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THE COLLECTION AND DISPOSAL OF URBAN REFUSE
WITHIN THE JEDDAH MUNICIPAL AREA

Hassan Mosbah Dajani

Submitted to the University of Durham
for the degree of Master of Philosophy

Department of Geography 1989

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Hassan Dajani
Durham 1989

ACKNOWLEDGEMENT

The writer acknowledges the contribution and encouragement of H. E. Dr. Mohammed Said Farsi, former Mayor of Jeddah, Dr. Khalid Abdul Ghani, the present Mayor of Jeddah, Engineer Issam Merdad and Engineer Mohammed Bamanie from the Central Technical Committee, Municipality of Jeddah. The writer also acknowledges the help and support given to him by Waste Management Inc. and in particular to Arabian Cleaning Enterprise's resident managers, William Reichert, George Villasana and James Waters. The writer wishes to express his special thanks and appreciation to his supervisor, Roy Gazzard, formerly Director of the Centre for Middle Eastern and Islamic Studies in the University of Durham, whose continuous support and guidance made it possible to complete this work.

The writer extends his thanks to Padmanabhan Nambiar for typing the drafts and Bernie S. Lingat for typing the final version of this thesis.

THE COLLECTION AND DISPOSAL OF URBAN REFUSE WITHIN THE
JEDDAH MUNICIPAL AREA.

ABSTRACT

The work comprises a case study and evaluation of the contractual procedures and management techniques attending the disposal of urban waste in a well endowed and rapidly expanding municipality in the Kingdom of Saudi Arabia. The work is in six parts.

The first part traces the evolution of Jeddah as a point on the South North Caravan route across Arabia and its importance as the gateway to the Holy Cities of Mecca and Madina.

The second part outlines the development of cleaning services in the national context, and the evolution of cleaning services in Jeddah.

The third part offers a detailed description of the operational aspects of the first comprehensive cleaning contract for the City of Jeddah, and the performance specification that accompanied it.

The fourth part outlines the computer mapping system established by the contractor on which the annual costing of the cleansing operation could be based. It also describes how this system was used by the Municipality in updating planning information.

The fifth part analyse the different aspects of the

cleaning contract, evaluates the performance of the contractor during the first five years contract, and attempts to identify the optimum way of spending money in order to provide the required service at an acceptable level of cost.

Having analysed and compared the various aspects of the collection and disposal of waste in Jeddah, the writer in the sixth part concludes that Jeddah has gained many financial, administrative and environmental advantages by awarding the city cleaning operations to a private contractor through a competitive tendering process. The writer also demonstrates that the contractor's urban data base, if continually updated, could further assist the development control procedures and urban planning techniques of the Jeddah Municipality.

Hassan M. Dajani
Durham 1989

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INTRODUCTION

INTRODUCTION

Waste is a Global Problem

1. Waste is being produced in ever increasing quantities by the world population, both by the developed and developing countries. Waste management is therefore by nature a global problem but like many other management orientated problems, it has no universal solution. By examining different locations, one concludes that every urban society has its own unique socio-economic composition requiring a tailor made system suited to its particular physical environment and socio-economic conditions.
2. In the past waste collection and disposal services have not received the attention they deserve as a primary municipal service affecting the quality of the environment and the public health. It is now apparent that there is a global awareness of the importance of the problem, and most municipal authorities have taken action, of one kind or another, that reflects the concern of local authorities for improved efficiencies in this field.
3. The solutions presented for waste management problems in the developed and industrial countries made use of advanced technology and modern mechanical equipment. Combined with efficient administration and ever growing

public concern for the environment and public health, the management of waste in developed countries was able to present various methods, and a range of resources which could be applied to resolving this problem.

4. Meanwhile, solid waste management, within the urban service sector, received little priority and attention from developing countries. As a result, the service is often available only to residents in the more affluent areas of these cities. Low-income, densely populated urban areas are rarely provided with disposal facilities or services of this kind.
5. The term "developing country" covers a large number of countries in a wide variety of economic and social situations. In this work, we shall be looking at the experience of Jeddah, the second largest city in Saudi Arabia, and the most important port on the Red Sea. The oil producing countries, as a result of the immense wealth earned during the oil boom, lie at the top of the range of "developing countries". The affluent oil-rich nations can afford to improve their public services and use capital intensive methods in the provision of such services. By contrast, the impoverished developing countries, do not rate public and cleaning services high in their priorities, and due to their limited financial resources, they tend to use labour intensive methods for the collection and disposal of waste.

Waste collection as a Public Service in Saudi Arabia

6. The provision of efficient public services within urban areas is a primary consideration of all municipal organizations. The problems of providing the basic services, such as power stations, the road network, water supply and finally the collection and disposal of waste are common to all municipalities. Solutions to these problems differ in various parts of the world.
7. In the case of waste management, local conditions such as climate, the character of the waste, types housing, wage rates, etc., provide a wide ranging approach towards methods of waste collection, treatment and disposal. Additionally, factors such as the financial resources available and the capability of the community concerned to determine the level and extent of service to be provided, influences whether the public sector or a specialised private company should be entrusted with the provision of the service.
8. Environmental health, together with methods for improving and protecting the environment are of universal application, but this work proposes to deal with the problem in relation to the writer's practical experience in the Kingdom of Saudi Arabia generally and the Municipality of Jeddah in particular.

The unique process of urban development at Jeddah in its various physical, social and economic aspects, makes it a relevant case study for analysis.

9. Following the oil boom in 1973, almost unlimited financial resources became available to the oil producing countries and more particularly the Arab States of the Gulf region. During the ensuing 10 years, the urban centres of these countries experienced an unprecedented rate of growth. The cities of Jeddah, Riyadh, Kuwait and to some extent Baghdad had to find solutions to the problems created by such rapid expansion, particularly in the provision of municipal services. Whereas the basic services of power, water supplies and road network had already established, needing only to be expanded, other services including waste collection and disposal needed radical and immediate attention to protect public health and thereby improve the quality of the environment.
10. In providing these services some authorities decided to depend on local resources, i.e., all operations related to waste collection were performed by the local authority itself. Other authorities, especially those already suffering from acute shortage of local manpower, appointed specialised contractors to provide a wide range of related services. The latter approach was adopted by Ministry of Municipal and Rural Affairs

(MOMRA) in Saudi Arabia, and resulted in the creation of a new form of comprehensive service industry.

11. In 1977, the Riyadh Municipality signed a contract with an American, British and Saudi Joint Venture (Waste Management-Saudi Pritchard) for a comprehensive cleansing operation of Riyadh. This was one of the first international contracts of its kind for waste collection and disposal. Waste Management International (WMI) the leading company in this joint venture, had to provide a wide scope of services including the supply of skilled and unskilled personnel; the purchase and maintenance of equipment, the provision of housing for labourers, administrative buildings and workshops and the formation of sanitary landfill. In short, the Riyadh Municipality delegated to a private company its entire responsibility for waste collection and disposal in the capital city.
12. In August 1981, the Municipality of Jeddah went a step further and awarded Arabian Cleaning Enterprise Ltd. (ACE), a subsidiary of WMI, a five year contract not only to collect urban refuse and clean the city of Jeddah (population 1.5 million), but also to maintain its streets. The contract, which was the largest of its kind in the world, included in addition to refuse collection and disposal the maintenance of streets, the cleaning of public buildings and monuments, the removal of abandoned cars, as well as insect, rodent, and stray

animal control.

13. The Jeddah contract therefore included many services additional to those forming the Riyadh Contract. When the contract was signed, Jeddah was one of the fastest developing cities of the world, and the Municipality of Jeddah realized that the form and extent of the city would change considerably during the five year period of the cleaning contract. The Municipality therefore decided that it would be more economical and efficient to place all work related to cleansing under one contractor, enabling the limited technical human resources at the disposal of the Municipality to be concentrated on matters related to development control.
14. The intention of this thesis is therefore:
 - a) To outline the urban growth of Jeddah, and trace the development and expansion which eventually transformed the city from a small harbour into the biggest and busiest urban centre on the Red Sea. Coupled with this to describe the services required to maintain the resident population, and establish city cleaning services at both national and local levels.
 - b) To describe the range of services provided by ACE for the Municipality including the necessary financial, manpower and organization requirements

for implementing this wide range of services and also the consequences of having provided them.

- c) Additionally to describe the unique experience of using information provided by a city cleansing contract to improve other municipal functions relating to the development control process; the use of computer expertise and equipment to improve the efficiency of the town planning process and map preparation together with the updating of information required for overall city management.
- d) To compare different aspects of waste collection and street cleaning services provided for Jeddah by the Municipality itself as opposed to that provided by a private contractor.
- e) To evaluate ACE's operation in Jeddah, and instance the advantages gained by the Municipality of Jeddah as a result of putting the cleaning contract out to competitive tender.
- f) Assess the Kingdom's experience in the field of city cleaning, and derive general conclusions on aspects of providing city cleaning in the urban areas of an oil rich rapidly developing countries.

PART ONE

PART ONE : URBAN DEVELOPMENT OF JEDDAH
REGIONAL IMPORTANCE AND URBAN GROWTH

Importance and Role

- 1.1. The City of Jeddah lies to the south of the Tropic of Cancer, on the eastern shore of the Red Sea (approx. 80 kilometers west of Mecca). It is situated at a natural break in the coral reef which extends along the Red Sea. It lies at the foot of the Hejaz-Asir-Yemen mountain system, that forms the backbone of the Arabian Peninsula. (Fig. 1.1)
- 1.2. Historically, Jeddah is considered a settlement of antiquity, dating from pre-Islamic times, and contains, the famous Tomb of Eve. Some popular views suggest that the name Jeddah is derived from jaddah, i.e. grandmother, referring to Eve's Tomb which was located near the city.
- 1.3. However, Jeddah's more recent history is closely related to the history of Islam, being the main service center for Mecca and Medina, two of the holiest cities of Islam. Jeddah has played and continues to perform this roll even after discovery of oil, and the consequent social economic changes which brought this new source of wealth to the cities of the Kingdom.
- 1.4. Jeddah is currently the most important entry point



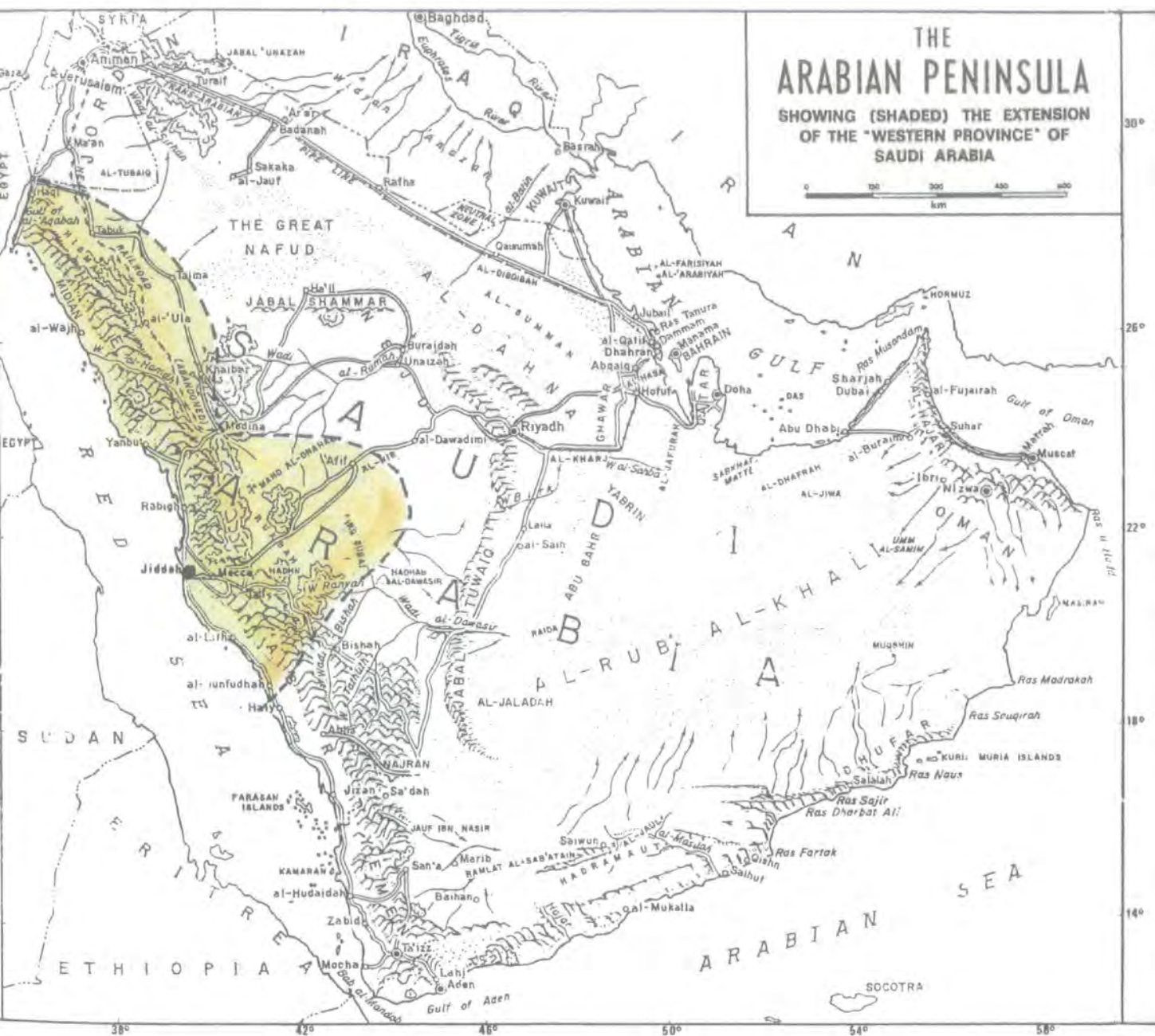


Fig. 1.1. Jeddah location in relation to the Arabian Peninsula and the Western Province of Saudi Arabia.

Source : Jiddah - Portrait of An Arabian City - Angelo Pesce - 1977

into Saudi Arabia, the biggest city on the Red Sea, and the second largest city in Saudi Arabia (The 1984 population was 1.5 million). Together with Mecca, "the holiest city in Islam", and Taif, "the prime Saudi summer resort", Jeddah forms the most populous sub-region of the Kingdom. These three cities and their surrounding areas are estimated to contain about one quarter of the total population of the Kingdom. (1)

1.5. Jeddah, according to the third Five Year Plan definitions, is considered as an established "National Center" (2). As an indication of its national importance, approximately 30% of the government's project expenditure during the second Five Year Plan was invested in Jeddah.

1.6. Jeddah airport and seaport are among the largest and busiest in the Kingdom. King Abdul Aziz International Airport in Jeddah is the main arrival point for pilgrims coming to Mecca throughout the year. In the first quarter of 1984, the total domestic and international traffic was approximately two million passengers (3). It is also estimated that 80 per cent of the foodstuffs imported into the country arrive through Jeddah Seaport. (4)

- 1.7. By Saudi Arabian standards, Jeddah is an old city. It has always played an important role at the regional level and is considered to be one of the primary settlements in the Western Region. The proximity to Mecca, and its convenient location on the Red Sea, gave Jeddah its prominence and provided the City with continuous means for survival and growth. Jeddah was an established outlet to the Red Sea since the early days of the ancient Kingdom of Saba and the later period of dominance by the tribe of Himyar which flourished at the southern tip of the Arabian Peninsula, known today as North and South Yemens.
- 1.8. Modern Jeddah is one of the most attractive and rapidly growing cities in the Arabian sub-continent. During the twenty years period 1965-1985, the urban structure and municipal services developed beyond all expectations. It now enjoys a modern road network, an efficient public transport system, and extensive public services. It has also a recently developed sea front promenade (Corniche), which extends for 100 kilometers along the Red Sea, and includes recreational facilities, gardens, artificial lagoons, mosques and many artistic sculptures.
- 1.9. Jeddah is now an established centre for sea, air and land communications. Additionally it has other significant national and regional functions as a

commercial, business, manufacturing, educational, health and cultural centre.

1.10. Urban growth depends on a variety of geographical, political, economical and strategic factors prevailing at various stages in the evolution of the settlement. Jeddah's physical growth is a good example of how such factors can influence the development of a city. Jeddah's expansion can be divided into three distinct periods:

1. Pre 1947 (5)
2. 1947 - 1975
3. 1972 - todote

Pre 1947 Period

1.11. There is no recorded information as such to indicate the growth of the city during the period preceding 1947. Neither have significant archaeological excavations been undertaken within the historic core of the city. However we know that the 6th century A.D., saw growing Persian interest in Jeddah due to its strategic location and consequently, underground conduits and cisterns were constructed to bring water from Wadi Fatima (6). The remnants of these systems can still be seen.

1.12. The earliest written description of Jeddah dates from the eleventh century:

"....Jeddah is a great city situated on the coast and surrounded by strong wall. Its population reaches the number of five thousand male inhabitants. Its position is in the northern half of the Red Sea. The bazaars are beautiful; the giblih of the Great Mosque faces the east. There are no buildings to be seen outside the city, except a mosque which is called Masjid ar-Rassoul (The Mosque of the Prophet). The city has two gates; one, to the east, opens onto the Mekka Road; the other, to the west, opens to the sea.... There are no trees nor any vegetation in Jeddah; all that is necessary for everyday life is brought in from nearby villages..." (7).

1.13. During the early days of Islamic period, Jeddah witnessed a flourishing trade, with increased wealth and prosperity derived from its linkage to Mecca, the Center of Islam. However, Jeddah suffered a temporary setback when the secular capital of Islam moved first to Damascus and then to Baghdad. The decline in trade which resulted from these moves ended with the collapse of the Abbasid domain in Mesopotamia, and thereafter Jeddah enjoyed a renewed interest by the Abbasid's successors.

1.14. The city wall was reconstructed at the early part of the 16th Century (8). This provided the city with fortifications that saved it from potential invaders, and at the sametime gave Jeddah one of its most significant physical features. The wall was demolished in 1947 to give way for city's expansion eastwards, in the direction of Mecca and northwards, in the direction of Medina.

1.15. In 1869, the Suez Canal was opened, and the Red Sea

was established as the main route of trade between East and West. this resulted in the confirmation of Jeddah as the dominant trading center in the Red Sea. Consequently, wealth and prosperity increased amongst the residents of the city.

1.16. Between the opening of the Suez Canal and the demolition of the wall on 1947, there was little change or growth outside the wall (figure 1.2). However it was during this period that some of the most interesting architectural and urban features of the old Jeddah were formed. Within the city wall. a dense conglomerate of mosques, minarets, squares and narrow foot paths formed the core of the built environment. It was also during this period that some of the splendid merchant houses and palaces were built.

1.17. In August 1947, the "Architectural Review" published an article by the writer, J.M. Richards describing Jeddah at that time:

"Inside the walls the town is one of closely packed buildings, arranged on no regular plan; there are few streets of any length, the tall buildings giving the impression of having been stacked inside the town walls like flowering stalks into a vase. They are separated by narrow alleys that open out here and there into little squares. The only large open spaces are an oblong one behind the docks, containing such public buildings as quarantine and customs offices, and a wide roadway immediately within the walls on the north and north-east sides, separating them from the outer row of houses. There is no paving - since there is no durable stone. these open places and the courts

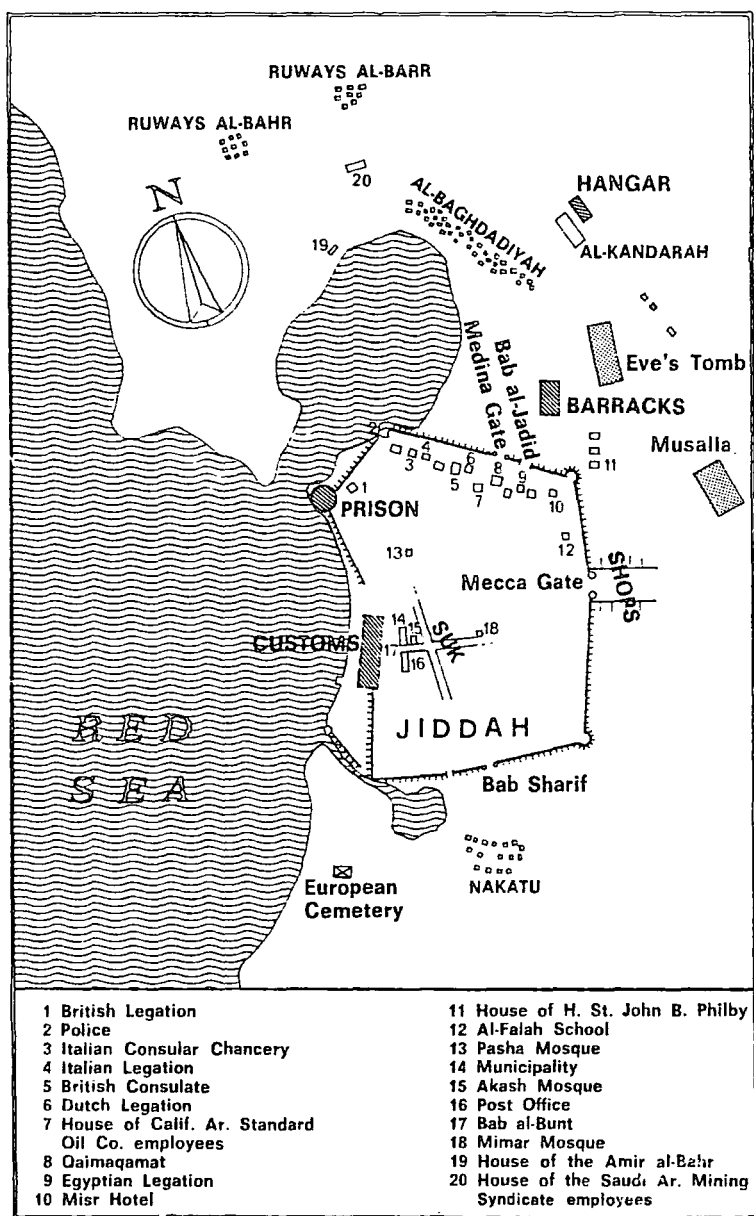


Fig. 1.2. Plan of Jeddah 1938.

Redrawn from C.A. Nallino *L'Arabia Saudiana* ed. by M. Nallino, Rome 1939.

and small squares are all floored with a fine sands, trodden hard, but with a dusty surface that glistens whitely in the sun. It makes Jeddah a city of silent traffic; the rare wheels of carts grate dreamily as they pass, and the padding of bare feet is pleasantly muffled."

B. 1947 - 1975 Period

- 1.18. Oil production increased from 20,000 barrels per day before 1944 to 546,703 bpd in 1950, and jumped to 1,247,140 bpd by early 1960's. The steady expansion of oil production continued, and by 1970, production reached 3,548,865 bpd (9). As a result between 1950 and 1970 the Kingdom's revenue increased more than five and a half fold.
- 1.19. This substantial increase in revenues, allowed an increased rate of investment to be made throughout the Kingdom covering all aspects of development. Jeddah had its share of this investment, and the government gave priority at this stage to road communications, health and education projects. Within the city, development intensified in three directions, along Mecca Road, along Medina Road; and also along the Ring Road connecting the Sea Port with the Khuzam Palace, and the Airport. This growth was necessary to accommodate the enormous increase in population and employment.
- 1.20. While the majority of development activities took place in the form of new areas along the Mecca and

Medina Roads, two main road projects within the densely built-up area were completed. The first was cut through the heart of the city to provide vehicular access for the central business area. The second demolished approx. 80,000 square meters of the low quality housing in Al Sabeel Area in order to alleviate traffic, sanitary and security problems within its densely populated area and that of Al Hindawiyah adjoining it to the south west.

1.21. During this period, major development also occurred elsewhere. Both airport and sea port were extended, a desalination plant was constructed, water, sewage and storm water systems were designed and contractors proceeded with the construction of these and several other utilities. In spite of all this activity, development up to 1972 was of a controlled form.

1.22. No accurate information about population or statistics about employment levels and related socio-economic activities are available for this period. However, there was an economic crisis in 1956 due to the closure of the Suez Canal which only re-opened in 1964 when King Faisal bin Abdul Aziz assumed power. This and other crises resulted in the application by the government of strict austerity measures and a consequent slow down in Jedda's rapid growth.

1.23. After 1964, Jeddah continued to grow steadily. The

bulk of population increase occurred as a result of a resumption of resumed unrestrained investment in public works and utilities, road construction and other projects. There was also a corresponding increase in the private sector investment, directed mainly on the construction of palaces, private houses and residential blocks.

1.24. Thus, between 1946 and 1975, Jeddah expanded considerably beyond the core of the old walled city and by 1974, it could be divided into 5 distinct areas or sections which collectively formed the greater urban area. (Fig. 1.3.)

- 1) The old town which form the commercial and historic center of the city was bounded by the King Abdul Aziz inner ring road. Tower blocks started to appear along the main roads, particularly King Faisal Street, but the inner area continued to keep its original built form, with its separate and distinctive Gabel, Al Alawi and Al Nada souks.
- 2) The outer central area, which mainly consisted of the Bagdadiyah, and Al Kandara districts. This area is bounded by the outer ring road connecting the sea port, Mecca Road, the Airport and Medina Road. Most of this area is of medium density, mixed residential, commercial and light

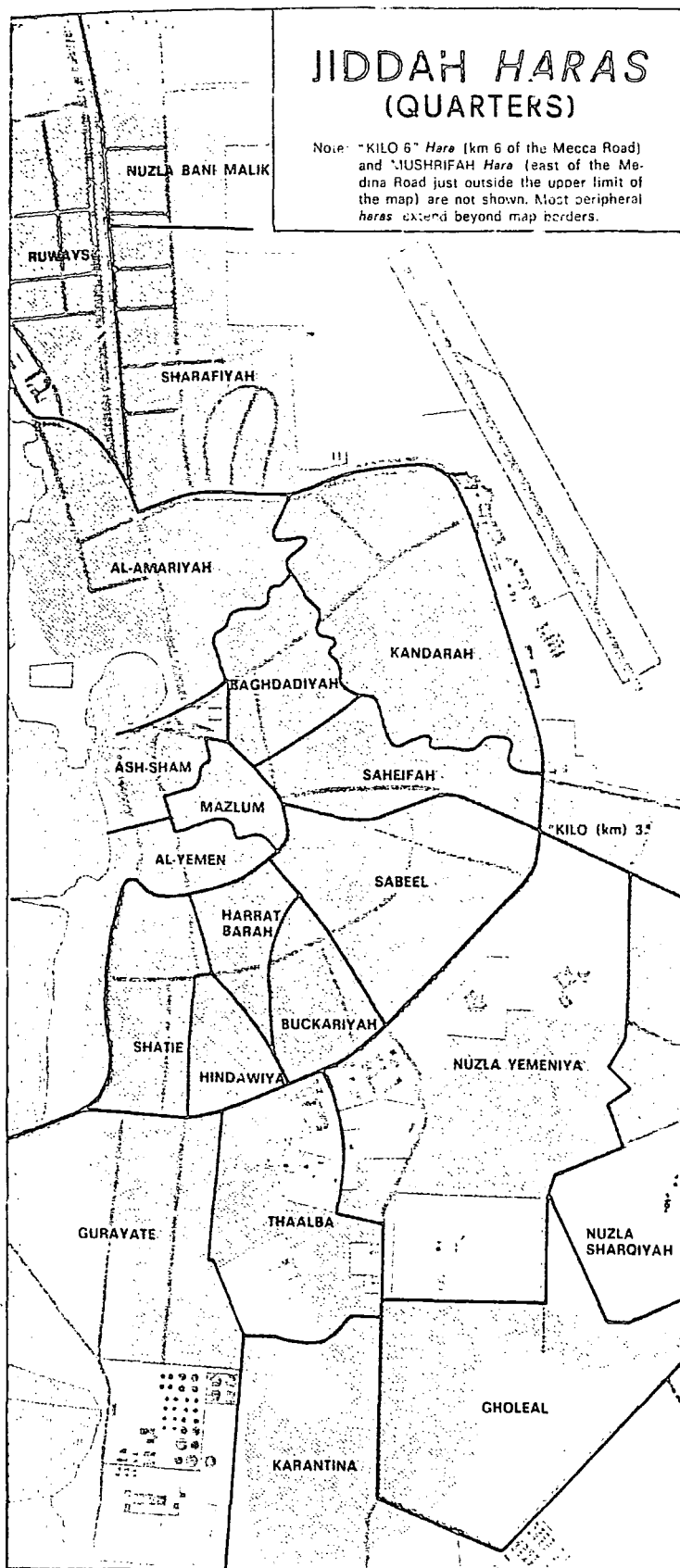


Fig. 1.3. Jeddah 1974

industrial uses.

- 3) The southern sector of the city comprises parts of Al Sabeel, Al Hindawiyah, Al Nozlah, Gholail and the industrial estate. Most of these high density areas were developed with little or no control, to accommodate low income Saudi and non-Saudi families. This sector also included a "squatters camp", consisting of shacks and tin huts housing illegal migrants from Africa and elsewhere.
- 4) The Mecca Road area. This first developed as a distinctive residential district containing the earlier palaces and villas of high income families. At a later stage, some industrial activity began to take over, particularly along Mecca Road.
- 5) The Medina Road area. This area was formerly the second most prestigious residential area for high income Saudi and non-Saudis. By 1970 the Madina Road area had become the preferred high standard residential district, and consequently the growth of the city began to extend in a northerly direction. There were, however, some lower income settlements, for example at Rowais and Bani Malik.

1.25. To summarize, Jeddah witnessed a steady growth over the 15 years from 1960 to 1975. During this period amenities and facilities were improved, but by contrast, there was an obvious lack of organized municipal activities dealing with the day-to-day matters of development control, sanitation and refuse collection. The only planning directive for the city was the outdated physical Master Plan prepared in 1962, (10) and beyond this the city had practically no comprehensive planning framework or information collecting system. The first Master Plan and Action Areas Plan for the City of Jeddah was commenced in 1972.

C. 1975 - to date

1.26 Urban development in Jeddah during this period was greatly influenced by 3 factors:

1. The availability of a planning framework to guide the city growth.
2. Substantial public expenditure on infra-structure and human resource development projects.
3. Significant improvement in the Municipalities, administrative, financial and management efficiency, coupled increasingly with the transfer of power from the Ministry in Riyadh to the Mayor of Jeddah as part of a decentralization policy.

1.27 In 1973, the Saudi Council of Ministers approved the

Master Plan for Jeddah prepared by the British Consultants Robert Matthew, Johnson-Marshall and Partners (RMJMP). The Master Plan provided the city, with a comprehensive framework of programmed development, and for the first time clear guidelines for future urban growth. The coordinated programme was developed in four five year phases to span the 20 year plan period - from 1971-1991. (11)

- 1.28 The principal features of post 1972 Jeddah were created over a relatively short period (1975-1985). The induction of virtually unrestrained investment in roads construction, public utilities and private projects during this period turned Jeddah into, "one big construction site". The Municipality's budget during the Third Five Year Plan (1980-1985) was of the order of SR 4,272 million. Table 1.1 summarizes the amounts allocated for different projects. (12)

Table 1.1. Third Five Year Plan - Jeddah Municipality
Projects: Total Cost

<u>Subject</u>	<u>Budget (SR)</u>
Jeddah Corniche	272,000,000
Tunnels and bridges	137,600,000
Roads:	
Beautification	1,827,202,000
Temporary asphaltting	470,000,000

Walkways and lighting	210,000,000
Storm water	732,273,000
Public Gardens and Plantations	120,946,000
Public Markets	119,888,000
Other Projects	366,820,000
<u>Computers</u>	<u>16,000,000</u>
Total	4,272,729,000

1.29 Over 68% of the total budget was spent on roads and other related projects, such as the corniche, tunnels and bridges. This enabled the Municipality to implement, over a short period, most of the major network featured in the 20 year Master Plan (1972-1992).

1.30 During this period many other projects related to education, health, sewage, telecommunications, religious and cultural activities were also completed, including a new airport, 3 big housing projects, expansion of the seaport and the development of the King Abdul Aziz University. In 1981 the Municipality signed a comprehensive 5 years contract with ACE to clean the city and maintain its streets. It is estimated that the total public expenditure on Jeddah during these two decades could have peaked at over SR 500,000,000 (approx. £ 80,000,000) per week. (11)

1.31 The built-up or partially built-up area of Jeddah had increased from 1.5 sq. km. in 1947 (within the city

wall), to over 40 sq. km. by 1971, but by 1985, the overall area of the city had grown to more than 1,200 sq. km. By then the city extended 80 kms. along the Red Sea from North to South, which is almost the distance between Jeddah and Makkah.

- 1.32 By 1985 the length of major roads in Jeddah (wider than 20 meters in cross-section) was 890.7 kms. and local roads (20 meters or less in cross-section) was 3192.1 kms. (13). This network included the corniche recreational routes. (Fig. 1.4)
- 1.33 One of the major achievement of the Municipality was the initiation of a special study for the Historic Area of the city. This lead to the implementation of a comprehensive plan for the preservation of buildings of architectural and historical significance followed by massive project for the landscaping, asphaltting and refurbishing the Historic Area. When it was completed during 1985, much of the beautiful and historic fabric of the old city had been saved or restored.
- 1.34 The Number and efficiency of the Municipality's technical staff was substantially increased during this period when the management and coordination of all aspects of the development of the city became the responsibility of the Technical Affairs Department. 17 Sub-Municipalities were established to deal with ongoing technical and administrative matters for

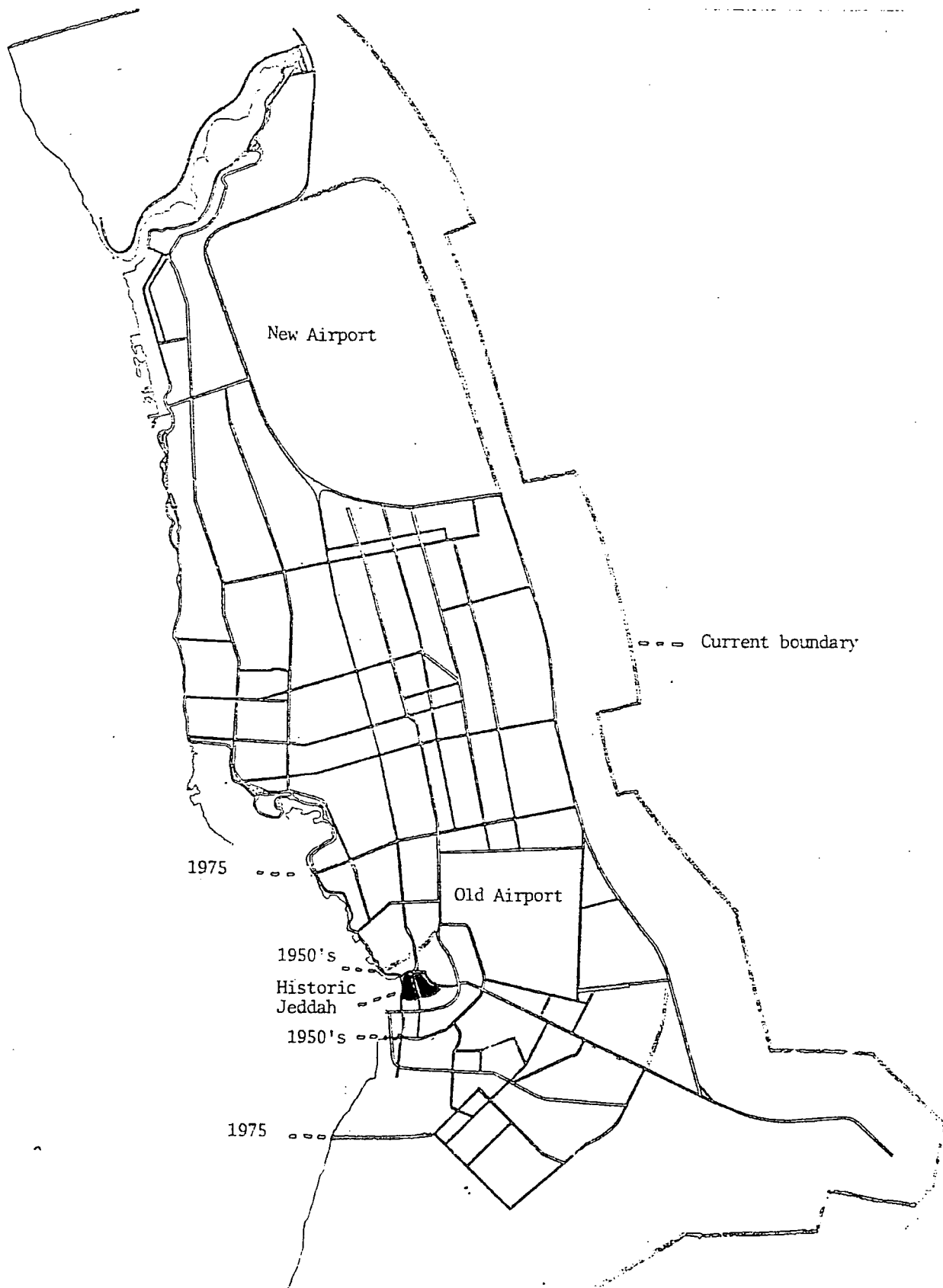


Fig. 1.4. Main roads and Jeddah boundary 1985.

Source : Arabian Cleaning Enterprise computer mapping system (1985).

different districts of Jeddah and by 1985 more than 150 architects, engineers and urban design consultants were employed by the Central and Sub-Municipalities.

- 1.35 To summarize, the growth of Jeddah during the nineteen seventies and eighties took place within an ordered and generally controlled framework, in marked contrast to the earlier unplanned development which occurred during the sixties. It was a mixture of good fortune and bold action that led to the evolution of Jeddah as the most beautiful city on the Red Sea. The availability of funding, finalized plans and sound management gave the Municipality the essential tools for implementing, guiding and controlling development during a period of unparalleled urban growth and expansion.

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Western Region Survey 1971.
2. Centres are classified as of national, regional, or local significance. The National Centre is defined as "fulfilling various economic and administrative functions for the whole country, providing very specialized service, and a growth pole of national significance". (Third National Plan (1980-1985), P.109).- Ministry of Planning.
3. Figures released by the Presidency of Civil Aviation for this period showed 1,100,000 domestic passengers and 851,000 international passengers.
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5. When the city wall was demolished.
6. The fertile wadi running generally Northeast-Southwest between Jeddah and Mecca.
7. Nasir-i Khosrow, Safar Nameh (Book of Travel), c.1050. The writer was a celebrated Persian poet and philosopher.
8. Different sources place this reconstruction occurring in 1514 or between 1506-1507. Barros, a Portuguese

historian states that the wall was built by Husayn al-Kurdi in 1514, while other sources state that the fortifications were built in 912H (1506-1507).

9. ARAMCO Handbook - oil and the Middle East, revised edition, Arabian American Oil Company, Dhahran, 1968.
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11. DUNCAN, G. O., The Planning and Development of the City of Jeddah 1970-1984., Department of Geography-University of Durham 1987.
12. Municipality of Jeddah, Training Seminar for Engineers, February 1984.
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PART TWO

PART TWO: DEVELOPMENT OF CLEANSING SERVICES - JEDDAH

CHAPTER ONE: Cleaning Services in the National Context

- 2.1.1. Street Cleaning and Refuse Collection in Saudi Arabia has been a Municipal function since 1962 when the first Saudi Administration was established in the Hijaz Region. All matters relating to public health and municipal works remained under the Ministry of Interior until the formation of the Ministry of Municipal and Rural Affairs in 1975.
- 2.1.2. The transfer of responsibility from the Ministry of the Interior (MOI) to the Ministry of Municipal and Rural Affairs (MOMRA) was gradual. In 1962, the Council of Minister's resolution No. 808 established a Municipal Services Department of MOI to supervise some municipal affairs, and almost immediately this was transferred to an Agency for Municipal Affairs. This Agency continued to perform all functions related to the direction and control of municipal services until the establishment of MOMRA in 1975 by Royal Decree No. A/236. The creation of this new ministry was essential to cope with the vast growth and expansion experienced by most urban centres in

Saudi Arabia since 1960.

2.1.3. Prior to the formation of the Agency for Municipal Affairs, (The Agency) there was little, if any, organized effort to clean the various Saudi cities, or to control the municipal and private collection of waste. However, during the early sixties the Agency began to be aware of the declining level of cleanliness in both urban and rural areas. Consequent upon the danger to public health resulting from this situation, the Agency produced a series of directions and regulations (Appendix A) (1) to establish the necessary steps required by both public and by private concerns to contain the situation and raise the general standard of cleanliness throughout the populated areas.

2.1.4. However, these circulars and directives infact dealt only with isolated or occasional problems. They carried no legislative authority. This meant that the directives were a temporary expedient rather than a permanent solution to the problem. For example, a circular issued in 1967 to Municipalities and by the Deputy Minister for Interior and Municipal Affairs reads as follows:

"It has been recently noticed that some, if not most of municipalities are neglecting street cleaning in their cities and consequently garbage is left for days or weeks to produce bad odours and cause the spread of flies and mosquitoes which in turn spread diseases. This problem has been a subject of complaint by

citizens and authorities.

Since the budget allocated for city cleaning at most of municipalities is not small, then the matter requires only more attention and care by municipal cleaning departments. It has been observed also that these departments do not cooperate with the environmental health departments and sometimes interfere with their work. No matter how frequent the city is sprayed, accumulations of garbage on the streets and alleys for long time will make the efforts of environmental health department as useless.

Therefore, each mayor is fully and solely responsible for the cleanliness of his city and to improve sanitary conditions in it within his capabilities. He is also responsible for any negligence on the part of his employees and is supposed to penalize those negligent employees, or refer them to us for application of penalties.

Deputy of Interior Ministry for Municipal
Affairs,
"Abdullah Al Sudairi"

2.1.5. The early seventies experienced a sudden increase in economic activities resulting in immense growth in most urban areas. In the main cities of Riyadh, Jeddah and Dammam the increased population and construction activities lead to a decline in public health standards. This was aggravated by the failure of the municipalities to achieve an appropriate standard of city cleanliness, comparable with the progress evinced in other aspects of economic, social and urban development.

2.1.6. The main problems facing both the Agency and the Ministry of Municipal and Rural Affairs in their

efforts to clean the cities at that time can be summarised as follows.

1. Lack of a national legislative framework for the protection of the environment by the collection and disposal of solid, liquid and chemical wastes.
2. Unsuccessful attempts by municipalities to perform duties related to the collection of waste and the management of sanitary landfills or treatment sites due to the shortage of qualified and experienced personnel in this field.
3. Unavailability of local labour, and the administrative and logistic efforts needed to recruit, train and supervise an alternative labour force from outside the Kingdom.

2.1.7. The Ministry of Municipal and Rural Affairs adopted a series of principles intended to meet the immediate demands and long term objectives for protecting the environment and raising the standard of public health. The most important of these principles were:

1. The main municipalities to have delegated powers enabling them to carry out their main functions and responsibilities more effectively. (2)

2. Establish and enforce regulations and measures dealing with environmental protection, both at local and national levels.
3. Solve the imminent problem of waste collection and city cleaning by awarding city cleaning contracts to specialized firms.

2.1.8. In 1981 four municipalities (Riyadh, Makkah, Jeddah and Medina) were upgraded to Metropolitan Status, (Amanat), in order to provide more flexibility and efficiency in the management, control and development of these important cities. In line with the recommendations of Mackinsey International, the Mayors of the four cities were given extra responsibilities and resources in order to expedite the implementation of vital projects related to physical, social and cultural development.

2.1.9. Public health, refuse collection and cleaning operations also benefited from the new steps taken towards achieving decentralization. The first attempt to solve the problems relating to refuse collection and disposal was taken by Riyadh Municipality in 1977 when the Municipality invited international companies to tender for the first comprehensive city cleaning project in the Kingdom. This was followed by Jeddah in 1981 and other cities

throughout Saudi Arabia.

2.1.10. On 25.2.1981 (21.4.1401 H), Royal Decree No. 7/M/8903 was issued to establish "Meteorology & Environmental Protection Administration" (MEPA), and was directly connected to the Ministry of Defense and Aviation. The main objective of creating MEPA was the establishment of an administration capable of undertaking the task of providing regulations and procedures for the protection of the environment. This confirmed the increased awareness of problems created by the lack of effective methods and organizations to carry out tasks related to environmental protection.

2.1.11. The Public Administration Institute in Riyadh issued a "Charter of Duties and Authorities", setting out the main duties and functions of MEPA in the field of environmental protection as follows:

1. Conduct environmental surveys to identify problems and recommend environmental standards and measures.
2. Recommend protection regulations and measures dealing with environmental problems.
3. Recommend practical measures necessary to deal with emergency situations affecting the environment.
4. Assess existing environmental pollution levels and future variations.

5. Keep abreast with developments in the field of environmental protection at both regional and international levels.
6. Establish environmental standards and specifications for pollution control and environmental protection, in a definitive and stable form capable of being considered by the appropriate authorities when issuing permits for industrial and agricultural projects having an environmental impact.

2.1.12. An Environmental Protection Directorate (EPD) was to become the special department in MEPA responsible for the environmental protection matters such as issuing and implementing standards and the evaluation of environmental conditions. Policies to protect and improve the environment were recommended in the following areas:-

1. Prepare and recommend environmental quality and source standards and the necessary implementation procedures to be applied.
2. Submit reports on the environmental impact of major projects in the Kingdom.
3. Provide assistance and technical advice to those engaged in industrial and agricultural activities enabling them to comply with environmental standards.
4. Submit reports on the state of the environment and "follow up" on the application of environmental standards and their effects.

2.1.13. The objectives of the above functions were deemed appropriate to the Kingdom's development plans and were intended to lead to the improvement in site selection for new projects as well as in their

design and performance to reduce environmental damage resulting from developmental and associated activities. (Appendix B.)

- 2.1.14. The creation of MEPA was a significant step towards the establishment of a national framework for the protection of the environment. By making the main municipalities more autonomous, contracting specialized city cleaning companies to clean these main cities and finally creating MEPA, the government successfully achieved its main short and long term objectives towards maintaining a high standard of city cleanliness.
- 2.1.15. However, there are still, many issues to be settled by the Saudi government in order to maintain, the high standard of city cleanliness achieved during the eighties. For example, there should be tighter legislation controlling waste collection and disposal (3), and the enforcement and implementation of such regulations. The government would also have to decide what role government agencies and the private sector will play in the city cleaning functions.

CHAPTER TWO: CLEANING SERVICES IN JEDDAH

2.2.1. Unfortunately, there are no records available to indicate methods of waste collection and disposal in Jeddah prior to 1970. However, after the demolition of the wall in 1947, the limited population of Jeddah did not require much by way of sophisticated cleaning services, and it was only after 1975, when the city had expanded, and the population had risen to more than a million that refuse collection presented itself as a major municipal problem. In 1976 the city generated approximately 300 tons of waste, and this was when the Municipality decided to appoint a local company (Dallah) to take charge of all cleansing responsibilities within the city.

2.2.2. The services performed by Dallah were limited to manual sweeping and garbage collection and open incineration of refuse as well as the use of vacant lots as transfer sites known as "refuse throwing areas". However the local company was not able to handle the continually increasing quantity of refuse. Problems also resulted from lack of manpower and absence of spare parts for its vehicles. This forced the municipality to cancel its contract with that company and to attempt to carry out the cleaning itself.

2.2.3. The cleaning operation, "collection and disposal of refuse and street cleaning", became a municipal function and the Municipality continued to perform these services till 1982 when ACE was awarded the cleaning contract. During the 6 years period, preceding the ACE contract, the Municipality depended mainly on manual labour, using hand-brooms and trolleys to collect the refuse and transfer it to collection points within the city, where it was dumped on the ground. From there the refuse was manually loaded into rear-end-loading compactor vehicles, and in some cases mechanically removed by shovels and tippers. Finally the waste was then transported to disposal sites outside the city where it was burned in the open air.

2.2.4. Administrative measures were introduced in order to decentralize the overall cleaning functions. The city was therefore divided into North and South divisions, and in 1978 the number of sub-divisions was increased to four. The responsibility for running, and supervising the cleaning operation became the responsibility of the head of the sub-municipality concerned. Each sub-municipality was allocated a cleansing manager, supervisors and labourers whose numbers increased in line with the continuing growth of the city. In 1980, this policy was reversed and a new Central Cleansing Department

was created to take responsibility for the planning, programming, supervision and implementation of all related cleansing matters.

- 2.2.5. There was a noticeable increase in the manpower and equipment used during this period. Labourers increased from 4,000 in 1976 to 5,080 in 1978 and to 7,000 in 1979. Metal containers fitted on top of hand carts were distributed within residential areas and at congested shopping centres. The Municipality also installed hydraulic compactors of 10m³ capacity, and used its own shovels and dumpers to transport accumulated construction rubble to designated filling areas. Table 2.1 indicates the increase in equipment available to the Municipality between 1978-1981.

Table 2.1

Type of Equipment	Quantities/Year		
	(1978/79)	(1979/80)	(1980/81)
Rear-loader compactor trucks	84	86	96
Tipper vehicles	39	90	103
Wheel loader (shovels)	9	15	25
Motorized streets sweepers	15	25	35
Push hand-carts	800	1,000	2,000
Steel containers (300 liter)	300	1,000	2,000
Skip containers (10 m ³)	-	63	87

Skip open containers (3m3)	-	48	48
Load lugger vehicles	-	5	5
Skip closed containers (6.5m3)	-	32	150
Dodge tipper vehicles	-	12	30
Steel static compaction units (10m3)	-	20	20
Pick-up trucks (1-t)	50	50	50
Bulldozers	1	2	4
Motor graders	1	2	3

SOURCE:- Holmes, J. R., Managing Solid Waste in Developing Countries, John Wiley & Sons Ltd., London, 1984.

2.2.6. The increase in manpower and equipment resulted in a noticeable improvement in the standard of street and road sweeping, but due to the shortage of transportation, equipment and lack of an organized system for refuse disposal, rubbish accumulated on the open dump areas. Incineration on these open lots and the inefficiency of refuse collection created a situation where public health was endangered. The public, oblivious of the dangers created by their action, continued to dispose refuse in the streets and open lots.

