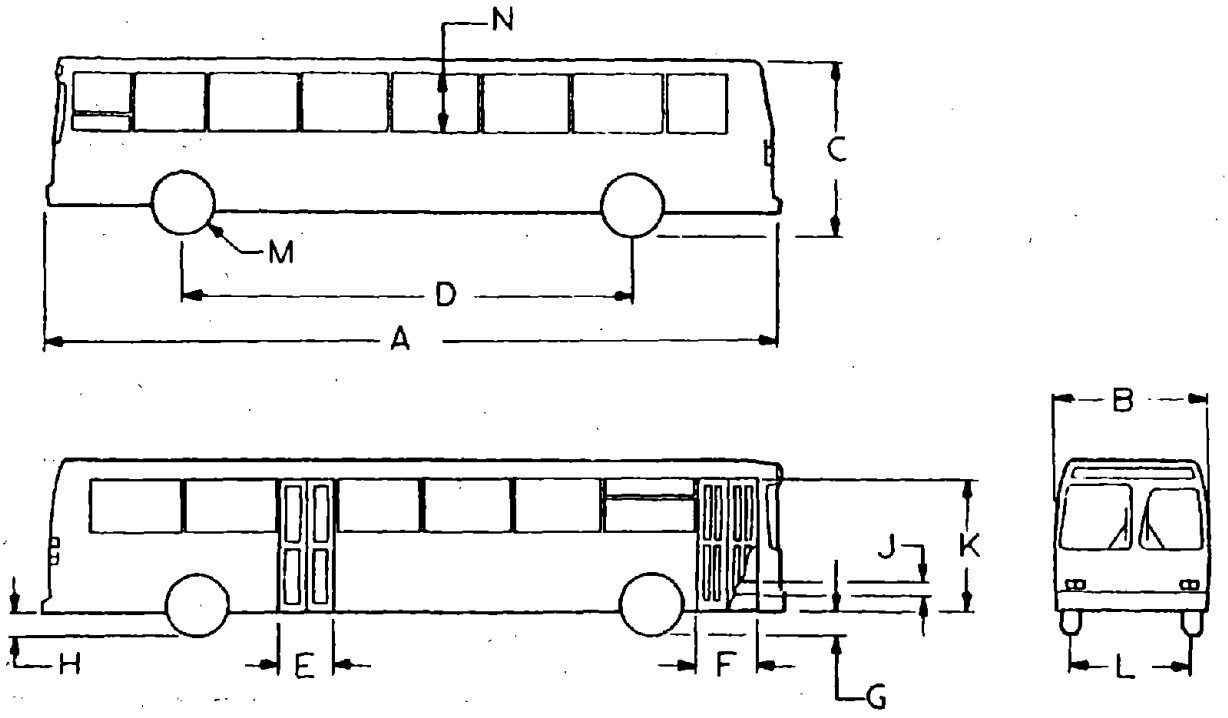
COMPONENT	TECHNICAL DESCRIPTION	SUPPLIER
Engine		
- Standard	6V92 TA, Turbocharged	Detroil Diesel
- Optional	6V92 TAC, Turbocharged	Detroit Diesel
Transmission	HT-740, Automatic 4-Speed	Detroit Diesel
Axles		
- Front	Heavy Duty 13,340 lb. rating	Rockwell
- Rear	Heavy Duty 25,000 lb. rating	Rockwell
Propeller Shaft	1710 Series, Heavy Duty	Spicer

TABLE 4-37. PLANT INFORMATION - GILLIG CORPORATION

Location:	Hayward, California
Employment:	200 (1981 transit operators)
Investment:	N/A
Products:	"Phantom transit coach" School Buses
Capacity:	800 transit buses per year

TABLE 4-38. PRODUCTION TRENDS - GILLIG CORPORATION

YEAR	PRODUCTION
1976	0
1977	0
1978	0
1979	0
1980	15
1981	130
1982 (projected)	350



A.	length----------	30', 35' or 40'
B.	width----------	96" maximum
C.	height----------	119"
D.	wheelbase----------	173", 222", or 282"
E.	rear door	
	clear opening-- ------	26"
	front door	
	clear opening---------	37"
G.	first step height	
	front----------	14"
	kneeling--------	10"
	rear----------	16"
	kneeling--------	
H.	ground clearance--------	
J.	interior steps--front---	10"
	rear----	10"
K.	door height-----front---	
	rear----	
L.	track----------front---	78"
	rear----	
M.	tires	
	dimension----------	11.00 x 22.5 (14 ply)
N.	windows	
	1/4" safety glass	

FIGURE 4-12. EXTERIOR TRANSIT BUS DIMENSIONS - GILLIG CORPORATION

4.7 M.A.N.

4.7.1 Summary

M.A.N. is a West Germany engineering company with major interests in truck and bus manufacture. M.A.N. established a subsidiary in the U.S. in 1980 to build articulated-transit buses. The subsidiary opened a plant during 1981 and by the end of 1981, the company had orders for 635 articulated buses in the United States. Production for these orders will continue through 1983. M.A.N. may extend its U.S. product line to include standard-size transit buses by 1984.

A previous venture in which M.A.N. undertook bus production in the U.S. jointly with AM General resulted in the production of 399 articulated buses.

Some salient company data is contained in Table 4-39.

4.7.2 Corporate Overview

M.A.N. Truck and Bus Corporation is the U.S. subsidiary of Maschinenfabrik Augsburg-Nuremburg (M.A.N.) A.G. M.A.N. Truck and Bus Corporation was established in 1980 to build and sell articulated-transit buses in the U.S. The company has its headquarters in Southfield, Michigan, near Detroit, and has built a plant in Cleveland, North Carolina.

M.A.N. A.G. is a West German corporation with multinational interests in the engineering industries. To organize its activities, M.A.N. employs a decentralized, divisional organizational structure, as shown in Figure 4-13. The buses are the responsibility of the Commercial Vehicles Division.

M.A.N.'s product lines range across the whole spectrum of civil and mechanical engineering, as shown in Table 4-40. M.A.N.'s vehicle manufacturing operations are concentrated on diesel trucks in the medium and heavy range. M.A.N. produces a line of light to medium trucks jointly with Volkswagen. The

company also produces a number of custom vehicles and chassis for special purposes. These include public utility vehicles such as garbage trucks and chassis for fire trucks. M.A.N.'s commercial vehicle operations include producing a full range of buses and coaches.

M.A.N. A.G., the parent of the M.A.N. Group, is a stockholder-owned West German corporation. The M.A.N. Group reported total sales in its 1980 fiscal year of $4.3 billion and net income of $28 million. The company employs 43,000 people. M.A.N. production statistics for previous years are given in Table 4-41.

No financial information is available for M.A.N. Truck and Bus Corporation because it is privately held.

4.7.3 Company History

M.A.N. was founded in 1840. The company's involvement with vehicle production began in the late 19th century with railway cars. The company was closely involved with the development of the diesel engine, introducing one of the first practical diesels in 1897.

The commercial vehicle division was formed in 1915. The first bus models were built under license, but in 1924, the company introduced its own model utilizing a special chassis to permit a lower floor. A year later, M.A.N. had equipped its bus with a diesel engine.

Although quick to use diesel engines, M.A.N. did not turn to integral construction until the early 1950s. An articulated bus was introduced in 1959.

M.A.N.'s involvement in the U.S. market began in 1974 with a demonstration in several U.S. cities of an articulated bus. In 1975, M.A.N. entered into a joint venture with AM General, then one of three major U.S. transit-bus builders. The M.A.N.-AM General venture sold some 399 articulated buses before being dissolved.

The M.A.N. Truck and Bus Corporation wholly-owned by M.A.N. A.G., was formed in 1980. A $13 billion plant was opened in 1981. By December, 1981, M.A.N. had new orders for 635 articulated buses.

Table 4-42 presents a chronology of events.

4.7.4 Product Line of Buses

M.A.N., in West Germany, markets a complete line of standard city, suburban and touring coaches, including articulated, double-decker and trolleybuses. The company also builds bus chassis and truck chassis suitable for mounting with a bus body.

M.A.N. uses a system of letter names to designate its various bus models. A first letter, S, indicates a complete bus. The second letter usually indicates the type of service for which the bus is intended:

R - touring

L - city service

U - suburban service.

A second letter, G, however, indicates an articulated bus, and a second letter, D, indicates a double-decker. A third letter attached with a hyphen is used to indicate an additional attribute, such as power source, if other than diesel engine. For example, E for electric bus, T for trolley and G for gasoline.

Chassis have their own system of designations. First letter, B, indicates a chassis-floor assembly for a bus. First letters, CH, indicate a truck chassis suitable for bus use.

The range is described briefly, below.

SR - The SR-series buses are touring coaches, available in lengths of 35, 37, and 39 feet. A variety of configurations for the seating, doors and luggage compartments are available. The bus is equipped with either a 240 or 280 HP, rear-mounted, underfloor engine.

The SL-200 is the standard city bus, with rear-mounted, under-floor engine. This bus is also built as an electric bus with a battery trailer (SL-E), a trolley bus (SL-T), and a gasoline engine bus (SL-G). This bus is 36-feet long.

SU - The SU-series are suburban configuration buses, with rear-mounted engines. They are 38 feet in length.

SD - M.A.N. produces double-decker buses with rear-mounted engines and with a length of 38 feet. These are also available with three axles (SD-D).

SG - M.A.N.'s articulated buses are configured for city or suburban service (SG-U). They are 54, 56, or 59 feet in length and the engine is mounted under-floor in the forebody. A rear-mounted engine version (SG-H) is also available as is an articulated trolley bus (SG-T).

In addition to the standard buses described above, M.A.N. supplies special coaches built on its chassis-floor assemblies. These may be for special purposes, such as conference buses, traveling libraries, mobile X-ray units, etc.

M.A.N. also builds medium (30 passenger) buses.

M.A.N. chassis include floor assemblies for standard city buses (B-S), touring coaches (S-SR) and articulated buses (B-SG). M.A.N. also supplies front-engine, forward-control truck chassis with leaf springs for bus use and a rear-engine, truck chassis for buses.

Some of the buses offered by M.A.N. may be built by independent body-builders. The SL-T, SG-T and SD-D mentioned above are products of OAF Graf and Stift AG.

In the U.S., M.A.N. Truck and Bus Corporation produces only an articulated-transit bus. The M.A.N. articulated bus has proven to be the most popular artic offered in the U.S. 399 artics were built jointly by M.A.N. and AM General in 1978-79 for the U.S. market, and 635 artics had been sold by the new M.A.N. Truck and Bus Corporation as of December, 1981. The

artics currently offered by M.A.N. feature a M.A.N. engine and axles combined with a Renk automatic transmission. Steering is a ZF design. Foreign content is just under 50 percent, although M.A.N. expects the value of the U.S. market to increase eventually to around 60 percent.

A standard-size transit bus and an intercity bus are being considered for future production.

The M.A.N. articulated buses are produced at a newly constructed plant located in Cleveland, North Carolina. Total investment in the plant is reportedly $13 million. Some 500 workers are expected to be employed there by mid-1982.

Data on the exterior articulated bus dimensions are shown in Figure 4-14.

A specification profile with components and suppliers is presented in Table 4-43.

Some essential plant information is shown in Table 4-44.

4.7.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment efforts. The definitions of Reference Sources and Bibliography are the same as defined previously in Section 4.1.5

In addition, staff members of the Transportation Industry Analyses Branch corresponded with representatives of the M.A.N. Group and specifically with Mr. G. Pickett, Manager, Transit Sales, M.A.N. Truck and Bus Corporation, Southfield, Michigan. Correspondence was complemented by telephone conversations with company officials.

M.A.N. press releases and photographic coverage of their product line buses also were used as reference sources.

The following additional company literature was used in support of the analyses and assessment:

- "M.A.N., Technical Descriptions, Articulated Bus" (1981).
- "U.S. Fleet of M.A.N. Articulated Buses," (10/22/80).
- "The 'S-80', A New Generation Transit Bus," prepared for presentation at APTA meeting 1979.
- "M.A.N. Annual Report (1978-80 abridged) (no date)
- Letter from L.M. Eggert, American M.A.N. Corporation to W. Raithel, UMTA (10/31/79).
- "M.A.N. SG192 Articulated Bus Demonstration Survey Results," Prepared for AC Transit, NYCTA, PAT, SEMTA, CTA, Seattle Metro, SCRTD and Dallas Transit, by Booz-Allen & Hamilton, (12/74).
- "Here's What People Are Saying About M.A.N. Buses," (no date).
- "M.A.N. Articulated Bus 305 HP," (includes specs) (no date).
- "M.A.N. Buses and Coaches," (no date).
- "M.A.N. Long-Distance Touring" SR, Long Distance Touring Coach (no date).
- "M.A.N., Proven in Transit Systems Across the U.S.A." (no date).
- "M.A.N., Quality Means Extraordinary Availability," (no date).
- "M.A.N., Service Philosophy Sets Us Apart," (no date).
- "M.A.N. Standard Buses for City and Intercity Service et. al. Large Chart (no date).
- "M.A.N. SL200, Standard City Service Bus," (no date).
- "M.A.N. Truck & Bus Corporation, Articulated Bus 206kW (280 hp)," (no date).

Bibliography - The following significant publications were used in support of the analysis and assessment.

- "M.A.N. Unveils First U.S. Built Bus," Automotive News, (1/4/82), pp. 14-19.

