DESIGN PROPOSAL OF AN AUTOMOBILE VILLAGE, MINNA

(WITH EMPHASIS ON WASTE DISPOSAL)

BY

ASIEGBU KENNETH OGADINMA

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CERTIFICATION

This thesis tilted "**AUTOMOBILE VILLAGE MINNA**" duly fulfils the requirement for award of degree of masters of technology (M. Tech) in Architecture of Federal University of Technology Minna and approved for it's contributions to knowledge.

ABIEGBU LEONARD O — STUDENT

K.O ABIEGBU 28/07/2012 — SIGNATURE & DATE

P. B. Haruna — SUPERVISOR
ARC. PAUL HARUNA

11/08/12 — SIGNATURE & DATE

HEAD OF DEPARTMENT
DR. (MRS) S.N. ZUBAIRU

8/8/12 — SIGNATURE & DATE

DEAN SCHOOL OF POST-GRADUATE STUDIES

SIGNATURE & DATE

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DECLARATION

I **ASIEGBU KENNETH OGADINMA**, declare that this thesis for the Master of Technology, Architecture is solely composed by me and has by means been presented either wholly or partially for any degree.

DEDICATION

This thesis is solely dedicated to ALMIGHTY GOD in heaven who has given me life, strength and privilege to be where I am now. I bless His Holy Name and pray that his promises over me will prevail.

ACKNOWLEDGEMENT

First of all my gratitude goes to Almighty God, maker of heaven and earth and his son the Lord Jesus Christ redeemer of my soul, for the opportunity and life. They both have granted me. I bless and adore you Holy names.

Then, my profound gratitude to my beloved parent MR. AND MRS EZEKIEL CHUKWUDI ASIEGBU for their prayers, moral and financial support in my life. THANK YOU both. My love still extends to UCHENNA ASIEGBU for also your support and love as an elder brother, CHIOMA though you still owe me one, but I still love you. Now to my boys CHIKAODI ASIEGBU, CHINONSO ASIEGBU & CHIMAOBI ASIEGBU for making me realize who I am, I love you for that and you guys are my source of inspiration. Also to Stella Asiegbu, Nnene, Ifeanyi (Ernest), Chinonso Asuzu.

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ABSTRACT

The purpose of this project is to look into the need for a standard automobile village in Minna as an industrial and commercial venture, in order to alleviate the problem and difficulties in automobiles nowadays.

The proposed automobile village is to check or eradicate the problem of vehicles below standard.

The criteria needed to meet up with the required standard, has been highlighted in chapter one (1) to nine (9), which discussing the meaning, literature review, space allocation movement as well as the materials, services and maintenance culture.

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CHAPTER ONE

1.0 INTRODUCTION

An automobile workshop is an area arranged specially for various repairs of vehicles or automobiles, requiring special equipment and skills to bring vehicles back to shape and good sound. The use, growth and development of vehicles has closely followed advances in automotive technology and the improvement and expansion of the national highway network. Vehicles provide convenient and economical transportation in every major city and many smaller communities in all parts of the nations ,help to convey humans, animals and goods from one point to another. Knowing the degree and extent of use in our vehicles that results to break-down and deterioration brings about restoration or repairs. When it comes to restoring automobile workshops are the perfectionist. Various exquisite cars have taken prizes at concourse event all over the world. The believe in the ethos of the "ultimate restoration" and there is pride in the ability to provide customers with some of the most beautifully restored vehicles in the world.

Automobile workshops employ traditional methods and time – honoured techniques to ensure that vehicles are equally special. By combining modern technologies with the commitment to originality passion and dedication ensures that vehicles are as good – if not better today than the day they left the factory. Furthermore, the development of be spoke computerized in voicing faults and

jobs costing program that allow weekly or even daily breakdown of the work that has been carried out.

1.1 AIMS AND OBJECTIVES OF THE STUDY

The aim of this study is to provide a standard workshop that can shelter and for refurbishment of all kinds of vehicles used in Nigeria.

OBJECTIVES

- Bringing kinds of vehicle experts under the same umbrella.
- Creating a condusive environment for both humans and the vehicles themselves.
- Creating an opportunity for various individuals who want to learn automobile technology.

1.2 RESEARCH METHODOLOGY

The method of research that will be adopted for this project includes: -

1. LITERATURE SURVEY: These are information collected on the project from the reading of books, magazines, journals and textbook.
2. PHOTOGRAPHIC SURVEY: This will involve the taking of photographs of some features for visualizing purpose.
3. ORAL INTERVIEW: This will involve the direct interview of the people on the project.
4. CASE STUDIES: This involves visiting some existing similar infrastructures within the country, critical analysis of such infrastructures. The type of facilities of staff, the capacities as well as type of operation of services

being carried out. Case study was not limited to infrastructure found within the country alone. In included those found outside the country, so as to have adequate information to meet international standards.

5. FIELD SURVEY: This reveals the topography vegetation, soil condition, access facilities that are available on site during inspection and visitation to the site of study.

1.3 SCOPE OF THE STUDY

The scope of this project shall be made up of the following units / departments.

WORKSHOP UNIT

1. Various servicing spaces
2. Tool store
3. Parts store
4. Computer room – to detect faults
5. Changing rooms
6. Body shop
7. Paint room
8. Storage room
9. Welding shop
10. Mechanic shop
11. Car wash
12. Show room

ADMINISTRATION UNIT

1. General Manager's office
2. Assistant General Manager's office
3. Computer room
4. Record / Data room
5. Offices

OTHER SUPPORTING FACILITIES

1. Cafeteria – Junior & Senior Staffs
2. Clinic
3. Leisure Corner.
4. Fire Station
5. Filling Station.

1.4 IMPORTANCE OF STUDY

The neglect and degradation of automobile profession, degeneration of the physical environment and it's befitting human animal and vegetational populace, has brought to the importance of this study which is to provide automobile with a condusive environment for work and help with sewage disposal.

1.5 DEFINITION OF TERMS:

AUTOMOBILE: Self propelled vehicle used for traveling on land. The term is commonly applied to a four – wheeled vehicle designed to carry two to six passengers and a limited amount of cargo as contrasted with a truck, which is

designed primarily for the transportation of goods and is constructed with larger and heavier parts, or a bus (or omnibus or coach), which is a large public conveyance designed to carry a large number of passengers and sometimes additional small amounts of cargo. For operation and technical features of automobiles, differential; fuel injection; ignition; internal combustion engine, lubrication; muffler; odometer; shock absorber; speedometer; steering system; suspension, tachometer, tire, transmission.

VILLAGE: an area created or set aside comprising of structures which activities can be carried out, in this case automobile activities, repairing and testing of vehicles.

CHAPTER TWO

LITERATURE REVIEW

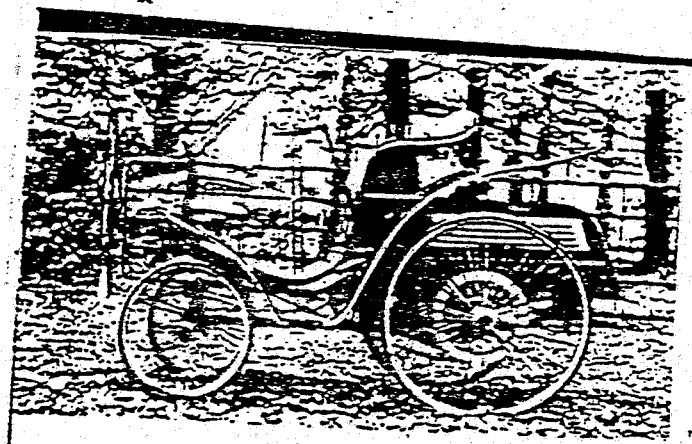
2.0 AUTOMOBILE INDUSTRY

The business of producing, repairing and selling self-powered vehicles, including passenger cars, trucks, farm equipment, and other commercial vehicles. By allowing consumer to commute long distances for work, sopping and entertainment, the auto industry has encouraged the development of an extensive road system, made possible the growth of suburbs and shopping centers around major cities, and played a key role in the growth of ancillary industries, such as the oil and travel business. The auto-industry has become one of the largest purchasers of many key industrial products, such as steel. The large number of people the industry employs has made it a very determinant of economic growth.

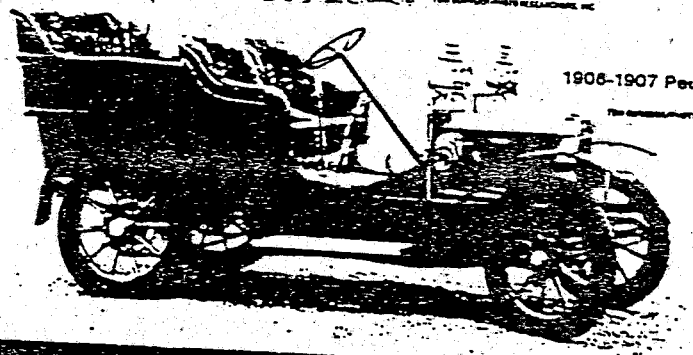
2.1 HISTORY

Although ancient Chinese writers described steam – powered vehicles, and both steam – and electric – powered cars competed with gas –p powered vehicles in the late 19th Century. Frenchman Jean Joseph Etienne developed the first practical internal – combustion engine (1980), and later in the decade several inventors, most notably Karl Benz and Gottlied Daimler, produced gas – powered vehicles that ultimately dominated the industry because they were lighter and less expensive to build. French companies set the design of the moderns auto by placing the engine over the front axle in the 1890s and it's

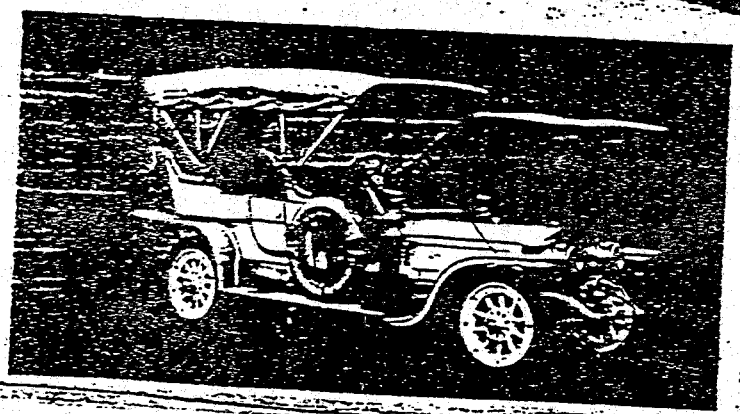
AUTOMOBILES BEFORE WORLD WAR I



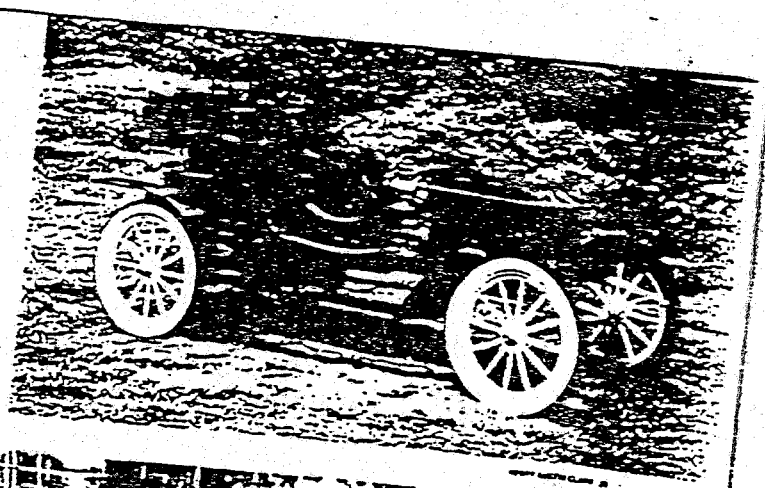
Benz carriage of the 1890's



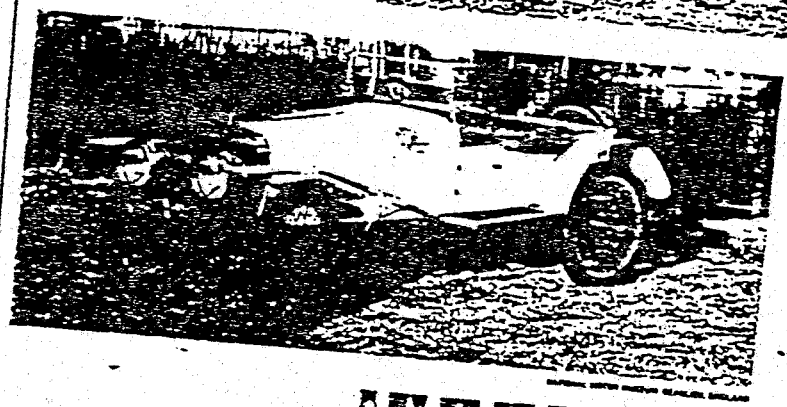
1906-1907 Peugeot Lion



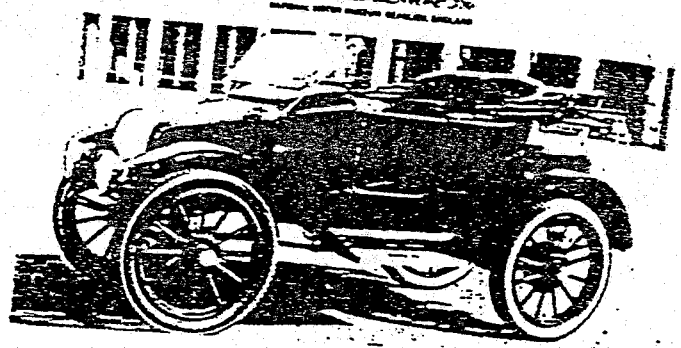
1907 Rolls-Royce Silver Ghost



1908 Stanley Steamer



1912 Hispano-Suiza



1914 Baker Electric

manufacturers made important advances in the mass production of the auto by introducing cars with interchangeable machine – produced parts (one such car was created by Ransom E. Olds in 1901).

In 1914 Henry Ford began to mass produce cars using assembly lines. In addition, his practice of providing loans to consumers to buy cars (1915) made the model – T affordable to the middle class. In the 1920s, general Motors further changed the industry by emphasizing car design. The company introduced new models each year marketed different lines of cars to different income brackets (the Cadillac for the rich, the Chevrolet for the masses), and created a modern decentralized system of arrangement. U.S. auto sales grew from 4,100 in 1900 to 895,900 in 1915 to 3.7 million in 1925. Sales dropped to only 1.1 million in 1932 and during world war II, the auto factories were converted to war time production.

2.2 THE MODERN INDUSTRY

After 1945, sales once again took off, reaching 6.7 million in 1950 and 9.3 million in 1965. The U.S auto industry dominated the global market with 83% of all sales, but as Europe and Japan rebuilt their economies, their auto industries grew and the U.S. share dropped to about 25%. Following the OPEC oil embargo in 1973 smaller, fuel – efficient imports increased their share of the U.S. market to 26% by 1980. In the early 1980s U.S. auto makers cut costs with massive lay offs. Throughout the 1990s imports particularly from Japan – took an increasing share of the U.S. market.

Beginning in the early 1980s. Japanese and, later, German Companies set – up factories in the United States; by 1999, these were capable of producing about 3 million vehicles per year. As a result, the three bid U.S. auto makers now produce only 66% of the cars sold in America. In the early 1990s, over $140 billion worth of motor vehicles and parts were produced in the United States by companies employing more than 210,000 workers. Complaints about auto pollution, traffic congestion, and auto safety led to the passage of government regulations beginning in the 1970s, forcing auto manufacturers to improve fuel efficiency and safety. Auto companies are now experimenting with cars powered by such alternative energy sources as natural gas, electricity and solar power.

In the year 1896, the French word 'automobile' came into vogue with the press in the United States to describe the horseless carriage that many inventors around the country were working on. Frank Duryea and his brother Charles were the first to produce more than one automobile at a time, they intended to build many Duryea's and to make a profit doing so. The Duryea factory is spring field, Massachusetts produced 13 Automobiles in 1896, thus giving birth to the automobile industry in America.

Many other notable events occurred in 1986. in Detroit (The motor city). Charles King introduced his auto in March 6th. The King auto was notable in that it was one of the first to have a four cylinder engine. An enthusiastic participant in the first test drive, was a young Electrical Engineer named Henry

Ford who pedaled his bicycle along side King's auto as it reached a top speed of 5mph.

On June 4th, using parts borrowed from King, such as a chain drive. Henry Ford introduced his first automobile to Detroit. Fords "Quadricycle as he named it weighed much less than other autos, just over 500 pounds, compared to the Duryea at 700pounds and the king at 1300 pounds. It had a top speed of 20mph which was also on improvement over King's 5mph. In his enthusiasm to build his first prototype. Henry did not consider how the would get it out of his tiny workshop. With a pickaxe in hand he widen the small doorway to his workshop till he could get the Quadricycle out. Late into the moving he tested his prototype, braking down only once about 2:00am in front of the Cadillac Hotel.

By October of 1896 Ford has sold his first Quadricycle and with the proceeds started to built an improved version. Also in October, Alexander Winton, of Cleveland, announced his first automobile in "The Horseless" age magazine. His auto weighted in at over 1600 pounds, which showed it's performance. A second Winston was introduced in February of 1897, and the Winston Motor carriage company was incorporated in March. The second Winston was longer and wider accommodating three people across each of its two seats, the second seat facing rear-ward in what the French called the dos-a-dos (back to back) arrangement. Leo Melanowski, Winston's Chief Engineer invited Henry Ford to come to Cleveland for an interview at the Winston

Company. Alexander Winston was not impressed with Henry and decided not to hire him. Henry went back to Detroit to continue working on his second Quadricycle. The Winston Company recorded it's first sale in March of '98 for $1000 dollars, by years end 33 Winston's were sold. James Packard was the most notable purchaser of a Winston later deciding to build his own "Parkard" automobiles. By 1899 more than 100 Winston's were delivered making Winston's the largest manufacturer of gasoline powered autos in the United States. With the Winston starting to show a fair amount of success the first auto dealership in the United States was opened in Reading, Pennsylvania by H.W. Koler.

Another great automotive inventor, Ransom Olds introduced his first auto in the later part of 1896. By August of 1897 Ransom, established the olds motor vehicles company with the support of local Lansing businessmen. Two years later Olds, getting off to a slow start, had built only six autos. In May of 1899 the Olds motor works came into existence and by 1901 slowly refining his autos had been produced. This same year a fire burned the motor works to the ground One prototype was saved which became the basis of America's first mass produced automobile. The curved Olds. It has been said that thanks to the fire, Olds finally had to focus one idea and design. The Curved Dash Olds was 98 inches long and weighed 700 pounds. It was powered by a 4.5 H.P Sing Le-cylinder engine of 95.5 cubic inches, mounted horizontally under the seat. The curved Dash sold for $650.00 which remained the same for the entire seven year

production life, of 18,933 cars. Because the fire reduced their manufacturing capacity the curved Dash was parted out to many different company's to make different components, many of these companies would go on to build their own automobiles. The engines were built by Henry Leland's Company Leland and Faulconer, Leland would go on to build the Cadillac, and the transmissions were built by the Dodge brothers, Ransom olds wanted to continue production and improved upon the curved Dash but was voted down by his board of directors. If Ransom olds would have been allowed to improve upon the curved Dash perhaps Henry Ford would have never become the top manufacturer.

