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Surrogate Plant Data Base

Volume IV Appendix E: Medium and Heavy Truck Manufacturing

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Transportation Systems Center
Cambridge MA 02142

May 1983
Final Report

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16. Abstract This four folume report consists of a data base describing "surrogate" automobile and truck manufacturing plants-developed as part of a methodology for evaluating capital investment requirements in new manufacturing facilities to build new fleets of automobiles. The report describes the data base, its past uses and potential applications. Separately bound appendices contain the actual data base information. The surrogate plants are typical of automotive manufacturing plants in terms of size, production rates, manufacturing processes, technological sophistication and flexibility. The data for a particular type of surrogate plant, while not representing any specific plant, provides information that, when appropriately aggregated or scaled, will yield accurate industry statistics.				13. Type of Report and Period Covered FINAL REPORT March 1981 - June 1982	
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PREFACE

The development of Appendix B--Application of Surrogate Plant Data Base-- was made possible through the efforts of Joseph F. Petrie, who is responsible for this Appendix. The author also wishes to acknowledge the Transportation Consulting Division, a division of Booz, Allen & Hamilton, Inc., and Harbour Associates, Inc., who carried out Contract DOT-TSC-1609 encompassing the acquisition and analysis of information relative to manufacturing equipment required to produce a socially acceptable and efficient motor vehicle. He would also like to thank the staff of Raytheon Service Company for providing support.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol When You Know Multiply by To Find Symbol

LENGTH

inches
feet
yards
miles

centimeters
meters
kilometers

cm
m
km

AREA

square inches
square feet
square yards
square miles
acres

square centimeters
square meters
square kilometers
hectares

cm²
m²
km²
ha

MASS (weight)

ounces
pounds
short tons
(2000 lb)

grams
kilograms
tonnes

g
kg
t

VOLUME

teaspoons
tablespoons
fluid ounces
cups
quarts
gallons
cubic feet
cubic yards

milliliters
liters
cubic meters

ml
l
m³

TEMPERATURE (exact)

Fahrenheit
temperature

5/9 (after
subtracting
32)

Celsius
temperature

°C

Approximate Conversions from Metric Measures

When You Know Multiply by To Find Symbol

LENGTH

millimeters
centimeters
meters
kilometers

inches
feet
yards
miles

mm
cm
m
km

AREA

square centimeters
square meters
square kilometers
hectares (10,000 m²)

square inches
square yards
square miles
acres

in²
yd²
mi²
ac

MASS (weight)

grams
kilograms
tonnes (1000 kg)

ounces
pounds
short tons

oz
lb
t

VOLUME

milliliters
liters
cubic meters

fluid ounces
pints
quarts
gallons
cubic feet
cubic yards

ml
l
m³

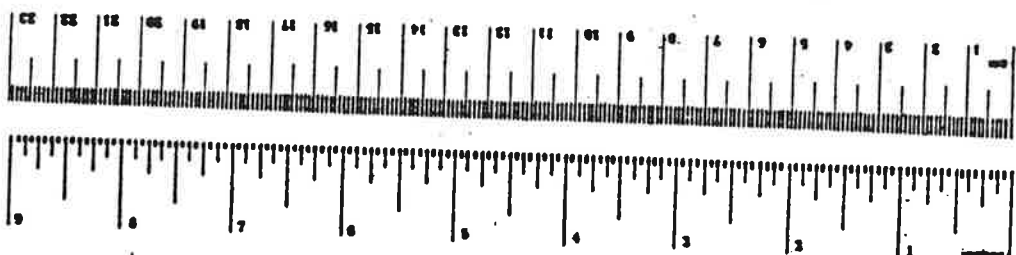
TEMPERATURE (exact)

Celsius
temperature

9/5 (then
add 32)

Fahrenheit
temperature

°F



REPORT CONTENT AND ORGANIZATION

This report documents the Surrogate Plant Data Base, covering typical manufacturing plants and facilities representing the major types used to produce motor vehicles. This report is organized into four separate volumes as follows:

o VOLUME I

- INTRODUCTION
- Appendix A describes how the surrogate plant data was developed. It also describes how a manufacturer would plan for a new component or assembly plant including the staffing functions, personnel requirements, leadtime requirements, and cost requirements associated with the planning of a new component, part, or assembly plant.
- Appendix B describes how the surrogate plant data base can be used to develop estimates of the capital cost impacts of developing new facilities or modifying existing facilities. It includes a summary of capital cost impact data on 39 automotive manufacturing plants plus a surrogate plant coding scheme and a method for identifying suppliers to the automotive industry.

o VOLUME II

- Appendix C provides capital cost data for 39 automotive manufacturing plants broken down by major cost element: land, building and equipment, plant facilities, machinery and equipment, and tooling. It also contains a breakdown of the data by major department in the plant, a summary of the plant's size (i.e., square footage) by major department and a diagram depicting the layout of the plant.

o VOLUME III

- Appendix D provides operating manpower, manufacturing plant budgets (i.e., labor, maintenance, utilities, taxes and insurance expenses), and pre-production and launch timing charts and expenses for 10 automotive manufacturing plants. The information presented for the 10 plants is representative of the 39 plants included in Volume II, Appendix C.

o VOLUME IV

- Appendix E discusses the major differences in manufacturing light and heavy duty vehicles in terms of the processes employed and make-up of the plant, and the need to develop surrogate plant data on medium and heavy duty truck assembly and component plants. It includes a list of plants proposed for initial development.

APPENDIX E. CONTENTS

<u>Plant No.</u>	<u>Plant Name</u>	<u>Page</u>
1.	Medium Duty Truck Assembly Plant.....	E-11
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4.	New Medium/Heavy Duty Frame Components Plant.....	E-43
5.	Heavy Duty Truck Braking Systems Plant.....	E-53
6.	Diesel Engine (6-9 Liter) Plant.....	E-67
7.	Diesel Engine (9+Liter) Plant.....	E-75
8.	Manual Transmission Plant.....	E-83
9.	Rear Tandem Axle Plant.....	E-97
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11.	Road Hauling Trailer Assembly Plant.....	E-125
12.	Trailer Chassis/Dead Axle Assemblies Plant.....	E-133
13.	Small Engine Gas and Diesel Components Plant.....	E-141

SURROGATE PLANT DATA BASE

VOLUME IV

APPENDIX E

MEDIUM AND HEAVY TRUCK MANUFACTURING

Manufacturing data for various truck assemblies and parts will differ markedly from light-duty manufacturing data for several reasons:

- o Basic differences in vehicle assemblies. The large size and weight of heavy truck parts necessitates different manufacturing techniques, especially in the areas connected with material handling.
- o Differences in manufacturing procedures. Trucks tend to be manufactured in lower volumes and with greater options than automobiles. Thus the manufacturing system must be more flexible for medium and heavy trucks than for light vehicles. Assembly is done in more of a "job shop" mode, with much lower annual production levels.
- o Differences in models. Trucks come with a wide variety of features such as engine type, axle type, body material, etc. Many different engines, transmissions and axle types are routinely used in assembly. Thus material storage and manufacturing planning needs are quite different than with light duty vehicle manufacturing.

- o Differences in plant function. The breakdown of functions between assembly plants, stamping plants, etc. is different with heavy trucks than with light vehicles. The size and weight of certain assemblies discourages the separation of manufacturing facilities. On the other hand, the greater variety of truck options leads to greater use of subassemblies for certain items.

To investigate the capital, manpower and expenses associated with heavy truck manufacturing, surrogate plants need to be developed for those plants that differ markedly from light vehicle plants. These include:

- o Medium duty truck assembly. Medium duty truck manufacturing has many of the distinguishing features of heavy truck manufacturing such as greater production flexibility and slower production rates.
- o Heavy duty truck assembly. Compared to a medium duty truck assembly plant, the heavy duty truck assembly plant will have more transmission and axle variety, a slower production rate and more employees (See Figure E-1).
- o Fiberglass Body. Heavy trucks use much more fiberglass than automobiles. Hoods, fenders and many interior parts are often fiberglass.
- o Frames. Truck manufacturing still places heavy reliance on frame construction. Stamped frame parts are often assembled in the final assembly, whereas light duty vehicle frames are usually pre-assembled.
- o Brake systems. Truck brake systems are much larger than those in light vehicles and use different operating systems. Most are air operated.
- o Diesel engine (6-9 liter). Heavy duty diesel engine manufacturing differs from light duty diesel manufacturing in the following ways:
 - Heavier blocks

**PASSENGER CAR ASSEMBLY PLANT
BUILDING LAYOUT**

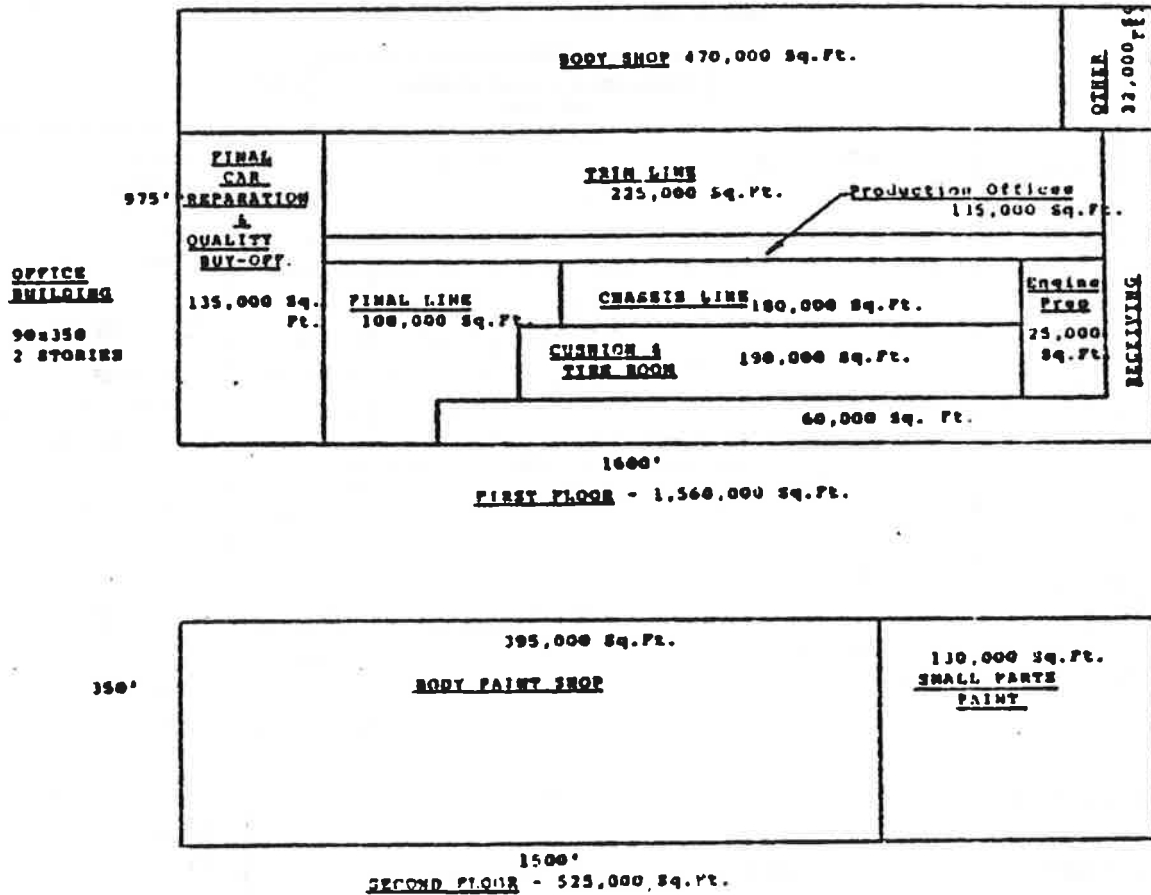


FIGURE E-1. COMPARISON OF A LIGHT DUTY VEHICLE ASSEMBLY AND A HEAVY DUTY VEHICLE ASSEMBLY PLANT. (1 of 2)

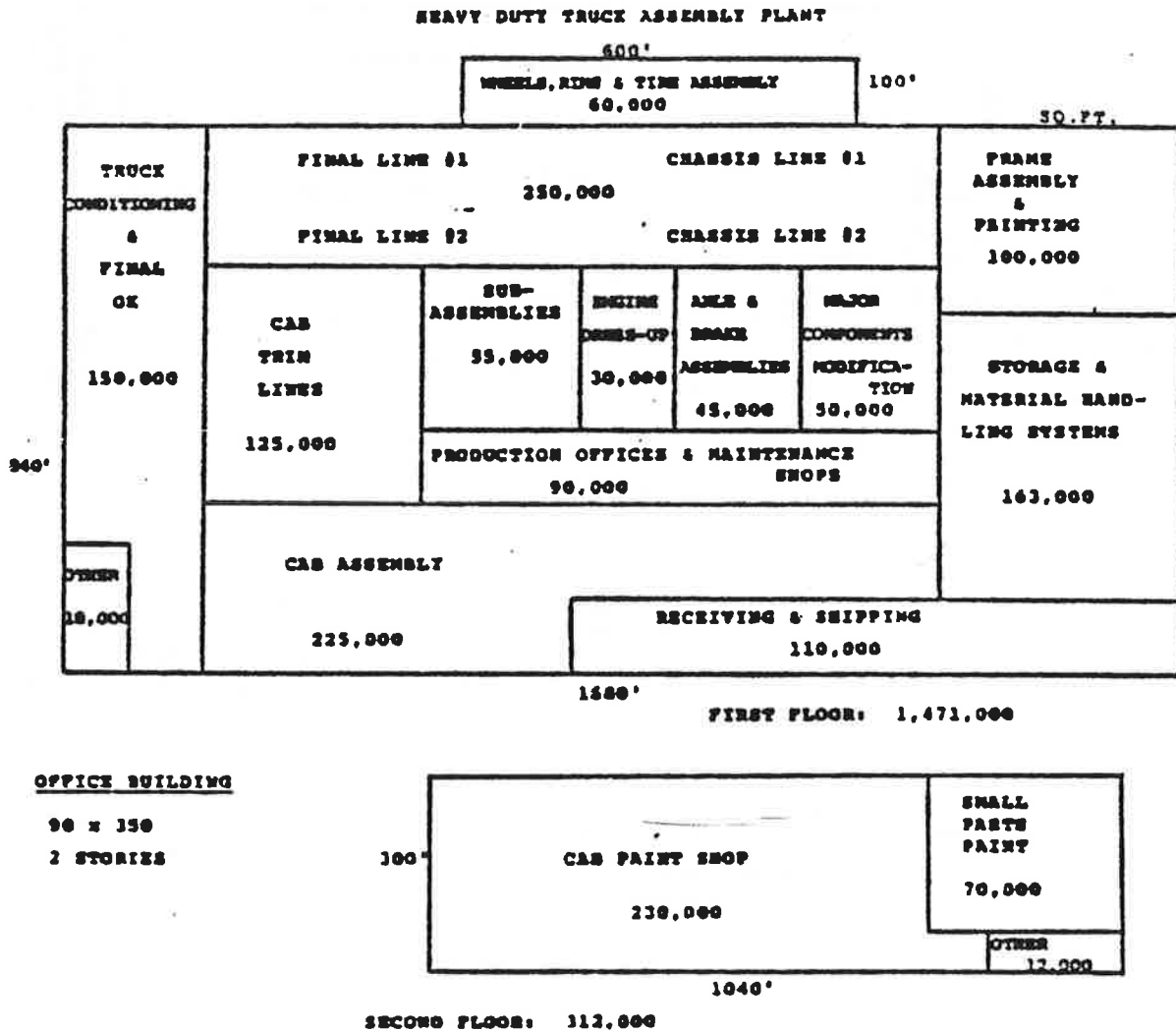


FIGURE E-1. COMPARISON OF A LIGHT DUTY VEHICLE ASSEMBLY AND A HEAVY DUTY VEHICLE ASSEMBLY PLANT. (2 of 2)

- More massive cylinder heads
- Often turbocharging additions.
- o Diesel Engines (9+ liter). Heavy duty diesel engine manufacturing differs from light duty diesel manufacturing in the following ways:
 - Heavier blocks
 - More massive cylinder heads
 - Often turbocharging additions.
- o Transmission. Transmissions are critical and costly components for heavy trucks. They are large and complex and have 10-15 speeds to cover the torque conversion requirements of the vehicles.
- o Axles. Axles are large and heavy on trucks and use standard beam axle design (no independent suspension).
- o Diesel engine accessory systems. Special engine systems include turbochargers and the injection system.
- o Trailer Assembly.
- o Trailer Chassis Components.
- o Small Engine Gas & Diesel Components.

Other plants that should be considered in developing a heavy vehicle manufacturing data base include:

- o Wheel
- o Radiator
- o Suspension
- o Complete cab
- o Exhaust system.

With data on these key plants and the data already developed for light duty vehicles, it would be possible to perform the various impact studies currently done for light duty vehicles.

Presented below are 1) a detailed description of the data contained in this report and 2) a description of the plants covered.

PLANT DATA

For each plant seven categories of information are provided:

- . Basic production and operating assumptions
- . Plant capital costs
- . Facility planning data
- . Process and components summary
- . Area required for each department
- . Plant layout
- . Per unit manufacturing cost.

Presented below are explanations of the information provided under each of these categories.

Basic Production and Operating Assumptions

For each plant all the assumptions used to develop the surrogate plant information--the "typical" characteristics of the plant--are covered under the heading "Basic Production and Operating Assumptions." These are the key assumptions used to determine appropriate plant size and type of machinery and manpower. Key plant characteristics specified in this section include:

- . Product manufactured
 - The type of product, detailed as much as necessary to determine the manufacturing processes

- The number of product variations manufactured in the same plant. This determines required plant flexibility and complexity
- . Production rate
 - The number of parts that are manufactured in a year by a typical plant
 - The number of shifts used by a typical plant
 - The amount of overtime to be expected in a years production run
 - The number of productive days to be expected.

- These basic assumptions are important in interpreting the derived plant statistics presented in the later sections. Product complexity and production rate will directly impact manpower and capital requirements.

Plant Capital Costs

For each plant a summary table of plant capital costs is provided. The estimates indicate the costs of building an entirely new plant to manufacture the products. Major elements of the costs include:

- . Land
- . Site development, which includes clearing the land, road construction, truck and rail areas, lighting, storage, sewers and landscaping
- . Building, which includes architectural/engineering work, waste treatment, boilers, scrap facilities, power house, tank farm and paint mixing facilities
- . Building support facilities, which includes electrical equipment, cooling equipment, steam, air, water, heating, and telephone equipment
- . Manufacturing support facilities, including paint equipment, heat treat equipment, conveyors, cranes, lifts, etc.

- Machinery which includes automatic machinery, welding equipment and related support equipment
- Tooling which includes fixtures for multiwelders, fixtures for automatic body shop, assembly fixtures and guages and checking fixtures.

Facility Planning Data

Data on capital and manpower requirements by plant function are presented under the "Facility Planning" heading. In this section capital and manpower requirements are broken out in detail for each plant function or activity. In some cases manpower and capital requirements for two different production levels are provided. The information by plant function provides data at a level of detail sufficient to identify the capital and manpower requirements by major activity within the plant. The total of all the capital items is the cost of the entire plant.

Process and Component Summary

Plant data under the "Process and Component Summary" heading is the most detailed available. Each major department within the plant is broken out separately to identify department function, capital requirements, manpower requirements and area. Only production facilities and equipment are shown in this section, so total capital costs do not include building and building facilities. In this section labor requirements are broken out by direct labor which includes direct production labor, indirect labor which includes hourly employees associated with overhead activities and salaried labor.

Area Required for Each Department

This section presents the area requirements for the entire plant. This includes manufacturing area, office area and auxiliary area. Manufacturing area is broken down to major departments.

Plant Layout

A layout is shown for each plant. The layout shows actual typical locations of various departments in a plant, the approximate shape and areas of each department and the separation of plant functions into separate buildings or floors.

Per Unit Manufacturing Cost

For each plant, per unit labor and capital costs are calculated using a set of assumptions for:

- . Employee wage rates
- . Working days per year
- . Depreciation rates
- . Annual production

In addition, estimates are provided for taxes and insurance and other manufacturing costs (maintenance, perishable tools, spoilage, utilities, supplies and other expenses). The data are assembled into a total manufacturing cost per unit. The manufacturing cost includes all costs associated with the operation of the plant. It does not include material costs or costs of ancillary components that may be required to make the product function in an automobile. However, when the typical plants are linked together and adjusted to appropriate production volumes, the costs of input materials and components to one plant are the outputs of another surrogate plant.

PLANTS COVERED

1. Thirteen plants are covered in this document.

The major categories are:

1. Medium duty truck assembly
2. Heavy duty truck assembly
3. Fiberglass body
4. Frame
5. Heavy duty truck braking systems
6. Diesel engine (6-9 liter)
7. Diesel engine (9+ liter)
8. Transmission
9. Rear tandem axle
10. Diesel engine components/accessories
11. Road hauling trailer assembly
12. Trailer chassis/dead axle assemblies
13. Small engine gas and diesel components

PLANT NO. 1
MEDIUM-DUTY TRUCK ASSEMBLY PLANT

NEW MEDIUM-DUTY TRUCK PLANT - ASSUMPTIONS

PRODUCT

- CONVENTIONAL RWD MEDIUM-DUTY TRUCK
10,001 to 26,000 GVW
- CAB-OVER-ENGINE RWD MEDIUM-DUTY TRUCK
10,001 to 26,000 GVW
- CABS ONLY - NO BOXES
- 6 CYLINDER DIESEL AND V-8 GAS AND DIESEL ENGINES
OFFERED. TURBO-CHARGED VERSIONS INCLUDED.
- 6 DIFFERENT TRANSMISSIONS OFFERED
- 4 DIFFERENT FRONT AXLES OFFERED
- 12 DIFFERENT REAR AXLES OFFERED
- POPULAR OPTIONS OTHER THAN ABOVE INCLUDE:
 - Power Steering, Special Braking System, Air Conditioning,
AM-FM Radios, C.B. Radios & Tape Decks, Special Trim,
Special Paint, Etc.

PRODUCTION RATE

- 320 VEHICLES PER DAY (10 UNITS PER HOUR PER LINE)
- 76,800 VEHICLES PER YEAR ON STRAIGHT TIME BASIS
- 89,000 VEHICLES PER YEAR AT MAXIMUM PRACTICAL OVERTIME.

NEW MEDIUM-DUTY TRUCK PLANT - ASSUMPTIONS

OPERATING PATTERN

- STRAIGHT TIME - TWO 8 HOUR SHIFTS - 5 DAYS/WEEK - 240 DAYS/YEAR
- MAXIMUM PRACTICAL OVERTIME - 9TH HOUR DURING WEEK
- AND APPROXIMATELY EVERY OTHER SATURDAY(8 HOURS) 16%

MANUFACTURING

- LAND WILL PERMIT EXPANSION OF MANUFACTURING BUILDING
- PAINT FACILITIES ARE CAPABLE OF HANDLING MULTI-COLOR PAINT JOBS ON EACH CAB.
- AXLES, ENGINES, TRANSMISSIONS, BRAKES, STAMPINGS, FIBERGLASS PARTS, STEERING & SUSPENSION COMPONENTS ARE PRODUCED AT ANOTHER SITE OR PURCHASED AND SHIPPED TO THIS FACILITY.
- FACILITIES ARE PROVIDED TO MODIFY THE ABOVE PRODUCTS TO MEET SPECIAL ORDER REQUIREMENTS.