- "Buses that Bend, Hold 60% More Riders Ring Bell for Cost Savings Across Nation," Wall Street Journal, (11/12/81), p. 10.
- "M.A.N. To Lift Domestic Content," American Metal Market/ Metalworking News, (11/16/81).
- "M.A.N. Sales Up By 14% in Full Year," Financial Times, (8/20/81), p. 1.
- "Manufacturers Vie to Build Bending Buses for U.S. Cities," American Metal Market/Metalworking News, (June 22, 1981), pp. 5-6.
- "M.A.N. Truck and Bus Corporation," Metropolitan, (3/4/81), p. 31.
- "American Facility Plans Announced by M.A.N.," Metropolitan, (March/April 1981), pp. 53-55.
- "Coachbuilders Serve Expanding Market," Financial Times, (2/20/80), p. 31.
- "M.A.N. Slates N.C. Plant for Diesel Bus Production," American Metal Market/Metal working News, (10/27/80), p. 4.
- "M.A.N. May Expand U.S. Vehicle Production Beyond Stated Facility," Wall Street Journal, (4/20/80), p. 2.
- "AM General/M.A.N. Articulated Bus," SAE Technical Paper Series, (2/3/79).
- "AMG Texas Plant Now is Building Buses that Bend," Automotive News, (5/22/79).
- "Europe's Bus Market Grows and May Double During 1980s," Automotive News, (8/29/77), p. 12.
- " Metro is Sent a Message - Look Again at Superbuses," Washington Star, (9/22/76), p. B1.
- Bus Imports Build Momentum," Business Week.

TABLE 4-39. COMPANY DIGEST - M.A.N.

Name of Company:	M.A.N. Truck and Bus Corp.
Address: Headquarters:	3000 Town Center Southfield, MI 48075
Plant:	Cleveland, NC 27013
Telephone:	(313) 352-7850
Transit Bus:	M.A.N. Articulated-Transit Bus

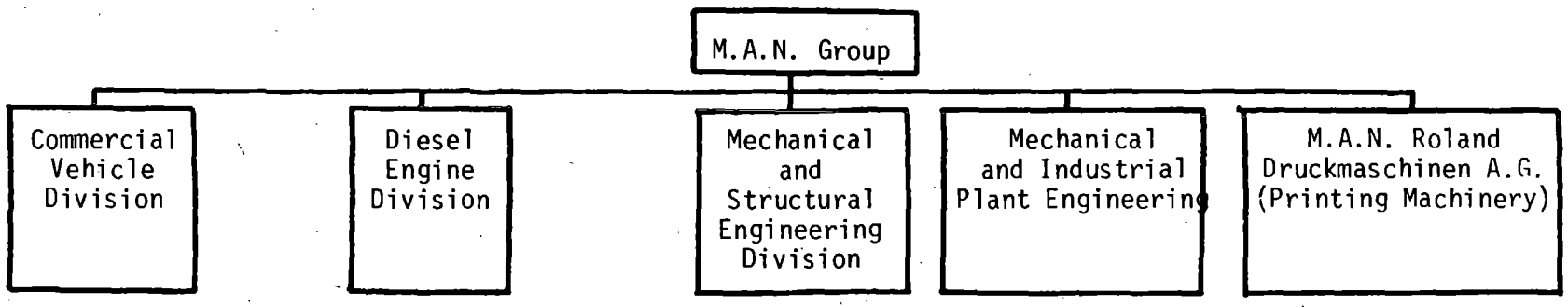


FIGURE 4-13. M.A.N. GROUP CORPORATE STRUCTURE

TABLE 4-40. PRODUCT LINES - M.A.N. GROUP

Basic Industries	Power Generation	Transport	Communications	Industrial Equipment
o Mining Plant and Equipment o Iron and Steel Making Equipment o Raw Materials Processing Plant o Water Making Plant o Material Handling Systems o Components and Equipment for Offshore Facilities	o Thermal Power Plant and Components o Diesel Power Stations and Components o Heat Pump Installations o Nuclear Power Plants Components and Services o Gas Turbine Plants o Hydraulic Power Plants	o Diesel Trucks o Diesel Engines o Complete Vehicle Chassis o Standard, Arctic, and Double-Decker Buses and Coaches o Metal Stampings o Steel Bridges o Railway Rolling Stock o High-speed Rail Systems o Ships up to 3000 Metric Tons Capacity o Dry Docks o Marine Diesel Engines o Cranes o Hydraulic Steel Structures o Propulsion Systems for Spacecraft o Buildings and Hangers for Airports	o Printing Machinery o Printing Farm Production Equipment o Radio Telescopes	o Heat Exchangers o Heat Recovery Equipment for High Pressure Oil or Coal Gasification o Incinerators o Large Vessels for all Types of Gases or Liquids under Pressure or Vacuum o Pumps, Compressors and Mixers o Water Treatment Plant o Evaporative Cooling Towers o Oil and Gas Treatment Plant o Mechanized Storage Systems
	Civil Engineering, Contract Manufacture and Related Services			

TABLE 4-41. M.A.N. PRODUCTION STATISTICS

	1976	1977	1978	1979
West Germany	1,088	1,070	929	1,115
City/Suburban				
Intercity/Touring	792	702	458	607
Double-Decker	97	202	98	109
Articulated	180	282	710	343
Miscellaneous or not identified	622	459	133	912
Total	2,779	2,715	2,328	3,086
Source: V.D.A.				
U.S.A.	0	0	0	0
M.A.N. Truck and Bus	0	0	0	0
M.A.N.-AM General Articulated	0	0	236	163
Source: M.V.M.A., M.A.N.				

TABLE 4-42. CHRONOLOGY OF EVENTS - M.A.N.

1840	M.A.N. founded.
1897	M.A.N. engineers work with Rudolf Diesel in perfecting the diesel engine.
1915	M.A.N. commercial vehicle division founded.
1924	Begins producing low-floor buses.
1925	Begins producing diesel engine buses.
1950-'s	M.A.N. adopts integral construction for buses.
1959	An articulated bus is introduced.
1974	M.A.N. demonstrates an articulated bus in the U.S.
1976	AM General sells M.A.N. articulated buses to several U.S. cities, planning to do final assembly in the U.S.
1980	M.A.N. Truck and Bus Corp. is formed with headquarters in Southfield, Michigan.
1981	A plant to assemble articulated buses in the U.S. is completed.

LEGEND

A.	length----------	55' or 60'
B.	width----------	102" maximum
C.	height----------	125" maximum
D.	wheelbase----------	tractor - 222.4 trailer - 255.5" or 287.4"
E.	rear door opening width--------- clear opening-- ------	47.75"
	front door opening width--------- clear opening---------	47.75"
G.	first step height front---------- kneeling-------- rear---------- kneeling--------	14.53" 14.53"
H.	ground clearance--------	
J.	interior steps--front--- rear----	
K.	door height-----front--- rear----	
L.	track----------front--- rear----	
M.	tires dimension----------	8.5 x 20 or 8.25 x 22.5
N.	windows height---------- thickness---------- total area----------	

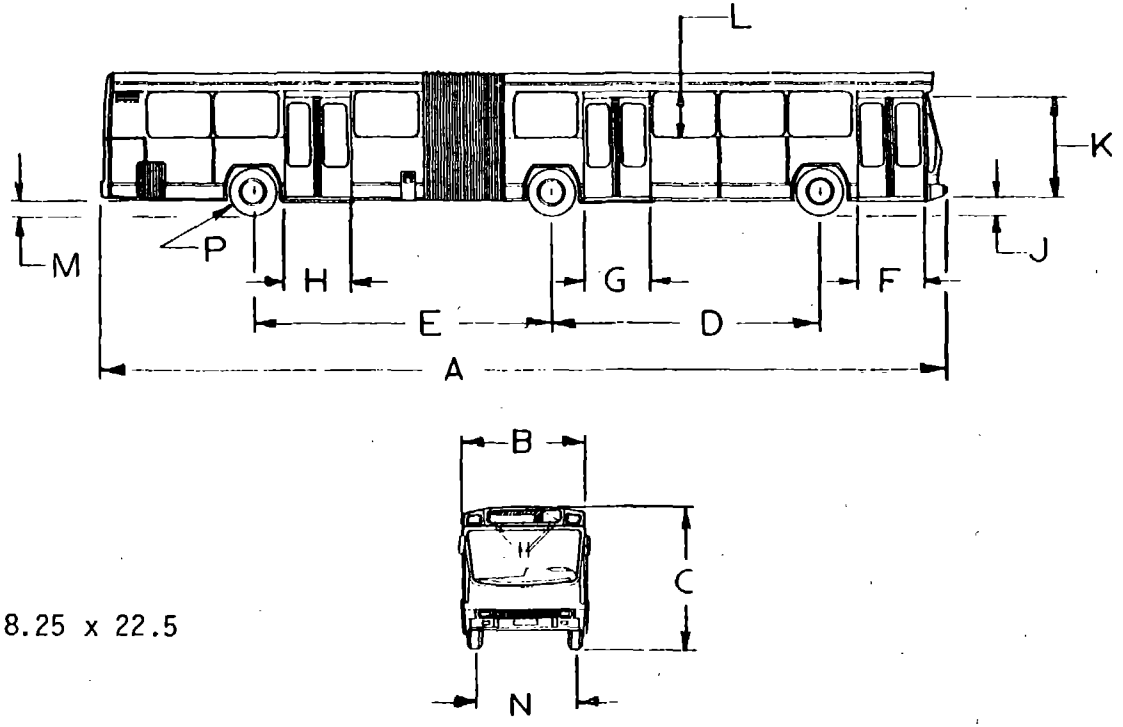


FIGURE 4-14. EXTERIOR ARTICULATED BUS DIMENSIONS - M.A.N.

TABLE 4-43. SPECIFICATION PROFILE - M.A.N. ARTICULATED BUS

ENGINE - UNDERFLOOR BETWEEN TRACTOR AXLES

	MANUFACTURER	MODEL	TYPE	HP AT RPM	COMMENT
STANDARD	M.A.N.	D2566MTUM/US	6 Cylinder Turbocharged	280 @ 2200	Torque - 745 ft-lb Displacement=669 cubic inches
OPTIONAL	M.A.N.	D2566MLUM/US	6 Cylinder Turbocharged Intercooled	305 @ 200 300 (California)	860 ft-lbs @ 5100 RPM 669 cubic inches

TRANSMISSION

MANUFACTURER---Renk

MODEL----------Doromat 874 A

TYPE-----------Automatic 4-Speed

AXLES

	MANUFACTURER		COMMENT
FRONT	M.A.N.	16,535 lbs	
DRIVE	M.A.N.	26,455 lbs	Gear ratio of 5.22 to 1
TRAILER	M.A.N.	16,535 lbs	

TABLE 4-44. PLANT INFORMATION - M.A.N.

Location:	Cleveland, N.C.
Employment:	500 (1982)
Investment:	$13 million
Size:	280,000 square feet
Products:	Articulated-transit buses
Capacity:	M.A.N. expects to reach a production rate of 1.5 per day during 1982. Full capacity may be about 600 per year.

4.8 NEOPLAN

4.8.1 Summary

Neoplan, based in West Germany, established a plant to assemble transit buses in Lamar, Colorado in 1981. The company has successfully bid on orders for standard-size "New Look" and ADBs and for articulated buses to be built in the Lamar plant. The company has previously built double-decker transit buses in Germany for the Southern California Rapid Transit District, and also briefly licensed production of a medium transit bus by Gillig in 1976-1978. Neoplan is the apparent winner of a 1000 bus order from the Pennsylvania Department of Transportation consortium. It is possible that Neoplan will construct an additional manufacturing facility in Pennsylvania, should it receive the Pennsylvania contract. Table 4-45 summarizes some basic company reference information.

4.8.2 Corporate Overview

Neoplan U.S.A. Corporation is a privately-held company owned by a West German family. That family also owns the West German firm, Gottlob Auwater Gmbh, which uses "Neoplan" as a tradename. For convenience, both the U.S. company and the West German company will be referred to in this report as Neoplan.

Neoplan in West Germany produces a full-line of integral-construction buses, including transit intercity and specialty-types such as airport-apron buses. The company has tended to specialize in luxury touring buses, including double-deckers, articulated buses, and articulated double-deckers.

The company has pursued a growth strategy based in part on international sales. Neoplan opened a plant in Ghana in 1974 and in the U.S. in 1981. Approximately 60 percent of the company's West German output is exported.

Because both the U.S. and German companies are privately-held, detailed financial statistics are unavailable. Neoplan's total revenue in 1979 was about DM 280 million ($70 million). The company employed nearly 2000 persons worldwide in 1980. Neoplan revenues in the U.S. in 1982 should reach $50 to 60 million. Bus production in Germany was around 1100 units in 1979.

4.8.3 Company History

The company was founded in 1935 by Gottlob Anwarter with six employees. The first bus produced was a wooden body placed on a truck chassis. Production of integral-construction buses was started in 1953 and the name "Neoplan," for new plan, was adopted to mark the change in production methods.

Neoplan entered a period of rapid growth in the late 1960s. In 1969, an expansion of the Stuttgart plant was undertaken. This was followed by the establishment of a second German plant in Pilsting in 1973 and an overseas plant in Ghana in 1974. The Pilsting plant was expanded in 1975, and the Stuttgart plant again in 1976. A new plant opened in Berlin in 1980 and the Lamar, Colorado plant was built in 1981.

In line with its new plant investments, Neoplan created a highly diversified product line by introducing a series of new bus models. In 1969, Neoplan introduced the Skyliner, a luxury double-decker bus. (The Skyliner has been sold in the U.S. in a transit configuration.) In 1971, Neoplan introduced the Cityliner, a high-floor, ultra-luxury intercity bus. In 1973, Neoplan introduced the Jetliner, another intercity bus. The Jetliner was the most successful Neoplan bus in the 1970s in terms of units produced. In 1977, Neoplan introduced the Jumbocruiser, an articulated double-decker based on the Skyliner, and one of the largest buses ever built. In 1979, Neoplan introduced the Spaceliner. A double-decker in concept, the Spaceliner has passenger seating on the upper deck and restrooms, kitchen, crew seating and extensive storage space on the lower deck.

Neoplan's involvement with transit buses is relatively recent. Neoplan participated with other German companies in the S80 (city bus of the 1980s) program in West Germany.

The result of that program was the U-80, a prototype urban-transit bus which Neoplan presented in 1980.