2.3 DEVELOPMENT OF THE AUTOMOBILE

The automobile has a long history. The French engineer Nicolas Joseph Cugnot built the first self – propelled vehicle (Paris, 1789), a heavy, three – wheeled, steam – driven carriage with a boiler that projected in front, its speed was C.3 mph (5Kph). In 1801 the English engineer. Richard Trevithick also built a three wheeled, steam – driven car, the engine drove the rear wheel. Development of the automobile was retarded for decades by over-regulation; speed was limited to 4mph (6.4kph) and until 1896 a person was required to work in front of a self-propelled vehicle , carrying a red flag by day and a red lantern by night. The Stanley brothers of Massachusetts, the most well-known American manufacturers of steam – driven autos produced their Stanley Steamers from 1897 until after world war I.

The development of the automobile was accelerated by the introduction of the internal – combustion engine. Probably the first vehicle of this type was three wheeled car built in 1855 by the engineer Karl Benz in Germany, Another German Engineer, Goltlied Daimler, built an improved internal combustion engine C. 1885. The Pan hard car, introduced in France by the Daimler company in 1894, had many features of the modern car. In the United States, internal – combustion cars of the horseless buggy type were manufactured in 1890s by Charles Duryea and J. Frank Duryea, Elwood Haynes, Henry Ford, Ransom E. Olds ands Alexander Winston. Many of the early engines had only one cylinder, with a chain-and-sp-rocket drive on wooden carriage wheels. The cars generally were open, accommodated two passengers, and were steered by a lever. The free growth of the automobile industry in the early 20th century was threatened by the American inventor George Selden's patent, issue in 1895. several early manufacturers licensed by Selden formed as associated in 1903 and took over the patent in 1907. Henry Ford, the leader of a group independent manufacturers who refused to acknowledge the patent, was engaged in litigation with Selden and the association from 1903 until 1911, when the U.S. circuit Court of Appeals ruled that the patent, although valid, covered only the two-cycle engine, most cars including Ford's used a four-cycle engine. The mass production of automobiles that followed, and the later creation of highways linking cities to suburb and region-to-region, transformed American landscape and society.

2.4 MOTOR CAR

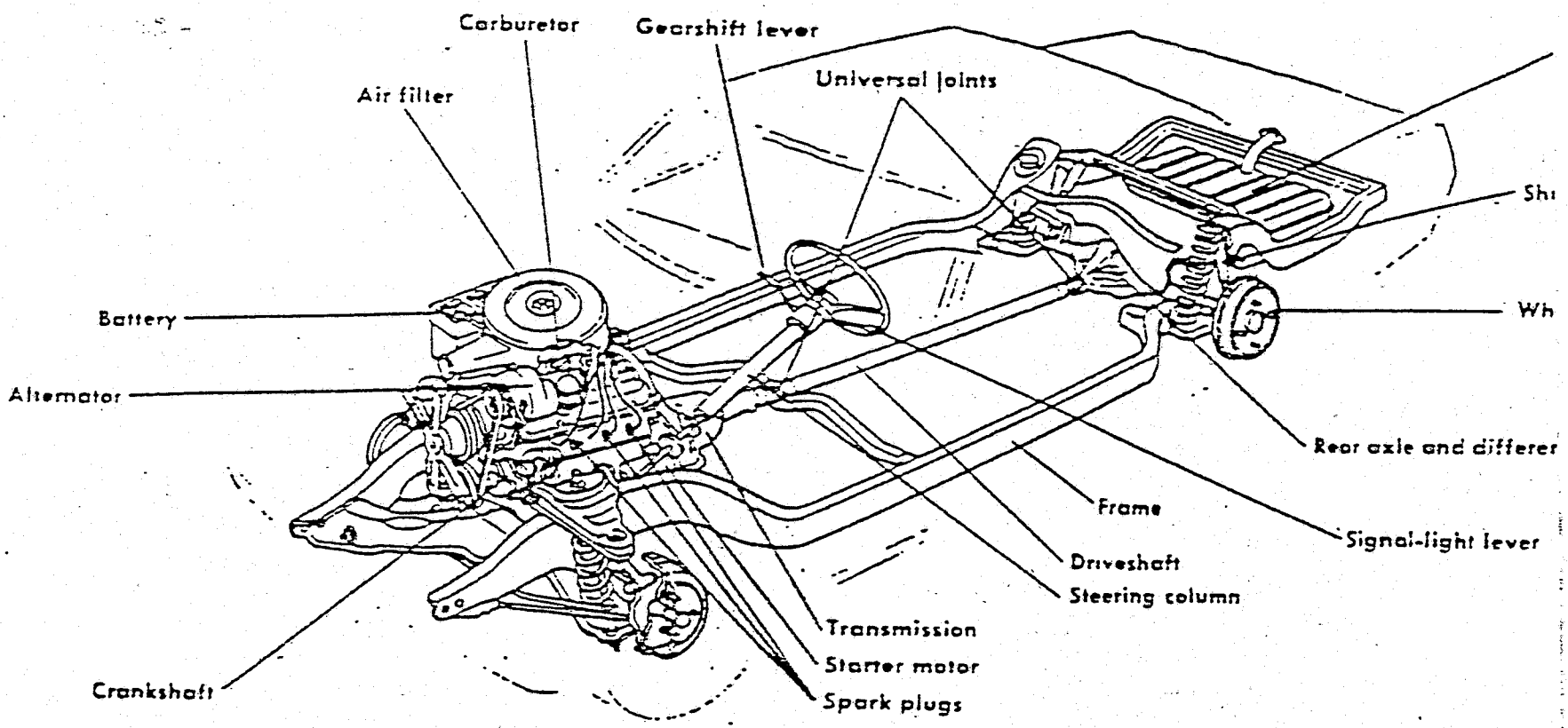
Any self-propelled vehicle with more than two wheels and a passenger compartment, capable of being steered by the operator for use on roads. The term is used more specifically to denote any such vehicle designed to carry a maximum of seven people.

The primary components of a car are the power plant, the power transmission, the running gear, and the control system. These constitute the chassis, on which the body is mounted. The power plant includes the engine and its fuel, the Carburetor, ignition, lubrication and cooling systems, and the starter motor.

2.4.1 HOW CAR ENGINES WORK

A. **FOUR-STROKE CYCLE** – The overwhelming majority of car engines still employ the four-stroke cycle (four piston stroke per cycle). Invented by Nicholas oho in 1876, the first down stroke of the piston that is attached to a connecting rod at it, stop end and to the crankshaft at the bottom, draws a petrol – air mixture into the cylinder this is then compressed, which is the second stage of the process. The volatile cocktail is then ignited by a sparking plug and the resulting explosion forces down the piston, so turning the crankshaft .The final phase of the operation is the stroke that expels the exhaust gases from the cylinder

B. **CYLINDER HEAD** – The engines cylinder block is invariably made of cast iron which is bolted an aluminum cylinder head this contains the

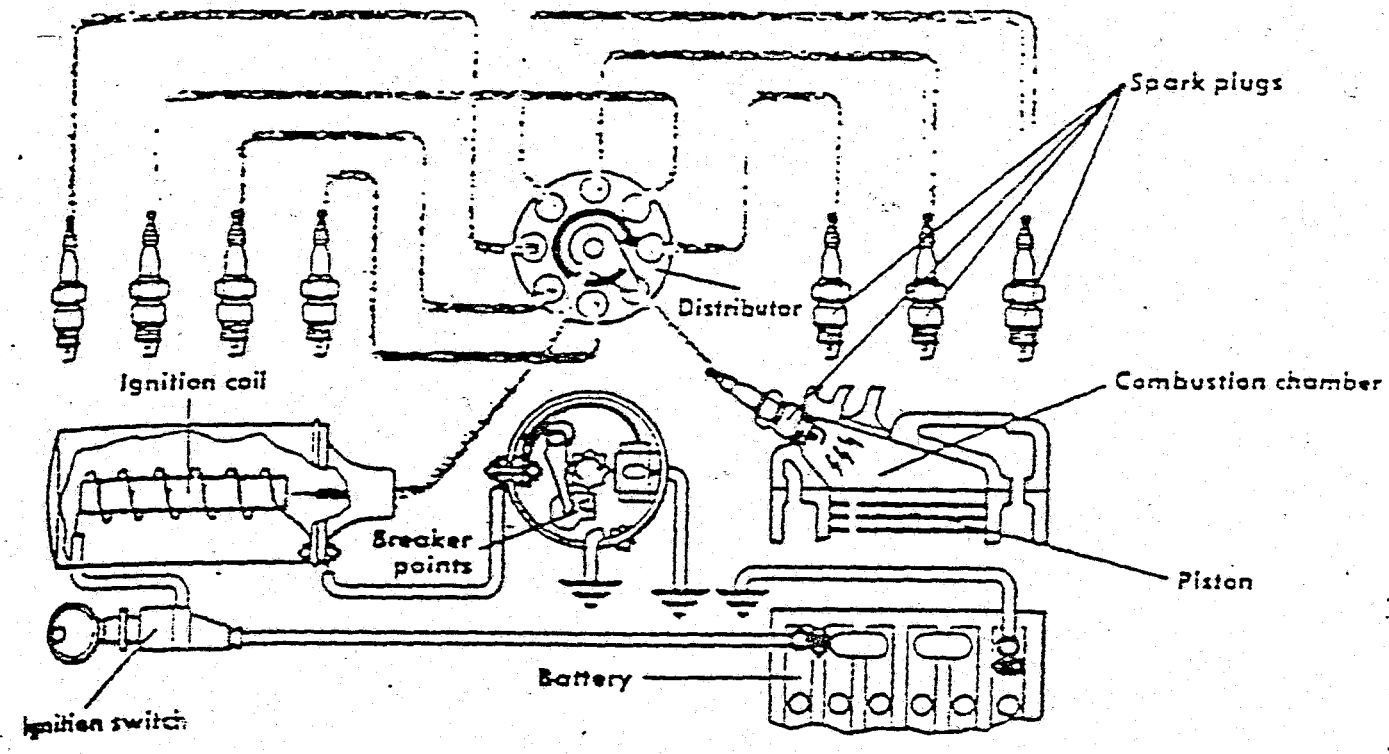

Carburetor
Gearshift lever
Air filter
Universal joints
Battery
Alternator
Crankshaft
Transmission
Starter motor
Spark plugs
Driveshaft
Steering column
Frame
Rear axle and differer
Signal-light lever

valves that permit the petrol – air mixture to enter the combustion chamber and the exhaust gases to leave it. These can be actuated by push rods from a block located crankshaft –driven crankshaft, although the head more usually incorporates single or twin overhead crankshafts driven by a ribbed rubber belt.

C. **FUEL INJECTION** – A carburetor had been used from the earliest days of motoring as a component in which the petrol – air mixture was created. The limit of such an arrangement was that the mixture was unevenly distributed which resulted in incomplete combustion and an undesirable amount of unburnt fuel reaching the atmosphere.

As a result, the carburetor has now been replaced by fuel injection. This first appeared on high performance cars in the 1950s. Not only is a precise amount of metered petrol delivered by pump to each cylinder, but the air supply can also be carefully controlled by the use of an individual inlet manifold.

D. **LUBRICATION** – An engine cannot function unless it is well lubricated with oil. This is circulated under pressure from a pump that draws lubricant from a reservoir contained within the sump at the base of the engine. It is delivered under pressure to the main crankshaft bearings from a gallery located in the side of the block, and to the appropriately named big-ends of the connecting rods via holes drilled in the shaft. Oil reaches the bores by splash although it is pumped to the crankshaft and valve gear.



IGNITION SYSTEM is the part of the electrical system that produces a spark to ignite the fuel-air mixture.

E. **COOLING** – As the combustion temperature of petrol is 2500^0C, the engine must be cooled. The cylinders and head therefore incorporate water jacketing for a coolant that contains an antifreeze mixture circulated by pump. It is cooled in a radiator located at the front of the car by a passage of air that is drawn through it by a thermostatically operated electric fan.

F. **IGNITION** – Whether a carburetor or fuel injection is employed, the petrol – air mixture has to be ignited by a sparking plug. Current is fed to each via a distribution supplied from a high-tension coil. The current requires interruptions in it's cycle, and these are produced by a contact brake contained within the distributor. Nowadays, more efficient contactless distributors are employed that work in conjunction with a computerized engine management system.

G. **ELECTRICAL EQUIPMENT** – The cars management system is yet another component to make demands on the cars battery. The system is charged by an engine driven alternator that, unlike the dynamo it replaced in the 1970s, is efficient at low speeds or when a car is "ticking over" in a traffic queue. A key function of the electrical system is to start the car's engine. This is usually undertaken by a pre-engaged motor, in which a solenoid moves a bevel gear into mesh with the teeth on the engine's flywheel. In addition to providing current for the car's lights and windscreen wipers, modern electrical system have to service a radio/tape recorder cigarette lighter, heated rear window, central door locking, windows, seat adjustment.

H. **MANUAL TRANSMISSION** – On most front – and – rear drive cars the gear box is attached directly to the engine. To facilitate gear changing, the drive passes through a clutch that must be briefly disengaged by the driver. This detaches the components pressure plate from the driven one.

The gearbox usually incorporates four or five forward speeds and reverse. It consists, in essence, of three lines of gear clusters, all of which are in constant engagement. There is a short first motion shaft, connected to an output shaft, that meshes with an offset layshaft. The changes are effected by sliding dog clutches positioned on the combined first – motion / output shaft. This also incorporates synchromesh cones, which facilitate silent gear changes.

I. **AUTOMATIC TRANSMISSION** – This works in conjunction with a torque converter or fluid flywheel, which transmits the engines power through the medium of hydraulic fluid to the automatic gearbox. It accordingly does not require a clutch pedal.

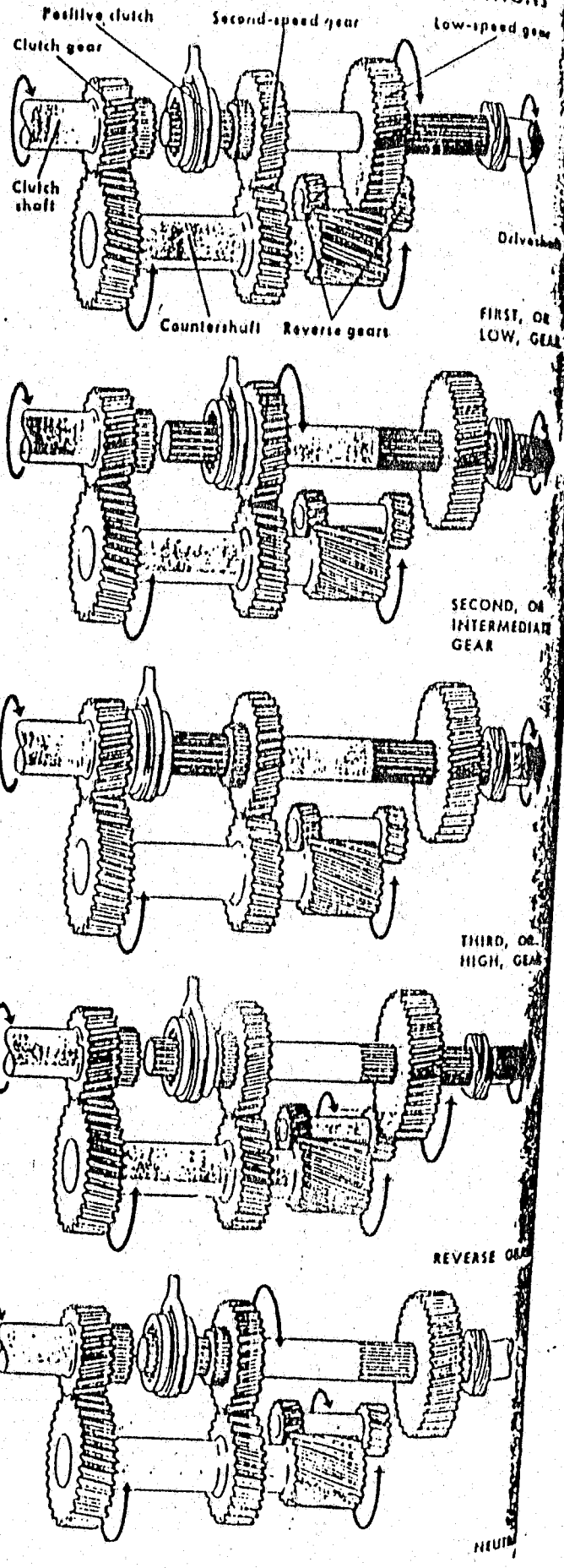
An automatic unit is far more complex than a manual one and has at its heart a series of epicyclical gears, which are selected mechanically. Changes are effected automatically by a complex sequence of hydraulically by a controlled commands. A simpler system that makes fewer demands on the engine, and is therefore more economical is continual variable transmission. This initially used rubber belts in conjunction with pulleys that expanded and contracted to alter the engines power ratio. On the current version, however, this function is undertaken by a steel belt.

J. **DRIVE LINES** – In a front – wheel drive car, power is conveyed by gearing to a differential that is incorporated in the engine / gearbox unit. It's function is to permit concerning so that the outer – driven wheel turns faster and further than the inner one. Drive is transferred to each wheel by a constant velocity joint that can also absorb steering forces. On a rear-drive vehicle, power is transmitted from the gearbox to the rear located differential via a propeller shaft. It is then conveyed to the wheels by half – shafts (in the case of a live rear axle) or universally jointed drive shafts (if independent rear suspension is employed).

K. **INDEPENDENT SUSPENSION** – The arrival of front – wheels drive saw an increase in the use of independent front suspension, in which each wheel is able to act in isolation to the other. One of its most important advantages is that it keeps the wheel is able to act in isolation to the other. One of it's most important advantages is that it keeps the wheels vertical and the tyres on the highway, regardless of body roll, and therefore enhances the car's road – holding ability. The most common version employs two unequal length "wish bones", with coil springs providing the suspension medium. In the alternative Mac Pherson strut system there are no wish bones and the spring is combined with a shock absorber.

L. **BRAKES** – Most cars use disc brakes on their front wheels; these are fitted on front and back wheels on more expensive models. When the brake pedal is applied, hydraulic power is applied to calipers that grip the disc and so

THREE-SPEED-TRANSMISSION GEAR POSITIONS



contribute to arresting the car's progress. Drum brakes that use internally actuated shoes, are often filled at the rear. All cars feature a hand or parking brake that operates on the vehicle's rear brake shoes or discs.

M. **STEERING** – The most popular steering system is rack and pinion power assisted steering, which is hydraulically activated by an engine – driven pump and previously the pressure of expensive cars, is becoming increasing popular.

N. **BODYWORK** – A body's aerodynamic efficiency is measured by drag coefficient (cd) and the lower the figure the greater the car's wind cheating properties. Nowadays, most cars register a reading of 0.3 to 0,4 and such features as integrated bumpers, a tapered nose, and windows that are flush with the body sides are incorporated to keep a vehicle's cd as low as possible.

O. **SOCIAL IMPACT OF THE CAR** – Potentially, the motor car provided universal mobility for the population of the industrialized world. At first, only the wealthy could afford cars although the arrival o the model T Ford. Mass produced from 1913 , the price fell and the beloved "Tin Lizzie" inspired a host of imitators across the globe. Nevertheless, during the inter-war years motoring remained a pursuit of the affluent. The increasing prosperity that followed World War II brought growing numbers of cars to the world's roads that currently accommodate over 500 million motor vehicles. Britain accounts for 24 million of them. Traffic – related air pollution, traffic congestion and traffic control, and road safety are major issues in developed and other countries.