2.2.7. In 1980 the Municipality of Jeddah awarded two contracts in connection with city cleansing. The first was for the removal of the 10,000 abandoned and damaged cars littering the city. The second was to install three controlled combustion mechanical incinerators. The combustion rate of these

incinerators was 4.4 tons of refuse per hour.

- 2.2.8. In the same year, the Municipality of Jeddah engaged a British consultancy company, Powell Duffryn Pollution Control Limited, and integrated its team of 36 employees, including expatriate staff and engineers, within the Municipality's own organization. The consultant's terms of reference, as drawn by the Municipality were to:
- a) Draft two detailed plans for waste collection, transport and disposal for one and five years.
 - b) Supervise municipality workshop and draft a programme for maintenance and spare parts.
 - c) Train municipality employees on modern methods used in the cleaning operations.
 - d) Evaluate the current municipal fleet condition and specify the technical specifications and quantities needed to implement the cleaning operations.
 - e) Prepare the drawings and specifications needed to build transfer stations and two landfills.
 - f) Draft a public awareness programme.
 - g) Prepare an urgent programme for the cleaning of the city beginning with the date of signing the contract.
 - h) Submit cleaning condition reports to municipality officials.
- 2.2.9. In order to identify the key problems, the Consultant carried out a detailed survey covering the administrative, operational and maintenance aspects of the refuse collection and street sweeping systems. (4) The summary of these key problems

identified by the Consultant were:

- (i) Lack of a reliable day-to-day refuse collection service to the public.
- (ii) A deteriorating collection system leading to accumulation on open dumps of the back log of refuse in all areas thus neutralising the best efforts at city beautification.
- (iii) Poor operational supervision of refuse collection, refuse disposal and street sweeping and the use in the field of methods often inappropriate to the areas served.
- (iv) Poor vehicle availability due to lack of:-
 - (a) Necessary skills in the fields of maintenance and supervision.
 - (b) Maintenance facilities.
 - (c) Essential spares and a central store.
 - (d) Controls and records.
 - (e) Preventative maintenance systems.
 - (f) Standardisation of vehicle types.
- (v) Inability to carry out major vehicle repairs internally leading to the use of costly Agency services and extended time off the road.
- (vi) The accumulation of construction debris resulting from the continuing rapid expansion of Jeddah.
- (vii) Lack of proper disposal methods giving rise to:
 - (a) The insanitary tips with the resultant public health dangers of smoke, flies, rats and scavenging.
 - (b) Unauthorised dumping of refuse in all parts of the City.
- (viii) Levels of skill and specialised knowledge that could be bettered by organized training schemes.
- (ix) Budgetary control, financial management, administration and purchasing systems that

could be further improved.

- (x) The need for the development of continuous communication with the public to secure their cooperation in the work and aims of the cleansing services.
- (xi) Cleansing legislation that might be strengthened as a deterrent to anti-social behaviour with enforcement and control over transgressors simplified.

2.2.10. The Consultants outlined their recommendations for the short term and long term plans in many areas of activity, but especially in:

- (a) Refuse Collection and Street Sweeping
- (b) Refuse Disposal and
- (c) Maintenance

The short Term Plans were to cover the nine month period following the publication of their report and the long Term Plan was meant as an alternative to a cleansing contract.

2.2.11. Regarding Refuse Collection and Street Sweeping, the Consultant's Short Term Plan recommendations stressed the need for improving the refuse collection capacity on the ground, increased vehicle availability by improving maintenance procedures, and the reallocation of human resources.

2.2.12 Regarding Refuse Disposal, the Consultants proposed to stop the insanitary tipping practice and move towards proper sanitary landfill methods.

Existing tipping areas were to be sealed off as soon as new areas were prepared for the purpose. Adequate plant and equipment should be obtained and efforts made to improve accessibility to sites with reinforced control measures to prevent unauthorised tipping.

2.2.13. The Consultant's report also proposed the action to be taken on vehicle maintenance. The principal activities were related to spare parts control and purchase, centralised repair of major works, records, preventive maintenance techniques, training, centralised sub-municipality garbages points.

2.2.14. The Consultant's long term proposal regarding collection, disposal and maintenance envisaged a five year programme, requiring a municipal policy of investment from its own resources. The programme, which the Consultants termed "an alternative to a cleansing contract", called for the modernization of the refuse collection system which would result in the improvement of services in both the low and high-density areas of the City. The programme also called for supplementing the then existing fleet of mechanical sweepers, re-equipping sweeping teams with purpose-designed tools and trolleys, and reorganising various systems for maximum efficiency.

2.2.15. Long term proposals for disposal were outlined as follows:

- 1) Rehabilitation - A controlled programme of progressive rehabilitation of the existing uncontrolled tips and access roads.
- 2) Future Disposal Options - Incinerator performance to be studied and reviewed as a pilot scheme for the future. The feasibility of composting as a possible future disposal option would also be studied.
- 3) Specialised Disposal Sites - Consideration would be given to concentrating the disposal of all industrial waste at the Southern site, and designating the Northern site as the principal domestic refuse disposal area. This move would be supported by the general shift in the centre of gravity of residential development Northwards the growth of industrial development to the South.

2.2.16. Longer term proposals for maintenance directed attention towards providing maintenance schedules and programmes for the present projects under construction or consideration (i.e. Incinerators and Transfer Stations), and the possible re-development and reconstruction of the garages of the sub-municipalities to suit any new plant and vehicle purchase.

2.2.17. The Consultants also highlighted the need for additional capital and further recurrent expenditure, the use of computer technology in future operations, the need for training programmes, the importance of public information programmes, and brief directions towards the

improvements that could be made in administration and organisation. It was also pointed out that the Kingdom had little direct legislation related to cleaning matters. Coordinated effort should therefore be made in order to establish legislation that would control the waste disposal activities of the general public, industrialists and contractors.

2.2.18. However, only limited success was achieved by the Consultants with marginal improvements made in various day-to-day matters affecting the municipal workshops. A combination of organizational, financial and personal matters contributed to the unsatisfactory results of the Consultants appointment. These included:

- (a) The Consultant's played only an advisory role, with little or no executive power. What the Municipality needed was an effective, dynamic organization. Powell Duffryn, were not, and in some respects, were not allowed to become one.
- (b) The appointment was for one year only. Some members of the Consultants team were familiar with the local conditions, but many others had to be specially recruited for the work. Obviously, there were many problems for the newcomers, and the contract period was too

short to allow for the acclimatization of some of the expatriate members of the team.

(c) Financial arrangements continued to hamper any positive attempts to change or expedite action. Of special importance was the provision of spare parts for vehicles and equipment. The delay in securing the required spare parts resulted in constant time wasting and the disruption of services.

(d) Lack of qualified or trained Saudis to carry out an organized operational plan for refuse collection, disposal and vehicle maintenance. As a result, the necessary and important communication between municipal employees and the Consultants team was mostly unproductive.

2.2.19. There were also other problems, related to the general appearance of the city and its sanitary conditions which the Municipality failed to resolve such as:

- (a) Stray dogs and animals in all parts of the city.
- (b) Rats and other rodents concentrated at the newly built Cornich.
- (c) Cleaning of the hundreds of monuments and sculptures which the city proudly exhibited along the Corniche and other significant locations in Jeddah.
- (d) Cleaning of public toilets on a regular basis.

- 2.2.20. Additionally, the Municipality had to divert a great deal of its administration to recruit, maintain and control the thousands of foreign labourers, who formed the cleaning labour force. There was general dissatisfaction with their performance, and the Municipality had practically no way of controlling the movement or productivity of this force. Without effective supervision, and with only limited incentives, the running of this labour force became a nightmare for the Municipality officials. Radical solutions to these and another problems were therefore considered by senior officials at both the Ministry of Municipal and Rural Affairs and the Municipality of Jeddah.
- 2.2.21. One of the main problems facing the financing of successful and efficient municipal refuse collection services is the lack of funds and financial allocations. In developed countries, the taxation system and rates collected by the local councils cover such services. In developing countries, where funds are usually limited, refuse collection is usually performed using primitive and labour intensive methods. Financial resources resulting from municipal taxation do not exist in Saudi Arabia, but the country enjoys high revenues through oil production, and consequently it was

possible to allocate substantial funds for cleaning projects in the Kingdom.

2.2.22. In 1977, ACE was awarded a 5 year contract, for the cleaning of Riyadh, the capital city of Saudi Arabia. ACE, through this contract took over all city cleaning activities, in addition to building a camp to accommodate the foreign labour recruited for this contract. They were also required to construct and operate a sanitary landfill. This contract established a new concept in comprehensive city cleaning, and its success promoted other cities in the kingdom to follow suit.

2.2.23. The Municipality of Jeddah prepared a detailed and comprehensive specification for the cleaning of Jeddah, based on the Riyadh contract. The Jeddah specification was, however, extended to cover aspects such as the cleaning of monuments and municipal buildings; municipal vehicle maintenance and other matters making it the largest contract of its kind in the world. The Municipality also devised a different system of payment, based on the unit rate (5) rather than equal monthly payments as was the case in the Riyadh contract.

2.2.24. The details and the contents of the contract, and the wide range of activities it covers will be explained in Part Three. Meanwhile, the following

outline summarises those activities, which the specification required the successful tender perform:

- * Collect, transport and dispose of all generated and accumulated refuse and waste (domestic, commercial, industrial, as well as building rubble, damaged cars, and other bulky metal household waste).
- * Clean and sweep the streets, dispose of dead animals and vacuum any water from any sources causing flooding or ponding of the streets and open land.
- * Clean and maintain all buildings of the central and sub-municipalities as well as public toilets and monuments.
- * Operate the extermination of insects, rodents, and stray dogs under the internationally acknowledged regulations for public health.
- * Eliminate all existing open-dump areas in the city used as temporary collection points and construct a proper number of fully mechanized transfer stations where operational circumstances can dictate their use.
- * Manage and operate all final waste disposal sites by sanitary methods. This includes mechanical incinerators and two sanitary landfills for the northern and southern section of the city.
- * Construct a housing facility and depot for the project workers and provide them with subsistence and health care of high standard.
- * Establish integrated training programmes for the Municipality personnel in the administrative, technical, planning, and executive areas of the project.
- * Establish and implement educational and awareness programs for citizens and residents.
- * Mobilize the necessary skilled and unskilled manpower, accommodate and provide all support services for them.

- * Purchase and deliver to Jeddah all domestic and commercial refuse collection equipment, transportation and compaction equipment, sweepers, rear-end-loaders, landfill equipment, and all other equipment and vehicles listed in the specification.

2.2.25. Several international companies competed for this unique contract. ACE were the eventual successful bidders, and a five year contract was signed in August 1981, with 6 months allowed as mobilization period.

2.2.26. Waste Management International, the leading company in the ACE consortium (6) used all its available resources in order to complete the mobilization within the prescribed period. At the request of the Municipality, work on some badly affected areas began earlier than scheduled. ACE completed the construction of the administrative, residential and the maintenance areas within one year. The mobilization programme was successfully completed, and the largest contract of its kind, both cost and sizewise, officially started on February 1982. In less than two years from that date, Jeddah was acclaimed as one of the cleanest cities in the Middle East region.

REFERENCES - PART TWO

1. This list, which was compiled by the writer, may not cover all directions issued through this period, but it highlights the nature, and means of control used during this period in most Saudi cities.
2. Decentralization was strongly recommended by a report presented to the Ministry of Municipal and Rural Affairs by Mckinsey International, Inc. - (Mastering Urban Growth: A Blueprint for Management - February 1978).
3. MEPA produced a draft report outlining siting criteria for solid waste facilities (See Appendix B).
4. The One Year Plan - Short Term Proposals for Refuse Management - Volume 1. The Key Issues. Produced by Powell Duffryn Pollution Control Limited. February 1981.
5. In order to achieve monthly payments based on quantities of streets and open areas cleaned, it was necessary to resort to computer mapping methods. Part 4 describes the system used for this purpose and the spin off of the computer mapping system.
6. Other parties forming the Arabian Cleaning Enterprise Ltd. were: H. H. Abdulrahman Bin Abdullah Bin Abdulrahman - a leading Saudi businessman and Pritchard Services Group PLC - a U.K. based company.

PART THREE

PART THREE: JEDDAH CLEANING CONTRACT (1982-1987)
SCOPE & IMPLEMENTATION

CHAPTER ONE : Introduction

CHAPTER TWO : The Contract

CHAPTER THREE : ACE Organization and Operations

CHAPTER FOUR : Contract's Implementation

3.1 CHAPTER ONE - INTRODUCTION

3.1.1 In 1981 (17.3.1401 H.), an announcement by the Municipality of Jeddah was advertised, inviting companies with established reputations to bid for one of the most comprehensive projects of its type. Specifications for "The Contract for Public Cleansing and Street Maintenance", were issued, and the qualified companies were asked to submit their bids for undertaking a wide scope of services, extending over five years. The scope of services required by the contractor were summarized in the Specification as follows:

1. Distribution of small refuse bins for Pedestrian (plastic baskets positioned on the lighting posts) with a capacity of about 35 ltrs.
2. Distribution of hardened plastic containers and other metal containers of various sizes for the collection of household, commercial, industrial and private refuse together with the provision for the replacement or renovation of these bins and containers.
3. Mechanical collection and emptying of refuse bins and containers by means of the vehicles best suited to them daily over the days of the week and according to the detailed collection frequencies later described.
4. Mechanical and manual street sweeping and flushing according to the quality of streets with the sweeping and flushing frequencies later described.
5. Establishment of mechanical transfer stations (refuse compaction stations) for the momentary disposal of the refuse collected from the city.
6. Erection of two stations for sanitary burial of refuse in the ground north and south of the city.

7. Erection of a central workshop or the use of the present central workshop after furnishing it with the instruments and equipment necessary for maintenance and repair of all equipment and vehicles used for the implementation of the required works.
8. Making ready and the provision of all competent employees including technicians and non-technicians necessary for the operation and maintenance of the cleansing means in Jeddah.
9. Provision of all equipment, vehicles, machinery, buildings, roads, sites, means of maintenance and what is necessary for the collection, transportation and disposal of all refuse resulting from the city including damaged cars and building rubble. This is in addition to:
 - a) Control works of insects, mice and lost dogs under the regulation of public health.
 - b) Cleansing works of the Municipality buildings under the enclosed detailed specifications for them.
 - c) Cleansing and maintenance works of public bathrooms in the city under the enclosed detailed specifications for them.
10. Provision of all offices and centres in the districts, warehouse, garages and warehouse of consumable materials including telephone, radio communication, water and electricity services, fuels, spare part and all that is necessary for work implementation.
11. Provision of housing means for all workers, employees and providing means of living and medical treatment.
12. Provision of training facilities for all employees.
13. Development and implementation of public awareness programs for the populace of Jeddah through literature, public information media and by working with the Ministry of Education.

3.1.2 Seven companies submitted their offers, which were

opened on 31.03.1981. The prices ranged from SR. 1,294,644,000 (ACE price) to SR. 1998,388,600. All offers were analysed, checked against the specification, and a detailed comparative analysis between the seven companies was prepared. As a result of this study, ACE was awarded the contract, which was signed on 26.8.1981, with the actual work starting after a mobilization period of 6 months. At a later stage, however, the Municipality and ACE agreed that work on Municipal Vehicle Maintenance and Monument Cleaning should start ahead of the official date.

- 3.1.3 On 26.2.1982, ACE had finalized (1) and proceeded with the mammoth task of clearing the huge quantities of refuse, rubble and abandoned cars that had been piling up in Jeddah's streets and open spaces. The first year of operation was a difficult one, as extra efforts had to be extended on all fronts in order to satisfy the numerous contract requirements. After one year, ACE completed the construction of a camp to house its personnel, maintenance, administrative and warehouse facilities. ACE began running its operation from the new camp at the beginning of its second contract year and by the end of that year the cleanliness of Jeddah had become one of the main attractions of the city. The ACE operation was considered an important element in the

overall environmental image of Jeddah.

"But beautified Jidda might have been a whitened sepulcher, decaying with the neglect of public places that is endemic in the Middle East; where cleanliness is expected only at home. Instead Jidda bustles about keeping tidy almost like a right-thinking American suburb. Indeed, the cleanliness is mainly the work of Waste Management, a Chicago firm. Their crews emblazoned in Day-glo turquoise with hundreds of trucks and thousands of litter bins in the same color had their work cut out for them when they moved into Jidda two years ago. A pestilential odor hung over the city, and Jidda's municipal cleaners were hopelessly over-matched and undermanaged.

So Mayor Farsi privatized the city's sanitation with a five-year contract worth nearly a half billion dollars. 'Nothing as comprehensive as this exists elsewhere, to our knowledge,' says Bill Reichert, a crisply dressed manager. The crews and equipment, constantly scurrying through town, reveal their full dimensions when they marshal for lunch at the base camp in the hills east of the city. In this lunar landscape, the impeccably painted trucks resemble a colorful circus parade, culminating in the elephantine garbage trucks." (2)

3.2 CHAPTER TWO : THE CONTRACT

3.2.1 The contract for the Public Cleansing and Street Maintenance of the City of Jeddah provides for a broad range of services as outlined in 3.1.1. The Jeddah contract differs from other city cleansing contracts in two main aspects:

- a. Scope of work
- b. Method of payment

This section will consider the special features of the contract, which made it unique of its kind.

First - Scope of Work

3.2.2 The specification produced by the Municipality of Jeddah outlined in considerable detail the contractor's duties and obligations under the contract. The main duties can be summarized as follows:

- (i) Collection of residential, commercial and industrial refuse as well as removal of all building rubble.
- (ii) Cleaning and sweeping of all streets and paths.
- (iii) Design, development and operation of two landfills to receive and hygienically dispose of all Jeddah refuse.
- (iv) Cleaning of all markets and souks.

- (v) Cleaning and maintenance of defined Municipal buildings and public toilets.
- (vi) Maintenance of all municipal vehicles and the operation of Jeddah's central Municipal Workshop and all other Municipal subworkshops and to maintain all such vehicles.
- (vii) Cleaning of all "beautification forms" (i.e. monuments).
- (viii) Municipality-wide control of stray dogs, rodents and insects.
- (ix) Operation of transfer stations and incinerators.
- (x) Maintenance and repair of all streets.
- (xi) Construction, maintenance and operation of housing facilities for over 3,000 personnel; maintenance facilities for all cleansing vehicles; administrative and warehouse facilities for the project and all support facilities and utilities.
- (xii) Provision of equipment and vehicles to execute the foregoing works.

3.2.3 The specification also determined the frequency of of service to be provided by the contractor while performing the responsibilities related to each of

the prescribed service items. While the Municipality of Jeddah followed the standard format of the contract provided by the Ministry of Municipal and Rural Affairs, it made some changes and added additional items to the standard Ministry contract. These items were:

- a) Cleaning and maintenance of Municipal buildings and public toilets.
- b) Maintenance of Municipal vehicles.
- c) Cleaning of monuments.
- d) Streets and roads maintenance.

3.2.4 The Municipality of Jeddah decided that it would be more practical and possibly more economical if items a), b) and c) above were performed by the contractor responsible for the city cleaning, especially as they can be classified as "cleaning works". At the same time, the Municipality of Jeddah decided that it would be more logical to put street maintenance and street cleaning under the same organization for two reasons:

- a) Budgetary and financial: Under a single, "five year contract", the amount of money required for street maintenance for the five years was to be allocated in advance permitting reduced bureaucratic procedures for budget allocation, and

improved methods of spending the allocated budget.

- b) Streets would be more efficiently cleaned and swept (mechanically or manually), if these streets were asphalted, and their surfaces evenly maintained. The cleaning contractor would be able to identify any defect in the streets and repair damage promptly which would improve his cleaning operation.

Second - Method of Payment

- 3.2.5 As described in 3.2.2 above, the Specifications produced by the Municipality of Jeddah covered a wide range of duties and responsibilities in a variety of different services. It was necessary, therefore to devise a method of payment for each of the required services priced in accordance with the nature of the service to be provided. The methods applied were:

I. Fixed Prices

- 3.2.6 Certain services, such as pest control, landfill and transfer stations; the construction and operation of certain facilities, and the provision of vehicles and equipment were to be paid for on a fixed price basis for the duration of the Contract.

II. Unit Prices

- 3.2.7 Other services, including street cleaning, refuse collection, municipal building cleaning and

maintenance, monument cleaning and street maintenance were to be paid for under the Contract in accordance with the actual quantities serviced on a unit price basis, according to a different bill of quantities. Those services and their related bills of quantities are described below:

A. Refuse Collection: Ten categories of land were identified, according to building types and population density - (Table 3.1.). Each category had its own unit rate measured in Hectares, and the total area of each category was given in Bill of Quantities (A), representing areas to be serviced for one year. The contractor was asked to produce five copies of each schedule and fill in its items for the five year contract period.

Table 3.1 BILL OF QUANTITIES (A)

Items of various areas where refuse resulting therefrom must be collected:

Item No.	Kind of area	Area Htr.	Price in SR Unit Total	Kind of Service
1.	Mid town area - the Historical area	100		
2.	Area of more than 3 story buildings - organized	1476		
3.	3 story buildings organized area 60%	2269		
4.	Unorganized area - 3 stories	1190		
5.	Unorganized crowded area	354		
6.	Organized area - villas palaces & 2 story bldgs.	4685		
7.	Semi open organized and unorganized area	2190		
8.	Unorganized area where there are many shacks	580		
9.	Open area, a part organized and another part un-organized	18670		
10.	Open areas	32000		

As markets received a special type of service for which a separate Bill of Quantities (D) was required (Table 3.2), where areas of different types of markets were measured in square meters (m2).

Table 3.2. BILL OF QUANTITIES (D)

No.	Type of Market	Area in square m2 meter	Price		Type of required cleaning
			Unit	Total	
1.	Commercial markets (souqs) terrace or marble tiled. The area starts from the outside limit of shops or stores. Public and private cars may go through if traffic allows.	40,000 M2			
2.	Black topped commercial (souqs) with sidewalks, public vehicles can go through. Some areas of the streets may not be asphalted (2% of the total area). the actual area starts outside the commer- cial stores, light workshops or shops.	250,000 M2			
3.	Unasphalted commercial areas. The streets might be asphalted to about 20% out of the total area.	160,000 M2			

- B. Street Cleaning: The Municipality identified fourteen road categories in width, surface type and function, each of which had its own unit rate of payment. The unit of this category is measured in kilometers and quantified by the Municipality of Jeddah in two bills of quantities B and C. Bill of Quantities B identified secondary streets and paths belonging to the various areas mentioned in the Bill of Quantities (A) - Table 3.3. Bill of Quantities (C) represents main roads outside and inside the city.

Table 3.3 BILL OF QUANTITIES (B)

Kind of Street	Area Item No.	Length of street Km.	Price in SR. Per unit Total	Kind of service
Paths and streets on the spot	1	30		
8-20 asphalted street	2	50		
8-20 unasphalted street		12		
8 meter and less-paths - asphalted		5		
8 meter and less paths- unasphalted		3		
8-20 street - asphalted	3	26.5		
8-20 street - unasphalted		11.4		
8-20 asphalted street	4	10		
8-20 unasphalted street		7		
Less than 8 meter paths asphalted		26		
Less than 8 meter paths unasphalted		19		
8-20 asphalted street	5	10		
8-20 unasphalted street		5		
Asphalted paths		100		
Unasphalted paths		50		
8-20 asphalted street	6	12		
2-20 unasphalted street		48		
8-20 asphalted street	7	2		
8-20 unasphalted street		2		
Asphalted paths		2		

Kind of Street	Area Item No.	Length of street Km.	Price in SR. Per Unit Total	Kind of Service
Unasphalted paths		2		
8-20 asphalted street	8	2.5		
11-11 unasphalted street		5.5		
Less than 8 metre paths asphalted		40		
Less than 8 metre paths unasphalted		105		
----	9			
----	10			

Table 3.4 BILL OF QUANTITIES (C)

No.	Name of Streets	Length in kilo- meter to the nearest 50 mtrs.	Price in SR per Km to the nearest 50 mtrs.	Total Clean- price in S.R.	Clean- liness standard required
1.	Coastal line from New Jeddah to its meeting Medina Road. South of Obhur Bay	52			
2.	Expressway from its meeting with Mecca Road until its inter- section north of Karra', with Medina Road.	44.5			
3.	Seventy street (Asbaa' Street)	12			
4.	Bani Malek street crossing with Mecca- Jeddah express line and its intersection with H.H. Prince Fahad Bin Abdul Aziz Street.	5			
5.	H.H. Prince Fahad Bin Abdul Aziz street	17.5			
6.	Other streets	90			
Total on the basis of which the price should be given. The Munici- pality will take the unit price (if the Kilometers are actually more or less implied).					

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NB: This Bill covers only roads more 40 meters wide. Another Bill of Quantities (C) covers, 30-40 meters roads, 20-30 meters roads with commercial services, 20 meters or less roads with important traffic and roads where

Municipal services did not exist at the time that tenders were issued.

- C. Special Works: Other items of specialized nature were grouped in Bill of Quantity (E) Fig. 2.5, which covered monuments, hospitals and municipality markets.

Table 3.5 BILL OF QUANTITIES (E)

Special Works

No.	Type	Each	<u>Price in Saudi Riyals</u>		Scope of Work
			Unit price	Total Price	
1.	Beautification forms (structure entries)	180			Cleaning, maintaining and polishing these forms using different cleansing materials monthly.
2.	Private and government hospital	25			The item includes all hospital, private and public. The required work is to transport the waste daily from the collection point inside the hospitals. It should be taken into consideration that this number of hospital will be increased.
3.	Municipality markets, slaughterhouse, fish market, vegetable market, sheep market, etc.	10			Cost estimation according to the available number.

III. Reimbursed Cost

3.2.8 Spare parts used by the Contractor to repair

Municipal vehicles are reimbursed by the Municipality at cost for the parts actually used. This reimbursement applies only to Municipal vehicles. No reimbursement is made for the spare parts used by the Contractor to repair the vehicles utilized by him to perform the cleansing services, except for the initial supply of parts and tires.

IV. Direct Municipal Payment

3.2.9 The Contractor's technicians authorized by the Municipality are employed only in the Municipality workshops to maintain the Municipal vehicles and are paid directly by the Municipality at the monthly rates set out in Schedule (5) of the Contract. The categories and rates are shown in table 3.6.

Table 3.6 : Minimum Technical Labour Required for Central Workshop (It does not include ordinary labour)

Category	** No.	* Wages in S.R.	
		Monthly	Total
Equipment Operations Mechanics	5	3,410	17,050
Engine Mechanics	7	3,925	27,475
Tyre Technicians	6	2,270	13,620
Heavy Equipment Mechanics	8	3,925	31,400
Body Repair Technicians	4	3,410	13,640
Auto Electrician	4	3,926	15,700

Vehicle General Repair Mechanics	11	3,410	37,510
Vehicle Lubrication Mechanics	2	2,270	4,540
<hr/>			
Total	47		60,935
<hr/>			

Note:

The Municipality pay these wages under the quantities mentioned above and the numbers quoted on the basis of the monthly wages so that the Municipality can repair the vehicles and equipment which belong to it during the five year period of the cleansing contract.

* Include overtime, social insurance, employer contributions, housing and food.

** determined as eight hour workday equivalents.

V. Progress Payments

3.2.10 This method of payment was used in billing items related to construction, i.e., street maintenance and facilities construction:-

a. Street Maintenance: this item included the maintenance of the asphalt surface, shoulders, pavement, curbstones, pavement tiles, floor basins and painting of road center and sides and pedestrian crossing with reflective paint. An approximate Bill of Quantities (Table 3.7), describing and quantifying these items was included in the contract, and pavements were made according to work progress.

Table 3.7. ROAD MAINTENANCE APPROXIMATE BILL OF QUANTITIES

No.	Description of Works	Unit	Qty.	Unit Price	Total Price	Remarks
1.	Earth works - levelling					
	15-20 cm. phased-in base	M2	1,750,000			
2.	Asphalt					
2.1	10 cm. thick patches	M2	2,000,000			
2.2	5 cm. thick patches	M2	2,500,000			
2.3	Putting 5 cm. asphalt layer	M2	2,000,000			
3.	Sidewalks					
3.1	Supply & Install					
	40 x 40 x 4 tiles	M2	500,000			
3.2	15x30x60 curbstones	M long	500,000			
3.3	Construction of complete sidewalks (tile and curb stones)	M2	250,000			
3.4	Removal of some sidewalks and making openings in reservations. Price includes reasphalting, curb repair and tile installation	M2	25,000			
4.	Flower basins					
4.1	Concrete curb stones	M long	350,000			
4.2	Riyadh stone covering	M2	50,000			
4.3	Marble covering	M2	25,000			
5.	Painting with reflective paint					
5.1	Road Centre & Sides	M long	370,000			
5.2	Pedestrian crossing areas	M2	75,000			
5.3	Guards rails	M long	25,000			

b. Housing Facility (CAMP):

The Contract included the construction of housing for workers and Senior staff's families, the administration building, mosque, kitchens, clinic, laundry, warehouses and all relevant facilities necessary to run and maintain the camp. General building specifications were outlined

and bill of Quantities for the buildings to be constructed was included in the specification (Table 3.8). The contractor was asked to prepare a schematic design based on this Bill of Quantities, following which final working drawings was approved by the Municipality. The construction period was limited to one year, and the contractor was paid according to the work completed.

Table 3.8 BILL OF QUANTITIES & PRICES OF BUILDING CONSTRUCTION

No.	Kind of Building	Unit	Quantity	<u>Price in SR</u>		Remarks
				Unit	Total	
<u>First - Accommodation</u>						
1.	Family Housing	M2	1,760			
2.	Management Key Staff Accommodation	M2	1,600			
3.	Supervisors Accommodation	M2	3,800			
4.	Workers Accommodation	M2	5,100			
5.	Bathrooms & Toilets	M2	1,320			
6.	Management Key Staff Mess	M2	1,600			
7.	Workers' Mess	M2	1,800			
8.	Clinic	M2	300			
9.	Laundry	M2	300			
<u>Second - Industrial Bldgs.</u>						
1.	Admin. & Ops. Bldgs.	M2	1,600			
2.	Maintenance Buildings	M2	2,000			
3.	Paint Bldg.	M2	150			
4.	Maintenance offices	M2	400			
5.	Warehouse	M2	2,000			

Third - Civil Works

1. Fuel storage	No.	2
2. Vehicle Wash Bldg.	M2	150
3. Repair Canopy	M2	1,500
4. Generators	No.	2
5. Electrical Distribution (External electric system)	Lumpsum	
6. Water Plant	No.	1
7. Sewage System	Lumpsum	
8. Sewage Plant	Lumpsum	
9. Boundary Wall (Wall)	Lumpsum	
10. Roads/Tarmac	M2	37,500
11. Recreation Building	M2	44
12. Fire water storage tanks/Swimming Pools	M2	250
13. Fire System	Lumpsum	
14. Telephones	Lumpsum	
15. Mosque	M2	200

Total Price of
Building Construction

3.2.11 In addition to Refuse Collection, Bill of Quantity

(A), covered payments for other works such as:

(a) Container washing and maintenance

(b) Removal of abandoned vehicles

(c) Suction of street water

(d) Municipal Buildings cleaning and maintenance

(e) Public toilets cleaning and maintenance

(f) Removal of construction rubble from streets and open lots.

3.2.12 A comprehensive list of equipment was specified and the contractor was required to purchase all new equipment and vehicles. The Municipality reimbursed the contractor for the full amount on delivery. The contractor included the procurement of 591 vehicles and pieces of equipment including 220 refuse and industrial refuse transportation vehicles; 17 appliances for damaged and abandoned vehicle removal; 19 vehicles and equipment for refuse disposal; 34 vehicles for maintenance repair and support; 124 vehicles for transporting workers.

3.2.13 The contract stipulated an annual increase in rates paid for services included in the Bill of Quantities and the contractors were asked to indicate this increase in their bid. This increase was not however, applicable to fixed items such as street maintenance and the Camp's construction.

3.3 CHAPTER THREE: ACE ORGANIZATION AND OPERATIONS

3.3.1 In order to fulfill all the services described in the previous section, it was necessary to create an organization to study, plan, manage and carry out the work. The first task was to produce a management structure which would provide control over all the tasks, together with communications and liaison with the client. From the outset, ACE established a management structure, (Fig. 3.1), headed by a Resident Manager, a Deputy Resident Manager and a team of a Senior Directors, who manage the four main divisions of the project:

- (a) Operations
- (b) Maintenance
- (c) Administration and Support Services
- (d) Finance

3.3.2 The Resident Manager has overall responsibility for project management, the Deputy Resident Manager is responsible for Municipal Liaison, Public Education and Training. The Senior Director of Operations (Fig. 3.2) is responsible for Street Cleaning, Refuse removal and disposal, Pest Control, Monument and Public Toilet cleaning. The Senior Director of Maintenance (Fig. 3.3) is responsible for Vehicle, building and facilities maintenance. The Senior Director of Administration (Fig. 3.4) is responsible

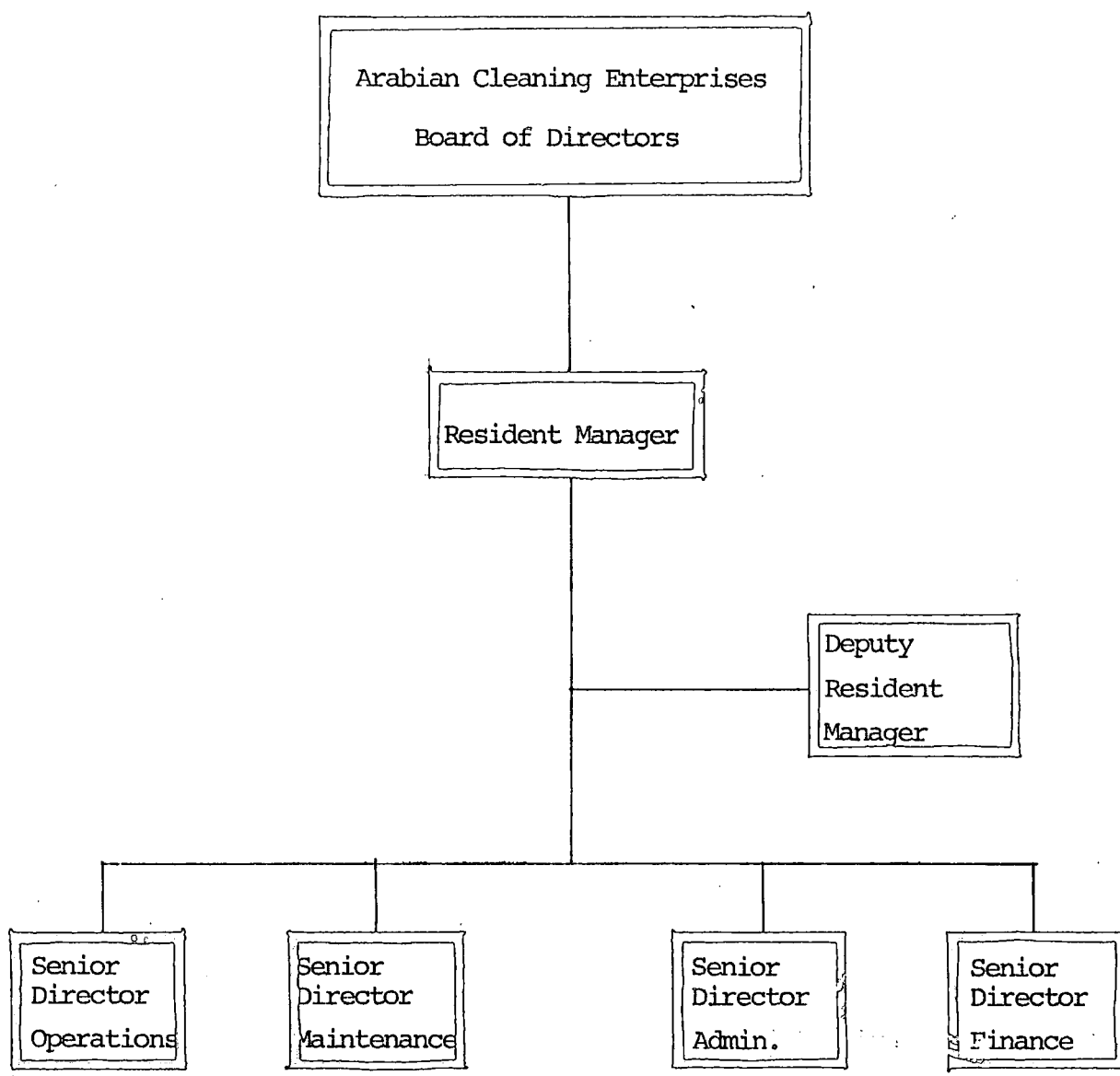


Fig. 3.1. ACE Management Structure

for Site Services, Employee Relations, Catering, Medical Services and Travel. The Senior Director of Finance (Fig. 3.5) is responsible for Finance, Systems, Survey, Warehouse, Purchase and Supply. Each Senior Director is assisted by Directors, Senior Managers, Managers, Senior Supervisors and Supervisors.

3.3.3 The design of ACE's Management organization in Jeddah was based on experience gained from similar contracts in Riyadh and other cities throughout the world. Considerable pre-planning was required to produce the management system followed by ACE. In this chapter, a general description of the main activities performed by ACE, and their organization is given.

3.3.4 An important requirement of the contract was that ACE should prepare an Operating Plan within the mobilization period, so that this plan could be submitted to the Municipality of Jeddah one month before start-up. The detailed survey information was used to establish the routes of the three main operational routes:

- Refuse Collection routes
- Litter-picking/mechanical sweeping routes
- Mechanical suction sweepers routes

Many factors were taken into consideration in preparing these routes. These included traffic

patterns, travelling time from facility site to route location and return, labour productivity, times required to discharge loads, types of streets, their lengths, number of curbs, etc..

3.3.5 A major factor in forming the Operation Plan was the contract requirement for the provision of the wide range of services at a specified frequencies. Appendix D outlines the details of such services and their requested frequency and quantity. The following is a summary of the same:

1. Refuse Collection, Rubble, Auto removal

<u>Activity</u>	<u>Frequency</u>
A. Household refuse-does not include liquids.	Daily
B. Commercial refuse, including stores. Does not include liquid or hazardous refuse	Daily
C. Public building refuse, including schools, public areas, government buildings, This does not include emptying containers inside public buildings.	As necessary to prevent container overflow
D. Industrial refuse, placed in containers by generators. Does not include any liquid or hazardous refuse.	As necessary to prevent container overflow
E. Municipal markets refuse, including vegetable, fish and sheep markets, slaughterhouses.	Daily
F. Bulky items - household furnishings and appliances and other bulky items. Items no to be removed from private property - must be placed in container or along public street or in open lot.	Daily

G. Building rubble and materials including removal of surplus construction materials deposited in containers by contractors. Supply and collect containers at worksites.	Continuous programme
H. Abandoned auto removal and disposal. Must be marked for 7 days.	Continuous programme
I. Collect and dispose of old rubble refuse accumulated within the city. Demolished buildings or private property and their removal is the responsibility of the private property owner.	5 years planned programme
J. Hospital refuse (both public and private). does not include liquid or hazardous refuse.	Daily
 <u>2. Street Sweeping</u>	
A. Secondary streets unasphalted	Twice/week-manual
B. Secondary streets asphalted	Once/week-mechanical
C. Expressway - City outskirts	Once/2 weeks Mechanical
D. Important commercial avenues (e.g., Palestine Road, etc.)	Once/week, or more often for high traffic area/mechanical.
E. Open area streets, plus clean 10 meters from street edge	Once/two months - mechanical.
 <u>3. Flushing and Washing of Marble Streets and Commercial Centres</u>	
A. Tiled and marbled streets and sidewalks.	Once/2 weeks
B. Commercial Centre streets and sidewalks.	Once/week

4. Pest Control

Insect and Rodent control using chemical pesticides and capture and destruction of stray dogs.

Continuous programme

5. Removal of Standing Water

Water accumulation and flood control, including removal of standing water resulting from excess rainfall, floods, cesspool and sewer overflow, water mains and other sources. "Private Property" exclusion also applies to these operations. Contract excludes suctioning of cesspits.

Continuous programme- Operations must commence within 12 hours

6. Removal of Dead Animals from Streets

Continuous programme - Removal must take place within 12 hours.

A. OPERATIONS

3.3.6 On completion of the Operating Plan, the management team were allocated their individual posts and responsibilities so as to cover the work in the whole contract area. For this purpose ACE produced an organization chart to show structure of the Operations Department indicating all management post (Fig. 3.2). This management structure controls all tasks, together with liaison and communication with the Municipality and Sub-municipalities of Jeddah. Responsibilities were determined as follows:

A) Senior Director of Operations: Responsible to the Resident Manager of ACE for the overall control of

OPERATIONS - ORGANISATION CHART 1986

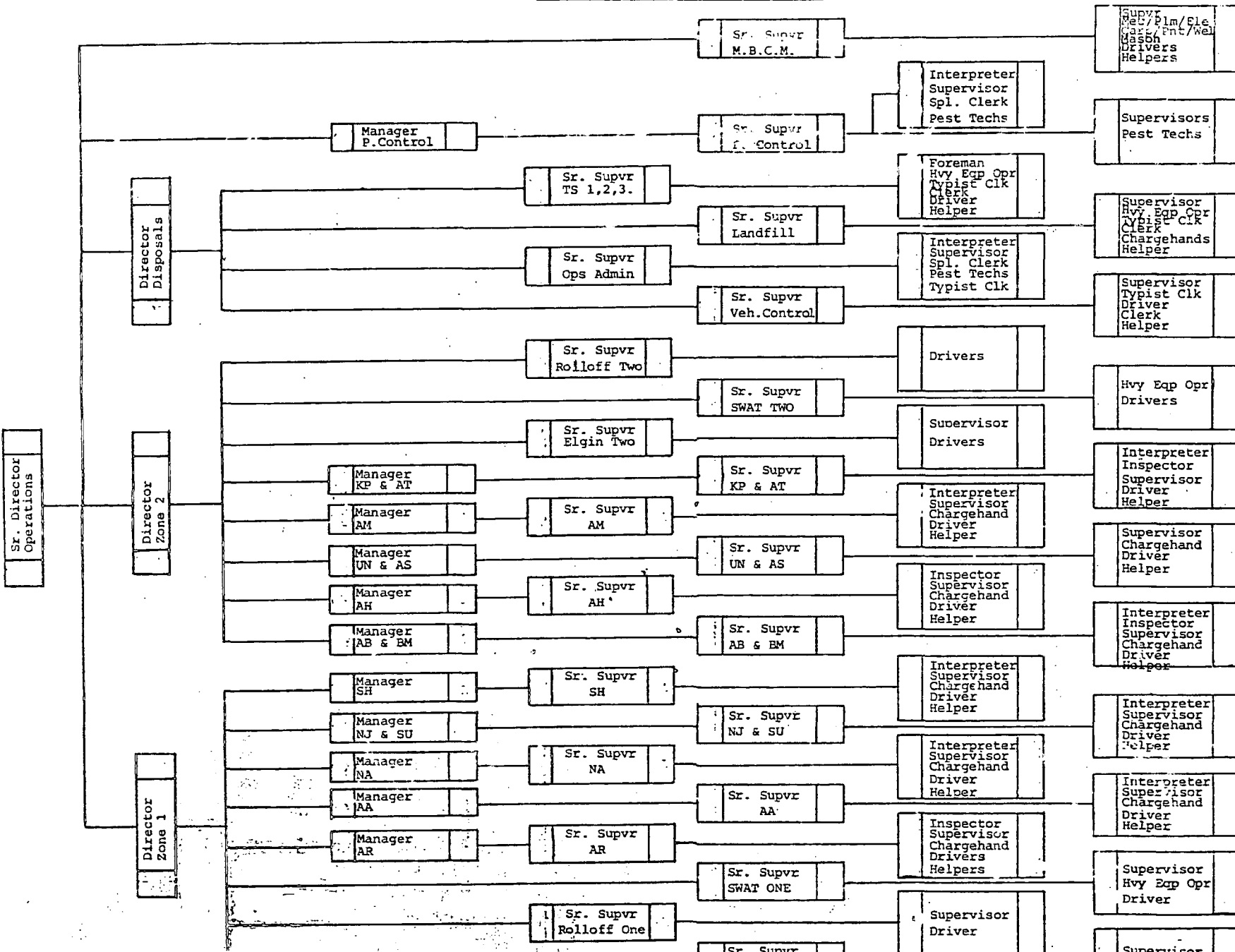


Fig. 3.2. Operation Department

the Operations Division and liaison with the Central Technical Committee of the Municipality of Jeddah.

- B) Director of Operations: Each is responsible for the implementation of the Operating Plan, as described in 3.3.4 above, for half of the city, which is divided into North and South Zones (see fig. 3.2). They report directly to the Senior Director of Operations.
- C) Senior Managers and Managers, Operations : Each is responsible for managing the daily cleaning tasks with their operating area and for regular liaison with their designated sub-municipalities. They report to their Director of Operations
- D) Senior Supervisors Operations : Reporting directly to a Manager Operations, and assisting in coordinating all activities of the cleansing work within his area.
- E) Operations Supervisor: Each sub-municipality is divided into a number of Supervisors' routes, the number of routes being dependent on the size and nature of the sub-Municipality. Within these routes each Supervisor Operations, is responsible to a Manager for implementing all the daily tasks.

3.3.7 The main objective of the Operations Divisions of ACE

is to implement all contractual requirements efficiently, and to make sure that different services are performed under all conditions and without interruption. In order to achieve this objective, a plan had to be devised for each type of service performed. A description follows of the method of operation applied by ACE in performing these services:

Refuse Collection

- 3.3.8 ACE's contractual obligation is to collect all forms of refuse on seven days per week, including public holidays. There are three main type of refuse:-
- a). Domestic refuse from living units such as flats, traditional houses, villas and palaces.
 - b). Trade refuse from shops, restaurants and offices (in this is also included schools, clinics and hospitals).
 - c). Industrial refuse coming from manufacturing sources. Appendix F defines the types of refuse included in the contract.
- 3.3.9 The method used in Jeddah is the house-to-house type of collection in which the collection vehicles proceed through the streets collecting the refuse from containers outside each of the premises. If it is impossible for a collection vehicle to drive safely through any street due to the narrow width of

the street, road works/trenching, or parked cars, then the vehicle parks at the nearest convenient place and the refuse is carried out to it by ACE employees.

3.3.10 This service is operated using 20 cubic yard rear-end loaders in all streets which are wide enough to accommodate their operation. These vehicles with a crew of a driver and two labourers can, in addition to small containers, empty 2 cubic yard and 6 cubic yard containers by means of an inch. These 6 cubic yard containers are positioned at large shops, schools, supermarkets, clinics, hospitals and palaces. When the 20 cubic yard container is full vehicles deliver the load to the landfill. On average ACE collects and delivers 11,000 loads of refuse to the landfill each month.

3.3.11 The 6 cubic yard mini rear-end loaders with a crew of a driver and two labourers, are operated in narrow and and congested streets after which they deliver their loads to transfer stations. As these transfer stations are located at points as near as possible to their routes the time taken to go unload and return is much less than travelling to landfill. This improves the daily production time.

Litter-Picking/Manual Sweeping:

3.3.12 Litter-picking, by route, is carried out on all

streets, paved and unpaved, on six days per week (no service on Fridays). However on certain main and commercial streets, having considerable shopping activity and a high level of pedestrian traffic, and in other areas, such as the Corniche, which are popular gathering places on the week end, the service is performed on seven days per week. A total of 3,064 kilometers (more than 3 times the road distance from Jeddah to Riyadh) are litter-picked daily. Litter-pickers are assigned to, and cover, their specified route each day and this assists direct supervision. The manual sweeping of all paved sidewalks, median strips and any paved roads which are too narrow to be swept mechanically, is carried out in accordance with the Bill of Quantities of the contract, but at a minimum of twice per week. All busy commercial areas are swept daily seven days per week. The Litter-picking routes are contained within the boundaries of each refuse collection route for each of the supervised areas.

Mechanical Street Sweeping:

- 3.3.13 The most effective means of removing sand and dust from the surface of paved roads is by the use of mechanical sweepers. In Jeddah two types of equipment are used for this purpose to sweep a daily average of 6.115 curb kilometers:

1. Large Mechanical Suction Sweepers: these vehicles operate on all paved curbed and non-curbed streets in residential and commercial areas. They remove sand and dust by means of a suction system and have multi-directional channel brushes and a wide-sweep central brush. The vehicles are fitted with dual controls which enable the driver to sweep on the right or left side, as required on service roads, one-way streets and for median street curbs. One driver operates the vehicle and can perform all the mechanical sweeping functions from within the cab.
2. Tow-Sweep Units: These units clean non-curbed paved streets in unoccupied areas. As these areas become occupied or the streets curbed, large mechanical suction sweepers commence cleaning the area. The Tow-sweep unit, which is towed by a pick-up truck, has a large, angled, revolving brush which sweeps the sand and dust off the edge of the paved surface. The unit is operated by one driver.

Rubble Removal:

- 3.3.14 This task, which occurs throughout the length of the contract is carried out for six days each week and is programmed to meet the priorities of each sub-municipality. In order to establish the

priorities for rubble removal each manager tours his area with the appropriate sub-municipality cleansing manager. Photographs of each rubble location indicated by the cleansing manager are taken and are placed in folders as the 'before' picture. The sub-municipality decide the order in which each of the rubble locations will be cleared and on completion of each location another 'after' photograph is taken. When all the locations in the file are completed this system is prepared and a new programme of priorities set up. This system varies between different sub-municipalities. However a file system of all such photographs is kept for the whole contract area. The equipment used in rubble clearance consists of large and small wheeled shovels, dump trucks and roll-on-of vehicles with 15 cubic yard containers. An average of 120,000,000 kilograms of rubble is collected in each month.