Another important spur to the development of Neoplan transit buses was an order for 500 transit buses for Saudi Arabia which was filled in 1979. A follow-up order for 210 buses was made in 1980.

Neoplan's involvement in the U.S. market dates back to 1968. During the early 1970s Neoplan was able to sell only a small number of buses in the U.S. These were primarily special purpose buses, such as low-floor, airport-apron buses and double-deckers. In 1976, Neoplan licensed Gillig to build a medium transit bus, but this venture was not successful.

Neoplan announced plans for a bus assembly plant in Lamar, Colorado, in 1980 and began bidding as a U.S. manufacturer on solicitations for "New Look" buses and ADBs. During 1981, Neoplan also began bidding on articulated orders. The plant at Lamar was completed in 1981 and began production. A chronology of events is detailed in Table 4-46.

In early 1982, Neoplan apparently won a 1000 bus order from Pennsylvania. An informal understanding between Neoplan and state officials may lead Neoplan to build an additional bus assembly plant in Pennsylvania or a plant to augment the production capability at Lamar.

4.8.4 Product Line of Buses

Neoplan manufactures an extensive line of both intercity and transit style coaches. In its newly constructed U.S. plant, Neoplan produces "New Look", "advanced design" and articulated buses. An intercity model is a strong possibility later.

Other Neoplan products include articulated buses, double-deck artics, low-floored buses, airfield buses, and touring buses. Altogether, more than thirty different models are produced, ranging in length from 25 to 59 feet.

During 1978, the most popular bus series in the Neoplan line was its N214 Jetliner model, accounting for 169 of the company's 749 units produced. The N116 Cityliner model was next highest with 135 buses manufactured. Both are conventional intercity-type buses.

Exterior dimensions of the Neoplan standard size buses are as follows:

Length	40 feet
Width	102 inches
Height	113 inches

In the "New Look" or current design version, Neoplan offers a choice of Detroit Diesel engines (V8 71N, 6V 92 TA and 6V 71N) mounted transversely, with an Allison V-730 automatic transmission.

In the Advanced Design Bus version, Neoplan offers a Detroit Diesel Allison 6V 92 TA engine in an in-line configuration with an Allison HT-740 transmission.

The Lamar, Colorado plant covers 130,000 square feet. There are two, parallel, assembly lines. Each will produce one bus a day on a one-shift operation when full production is reached in May, 1982. Employment (one-shift) at that time will be around 500. The plant was built with sufficient roof height to permit the building of double-decker buses. Although an additional shift could take production up to the neighborhood of 800 vehicles per year, Neoplan's manufacturing philosophy is to limit production to one shift operations and 400-500 buses per year per plant. Therefore, if Neoplan's sales grow much beyond 500 buses per year, they are likely to consider additional assembly plants. Information on the plant is summarized in Table 4-47.

In West Germany, Neoplan produced almost 1100 buses in 1979, the last year for which figures are available. Neoplan has increased its German production volume every year since 1964. Neoplan finished 50 buses in 1981 in the U.S. and production is projected to be around 350-400 in 1982. A production summary is presented in Table 4-48.

4.8.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment efforts. The definition of Reference Sources and Bibliography are the same as defined in Section 4.1.5.

In addition, staff members of the Transportation Industry Analysis Branch conversed by telephone with Neoplan Company officials and representative company officials (Rolf Ruppenthal and Associates); with Metropolitan Atlanta Regional Transit Authority (MARTA) officials; with Massachusetts Bay Transportation Authority (MBTA) officials; and with UMTA regional office officials. Other reference sources are itemized as follows:

- Neoplan proposal to build 80 city transit buses for the MBTA, No. CAP-10-80, (12/8/80).
- Contract Documents -- Contract No. VG B.06, MARTA, Neoplan Buses, (12/80).
- U.S. Government Memorandum from D. J. Symes, UMTA to W. Raithel, J. Moreno, and T. Norman re: meeting with Gottlab Anwarter GmbB and Co. (7/17/80).

Reference material also included Neoplan Product media advertisements and photographic coverage of their product line buses.

The following additional company literature was used in support of the analyses and assessment:

- "Neoplan Current Design Bus - The Atlantis," (1981).
- "Neoplan USA Lamar Colorado," (1981).
- "Neoplan Aktvel LZ8," (1980).
- "Neoplan One Step Ahead of Progress," (1980).
- "Skyliner N/22/3 Long Distance Coach," (10/77).
- "Meet the Jumbos," Brochure by Transportation Equipment Development Company (U.S. Distributor - November 1973).
- "The Formula for the 1980s is...," (no date).
- "Autobuses," (no date).
- "General Design Specifications, Neoplan City Bus," (no date).
- "Kunststoffe Nach MaBl Ihrer kreativität Sind Keine Grenzen Gesetzt," (no date).
- "Neoplan Buses," (Skyliner information), (no date).
- "Neoplan Double-Decker Buses," (no date).
- "Neoplan Skyliner," (no date).
- "Neoplan Spaceliner," (no date).
- "Neoplan Technik," (no date).
- "Neoplan Telebus," (no date).
- "Neoplan Today," (no date).
- "Neoplan USA - Visit the New Kid on the Block," (no date).
- "The Buses," (no date).

Bibliography - The following significant publications were used in support of the analyses and assessment.

- "Newest Plant in U.S. Opens on Schedule," Metropolitan, (July/August 1981), pp. 30+.
- "New Plant Boasts Assembly Efficiency," Metropolitan, (July/August 1981), pp. 38-39.

- "Neoplan Double-Deckers Cross the Rockies," Metropolitan, (July/August 1981), pp. 40-41.
- "Manufacturer's Vie to Build Bending Buses for U.S. Cities," American Metal Market News, (6/22/81), p. 5+.
- "Neoplan Sovenier Edition," Lemar Daily News, (5/21/81).
- "Neoplan-Rolf Ruppenthal," Metropolitan, (March/April 1981), p. 31-2.
- "Gillig Neoplan," Bus Ride, (11/78), p. 34.
- "How Specialists Build Luxury Touring Buses," Automotive News, (8/28/78), p. 12.
- "Gillig/Neoplan Transit Bus," LEA Transit Compendium (Vol. 111, Nov. 9, 1977).
- "Europe's Bus Market Grows and May Double During 1980s," Automotive News, (8/29/77), p. 12.
- "Bus Imports Build Momentum," Business Week, (date unknown).
- "New Plan From Neoplan," Bus World, (date unknown).

TABLE 4-45. COMPANY DIGEST - NEOPLAN

Name of Company:	Neoplan U.S.A. Corporation
Plant Address:	1 Gottlob Anwarter Drive P.O. Box 1419 Lamar, Colorado 81052
U.S.A. Representative:	Rolf Ruppenthal 3216 Arapahoe Ave. Suite E Boulder, Colorado 80303
Phone:	(303) 443-3992
Transit Bus:	- The Atlantis ("New Look") - N412 (ADB) - Articulated transit bus

TABLE 4-46. CHRONOLOGY OF EVENTS - NEOPLAN

1935	Company founded by Gottlob Anwater in Stuttgart, West Germany.
1953	Company begins building integral-construction buses.
1976	Licenses transit bus design to Gillig Corporation (American Manufacturer).
1980	Won bid for Atlanta "New Look" bus procurement.
1981	Opened plant in Lamar, Colorado to build transit buses.

TABLE 4-47. PLANT INFORMATION - NEOPLAN

Location:	Lamar, Colorado
Employment:	500 (mid-1982)
Investment:	$6 million
Size:	130,000 square feet
Products:	Standard and articulated transit buses
Capacity:	800 buses per year (two shifts)

TABLE 4-48. PRODUCTION TRENDS - NEOPLAN

WEST GERMANY	
YEAR	PRODUCTION
1975	485
1976	574
1977	687
1978	749
1979	1092
U.S.A.	
1981	50

4.9 VOLVO

4.9.1 Summary

Volvo is Sweden's largest corporation and a major producer of motor vehicles. Its heavy truck manufacturing operation is the third largest in Western Europe. Volvo produced a total of 30,200 trucks and 4400 buses in 1980.

Volvo has been aggressive internationally. In 1980, only about half of its trucks and buses were assembled in Sweden and less than 15 percent were sold here.

During 1981, Volvo acquired the U.S. heavy-truck manufacturing operations of the White Motor Co.

In 1982, Volvo will be demonstrating buses in service with New Jersey Transit.

Table 4-49 summarizes some basic company reference information.

4.9.2 Corporate Overview

Volvo is a multinational industrial company headquartered in Sweden. It is the largest private enterprise in Sweden and the international character of its businesses is shown by the fact that over 75 percent of its revenue is accounted for by sales outside of Sweden. Recently announced acquisitions--most notably the merger with Beijer Invest--promise increased diversification.

To manage its diverse businesses, Volvo uses a highly decentralized organization. Volvo adopted this type of organization in 1972. The organization, as it existed in early 1981, is shown in Figure 4-15. Volvo Car Corporation and the Volvo Commercial Vehicles Corporation, represent Volvo's two most important businesses.

Renault, the French automaker, holds a ten percent interest in the Volvo Car Corporation as part of an agreement on cooperation in the development and production of cars. (Renault is

expected to increase its interest to 15 percent in 1981 and later to 20 percent.) Volvo, however, has retained 100 percent ownership and control of its car components plants by transferring them to the Volvo Components Corporation. Volvo also retains independent control of its marketing subsidiaries such as Volvo of America which imports its cars into the U.S.

Responsibility for the design and marketing of bus chassis rests with the Volvo Bus Corporation, part of the Volvo Commercial Vehicles Corporation. The Volvo Bus Corporation is also responsible for Volvo's involvement in public transport systems planning. Responsibility for the production of bus chassis belongs to the Volvo Truck Corporation, also part of the Commercial Vehicles Group.

The Volvo Commercial Vehicles Corporation is also responsible for the production of Volvo trucks and (through Volvo BM) construction equipment, and farm and forest machinery

Other Volvo product lines include marine and industrial engines (Volvo Penta) and aircraft engines (Volvo Flygmotor). Volvo's principle product lines are listed in Table 4-50.

The Volvo Group, the largest industrial enterprise in Scandanavia, recorded sales of $5,630 million in 1980, only slightly changed from 1979. Accounting for the relatively flat sales, was a decline in car sales offset by modest increases in other products, including trucks and buses. The decline in Volvo car sales can be attributed to the general worldwide recession in auto sales. The same recession also affected truck sales, although less profoundly and sales revenue increased despite a decline in unit deliveries of trucks. Sales of bus chassis accounted for the sharpest increase among Volvo product groups, reflecting a substantial increase in unit deliveries. Car sales accounted for 50 percent of sales; trucks, 28 percent, buses, 3 percent.

Volvo is a shareholder-owned corporation. The shares are widely distributed and no individual or corporation holds a controlling interest. The largest shareholder, with a 6 percent interest, is a government-run pension fund.

Profitability of the group declined with the decline in sales. Net income was further reduced by an increase in before-tax-allocations to reserves. (Before-tax-allocation income to reserve accounts is not permitted in the U.S., distorting comparisons of net income between Swedish and American companies. A better line for comparison is "income before taxes and allocations".) Cars fell into a loss position, but trucks and buses increased their profits substantially. Because of the loss in cars and other products, trucks and buses, accounted for more than 100 percent of total group income before allocations and taxes. Trucks remained more profitable than buses, although no figures are published by Volvo for buses alone.

Reflecting the international character of the company, 75 percent of the Group's sales are accounted for outside of Sweden. In 1980, for the first time, the company's largest car market was not Sweden, but the United States, and Volvo's largest truck market was France, displacing Great Britain.

Only preliminary financial results are available for 1981. These indicate that Volvo increased its profit substantially primarily by eliminating its loss in car production. Volvo eliminated this loss in part by increasing sales and in part by selling off a majority share in its Dutch subsidiary, Volvo Car B.V., to the Netherlands government. Volvo suffered falling profit margins in its truck group due to the tight world market.* Financial production, and enployment statistics are presented in Table 4-51.

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*Financial Times, "Volvo Profits Increase 40% as Car Sector Improves Sales," January 28, 1982, p. 1.
Financial Times, "Volvo Cars Recovers With SKr 500m Profit," January 4, 1982, p. 21.

4.9.3 Company History

Volvo began operation in 1926 as a wholly-owned subsidiary of SKF, a Swedish ball bearing producer. One year later Volvo's first production automobile rolled off the assembly line, Another milestone was achieved in 1928 with the completio· of the company's first trucks. Gaining more control over the manufacturing process, Volvo, in 1931, acquired its engine manufacturer, enabling it to make the transition from simple assembly to a manufacturing operation. A major turning point in the history of Volvo occurred in 1935 when the parent company, SKF, distributed its Volvo stock as a dividend, thus making Volvo an independent entity.

Until the mid-1950s, Volvo concentrated its efforts on truck production. In the late 1950s and 1960s, Volvo gained prominence as an automobile producer. Automobile production became the company's predominant activity, accounting for over half of sales in recent years. In 1972, the company adopted a more decentralized organizational structure, giving greater autonomy to different product groups. A policy of diversification, with an emphasis on increasing truck and bus sales faster than car sales, was also adopted. Truck and bus sales, which were 20 percent of Volvo sales in 1972, were 28 percent of total sales in 1979.

In the late 1970s, Volvo began to cast about for new means to increase the size and scope of its operations. One impetus for this was that Volvo was clearly being outstripped in scale as a car manufacturer by its competitors, and that financing a new car development program would require extradordinary measures. In 1977, a merger was attempted with Saab-Scania, but failed due to the apparent objections of some Saab executives. An appeal to the Swedish government, made in secret, for car development funds, also failed. In 1978, a complex agreement was signed with the Norweign government, which called for a major investment in Volvo by Norway, the transfer to Norway of certain Volvo activities and the granting of oil exploration rights to Volvo (which, at the time, had no oil business). This deal also fell through.

In 1979, Volvo agreed to sell an interest in its passenger car operations to Renault, a French automobile manufacturer, and to cooperate with Renault in research, product development and production.