P. **EARLY DEVELOPMENT** – The motor car first appear in Germany in 1885 when Karl Benz and Gottlied Daimler, each working independently of the other, produced self- propelled vehicles powered by rear – mounted, petrol – fuelled single – cylinder engines. These were based on the stationary gas engine that used the four – stroke principle.

The replicas of the originals that each engineer produced gave birth to the world's motor industry, although in 1896, France and not Germany became the world's largest manufacturer of motor vehicles. In 1891 a French engineer, Emile Levassor, transferred the engine of the Panhard et Levassor car from its established rear location to the front of the vehicle , from where it drove the rear wheels via a clutch and in-line gearbox. Named systeme Panhard, it rapidly overtook the original layout in popularity and survives, in essence, on large capacity cars. The progressive Gottlied Daimler soon produced, in 1893, a vertical two-cylinders in-line engine and Benz followed, in 1897, with a horizontally opposed twin in which the cylinders were in the same plane as the crankshaft. Panhard had introduced the in-line four in 1896 and this configuration soon outstripped all other types in popularity, most notably in the Henry Ford Model T, built between 1908 and 1927.

Over 15 million of these Fords were produced and their success helped America to consolidate its position, attained in 1906, as the world's largest manufacturer of motor cars. The United States dominated the industry until 1980, when it was overtaken by Japan.

Britain had lagged behind France and Germany in introducing the motor cars, as its industry was shifted by the presence of the locomotive Act of 1865. The required self-propelled vehicles to be limited to a speed of 3.2km/h (2mph) in towns and 6.2km/h (4mph) elsewhere. Originally, motor cars were required to be proceeded by a man carrying a red flag but this stipulation was usually set aside following an amendment to the act in 1878.

As early cars were capable of at least 32km/h (20mph), continental imports could be not be practically or legally run on Britain's roads until 1896, when the locomotive Act was modified. The speed limit was raised to a blanket 19km/h (12mph) and increased again, in 1904, to 32km/h (20mph).

Britain's motor industry therefore dates from 1896, although most manufacturers were initially only responsible for their vehicles mechanical components. Body work, usually of the open type with only rudimentary weather protection in the form of a canvas hood, was the responsibility of coach builders, who had hitherto manufactured horse – drawn vehicles. In 1904 the English Napier company had built he world's first usable six cylinder car, although the costly straight – eight engine did not make any impact until after world war I. The more compacts V_8, in which four in line cylinders were positioned in a V-shaped configuration, was popularized by the American Cadillac company in 1915. It's Lincoln rival was responsible for the world's first successful V_{12} – engined car that date from 1915. however, the V_6 unit, pioneered by Lancia, did not arrive until 1950.

Q. **SALOON BODIES** – Most cars were fitted with open, wooden-framed, handcrafted steel or Aluminums body work that was mounted on a separate chassis frame. Saloons were more expensive because they used more materials. It was not until 1925 that the America Essex Company risked all by offering a closed car that sold for less than touring vehicle. The gambler paid off and the rest of the monitoring world soon followed suit.

Mechanic – made pressed steel body panels had been used by Dodge in America from 1916; this led to the all-steel saloon and, finally, the unitary body, which dispensed with the chassis and transferred stresses to the hull, Citroen's advanced front – wheel drive Traction Avant model of 1934 was the first mass produced can to feature the concept and was followed by General motors. German Opel subsidiary in 1935, General motors was also responsible for introducing silent gear changes to monitoring in 1928, and in 1940 and American car, olds mobile, was the first vehicle to have automatic transmission.

Cars used leaf springs inherited from horse drawn carriages until the 1930s, when independent front suspension was developed. However, it's rear equivalent was rear and usually confined to more expensive vehicles. An exception was provided by Volkswagen AG in Germany. The Beetle was the Volkswagen which was design by Ferdinand Porche in 1934 and entered series production in 1945. featuring all independent suspension, it was powered by a rear – mounted, horizontally opposed, four – cylinder engine that was cheap to run, and which also defied convention by being air rather than water cooled.

The beetle became the most popular car in the history f motoring; it is still in production and a record 21 million have been built. A Germany company also produced the economical and efficient diesel engine, invented in 1893 by Rudolf Diesel. Adopted in the 1920s for use in commercial vehicles in 1935 Mercedes – Benz introduced the 2600 as the world's first diesel – engined car.

R. **FRONT – WHEEL DRIVE** – 1937 the French Citroen company briefly offered a diesel option in it's front-wheel drive traction avant. This model represented the first serious challenge to the orthodox front – engine / rear drive configuration. Although the mechanics were more sophisticated, the Traction Avant cornered better and could be built with lower body lines because there as no obstrusive transmission tunnel. While the Citroen's engine was conventionally positioned, the British motor corporation's front – wheel drive mini of 1959, designed by it's chief engineer Alec Issigonis, had its power unit turned 90^0 to a transverse – mounted location. This allowed for more passenger accommodation: four adults could be seated in a car only 3m (10ft) long.

S. **FUEL ECONOMY** – In Europe Mini – inspired cars became increasingly popular and the mini itself became a classic. However, the global influence of the Issigonis approach attained it's height following the oil price rises in the early 1970s. This resulted in a trend in designing and producing smaller front – wheel drive cars with hatch back bodies, so called because they incorporated a single opening tailgate. (It also marked a decline in production of

the vast American "gas-guzzlers", which had been so popular in the 1950s). These cars currently dominate the world market.

The soaring price of petrol also revived research, dormant on passenger cars since the 1930s, into more aerody namically efficient body work. This meant that a car's styling was contoured to assist it's passage through the air in order to minimize petrol consumption. This had hitherto been the preserve of sports – car makers.

T. PERFORMANCE AND FOUR WHEEL DRIVE

From the 1970s the performance of such vehicles had also been enhanced by the development of the turbocharger. Driven by otherwise wasted exhaust gases. It is a small high – revolution pump that forces air into the cylinders at pressure and is invariably used in conjunction with an intercooler. This cools incoming air to make it denser, further increasing engine power. Performance cars were usually front – engined (and some time rear – engined) until the appearance, in 1966, of the Lamborghini Muira, which had a mid-located power on it. This meant a better balanced car, but at the expense of greater interior noise and loss of rear seating. Yet a further development in performance was the four-wheel drive with superior road holding. This was a luxury fitment until the arrival, in 1980, of the Audi Quatto, a make that had also introduced, in 1976, the petrol – fuelled five cylinder engine. Four wheel drive had already been incorporated in the cross – country Land Rover, its design inspired by the

American jeep. It first appeared in 1948 and paved the way to the better equipped Range Rover.

U. **FURTHER DEVELOPMENTS -**

UI. **REDUCING CAR EMISSIONS** – In recent years environmental considerations and growing concern over traffic pollution have had a profound effect on car design. The United States introduced the first regulations on noxious cars emissions in 1967; the California clean Air Act requires that, by 2003, 10 percent of all new cars sold in that state must have zero exhaust emissions. However, as these restrictions become more vigorous, their effects non the power and efficiency of car engines grow more adverse. Noxious emissions include carbon monoxide, nitrogen oxides, volatile organic compounds, and particulates. In 1986 the Japanese Toyota company introduced the more efficient multi valve twin overhead crankshaft engine, a unit move usually associated with high – performance models. This concept has now been widely adopted by the world's motor industries.

All new cars sold in Europe since 1990 have had to be capable of running on unleaded petrol. Lead has been added to petrol since the 1920s to improve engine performance, but was found to be a health hazard when emitted from car exhausts. In Britain unleaded fuels account for 67 percent of petrol sales.

Similarly, the exhaust systems of all new cars have had to be fitted with catalytic converters since 1993. In its basic two- way form, the catalytic converter uses platinum and palladium to catalyse the carbon monoxide and

hydrocarbons that are produced by the engines combustion process into carbon dioxide and water.

Manufacturers are currently undertaking research into "lean-burn" engines, which use less petrol and therefore produce a lower level of harmful emissions. The diesel engined car has grown in popularity but recent evidence shows that the minutes specks of soot, called particulates, that it produces are likely to exacerbate conditions such as bronchitis and asthma, mostly in city centers.

U2. **SAFETY** – Although cars have become faster, current models are safer than many of those manufactured in previous decades. Modern cars incorporate beam sat their front and rear, which crumple progressively in order to absorb energy, while having a strong central cell to protect occupants in the vent of a crash.

Braking has greatly improved in recent years and most systems feature servo assistance. This harnesses the vacuum produced by the engine to actuate the brakes, so that the driver does not need to apply an excessive amount of pressure to the pedal.

A further refinement is an automatic braking system. This sophisticated anti – locking device operates in conjunction with the vehicles' engine management unit, and was initially used on expensive cars to prevent skidding.

U3. **ELECTRICAL CARS** – The only vehicle to meet the requirements of the California clean Air Act is the electric car. This type of car produces no

harmful exhaust fumes, and does not absorb power when stationary. In 1996 General Motors became the world's first major car manufacturer to put a purpose designed electric car, the EVI, into production.

2.5 AUTOMOBILE PROPULSION SYSTEMS

Reciprocating Internal – Combustion Engines :

The modern automobile is usually driven by a water – cooled, piston – type internal – combustion engine, mounted in the front of the vehicle, it's power may be transmitted either to the front wheels, or to all four wheels. Some automobiles use air – cooled engines, but these are generally les efficient than the liquid – cooled type. In some models the engine is carried just forward of the rear wheels; this arrangement, while wasteful of space, has the advantage of better weight distribution. Although passenger vehicles are usually gasoline fueled, diesel engines (which burn a heavier petroleum oil) are employed both for heavy vehicles, such as trucks and buses and for a small number of family sedans. Both diesel and gasoline engines generally employ a four – stroke cycle.

2.6 THE WANKEL ENGINE

For some years, it was hoped that the wankel engine, a rotary internal – combustion engine developed by Felix Wankel of Germany in 1954, might provide an alternative to the reciprocating internal – combustion engine because of it's low exhaust emissions and feasibility for mass production. In this engine a three – sided rotor revolves within an epithrochoidal drum (combustion chamber) in which the free space contracts or expands as the rotor turns. Fuel is

inhaled, compressed, and fired by the ignition system. The expanding gas turns the rotor and the spent gas is expelled. The wankel engine has no valves, pistons, connecting rods, reciprocating parts, or crankshaft. It develops a high horse power per cubic inch and per pound of engine weight, and it is essentially vibrationless, but it's fuel consumption is higher than that of the conventional piston engine.

2.6.1 Alternative Fuels and Engines:

Internal – combustion engines consume relatively high amounts of petroleum, and contribute heavily to air pollution; therefore, other type of fuels and non conventional engines are being studied and developed. It is estimated that abut 418,000 alternative – fuel vehicles were in use in the United States in 1999, 50% of these operate on liquefied petroleum gas (LPQ, or propane) and almost 5% us compressed natural gas (CNG).The ideal alternative – fuel engine would burn fuel much more cleanly than conventional gasoline – powered internal combustion engines and yet still be able to use the existing fuel infrastructure (i.e. gas stations). Compressed natural gas, propane, hydrogen and alcohol based substances (gasohol, ethanol, methanol, and other 'neat' alcohols) all have their proponents. However, although these fuel burn somewhat cleaner than gasoline, the use of all of them involves trade offs. For example, because they take up more space per mile driven, these alternatives require larger fuel capacities or shorter distances between refueling stops. In addition, conventional automobiles may require extensive modifications to use alternative fuels; for

example, to use gasohol containing more than 17% ethanol, the spark plugs, engine timing, and seals of an automobile must be modified. Grain-derived fuels, such as ethanol, are a popular concept because they do not deplete the world's oil reserves, in various locations, "biodiesel" test cars have run on fuel similar to sunflower – seed oil. Similarly, dual – fuel – (gasoline – diesel and gasoline – propane) and water – fuel – emulsion – powered cars are being tested.

Alternative propulsion systems are also being studied. Steam engines, which were once more common than gasoline engines, are being experimented with now because they give off flower noxious emission, they are, however, less efficient than internal combustion engines. Battery powered electric engines, previously used mainly for local delivery vehicles, can now be used in automobiles capable of highway speed, but they are restricted to relatively short trips because of limitations on the storage batteries that power the motors. Automobiles with gasoline – electric hybrid engines first appeared on the consumer market in 199. some engineers worry that widespread adoption of electric cars might actually generate more air pollution, because additional electric power plants would be needed to recharge their batteries. Therefore, design and research work has also intensified on solar batteries, but they are generally not yet powerful enough to power such vehicles. The most promising technology for electric engines is the fuel cell, but fuel cells currently are too expensive for practical applications.

2.7 AUTOMOBILES AND THE ENVIRONMENT

Pollutants derive from automobile operation have begun to pose environmental problems of considerable magnitude. It has been calculated, for example that 70% of the carbon monoxide, 45% of the nitrogen oxide, and 34% of the hydrocarbon pollution in the United States can be traced directly to automobile exhausts. In addition, rubber (which wears away from tires), motor oil, brake fluid and other substances accumulate on roadways and are washed into streams, with effects nearly as serious as those of untreated sewage. A problem also exists in disposing of the automobiles themselves when they are no longer operable.

2.8 AUTOMOTIVE SAFETY:

Fatalities due to automobile accidents have stimulated improvements in automotive safety design. The first innovation involves creating a heavy cage around the occupant of the automobile, while the front and rear of the car are constructed of lighter materials designed to absorb impact forces. The second safety system uses seat belts to hold occupants in place. This was largely ineffective until states in the United States began passing laws requiring seat belt use. The Third system is the air bag; within a few hundredths of a second after a special sensor detects a collision, an air bag in the steering wheel or dashboard inflates to prevent direct human impact with the wheel, dashboard, or windshield (newer vehicles also includes side air bags, to protect occupants from side collisions). Other advances in vehicles safety include the keyless

ignition, which makes it impossible for a driver to start a car while under the influence of alcohol (over half of all vehicle fatalities involve at least one driver who has used alcohol) and antilock braking systems, which prevent an automobiles' wheels from locking during braking.

CHAPTER THREE

WASTE DISPOSAL

3.0 INTRODUCTION: WASTE DISPOSAL OR WASTE – WATER.

Various processes involved in the collection treatment, and sanitary disposal of liquid and water – carried wastes from households and industrial plants (factories). The issue of waste disposal assumed increasing importance in the early 1970s as a result of the general concern expressed worldwide about the wider problem of pollution of the human environment, the contamination of the atmosphere, rivers, lakes, oceans, and groundwater by domestic, municipal, agricultural, and industrial waste.

3.1 HISTORY

Methods of waste disposal date from ancient times and sanitary sewers have been found in the ruins of the prehistoric cities of Crete and the ancient Assyrian cities. Storm-water sewers built by the Romans are still in service today. Although the primary function of these was drainage, the Roman practice of dumping refuse in the streets caused significant quantities of organic matter to be carried along with the rain water run-off. Towards the end of the middle Ages, below – ground privy vaults and, later, cesspools were developed in Europe. When these containers became full, sanitation workers removed the deposit at the owner's expense. The wastes were used as fertilizer at nearly farms or were dumped into water courses or on to vacant land.

A few centuries later, there was renewed construction of storm sewers, mostly in the form of open channels or street gutters. At first, disposing of any waste in these sewers was forbidden, but the 19th century it was recognized that community health could be improved by discharging human waste in the storm sewers for rapid removal ;such a system was devised by Joseph Bazalgelte between 1875 for diverting rain water and waste into the lower reaches of the Thames in London. Development of municipal water supply systems and house hold (plumbing brought about flush toilets and the beginning of modern sewer systems. Despite reservations that sanitary sewer systems wasted resources, posed health hazards, and were expensive, any cities built them.

At the beginning of the 20th century, a few cities and industries began to recognize that the discharge of sewage directly into the streams caused health problems, and this led to the construction of sewage treatment faculties. At about the same time, the septic tank was introduced as a means of treating domestic sewage from individual households both in suburban and rural areas. In public sewage – treatment works the trickling fitter technique was first adopted, and then in the second decade of the 20th century the activated sludge process, a significant improvement, was developed in Britain, and began to be used in many cities in Britain and world wide. Since the 1970s, a further stage of chemical treatment, principally chlorination, has become common in the industrialized world.

3.2 TRANSPORT OF WASTE WATER

Waste water is carried from its source to treatment facility through pipe systems that are generally classified according to the type of waste water flowing through them. If the system carries both domestic and storm water sewage, it is called a combined system, and these usually serve the older sections of urban areas. As the cities expanded and began to provide treatment of sewage, sanitary sewage was separated from storm drains by a separate pipe network. This arrangement is more efficient because it excludes the voluminous storm run-off from the treatment plant. It permits flexibility in the operation of the plant and prevents pollution caused by combined sewer is not big enough to transport both household sewage and storm water. Another solution to the overflow problem has been adopted by some cities, most notably Chicago, to reduce costs. Instead of building a separate household sewer network, large reservoirs, mostly underground, are built to store the combined sewer overflow, which is pumped back into the system when it is no longer overloaded.

Households are usually connected to the sewer mains by clay, cast – iron, or polyvinyl chloride (pvc) 8 to 10cm (3 to 4in) in diameter, larger – diameter sewer mains can be located along the centerline of a street about 1.8m (6ft) or more below the surface. The smaller pipes are usually made of clay, concrete, or asbestos cement, and the large pipes are generally of unlined or lined reinforced – concrete construction. Unlike the water supply system, wastewater flows through sewer pipes by gravity than by pressure.

The pipe must be sloped to permit the wastewater to flow at a velocity of at least 0.46n per sec. (1.5ft per sec), because at lower velocities the solid material tends to settle in the pipe. Storm – water mains are similar to sanitary sewers except that they have a much larger diameter. Certain types of sewers, such as inverted siphons and pipes from pumping stations flow under pressure, and are thus called force mains.

Urban sewer mains generally discharge into interceptor sewers, which can then join to form a trunk line that discharges into the waste water – treatment plant. Interceptors and trunk lines, generally made of brick or reinforced concrete, are sometimes as large as 6m (20ft) across.

3.3 NATURE OF SEWAGE

The origin, composition and quantity of waste are related to existing life patterns. When waste matter enters water, the resulting product is called sewage or waste water.

A. **ORIGIN AND QUANTITY** – Waste water originates mainly from domestic, industrial, groundwater, and metrological sources, and these forms of wastewater are commonly referred to as domestic sewage, industrial waste, infiltration , and storm –water drainage , respectively .

Domestic sewage results from peoples day- to day activities, such as bathing, body excretion, food preparation, and recreation, averaging about 150 litres (31.5 gal) per person daily in the United Kingdom, ranging up to as much as 950 litres (250 gal) in parts of the United States. The quantity and character

of industrial wastes water is highly varied, depending on the type of industry, the management of it's water usage, and the degree of, treatment the wastewater receives before it is discharged. A steel mill, for example might discharge anywhere from 5,700 to 151,000 litres (1,500 to 40,000 gal) per ton of steel manufactured. Less water is needed if recycling is practiced.

Infiltration occurs when sewer lines are placed below the water table or when rainfall percolates down to the depth of the pipe. It is undesirable because it imposes a greater load on the piping system and the treatment plant. The amount of storm water drainage to be carried away depends on the amount of rainfall as well as on the run-off or yield of the drainage basin.

A typical metropolitan area discharges a volume of waste water equal to about 60 to 80 percent of it's total daily water requirements, the rest being used for washing cars and watering gardens, and for manufacturing processes such as food canning and bottling.