MEDIUM DUTY TRUCK ASSEMBLY PLANT

<u>LEVEL</u>			
<u>LAND</u>			
	PURCHASE LAND(200 ACRES @\$10,000/ACRE)	\$ 2,000,000	
	SITE DEVELOPMENT	5,000,000	
	SUB TOTAL		\$ 7,000,000
<u>BUILDING & SUPPORT FACILITY</u>			
	ENGINEERING	\$ 4,000,000	
	MANUFACTURING BLDG. (1.48M @ \$55/Sq. Ft.)	81,400,000	
	POWER HOUSE	8,000,000	
	WASTE TREATMENT	3,500,000	
	PAINT MIXING BUILDING	2,500,000	
	TANK FARM	2,000,000	
	OTHER	2,100,000	
	USEFUL LIFE-30 YRS - SUB TOTAL		\$103,500,000 (1980 \$)
		+7%	110,745,000 (1981 \$)
<u>BUILDING FACILITIES</u>			
	ELECTRICAL	\$ 10,000,000	
	RAIL AND CARRIER SHIPPING	5,000,000	
	UNDERGROUND SERVICES (SEWER, WATER, GAS)	4,000,000	
	BUILDING UTILITIES	4,000,000	
	HEATING AND VENTILATION	4,500,000	
	USEFUL LIFE-30 YRS - SUB TOTAL		\$ 27,500,000 (1980 \$)
		+6%	29,150,000 (1981 \$)
<u>PLANT FACILITIES</u>			
	PAINT SHOP	\$75,000,000	
	TOOL ROOM AND MAINTENANCE	4,500,000	
	MATERIAL HANDLING EQUIPMENT	2,500,000	
	AUTOMATIC SUPPLIER PARTS STORAGE	6,000,000	
	OTHER	2,000,000	
	USEFUL LIFE-12 YRS - SUB TOTAL		\$ 90,000,000 (1980 \$)
		+6%	95,400,000 (1981 \$)
<u>MACHINERY & EQUIPMENT</u>			
	PRODUCTION MACHINES & EQUIPMENT	\$ 40,000,000	
	FRAME FABRICATING EQUIPMENT	4,000,000	
	CHASSIS AND FINAL TRIM	5,000,000	
	CONVEYORS	1,500,000	
	MATERIAL HANDLING EQUIPMENT, ETC.	15,500,000	
	CONTAINERS, RACKS AND BINS	3,500,000	
	OTHER	1,000,000	
		3,500,000	
	USEFUL LIFE-12 YRS - SUB TOTAL		\$ 74,000,000 (1980 \$)
		+6%	78,440,000 (1981 \$)
<u>TOOLING</u>			
	2 DIFFERENT CABS	\$ 16,000,000	
		+6%	\$ 16,960,000 (1981 \$)
<u>LEVEL I</u>			
	TOTAL FACILITIES, EQUIPMENT AND TOOLING		\$318,000,000 (1980 \$)
			337,695,000 (1981 \$)
<u>PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%</u>			
			\$ 63,600,000 (1980 \$)
			67,539,000 (1981 \$)
	TOTAL PROGRAM COST		\$381,600,000 (1980 \$)
			405,234,000 (1981 \$)

FACILITIES PLANNING AND PROCESS SUMMARY
(DATA) IS A NOMINAL ESTIMATE

March 1982
Level III

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	WORKING FORCE	LEVEL II	
TRUCK ASSEMBLY										
• FRAME ASSEMBLY & PAINT			80						63/77 (7 0)	
• CHASSIS LINE			200						288/352 (320)	
• FINAL LINE									218/266 (242)	
• FINAL PREP & O.K.			100						189/231 (210)	
• CAB ASSEMBLY & PAINT			408						378/462 (420)	
• TRIM			100						171/209 (190)	
• SUB-ASSEMBLIES			145						360/440 (400)	
• ENGINE DRESS-UP			30						63/77 (70)	
• OTHER			25						115/141 (128)	
• PLANT FACILITIES			388							
• BUILDING AND LAND										
										1,500,000 SQ.FT. TOTAL BUILDINGS

March 1982
Level III

E-16

*Major capital expenditures adjusted for 1981 economics \$337,695,000.

MEDIUM-DUTY TRUCK ASSEMBLY PLANT

AREA (SQ.FT.)

40,000

OFFICE BUILDING

MANUFACTURING BUILDING

1st FLOOR

FRAME ASSEMBLY & PAINT	80,000
CHASSIS & FINAL LINE	200,000
CAB ASSEMBLY	200,000
CAB TRIM (INCLUDING INSTRUMENT PANEL ASSEMBLY)	100,000
TRUCK CONDITIONING & FINAL O.K.	100,000
WHEEL, RIM & TIRE ASSEMBLY	60,000
ENGINE DRESS-UP	30,000
AXLE & BRAKE ASSEMBLY	35,000
SUB-ASSEMBLIES (PROP.SHAFT, FUEL TANK & RADIATOR ASSEMBLIES)	50,000
STORAGE & MATERIAL HANDLING	140,000
PRODUCTION OFFICES & MAINTENANCE SHOPS	80,000
RECEIVING & SHIPPING	110,000
OTHER	15,000
SUB TOTAL	1,200,000

2nd FLOOR

CAB PAINT SHOP	208,000
SMALL PARTS PAINT	58,000
OTHER	10,000
SUB TOTAL	276,000

GRAND TOTAL MANUFACTURING

1,476,000

AUXILIARY (OUTSIDE MAIN BUILDING)

24,000

GRAND TOTAL

1,500,000

MEDIUM DUTY TRUCK ASSEMBLY PLANT

600' 100' (SQ.FT.)

WHEELS, RIMS & TIRES 60,000		CHASSIS LINE #1 200,000		CHASSIS LINE #2 200,000		FRAME ASSEMBLY & PAINTING 80,000	
FINAL LINE #1		FINAL LINE #2		FINAL LINE #3		FINAL LINE #4	
CAB TRIM LINES 100,000		SUB-ASSY. 50,000		ENGINE DRESS-UP 30,000		AXLE & BRAILLE ASSEMBLY 35,000	
TRUCK CONDITIONING & FINAL O.K. 100,000		PRODUCTION OFFICES & MAINTENANCE SHOPS 80,000		CAB ASSEMBLY 200,000		STORAGE & MATERIAL HANDLING SYSTEMS 140,000	
OTHER 15,000		RECEIVING & SHIPPING 110,000					

800'

1,425'

FIRST FLOOR

1,200,000

90 x 350

1 STORY PLUS
PARTIAL 2ND
STORY

CAB PAINT SHOP 208,000		SMALL PARTS PAINT 58,000	
		OTHER 10,000	

300'

SECOND FLOOR

920'

PRODUCTION: 76,800 UNITS PER YEAR

MANPOWER:	240 DAYS	EMPLOYEES	ANNUAL HOURS	HRS/UNIT
- DIRECT LABOR	1920	2,050	3,936,000	51.25
- INDIRECT - HOURLY	1920	725	1,392,000	18.13
- INDIRECT - SALARY	2000	350	700,000	9.11
		<u>3,125</u>	<u>6,028,000</u>	<u>78.49</u>

ANNUAL HOURS ÷ 76,800 UNITS = HOURS PER UNIT = 78.49

WAGE & FRINGE COSTS:

- DIRECT LABOR	\$19.50	x	51.25	=	\$ 999.38
- INDIRECT - HOURLY	\$21.50	x	18.13	=	\$ 389.80
- INDIRECT - SALARY	\$23.50	x	9.11	=	\$ 214.09
	TOTAL WAGES & FRINGE COSTS				
					<u>\$1,603.27</u>

INVESTMENT: (1981\$)

	FACILITIES COST	DEPRECIATION	COST-PER-UNIT
- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS	\$110,745,000	3,691,500	\$48.07
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	\$ 29,150,000	971,666	12.65
- PLANT FACILITIES USEFUL LIFE - 12 YRS	\$ 95,400,000	7,116,666	92.66
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	\$ 78,440,000	6,536,666	85.11
			<u>\$238.49</u>

DEPRECIATION ÷ 76,800 UNITS = TOTAL DEPRECIATION PER UNIT = \$238.49

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST

T & I ESTIMATE OF 3.9% \$1603.27 X 3.9% = \$62.53

OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST

OME ESTIMATE OF 13.2% \$1603.27 X 13.2% = \$211.63

TOTAL WAGE & FRINGE COSTS \$1603.27

TOTAL DEPRECIATION COSTS \$ 238.49

TOTAL TAXES & INSURANCE \$ 62.53

TOTAL OME \$ 211.63

TOTAL \$2115.92

PLANT NO. 2
HEAVY DUTY TRUCK ASSEMBLY PLANT

NEW HEAVY-DUTY TRUCK PLANT - ASSUMPTIONS

PRODUCT

- CONVENTIONAL RWD HEAVY DUTY TRUCK OVER 26,000 GVW
- CAB-OVER-ENGINE RWD HEAVY DUTY TRUCK OVER 26,000 GVW
- ALUMINUM CAB WITH FIBERGLASS HOOD & FENDERS
- 4 x 4 AND 6 x 6 VERSIONS
- 6 CYLINDER DIESEL AND V-8 DIESEL ENGINES OFFERED. TURBO-CHARGED VERSIONS INCLUDED.
- 10 DIFFERENT TRANSMISSIONS OFFERED
- 6 DIFFERENT FRONT AXLES OFFERED
- POPULAR OPTIONS OTHER THAN ABOVE INCLUDE:
POWER STEERING, VARIOUS BRAKING SYSTEMS, AIR CONDITIONING, AM-FM RADIOS,
CB RADIOS & TAPE DECKS, SPECIAL TRIM, SPECIAL PAINT, ETC.

PRODUCTION RATE

- 208 VEHICLES PER DAY (6.5 UNITS PER HOUR PER LINE)
- 50,000 VEHICLES PER YEAR ON STRAIGHT TIME BASIS
- 58,000 VEHICLES PER YEAR AT MAXIMUM PRACTICAL OVERTIME

OPERATING PATTERN

- STRAIGHT TIME - TWO 8 HOUR SHIFTS - 5 DAYS/WEEK - 240 DAYS/YEAR
- MAXIMUM PRACTICAL OVERTIME - 9TH HOUR DURING WEEK AND APPROXIMATELY EVERY OTHER SATURDAY (8 HOURS) 16%

MANUFACTURING

- LAND WILL PERMIT EXPANSION OF MANUFACTURING BUILDING
- PAINT FACILITIES ARE CAPABLE OF HANDLING MULTI-COLOR PAINT JOBS ON BOTH CABS.
- AXLES, ENGINES, TRANSMISSIONS, BRAKES, STAMPINGS, FIBERGLASS PARTS, STEERING AND SUSPENSION COMPONENTS ARE PROVIDED AT ANOTHER SITE OR PURCHASED AND SHIPPED TO THIS FACILITY.
- FACILITIES & EQUIPMENT ARE PROVIDED TO MODIFY THE ABOVE PRODUCTS TO MEET SPECIAL ORDER REQUIREMENTS WHERE REQUIRED.

HEAVY DUTY TRUCK ASSEMBLY PLANT

(NOMINAL ESTIMATE)

<u>LEVEL</u>			
<u>LAND</u>	PURCHASE LAND (200 ACRES @ \$10,000/ACRE) SITE DEVELOPMENT	\$ 2,000,000 5,000,000	
	SUB TOTAL		\$ 7,000,000
<u>BUILDING & SUPPORT FACILITY</u>	ENGINEERING MANUFACTURING BLDG. (1.78M @ \$55/Sq. Ft.) POWER HOUSE 3/150,000 # BOILERS WASTE TREATMENT PAINT MIXING BUILDING TANK FARM OTHER	\$ 5,000,000 98,000,000 10,000,000 4,000,000 3,000,000 2,500,000 2,500,000	
	USEFUL LIFE-30 YRS - SUB TOTAL		\$125,000,000 (1980 \$) 133,750,000 (1981 \$)
<u>BUILDING FACILITIES</u>	ELECTRICAL RAIL AND CARRIER SHIPPING UNDERGROUND SERVICES (SEWER, WATER, GAS) BUILDING UTILITIES (STEAM, AIR, WATER, GAS) HEATING AND VENTILATING	\$ 12,000,000 5,000,000 5,000,000 6,000,000 6,000,000	
	USEFUL LIFE-30 YRS - SUB TOTAL		\$ 34,000,000 (1980 \$) 36,040,000 (1981 \$)
<u>PLANT FACILITIES</u>	PAINT SHOPS TOOL ROOM AND MAINTENANCE MATERIAL HANDLING EQUIPMENT AUTOMATIC SUPPLIER PARTS STORAGE OTHER	\$ 90,000,000 5,000,000 2,500,000 6,000,000 2,500,000	
	USEFUL LIFE-12 YRS - SUB TOTAL		\$105,000,000 (1980 \$) 111,300,000 (1981 \$)
<u>MACHINERY & EQUIPMENT</u>	PRODUCTION MACHINES AND EQUIPMENT FRAME FABRICATING EQUIPMENT CHASSIS AND FINAL TRIM CONVEYORS MATERIAL HANDLING EQUIPMENT, ETC. CONTAINERS, RACKS AND BINS OTHER	\$ 52,000,000 4,000,000 6,000,000 2,000,000 18,000,000 4,000,000 1,000,000 5,000,000	
	USEFUL LIFE-12 YRS - SUB TOTAL		\$ 92,000,000 (1980 \$) 97,520,000 (1981 \$)
<u>TOOLING</u>	TWO DIFFERENT CABS	\$ 20,000,000	
<u>LEVEL I</u>	TOTAL FACILITIES, EQUIPMENT AND TOOLING		\$ 20,000,000
	PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%		\$384,000,000 (1980 \$) 405,610,000 (1981 \$)
			\$ 76,800,000 (1980 \$) 81,122,000 (1981 \$)
	TOTAL PROGRAM COST		\$460,800,000 (1980 \$)

FACILITIES PLANNING AND PROCESS SUMMARY
(DATA) IS A NOMINAL ESTIMATE

Level III

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	WORKING FORCE		
									TOTAL	
TRUCK ASSEMBLY					50					
• FRAME ASSY. & PAINT		100						\$7.2/\$8.8 (\$8.0)	68/84 (76)	
• CHASSIS LINE		250						\$9.0/\$11.0 (\$10.0)	315/385 (350)	
• FINAL LINE								\$10.8/\$13.2 (\$12.0)	256/312 (284)	
• FINAL PREP AND O.K.		150						\$14.4/\$17.6 (\$16.0)	216/264 (240)	
• CAB ASSEMBLY & PAINT		455						\$99.0/121.0 (\$110.0)	414/506 (460)	
• TRIM		125						\$1.8/\$2.2 (\$2.0)	202/246 (224)	
• SUB-ASSEMBLIES		160						\$18.0/\$22.0 (\$20.0)	410/502 (456)	
• ENGINE DRESS-UP		30						\$3.6/\$4.4 (\$4.0)	72/88 (80)	
• OTHER		80						\$18.0/\$22.0 (\$20.0)	162/198 (180)	
• PLANT FACILITIES		433						\$45.0/\$55.0 (\$50.0)		
• BUILDING AND LAND								\$118.5/145.5 (\$132.0)		
		1,793			50			\$345.3/422.7 (\$384.0)*	2115/2585 (2350)	1,813,000SQ.FT TOTAL BUILDINGS
									805/985 (895)	DIRECT LABOR
									365/445 (405)	INDIRECT LABOR
										SALARY
									3,285/ 4,015 (3,650)	TOTALS

*Major capital expenditures adjusted for 1981 economics \$405,610,000.

HEAVY DUTY TRUCK ASSEMBLY PLANT

AREA (SQ.FT.)

<u>OFFICE BUILDING</u>	70,000
<u>MANUFACTURING BUILDING</u>	
<u>1st FLOOR</u>	
FRAME ASSEMBLY & PAINT LINE	100,000
CHASSIS & FINAL LINE	250,000
CAB ASSEMBLY	225,000
CAB TRIM (INCLUDING INSTRUMENT PANEL ASSEMBLY)	125,000
TRUCK CONDITIONING & FINAL OK	150,000
WHEEL, RIM & TIRE ASSEMBLY	60,000
ENGINE DRESS-UP	30,000
AXLE & BRAKE ASSEMBLY	45,000
SUB ASSEMBLIES (PROP SHAFT, FUEL TANK & RADIATOR ASSEMBLIES)	55,000
MAJOR COMPONENTS MODIFICATIONS	50,000
STORAGE & MATERIAL HANDLING	163,000
PRODUCTION OFFICES & MAINTENANCE SHOPS	90,000
RECEIVING AND SHIPPING	110,000
OTHER	18,000
SUB TOTAL	<u>1,471,000</u>

HEAVY DUTY TRUCK ASSEMBLY PLANT

AREA (SQ. FT.)

2nd FLOOR	
CAB PAINT SHOP	230,000
SMALL PARTS PAINT	70,000
OTHER	12,000
SUB TOTAL	<u>312,000</u>
TOTAL MANUFACTURING	1,783,000
AUXILIARY (OUTSIDE MAIN BUILDING)	<u>30,000</u>
GRAND TOTAL	1,813,000

HEAVY DUTY TRUCK ASSEMBLY PLANT

		600'		100'		SQ.FT.	
		WHEELS, RIMS & TIRE ASSEMBLY 60,000					
TRUCK CONDITIONING & FINAL OK 150,000	FINAL LINE #1		CHASSIS LINE #1 250,000		FRAME ASSEMBLY & PAINTING 100,000		STORAGE & MATERIAL HAND- LING SYSTEMS 163,000
	FINAL LINE #2		CHASSIS LINE #2				
	CAB TRIM LINES 125,000	SUB- ASSEMBLIES 55,000	ENGINE DRESS-UP 30,000	AXLE & BRAKE ASSEMBLIES 45,000	MAJOR COMPONENTS MODIFICA- TION 50,000		
		PRODUCTION OFFICES & MAINTENANCE SHOPS 90,000					
	CAB ASSEMBLY 225,000		RECEIVING & SHIPPING 110,000				
OTHER 18,000							

840'

1680'

FIRST FLOOR: 1,471,000

OFFICE BUILDING

90 x 350

2 STORIES

CAB PAINT SHOP

230,000

SMALL
PARTS
PAINT

70,000

HEAVY DUTY TRUCK ASSEMBLY PLANT
TOTAL MANUFACTURING COST
 (EXCLUDING MATERIAL)

<u>PRODUCTION: 50,000 UNITS PER YEAR</u>			
<u>MANPOWER:</u>	<u>240 DAYS</u>	<u>EMPLOYEES</u>	<u>ANNUAL HOURS</u>
- DIRECT LABOR	1920	2350	4,512,000
- INDIRECT - HOURLY	1920	895	1,718,400
- INDIRECT - SALARY	2000	405	810,000
		<u>3650</u>	<u>7,040,400</u>
<u>ANNUAL HOURS ÷ 50,000 UNITS = HRS PER UNIT = 140.81</u>			
<u>WAGE & FRINGE COSTS:</u>			
- DIRECT LABOR	\$19.50	x 90.24	= \$1759.68
- INDIRECT - HOURLY	\$21.50	x 34.37	= 738.96
- INDIRECT - SALARY	\$23.50	x 16.20	= 380.70
	<u>TOTAL WAGES & FRINGE COSTS</u>		<u>\$2879.34</u>
<u>INVESTMENT:</u>	<u>FACILITIES COST</u>	<u>DEPRECIATION</u>	<u>COST-PER-UNIT</u>
- BUILDING & SUPPORT FACILITIES USEFUL LIST - 30 YRS	\$133,750,000	4,458,333	\$ 89.17
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	\$ 36,040,000	1,201,333	24.03
- PLANT FACILITIES USEFUL LIFE - 12 YRS	\$111,300,000	9,275,000	185.50
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	97,520,000	8,126,666	162.53
			<u>\$461.23</u>

DEPRECIATION ÷ 50,000 UNITS = TOTAL DEPRECIATION PER UNIT = \$461.23

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST
 T & I ESTIMATE OF 3.9% \$2879.34 X 3.9% = \$112.29
 OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST
 OME ESTIMATE OF 13.2% \$2879.34 X 3.9% = \$380.07
 TOTAL WAGE & FRINGE COSTS \$2879.34
 TOTAL DEPRECIATION COSTS \$ 461.23
 TOTAL TAXES & INSURANCE \$ 112.29
 TOTAL OME \$ 380.07
 TOTAL \$3832.93

PLANT NO. 3

FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT

NEW FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT
(ASSUMPTIONS)

PRODUCTS

FIBERGLASS PLASTIC PARTS FOR MEDIUM AND HEAVY DUTY TRUCK CABS. THESE CABS ARE CONSTRUCTED OF AN ALUMINUM SHELL AND ALUMINUM SUB-STRUCTURE WITH SEVERAL MAJOR FIBERGLASS REINFORCED PLASTIC PANELS (SMC - SHEET MOLDING COMPOUND). THE TILT - CAB HEAVY DUTY TRUCK CAB IS AN ALL FIBERGLASS UNIT. THE PARTS PRODUCED IN THIS PLANT INCLUDE THE FOLLOWING:

CONVENTIONAL CAB

O HOOD
O FENDERS (R&L)
O INNER FENDERS (R&L)
O OUTER SHROUD
O INNER DOOR PANELS (R&L)
O OUTER DOOR PANELS (R&L)

OTHER

O DRAG FOILER
O BATTERY BOX
O HEATER HOUSING
O ENGINE TUNNEL COVER
O STORAGE ACCESS DOORS (SLEEPER ONLY)

TILT-CAB ASSEMBLY

O INNER DOOR PANELS (R&L)
O OUTER DOOR PANELS (R&L)
O OUTSIDE SURFACE PANELS,
UNDERBODY & STRUCTURAL
PANELS FOR CAB

NEW FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT
(ASSUMPTIONS)

PRODUCTION RATES

- O PLANT SIZED FOR 153,600 EQUIVALENT CABS PER YEAR (640 CABS/DAY)
- O 98,000/YEAR CONVENTIONAL CAB (408/DAY) - 55,600/YEAR TILT CABS (232/DAY)
- O 20,000/YEAR OF THE CONVENTIONAL CABS ARE SLEEPERS
- O 10,000/YEAR OF THE TILT CABS ARE SLEEPERS.

<u>SMC PANELS</u>	<u>DAILY</u>	<u>ANNUAL</u>
O HOOD	408/DAY	98,000/YEAR
O FENDERS (R&L)	408 SETS/DAY	98,000 SETS/YEAR
O INNER FENDERS (R&L)	408 SETS/DAY	98,000 SETS/YEAR
O OUTER SHROUD	408/DAY	98,000 YEAR
O DOORS		
O INNER PANEL (R&L)	640 SETS/DAY	153,600 SETS/YEAR
O OUTER PANEL (R&L)	640 SETS/DAY	153,600 SETS/YEAR
O DRAG FOILER	306/DAY	73,400/YEAR
O BATTERY BOX	306/DAY	73,400/YEAR
O HEATER HOUSING	640/DAY	153,600/YEAR
O STORAGE ACCESS DOORS (R&L)	125 SETS/DAY	30,000 SETS/YEAR

NEW FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT
(ASSUMPTIONS)

O TILT - CAB ASSEMBLIES - 55,600/YEAR	
- COWL PANEL & W/S FRAME	SUB-ASSEMBLY
- SASH PANEL & W/S FRAME	
- ROOF PANEL	SUB-ASSEMBLY
- ROOF INNER PANEL	
- SIDE PANEL	
- DOOR OPENING RE-ENFORCEMENT	SUB-ASSEMBLY
- REAR CAB PANEL	
- FLOOR PAN	

OPERATING PATTERN

NORMAL OPERATING PATTERN - CAB ASSEMBLY

O TWO (8) HOUR SHIFTS PER DAY
 - SMC PRODUCTION
 O THREE (8) HOUR SHIFTS PER DAY
 O 240 DAYS PER YEAR

OVERTIME

O EVERY OTHER SATURDAY 2 - SHIFTS (8 HOURS) - 10%

NEW FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT
(ASSUMPTIONS)

FACILITIES & EQUIPMENT

SHEET MOLDING COMPOUND (SMC) FABRICATION

- O AUTOMATED RAW MATERIAL HANDLING & MIX CONTROL SYSTEM
- O TEMPERATURE & HUMIDITY CONTROLLED MATURATION ROOM

(AVERAGE TIME THREE TO FIVE DAYS.)

MOLDING PRESS

- O CURRENT STATE OF THE ART HYDRAULIC PRESS EQUIPMENT

ASSEMBLY

- O SPECIAL FIXTURES & TOOLING FOR ADHESIVE BONDING OF INNER & OUTER DOOR PANELS, HOOD & FENDER ASSEMBLIES.

- O SPECIAL FIXTURES FOR ASSEMBLY OF TILT CAB FROM FIBERGLASS PANELS

- O HAND TOOLS/SPECIAL FIXTURES FOR ATTACHING MISCELLANEOUS BRACKETS

PAINT

- O AUTOMATIC & MANUAL SPRAY APPLICATION OF PRIMER COAT.