In 1981, Volvo completed a merger with another Swedish company, Beijer Invest, creating the largest private company in Scandanavia.

Volvo's involvement in bus chassis manufacture began very early when some of the early trucks were modified to accept bus bodies. The first series of bus chassis were fabricated in 1934.

During the period 1946-1952 Volvo's B510-B530 bus lines were developed, paralleling the introduction of diesel engines by the company. A mid-engine bus was next introduced in 1951.

Later developments in Volvo's involvement in the bus chassis industry include its B57 and B58 chassis, introduced in 1966, an articulated bus chassis modeled after the B58 in 1967, and a B59 chassis in 1971 which was designed for low-floor construction and horizontal rear engine mounting.

In 1973, the company extended its purview from bus manufacture by entering the business of analysis and planning of public transport systems. The B10R, a further development of the B59 City Bus was unveiled in 1978. That same year saw a new bus chassis plant in Boras, Sweden begin production. Another bus chassis production plant, located in Brazil and partially owned by Volvo, began production in 1979. One year later, truck making started at the same facility.

In early 1982, Volvo began a demonstration of its buses in a program with New Jersey Transit.

A chronology of events is presented in Table 4-52.

4.9.4 Line of Buses

Volvo produces and sells a range of complete bus chassis suitable for buses ranging in capacity from 30 to 150 passengers. Volvo supplies the chassis to independent body builders who complete the bus. Volvo may provide technical advice and participate, as requested by the body builder, in the design or bus bodies. Volvo, itself, does not build complete buses.

Volvo designates its bus chassis by combinations of letters and numbers. The first letter is always B, for bus. It is followed by a number, which is followed by another letter. The number identifies the powertrain. The second letter refers to the engine placement: F for front, M for mid-engine and R for rear-engine. There are six basic chassis.

The B6F and B6FA are small conventional, front engine chassis. The B6FA has the engine placed forward of the front axle rather than over it (as in the B6F) and is equipped with somewhat heavier brakes and springs, etc. for a somewhat larger load capacity. These two chassis are intended for use as school buses or small tourist coaches. The B6FA has a gross vehicle weight of 24,000 pounds.

The B57 and BB57 are conventional front engine chassis, designed for markets with axle load restrictions. The B57 engine is placed ahead of the front axle; in the BB57, the engine is over the front axle, permitting a much shorter front overhang and consequently larger approach angle. The B57 has a gross vehicle weight rating of 33,000 pounds.

B10R is a rear engine chassis designed for use as the basis for a city bus. The use of special subframes connecting the main frames of the front control section and rear powertrain make possible a low floor height. The GVW of the B10R is approximately 36,000 pounds.

The B10M is similar in size to the B10R, but places the engine horizontally under the floor, near the middle of the bus. This location precludes the use of subframes to lower the floor height but permits construction of a large luggage compartment and contributes to a low center of gravity. This, the B10M is used primarily as a basis for intercity and tourist coaches, although it can also be used for city buses. Its GVW is approximately 36,000 pounds.

The B10M can also be modified for use as the basis of the articulated bus with the engine in the front section. The transmission, propeller shafts, retarder and final drive are special in the articulated version.

Volvo's main bus chassis assembly plant is located at Boras, Sweden. This plant, completed in 1978, produces both fully assembled chassis and kits for assembly abroad. Since Volvo does not produce complete buses, no final bus assembly occurs in this plant. Key information on this plant is presented in Table 4-53.

The Boras factory was designed according to the assembly principles previously developed by Volvo at its Kalmar auto assembly plant. These principles, which involve elimination of the traditional central assembly line, aimed at giving a worker a greater feeling of responsibility by involving him in a team. This team is fully responsible for production and quality control in some particular sector. Instead of the traditional assembly line, mobile assembly wagons, freely moveable on a cushion of air, transport materials and finished parts to and from fixed points inside the factory.

The Boras plant produced over 55 percent (2500) of the 4390 Volvo bus chassis completed in 1980. The remainder were built in Volvo plants in Belgium (60 in 1980), Great Britain (70), Australia (180), Peru (370) or by importers in other markets (1210).

4.9.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment efforts. The definitions of Reference Sources and Bibliography are the same as defined in Section 4.1.5.

In addition, staff members of the Transportation Industry Analysis Branch conversed by telephone and corresponded with Volvo Company officials.

Reference material also included photographic coverage of Volvo product line buses.

The following additional company literature was used in support of the analyses and assessments.

- "Interim Report," (6/30/81).
- "Interim Report, (3/31/81).
- "Volvo Bus Corporation," (1981).
- "Financial and Operating Statistics," (1980/81).
- Volvo Annual Report, (1980).
- "Financial and Operating Statistics," (1979/80).
- "Volvo B6F."
- "Volvo B10M."
- "Volvo B10R."
- "Volvo B58."
- "Volvo B59 - The New City Bus,"
- "Volvo Transportation Systems."

Bibliography - The following significant publications were used in support of the analyses and assessment:

- "White Motor Says $60 Million Loss Due in Assets Sale," Wall Street Journal, (6/10/81), p. 18.
- "For Volvo, A Shift Away from Autos," Business Week, (5/25/81), p. 75.

- Mass Transit, (4/80), p. 12.
- "Volvo Bus Plant Opens in Brazil; Trucks Due in '80," Automotive News, (6/26/79), p. 10.

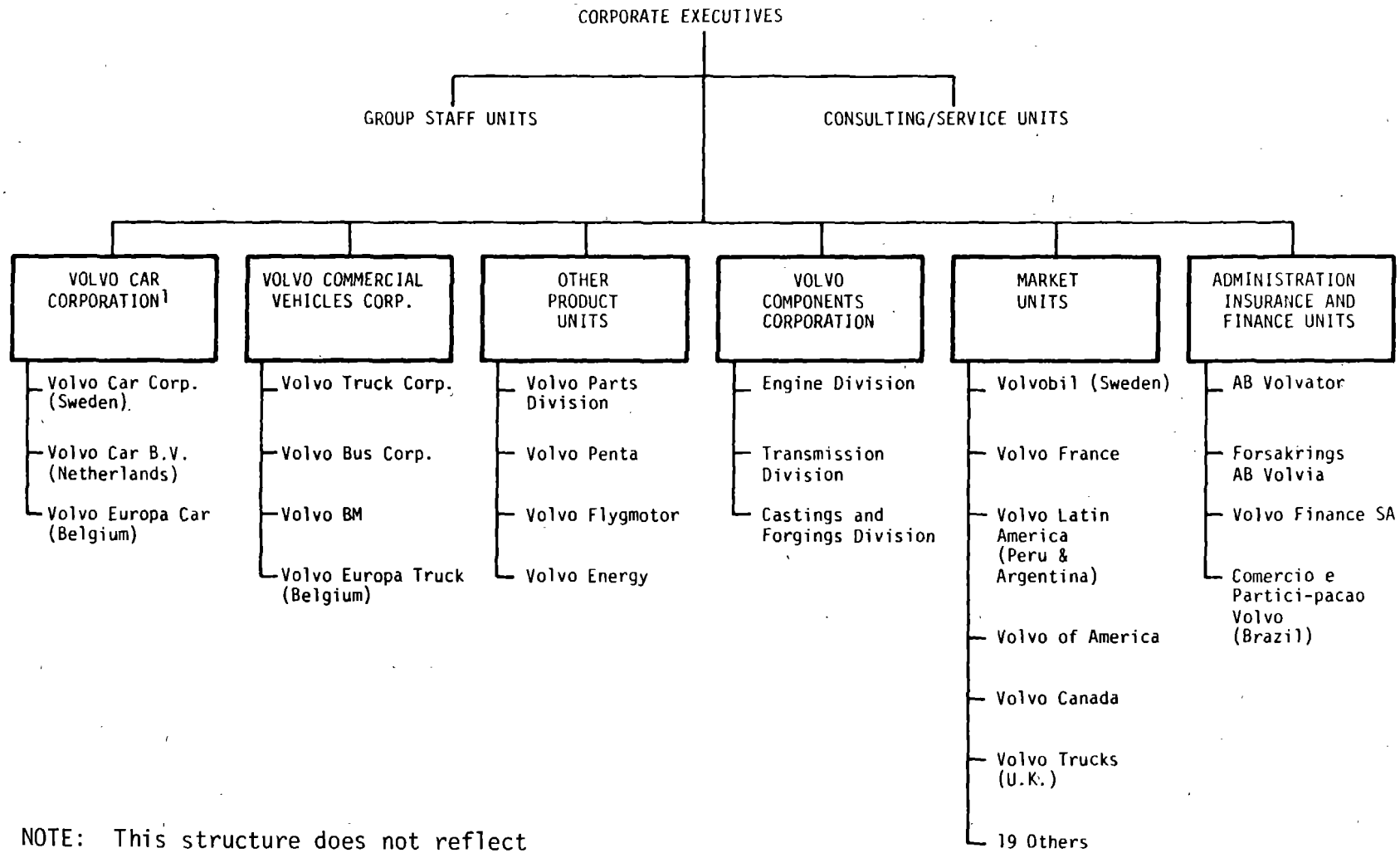
TABLE 4-49. COMPANY DIGEST - VOLVO

Name of Company:	Volvo of America Corp.	Volvo Bus Corporation
Address:	Rockleigh, N.J. 07647	S-405 08 Gothenbury Sweden
Telephone:	(201) 768-7300	031-59 15 00

TABLE 4-50. PRODUCT LINES - VOLVO

Cars	Trucks	Buses	Marine and Industrial Engines	Construction Equipment, Farm and Forest Machinery	Aircraft Engines
240 series 260 series 340 series 66	Medium-heavy forward-control Heavy forward-control Normal-control	B6F B57 BB57 B10M B10R	Diesel engines for marine and industrial use	Wheel loaders Dampers Road graders Backhoe-loaders Tractors Combine harvestors	RM8 engine for Viggen aircraft Subcontract and partnership participation in aerospace industry Hydraulic pumps and motors car heaters diesel engine components

NOTE: The products of Beijer Invest are not included.



NOTE: This structure does not reflect the merger with Beijer Invest.

FIGURE 4-15. CORPORATE STRUCTURE - VOLVO

TABLE 4-51. FINANCIAL STATISTICS - VOLVO

Volvo Group	1976	1977	1978 ($ MILLION)	1979	1980
Sales	3,614	3,616	4,237	5,476	5,630
Income before taxes and allocations	134	104	143	290	238
Net Income	14	44	69	97	9
Investments	162	147	148	224	392
Trucks and Buses					
Sales	933	1,008	1.170	1,545	1,474
Income before taxes and allocations	80	107	115	168	239
Investments	44	58	42	41	71
Bus					
Sales	98	100	101	147	188
Production			(Units)		
Cars	296,800	228.700	260,300	320,000	268,600
Trucks	25,300	25,200	24,200	28,000	26.300
Bus Chassis	2,950	2,800	2,480	3,830	4,390
Employment					
Total Group	62,441	59,874	61,650	65,054	63,893
in Sweden	45,217	44,033	45,583	47,880	46,825
Cars	29,700	27,800	29.750	32,450	31,700
Trucks	11,850	12,100	12,250	13,450	13,250
Buses	1,000	1,000	950	1,300	1,300
Exchange Rate ($=1Skr)	.2296	.2237	.2214	.2333	.2365

TABLE 4-52. CHRONOLOGY OF EVENTS - VOLVO

1926	Volvo commences business as a wholly-owned subsidiary of SKF, the Swedish ball bearing producer.
1927	The first Volvo production car leaves the assembly line, April 14.
1928	Volvo produces its first truck.
1931	Volvo acquires its engine manufacturer, begins to develop its business from an assembly to a manufacturing operation.
1934	First bus chassis produced. Of the first 18 produced, five are sold to Brazil.
1935	SKF distributes its Volvo stock as a dividend, making Volvo independent.
1946-52	B510-B530 bus series developed, and diesel engines are introduced.
1951	First mid-engine bus introduced.
1966	B57 and B58 chassis introduced.
1967	Articulated bus chassis based on the B58 introduced.
1971	B59 chassis designed as a basis for city buses is introduced. The engine is positioned horizontally in the tail of the bus; features include a low floor and tight turning circle.
1973	Volvo enters the business of public transport systems analysis and planning.
1978	B10R, a further development of the B59 city bus, is introduced.
	A bus chassis plant in Boras, Sweden, begins production.
1979	Bus chassis production begins at a new plant partially owned by Volvo in Brazil; truck production begins at the same plant one year later.
	Volvo reaches an agreement with Renault regarding cooperation in passenger car assembly which involves the sale of a minority interest in its car business to Renault.
1981	Volvo agrees to merge with Meijer Invest, a conglomerate and Sweden's fifth largest company. The result is Scandanavia's largest private company.
	Volvo agrees to buy the heavy-truck operations of White Motor.
1982	Volvo begins a bus demonstration project with N.J. Transit.

TABLE 4-53. PLANT INFORMATION - VOLVO

Location:	Boras, Sweden
Employment:	320
Products:	Bus chassis, all models
Capacity;	3600 assembled chassis and 200 kits for assembly abroad

4.10 SAAB-SCANIA

4.10.1 Summary

Saab-Scania is Sweden's second largest motor-vehicle manufacturer.

Although very small as an automobile manufacturer, the company is a major international force in heavy trucks and buses. Over 80 percent of its sales are accounted for outside of Sweden.

Scania's bus sales have been increasing with sales outside Sweden taking nearly 90 percent of production. Scania is demonstrating buses in Norwalk, Conn., and has announced that it is exploring the idea of U.S. assembly.

4.10.2 Corporate Overview

Saab-Scania is a multinational industrial corporation headquartered in Sweden. It is a diversified manufacturer and one of the largest industrial concerns in Scandanavia. To manage its operations the company employs a decentralized divisional structure, as illustrated in Figure 4-16.