B. **COMPOSITION** – The composition of waste water is analysed using several physical, chemical, and biological measurements. The most common analyses include the measurements of solids, biochemical oxygen demand (BOD5), chemical oxygen demand (COD), and PH.

The solid wastes include dissolved and suspended solids. Dissolved solids are the materials that will pass through a filter paper, and suspended solids are those that do not. The suspended solids are further divided into settle able and nonsettleable solids, depending on how many milligrams of the solids with

settle out of 1 litre of waste water in 1 hour. All these classes of solids can be divided into volatile or fixed solids, the volatile solids generally being organic materials and the fixed solids being inorganic or mineral matter.

The concentration of organic matter is measured by the BOD5 and COD analyses. The BOD 5 is the amount of oxygen used over a five-day period by micro-organisms as they decompose the organic matter in sewage at a temperature of 20^0C (68^0F). Similarly, the COD is the amount of oxygen required to oxidize the organic matter by use of dichromate in an acid solution and to convert it to carbon dioxide and water. The value of COD is always higher than that of BOD5 because many organic substances can be oxidized chemically but cannot oxidize biologically. Commonly, BOD 5 is used to test the strength of untreated and treated municipal and biodegradable industrial waste waters. COD is used to test the strength of waste water that is either not biodegradable or contains compounds that inhibit activities of micro-organisms. The P.H analysis is a measure of the acidity of a waste water sample. The organic matter in typical domestic sewage is approximately 50 percent carbohydrates, 40 percent protein, and 10 per cent fat; the PH can range from 6.5 to 8.0.

The composition of industrial waste cannot be really characterized by a typical range of value because its make up depends on the type of manufacturing process involved. The concentrations of an industrial waste is usually placed in perspective by stating the number of people, or population

equivalent (PE), that would be required to produce the same quantity of waste. PE is most commonly expressed in terms of BOD5. An average value of 0.077kg (0.171b) 5-day, 20^0C BOD per person per day is used for determination of the PE. The population equivalent of a slaughterhouse operation, for example, will range from 5 to 25 per animal.

The composition of infiltration depends on the nature of the groundwater that seeps into the sewer, storm-water sewage contains significant concentrations of bacteria, trace elements, oil, and organic chemicals.

3.4 WASTE WATER TREATMENT

The processes involved in municipal waste water treatment plants are usually classified as being part of primary, secondary, or tertiary treatment.

3.4.1 PRIMARY TREATMENT

The waste water that enters a treatment plant contains debris that might clog or damage the pumps and machinery. Such materials are removed by screens or vertical bars, and the debris is burned or buried after manual or mechanical removal. The wastewater then passes through a comminutor (grinder), where leaves and other organic materials are reduced in size for efficient treatment and removal later.

A1 **GRIT CHAMBER** – In the past, long and narrow channel – shaped settling tank, known as grit chamber, were used to remove inorganic or mineral matter such as sand, silt, gravel and cinders. These chambers were designed to permit inorganic particles 0.2mm (0.008in) of larger to settle at the bottom while the

smaller particles and most of the organic solids that remain in suspension pas through. Today, spiral flow aerated grit chambers with hopper bottoms, or clarifiers with mechanical scraper arms, are most commonly used. The grit is removed and disposed of as sanitary landfill. Grit accumulation can range from 0.08 to 0.23cum (3 to 8cuft) per 3.8 million litres (about 1 million gal) of waste water.

A2 **SEDIMENTATION** – With grit removed, the wastewater passed into a sedimentation tank in which organic materials settle out and are drawn off for disposal. The process of sedimentation can remove about 20 to 40 percent of the BOD5 and 40 to 60 percent of the suspended solids. The rate of sedimentation is increased in some industrial waste-treatment stations by incorporating processes called chemical coagulation and flocculation in the sedimentation tank. Coagulation is the process of adding chemicals such as aluminum sulphate, ferric chloride, or polyelectrolytes to the wastewater; this causes the surface characteristics of the suspended solids to be altered so that they attach to one another and precipitate. Flocculation causes the suspended solids to coalesce. Coagulation and flocculation can remove more than 80 percent of suspended solids.

A3 **FLOTATION** – An alternative to sedimentation that is used in the treatment of some waste waters is flotation, in which air is forced into the wastes water under pressures of 1.75 to 3.5kg sq cm (25 to 50 lb per sq in). the wastewater, supersaturated with air, is then discharged into an open tank; there

the rising air bubbles cause the suspended solids to rise to the surface, where they are removed. Flotation can remove more than 75 percent of the suspended solids.

A4 **DIGESTION** – Digestion is a microbiological process that converts the chemically complex organic sludge to methane, carbon dioxide, and an in offensive humus like material. The reactions occur in a closed tank or digester that is anaerobic that is, devoid of oxygen. The conversion takes place through a series of reactions. First the solid matter is made soluble by enzymes, then the substance is fermented by a group of acid – producing bacteria, reducing it to simple organic acids such as acetic acid. The organic acids are then converted to methane and carbon dioxide by bacteria. Thickened sludge is heated and added as continuously as possible to the digester where it remains for 10 to 30 days and is decomposed. Digestion reduces organic matter by 45 to 60 percent.

A5 **DRYING** – Digested sludge is placed on sand beds for air drying. Percolation into the sand and evaporating are the chief processes involved in the dewatering process. Air drying requires dry, relatively warm weather for greatest efficiency, and some plants have a green house like structure to shelter the sand beds. Dried sludge in most cases is used as a soil conditioner; sometimes it is used as a fertilizer because of its 2 percent nitrogen and 1 percent phosphorus content.

3.4.2 SECONDARY TREATMENT –

Having removed 40 to 60 percent of the suspended solids and 20 to 40 percent of the BOD5 in primary treatment by physical means, the secondary treatment biologically reduces the organic material that remains in the liquid stream. Usually the microbial processes employed are aerobic that is, the organisms function in the presence of dissolved oxygen. Secondary treatment actually involves harnessing and accelerating nature's process of waste disposal. Aerobic bacteria in the presence of waste disposal. Aerobic bacteria in the presence of oxygen convert organic matter to stable forms such as carbon dioxide, water, nitrates, and phosphates, as well as other organic materials. The production of new organic matter is an indirect result of biological treatment processes, and this matter must be removed before the wastewater is discharged into the receiving stream.

Several alternative processes are also available in secondary treatment, including a trickling filter, activated sludge, and lagoons.

B1 **TRICKLING FILTER**: In this process, a waste stream is distributed intermittently over a bed or column of some type of porous medium. A gelatinous film of micro-organisms coats the medium and functions as the removal agent. The organic matter in the waste stream is absorbed by the microbial film and converted to carbon dioxide and water. The trickling – filter process, when preceded by sedimentation, can remove about 85 percent of the BOD5 entering the plant.

B2. **ACTIVATED SLUDGE** – This is an aerobic process in which gelatinous sludge particles are suspended in an aeration tank and supplied with oxygen. The activated sludge particles, known as floc, are composed of millions of actively growing bacteria bound together by a gelatinous smile. Organic matter is absorbed by the floc and converted to aerobic products. The reduction of BOD5 fluctuates between 60 and 85 percent.

An important companion nit in any plant using activated sludge or a trickling filter is the secondary clarifier, which separates bacteria from the liquids stream before discharge.

B3. **STABILIZATION POND OR LAGOON**: Another form of biological treatment is the stabilization pond or lagoon, which requires a large land area and thus is usually located in rural areas. Facultative lagoons, or those that function in mixed conditions, are the most common, being 0.6 to 1.5m (2 to 5ft) in depth, with a surface area of several acres. Anaerobic conditions prevail in the button region, where the solids are decomposed the region near the surface is aerobic allowing the oxidation of dissolved and colloidal organic matter. A reduction in B O D 5 of 75 to 85 percent can be attained.

3.3.4 ADVANCED WASTEWATER TREATMENT

If the receiving body of water requires a higher degree of treatment than the secondary process can provide, or if the final effluent is intended for reuse advanced wastewater treatment is necessary. The term tertiary treatment is often used as a synonym for advanced treatment, but the two methods are not exactly

the same. Tertiary or third stage treatment is generally used to remove phosphorus, while advanced treatment might include additional steps to improve influent quality by removing refractory pollutants. Processes are available to remove more than 99 percent of the suspended solids and B O D 5. Dissolved solids are reduced by processes such as reverse osmosis and electro dialysis. Ammonia stripping, denitrification, and phosphate precipitation can remove nutrients. If the wastewater is to be reused, disinfections by ozone treatment is considered the most reliable method other than break point chlorination. Application of these and other advanced water waste treatment methods is likely to become widespread in the future in view of effort to conserve water through reuse.

3.4.4 LIQUID DISPOSAL – The ultimate disposal of the treated liquid stream is accomplished in several ways. Direct discharge into a receiving stream or lake is the most commonly practiced means of disposal. In parts of the world that are faced with worsening shortages of water for both domestic and industrial use, authorities are turning to reuse of appropriately treated wastewater for groundwater recharge, irrigation nonedible crops, industrial processing, recreation, and other uses. In one such project, the potable Reuse Demonstration Plant in Denver, Colorado, the treatment process involves conventional primary and secondary treatment followed by lime clarification to remove suspended organic compounds. During this process an alkaline (high-PH) condition is created to remove the process. In the next step recarbonation is

used to bring the PH level to neutral. Then the water is filtered through multiple layers of sand and charcoal, and ammonia is removed by ionization. Pesticides and any other dissolved organic materials still present are absorbed by a granular, activated – carbon filter. Viruses and bacteria are then killed by ionization. At this stage the water should be cleansed of all contaminants, but, for added reliability, second – stage carbon absorption and reverse osmosis are used, and chlorine dioxide is added to attain the highest possible water standard.

3.4.5 SEPTIC TANK – A sewage treatment process commonly used to treat domestic wastes is the septic tank: a concrete, cinder block or metal where the solids settle and the floatable materials rise. The partly clarified liquid stream flows from a submerged outlets into subsurface rock-filled trenches through which the waste water can flow and percolate into the soil where it is oxidized aerobically. The floating matter and settled solids can be held from six months to several years, during which they are decomposed anaerobic ally.

3.5 RECYCLING

The process of recovering and reusing waste products – from household use, manufacturing, agriculture and business and thereby reducing their burden on the environment. During world war 1 and world war II, shortages of essential materials led to collection drives for silk, rubber, and other commodities. In recent years the environmental benefits of recycling have become a major component of waste management programs.

3.5.1 WASTE DISPOSAL AND RECYCLING – For many years direct recycling by producers of surplus and defective materials constituted the main form of recycling. However, indirect recycling, the recycling of materials after their use by consumers, has become the focus of activity in the 1990s. For some time, most solid waste has been deposited in landfills or dumps. Landfills are filling up, however, and disposal of wastes in them has led to environmental problems. Also government (which had little authority over disposal of wastes until the 1970s) now has extensive regulatory powers.

A growing alternative to such disposal is recycling. Industry has found that when it undertakes serious recycling programs, the savings can be considerable. In addition to reducing manufacturing and materials costs, such programs can insulate the companies from liability for environmental violations. Agriculture, which is the cause of much environmental degradation, can use organic recycling or the reuse of manure and crop residues (sometimes called "green manure").

Water, in one sense is always recycled, in as much as there is a finite amount of it available on earth and it constantly moves through it's cycle of evaporation, condensation, and precipitation. Deliberate programs for recycling water include use of wetlands as areas of filter harmful wastes from the substances, or using partly sewage for raising fish. Municipal sewage and water – treatment plants, of course, are fundamental recycling agents.

The individual consumer plays a large part in recycling. Originally, household containers such as beverage cans and bottles were recycled as a matter of course, with a glass beer container or milk bottle being refilled as many as 30 times; in 1935, brewers began putting their products in no refillable, "one-way" cans for the convenience of customers, and son glass containers were declared disposable as well. With the rise of environmentalism in the early 1970s, recycling regained favour. Several states instituted deposit laws for beverage containers, a 5 – or 10 cent deposit was charged the consumer at the time of purchase for each can or bottle, the refunded when the container was returned to a store or recycling center. Newspapers take up much volume in landfills, and some recycling programs seek to collect them (along wit other sorted categories of waste, such as organic matter, bones, and plastic).

3.5.2 USE OF RECYCLED MATERIALS

In 1996, 27% of solid waste in the United States was recycled. Products that are recycled in large quantities include paper and paper board, ferrous metals, aluminum and other non ferrous metals, glass, plastics, and yard wastes. Although many local communities have instituted comprehensive recycling programs, these remain expensive. Because the quality of the recycled product is often inferior and cannot be used for its original purpose, the price for recycled raw materials remains low; this could make the entire process economically nonviable. In an attempt to solve this problem, new uses have been created for recovered waste material crushed glass, for instance, can be

substituted for gravel or sand in road surfacing and other construction applications; the resulting product is called "glassphalt". Scientists and entrepreneurs are also working on ways to turn the world's growing piles of discarded automobile tires into new products or to use them to generate safe energy.

3.6 TOXIC WASTE – is waste material, often in chemical form, that can cause death on injury to living creatures. It usually is the product of industry or commerce, but comes also from residential use, agriculture, the military, medical facilities, radioactive sources, and light industry, such as dry cleaning establishments. The term is often used interchangeably with "hazardous waste". Or discarded materials that can pose a long term risk to health or environment.

Toxics can be released into air, water or land. In 1976 the Toxic Substances Control Act required the Environmental Protection Agency to regulate, potentially hazardous industrial chemicals, including halogenated fluorocarbons, dioxin, asbestos, polychlorinated biphenyl (PCBs), and vinyl chloride. Other federal legislation pertaining to hazardous wastes includes the Atomic Energy Act (1954), the Resource Conservation and Recovery Act (1976), and the Comprehensive Environmental Response, Compensation and Liability act, or Superfund Act (1986). Toxic waste treatment and control has proved to be expensive and time-consuming with more resources spent on count battles than on actual cleanup. The disposal of toxic wastes is also a topic of international concern. In 1989, some 50 countries signed a treaty aimed at

regulating the international shipment of toxic wastes. In some cases such wastes are shipped to developing countries for cheap disposal without the informed consent of their governments. The often substandard shipping, storage and treatment methods endanger human health and the health of the environment.

CHAPTER FOUR

CASE STUDY

4.0 OUTLINE OF CASE STUDY

Case study – a research methodology put in place to enhance good design, planning, devices, space utilization. This involves visiting existing similar infrastructure within the country and outside the country. Critical analysis of the facilities present, the number of unit the number of staff and the type of services carried out.

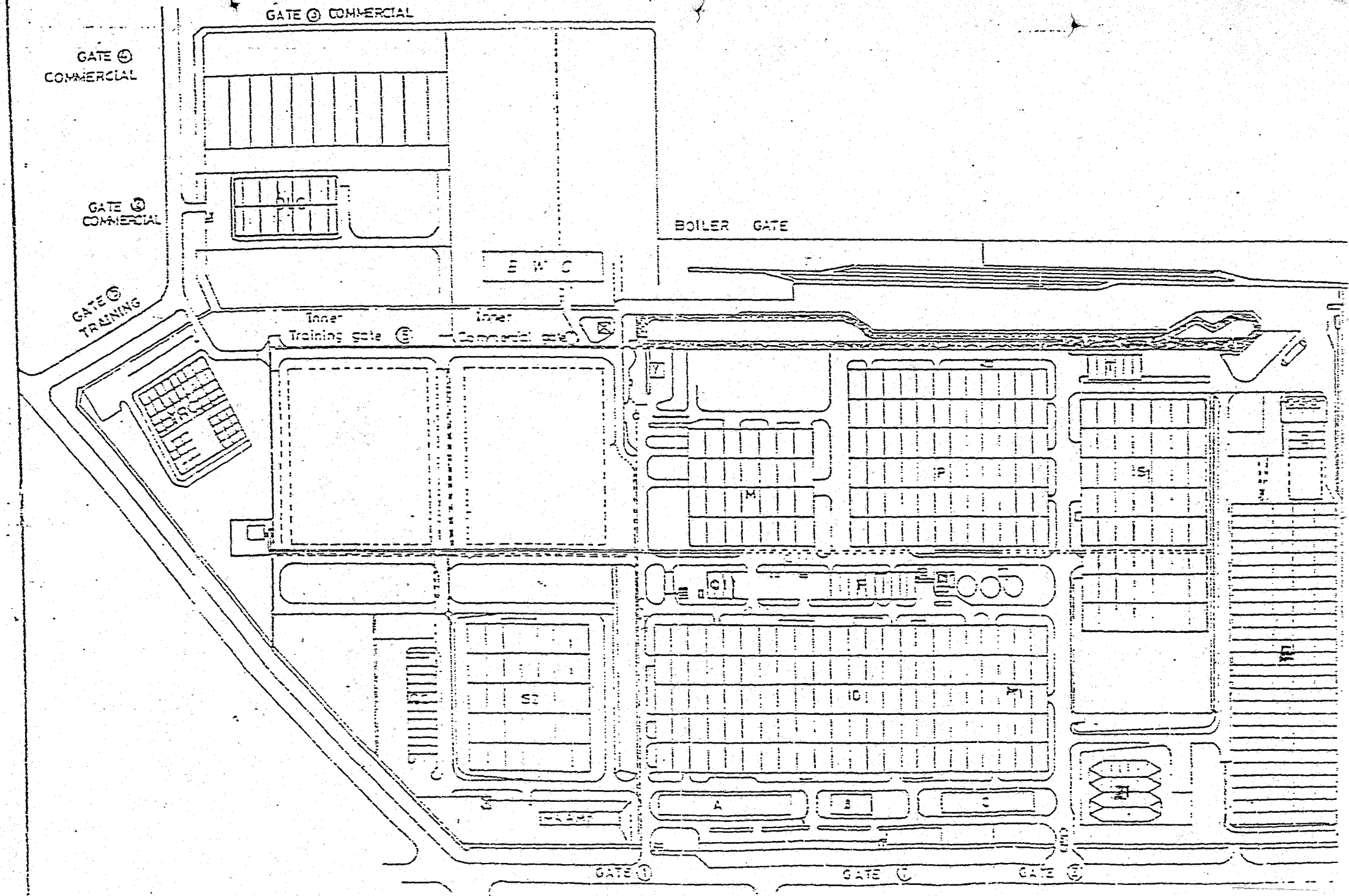
The case studies include:

1. Peugeot Automobile Nigerian Limited, Kaduna.
2. APO mechanic village, Abuja
3. ASTON MARTIN, United Kingdom

4.1 PEUGEOT AUTOMOBILE NIGERIAN LIMITED, KADUNA PAN IN PRESENT PERSPECTIVE

Peugeot products first came in to Nigeria in 1957, when 100 unit of Peugeot cars were imported by individual in 1959 SCOA was appointed the sole Agent and Distributor for the importation of Peugeot 403 cars.

To meet the rising demand, the then military Government opened negotiations with Automobile Peugeot of France with a few to establishing an assembly outfit in the country.


GATE ③ COMMERCIAL
GATE ④ COMMERCIAL
GATE ② COMMERCIAL
BOILER GATE
E W C
GATE ⑤ TRAINING
Inner Training gate ⑥
Inner Commercial gate ⑦
GATE ①
GATE ⑧
GATE ⑨

On 15 December 1972, PAN was incorporated with #3 million share capital and paid up capital of $2 million. On 14th March 1975, the assembly plant in Kaduna was commissioned by General Yakubu Gowon, the then Head of Sate.