Removal of Bulky Items:

- 3.3.15 Although the refuse containers provided throughout the city, and the Rear-End Loaders servicing them, can handle most of the refuse generated, there are some items deposited by citizens for collection, on sidewalks or open ground, which are too large and/or non-compactable and need to be collected by a different method. For those items such as

refrigerators, air-conditioning units, stoves, furniture and mattresses collection is made by special vehicles. the vehicles used are flat-bed trucks equipped with an hydraulic crane located behind the vehicle cab enabling such items to be lifted onto the vehicle known as a Boom Truck. Following identification by supervisors, these items are transported directly to the landfill.

Removal of Water Accumulation:

- 3.3.16 All standing water on streets, from overflowing cesspits, burst water pipes, leaking sewers or heavy rainfall is dealt with by Suction Tankers or by mechanical Suction Sweepers. This service is operated for six days each week but also deals with emergencies or urgent situations at all times.

Removal of Dead Animals:

- 3.3.17 Dead animals are removed as soon as found by any refuse collector or litter-picking employees. These animals are delivered to landfill by a collection vehicle.

Cleaning of Souks and Tile Washing:

- 3.3.18 In the souks and historic areas a two-shift system is operated for refuse collection and litter-picking/ manual sweeping. The tiled surfaces are washed

regularly, after the close of business, by mechanical means where possible and by mopping in the less accessible places.

Container Cleaning and Maintenance:

- 3.3.19 Containers require regular cleaning and maintenance in order that they remain hygienic and have a good appearance. To deal with this, a depot has been established at the maintenance area in the main facility site. This depot is capable of handling all the containers brought to it by Boom Trucks and by the 15 cubic yard containers on Roll-on-Off vehicles. All cleaning functions, as well as the required repairs and maintenance can be dealt with at this depot.
- 3.3.20 The Managers play an important role in the implementation of the overall plan of the Operation Department. They must know at all times what is happening in their areas of responsibility. They must also know how the work is progressing, and manage it in a flexible manner so as to be able to handle changing situations or emergencies. It is necessary for managers to up-date all the information for their operating areas whether it be new streets, paving of previously non-paved streets or new buildings being occupied etc., all of which have to be recorded continuously in their individual

operations manuals which form the current operating plan. They are required constantly to check on the loads and weights carried by their refuse collection vehicles each day, the weights of rubble removed, the number of curb kilometers swept daily and number of abandoned vehicles and bulky items removed each day.

3.3.21 Accurate daily records are also kept of the hours worked by every employee. This starts with a daily muster attended by an operations manager and is carried out by supervisors who check off every man to ensure that he is properly dressed and equipped and that he has with him the necessary documentation such as "Iguama" (Residence Permit) and driving licence. The supervisors also check that the drivers carry out a pre-trip inspection of their vehicles. The supervisors ensure that once in the operating area every man is in his allocated place and carries out his duties efficiently and finishes his task in the allotted time. At the end of the working day, when the workforce returns to camp every man is booked off and time records maintained.

3.3.22 Another aspect of operations management is the control of vehicles. For this purpose ACE formed the transport control section being the liaison between operations and maintenance which ensures that

the correct number of every vehicles type is available for work each day. Transport Control operates for 24 hours per day and all maintenance requirements, including preventive maintenance servicing, are fed through Transport Control, the vehicle user advised, and a substitute vehicle supplied. Transport Control maintains individual vehicle files, by fleet number, including registration documents copies and a history of movement and allocation. Keyboards are fitted to hold spare keys for every vehicle.

3.3.23 The Operations Division is the main tool with which ACE fulfills its contractual obligations. There are however other departments which provide the necessary support for operations, and who ensure the continuous supply of labour, vehicles and equipment. Vehicle Maintenance, Administration and Support Services and Finance are these other departments in ACE, the function of each will be explained in this chapter.

B. VEHICLE MAINTENANCE

3.3.24 In recent years the trend in city cleansing projects has been to become equipment intensive rather than labour intensive. This has resulted in the use of sophisticated, highly technical equipment and machinery. The decision to mechanise the cleansing

operation in Jeddah was made following the failure of the labour intensive methods described in Part Two of this work.

3.3.25 The ability to maintain the machinery used in the cleansing operation is therefore a major component of the overall operations, which is essential if the project is to be carried out efficiently and reliably. Therefore, the main objects of the vehicle maintenance department in ACE was to produce and maintain an agreed number of vehicles in a serviceable condition for operational usage.

3.3.26 This objective was achieved by having a maintenance service for 24 hour a day, seven days a week. Three shifts operate within these 24 hours (Fig. 3.3). Each shift is mainly responsible for major repairs while the second and third shifts carry out general repairs such as adjustments to controls repair of oil leaks and replacement of hydraulic cylinders.

3.3.27 The department is divided into 12 sections. These sections are listed below and their role in the department is briefly explained.

- (1) Administration
- (2) Rebuild
- (3) Heavy Vehicle Repair
- (4) Light Vehicle Repair

VEHICLE MAINTENANCE ORGANIZATION CHART

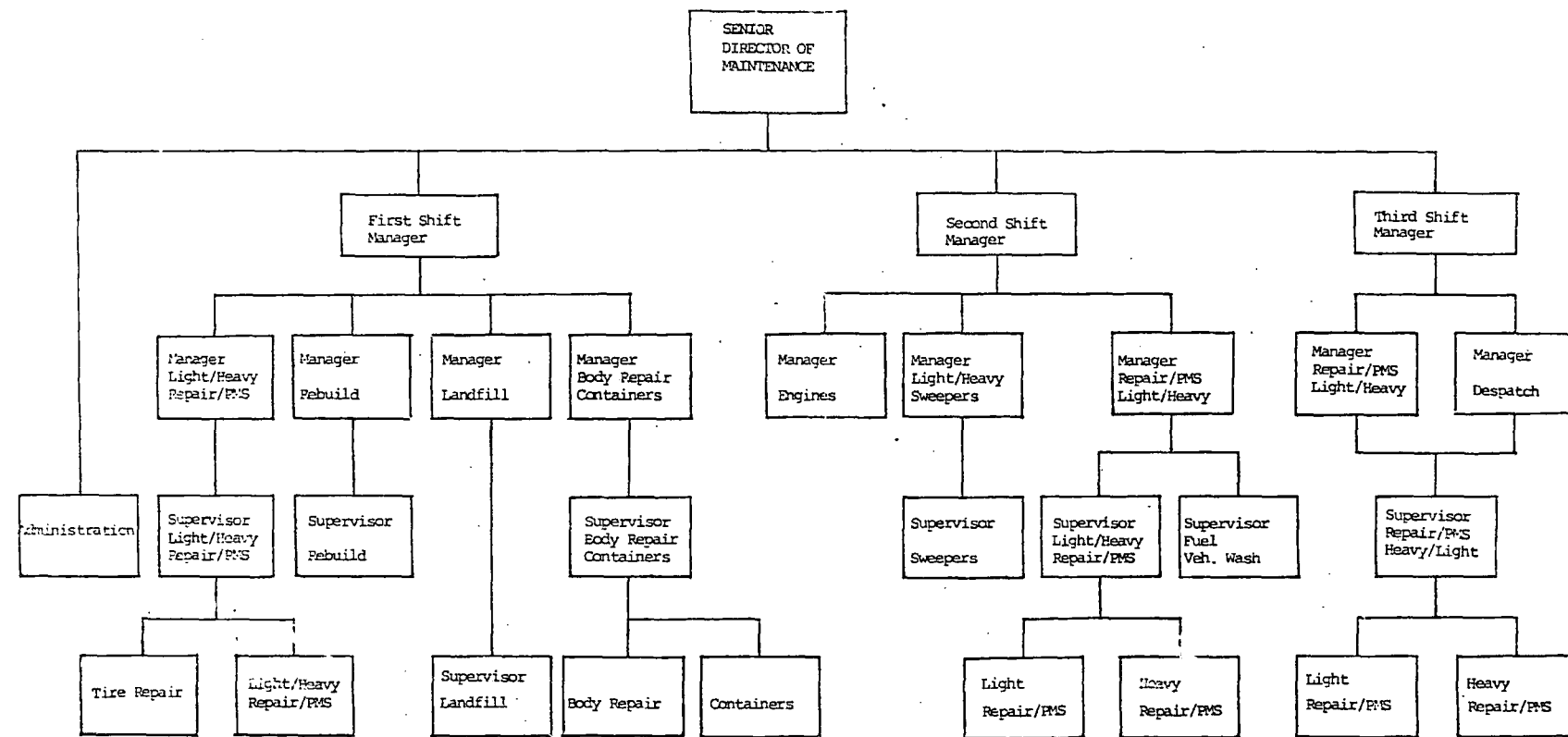


Fig. 3.3. Vehicle Maintenance Department

- (5) Elgin Sweeper
- (6) Preventive Maintenance
- (7) Fabrication and Welding
- (8) Body Repair and Paint
- (9) Mobile Repair
- (10) Tyre Bay
- (11) Wash Dock and Refueling
- (12) Landfill Repair

3.3.28 Administration: The Administrative section is responsible for the control of all paper work generated within the department, the coordination of files and stock control as well as the preparation of monthly operating reports.

3.3.29 Rebuild Section: This section deals entirely with the overhauling of failed major assemblies with the added ability to manufacture parts that are not available or where a cost saving on externally purchased parts may be achieved. The section is sub-divided into specialist areas: Machine shop, fuel injection shop, electrical repair, hydraulic repair, engine rebuild shop and tailors shop.

3.3.30 Heavy Vehicle Repair: This section operates on 3 shifts basis. The first shift is responsible for repairs that are likely to immobilize a vehicle or equipment over a long period. The second and third

shifts carry out the general repairs that have been reported on vehicle condition reports. These repairs vary from minor adjustments to major repairs.

3.3.31 Light Vehicle Repair: This section operates to the same degree and purpose as they heavy vehicle repair except that it handles light vehicles.

3.3.32 Elgin Sweeper Repair: The function of this section is the same as for heavy vehicle repair, except that all sweepers are checked daily to ensure that the specialist equipment on the vehicle is functioning correctly. Daily checks are required as certain items on sweepers have a high usage.

3.3.33 Preventive Maintenance Section: The purpose of this section is to ensure that every vehicle is periodically serviced and checked in accordance with the manufacturer's recommendation. An average of 45 vehicles are serviced within each 24 hour period. The preventive maintenance (PM) service schedule is the most important of all programme carried out in the maintenance department. The PM service not only helps to prolong the life of the vehicle but also assists in reducing breakdowns and possible assembly failures. In a period of 28 days every vehicle and piece of equipment has at least one PM service depending on its frequency cycle. Most heavy vehicles are on a 14 day PM service cycle while

light vehicles are on a 28 day PM service cycle. Defects found during inspections are passed to the relevant repair section for attention.

- 3.3.34 Fabrication & Welding Section: The main purpose of this section is to refurbish reworkable items that would be costly to replace with new parts.
- 3.3.35 Body Repair and Paint Section: This section is responsible for all body repairs and vehicle repaints. Typical work done by this section includes vehicle resprays, body rebuild after accidents and general body repairs that occur due to normal wear and tear.
- 3.3.36 Mobile Repair: The main functions of this section is to carry out quick temporary repairs and change punctured wheels on units that breakdown in the city. A total of seven mobile service trucks are in use on each day and each is fitted with a VHF radio. The units are controlled from a VHF radio station sited in the maintenance department.
- 3.3.37 Tyre Bay: The main responsibility of this section is to ensure that an adequate supply of serviceable tyres is available for daily use. The main tasks carried out are tyre and puncture repairs loading of mobile service trucks and the inspection and disposal of unserviceable tyres.

3.3.38 Washdock and Refueling: This section has two functions: The first being to refuel all the vehicles as they return to the site and to inspect the units and list the drivers defects on the vehicle condition reports. The resulting defects are forwarded to the relevant vehicle repair sections for the type of unit concerned. The second function is to ensure that every vehicle is washed at least once within a 10 day period. Sweepers being specialist equipment are subject to more dirt and dust and therefore necessitate washing every day.

3.3.39 Landfill Repair: Landfill repair deals with the repair and maintenance of the heavy equipment used at the landfill or for other off-road work. Preventive maintenance minor and major repairs are carried out at the landfill. Repairs are scheduled to ensure that the maximum amount of heavy equipment is available for operational use. As in all repair sections items requiring overhaul are sent to the rebuild section.

C. SUPPORT SERVICES

3.3.40 This department of ACE's organization provides the services necessary to support and maintain the day to day requirements of more than 4,000 employees. Support Services cover the following areas of activity:

- I. Personnel and Government Relations
- II. Employee Relations
- III. Administration
- IV. Catering
- V. Clinic
- VI. Site Services

Each area and its function is now explained below and figure (3.4.) demonstrates the organization of this department.

3.3.41 Personnel and Government Relations: Under the control

of a Manager; provides a service to the Company in:

- (a) Aquisition of residence permits and driving licences.
- (b) Liaison with all Government Departments to ensure ACE compliance with Government Rules and Regulations.
- (c) Represents the Company at Government departments and offices such as, the Labour Office, Traffic Department and Ministry of Interior.
- (d) Provision of work permits and block visas.
- (e) Represents the Company at Embassies.
- (f) Ensures that Company vehicles are registered correctly.
- (g) Provides a Travel Department service to employees for leave, exit cases and domestic

ORGANIZATION CHART - ADMINISTRATION

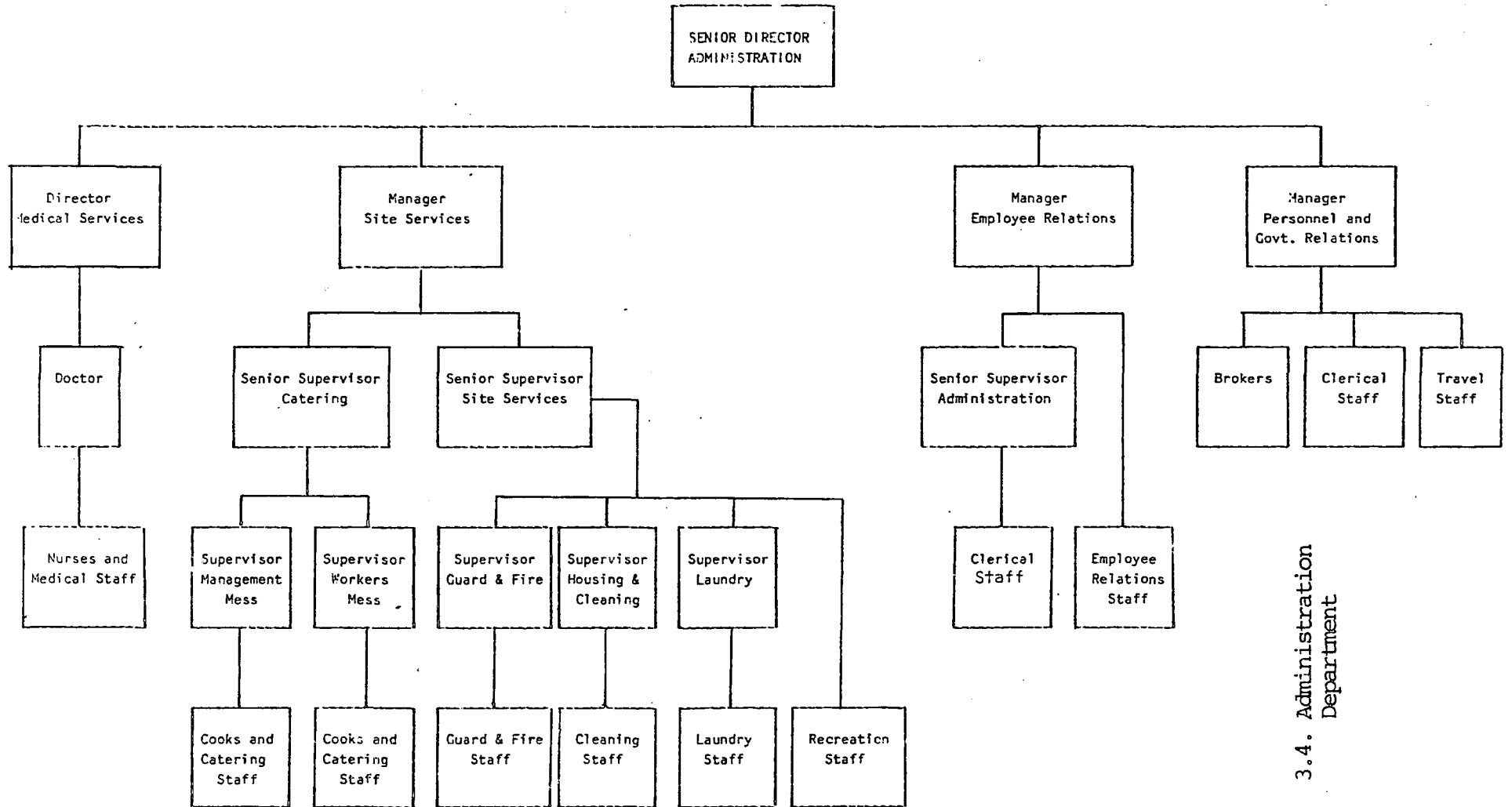


Fig. 3.4. Administration Department

travel.

3.3.42 Employee Relations: Under the control of a Manager, provides an employee relations administration service for all staff covering such item as:

- (a) Leave administration
- (b) Salary administration
- (c) Recruitment
- (d) Personal files and records
- (e) Company discipline and grievance procedures
- (f) Employee welfare
- (g) Monthly and annual statistical data on manpower turnover.

The personnel records are computerized in addition to the individual manual files.

3.3.43 Administration: Under the control of a Senior Supervisor, provides a service to the Company in:

- (a) Clerical staff
- (b) Telex
- (c) Word processing
- (d) Photocopying
- (e) Telephone Exchange
- (f) Operation of IBM Personal Computer
- (g) Post Office - dealing with approx. 1,500 incoming and outgoing letters per day.

3.3.44 Catering: Under the control of a Manager and a Senior Supervisor. Provides all employees with 3 meals per day. Also provides meals for employees at

their places of work in addition to those provided at the facilities site.

3.3.45 Clinic: Under the control of a doctor. Provides a 24 hour per day medical service for the Company's employees, and is also responsible for camp hygiene. The clinic usually averages 500 patients per week visiting the doctor and 800 per week for nursing advice or treatment.

3.3.46 Site Services: This service area is under the control of a Senior Supervisor and has the following four sub departments:

- (a) Laundry. Provides a daily laundry service to the company's employees. Also provides a tailoring service in repairs and alterations to uniforms. Cleans weekly over 25,000 items of clothing, weighing approximately 15,000 kg.
- (b) Security and Fire. Controls the access to the facility site and patrols the site to maintain discipline. Security guards are also trained as fire fighters and act as such in the event of fire on the facilities site. One fire engine is available at all times.
- (c) Cleaning and Housing. Provides a daily cleaning service to all accommodation units with particular daily emphasis on the ablutions.
- (d) Recreation. Provides a recreation service to the

employees in the organization of recreational activities including a daily film show.

D. FINANCIAL DEPARTMENT

3.3.47 The main objective of this department is the organization and communication of economic events and financially related matters within ACE such as, accounting, inventory, purchasing, computers, etc. In order to facilitate this wide range of activities, the department is divided into 3 sub-departments:

1. Finance
2. Warehouse and Supply
3. Systems
1. Finance:

3.3.48 The main function of the Finance Department is to produce a general ledger each month. The general ledger is a record of the company's assets, liabilities, revenue and expenses. The information flowing into the general ledger is obtained from the following sub-systems:

Payroll
Inventory
Accounts Payable
Cash disbursement
Miscellaneous

All of these systems are maintained in a computer

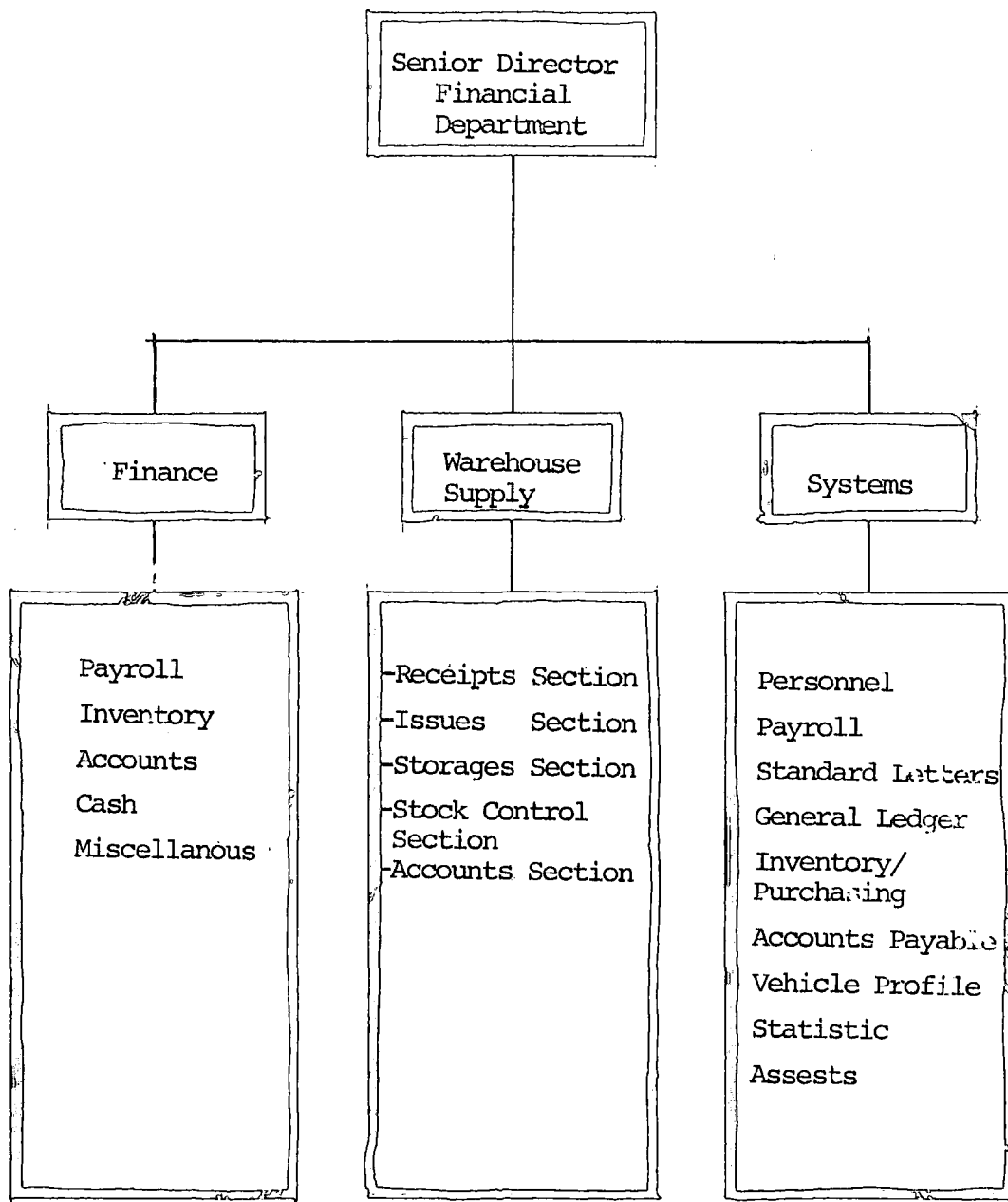


Fig. 3.5. Financial Department

environment.

3.3.49 Payroll - The payroll system is a system by which an employee receives his regular, overtime and vacation pay. The payroll system is split into:-

- 1) Hourly paid employees
- 2) Management employees

The employees on the hourly payroll are paid on the 15th of the following month for regular and overtime hours working during the month which they have worked.

Employees on the management payroll are paid on the last Thursday of the month. The payroll earning of all employees as calculated by the payroll system and interfaced with the general ledger where it is recorded as expense.

3.3.50 Inventory - With a fleet of about 1,000 vehicles and a housing complex of some 4,000 people, a wide variety of items need to be kept in stock to meet routine maintenance requirements and also urgent requisitions in the case of breakdown.

In the ACE warehouse there are approx. 15,000 line items. These items when bought and used need to be accounted for. To keep track of all the items in the warehouse, receipt and issue notes are prepared.

Finance uses these receipts and issues accounts for all the items. The inventory system automatically

replaces into stock from the receipts as costed out by the inventory section. The system also automatically charges departments for items used by them as described on the issue notes. Like the payroll system, the inventory system is also interfaced with the ledger where all receipts are recorded as assets and all issues as expenses.

3.3.51 The inventory system also produces a report known as the "stock status report". This report gives the following information of each line item in stock:

- 1) Stock number
- 2) Description
- 3) Unit measure
- 4) Year-to-date issues
- 5) Quantity in order
- 6) Quantity on hand
- 7) Re-order level
- 8) Location
- 9) Date last received
- 10) Unit cost last received
- 11) Stock value
- 12) Date last issued

This information is important for the control of stock levels.

3.3.52 Accounts Payable - Items when purchased by the company are either paid for in cash or purchased on

credit. The accounts payable system keeps track of purchases made on credit. When items are purchased on credit the invoices for these items are received by ACE at a later date. These invoices are then processed through the system. The accounts payable system keeps track of amounts due to different suppliers and automatically pays them on the specified due dates. This system also automatically records the various transactions into the general ledger.

3.3.53 Cash Disbursement - When items are purchased from suppliers with whom the company has no credit facilities then such items are paid for in cash. Employee petty expenses are also paid for in cash. When cash payments are made the payment vouchers are processed through the system whereby the various departments are charged for various items of expenditure. Like the other systems, this system is also automatically interfaced with the ledger.

3.3.54 Miscellaneous - Apart from all the above systems, there are some items of expenditure not covered by these systems which need to be included in the general ledger. Examples of such items are:-

- 1) Charges from Home/Branch Office
- 2) Amortisation of prepaid expenses
- 3) Accruals

These items are included in the ledger by the use of journal vouchers.

2. Warehouse and Supply

3.3.55 The function of this department is vital for both the day to day operations of ACE, and the forward planning requirements of the Company. It is especially important in a country like Saudi Arabia where, at present, a large percentage of materials have to be imported. The function of this department can be summarized as follows:-

- a) Regular provision of materials necessary to meet operational requirements.
- b) Ensure the availability of items required for the maintenance, spare parts and warehousing, as may be required.

3.3.56 The Warehousing function has to be well planned and executed if it is to serve the other user departments of ACE. The main responsibilities of this function are:

1. Identification of materials. This is the process of systematically defining and describing all items of stock. By means of a stock number and other relevant information, materials can be identified and located within the stock holding system.

2. Receipt. Receipt is the process of accepting, from all sources, all materials and parts which are used throughout ACE.
3. Inspection. Inspection is the examination of all incoming materials for quality. If the necessary inspection cannot be undertaken by Warehouse staff then a qualified person from each of the user departments is nominated to do so.
4. Issues and Dispatch. This is the process of receiving demands, selecting the items required and "handling them over" to the users. It includes, when necessary, the loading of vehicles with goods for delivery.
5. Stock records. These are the documents which record from day to day, details of individual receipts, issues and stock balances.
6. Stock Control. Stock control is the operation of continuously arranging receipts and issues to ensure that stock balances are adequate to support the current rate of consumption. It involves the related process of provisioning, which is the means whereby instructions are given for the placing of the orders.
7. Stocktaking. Stocktaking involves the physical verification of the quantities and condition of



materials.

8. Storage. Storage involves the management of the Warehouse, store and/or stock-yard the operation of handling and storage equipment and last, but by no means least, the safe custody and protection of all stock items.

3.3.57 This department provides services to all other departments in ACE, but especially Vehicle Maintenance, Site Services and Building Maintenance. There are approximately 14,000 line items in constant use, and the current stock value of all items available at the warehouse is approximately SR 7,000,000.00. All items are catalogued on ACE's computer system.

3.3.58 In order to keep all departments of ACE supplied at all times, this department has to provide the Vehicle Maintenance department with spare parts and other items in order to maintain the company's fleet of approx.1,000 vehicles. It also provides the Site Services department with vegetables, cooking equipment and food items to feed a workforce of around 4,000, three times each day, seven days a week and 52 weeks per year.

3. Systems

3.3.59 The Systems Department is responsible for the

operation of the company's computer and for all the data processing activities for which the computer is used. Like the Finance and Warehousing departments, it is a service department. It does not contribute directly to the operational functions of the company - namely cleaning the city, but exists to assist the other departments of the company. All operations require clerical support - monitoring, recording, reporting and analysing the functioning of the Company. The Systems department exists to make these support functions as efficient, as automatic, and as informative as possible.

3.3.60 Information about all aspects of the Company is stored in the computer. It is kept constantly up to date. Most of the new data is supplied written on specially designed input documents. Specialist data entry operators key (type) the data onto diskettes for input into the computer. Specially written computer programmes (around 200 in total) check the data for accuracy, add the data to the accumulating store of information and produce the required analyses and reports from the data. Seven computer terminals distributed throughout the Company allow other departments to examine the data stored in the computer "on-line" to assist them in their daily work.

3.3.61 The Survey department is also a service department.

Its purpose is to produce, and keep up to date, maps of the cleaning contract area of the city. In the first cleaning contract (1982-1987) the primary function of this department was to produce accurate calculations of the lengths of road cleaned and the area of land serviced in order to allow calculation of the payment for these services based on a unit price costing system.

3.3.62 The major areas of information processed on the computer are:

Personnel - all necessary information about all employees of the Company to provide reports to government agencies, to keep visas, driving licenses, passports up to date and to help the general operation of the Manpower department.

Payroll - closely associated with the personnel data, are details of employees salaries, including overtime worked, sick leave, vacations etc. which is used to produce employees monthly pay packets.

Standard letters - the text of all letters generated as a matter of routine by the Manpower Department is stored in English and Arabic. When linked with individual employee details held in the personnel records, letters can be generated automatically by the computer and, in particular, a register of disciplinary penalties is maintained.

General Ledger - the company's financial accounts - maintains a record of all financial transactions according to account codes and compared to budget levels. Analytical reports produced from the data allow proper control of the Company's finances to be maintained. To comply with the local regulations, the ledger is also produced in Arabic. The input for the ledger comes from the data systems on the computer.

Inventory/Purchasing - keeps track of the current levels of stock in the warehouse, all movements of items into and out of the warehouse and the status of goods still on order. All items issued are automatically charged to users accounts on a first-in-first-out basis. Analysis of usage statistics assist in setting re-order levels and in placing of purchase orders.

Purchase Order entry - closely linked with the inventory system allows the Supply department to generate orders for new purchases with the minimum of effort.

Accounts Payable - controls payments against all invoices received and transfers costs automatically to the general ledger system.

Vehicle Profile - details of all vehicles in the fleet, produces routine preventive maintenance schedules. It is linked with the inventory system,

where it records and analyses repair costs for each vehicle.

Operational statistic/landfill - details of all loads ACE and private - dumped at the landfill site and transfer stations, and of hours worked by men and vehicles are analysed to help monitor operational performance against norms and budgets.

Assets register - details of all Company's assets are kept, and depreciation charges are interfaced automatically to the general ledger system.

3.4 CHAPTER FOUR: CONTRACTS IMPLEMENTATION

3.4.1 The Jeddah cleaning contract was unique among other cleaning contracts, not only in terms of the wide scope of work it covered, but also for the supplementary tasks which ACE had to perform. In addition to the essential refuse collection services, the Municipality requested the contractor to undertake a variety of tasks, in the fields of construction, public awareness and training. These tasks were included in the Municipality's specification and described in detail to varying degrees.

3.4.2 This chapter outlines the different activities performed by ACE during the initial contract period (1982-1987) and cover the most significant aspects of what was achieved during this period. By quantifying the major activities performed during the 5 years. It also reveals the remarkable extent of ACE's operation.

A. Refuse Removal

3.4.3 This is the most important part of ACE's cleansing programme. Different types and sizes of containers, large and small rear-end loaders and roll-off vehicles were used to collect 2,958,136 metric tons of residential and commercial refuse over a period of 60 months, representing an average of 49,302 metric tons per month, and 6,493,020 metric tons of industrial refuse in total, representing an

average of of 108,217 metric tons per month. The total weight of all refuse (residential, commercial and industrial) collected by ACE during the five year period was 9,451,200,809 kilograms, at the average of 157,520,010 kilograms per month. Table 3.9 shows the details of refuse collected each month for the whole of the initial contract paid.

3.4.4 Due to financial restrictions imposed by the Municipality, the industrial refuse collection service was significantly reduced first, after 24 month, and again after 40 months of the 60 month contract's duration. The first reductions reduced the average monthly collection from 164,129 to 96,951 metric tons per month. The collection service was thereby reduced by more than 40%. The second reduction further reduced the average monthly collection to 50,135.8 metric tons, representing a further further 48% reduction. These two reductions represent almost 70% reduction in the industrial refuse collection during the contract period.

3.4.5 Concomitant with this reduction in the industrial refuse collection, ACE had to mobilize manpower and vehicles to help the Municipality in moving rubble from one area of the city to another. The amount removed by ACE at the third month of the fifth year more than doubled that of the previous month. This was due to a major municipal reclamation project.

Table 3.9.

ARABIAN CLEANING ENTERPRISE LTD.
REFUSE COLLECTION
YEAR 1 THROUGH 5 - JEDDAH-I CONTRACT

		Month												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
Year 1	Commercial	27,947,000	37,468,350	39,287,740	43,273,410	43,919,090	36,863,490	41,287,660	42,408,650	43,248,260	45,413,490	43,866,310	42,622,260	487,605,710
1402-1403	Industrial	30,676,000	56,504,850	77,450,990	100,678,310	250,716,260	180,600,800	195,168,990	258,584,250	164,059,510	302,699,250	236,418,020	200,500,600	2,054,057,630
	Total	58,623,000	93,973,200	116,738,730	143,951,720	294,635,350	217,464,290	236,456,650	300,992,900	207,307,770	348,112,740	280,284,330	243,122,860	2,541,663,540
Year 2	Commercial	44,595,460	47,955,040	42,872,190	42,293,120	44,856,350	31,289,400	46,276,640	51,369,380	58,805,200	62,174,410	61,511,350	60,144,200	594,142,740
1403-1404	Industrial	191,454,660	168,300,580	156,648,240	191,801,090	164,632,720	165,064,850	177,452,450	152,082,520	138,335,750	118,531,440	140,791,360	119,961,950	1,885,057,610
	Total	236,050,120	216,255,620	199,520,430	234,094,210	209,489,070	196,354,250	223,729,090	203,451,900	197,140,950	180,705,850	202,302,710	180,106,150	2,479,200,350
Year 3	Commercial	64,370,600	65,509,280	67,496,910	56,403,010	52,392,410	46,136,560	47,424,950	48,915,580	48,524,440	47,340,240	48,405,470	46,721,180	639,640,630
1404-1405	Industrial	90,590,040	95,152,690	115,199,100	99,986,770	71,060,310	98,115,560	101,418,590	119,117,490	89,777,270	82,882,270	92,605,480	95,003,240	1,150,908,810
	Total	154,960,640	160,661,970	182,696,010	156,389,780	123,452,720	144,252,120	148,843,540	168,033,070	138,301,710	130,222,510	141,010,950	141,724,420	1,790,549,440
Year 4	Commercial	46,612,530	50,748,720	52,225,030	51,638,060	57,719,740	50,504,150	52,944,370	50,555,330	51,637,890	48,758,290	54,815,930	53,279,200	621,439,240
1405-1406	Industrial	99,938,670	90,204,240	105,401,590	104,780,260	34,082,240	37,094,680	33,592,250	44,685,250	57,060,900	70,733,240	49,656,370	52,932,710	780,162,400
	Total	146,551,200	140,952,960	157,626,620	156,418,320	91,801,980	87,598,830	86,536,620	95,240,580	108,698,790	119,491,530	104,472,300	106,211,910	1,401,601,640
Year 5	Commercial	52,505,750	51,667,950	54,246,180	52,935,280	56,290,940	50,904,000	48,943,750	49,375,770	48,841,920	50,590,320	48,198,150	50,808,080	615,308,090
1406-1407	Industrial	45,006,800	45,881,150	59,748,040	58,711,270	36,961,000	41,194,410	61,804,630	46,383,040	43,281,730	51,722,810	51,145,600	41,036,350	622,877,930
	Total	97,512,550	97,549,100	113,994,220	111,646,550	93,251,940	92,098,410	110,748,380	95,758,810	92,123,650	102,313,130	99,343,750	91,845,430	1,238,186,020
Grand Total		693,697,510	709,392,850	810,576,010	802,500,580	812,631,060	737,767,900	806,314,280	863,477,260	743,572,870	880,845,760	827,414,040	763,010,770	9,451,200,890

3.4.6 A special rubble removal programme was set up to organize the collection of refuse of this type resulting from demolished building and construction sites. Priority tasks were established at weekly meetings between ACE and each sub-mayor in order to assign manpower and equipment to a specified area.

B. Bulky Item Removal

3.4.7 During the contract period, ACE moved more than 11 million bulky items from residences and commercial establishments. This including everything from refrigerators and washing machines to large boxes filled with old clothes and sewing machines. A special service request number was advertised so that citizens could call ACE if they needed a special item removed. A large boom truck was then directed to specific areas where bulky items of this kind had accumulated.

C. Mechanical Street Sweeping

3.4.8 41 mechanical sweepers were used to clean nearly 50,000 kilometers of Jeddah streets each month totalling about 6,000,000 kilometers for the duration of the five years contract. The daily sweeping programme began at 3.00 A.M. each morning during which the main roads were cleaned while traffic was light. Residential streets are usually cleaned in mid-morning by the time most residents had

left for work taking with them their cars which were no longer parked along the kerbs of the internal streets.

D. Manual Sweeping and Litter Picking

3.4.9 In addition to the mechanical sweeping of the streets, ACE utilized more than 2,000 of its employees on manual street sweeping and litter picking. These two functions insured the absolute cleanliness of the streets by collecting the remaining refuse and dirt not picked up by its vehicles.

E. Abandoned Vehicle Removal

3.4.10 When ACE began its contract, it was estimated that there were about 15,000 abandoned cars and trucks scattered throughout the city. During the first year of operation ACE managed to pick up 8,102 vehicles, 7,537 during the second year; 6,792 during the third year; 6,342 during the fourth year and 4301 during the final year of the contract.

F. Pest Control

3.4.11 One important part of the overall pest control function was ACE's continuous programme of monitoring and spraying mosquito breeding places. Breeding locations are wherever water is allowed to stand more than seven consecutive days. This included trapped lagoons along the Corniche and various road work areas. ACE Pest Control teams throughout the 5 years sprayed these locations with

insecticide to kill off the mosquito larvae. ACE also implemented a fly monitoring programme. This was carried out by using fly tapes at 120 locations throughout the city. Flies caught were recorded during 24-hour periods and averages were taken to determine seasonal cycles and other useful information.

3.4.12 ACE Pest Control teams succeeded in dramatically reducing the number of rodents in the city through a specialised programme of planting poison baits in infested areas. Special emphasis was placed in areas such as the Corniche, fruit and vegetable markets, fish and sheep markets and the slaughterhouse. During the contract period ACE laid more than 550,000 kilograms of rodent bait throughout the city.

3.4.13 One of the most successful components of the Company's pest control activities was the virtual elimination of most of the city's stray dog population. During the contract period, ACE put down more than 35,000 dogs thereby making the city's streets safe for Jeddah residents and their children.

3.4.14 The pest and rodent population has been substantially reduced not only because of ACE's pest control efforts but also because of the Company's successful refuse collection programme which meant that far less garbage was on the

streets for the pests to breed in.

H. Public Awareness

3.4.15 ACE implemented a special public awareness programme, especially designed to educate Jeddah citizens on the importance of assisting the Municipality in its efforts to keep the city clean. The programme consisted mainly of the following activities:

- a. Visiting Jeddah schools to deliver an audio-visual presentation to the children on the importance of properly disposing of their litter.
- b. A weekly visit to ACE's facilities by one of the Jeddah schools, where children were shown different aspects of ACE's operation.
- c. Initiating an art contest among school children with the theme, "Keep Jeddah Clean".
- d. Producing 3 one-minute video tapes for Saudi Arabian Television as part of the overall campaign to promote the concept of "cleanliness".

3.4.16 In addition to this, ACE participated in the special annual "Cleaning Week", organized by the Municipality. ACE took part in the setting up of programmes, parades and

final ceremonies where schools and other government departments received prizes. One main aspect of this week was the major public awareness programme organized by the Municipality. ACE had a major role in this programme by distributing publications and posters and by setting up special exhibitions. Special advertisements were also organized by ACE inviting contractors to use the Municipal landfill and other facilities for the disposal of their waste and construction rubble. (Fig. 3.6).

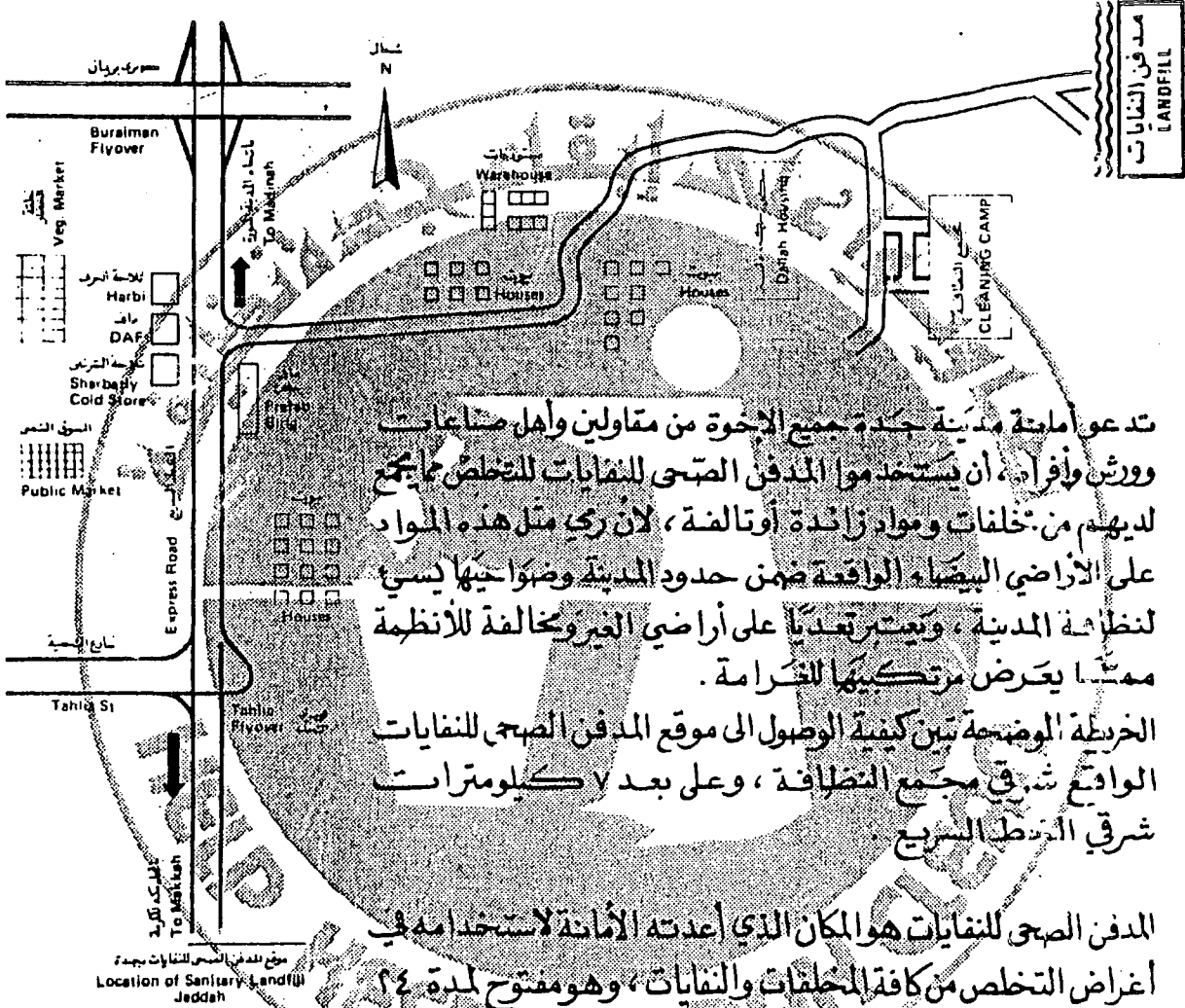
I. The Camp

3.4.17 As required by the Contract, ACE completed the construction of special housing, administration and maintenance facilities on a 280,000 square meter site east of Jeddah. The construction of this facility, "the camp", was completed as scheduled on the 4th April, 1983, just one year to the day from breaking ground. The complex was immediately occupied by ACE personnel, and was officially dedicated by the Mayor of Jeddah on 21st November, 1983.

3.4.18 This camp is unique among other camps built by foreign or local companies in the Middle East as it is entirely self sufficient with its own electrical, water and sewage facilities. The camp can accommodate up to 4,000 people in 61 buildings (27,840 square meters under roof). Aside from administrative, warehouse, maintenance and housing facilities, the camp features three swimming pools, two



رسالة من أمانة مدينة جدة
وشركة النظافة العربية
لسكان مدينة جدة الكرام



تدعو أمانة مدينة جدة جميع الإخوة من مقاولين وأهل صناعات
وورش وأفراد، أن يستخدموا المدفن الصحي للنفايات للتخلص مما يجمع
لديهم من مخلفات ومواد زائدة أو تالفة، لأن رمي مثل هذه المواد
على الأراضي البيضاء الواقعة ضمن حدود المدينة وضواحيها يسيء
لنظافة المدينة، ويعتبر تعدياً على أراضي الغير ويخالفه للأنظمة
مما يعرض مرتكبيها للعقوبات.

الخريطة الموضحة تبين كيفية الوصول الى موقع المدفن الصحي للنفايات
الواقع شرق مجمع النظافة، وعلى بعد ٧ كيلومترات
شرقي المدخل السريع.

المدفن الصحي للنفايات هو المكان الذي أعدته الأمانة لاستخدامه في
أغراض التخلص من كافة المخلفات والنفايات، وهو مفتوح لمدة ٢٤
ساعة بصفة مستمرة يستقبل خلالها كافة السيارات لتفريغ حمولتها
من المخلفات والنفايات.

وفي كل وقت ستجدون موظفي شركة النظافة العربية هناك لمساعدتكم.

مع تحيات

شركة النظافة العربية

أمانة مدينة جدة



Fig. 3.6. Public awareness advertisement urging contractors to use the landfill provided by the Municipality.

squash courts, a tennis court, an outdoor theatre stage and cinema screen, a mosque, 12 executive villas and four dining halls. (Fig. 3.7).

3.4.19 The vehicle maintenance facility was equipped to handle ACE's fleet of nearly 1,000 vehicles. On average, 200 vehicles were repaired and 140 vehicles were washed every day. 480 tyres were replaced each month, and refuse containers were washed and disinfected almost 24 hours a day.

3.4.20 A sample weekly shopping list indicates the size of operation required to feed almost 4,000 employees, three times a day. ACE catering department consumed the following quantities on a weekly basis: rice (9500 kilograms), sugar (2000 kilograms), eggs (25,000), tea (4200 litres) and bread (6300 ACE-baked loaves).

3.4.21 To keep ACE fully supplied at all times, the Company's warehouse stocks 14,000 line items, which are catalogued on the computer system. The camp has its own water storage tanks which hold enough water to meet ACE's daily requirement of 909,200 litres.

3.4.22 There are many other facilities serving the population within the camp. A modern laundry is equipped with machinery that handled 150,000 pieces of clothing a month,



Fig. 3.7. Camp Layout

and the laundry tailors repaired or altered 4,500 uniforms during the same period. The facility features a post office which handled 1500-2000 pieces of mail a day and a medical clinic staffed by three doctors and six nurses.

3.4.23 ACE was required to report the monthly progress on all these activities to the Municipality. Details of weights, quantities and areas covered by ACE's operations during the five year contract were included in 60 monthly progress reports, submitted to the Municipality not later than one week following the month end. The overall results compiled into these 60 reports forms an impressive record of achievements in the field of health and environmental care, and highlights the amount of work and organization needed to transform Jeddah into a clean and healthy city.

PART FOUR

PART FOUR: USE OF COMPUTER MAPPING IN JEDDAH CLEANING
CONTRACT

Chapter One: Use of Computers in Cleansing Operations

Chapter Two: Use of Computer Mapping in the Updating of
Planning Information - CAMPUS PROJECT

4.1. CHAPTER ONE: USE OF COMPUTERS IN CLEANSING OPERATIONS

4.1.1 As previously described, the Municipality of Jeddah prepared a cleansing contract with the intention of providing a cleansing service for the city to a high standard of excellence. There were, however, two unusual aspects of this contract:-

1. The payment for cleaning services was based upon the actual lengths of road and areas of land serviced.
2. The contractor was asked to furnish the Municipality with specified data about the city related to growth in urban areas.

4.1.2 The contract identified ten categories of land according to building types and density, each category with its own unit rate (per hectare) of payment. The Municipality also identified fourteen categories of roads according to their width, surface type and function, each of which has its own unit rate (per kilometer) of payment. The contractor was required to prepare annually a detailed schedule of the hectares and kilometres in each category so that the amount of payment could be evaluated. This method enabled the Municipality to pay only for the actual lengths of road and areas of land serviced.

4.1.3 Lengthy discussions took place between the Municipality and the contractor in order to establish an acceptable method for the information collection and updating. Arising from these discussion, ACE eventually appointed a specialist American Consultancy, CLM Systems Inc., to advise on the design of a system for information updating, which was compatible with current systems used by the Municipality and already under discussion by the Municipality with CLM Systems. These discussions envisaged a "Jeddah Information and Mapping System" (JIMS), which would eventually record comprehensive information on every parcel of land and building in Jeddah.

4.1.4 It subsequently became clear that the only acceptable means of evaluating the payment to ACE was to install a computer based mapping system with the capability to hold the maps digitally, and receive, updates on the measurement of the lengths of road segments and areas of blocks of land. Consequently CLM designed, installed and operated a computer system capable of meeting the contractual and operational requirements outlined by the Municipality and ACE. This system was referred to as ACE Information Management System (AIMS), and was initialled as a subsystem of the Master Information Systems (JIMS).