NEW FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT
(NOMINAL ESTIMATE)

		LEVEL I	LEVEL II
<u>LEVEL II</u>			
<u>LAND</u>			
	PURCHASE (40 ACRES @ \$10,000/ACRE)	\$ 400,000	
	SITE DEVELOPMENT	600,000	
	SUBTOTAL		\$ 1,000,000
<u>BUILDING & SUPPORT FACILITIES</u>			
	ENGINEERING	\$ 500,000	
	MANUFACTURING BLDG. (0.230M Sq. Ft. @ \$40/Sq. Ft.)	9,200,000	
	AIR COMPRESSORS & FIRE PROTECTION	1,200,000	
	TANK FARM, WASTE TREATMENT & PACKAGE BOILERS	2,000,000	
	OTHER	2,200,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 15,100,000 (1980 \$)
		+7%	16,157,000 (1981 \$)
<u>BUILDING FACILITIES</u>			
	CRANES, CONVEYORS & SCRAP HANDLING	\$ 1,200,000	
	ELECTRICAL	1,000,000	
	HEATING & VENTILATION (PENTHOUSE-HEATERS)	1,200,000	
	BUILDING UTILITIES (SEWER, WATER & GAS)	1,400,000	
	PARTS PAINT SHOP (PRIMER ONLY)	1,000,000	
	CAB PAINT SHOP (PRIMER ONLY)	4,500,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 10,300,000 (1980 \$)
		+6%	10,918,000 (1981 \$)
<u>PLANT FACILITIES</u>			
	TOOL ROOM & MAINTENANCE	\$ 1,300,000	
	MATERIAL HANDLING EQUIPMENT	1,000,000	
	OTHER	700,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 3,000,000 (1980 \$)
		+6%	3,180,000 (1981 \$)
<u>MACHINERY & EQUIPMENT</u>			
	SMC FABRICATION & HANDLING	\$ 2,000,000	
	MOLDING PRESSES	10,200,000	
	SUBASSEMBLY FIXTURES	800,000	
	CAB ASSEMBLY FIXTURES	2,200,000	
	MATERIAL HANDLING EQUIPMENT, ETC.	800,000	
	CONTAINERS, RACK & BINS	1,500,000	
	OTHER	2,000,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 19,500,000 (1980 \$)
		+6%	20,670,000 (1981 \$)
<u>LEVEL I</u>			
	TOTAL FACILITIES, EQUIPMENT AND TOOLING		\$ 48,900,000 (1980 \$)
			51,925,000 (1981 \$)
	PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%		\$ 9,780,000 (1980 \$)
			10,385,000 (1981 \$)
	TOTAL PROGRAM COST		\$ 58,680,000 (1980 \$)
			62,310,000 (1981 \$)

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DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE	
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II
SMC FABRICATION									
• BLENDING/MIXING		15				\$ 1.8/2.2 (\$2.0)			17/13 (12)
• ROLL ON SHEETING LINE									
• CURE IN TEMP-HUMIDITY CONTROLLED ENVIRONMENT									
LOADING PRESSES		32				\$ 9.2/11.2 (\$10.2)			38/46 (42)
• CUT SMC SHEET TO "BLANK" SIZE									
• PLACE SHEET IN DIE									
• APPLY COATING/LAMINATE AS REQUIRED									
• TRIM AS REQ'D.		10				\$0.7/0.9 (\$0.8)			18/22 (20)
SUB-ASSEMBLY									
• ADHESIVE BOND INNER & OUTER PANELS									
• ATTACH MISC. BRACKETS		6				\$ 0.9/1.1 (\$1.0)			9/11 (10)
PARTS PAINT									
• PREPARE SURFACE									
• APPLY PRIMER									
• CURE IN OVEN		19				\$ 2.0/2.4 (\$2.2)			34/42 (38)
AB ASSEMBLY									
• INSTALL PANELS IN ASSEMBLY FIXTURE									
• DRILL ATTACHING HOLES									

FACILITY TYPE/PRODUCT: FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT

NEW FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT
AREA BREAKDOWN

	<u>SQ. FT.</u>
<u>MANUFACTURING BUILDING</u>	
MATERIAL STORAGE	10,000
SMC MATERIAL PREPARATION (INCLUDING MATURATION)	15,000
MOLDING PRESSES	32,000
SUB-ASSEMBLIES	10,000
PARTS PAINT	6,000
CAB ASSEMBLY	19,000
CAB PAINT	8,000
FINISHED PARTS STORAGE	30,000
TOOL & DIE ROOM	20,000
PRODUCTION OFFICE & MAINTENANCE	24,000
RECEIVING	10,000
SHIPPING	20,000
UTILITIES ROOM (AIR COMPRESSOR, GAS & ELECTRICAL)	10,000
OTHER (REST ROOMS, EATING AREAS, ETC.)	10,000
OPERATIONS OFFICES	10,000
	234,000
SUB-TOTAL	
6 1/2 BAYS @ 60' - 390' x 15 BAYS @ 40' - 600'	
<u>AUXILIARY STRUCTURES</u>	
	10,000
	244,000
GRAND TOTAL	

NEW FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT
(SQ. FT.)

RECEIVING & RAW MATERIAL STORAGE 20,000		SMC MATERIAL PREPARATION 15,000		TOOL & DIE ROOM 20,000	
MOLDING PRESSES 32,000		UTILITIES 10,000		PRODUCTION OFFICE & MAINTENANCE 24,000	
OPERATIONS OFFICES 10,000	SUB-ASSY. 10,000	PARTS PAINT 6,000	CAB ASSEMBLY 19,000		
FINISHED PARTS STORAGE 30,000			CAB PAINT 8,000		
OTHER 10,000	SHIPPING 20,000				

390'

600'

TOTAL AREA 234,000

FIBERGLASS REINFORCED PLASTIC TRUCK PARTS PLANT
TOTAL MANUFACTURING COST
 (EXCLUDING MATERIAL)

PRODUCTION: 153,600 UNITS PER YEAR

MANPOWER:	245 DAYS	EMPLOYEES	ANNUAL HOURS	HRS/UNIT
-	1920	136	261,120	1.70
- INDIRECT - HOURLY	1920	89	170,880	1.11
- INDIRECT - SALARY	2000	25	50,000	0.33
		<u>250</u>	<u>482,000</u>	<u>3.14</u>

ANNUAL HOURS ÷ 153,600 UNITS = HOURS PER UNIT = 3.14

WAGE & FRINGE COSTS:

- DIRECT LABOR	\$19.50	X	1.7	=	\$33.15
- INDIRECT - HOURLY	\$21.50	X	1.11	=	\$23.87
- INDIRECT - SALARY	\$23.50	X	0.33	=	\$ 7.76
	TOTAL WAGE & FRINGE COSTS				<u>\$64.78</u>

INVESTMENT: (1981\$)

- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS	FACILITIES COST	DEPRECIATION	COST-PER-UNIT
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	\$16,157,000	538,566	\$3.51
- PLANT FACILITIES USEFUL LIFE - 12 YRS	\$10,918,000	363,933	\$2.37
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	\$ 3,180,000	265,000	\$1.73
	<u>\$20,670,000</u>	<u>1,722,500</u>	<u>\$11.21</u>
			<u>\$18.82</u>

DEPRECIATION ÷ 153,600 UNITS = TOTAL DEPRECIATION PER UNIT = \$18.82

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST
 T & I ESTIMATE OF 3.9% \$64.78 X 3.9% = \$2.53
 OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST
 OME ESTIMATE OF 13.2% \$64.78 X 13.2% = \$8.55
 TOTAL WAGE & FRINGE COSTS \$64.78
 TOTAL DEPRECIATION COSTS \$18.82
 TOTAL TAXES & INSURANCE \$ 2.53
 TOTAL OME \$ 8.55
 TOTAL \$94.68

PLANT NO. 4
NEW MEDIUM/HEAVY DUTY FRAME COMPONENTS PLANT

NEW MEDIUM/HEAVY DUTY FRAME COMPONENTS PLANT
(ASSUMPTIONS)

PRODUCTS

- o COMPONENTS AND SUB-ASSEMBLIES FOR FULL FRAMES FOR MEDIUM/HEAVY DUTY TRUCKS
 - CAB & CHASSIS WITH SINGLE AXLE
 - CAB & CHASSIS WITH DUAL AXLES
 - TRACTOR WITH DUAL AXLES
- o MISCELLANEOUS HEAVY GAUGE CHASSIS STAMPINGS

PRODUCTION RATES

- o PLANT SIZED FOR 156,800 SETS OF FRAME COMPONENTS ANNUALLY
- o 640 SETS OF FRAME COMPONENTS PER DAY, 2-8 HOUR SHIFTS
- o 40 SETS OF FRAME COMPONENTS PER HOUR
- o AT MAXIMUM PRACTICAL OVERTIME - CAPACITY 172,480 SETS OF FRAME COMPONENTS PER YEAR. (10% OVERTIME)

OPERATING PATTERN

- o STRAIGHT TIME
 - ASSEMBLY OPERATIONS - TWO EIGHT HOUR SHIFTS PER DAY
 - BLANKING, FORMING AND STAMPING OPERATIONS. TWO EIGHT HOUR SHIFTS PER DAY. (THIRD SHIFT LIMITED TO SPOT PRODUCTION, DIE CHANGING AND MAINTENANCE)
- o OVERTIME
 - APPROXIMATELY EVERY OTHER SATURDAY (8 HOURS PER SHIFT) - 9TH HOUR PER SHIFT AVAILABLE FOR SPOT OVERTIME PRODUCTION FOR SHORT PERIODS.

NEW MEDIUM/HEAVY DUTY FRAME COMPONENTS PLANT
(ASSUMPTIONS)

NUMBER OF DAYS AT STRAIGHT TIME

- o 245 DAYS PER YEAR - A MAJOR PRODUCT OR ENGINEERING CHANGE CAN SIGNIFICANTLY REDUCE THE NUMBER OF AVAILABLE PRODUCTION DAYS.

FACILITIES

- o ARE PROVIDED TO PRODUCE THE RAILS, CROSSMEMBERS, BRACKETS, RE-ENFORCEMENT, MISCELLANEOUS STAMPINGS AND SUB-ASSEMBLIES. FOR A MEDIUM/HEAVY DUTY TRUCK FRAME AND ARE SHIPPED TO THE ASSEMBLY PLANT WHERE THE FRAME IS ASSEMBLED. THE EQUIPMENT AND TOOLING IS PLANNED CONSISTENT WITH THE VOLUME LEVEL. SOME PARTS HAVE RELATIVELY HIGH PRODUCTION LEVEL WHILE OTHERS HAVE LOW RATES. MOST OPERATIONS REQUIRE SIMPLE PROCESSES SUCH AS BLANKING, SHEARING, BRAKING, PUNCHING, DRILLING, ETC. A FEW PARTS REQUIRE LARGE PRESSES AND HEAVY GAUGE STAMPING TECHNOLOGY.

NEW MEDIUM/HEAVY DUTY FRAME COMPONENTS PLANT
(NOMINAL ESTIMATE)

		LEVEL I	LEVEL II
<u>LEVEL I</u>			
<u>LAND</u>			
	PURCHASE LAND (50 ACRES @ \$10,000 ACRE)	\$ 500,000	
	SITE DEVELOPMENT	900,000	
	SUBTOTAL		\$ 1,400,000
<u>BUILDING & SUPPORT FACILITIES</u>			
	ENGINEERING	\$ 1,000,000	
	MANUFACTURING BLDG. (0.270M Sq. Ft. @ \$70/Sq. Ft.)	18,900,000	
	AIR COMPRESSORS & FIRE PROTECTION	1,600,000	
	WASTE TREATMENT	3,000,000	
	SCRAP BUILDING	1,000,000	
	OTHER	1,500,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 27,000,000 (1980 \$)
			+7% 28,890,000 (1981 \$)
<u>BUILDING FACILITIES</u>			
	CRANES, CONVEYORS & SCRAP HANDLING	\$ 3,500,000	
	ELECTRICAL (INCLUDING SUB-STATION)	2,200,000	
	HEATING AND VENTILATION (PENTHOUSE HEATERS)	1,300,000	
	BUILDING UTILITIES (SEWER, WATER & GAS)	1,500,000	
	PAINT SHOP	2,000,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 10,500,000 (1980 \$)
			+6% 11,130,000 (1981 \$)
<u>PLANT FACILITIES</u>			
	TOOL & DIE & MAINTENANCE	\$ 3,200,000	
	MATERIAL HANDLING EQUIPMENT	1,500,000	
	OTHER	1,900,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 6,600,000 (1980 \$)
			+6% 6,996,000 (1981 \$)
<u>MACHINERY & EQUIPMENT</u>			
	BLANKERS, SHEARS, BRAKES & PRESSES	\$ 5,000,000	
	MAJOR PRESSES	18,000,000	
	MISCELLANEOUS PRESSES, MACHINES & EQUIPMENT	5,000,000	
	WELDING, RIVETING AND OTHER ASSEMBLY EQUIPMENT	3,000,000	
	CONTAINERS & RACKS	1,500,000	
	OTHER	2,000,000	
	- USEFUL LIFE 12 YRS - SUBTOTAL		\$ 34,500,000 (1980 \$)
			+6% 36,570,000 (1981 \$)
<u>LEVEL I</u>			
	TOTAL FACILITIES, EQUIPMENT AND TOOLING		\$ 80,000,000 (1980 \$)
			84,986,000 (1981 \$)
	PREPRODUCTION AND LAUNCH @ APPROXIMATELY 20%		\$ 16,000,000 (1980 \$)
			16,997,200 (1981 \$)
	TOTAL PROGRAM COST		\$ 96,000,000 (1980 \$)
			101,983,200 (1981 \$)

DEPARTMENT AND PROCESS	MATERIAL	AREA - SQ. FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE	
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II
BLANKING AND FORMING	STEEL	82				\$ 4.5/5.5 (\$5.0)		29/35 (32)	
• BLANKING	ALUMINUM								
• SHEARING									
• ROLLING									
• FORMING									
TAMPING		30				\$16.2/19.8 (\$18.0)		73/85 (81)	
• BLANKING	STEEL								
• DRAWING	ALUMINUM								
• FORMING									
• TRIMMING									
• PUNCHING									
ISC. OTHER		15				\$ 4.5/5.5 (\$5.0)			
• DRILLING	STEEL								
• TAPPING	ALUMINUM								
• FLAME CUTTING									
SUB-ASSEMBLY		20				\$ 2.7/3.3 (\$3.0)		18/22 (20)	
• WELDING									
• RIVETING									
• BOLTING									
PAINT SHOP		20				\$ 1.8/2.2 (\$2.0)		14/18 (16)	
• METAL	STEEL								
• TREATING	ALUMINUM								
• PRIMING									
• PAINTING									
• OTHER									
PLANT FACILITIES						\$ 6.2/7.6 (\$6.9)			
						\$10.5/12.9 (\$11.7)			

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DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	TOTAL		
									LEVEL I	
LAND AND BUILDING										
TOTALS		270					\$25.6/31.2 (\$28.4)		157/193 (175) 164/200 (182) 68/82 (75)	DIRECT INDIRECT LABOR SALARY TOTAL
							\$72.0/\$88.0 (\$80.0) *	389/475 (432)		

*M

MEDIUM/HEAVY DUTY FRAME COMPONENTS PLANTS

<u>MANUFACTURING BUILDING</u>	<u>AREA</u>
BLANKING & FORMING	82,000
STAMPING	30,000
MISCELLANEOUS OTHER	15,000
SUB ASSEMBLY	20,000
PAINT SHOP	20,000
RECEIVING	10,000
RAW STOCK STORAGE	10,000
FINISHED PARTS STORAGE	20,000
SHIPPING	10,000
TOOL & DIE ROOM	10,000
PRODUCTION OFFICES, MAINTENANCE & LABS	12,000
UTILITIES ROOM	10,000
OTHER (REST ROOMS, EATING AREA, ETC.)	9,000
OPERATIONS OFFICE	12,000
7 1/2 BAYS @ 60' - 450' x 15 BAYS @ 40' - 600'	TOTAL 270,000
AUXILIARY	8,000
GRAND TOTAL	278,000

MEDIUM/HEAVY DUTY FRAME COMPONENTS PLANT
(Square Feet)

RECEIVING 10,000	RAW STOCK STORAGE 10,000	BLANKING & FORMING			PAINT SHOP 20,000
STAMPINGS 30,000		82,000			
OPERATIONS OFFICE 12,000		SUB-ASSEMBLY 20,000			FINISHED STOCK STORAGE 20,000
		MISC. OTHER 15,000			
		UTILITIES 10,000			
OTHER 9,000		TOOL & DIE ROOM 10,000			SHIPPING 10,000
		PRODUCTION OFFICES MAINTENANCE 12,000			

450

450'

600'

TOTAL: 270,000 SQUARE FEET

MEDIUM/HEAVY DUTY FRAME COMPONENTS PLANT
TOTAL MANUFACTURING COST
 (EXCLUDING MATERIAL)

PRODUCTION: 156,800 UNITS PER YEAR

<u>MANPOWER:</u>	<u>245 DAYS</u>	<u>EMPLOYEES</u>	<u>ANNUAL HOURS</u>	<u>HRS/UNIT</u>
- DIRECT LABOR	1960	175	343,000	2.19
- INDIRECT - HOURLY	1960	182	356,720	2.28
- INDIRECT - SALARY	2000	75	150,000	0.96
		<u>432</u>	<u>849,720</u>	<u>5.43</u>

ANNUAL HOURS ÷ 156,800 UNITS = HOURS PER UNIT = 5.43

WAGE & FRINGE COSTS:

- DIRECT LABOR	\$19.50	X	2.19	=	\$42.71
- INDIRECT - HOURLY	\$21.50	X	2.28	=	\$49.02
- INDIRECT - SALARY	\$23.50	X	0.96	=	\$22.56
			<u>TOTAL WAGE & FRINGE COSTS</u>		<u>\$114.29</u>

INVESTMENT: (1981\$)

	<u>FACILITIES COST</u>	<u>DEPRECIATION</u>	<u>COST-PER-UNIT</u>
- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS	\$28,890,000	963,000	\$6.14
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	\$11,130,000	371,000	\$2.37
- PLANT FACILITIES USEFUL LIFE - 12 YRS	\$ 6,996,000	583,000	\$3.72
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	\$36,570,000	3,047,500	\$19.44
			<u>\$31.67</u>

DEPRECIATION ÷ 156,800 UNITS = TOTAL DEPRECIATION PER UNIT = \$31.67

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST

T&I ESTIMATE OF 3.9%	\$114.29 X 3.9% = \$4.46
OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST	
OME ESTIMATE OF 13.2%	\$114.29 X 13.2% = \$15.09
TOTAL WAGE & FRINGE COSTS	\$114.29
TOTAL DEPRECIATION COSTS	\$ 31.67
TOTAL TAXES & INSURANCE	\$ 4.46
TOTAL OME	\$ 15.09
TOTAL	<u>\$165.51</u>

PLANT NO. 5

HEAVY DUTY TRUCK BRAKING SYSTEMS

NEW PLANT - HEAVY DUTY TRUCK BRAKING SYSTEMS
ASSUMPTIONS

PRODUCTS

THE FOLLOWING PARTS WOULD BE PRODUCED IN THIS PLANT AT THE VOLUMES SHOWN AND WOULD SUPPORT TRUCK PRODUCTION OF 100,000 SIX WHEEL TRACTORS. 50,000 EQUIPPED WITH HYDRAULIC BRAKES AND 50,000 WITH AIR BRAKES. (A SERVICE ALLOWANCE HAS BEEN INCLUDED)

	<u>ANNUAL VOLUME</u>	<u>DAILY/HOURLY RATES</u>
- HYDRAULIC BRAKES	51,000 VEHICLES SETS	208/13
O WHEEL BRAKES		
O VACUUM SYSTEM		
O BRAKE PEDAL AND LINKAGE		
- AIR BRAKES	51,000 VEHICLE SETS	208/13
O WHEEL BRAKES		
O AIR SYSTEMS		
O VALVING		
O COMPRESSOR & GOVERNOR		
O BRAKE TREADLE AND LINKAGE		
- PARKING BRAKE	102,000 VEHICLE SETS	416/26
O DRIVE SHAFT BRAKE		
O LINKAGE AND HAND BRAKE		

A LIST OF THE MAJOR COMPONENTS AND ASSEMBLIES OF THESE SYSTEMS IS SHOWN ON THE FOLLOWING PAGES AND ARE IDENTIFIED BY THE MANUFACTURING PROCESSES INVOLVED.

NEW - HEAVY DUTY TRUCK BRAKING SYSTEMS ASSUMPTIONS (CONT.)

FACILITIES

- ARE PROVIDED TO PRODUCE THE PRODUCTS LISTED AND THEIR DETAILS.
THE EQUIPMENT AND TOOLING PLANNED FOR THIS OPERATION IS CONSISTENT WITH THE PRODUCTION LEVEL REQUIRED. GENERALLY, AUTOMATED EQUIPMENT IS PROVIDED IN THE HIGHER VOLUME PARTS. TRANSFER MACHINES ARE LIMITED TO THOSE COMPONENTS WHICH WOULD JUSTIFY THIS DEGREE OF SOPHISTICATION SUCH AS WHEEL CYLINDERS;
- SOME COMPRESSOR COMPONENTS WOULD BE PRODUCED ON A TRANSFER LINE EVEN THOUGH THE VOLUME IS RELATIVELY LOW.

SINGLE PURPOSE EQUIPMENT IS THE RULE IN THIS OPERATION PRODUCING A MULTIPLICITY OF PARTS WITH MINIMAL SET-UP TIME AND TOOL CHANGES. TOOL CHANGES IN MANY CASES ARE AUTOMATIC. SCREW MACHINES, MILLS, DRILLING AND BORING MACHINES AND LATHES ARE USED EXTENSIVELY. FURTHER ROLLS, BLANKERS AND SMALL PRESSES ARE USED IN THE STAMPING AND METAL FABRICATION OPERATIONS.

ASSEMBLY OPERATIONS AND TESTING ARE MOSTLY MANUAL OPERATIONS TO MINIMIZE CAPITAL EXPENDITURES CONSISTENT WITH THE PRODUCTION RATES THAT PREVAILS.

OPERATING
PATTERN

- STRAIGHT TIME
TWO EIGHT HOUR SHIFTS
- MAXIMUM PRACTICAL OVERTIME
EVERY OTHER SATURDAY (10%)

NUMBER OF
STRAIGHT
TIME DAYS

- 245 DAYS PER YEAR. NOTE: IN THOSE YEARS WHEN A NEW ENGINE OR A MAJOR CHANGE IS PLANNED, THE NUMBER OF PRODUCTION DAYS PER YEAR MAY BE REDUCED DEPENDING ON THE EXTENT OF THE CHANGE.

NEW PLANT - HEAVY DUTY TRUCK BRAKING SYSTEMS
PRODUCTS, PROCESSES AND PRODUCTION RATES

PART	PROCESS					PIECES/ VEHICLE	PIECES/ YEAR
	FABRI- CATION & WELDING	STAMP- ING	MACH- INING	VALVE MACH, ASSY.& TEST	COMPO- NENT ASSY.& TEST		
HYDRAULIC BRAKES							
-BRAKESHOES & LINING	x				x	12	50,000
-BACKING PLATE		x				6	600,000
-WHEEL CYLINDERS			x		x	12	300,000
-BRAKE DRUM			x			6	600,000
-VACUUM PUMP			x		x	1	300,000
-VACUUM CHAMBER	x	x			x	1	50,000
-POWER CYLINDER			x			1	50,000
-MASTER CYLINDER			x		x	1	50,000
-ADJUSTING MECH.						6	
-BRAKE PEDAL ASSY.	x	x	x		x	1	50,000
-VACUUM CHECK VALVE				x		1	50,000
AIR BRAKES							
-BRAKE SHOES & LINING	x				x	12	50,000
-BACKING PLATE		x				6	600,000
-CAM			x			6	300,000
-CHAMBER BRACKET		x			x	6	300,000
-SLACK ADJUSTER	x		x		x	6	300,000
-SERVICE BRAKE CHAMBER		x			x	2	100,000
-SPRING BRAKE CHAMBER	x				x	4	200,000

NEW PLANT - HEAVY DUTY TRUCK BRAKING SYSTEMS PRODUCTS,
PROCESSES AND PRODUCTION RATES (CONT.)

PART	PROCESS					PIECES/ VEHICLE	PIECES/ YEAR
	FABRI- CATION & WELDING	STAMP- ING	MACH- INING	VALVE MACH., ASSY. & TEST	COMPO- NENT ASSY. & TEST		
- BRAKE DRUM			x			6	300,000
- COMPRESSOR & GOVERNOR			x		x	1	50,000
- SUPPLY RESERVOIR	x					1	50,000
- FRONT RESERVOIR	x					1	50,000
- REAR RESERVOIR	x					1	50,000
- AIR DRYER	x					1	50,000
- AIR COOLER	x					1	50,000
- DUAL APPLICATION VALVE				x		1	50,000
- SINGLE CHECK VALVE				x		2	100,000
- DUAL CHECK VALVE				x		2	100,000
- BRAKE CONTROL VALVE-PARKING				x		1	50,000
- WHEEL LOCK CONTROL MODULATOR				x		2	100,000
- QUICK RELEASE/ DOUBLE CHECK VALVE				x		1	50,000
- QUICK RELEASE VALVE				x		2	100,000
- AUTOMATIC FRONT BRAKE RATIO VALVE				x		1	50,000
- TRACTOR PROTECTION VALVE				x		1	50,000
- SAFETY VALVE				x		1	50,000

NEW PLANT - HEAVY DUTY TRUCK BRAKING SYSTEMS PRODUCTS,
PROCESSES AND PRODUCTION RATES (CONT.)