This structure reflects the company's origin in the 1969 merger of Scania, a truck maker, with Saab, a car and aircraft manufacturer. Scania has been preserved as a division, while Saab's two businesses--cars and aerospace--have become two divisions of the company. The various products of the group are listed in Table 4-54, under the divisions responsible. It is interesting to note both interdivisional competition and dependance. For example, Scania markets Volkswagen cars in Sweden in competition with Saab. Scania's share of the car market in Sweden in Volkswagen/Audi products was 11.8 percent in 1980 compared to 14.7 percent for Saab. At the same time, Scania supplies engines and transmissions for Saab cars.

Bus production and design is the responsibility of Scania-Bussar, a subsidiary within the Scania Division. In 1971

Scania-Bussar began to assume responsibility for testing and evaluating new bus products, taking it over from the Scenia Central Laboratory. The Scania-Bussar plant, in Katrineholm, Sweden has a capacity for 2500 buses and bus chassis per year.

Scania represents the largest and most stable business unit in the group, accounting for over half of Saab-Scania's revenue and a disproportionate share of profits. Scania, as a truck manufacturer, ranks well in scale in comparison to other major European medium and heavy truck makers. Saab Cars is second in the Group in terms of sales. Saab is a very small automaker, producing fewer than 100,000 cars annually. Even within the European luxury car market segment, where its model falls, Saab is not particularly large.

The aerospace business, which accounts for about 7 percent of total sales, is heavily dependent on the Swedish government's commitments to develop and purchase military aircraft.

Saab-Scania Group reported sales of $3,300 million in 1980, up somewhat from the year before, reflecting sluggish sales of both cars and trucks. The Group's profits remained largely unchanged.

The Scania Division accounts for the largest share of both Group sales (47 percent) and profits. Reflecting the international character of its business, over 80 percent of the sales of Scania trucks, buses, engines and other products were accounted for outside of Sweden. Although Sweden has traditionally remained the largest single market, in 1979, an increase of over 200 percent in deliveries to Iraq made that Middle Eastern country Scania's largest truck market. Scania bus chassis have a similarly extensive international market, with Sweden taking less than 300 of the 2665 buses and bus chassis sold by Scania in 1980. Scania's sales of complete buses, however, are largely limited to Sweden.

Scania is Sweden's second largest bus producer. Its market share in Sweden averages around 40 percent and in the other Nordic countries, around 30 percent. Sweden, however, represents only about 11 percent of Scania's total bus sales. The largest markets are the Middle East, particularly Iraq, and South America, particularly Brazil. Both the Middle East and South America take over 25 percent each of Scania total bus sales. Iraq and Brazil also ranked as Scania's largest truck markets in 1980.

Saab-Scania AB is a shareholder-owned corporation and the shareholdings are widely dispersed. Nevertheless, the company has been controlled for many years by the Wallenberg family, which, through telescoping shareholdings and interlocking directorates, has dominated or influenced many of Sweden's biggest companies, throughout the period of Sweden's industrialization. The family is represented on the board.

Financial, sales, and employment statistics are detailed in Table 4-55.

4.10.3 Company History

Saab-Scania was created in 1969 by the merger of Saab and Scania, two Swedish companies. Saab, an aircraft manufacturer since 1937 had entered the automobile business in 1949. Scania had been a truck builder since the early part of the century.

The building of integral-construction buses began at Scania in the early 1950s in collaboration with Mack Truck, then a U.S. bus producer. Having developed a series of bus models, Scania formed a separate company in 1967 to handle its growing bus business. This new subsidiary assumed an expanding role in Scania's bus business, gradually taking over responsibilities from the parent company.

An important milestone was passed in 1971 when the 111 city bus model was introduced. This bus model was succeeded in 1978

by the current 112 model from which articulated and double-decker versions were developed.

A new plant was expected to begin operation in August, 1981 Also, in 1981, Saab-Scania of America announced formation of a Scania Division to explore the market for Scania buses in the United States. Scania is leasing three buses to Norwalk, Connecticut for a demonstration. Saab-Scania of America has indicated that it may try to expand on this demonstration. The company is seeking a U.S. partner to establish a bus assembly operation.

A chronology of events is presented in Table 4-56.

4.10.4 Product Line of Buses

Scania-Bussar markets a line of complete buses and bus chassis. Two basic chassis types are offered: a conventional full-frame chassis with front engine and also a chassis designed for incorporation into an integral-bus body.

Scania bus models are designated by a combination of one or two letters and a two or three digit number. The number refers to the engine. The first letter is "B" in the case of a chassis and "C" in the case of a complete bus. The second letter indicates the placement of the engine--R for rear engine and F for an engine placed forward of the front axle. No second letter indicates that the engine is placed over the front axle. It is the rear engine chassis which are intended for incorporation in an integral-construction vehicle.

The integral-construction chassis are used as the basis for city and intercity buses. Special versions have been developed for use as the basis of articulated and double-decker buses. The integral-construction chassis are designated BR86, BR112, BR116. The articulated chassis is designated BR112A; the double-decker, BR112DH. The BR116 is designed for intercity coaches.

Scania-Bussar itself manufactures a complete city bus, designated CR-112, which is available in a standard model and a low-floor model. Articulated and double-decker buses are bodied by independent body-builders. Scania-Bussar's production of complete buses is limited to the Swedish market, where it sells about 200 per year.

The chassis for integral-construction consists of a front section with front axle, full suspension and driver controls and a rear section consisting of the transversely mounted engine, transmission, final drive and rear axle housing. The two sections can be temporarily joined by a side-member frame for testing and delivery to coach-builders.

The conventional front engine chassis buses have complete frames. They are general purpose vehicles appropriate for most types of city or intercity operation. They are mostely used in countries where the local coach-building industry is not geared to integral-construction or where vehicle or axle weight considerations make an integral bus inappropriate. Most of the components in these chassis are identical to those used in the integral-construction chassis. The transmission, brakes and steering gear are identical to those fitted to Saab's complete buses.

Scania's main bus assembly plant, located in Katrincholm, Sweden is new, having started operation in August, 1981. The new plant, which replaced an older, smaller facility, has a capacity to assemble approximately 2500 buses and complete bus chassis and an additional 800 assembly kits per year. About 70 percent of Scania's total deliveries of buses are sourced from the plant in Sweden. Of the remainder, 24 percent come from a Brazilian plant and 6 percent from Scania's Argentina plant. About 800 people are employed by Scania-Bussar, the Scania subsidiary responsible for bus design and production.

Scania is considering bus assembly in the U.S. If the company were to establish an operation in the U.S. the chassis would probably be imported for final assembly into a bus body

fabricated in the U.S. Scania is currently looking for a U.S. partner who could build a body for the BR112 and BR112A (articulated) chassis.

4.10.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment efforts. The definitions of Reference Sources and Bibliography are the same as defined in Section 4.1.5.

In addition, staff members of the Transportation Industry Analysis Branch conversed by telephone with Scania officials, and corresponded with Scania and Saab officials. A personal interview was conducted with a Scania official.

The following additional company literature was used in support of the analyses and assessment:

- "Scania BR112 - For Heavy City Service," (1981).
- "Scania Means More," (1981).
- "Scania Worldwide," (1981).
- "Facts About Articulated Buses," (1980).
- "Scania Information," (1980).
- "Saab-Scania, Annual Report, 1980.
- "Articulated Pusher Bus for Interurban Service," (1979).
- "Saab-Scania, Annual Report, 1979.
- "Scania BK116,: (1979).
- "New Public Service Vehicle From Scania - The BR112 Articulated Bus," (no date).
- "The Scania Range of Buses."
- "Thirty Years of Turbocharged Scanias," (no date).

Bibliography - The following significant publications were used in support of the analyses and assessments:

- "Saab to Expand Bus Test in U.S.," Automotive News, (5/18/81), p. 22.
- "Scania Continues Global Growth,: Automotive News, (1/26/81). p. 12.
- Mass Transit, (4/80), p. 12.
- "A Super Quiet, Super Smooth Swede," Truck & Bus Transportation, (10/79), p. 9+.

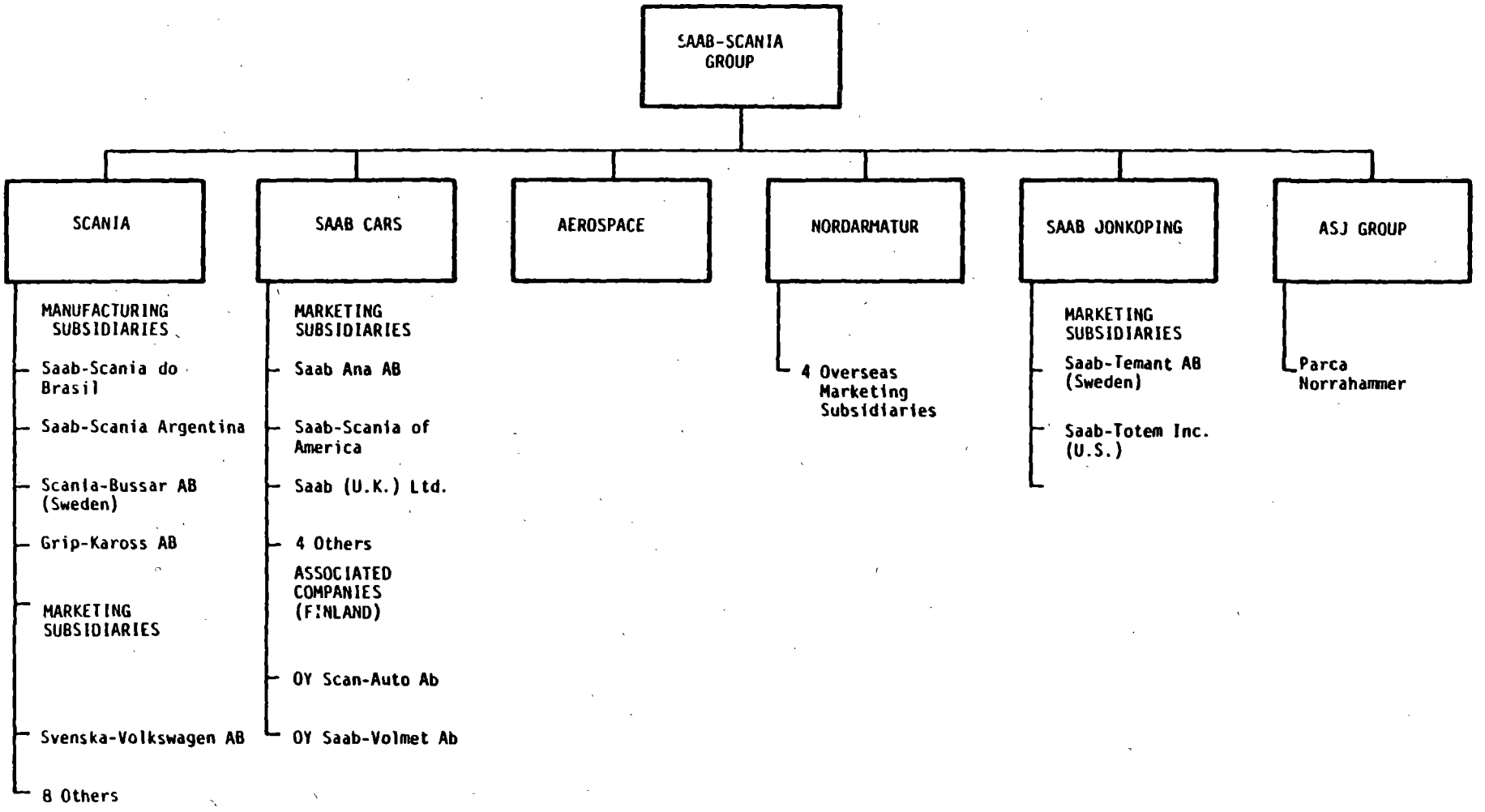


FIGURE 4-16. CORPORATE STRUCTURE - SAAB-SCANIA GROUP

TABLE 4-54. PRODUCT LINES - SAAB-SCANIA

Scania	Saab Cars	Aerospace	Nordarmatur	Saab Jonkoping	ASJ Group
Trucks of 16 tons Buses of 30 passengers Diesel engines Gasoline engines and transmissions for cars Volkswagen, Audi and Porsche products in Sweden	Saab cars Lancia cars in the Nordic countries Massey-Ferguson products in Sweden	Military and civil aircraft Missiles Electronics	Valves Fittings Instruments Process control equipment	Instruments for aircraft and missiles Sights Industrial electronics Target equipment Simulators for military training	Gray iron castings Heating boilers Heat exchangers Water heaters Electrical heating products Oil burners

TABLE 4-55. FINANCIAL STATISTICS - SAAB-SCANIA

	1976	1977	1978	1979	1980
		($ MILLIONS)			
Saab-Scania					
Sales	2,207	2,415	2,578	3,131	3,308
Income before appropriations and taxes	310	66	103	222	223
Net Income	25	41	44	54	
Capital Expenditures	134	137	118	183	253
Scania					
Sales	1,058	1,208	1,355	1,758	1,940
Capital Expenditures	77	77	74	95	137
Scania-Bussar AB					
Sales	42	39	50	69	81
Income before appropriations and taxes	N/A	N/A	0.6	2.3	4.5
Capital Expenditures	N/A	N/A	0.9	0.9	1.2
Saab-Scania of America, Inc.					
Sales	54	97	122	133	142
Income before appropriations and taxes (loss)	N/A	N/A	0.3	0.3	(0.3)
Capital Expenditures	N/A	N/A	0.5	0.4	0.2
Unit Sales Volume					
Cars	95 900	76,500	76,389	81,875	66,100
Trucks	20,800	21,650	19,180	22,841	23,900
Buses (incl. chassis)			2,059	2,558	2,665
Employment					
Saab-Scania Group	41,386	41,105	39,249	39,006	39,347
in Sweden	35,576	34,998	32,645	32,073	31,946
Scania			18,413	19,038	20,117
Scania-Bussar	686	630	655	684	748
Exchange Rate ($=1 Skr)	.2296	.2237	.2214	.2332	.2365

TABLE 4-56. CHRONOLOGY OF EVENTS - SAAB-SCANIA

1937	Saab begins the manufacture of aircraft.
1949	Saab begins passenger car production.
c.1950	Saab develops its first integral construction bus in collaboration with Mack, the U.S. truck builder.
1967	Scania-Bussar AB is formed to assume responsibility for bus production.
1969	Scania merges with Saab to form Saab-Scania.
1971	Scania-Bussar begins to assume responsibility for bus testing and evaluation.
	The 111 city bus is introduced, featuring a low noise level due to an encased engine compartment.
1978	The 112 city bus is introduced, replacing the 111. A pusher-type articulated version is introduced one year later and a double-decker version is introduced two years later.
1981	A new bus chassis assembly plant began operation (August).
1981	Saab-Scania of America forms a Scania Division to determine the marketability of Swedish buses on the American market. Scania buses enter a demonstration program in Norwalk, Conn.