4.1.5 The major components of the AIMS computer mapping systems were:

1. Central Processor - Digital Equipment Corporation (DEC) PDP 11/23. The "mind" of the computer, where all the calculations are performed.
2. Storage Units - two DEC RLO/2 disk drives.

Data is stored on removable disk cartridges, each capable of holding 10 megabytes (10 million characters) of information. One of the disk drives is used permanently for disk cartridges containing all of the system programmes. The second is used for the data disks, storing the maps of the city.

3. Input Devices

- a) DEC VT100 visual display terminal.

This is the main control console, from which the operator instructs the computer to execute the various programmes in the mapping system. It is also used for entering new programmes.

- b) Calcomp 9600 digitizer.

The main input device for maps. This device converts drawings into a series of numbers so that the computer can manipulate the data.

4. Output Devices

- a) DEC LS120 matrix printer.

The device on which all analyses of statistics relating to the maps are tabulated.

- b) Houston Instruments CPS 15/6 Plotter.

The main output device, on which all the revised and updated maps of the city are drawn by the computer. This plotter is capable of drawing maps using four colours (red, blue, green, black).

- c) AED 512 colour graphics terminal.

This is used for displaying maps or parts of maps to assist in the updating process. It can also be used to make corrections to maps.

Fig. 4.1. Shows a schematic layout of the computer mapping system, and Fig. 4.2. Shows the complete system installed at the Municipality.

4.1.6 The programming language used on the AIMS computer is "Fortran". The software which controls the mapping system is a set of programmes called "STRINGS" (Storage and Retrieval of Information Geographics) developed by Geobased Systems Inc. of America. To provide the particular reports and analyses

JIMS

SYSTEM CONFIGURATION

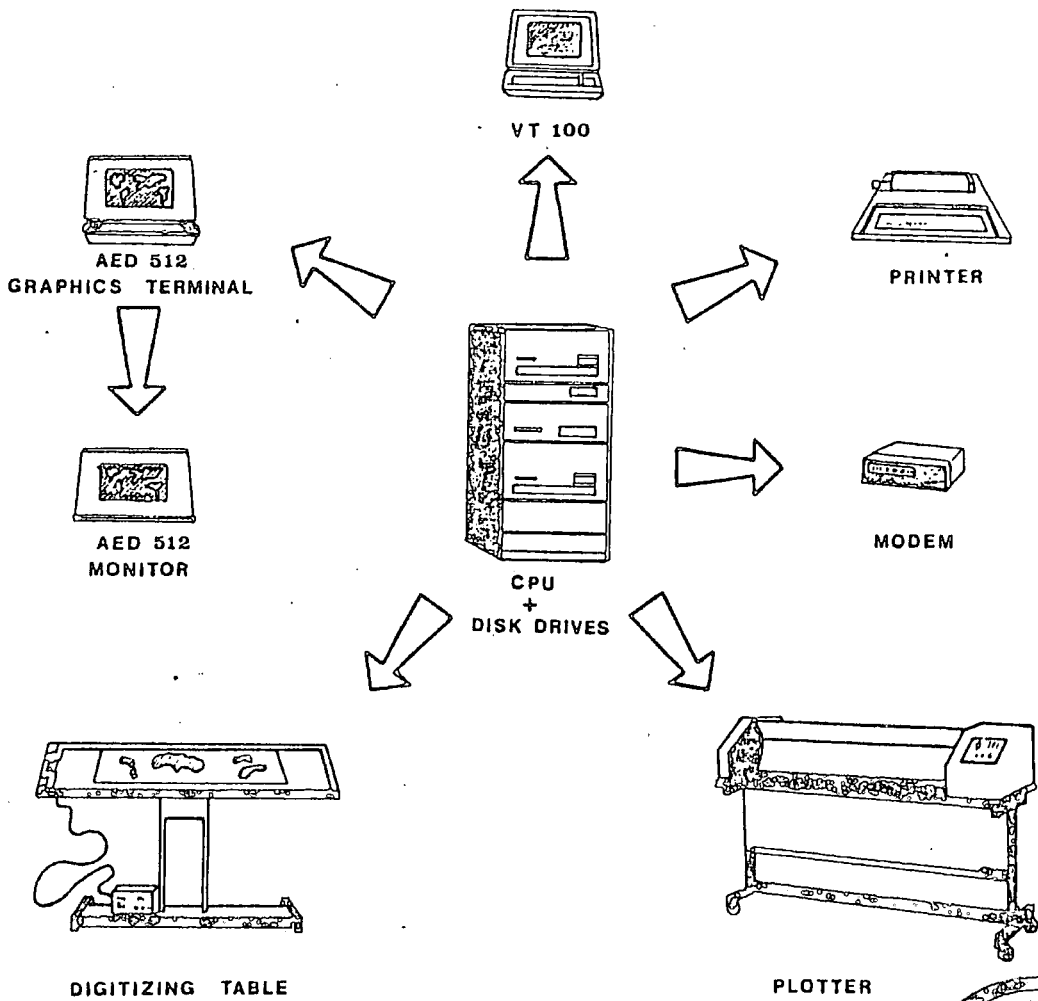


Fig. 4.1. Schematic Diagram of Computer Mapping System.

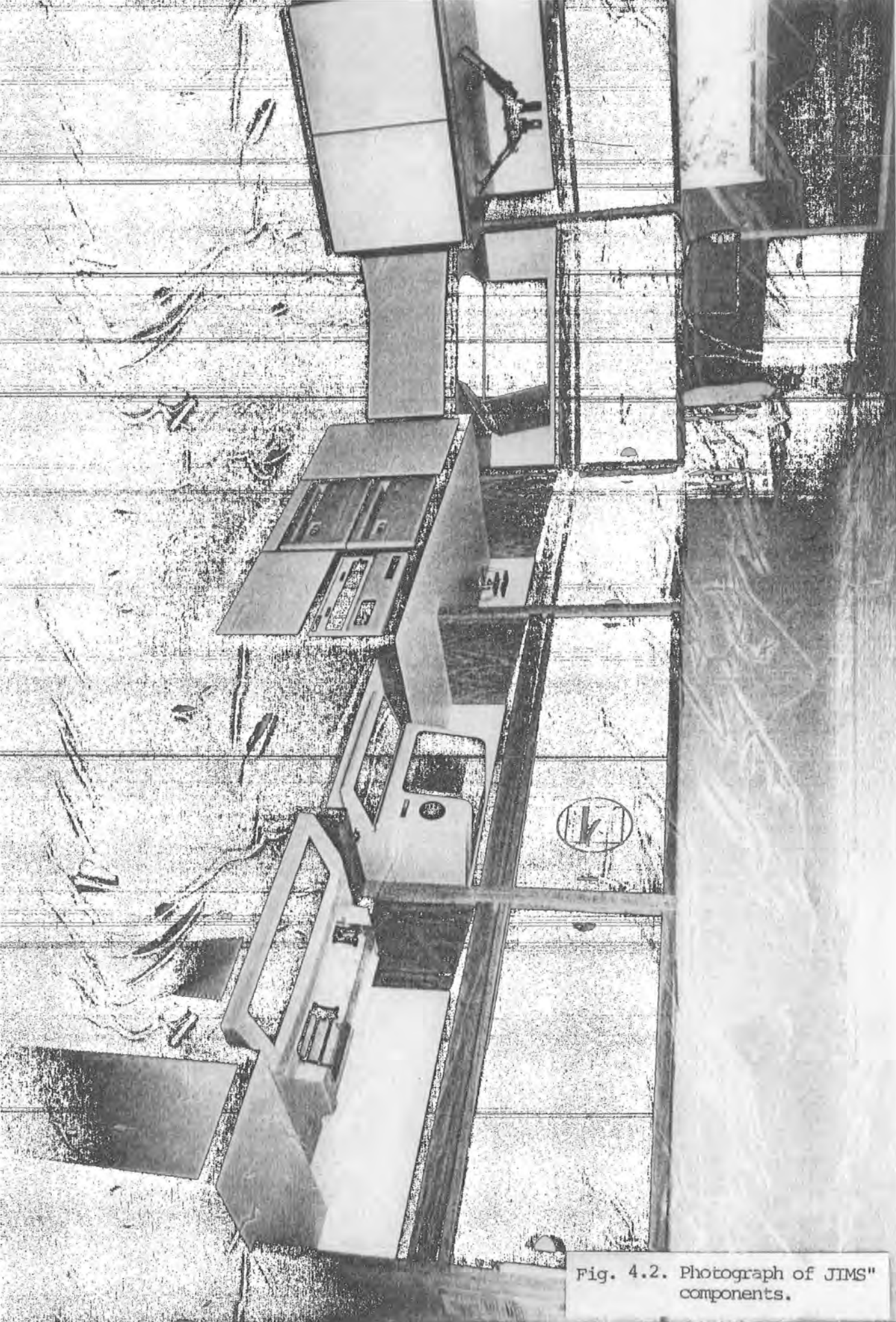


Fig. 4.2. Photograph of JIMS" components.

required for the Municipality's cleansing contract. The system has been set up and used in a particular way and several additional, specific programmes have been written.

4.1.7 When the cleaning contract commenced in 1981 the only available maps of the city were already out of date, having been produced in 1977. Recognizing this the cleaning contract required that scaled aerial photography of the city should be produced and that the calculation of the payment quantities should be based on these photographs. Consequently, ACE commissioned Arabian Aerosurvey Company Ltd. to carry out the necessary aerial photographs enabling ACE to provide the information required by the client. Photography from heights of 2500 ft., 5000 ft., 10000 ft. was completed during December 1981. These produced photographs at scales of 1:5000, 1:10000 and 1:20000. Each of the photographs was then enlarged photographically by a factor of four to give the prints at the three scales which were used for the mapping.

4.1.8 These aerial photographs formed the basis from which the digital computer maps were produced (1). These maps provided AIMS with the essential data base of all blocks and streets in Jeddah. The computer system can thus display and plot these maps at any required scale. Similarly, maps can be combined together to

produce "composite" maps from which lengths of lines can be measured and areas of blocks can be calculated precisely. The system was ideal, in that it had many advantages resulting from the facility to manipulate maps once they are in digital form.

Up-Date of Computer Maps

- 4.1.9 The aerial photographs show the state of development of the city of Jeddah at one fixed time (December 1981). However, the city was continually expanding as new roads continue to be laid out in accordance with the master plan. New buildings were similarly being erected in the new sub-divisions and some existing areas were being redeveloped. Thus, even as the information from the aerial photographs was being transferred onto the computer, it was becoming out of date. To keep track of the development and thus meet the requirement of the cleansing contract to keep the maps up to date ACE employed a team of six surveyors each being allocated a separate section of the city. This team travelled throughout the City each day to familiarise itself with changes taking place within each allocated section. These surveyors were thoroughly trained and worked to a clear set of written instructions.

4.1.10 Each surveyor updates his allocated maps on a cyclical basis. Each map is checked by senior staff to insure that it correctly represents the current situation on the ground. A complete revision of maps covering one section of the city takes three months and covers aspects of change such as new roads, type of surface, number of kerbed edges, buildings under construction, locations of all large refuse containers and general land use information.

4.1.11 The appropriately amended maps are returned to the computer mapping center where the digital versions of the maps are updated to include all the changes identified by the surveyors. New, up-to-date, maps are then plotted by the computer, and the cycle is repeated. A typical working map produced by the computer for a small part of the city is included as Fig. 4.3.

Use of Maps for cleaning Operations

4.1.12 As already indicated, the computer mapping system used by ACE had many advantages, and was fully used in order to serve management and operational requirements in both the Municipality and ACE. This chapter outlines the many financial and operational aspects carried out with the help of this system. The second chapter demonstrates how this system was further utilized in a Pilot



Fig. 4.3. Typical Map produced by computer.

Scheme in order to develop a system of constant updating of information for the use of the Municipality's Town Planning Office.

(A). Annual Bill Calculation

4.1.13 As described in Part Three, the cleaning contract required ACE to produce a bill for its services annually (at the beginning of each year), based upon the actual hectares of land and kilometers of road serviced. The land was divided into ten categories according to the type of buildings and there was a different rate of charging for each category. Similarly the roads were divided into seven categories of main roads and seven categories of secondary roads. The charge per kilometer is different for each category and depends upon the type of road (width and surface type) and the level of service required by the contract. All the charging categories (for land and roads) are summarized in Table 4.1.

4.1.14 The main purpose of the computer is to keep up to date maps of the whole of the area of the cleaning contract. At the end of each year a special analysis programme is used to establish the length of every individual road and the area of every individual block of land. These are added to the totals for the

Table 4.1. AREA CLASSIFICATION CODES

CLEANING QUANTITIES

- 01 - Downtown; Historical area
- 02 - Organized area of more than 3 story buildings
- 03 - 80% organized area; 2 and 3 story buildings
- 04 - Unorganized area; variable building heights
- 05 - Unorganized croded area; 3 to 6 story buildings
- 06 - Organized area; villas, palaces and 2 story buildings
- 07 - Semi open, organized and unorganized area; dispersed buildings
- 08 - Unorganized area of shacks
- 09 - Open area; party organized
- 10 - Open area; no buildings
- 11 - Non-service/non-payment area

SECONDARY ROADS AND PATHS

CLASSIFICATION CODES

CLEANING QUANTITIES

- 11 - Paved streets; 8 - 20 m wide in area types 2,4,5,7,8,9 & 10
- 12 - Unpaved streets; 8 - 20 m wide in area types 2,4,5,7 & 8,9,10
- 13 - Paved paths, less than 8 m wide in area types 2,4,5,7,8,9 & 10
- 14 - Unpaved paths; less than 8 m wide in area types 2,4,5,7,8,9 & 10
- 15 - Paved streets; 8-20 m wide in area types 3 and 6
- 16 - Unpaved streets; 8-20 m wide in area types 3 and 6
- 17 - All streets and paths in area type 1
- 19,8 Non-service/non-payment street.

PRIMARY ROADS CLASSIFICATION CODES

CLEANING QUANTITIES

- 21 - Expressways; outside city; more than 40 m wide
- 22 - Express roads; inside city; 30 m wide; some commercial
- 23 - Express roads; inside city; 30 - 40 m wide; commercial
- 24 - Main roads, inside city; 20 - 30 m side; commercial
- 25 - Secondary roads; important traffic; stores or industries
- 26 - Roads outside inhabited area; no municipal services
- 27 - Roads inside residential units; not in city system
- 29 - Non-service/non-payment road.

appropriate classifications (according to the Bill of Quantity (BOQ) levels associated with the centre lines of blocks and streets at the time digitizing). A total is produced for each charging district in three tables:

BOQ 'A' - areas of land

BOQ 'B' - lengths of secondary roads

BOQ 'C' - lengths of main roads

Examples of these are given in Appendix G.

The totals for all 49 charging districts are then added together to produce the total for the whole of the coming year.

(B) Operational Vehicle Routes

4.1.15 The ACE contract area is divided into fourteen sub-municipalities (city districts) each with its own subMayor and municipal administrative team. The ACE cleaning operations mirror this organization, with one cleaning manager and a team of workers allocated to each submunicipality. As a first stage of planning the cleaning operations it was therefore necessary to have a map of the whole submunicipality on which Rear End Loaders (REL) route allocations and mechanical sweeping route allocations can be made. By combining several of the basic maps together (in some cases up to 30 maps), and outlining detailed information, and

plotting at a large scale (typically 1:10000 or 1:20000) maps were produced by the computer.

4.1.16 Having divided the area into vehicle routes, larger maps of the individual routes can be produced. The locations of all major containers are plotted automatically to assist in the detailed street-by-street routing of the vehicles. (Fig. 4.4) shows a map of one REL route from the Al Ruwais submunicipality.

(C) Mechanical Sweeping

4.1.17 In addition to producing maps of submunicipality areas and operational routes the computer can be used to calculate the lengths of all streets in any area. These can be aggregated according to the type of road (i.e. its width and surface type) and the number of kerbed edges. (Fig. 4.5) is an example of such a tabulation in which the categories at the left (11-19 and 21-29) indicate the road type and the columns are for differing numbers of kerbs. Together with an operating norm for mechanical sweeping these tabulations can be used to evaluate vehicle requirements more precisely and so utilize the fleet more efficiently.

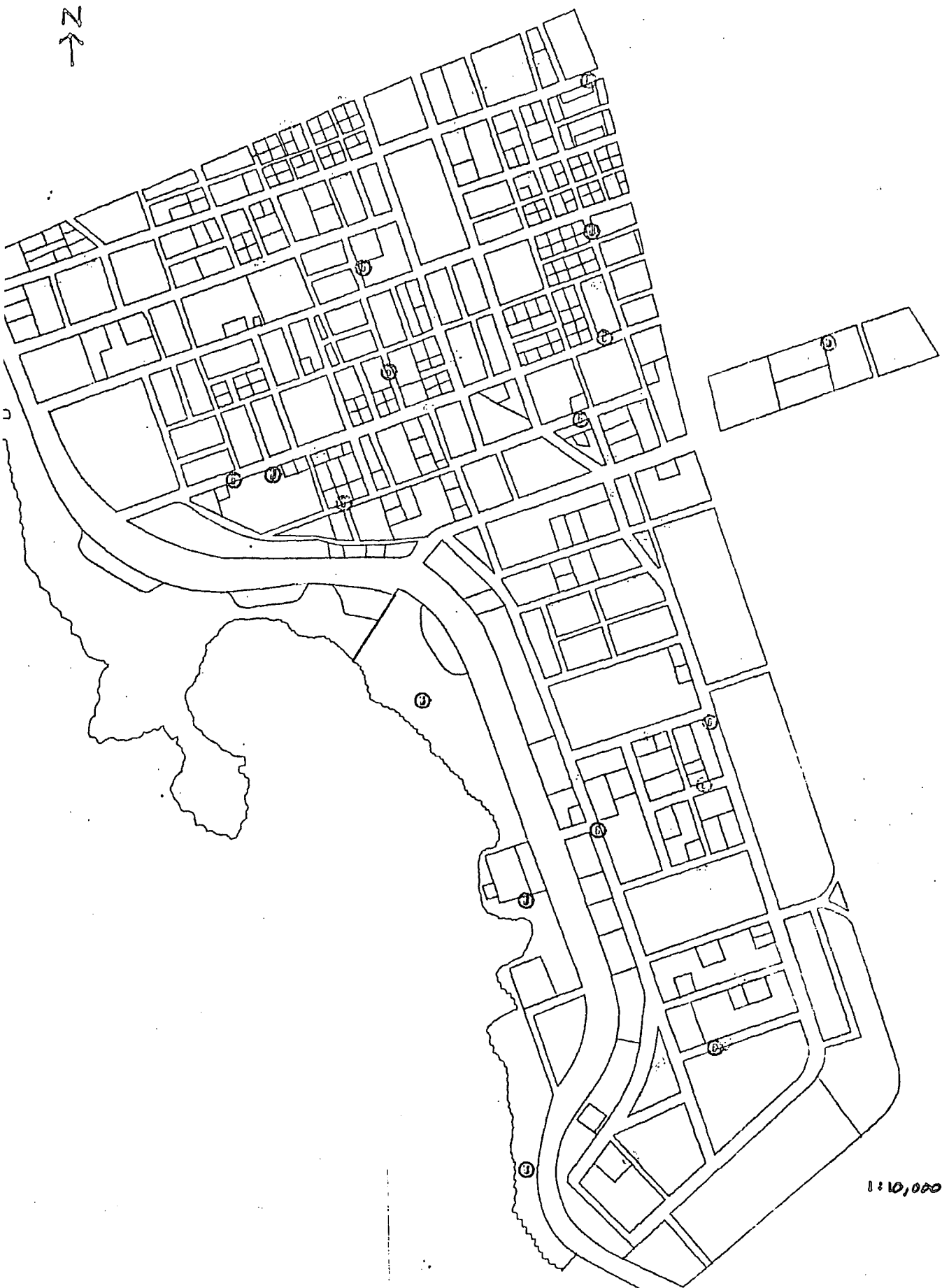


Fig. 4.4. Operational Route Map
Showing Container Locations.

ARABIAN CLEANING ENTERPRISE LTD.

JEDDAH, SAUDI ARABIA

OPERATIONS REPORTS

ROUTE NUMBER: AR01

TOTAL LENGTH OF ROADS IN METERS - BY NUMBER OF KERES

ROD	TOTAL	UNSPEC.	0	1	2	3	4	6	8
11	4910.	0.	307.	0.	4603.	0.	0.	0.	0.
12	0.	0.	0.	0.	0.	0.	0.	0.	0.
13	136.	0.	0.	0.	136.	0.	0.	0.	0.
14	44.	0.	0.	0.	44.	0.	0.	0.	0.
15	15852.	0.	75.	0.	15664.	0.	113.	0.	0.
16	125.	0.	0.	41.	83.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	21067.	0.	382.	41.	20530.	0.	113.	0.	0.
21	2076.	0.	0.	0.	0.	0.	0.	0.	2076.
22	3399.	0.	0.	0.	0.	0.	603.	2796.	0.
23	446.	0.	0.	0.	0.	0.	446.	0.	0.
24	4082.	0.	0.	0.	2732.	0.	1350.	0.	0.
25	0.	0.	0.	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	10003.	0.	0.	0.	2732.	0.	2398.	2796.	2076.
TOTAL	31070.	0.	382.	41.	23262.	0.	2511.	2796.	2076.

Fig. 4.5. Road length calculation
by type of road.

(D) Manual Sweeping

4.1.18 As well as mechanical sweeping of main roads ACE is required to provide manual sweeping of sidewalks and of internal streets too narrow for mechanical sweeping and to provide litter picking in unpaved areas. A daily operating norm for this service is generated depending upon the nature of the area. The number of men required to provide the service is then calculated from the total linear kilometers of streets. The allocation of particular streets to particular men is greatly assisted by skeleton street maps produced by the computer, showing the exact length of every street. (Fig. 4.6) is an example of this type of map.

(E) Tile Washing

4.1.19 Throughout the life of the cleaning contract the Municipality has pursued city "beautification" projects - one aspect of which has been the tiling (with either marble, terrazzo, or asphalt tiles) of the market, "souk", and historic area. ACE is required to wash these tiled areas on a regular basis and additionally to provide an intensive litter collection programme. By their nature, these streets and areas are irregularly shaped. An accurate calculation of the area to be serviced would be extremely difficult by manual methods. However, with

the specially prepared computer maps of the market districts (using 1:1000 scale to enable the recording of all necessary detail), the assessment of the manpower and equipment required becomes much more precise. (Fig. 4.7) shows an example of a map for a souk area, where the computer's ability to shade areas has been used to identify the tile washing surfaces - red for marble tiling, blue for asphalt tiling, and green for unpaved areas (litter collection only).

(F) Buildings Under Construction

4.1.20 The cleaning contract requires ACE to remove construction rubble from all building sites and to report to the Municipality regularly on the numbers of buildings currently being built. In a city expanding as Jeddah has done in recent years the accurate registration of new buildings under construction is a major task. Annotation of the details of these buildings onto computer maps provides the basis for automatic reporting of the numbers of such buildings (Fig. 4.8). In addition, shaded maps can be produced to show the locations graphically (Fig. 4.9).

(G) Property Counts

4.1.21 As new building construction is complete the information on the computer maps can be retained, to



Fig. 4.7. Souk Tiled Area Shading Map.

ARABIAN CLEANING ENTERPRISE LTD.

JEDDAH, SAUDI ARABIA

OPERATIONS REPORTS

SUB MUNICIPALITY: AL RUWAIS

CLASSIFICATION	EXISTING BUILDINGS	NEW BUILDINGS	NEW FLOORS	BUILDINGS % COMPLETE				
				0	25	50	75	100
RA 1	9	8	8	1	6	0	0	1
RA 2	837	25	50	0	6	8	9	2
RA 3	461	15	45	1	2	4	2	6
RA 4	147	17	68	1	0	5	5	5
RA 5	38	9	45	0	4	3	1	1
RA 6	37	3	18	0	0	1	1	1
RA 7	20	2	14	0	0	1	0	1
RA 8	9	0	0	0	0	0	0	0
RA 9	4	1	9	0	0	0	1	0
RA >9	12	1	16	0	0	0	1	0
RV	823	1	1	0	1	0	0	0
RP	6	0	0	0	0	0	0	0
RX	1788	0	0	0	0	0	0	0
RS	318	0	0	0	0	0	0	0
CN	559	0	0	0	0	0	0	0
CR	37	0	0	0	0	0	0	0
CH	2	2	11	0	1	0	1	0
MM	18	0	0	0	0	0	0	0
PS	18	0	0	0	0	0	0	0
PH	6	0	0	0	0	0	0	0
PM	25	0	0	0	0	0	0	0
ID	27	0	0	0	0	0	0	0
IL	28	0	0	0	0	0	0	0
FB	4	0	0	0	0	0	0	0
CO	122	1	6	0	0	0	1	0
IH	47	0	0	0	0	0	0	0
CC	28	0	0	0	0	0	0	0
FS	1	0	0	0	0	0	0	0
FO	1	0	0	0	0	0	0	0
VE	71	0	0	0	0	0	0	0
VR	198	0	0	0	0	0	0	0
PC	50	0	0	0	0	0	0	0
PG	26	0	0	0	0	0	0	0
RM	68	0	0	0	0	0	0	0
TOTAL	5845	85	291	3	20	23	22	17

ESTIMATED POPULATION IS 65500.

Fig. 4.8. Report of Building Under Construction, Al Ruwais.

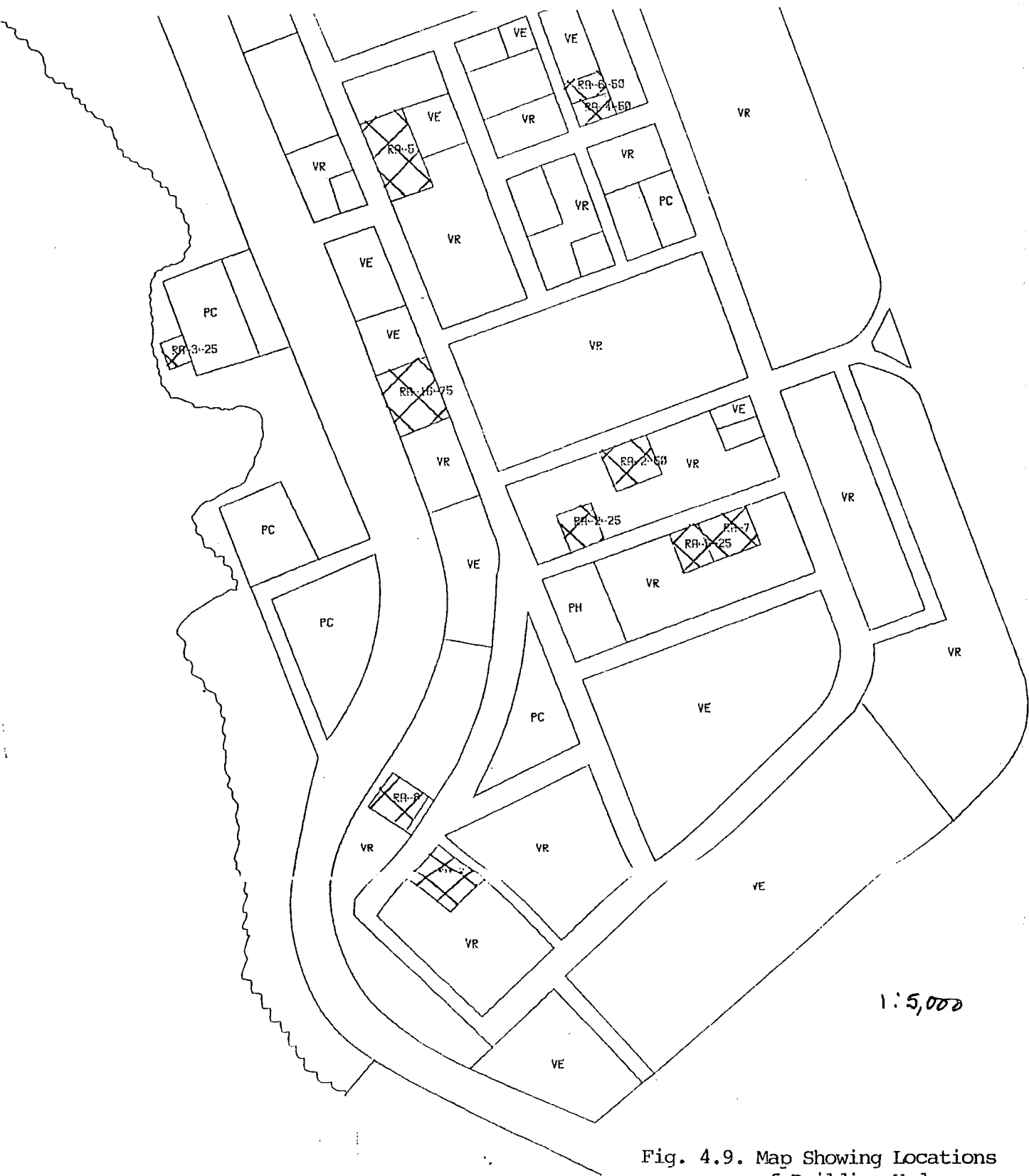


Fig. 4.9. Map Showing Locations of Building Under Construction.

add to the stock of information about numbers and types of properties within the city. Together with other land use information recorded on the maps this can lead to a comprehensive picture of the number, type and distribution of properties (Fig. 4.10). This information is of major importance to the cleaning contractor, who by using empirical formulae, can estimate the population and the refuse expected to be generated from any area. This information contributes to the allocating of REL routes.

4.2. CHAPTER TWO: USE OF COMPUTER MAPPING IN THE UPDATING OF PLANNING INFORMATION

Introduction and Summary

4.2.1 During the last ten years considerable pressure has been placed upon the Municipality of Jeddah and, in particular, its Department of Technical Affairs. This has resulted in a continuous effort to improve the municipal organization, and provide the level of administrative, financial and technical staff required to meet the expanding needs of the city.

4.2.2 The Municipality of Jeddah made some progress in using computers towards the achievement of this objective by establishing 3 computer systems and awarding a contract to provide the fourth. These four system are:

- i) IBM 4331 mainframe processor dedicated to a conventional information system type of operation, e.g., accounting and financial management.
- ii) Arabian Cleaning Information and Mapping System (AIMS), installed by ACE in June 1982 and based on a DEC PDP 11/23 Processor.
- iii) Town Planning System (TOPS) : This system is being developed by the Town Planning Office to

carry out new town planning activities. TOPS system is also based on a DEC PDP 11/23 Processor.

iv) Topographical and Cadastral Information

Management System (TACIMS) : This project will eventually produce a topographic and cadastral information and mapping system. The contract was awarded to a consortium of 3 companies (2), and the project is actually underway.

4.2.3 However, due to lack of experienced computer programmers and planners, the Town Planning Office computer system was under-utilized, and never met with the Municipality's expectations. Since the beginning of ACE's Contract, significant progress was made towards the achievement of (AIMS), and ACE computer experts succeeded in producing impressive results in the field of computer mapping through the use of ACE computer mapping system. As the TPO was running an identical system to (AIMS), ACE offered to transfer the experience it had to the TPO in order to develop a system of constant updating of planning information. The ultimate objective of this system was to enable the Municipal Manager instantly to retrieve and display, mainly in graphic form, any information related to land use and planning proposals.

4.2.4 Both the Municipality and ACE agreed that the most appropriate approach towards the achievement of this objective would be to:

- a) Select a pilot area that provides a comprehensive selection of land uses and activities being representative of the city as a whole.
- b) Prepare a "scope of work" study to define the approach and methodology to be applied and tested in the pilot area; to establish the procedure for the preparation of information; and to test the systems proposed for the preparation of information required for the computerized updating and reviewing of the Master Plan.
- c) Form a team of planners, computer programmers, technicians and surveyors to prepare a Pilot Project by carrying out the tasks and scope of work mentioned in (b).

4.2.5 A pilot area (approximately 1 sq.km) was selected in the Sharafiya District. This area is within the Sherafiyah sub-municipality and is bounded on the north by Palestine Road, on the east by Khalid Ibn El Walid Street, on the south by Waliy El Ahd Street and on the west by Medina Road (Fig. 4.11). This section of Sharafiya contains a wide range of land uses and buildings of varying heights and



حدود البلديات الفرعية

Sub Municipality Boundary

المنطقة التحريية

Pilot Area

الشكل ٣/٢

Figure 4.11

منطقة الدراسة التحريية بالشرف

SHARAFIYAH PILOT STUDY AREA

structural types. It also contains areas of high and low densities, and wide range of road categories. Therefore, the Municipality considered it to be a suitable area to test and demonstrate the procedures and methodology required to support a city wide data system.

4.2.6 The scope of work was prepared, and consisted of three stages as follows:

STAGE ONE: PREPARATION OF DIGITIZED MAPPING ON THE TPO COMPUTER

1. Preparation of digitized 1:1,000 scale mapping from the 1984 air photography to be prepared by Huntings for the pilot area.
2. Set up this base mapping on the TPO computer.
3. Co-relate computerized base mapping and information prepared by Arabian Cleaning Enterprise (ACE) for the pilot area.

STAGE TWO: METHODOLOGY & DATA COLLECTION FOR THE PILOT AREA

1. Review of the existing situation within the pilot area to bring the base maps up to date. Carry out surveys and prepare computer inputs on the following subject headings:
 - Land use by Master Plan category
 - Population and Employment Data
 - Road Hierarchy
 - Public Utility Networks.
2. Review any current approved planning proposals, including development under construction and prepare input system into computer as part of examining updating processes.
3. Set up graphically and non-graphically the computer mapping and data to show all survey information on the computer for the Pilot Area at Master Plan level of information and within its Master Plan context. This will demonstrate the

use of the computer in the preparation of the overall Master Plan (using the new digitized mapping) and will allow different layers of information, e.g. location of schools related to population; provision of shops in relation to population need, density and distribution of population and employment; use and height of buildings, etc.

STAGE THREE: POTENTIAL FOR APPLICATION OF PILOT AREA
 SYSTEM TO THE OVERALL MASTER PLAN AND
 DETAILED PLANS AND PROCEDURES FOR UPDATING
 INFORMATION

1. Review the methodology and processes required to prepare a comprehensive data base required to support the overall Master Plan of information. This will consist of a review of ALL aspects of data, including socio-economic, land use, transportation and highways and all the utility services.
2. Review the scope of the TACIMS computer data base and the objectives of its data management system. Examine the compatibility and future inter-relationships between the TPO computer and the TACIMS system and from this, recommend how the TPO can achieve a future integration and use of the TACIMS system at Master Plan and Detailed Plan levels of information.
3. In order to keep the data base up to date, a systematic procedure will have to be established which covers all aspects of technical information. To achieve this a consistent system of recording, ALL new development - roads, buildings, utility services, change in land ownership etc., will require to be set up so that all technical departments and sub-municipalities follow and adhere to procedures which will achieve this purpose. These procedures, including the required proformas will be studied and report prepared on how to achieve this essential aspects of data management and updating.

4.2.7 The Municipality of Jeddah appointed Associated Consultants Bureau (ACB)-(RMJM.P) as Planning Consultants to this Pilot Project which was called "STUDY FOR ESTABLISHMENT OF A SYSTEM FOR UPDATING DATA RELATED TO TECHNICAL AFFAIRS DEPARTMENT

PROJECTS". However, the project team preferred their own title, "CAMPUS", (COMPUTER AIDED MASTER PLAN UPDATING SYSTEM).

4.2.8 The Project team consisted from:

1)	George Duncan	- Planner] ACB RMJM.P
2)	Trevor Good	- Technician	
3)	Hassan Dajani	- Arch. Planner] ACE
4)	Alan Fawcett	- Senior Computer Analyst	
5)	Robert Smith	- Programmer/Analyst	
6)	Siva Kumar	- Senior Operator	
7)	Satish Chandran	- Operator	
8)	2 Surveyors] TPO/MOJ
9)	Aydarous El Bar	- Engineer-Planner	

ACE also appointed Charlie Miller, President of CLM systems Inc., as Special Advisor to the project.

4.2.9 The project team from ACE, ACB/RMJM.P and the Municipality of Jeddah set the project objectives as:

1. To demonstrate how to prepare survey information on all aspects of data requirement and how to prepare and present this information graphically on TPO computer generated base maps.
2. To examine the progressive inter-relationship between the existing TPO and AIMS computer graphic systems and the existing IBM main frame computer

and the future TACIMS computer graphic system to ensure, in so far as possible, a compatibility and consistency towards common goals within and between these three systems.

3. To advise and guide the TPO in the scope and use of the TPO computer to achieve its maximum potential use on all possible planning matters.
4. To train the TPO engineers in the preparation and use of computer based data/information systems.
5. To advise the Deputy Mayor for Technical Affairs on the procedures required to ensure that all Technical Departments and sub-municipalities:
 - (a) Prepare data (including surveys) in a format suitable for both computer based and manual usage and updating.
 - (b) Understand the scope and nature of the future TACIMS technical data system and the steps being taken towards its implementation.
 - (c) Learn how to use and apply this information at both local and strategic level as part of the ongoing process of city planning and development.

4.2.10 The study Team completed the programme and submitted a report describing the approach, methodology and the

application of the proposed system to the Technical Department of the Municipality. A series of computer produced maps and drawings were also submitted to indicate methods of presenting information related to land use, roads, street formation and public utilities within the Pilot Area. The Municipality accepted the work presented by the Study Team, and asked that a training programme for officials from four sub-municipalities should be immediately set up.

- 4.2.11 This section summarises the overall scope of work completed by the Study Team, with particular emphasis on the information updating procedure, and its application within the Pilot Area.

TOPOGRAPHIC AND CADASTRAL INFORMATION SYSTEM (TACIMS):

- 4.2.12 As an initial step in the preparation of a computerized data base, the project for the Jeddah Topographic and Cadastral Information Management System (TACIMS) was being carried out for the Surveying Department. This project was intended to establish a computer graphic/non-graphic system for information storage and retrieval. The basis of this system was the new (1984) aerial photography and mapping. This base mapping was prepared in standard cartographic map sheets form and also recorded on magnetic tapes for computer use, computer/plotting/

screen visual display and computer digitized map preparation.

4.2.13 The digitized base mapping produced under this project consist of the following:

- a) Digital mapping at 1:1,000 scale for 150 square kilometres of built-up area.
- b) Digital mapping at 1:2,500 for 1,000 square kilometres showing roads only.
- c) Digital mapping (derived from the 1:2,500 road mapping) at 1:10,000 - 1:20,000 and 1:50,000 scale for 1,000 square kilometres.
- d) 1:500 scale enlargements of the 1:1,000 scale digital mapping for the old city (Historic Area).

4.2.14 The original digitized maps produced by ACE, (from 1982 aerial photography) could have been used for the purpose of "CAMPUS". However, it was decided to use the new digitized mapping produced by Hunting Survey Ltd. (Arabian Aerosurvey Company Ltd.), as part of (TACIMS) project for the following reasons:

- a) (TACIMS) mapping, which is based on 1984 photography is more up-to-date and has more planning oriented information than (AIMS) mapping, which was based on 1982 photography which, primarily was designed to serve the cleansing contract.

b) (TACIMS) system, covers the entire city and is used by all departments of the Municipality. Thus it will be the basis of the city wide comprehensive data bank.

4.2.15 To enable the Study Team to use the (TACIMS) digital mapping on TPO and ACE computers, the Municipality requested Hunting Survey Ltd., to produce the information from their computer tapes, onto computer disk cartridges which can be used on both the TPO and ACE computers. In this way, it became possible to test the use and application of the TACIMS information, and also to demonstrate how to prepare survey information as overlays to the computer generated base mapping.

SURVEY INFORMATION

4.2.16 The first obvious step towards achieving the purpose of the study was to check the levels of information to be updated, and then formulate a methodology for the process of information collection, updating and presentation. This methodology needed to be consistent with current methods used by the Municipality's Technical Departments. This section sets out types and levels of information identified by the study as relevant and consistent with the known strategy of the Department of Technical Affairs.

4.2.17 Two major factors of change in a city were identified:

- 1) New Building Development
- 2) New or upgraded Highways

However, a host of other matters also create change, some visible such as street lights, traffic signs, road naming and numbering signs, parks, landscaping and tree planting, advertising signs, sculptures and monuments and so on and some, which after the construction period are not visible. The essential utility services under the surface are an example.

4.2.18 Similarly, five levels of information, and the appropriate mapping scales were recommended to be carried out as part of the updating process:

	Level	Scale Mapping
1. The Metropolitan Area i.e.	CITY	1:20,000, 1:10,000
2. The City divided into	SUB-MUNICIPALITIES	1:10,000, 1: 5,000
3. The Sub-Municipality divided into	ZONES	1: 5,000, 1: 2,500
4. Within each zone sub-divisions termed	BLOCKS	1: 2,500, 1: 1,000
5. Within each block	INDIVIDUAL PLOTS)	
	OF LAND) 1: 1,000, 1: 500

4.2.19 The Study took in consideration that the preparation of such information must be consistent with both the

level and scale at which information was required and that it co-relates with the higher or lower level of which it forms an integral part.

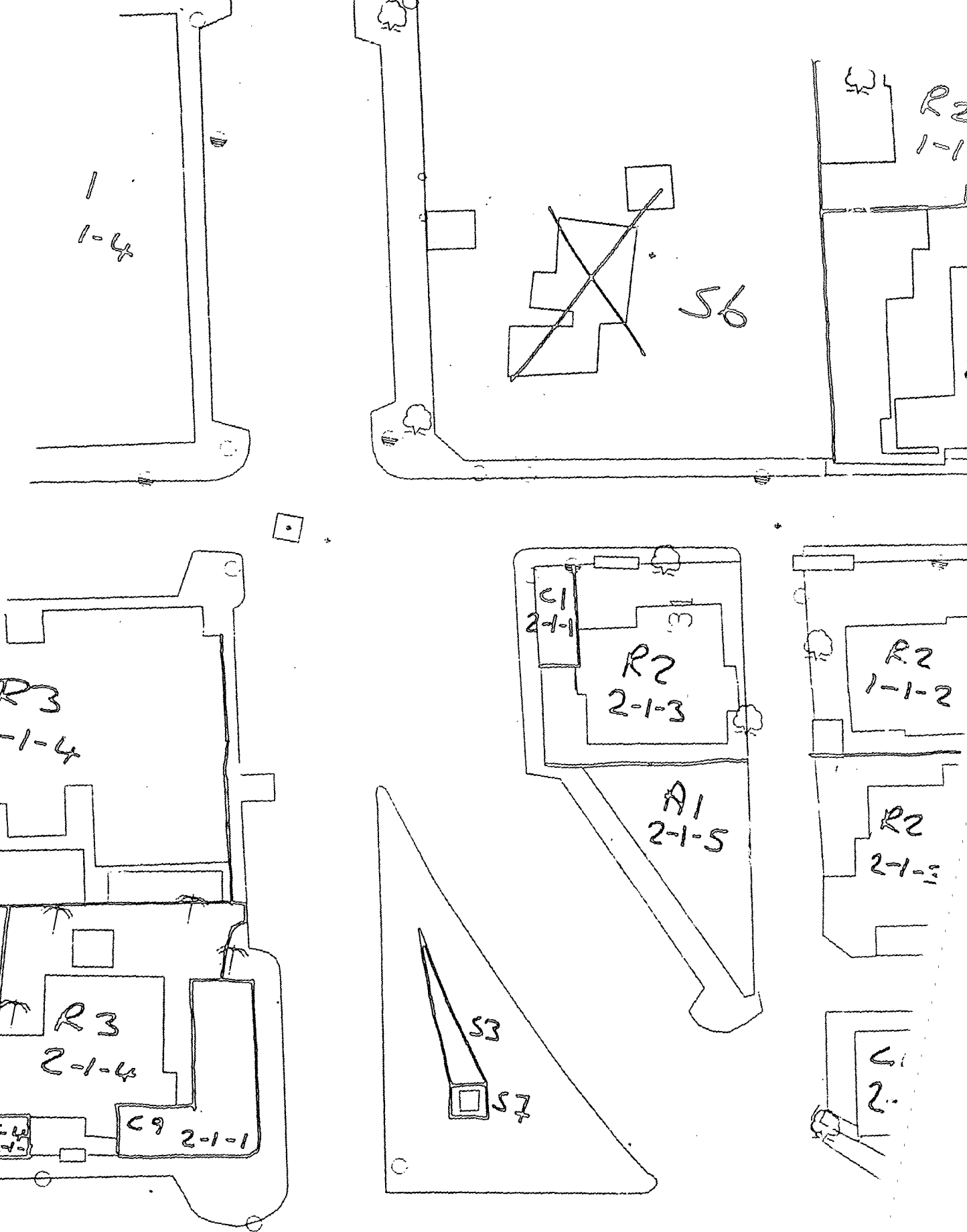
4.2.20 Consequently, a major survey operation of the Pilot Study Area was carried out during December 1985 and January 1986. This survey covered the following subjects:

1. Land Use Survey
2. Road Survey
3. Street Furniture Survey
4. Public Utilities Information

LAND USE

4.2.21 To meet the detailed requirements of local or Action Area Planning needs, the land use survey was carried out as a plot by plot, building by building survey. Site surveys were carried out on 1:500 computer print outs of the Huntings 1:1,000 scale base mapping. An example of this computer generated 1:500 scale mapping is shown in Figure 4.12.

4.2.22 To facilitate analysis and updating of the 1978 Master Plan and, because of the ability of the computer to print out graphical information to any required scale, the detailed land use survey information was aggregated into block areas of the Master Plan for statistical purposes.



الشكل ١/٨
لوحة النموذج من مسح استعماري
بمقياس ١ : ٥٠٠

4.2.23 The surveyors were briefed on the use of the Land Use Tables, and were then sent out into the field with their respective survey maps, and provided with a list of ten major land uses to identify.

The following land uses were listed:

Residential	:	R
Government	:	G
Commercial	:	C
Religious	:	M
Open Space	:	S
Education	:	E
Community	:	H
Industry	:	I
Transportation	:	T
Utilities	:	U

There are also two mixed land uses for Apartments (A) and Offices (O) above commercial uses.

4.2.24 Within each major component there are further, more specific, categories of land use denoted by number, e.g.:

C1 = Shop, and

C2 = Supermarket See Land Use Table 4.2.

The land use codes drawn on the map have been selected from this table. They contain a letter

followed by a number. For the two mixed land uses, of Apartments and Offices, the specific category of land use was selected from the commercial section of the table and relates to the ground floor land usage.

All schools have a further letter code to denote whether they are Boys (B), Girls (G) or Mixed (M), eg.:

E3B = Boys Intermediate School

4.2.25 Following the land use codings, the surveyor is required to write down the condition, construction and height of the principal building within each plot area. A building condition and height code was formulated to enable this to be done with ease and efficiency. This is a three figure number defining condition, construction and height, see Table 4.3.

4.2.26 The building condition has been noted and the number from 1 to 4 selected from part one of the table the construction of the principal building can be defined from part two of the table, a number from 1 to 6 being recorded. Finally, the building height is recorded in numbers of floors.

LAND USE CODINGS

RESIDENTIAL

R 1 Palace
R 2 Villa
R 3 Apartments
R 4 Traditional
R 5 Shanty

GOVERNMENT

G 1 Government Office
G 2 Municipal Office
G 3 Post/Telephone Office
G 4 Police Station
G 5 Fire Station/Civil Defense
G 6 Prison
G 7 Municipal Plant Nursery

COMMERCIAL

C 1 Shop
C 2 Supermarket
C 3 Market
C 4 Office
C 5 Bank/Money Changer
C 6 Embassy/Consulate
C 7 Hotel
C 8 Petrol Station
C 9 Restaurant
C10 Wholesale
C11 Exhibition Hall
C12 Marriage Hall
C13 Market
C14 Car Shroom
C15 Fun Fair
C16 Plant Nursery
C17 Bakery

TRANSPORTATION

T 1 Car Parking
T 2 Bus Station
T 3 Mini Bus/Taxi Stand

UTILITIES

U 1 Electricity Sub-Station
U 2 Water Pumping Station
U 3 Telephone Exchange
U 4 Sewerage Pumping Station
U 5 Sewerage Treatment Plant
U 6 Storm Water Pumping Station
U 7 Public Convenience

X Demolished
UC Under Construction

OPEN SPACE

S 1 Playground
S 2 Neighbourhood Park
S 3 Ornamental Garden
S 4 Public Paved Area
S 5 Picnic Area
S 6 Incidental Open Space
S 7 Sculpture

EDUCATION

E 1 Kindergarten
E 2 Primary School
E 3 Intermediate School
E 4 Secondary School
E 5 College/Special School
E 6 Private School
Use subcodes ... B for boys
G for girls
and M for mixed
i.e. E3B = Boys Intermediate

COMMUNITY

H 1 Government Hospital
H 2 Private Hospital
H 3 Government Clinic
H 4 Private Clinic
H 5 Pharmacy
H 6 Cemetery

INDUSTRY

I 1 Workshop
I 2 Warehouse
I 3 Light Industrial
I 4 Heavy Industrial
I 5 Oil Related Industry
I 6 Car Service Station

APARTMENTS

A 1 - Commercial on ground
12 level, Apartments above

OFFICES

O 1 Commercial on ground
12 level, Offices above

RELIGIOUS

M 1 Mosque
M 2 Friday/Eid Mosque
M 3 Eid Prayer Ground

PRIMARY LAND USE
Table 4.2.

BUILDING CONDITION

1	Good	No defects visible, no remedial work needs to be carried out on the fabric of the building in the near future.
2	Fair	Only minor defects visible, remedial work will have to be carried out in the near future to prevent deterioration of the building fabric.
3	Poor	Major defects visible, immediate remedial work should be carried out on the building to prevent it becoming hazardous.
4	Derelict	A hazardous building, i.e. one that has major defects that are too serious for repair. Or a building left unused for such a period of time that it will be uneconomical to renovate.