OWNERSHIP AND MANAMGEMENT

The company's equity share structure stands at Federal Government of Nigeria 35%, Kaduna Industrial Finance Company Limited 4.7%, Katsina State Development Company Limited 5.3%, Automobiles Peugeot France 40%, Nigerian Industrial Development Bank 5%, UTC Nigerian PLC 5%, SCOA Nigerian PLC 5%.

The company's policy affairs are looked after by a Board of Directors headed by a chairman, while the management structure is headed by the Managing Director, assisted by the Deputy.

There are five major divisions. These are personnel/Administration, commercial, finance and industrial divisions. The logistic and internal audit is directly under Managing Director.

QUALITY: As a tradition, quality is both an integral and an international permanent priority of all Peugeot workers, whether involved in production, management or sales. Quality is also required from all PAN local suppliers of parts, industrial chemicals products and distributors who sell and service its products. In line with this quality requirement, one third of PAN's labour forces is solely dedicated to quality services with a team of highly skilled technicians and engineers.

LOCAL CONTENT DEVELOPMENT

PAN receives local parts from over 70 suppliers, supplying about 700 different parts, responsible for 37% local content. PAN has several projects with suppliers, seven of which are at advanced stages of completion with a view to contributing a additional 5.6% to make up 4.26%. Other suppliers who are still developing other parts, such as gear shift knobs, roof light covers and other body parts, are expected to add to about 8.4%.

TECHNOLOGY THROUGH TRAINING

In order to satisfy their numerous customers, all facts of PAN operations are driven by the latest technologies their cataphorised paint technology, their multiplexed vehicles, their network sales and services diagnostic equipment, their management tools. And now training is, too, with the introduction of our modern Apprenticeship in production techniques (MAPT) a new training technology, the first of it's kind in the history of the company, with the mission statement of:

- Creating a new generation of technicians with a more profound knowledge capable of working in the company with psychometric precision.
- Select technicians adaptable to training on new Peugeot products with technical knowledge and total quality production skills
- Support the Federal Government's laudable efforts in national youth employment scheme (NYES).

- Select technicians that are imaginative, loyal and add value o the company operations.

The Automobile industry consist o the following:

- An administrative building/block
- Clinics/senior staff/managers cafeteria/kitchen
- Junior staff cafeteria/kitchen
- Assembling plant/paint shop
- Store
- Maintenance (electrical/welding) section
- Faratex
- Touch-up
- Body shop
- Garage
- Training center/head office
- Delivery center/commercial
- Train track
- Test track (express)

Merits

- Very good location
- Enough facilities for automobile services
- Enough parking area
- Aesthetic pronounced

Demerits

- landscaping is below average
- restricted to only Peugeot products

4.2 APPO MECHANIC VILLAGE, ABUJA

The Appo mechanic village of located along the Abdulsalam Abubakar way after the Legislative quarters when approaching from the Nnamdi Azikiwe junction.

The site has no defined form of architecture. The typical road side mechanic structure is found all around except for a few that defile such formal that is the normal timber post space demarcation in mechanic sites.

Facilities provided are as follows:

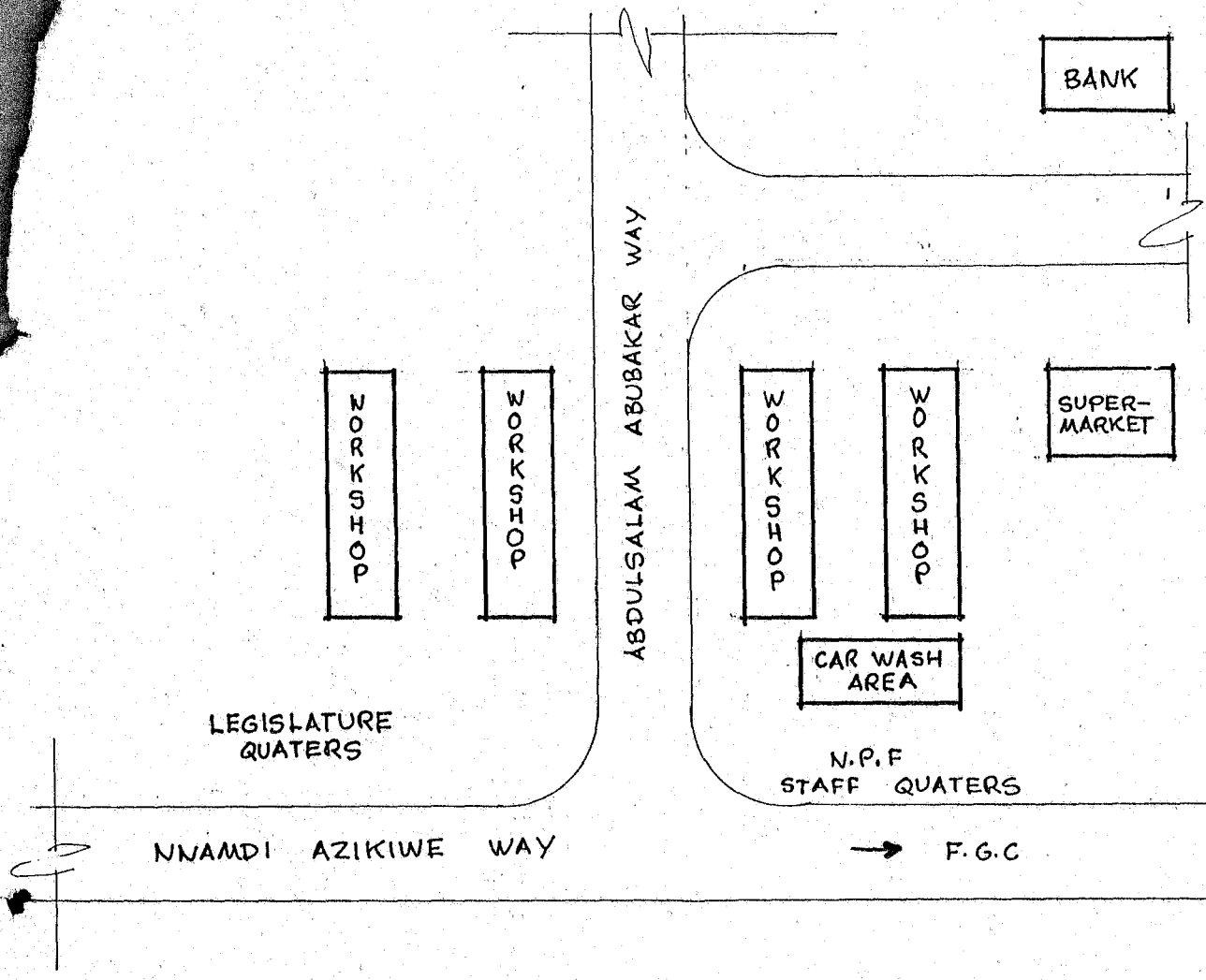
- Administrative unit
- Shops
- Restaurant

Merits

- Good orientation
- Well located
- Enough circulation space

Demerits

- To close to residential buildings
- No defined planning
- No good security



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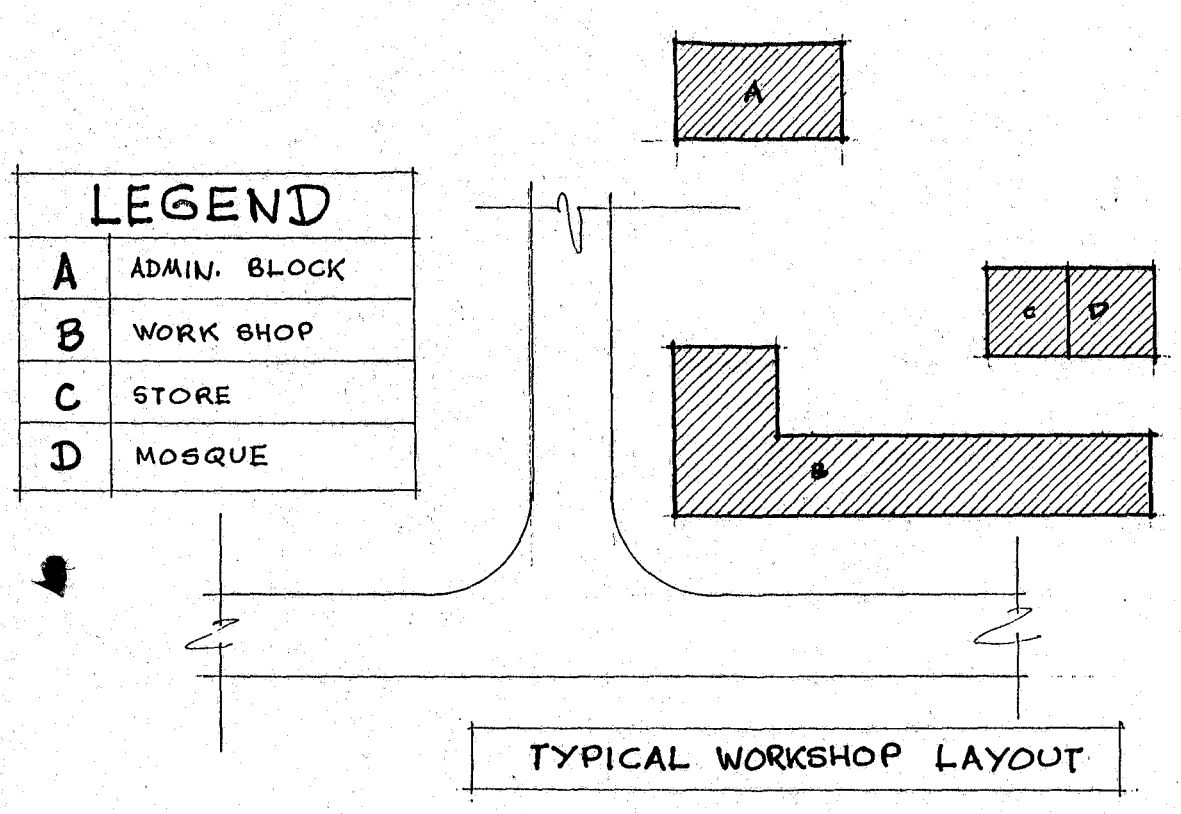


LEGEND	
A	ADMIN. BLOCK
B	WORK SHOP
C	STORE
D	MOSQUE

TYPICAL WORKSHOP LAYOUT

NAME: ASIEGBU, K. O.

Design Proposal

- No workers facilities
- Some workshops are open

4.3 ASTON MARTIN WORKSHOP, UNITED KINGDOM

Aston workshop was established by a man who remains it' sole proprietor, Bob Fountain, in 1988. Four years gestation, the workshop grew out to Bob' personal interest in restoring Aston Martins to the highest specializations, one that would meet the exacting standard of the international market place, for quality classic cars.

Business was attracted by words of mouth and company's reputation grew within a short space of time. The Aston workshop became synonymous with superb craftsmanship, together with the production of impeccably restored Aston Martins.

So, from humble beginning, company has grown to one whose services, now span all five continents. Our custom built premises were created to held further the legend of Aston Martin. They provided the best possible facilities for restoring some of David Brown's finest creation.

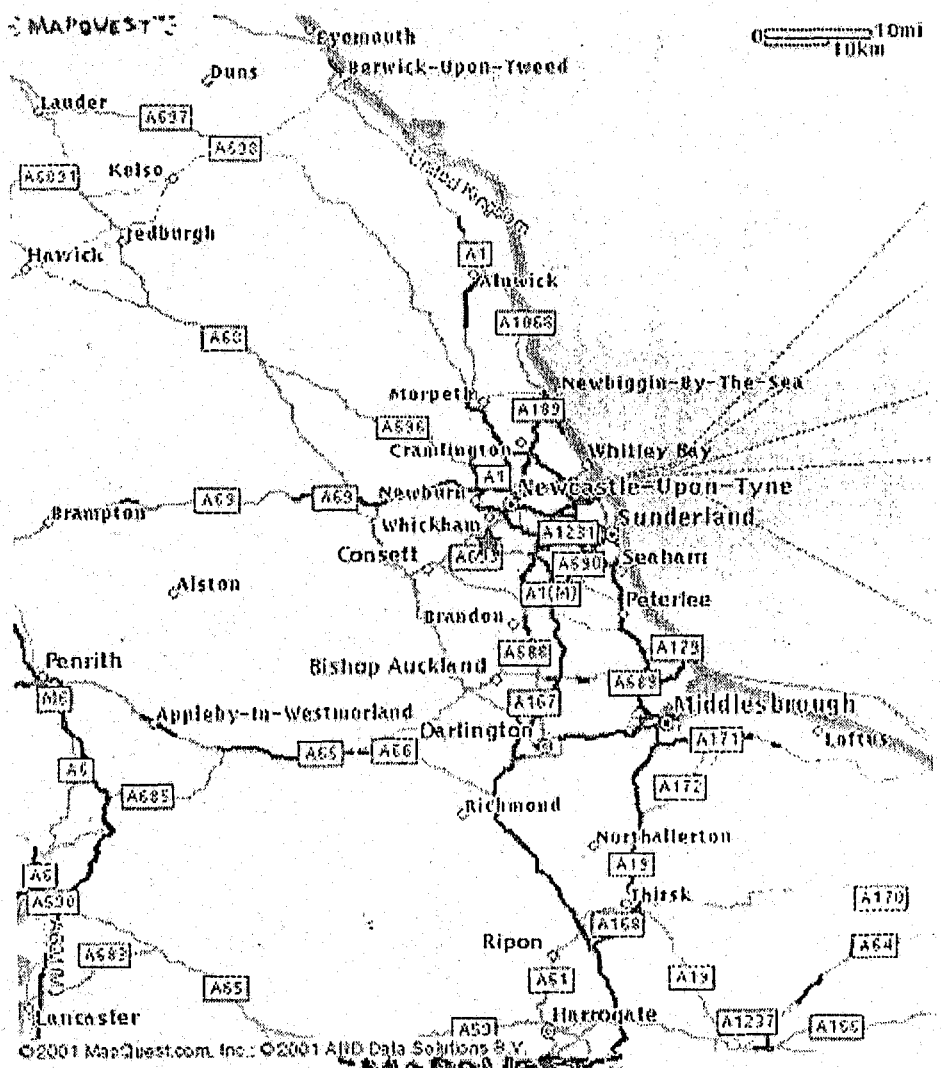
Located in North East of England, the Aston workshop is easily reached via the A.I. It is conveniently situated within twenty minutes drive of Newcastle International Airport. Furthermore, North shields ferry port regularly receives crossing, from the continent.

The Aston workshop boast a dedicated team of staff who are committed to building and carrying for, the very finest of car specializing in DB4s, DB45

The ASTON WORKSHOP

RECREATING The LEGEND

LOCATION MAP



Click here for a more detailed map & directions

Click here for directions

[Home][About][Locate][Sales][Parts][Restoration][Servicing][Contact]

Red Row, Beamish, Co. Durham, DH9 0RW.
Tel. +44 (0)1207 233525 - Fax. +44 (0)1207 232202
Email : astonworkshop@aston.co.uk

Last updated: 10th September 2001

and DB6s, they have restored cars that have won prices in U.S.A. and Switzerland, Hong Kong and Netherlands.

They can perform routine servicing and full rebuilds from original to up-rated specifications. They manufactured parts that were previously unavailable for Aston Martins.

They aim to find a vehicle to match ones precise requirements, be it a barn-find restoration project, or concourse winning show car. Having found the vehicle, they then supply it at a contracted price. They deal in excellence and they specialize on originality. Aston workshop is committed to providing each one of their customers with the best possible services. Totally dedicated to take Aston Martin marques they take great pride in keeping the legend alive and are equally a dept at providing right hand drive models whether you require an Aston for every day use, or are searching for a unique example. They will be happy to help in the realization of ones dream.

They have a bespoke computerized database developed over the past five years, aimed at providing cars for clients throughout the world. This highly sophisticated database has up to five hundred prospective buyers and up to three hundred car vendors at any one time. Attention to detail allows use to match up the right customer with the right car.

Aston workshop consist of the following:

- New car store
- Offices and administration

- Mechanic shop
- Parts and stores
- Trim shop and storage
- Car building shop
- Main workshop
- Dyno room/engine shop
- Ship down bay
- Metal work ad component refinishing
- Paint shop

Merits

- Well located
- Good landscape
- Sufficient automobile faculties
- Good parking corners

Demerits

- Restricted to only Aston products

CHAPTER FIVE

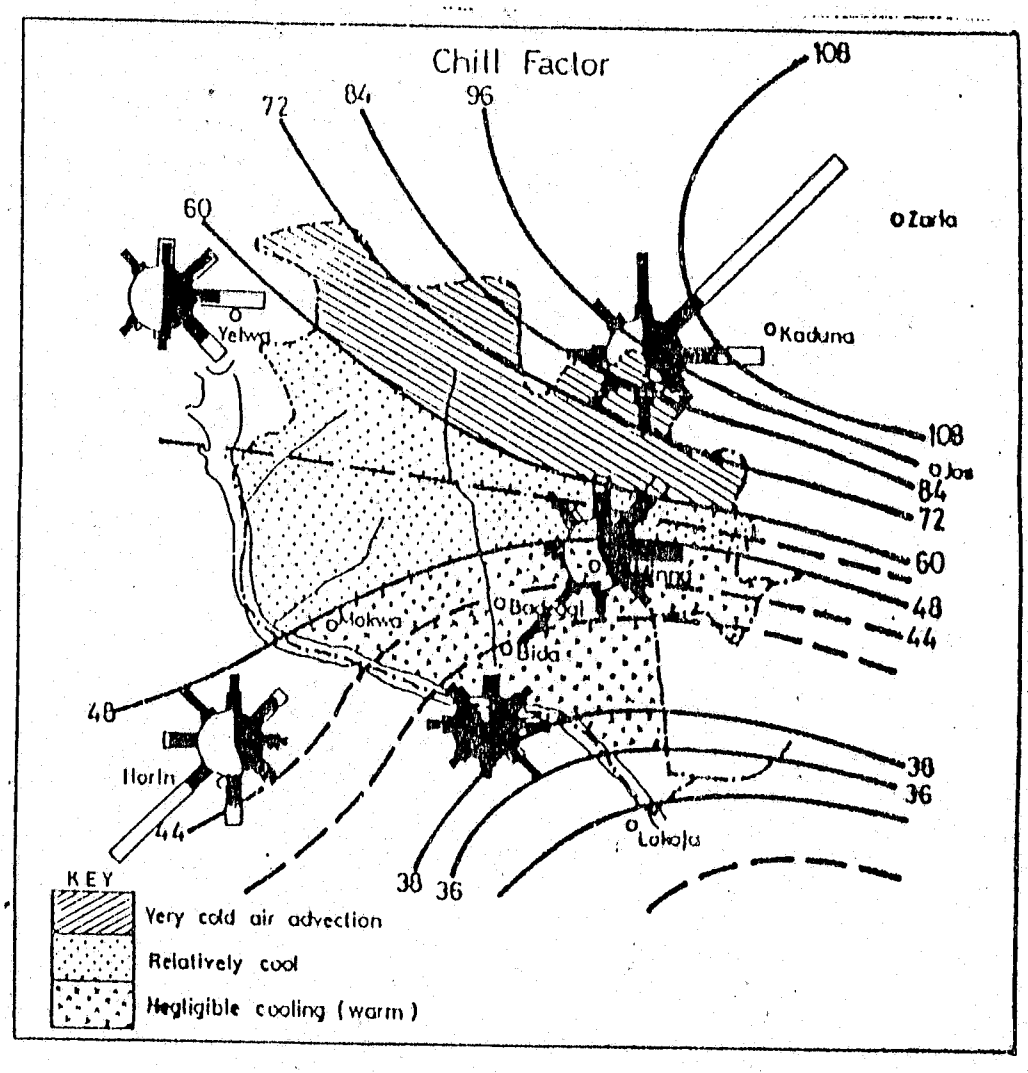
5.0 DATA COLLECTIONS

To choose the site for a building project many factors have to be considered, especially when choosing a site for buildings like industries, space for future expansion has to be considered, location of site itself, climatic conditions, temperature, geology and topography, transportation and traffic flow, existing land use and future trends, assess and circulation, utilities and environmental problems.