PART	PROCESS						PIECES/ VEHICLE	PIECES/ YEAR
	FABRI- CATION & WELDING	STAMP- ING	MACH- INING	VALVE MACH., ASSY.& TEST	COMPO- NENT ASSY.& TEST	PURCH- ASED		
-PRESSURE PROTECTION VALVE.				x			1	50,000
AUTOMATIC DRAIN VALVE				x			3	150,000
-AIR SUPPLY VALVE				x			1	50,000
-BRAKE TREADLE ASSY.		x	x	x	x	x	1	50,000
PARKING BRAKES								100,000
-BRAKE SHOE & LINING	x				x	x	2	200,000
-SUPPORT PLATE		x					1	100,000
-CAMSHAFT			x				1	100,000
-CAMSHAFT SUPPORT BRACKET		x					1	100,000
-ACTUATOR LEVER	x						1	100,000
-ADJUSTING MECH.						x	2	
-BELL CRANK	x						1	100,000
-BRAKE DRUM	x						1	100,000
-LINKAGE, CABLE LEVER		x			x		1	100,000

NEW HEAVY DUTY TRUCK BRAKING SYSTEMS PLANT
(NOMINAL ESTIMATE)

<u>LEVEL II</u>			<u>LEVEL I</u>	<u>LEVEL II</u>
<u>LAND</u>				
	PURCHASE LAND (75 ACRES @ \$10,000/ACRE)	\$ 750,000		
	SITE DEVELOPMENT	<u>1,250,000</u>		
	SUB TOTAL		\$ 2,000,000	
<u>BUILDING & SUPPORT FACILITIES</u>				
	ENGINEERING	\$ 1,300,000		
	MANUFACTURING BLDG (0.480M Sq. Ft. @ \$55/Sq. Ft.)	26,400,000		
	AIR COMPRESSORS & FIRE PROTECTION	1,800,000		
	WASTE TREATMENT	1,800,000		
	TANK FARM	1,000,000		
	OTHER	<u>1,500,000</u>		
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 33,800,000 (1980 \$)	
			+7%	36,166,000 (1981 \$)
<u>BUILDING FACILITIES</u>				
	CRANES, CONVEYORS & SCRAP HANDLING			
	ELECTRICAL	\$ 1,800,000		
	HEATING AND VENTILATION (PENTHOUSE HEATERS)	2,500,000		
	BUILDING UTILITIES (SEWER, WATER & GAS)	1,500,000		
		<u>1,700,000</u>		
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 7,500,000 (1980 \$)	
			+6%	7,950,000 (1981 \$)
<u>PLANT FACILITIES</u>				
	TOOL ROOM, CUTTER GRIND AND MAINTENANCE	\$ 3,000,000		
	MATERIAL HANDLING EQUIPMENT	1,400,000		
	OTHER	<u>1,600,000</u>		
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 6,000,000 (1980 \$)	
			+6%	6,360,000 (1981 \$)
<u>MACHINERY & EQUIPMENT PLUS TOOLING</u>				
	FORMING AND WELDING	\$ 3,000,000		
	STAMPING	2,500,000		
	MACHINING	13,000,000		
	VALVE PRODUCTION	3,000,000		
	MISC. FABRICATION	1,000,000		
	ASSEMBLY AND TESTING	3,000,000		
	CONTAINERS AND RACKS	1,500,000		
	OTHER	<u>2,200,000</u>		
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 29,200,000 (1980 \$)	
			+6%	30,952,000 (1981 \$)
<u>LEVEL I</u>	TOTAL FACILITIES, EQUIPMENT AND TOOLING		\$ 78,500,000 (1980 \$)	
			83,428,000 (1981 \$)	
	PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%		\$ 15,700,000 (1980 \$)	
			<u>16,685,600</u> (1981 \$)	
	TOTAL PROGRAM COST		\$ 94,200,000 (1980 \$)	
			\$100,113,600 (1981 \$)	

FACILITIES PLANNING AND PROCESS SUMMARY
(DATA) IS A NOMINAL ESTIMATE (CONT.)

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	
ASSEMBLY & PAINTING OTHER			53						77/95 (86)	
			215			\$ 2.7/\$3.3 (\$3.0)				
						\$ 6.0/\$7.4 (\$6.7)				
PLANT FACILITIES LAND & BUILDING						\$ 9.5/\$11.5 (\$10.5)				
						\$32.2/\$39.4 (\$35.8)				492,000 SQ.FT. TOTAL BUILDINGS
TOTALS										
								324/396 (360)		DIRECT LABOR
								185/225 (205)		INDIRECT LABOR
								103/127 (115)		SALARY
			480							
					102 EQUIVALENT VEHICLES	\$70.6/\$86.4 (\$78.5) *			612/748 (680)	TOTAL

FACILITY TYPE/PRODUCT: HEAVY DUTY TRUCK BRAKING SYSTEMS PLANT

*Major capital expenditures adjusted for 1981 economics \$83,428,000

NEW HEAVY DUTY TRUCK BRAKING SYSTEMS PLANT
PARTS PRODUCTION BY AREA

<u>FORMING & WELDING</u>	60,000 SQ.FT.	<u>MACHINING</u>	75,000 SQ.FT.
Reservoirs & Tanks		Wheel Cylinders	
Brake Shoes		Brake Drums	
Brake Pedal		Vacuum Pump	
Vacuum Chamber		Power Cylinders	
Slack Adjuster		Master Cylinders	
Parking Brake Actuator Lever		Brake Pedal Components	
Parking Brake Bell Crank		Brake Camshafts	
		Slack Adjusters	
		Compressor & Governor	
		Treadle Mounting Plate	
	25,000 SQ.FT.	<u>VALVE PRODUCTION</u>	37,000 SQ.FT.
<u>STAMPING</u>		(Components Machining & Assembly)	
Backing Plates		Vacuum Check Valve	
Vacuum Chamber Housings		Dual Application Valve	
Brake Treadle		Single Check Valve	
Parking Brake Support		Dual Check Valve	
Misc. Brackets & Clips		Brake Control Valve - Parking	
		Wheel Lock Control Modulator	
		Quick Release/Double Check Valve	
		Quick Release Valve	
		Automatic Front Brake Ratio Valve	

NEW HEAVY DUTY TRUCK BRAKING SYSTEMS PLANT
PARTS PRODUCTION BY AREA (CONT.)

VALVE PRODUCTION (Continued)

Tractor Projection Valve
 Safety Valve
 Pressure Protection Valve
 Automatic Drain Valve
 Air Supply Valve

MISCELLANEOUS FABRICATION

15,000 SQ.FT.

Tubing - Hydraulic & Air
 Linkage, Cable & Control Levers
 Fittings - Hydraulic & Air
 Brake Adjusting Mechanisms

ASSEMBLY & TESTING

53,000 SQ.FT.

Brake Shoes & Lining
 Wheel Cylinders
 Vacuum Pump
 Vacuum Chamber
 Master Cylinder
 Brake Pedal
 Slack Adjusters
 Brake Chambers
 Compressor & Governor
 Brake Treadle

NEW HEAVY DUTY TRUCK BRAKING SYSTEMS PLANT
(SQUARE FEET)

	AREA
MANUFACTURING BUILDING	
MACHINERY & EQUIPMENT (INCLUDING AISLE ALLOWANCE)	265,000
FINISHED PARTS STORAGE	30,000
PURCHASE PARTS STORAGE	20,000
SHIPPING & RECEIVING	40,000
TOOL ROOM & CUTTER GRIND	25,000
PRODUCTION OFFICES & MAINTENANCE	35,000
LABS (QUALITY & ENGINEERING)	10,000
UTILITIES ROOM (AIR COMPRESSOR, GAS & ELECTRICAL)	15,000
OTHER (REST ROOMS, EATING AREAS, ETC.)	20,000
OPERATIONS OFFICE	20,000
10 BAYS @ 60' - 600' x 20 BAYS @ 40' - 800'	480,000
AUXILIARY	12,000
	492,000

NEW HEAVY DUTY TRUCK BRAKING SYSTEMS PLANT
(SQUARE FEET)

LABS 10,000		TOOL ROOM & CUTTER GRIND 25,000		MISC. FABRICATION 15,000		STAMPING 25,000		FORMING & WELDING 60,000		PRODUCTION OFFICE & MAINTENANCE 35,000		MACHINING 75,000		FINISHED PARTS STORAGE 30,000		SHIPPING 25,000		RECEIVING 15,000	
OPERATIONS OFFICE 20,000																			

600'

800'

TOTAL AREA: 480,000

HEAVY DUTY TRUCK BRAKING SYSTEMS
TOTAL MANUFACTURING COST
(EXCLUDING MATERIAL)

PRODUCTION: 100,000 UNITS PER YEAR

MANPOWER:	245 DAYS	EMPLOYEE	ANNUAL HOURS	HRS/UNIT
- DIRECT-LABOR	- 1960 -	360	705,600	7.06
- INDIRECT - HOURLY	- 1960 -	205	401,800	4.02
- INDIRECT - SALARY	- 2000 -	115	230,000	2.30
		<u>680</u>		<u>13.38</u>

ANNUAL HOURS ÷ 100,000 UNITS = HOURS PER UNIT = \$13.38

WAGE & FRINGE COSTS

- DIRECT - LABOR	\$19.50	X	7.06	=	\$137.67
- INDIRECT - HOURLY	\$21.50	X	4.02	=	\$ 86.43
- INDIRECT - SALARY	\$23.50	X	2.30	=	\$ 54.05
	TOTAL WAGE & FRINGE COSTS				<u>\$278.15</u>

INVESTMENT: (1981\$)

	FACILITIES COST	DEPRECIATION	COST-PER-UNIT
- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS	\$36,166,000	1,205,533	\$12.06
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	7,950,000	265,000	2.65
- PLANT FACILITIES USEFUL LIFE - 12 YRS	6,360,000	530,000	5.30
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	30,952,000	2,579,333	25.79
			<u>\$45.80</u>

DEPRECIATION ÷ 100,000 UNITS = TOTAL DEPRECIATION PER UNIT = \$45.80

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST

T & I ESTIMATE OF 3.9% \$278.15 X 3.9% = \$10.85

OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST

OME ESTIMATE OF 13.2% \$278.15 X 13.2% = \$36.72

TOTAL WAGE & FRINGE COSTS	\$278.15
TOTAL DEPRECIATION COSTS	\$ 45.80
TOTAL TAXES & INSURANCE	\$ 10.85
TOTAL OME	36.72
TOTAL	<u>\$371.52</u>

PLANT NO. 6
DIESEL ENGINE (6-9 LITER)

NEW V-8 DIESEL ENGINE PLANT

PRODUCT

- V-8 4 CYCLE DIESEL ENGINE
- 6.5 L(396 CU.IN.)
- TWO VERSIONS
 - NATURALLY ASPIRATED
 - TURBO CHARGED

PRODUCTION RATES

- PLANT SIZED FOR 400,000 ENGINES ANNUALLY - STRAIGHT TIME BASIS
 - 200,000 NATURALLY ASPIRATED
 - 200,000 TURBOCHARGED
- 1,632 ENGINES PER DAY
- 102 ENGINE ASSEMBLIES PER HOUR - TWO SHIFT BASIS
- AT MAXIMUM PRACTICAL OVERTIME - CAPACITY
440,000 PER YEAR (10% OVERTIME)

OPERATING PATTERN

- STRAIGHT TIME
 - ASSEMBLY OPERATIONS - TWO 8 HOUR SHIFTS PER DAY
 - MACHINING OPERATIONS - THREE 8 HOUR SHIFTS PER DAY
- OVERTIME
 - APPROXIMATELY EVERY OTHER SATURDAY (8 HOURS PER SHIFT)

NUMBER OF DAYS AT STRAIGHT TIME

- 245 DAYS PER YEAR - NOTE: IN THOSE YEARS WHEN THERE IS A MAJOR CHANGE TO

THE ENGINE, THE NUMBER OF PRODUCTION DAYS PER YEAR MAY BE REDUCED SIGNIFICANTLY.

NEW V-8 DIESEL ENGINE PLANT
(Nomial Estimate)

LEVEL I
LEVEL II

<u>LEVEL II</u>					
<u>LAND</u>					
	PURCHASE LAND (150 ACRES @ \$10,000/ACRE)	\$ 1,500,000			
	SITE DEVELOPMENT	4,500,000			
	SUB TOTAL		\$ 6,500,000		
<u>BUILDING & SUPPORT FACILITIES</u>					
	ENGINEERING	\$ 2,800,000			
	MANUFACTURING BLDG. (1.0M Sq. Ft. @ \$55/Sq. Ft.)	55,000,000			
	POWER HOUSE - BOILERS AND COMPRESSORS	8,000,000			
	WASTE TREATMENT	5,000,000			
	TANK FARM	1,500,000			
	OFFICE BUILDING	3,000,000			
	OTHER	2,700,000			
	- USEFUL LIFE-30 YRS - SUBTOTAL		+7%	\$ 78,000,000 (1980 \$)	
				83,460,000 (1981 \$)	
<u>BUILDING FACILITIES</u>					
	CENTRAL COOLANT SYSTEM	\$ 4,000,000			
	ELECTRICAL	6,000,000			
	HEAT AND VENTILATION	2,500,000			
	UNDERGROUND SERVICES	3,000,000			
	BUILDING UTILITIES	3,000,000			
	- USEFUL LIFE-30 YRS - SUBTOTAL		+6%	\$ 18,500,000 (1980 \$)	
				19,610,000 (1981 \$)	
<u>PLANT FACILITIES</u>					
	TOOL ROOM & CUTTER GRIND	\$ 5,000,000			
	MAINTENANCE SHOPS	3,000,000			
	AUTOMATIC STORAGE SYSTEMS	7,000,000			
	WASHERS	4,000,000			
	MATERIAL HANDLING	2,000,000			
	OTHER	2,000,000			
	- USEFUL LIFE-12 YRS - SUBTOTAL		+6%	\$ 23,000,000 (1980 \$)	
				24,380,000 (1981 \$)	
<u>MACHINERY & EQUIPMENT</u>					
	PRODUCTION EQUIPMENT & PERMANENT TOOLS	\$186,000,000			
	ENGINE ASSEMBLY & TEST EQUIPMENT	26,000,000			
	CONTAINERS & RACKS	3,000,000			
	OTHER	2,500,000			
	- USEFUL LIFE-12 YRS - SUBTOTAL		+6%	\$217,000,000 (1980 \$)	
				230,020,000 (1981 \$)	
<u>LEVEL I</u>	TOTAL FACILITIES, EQUIPMENT AND TOOLING			\$343,000,000 (1980 \$)	
				363,970,000 (1981 \$)	
	PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%			\$ 68,600,000 (1980 \$)	
				72,794,000 (1981 \$)	
	TOTAL PROGRAM COST			\$411,600,000 (1980 \$)	
				436,764,000 (1981 \$)	

FACILITIES PLANNING AND PROCESS SUMMARY

(DATA) IS A NOMINAL ESTIMATE

DEPARTMENT AND PROCESS	MATERIAL	AREA - SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	
V-8 DIESEL ENGINE										
• MACHINING	CAST IRON									
• - BLOCK										
• HEADS	CAST IRON									
• MANIFOLDS	MODULAR IRON & CAST IRON									
• CRANKSHAFT	FORGED STEEL									
• CAMSHAFT	ALLOY IRON									
• PISTONS	FORGED ALUMINUM									
• CONNECTING RODS	FORGED STEEL									
• MISC.										
• MACHINING										
• MISC.										
• SUB-ASSEMBLY										
• ENGINE										
• FINAL ASSEMBLY										
• ENGINE										
• TESTING										
• REPAIR & FINAL O.K.										
• PLANT FACILITIES										
• MATERIAL HANDLING & OTHER										
• LAND & BUILDINGS										

(DATA) IS A NOMINAL ESTIMATE

	FACILITY TYPE/PRODUCT	V-8 DIESEL ENGINE PLANT
*Major capital expenditures adjusted for 1981 economics	\$363,970,000	

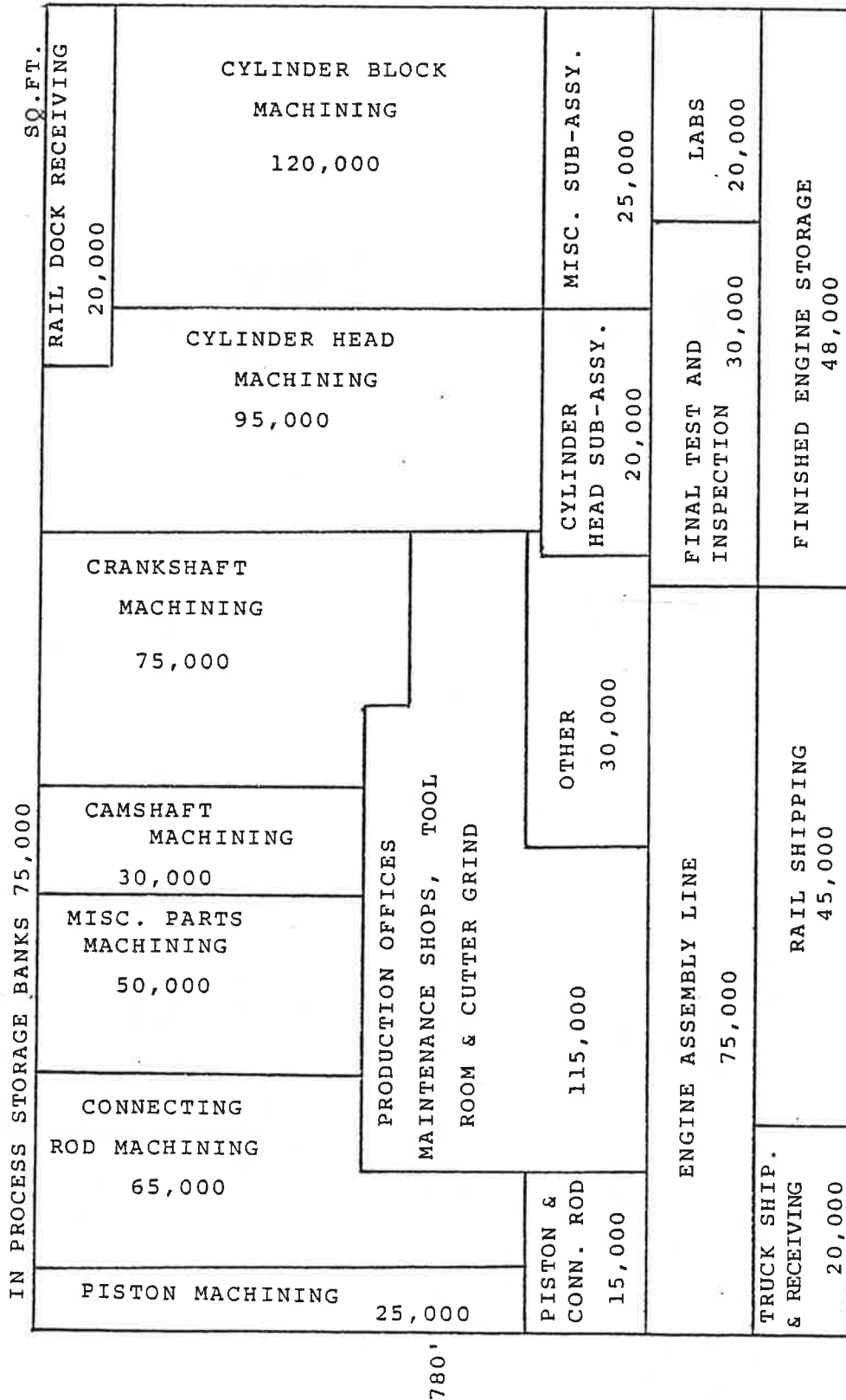
V-8 DIESEL ENGINE AREA BREAKDOWN

(SQ. FT.)

	<u>AREA</u>
OFFICE BUILDING	45,000
MANUFACTURING BUILDING	
MACHINES & EQUIPMENT	673,000
IN PROCESS STORAGE BANKS	75,000
SHIPPING & RECEIVING	85,000
TOOL ROOM & CUTTER GRIND	35,000
PRODUCTION OFFICES & MAINTENANCE SHOPS	80,000
LABS (QUALITY, ENGINEERING & REPAIR)	20,000
OTHER (REST ROOMS, EATING AREAS, ETC.)	30,000
	<u>998,000</u>
GRAND TOTAL MANUFACTURING	
13 BAYS @ 60' - 780' x 32 BAYS @ 40' - 1,280	
AUXILIARY (OUTSIDE MAIN BUILDING)	50,000
	<u>1,093,000</u>

V-8 DIESEL ENGINE PLANT

400,000 ENGINES PER YEAR
1,632 ENGINES PER DAY



TOTAL AREA 998,000

DIESEL ENGINE (6-9 Liter) PLANT
TOTAL MANUFACTURING COST
(EXCLUDING MATERIAL)

PRODUCTION: 400,000 UNITS PER YEAR

<u>MANPOWER:</u>	<u>245 DAYS</u>	<u>EMPLOYEES</u>	<u>ANNUAL HOURS</u>	<u>HRS/UNIT</u>
- DIRECT LABOR	- 1960 -	860	1,685,600	4.21
- INDIRECT - HOURLY	- 1960 -	540	1,058,400	2.65
- INDIRECT - SALARY	- 2000 -	320	640,000	1.60
		<u>1,720</u>	<u>3,384,000</u>	<u>8.46</u>

ANNUAL HOURS ÷ 400,000 UNITS = HRS PER UNIT = 8.46

WAGES & FRINGE COSTS:

- DIRECT LABOR	\$19.50	X	4.21	=	\$82.10
- INDIRECT - HOURLY	\$21.50	X	2.65	=	\$56.98
- INDIRECT - SALARY	\$23.50	X	1.60	=	\$37.60
					<u>\$176.68</u>

TOTAL WAGE & FRINGE COSTS

INVESTMENT: (1981\$)

- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS
- BUILDING FACILITIES USEFUL LIFE - 30 YRS
- PLANT FACILITIES USEFUL LIFE - 12 YRS
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS

<u>FACILITIES COST</u>	<u>DEPRECIATION</u>	<u>COST-PER-UNIT</u>
\$83,460,000	2,782,000	\$ 6.96
\$19,610,000	653,666	1.63
\$24,380,000	2,031,666	5.08
\$230,020,000	19,168,333	47.92
		<u>\$61.59</u>

DEPRECIATION ÷ 400,000 UNITS = TOTAL DEPRECIATION PER UNIT = \$61.59

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST

T & I ESTIMATE OF 3.9% \$176.68 X 3.9% = \$6.89

OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST

OME ESTIMATE OF 13.2% \$176.68 X 13.2% = \$23.32

TOTAL WAGE & FRINGE COSTS	\$176.68
TOTAL DEPRECIATION COSTS	\$ 61.59
TOTAL TAXES & INSURANCE	\$ 6.89
TOTAL OME	\$ 23.32
TOTAL	<u>\$268.48</u>

PLANT NO. 7

V-8 DIESEL ENGINE (OVER 9.0 LITER)

NEW V-8 DIESEL ENGINE (OVER 9.0 LITER) PLANT

ASSUMPTIONS

PRODUCT

- V-8 2 CYCLE DIESEL ENGINE
- 12.0 L (725 cu.in.)
- TWO VERSIONS
 - o NATURALLY ASPIRATED
 - o TURBO-CHARGED

PRODUCTION RATE

- PLANT SIZED FOR 50,000 ENGINES ANNUALLY ON A STRAIGHT TIME BASIS
 - o 25,000 NATURALLY ASPIRATED
 - o 25,000 TURBO-CHARGED
- 200 ENGINES PER DAY
- 12.5 ENGINE ASSEMBLIES PER HOUR - TWO SHIFT BASIS
- AT MAXIMUM PRACTICAL OVERTIME - CAPACITY 55,000 PER YEAR (10% OVERTIME)

OPERATING PATTERN

- STRAIGHT TIME
 - o ASSEMBLY OPERATIONS - TWO 8 HOUR SHIFTS PER DAY
 - o MACHINING OPERATIONS - THREE 8 HOUR SHIFTS PER DAY
- OVERTIME
 - o APPROXIMATELY EVERY OTHER SATURDAY
(8 HOURS PER SHIFT)

NUMBER OF DAYS AT STRAIGHT TIME

- 245 DAYS PER YEAR - NOTE: IN THOSE YEARS WHEN THERE IS A MAJOR CHANGE TO THE ENGINE, THE NUMBER OF PRODUCTIVE DAYS PER YEAR MAY BE REDUCED SIGNIFICANTLY.