4.11 RENAULT

4.11.1 Summary

Renault is a major French motor-vehicle producer. Although owned by the French government, Renault in recent years has become a major multinational manufacturer. In the U.S. Renault owns 46 percent of American Motors Corporation and 10 percent of Mack Trucks. In association with Mack Trucks, Renault is exploring the idea of producing transit buses in the United States. Renault is currently demonstrating buses in New York. Plant sites are being examined in New York and New Orleans. Table 4-57 summarizes some basic company reference information.

4.11.2 Corporate Overview

Renault is a large multinational automobile manufacturer with diverse interests in other businesses. Although wholly owned by the French government, Renault is constituted and functions like an independent business enterprise. The Board of Directors is made up of individuals representing various Ministries of the French government and representatives of Renault employees.

Under a reorganization carried out in 1976, Renault's business activities are divided among four groups, as shown in Figure 4-17. The Automobile Division is the largest of these groups. Buses are the responsibility of Renault Vehicles Industriels (RVI) which constitutes the Truck and Bus Division. Renault Vehicles Industriels was formed in 1978 through the merger of Berliet and Saviem, two French truck and bus manufacturers owned by Renault.

Renault's product lines, as listed in Table 4-58, are very diverse. The automobile division produces a full (European) range of passenger cars and small, car-derived trucks and vans. One of the largest European automakers, but second in France behind P.S.A. Peugeot-Citroen, Renault has embarked on a strategy aimed at becoming a major force in the automobile industry on a world-wide basis. As part of this strategy, the company has entered into tie-ups with other, small automakers, such as AMC and Volvo.

RVI, in commercial vehicles, has a similar mandate to "establish a business competitive of the world level."* It moves in this direction from a strong base in France where it accounted in 1980 for 70 percent of the production vehicles over 5 metric tons (11,000 lbs) gross vehicle weight (GVW), including 90 percent of the city buses and 99 percent of the intercity buses produced. Renault has over 40 percent of the market in France for trucks over 5 metric tons, over 60 percent of the intercity bus market and 80 percent of the transit bus market.**

As part of its world strategy, RVI has been in partnership with Mack Truck in the U.S. since 1979. Mack markets medium-duty Renault trucks under the Mack trademark in the U.S., in addition to its own heavy truck line. Renault has a 10 percent interest in Mack, which is controlled by Signal Corp.

Renault, although wholly owned by the French government, is structured like a private company. Since 1963, the company has received regular capital injections from the state. These injections take the form of increases in equity. Renault pays a dividend to the state and since 1963, the company has been required to pay 5 percent annual interest on its total capital.

As shown in Table 4-59, Renault sales in 1980 were $18 billion. Of these, car sales accounted for over 70 percent of the total. Sales by RVI were over $2.5 billion. Declining unit sales by RVI were reflected in substantial losses for that division in 1977-79. Investment nevertheless continued to grow. Historically, Renault has always been only marginally profitable, but has grown rapidly because of aggressive investment programs.

Only preliminary financial results are available for 1981. These indicate that Renault has suffered a loss of about $150 million due to a sharp decline in output from 1980. Sales for the whole Renault Group increased about 10 percent in terms of francs (but declined in dollar terms to about $15 billion because

*1979 Renault annual report, p. 47.
**1980 Renault Annual Report, p. 48.

of a fall in the exchange rate.) RVI is expected to declare a loss of $17 million, in part due to an acutely depressed French market.

Renault continued its aggressive capital spending program, financing only 50 percent of it with internally-generated funds. Nearly $170 million will be injected by the French State in 1982, although none was given in 1981.

4.11.3 Company History

Renault can trace its history to 1898, when Louis Renault finished his first car, built in the family garden shed. In the years before the second World War, Renault had grown to a respectable size, producing 65,000 vehicles in 1939.

After it had been effectively destroyed by WW II, Renault was nationalized in 1945 under the provisional government of Charles DeGaulle, in part to punish its collaborationist owner. The nationalized Renault Company, organized and administered as a private enterprise, was given financial independence; i.e., in the absence of any State assistance, it had to borrow money. Renault did not begin to receive regular capital injections from the State until 1963, when officials became convinced that excessive borrowing against an unchanging equity base was creating an unnecessarily risky financial structure.

After nationalization, Renault grew rapidly as an automobile manufacturer under the leadership of gifted technocrats. Gradually over the following decades, the company grew to be the largest automobile manufacturer in France. In 1969, Renault passed several milestones. It produced the ten millionth Renault; it produced one million vehicles in a year for the first time; and it exported from France 500,000 vehicles in one year for the first time.

In 1966, Renault signed an association with Peugeot which committed the two companies to very close cooperation without affecting their indentities, independence, or corporate structures.

Under the association, the two companies shared information on every aspect of their planned product and component development and eventually established plants for the common production of certain engines, automatic transmissions and bodywork. The merger of Peugeot with Citroen in 1974 reduced the extent of cooperation between the two companies, although the common production projects continue in operation.

As part of the merger of Peugeot and Citroen, Renault acquired Citroen's truck building subsidiary, Berliet. Together with its own Saviem, this purchase gave Renault control over 70 percent of France's production of vehicles over 6 metric tons gross vehicle weight (GVW).

In recent years, the company has aimed at establishing itself as a major, international automobile and truck manufacturer. Entry into the U.S. car and truck market has become an important means to achieve that aim. Beginning in 1979, Renault formed an association with American Motors Corporation (AMC) which is expected to result in AMC producing a Renault car beginning in 1982. Renault now holds a 46 percent interest in AMC.

Renault also established an association with Mack Trucks (a subsidiary of the Signal Companies) in 1979, under which Mack sells Renault-built medium trucks in the U.S. under its own trademark. Renault holds a 10 percent interest in Mack along with convertible bonds representing a potential additional 10 percent interest.

In August, 1980, the chairman of Mack Trucks, Alfred Pelletier reported that additional collaboration between Mack and Renault was under consideration, including the possible marketing by Mack of Renault-built transit buses in the U.S. Renault has advertised its transit vehicles heavily in U.S. transit journals in 1980 and 1981. Renault has demonstrated buses in service in New York in the same program in which Hino is particpating.

A chronology of events is presented in Table 4-60.

4.11.4 Product Line of Buses

Renault produces a complete range of transit (city) and intercity (touring) coaches, including trolleybuses and articulated buses.

The city bus is designated the PR-100. The trolleybus version of it is designated the ER-100, and the articulated version, PR-180.

The Renault line of the intercity buses includes the PR 10, PR 12, and PR 14.

Renault is working to develop a new line of transit buses, the basic version of which will be marketed beginning in 1985.

4.11.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessemnt efforts. The definitions of Reference Sources and and Bibliography are the same as defined in Section 4.1.5.

In addition, staff members of the Transportation Industry Analyses Branch conversed by telephone with Renault company officials and corresponded with John Bowerman-Davies, Director, Planning and Strategy, Mack Trucks, Inc.

The following additional company literature was used in the support of the analyses and assessment:

- Regie Nationale Des Usines Renault, Report on Trading Activity for the 1980 Financial Year.
- "PR 180 Articulated Bus," (1979).
- "PR 100," (1979).
- Regie Nationale Des Usines Renault, Report on Trading Activity for the 1979 Financial Year.
- "Berliet Gamme 75".
- "L'autobus SC10".
- "Le Car ... Le Buses".

- "Renault PR 180 Autobus Articule".
- "Renault Saviem SC-110".

Bibliogrpahy - The following significant publications were used in support of the analyses and assessment:

- Mass Transit, (4/80), p. 4.
- "Europe's Bus Market Up: May Double During 1980s," Automotive News, (8/29/77), p. 9-10.
- "Mack, Renault Bus Venture Possible," American Metal Market/ Metal Working News, (9/10/80), p. 8.

TABLE 4-57. COMPANY DIGEST - RENAULT

Name of Company;	Renault Vehicles Industriels Bus and Coach Division
Address:	C/O Mack Trucks Inc. Mack International Box M-2100, Mack Blvd. Allentown PA 18105
Telephone:	(215) 439-3756

TABLE 4-58. PRODUCT LINES - RENAULT

Automobiles	Finance And Services	Commercial Vehicles	Industrial Enterprises
Passenger Cars Renault 4 5 6 siete 12 14 16 18 20 30 Small Commercial Vehicles Renault 4 four gonnette 5 societe' 12 societe' Estafette	Vehicle purchase financing and leasing Real estate Capital Equipment leasing Banking Car rental	Trucks over 2.5 metric tons GVW Buses over 16 metric tons	Farm Machinery Steel Forgings Bearings Rubber Plastics Castings Extrusions General contracting Machine tools Lawn movers Bicycles (Gitane)

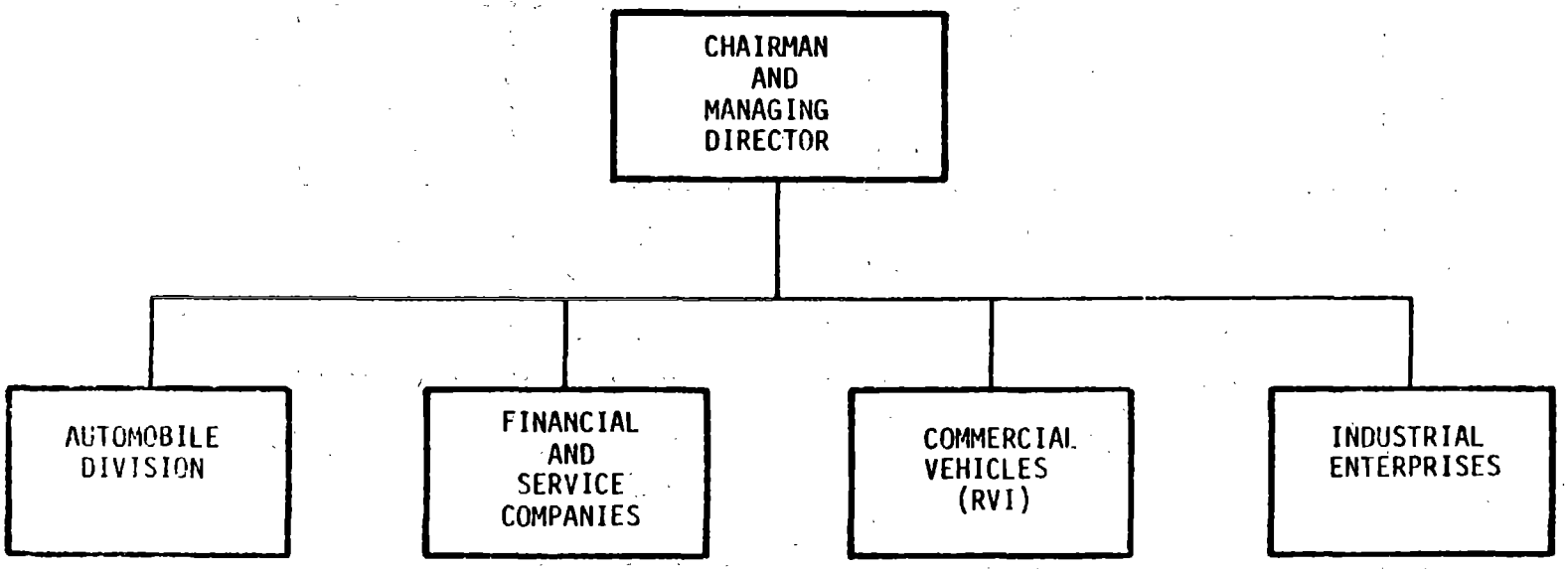


FIGURE 4-17. CORPORATE STRUCTURE - RENAULT

TABLE 4-59. FINANCIAL STATISTICS - RENAULT

	1976	1977	1978 ($ MILLIONS)	1979	1980
Renault Group (Consolidated)					
Net Sales	9,292	9,888	12,491	16,119	18,315
Net Income (Loss)	121	(23)	(23)	238	145
Capital Expenditures	N/A	709	781	1,047	1,530
RVI					
Net Sales - Saviem	815	789	1,920	2,162	2,544
Berliet	839	803			
Profit (Loss) Saviem	0	(36)	(88)	(63)	4
Berliet	25	(15)			
Capital Expenditure-					
Saviem	48	47	110	91	87
Berliet	23	35			
Unit Production					
Cars and Light Commercial Vehicles (Auto. Division)	1,659,973	1,737,707	1,718,398	1,899,470	2,053,677
RVI Total Vehicles -					
Saviem	40,671	35,059	48,948	45,819	54,086
Berliet	23,801	20,455			
RVI Buses -					
Saviem	2,385	2,429	3,571	3,223	2,979
Berliet	1,332	651			
Employment					
Renault Total	106,253	106,310	108,586	106,740	105,319
RVI - Berliet	20,230	19,974	33,861	30,028	29,466
Saviem	15,996	15,676			
Exchange Rate ($ = 1 Fr)	.2095	.2035	.222	.2352	.2386

TABLE 4-60. CHRONOLOGY OF EVENTS - RENAULT

1898	Louis Renault finishes his first car, built in the family garden shed.
1945	Charles DeGaulle nationalizes Renault to punish its collaborationist founder.
1963	Renault begins to receive regular capital injections from the State.
1974	Peugeot merges with Citroen. Citroen's truck builder, Berliet, is sold to Renault.
1978	Renault merges Berliet with its own truck builder, Saviem to form Renault Vehicles Industriels (RVI).
1979	RVI begins an association with Mack Truck of the U.S.
	Renault initiates the first of several joint agreements with American Motors. By 1980, Renault has agreed to acquire 46% of AMC's equity.
1980	Mack Trucks announces that it may market Renault buses in the U.S.