5.1 CLIMATIC CONDITION

The Niger state capital 'Minna' is located in the guinea savannah region of Nigeria and seasonal alteration occurs between dominance of moist air masses and dry continental tropical air masses of the Gels tropical high pressure belt. As a result there is a very wet season at time of high sun and very dry season at time of low sun. cooler temperature accompany the dry season, but give way to a very hot period before the rain begins.

The two winds responsible for the two seasons are the North-east trade winds and the South-east trade winds. The North-east winds usually come between October to March and they are largely responsible for the dry dusty winds that occur around this time. These winds that occur around this time. These winds are commonly known as harmattan and they cause the place to be dry with very little humidity.


Chill Factor
108
72
84
96
60
Zaria
Yelwa
Kaduna
108
Jos
84
72
60
48
44
Mokwa
Bida
48
Ilorin
44
38
36
Lokoja
38
36
KEY
Very cold air advection
Relatively cool
Negligible cooling (warm)

The South-west trade winds which are from April to September are responsible for the rainy season. These winds are characterized by heavy rainfall accompanied with thunder and lightening.

5.2 TEMPERATURE

The temperature of the site and Minna as a whole also depends on the trade winds, naturally since Minna is in the guinea savannah region, it means that the place is hot. The average temperature is about 34^0C.

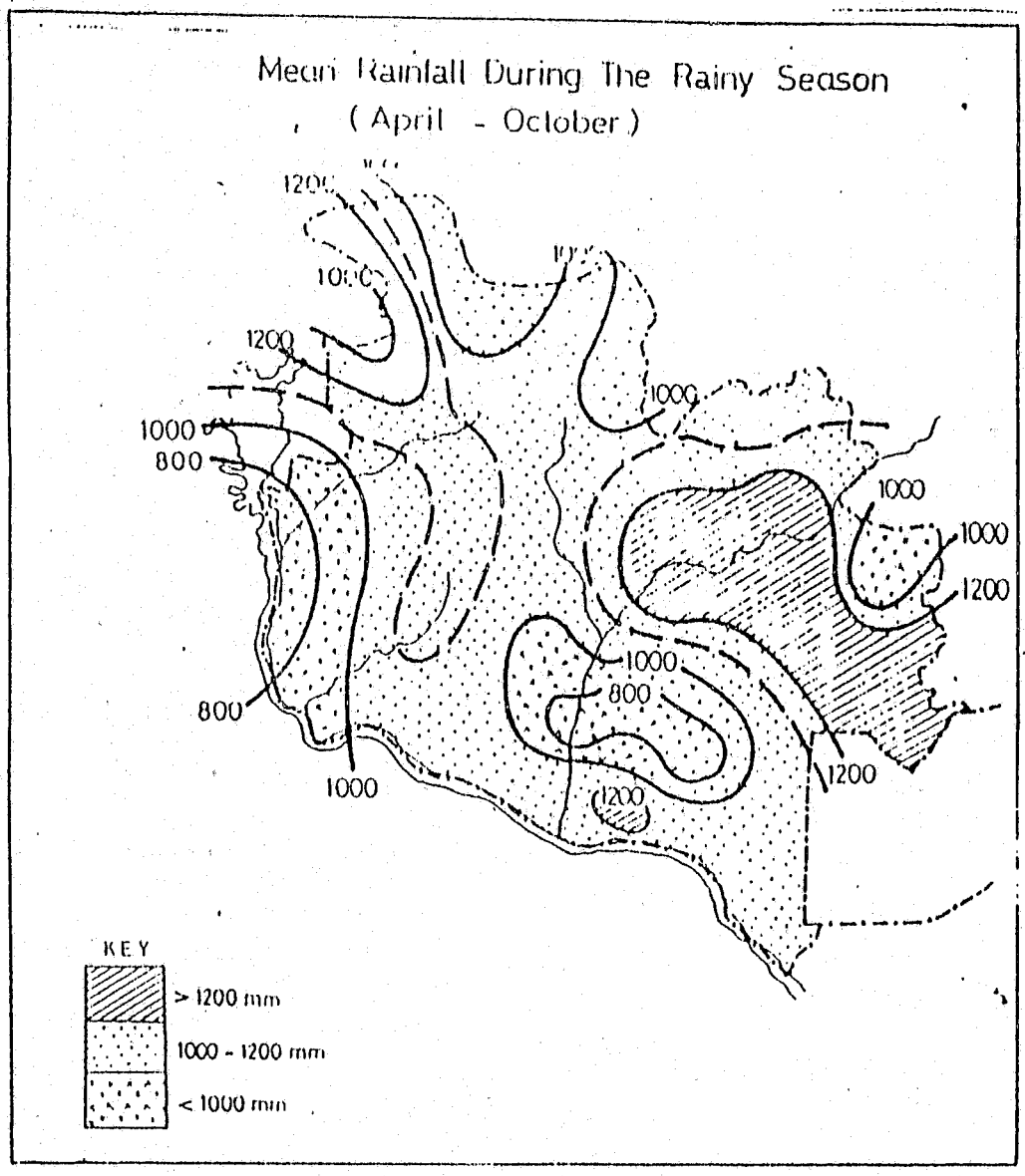
5.3 HUMIDITY

Humidity results from evaporation of water from plants and water body. Evaporation from water and soil transpiration from sol micro-flora, plant crop and other vegetations are termed evapo-transpiration.

The transpiration amount up to 85% of rainfall water. The amount of moisture released to the atmosphere from the soil/vegetation cover gives the term potential evapo-transpiration. In other words it is a maximum demand of transpiration to place. This entranced more because of the rainfall regime of the state which provides ample water to satisfy evapo-transpiration to take place at potential stage where as this rate is drastically reduced in the dry season.

5.4 SUNSHINE

During the dry period, which cover from November to April, there is a monthly variation in the amount of sunlight which follows a general trend of an increase from 215 hours.


Mean Rainfall During The Rainy Season
(April - October)
1200
1000
1200
1000
1000
800
1000
1000
1200
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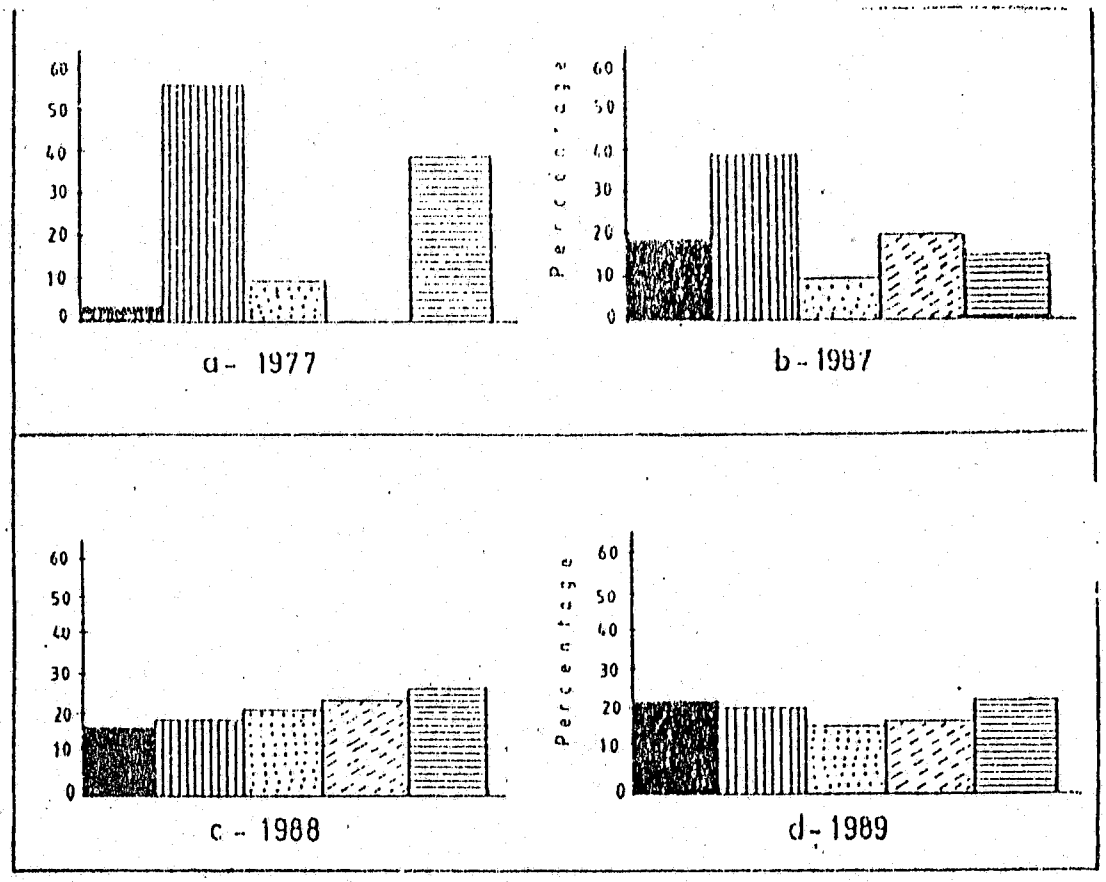
800
1000
1200
KEY
> 1200 mm
1000 - 1200 mm
< 1000 mm



Percentage of Vegetal Cover In Niger State

S decline in the sunshine hours is experienced as the rainy season approaches. This is intense as a result of cloud cover. This becomes intense as the rainy season progresses and it reaches it's lowest value ay the peak of the raining season, which is in the month of August.

5.5 GEOLOGY AND TOPOGRAPHY

The geology of the site has to do mostly with the soil then vegetation. The word soil is also a natural surface layer containing living matter and supported or capable of supporting inorganic (mineral) matter and organic matter, the later both living and dead.

The type of soil normally retains water during the wet season and losses it in the dry season and even crack during severe temperature, shrinkage of clay soil occurs both horizontal and vertically so there is a tendency for the walls on the building to be drawn outwards in addition to settling and for cracks to open the soil between the clay and the sides of foundation.

The topography of the site refers to the rise and fall of the soil of the site. The site is basically leveled in the steep slope and large gullies located on the western part of the site.

The site is also dotted trees and shrubs. The types of trees includes mangoes, cashew, nim tree. There are also several farming activities on the site. Because it had been abandoned for a long time, people have cut the site in to various portions and are growing crops on the land.

5.6 SOCIO-CULTURAL LIFE

Minna the Niger State capital is basically a Gwari town which derived its name from a ritual performed every annually by the Gwari's founders of the town, to observe the beginning of yet another new year.

The early settlers and founders of the town lived son the top of the range of hills lying to the Eastern and Northern sides of the town (Minna). Remains in the form of dilapidated foundations, broken pots and baobab trees that characterized ancient towns on the North shows an evidence of early settlement on the hill top.

The town Minna went through what it is today. In 1905, history has taken it that when the rail line construction stormed the area, the Gwari, Nupes and Hausa, resident were recruited at that time and were accommodated in different camps to check dissertation and aid easy access. The present Keteren Gwari area was the camp site for the Gwari, the Nupes had their camp in what is now known as Kwangila while the Limawa and Kasuwan Zanbarma area provided camp area for the Hausas. These camps became permanent settlements and eventually formed some of the present wards of the town.

The appointment if Alkali (Judge) for the camps in 1908 recorded the 2nd phase at change. A permanent house was built and within the house was a prison which led to the introduction of the first police condiment.

The completion of the railway line and the consequent introduction of the first locomotive engine in 1911 gave the town another look as the first town to

have a rail engine in the country. An aerodrome was also built in 1929 (being part of the firsts 3 aerodrome in the country). 1949 saw the construction of Bosso dam which serve as the sole source of pipe water.

Minna later became the capital of Niger State in 1979 when additional seven states were created to bring the number of states in Nigeria to nineteen (19).

5.7 ECONOMY AND COMMERCE

5.7.1 ECONOMY

Not much is realized by way of internal revenue because the state's economy is still at the development stage.

Notwithstanding provision is being made to change it's present situation so as to boost the internal revenues generation which is the backbone for economy sustenance.

All productive units in the state are too small scale investment, the industries, where they are of small scale enterprises made up of mainly traditional craft work, food processing plants and services and repairs.

In the state, land is also a thing of great visibility as it represents the main asset of the people hence most, if not all resort to agriculture as a means of livelihood, though they are faced with a comparatively low productivity from the farm, steps are taken to combat that and it is expected ha the productivity level of the farms will improve substantially within the yeas. There are a few

known mineral deposit in the state in commercial quantity, most of which are yet to be fully exploited.

5.7 COMMERCE

The expanding market around and within Minna will soon have the support of some well-established commercial institutions in the likes of Leventis, Chellarm and Kingsway. For the present, the available commercial centers are the Minna main market by the PZ road opposite John Holt, the weekly Saturday market and other privately owned supermarkets spread around the city.

The government is not left out in the commercial activity of the state, it has to its credit a departmental store, though not functional now, located along the present old airport road. Also the government is providing and improving on the conditions of the various rest houses.

5.8 TRANSPORTATION AND TRAFFIC FLOW

The town of Minna is physically divided into two halves by the railway line that runs east to west.

Presently there is little or no transport problem. This is largely for the adequate provision of privately operated taxis and commercially run motor – cycles plying the roads of the city. In other to supplement the effort of the private operators, the state government and the Nigerian Labour Congress now run respectively transport outfit Niger State Transport Authority (NSTA) and the Labour bus. These private and state owned outfits all ply the main street of

Minna as such commuters have no problem in transporting themselves from place to another.

However, a point worth mentioning is the growing traffic congestion around Mobil roundabout during the day especially towards the evening (during the rush back home hour). This is attributed to the increasing commercial activities in the state and its concentration around the Mobil area.

CHAPTER SIX

SITE ANALYSIS

6.0 CRITERIA FOR SITE SELECTION

Site selection is the first stage of any design procedure. Inadequate or adequate selection of a site determines the overall efficiency of a building. The choose of the site for the proposed project was based on the followings:-

(i) TOPOGRAPHY OF THE SITE

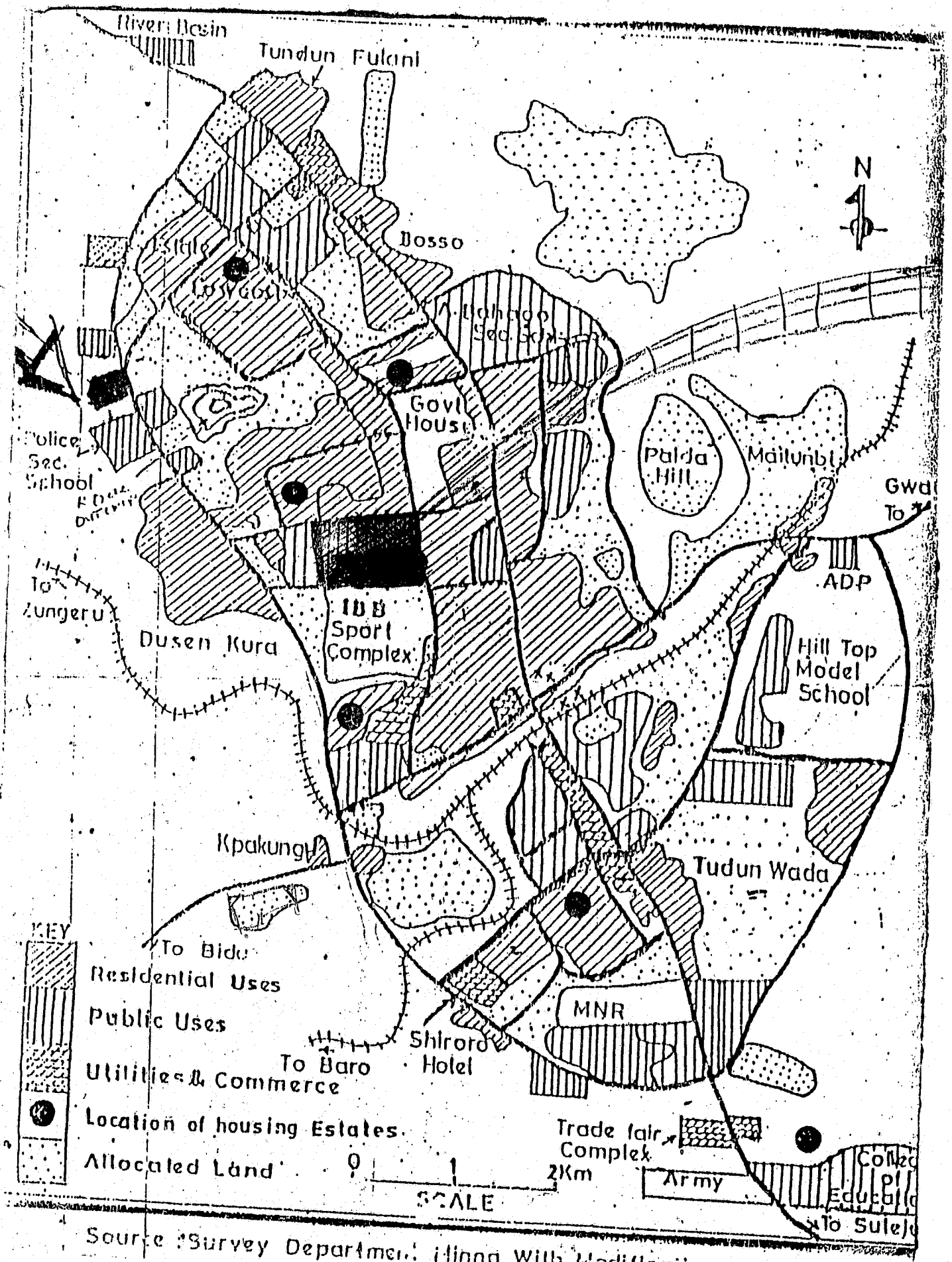
The contours of a site may provide the first line of thought on how a site should be developed. This will suggest the best possible position for the buildings and possible construction problems. It will also gives a view of the scenic qualities of the site in relation to the function which is to serve.

(ii) VEGETATION

Where any part of the site can remain undisturbed, the existing ground cover should be examined to see if it is suitable for retention. Any existing features (i.e. trees, shrubs grasses) with are to be kept will play a major role in subsequent design and landscaping plans or procedures.

(iii) ACCESS AND TRAFFIC REDQUIREMENTS

This deals with how accessible the site is. Since the site is located a long an existing road, the inlet would be tapped of the existing road. Also, within the site, provision has been made for parking facilities to accommodate all parking facilities.



Source :Survey Department Minna With Modification

6.1 LOCATION OF SITE

The proposed site is located along Bida express road at Kpakungu. There is an existing tarred road, which passes by the side of the site, with the site inlet being tapped from the major road.