NEW V-8 DIESEL ENGINE (9.0+ LITER) PLANT

<u>LEVEL II</u>		<u>LEVEL I</u>	<u>LEVEL II</u>
<u>LAND</u>			
	PURCHASE LAND (75 ACRES @ \$10,000/ACRE)	\$ 750,000	
	SITE DEVELOPMENT	<u>2,250,000</u>	
	SUB TOTAL		\$ 3,000,000
<u>BUILDING & SUPPORT FACILITIES</u>			
	ENGINEERING	\$ 1,200,000	
	MANUFACTURING BLDG (0.43M Sq. Ft. @ \$55/Sq. ft.)	23,650,000	
	AIR COMPRESSORS, FIRE PROTECTION	2,000,000	
	WASTE TREATMENT	2,850,000	
	TANK FARM	500,000	
	OTHER	<u>500,000</u>	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 30,700,000 (1980 \$)
		+7%	<u>32,849,000 (1981 \$)</u>
<u>BUILDING FACILITIES</u>			
	CENTRAL COOLANT SYSTEM	\$ 2,000,000	
	ELECTRICAL	2,500,000	
	HEAT AND VENTILATION (PENTHOUSE-HEATERS)	1,500,000	
	UNDERGROUND SERVICES	1,000,000	
	BUILDING UTILITIES (AIR, WATER & GAS)	<u>800,000</u>	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 7,800,000 (1980 \$)
		+6%	<u>8,268,000 (1981 \$)</u>
<u>PLANT FACILITIES</u>			
	TOOL ROOM & CUTTER GRIND	\$ 4,000,000	
	MAINTENANCE SHOPS	1,500,000	
	AUTOMATIC STORAGE SYSTEM	2,500,000	
	WASHERS	2,000,000	
	MATERIAL HANDLING EQUIPMENT	1,500,000	
	OTHER	<u>1,700,000</u>	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 13,200,000 (1980 \$)
		+6%	<u>13,992,000 (1981 \$)</u>
<u>MACHINERY & EQUIPMENT</u>			
	PRODUCTION EQUIPMENT & PERMANENT TOOLS	\$81,500,000	
	ENGINE ASSEMBLY & TESTING EQUIPMENT	9,000,000	
	CONTAINERS & RACKS	1,500,000	
	OTHER	<u>2,300,000</u>	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 94,300,000 (1980 \$)
		+6%	<u>99,958,000 (1981 \$)</u>
<u>LEVEL I</u>	TOTAL FACILITIES, EQUIPMENT AND TOOLING		\$149,000,000 (1980 \$)
			<u>158,067,000 (1981 \$)</u>
<u>PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%</u>			\$ 29,800,000 (1980 \$)
			<u>31,613,400 (1981 \$)</u>
	TOTAL PROGRAM COST		\$178,800,000 (1980 \$)
			<u>189,680,400 (1981 \$)</u>

FACILITIES PLANNING AND PROCESS SUMMARY
(DATA) IS A NOMINAL ESTIMATE

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	
V-8 DIESEL ENGINE (12.0 LITER) MACHINING					20					
-BLOCK	CAST IRON	38			50				20/24 (22)	
-HEADS	CAST IRON	30			100				15/17 (16)	
-CRANKSHAFT	FORGED STEEL	22			50				15/17 (16)	
-PISTONS CROWN & SKIRT	FORGED STEEL	18			400 SETS				11/13 (12)	
-CONNECTING RODS	FORGED STEEL	18			400 SETS				15/17 (16)	
-CAM SHAFTS	CAST STEEL	10			100				7/9 (8)	
-MANIFOLD	CAST MALLEABLE IRON	5			100				3/5 (4)	
MISC. MACHINING										
-COVERS & HOUSINGS	CAST IRON & ALUMINUM	38			150 to 300				7/9 (8)	
-CYLINDER LINERS	STEEL TUBE				400				7/9 (8)	
-BLOWER MOUNTING	CAST IRON				50				3/5 (4)	
-ACCESSORY MOUNTING	CAST IRON & STEEL STAMPING				150 to 250				5/7 (6)	
-GEARS	CAST IRON & SINTERED IRON				300				9/11 (10)	

V-8 DIESEL ENGINE (OVER 9.0 LITER) AREA BREAKDOWN
(SQUARE FEET)

	AREA
MANUFACTURING BUILDING	
MACHINES AND EQUIPMENT	234,000
IN-PROCESS STORAGE BANKS	20,000
FINISHED ENGINE STORAGE	16,000
SHIPPING & RECEIVING	40,000
PURCHASE PARTS STORAGE	10,000
TOOL ROOM & CUTTER GRIND	25,000
PRODUCTION OFFICES & MAINTENANCE SHOPS	34,000
UTILITIES (AIR COMPRESSOR, GAS & ELECTRICAL)	12,000
LABS (QUALITY, ENGINEERING & REPAIR)	10,000
OPERATIONS OFFICES	16,000
OTHER (REST ROOMS, EATING AREAS, ETC)	15,000
	432,000
9 BAYS @ 60' - 540' x 20 BAYS @ 40' - 800'	
AUXILIARY (OUTSIDE MAIN BUILDING)	10,000
	442,000
GRAND TOTAL	

NEW V-8 DIESEL ENGINE (OVER 9.0 LITER) PLANT
50,000 ENGINES PER YEAR
200 ENGINES/DAY

IN-PROCESS STORAGE BANKS 20,000										(SQUARE FEET)												
OPERATIONS OFFICES 16,000										CONNECTING ROD MACHINING		18,000	CAMSHAFT MACHINING		10,000	CRANKSHAFT MACHINING		22,000	RAIL DOCK RECEIVING		10,000	
										MANIFOLD		5,000	PRODUCTION OFFICE & MAINTENANCE SHOPS 34,000		UTILITIES 12,000		TOOL ROOM 25,000		CYLINDER HEAD MACHINING 30,000		CYLINDER BLOCK MACHINING 38,000	
										PISTON MACHINING		12,000										
										MISCELLANEOUS MACHINING		23,000										
										GEAR MACHINING		15,000	OTHER 15,000		RODS & PISTONS 6,000		CYLINDER HEAD SUB-ASSEMBLIES 10,000		INJECTOR TUBES & MISC ASSYS 5,000			
										PURCHASED PARTS STORAGE		10,000										
										ENGINE ASSEMBLY LINE 30,000		FINAL TEST & INSPECTION 10,000										
										LABS 10,000		TRUCK SHIP & RECEIVING 8,000		RAIL SHIPPING 22,000		FINISHED ENGINE STORAGE 16,000						

540'

800'

FACILITIES PLANNING AND PROCESS SUMMARY
(DATA IS A NOMINAL ESTIMATE (CONT.))

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)			DIRECT LABOR		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	TOTAL	WORKING FORCE				
							LEVEL I	LEVEL II			
OSUR ASSEMBLY - CYLINDER HEAD - CONN. RODS - BUSHINGS - INJECTOR TUBES - MISC. ASSYS. ENGINE FINAL ASSEMBLY ENGINE TESTING SEPARATOR & FUEL OK PLANT FACILITIES		21	100 400 100 50 50			\$ 2.7/\$3.3 (\$3.0)			9/11 (10)		
						\$ 1.8/\$2.2 (\$2.0)			3/5 (4)		
						\$.4/\$.6 (\$.5)			3/5 (4)		
						\$ 5.4/\$6.6 (\$6.0)			62/74 (68)		
						\$ 2.7/\$3.3 (\$3.0)			8/10 (9)		
						\$16.0/\$19.6 (\$17.8)					
OPERATIONAL HAND- LING & OTHER ISLAND & BUILDING		198				\$ 6.3/\$7.7 (\$7.0)					
						\$30.3/\$37.1 (\$33.7)				202/248 (225)	113/137 (125)
TOTAL		432				\$134.0/164.0 *(\$149.0)			382/468 (425)		DIRECT LABOR INDIRECT LABOR SALARY GRAND TOTAL

NEW V-8 DIESEL ENGINE (OVER 9.0 LITER) PLANT

*Major Capital Expenditures Adjusted for 1981 Economics \$158,067,000

V-8 DIESEL ENGINE (9+ LITER) PLANT
TOTAL MANUFACTURING COST
(EXCLUDING MATERIAL)

PRODUCTION: 50,000 UNITS PER YEAR			
<u>MANPOWER:</u>			
	<u>245 DAYS</u>	<u>EMPLOYEES</u>	<u>ANNUAL HOURS</u>
- DIRECT LABOR	- 1960 -	225	441,000
- INDIRECT - HOURLY	- 1960 -	125	245,000
- INDIRECT - SALARY	- 2000 -	75	150,000
		<u>425</u>	<u>836,000</u>
			<u>16.72</u>

ANNUAL HOURS ÷ 50,000 UNITS = HOURS PER UNIT = 16.72

WAGE & FRINGE COSTS

- DIRECT LABOR	\$19.50	X	8.82	=	\$171.99
- INDIRECT - HOURLY	\$21.50	X	4.90	=	105.35
- INDIRECT - SALARY	\$23.50	X	3.00	=	70.84
	TOTAL WAGES & FRINGE COSTS				
					<u>\$347.84</u>

INVESTMENT: (1981\$)

- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS	
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	
- PLANT FACILITIES USEFUL LIFE - 12 YRS	
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	

<u>FACILITIES COST</u>	<u>DEPRECIATION</u>	<u>COST-PER-UNIT</u>
\$32,849,000	1,094,966	\$ 21.99
\$ 8,268,000	275,600	\$ 5.51
\$13,992,000	1,166,000	\$ 23.32
\$99,958,000	8,329,833	\$166.60
		<u>\$217.42</u>

DEPRECIATION ÷ 50,000 UNITS = TOTAL DEPRECIATION PER UNIT = \$217.42

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST

T & I ESTIMATE OF 3.9% \$347.84 X 3.9% = \$13.57

OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST

OME ESTIMATE OF 13.2% \$347.84 X 13.2% = \$45.91

TOTAL WAGE & FRINGE COSTS	\$347.84
TOTAL DEPRECIATION COSTS	\$217.42
TOTAL TAXES & INSURANCE	\$ 13.57
TOTAL OME	\$ 45.91
TOTAL	<u>\$624.74</u>

PLANT NO. 8
MANUAL TRANSMISSION PLANT

NEW MANUAL TRANSMISSION PLANT
FOR MEDIUM & HEAVY TRUCKS

PRODUCT

(10 - 13 SPEED)

- 10-13 SPEED MANUAL TRANSMISSION FOR HEAVY DUTY TRUCKS
- SYNCHRONOUS IN LOW GEAR ONLY
- INTEGRAL CLUTCH HOUSING
- 8 BACK OF BLOCK CONFIGURATIONS
- 14-15½ INCH CLUTCH ASSEMBLIES (PULL TYPE)
- INCLUDES CLUTCH PEDAL AND LINKAGE ASSEMBLIES

PRODUCTION RATES

- PLANT SIZED FOR 137,000 TRANSMISSIONS ANNUALLY
 - o 110,000 10 SPEED
 - o 27,000 13 SPEED
 - o 100,000 14 INCH CLUTCH ASSEMBLIES
 - 37,000 15½ INCH CLUTCH ASSEMBLIES
 - o 137,000 FLYWHEEL & RING GEAR
- 560 TRANSMISSIONS/DAY, 2 8 HOUR SHIFTS
- 35 TRANSMISSIONS/HOUR
- AT MAXIMUM PRACTICAL OVERTIME - CAPACITY 150,000 UNITS PER YEAR

(10% OVERTIME)

OPERATING PATTERN

- STRAIGHT TIME
 - o ASSEMBLY OPERATIONS - TWO 8 HOUR SHIFTS PER DAY
 - o MACHINING OPERATIONS - THREE 8 HOUR SHIFTS PER DAY
- OVERTIME
 - o APPROXIMATELY EVERY OTHER SATURDAY (8 HOURS PER SHIFT)

NEW MANUAL TRANSMISSION PLANT

NUMBER OF DAYS AT STRAIGHT TIME

- 245 DAYS PER YEAR - A MAJOR PRODUCT OR ENGINEERING CHANGE CAN SIGNIFICANTLY REDUCE THE NUMBER OF AVAILABLE PRODUCTION DAYS IN ANY ONE YEAR.

FACILITIES

- ARE PROVIDED TO PRODUCE THE PRODUCTS AND THEIR COMPONENT DETAILS. THE EQUIPMENT AND TOOLING PLANNED IS CONSISTENT WITH THE PLANNED VOLUME. THE HOUSINGS ARE PRODUCED ON TRANSFER LINES OR RELATIVELY SOPHISTICATED EQUIPMENT. GEARS ARE PRODUCED ON STATE-OF-THE-ART MACHINES CONSISTENT WITH GOOD QUALITY. ASSEMBLY & TEST IS MOSTLY A MANUAL-OPERATION WITH SOME MECHANICAL AIDS INCLUDED.

NEW (10-13 SPEED) MANUAL TRANSMISSION PLANT
PRODUCTS, PROCESSES AND PRODUCTION PATES

PART	MACHINING			OTHER PRO- CESSES	ASSEMBLY AND TEST	PUR- CHASED	PIECES/ VEHICLE	P.E.F.S. YEAR
	GEAR CUTTING	TRANSFER MACHINES	SCREW MACHINES					
SHIFT BAR HOUSING								
HOUSING		x			x		1	197,000
SHIFT BAR			x				3	411,000
SHIFT YOKE				x			3	411,000
SHIFT BLOCK				x			3	411,000
ACTUATING PLUNGER							3	411,000
SPRING			x				1	197,000
BALLS						x		
OTHER						x		
REAR SHIFT LEVER HOUSING						x		
HOUSING		x			x		1	197,000
LEVER				x			1	197,000
SPADE PIN				x			1	197,000
BOOT								
SHIFT KNOB						x		
ELECTOR VALVES						x		
BODY								
TOP PLATE				x			1	197,000
CONTROL BUTTON								
CONTROL VALVE				x			1	197,000
HOUSING REAR								
HOUSING FRONT				x			1	197,000
SLIDE				x			1	197,000
CONTROL BUTTON								
						x	1	197,000

NEW (10-13 SPEED) MANUAL TRANSMISSION PLANT
PRODUCTS, PROCESSES AND PRODUCTION RATES

PART	MACHINING			OTHER PRO- CESSES	ASSEMBLY AND TEST	PUR- CHASED	PIECES/ VEHICLE	PIECES/ YEAR
	GEAR CUTTING	TRANSFER MACHINES	SCREW MACHINES					
SLAVE VALVE					x		1	137,000
HOUSING				x			1	137,000
ADAPTER PLATE				x			1	137,000
PISTON			x				1	137,000
CAPS			x				2	137,000
ACTUATOR PLUNGER			x				1	137,000
ALIGNMENT SLEEVE			x				1	137,000
FILTER/REGULATOR ASSEMBLY					x		1	137,000
HOUSING				x			1	137,000
BRACKET				x			1	137,000
REGULATOR			x				1	137,000
AIR SUPPLY FITTING					x		1	137,000
HOUSINGS								
FRONT HOUSING		x					1	137,000
AUXILIARY HOUSING		x					1	137,000
CLUTCH HOUSING (ALUM.)		x					1	137,000
SHAFTS								
OUTPUT				x			1	137,000
MAIN				x			1	137,000
COUNTER (WITH INTEGRAL GEARS)	x			x			2	137,000
IDLER				x			2	137,000

NEW (10-13 SPEED) MANUAL TRANSMISSION PLANT
PRODUCTS, PROCESSES AND PRODUCTION RATES

PART	MACHINING			OTHER PRO- CESSES	ASSEMBLY AND TEST	PUR- CHASED	PIECES/ VEHICLE	PRICE PER YEAR
	GEAR CUTTING	TRANSFER MACHINES	SCREW MACHINES					
GEARS								
MAINSHAFT								
o LOW	x						1	137,000
o 1st SPEED	x						1	137,000
o 2nd SPEED	x						1	137,000
o 3rd SPEED	x						1	137,000
o REVERSE	x						1	137,000
COUNTER SHAFT								
o DRIVE	x						2	137,000
o 2nd GEAR	x						2	137,000
o 3rd GEAR	x						2	137,000
o 4th GEAR	x						2	137,000
P.T.O	x						2	137,000
OTHER								
o LOW SPEED (OUTPUT)	x						1	137,000
o DRIVE (MAINSHAFT)	x						1	137,000
o REVERSE IDLER	x						2	137,000
MISCELLANEOUS								
SYNCHRONIZER ASSEMBLY					x		1	137,000
o DIRECT RING	x						1	137,000
o SLIDING CLUTCH							1	137,000
SPACERS			x				6	137,000
SLIDING CLUTCH			x				3	137,000
BEARING RETAINER				x				137,000

NEW (10-13 SPEED) MANUAL TRANSMISSION PLANT

PRODUCTS, PROCESSES AND PRODUCTION RATES

PART	MACHINING			OTHER PRO- CESSES	ASSEMBLY AND TEST	PUR- CHASED	PIECES/ VEHICLE	PIECES/ YEAR
	GEAR CUTTING	TRANSFER MACHINES	SCREW MACHINES					
CLUTCH								
CLUTCH HOUSING		x			x		1	137,000
FLYWHEEL HOUSING		x						137,000
DRIVEN DISC				x	x			137,000
DRIVE PLATE				x				137,000
PRESSURE PLATE				x				137,000
FLYWHEEL RING				x			1	137,000
RELEASE YOKE				x			1	137,000
GROSS SHAFT				x			1	137,000
RELEASE SLEEVE RETAINER				x				137,000
RELEASE BEARING ASSEMBLY				x	x		1	137,000
MAIN DRIVE GEAR				x			1	137,000
CLUTCH PEDAL & LINKAGE					x			
PEDAL				x			1	137,000
BRACKET				x			1	137,000
LEVERS				x			2	274,000
LINKS				x			2	274,000
OTHER				x		x		

NEW (10-13 SPEED) MANUAL TRANSMISSION PLANT
(NOMINAL ESTIMATE)

LEVEL I
LEVEL II

<u>LEVEL II</u>			
<u>LAND</u>			
	PURCHASE LAND (75 ACRES @ \$10,000/ACRE)	\$ 750,000	
	SITE DEVELOPMENT	1,250,000	
	SUBTOTAL		\$ 2,000,000
<u>BUILDING & SUPPORT FACILITIES</u>			
	ENGINEERING	\$ 1,300,000	
	MANUFACTURING BLDG. (0.480M Sq. Ft. @ \$55/Sq. Ft.)	26,400,000	
	POWERHOUSE - BOILERS & COMPRESSORS	6,000,000	
	WASTE TREATMENT	3,500,000	
	TANK FARM	1,000,000	
	OTHER (INCLUDING OFFICE)	2,300,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 40,500,000 (1980 \$)
		+7%	43,335,000 (1981 \$)
<u>BUILDING FACILITIES</u>			
	CENTRAL COOLANT SYSTEM	\$ 2,500,000	
	ELECTRICAL	3,500,000	
	HEAT AND VENTILATION	2,200,000	
	HEAT TREAT EQUIPMENT	4,000,000	
	UNDERGROUND SERVICES	1,800,000	
	BUILDING UTILITIES	2,000,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 16,000,000 (1980 \$)
		+6%	16,960,000 (1981 \$)
<u>PLANT FACILITIES</u>			
	TOOL ROOM CUTTER GRIND & MAINTENANCE	\$ 4,700,000	
	AUTOMATIC STORAGE SYSTEM	3,000,000	
	MATERIAL HANDLING EQUIPMENT	2,500,000	
	WASHERS	2,800,000	
	OTHER	2,000,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 15,000,000 (1980 \$)
		+6%	15,900,000 (1981 \$)
<u>MACHINERY & EQUIPMENT</u>			
	TRANSFER LINES	\$ 12,000,000	
	GEAR MACHINING (CUTTING)	20,000,000	
	SCREW MACHINES	4,000,000	
	SHAFT MACHINING	5,000,000	
	OTHER PROCESSES	7,000,000	
	TRANSMISSION ASSEMBLY AND TEST	4,000,000	
	CLUTCH FLYWHEEL & SHIFT LINKAGE	6,000,000	
	CONTAINERS & RACKS	2,100,000	
	OTHER	1,900,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 62,000,000 (1980 \$)
		+6%	65,720,000 (1981 \$)
<u>LEVEL I</u>			
	TOTAL FACILITIES, EQUIPMENT AND TOOLING		\$135,500,000 (1980 \$)
			143,915,000 (1981 \$)
	PREPRODUCTION AND LAUNCH @ APPROXIMATELY 20%		\$ 27,100,000 (1980 \$)
			28,783,000 (1981 \$)
	TOTAL PROGRAM COST		\$162,600,000 (1980 \$)
			172,698,000 (1981 \$)

FACILITIES PLANNING AND PROGRESS SUMMARY
(DATA) IS A NOMINAL ESTIMATE

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE	
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II
MANUAL TRANSMISSION (10-13 SPEED)									
o MACHINING		50				\$10.8/\$13.2 (\$12.0)		52/64 (58)	
-HOUSINGS		25				\$4.5/\$5.5 (\$5.0)		23/29 (26)	
-SHAFTS		68				\$14.0/\$22.0 (\$20.0)		100/110 (113)	
-GEARS		25				\$3.6/\$4.4 (\$4.0)			
-SCREW MACHINE PARTS		15				\$3.8/\$4.6 (\$4.2)			
-FLYWHEEL, RING GEAR & CLUTCH		15				\$4.9/\$6.1 (\$5.5)		36/40 (30)	
-MISCELLANEOUS		10				\$1.4/\$1.6 (\$1.5)		29/35 (32)	
o STAMPING & OTHER PROCESSES									
-CLUTCH DISCS									
-COVERS									
-BRACKETS									
o HEAT TREAT		40				\$3.6/\$4.4 (\$4.0)		29/35 (32)	
-GEARS	ANNEAL, CARBURIZING & INDUCTION HARDENING								
-SHAFTS									
-RINGS									
o TRANSMISSION ASSY. & TEST		55				\$3.6/\$4.4 (\$4.0)		162/198 (180)	
o CLUTCH ASSEMBLY		6				\$0.7/\$0.9 (\$0.8)		29/35 (32)	
o SHIFT LINKAGE & CLUTCH PEDAL ASSY.		4				\$0.9/\$1.1 (\$1.0)		14/18 (16)	
o PLANT FACILITIES		167				\$20.3/\$24.7 (\$22.5)			

FACILITY TYPE/PRODUCT: 10-13 SPEED MANUAL TRANSMISSION PLANT

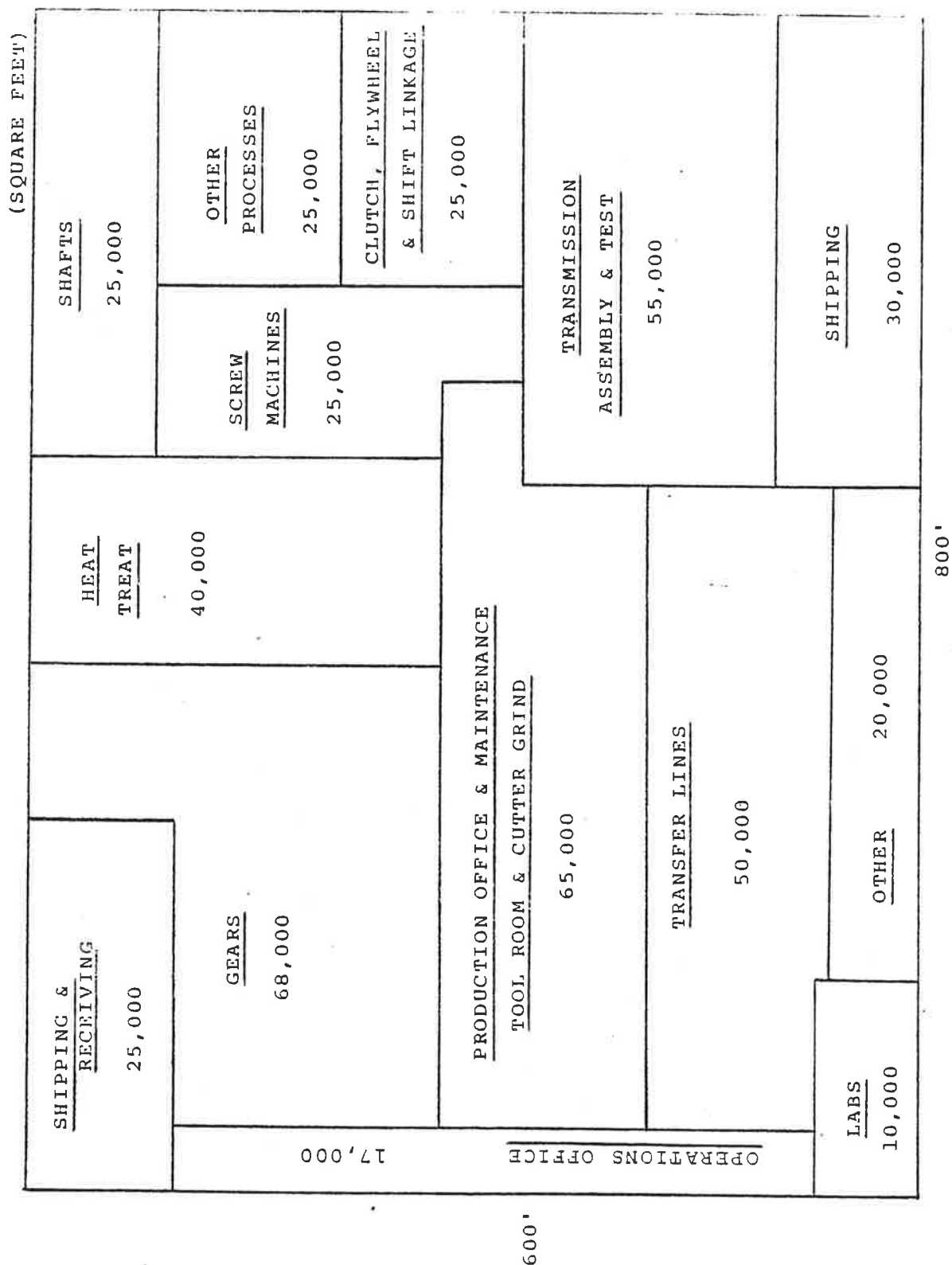
NEW (10-13 SPEED) MANUAL TRANSMISSION PLANT

<u>MANUFACTURING BUILDING</u>	<u>AREA</u>
MACHINE & EQUIPMENT (INCLUDING AISLE ALLOWANCE)	
TRANSFER LINES (HOUSINGS)	50,000
SHAFTS	25,000
GEARS	68,000
SCREW MACHINE PARTS	25,000
OTHER PROCESSES	25,000
CLUTCH, FLYWHEEL, SHIFT & CLUTCH LINKAGE	25,000
TRANSMISSION ASSEMBLY & TEST	55,000
HEAT TREAT	40,000
RECEIVING AND SHIPPING	55,000
TOOL ROOM AND CUTTER GRIND	25,000
PRODUCTION OFFICE AND MAINTENANCE	40,000
LABORATORY	10,000
OTHER	20,000
OPERATIONS OFFICES	17,000
10 HAYS @ 60' - 600 x 20 BAYS @ 40' - 800	480,000
AUXILIARY	25,000
GRAND TOTAL	505,000

NEW (10-13 SPEED) MANUAL TRANSMISSION PLANT

137,000 UNITS PER YEAR

560 UNITS PER DAY



MANUAL TRANSMISSION PLANT
TOTAL MANUFACTURING COST
(EXCLUDING MATERIAL)

PRODUCTION: 137,000 UNITS PER YEAR

<u>MANPOWER:</u>	<u>245 DAYS</u>	<u>EMPLOYEES</u>	<u>ANNUAL HOURS</u>	<u>HRS/UNIT</u>
- DIRECT LABOR	1960	600	1,176,000	8.58
- INDIRECT - HOURLY	1960	360	705,600	5.15
- INDIRECT - SALARY	2000	230	460,000	3.36
		<u>1190</u>	<u>2,341,600</u>	<u>17.09</u>

ANNUAL HOURS ÷ 137,000 UNITS = HOURS PER UNIT = 17.9

WAGE & FRINGE COSTS:

- DIRECT LABOR	\$19.50	X	8.58	= \$167.31
- INDIRECT - HOURLY	\$21.50	X	5.15	= \$110.73
- INDIRECT - SALARY	\$23.50	X	3.36	= \$ 78.96
	TOTAL WAGE & FRINGE COSTS = \$357.09			

INVESTMENT: (1981\$)

	<u>FACILITIES COST</u>	<u>DEPRECIATION</u>	<u>COST-PER-UNIT</u>
- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS	\$43,335,000	1,444,500	\$10.54
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	\$16,960,000	565,333	4.13
- PLANT FACILITIES USEFUL LIFE - 12 YRS	\$15,900,000	1,325,000	9.67
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	\$65,720,000	5,476,666	39.98
			<u>\$64.32</u>

DEPRECIATION ÷ 137,000 UNITS = TOTAL DEPRECIATION PER UNIT = \$64.32

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST
T & I ESTIMATE OF 3.9% \$357.00 X 3.9% = \$13.92
OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST
OME ESTIMATE OF 13.2% \$357.00 X 13.2% = \$47.12
TOTAL WAGE & FRINGE COSTS \$357.00
TOTAL DEPRECIATION COSTS \$ 64.32
TOTAL TAXES & INSURANCE \$ 13.92
TOTAL OME \$ 47.12
TOTAL \$482.36

PLANT NO. 9

REAR/TANDEM AXLE

NEW REAR/TANDEM AXLE PLANT
ASSUMPTIONS

PRODUCT

- REAR/TANDEM AXLE

- o FORWARD TANDEM AXLE
- o REARWARD TANDEM AXLE
- o BRAKE ASSEMBLIES (INSTALLATION ONLY)
- o EQUALIZING BEAMS
- o TORQUE RODS
- o SPRING SADDLES
- o WHEEL SPIDER, CAMSHAFT & DUSTSHIELD
- o AIR SHIFT SYSTEM

PRODUCTION RATE

- STRAIGHT TIME RATES

	<u>HOURLY</u>	<u>DAILY</u>	<u>ANNUAL</u>
34,000 POUND AXLES	12.5	200	50,000
44,000 POUND AXLES	12.5	200	50,000

OPERATING PATTERN

	<u>ASSEMBLY</u>	<u>MACHINING</u>
- STRAIGHT TIME	TWO SHIFTS	THREE SHIFTS
	16 HOURS/DAY	20 HOURS/DAY
	245 DAYS/YEAR	
- OVERTIME 10%	ALTERNATE SATURDAYS	

NEW REAR/TANDEM AXLE PLANT
ASSUMPTIONS (CONT.)