BUILDING CONSTRUCTION

1	Reinforced Concrete
2	Steel Frame
3	Brick/Blockwork
4	Pre-Fabricated
5	Traditional
6	Timber

BUILDING HEIGHT

1 to 9	No. of Floors
0	Above Nine Floors

Example of Land Use and Condition coding.

G 2 2 1 6

Government	6 Floors
Municipal Office	Reinforced Concrete
	Fair Condition

BUILDING CONDITION, CONSTRUCTION AND HEIGHT
Table 4.3.

4.2.27 Following completion of the land use survey, a master set of 1:500 scale drawings was prepared. This set showed the land use plot boundaries, the land use codes and a unique plot number allocated to each plot from its block reference as made up in Table 4.4.

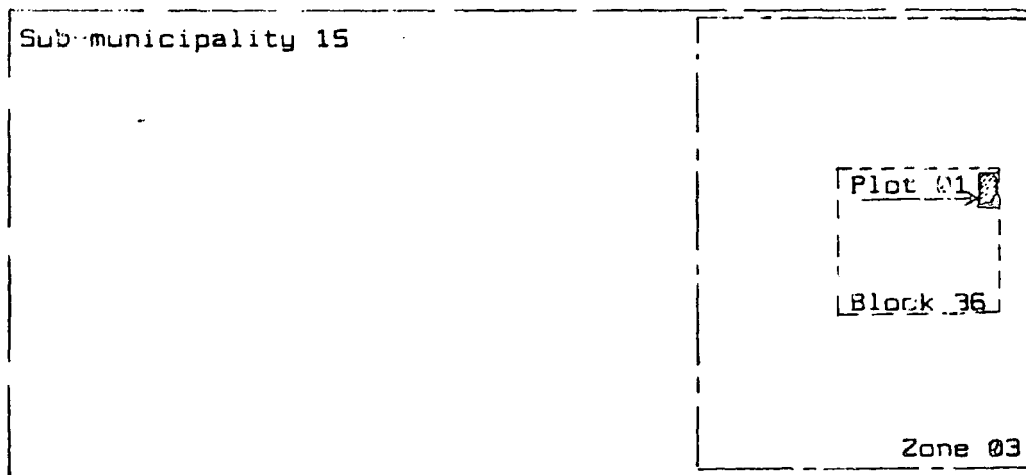
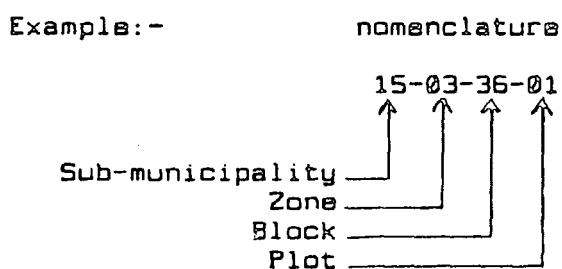
4.2.28 This master set of drawings formed the basis for the comprehensive Land Use Study being prepared by the Sub Municipalities for the Studies Department. It has been digitised to create the plot and land use information for the pilot area study on the computer. (Figures 4.13 and 4.14).

ROADS

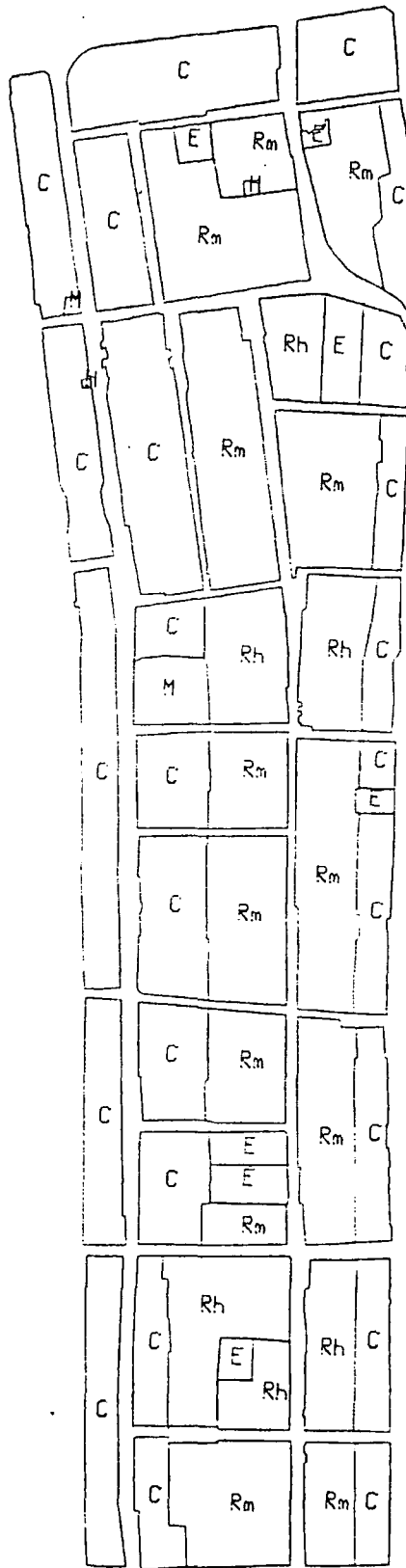
4.2.29 After consultation with the Municipality's roads department, it was agreed to follow this street naming and numbering system for filing all road information.

4.2.30 Following the street naming and numbering code, an alpha/numeric string code has been used to present the road information. This string code will, in the future be able to be called up in tabular form using a similar format to that of the Studies Department, (see Figure 4.15). When called up in tabular form, the computer will be able to assign road lengths to each information code from the digitised centre lines.

City Wide Scale



163



عالية الكثافة السكانية
متوسطة الكثافة السكانية
تجارية
مسجد
مدرسة
عيادة (مستوصف)

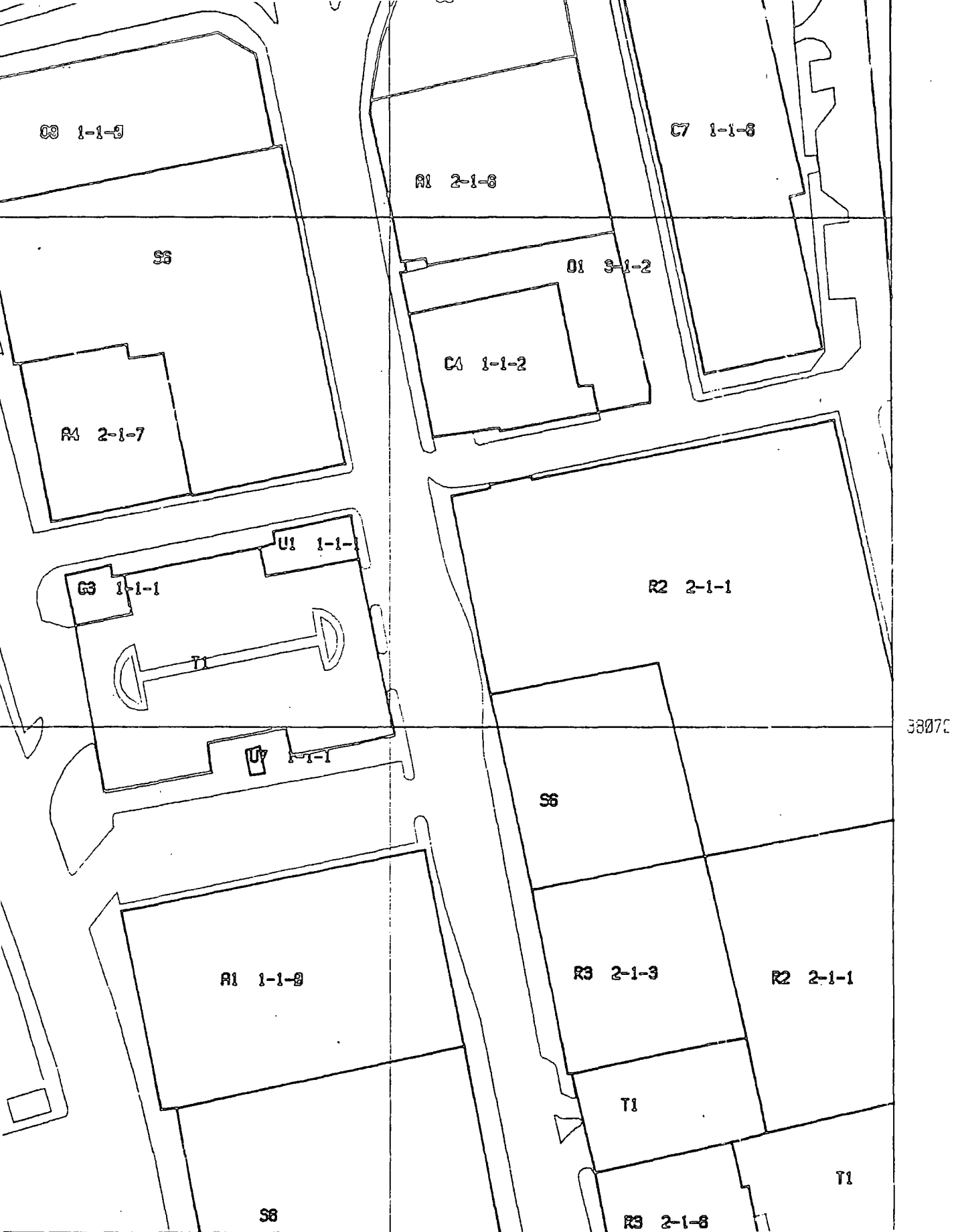
Rh Residential High Density
Rm Residential Medium Density
C Commercial
M Mosque
E School
H Clinic

Figure 4.13

PILOT AREA BLOCK LAND USES

الشكل ٢/٨

استخدام ارض البلوكات في المنطقة التحري



الشكل ٤/٨
معلومات رقمية عن استعمالات الاراضي
بمقياس ١ : ١٠٠٠

Figure 4.14
LAND USE DIGITISED INFORMATION
Scale 1:1,000

MUNICIPALITY OF JEDDAH

SUPERVISION DEPARTMENT
COMPUTER DEPARTMENT

DISPLAY OF ROAD NAME USING ITS NUMBER

STREET ()

DISTRICT /

CODE : STREET: SECTOR:

SERVICES:

SUBMUNICIPALITY: MAYCR:

ROAD HIERARCHY: ROAD LENGTH:

ROAD CLASSIFICATION:	NO. OF LANES	NO. OF PARKING LANES	AREA OFM ² ROAD
----------------------	-----------------	----------------------------	-------------------------------------

TYPE OF ASPHALTING: NO. OF PLANTINGS:

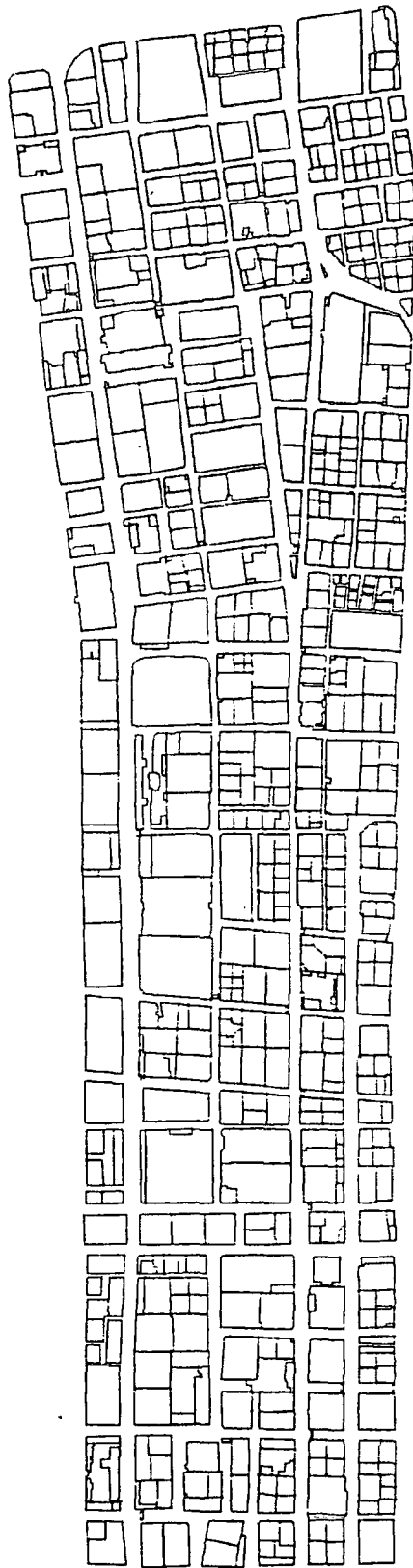
STORMWATER LINE: CONTRACT NO. OF LIGHTING
POLES :

IMPROVEMENT & BEAUTIFICATION:

KERBSTONES	WALKWAY	ST. LIGHTING	PLANTING
------------	---------	--------------	----------

HCSPITAL / CLINIC:

Figure 4.15
SUPERVISION DEPARTMENT
COMPUTER TABULATION



طرق رئيسية

Primary Road

طرق فرعية

Secondary Road

طرق محلية

Local Road

الشكل ٩ / ٤
نوعية الطرق

Figure 4.16
ROAD HEIRARCHY

4.2.31 The Road Information code number is split into five distinct groups of information, these are:

Street naming and numbering code

Road Hierarchy

Lane Format

Fabric Condition

Street Furniture

(Tables 4.5. and 4.6.)

4.2.32 The street naming and numbering code is identical to that prepared by the Supervision Department, i.e., the road number followed by the district and sector numbers.

4.2.33 The Road Hierarchy is shown by a single letter code and follows the Roads Directorate Hierarchy map prepared by consultant ACB and submitted and approved during 1985. Figure 4.16 shows the road hierarchy in the Pilot Study Area at 1:10,000 scale.

4.2.34 The third group of information is a four digit code which makes up the lane format. Each digit represents one of the following:

Single or Dual Carriageway

Number of lanes per carriageway

Number of Service Roads

ROAD CLASSIFICATION

Road Number
District Number..... Information taken from Street Numbering
Sector Number.....

Road Hierarchy	Primary Road	P
	Secondary Road	S
	Local Road	L
	Corniche	C

Number of Carriageways....	Single	1
	Dual	2

Number of Traffic Lanes per Carriageway	One	1
	Two	2
	Three	3
	Four	4
	Etc.	

Number of Service Roads....	None	0
	One	1
	Two	2

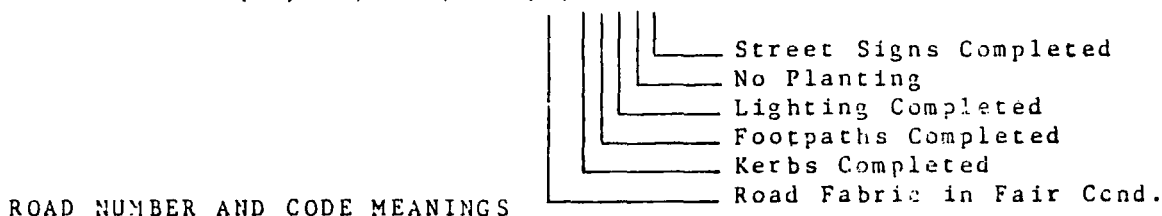
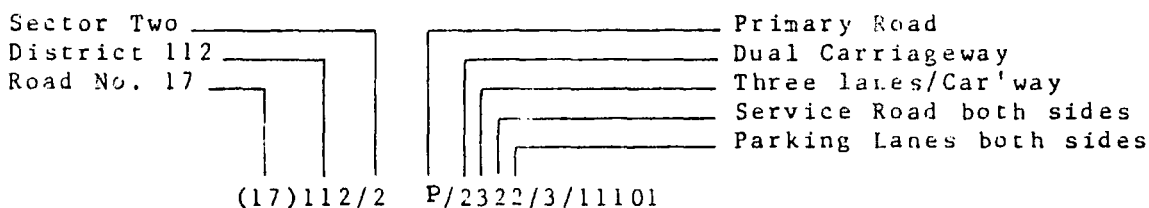
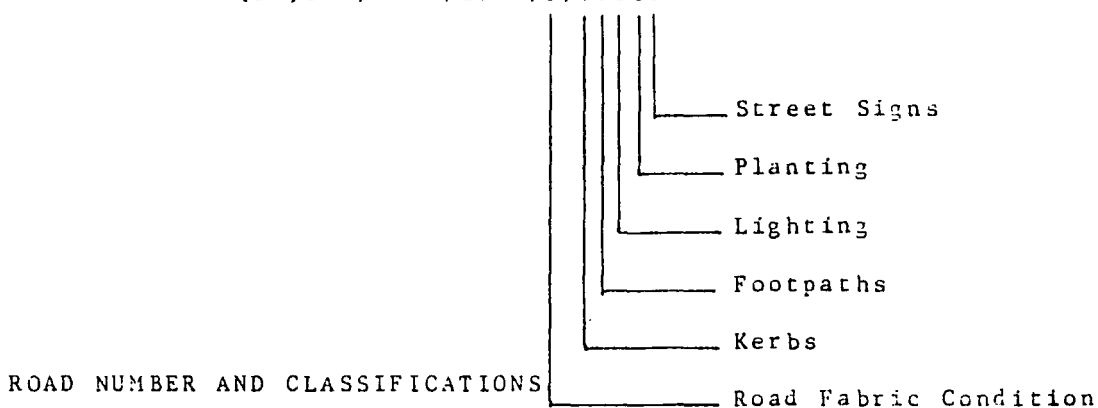
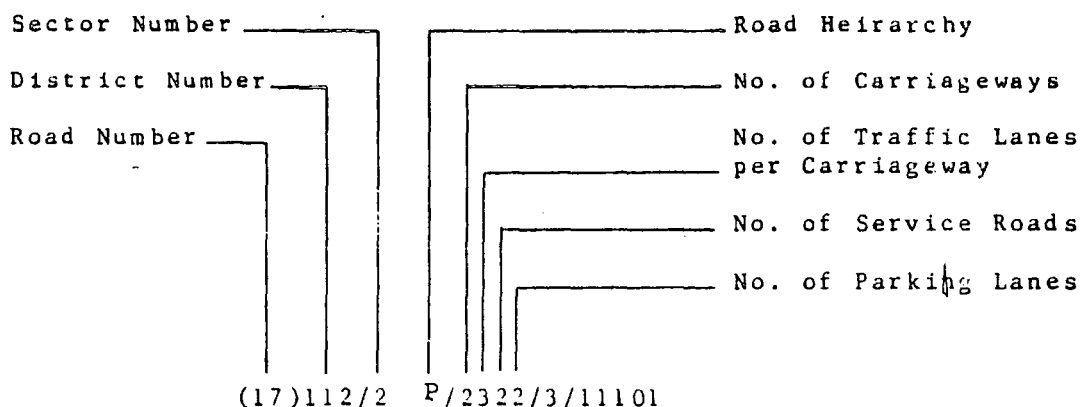
Number of Parking Lanes....	None	0
	One	1
	Two	2

Road Surface Condition.....	Excellent	1
	Good	2
	Fair	3
	Cracks	4
	Disintegration	5
	Deformation	6
	Utilities Faults	7
	Unsurfaced	8

Street Furniture.....		
Kerbs...	Complete	1
	Not Complete	0
Footpaths..	Complete	1
	Not Complete	0
Lighting..	Complete	1
	Not Complete	0
Planting..	Complete	1
	Not Complete	0
Street....	Complete	1
Signs	Not Complete	0

ROAD CLASSIFICATION
Table 4.5.

ROAD CLASSIFICATION EXAMPLE



EXAMPLE SHEET

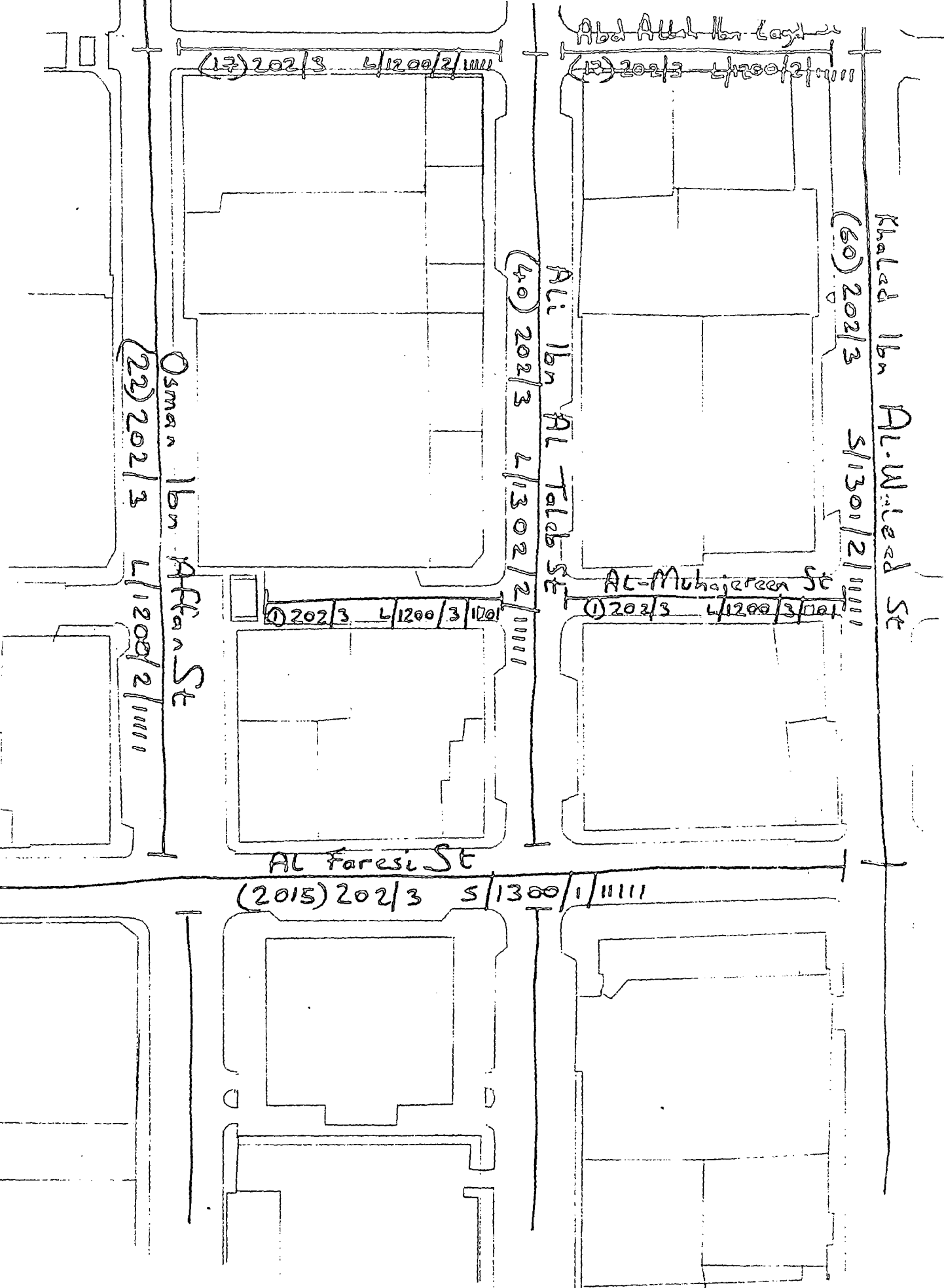
Table 4.6.

Number of Parking Lanes

- 4.2.35 Fabric condition is the name given to the overall condition of the asphalted surface of the road. The condition code is the same as that applied by the Studies Department.
- 4.2.36 Lastly the major items of street furniture, Kerbs, Footpaths, Lighting, Planting and Street Signs are noted as to whether they are completed or not.
- 4.2.37 On completion of the Road Information survey, the surveyors prepared a set of drawings at 1:1,000 scale. The road centrelines were accurately plotted by scaling, and the coded information was written in. Street names being included where space permitted. (See Figure 4.17).
- 4.2.38 The Road Information survey details were entered into the computer for the Pilot Study Area. A sample of a final plotted sheet is shown in Figure 4.18.

STREET FURNITURE

- 4.2.39 In order to present an accurate graphical representation of street furniture on the computer digitised mapping, a system of survey and updating has been set up whereby street furniture can be plotted as an overlay to any of the digitised maps.



الشكل ٩/٢
لوحة انموذج من مسح
بمقياس ١ : ١٠٠٠

Figure 4.17
ROAD INFORMATION SURVEY SAMPLE SHEET
Scale 1:1,000
















الشكل ٩ / ٣
معلومات عن الشارع
مثال رسم كمبيوتر
مقياس ١ : ١٠٠٠

Figure 4.18
ROAD INFORMATION
COMPUTER PLOTTED EXAMPLE
Scale 1:1,000

- 4.2.40 After the surveyors had been briefed on the use of symbols for plotting street furniture the Street Furniture survey was carried out manually on prints of the 1:500 scale computer enlargements from the Huntings 1:1,000 scale base mapping. (Table 4.7).
- 4.2.41 Following completion of the survey, a master set of 1:500 scale drawings was prepared. (See Figure 4.19) This master set drawings formed the basis for the comprehensive city wide study being prepared by the Sub-Municipalities for the Studies Department.
- 4.2.42 The Street Furniture information was digitised into the computer to create the street furniture overlay of the pilot study area. A sample of a final digitised plot is shown in Figure 4.20. Updating of this information can be carried out periodically by "local" surveys or by inclusion of "as-built" drawing data onto the record set and computer file.

PUBLIC UTILITIES

- 4.2.43 Public Utilities are to be taken into consideration when embarking upon any large municipal undertaking. It has therefore been a requirement that the computer digitised mapping should have the facility to plot all public utilities within street corridors, so that any new or maintenance works can be easily, and accurately, related to existing utilities.

Street Lighting	
Traffic Signal	 IS
Fire Hydrant	 FH
Telephone	 Telephone
Street Name and Number Pole	 SN
Street Route Direction Sign	 DS
Direction Sign Gantry	
Large Waste Disposal Container	
Roadside Tree	
Pedestrian Crossing	
Pedestrian Footbridge	
Pedestrian Underpass	
Utilities Trench	

STREET FURNITURE SYMBOLS
Table 4.7

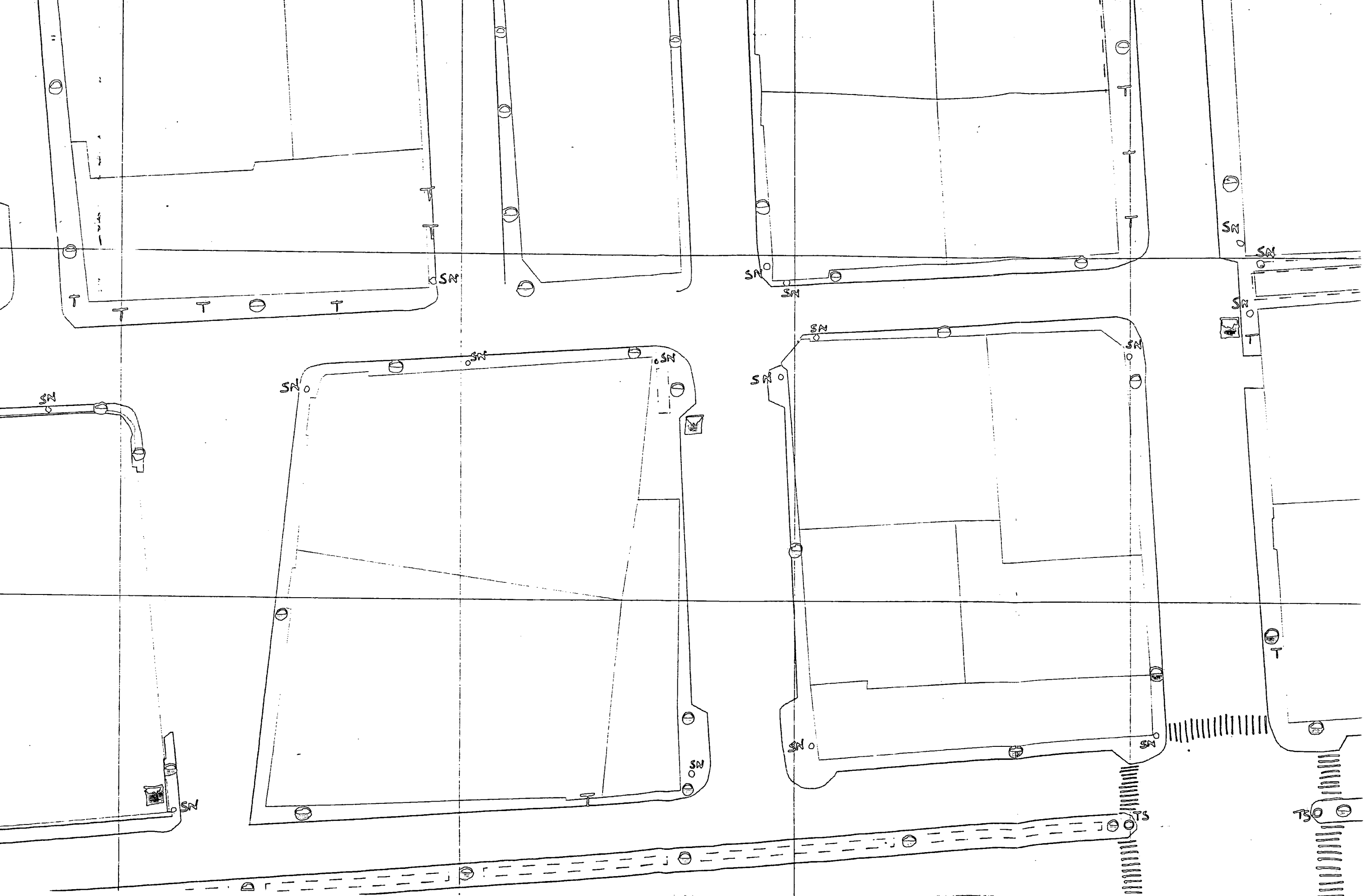


Figure 4.19

STREET FURNITURE SURVEY INFORMATION
EXAMPLE SHEET 1:500

الشكل ١-١٠
معلومات عن تجهيزات الشوارع
لوحة تمثيلية بمقياس ١:٥٠٠



الشكل ١٠-٢

تجهيزات الشوارع
مثال رسم كمبيوتر
مقياس الرسم : ١ : ١٠٠٠

Figure 4.20

STREET FURNITURE
COMPUTER PLOTTED EXAMPLE
Scale 1:1,000

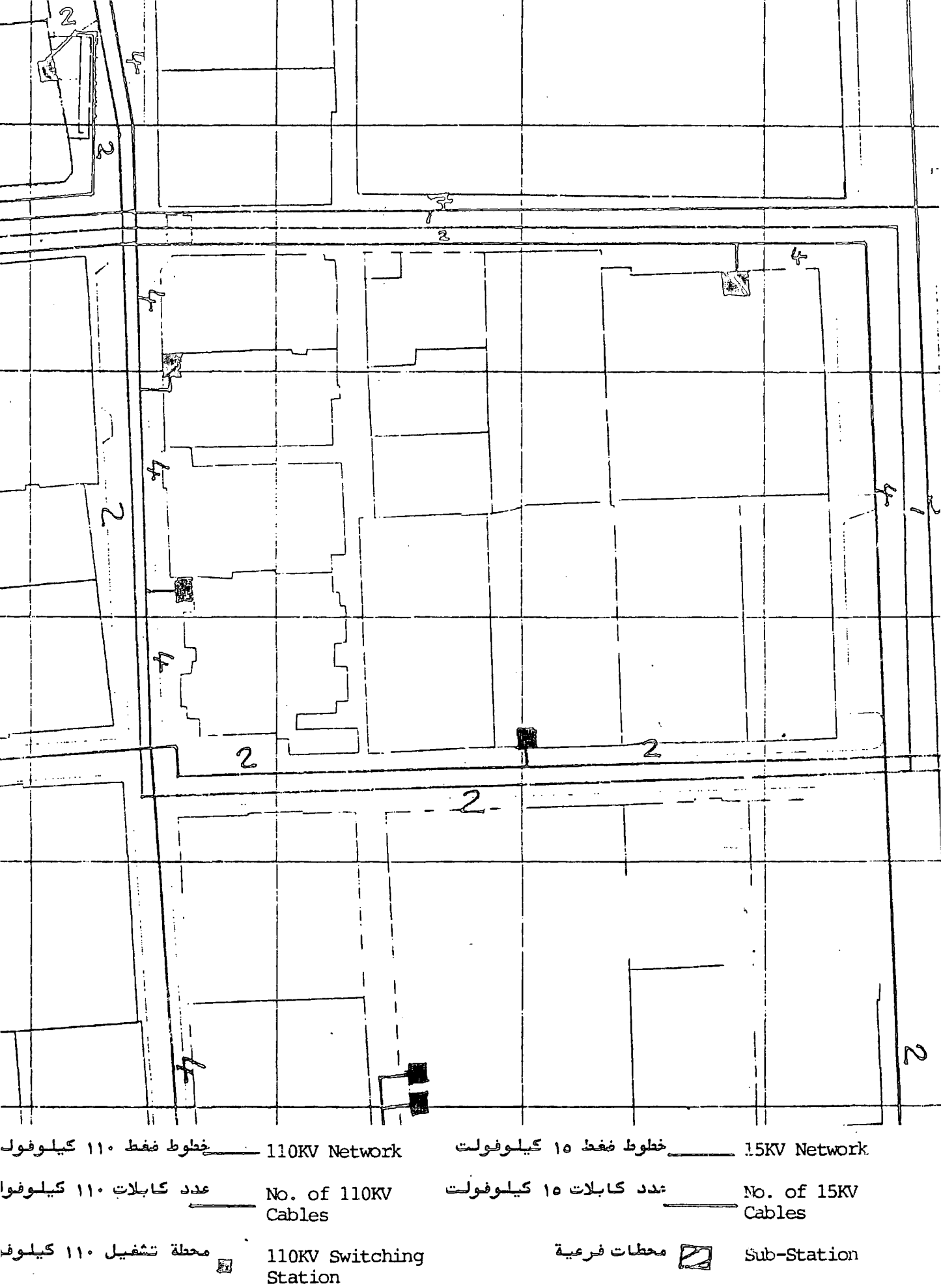
4.2.44 There are five main areas of public utilities that have been recorded upon the digitised base mapping, these are:

- 1) Electricity
- 2) Water
- 3) Sewerage
- 4) Storm Water
- 5) Telephone

Information on the five utilities has been collected from each of the five relevant authorities in the form of updated graphical representations of all utilities within the pilot study area.

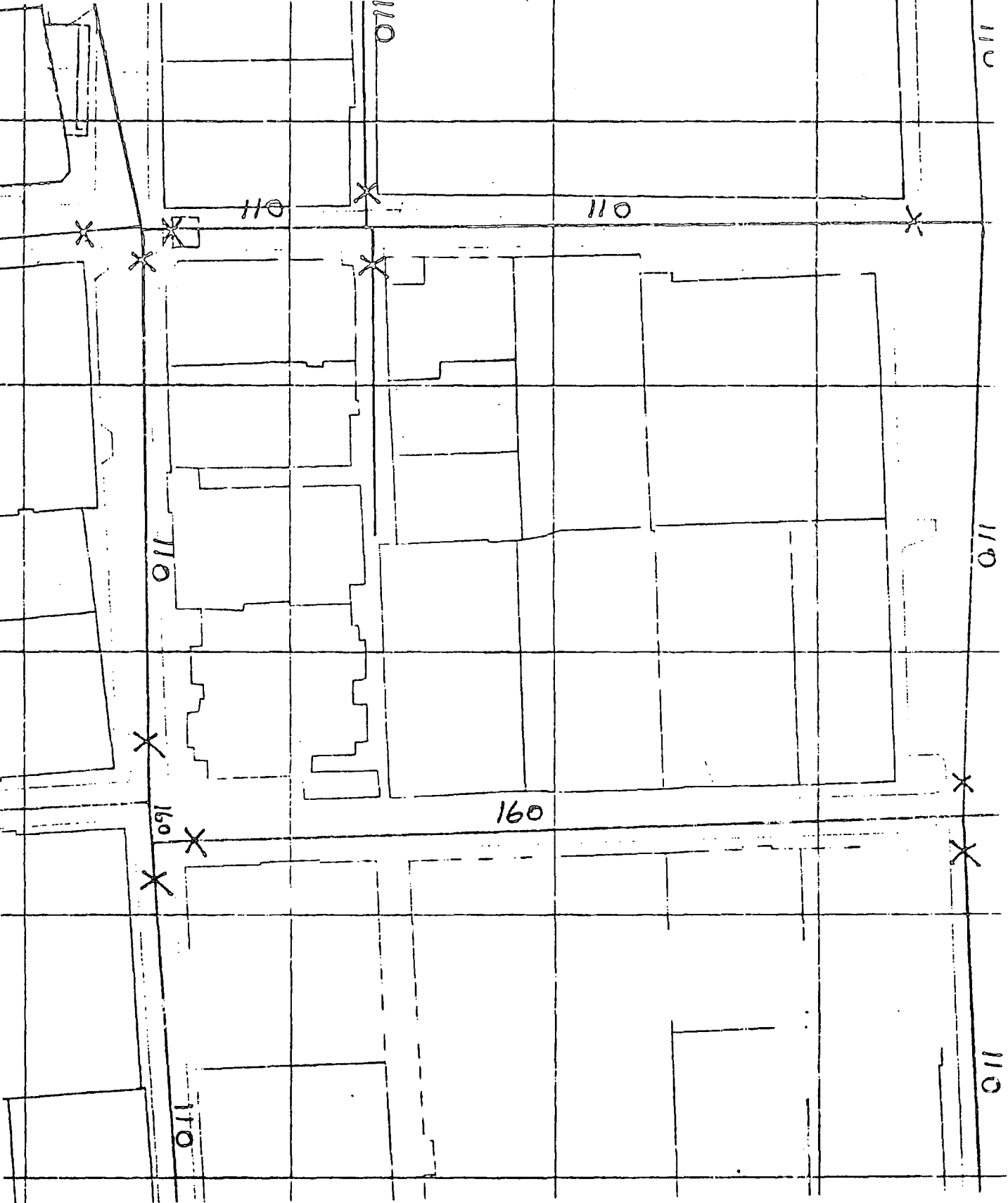
4.2.45 For the purpose of the Pilot Study, the utility information was re-drawn by hand onto separate copies of land use plots and road edges at 1:1,000 scale for each utility.

4.2.46 After the information was drawn on the 1:1,000 scale plans, the computer digitisation was prepared. A copy of each of the final plots of the utility information from the computer at 1:1,000 scale is shown in Figures 4.21 to 4.30.



الشكل 11 - 1
 عمليات مسح المرافق العامة : الكهرباء
 مقياس الرسم 1 : 1000

Figure 4.21
 UTILITIES SURVEY: ELECTRICITY
 Scale 1:1,000



Water Main _____ خطوط مياه رئيسية

Dia. in mm _____ القطر بالملم

Valve Pit  ثرفة الصمام

الشكل ١١-٢ Figure 4.22

عمليات مسح المرافق العامة : المياه

UTILITIES SURVEY: WATER

مقياس الرسم ١ : ١٠٠٠

Scale 1:1,000



شبكة مجاري رئيسية

Primary Sewage Network

شبكة مجاري محلية

Local Sewage Network

غرفة تفتيش رئيسية

Primary Manholes

غرفة تفتيش محلية

Local Manholes

محطة فح

Pumping Station

محطة رفع رئيسية

Rising Main

الشكل ١١-٣

Figure 4.23

عمليات مسح المرافق العامة : المجاري

UTILITIES SURVEY: SEWERAGE

مقياس الرسم ١ : ١٠٠٠

Scale 1:1,000

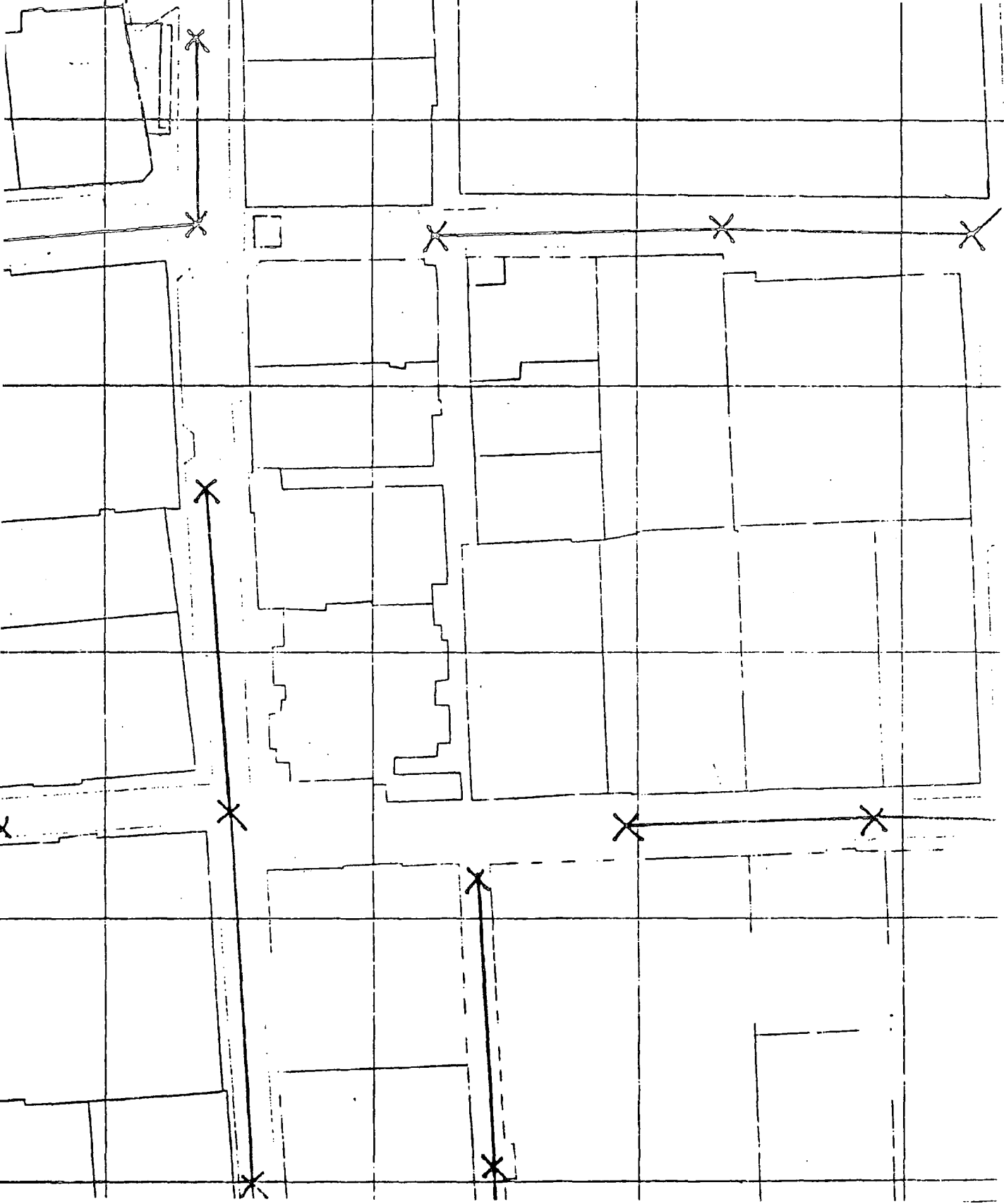


Figure 4.24

UTILITIES SURVEY: STORM WATER

Scale 1:1,000



مواسير هاتف ————— Telephone Conduit
 عدد الفتحات للكابلات 4 ————— No. of Wire Voids
 غرفة تفتيش X ————— Manhole

Figure 4.25

UTILITIES SURVEY: TELEPHONES

Scale 1:1,000

الشكل ١١-٥
 عمليات مسح المرافق العامة : الهاتف
 مقياس الرسم ١ : ١٠٠٠



خطوط ضغط ١١٠ كيلوفولت = 110KV Network

عدد كابلات ١١٠ كيلوفولت 2 No. of 110KV Cables

محطة تشغيل ١١٠ كيلوفولت 110KV Switching Station

الشكل ١١-٦

رسم كمبيوتر للمرافق - الكهرباء

مقياس الرسم ١ : ٠

خطوط ضغط ١٥ كيلوفولت 15KV Network

عدد كابلات ١٥ كيلوفولت 2 No. of 15KV Cables

محطات فرعية Sub-Station

Figure 4.26

UTILITIES COMPUTER PLOT: ELECTRICITY

Scale 1:2,500



الشكل ١١ - ٧

رسم كمبيوتر للمرافق - الم
مقياس الرسم ١ : ٢٥٠٠

Figure 4.27

UTILITIES COMPUTER PLOT: WATER

Scale 1:2,500



شبكة مجاري رئيسية — Primary Sewage Network
 غرفة تفتيش رئيسية — Primary Manholes
 محطة ضخ PS Pumping Station

شبكة مجاري محلية - - - Local Sewage Network
 غرفة تفتيش محلية — Local Manholes
 محطة رفع رئيسية - - - - - Rising Main

الشكل ١١ - ١٨
 رسم كمبيوتر للمرافق - الم
 مقياس الرسم ١ : ١

Figure 4.28
 UTILITIES COMPUTER PLOT: SEWERAGE
 Scale 1:2,500.



قناة رئيسية لتصريف مياه الامطار ————— Storm Water Main

الشكل ٩ - ١١

رسم كمبيوترى للمرافق : السيول

مقياس الرسم ١ : ٢٥٠٠

Figure 4.29

UTILITIES COMPUTER PLOT: STORM WATER

Scale 1:2,500



مواسير هاتف ————— Telephone Conduit
 عدد الفتحات للكابلات 12 ————— No. of Wire Voids
 غرفة تفتيش —○— Manhole

الشكل ١١-١٠

رسم كمبيوتر للمرافق : الهـ

مقياس الرسم ١ : ٢٥٠٠

١٥-١١

Figure 4.30
 UTILITIES COMPUTER PLOT: TELEPHONES
 Scale 1:2,300

UPDATING PROCEDURES:-

4.2.47 In this respect, the use of digitised base mapping tapes allows the updating of base mapping to be done by the computer to the same accuracy as the base maps themselves (this is achieved by the use of coordinates which give complete accuracy). An example of an updated base map is illustrated in Figure 4.31. This portion of a 1:1,000 scale map was updated following surveys carried out in January 1986 and should be compared with the figure illustrated which shows the same area mapped by Huntings from their 1984 air photography. The updated map shown in Figure 4.32 was submitted to the Survey Department for checking and approval, following which it was approved.