4.12 HINO MOTORS LTD.

4.12.1 Summary

Hino Motors, Ltd. is a major Japanese truck and bus producer, building nearly 5000 buses and 70,000 trucks annually. Hino is actively pursuing a program to become a competitive international truck producer.

In 1981, Hino began a demonstration program in New York at the invitation of Governor Carey and may build a plant in the U.S. to assembly buses. Table 4-61 summarizes some basic company reference information.

4.12.2 Corporate Overview

Hino Motors, Ltd. is a Japanese motor vehicle producer. It is one of four major heavy truck and bus producers in Japan.* The company also produces cars and light trucks for Toyota, and diesel engines.

Although an independent and publicly-owned company, Hino is affiliated with the Toyota group. Toyota Motor Co. is Hino's largest stockholder, holding an 8.5 percent share in the company. Hino's entire passenger car and light truck production, representing 25 percent of the company's total sales, is contract assembly work for Toyota. Toyota supplies the designs and parts and markets the finished vehicles as its own.

Hino markets its own medium and heavy truck and bus chassis. The Hino product line of truck chassis includes models ranging in gross vehicle weight from 18,520 lb. to 77,160 lb. Hino's bus chassis, all powered with diesel engines, include

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*Hino's major competitors in the heavy truck and bus field are Mitsubishi (a subsidiary of Mitsubishi Heavy Industries and an affiliate of Chrysler), Isuzu (a General Motors affiliate) and Nissan Diesel (a Nissan affiliate).

small-, medium- and standard-size buses of both the integral-construction and body-on-chassis type.

Through March, 1980, the company was operating at 134 percent of nominal, straight-time* capacity, averaging production of 6286 trucks and buses monthly. Its total output of such vehicles for the year ending March, 1980 was 75,430.

Hino employs over 8296 workers, 4795 of which are located at its Tokyo truck and bus factory. Total corporate sales in the year ending March, 1980, were approximately $1.6 billion. Total invested capital in its Tokyo truck and bus factory is roughly $92.5 million, representing about one-half of all of Hino's capital investment.

Financial, sales, and employment statistics are presented in Table 4-62.

4.12.3 Company History

Hino Motors, Ltd. traces its history to the establishment of the Tokyo Gas Industry Co., Ltd. in 1910. That company formed a motor vehicle division in 1917, and began producing the first motor vehicle developed in Japan, a small truck, in 1918. The product line proliferated during the 1920s, and in 1930 the first buses were produced.

The automobile division was consolidated with two other companies in 1937 to form the Tokyo Automobile Industry Co., Ltd. Hino was separated from this company in 1942 as Hino Heavy Industry Co., Ltd. The present name--Hino Motors, Ltd.--was adopted in 1959.

After World War II, Hino began to develop its capabilities with the aim of becoming a major motor vehicle producer. Since Japan was very backward at this point (in terms of automotive technology and product development), this meant the development of a large number of product types already well-developed in the U.S. and, to a lesser extent, Europe. In 1946, Hino

*Without overtime work.

completed the first heavy-duty tractor-trailer combination built in Japan. In 1947, Hino produced Japan's first large semi-trailer bus. In 1953, the company began producing a subcompact car, the Renault 4CV, under license. In 1954, the company introduced a heavy-duty dump truck.

Among the products being developed for the first time by the Japanese motor vehicle industry in the late 1940s and early 1950s were integral-construction buses. A number of rear-engine buses were introduced in Japan in 1951 and 1952, but Hino chose to develop an underfloor, mid-engine bus. Hino's first mid-engine bus was completed in December, 1952, and put on sale in January, 1953. Hino was able to adapt this bus to air suspension in 1958, only five years after GM had introduced the concept in the U.S.

During the 1960s, Hino attempted to extend its efforts as a passenger automobile manufacturer without much success. In 1961, the company introduced a small, rear-engine car called the Contessa and followed this in 1964 with another Contessa, the 1300, styled by the Italian designer, Michelotti. Although the Contessa 1300 won a number of European design awards, Hino achieved little commercial success. In 1966, with the encouragement of the Japanese government, which was concerned that the proliferation of automakers would hobble the country's attempt to become competitive internationally, Hino affiliated itself with the Toyota group. Under this affiliation, Hino has continued to produce cars--Toyota models--as a subcontractor.

During the 1970s, Hino began a drive toward international presence with its exports of trucks and buses. The company established a subsidiary in Antwerp in 1974 to serve as a parts supply depot for Europe and Africa. The company also began the establishment of a series of joint venture firms to market Hino products. Such firms were established in the Phillipines in 1975, in Malaysia in 1977, in Saudi Arabia in 1977 and in Thailand in 1979.

Hino has continued its bus development work as well. In 1963, Hino developed an intercity express bus to coincide with the opening of Japan's first expressway. In 1975, Hino participated in a Ministry of Transportation program to develop a 40 foot, low-floor bus. This program was considered in Japan to be equivalent to the U.S. Transbus development program.

In 1977, Hino introduced its RS-series bus. The RS-series is significant because it is nearly equivalent in design to U.S. buses. The RS-series has a skeleton body structure which eliminates rivets on the outside of the bus.

In early 1981, the possibility of Hino entering the U.S. market was raised following a visit to the Far East by Governor Carey of New York. Mr. Carey indicated that Hino might produce buses in a new plant in New York State.

In May, 1981, the New York Transit Authority began testing two Hino buses on New York City routes. These initial tests will be used to determine what design modifications need to be made to accommodate New York operating conditions. Testing of a third modified vehicle is planned. After a year of testing, a design would be developed consistent with U.S. bus standards and a decision would be made concerning establishment of a bus plant.* Hino is reportedly considering a plant with a capacity for about 2000 buses per year and employing 1000 workers.**

A chronology of events is presented in Table 4-63.

4.12.4 Product Line of Buses

Hino produces a full range of buses in seven principal series. These are listed in Table 4-64. They range from the small bus, AM-series, to the large RS-series, and include both integral-construction and body-on-chassis types.

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* New York Times, February 24, 1981, p. B3.

** Japan Economic Journal, February 17, 1981. p. 3.

The two buses originally delivered to New York City for demonstration purposes belong to the RC-series.

Hino, in building trucks and buses concentrates its attention on some parts.

Only the main parts which require high precision, such as crankcase, crankshaft, cam shaft, transmission and other gears, rear axle assembly, and body for passenger cars are manufactured and assembled in-house. Other parts such as tires, springs, bearings, and body for buses are subcontracted. This ratio for outside order is approximately 80 percent of the total manufacturing cost in the case of a large size bus or truck.

The assembly of bus bodies is done principally by Hino Shatai. The production rate at Hino Shatai is about eight per day. Hino Shatai does about 85 percent of Hino contracted bus assembly.

The production trend for all Hino buses is indicated in Table 4-65. Hino exported 2689 buses in 1980, all in the "heavy" class. This represented an increase of 221 percent over 1978.

4.12.5 Reference Sources and Bibliography

This section serves to identify the reference sources and the bibliography used as source data and information in the analytical and assessment efforts. The definitions of Reference Sources and Bibliography are the same as defined in Section 4.1.5.

In addition staff members of the Transportation Industry Analysis Branch conversed by telephone and corresponded with New York Transit Authority Officials regarding the demonstration and revenue service testing of Hino buses. Staff members also corresponded with Hino company officials. Analysis embodied in a report entitled "A Study of Japanese Large-Size Buses with the Highlights of Hino Motor Ltd." submitted to the Transportation Systems Center under Purchase Order Number 81266 by Mitsubishi Research Institute, Tokyo, Japan, August, 1981, was also used as reference material.

The following additional company literature was used in support of the analyses and assessment:

- "Company History."
- "Hino LA/LB Series Diesel Trucks."
- "Hino Motors, Ltd.," (Fact Sheet).
- "Hino Motors Co., Ltd., Financial and Operating Tables."

Bibliography - The following significant publications were used in support of the analyses and in assessment.

- "New York City Puts Hino Buses to the Test on City Streets," Fleet Owner, (July 1981), pp. 121-122.
- "Japan Reaches Accord with New York State on Bus Factory," Japan Economic Journal, (2/17/81), p. 3.
- "Japanese Buses to be Tested on New York Streets," New York Times, (2/4/81), p. B3.
- "A Guide to the Motor Vehicle Industry of Japan 1980," by Japanese Motor Industrial Federation.

TABLE 4-61. COMPANY DIGEST - HINO MOTORS LTD

Name of Company:	Hino Motors, Ltd.
Address:	1-1, Hinodai 3- Chome Hino-Shi, Tokyo JAPAN

TABLE 4-62. FINANCIAL STATISTICS - HINO MOTORS, LTD.

	For the Fiscal Year Ending March 31				
	1977	1978	1979	1980	1981
			($ Million)		
Sales	910	1,274	1,597	1,642	1,830
Operating Profit	18	24	41	50	20
Net Profit	10	14	20	24	22
Capital Investment	7	7	7	7	44*
Employees	7,529	7,985	7,977	8,009	8,296
Exchange Rate ($=1=)	.00357	.00431	.00485	.00450	.00470
		Sales by Product Group %			
Diesel Truck and Bus	58.7	54.5	58.9	60.6	57.5
Pickup Truck and Compact Car	27.2	31.5	26.4	24.3	26.5
Engines and Parts	14.0	14.0	14.6	15.1	16.1
Total**	100.0	100.0	100.0	100.0	100.0

*The large increase in capital investment is attributable to the establishment of the Nitta works, a new parts plant.

**Total may not add to 100 due to rounding.

TABLE 4-63. CHRONOLOGY OF EVENTS - HINO MOTORS LTD

1910	Tokyo Gas Industry Co. (predecessor of Hino) established.
1918	Mass production of Model TGE "A-type" truck.
1930	Four- and six-wheel low-frame buses are marketed.
1942	Hino Heavy Industry Co. established.
1946	Hino builds the first tractor-trailer combination in Japan.
1953	Hino introduces an underfloor, mid-engine bus.
1958	Hino adopts air suspension.
1959	The name Hino Motors, Ltd. is adopted for the company.
	Hino adopts monocoque body construction with the introduction of its BN-series.
1960	Hino adopts rear engine placement for its buses.
1976	Hino introduces a special series of export-only trucks, designed to be competitive internationally.
1977	Hino introduces its RS-series bus, the first Japanese bus using a full scale skeleton "rivetless" body construction.
1981	Hino begins a bus demonstration project in New York City.

TABLE 4-64. HINO BUS MODELS

SERIES DESIGNATION	YEAR OF INTRODUCTION	LENGTH	ENGINE LOCATION
AM	1977	23'	Front
BX	1975	29-36'	Front, under seat
BY	1975	34-37'	Front
RF	N/A	32-36'	Rear, under seat
RE	1968	33-34'	Rear, under floor
RC	1967	36'	Rear, under floor
RS	1977	39'	Rear, under floor

NOTE: The rear, under-floor engine buses are of the integral-construction type. The others are body-on-chassis types.

N/A - data not available.

TABLE 4-65. HINO BUS PRODUCTION TRENDS

	(Calendar Year)		
	HEAVY (>30 Passengers)	LIGHT	TOTAL
1976	3,835	337	4,172
1977	4,728	489	5,217
1978	4,232	611	4,843
1979	4,357	903	5.260
1980	5,024	863	5,887

4.13 OTHER BUS MANUFACTURERS

4.13.1 Daimler-Benz

Daimler-Benz is a multinational business enterprise with two basic businesses: luxury passenger cars and commercial vehicles. The passenger car line includes both diesel and gasoline engine models built on two basic platforms. The company's commercial vehicles include a full line ranging from light-duty vans to heavy trucks. Daimler-Benz is the world's largest producer of heavy trucks (over 33,000 pounds GVW). Commercial vehicles also include tractors and a utility recreational vehicle produced jointly with Steyr-Daimler-Puch of Austria.

Daimler-Benz A.G., the parent company of the Daimler-Benz Group, is a publicly-held German corporation. Traditionally, it has been regarded as extremely conservative financially and its stock a sound secure investment. The largest stockholder is the Deutsche Bank, Germany's largest bank, which is believed to hold about 25 percent of the shares. Kuwait, the Arab oil producing country, is also a major stockholder, holding over 14 percent of the shares. The chairman of Daimler's Supervisory Board of Directors is traditionally a representative of the Deutsche Bank.

Daimler-Benz, during the 1979 calendar year, amassed total worldwide sales of about $17.1 billion, earning $607 million in net income. Sales of its commercial vehicles accounted for $8.5 billion, or about 50 percent of all business. Capital investment was almost $1.2 billion in 1980. Worldwide, the company employs over 180,000 workers.

U.S. activity by Daimler-Benz has increased substantially in recent years. Sales by the two Daimler-Benz North American sales subsidiaries amounted to over $1.5 billion in 1980. This activity includes the sale of both luxury passenger cars and heavy commercial vehicles. Daimler does not currently sell a transit bus in the U.S. However, in the mid-1970s, the company did sell a small bus in the U.S. The small bus was not equipped with a wheelchair lift and the company discontinued sale of the buses following institution of the "504" requirements.