NUMBER OF STRAIGHT TIME DAYS

- 245 DAYS PER YEAR - MAJOR PRODUCT OR ENGINEERING CHANGES CAN SIGNIFICANTLY REDUCE THE NUMBER OF DAYS.

FACILITIES

- ARE PROVIDED TO PRODUCE THE PRODUCTS AND THEIR COMPONENT DETAILS. THE EQUIPMENT AND TOOLING PLANNED FOR THIS OPERATION IS CONSISTENT WITH THE PRODUCTION LEVEL REQUIRED. SOME COMPONENTS WOULD BE PRODUCED ON A TRANSFER LINE OR OTHER RELATIVELY SOPHISTICATED EQUIPMENT EVEN THOUGH THE VOLUME IS RELATIVELY LOW.

NEW REAR/TANDEM AXLE PLANT PRODUCTS,
PROCESSES AND PRODUCTION RATES

PART	MACHINING GEAR CUTTING	MACHINING OTHER	FABRICATION & WELDING	STAMPING	ASSEMBLY & TEST	PUR- CHASED	PIECES/ VEHICLE	PIECES/ YEAR
FORWARD TANDEM AXLE UNIT								
CARRIER HOUSING		X			X		1	100,000
INTER-AXLE DIFF. CASE		X					1	100,000
AXLE DIFF. CASE		X					1	100,000
BEARING CAGE		X					1	100,000
INPUT SHAFT		X					1	100,000
THROUGH SHAFT		X					1	100,000
INTER AXLE DIFF. SPIDER		X					1	100,000
DRIVE DIFF. SHAFT		X					1	100,000
INPUT YOKE		X					1	100,000
OUTPUT YOKE		X					1	100,000
AXLE HOUSING			X				1	100,000
AXLE BRACKET			X	X			2	200,000
AXLE FLANGE		X	X				2	200,000
HOUSING COVER				X			1	100,000
AXLE SHAFT & FLANGE		X					2	200,000
RETAINER		X					2	200,000
HELICAL DRIVE GEAR	X						1	100,000
HELICAL DRIVEN GEAR	X						1	100,000
DRIVE PINION	X						1	100,000
RING GEAR	X						1	100,000
INTERAXLE DIFFERENTIAL								
- SIDE GEARS	X						2	200,000
- PINION GEARS	X						2	200,000

NEW REAR/TANDEM AXLE PLANT PRODUCTS,
PROCESSES AND PRODUCTION RATES (CONT.)

PART	MACHINING		FABRICATION & WELDING	STAMPING	ASSEMBLY & TEST	PUR- CHASED	PIECES/ VEHICLE	PIECES/ YEAR
	GEAR CUTTING	OTHER						
DRIVE DIFFERENTIAL								
- SIDE GEARS	X						2	200,000
- PINION GEARS	X						2	200,000
INTERAXLE CLUTCH COLLAR		X					1	100,000
SHIFT FORK		X					1	100,000
SHIFT SHAFT		X					1	100,000
INTERAXLE DIFFERENTIAL SHIFT COLLAR								
OIL FILTER ADAPTER		X					1	100,000
INTERAXLE DIFF. SHIFT UNIT							1	100,000
OIL FILTER & PUMP					X		1	100,000
BRAKE DUST SHIELD					X		1	100,000
WHEEL SPIDER		X		X			2	200,000
							2	200,000

NEW REAR/TANDEM AXLE PLANT
PRODUCTS, PROCESSES AND PRODUCTION RATES

PART	MACHINING		FABRICATION & WELDING	STAMPING	ASSEMBLY & TEST	PUR- CHASED	PIECES/ VEHICLE	PIECES/ YEAR
	GEAR CUTTING	OTHER						
REARWARD TANDEM AXLE UNIT					X			
DIFFERENTIAL CASE		X					1	100,000
DRIVE PINION	X						1	100,000
RING GEAR	X						1	100,000
DIFFERENTIAL SIDE GEARS	X						2	200,000
DIFFERENTIAL PINIONS	X						2	200,000
DIFFERENTIAL SHAFT		X					1	100,000
CAPS		X					1	100,000
YOKE		X					1	100,000
AXLE HOUSING			X				1	100,000
AXLE BRACKET			X	X			1	100,000
AXLE FLANGE			X				1	100,000
HOUSING COVER		X		X			1	100,000
BRAKE DUST SHIELD				X			1	100,000
AXLE SHAFT & FLANGE				X			1	100,000
WHEEL SPIDER		X						
SUSPENSION COMPONENTS								
EQUALIZER BEAM		X					2	200,000
SADDLE & CAPS		X					2	200,000
SPRING BRACKET				X			4	400,000
TORQUE ROD		X					2	200,000
AXLE BUMPER				X			4	400,000
TORQUE ROD BRACKET		X					4	400,000

NEW REAR/TANDEM AXLE PLANT

PARTS PRODUCTION BY AREA

GEAR PRODUCTION	43,000	MACHINING	45,000
- FORWARD TANDEM AXLE UNIT		- FORWARD TANDEM AXLE UNIT	
o HELICAL DRIVE GEAR		o CARRIER HOUSING	
o HELICAL DRIVEN GEAR		o ADAPTOR CASE	
o DRIVE PINION		o INTER-AXLE DIFFERENTIAL CASE	
o RING GEAR		o AXLE DIFFERENTIAL CASE	
o INTER-AXLE DIFFERENTIAL		o BEARING CAGE	
SIDE GEARS		o INPUT SHAFT	
PINION GEARS		o THROUGH SHAFT	
o DRIVE DIFFERENTIAL		o INTER-AXLE DIFFERENTIAL SPIDER	
SIDE GEARS		o DRIVE DIFFERENTIAL SHAFT	
PINION GEARS		o INPUT YOKE	
- REARWARD TANDEM AXLE UNIT		o OUTPUT YOKE	
o DRIVE PINION		o AXLE FLANGE	
o RING GEAR		o AXLE SHAFT & FLANGE	
o DIFFERNETIAL		o RETAINER	
SIDE GEARS		o INTER-AXLE CLUTCH COLLAR	
PINION GEARS		o SHIFT FORK	
		o SHIFT SHAFT	
		o OIL FILTER ADAPTER	
		- REARWARD TANDEM AXLE UNIT	
		o DIFFERENTIAL CASE	
		o DIFFERENTIAL SHAFT	
		o CAPS	
		o YOKE	
		o AXLE FLANGE	
		o AXLE SHAFT & FLANGE	

PARTS PRODUCTION BY AREA

<u>MACHINING</u> (Continued)	<u>ASSEMBLY & TESTING</u>	32,000
- SUSPENSION COMPONENTS	- FORWARD TANDEM AXLE UNIT	
o EQUALIZER BEAM	- REARWARD TANDEM AXLE UNIT	
o SADDLE & CAPS	- SUB-ASSEMBLIES	
o TORQUE ROD	o INTER AXLE DIFFERENTIAL	
o TORQUE ROD BRACKET	o DRIVE AXLE DIFFERENTIAL	
- MISCELLANEOUS MACHINING	o REARWARD AXLE DIFFERENTIAL	
<u>FABRICATION & WELDING</u>	<u>STAMPING</u>	8,000
- FORWARD TANDEM AXLE UNIT	- FORWARD TANDEM AXLE UNIT	
o AXLE HOUSING	o AXLE BRACKET	
o AXLE BRACKET	o HOUSING COVER	
o AXLE FLANGE	- REARWARD TANDEM AXLE UNIT	
- REARWARD TANDEM AXLE UNIT	o AXLE BRACKET	
o AXLE HOUSING	o HOUSING COVER	
o AXLE BRACKET	- SUSPENSION COMPONENTS	
o AXLE FLANGE	o SPRING BRACKET	
	o AXLE BUMPER	
	- MISCELLANEOUS STAMPINGS	

NEW REAR/TANDEM AXLE PLANT
(NOMINAL ESTIMATE)

<u>LEVEL II</u>		<u>LEVEL I</u>	<u>LEVEL II</u>
<u>LAND</u>			
	PURCHASE LAND (50 ACRES @ \$10,000/ACRE)	\$ 500,000	
	SITE DEVELOPMENT	1,000,000	
	SUB TOTAL		\$ 1,500,000
<u>BUILDING & SUPPORT FACILITIES</u>			
	ENGINEERING	1,000,000	
	MANUFACTURING BLDG (0.367M Sq. Ft. @ \$55/Sq. Ft.)	\$20,200,000	
	AIR COMPRESSORS & FIRE PROTECTION	1,600,000	
	WASTE TREATMENT	1,800,000	
	TANK FARM	1,000,000	
	OTHER	1,400,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 27,000,000 (1980 \$)
		+7%	28,890,000 (1981 \$)
<u>BUILDING FACILITIES</u>			
	CRANES, CONVEYORS & SCRAP HANDLING	\$ 1,500,000	
	ELECTRICAL	2,200,000	
	HEATING AND VENTILATION (PENTHOUSE HEATERS)	1,200,000	
	BUILDING UTILITIES (SEWER, WATER & GAS)	1,300,000	
	HEAT TREATMENT	3,800,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 10,000,000 (1980 \$)
		+6%	10,600,000 (1981 \$)
<u>PLANT FACILITIES</u>			
	TOOL ROOM, CUTTER GRIND & MAINTENANCE	\$ 3,000,000	
	WASHERS	1,500,000	
	MATERIAL HANDLING	1,500,000	
	OTHER	1,500,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 7,500,000 (1980 \$)
		+6%	7,950,000 (1981 \$)
<u>MACHINERY & EQUIPMENT</u>			
	GEAR PRODUCTION	\$10,000,000	
	MACHINING	18,000,000	
	FABRICATION & WELDING	5,000,000	
	STAMPING	1,500,000	
	BRAKE SUB-ASSEMBLIES & TEST	2,500,000	
	FINAL ASSEMBLY & TEST	3,500,000	
	CONTAINERS & RACKS	1,500,000	
	OTHER	2,000,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 44,000,000 (1980 \$)
		+6%	46,640,000 (1981 \$)
<u>LEVEL I TOTAL FACILITIES, EQUIPMENT AND TOOLING</u>			\$ 90,000,000 (1980 \$)
			95,580,000 (1981 \$)
<u>PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%</u>			
			\$ 18,000,000 (1980 \$)
			19,116,000 (1981 \$)
	TOTAL PROGRAM COST		\$108,000,000 (1980 \$)
			114,696,000 (1981 \$)

FACILITIES PLANNING AND PROCESS SUMMARY

(DATA) IS A NOMINAL ESTIMATE ..

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)			DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	TOTAL	LEVEL I	LEVEL II	
EAR PRODUCTION											
HELICAL DRIVE GEARS			43					\$9.0/\$11.0 (\$10.0)		99/121 (110)	
DRIVE PINIONS											
RING GEARS								\$ 4.5/\$5.5 (\$5.0)		81/99 (90)	
DIFF. PINION								\$ 5.4/\$6.6 (\$6.0)			
SIDE GEARS								\$ 1.8/\$2.2 (\$2.0)			
HIRING								\$ 2.3/\$2.7 (\$2.5)			
ARRIER								\$ 0.7/0.9 (\$0.8)			
HOUSINGS								\$ 0.6/\$0.8 (\$0.7)			
DIFFERENTIAL GEARS								\$ 0.9/1.1 (\$1.0)			
DRIVE SHAFTS								\$ 4.5/\$5.5 (\$5.0)		27/33 (30)	
AXLE SHAFTS								\$ 1.4/\$1.6 (\$1.5)		18/22 (20)	
DRIVE YOKES								\$ 0.4/\$0.6 (\$0.5)		27/33 (30)	
EQUALIZER BEAM											
MISCELLANEOUS											
BRICATION & BEDING			30								
WHEEL HOUSING											
SPINDLES											
DRIVING COVERS											
WHEEL BRACKET											
ELSC. SMALL STANDINGS											
WHEEL ASSEMBLY			10								

FACILITY TYPE/PRODUCT

REAR/TANDEM AXLE PLANT

FACILITIES PLANNING AND PROCESS SUMMARY

(DATA) IS A NOMINAL ESTIMATE

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)			ANNUAL CAPACITY (000)			MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)			DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL III	LEVEL I	LEVEL II	LEVEL III	LEVEL I	LEVEL II	TOTAL	LEVEL I	LEVEL II	
PRELIMINARY DESIGN & TEST				10						\$ 1.8/\$2.2 (\$2.0)		54/66 (60)	
GENERAL ASSEMBLY TEST				32						\$ 3.2/\$3.8 (\$3.5)		54/66 (60)	
HEAT TREAT FINISHES				20						\$ 3.4/\$4.2 (\$3.8)		18/22 (20)	
PAINT FACILITIES				117						\$ 5.8/\$7.2 (\$6.5)			
PAINT & BUILDING										\$ 9.7/\$11.7 (\$10.7)			
										\$25.6/\$31.4 (\$28.5)			
													DIRECT LABOR
												378/462 (420)	
													INDIRECT LABOR
												180/220 (200)	
													SALARY
												126/154 (140)	
TOTALS				367						\$81.0/\$99.0 (\$90.0)		684/836 (760)	TOTALS

FACILITY TYPE PRODUCT

YEAR/TANDEM AXLE PLANT

NEW REAR/TANDEM AXLE PLANT

(SQUARE FEET)

	AREA
<u>MANUFACTURING BUILDING</u>	
MACHINERY & EQUIPMENT (INCLUDING AISLE ALLOWANCE)	198,000
FINISHED PARTS STORAGE	25,000
PURCHASE PARTS STORAGE	12,000
SHIPPING & RECEIVING	30,000
TOOL ROOM & CUTTER GRIND	20,000
PRODUCTION OFFICES & MAINTENANCE	25,000
LABS (QUALITY & ENGINEERING)	10,000
UTILITIES ROOM (AIR COMPRESSOR, GAS & ELECTRICAL)	15,000
OTHER (REST ROOMS, EATING AREAS, ETC.)	17,000
OPERATIONS OFFICE	15,000
8 1/2 BAYS @ 60' - 510' x 18 BAYS @ 40' - 720'	367,000

NEW REAR/TANDEM AXLE PLANT

(SQUARE FEET)

OPERATIONS OFFICE 15,000	LABS 10,000	STAMPING 8,000	MACHINING 45,000	FABRICATION & WELDING 30,000	PRODUCTION OFFICES & MAINTENANCE 25,000	GEAR PRODUCTION 43,000	FINISHED PARTS STORAGE 25,000	SHIPPING 18,000	RECEIVING 12,000	PURCHASED PARTS & STOCK STORAGE 12,000	
		TOOL ROOM & CUTTER GRIND 20,000	UTILITIES 15,000	HEAT TREAT 20,000	SUB ASSEMBLY & TEST 10,000	BRAKE ASSEMBLY 10,000					ASSEMBLY & TEST 32,000

510'

720'

TOTAL AREA 367,000

REAR/RANDEM AXLE PLANT
TOTAL MANUFACTURING COST
(EXCLUDING MATERIAL)

PRODUCTION: 100,000 UNITS PER YEAR

MANPOWER:	245 DAYS	EMPLOYEES	ANNUAL HOURS	HRS/UNIT
- DIRECT - LABOR	- 1960 -	420	823,200	8.23
- INDIRECT - HOURLY	- 1960 -	200	392,000	3.92
- INDIRECT - SALARY	- 2000 -	140	280,000	2.80
		760	1,495,200	14.95

ANNUAL HOURS ÷ 100,000 UNITS = HOURS PER UNIT = 14.95

WAGES & FRINGE COSTS:

- DIRECT - LABOR	\$19.50	X	8.23	=	\$160.49
- INDIRECT - HOURLY	\$21.50	X	3.92	=	\$ 84.28
- INDIRECT - SALARY	\$23.50	X	2.80	=	\$ 65.80
	TOTAL WAGES & FRINGE COSTS				
					\$310.57

INVESTMENTS: (1981\$)

	FACILITIES COST	DEPRECIATION	COST-PER-UNIT
- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS	\$28,890,000	963,000	\$ 9.63
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	10,600,000	353,333	\$ 3.53
- PLANT FACILITIES USEFUL LIFE - 12 YRS	7,950,000	662,500	\$ 6.63
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	95,580,000	7,965,000	\$79.65
			<u>\$99.44</u>

DEPRECIATION ÷ 100,000 UNITS = TOTAL DEPRECIATION PER UNIT = \$99.44

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST

T & I ESTIMATE OF 3.9% \$310.57 X 3.9% = \$12.11

OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST

OME ESTIMATE OF 13.2% \$310.57 X 13.2% = \$41.00

TOTAL WAGE & FRINGE COSTS	\$310.57
TOTAL DEPRECIATION COSTS	\$ 99.44
TOTAL TAXES & INSURANCE	\$ 12.11
TOTAL OME	\$ 41.00
TOTAL	<u>\$463.12</u>

PLANT NO. 10

DIESEL ENGINE COMPONENTS/ACCESSORIES

NEW DIESEL ENGINE COMPONENTS/ACCESSORIES PLANT

ASSUMPTIONS

PRODUCT

THE FOLLOWING PARTS WOULD BE PRODUCED IN THIS PLANT AT THE DAILY RATES SHOWN. THESE PRODUCTS WOULD SUPPORT ENGINE PRODUCTION FOR THE 6.5 and 12.0 LITER V-8 DIESEL ENGINES.

<u>ENGINE</u>	<u>ANNUAL VOLUME</u>	<u>DAILY/HOURLY RATE</u>
V-8 DIESEL 5.5L	400,000	1632/102
V-8 DIESEL 12L	50,000	200/12.5
TOTAL	450,000	

PRODUCTS AND PRODUCTION RATES

<u>ENGINE COMPONENTS</u>	<u>PER VEHICLE</u>	<u>ANNUAL VOLUME IN PIECES</u>
- INTAKE VALVES		
o 6.5L V-8 DIESEL	8	3,200,000
- EXHAUST VALVES		
o 6.5L V-8 DIESEL	8	3,200,000
o 12.0L V-8 DIESEL	32	1,600,000
- EXHAUST VALVE INSERTS		
o 12.0L V-8 DIESEL	32	1,600,000
- VALVE GUIDES		
o 6.5L V-8 DIESEL	16	6,400,000
o 12.0L V-8 DIESEL	32	1,600,000
- VALVE SPRING SEATS		
o 6.5L V-8 DIESEL	16	6,400,000
o 12.0L V-8 DIESEL	32	1,600,000
- VALVE RETAINERS & LOCKS		
o 6.5L V-8 DIESEL	16	6,400,000
o 12.0 L V-8 DIESEL	32	1,600,000
- ROLLER HYDRAULIC VALVE LIFTERS		
o 6.5L V-8 DIESEL	16	6,400,000
- VALVE BRIDGE		
o 12.0L V-8 DIESEL	16	6,400,000
- VALVE BRIDGE GUIDE		
o 12.0L V-8 DIESEL	16	6,400,000

ENGINE COMPONENTS	PER VEHICLE	ANNUAL VOLUME IN PIECES
- PUSH RODS		
o 6.5L V-8 DIESEL	16	6,400,000
o 12.0L V-8 DIESEL	32	1,600,000
- ROCKER SHAFT		
o 6.5L V-8 DIESEL	2	800,000
o 12.0L V-8 DIESEL	8	400,000
- ROCKER SHAFT BRACKETS		
o 6.5L V-8 DIESEL	10	4,000,000
o 12.0L V-8 DIESEL	16	800,000
- CAM FOLLOWERS		
o 12.0L DIESEL	32	1,600,000
- CAM FOLLOWER GUIDE		
o 12.0L DIESEL	8	400,000
- ROCKER ARMS		
o 6.5L DIESEL	16	6,400,000
o 12.0L DIESEL	24	1,200,000
- PISTON PINS		
o 6.5L DIESEL	8	3,200,000
o 12.0L DIESEL	8	400,000
- FUEL INJECTORS		
o 6.5L DIESEL (INDIRECT)	8	3,200,000
o 12.0 L DIESEL (DIRECT)	8	400,000
- WATER NOZZLE		
o 12.0L DIESEL	16	800,000

ENGINE COMPONENTS	PER VEHICLE	ANNUAL VOLUME IN PIECES
- VIBRATION DAMPER		
o 6.5L V-8 DIESEL	1	400,000
o 12.0L V-8 DIESEL	1	50,000
- FUEL PUMP		
o 6.5L V-8 DIESEL	1	400,000
o 12.0L V-8 DIESEL	1	50,000
- WATER PUMP		
o 6.5L V-8 DIESEL	1	400,000
o 12.0L V-8 DIESEL	1	50,000
- GOVERNOR		
o 12.0L V-8 DIESEL	1	50,000

PRODUCTS AND PRODUCTION RATES (CONT.)

- THE ENGINE COMPONENTS/ACCESSORIES PLANT HAS BEEN PLANNED TO SUPPORT THE ENGINE PRODUCTION CAPACITY FOR THE SURROGATE PLANT'S AT THE VOLUME LEVEL SHOWN AT THE BEGINNING OF THIS SECTION.
- THE DIESEL ENGINE COMPONENTS NOT SHOWN IN THIS PRODUCT LINE-UP WOULD BE PURCHASED FROM A SUPPLIER WHO SPECIALIZES IN THAT TYPE OF PRODUCT.

PRODUCTS AND PRODUCTION RATES (CONT.)

FACILITIES - ARE PROVIDED TO PRODUCE THE PRODUCTS LISTED AND THEIR DETAILS

OPERATING
PATTERN

- STRAIGHT TIME

TWO EIGHT HOUR SHIFTS

- MAXIMUM PRACTICAL OVERTIME

EVERY OTHER SATURDAY (10%)

NUMBER OF
STRAIGHT
TIME
DAYS

- 245 DAYS PER YEAR. NOTE: IN THOSE YEARS WHEN A NEW ENGINE OR A MAJOR CHANGE IS PLANNED, THE NUMBER OF PRODUCTION DAYS PER YEAR MAY BE REDUCED DEPENDING ON THE EXTENT OF THE CHANGE.