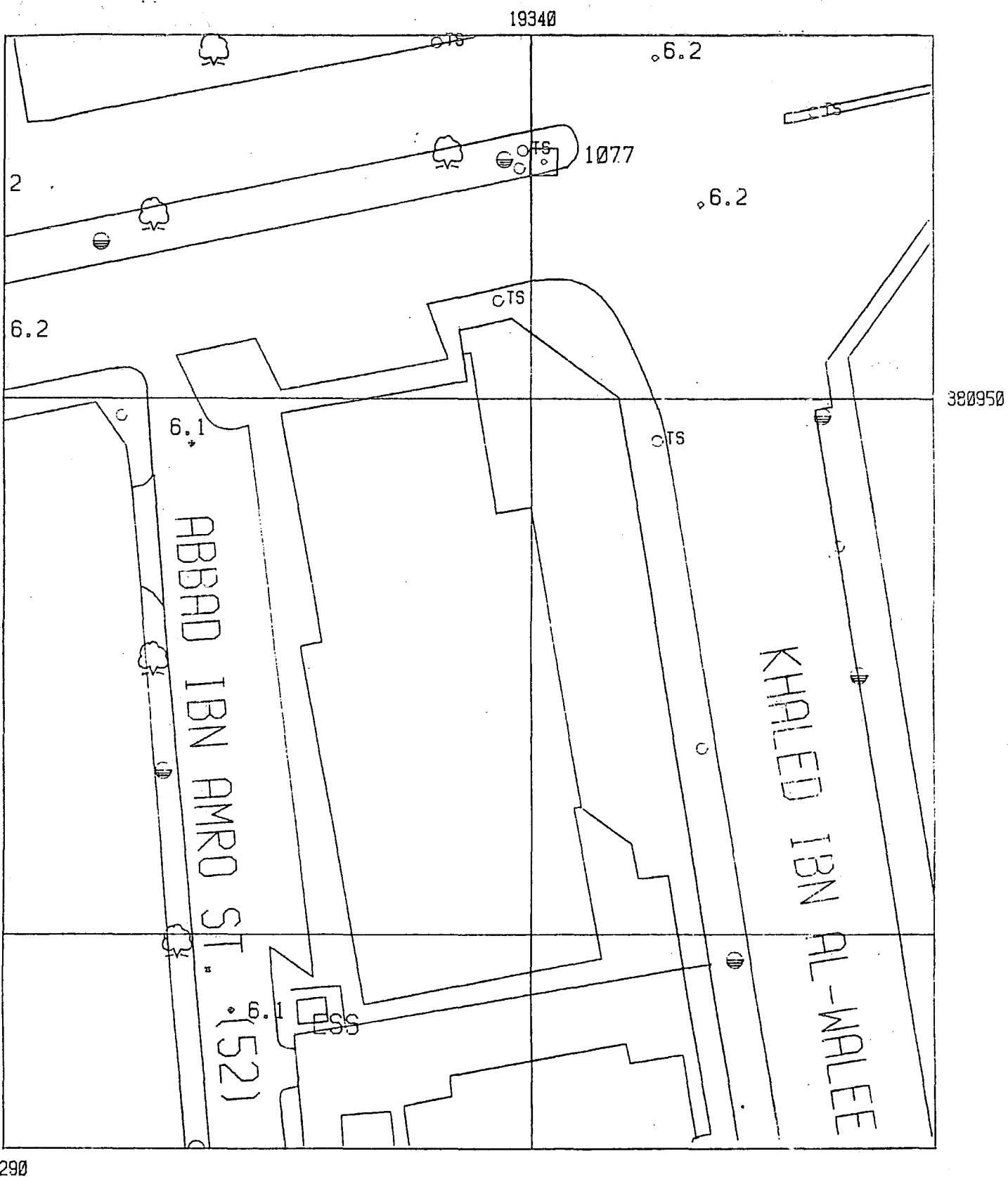
4.2.48 The updating of information which is a key element in the use of Technical Data Bank, requires very clear PROCEDURES so that ACCURACY and CONSISTENCY are achieved. There are two basic aspects to this:

1. Updating of BASE MAPPING
2. Updating of TECHNICAL INFORMATION

The recommended procedures which should be followed in both cases were set out as follows:

UPDATING PROCEDURES ONE: BASE MAPPING

4.2.49 This is a demanding and specialised task. The essential pre-requisite is that updated information

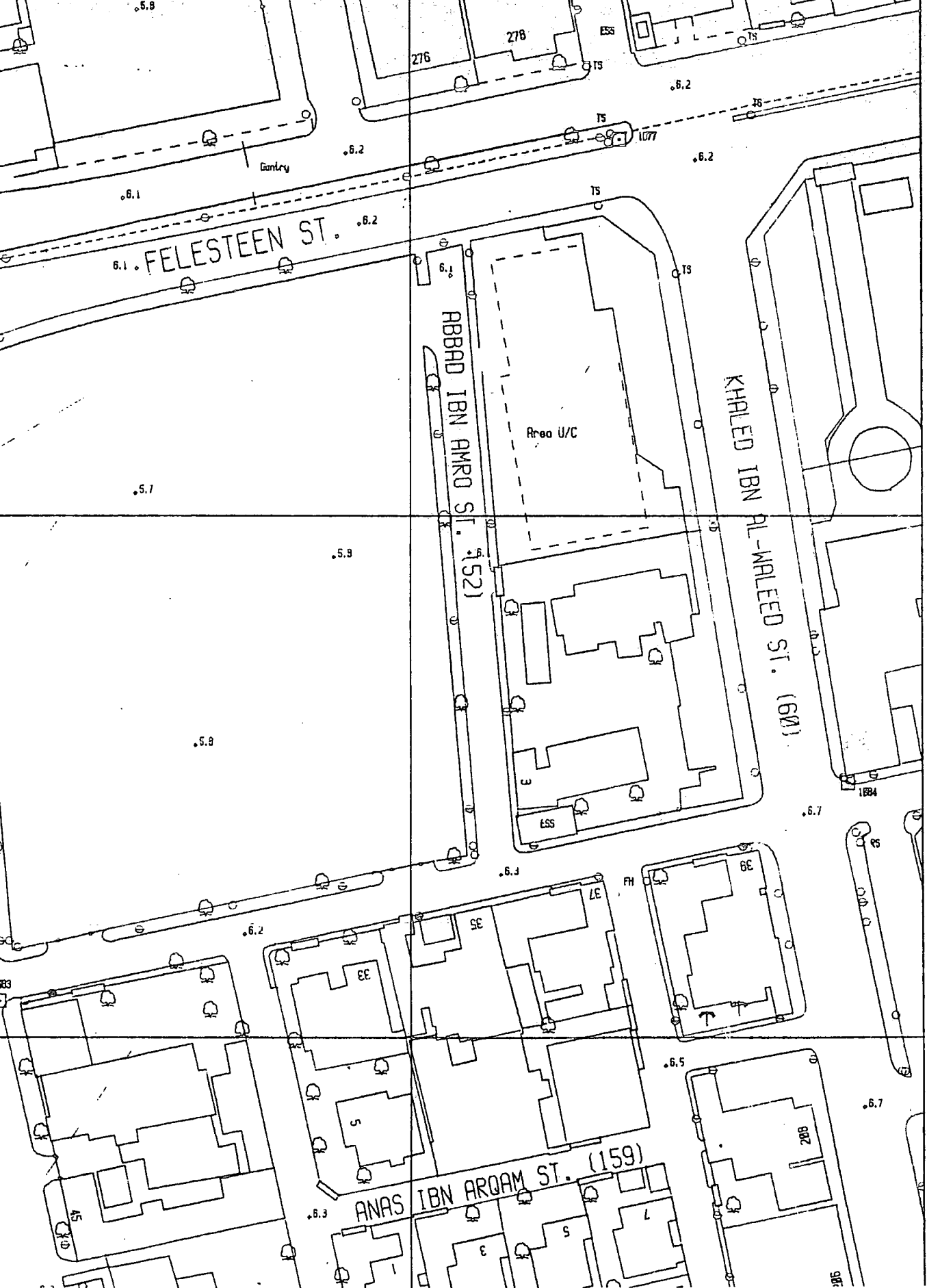


File Name : UPDATE

Scale 1 : 500

الشكل ١-١٥
مثال من اساس خريطة كمبيوترية
محدثة

Figure 4.31
EXAMPLE OF COMPUTER
UPDATED BASE MAP



الشكل ٢-١٥

خريطة من انتاج هنتينغ ١٩٨٤

مقياس الرسم ١ : ١٠٠٠

Figure 4.32

1984 HUNTING MAP

Scale 1:1,000

must be to the same accuracy as the base mapping on which the updating is performed. This means that any alterations or additions to the base map must be derived from;

1. Coordinates (for line control)
2. Datum (for level control)

The coordinates and datum used for the base mapping must be used as the basis on which updating is carried out. In the case of Jeddah, this is the Jeddah Cadastral Grid and the Trigonometric Control Stations established within that grid and to the datum established on the mapping.

4.2.50 Surveyors of the Survey Department are already responsible for the preparation of site plans for issuing with planning permits, and thereby ensure that these site plans are prepared in accordance with the Jeddah Grid coordinate control. It was therefore logical that the updating of base mapping should be the responsibility of the Survey Department.

4.2.51 The Survey Department has the responsibility to check and ensure that records of all new developments such as roads, buildings and street furniture or any other information recorded on the digitised base mapping are correctly recorded and mapped. All other Technical Departments should refer to the Survey Department for base mapping and the Survey Department

should be equipped to carry out this updating process.

UPDATING PROCEDURES TWO: TECHNICAL INFORMATION

4.2.52 Technical information is essentially those matters related to Land Use, Highways, Street Furniture & Public Utility Information. This information should be considered as "layers" of data superimposed on base maps.

4.2.53 The Studies Department, in consultation with the Deputy Mayor for Technical Affairs, has set out in a report the scope and methodology which is to be followed by the seventeen sub-municipalities, responsible for the collection and presentation of this data. At present, this information is presented manually, but the purpose of the TACIMS project, is to prepare this information for computer graphic presentation. Until this facility is available, the Studies Department will monitor and check that the sub-municipalities prepare their information accurately and consistently. The methodology which the sub-municipalities will follow, has been set out in a format making it possible for the accurate transposition of all this information on to the computer so that it can be attached to the computer base map.

4.2.54 A system has therefore been established which will:

1. Collect and prepare all the survey information by sub-municipality.
2. Have a methodology suitable for insertion into the TACIMS data base and then be capable of computer graphic reproduction at whatever scale and detail is required.
3. Computer programmes are prepared as part of the TACIMS scope of work. This information can be analysed and particular facets (e.g. location of schools or clinics or shopping centres) could be related to the Master Plan standard of provision or to local requirements for such facilities to ascertain the need or over provision related to the distribution and density of population they serve.

4.2.55 The sub-municipalities will be responsible for keeping this data up to date and should revise and resubmit survey information at, possibly, six month intervals. If significant changes have taken place over this period, then new base mapping has to be provided by the Survey Department and the technical information surveys updated on the new maps. The Roads Department are also participating in the

updating of technical information.

MASTER PLAN UPDATING PROCEDURES

4.2.56 It is usual to consider a full review of the Master Plan at five year intervals. To a large extent, this depends on the rate of change and growth of the city. From about 1973 to 1983, Jeddah witnessed a very high growth in population (from about 400,000 to 1,500,000 people) and in land area (from about 150 sqm. kms. to just under 1,000 sq. kms.) It is unlikely that this rate of growth will continue at the present or in the near future.

4.2.57 The two main basic elements of Master Plan updating were identified as:-

1. The Statistical Base
2. Highway and Land Use Update

A continuous updating of information related to these elements should be carried out, and prepared on digitised base maps, converted by the Computer to the Master Plan scale and immediately inserted into the Master Plan updating process.

MASTER PLAN STATISTICAL BASE UPDATE:-

4.2.58 The updating process must be constantly correlated to:

1. Demographic Information

2. Transportation Information

If the rate of growth of the city is rapid, then updating of information should be carried out at no greater than five year intervals, otherwise eight to ten years interval should be adequate. This information is related to family size and employment which can affect the Master Plan balance of population and employment when related to densities and housing types. Similarly an increase or decrease in car ownership or change in the level of public transport would indicate a need for a review of the Master Plan strategy.

4.2.59 It was possible, within this Pilot Area study, to review the Master Plan context for population resident within the area related to the existing situation as obtained from an assessment of residential density.

4.2.60 In 1971, the RMJMP Socio-Economic survey placed the population resident in the Pilot Area as 2,800. Figure 4.33 shows a 1:10,000 scale map of the area in 1971. By 1978, when Sert Jackson Int./Saudi Consult. Carried out their socio-economic survey, the population resident in the Area had increased to 5,000 people. Figure 4.34 shows, from the 1:10,000 scale 1978 mapping, how the built-up area had increased over this seven year period.



الشكل ٥/١٢

المنطقة التجريبية عام ١٩٧١

Figure 4.33

PILOT AREA IN 1971



الشكل ٦/١٧

المنطقة التحريية في عام ١٩٧٨

Figure 4.34

PILOT AREA IN 1978

4.2.61 The projected Master Plan ultimate population for the Pilot Area is 8,700 residents, (i.e. an increase of 3,700 over the 1978 situation). This is calculated from the High Residential Density of 150 persons per hectares zoned over most of the Area. From the amount of unbuilt land remaining in the Area, the Master Plan population for the Area can be maintained provided that part of the Area is zoned at a medium density of 100 p.p.h. This is required because the land zoned for commercial use in the Master Plan (i.e. the frontages to the Medina Road, Palestine Road West and Khalid Ibn Walid Street) has residential accommodation over the ground floor commercial use and thus the "capacity" of the Area, in population terms, is greater than the Master Plan allocation. To meet the Master Plan allocation, the use zoning should be as follows:

Residential (High Density of 150 pph)	11.54	Ha=1750 persons
Residential (Medium Density of 100 pph)	30.30	Ha=3050 persons
Residential over Commercial	39.03	Ha=3900 persons

i.e. Total Population = 8,700 persons

At an average family size of 5 (the average family size adopted by Sert Jackson for housing requirement estimates), this can be expressed in dwellings per

hectare as follows:

Residential (High Density of 30 dwellings/ha)
11.54 Ha = 346 dwellings

Residential (Medium Density of 20 dwellings/ha)
30.30 Ha = 606 dwellings

Residential over Commercial (20 dwellings/ha)
39.03 Ha = 780 dwellings

i.e. Total Dwellings = 1732 dwellings

Thus, in order not to exceed the Master Plan population allocated to this zone, the residential land use zoning should now be designated as Residential Medium Density.

MASTER PLAN HIGHWAY AND LAND USE UPDATE

4.2.62 In 1985, the Roads Department carried out a comprehensive review of the existing and proposed city highway network. The study indicated that considerable modifications were made to the Sert Jackson Master Plan as a result of their detailed highway engineering road studies being implementated. From the land use point of view, the Master Plan showed no significant change in residential development.

4.2.63 To illustrate how the updating of information on the Master Plan level can be inserted into the Master Plan updating process, the land use surveys carried out as part of this pilot study at 1:1000 and 1:500

scale, were aggregated, using computer programmes, to the Master Plan existing situation at 1:20,000 and 1:10,000 scale.

4.2.64 The pilot study demonstrated how it is possible to achieve a consistent methodology and appropriate format of presentation of information from 1:500 to 1:20,000 scale i.e. how, from detailed survey information, it is possible to re-process this to update a Master Plan. It also indicates how Master Plan targets are related to the existing situation and what steps should be taken to maintain the Master Plan population distribution for a given area or part of a city.

REFERENCE - PART FOUR

1. In order to store a map on a computer, it is necessary to convert the graphical representation onto a digital representation as computers can work only on numbers. Every point is given a unique identity in the form of a pair of numbers, called its coordinates.
2. The Consortium consisted of:
 - (a) Arabian Aerosurvey Company Inc.
 - (b) TCB Data Systems Inc.
 - (c) Engineer Raif A. Sadat

PART FIVE

PART FIVE : ANALYSIS AND EVALUATION

CHAPTER ONE: Specification for Jeddah Cleaning : Scope,
Evolution and Analysis

CHAPTER TWO: Evaluation of Jeddah Experience in City Cleaning

5.1. CHAPTER ONE: SPECIFICATION FOR JEDDAH CLEANING: SCOPE AND
EVOLUTION

5.1.1 As previously mentioned in Part Two, refuse collection and street cleaning in Jeddah during the Seventies and Eighties was performed by one of the following three methods:

1. Municipality using and managing own labour and equipment (1976-1981).
2. Appointing a national firm (1974).
3. Putting the comprehensive city cleaning task in a competitive tender open for international firms (1982-1992).

5.1.2 These three methods present a wealth of experience in city cleaning for the city of Jeddah, in particular, and the service industry in general. Progress in setting up, managing and monitoring each method reflects the increasing attention which both public and private sectors are giving to public health matters. The decision of the authorities concerned to change from one method of cleaning the city to another suggests a willingness to adopt the most suitable method, and to allocate the necessary funds in order to achieve higher standards in the field of city cleaning and environmental health.

5.1.3 Considering that the interest in urban cleaning in Saudi Arabia started as recently as the early seventies, the progress made in this field since then compares favourably with the progress achieved in other aspects of the urban growth of Jeddah, described in Part One. This progress is reflected in the wide scope of services specified by the Municipality for contractors during the seventies and the eighties. Factors which have been considered are the manpower and equipment requirements, the duration of the contract, the area to be serviced, and the ultimate cost of performing these services.

5.1.4 In order to instance such development and the extended range of services required from contractors, a comparison was made between the specification produced by the Municipality in 1974 (Dallah Contract), and in 1981 (first ACE Contract). A subsequent comparison between the specifications for the first and second ACE contracts reveals comparable changes introduced on the Municipality's initiative to improve contract management.

5.1.5. The following is a comparison between the specifications prepared in 1974 and 1981:-

1981 (first ACE Contract)

1974 (Dallah Contract)

a. Scope of Service:

- | | |
|--|--|
| 1. Mechanical street sweeping at regular intervals included for in contract. Increased or decreased according to street location and importance. | 1. Sweeping and cleaning of streets, open lots, alleys, markets, internal areas and transportation of collected material to main dumping places. |
| 2. Domestic refuse collection daily and twice daily in population density areas. | 2. Cleaning and flushing of vegetable, meat and fish markets. |
| 3. Twice daily collection of market refuse. | 3. Cleaning of markets and commercial centres 3 times daily. |
| 4. Collection of building rubble from streets and open lots. | 4. Cleaning of main roads twice daily and secondary streets once daily. |
| 5. Litter collection and manual sweeping (paper and cans etc.) from sidewalks and unasphalted streets at intervals depending upon street type. | 5. Transportation of refuse from dumping places to public incinerator for burning there. |
| 6. Operation and maintenance of | |

3 Transfer Stations as to
transport refuse therefrom
to Landfill.

7. Sanitary landfill of refuse
under Contract Specifications
in the designated location.
8. Scrap vehicle collection and
transportation from streets.
9. Removal of rain water
accumulations on streets.
10. Flushing of marble tiled
streets with water and soap.
11. Public toilet cleaning and
maintenance
12. Central Municipal buildings
cleaning and maintenance.
13. Monument cleaning once each
month.

b. <u>Contract Area</u>	<u>1981</u>	<u>1974</u>
	360 Sq.Kms	84.5 Sq.Kms.

Street Kilometers

Main Roads	711 Kms	Unspecified
20M and less wide asphalted	2160 Kms	
20M and less wide		

unaspalted	1500 Kms
Tiled streets and	
paths	13.5 Kms

Total	4384.5 Kms
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c. <u>Contract Equipment</u>	<u>1981</u>	<u>1974</u>
Rear End Loaders	200	28
Refuse Compactors	3	-
Shovels	36	1
Dozers	5	-
Grader	1	-
Scraper	2	-
Dumper Truck	37	7
Street Sweepers	79	8
Trailers	2	15
Suction Tankers	12	3
Water Tankers	17	-
Fuel Tankers	4	-
Container Carrying Vehicle	68	-
Abandoned Vehicle		
Transport Vehicle	8	-
Tractors	4	-
Trailer	4	-
Fuel Tanks	-	10
Monument Cleaning Truck	1	-

4 x 4 Vehicle	3	1
Beach Cleaner	2	-
Support Eqpt. & Vehicles	241	17
	----	----
	729	90
	====	====

d. Containers

Metal Containers:-

2 Cubic Yard	4,788
6 Cubic Yard	720
10 Cubic Yard	500

Total	6,008	unspecified	700
Trolleys	770	unspecified	400

Plastic Containers

50 Litre	2,010
60 Litre	96,791
80 Litre	50,100
240 Litre	34,136

Total	183,037	unspecified 100,000 capacity
-------	---------	---------------------------------

e. Duration:-

The contract duration for the 1974 Specification was limited to two years, whereas the 1981 specifications extended the contract period to 5 years. This reflects

a more realistic approach towards appointing a contractor for city cleaning functions, and indicates a better understanding of the nature of such operations. By monitoring the implementation of the 1974 contract, and studying the contractors performance, Municipal officials came to realize that 2 years was too short a period for any contractor to mobilize, start-up and achieve any positive results.

f. Mobilization Period:-

Following the decision to award ACE the first comprehensive contract for cleaning the city, a mobilization period of 6 months was offered to ACE for the purchase of the required equipment and the recruitment of 2,623 technically, skilled and unskilled personnel. A mobilization period was not included in the 1974 specification.

g. Contractor's Proficiency:-

In the 1974 specification, the Municipality did not require the Contractor to prepare a plan describing the operational, technical, maintenance and administrative methods, which the contractor intends to follow in order to achieve the main objectives of his contract. The absence of such plan made it difficult, if not impossible, for the Municipality to monitor the work of the

contractor, and assess his performance. As opposed to this the 1981 specification required that:

"The Contractor should submit with his bid the city general cleansing plan which includes the programme of implementation of street sweeping, cleansing and flushing, collection, transportation and disposal services of all refuse resulting from the city and cleaning of Municipality buildings and cleaning and maintenance of public bathrooms in the city and also the pest, rodent, mice, lost dogs control services program and removal of dead animals from the street under the regulations of public health".

The contractor was also requested to submit an annual operating plan which included methods of implementation of all above operations. This plan must be submitted 3 months prior to the commencement of the working year for municipal approval.

These requirements indicate the Municipality's increasing awareness of the administrative and technical skills required by the contractor to carry out his contractual obligations.

The Municipality also made sure that only those Contractors who could demonstrate their ability to undertake such a wide scope of services would submit their bids. This was achieved by requesting the prospective contractors to present qualifications, and evidence of proven ability for applying the most up to date sanitary methods for waste collection, disposal and overall city cleaning.

h. Monitoring and Supervision

In order to implement the full extent of ACE's first contract, the Municipality's own personnel had to be involved from the outset to ensure the smooth start up of the contract, and at the same time to monitor ACE's performance of the biggest contract of its kind. A special Central Technical Committee (CTC) was established to ensure ACE's compliance with the contract requirements, and also to act as a liaison between the Municipality (Mayor of Jeddah and his deputies) and ACE. No such arrangements were provided for in the 1974 contract.

5.1.6. Specifications for 1982 and 1987 Contracts

Two years before the end of ACE's first contract, the Municipality's Central Technical Committee proceeded to prepare specifications for the second 5 year contract. While the 1981 specifications were adequate in broad terms, the Municipality decided that some modifications should be introduced in order to avoid the negative aspects observed during the implementation of ACE's first contract. The most significant change was made to the method of payment but the contract boundary was also

changed to take account of the expansion of the city that occurred since the first specification was prepared. A comparison between the main aspects of the two specifications is outlined below:

a. Scope of Service

Scope of work broadly covers the same services for both specifications. Several services have been slightly amended to meet the Municipality's requirements such as the inclusion of fountain cleaning and maintenance. Similarly, the new specification does not include the operation of the municipal workshop. Street maintenance services were included only as an optional item which could be taken up or otherwise by the Municipality (1).

b. Contract Area

1981 Specifications

Covers an original area of approx. 36,000 hectares, bounded by the sea in the west, the New Airport in the north, Makkah in the east as far as Kilo 17 on Makkah Road, and the Industrial Zone in the south. However, the area was reduced afterwards to approx. 28,000 hectares.

1986 Specifications

The boundary contains the whole city, taking in consideration future growth possibilities. The area extends the current contract boundary to include Ubhur area, South Corniche, Old Airport area, Prince Fawaz Housing Project, Iskan, Buraiman, Um Al Salam and Makkah Road as far as Kilo 21. Total contract area including the New Airport and street areas amounts to 83,000 hectares. (Note: Area of New Airport is around 6,500 hectares).

c. Facilities

Contract included construction of Worker & Family Housing, Admin Building, Mosque, Kitchen areas, Clinic, Laundry, Warehouses and all relevant facilities necessary for the operation thereof.

Existing compound and maintenance facilities will be used. Contractor is required to establish a new low cost transfer station and to propose and implement a plan for the establishment of a new landfill or the expansion of the existing one.

d. Equipment

All equipment was purchased by the Municipality on delivery. Contractor will continue using new, and the price was paid many items of the existing equipment, and should provide the following new items:

Equipment includes: 150 large RELs, 50 small RELs, 2 Compactors, 17 large Shovels, 5 small Shovels, 5 Dozers, 1 Grader, 1 Scraper, 37 Tippers, 40 Street Sweepers, 5 Trailors, 12 Suction Vehicles, 17 Tankers, 50 Container Loaders, 1 Goods Loader, 4 Units for abandoned car removal, 2 Trailors, 1 Tractors, 14 Mobile Repair Vehicles, 4 Fuel Tankers, 25 Large Buses, 5 Small Buses, 120 Small Pickups, 1 Fire Vehicle, 2 Ambulance Vehicle, 95 units were added to the original bills of quantities of the contract.

150 Large RELs, 60 Small RELs, 50 Sweepers, 35 Roll-on-off Trucks and other vehicles of various types needed to replace existing vehicles.

e. Method of Payment

This was an area where significant changes were made to 1981 specifications. Part Three included a detailed description of the method by which the Municipality paid ACE for performing the required services. Instead of the elaborate method of payment based on Bills of Quantities, the new specifications provided payment for services and installations on the basis of a fixed price, paid on 60 equal instalments. Payment for equipment being made upon delivery.

5.2. CHAPTER TWO: EVALUATION OF JEDDAH'S EXPERIENCE

IN CITY CLEANING

5.2.1 Worldwide, there is an increasing tendency towards privatizing city cleaning operations. In the United Kingdom strong recommendations were made towards extending competitive tendering to a wide range of local authority services and activities(2): In the United States of America, a study prepared 10 years ago indicated that the number of cities that have private firms collecting some of their residential refuse is twice as large as the number that have municipal collection of at least some refuse(3). This number has increased since this study was commenced. In 1981, a compilation of International Municipal Cleansing Contracts indicated that such contracts were being performed for cities in Argentina (Buenos Aires and Cordoba), Venezuela (Caracas, Maracaibo and Valencia), Saudi Arabia (Riyadh and Jeddah), Kuwait and Nigeria (Lagos) (4). These contracts were serving 12,750,000 people at a cost of US\$ 1,911,000,000. In 1984, approximately 375,000 residents of Brisbane, Australia were added to the list of people served by private contractors. (5)

5.2.2 While many private contractors, as mentioned in 5.2.1 above, are performing waste collection and disposal services all over the world, ACE's work in Jeddah had a unique scope of services and circumstances, which makes it difficult to compare to any other private contract of this

type. The most obvious of these differences are:

1. The inclusion of many additional services, which have no direct relation to street cleaning and refuse collection services.
2. The extent of such services and their frequencies.
3. The inclusion of substantial construction requirements such as the construction of fully equipped camps, to house all employees, and provide accommodation for administrative, maintenance and operational services.
4. The use of entirely foreign manpower in performing the contract obligations.

5.2.3 Another unique factor is the fact that the Saudi Government provides these extensive services completely free of taxation or any other form of municipal charges. Therefore, any cost-benefit to the individual is immaterial, and consideration in this regard is given only to the financial advantages or disadvantages to the local authority concerned, i.e., the Municipality of Jeddah as agent for the Ministry of Municipal and Rural Affairs.

A. Financial Aspects

5.2.4 Statistics indicate a significant reduction in costs of refuse disposal to the community when the work is carried out by a private contractor, based on a competitive tender. A report produced by the Institute of Fiscal

Studies indicated that where services have been tendered for, costs were lower by broadly 20% than where they had not been the subject of a bid. The same report indicates that there was no evidence to suggest that these cost savings have been achieved at the expense of a deterioration in the quality of service provided to householders (6).

5.2.5 In order to present an objective financial evaluation of the Jeddah experience in providing cleaning and waste collection services to its inhabitants, a comparison will be made between the costs of these services performed before and after these services were subjected to the tendering process. A further comparison between the costs of the first and second ACE Contracts should offer additional evidence for this evaluation.

5.2.6 The available information for the first contract awarded by the Municipality in 1974 to a private contractor (Dallah Corporation), indicates that the total contract value, for two years, was SR 21,020,020. This amount, was however, paid to the Contractor against cleaning 34.5 square kilometers of the city, compared to 360 square kilometers and 4384.5 kilometers of roads and paths specified for Jeddah's first comprehensive cleaning project in 1981. Furthermore, this price was only for street sweeping and refuse and rubble collection services. Dallah's contract will however, not be

included in this evaluation due to the lack of precise details regarding the breakdown of services. It would also be difficult to present a realistic financial evaluation for 1974 prices after such a long interval of time.

5.2.7 Following the completion of Dallah's two years contract, the Municipality decided not to extend the contract due to dissatisfaction with the general standard of cleanliness of the city during those two years and operational difficulties in implementing the contract. The Municipality therefore decided to take over the operation, and subsequently mobilized both manpower and equipment for the purpose. The performance of the Municipality was similarly unsatisfactory.

5.2.8 Available records at the Municipality's finance department provides the following information about costs incurred by the Municipality in performing cleaning services for the year 1981-1982 (1401-1402H), which was the year preceding the commencement of ACE Contract: (Table 5.1).

Table 5.1.

Worker Salaries	SR 140,000,000
Maintenance of Cleansing Equipment & Spare Parts	14,000,000
Cleansing Management Staff	3,000,000
Pest Control Materials	2,000,000
Fuel Costs	2,000,000

Total Costs	SR 161,000,000

5.2.9 The total value of ACE's first contract with the Municipality of Jeddah was SR 1,379,887,335 for 5 years.

Table 5.2 indicates that this sum was made up as follows:

Table 5.2	<u>SR</u>	<u>% of Total</u>
a] Cleaning and Vehicle Maintenance	792,630,884	57.5%
b] Street Maintenance Cost	227,933,570	16.5%
c] Construction Cost (Camps,	204,933,380	14.9%
d] Spare Parts	41,373,501	3.0%
e] Equipment, Vehicle Cost and Plant	112,516,000	8.1%
	-----	-----
Total Contract Value	1,379,387,335	100%

5.2.10 The above analysis indicate that only 57.5% of the total contract value was allocated for cleaning services and vehicle maintenance. It is however imperative, that the range of services included in this contract (refer to paragraph 4.2.5) are taken into consideration when evaluating these costs.

5.2.11 The annual cost of cleaning and vehicle maintenance in ACE's first contract was SR 158,526,176.8. This allocation, however, was subjected to a mandatory 15% reduction applied to all operation and maintenance projects in 1985. As a result, the cost of this item for 1985 and 1986 becomes SR 134,747,240.

5.2.12 The total value of ACE's second contract 1987 was US\$ 135,209,000.00. The rate of exchange at the time of

awarding contract was US\$ 1 = SR 3.75, which brings the total contract value to SR. 507,033,750.00. This contract, however, did not include street maintenance, further camp construction or other substantial operations.

5.2.13 Table 5.3 indicates the breakdown of services in ACE's second contract (1987-1992) and their relative costs in US\$:

Table 5.3.

<u>Service</u>	<u>SR</u>	<u>% of Total</u>
1] Refuse Collection, Sweeping and Pest Control Services	84,258,000	62.32%
2] Vehicle Maintenance	14,838,000	10.97%
3] Municipal Facilities Maintenance (offices, fountains and public toilets)	3,091,000	2.29%
4] Site and Supporting Services	29,576,000	21.88%
5] Others (Aerial photography, inventory, public awareness and transfer station construction)	3,446,000	2.54%
	-----	-----
Total	135,209,000	100%

5.2.14 The combined annual cost of refuse collection services, vehicle maintenance and municipal facilities maintenance amounts to US\$ 20,437,400 (SR 76,640,250). This represents 56.8% of 1986 price of performing those services.

5.2.15 (Table 5.4) summarises the annual cost to the Municipality of waste collection and street cleansing operation between 1981-1988 and indicates the gradual decrease in cost for performing these services:

Table 5.4.

<u>Operator</u>	<u>Year</u>	<u>Annual Cost</u>	<u>% Decrease in Contract</u>	<u>% Decrease compared to 1981</u>
MOJ	1981	161,000,000.00		
	1982	158,526,177.00)		
	1983	158,526,177.00)	1.53%	1.53%
ACE Contract 1	1984	158,526,177.00)		
	1985 ⁶	134,598,574.00)		
	1986	134,598,574.00)	15%	16.39%
ACE Contract 2	1987	76,640,250.00	43%	52.39%
	1988 ⁷	76,395,750.00	0.3%	52.55%

5.2.16 The above table clearly demonstrates that since 1981, there has been a gradual decrease in the cost to the Municipality for providing waste collection and street cleaning services. In 1988, the cost of providing comparable services to the Municipality was 52.55% less

than those incurred by the Municipality in 1981. The most significant decrease in price occurred in 1987 when the contract was readvertised, and the resulting prices were 43% lower than 1986 prices for the same services.

B. Social Aspects and Attitudes

5.2.17 A great improvement has been achieved in living standards in the Gulf Region since the 1973 oil boom. This has been reflected in better public and social services, housing and environmental conditions, generally. The tremendous growth in economic activity, coupled with the shortage of locally available manpower able to carry out construction and services projects has produced a new social phenomenon of the expatriate labour force.

5.2.18 This situation continued during the Seventies and through the Eighties. In Jeddah, almost all construction and services manpower was non-Saudi. When ACE signed their first cleaning contract for Jeddah, it had to rely entirely on foreign manpower, at all levels of their organization. The result was a mixture of people coming from diverse cultural backgrounds, working, living, and spending their leisure time within a newly constructed compound.

5.2.19 Within the ACE organization, four main cultural groups could be identified: Arab (Saudis, Yemenis, Jordanians,

Palestinians, Lebanese, Sudanese, etc..), Western (U.S. and British), Indian and Sri Lankan. There were also four main religions associated with these cultures: Moslems, Christians, Hindus and Buddhists. There are, however, many sects, denominations and sub-cultures within these four main groups, e.g. Sunnis and Shiites (Islam), Brahmin, Kshatriya, Shoodra and Vaishya (Hindu), and Govigama and Karawe (Buddhism).

5.2.20 This presented ACE with a difficult problem because the characteristics of each cultural group and their attitude towards each others beliefs and life style varied to a great extent. The management of ACE had also to consider other differences such as religious worship, language, attitude to work, time, authority, family, education, diet etc. Furthermore, there are sub-cultures within the main cultures where attitudes again may differ i.e. not all Indians are Hindus and neither are all Sri Lankans Buddhist. Not all Arabs are Muslims.

5.2.21 English was accepted as the working language of ACE, but some difficulties of understanding and communication were encountered due to the wide difference in educational attainment of the different personnel concerned.

5.2.22 One of the difficulties encountered through the American oriented management of ACE was the fact that Indian and

Sri Lankan, and to a certain extent some Arab employees did not understand the Western culture, and that for historic reasons, the perception of the British sub-culture by Indians and Sri Lankans was greater than that of the American sub-culture. It was therefore necessary, to create an intermediate group of managers and supervisors, who understood and appreciated both cultures. Thus most people recruited for such positions were either British, or Indians (Sri Lankans) with a British educational background.

5.2.23 It was essential for ACE, that an effective system of management should be established at an early stage of the contract start up. In spite of all the external pressures of starting a project of this magnitude, and the internal difficulties created by the composition of the team, the ACE management structure, earlier described appears to have been adequate and well suited to the management of the operation.

C. Local Attitudes

5.2.24 With the exception of the nominal religious tax or tithe of Zakat, the Saudi government provides extensive services free of any other taxation or municipal charge. This principle has been accepted by the Saudi government since its foundation. All public services, except electricity and water are provided without charge.

5.2.25 Naturally this has been appreciated by the citizens, but meanwhile it has created an attitude of complete reliance on government help, which has resulted in a gradual weakening of individual responsibility towards the community services provided by their Government.

5.2.26 Refuse collection and city cleaning was one of the services that suffered most as result of this attitude. This situation was also made more difficult due to the lack of any legislation treating litter as a punishable offence. Needless to say, only a minority of citizens acted in such an irresponsible manner but unfortunately their action was enough to spoil the good image of the city, and as a result extra effort was needed to achieve the high standard of cleanliness desired by the Municipality.

5.2.27 Both the Municipality and ACE became heavily involved in an intensive public awareness campaign to ensure that the main objectives of ACE work were made known to all sections of the community. Newspaper advertisements, T.V. commercials, special leaflets and books were produced by ACE for this purpose. The most important and effective aspect of this campaign, however, were the school programmes previously described. These programmes proved to be very successful, and it was rewarding to see the

enthusiasm and the interest shown by children of all ages participating in these programmes.

5.2.28 In spite of the success of this campaign, it was obvious that there remained the need for legislation which would contribute towards the protection of the environment, in general, and the cleanliness of the urban areas in particular. The introduction of legislation ensuring the proper enforcement of this policy has proved to be the only solution to the declared aim of a clean city.

5.2.29 One negative aspect of ACE's operation is related to the continuous presence of containers provided by the Municipality in all parts of the city. This results in those containers remaining full of refuse in the streets for at least 12 hours and becoming an unsightly feature of most streets in the city. This problem was caused by specifying communal containers, rather than individual receptacles stored inside the property until the collection time.

5.2.30 In specifying collection by this method, the Municipality might have decided that it had more chance of success than any other. The individual container system will nevertheless require a massive public awareness programme to ensure that citizens comply with the requirements to place their individual containers outside their doors when

collection is due. Another reason for the selection of communal containers could be the Municipality's acceptance of the importance of privacy in the Moslem society. Communal containers ensure that refuse collectors and municipal inspectors do not intrude on private property.

D. Additional Advantages to the Municipality

5.2.31 There are many other positive results achieved during ACE's work in Jeddah. The most obvious one was the general improvement in the environment, public health and awareness of the newly acquired urban aesthetic. There are, however, many other indirect contributions made by ACE both to the city and to the Municipality itself.

5.2.32 Prior to awarding the cleaning contract to ACE, the Municipality was responsible for recruiting, supervising and providing all administrative support services for about 6,000 workers. Obviously this was an administrative burden for the Municipality, and created a constant pressure on its financial and human resources. ACE's contract relieved the Municipality from time consuming services such as the recruitment of manpower, travel arrangements, obtaining residence permits, following up accidents resulting from cleaning operations, and other tedious administrative obligations.

5.2.33 The introduction of computer mapping techniques to the technical departments became one of the Municipality's major priorities. There was, however, an obvious shortage of skilled personnel able to carry out the required work. Chapter Four of this thesis described ACE's contribution towards the setting up of a computer mapping system for the recording, updating and retrieval of information (CAMPUS).

5.2.34 Another priority of the Municipality was the provision of sculptures and monuments at the main road intersections, roundabouts and service points along the sea front. The objective of the Municipality was to create a series of recognizable landmarks throughout the city, by which certain locations could be easily identified. ACE decided to participate in this effort, and presented the city with a monument called "PEACE", created by the well known American artist, L. Nierman. This monument is a much larger replica of that kept at Waste Management Inc. Head Office in Chicago (Fig. 5.1).

5.2.35 In another move to assist the Municipality in its efforts towards erecting monuments and sculptures, ACE used its skilled staff and well equipped workshops to rebuild many abandoned and unused cars for use by the Municipality in various ways. Two early aircraft were also rebuilt and mounted at one of the major roundabouts north of Jeddah.

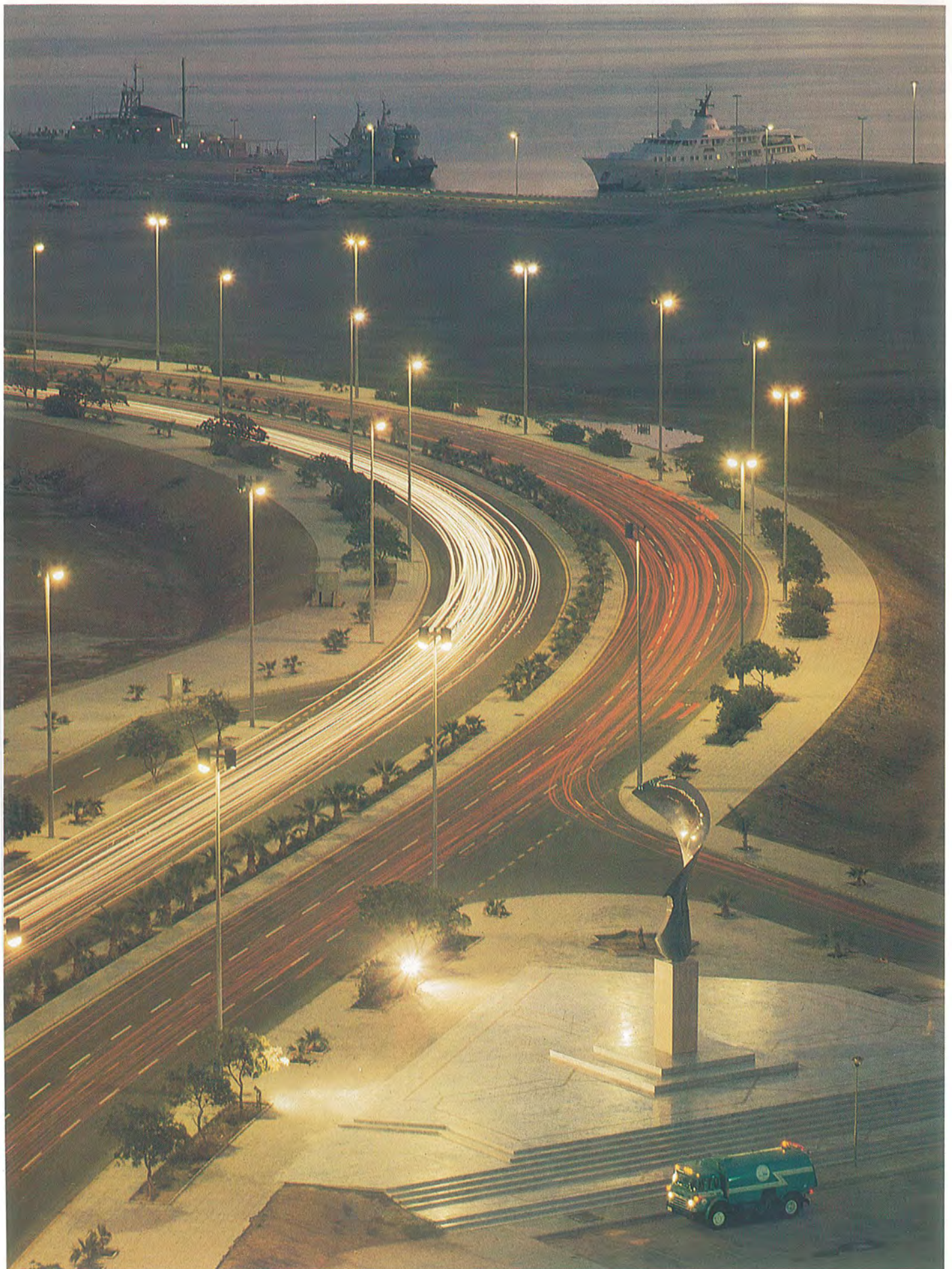


Fig. 5.1. Peace Monument

5.2.36 ACE financed and assisted in setting up the first and the most elaborate fireworks display in Jeddah to celebrate the end of Ramadan, the Holy Month of Islam. The sea-front location for the display was selected jointly by the Municipality and ACE so that maximum number of citizens and residents were able to participate in this traditional celebration.

REFERENCES - PART FIVE:

1. This item was eventually dropped from the specification, and was tendered separately.
2. DOMBERGER, MEADOWCROFT AND THOMPSON, Competitive Tendering and Efficiency: The case of refuse Collection, Fiscal Studies, November 1986.
3. COLUMBIA UNIVERSITY, PUBLIC TECHNOLOGY, INC. AND THE INTERNATIONAL CITY MANAGEMENT ASSOCIATION, Evaluating Residential Refuse Collection Cost, Washington D.C.; Public Technology, 1978.
4. HOLMES, J. R., Managing Solid Wastes in Developing Countries, John Wiley & Sons Ltd., London, 1984.
5. In 1984, Waste Management Queensland began providing residential collection service to half the City of Brisbane, under a seven year contract.
6. See reference (2) above
7. 15% reduction applied.
8. Municipal maintenance services were reduced by 50%

PART SIX

PART SIX: SUMMARY AND CONCLUSIONS

Waste is a Global Problem

- 6.1 Waste is being produced in ever increasing quantities by the world's population, in both developed and developing countries. Waste management is therefore by nature a global problem, but like many other management orientated problems it has no universal solution. By examining different locations and societies, one can conclude that every society or city has its own unique socio-economic mix, and therefore needs a system "tailor made" to its own physical and economic environment.
- 6.2 In the past, waste collection and disposal services have not received the attention they deserve as one of the main municipal services affecting the environment and the standard of public health. Clearly there is a growing awareness of its importance in many parts of the world and most municipal authorities are taking measures which while varying in their nature, are indicative of local authority concern for this matter.
- 6.3 The solutions presented towards waste management problems in the developed and industrial countries have made use of advanced technology and modern mechanical equipment. Combined with efficient administration and increased

public concern with the environment and public health. Waste management in developed countries has presented a variety of methods, and allocated substantial resources to deal with the problem.

6.4 Meanwhile, solid waste management, as an urban service sector has, received scant attention and low priority in developing countries. As a result, the service is often available only to those resident in the more affluent areas of cities in the developing countries. Low-income, highly populated urban communities are rarely provided with any waste disposal facilities or services.

6.5 The term "developing country" covers countries with wide variety of economic and social conditions. In this work, we have examined the experience of Jeddah, second largest city in Saudi Arabia, and the most important port on the Red Sea. The oil producing countries, as a consequence of the immense fortune they earned during the oil boom, lie within the top range of the "developing countries". The oil-rich nations can afford to improve their public services and use capital intensive methods in providing such services. By contrast the poorer developing countries, do not place public cleaning services high in their priorities, due to their limited financial resources. They rely on labour intensive methods

to provide services, such as waste collection and disposal.

Waste Disposal in Jeddah

6.6 In the case of Jeddah, the Municipality's choice of capital intensive methods in providing city cleaning services was due to:

- a) availability of financial resources
- b) lack of indigenous and local manpower

The combined factors of financial resources and the presence of a dynamic and ambitious administration within the Municipality initiated an unprecedented cleaning contract, with a scope of services that included additional items. Expenditure on this contract became the single highest ever in a service contract of this kind.

6.7 The comprehensive cleaning contract changed the overall appearance of Jeddah, and when coupled with massive landscaping and extensive urban development, acquired for Jeddah its reputation as "The bride of the Red Sea". The cost of this work, however, was high, and Jeddah was fortunate in being able to rely on the favorable economic conditions that prevailed during the late seventies and early eighties.

6.8 Saudi Arabia has pioneered the process of "comprehensive cleaning", and the results achieved in Riyadh, Jeddah and other cities of the Kingdom are remarkable. There are however some negative aspects of such experience, that can only be rectified by studying the experience gained from ACE's implementation of the two major cleaning contracts in Jeddah. Some of these negative aspects are of general nature, such as social attitudes towards cleaning functions, and others are of particular significance such as treatment of refuse and its by-products. Negative social attitudes were discussed in paragraphs 5.2.24 - 5.2.30, where it is concluded that such negative attitudes could be rectified by enforcing certain legislation regarding the protection of the environment, and the maintenance of the street cleanliness, supported by a massive public awareness programme.

6.9 Other particularly negative aspects such as the treatment of waste disposal sites and waste by-products, have not yet reached a critical stage. However, if these aspects are not properly addressed in the near future, they will eventually become a nuisance to the authorities concerned.

6.10 It may appear to the outsider that there is plenty of unused land available in Jeddah, and that, the Municipality of Jeddah should not therefore be concerned with shortage of landfill sites. This is not entirely true as most of the sites suitable for this purpose are either no longer owned by the Municipality or cannot be used for this purpose due to various restrictions. The vast and fast urban growth that occurred in Jeddah deprived the city of most of the potentially suitable sites for future landfill operations.

6.11 This problem, however, is not peculiar to Jeddah. Most of the urban centers in the industrial world are in the same situation. According to a report published by the Washington based Worldwatch Institute, half of all towns and cities in the United States will fill their existing sites by 1990.⁽¹⁾ The Institute warns that municipal authorities around the world face similar problems.

6.12 The same report indicates that in the USA, the cost of burying household waste (90% of all waste is buried in the USA) is increasing at an astonishing rate as suitable sites run out and local authorities are forced to pay more for land to be used as landfills. The authorities in the city of Philadelphia now pay \$ 90 a ton to dispose of waste as opposed to \$ 20 seven years ago.

- 6.13 The above discussion can lead to the following conclusion: While there seems to be no immediate problem regarding disposal sites, measures should be taken to utilise the waste generated by the inhabitants of Jeddah. The long term problems of providing adequate space for landfilling, should be addressed now and alternative methods of disposal must be explored.
- 6.14 Limited efforts have been made to use the waste collected and disposed off at the landfill in Jeddah. One establishment was granted permission to collect paper and cardboard from the landfill. Another company was conducting a feasibility study for recycling rubber from used tyres dumped at the landfill. However, no major efforts, at a national level have been exerted to look at the possibility of recycling waste materials nor have the public and private sector been encouraged to recycle waste materials whenever it is economic to do so.
- 6.15 There are no indications that the idea of using waste to generate energy in Saudi Arabia is forthcoming. Oil provides the Kingdom with its requirement for energy at very economical prices. At this stage therefore, direct delivery of waste to the landfill is the most economic and practical way for its disposal. However, public and private sectors should be encouraged to review the scope of reclaiming waste materials, such as reject bottles,

roll ends of newsprint and scrap from cars, and to identify recycling possibilities for materials of this kind.

6.16 The rate of generating methane gas inside the Jeddah landfill is low due the prevailing climatic conditions (hot and very scarce rain) and the large quantities of non-organic materials dumped at the landfill, (rubble, sand, wood, etc.) However the methane, which is generated by micro-organisms as they break down the organic materials present in waste tips, must eventually be collected, vented or flared if landfilling is to continue as the main method of disposal. The collection of methane in Saudi Arabia is not economically viable, but for safety reasons, the next cleaning contract for Jeddah (No. 3) must include measures to check and to control the generation of this gas.

6.17 The Jeddah experience in providing city cleaning services indicates many obvious advantages gained by the Municipality as a result of putting such services to competitive tender, and awarding the contract to a private contractor. It may be argued, however, that the unique circumstances of Saudi Arabia, especially the vast economic resource that became available as a result of the oil boom, made it possible for cities such Riyadh, Jeddah

and Makkah to contemplate such an extensive and elaborate service.

6.18 While recognizing the vast difference in economic power and levels of expenditures between Saudi Arabia and other third world countries, many lessons could still be learnt by these countries from the way the Jeddah Municipality formerly managed its own waste collection and disposal. Waste disposal authorities in such countries should look closely at this operation, and attempt to benefit from this unique experience. For example, operational and landfill management are two practical aspects of great importance to the success of any waste collection operation, and their success is more dependent on human skills than economic resources.

6.19 The first Jeddah contract, comprised of three main parts:

a] basic waste collection and disposal

b] additional services and activities, such as municipal building cleaning, computer mapping, public awareness, etc.

c] road maintenance

While the contract, as a whole achieved many positive results, some municipal officials argued that the expanded scope of services provided by the contract was not essential to the cleaning process. This argument was strongly supported when budget allocations for city cleaning were reduced during the fiscal years 1985, 1986, 1987. As a result, the Municipality decided to keep the basic waste collection services intact, and reduce or cancel the additional services, without affecting the underlying cleanliness of the city.

- 6.20 With the road maintenance element already excluded from the second contract, the drastic reductions and changes introduced to the original 1982 contract are becoming increasingly obvious. The general feeling within the Municipality is that, even if there was an upturn in economic activity within the Kingdom, Jeddah is not likely to see another contract of similar scope, magnitude or cost as that of the 1982 contract.

REFERENCES - PART SIX:

1. MOORE, T., Throwaway Society runs out of room,
The Sunday Times - 5 April 1987.

APPENDICES

APPENDICES:

- Appendix A : List of Directions and Regulations related to Municipal Refuse Collection
- Appendix B : Solid Waste Management Facilities - Siting Criteria
- Appendix C : Summary and Frequency of Tasks Required by ACE to Perform as outlined in the Contract
- Appendix D : Waste Management Inc.
- Appendix E : Contract between Municipality of Jeddah and Dallah Corporation (7.8.1974)
- Appendix F : Definition of Refuse - MOJ's Specification-1981
- Appendix G : Bill of Quantities - Area and Prices Reports.