6.2 SITE CHARACTERISTICS

The site characteristics involves taking stock of prevailing climatic conditions of the site in order to make correct decisions in planning. The following are the inventory taken into consideration.

6.3 ACCESS AND CIRCULATION

The site is on Minna – Bida express way which is generally know as by-pass. This will help facilitate free movement of staff, visitors and delivery trunks to the site.

Circulation within the site connects all the facilities together conveniently. The design has provided sufficient parking spaces for both staff and visitors. There is a separate parking lots for visitors in front of the administrative building.

6.4 UTILITIES

Electrical power lines passes across the face of the site along the expressway. This will be interrupted to facilitate electricity supply to the site. Telephone line cables and exchange box is located along the same road.

In view of the topography of the site, the layout of physical structures will require land leveling in the form of terrace. In some areas, the natural shape of the ground will be preserved as part of the landscaping.

CHAPTER SEVEN

DESIGN CONCEPT AND CONSTRUCTION

7.0 INTRODUCTION:

Toa chive the outlined objectives of the project, the automobile workshop is characterized with repair of vehicles guiding principles to the design includes:

1. Giving consideration to what the designer wishes to express through the building as well as to its adaptability and usefulness for the activities it is to house. The building should be designed for maximum use at minimum operating cost. The design should be such that it is evident from the outside that something is going on within.

2. Maximum effectiveness in use of staff time. The element of control of the building should be given major consideration. Program staff offices should be related to the activity areas to be supervised by respective staff members. This gives opportunity for the supervision of the groups and for informal contacts with individuals before and after the activities.

3. Ease of maintenance: Areas to be used for public should be readily accessible and located so as to reduce unnecessary traffic. Interior construction and decoration should provide a colorful appearance and at the same time be durable and easy to maintain. Ingenuity in planning is required; it pays off both in long-term satisfaction and in economy of operation.

4. Flexibility in use, with the amount of space for single-purpose use kept to the minimum.

Wherever possible, the plan must permit flexibility so that later adaptations or modifications can be without undue expense or waste.

7.1 DESIGN CRITERIA

The automobile workshop in its function be able to satisfy the basic needs for which it is to be established. The design criteria could be summarized as: -

1. To incorporate natural and physical features in a functional relationship with the surrounding environment. Hence, the site should be allowed to produce the architectural design of the complex so as to obtain a high level of site utilization and planning, a landscape of outstanding beauty.
2. To achieve a satisfactory level of customer as to quality the workshop to be a place of safety and also to position activity areas in such a way that a working atmosphere is achieved without conflict.
3. To achieve a satisfactory level of easy pedestrian and vehicular access to necessary parts of the site.

7.2 THE DESIGN CONCEPT

The design concept for the automobile workshop was got from the design approach, which is the transformation design approach. The transformation of an engine crankshaft into an elevational approach.

7.3 MATERIAL AND CONSTRUCTION

Before one begins to design and construct a building one should carefully consider the implications of its proposed physical context, the building site. Its geographical location, topography, climate, orientation, and peripheral

conditions should influence the overall building form its orientation and relationship to the ground plane, and its interior space design land layout. These factors affect the choice of a building's structural system, and its materials and construction. The correct sitting of a building can also help to control natural light, heat, view, noise and other environmental elements by providing the building and its occupants with access to desirable elements and absorbing or shielding the building form those elements which may be undesirable.

7.3.1 MATERIALS

The selection of materials for a social facility like an automobile workshop lot of considerations which may be broadly classified into economic, mechanical and aesthetic considerations. Economic considerations in the use of materials are done on the basis of cost maintenance, fire resistance, replaceability and durability. Building materials are characterized by distinct properties of strength, stuffiness, and elasticity, density or hardness, resistance, to wear caused by physical or chemical action, fire resistance and thermal conductivity.

The most effective structural materials are those which combine elasticity with stiffness. Elasticity is the ability of a material to deform under stress (bend, strength or compress) and return to its original shape. Every material has its elastic limit behind which it will permanently deform or break. Those materials that have low elastic limits are termed brittle. The stiffness of a material is a measure of the force required to pull or push a material to its elastic limit.

Most building materials are manufactured in standard sizes. These "stock" sizes may very slightly between manufacturers and should be verified during the design and planning phase of the building to avoid unnecessary cutting and waste of material during construction.

Methods of fastenings and finishing materials should also be given careful consideration keeping in mind the functions of the building(s) on which they are to be sign of this project are discussed below: -

(i) CONCRETE AND MASONRY

Concrete is a mixture of sand, grave, crushed rock or other aggregate held together by a hardened paste of cement and water. This mixture when properly proportioned is at first a plastic mass that can be cast or moulded into a predetermined size and shape. Upon stone like in strength, hardness and durability. Characteristic of concrete can vary through a wide range, depending on the characteristics of the ingredients and the proportions of the mixture. The techniques used for mixing, placing, finishing, and caring can also affect the quality of the concrete.

Masonry refers to man-made units, which are formed and hardened into modular building unit. Masonry units, (blocks and bricks) must be laid up in such a way as to enable the entire masonry mass to act as an entity. Masonry is structurally effective in compression.

The three basic types of concrete block are load-bearing, non-load bearing and hollow-now-load-bearing units. Sand and gravel are the aggregates

used in concrete blocks, which can be manufactured in many shapes to satisfy various construction conditions.

(ii) WOOD

As a construction material, wood offers, in addition to its strength, durability, light weight, an I easy workability, natural beauty, and warmth to sight and touch. There are two major classes of wood; Soft Wood and Hard Wood. Soft woods are the evergreens and are used for general construction. Hard woods come from deciduous or broad leaf trees and are generally used for flooring, stairs, paneling, furniture and interior trim. In the design wood is employed for the roof construction in the rafters, for doors, interior pertains and flexibility in the design of a building's interior spaces.

(iii) GLASS

Glass is a chemically inert, transparent, hard, brittle material. It is used in building construction in various forms. Glass is used most commonly to glaze a building's window, as it is being used in this design. The three basic types of glass are: Sheet, Float and Plate glass. The variations of these three types are many and include: Heat – absorbing glass, tempered glass, safety – laminated glass, wired glass, insulating glass.

(iv) TILES

Tiles are relatively small surfacing units made of fired clay and other ceramic materials: It provides a permanent, durable, waterproof and easily cleanable surface for interior walls, floors and ceilings. The types of ceramic

tiles differ according to material composition, manufacturing process, finish, and degree of verification (a measure of the tiles density and absorbtivity).

For finishing work in this design, ceramic tiles will be used over sound, dimensionally stable masonry walls, set with organic adhesive.

The appearance of ceramic tile surface depends on the tile size, laying pattern, finish and colour. Glazed tiles will be used on the walls in the toilets, and kitchenette as well as on the tiles be used on the floors for their non-slippery surfaces.

The choice of tile sis based on consideration of beauty, cost, easy-of-maintenance and durability.

(v) PAINT FINISHES

The purpose of a finish is to protect, preserve or visually enhance the surface to which it is applied. Paint generally refers to an opaque or clear film-forming material that acts as a shield or barrier between the material and those elements or conditions that adversely affect or deteriorate it. Depending on its end use, the paint film must resist deterioration due to sunlight, heat, temperature variations, water to moisture vapour, mildew and decay, chemicals and physical abrasion. Paint may also serve to make surfaces more sanitary, improve heating and lighting effects and promote human comfort and safety.

When using paint, the psychological effects of colour and texture must be considered. Certain colours may be stimulating while others are relaxing. Light

colours will be used in this design to reflect light, brighten interior spaces and increases visibility as well as create interest in form and space.

Considerations in the selection and use of paint include: surface preparation, type of paint, film thickness, and coverage, method of application and drying.

(vi) ROOFING SHEETS

Corrugated sheet material may be used as structural, self-supporting roofing, spanning between linear support members. Long span aluminum corrugated sheets will be used for the purpose of this design and the manufacturer will be consulted for material specification, sizes finishes, colour, spanning capability and application details.

The support system will consist of wood crushed rafters, beams and purlins and expansion joint requirements, appearance and colour all depend on the material used, the profile and the depth of the corrugations. The sheets are mechanically fastened to the support frame through the upper portion of the corrugation.

7.3.2 CONSTRUCTION

SITE CLEARANCE

Before any construction work begins on site, the site has to be cleared. Site clearance involves a number of operations which includes: taking a reconnaissance , noting existing features on site, removing existing trees that

will affect construction, demolishing unwanted structures on site, clearing the ground, setting out the site, locating the building line etc.

All these, as well as other necessary operations will be carried out on site before construction begins

FOUNDATIONS

The foundation system of a building, which is its substructure, is critical link in the transmission of building loads to the ground. Bearing directly on the soil, the foundation system must both distribute vertical loads so that settlements of the building is either negligible or uniform under all parts of the buildings; and anchor the superstructure of the building against uplift and racking forces. The most critical factor in determining the foundation system of a building is the type and bearing capacity of the soil to which the building loads are distributed.

The choice of foundation system and material affects and is affected by the soil which supports the building as well as the potential form of the superstructure.

The foundation footings will be designed to rest directly on the soil and support specific portions of the building to the engineer's specification. Care will be taken to design the footing system so that the building loads are transmitted directly to the soil without exceeding the bearing capacity of the soil.

In designing the foundation system, other things that will be kept in mind include: the loads it will carry (dead and live loads of both occupants and contents), lateral loads from both ground pressure and wind, uplift and other forces settlement, etc.

The footing of the foundation will be resting on undisturbed soil and the drainage on site is good such that the soil's bearing capacity is protective maintained and leakage of water into the building interior is avoided. A well-laid damp roof course will also help to avoid moisture penetration.

Expansion joints will be required due to the extent, size and form of the building structure.

STRUCTURAL SYSTEM

Understanding the type and magnitude of the forces acting on a building and how the building might deform when acted upon by these force give significant clues as to how best to resolve the forces with the buildings' settlement system.

Basic structural elements (beams and horizontal slabs supported columns and bearing walls) are joined together to compose three dimensional forms and define space. Care should be taken such that these individual members are structurally stable to internally withstand the stresses acting on them.

The joints between these linear and planar elements are critical in achieving structural integrity and efficiency in a building. These joints, if rigid,

facilitate the transfer of stresses from one member to another and enable the overall structure to withstand heavier loads.

The composite structural system, utilizing both linear columns and beams, and horizontal and vertical bearing planes to define space and provide volumetric enclosure employed in the design. This system allows for flexibility of form in the manipulation of linear and planar structural elements.

Allowance is made as well for the expansion and contraction of building materials which occur in response to normal temperature changes in the form of expansion joints to prevent distortion, cracks and breaks in the building materials. These expansion joints will provide a separation of materials and allow free movement which maintaining at the same time the weather tightness and water tightness of the structure.

WALLS

Wall system are the building's primary vertical planner elements. In this case, they are composed of linear bearing elements (columns and beams) with both structural and non-structural panels distributed to fill in between them.

How these walls and columns support either floor or roof systems above and how they are supported in turn by walls, floor or foundation systems below is determined by the structural compatibility of these systems and the type of connection and materials used. Rigidity is critical factor in the design and construction of these joints.

Exterior walls serve as a protective shield against exterior condition for a building's interior spaces. Thus it will be durable, resistant to wear and the elements (sun, wind, rain). Depending on its orientation on the site, a wall's heat transmission properties, its reflectivity and absorptivity, should be important factors in the choice of a wall system. The exterior wall is also the point at which the control of air, moisture and water vapour flow must take place.

Interior walls and partitions may either be load bearing or non-structural, and serve as dividers and defining elements of space, visually and acoustically. As such, their surfaces will be designed to be durable and wear-resistant and the desired finish, colour, and texture will be compatible with the wall system used. Wall elements will also serve a useful purpose in accommodating the vertical and horizontal travel of mechanical and electrical lines as well as their outlets.

The size and location of door and window openings in walls will be determined by the type of natural light, ventilation, view and access required. These openings will also comply with the restraints of wall system construction, so that structurally vertical loads are properly distributed around the openings and ensure that stresses around the opening are not transferred to the door and window units themselves.

For the purpose of this design, and considering the functions of a wall system in this case, durability, cost, strength, maintenance, etc. are all worthy of consideration. Thus block walls will be used. The bearing strength of a masonry wall is dependent on:

- The quality of the masonry and its compressive strength
- The quality of mortar and its compressive strength
- The quality of the work manship

All these will be considered duly taken care of.

DOORS AND WINDOWS

Doors and windows provide for physical, visual and light penetration into and through a building interior while enclosing space and maintaining quality of the building skin.

Doors and windows provide means of access into a building's interior from the exterior and passage between interior spaces. Exterior doors and windows must provide weather-tight seals when closed, have insulative value and be free from condensation. The doors must be large enough to move through easily and accommodate the moving of interior furnishings and equipment. Ease of operation, privacy, security and possible need for light, ventilation, and view must also be considered in the performance of doors and windows.

Interior doors provide for passage, visual privacy and sound control between interior spaces. Doors into closet and storage spaces are primarily for visual although ventilation may also be a requirement.

There are many types and sizes of doors and windows, the choice of which affects not only the physical appearance of a building but also the natural lighting, ventilation, view potential and spatial quality of a building's interior.

From an exterior point of view, doors and windows are important compositional and scale-giving elements in a building's façade. The manner in which they break up buildings surfaces affects the massing, visual weight, scale and articulation of the building's major planes.

Considering this, the size, proportion and location of doors and windows have been carefully planned for, keeping in mind the standard sizes from the manufacturer. The choice of materials for both doors and windows have been carefully made as well considering factors such as security durability, maintenance, cost etc.

ROOF AND CEILINGS

The roof system of building functions as the primary sheltering element protecting the interiors spaces of the building from the natural elements. It should also control the flow of rain water, water vapour heat and air. It should also be structured to carry its own weight as well as wind loads. The roof system should also be fire-resistant.

Since the roof system is a primary generator of building loads, it must be compatible with the wall and/or column system through which these loads are transferred down to the foundation system.

The roof system is potentially the most expensive system of a building because of its varied functional tasks spread over a large area. Economy of erection and maintenance, durability and potential heat loss or gain should all be considered in the choice of roof system and its materials.

The form of the roof system is a critical element in the visual image a building. The roof form, and the spacing, space and slope of its structural members also affect the choice of the finish roofing material, the interior ceiling systems and the layout and form of the building's interior spaces.

In this design, the roof plays a very important role in defining the building and giving it character. All the above roof functions have been duly considered and applied in the choice of roof system, materials and construction.

FINISHES AND FITTINGS

Exterior wall surface must be weather resistant, durable and relatively maintenance-free. Interior walls should be wear-resistance and easy to clean. Floors should be safe: non-slippery and durable against traffic wear, ceilings should be maintenance-free.

The finish material to be used in any case depends heavily on may factors such as its strength, size, acoustical, thermal and fire resistance values etc.

For visual appearance, all finish materials should be considered in terms of their colour, texture, pattern, scale, modular characteristics and their jointing and edge conditions.

For the purpose of this project, finish materials are considered primarily based on durability, maintenance and cost, considering the users and nature of the facility: the functions it serves, the services it offers.

CHAPTER EIGHT

DESIGN SERVICES

8.0 ELECTRICITY AND LIGHTING

The power supply company should be notified of thee estimated total electrical load requirements to confirm service availability and coordinate the location of the service connection, service switch and switchboard. A transformer may be necessary to switch from the supply voltage to the service voltage. An overhead service connection will be used as it will help to save cost, be accessible for maintenance and carry high voltages over long runs.

The meter, service switch, main switchboard, panel boards and branch circuits will be properly installed and separate wiring circuits will be used for sound and signal equipment, alarm system, telephone, television/cable systems etc.

Electrical conductors will be run within concrete floor systems for convenient access to floor and ceiling outlets. Light fixtures and wall switches are usually the most visible parts of an electrical system and they will be located for convenience, easy access and in coordination with visible surface patterns. Wall plates for these devices will be of insulating plastics for safety.

Load requirements for light fixtures and electrically powered equipment as specified by the manufacturer will be strictly adhered to.

A stand-by generating plant will also be installed on site to serve when there is power failure.

8.1 HEATING, COOLING AND VENTILATION

Environmental comfort factors may be controlled by mechanical systems include: the temperature of the surrounding air (cooling), the mean radiant temperature of surrounding surfaces (heating), the relative humidity of the air (ventilation).

In achieving thermal comfort in the facility, these factors will be taken care of in design and proper planning of the building's location and orientation; spacing between buildings; choice of building materials and construction assembly which can control heat, air and water vapour flow; screening the building from solar radiation; application of landscape features; regulation and treatment of openings on buildings and application of the stack effect in ventilation.

The air temperature in the building is affected by the mean radiant temperature, relative humidity and air motion. Air temperature requirements are also affected by the age group of the building's occupants and the level of their activity. The important of ventilation in this therefore cannot be overemphasized considering the age groups that will be using the facility, the level of their activity and how all this affect air temperature. In addition to the measures listed above, also considered in the design is the provision of free spaces, high ceilings, open courts and adequate penetration to ensure good ventilation in the buildings.

8.2 WATER SUPPLY

Water supply works in the building have to do with the consumption, circulation and storage of water. Water supply should be in the right quantity, and at the proper flow rate, pressure and temperature. Water supply systems work under pressure. The service pressure of a water system must be great enough to absorb pressure losses due to vertical travel and friction as the water flow through pipes and fittings, and still satisfy the pressure requirements of each building fixture. For safety, temperature relief valves are required for all water heaters. There must be sufficient pressure at each fixture to ensure satisfactory operation. The water pipes should be rust and corrosion resistant.

In this design, typical toilet is considerably meant to allow for economy in placement of plumbing fixtures will be verified so that the piping will be correctly installed during the proper phase of construction.

The sanitary drainage system depends on gravity flow and will require large pipes and adequate installation space. All this will be properly taken care of and the layout of the sanitary drainage system will be straight forward and direct with properly sloped horizontal runs and angular connection. This is very important the number of people that will be using these facilities and a breakdown would certainly mean disaster. Also in the design, minimum standards and requirements are followed in order to ensure adequacy in use.

8.3 DRAINAGE SEWAGE AND REFUSE DISPOSAL

Drainage of sub-soil water is very important in order to improve the run-off of ground water, in other to maintain the water table at considerable depth below the soil surface.

A network of drainage channels will follow the pattern of pedestrian walks and roads. The sloppy nature of the site allows for natural flow of water to be discharged into the neighbouring channels.

A sewage disposal arrangement of both control sewage system by a central cesspool as well as individual septic tanks and soak away pits would be provided for. This largely due to the ground condition which will allow the use of both systems effectively.

Refuse disposal is the solid form of domestic waste that needs proper strategy of disposal. For the proposed automobile workshop various buildings within the station would have dustbins placed close t or outside the building and also within the internal spaces. Smaller sizes of bin would be provided for proper collection of waste products. The waste from these dusts bins are latter discharged into an incinerator provided somewhere, at somewhere, at some distance, the building and can be easily be accessed by service vehicles.

8.4 ACOUSTICS

Acoustics may be defined as the science of sound, including its production, transmission, and control of its effects. The acoustic design spaces involves the reinforcement of desirable sounds and the control of undesirable

noise. The acoustics of a room is dependent on its shape, form, volume and the nature of its surfaces.

The sources of sound/noise in this facility will basically the from human activities as well as from engineering and services, water supply and drainage.