NEW DIESEL ENGINE COMPONENTS/ACCESSORIES PLANT
(NOMINAL ESTIMATE)

		LEVEL I	LEVEL II
<u>LEVEL II</u>			
<u>LAND</u>			
	PURCHASE LAND (40 ACRES @ \$10,000/ACRE)	\$ 400,000	
	SITE DEVELOPMENT	600,000	
	SUB TOTAL		\$ 1,000,000
<u>BUILDING & SUPPORT FACILITIES</u>			
	ENGINEERING	\$ 700,000	
	MANUFACTURING BLDG (.235M Sq. Ft. @ \$55/Sq. Ft.)	12,900,000	
	AIR COMPRESSORS & FIRE PROTECTION	1,200,000	
	WASTE TREATMENT	900,000	
	TANK FARM	1,000,000	
	OTHER	1,300,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$18,000,000 (1980 \$)
		+7%	19,260,000 (1981 \$)
<u>BUILDING FACILITIES</u>			
	CRANES, CONVEYORS & SCRAP HANDLING	\$ 1,400,000	
	ELECTRICAL	2,000,000	
	HEATING AND VENTILATION (PENTHOUSE-HEATERS)	1,500,000	
	BUILDING UTILITIES (SEWER, WATER & GAS)	1,400,000	
	- USEFUL LIFE-30 YRS -- SUBTOTAL		\$ 6,300,000 (1980 \$)
		+6%	6,678,000 (1981 \$)
<u>PLANT FACILITIES</u>			
	TOOL ROOM, CUTTER GRIND & MAINTENANCE	\$ 2,200,000	
	MATERIAL HANDLING EQUIPMENT	900,000	
	OTHER	1,200,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 4,300,000 (1980 \$)
		+6%	4,558,000 (1981 \$)
<u>MACHINERY & EQUIPMENT (& TOOLING)</u>			
	SMALL PARTS	\$ 2,000,000	
	COMPONENT ASSEMBLIES	4,000,000	
	ACCESSORY COMPONENTS	4,200,000	
	RECIPROCATING PARTS	8,600,000	
	CONTAINERS & RACKS	1,200,000	
	OTHER	1,400,800	
	- USEFUL LIFE-12 YRS SUBTOTAL		\$21,400,000 (1980 \$)
		+6%	22,684,000 (1981 \$)
<u>LEVEL I</u>	TOTAL FACILITIES, EQUIPMENT AND TOOLING		\$51,000,000 (1980 \$)
			54,180,000 (1981 \$)
<u>PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%</u>			
			\$10,200,000 (1980 \$)
			10,836,000 (1981 \$)
	TOTAL PROGRAM COST		\$61,200,000 (1980 \$)
			65,016,000 (1981 \$)

FACILITIES PLANNING AND PROCESS SUMMARY

(DATA) IS A NOMINAL ESTIMATE

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	
ALL PARTS AUTOMATIC TAMPING MACHINES CORE MACHINE OPERATIONS GRINDING MILLING BENDING	STEEL		20		SEE PRODUCTION RATE SCHEDULE				18/22 (20)	
COAGULANT MACHINES CORE MACHINE OPERATIONS GRINDING MILLING BENDING CORE MACHINE OPERATIONS	STEEL ALLOYS		27						41/49 (45)	TRANSFER LINES
COAGULANT MACHINES CORE MACHINE OPERATIONS GRINDING MILLING BENDING CORE MACHINE OPERATIONS	STEEL CAST IRON		36						81/99 (90)	TRANSFER LINES
COAGULANT MACHINES CORE MACHINE OPERATIONS GRINDING MILLING BENDING CORE MACHINE OPERATIONS	STEEL CAST IRON		32						45/44 (50)	

FACILITY TYPE/PRODUCT: DIESEL ENGINE COMPONENTS/ACCESSORIES PLANT

NEW DIESEL ENGINE COMPONENTS/ACCESSORIES PLANT

PARTS PRODUCTION BY AREA

<u>SMALL PARTS</u>	<u>20,000 SQ.FT.</u>	<u>RECIPROCATING PARTS</u>	<u>32,000 SQ.FT.</u>
VALVE BRIDGE		PUSH RODS	
VALVE BRIDGE GUIDES		ROCKER ARMS	
ROCKER SHAFTS		PISTON PINS	
ROCKER SHAFT BRACKETS		VALVES	
VALVE GUIDES			
VALVE INSERTS			
VALVE SPRING SEATS			
VALVE RETAINERS & LOCKS			
CAM FOLLOWER GUIDES			
MISCELLANEOUS			

<u>COMPONENTS & ASSEMBLIES</u>	<u>27,000 SQ.FT.</u>
FUEL INJECTORS	
WATER NOZZLES	
ROLLER HYDRAULIC VALVE LIFTERS	
CAM FOLLOWERS	

<u>ACCESSORY COMPONENTS</u>	<u>36,000 SQ.FT.</u>
VIBRATION DAMPER	
FUEL PUMP	
WATER PUMP	
GOVERNOR	

NEW DIESEL ENGINE COMPONENTS/ACCESSORIES PLANT

(SQUARE FEET)

MANUFACTURING BUILDING

	<u>AREA</u>
MACHINERY & EQUIPMENT (INCLUDING AISLE ALLOWANCE)	115,000
FINISHED PARTS STORAGE	20,000
SHIPPING AND RECEIVING	18,000
TOOL ROOM & CUTTER GRIND	18,000
PRODUCTION OFFICES & MAINTENANCE	25,000
LABS (QUALITY & ENGINEERING)	8,000
UTILITIES ROOM (AIR COMPRESSOR, GAS & ELECTRICAL)	10,000
OTHER (REST ROOMS, EATING AREAS, ETC.)	9,000
OPERATIONS OFFICE	12,000
7 BAYS @ 60' - 420' x 14 BAYS @ 40' - 560'	235,000
AUXILIARY	7,000
GRAND TOTAL	242,000

DIESEL ENGINE COMPONENTS/ACCESSORIES PLANT
(SQUARE FEET)

LABS		TOOL ROOM & CUTTER GRIND 18,000		COMPONENT ASSEMBLY PRODUCTION 27,000		PRODUCTION OFFICES & MAINTENANCE 25,000		RECIPROCATING PARTS PRODUCTION 32,000		FINISHED PARTS STORAGE 14,000		SHIPPING 12,000		RECEIVING 6,000	
8,000										PURCHASED PARTS & STOCK STORAGE 6,000					
OPERATIONS OFFICE 12,000															

DIESEL ENGINE COMPONENTS/ACCESSORIES
TOTAL MANUFACTURING COST
 (EXCLUDING MATERIAL)

<u>PRODUCTION:</u> 450,000 UNITS PER YEAR			
<u>MANPOWER:</u>	<u>245 DAYS</u>	<u>EMPLOYEES</u>	<u>ANNUAL HOURS</u>
- DIRECT - LABOR	- 1960 -	205	401,800
- INDIRECT - HOURLY	- 1960 -	120	235,200
- INDIRECT - SALARY	- 2000 -	75	150,000
		<u>400</u>	<u>787,000</u>
			<u>HRS/UNIT</u>
			0.89
			0.52
			0.33
			<u>1.74</u>

ANNUAL HOURS ÷ 450,000 UNITS = HOURS PER UNIT = 1.74

WAGE & FRINGE COSTS

- DIRECT - LABOR	\$19.50	X	.89	=	\$17.36
- INDIRECT - HOURLY	21.50	X	.52	=	\$11.18
- INDIRECT - SALARY	23.50	X	.33	=	\$ 7.76
	<u>TOTAL WAGES & FRINGE COSTS</u>				
					<u>\$36.30</u>

INVESTMENT: (1981\$)

	<u>FACILITIES COST</u>	<u>DEPRECIATION</u>	<u>COST-PER-UNIT</u>
- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS	\$19,260,000	642,000	\$1.43
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	6,678,000	222,600	\$.49
- PLANT FACILITIES USEFUL LIFE - 12 YRS	\$ 4,558,000	379,833	\$.84
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	\$22,684,000	1,890,333	<u>\$4.20</u>
			<u>\$6.96</u>

DEPRECIATION ÷ 450,000 UNITS = TOTAL DEPRECIATION PER UNIT = \$6.96

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST
 T & I ESTIMATE OF 3.9% \$36.30 X 3.9% = \$1.42
 OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST
 OME ESTIMATE OF 13.2% \$36.30 X 13.2% = \$4.79
 TOTAL WAGE & FRINGE COSTS \$36.30
 TOTAL DEPRECIATION COSTS \$ 6.96
 TOTAL TAXES & INSURANCE \$ 1.42
 TOTAL OME \$ 4.79
 TOTAL \$49.47

PLANT NO. 11
ROAD HAULING TRAILER ASSEMBLY PLANT

NEW ROAD HAULING TRAILER ASSEMBLY PLANT

PRODUCT

- 40 TO 45 FEET ROAD HAULING TRAILERS.
 - 8 WHEEL - TANDEM AXLES WITH VARIABLE LOCATION OPTION FOR DIFFERENT LOADING CONDITIONS
 - COMMON ROAD HAULERS
 - REFRIGERATION VANS
 - AIR BRAKES

PRODUCTION RATES

- PLANT IS SIZED TO PRODUCE 7,840 UNITS ANNUALLY ON A STRAIGHT TIME BASIS.
- STRAIGHT TIME DAILY RATES
 - TRAILERS PER HOUR - 2
 - TRAILERS PER DAY - 32

OPERATING PATTERN

- STRAIGHT TIME:
 - 2 8 HOUR SHIFTS
 - 16 HOURS PER DAY
 - 5 DAYS PER WEEK
 - 245 DAYS PER YEAR
- OVER TIME (10%) EVERY OTHER SATURDAY

MANUFACTURING

THE OPERATION IS LABOR INTENSIVE WITH MINIMAL AUTOMATION BECAUSE OF THE LOW VOLUME AND THE DEGREE OF VARIETY OF PRODUCT. CONVEYORS AND HANDLING DEVICES ARE PROVIDED TO MINIMIZE THE MANUAL LABOR REQUIRED TO MOVE THE PRODUCT THROUGH THE ASSEMBLY OPERATIONS.

ROAD HAULING TRAILER ASSEMBLY PLANT (Nominal Estimate)

		LEVEL I	LEVEL II
<u>LEVEL II</u>			
<u>LAND</u>			
	PURCHASED LAND (50 ACRES @ \$10,000/ACRE)	\$ 500,000	
	SITE DEVELOPMENT	800,000	
	SUBTOTAL		\$ 1,300,000
<u>BUILDING & SUPPORT FACILITIES</u>			
	ENGINEERING	\$ 400,000	
	MANUFACTURING BLDG. (0.15M Sq. Ft. @ \$40/Sq. Ft.)	6,000,000	
	AIR COMPRESSORS, FIRE PROTECTION	1,000,000	
	OTHER	1,000,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 8,400,000 (1980 \$)
		+7%	8,988,000 (1981 \$)
<u>BUILDING FACILITIES</u>			
	CRANES, CONVEYORS & SCRAP HANDLING	\$ 1,000,000	
	ELECTRICAL	1,000,000	
	HEATING & VENTILATION (SPACE HEATERS)	800,000	
	BUILDING UTILITIES (SEWER, WATER & GAS)	1,900,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL		\$ 4,700,000 (1980 \$)
		+6%	4,982,000 (1981 \$)
<u>PLANT FACILITIES</u>			
	TOOL ROOM, CUTTER GRIND & MAINTENANCE	\$ 1,000,000	
	PAINT	200,000	
	MATERIAL HANDLING EQUIPMENT	500,000	
	OTHER	500,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 2,200,000 (1980 \$)
		+6%	2,332,000 (1981 \$)
<u>MACHINERY & EQUIPMENT</u>			
	PRODUCTION, MACHINES & EQUIPMENT	\$ 2,000,000	
	SUBASSEMBLY PRODUCTION	1,000,000	
	MAIN ASSEMBLY LINE PRODUCTION	1,500,000	
	CONVEYORS & SHUTTLES	1,400,000	
	MATERIAL HANDLING RACKS, CONTAINERS & BINS	600,000	
	OTHER	1,000,000	
	TOOLING	3,000,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL		\$ 10,500,000 (1980 \$)
		+6%	11,130,000 (1981 \$)
<u>LEVEL I</u>	TOTAL FACILITIES, EQUIPMENT AND TOOLING		\$ 27,100,000 (1980 \$)
			28,732,000 (1981 \$)
	PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%		\$ 5,420,000 (1980 \$)
			5,746,400 (1981 \$)
	TOTAL PROGRAM COST		\$ 32,520,000 (1980 \$)
			34,478,400 (1981 \$)

FACILITIES PLANNING AND PROCESS SUMMARY
(DATA) IS A NOMINAL ESTIMATE

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ. FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	
TRAILER					7,840					
- SUB-ASSEMBLY		34,000							90/110 (100)	
- RIVETING	ALUMINUM STEEL					\$ 2.7/\$3.3 (\$3.0)				
- WELDING						\$ 2.0/\$2.4 (\$2.2)			42/50 (46)	
- ASSEMBLY		50,000				\$ 0.3/\$0.3 (\$0.3)			9/11 (10)	
- BODY						\$ 0.7/\$0.9 (\$0.8)			11/13 (12)	
- EXTERIOR COMPONENTS						\$ 0.5/\$0.7 (\$0.6)			11/13 (12)	
- INTERIOR INSTALLATION						\$ 1.4/\$1.6 (\$1.5)			14/18 (16)	
- OTHER CARRIAGE INSTALLATION						\$ 0.5/\$0.5 (\$0.5)			8/10 (9)	
- FINAL ASSY. & FINAL OK						\$ 5.3/\$6.5 (\$5.9)				
- OTHER		67,000				\$ 2.3/\$2.9 (\$2.6)				
- PLANT FACILITIES						\$ 8.7/\$10.7 (\$9.7)				160,000 SQ. FT. TOTAL BLDGS.
- MATERIAL HANDLING AND STOCK								185/225 (205)		DIRECT LABOR
- BUILDING AND PAINT								95/115 (105)		INDIRECT LABOR
								45/55 (50)		SALARY
- TOTALS		151,000			7,840	\$24.4/\$29.8 (\$27.1K)		324/396 (360)		TOTAL

FACILITY TYPE/PRODUCT: ROAD HAULING TRAILER ASSEMBLY PLANT

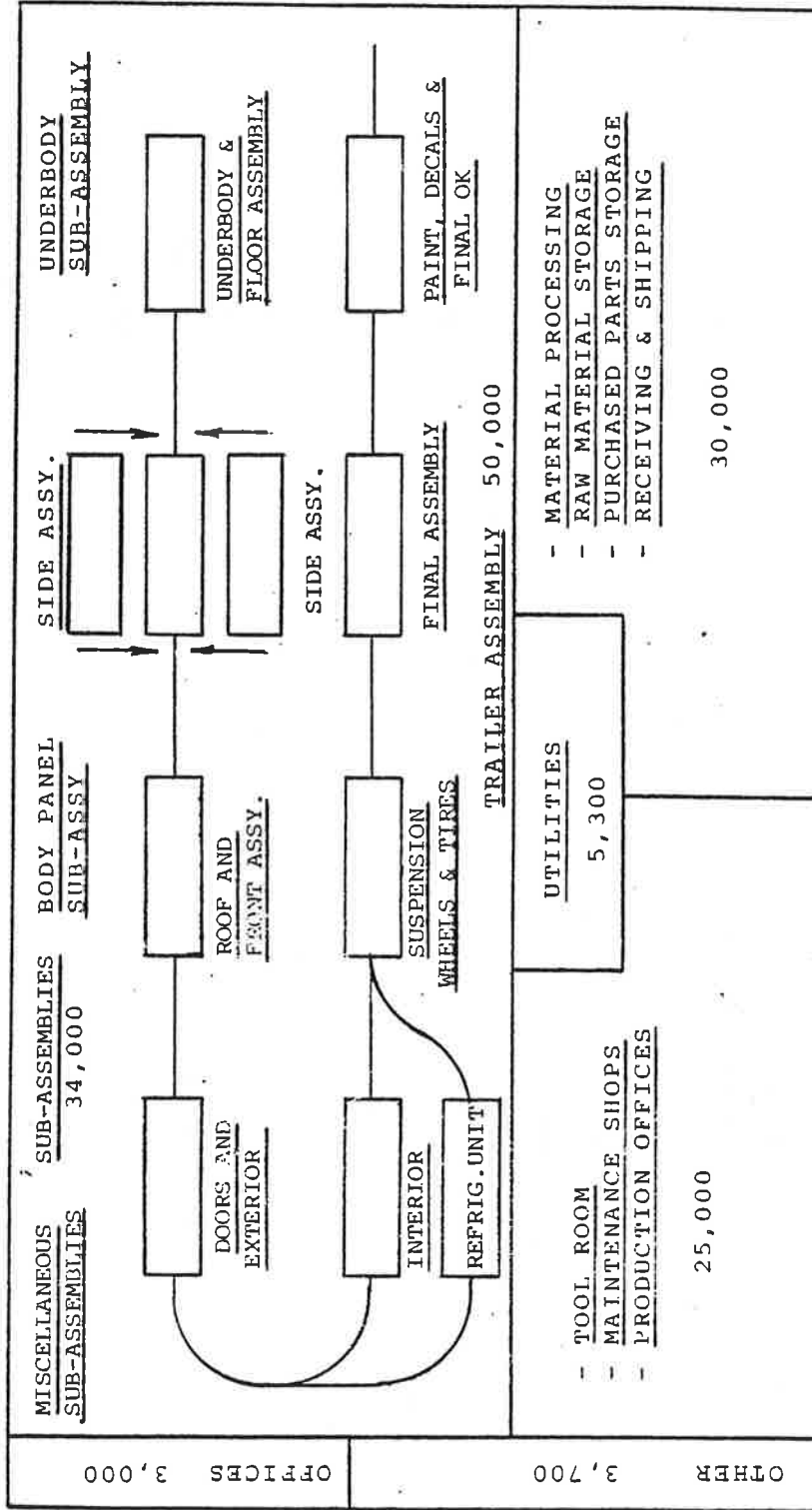
*MAJOR CAPITAL EXPENDITURES ADJUSTED FOR 1001 ECONOMY AND 700 000

ROAD HAULING TRAILER ASSEMBLY PLANT
(SQUARE FEET)

	<u>AREA</u>
MANUFACTURING BUILDING	
SUB-ASSEMBLY PRODUCTION	34,000
TRAILER ASSEMBLY PRODUCTION	50,000
MATERIALS AREA	30,000
- MATERIAL PROCESSING	
- RAW MATERIAL STORAGE	
- PURCHASED PARTS STORAGE	
- RECEIVING & SHIPPING	
SUPPORT AREA	25,000
- TOOL ROOM	
- MAINTENANCE SHOPS	
- PRODUCTION OFFICES	
UTILITIES (AIR COMPRESSORS, GAS & ELECTRICAL)	5,300
OFFICES	3,000
OTHER (REST ROOMS, EATING AREAS, ETC.)	3,700
	151,000
4 1/2 BAYS @ 60' - 270' x 14 BAYS @ 40' - 560'	
AUXILIARY (OUTSIDE MAIN BUILDING)	9,000
	160,000
GRAND TOTAL	

NEW ROAD HAULING TRAILER ASSEMBLY PLANT

(SQUARE FEET)



ROAD HAULING TRAILER ASSEMBLY PLANT
TOTAL MANUFACTURING COST
 (EXCLUDING MATERIAL)

PRODUCTION: 7,840 UNITS PER YEAR	245 DAYS	EMPLOYEES	ANNUAL HOURS	HRS/UNIT
<u>MANPOWER:</u>				
- DIRECT LABOR	1960	205	401,800	51.25
- INDIRECT - HOURLY	1960	105	205,800	26.25
- INDIRECT - SALARY	2000	50	100,000	12.76
		360	707,600	90.26

ANNUAL HOURS ÷ 7,840 UNITS = HOURS PER UNIT = \$90.26

WAGE & FRINGE COSTS:

- DIRECT LABOR	\$19.50	X	51.25	=	\$999.38
- INDIRECT - HOURLY	\$21.50	X	26.25	=	564.38
- INDIRECT - SALARY	\$23.50	X	12.76	=	299.86
					<u>\$1863.62</u>

TOTAL WAGE & FRINGE COSTS

INVESTMENT: (1981\$)

- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS	
- BUILDING FACILITIES USEFUL LIFE - 30 YRS	
- PLANT FACILITIES USEFUL LIFE - 12 YRS	
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS	

FACILITIES COST	DEPRECIATION	COST-PER-UNIT
\$ 8,988,000	299,600	\$38.21
\$ 4,982,000	166,066	\$21.18
\$ 2,332,000	194,333	\$24.79
\$11,130,000	927,500	\$118.30
		<u>\$202.48</u>

DEPRECIATION ÷ 7,840 UNITS = TOTAL DEPRECIATION PER UNIT = \$202.48

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST

T & I ESTIMATE OF 3.9% \$1863.62 X 3.9% = \$72.68

OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST

OME ESTIMATE OF 13.2% \$1863.62 X 13.2% = \$246.00

TOTAL WAGE & FRINGE COSTS	\$1863.62
TOTAL DEPRECIATION COSTS	\$ 202.48
TOTAL TAXES & INSURANCE	\$ 72.68
TOTAL OME	\$ 246.00
TOTAL	<u>\$2384.78</u>

PLANT NO. 12

TRAILER CHASSIS/DEAD AXLE ASSEMBLIES

TRAILER CHASSIS/DEAD AXLE ASSEMBLIES

PRODUCT

- O FOR 40 TO 45 FOOT ROAD HAULING TRAILERS (UP TO 40,000 #GCW)
- AXLE ASSEMBLIES (NON-DRIVING) - INCLUDING WHEELS & BRAKES
 - SUSPENSION ASSEMBLY (DUAL AXLES)
 - VERTICAL SUPPORT LEG ASSEMBLIES
 - AIR HOSE SHIELD ASSEMBLY
 - SUSPENSION SLIDER LOCKING ASSEMBLY

PRODUCTION RATES

O PLANT IS SIZED TO PRODUCE ASSEMBLIES FOR 4,000 EQUIVALENT TRAILERS PER MONTH (45,080/YEAR) ON A STRAIGHT TIME BASIS.