APPENDIX A

APPENDIX A: LIST OF DIRECTIONS AND REGULATIONS RELATED TO
MUNICIPAL REFUSE COLLECTION

<u>Number</u>	<u>Date</u>		<u>Subject</u>
	<u>Hijra</u>	<u>Gregorian</u>	
713/S	24.10.1387	24.1.1968	Directions to Municipalities to increase their cleaning efforts
922/S	21.11.1389	28.1.1970	Penalising owners of flooding cesspits
366/S	21.05.1391	14.1.1971	Steps to be taken by Municipalities at the beginning of Summer
395/S	10.03.1395	12.3.1975	Improvement of level of cleanliness by Municipalities
544/S	01.06.1395	10.6.1975	Use of plastic bags
202/S	18.03.1396	19.3.1976	Establishment of Environmental Health Department at Municipalities
643/S	08.05.1398	15.4.1978	Request of excessive cleaning labors by some Municipalities
280/3/S	28.4.1399	27.3.1979	Employment of foreign labors
17/3/S	04.01.1402	1.11.1981	Refuse collection from areas outside cities boundaries
299/3/S	14.03.1402	09.1.1982	Labor housing - sanitary conditions
964/WZ	24.11.1402	12.9.1982	Specification and condition of cleaning works
2217/3/S	25.12.1403	2.10.1983	Directions for killing of stray dogs

Source: Regulations and directions related to Environmental Health - Saudi Arabian Municipalities.

Issued by: General Directorate - Ministry of Municipal & Rural Affairs - 1985

Number : 366/S

Date : 21.5.1391

Subject : Circular

As the Summer is due to start soon, and usually brings different diseases spread by flies, water and foods, and as cholera has been detected in some neighbouring countries, and as we wish to improve public health level and health awareness among citizen; each municipality should strictly take the following procedures :

1.
2.
3.
4. Shopkeepers should be instructed to place small steel or plastic containers with tight lids for garbage disposition. Any person who disposes of his garbage in front of his shop or on public streets will be penalized.
5. Cleaning Department should be instructed to increase its efforts in order to achieve speedy collection of garbage and complete incineration thereof at municipal incinerators.
6.
7.
8.
9.
10.
11.

Number : 713/S

Date : 24.10.1387

Subject : Circular to All Municipalities and Governorates

It has been recently noticed that some, if not most of municipalities are neglecting street cleaning in their cities and consequently garbage is left for days or weeks to produce bad odours and cause spread of flies and mosquitoes which in turn spread diseases. This problem has been a subject of complaint by citizens and authorities.

Since the budget allocated for city cleaning at most of municipalities is not small then the matter requires only more attention and care by municipal cleaning departments. It has been observed also that these departments do not cooperate with the environmental health departments and sometimes interfere with their work, no matter how frequent the city is sprayed, accumulations of garbage on the streets and alleys for long time will breed new generations of flies and mosquitoes which will make the efforts of environmental health department as useless.

Therefore, each sub-mayor is fully and solely responsible for the cleanliness of his city and to improve sanitary condition in it within his capabilities. He is also responsible for any employees negligence and is supposed to penalize those negligent employees or refer them to us for application of penalties.

Deputy of Interior Ministry for Municipal Affairs

Abdullah Al Sudairi

Number : 922/S

Date : 21.11.1389

Subject : Circular to All Municipalities and Governorates

Due to repeated complaints by some municipalities regarding some citizens who leave their cesspits overflow in the public streets which result in the defacing of the area and causing health hazards despite warnings issued to them. Such cesspit owners should be penalized when they fail to repair, empty or change their cesspits as directed by the Municipality for public interest. If necessary, the municipality can repair or empty the cesspit and claim double the cost from the owner.

Our previous circular No. 252/S of 20.2.1389 should be strictly carried out without toleration.

Minister of Interior

Fahd Bin Abdulaziz

Number : 366/S

Date : 21.5.1391

Subject : Circular

As the Summer is due to start soon, and usually brings different diseases spread by flies, water and foods, and as cholera has been detected in some neighbouring countries, and as we wish to improve public health level and health awareness among citizen; each municipality should strictly take the following procedures :

1.
2.
3.
4. Shopkeepers should be instructed to place small steel or plastic containers with tight lids for garbage disposition. Any person who disposes of his garbage in front of his shop or on public streets will be penalized.
5. Cleaning Department should be instructed to increase its efforts in order to achieve speedy collection of garbage and complete incineration thereof at municipal incinerators.
6.
7.
8.
9.
10.
11.

- 12 Owners of overflowed cesspits should be instructed to empty their cesspits within 24 hours; otherwise, municipality should do the necessary on their behalf and claim double the cost from them as per the Circular of Minister of Interior No. 922/S of 21.11.1389.
- 13 Each municipality should provide vehicles necessary for Environmental Health Department and Cleaning Department, even if such vehicles are withdrawn from other departments on a temporary basis.

Deputy Minister of Interior

Nayef Bin Abdulaziz

Number : 395/S

Date : 20.4.1395

Subject : Circular to All Municipalities and Governorates

Due to low level of cleanliness recently noticed at most of municipalities, especially that the Summer season has come with increasing numbers of flies and other insects; each Mayor should be accounted responsible for improvement of cleanliness level within his municipality area and should develop with his employees a daily work programme for this purpose to be under his daily personal supervision for strict implementation.

Governorates have been provided with copies of this circular for supervision and evaluation of cleanliness level. Responsibility for any negligence will be the Mayors in the first place.

Minister of Interior Affairs

Nayef Bin Abdulaziz

Number : 544/S

Date : 1.6.1395

Subject : Circular

1. As the Summer season has arrived, with multiple number of flies, and due to non-response by most of shopkeepers and hotels to deposit their refuse in containers with lids, causing spread of flies, rodents, cats, dogs, bad odours and fires; municipality is responsible to instruct those people to deposit all types of refuse in plastic bags to be thick enough to cope with the type of refuse. These bags should be left in front of shops for collection by municipality workers or transferred to nearest dumping site assigned by the municipality. In the event of any violation, penalty is 2 days in jail as per article 112 of Roads & Buildings Regulation. Employees of Environmental Department should be accounted responsible for negligence or failure to advise the offenders. Mayors also shall bear major part of responsibility as they should carry out inspection tours every day.
2. It has been observed at some municipalities that cleaning workers incinerate garbage collected at dumping places in residential areas in order not to transport it thereof to public incinerator. Since this practice is against public health principles and could be hazardous to houses, such incineration is completely forbidden and garbage should be transported to public incinerators on a progressive basis.
3. Governorates should follow up execution of these instructions and refer to us any violation to take the proper action against Mayors and their employees.

Minister of Interior Affairs

Nayef Bin Abdulaziz

Number : 202/S

Date : 18.2.1396H

Subject : Circular to All Municipalities and Governorates

In reference to Circular # 298/S of 10.4.1394 and Circular No. 504/S of 29.5.1394 concerning consolidation of Health Division, Cleaning Division and Market Control Division under Municipality Environmental Health Department and under one manager, it has been reported that the divisions of cleansing and markets are still working separately.

For reasons of public interest and in order to consolidate all efforts, each Mayor should instruct manages of Health Division, Cleaning Division and Market Division to report to the Environmental Health Department Head technically and administratively, and to receive instructions and directions from him. Mayors who do not promptly implement these instructions will be responsible for the delay.

Minister of Municipal & Rural Affairs

Majid Bin Abdulaziz

Number : 280/3/S

Date : 28.4.1399

Subject : Circular to All Municipalities & Governorates

In reference to the letter of HRH Minister of Interior No. 5/118 of 6.4.1399 addressed to HRH Minister of Municipal & Rural Affairs concerning bringing the wives of cleaning workers into the Kingdom, we advise that the following are the relevant regulations :

1. Regulations prevent bringing such workers with their families.
2. Recruitment of workers with families and children is to be avoided.
3. Regarding workers already in the Kingdom, only families consisting of wife and 2 children are allowed.
4. Workers with families of more than 3 members, should be repatriated.
5. Cleaning of big cities can be awarded to national or mixed companies to assume cleaning, bring workers and provide them with accommodation.

Deputy Minister for Technical Affairs

Dr. Sulaiman Al-Hamdan

Number : 17/3/S

Date : 4.1.1402

Subject : Circular to Municipalities and Directorates

Some municipalities deposit refuse at locations near the cities and on public street sides for incineration which causes thick smoke and bad odour. Due to bad effects arising from this practice such as impeding traffic movement by smoke and possibility of causing fire, you are requested to observe this matter, and inform your municipalities to observe this in the future by collection of refuse at places far from cities to be sanitarily buried or completely incinerated. In the meantime, refuse currently deposited should be removed.

Deputy Minister, Technical Affairs

Dr. Eng. Sulaiman A. Al-Hamdan

Ref : 643/S

Date : 8.5.1398

A Circular to All Sub-Municipality and Rural Compounds

From : The Minister of Municipal & Rural Affairs

To :

Cleansing problem is the most important matter which confronts the Municipalities and Ministry and it is the measure with which citizens weigh the municipality performance.

Upon studying this problem and investigating its reasons, the Ministry observed exaggeration by municipalities in requesting to increase the numbers of workers on cleansing and other operations' item. It also noted dissimilarity in number of workers of a municipality and another despite their similar areas, population and other circumstances, which leads to believing that such requests do not have an actual basis.

As the large numbers of workmen, mostly foreigners, constitute a big burden in addition to the moralistic problems they cause and as the amounts allocated to cleansing and other operation items are specified by the budget decree and they are difficult even impossible to be exceeded on many occasions besides the embarrassment caused to the municipality and ministry by the procedure for such requests, the ministry suggests that this problem be overcome and number of workers be decreased by the following :

1. To use the machine in cleansing works such as small vehicles and dumpers which have access to alleys and internal areas by means of one worker as refuse could be easily collected in a short time.
2. To urge your Environmental Health Department to guide citizens and make them aware of the proper methods of refuse disposal.

3. To encourage citizens to use plastic bins or bags for collection of their refuse and placing it outside the door every morning so that the Municipality could collect it in the method described in Section 1 above.

A Ministry committee will shortly conduct comprehensive survey and field study to investigate the situation and determine actual requirement of each Municipality.

For information and compliance herewith.

Regards,

Minister of Municipal & Rural Affairs

Majed Bin Abdul-Aziz

Number : 299/3/S

Date : 14.3.1402

Subject : Circular to Municipalities and Directorates

Reference is made to the letter of Deputy Minister, Labor and Social Affairs No. 579/6/1 of 3.6.1401 enclosing the minutes issued by the committee consisted of Director General, Health Affairs, Eastern Region; Director General, Labor Office, Eastern Region; Director General Social Insurance; Director General Municipal & Rural Affairs, Eastern Region and Director General Water and Drainage, Eastern Region. This committee was formed to study company housing situation in the region, on the light of information published on "Al-Yaum Newspaper" about had sanitary and housing conditions relating to some workers. Since the above Committee recommended to establish the necessary specifications and conditions for worker housing and since the Minutes stated that some city cleaning contractors do not abide by health conditions at accommodation provided to cleaning workers, and since the committee suggested that the Ministry of Municipal and Rural Affairs should establish such conditions and specifications relating to cleaning worker housing, to be set forth in the contracts in order to bind contractors.

Therefore, we attach to you a copy of the same. You are requested to review and observe these conditions in contracts.

Acting Minister, Municipal & Rural Affairs

Abdulaziz Al-Khuwaiter

Sanitary Conditions for Contractors Accommodation Assigned
For Manpower and Cleaning Workers

Cleaning Contractors undertake to provide accommodation with the following sanitary conditions :

1st: Location :

Location of housing should be appropriate, exposed to fresh air, far from environmental pollution sources/Landfills/Slaughter houses/Cemeteries/Ponds/Drainage disposal areas/Treatment plans - etc.

2nd: Constructional Specs :

1. Accommodation and utilities thereof should be constructed of traditional materials. Shacks are prohibited. If built of bricks or stones, buildings should be plastered and painted as per current technical standards.
2. Floors should not be finished by earth or surfaced with stones but should be covered with evenly laid tiles or similar item.
3. Ground floor and internal lanes should be wide enough for ventilation. Minimum width is 6 m. but not less than 2/3 of height of buildings on sides and should be paved or tiled and void of holes.
4. Accommodation should consist of housing units; each contains sleeping rooms, separate dining area, area for food preparation (kitchen), area for clothes washing and toilet, containing hand washing basins, lavatories and showers. Internal wall and ceiling height should not be less than 275 cms.

3rd: Co-relation between housing unit size and number of occupants :

1. Average of 15 m³ of sleeping room and minimum of 5 m² of floor area should be allocated for each worker.

2. Natural lighting and ventilation should be sufficient inside the rooms which should be provided with windows to open on streets or space. Minimum area of one room windows should not be less than $\frac{1}{6}$ of floor area. Windows should be distributed amongst 2 opposite walls and provided with shutters.

4th: Utilities :

1. Accommodation should be provided with running fresh potable water, either connected with the main supply or to a local one. In the latter case water network should be connected to a raised, tight reservoir made of stainless material, void of growing mosses or fungus. The tank should have proper ventilation, not exposed to air dust, provided with fresh water properly treated with chlorine, chemically and bacteriologically examined to insure its validity for personal and drinking uses. In case a ground reservoir is used for storage of water, this water should be raised to overhead tanks. This reservoir should be far from sources of ground water or drain water. Walls should be solid, smoothly finished and provided with tight ceiling and lid.
2. Accommodation should be provided with sanitary s
ewers to discharge used water. Maintenance should be carried out to prevent overflow. Final disposal place should be far enough from potable water sources and ground tanks.
3. Each housing unit should be provided with number of lavatories, showers and wash hand basins to comply with the number of occupants, as follows :
 - (a) Separate lavatory with door for each 6 occupants and one shower inside a separate cabin with door and heater for each 8 occupants.
 - (b) Wash hand basins with running water tap for each 8 occupants. In areas where it gets cold in winter, warm water should be provided from a heater inside the bathroom.

- (c) Each unit should have a space for cloths washing provided with basis for cloths washing at average of 1 basin for each 4 persons, to be equipped with a tap connected with water heater.
 - (d) Plumbing and sanitary fixtures for toilets should meet technical standards; lavatories should have discharge tanks (siphons), ventilation pipes, and taps for washing basins, ground sinks of bathrooms and washing basins. Toilets, bathrooms, lavatories and cloths washing places should have enough wide windows which open to the streets or open space.
 - (e) Contractor is responsible to maintain water closets and fixtures and keep them always clean and provided with fresh water round the clock. Contractor should assign workers for this task who should replace the damaged items.
- 4. Housing should be provided with electrical network fed by continuous current for lighting and operation of various electrical systems.
 - 5. In areas where average temperature of 35°C is prevailing or temperature comes down in winter to 10°C, housing units should be provided with sanitary air-conditioning system such as desert air-conditioners as well as water coolers. Contractor is responsible to properly reconnect the power or repair the above systems in case of damages.
 - 6. Contractor is responsible to organize daily cleaning operation for inside and outside the houses, to remove the refuse away on daily and progressive basis and assign sufficient number of workers to carry out this task.

Conditions & Specifications for Environmental Health Works Tender
(Cleaning & Public Health Protection)

1st: Purpose of Tender :

In compliance with the rules of the Government Purchase Law and its Executive Regulation the Municipality (or Directorate) announces its wish to arrange a tender for town cleaning and public health protection therein, within the following conditions and specifications :

2nd: General Conditions :

1. Bidder should be sufficiently aware of the town conditions, possibilities of development and population increase according to its boundaries shown on the plan available with the Municipality, and to be aware of the works contained in the Tender before proposal submission. Bidder is responsible for its proposal sufficiency so that to consider contract value comprising all work requirements such as materials, equipment, manpower, systems, etc.
2. Proposal should be accompanied by a preliminary operation programme which includes method and programme of work (map if possible) as well as numbers of employees, technicians, unskilled workers and reserve manpower, in addition to numbers of necessary vehicles, systems and equipment. Such programme shall be subject to any amendments the work may need, upon the municipality's approval.

If the Municipality intends to identify a minimum number of labor, it should add the following sentence to the previous paragraph :

"To be known that worker number from all categories should not be less than ().

3. Contractor is considered responsible for accidents and any damages caused to persons, property or works by him or any of his workers or employees

or agents working for him in the implementation of contract, and he is responsible to compensate the municipality against any claims resulting from such accidents and damages.

4. The tender and contract are governed by the rules of Government Purchase Law and its Executive Regulation. Labor and Social Insurance laws shall be applied to the contractor's manpower, in addition to the observed regulations and instructions. Contractor and his manpower shall be subject and respectful to the country customs and traditions.
5. Workers must be free of diseases and disabilities which may prevent them from performing their work, and must be enjoying good health to enable them exert effort and activity required by the work.

3rd: Scope of Work :

1. Work covers () city and environs, as per its boundaries drawn on the plans available with the Municipality. (Description to be clearly and punctually made for scope of work, areas, markets and environs included in the tender).
2. Contractor is considered responsible also for cleaning main roads leading to the city as per the following distances : (names of streets and distances thereof which the contractor is required to clean should be identified, if the same was not mentioned in the above item).

4th: Contractor's Duties and Obligations :

- a) Collection of all types of garbage, refuse, dust and rubble including scrap household furniture, equipment and vehicles from streets, sidewalks, parks, yards, hotels, cafes, restaurants, groceries, bakeries, workshops, commercial stores, etc., and from popular neighbourhoods and extensions as well as schools, general departments, public parks, vegetable/fruit markets, animal markets, public markets of all types, slaughterhouses, parking areas for vehicles/public transportation/goods

transportation, and from refuse containers. All this to be carried out twice daily at least in the morning and evening, so that to keep all above areas void of any dirt or refuse accumulations on streets and, public markets and lanes on a permanent basis - to including Fridays and official holidays - then to transport the previously mentioned refuse and others to the public incinerator (or the place assigned by the Municipality) by closed vehicles. Precautions should be taken to insure that refuse will not be scattered on the streets. The transported refuse mentioned above should be incinerated after saturation with diesel or kerosine (or any other material recommended by the Municipality), and then buried on a daily basis at the assigned location.

- b) Sweeping and washing of floors at all markets, particularly animal/meat/fish markets, twice daily, round the week as well as spraying thereof with disinfectants and insecticides every day.
- c) Cleaning and washing of all refuse containers and spraying thereof one time at least per week, with insecticides and disinfectants.
- d) Hauling of all trailers assigned for refuse disposition from their assigned locations to the public incinerator twice daily, round the week for emptying and cleaning thereof. The same should be cleaned with water, soap and disinfectants and sprayed one time per week at least with insecticides.
- e) Cleaning of slaughterhouse, slaying areas and surroundings with water, soap and disinfectants; and hauling of incinerator refuse twice daily by emptying its cesspits on a regular basis. Slaughterhouse should be also sprayed with insecticides and any rodents and dogs available there should be controlled.
- f) Permanent cleaning, maintenance and disinfection of public toilets and bathing areas by permanent workers; provision of water when main source is cut and emptying cesspits thereof. Maintenance means repair of taps, wash basins, tiles, floors, ceramic, siphons, sprays and water pumps whether damage has been existing on contractor's taking over the work or occurred within the contract period.

Number : 964/WZ

Date : 24.11.1402

Subject : Circular to Municipal & Municipal Directorates

Attached is copy of draft contract, conditions and specifications which can be applied by all municipalities in cleaning contracts where contractors do not provide their own equipment or building (as in Riyadh and Jeddah). This draft contract can be used in case the contractor use his own equipment, which stays his own at the end of contract period, as currently conducted by municipalities.

You are requested to study the same and submit your comments before holding the next seminar for municipal officials.

Acting Minister, Municipal & Rural Affairs

Sulaiman Al Saleem

appropriate by Municipality. This should be clearly stipulated to avoid any dispute between the contract parties. Specifications for containers handcarts and other types of systems and equipment may also be included.

2. Bidder should point out in his proposal the value of insect/rodent/dog control operation including labor, pesticides, systems, fuel and necessary vehicles, and should include his proposal a declaration that if such pest control operation is awarded to other party, then this section of the contract will be withdrawn from it against deduction of its value from the Contractor's dues without any right for compensation.
3. Contractor should carry out under the Municipality's supervision a numbering system for each type of vehicles, equipment and containers.
4. All equipment, vehicles, tools, technicians, normal and other workers and all operation requirements should be ready before the contractor receives the work.
5. Contractor should consider all cleaning container item such as dustbins, drums, handcarts and the like as consumables which will be the Municipality's property upon expiry of contract period.
6. Contractor should provide worker uniforms (overalls) in colour. These uniforms should be clearly marked on the back by the name of the Municipality. Each worker should wear a badge, as per Municipality's specification.
7. Contractor should assign an office equipped with a telephone and manned by a competent employee, to open from 0600 to 2200 hours, and should also assign a communication employee to receive the Municipality departments directions.
8. Contractor should submit schedules equipment, vehicles, systems and other items allocated to the work, and the same may not be changed or withdrawn without prior approval from the Municipality.

- l) Removal of earth, sand, tree cuttings and foil from streets and sidewalks.
- m) Collection of dead animals and transportation thereof to the incinerator to be burnt and buried at 1 meter deep minimum after treatment with chemicals and disinfection of their places.
- n) Treatment of liquid refuse dumping places with lime-chlorine powder and spraying thereof with insecticides.
- o) To control harmful insects at streets, government offices, schools, markets, mosques and slaughterhouse, Contractor should apply insecticide treatment, at least twice weekly, according to an operational plan approved by the Municipality. Contractor should use the following insecticides and disinfectants as per concentrations approved by the Municipality. (Insecticide types and characteristics - etc., should be identified by Municipality Environmental Health Department).
- p) Utilization of proper toxic baits with sufficient precautions to control stray dogs and rodents.
- q) Cleaning and washing of locations assigned for washing of dead people bodies and prompt transportation of remaining items (in tight plastic bags) to incinerator for saturation with diesel and burying.
- r) Cleaning of all beaches located within the work area from litter, cans, paper, all refuse, wood items and others, on a permanent basis.
- s) Cleaning of pilgrims areas and removal of refuse thereof of whatever type, twice daily. (This item concerns only those municipalities which have pilgrims facilities.)

Notes :

1. Municipality may add other duties to be assumed by the contractor, and methods of refuse collection from houses may be changed as deemed

- g) Collection of household refuse is twice daily, morning and evening (or one time if deemed sufficient by the Municipality), through placement of large containers with lids (plastic or steel as assigned by the Municipality) in front of each residential unit (or group of units if approved by the Municipality) for deposition of household refuse. Such refuse can be collected from the household drums placed by residents in front of houses at the times assigned by the contractor. It should be known that the number of residential units in the city and environs is () minimum and in the case of increase of such units, contractor is responsible to provide the required number. Contractor is required also to wash, disinfect and spray the containers with insecticide at least once a week.
- h) Spraying of non-asphalted streets and lanes with water (frequencies to be clearly identified either per day or week).
- i) Suction of cesspits of houses, establishments, companies and various types of groceries (supermarkets & normal). In this, contractor is responsible to warn the owner of the flown cesspit by a written notice (form to be drafted by the Municipality). The cesspit owner signs a copy of the notice as receipt to empty his cesspit within 24 hours, and if he fails to do so, contractor will promptly empty it without waiting an authorization from the Municipality, and its dues will be collected from the owner through the Municipality and police. In realization of this, the municipality will announce the effectiveness date of such arrangement several times through media and district Umdahs (local representatives). This operation should be carried out at night.
- j) Removal of building rubble which should be carried out by contractor according to the above arrangement.
- k) Discharge or suction of water accumulated on streets, yards, lanes and depressions for whatever reasons including rain water.

9. Working hours and all duties required from the contractor, morning and evening, summer and winter, shall be identified by the Municipality provided that working hours will not be less than 10 hours per day.
10. Contractor should take in his consideration that incineration of garbage at any place or in any container (except at the incinerator or location assigned by the Municipality) is strictly prohibited, and contractor shall be responsible for all claims and damages arising from fire occurrence for any reason. Without releasing the contractor from his responsibility, he should in the case of fire, to promptly extinguish it by all means at his own expense.
11. Contractor may not assign the contract or part thereof without prior approval from the Municipality, although the contractor shall remain jointly responsible with the assignee.
12. Contractor shall be responsible to notify the Municipality of health hazardous conditions met during work.
13. Contractor should use Saudi makes and products as far as such items meet the purpose of his work.

5th: Minimum materials, Equipment, Vehicles and Manpower to be provided by the contractor, in addition to the items provided by the Municipality, are according to the following section (6th) :

Contractor is required to provide the following items as minimum and to increase such items as per work requirements and to carry out the same as required :

(Note: If the Municipality has nothing to provide, only the items to be provided by the contractor will be mentioned).

This section should define the items to be provided by the Contractor such as :

1. Monthly provision of washing materials, disinfectants, pesticides, dog/rodent toxic baits, equipment and instruments necessary for using thereof, sweeping brushes, rubber squeegees, steel rakes, powder soap, etc.
2. Schedule of sufficient manpower necessary for implementation of all contractual works.
3. Schedule of vehicle numbers, types and specs.
4. Schedule of sufficient number of refuse containers/trolleys and handcarts as per specifications circulated to municipalities or prepared or approved by municipalities.
5. Provision of fuel necessary for vehicles, equipment and pest control equipment.
6. Provision of houses with a sufficient number of dustbins with lids, as provided in paragraph "G" of section (4th).

(Note: It is preferable that municipality defines minimum labor, machinery, equipment, systems, etc., to have a reasonable comparison among proposals.)

6th: Municipality's Obligations :

If the Municipality has any vehicles, machinery and equipment which can reduce the contract value, the same should be provided as follows :

1. The Municipality provides the contractor with its vehicles, equipment and machinery detailed as follows (numbers and specifications to be mentioned).
2. Contractor undertakes to provide drivers, fuel, maintenance and necessary spare parts required for the above items, and to redeliver them to the municipality at the end of contract in their original condition, taking

into consideration the effects of normal wear and tear. Delivery and recovery of above items should be through a technical committee.

3. The Municipality will define to the contractor, locations of refuse collection and locations of liquid refuse disposal as well as location and area of the public incinerator.

7th : Control, Evaluation and Penalties :

To insure work implementation according to the conditions and specs, the municipality should appoint inspectors to supervise work progress and submit reports to the Head of Environmental Health Department who will send a monthly detailed report to the Mayor including the warnings and necessary deductions for approval by the Mayor.

When the contractor fails to remove the garbage and refuse, or fails to carry out the condition provisions within the determined period, the Municipality has the right to warn him. In the case of delay beyond 6 hours, the municipality will carry out the work at the contractor's expense and in the method deemed proper. Costs shall be deducted from his monthly dues in addition to the following deductions :

1. Deductions of 1% of contractor's monthly dues against each of the following violations :
 - a) Failure to remove earth, paper and tree cuttings from one or more streets.
 - b) Failure to remove papers, cardboards, timber items and scrap, ovens/airconditioners/washing machines to incinerator site.
 - c) Failure to have all workers wear uniforms everyday.
2. Deduction of 2% of contractor's monthly dues against each of the following violations :

4. Deduction will be repeated with the repetition of violations, whatever the number be in each month, with observation of provisions of above items.

If the violation was not rectified by the Municipality or contractor for any reason after issuing warning notice, penalty would be doubled consecutively each day as long as violation continues to exist, providing that such deduction will not exceed 10% of the contract annual value. However, in case of violation repetition or if penalties exceed 10% of the contract value, then the Municipality reserves its right to withdraw the work from the contractor, and to implement the work at Contractor's expense according to the rules of Article 29 of Executive Regulation of Government Purchase Law.

5. In addition to penalties defined in the above item, a limited amount will be deducted from the Contractor's dues against the cost of any shortage in labor, machinery, vehicles or equipment as outlined in the following schedule.

S.No.	Description	Unit	Deduction for each non-provided item	
			Per Day	Per Month
1.	Brush	One	SR 1	SR 30
2.	Squeegee			
3.	Cleaning Worker etc.			
4.	Supervisor			
5.	Driver			
6.	Vehicle			
7.	Shovel			
8.	Container			

(This schedule should include all items to be provided by the contractor monthly or for the whole contract period.)

- a) Failure to clean and wash refuse dustbins, containers and vehicles.
- b) Delay of refuse removal from containers, trolleys and streets.
- c) Failure to suck slaughterhouse cesspits.

3. Deduction of 3% at Contractor's monthly dues against each of the following violations :

- a) Negligence in maintenance of vehicles and systems provided by the Municipality.
- b) Negligence in cleaning of markets, slaughterhouses and their toilets as well as public toilets, or failure to carry out relevant maintenance.
- c) Negligence in prompt incineration and burial of refuse.
- d) Delay in removal of dead animals and prompt burial thereof.
- e) Failure to transport slaughterhouse refuse to incinerator at least twice daily and to bury the same every day.
- f) Failure to clean and wash places assigned for washing bodies of dead people or to transport refuse thereof to incinerator twice daily.
- g) Failure to empty cesspits of slaughterhouse, toilets, markets and residents or delay in doing the same.
- h) Failure to perform any duty assigned to the Contractor under the sections of above item, or delay in such performance.
- i) Failure to execute the Municipality instructions according to work program and public requirements.

TRANSLATION

Number : 2217/3/S of 25.12.1403

Circular To Municipalities

Due to the repeated complains by municipalities from spread of stray and feral dogs which endanger citizens, and since (astercanine ?) does not fulfill the required purpose; a Committee from Ministry of Interior and Ministry of Municipal and Rural Affairs have been formed to study the means necessary for eradication of dogs in the Kingdom. The Committee held a meeting on 16.10.1403, studied the subject from all its aspects, reviewed all relevant reports, orders and instructions issued by some Governors (such as Makkah which gave permission for use of some guns and darts in narcotising of dogs for eradication thereof by fatal injection or killing). The Committee agreed to give the Ministry of Municipal and Rural Affairs the authority to eradicate stray and feral dogs by guns designed for narcotising of animals and stressed that such darts should not be used for any other purposes. If such darts strike other targets by mistake, the result will be narcotising thereof for a short period without causing any harm.

Accordingly, we have received a letter from Deputy Minister of Interior for Administrative Affairs No. 52842/26 dated 15.11.1403 to instruct involved authorities to act as per the Committee's recommendation.

Therefore, there is no objection to use these guns and pipes assigned for dog narcotising and eradication, provided full precautions are taken in utilization thereof under supervision of municipal professionals only. Work teams must have first aid equipment with them including oxygen pipe.

This is for review and notification of your involved departments.

Deputy Minister, Technical Affairs

Dr. Eng. Sulaiman Al-Aquil Al-Hamdan

APPENDIX B

APPENDIX B: - Solid Waste Management Facilities - Siting Criteria

"Prepared by MEPA - 11.12.1983"

A. Definitions

1. 'Permit/License' means a permit/license to operate solid waste management facility, or facility reporting of solid waste or a facility producing solid waste pursuant to this document and Article 16.3 of the Environmental Protection Standards Document No. 1401-01.
2. 'Responsible Authority' means the
3. 'MEPA' means the Director General of Environmental Protection General Directorate of the Meteorological and Environmental Protection Administration.
4. 'Disposal' means the discharge, deposit, injection, dumping, spilling, leaking or placing on any solid waste into or on any land or water, so that such waste or any related constituent thereof may enter the environment or be emitted to the air or discharged into any surface or groundwaters of Saudi Arabia.
5. 'Solid Waste' means any garbage, refuse, sludge or any other waste material not excluded under ... Exclusions Article 1.5.
6. 'Other Waste Material' means any solid, liquid, semi-solid or contained gaseous material, resulting from industrial, commercial, mining or agricultural operations or from community activities which :-
 - i) Is discharged, or is being accumulated, stores, or physically, chemically or biologically treated prior to being discarded; or
 - ii) Has served its original intended use and sometimes is discarded; or
 - iii) Is a manufacturing or mining by-product and sometimes is discarded.
7. 'Discarded' means abandoned by being :-
 - i) Disposed of; or
 - ii) Burned or incinerated, including being burned as a fuel for the purpose of energy recovery; or
 - iii) Physically, chemically or biologically treated (other than burned or incinerated) in lieu of or prior to being disposed of.
8. 'Manufacturing or Mining-By-Product' means a material that is not one of the primary (main) products of a particular manufacturing or mining operation, and would not be solely or separately manufactured or mined by the particular operation.

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The term does not include an intermediate manufacturing or mining product which results from one of the steps in a manufacturing or mining process and is typically processed through the next step of the process within a short time.

9. SWMF means any structure, other than sewage treatment plant, used for storage, transfer, treatment, recovery or disposal of solid waste. A SWMF may consist of several storage, transfer, treatment, recovery or disposal operational units (e.g. one or more landfill, surface impoundments, incinerators or combinations of them). A SWMF will have one or more of the characteristics defined under Section A and Section B of the Implementation Procedures pursuant to Articles 4.6, 4.7, 4.10 and 4.11 of the Environmental Protection Standards Document No. 1401-01.

B. Sitting Criteria*

1. Population Density in the Vicinity of the Proposed Site

The responsible authority /MEPA shall focus their investigation on the current population density in areas adjacent to the proposed site and on population projections for such areas. Population density within 1 km of the proposed site boundary shall be the prime consideration unless specific conditions unique to a particular site dictate otherwise.

2. Population Density Next to Transport Route

The responsible authority /MEPA shall consider the average population densities along the major route through which it is anticipated the wastes will be transported to the site. The paramount concern is the extent to which an accident occurring in transit will result in exposure and injury to the adjacent population.

3. Risk of Accident in in Transportation

i) General Considerations

The responsible authority /MEPA shall evaluate the risk factors which impact on the likelihood of an accident occurring in transit. The routes over which the greatest amounts of waste will be carried shall receive prime consideration.

4. Proximity to incompatible Structure

The linear distance from a site boundary to a residence, airport, school, hospital, mosques, commercial centre must be considered. Acceptable buffer zones separating residences and certain other types of structures from the types of operation conducted at SWMF's are needed.

* This represents only an outline of MEPA's proposals. Each consideration is described in more details and divided into different situations under a subheading, Specific Criteria.

5. Utility Lines

The location of a proposed site shall take into account existing or proposed major utility lines. This is to ensure that the production, transportation, treatment, storage or disposal of solid wastes at, near or about such a site will not interfere with, cause damage to, or otherwise disrupt the operation of such utility lines.

6. Municipal Effects

The site shall be considered for consistency with present land use planning and zoning and future land use planning. It is important to ensure that the construction and operation of the proposed facility do not unduly adversely impact on planning schemes developed by the Municipalities in which they are located.

7. Contamination of Ground and Surface Waters

The responsible authority and MEPA shall consider all aspects of the facility's impact on sources of drinking water. The responsible authority and MEPA shall also take into account the effect that the facility will have on bodies of water or aquifers located on or in the vicinity of the site. The location of boundaries of water supply watersheds (both public and private) are of prime importance. The responsible authority and MEPA shall consider the current use and potential uses for such bodies of water and the extent to which the facility will create conditions inconsistent with those uses. Both onsite and offsite effects and proposed methods to mitigate any adverse effects relating to the contamination of all ground and surface water shall be analyzed.

8. Surface Water Supply Sources

The responsible authority and MEPA shall take into account the effect that the proposed facility will have on bodies of water located on and in the vicinity of the proposed site. The responsible authority and MEPA shall consider the current use and potential uses for such bodies of water and the extent to which the proposed facility will create conditions inconsistent with those uses.

9. Fire and Explosives

Due to the nature of many solid wastes special consideration will be given by the responsible authority and MEPA to the potential of fires and explosions at the proposed site. Because of the inherent quality of the wastes, the chief focus shall be on proposed safety measures and emergency response techniques.

10. Air Quality

Siting of a facility must take into account air pollution which may result from the operation of the proposed facility or accidental fires and explosions which may occur. The responsible authority and MEPA shall consider the degree to which air pollution will occur and to what extent such pollution will affect neighboring communities.

11. Seismic Risk

A potential risk to public health, welfare, structures and the environment exists for facilities located in zones of earthquake intensity (refer to Modified Mercalli Intensity Scale).

12. Areas of mineral development

Areas of concern are those where mineral resources of solid form have been removed by various procedures. Such areas commonly present limitations to land disposal facilities due to :-

- excavations close to or in groundwaters;
- avenues of rapid transmittal of contaminants should leakage or spillage occur through boreholes of improperly or uncased wells;
- structural instability and possibility of subsidence due to extensive subsurface removal of mineral resources.

13. Preservation of endangered and threatened species

The responsible authority and MEPA shall focus on adverse impacts of the proposed facility on endangered and threatened species or critical habitats for wildlife generally and the extent to which mitigative measures can be effectively implemented.

14. Conservation of historic resources

The construction and operation of the proposed facility may affect the preservation of historic, architectural, archeological and cultural resources. The extent to which these resources will be disturbed and/or lost and measures to mitigate adverse effects will be considered by the responsible authority and MEPA.

15. Open space, recreational, cultural and visual impacts

The responsible authority and MEPA will consider the extent to which the proposed facility will diminish available open spaces and recreational areas used by the surrounding communities and the visual aesthetic impact of the facility and its proximity to areas that are used by the general public. The responsible authority and MEPA will consider both active and constructive deprivation of the use of these areas. Proposed mitigative measures will also be considered.

APPENDIX C

APPENDIX C: SUMMARY AND FREQUENCY OF TASKS REQUIRED BY ACE TO
PERFORM AS OUTLINED IN THE CONTRACT

<u>Activity (Description)</u>	<u>Performance Basis (Frequency/Quantity)</u>
<u>A. CLEANSING AND RELATED SERVICES</u>	
1. <u>Refuse Collection, Rubble, Auto Removal</u>	
<u>Note:</u> Enclosed (fenced or walled) areas and obvious types of "private property" (such as inside houses and shops) are excluded from the scope of collection duties. Some case by case judgment may be required.	
a) Household Refuse - All types except liquids.	Daily, except twice daily in heavily populated areas.
b) Commercial Refuse, including stores, hotels, shopping centers - All types.	Twice daily
c) Public Building Refuse, including schools, public areas, government buildings - All types. This does not include emptying containers inside public buildings.	As necessary to prevent container overflow
d) Industrial Refuse - All types, placed in containers by generators.	As necessary to prevent container overflow
e) Municipal Markets Refuse, including vegetable, fish and sheep markets, slaughterhouses - All types, mostly organic.	Twice daily
f) Bulky Items - All types of household furnishings and appliances and other bulky items. Items not to be removed from private property - must be placed in container or along public street or in open lots.	Daily
g) Building rubble and materials including removal of surplus construction materials deposited in containers by contractors. Supply and collect container at worksites.	Continuous daily program

<u>Activity (Description)</u>	<u>Performance Basis (Frequency/Quantity)</u>
h) Abandoned auto removal and disposal.	Continuous daily program.
i) Collect and dispose of old rubble and refuse accumulated within the City. Demolished buildings are private property and their removal should be the responsibility of the private property owner.	5 year planned program
j) Hospital Refuse, including transportation of refuse from collection point inside hospitals (both public and private).	Daily
k) Clean all present open dumping places used as temporary or transitory accumulation points.	As soon as possible
l) Dispose of all refuse accumulated along roads leading to "public incinerators" (tipsites ?) north and south of the City.	Per approved "time program"
m) Special Services - Remove any "refuse" (limited to items A (i) above) upon request of Municipality.	Completion within 24 hours of receipt of request

2. Street Sweeping*

a) Secondary streets unasphalted	Twice/week - manual
b) Second streets asphalted	Once/Week - mechanical
c) Expressway - City outskirts	Once/2 weeks-mechanical
d) Important avenues (e.g. Palestine Road, etc.)	Once/week - mechanical
e) Important commercial avenues	Once/week - mechanical
f) Main commercial avenues	Once/day - mechanical
g) Secondary commercial avenues	Once/day - mechanical
h) Open area streets, plus clean 10 meters from street edge	Once/two weeks - mechanical

* Plus litter collection up to 3/week in residential areas and up to 2/day in souk areas (voluntary - per Bid but not contract requirement).

<u>Activity (Description)</u>	<u>Performance Basis (Frequency/Quantity)</u>
i) Streets inside residential units connecting to highways	Once/two weeks - mechanical
3. <u>Flushing and Washing</u>	
a) Tiled and marbled streets and sidewalks	Once/2 weeks
b) Commercial center streets and sidewalks	Once/week
4. <u>Municipal Building Maintenance</u>	
Including authorized Municipality and sub-municipality office facilities (additional facilities to be serviced upon receipt of Municipal authorization).	
a) General cleaning and minor maintenance, including :	Daily
- Sweeping, detergent washing and buffing (marble, mosaic and thermo plastic floors)	
- Mechanical polishing (sealed floors)	
- Vacuum carpets	
- Clean and disinfect toilets, sinks, other sanitary instruments.	
- Wastebaskets and ashtrays (emptied and cleaned).	
- Cupboards, desks, doors, handrails, staircases (cleaned and polished).	
- Collect and dispose of all refuse.	
- Wash windows	
- Sweep and clean entrance areas	
- Replace defective lightbulbs	

Activity (Description)

Performance Basis
(Frequency/Quantity)

-- Insect Control (spraying)

b) Weekly cleaning and maintenance,
including :

Daily

- Detergent washing, sealing and polishing of floors
- Doors and windows (clean and wash)
- Blinds and curtains (clean and wash)
- Remove dirt and spots from walls
- Cupboards, desks, chairs (cleaned and polished)
- Refuse drums and containers (washed and disinfected)
- Electrical fixtures and telephones (cleaned)
- Airconditioner filters (washed)

c) Monthly cleaning and interior maintenance,
including :

Monthly

- Floors mechanically cleaned and sealed
- Doors, walls and posts (cleaned and washed)
- Ceilings (vacuumed)
- Damaged wallpaper repaired or replaced
- Interior white-washing (where needed)
- Electrical light fixtures and switches (cleaned)

Activity (Description)

Performance Basis
(Frequency/Quantity)

- d) Maintenance of electrical fixtures, mechanical and sanitary equipment, including repair or replacement of all damaged electrical fixtures (including air conditioning) wiring, switches and sanitary instruments (including internal plumbing).

Continuous program

Note : Electrical fixtures do not include photocopiers, water coolers, refrigerators of any other item of electrical equipment which is not a permanent part of the building.

- e) Shampoo carpets and remove spots
f) Complete disassembly and cleaning of air conditioners
g) Pest Control including insect spraying and rodent baiting

Annually

Annually

Continuous program

5. Public Bathroom Maintenance

- a) General cleaning and maintenance and continuous attendance
b) Maintenance of electrical and mechanical works including sewage and water pumps, sanitary instruments, doors, walls and windows.
c) Water Supply - Periodic refilling of water tanks ("Provide permanent source of water").
d) Interior maintenance including white-washing and plaster and tile repair or replacement.

Daily from prior to dawn prayer until following evening prayer.

As needed

As needed

Annually

6. Public Monument Cleaning and Maintenance

Cleaning, maintenance and polishing using different cleaning materials.

Monthly

Activity (Description)

Performance Basis
(Frequency/Quantity)

7. Municipal Equipment Maintenance

- | | |
|--|-------------------------------------|
| a) Central workshop operation, including management and implementation of maintenance program for all Municipal non-cleansing vehicles and all cleansing vehicles not turned over to contractor. | All business days
- 1 Workshop |
| b) Secondary workshop operation, including management and implementation of maintenance program for Sub-Municipality non-cleansing vehicles and all cleansing vehicles and equipment not turned over to Contractor | All business days
- 10 Workshops |
| c) Provisioning, including establishment of central spare parts warehouse, purchase of maintenance tools and equipment for all workshops. | Continuous program |
| d) Survey, evaluate and inventory Municipal equipment and spare parts, design and implement internal work order and inventory control procedures, billing and administrative systems, general recordkeeping. | Continuous program |
| e) Submit schedule of vehicles, machinery and equipment which Contractor intends to use in cleaning operations. Follow-up and obtain possession. | As soon as possible |

8. Pest Control

- | | |
|--|---|
| Including insect and rodent extermination and control using chemical pesticides and capture and destruction of stray dogs. | Continuous program
to be approved by
Municipality |
|--|---|

9. Landfill Construction and Operation

- | | |
|---|---------------------------------|
| Including construction of weighbridge and scale house, perimeter fence, landfill operation. | Continuous program
- 2 Sites |
|---|---------------------------------|

Activity (Description)

Performance Basis
(Frequency/Quantity)

10. Transfer Station Construction & Operation

Including installation of new transfer and compaction equipment, construction (on site presently), general operation, mechanical maintenance and repair, supply spare parts.

Continuous operation
- 3 Sites*

* Per Bid Proposal and Operating Plan.

11. Incinerator Operation & Maintenance

Including general operation, mechanical maintenance and repair, supply spare parts.

Continuous operation
- 3 Sites. Small incinerator in Sabeel area operated as needed*

* Per Operating Plan

12. Equipment Procurement

Including procurement and delivery of waste collection and cleansing vehicles, transfer and hauling vehicles and equipment and containers of various capacities. Distribution and deployment of containers.

Delivery due on start-up. Distribution of containers immediately following start-up

13. Construction

Including permanent camp facilities two landfill sites and undefined number of transfer stations

Camp - completion due April 4, 1983. Landfill and transfer station schedule - undefined.

14. Miscellaneous

a) Water accumulation and flood control, including removal of standing water resulting from excess rainfall, floods, cesspool and sewer overflow, water-mains and other sources. "Private property" exclusion also applies to these operations.

Continuous program
- operations must commence within 12 hours

b) Removal of dead animals from streets.

Continuous program
- removal must take place within 12 hours

Activity (Description)

Performance Basis
(Frequency/Quantity)

- c) Public waste disposal awareness and education
- d) Municipal personnel training - Design and implement comprehensive training for municipal personnel in technical, administrative and planning areas and in scientific and practical methods for waste collection and disposal and vehicle maintenance.

Continuous program

Schedule undefined

APPENDIX D

Introduction

Waste Management, Inc. was established by Dean L. Buntrock, now Chairman of the Board of Waste Management, and grew from operating 12 trucks and \$750,000 in annual revenue in 1956 to becoming the largest company in its field worldwide. In 1985 Waste Management reported revenue exceeded \$ 1.6 billion and its worldwide operations employed approximately 20,000 men and women.

The adoption by the Congress of the Solid Waste Disposal Act in 1965 provided the initial impetus for Waste Management's emergence as the industry leader. The legislation mandated improved methods of collection and disposal which would necessitate substantial investments in equipment, facilities and personnel to comply. Few companies in the industry at that time operated outside their own geographical areas and even fewer operated disposal facilities.

Waste Management, however, saw opportunity for the formation of a national operating company with the financial resources and technical capabilities needed to meet the new requirements.

The proceeds from its first public offering of 320,000 shares in June, 1971 enabled Waste Management to invest in staff and financial control systems and to launch an expansion program which, over a 30-month period placed the Company in nearly 50 metropolitan areas in North America.

By the end of 1985, the Company's largest operating group -- Waste Management of North America -- served nearly 5,000,000 residential customers and more than 350,000 commercial/industrial customers and operated more than 90 sanitary landfills in the United States and Canada.

From its inception, Waste Management emphasized a complete system for the management of wastes, from storage through disposal, and the Company continues to place a high priority on the development of disposal capability in each service areas. Its sanitary landfills are widely regarded as models for the entire industry, and the Company also has earned recognition for its creative use of solid wastes to provide recreational amenities at completed sites in several of its operating communities.

Resource Recovery

Waste Management's first decade as a public corporation also saw the Company assume a leadership role in the delivery of innovative waste processing and resource recovery technology.

Its Solid Waste Reduction Center in Pompano Beach, Florida, the first privately operated solid waste shredding facility in the United States, was followed by the pioneering Recovery I plant in New Orleans, the nation's first municipal waste processing/material recovery facility.

Waste Management also focused on solid waste as a source of energy, constructing and operating a federally sponsored demonstration plant in Pompano Beach, Florida which generated methane gas from sewage sludge and obtaining exclusive North American rights to System Volund, a Danish mass combustion/energy recovery technology used throughout the world.

The Company is using System Volund in a 1,000-ton-per-day plant in Tampa, Florida which it will operate for 20 years under contract to the City. The McKay Bay Refuse to Energy Facility is providing electricity to 10,000 homes. Waste Management also will build and operate a 2,200-ton-per-day energy-producing plant near Ft. Lauderdale, FL under contract with Broward County.

Waste Management also operates methane gas recovery and purification systems at Company-owned landfills in Pompano Beach, Florida and near Milwaukee, WI. The Pompano Beach facility produces to energy equivalent of 250,000 barrels of oil annually for sale to Florida Gas Transmission Company for 15 years, beginning in 1985. The energy from the Wisconsin plants is being used to generate electricity for Wisconsin Electric Power Co. A plant planned for a Chicago disposal site will provide energy to a nearby industry. Other sanitary landfills in the Waste Management system are being evaluated to determine whether gas recovery is feasible.

Chemical Waste Management

Anticipating the need for environmentally sound handling of chemical wastes, Waste Management placed itself firmly in the forefront of an emerging industry. In the early 1970s, the Company built a sophisticated analytical laboratory and treatment facility in suburban Chicago, pre-dating federal legislation mandating stricter controls by some three years.

With the passage in 1976 of the federal Resource Conservation and Recovery Act, Waste Management moved quickly to accelerate the development of its chemical waste management capabilities.

Field laboratories, staff by qualified chemists and other technicians, were added at each treatment and disposal center to identify incoming waste streams and to select the proper treatment and disposal method for environmental security.

By year-end 1980, Waste Management had become the largest chemical waste management company in the United States and had extended its operations to Europe with the acquisition of Ocean Combustion Service of The Netherlands and the ocean incineration ship, "VULCANUS I". VULCANUS II, a sister ship delivered late in 1982, destroys chlorinated liquid wastes in areas of the oceans designated by international and national environmental authorities.

Stressing sophisticated systems and technology development, the Company opened a Chemical Waste Management Technical Center in 1981 in Riverdale, Illinois. The facility's analytical staff uses specialized instrumentation, much of it computer controlled, to perform centralized waste analysis at the Center.

Another specialized Chemical Waste Management unit, the Environmental Remedial Action Division, was formed in 1981 to engage in the clean up of plant-site disposal facilities, the restoration of abandoned hazardous waste sites and emergency response activities.