In the early 1970s, Daimler began to establish itself in the U.S. market for medium and heavy trucks by building a dealer and distributor network and importing trucks, principally from its Brazilian plants. In 1977, Daimler acquired Euclid, Inc., a Cleveland-based manufacturer of extra-heavy construction and mining equipment. In 1980, Daimler opened a plant in Hampton, Virginia to assemble medium trucks. In 1981, Daimler acquired the Freightliner truck manufacturing operations of Consolidated Freightways.

Daimler-Benz builds a complete range of buses and bus chassis. Its buses include a series of minibuses (for 13-25 passengers) derived from its van; a standard city bus designated O 305; an articulated "pusher" bus derived from the O 305 and designated O 305 G; and a touring and intercity bus series designated O 303. The O 305 was first introduced in 1969, and the O 303 was introduced in 1975.

Bus production worldwide, including small buses built as derivatives of vans, was 29,963 units in 1980. Production of heavy-duty buses (standard transit buses, intercity buses, etc.) is more limited, about 5000-6000 units, most of them produced in Germany. Total German production of buses and bus chassis was 9643, including small buses. Over the last five years, production by Daimler in Germany of intercity-type buses has averaged between 2500 and 3000 units per year while transit bus production has averaged between 1500 and 2000 units per year.

No plans to begin bus production or sales in the U.S. are known.

The staff of the Transportation Industry Analysis Branch has conversed by phone with Daimler-Benz company officials and used as reference sources the following company literature:

- Daimler-Benz Annual Report, (1980).
- Daimler-Benz Annual Report, (1979).
- "At the IVA 79, Mercedes-Benz Present, Technologies of the Future," Press Information.

- "Elektrobus OE 305".
- "Elektrotransparter LE 306".
- "Energy Recovery by Way of Gyrodrive," Press Information.
- "Low-Pollutant Propulsion for Trucks and Buses," Press Information.
- "Mercedes-Benz DUO-Bus," Press Information.
- "Mercedes-Benz Umweltfreundich Durch Gerauschgekapsetten Diesel".
- "Non-Pollutive Propulsion Systems for Trucks and Buses," Press Information.

"0305/0 307 Chassis for Regular Service Buses," (no date).

- "0 305/0 307 Chassis for Regular Service Buses," (no date).
- "0 305 Standard City Bus".
- "Verbesserter Korrosionsschutz for Standard-Linien-Ominbusse 0305 und Standard-Uberland-Linien-Ominbusse 0307".

The following significant publications serve as the more formal referenceable bibliography:

- "Daimler-Benz to Buy Freightliner," World's Automotive Reports, (3/9/81), p. 75.
- "Daimler: Tackling U.S. Truck Market by Acquisition," New York Times, (3/7/81), p. 31.
- "Daimler-Benz Set to Buy U.S. Truck-Making Unit," New York Times, (3/6/81), p. D1.
- "Daimler-Benz Boosts U.S. Sales," Financial Times, (2/17/81), p. 19.
- "Daimler-Benz A.G.," Moody's Industrials, (1980), p. 2810.
- "Germany Gets E/HV Buses," Electric Vehicle News, (5/78), p. 9.
- "Daimler-Benz 0305," LEA Transit Compendium, (Vol. III, No. 9, 1977).

- o "Daimler-Benz 0305G," LEA Transit Compendium.
- o "Daimler-Benz 0307," LEA Transit Compendium.

4.13.2 DeLorean Motor Company

DeLorean Motor Company's principle line of business is the production and sale of its DeLorean motor car. The company also owns a small plant in Michigan making a fiberglass product.

The DeLorean Motor Company (DMC) was founded in 1975 by former General Motors executive John Z. DeLorean, with the primary purpose of introducing a new luxury sports cars to the U.S. market. The company has established an assembly plant in Northern Ireland with substantial financial assistance from the U.K. government.

Providing the impetus for the potential entry of DMC into the transit-coach business was probably a combination of reasons centering on the Federal Transbus initiative and subsequent refusal to bid by U.S. producers, GM and Grumman Flxible. DeLorean, presenting a modified German bus design, proposed that such a bus (referred to as the DMC-80) could, in fact, be built to Federal requirements at reasonable cost.

In 1979, DeLorean unveiled a prototype of his DMC-80 in New York to mixed reviews, saying that it could be sold in the $130,000-$140,000 range. Critics said the bus did not meet UMTA standards for classification as a Transbus, while proponents greeted the low-floor, wide-door design enthusiastically. The prototype buses shown as the DMC-80 were, in fact, buses developed by Daimler-Benz and M.A.N. as part of a project in West Germany to create a standard transit bus for the 1980s.

DeLorean's plan to build a U.S. plant to assemble one of these German buses would have required substantial government financial assistance. An economically depressed area such as the Bronx was suggested as a site for the proposed plant in order to justify such aid.

The staff of the Transportation Industry Analyses Branch has conversed by phone with DeLorean Motor Company officials and has

used media advertisements of the DMC-80 and other DeLorean material as reference sources. In addition, the U.S. Government memorandum (UMTA) from L. Liburdi to W. Raithel with an attached report of the Source Evaluation Board on "Articulated Low-Floor Bus Design" of July 28, 1980, was used as reference material. The following company literature was utilized:

- o "DMC-80".
- o "DMC - Design Considerations" (VI).
- o Product Profile Description.

The following significant publications serve as the more formal, referenceable bibliography:

- o "DeLorean Motor Company," Metropolitan, (March/April 1981), p. 31.
- o "DeLorean's Proposed Bus Falls Short of Standards," Automotive News, (10/1/79).
- o "Windfall Profits Tax May Revive Transbus," American Metal Market/Metalworking News, (10/1/79), p. 1, 4.
- o "DeLorean to Build Buses GM Said Couldn't be Built," Detroit Free Press, (9/20/79), p. 1.

4.13.3 Skillcraft

Skillcraft Industries produces the Transmaster, a heavy duty coach. This small (31 foot) transit coach is powered by a Detroit Diesel (4053T) engine mated to an Allison MT643 transmission. The bus can trace its design roots to the early Transbus initiatives and small bus specification guidelines. The Transmaster features a low, 20-inch floor height, wide doors and low windows. Air conditioning is standard. The bus uses a leaf spring suspension.

Founded in 1969 by T.L. Huston as a company performing special application conversions of vans, Skillcraft, responding to the emphasis on increasing accessibility in transit, produced 13 small buses in 1973 designed for handicapped ridership. In 1974, Skillcraft designed a small (19-31 passenger) low-floor type. The

Transmaster medium-transit bus was developed in 1979. Two Transmaster prototypes entered a revenue service demonstration project in April, 1980, in Sarasota, Florida.

Skillcraft opened a new 22,500 square foot plant in Feburary, 1982. Production was initially at the rate of 2 per month. Total sales of the Transmaster, up to March, 1982, amounted to $3 million. The company anticipates further development and expansion of its bus program, predicting future production of 500 buses annually while generating a $50 million per year business in Florida.

The staff of the Transportation Industry Analyses Branch has conversed by phone and corresponded with Mr. T.L. Huston, President of Skillcraft Industries.

Photographic coverage of the Skillcraft product line of buses was used as reference material as well as a document entitled "Performance Testing and Evaluation of Transmaster Low-Floor Bus," Executive Summary, prepared by Advanced Technology, Inc. (McLean, VA) for the State of Florida Department of Transportation. In addition, reference material consisted of the "Technical Specifications for Skillcraft's Transmaster Heavy-Duty Travel Coach."

The following significant publications serve as the more formal, referenceable bibliography:

- o "Sarasota County Tries Out Two Skillcraft Buses," Passenger Transport, (5/30/81), p. 12.
- o "Venice Bus Building Firm Makes Buses for Local and National Use," Sun Coast Gondolier (Fla), (5/14/81), p. 1+.
- o "Florida Firm Introduces First U.S. Low Floor Bus," Automotive News, (1/7/80), p. 14.
- o "Windfall Profits Tax May Revive Transbus," American Metal Market/Metalworking News, (10/1/79), p. 1-4.
- o "Firm's Ground Floor Effort May Launch a Major New Bus Builder," St. Petersburg Times, (no date).

4.13.4 TMC/MCI (Greyhound)

Greyhound, the largest U.S. intercity bus operator, has two bus manufacturing subsidiaries. These are, Motor Coach Industries (MCI) and Transportation Manufacturing Corporation (TMC). These two companies manufacture intercity buses for sale to both Greyhound and other intercity bus operators. TMC built a medium transit bus from 1979 until late 1981.

MCI is headquarted in Winnipeg, Manitoba and has a component manufacturing plant in that city and an assembly plant in Pembina, North Dakota. Greyhound Lines of Canada acquired control (65 percent) of MCI in 1948, leading to 100 percent ownership in 1958. Greyhound (U.S.) began acquiring buses from MCI in 1963.

MCI has a capacity to produce about 1050 buses per year. There are plans to increase this to 1600.

TMC, was established in 1974, with a plant in Roswell, North Dakota. TMC produces the same design intercity bus as MCI and has depended on MCI for components. Almost all of TMC's production of intercity buses goes to Greyhound. TMC's capacity to produce intercity buses is about 500 per year. In 1979, TMC acquired a license from Ontario Bus Industries of Canada to produce a medium transit bus. From 1979 until 1981, TMC dominated the market for medium transit buses in the U.S. TMC elected to sell back its license to Ontario Bus Industries and end production of the transit bus. TMC will use the freed resources to expand intercity bus production.

Bus manufacturing has been an extremely profitable activity for Greyhound. In 1980, while producing at full capacity, Greyhound's bus manufacturing activity realized revenues of $227 million and a net profit of $23 million. Their net return on assets exceeded 20 percent.

The staff of the Transportation Industry Analyses Branch conversed by phone and corresponded with Leslie Ellis White, Director of Public Relations for Greyhound Lines, Inc.

The following company literature was utilized:

- o The Greyhound Corporation 1980 Annual Report.
- o The Greyhound Corporation 1979 Annual Report.
- o "Wider Means Better, 102" (no date).
- o "City Cruiser."
- o "Now From Roswell, New Mexico."
- o "MC-9 Crusader II."

The following significant publications serve as the more formal, referenceable bibliography:

- o "City Cruiser Deliveries Begin - Montgomery County Receive First Ones," Bus Ride, May, 1979, p. 44.
- o "Greyhound Canada: 50 Years of Vision," Bus Ride, April, 1979, p. 30-33.
- o "TMC Dedicates New Plant in Roswell, New Mexico," Bus Ride, April, 1975, p. 46.

4.13.5 Eagle (Trailways)

Eagle International is the bus manufacturing subsidiary of New Trails, Inc., parent company of Trailways.

Eagle produces an intercity bus called the Model 10. The Model 10 was introduced in 1980, replacing the Model 5. In October, 1981, Eagle announced a suburban version of the Eagle Model 10 which is being offered to transit operators. Prior to the introduction of the suburban version, Eagle had sold 55 buses to the Harris County, Texas (Houston) Metropolitan Transit Agency for use in a park and ride program. This was one of the first major sales of the Model 10 outside the Trailways system.

Eagle International was established in 1974 with a plant in Brownsville, Texas to produce intercity buses for Trailways. The model which it first produced, the Eagle Model 5, had been produced in Europe for Trailways since 1968. European production of

Trailways buses had its origins in the purchase by Trailways, beginning in 1956, of buses built by Kassbohrer (Setra), a German firm.

Eagle currently has a capacity to produce 600-700 buses per year. An increase in capacity to around 1500 is planned. As part of this capacity increase, Eagle plans to open a second assembly plant near Brownsville during 1982.

The staff of the Transportation Industry Analyses Branch conversed by phone and corresponded with David Millhouse, sales representative for American Coach Sales, Inc. and Bobbi Watson, Director of Public Relations for Trailways, Inc.

The following company literature was utilized:

- o Big Red, Vol. 1, No. 1, Summer 1981.
- o Trailways New Trails, Vol. 1, No. 2, August-September, 1980.
- o Trailways New Trails, Vol. 1, No. 1, July, 1980.
- o Trailways, Inc. Press Releases:

  "Trailways, Inc. Fact Sheet" (no date).

  "The Trailways Story," February, 1981.

The following significant publications serve as the more formal, referenceable bibliography:

- o "New Products," Metropolitan, Jan-Feb, 1982, p. 57.
- o "Trailways' Griffith," (interview with Stephen W. Griffith, executive vice-president of New Trail's Inc.) Metropolitan, March-April, 1981, p. 17+.
- o "Running Hard in Second Place," New York Times, Sunday, December 14, 1980, p.
- o "Eagle International Introduces a New, Fuel Efficient Intercity Bus," Fleet Owner, April, 1980, p. 37, 42.
- o "Eagle International Formally Opens New Plant in Brownsville, Texas," Bus Ride, October, 1974, p. 42.

4.13.6 Ontario Bus Industries

Ontario Bus Industries is a Canadian company headquarted in Mississauga, Ontario. The company builds a transit bus, called the Orion, in 30 foot and 35 foot lengths.

Ontario Bus Industries is descended from another company, Ontario Bus and Truck, which had been in the business of repairing buses and trucks for many years. This company developed a prototype bus in 1976-1977, going into actual production in 1978. In 1979, Ontario sold a license to manufacture and sell the bus in the U.S. to TMC (Greyhound). The TMC City Cruiser, produced from 1979 until 1981, was based on this design. Ontario Bus Industries repurchased the license from TMC in late 1981, and has resumed sales of the Orion in the U.S.

Although transit is the primary market for the company, they have used the Orion as the basis for an intercity bus, an ambulance and a motorhome.

The plant is located in Mississauga, Ontario. Production in 1981 ran at a rate of about 2 1/2 buses per week. The company, in March, 1982, had 198 employees, of whom 20-30 are involved in the company's original truck and bus repair business.

The company has purchased a second plant in Utica, New York, where it expects to begin production in June, 1982, under the name Bus Industries of America.

The staff of the Transportation Industry Analysis Branch conversed by phone with company officials. The following company literature was used:

- "What Kind of ORION Can We Build for You?"

☆U. S. GOVERNMENT PRINTING OFFICE: 1982--501-425--79