O STRAIGHT TIME DAILY RATES

EQUIVALENT TRAILERS PER DAY	184
EQUIVALENT TRAILERS PER HOUR	11.5

OPERATING PATTERN

O STRAIGHT TIME	ASSEMBLY & MACHINING
	TWO SHIFTS
	16 HOURS /DAY
	5 DAYS/WEEK
	245 DAYS/YEAR
O OVERTIME - 10%	ALTERNATE SATURDAYS

TRAILER CHASSIS/DEAD AXLE ASSEMBLIES PLANT
(NOMIAL ESTIMATE)

		LEVEL I	LEVEL II
<u>LEVEL II</u>			
<u>LAND</u>			
	PURCHASE OF LAND (50 ACRES @ \$10,000/ACRE)	\$ 500,000	
	SITE DEVELOPMENT	<u>1,200,000</u>	
	SUB TOTAL		\$ 1,700,000
<u>BUILDING & SUPPORT FACILITIES</u>			
	ENGINEERING	\$ 800,000	
	MANUFACTURING BLDG. (0.326M Sq. Ft. @ \$40/Sq. Ft.)	13,000,000	
	AIR COMPRESSOR & FIRE PROTECTION	1,500,000	
	WASTE TREATMENT	1,200,000	
	TANK FARM	1,000,000	
	OTHER	<u>1,400,000</u>	
	- USEFUL LIFE-30 YRS - SUBTOTAL	+7%	\$ 8,900,000 (1980 \$) 20,223,000 (1981 \$)
<u>BUILDING FACILITIES</u>			
	CRANES, CONVEYORS & SCRAP HANDLING	\$ 1,000,000	
	ELECTRICAL	1,500,000	
	HEATING AND VENTILATION (PENTHOUSE HEATERS)	1,500,000	
	BUILDING UTILITIES (SEWER, WATER, GAS)	<u>2,500,000</u>	
	- USEFUL LIFE-30 YRS - SUBTOTAL	+6%	\$ 6,500,000 (1980 \$) 6,890,000 (1981 \$)
<u>PLANT FACILITIES</u>			
	TOOL ROOM, CUTTER GRIND & MAINTENANCE	\$ 2,000,000	
	PAINT	1,000,000	
	MATERIAL HANDLING EQUIPMENT	2,000,000	
	OTHER	<u>1,500,000</u>	
	- USEFUL LIFE-12 YRS - SUBTOTAL	+6%	\$ 6,500,000 (1980 \$) 6,890,000 (1981 \$)
<u>MACHINERY & EQUIPMENT</u>			
	AXLE COMPONENTS AND ASSEMBLY	\$ 10,500,000	
	BRAKE COMPONENTS AND ASSEMBLY	5,000,000	
	SUSPENSION COMPONENTS AND ASSEMBLY	5,500,000	
	MISCELLANEOUS COMPONENTS AND ASSEMBLY	1,000,000	
	CONTAINERS AND RACKS	1,500,000	
	OTHER	<u>2,500,000</u>	
	- USEFUL LIFE-12 YRS - SUBTOTAL	+6%	\$ 26,000,000 (1980 \$) 27,560,000 (1981 \$)
<u>LEVEL I</u>			
	TOTAL FACILITIES, EQUIPMENT AND TOOLING	\$ 59,800,000 (1980 \$) 63,263,000 (1981 \$)	
	PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%	\$ 11,920,000 (1980 \$) 12,652,600 (1981 \$)	
	TOTAL PROGRAM COST	\$ 71,520,000 (1980 \$) 75,915,600 (1981 \$)	

FACILITIES PLANNING AND PROCESS SUMMARY

(DATA) IS A NOMINAL ESTIMATE

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)		DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	
MACHINED COMPONENTS: O TRANSFER LINES O DIAL MACHINES O MILLING O DRILLING O TURNING O GRINDING O SCREW MACH.	CAST IRON, STEEL FORGINGS & STEEL RODS	42							22/26 (24)	
STAMPED COMPONENTS: O SHEARING O BRAKE O SAWING O BLANKING O FORMING O STAMPING O BENDING O UPSETTING	STEEL	45							27/33 (30)	
MISCELLANEOUS: O RIVETING O GAS WELDS O INDUCTION HEATERS		7							7/9 (8)	
ASSEMBLIES: O AXLE -INDUCTION HEATING -UPSETTING -WELDING -STRAIGHTENING -MACHINING O BRAKES -WELDING -GRINDING -RIVETING O SUSPENSION -WELDING -IN-LINE DRILL- ING & REAMING -WELDING -STRAIGHTENING		34							21/27 (24)	
		8							1.8/2.2 (\$2.0)	
		24							3.1/3.9 (\$3.5)	27/33 (30)

FACILITIES PLANNING AND PROCESS SUMMARY

(DATA) IS A NOMINAL ESTIMATE

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)			DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	TOTAL	LEVEL I	LEVEL II	
ASSEMBLIES (CONT) O VERTICAL SUPPORT -WELDING -DRILLING O MISCELLANEOUS -BOLTING -PINING -WELDING PAINTING PLANT FACILITIES MATERIAL HANDLING & OTHER LAND & BUILDING			8					1.1/1.3 (\$1.2)		18/22 (20)	TOTAL BUILDING 335,000 sq.ft. DIRECT LABOR (152) INDIRECT LABOR (91) SALARY (42) GRAND TOTAL 256/314 (285)
			6					0.7/0.9 (\$0.8)		11/13 (12)	
								0.9/1.1 (\$1.0)		4/4 (4)	
			87					7.6/9.4 (\$8.5)			
			65					6.8/8.2 (\$7.5)			
								18.5/22.7 (\$20.6)			
			326					53.6/65.6 (\$59.6)*			

*Major capital expenditures adjusted for 1981 economics \$63,263,000
FACILITY TYPE/PRODUCT : TRAILER CHASSIS/DEAD AXLE ASSEMBLIES

TRAILER CHASSIS/DEAD AXLE ASSEMBLIES

<u>MANUFACTURING BUILDING</u>		<u>AREA</u>
MACHINERY & EQUIPMENT (INCLUDING AISLE ALLOWANCE)		174,000
FINISHED PARTS STORAGE		25,000
SHIPPING		23,000
RECEIVING		12,000
PURCHASED PARTS STORAGE		5,000
TOOL ROOM & CUTTER GRIND		18,000
PRODUCTION OFFICES & MAINTENANCE		24,000
LABS (QUALITY & ENGINEERING)		5,000
UTILITIES ROOM (AIR CONDITIONING, GAS & ELECTRIC)		15,000
OTHER (REST ROOMS, EATING AREAS, ETC.)		10,000
OPERATIONS OFFICE		15,000
8 BAYS @ 60' - 480' x 17@ 40' - 680	TOTAL	326,000
	AUXILIARY	9,000
	GRAND TOTAL	<u>335,000</u>

TRAILER CHASSIS/DEAD AXLE ASSEMBLIES

45,000 EQUIVALENT TRAILER PER YEAR
184 /DAY

<u>RECEIVING</u> 12,000		<u>MISC. FAB</u> 7,000	<u>PRODUCTION & MAINTENANCE</u> 24,000	<u>AXLE ASSEMBLY</u> 34,000	<u>SHIPPING</u> 23,000	
<u>PURCHASED PARTS</u> 5,000		<u>MACHINING</u> 42,000		<u>BRAKE ASSEMBLY</u> 8,000		
				<u>SUPPORT ASSEMBLY</u> 8,000		
		<u>TOOL ROOM & CUTTER GRIND</u> 18,000	<u>UTILITIES</u> 15,000	<u>MISC. ASSEMBLY</u> 6,000	<u>FINISH PARTS STORAGE</u> 25,000	
				<u>SUSPENSION ASSEMBLY</u> 24,000		
<u>STAMPING</u> 45,000			<u>OTHER</u> 10,000			
<u>LABS</u> 5,000			<u>OPERATIONS OFFICE</u> 15,000			
480' 680'						

TRAILER CHASSIS/DEAD AXLE ASSEMBLIES PLANT
TOTAL MANUFACTURING COST
 (EXCLUDING MATERIAL)

PRODUCTION: 45,080 UNITS PER YEAR

<u>MANPOWER</u>		<u>245 DAYS</u>	<u>EMPLOYEES</u>	<u>ANNUAL HOURS</u>	<u>HRS./UNIT</u>
- DIRECT LABOR		- 1960 -	152	297,920	6.60
- INDIRECT - HOURLY		- 1960 -	91	178,360	3.96
- INDIRECT - SALARY		- 2000 -	42	84,000	1.86
			285	560,280	12.42

ANNUAL HOURS ÷ 45,080 UNITS PER YEAR = HOURS/UNIT = 12.42

WAGES & FRINGE COSTS:

- DIRECT LABOR	X	6.60	=	\$128.70
- INDIRECT - HOURLY	X	3.96	=	\$ 85.14
- INDIRECT - SALARY	X	1.86	=	\$ 43.71
TOTAL WAGE & FRINGE COSTS				\$257.55

INVESTMENT (1981\$)

- BUILDING & SUPPORT FACILITIES USEFUL LIFE - 30 YRS
- BUILDING FACILITIES USEFUL LIFE - 30 YRS
- PLANT FACILITIES USEFUL LIFE - 12 YRS
- MACHINERY & EQUIPMENT USEFUL LIFE - 12 YRS

<u>FACILITIES COST</u>	<u>DEPRECIATION</u>	<u>COST-PER-UNIT</u>
\$20,223,000	674,100	\$14.95
\$ 6,890,000	229,666	5.09
\$ 6,890,000	574,166	12.74
\$27,560,000	2,296,666	50.95
		<u>\$83.73</u>

DEPRECIATION ÷ 45,080 UNITS = TOTAL DEPRECIATION PER UNIT = \$83.73

TAXES & INSURANCE AS PERCENT OF WAGE & FRINGE COST
 T & I ESTIMATE OF 3.9% \$257.55 X 3.9% = \$10.04
 OTHER MANUFACTURING COST AS PERCENT OF WAGE & FRINGE COST
 OME ESTIMATE OF 13.2% \$257.55 X 13.2% = \$34.00
 TOTAL WAGE & FRINGE COSTS \$257.55
 TOTAL DEPRECIATION COSTS \$ 83.73
 TOTAL TAXES & INSURANCE \$ 10.04
 TOTAL OME \$ 34.00
 TOTAL \$385.32

PLANT NO. 13
SMALL ENGINE GAS & DIESEL COMPONENTS

NEW ENGINE COMPONENTS/ACCESSORIES PLANT

PRODUCT

THE FOLLOWING PARTS, WOULD BE PRODUCED IN THIS PLANT AT THE
DAILY RATES SHOWN. THESE PRODUCTS WOULD SUPPORT ENGINE
PRODUCTION FOR FOUR-CYLINDER GAS AND DIESEL, V-6 AND V-8
ENGINES.

<u>ENGINE</u>	<u>ANNUAL VOLUME</u>		<u>DAILY/HOURLY RATE</u>	
	<u>LEVEL I</u>	<u>LEVEL II</u>	<u>LEVEL I</u>	<u>LEVEL II</u>
4 CYLINDER OHC GAS	400,000	800,000	1,632/102	3,265/204
4 CYLINDER DIESEL	200,000	400,000	816/51	1,632/102
V-6 PUSH-ROD GAS	400,000	800,000	1,632/102	3,264/204
V-8 PUSH-ROD GAS	400,000	800,000	1,632/102	3,264/204
TOTAL	1,400,000	2,800,000		

NEW ENGINE COMPONENTS/ACCESSORIES PLANT (CONT.)

ENGINE COMPONENTS	PER VEHICLE	ANNUAL VOLUME IN PIECES	
		LEVEL I	LEVEL II
- CORE PLUGS			
O 4 CYLINDER GAS	8	3,200,000	6,400,000
O 4 CYLINDER DIESEL	8	1,600,000	3,200,000
O V-6 GAS	20	8,000,000	16,000,000
O V-8 GAS	20	8,000,000	16,000,000
- TAPPED PLUGS			
O 4 CYLINDER GAS	12	4,800,000	9,600,000
O 4 CYLINDER DIESEL	12	2,400,000	4,800,000
O V-6 GAS	16	6,400,000	12,800,000
O V-8 GAS	20	8,000,000	16,000,000
- DOWELS			
O 4 CYLINDER GAS	4	1,600,000	3,200,000
O 4 CYLINDER DIESEL	4	800,000	1,600,000
O V-6 GAS	8	3,200,000	6,400,000
O V-8 GAS	8	3,200,000	6,400,000
- TIMING INDICATOR			
O ALL	1	1,400,000	2,800,000

NEW ENGINE COMPONENTS/ACCESSORIES PLANT (CONT.)

ENGINE COMPONENTS	PER VEHICLE	ANNUAL VOLUME IN PIECES	
		LEVEL I	LEVEL II
- OIL SEAL ASSEMBLY			
O 4 CYLINDER GAS	5	2,000,000	4,000,000
O 4 CYLINDER DIESEL	5	1,000,000	2,000,000
O V-6 GAS	3	1,200,000	2,400,000
O V-8 GAS	3	1,200,000	2,400,000
O SERVICE	(5%)	300,000	500,000
- SPROCKETS & KEY			
O 4 CYLINDER GAS	6	2,400,000	4,800,000
O 4 CYLINDER DIESEL	6	1,200,000	2,400,000
O V-6 GAS	4	1,600,000	3,200,000
O V-8 GAS	4	1,600,000	3,200,000
- TRANSMISSION DRIVE PINION			
O ALL	1	1,400,000	2,800,000
- TIMING CHAIN			
O 4 CYLINDER DIESEL	1	200,000	400,000
O V-6 GAS	1	400,000	800,000
O V-8 GAS	1	400,000	800,000
- VIBRATION DAMPER			
O ALL	1	1,400,000	2,800,000

NEW ENGINE COMPONENTS/ACCESSORIES PLANT (CONT.)

ENGINE COMPONENTS	PER VEHICLE	ANNUAL VOLUME IN PIECES	
		LEVEL I	LEVEL II
- PISTON PIN			
O 4 CYLINDER GAS	4	1,600,000	3,200,000
O 4 CYLINDER DIESEL	4	800,000	1,600,000
O V-6 GAS	6	2,400,000	4,800,000
O V-8 GAS	8	3,200,000	6,400,000
- CONNECTING ROD BUSHING (PIN END)			
O 4 CYLINDER GAS	4	1,600,000	3,200,000
O 4 CYLINDER DIESEL	4	800,000	1,600,000
O V-6 GAS	8	3,200,000	6,400,000
O V-8 GAS	8	3,200,000	6,400,000
O SERVICE	(3%)	300,000	500,000
- PISTON RINGS			
O 4 CYLINDER GAS	12	4,800,000	9,600,000
O 4 CYLINDER DIESEL	12	2,400,000	4,800,000
O V-6 GAS	18	7,200,000	14,400,000
O V-8 GAS	24	9,600,000	19,200,000
O SERVICE	(5%)	1,000,000	1,900,000
- INTAKE VALVE			
O 4 CYLINDER GAS	4	1,600,000	3,200,000
O 4 CYLINDER DIESEL	4	800,000	1,600,000
O V-6 GAS	6	2,400,000	4,800,000
O V-8 GAS	8	3,200,000	6,400,000

NEW ENGINE COMPONENTS/ACCESSORIES PLANT (CONT.)

ENGINE COMPONENTS	PER VEHICLE	ANNUAL VOLUME IN PIECES	
		LEVEL I	LEVEL II
- EXHAUST VALVE			
O 4 CYLINDER GAS	4	1,600,000	3,200,000
O 4 CYLINDER DIESEL	4	800,000	1,600,000
O V-6 GAS	6	2,400,000	4,800,000
O V-8 GAS	8	3,200,000	6,400,000
- VALVE GUIDES			
O 4 CYLINDER GAS	8	3,200,000	6,400,000
O 4 CYLINDER DIESEL	8	1,600,000	3,200,000
O V-6 GAS	12	4,800,000	9,600,000
O V-8 GAS	16	6,400,000	12,800,000
- VALVE SPRING SEAT			
O 4 CYLINDER GAS	8	3,200,000	6,400,000
O 4 CYLINDER DIESEL	8	1,600,000	3,200,000
O V-6 GAS	12	4,800,000	9,600,000
O V-8 GAS	16	6,400,000	12,800,000
- VALVE RETAINER & LOCK			
O 4 CYLINDER	8	3,200,000	6,400,000
O 4 CYLINDER DIESEL	8	1,600,000	3,200,000
O V-6 GAS	12	4,800,000	9,600,000
O V-8 GAS	16	6,400,000	12,800,000

NEW ENGINE COMPONENTS/ACCESSORIES PLANT (CONT.)

ENGINE COMPONENTS	PER VEHICLE	ANNUAL VOLUME IN PIECES
		LEVEL I LEVEL II
- VALVE OIL SHIELD		
O V-6 GAS	6	2,400,000 4,800,000
O V-8 GAS	8	3,200,000 6,400,000
- VALVE OIL SEAL		
O V-6 GAS	6	2,400,000 4,800,000
O V-8 GAS	8	3,200,000 6,400,000
- PUSH RODS		
O V-6 GAS	12	4,800,000 9,600,000
O V-8 GAS	16	6,400,000 12,800,000
- ROCKER ARMS		
O V-6 GAS	12	4,800,000 9,600,000
O V-8 GAS	16	6,400,000 12,800,000
- ROCKER SHAFT SUPPORT		
O V-6 GAS	8	3,200,000 6,400,000
O V-8 GAS	10	4,000,000 8,000,000
- VALVE TAPPET & LASH ADJUSTER		
O 4 CYLINDER GAS	8	3,200,000 6,400,000
O 4 CYLINDER DIESEL	8	1,600,000 3,200,000
O V-6 GAS	12	4,800,000 9,600,000
O V-8 GAS	16	6,400,000 12,800,000

NEW ENGINE COMPONENTS/ACCESSORIES PLANT (CONT.)

- THE ENGINE COMPONENTS/ACCESSORIES PLANT HAS BEEN PLANNED TO SUPPORT THE ENGINE PRODUCTION CAPACITY FOR THE SURROGATE PLANTS AT THE VOLUME LEVEL SHOWN AT THE BEGINNING OF THIS SECTION.
- THE DIESEL ENGINE COMPONENTS NOT SHOWN IN THIS PRODUCT LINE-UP WOULD BE PURCHASED FROM A SUPPLIER WHO SPECIALIZES IN THAT TYPE OF PRODUCT.

NEW ENGINE COMPONENTS/ACCESSORIES PLANT (CONT.)

FACILITIES

- ARE PROVIDED TO PRODUCE THE PRODUCTS LISTED AND THEIR DETAILS.
TWO CAPACITY LEVELS ARE SHOWN FOR FACILITY PLANNING PURPOSES.
CAPACITY LEVEL I AND CAPACITY LEVEL II AS SHOWN UNDER THE PRODUCT
SECTIONS OF THIS REPORT. PLANT SIZE HAS BEEN PLANNED AT CAPACITY
LEVEL II ONLY.

OPERATING
PATTERN

- STRAIGHT TIME
TWO EIGHT HOUR SHIFTS
- MAXIMUM PRACTICAL OVERTIME
EVERY OTHER SATURDAY (10%)

NUMBER OF
STRAIGHT
TIME
DAYS

- 245 DAYS PER YEAR. NOTE: IN THOSE YEARS WHEN A NEW ENGINE OR A
MAJOR CHANGE IS PLANNED, THE NUMBER OF PRODUCTION DAYS PER YEAR
MAY BE REDUCED DEPENDING ON THE EXTENT OF THE CHANGE.

NEW ENGINE COMPONENTS/ACCESSORIES PLANT

				LEVEL I	LEVEL II
<u>LEVEL II</u>					
<u>LAND</u>					
	PURCHASE LAND (100 ACRES @ 10,000/ACRE)	\$ 1,000,000		\$ 1,000,000	
	SITE DEVELOPMENT	1,500,000		1,500,000	
	SUB TOTAL	\$ 2,500,000		\$ 2,500,000	
<u>BUILDING & SUPPORT FACILITIES</u>					
	ENGINEERING	\$ 1,900,000		\$ 1,900,000	
	MANUFACTURING BLDG. (0.691M Sq. Ft. @ \$55/Sq. Ft.)	38,000,000		38,000,000	
	AIR COMPRESSORS & FIRE PROTECTION	2,000,000		2,500,000	
	WASTE TREATMENT	2,000,000		2,000,000	
	TASK FARM	3,000,000		5,000,000	
	OTHER	1,100,000		1,600,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL	\$ 48,000,000		\$ 51,000,000 (1980 \$)	
		+7%		54,570,000 (1981 \$)	
<u>BUILDING FACILITIES</u>					
	CRANES, CONVEYOR & SCRAP HANDLING	\$ 2,500,000		\$ 3,000,000	
	ELECTRICAL	2,000,000		2,500,000	
	HEATING AND VENTILATION (PENTHOUSE HEATERS)	2,000,000		2,500,000	
	BUILDING UTILITIES (SEWER, WATER, GAS)	3,000,000		3,000,000	
	- USEFUL LIFE-30 YRS - SUBTOTAL	\$ 9,500,000		\$ 11,000,000 (1980 \$)	
		+6%		11,660,000 (1981 \$)	
<u>PLANT FACILITIES</u>					
	TOOL ROOM, CUTTER GRIND & MAINTENANCE	\$ 4,000,000		\$ 6,000,000	
	MATERIAL HANDLING EQUIPMENT	1,500,000		2,000,000	
	OTHER	1,000,000		1,500,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL	\$ 6,500,000		\$ 9,500,000 (1980 \$)	
		+6%		10,070,000 (1981 \$)	
<u>MACHINERY & EQUIPMENT (INCLUDING TOOLING)</u>					
	SMALL PARTS	\$ 2,000,000		\$ 4,000,000	
	COMPONENT ASSEMBLIES	4,000,000		6,000,000	
	ACCESSORY COMPONENTS	5,000,000		7,000,000	
	RECIPROCATING PARTS	12,000,000		18,000,000	
	CONTAINERS & RACKS	1,500,000		2,000,000	
	OTHER	2,000,000		3,000,000	
	- USEFUL LIFE-12 YRS - SUBTOTAL	\$ 26,500,000		\$ 40,000,000 (1980 \$)	
		+6%		42,400,000 (1981 \$)	
<u>LEVEL I</u>	TOTAL FACILITIES, EQUIPMENT AND TOOLING	\$ 93,000,000		\$114,000,000 (1980 \$)	
				121,200,000 (1981 \$)	
<u>PRE-PRODUCTION AND LAUNCH @ APPROXIMATELY 20%</u>					
		18,600,000		\$ 22,800,000 (1980 \$)	
		19,782,000		24,240,000 (1981 \$)	
	TOTAL PROGRAM COST	\$111,600,000		\$136,800,000 (1980 \$)	
		118,692,000		145,440,000 (1981 \$)	

FACILITIES PLANNING AND PROCESS SUMMARY

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)			DIRECT LABOR WORKING FORCE		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	TOTAL	LEVEL I	LEVEL II	
SMALL PARTS •AUTOMATIC STAMPING PRESSES •SCREW MACHINE OPERATIONS •TURNING •DRILLING •GRINDING	STEEL		50	1,400/ 25,000	2,800/ 50,000	\$ 1.5/\$2.5 (\$2.0)	\$ 3.0/\$5.0 (\$4.0)		18/22 (20)	36/44 (40)	TRANSFER LINE
COMPONENT ASSEMBLIES •PRESSES •SCREW MACHINE OPERATIONS •TURNING •GRINDING •ASSEMBLY	STEEL & MAN- MADE SEALS		85	1,400/ 25,000	2,800/ 50,000	\$ 3.5/\$4.5 (\$4.0)	\$ 5.0/\$7.0 (\$6.0)		31/39 (35)	63/77 (70)	AUTOMATIC ASSEMBLY MACHINES
ACCESSORY COMPONENTS •MILLING •SHAPER OPERATION •ROLL FORM OPERATIONS •EXTRUDING	STEEL CAST IRON		90	1,400/ 6,800	2,800/ 13,600	\$ 4.0/\$6.0 (\$5.0)	\$ 6.0/\$8.0 (\$7.0)		54/66 (60)	108/132 (120)	
RECIPROCATING PARTS •UPSETTING •GRINDING •SCREW MACHINE OPERATION •INDUCTION HARDENING	STEEL CAST IRON		196	1,120 25,000	2,240 50,000	\$10.0/\$14.0 (\$12.0)	\$16.0/\$20.0 (\$18.0)		157/193 (175)	313/387 (350)	

FACILITY TYPE/PRODUCT: ENGINE COMPONENTS/ACCESSORIES PLANT

FACILITIES PLANNING AND PROCESS SUMMARY
(DATA) IS A NOMINAL ESTIMATE

DEPARTMENT AND PROCESS	MATERIAL	AREA SQ.FT. (000)		ANNUAL CAPACITY (000)		MAJOR CAPITAL EXPENDITURES (DOLLARS IN MILLIONS)			DIRECT LABOR		REMARKS
		LEVEL I	LEVEL II	LEVEL I	LEVEL II	LEVEL I	LEVEL II	TOTAL	LEVEL I	LEVEL II	
OTHER			270			\$3.2/\$3.9 (\$3.51)	\$4.5/\$5.5 (\$5.01)				
PLANT FACILITIES						\$14.4/\$17.6 (\$16.01)	\$18.5/\$22.5 (\$20.51)				
BUILDING AND LAND						\$45.5/\$55.5 (\$50.51)	\$48.0/\$59.0 (\$53.51)				705,000 SQ.FT TOTAL BUILDINGS
									260/320 (2901)	520/640 (5801)	DIRECT LABOR
									180/220 (2001)	325/395 (360)	INDIRECT LABOR
									135/165 (1501)	200/240 (220)	SALARY
			691						575/705 (640)	1,045/ 1,275 (1,160)	TOTALS
							\$82.0/104.0 (\$93.01)*	\$101.0/ 127.0 (\$114.0)*			

*Major capital expenditures adjusted for 1981 economies of \$08 010 000. \$171 000 000

NEW ENGINE COMPONENTS/ACCESSORIES PLANT
PARTS PRODUCTION BY AREA

SMALL PARTS

CORE PLUG
TAPPED PLUGS
DOWELS
TIMING INDICATOR
CONNECTING ROD BUSHING

50,000 SQ.FT.
VALVE GUIDE
VALVE SPRING SEATS
VALVE RETAINER & LOCK
VALVE OIL SHIELDS
VALVE OIL SEAL

COMPONENT ASSEMBLIES

OIL SEAL ASSEMBLY
TIMING CHAIN
VALVE TAPPET & LASH ADAPTOR

85,000 SQ.FT.

ACCESSORY COMPONENTS

SPROCKET & KEY
TRANSMISSION DRIVE PINION
VIBRATION DAMPER
ROCKER SHAFT SUPPORT

90,000 SQ.FT.

RECIPROCATING PARTS

PUSH RODS
ROCKER ARMS
PISTON PINS
PISTON RINGS
VALVES

196,000 SQ.FT.

NEW ENGINE COMPONENTS/ACCESSORIES PLANT
(SQUARE FEET)

		<u>AREA</u>
<u>MANUFACTURING BUILDING</u>		
MACHINERY & EQUIPMENT (INCLUDING AISLE ALLOWANCE)		421,000
PARTS STORAGE		45,000
SHIPPING AND RECEIVING		45,000
TOOL ROOM & CUTTER GRIND		30,000
PRODUCTION OFFICES & MAINTENANCE		50,000
LABS (QUALITY & ENGINEERING)		15,000
UTILITIES ROOM (AIR COMPRESSOR, GAS & ELECTRICAL)		25,000
OTHER (REST ROOMS, EATING AREAS, ETC.)		30,000
OPERATIONS OFFICE		30,000
12 Bays @ 60' - 720' x 24 Bays @ 40' - 960'	TOTAL	691,000
	AUXILIARY	14,000
GRAND TOTAL		705,000

ENGINE COMPONENTS/ACCESSORIES PLANT
(LEVEL II)

720'		(SQUARE FEET)		960'	
30,000		OPERATIONS OFFICE		FINISHED PARTS STORAGE 30,000	
LABS 15,000	TOOL ROOM & CUTTER GRIND 30,000		196,000	ACCESSORIES COMPONENT PRODUCTION 90,000	
85,000		COMPONENT & ASSEMBLY PRODUCTION		RECIPIROCATING PARTS PRODUCTION	
50,000		SMALL PARTS PRODUCTION		50,000	
		PRODUCTION OFFICE & MAINTENANCE		UTILITIES 25,000	
				OTHER 30,000	
				SHIPPING 30,000	
				RECEIVING 15,000	
				PURCHASE PARTS & RAW STOCK STORAGE 15,000	

TOTAL AREA: 691,000 SQ.FT.

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**Research and
Special Programs
Administration**

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