All this will be taken care of through proper planning especially in the selection and use of constructions and finish materials, nature of surfaces, shape and form of rooms and spaces, and noise from different sources.

The main treatment, however, lies in the use of acoustical ceilings, sheets/tiles. These acoustical tiles are used all through the facility.

8.5 SAFETY, FIRE & SAFETY

Fire-resistant construction refers to methods of controlling the spread of fire, increasing the length of exposure to fire a material can withstand without damage, and reducing a material's flammability.

Materials used to provide fire production for a building's construction must be inflammable and also withstand very high temperatures without disintegrating. They should also be low conductors of heat to insulate the protected materials from the heat generated by the fire.

For reasons of safety in controlling the spread of fire and allowing sufficient time for the occupants of a burning building to exit safety before the structure weakens to the extent that it becomes dangerous. Fire codes and requirements will be strictly adhered to.

Other measures that will be taken care of during the design and construction stages towards fire protection and safety include provision of structural protection, escapes routes and fire fighting aids.

Passages leasing to exist are direct and unobstructed, well-lit and accessible to the outside. The exit doors are made quite wide for easy escape and the balconies provide extra routes for escape. Exit enclosures (floor, wall, ceiling, stair construction) all satisfy a minimum of one hour fire rating requirements.

8.6 MAINTENANCE

To ensure a high level maintenance, a 'maintenance centre' – the service yard, will provided within the part. It will have a maintenance workshop. Plant maintenance will be minimal within if the natural balance of plant and maintained. Poor soils should be substituted with adequate make up soils. Talk soils produce good lawns. The adopted landscape pattern is natural. It is answer to minimal maintenance cost.

To reduce maintenance, the following has been given adequate consideration the course of the design and shall be upheld during the implementation of this object.

Trees within grass areas are placed wide enough apart to allow cutting machinery to pass through moving margins are allowed against walls.

Manhole covers are to be aligned with ground slop Pop-up sprinklers are to be well located apart.

To further ensure low maintenance, simple layouts and shapes such as large creeps of grass with clearly defined edge trims and/or moving strips shall be involved. Paving will also be inculcated, especially around buildings, to reduce areas to be maintained. It will equally be adopted in some cases to suppress.

Though such hard surfaces will also be severally evolved for less substance, they are required to be swept and cleaned periodically. Regular on for repairs is also repaired. Spaces for trimming will be provided on the hedges.

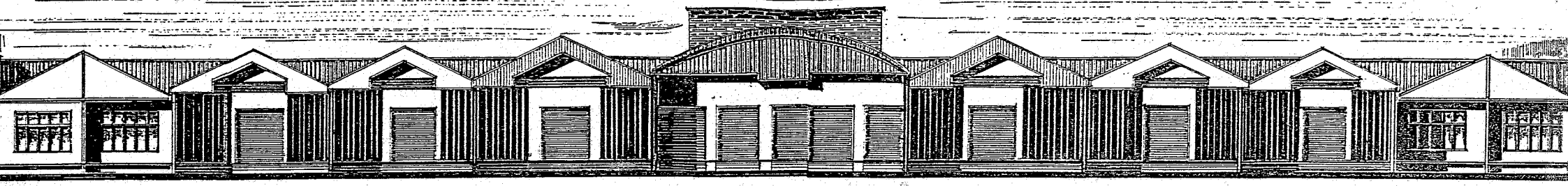
Weed control is inevitable because of the micro climate of this project's the most traditional method of hoeing should be readily used. Mechanical means (Scything), chemical means (weed killers) and mulching compost to suppress weeds should be applied appropriately, when and necessary.

CONCLUSION

Movement of man and goods from one place to another is a must all over the world. Since the time immemorial, man has devised means of conveying himself and his goods from one point to another. This is because, man, needs, food, shelter and this has generated the idea of movement.

Movement of man is inevitable and this has brought along with it's associated problems of urban pollution, traffic congesting, accidents, depression and fatigue.

The proposed modern automobile village is designed to reduce the breakdown of automobile and without doubt relevant to Minna and to the nation as a whole. It is designed also to suit the physical and social setting of the town chosen site in particular. Automobile repairs needs to be treated like the health treatments with adequate skills and services which enhances room for mass mobility.



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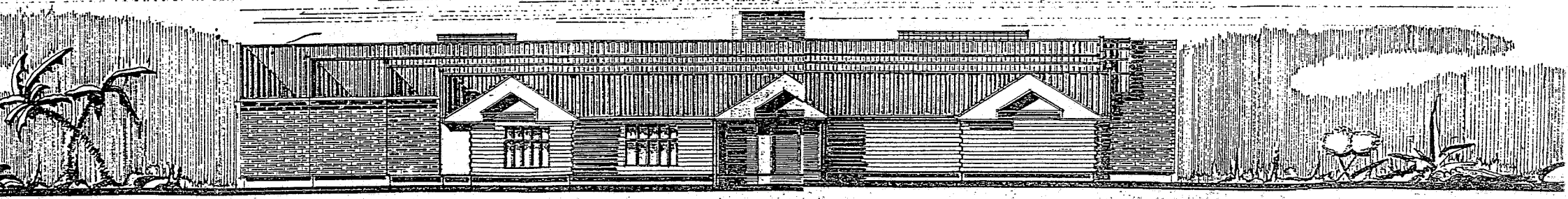

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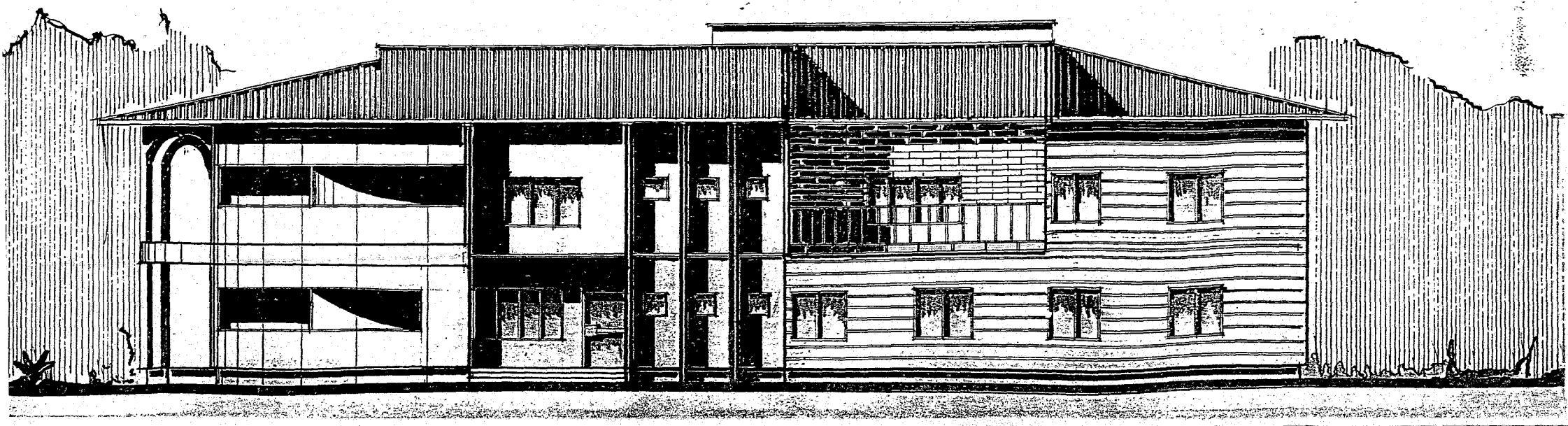

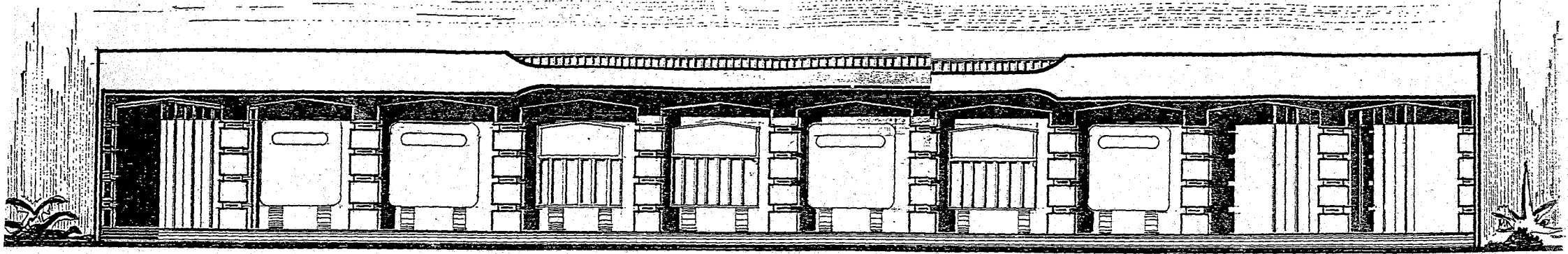

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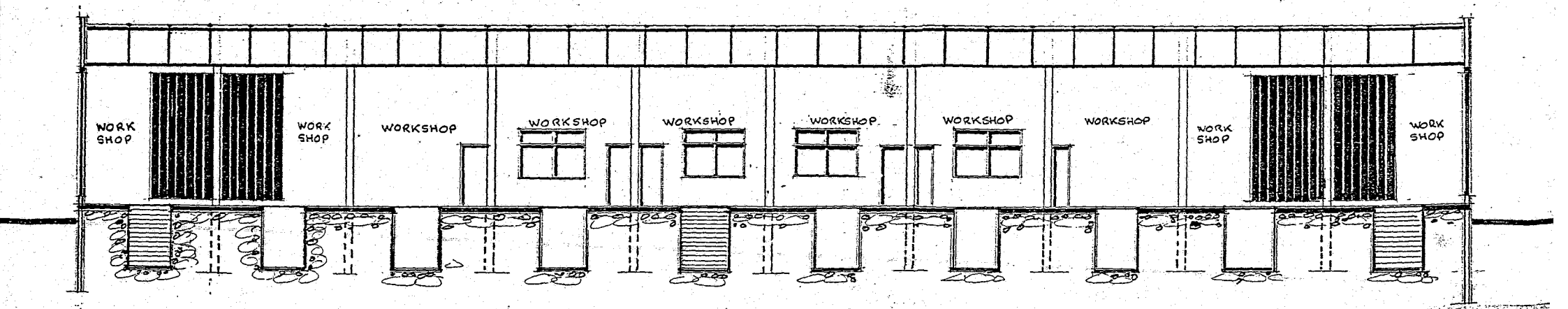

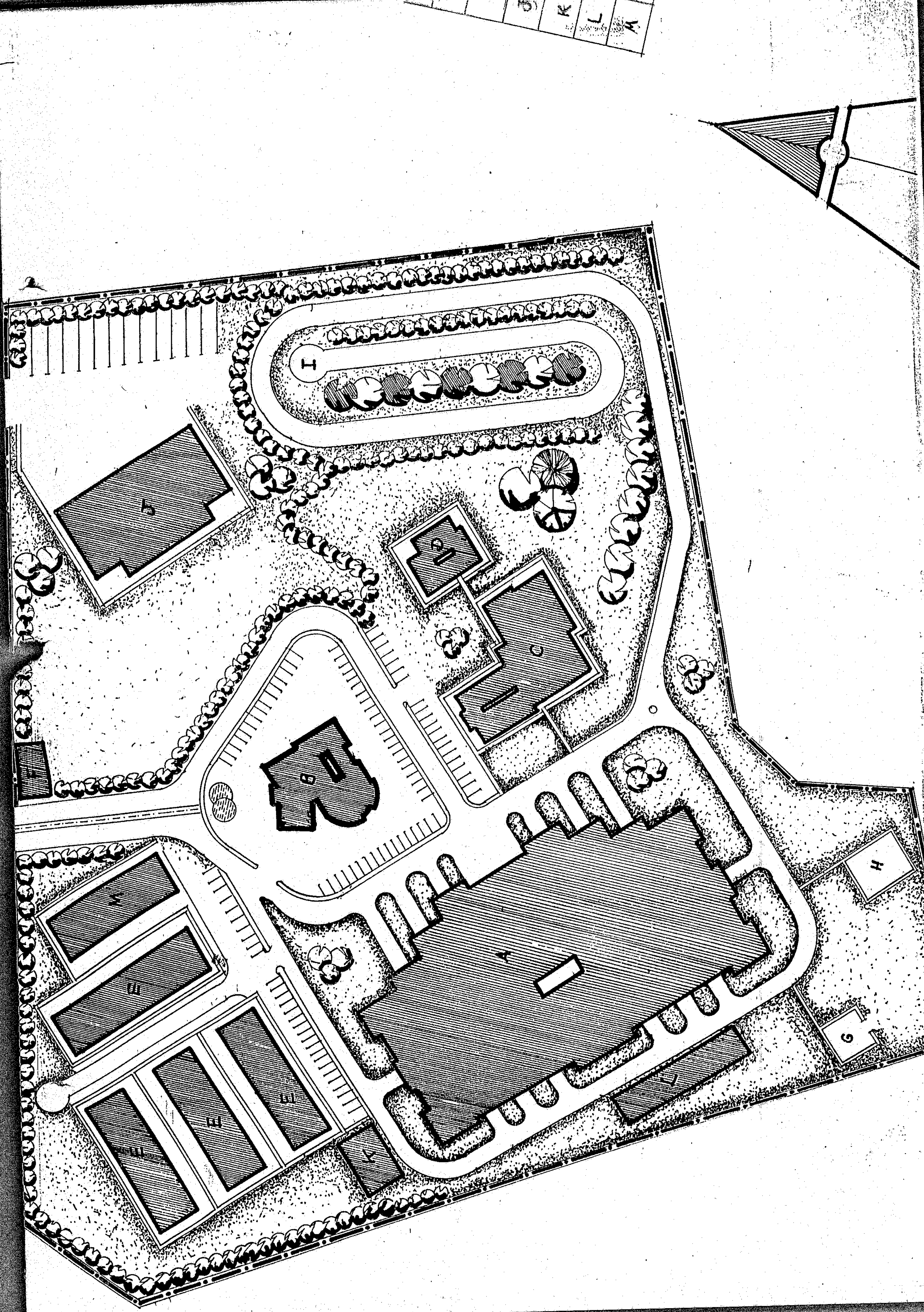

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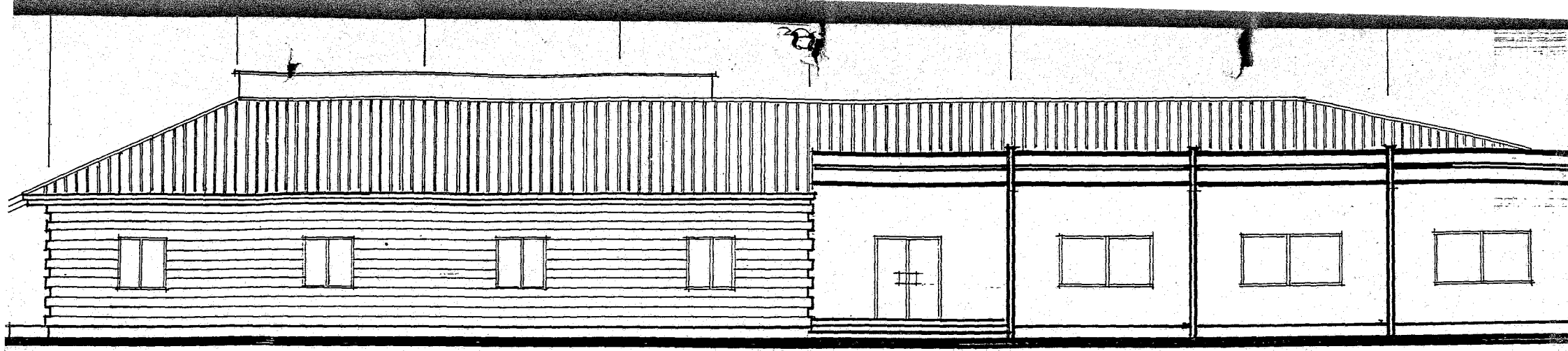

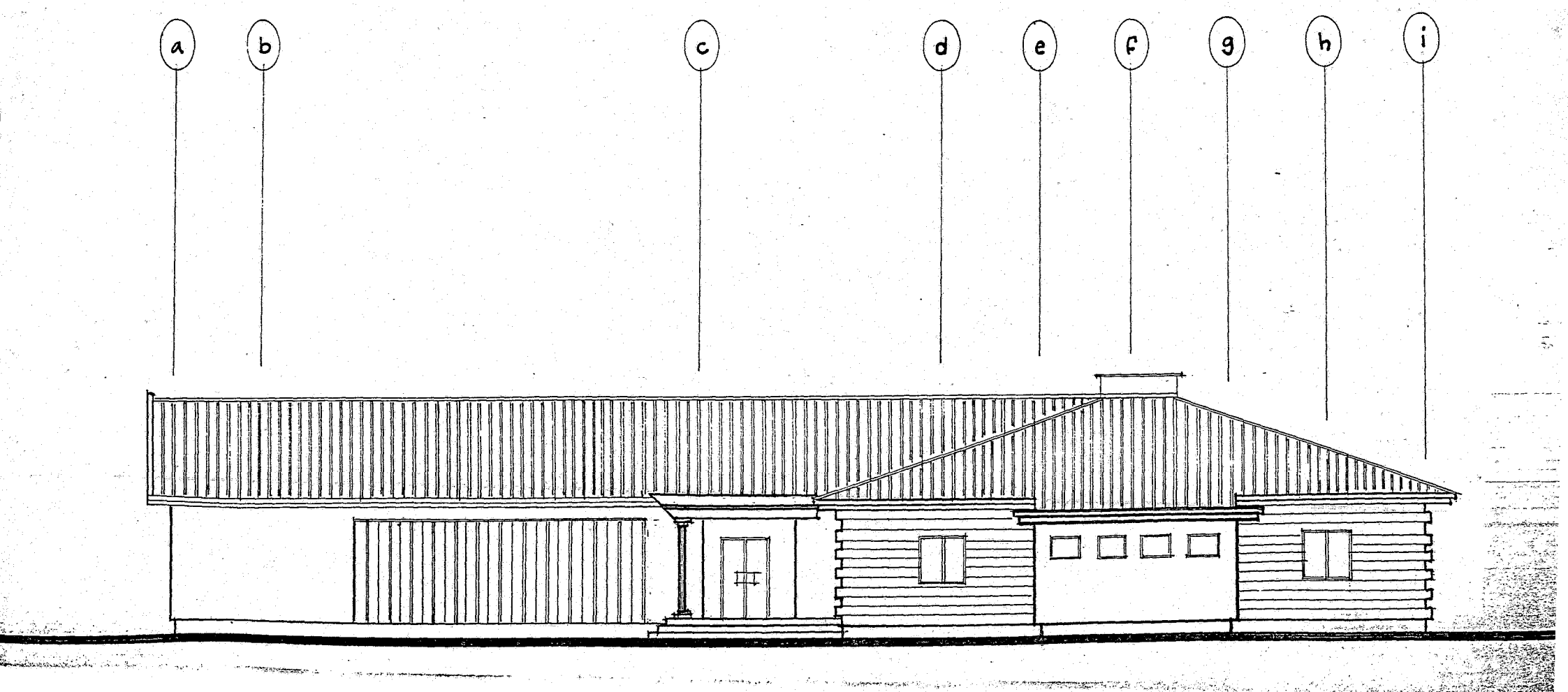
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