The Company's Chemical Waste Management group, staffed by professionals experienced in all aspects of managing the by-products of a wide range of manufacturing processes, is making a significant contribution to environmental protection both at home and overseas.

Low-Level Radioactive Waste Disposal

Waste Management entered the low-level radioactive waste disposal field in 1982 with the purchase of Chem-Nuclear Systems, Inc. which provides treatment, packaging, transportation and disposal of low-level radioactive wastes. Chem-Nuclear operates one of the three commercial disposal sites for low-level radioactive wastes in the United States and is recognized as the leader in this field.

Waste Management International

In 1975, in response to persistent reports of Saudi Arabian government interest in upgrading the municipal cleaning service in their royal capital of Riyadh, Waste Management dispatched its first survey team to the Middle East. The team's report convinced the Company that a substantial opportunity existed. Waste Management seized the opportunity, committing virtually all of its top management resources to the development of its proposal and to the negotiations which followed the submission. The Riyadh contract, signed in 1977, was the first and, at that time, the largest of its kind ever awarded, valued at \$242-million over its five-year term.

The Company's success, first in winning the contract and then in implementing its program in Riyadh, essentially created a new industry -- international city cleaning -- in which Waste Management is the world leader.

The industry's first multinational, Waste Management was awarded an even larger contract in Buenos Aires, Argentina. Its experience in Riyadh proved invaluable in mobilizing to provide refuse collection, street cleaning, catch basin cleaning and other sanitation services to 2,000,000 residents and thousands of businesses and industries in the Federal District.

Other foreign governments, observing the results achieved by Waste Management, also turned to the private sector to reduce their sanitation costs and to improve public health in their jurisdictions.

In 1981, the Company was awarded three additional city cleaning contracts in Jeddah, Saudi Arabia; Cordoba, Argentina and Caracas, Venezuela.

The Jeddah contract, the largest ever awarded, encompasses street cleaning and maintenance, the cleaning of public buildings and monuments, stray animal and pest control, abandoned car removal and maintenance of city-owned vehicles, as well as refuse collection and disposal for the city of 1,500,000 population.

In mid-1984, Waste Management Queensland began providing residential collection service to half the City of Brisbane, capital of the State of Queensland, under a seven-year contract. Waste Management International also is providing commercial/industrial services in Brisbane and in Canberra and Sydney, Australia.

APPENDIX E

APPENDIX E: Contract between Municipality of Jeddah and Dallah Corporation (7.8.1974)

Based on H.R.H., The Vice Minister's approval of awarding the Jeddah Cleansing Contract to Dallah Corporation effective 1.7.1394H under his letter No. 9765/2 of 6.7.1394, agreement has been made as follows on Wednesday morning, 19.7.1394H between Jeddah Municipality, represented by H.E. the Mayor of Jeddah, Eng. Mohamed Said Farsi (First Party) and Dallah Corporation, represented by its owner Sheikh Saleh Abdullah Kamel with its address being Madina Road, Sakka Building, Opposite Bafeel Station, Telephone: 54621 (Second Party):

1. Second Party undertakes to carry-out Jeddah cleansing works.
2. Second Party undertakes to implement such operation in accordance with the Conditions, Specifications and Obligations under which its proposal for such operation was submitted in addition to the following obligations and amendments as per its letters No. 2883/4 of 3.4.1394 and No. 3074/4 of 29.4.1394H:
 - a] To provide as minimum 100,000 plastic bins for collection of household refuse.
 - b] To provide 3 rain water suction tankers provided that it leases other tankers as necessary and required by work.
 - c] To provide 300 street refuse collection bins.
 - d] To provide 3 small sweeping and flushing vehicles for internal areas and sidewalks.
 - e] To provide 5 large sweeping and flushing vehicles for streets and squares.
 - f] To provide 3 dump trucks for transportation of trees and bulky items.
 - g] To provide one 4 x 4 vehicle.
 - h] To provide 10 pick-ups as a minimum.
 - i] To provide one small shovel for dirt removal.
 - j] To provide no less than 3 vehicle mounted fogging machines for insecticide spraying.
 - k] To increase pest control workers to 60.
 - l] To provide a number of bikes to its messengers.
3. Second Party undertakes to submit a study on feasibility of placing large metal boxes at garbage collection points.

4. In addition to the items provided by the Second Party under Article 2 of the Contract, the First Party shall deliver the following vehicles, insecticides and instruments to the Second Party provided that the Second Party maintains and returns them in an operating condition observing normal wear and tear:

Quantity Description

28	Automatic Refuse Collection Vehicle
7	Pickup
4	Dump Truck
2	Jeep
400	Large Containers
400	Handcarts
4	Tractor for trailers and insecticide fuel tanks
6	Tifa Generator (operational), one vehicle mounted
1	Vehicle mounted Dyna Fogger (operational)
1	V.P. Generator
3	?? Generator
54	Swingfogs, 3 of which mounted on Honda vehicles
15	Knapsack motors
10	Dusters
100	Knapsack Sprayers
10	Water Suction Pumps
10	Fuel Tanks

5. Total value of this operation shall be SR 12,119,600.
6. Period of contract shall be two years effective 1.7.1394H automatically renewable for two additional years in accordance with Article 9 of the Conditions & Specifications unless either Party notifies the other of its wish not to renew the contract two months prior to contract expiry. SC
CH
7. Second Party submitted a bank guarantee equal to 10% of the total contract value drawn on Cairo Bank, Jeddah, under No. 569/74 dated 19.7.1394 in an amount of SR 1,211,960 and valid throughout contract period.
8. Second Party undertakes to implement such operation in accordance with the advertised conditions and specifications under which its proposal was submitted.
9. The Conditions and Specifications for this operation are an inseparable part of this contract and they all supplement each other.
10. Second Party undertakes to implement all instructions addressed to it by the Municipality Supervision Authority under the Conditions, Specifications and this Contract.
11. Final payment hereunder shall be retained until the Second Party has submitted a certificate evidencing payment of due Zakat and

income taxes and redelivered the vehicles, instruments and equipment.

12. Method of Payment

At the beginning of each fiscal year, a local letter of credit equivalent to the entire annual contract value being SR 12,119,600 shall be opened with SAMA Jeddah in favor of the Contractor. First payment equal to 20% of such letter of credit shall be issued against a bank guarantee in the same value and the rest shall be paid in equal monthly instalments of SR 807,973.33 each under a letter signed by the First Party based on minutes taken by the Supervision Authority to the effect that the Contractor has carried out its monthly obligations in the required manner.

13. First Party undertakes to pay Second Party's dues on a monthly basis immediately upon submission of documents and minutes taken by the Supervision Authority.
14. In the event of Second Party's delay or failure to implement this operation, the First Party shall have the right to implement it at Second Party's expense and impose delay penalties in accordance with the Tender Regulation requirements.
15. First Party has the right to increase or decrease the scope of work by 20% of the total contract value under the regulation and in accordance with the conditions and specifications.
16. In the event insecticide spraying, dog destruction and rodent control works are awarded to a jet spraying company, SR 310,600 shall be deducted from contract value in accordance with the above referenced letter by H.H. the Vice Minister of Interior.
17. All correspondence exchanged between both parties in connection with this operation are considered documents supplementary to the provisions hereof.
18. Any matter not provided for in the Conditions and Specifications and herein shall be governed by the Tender Regulation.
19. By signing this Contract, the Second Party will be deemed to have understood all its provisions and undertakes to implement it.
20. Based on both parties agreement upon the above, 4 copies hereof have been executed with copy held by the Second Party.

Carries signatures of both parties with a handwritten comment by Second Party on validity of contents of his letter No. J/1206/74 dated 19.7.1394 regarding Contract Boundary.

APPENDIX F

APPENDIX F: Definition of Refuse

- a] Household refuse is refuse such as food rubbish, papers, cardboard (carton) textiles, plastic materials and vegetable refuse but excluding liquid wastes resulting from houses, apartments, residences and the like.
- b] Commercial refuse is refuse resulting from other than residential and industrial buildings. It includes refuse of commercial stores, restaurants, offices, hotel, schools and workshops.
- c] Industrial refuse is refuse resulting from the various kinds of workshops which are emptied by workshop owners inside the containers specified for them. The size of these containers ranges from 7-10 cubic meters. The Contractor shall transport, empty and return them to their stationary locations on the same day. Cost of transportation, emptying and returning shall be calculated in accordance with the cleansing items mentioned in the bill of quantities under which he is paid.
- d] Municipality Markets Refuse is refuse generated by the market areas such as the vegetable market, fish markets, abattoirs, and others.
- e] Private refuse is refuse generated by hospitals, residential or commercial facilities such as household furniture,

refrigerators, gas cookers and other bulky items left on the streets and yards. The contractor shall not receive wage for transporting them. Their price shall be charged on the Cleansing Works Items - General.

- f] Old rubble is all refuse resulting from demolition and building operations existing in the city.
- g] Damaged cars are all damaged, unfit for use, scrap cars and the like. They shall be collected in places to be designated by the Municipality. The contractor shall not receive wage for them and he does not have the right to make use of this collected scrap. Price of collection of them shall be charged on the other items.
- h] Building rubble is all rubble (surplus material) resulting from multi-story buildings and any buildings under construction. The Contractor must place a 7-10 cubic meter container inside the site of work and these containers shall be collected after they become full and returned to their location again on the same day.

APPENDIX G

APPENDIX G: Bill fo Quantities - Areas and Prices Reports.

١٢.٠٠/٥/٤٤
12-FEB-85
10:15:26

ARABIAN CLEANING ENTERPRISE LTD.

JEDDAH, SAUDI ARABIA

BILL OF QUANTITIES A

GRAND TOTALS REPORT

صافي المساحة (بالهكتار) حسب نوع المنطقة

NET AREA (HECTARES) - BY KIND OF AREA

شركة الرياض للمباني النظيفة
مبنى / المنطقة للمباني النظيفة
صندوق الحسابات
تقرير الكميات الإجمالية

المدينة	المساحة	المساحة	1	2	3	4	5	6	7	8	9	10	11
DISTRICT	SECTOR	TOTAL	1	2	3	4	5	6	7	8	9	10	11
1	ALL	151.90	51.95	0.00	19.65	40.66	0.00	0.00	39.54	0.00	0.00	0.00	0.00
١		١٥١,٩٠	٥١,٩٥	—	١٩,٦٥	٤٠,٦٦	—	—	٣٩,٥٤	—	—	—	—
2	ALL	24.77	0.00	0.00	0.00	0.00	24.77	0.00	0.00	0.00	0.00	0.00	0.00
٢		٢٤,٧٧	—	—	—	—	٢٤,٧٧	—	—	—	—	—	—
3	ALL	28.19	0.00	0.00	0.00	0.00	28.19	0.00	0.00	0.00	0.00	0.00	0.00
٣		٢٨,١٩	—	—	—	—	٢٨,١٩	—	—	—	—	—	—
4	ALL	122.81	0.00	0.00	66.51	56.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
٤		١٢٢,٨١	—	—	٦٦,٥١	٥٦,٣٠	—	—	—	—	—	—	—
5	ALL	55.55	0.00	0.00	42.03	13.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
٥		٥٥,٥٥	—	—	٤٢,٠٣	١٣,٥٣	—	—	—	—	—	—	—
6	ALL	92.45	0.00	23.35	0.00	49.16	0.00	19.73	0.00	0.00	0.00	0.00	0.00
٦		٩٢,٤٥	—	٢٣,٣٥	—	٤٩,١٦	—	١٩,٧٣	—	—	—	—	—
7	ALL	98.28	0.00	9.20	73.46	0.00	0.00	15.61	0.00	0.00	0.00	0.00	0.00
٧		٩٨,٢٨	—	٩,٢٠	٧٣,٤٦	—	—	١٥,٦١	—	—	—	—	—
8	ALL	246.75	0.00	46.67	77.14	31.31	0.00	91.63	0.00	0.00	0.00	0.00	0.00
٨		٢٤٦,٧٥	—	٤٦,٦٧	٧٧,١٤	٣١,٣١	—	٩١,٦٣	—	—	—	—	—
9	ALL	237.34	0.00	9.44	20.09	0.00	0.00	72.60	135.21	0.00	0.00	0.00	0.00
٩		٢٣٧,٣٤	—	٩,٤٤	٢٠,٠٩	—	—	٧٢,٦٠	١٣٥,٢١	—	—	—	—
10	ALL	268.11	0.00	63.36	29.36	32.79	0.00	142.10	0.00	0.00	0.00	0.00	0.00
١٠		٢٦٨,١١	—	٦٣,٣٦	٢٩,٣٦	٣٢,٧٩	—	١٤٢,١٠	—	—	—	—	—
11	ALL	115.89	0.00	0.00	74.75	7.28	0.00	3.91	29.95	0.00	0.00	0.00	0.00
١١		١١٥,٨٩	—	—	٧٤,٧٥	٧,٢٨	—	٣,٩١	٢٩,٩٥	—	—	—	—
12	ALL	130.61	0.00	0.00	64.23	14.04	0.00	0.00	52.34	0.00	0.00	0.00	0.00
١٢		١٣٠,٦١	—	—	٦٤,٢٣	١٤,٠٤	—	—	٥٢,٣٤	—	—	—	—
13	ALL	192.88	0.00	0.00	77.37	49.97	22.40	0.00	18.47	0.00	0.00	0.00	24.57
١٣		١٩٢,٨٨	—	—	٧٧,٣٧	٤٩,٩٧	٢٢,٤٠	—	١٨,٤٧	—	—	—	٢٤,٥٧
14	ALL	131.40	0.00	0.00	59.63	61.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00
١٤		١٣١,٤٠	—	—	٥٩,٦٣	٦١,٧٧	—	—	—	—	—	—	—

15 10	ALL	727.24 600,07	0.00 —	0.00 —	191.73 191,04	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	531.53 040,04
16 11	ALL	572.44 000,02	0.00 —	0.00 —	5.53 0,04	0.00 —	0.00 —	0.00 —	34.19 44,19	0.00 —	0.00 —	0.00 —	532.72 040,02
17 12	ALL	304.30 4,24	0.00 —	9.67 9,70	8.18 8,18	75.27 00,00	0.00 —	96.41 97,41	114.77 114,00	0.00 —	0.00 —	0.00 —	0.00 —
18 13	ALL	122.60 100,70	0.00 —	0.00 —	0.10 ,10	22.01 00,01	0.00 —	96.74 97,04	3.74 4,04	0.00 —	0.00 —	0.00 —	0.00 —
19 14	ALL	604.53 7,20	0.00 —	0.00 —	45.67 00,00	89.63 89,63	0.00 —	193.17 193,17	0.00 —	0.00 —	158.27 108,00	0.00 —	117.80 117,80
20 15	ALL	445.99 000,00	0.00 —	0.00 —	12.01 12,01	155.86 100,00	0.00 —	0.00 —	223.44 000,00	20.68 00,00	34.01 44,01	0.00 —	0.00 —
21 16	ALL	100.03 100,03	0.00 —	23.89 00,00	33.47 33,47	33.62 33,62	0.00 —	92.57 92,57	2.42 2,42	0.00 —	0.00 —	0.00 —	0.00 —
22 17	ALL	871.70 871,70	0.00 —	0.00 —	27.88 00,00	144.20 144,20	0.00 —	84.58 84,58	219.30 219,30	0.00 —	46.97 47,00	0.00 —	340.77 340,77
23 18	ALL	659.37 659,37	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	9.11 9,11	0.00 —	0.00 —	0.00 —	0.00 —	550.26 550,26
24 19	ALL	617.17 617,17	0.00 —	2.27 2,27	1.20 1,20	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	613.70 613,70
25 20	ALL	474.08 474,08	0.00 —	0.00 —	51.91 51,91	115.11 115,11	0.00 —	11.89 11,89	0.00 —	0.00 —	0.00 —	0.00 —	295.17 295,17
26 21	ALL	750.59 750,59	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	125.35 125,35	0.00 —	0.00 —	9.48 9,48	615.76 615,76
27 22	ALL	453.11 453,11	0.00 —	0.00 —	435.57 435,57	0.00 —	0.00 —	0.00 —	17.54 17,54	0.00 —	0.00 —	0.00 —	0.00 —
28 23	ALL	459.51 459,51	0.00 —	0.00 —	333.74 333,74	76.64 76,64	0.00 —	0.00 —	49.13 49,13	0.00 —	0.00 —	0.00 —	0.00 —
29 24	ALL	378.69 378,69	0.00 —	0.00 —	357.38 357,38	21.41 21,41	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
30 25	ALL	666.08 666,08	0.00 —	0.00 —	276.85 276,85	3.20 3,20	0.00 —	73.21 73,21	194.17 194,17	0.00 —	0.00 —	0.00 —	118.66 118,66
31 26	ALL	1015.03 1015,03	0.00 —	0.00 —	161.14 161,14	0.00 —	0.00 —	43.89 43,89	627.07 627,07	0.00 —	139.87 139,87	43.08 43,08	0.00 —
32 27	ALL	514.78 514,78	0.00 —	12.48 12,48	0.24 0,24	0.00 —	0.00 —	220.53 220,53	179.26 179,26	0.00 —	102.27 102,27	0.00 —	0.00 —
33 28	ALL	393.99 393,99	0.00 —	0.00 —	155.02 155,02	0.00 —	0.00 —	227.62 227,62	11.35 11,35	0.00 —	0.00 —	0.00 —	0.00 —
34 29	ALL	357.87 357,87	0.00 —	0.00 —	174.52 174,52	0.00 —	0.00 —	0.00 —	66.58 66,58	0.00 —	0.00 —	0.00 —	116.77 116,77

35 ٤٥	ALL	616.77 ٣١٦,٧٧	4.34 ٤,٤٤	0.00	0.00	0.00	0.00	427.36 ٤٢٧,٤٦	185.07 ١٨٥,٠٧	0.00	0.00	0.00	0.00
36 ٤٦	ALL	362.24 ٣٦٢,٤٤	0.00	0.00	308.27 ٣٠٨,٢٧	0.00	0.00	247.19 ٢٤٧,١٩	0.34 ٠,٣٤	6.45 ٦,٤٥	0.00	0.00	0.00
37 ٤٧	ALL	622.35 ٦٢٢,٤٥	0.00	0.00	40.82 ٤٠,٨٢	2.36 ٢,٣٦	0.00	191.11 ١٩١,١١	282.07 ٢٨٢,٠٧	0.00	105.99 ١٠٥,٩٩	0.00	0.00
38 ٤٨	ALL	642.66 ٦٤٢,٦٦	0.00	0.00	0.00	0.00	0.00	0.00	52.03 ٥٢,٠٣	0.00	0.00	0.00	550.63 ٥٥٠,٦٣
39 ٤٩	ALL	1323.25 ١٣٢٣,٢٥	0.00	0.00	21.50 ٢١,٥٠	0.67 ٠,٦٧	0.00	124.55 ١٢٤,٥٥	828.78 ٨٢٨,٧٨	0.00	0.00	0.00	347.75 ٣٤٧,٧٥
40 ٥٠	ALL	457.65 ٤٥٧,٨٥	0.00	0.00	153.19 ١٥٣,١٩	0.00	0.00	0.00	0.00	0.00	0.00	304.65 ٣٠٤,٦٥	0.00
41 ٥١	ALL	381.94 ٣٨١,٩٤	0.00	0.00	54.70 ٥٤,٧٠	0.00	0.00	0.00	0.00	0.00	0.00	61.76 ٦١,٧٦	265.48 ٢٦٥,٤٨
42 ٥٢	ALL	909.79 ٩٠٩,٧٩	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	909.79 ٩٠٩,٧٩	0.00
43 ٥٣	ALL	334.89 ٣٣٤,٨٩	0.00	0.00	0.00	0.00	0.00	334.89 ٣٣٤,٨٩	0.00	0.00	0.00	0.00	0.00
44 ٥٤	ALL	2309.88 ٢٣٠٩,٨٨	0.00	0.00	0.00	0.00	0.00	0.00	195.95 ١٩٥,٩٥	0.00	332.34 ٣٣٢,٣٤	594.69 ٥٩٤,٦٩	1186.91 ١١٨٦,٩١
45 ٥٥	ALL	533.23 ٥٣٣,٢٣	0.00	0.00	23.51 ٢٣,٥١	120.34 ١٢٠,٣٤	0.00	73.80 ٧٣,٨٠	309.55 ٣٠٩,٥٥	6.02 ٦,٠٢	0.00	0.00	0.00
46 ٥٦	ALL	1314.90 ١٣١٤,٩٠	0.00	0.00	0.00	0.00	0.00	214.53 ٢١٤,٥٣	177.94 ١٧٧,٩٤	0.00	323.19 ٣٢٣,١٩	413.29 ٤١٣,٢٩	185.93 ١٨٥,٩٣
47 ٥٧	ALL	1797.74 ١٧٩٧,٧٤	0.00	0.00	0.00	0.00	0.00	469.57 ٤٦٩,٥٧	34.04 ٣٤,٠٤	0.00	0.00	0.00	1294.12 ١٢٩٤,١٢
48 ٥٨	ALL	442.73 ٤٤٢,٧٣	0.00	0.00	0.00	36.30 ٣٦,٣٠	0.00	106.22 ١٠٦,٢٢	0.00	0.00	261.72 ٢٦١,٧٢	38.48 ٣٨,٤٨	0.00
49 ٥٩	ALL	948.15 ٩٤٨,١٥	0.00	0.00	24.97 ٢٤,٩٧	0.00	0.00	27.05 ٢٧,٠٥	14.47 ١٤,٤٧	0.00	139.59 ١٣٩,٥٩	197.35 ١٩٧,٣٥	544.73 ٥٤٤,٧٣
50 ٦٠	ALL	7792.70 ٧٧٩٢,٧٠	0.00	0.00	0.00	0.00	0.00	4.35 ٤,٣٥	273.72 ٢٧٣,٧٢	0.00	0.00	2107.15 ٢١٠٧,١٥	5397.49 ٥٣٩٧,٤٩
=====													
ALL	ALL	33453.01 ٣٣٤٥٣,٠١	56.3 ٥٦,٣	200.3 ٢٠٠,٣	3513.7 ٣٥١٣,٧	1253.4 ١٢٥٣,٤	75.4 ٧٥,٤	3716.1 ٣٧١٦,١	4497.8 ٤٤٩٧,٨	33.1 ٣٣,١	1644.2 ١٦٤٤,٢	4679.7 ٤٦٧٩,٧	13782.9 ١٣٧٨٢,٩

اشهد ان المعلومات المدونة اعلاه صحيحة وواقعية ومطابقة للمواصفات الواردة بجدول الكميات
شارلي ل. ميلر - مهندس مسجل ومستقل

I hereby certify that the above information is accurate, actual and identical with the specifications set forth in the B.O.Q.

Charlie L. Miller

CHARLIE L. MILLER

Registered Independent Engineer

12-FEB-85
10:15:26

ARARIAN CLEANING ENTERPRISE LTD.

JEDDAH, SAUDI ARABIA

BILL OF QUANTITIES A

GRAND TOTALS REPORT

PRICES IN SR 000 - BY KIND OF AREA

[illegible]

15 10	ALL	1822.96 1822.96	0.00 —	0.00 —	1822.96 1822.96	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
16 11	ALL	182.22 182.22	0.00 —	0.00 —	52.55 52.55	0.00 —	0.00 —	0.00 —	129.66 129.66	0.00 —	0.00 —	0.00 —	0.00 —
17 12	ALL	2150.71 2150.71	0.00 —	82.12 82.12	77.81 77.81	638.93 638.93	0.00 —	916.65 916.65	435.20 435.20	0.00 —	0.00 —	0.00 —	0.00 —
18 13	ALL	1121.85 1121.85	0.00 —	0.00 —	0.95 0.95	186.88 186.88	0.00 —	919.33 919.33	14.19 14.19	0.00 —	0.00 —	0.00 —	0.00 —
19 14	ALL	3046.45 3046.45	0.00 —	0.00 —	434.22 434.22	760.85 760.85	0.00 —	1836.66 1836.66	0.00 —	0.00 —	14.72 14.72	0.00 —	0.00 —
20 15	ALL	2323.28 2323.28	0.00 —	0.00 —	114.19 114.19	1323.10 1323.10	0.00 —	0.00 —	847.27 847.27	35.56 35.56	3.16 3.16	0.00 —	0.00 —
21 16	ALL	1696.30 1696.30	0.00 —	202.80 202.80	319.25 319.25	285.39 285.39	0.55 0.55	880.13 880.13	9.18 9.18	0.00 —	0.00 —	0.00 —	0.00 —
22 17	ALL	3129.36 3129.36	0.00 —	0.00 —	265.06 265.06	1224.14 1224.14	0.00 —	804.21 804.21	631.58 631.58	0.00 —	4.37 4.37	0.00 —	0.00 —
23 18	ALL	96.60 96.60	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	86.60 86.60	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
24 19	ALL	39.66 39.66	0.00 —	19.29 19.29	11.37 11.37	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
25 20	ALL	1583.77 1583.77	0.00 —	0.00 —	493.60 493.60	977.16 977.16	0.00 —	113.00 113.00	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
26 21	ALL	475.78 475.78	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	475.33 475.33	0.00 —	0.00 —	0.45 0.45	0.00 —
27 22	ALL	4207.88 4207.88	0.00 —	0.00 —	4141.35 4141.35	0.00 —	0.00 —	0.00 —	66.53 66.53	0.00 —	0.00 —	0.00 —	0.00 —
28 23	ALL	4010.12 4010.12	0.00 —	0.00 —	3173.19 3173.19	650.63 650.63	0.00 —	0.00 —	186.31 186.31	0.00 —	0.00 —	0.00 —	0.00 —
29 24	ALL	3578.77 3578.77	0.00 —	0.00 —	3396.99 3396.99	181.78 181.78	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
30 25	ALL	4091.71 4091.71	0.00 —	0.00 —	2632.25 2632.25	27.13 27.13	0.00 —	696.06 696.06	736.29 736.29	0.00 —	0.00 —	0.00 —	0.00 —
31 26	ALL	4342.24 4342.24	0.00 —	0.00 —	1532.09 1532.09	0.00 —	0.00 —	417.26 417.26	2377.85 2377.85	0.00 —	13.01 13.01	2.02 2.02	0.00 —
32 27	ALL	2894.27 2894.27	0.00 —	105.93 105.93	2.24 2.24	0.00 —	0.00 —	2096.83 2096.83	679.76 679.76	0.00 —	9.51 9.51	0.00 —	0.00 —
33 28	ALL	3681.19 3681.19	0.00 —	0.00 —	1473.97 1473.97	0.00 —	0.00 —	2164.18 2164.18	43.04 43.04	0.00 —	0.00 —	0.00 —	0.00 —
34 29	ALL	1911.76 1911.76	0.00 —	0.00 —	1659.30 1659.30	0.00 —	0.00 —	0.00 —	252.46 252.46	0.00 —	0.00 —	0.00 —	0.00 —

35	ALL	4911.25	45.15	0.00	0.00	0.00	0.00	4063.31	701.80	0.00	0.00	0.00	0.00
40		2811,67	27,10	—	—	—	—	274,11	4,1,8.	—	—	—	—
36	ALL	5293.67	0.00	0.00	2931.05	0.00	0.00	2350.25	1.28	11.09	0.00	0.00	0.00
47		0094,70	—	—	094,0	—	—	040,00	1,08	11,9	—	—	—
37	ALL	3304.67	0.00	0.00	388.11	20.00	0.00	1817.08	1059.63	0.00	9.85	0.00	0.00
40		44,2,70	—	—	48,11	0,0.	—	184,08	1059,63	—	9,85	—	—
38	ALL	197.31	0.00	0.00	0.00	0.00	0.00	0.00	197.31	0.00	0.00	0.00	0.00
48		197,31	—	—	—	—	—	—	197,31	—	—	—	—
39	ALL	4537.08	0.00	0.00	204.43	5.70	0.00	1184.21	3142.74	0.00	0.00	0.00	0.00
49		204,43	—	—	0,43	0,70	—	1184,21	3142,74	—	—	—	—
40	ALL	1470.36	0.00	0.00	1455.54	0.00	0.00	0.00	0.00	0.00	0.00	14.32	0.00
2.		147,36	—	—	1455,54	—	—	—	—	—	—	14,32	—
41	ALL	523.00	0.00	0.00	520.09	0.00	0.00	0.00	0.00	0.00	0.00	2.90	0.00
21		054	—	—	050,09	—	—	—	—	—	—	2,90	—
42	ALL	42.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.76	0.00
20		42,76	—	—	—	—	—	—	—	—	—	42,76	—
43	ALL	3184.13	0.00	0.00	0.00	0.00	0.00	3184.13	0.00	0.00	0.00	0.00	0.00
24		3184,13	—	—	—	—	—	3184,13	—	—	—	—	—
51	ALL	801.92	0.00	0.00	0.00	0.00	0.00	0.00	743.06	0.00	30.91	27.95	0.00
01		801,92	—	—	—	—	—	—	743,06	—	30,91	27,95	—
45	ALL	3131.06	0.00	0.00	223.58	1021.57	0.00	701.73	1173.83	10.35	0.00	0.00	0.00
20		3131,06	—	—	223,58	1021,57	—	701,73	1173,83	10,35	—	—	—
46	ALL	2764.02	0.00	0.00	0.00	0.00	0.00	2039.78	674.76	0.00	30.06	19.42	0.00
27		2764,02	—	—	—	—	—	2039,78	674,76	—	30,06	19,42	—
47	ALL	4593.78	0.00	0.00	0.00	0.00	0.00	4464.71	129.08	0.00	0.00	0.00	0.00
20		4593,78	—	—	—	—	—	4464,71	129,08	—	—	—	—
48	ALL	1344.24	0.00	0.00	0.00	308.16	0.00	1009.93	0.00	0.00	24.34	1.31	0.00
28		1344,24	—	—	—	308,16	—	1009,93	—	—	24,34	1,31	—
49	ALL	571.67	0.00	0.00	237.40	0.00	0.00	257.14	54.86	0.00	12.98	9.28	0.00
29		051,67	—	—	237,40	—	—	257,14	54,86	—	12,98	9,28	—
50	ALL	1178.30	0.00	0.00	0.00	0.00	0.00	41.33	1037.93	0.00	0.00	99.04	0.00
0.		1178,30	—	—	—	—	—	41,33	1037,93	—	—	99,04	—

ALL	ALL	99806.13	598.4	1700.7	33403.2	10640.5	640.3	35332.7	17055.6	57.0	152.9	219.9	0.0
		99806,13	598,4	1700,7	33403,2	10640,5	640,3	35332,7	17055,6	57,0	152,9	219,9	—

اشهد ان المعلومات المدونة اعلاه صحيحة وواقعية ومطابقة للمواصفات الواردة بجدول الكميات

شارلي ل. ميلر - مهندس مسجل ومستقل

I hereby certify that the above information is accurate, actual and identical with the specifications set forth in the B.O.Q.

Charlie L. Miller

CHARLIE L. MILLER

Registered Independent Engineer

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12-FEB-85

10/15/14

ARABIAN CLEANING ENTERPRISE LTD.

JEDDAH, SAUDI ARABIA

BILL OF QUANTITIES B

GRAND TOTALS REPORT

الطرق المستصلحة بالكمبيوتر - حسب نوع الشارع
STREET LENGTHS (KILOMETERS) - BY KIND OF STREET

المنطقة	القطاع	المجموع	11	12	13	14	15	16	17	18	19
DISTRICT	SECTOR	TOTAL	11	12	13	14	15	16	17	18	19
1	ALL	40.12	5.59	0.63	3.49	20.93	4.14	0.19	5.15	0.00	0.00
١		٤٠,١٢	٥,٥٩	٠,٦٣	٣,٤٩	٢٠,٩٣	٤,١٤	٠,١٩	٥,١٥	—	—
2	ALL	22.67	4.95	0.39	6.12	11.21	0.00	0.00	0.00	0.00	0.00
٢		٢٢,٦٧	٤,٩٥	٠,٣٩	٦,١٢	١١,٢١	—	—	—	—	—
3	ALL	15.51	5.92	0.28	2.20	7.12	0.00	0.00	0.00	0.00	0.00
٣		١٥,٥١	٥,٩٢	٠,٢٨	٢,٢٠	٧,١٢	—	—	—	—	—
4	ALL	51.04	5.08	0.06	9.96	22.00	11.25	1.59	0.00	0.00	0.00
٤		٥١,٠٤	٥,٠٨	٠,٠٦	٩,٩٦	٢٢,٠٠	١١,٢٥	١,٥٩	—	—	—
5	ALL	24.97	2.19	0.04	3.44	11.86	7.10	0.34	0.00	0.00	0.00
٥		٢٤,٩٧	٢,١٩	٠,٠٤	٣,٤٤	١١,٨٦	٧,١٠	٠,٣٤	—	—	—
6	ALL	48.14	16.23	0.88	7.40	19.23	4.42	0.00	0.00	0.00	0.00
٦		٤٨,١٤	١٦,٢٣	٠,٨٨	٧,٤٠	١٩,٢٣	٤,٤٢	—	—	—	—
7	ALL	36.38	1.56	0.00	9.20	9.47	15.57	0.58	0.00	0.00	0.00
٧		٣٦,٣٨	١,٥٦	—	٩,٢٠	٩,٤٧	١٥,٥٧	٠,٥٨	—	—	—
8	ALL	72.62	11.37	0.12	3.33	15.11	36.91	0.78	0.00	0.00	0.00
٨		٧٢,٦٢	١١,٣٧	٠,١٢	٣,٣٣	١٥,١١	٣٦,٩١	٠,٧٨	—	—	—
9	ALL	35.16	9.00	2.80	1.50	1.64	17.84	2.40	0.00	0.00	0.00
٩		٣٥,١٦	٩,٠٠	٢,٨٠	١,٥٠	١,٦٤	١٧,٨٤	٢,٤٠	—	—	—
10	ALL	80.13	9.08	1.60	14.70	26.24	26.49	2.02	0.00	0.00	0.00
١٠		٨٠,١٣	٩,٠٨	١,٦٠	١٤,٧٠	٢٦,٢٤	٢٦,٤٩	٢,٠٢	—	—	—
11	ALL	37.02	3.00	2.22	2.43	9.68	16.87	2.81	0.00	0.00	0.00
١١		٣٧,٠٢	٣,٠٠	٢,٢٢	٢,٤٣	٩,٦٨	١٦,٨٧	٢,٨١	—	—	—
12	ALL	18.45	3.47	0.38	0.44	7.27	6.76	0.14	0.00	0.00	0.00
١٢		١٨,٤٥	٣,٤٧	٠,٣٨	٠,٤٤	٧,٢٧	٦,٧٦	٠,١٤	—	—	—
13	ALL	52.44	10.08	1.83	4.72	21.01	11.42	3.39	0.00	0.00	0.00
١٣		٥٢,٤٤	١٠,٠٨	١,٨٣	٤,٧٢	٢١,٠١	١١,٤٢	٣,٣٩	—	—	—
14	ALL	61.63	8.76	0.69	8.63	27.75	15.46	0.34	0.00	0.00	0.00
١٤		٦١,٦٣	٨,٧٦	٠,٦٩	٨,٦٣	٢٧,٧٥	١٥,٤٦	٠,٣٤	—	—	—

15 10	ALL	15.62 10,70	0.00 —	0.00 —	0.00 —	0.15 1,10	2.30 1,10	1.38 1,10	0.00 —	0.00 —	11.80 11,10
16 17	ALL	4.97 2,90	3.71 2,01	0.00 —	0.00 —	0.00 —	1.09 1,09	0.16 1,10	0.00 —	0.00 —	0.00 —
17 18	ALL	71.51 11,01	18.01 11,10	1.92 1,10	11.02 11,10	25.98 11,10	13.98 11,10	0.60 1,10	0.00 —	0.00 —	0.00 —
18 19	ALL	36.95 11,10	6.65 1,10	0.36 1,10	2.88 1,10	4.53 1,10	22.16 11,10	0.36 1,10	0.00 —	0.00 —	0.00 —
19 20	ALL	92.44 11,10	21.04 11,10	3.57 1,10	7.06 1,10	34.29 11,10	24.91 11,10	1.58 1,10	0.00 —	0.00 —	0.00 —
20 21	ALL	185.39 11,10	42.07 11,10	17.50 11,10	7.21 1,10	116.96 11,10	1.45 1,10	0.20 1,10	0.00 —	0.00 —	0.00 —
21 22	ALL	64.51 11,10	11.61 11,10	0.08 1,10	10.60 11,10	16.72 11,10	24.78 11,10	0.72 1,10	0.00 —	0.00 —	0.00 —
22 23	ALL	221.73 11,10	35.49 11,10	3.01 1,10	20.72 11,10	130.88 11,10	21.52 11,10	1.72 1,10	0.00 —	0.00 —	8.39 11,10
23 24	ALL	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
24 25	ALL	0.92 1,10	0.47 1,10	0.00 —	0.08 1,10	0.21 1,10	0.15 1,10	0.00 —	0.00 —	0.00 —	0.00 —
25 26	ALL	79.48 11,10	18.34 11,10	7.17 1,10	4.82 1,10	38.76 11,10	9.44 1,10	0.94 1,10	0.00 —	0.00 —	0.00 —
26 27	ALL	8.29 1,10	7.27 1,10	1.02 1,10	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
27 28	ALL	51.50 11,10	3.89 1,10	0.00 —	0.00 —	3.99 1,10	38.38 11,10	5.24 1,10	0.00 —	0.00 —	0.00 —
28 29	ALL	136.34 11,10	13.50 11,10	4.84 1,10	7.22 1,10	38.48 11,10	70.94 11,10	1.36 1,10	0.00 —	0.00 —	0.00 —
29 30	ALL	96.37 11,10	4.05 1,10	0.22 1,10	9.65 1,10	7.80 1,10	74.12 11,10	0.54 1,10	0.00 —	0.00 —	0.00 —
30 31	ALL	88.35 11,10	14.83 11,10	0.23 1,10	0.22 1,10	1.95 1,10	67.57 11,10	3.56 1,10	0.00 —	0.00 —	0.00 —
31 32	ALL	140.78 11,10	99.87 11,10	0.00 —	0.00 —	0.00 —	35.08 11,10	5.83 1,10	0.00 —	0.00 —	0.00 —
32 33	ALL	50.75 11,10	14.10 11,10	0.90 1,10	0.15 1,10	0.00 —	35.03 11,10	0.58 1,10	0.00 —	0.00 —	0.00 —
33 34	ALL	53.90 11,10	0.49 1,10	0.00 —	2.15 1,10	0.04 1,10	51.11 11,10	0.11 1,10	0.00 —	0.00 —	0.00 —
34 35	ALL	57.45 11,10	6.94 1,10	0.52 1,10	0.00 —	0.00 —	31.55 11,10	0.11 1,10	0.00 —	0.00 —	18.32 11,10

35	ALL	111.73	24.03	0.12	0.00	0.00	84.58	3.00	0.00	0.00	0.00
٤٥		٣٣,٧٧٤	٤٦,٠٤	٣,١٤	—	—	٨٤,٥٨	٣	—	—	—
36	ALL	82.48	3.57	0.57	0.00	3.69	68.29	6.34	0.00	0.00	0.00
٤٦		٨٤,٤٨	٤,٥٧	٥,٥٧	—	٤,٦٩	٦٨,٢٩	٦,٣٤	—	—	—
37	ALL	61.78	32.12	0.00	0.00	0.00	27.26	2.41	0.00	0.00	0.00
٤٧		٦١,٧٨	٣٢,١٢	—	—	—	٢٧,٢٦	٢,٤١	—	—	—
38	ALL	5.10	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.01
٤٨		٥,١٠	٢,٠٩	—	—	—	—	—	—	—	٣,٠١
39	ALL	74.63	58.91	2.21	0.00	0.00	9.17	1.79	0.00	0.00	2.55
٤٩		٧٤,٦٣	٥٨,٩١	٢,٢١	—	—	٩,١٧	١,٧٩	—	—	٢,٥٥
40	ALL	29.97	4.95	1.68	0.00	0.00	20.70	1.63	0.00	0.00	0.00
٥٠		٢٩,٩٧	٤,٩٥	١,٦٨	—	—	٢٠,٧٠	١,٦٣	—	—	—
41	ALL	13.76	1.01	0.00	0.00	0.00	12.75	0.00	0.00	0.00	0.00
٥١		١٣,٧٦	١,٠١	—	—	—	١٢,٧٥	—	—	—	—
42	ALL	67.20	67.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
٥٢		٦٧,٢٠	٦٧,٢٠	—	—	—	—	—	—	—	—
43	ALL	69.60	0.00	0.00	0.00	1.27	59.55	9.78	0.00	0.00	0.00
٥٣		٦٩,٦٠	—	—	—	١,٢٧	٥٩,٥٥	٩,٧٨	—	—	—
44	ALL	160.55	120.81	16.47	2.94	20.34	0.00	0.00	0.00	0.00	0.00
٥٤		١٦٠,٥٥	١٢٠,٨١	١٦,٤٧	٢,٩٤	٢٠,٣٤	—	—	—	—	—
45	ALL	159.00	38.32	38.40	0.16	64.90	16.92	0.30	0.00	0.00	0.00
٥٥		١٥٩	٣٨,٣٢	٣٨,٤٠	٠,١٦	٦٤,٩٠	١٦,٩٢	٠,٣٠	—	—	—
46	ALL	102.18	100.34	0.00	0.00	0.00	1.41	0.21	0.00	0.00	0.22
٥٦		١٠٢,١٨	١٠٠,٣٤	—	—	—	١,٤١	٠,٢١	—	—	٠,٢٢
47	ALL	23.73	9.04	4.33	0.00	0.00	6.77	0.00	0.00	0.00	3.59
٥٧		٢٣,٧٣	٩,٠٤	٤,٣٣	—	—	٦,٧٧	—	—	—	٣,٥٩
48	ALL	71.29	29.24	1.95	0.00	20.15	19.70	0.26	0.00	0.00	0.00
٥٨		٧١,٢٩	٢٩,٢٤	١,٩٥	—	٢٠,١٥	١٩,٧٠	٠,٢٦	—	—	—
49	ALL	39.83	19.91	0.67	0.00	0.00	7.14	0.00	0.00	0.00	11.10
٥٩		٣٩,٨٣	١٩,٩١	٠,٦٧	—	—	٧,١٤	—	—	—	١١,١٠
50	ALL	183.08	121.44	61.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00
٦٠		١٨٣,٠٨	١٢١,٤٤	٦١,٦٤	—	—	—	—	—	—	—
=====											
ALL	ALL	3307.47	1052.58	181.31	169.41	741.62	1034.04	64.39	5.15	0.00	58.98
		٣٣٠٧,٤٧	١٠٥٢,٥٨	١٨١,٣١	١٦٩,٤١	٧٤١,٦٢	١٠٣٤,٠٤	٦٤,٣٩	٥,١٥	—	٥٨٩,٨

اشهد ان المعلومات المدونة اعلاه صحيحة وواقعية ومطابقة للمواصفات الواردة بجدول الكميات
شارلي ل. ميلر - مهندس مسجل ومستقل

I hereby certify that the above information is accurate, actual and identical with the specifications set forth in the B.O.Q.

Charlie L. Miller

CHARLIE L. MILLER

Registered Independent Engineer

12.00%
12-FEB-85
10:16:14

ARABIAN CLEANING ENTERPRISE LTD.

JEDDAH, SAUDI ARABIA

BILL OF QUANTITIES B

GRAND TOTALS REPORT

شركة النظافة العربية المحدودة
ص/ب المملكة العربية السعودية
عمدات الكميات ب
تقرير لمراجعة كلفة

مراجعة بالمقارنة بين الميزانية - بحسب نوع الشارع

		PRICES IN SR '000 - BY KIND OF STREET									
DISTRICT	SECTOR	TOTAL	11	12	13	14	15	16	17	18	19
المدينة	القطاع	المجموع	11	12	13	14	15	16	17	18	19
1	ALL	478.83	85.80	6.43	35.51	213.05	71.31	2.16	64.57	0.00	0.00
1		٤٧٨,٨٣	٨٥,٨٠	٦,٤٣	٣٥,٥١	٢١٣,٠٥	٧١,٣١	٢,١٦	٦٤,٥٧	—	—
2	ALL	256.36	75.97	3.97	62.29	114.13	0.00	0.00	0.00	0.00	0.00
2		٢٥٦,٣٦	٧٥,٩٧	٣,٩٧	٦٢,٢٩	١١٤,١٣	—	—	—	—	—
3	ALL	188.60	90.95	2.85	22.37	72.42	0.00	0.00	0.00	0.00	0.00
3		١٨٨,٦٠	٩٠,٩٥	٢,٨٥	٢٢,٣٧	٧٢,٤٢	—	—	—	—	—
4	ALL	532.10	93.44	0.63	101.34	223.87	193.55	19.27	0.00	0.00	0.00
4		٥٣٢,١٠	٩٣,٤٤	٠,٦٣	١٠١,٣٤	٢٢٣,٨٧	١٩٣,٥٥	١٩,٢٧	—	—	—
5	ALL	315.84	33.69	0.40	34.99	120.73	122.11	3.93	0.00	0.00	0.00
5		٣١٥,٨٤	٣٣,٦٩	٠,٤٠	٣٤,٩٩	١٢٠,٧٣	١٢٢,١١	٣,٩٣	—	—	—
6	ALL	605.14	249.27	9.93	75.27	195.71	75.96	0.00	0.00	0.00	0.00
6		٦٠٥,١٤	٢٤٩,٢٧	٩,٩٣	٧٥,٢٧	١٩٥,٧١	٧٥,٩٦	—	—	—	—
7	ALL	489.45	24.02	0.00	93.59	96.38	267.82	6.64	0.00	0.00	0.00
7		٤٨٩,٤٥	٢٤,٠٢	—	٩٣,٥٩	٩٦,٣٨	٢٦٧,٨٢	٦,٦٤	—	—	—
8	ALL	1059.38	174.60	1.23	84.80	153.92	635.05	8.88	0.00	0.00	0.00
8		١٠٥٩,٣٨	١٧٤,٦٠	١,٢٣	٨٤,٨٠	١٥٣,٩٢	٦٣٥,٠٥	٨,٨٨	—	—	—
9	ALL	533.01	139.19	28.52	15.26	16.71	307.02	27.30	0.00	0.00	0.00
9		٥٣٣,٠١	١٣٩,١٩	٢٨,٥٢	١٥,٢٦	١٦,٧١	٣٠٧,٠٢	٢٧,٣٠	—	—	—
10	ALL	1051.24	139.43	16.32	149.60	267.07	455.75	23.07	0.00	0.00	0.00
10		١٠٥١,٢٤	١٣٩,٤٣	١٦,٣٢	١٤٩,٦٠	٢٦٧,٠٧	٤٥٥,٧٥	٢٣,٠٧	—	—	—
11	ALL	514.32	46.16	22.64	24.63	98.55	290.22	32.06	0.00	0.00	0.00
11		٥١٤,٣٢	٤٦,١٦	٢٢,٦٤	٢٤,٦٣	٩٨,٥٥	٢٩٠,٢٢	٣٢,٠٦	—	—	—
12	ALL	253.46	53.27	3.86	4.50	73.99	116.27	1.56	0.00	0.00	0.00
12		٢٥٣,٤٦	٥٣,٢٧	٣,٨٦	٤,٥٠	٧٣,٩٩	١١٦,٢٧	١,٥٦	—	—	—
13	ALL	670.42	154.30	18.66	48.01	213.81	196.51	38.63	0.00	0.00	0.00
13		٦٧٠,٤٢	١٥٤,٣٠	١٨,٦٦	٤٨,٠١	٢١٣,٨١	١٩٦,٥١	٣٨,٦٣	—	—	—
14	ALL	781.79	134.62	6.93	87.85	282.49	265.96	3.89	0.00	0.00	0.00
14		٧٨١,٧٩	١٣٤,٦٢	٦,٩٣	٨٧,٨٥	٢٨٢,٤٩	٢٦٥,٩٦	٣,٨٩	—	—	—

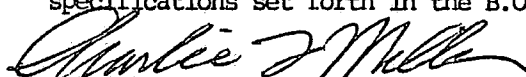
15 10	ALL	56.77 07,77	0.00 —	0.00 —	0.00 —	1.54 1,02	39.54 49,02	15.69 10,79	0.00 —	0.00 —	0.00 0.00
16 17	ALL	77.67 07,77	56.99 07,99	0.00 —	0.00 —	0.00 —	18.22 19,82	1.85 1,80	0.00 —	0.00 —	0.00 0.00
17 18	ALL	920.20 92,20	273.64 27,64	19.56 19,56	112.14 11,21	264.40 26,44	240.61 24,61	6.84 7,84	0.00 —	0.00 —	0.00 0.00
18 19	ALL	566.77 07,77	102.15 10,15	3.70 4,70	29.27 29,27	46.15 47,15	331.34 33,34	4.15 4,15	0.00 —	0.00 —	0.00 0.00
19 20	ALL	1226.91 12,26	323.20 32,20	36.37 36,37	71.81 71,81	349.00 34,90	428.57 42,85	17.96 17,96	0.00 —	0.00 —	0.00 0.00
20 21	ALL	2115.45 21,15	646.33 64,63	178.16 17,81	73.40 73,40	1190.43 11,90	24.89 24,89	2.25 2,25	0.00 —	0.00 —	0.00 0.00
21 22	ALL	891.76 89,17	178.39 17,83	0.77 0,77	107.92 10,79	170.16 17,16	426.34 42,63	8.19 8,19	0.00 —	0.00 —	0.00 0.00
22 23	ALL	2508.65 25,08	545.12 54,51	30.62 30,62	210.92 21,09	1332.11 13,32	370.25 37,25	19.64 19,64	0.00 —	0.00 —	0.00 0.00
23 24	ALL	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 0.00
24 25	ALL	12.90 12,90	7.27 7,27	0.00 —	0.82 0,82	2.14 2,14	2.66 2,66	0.00 —	0.00 —	0.00 —	0.00 0.00
25 26	ALL	971.47 97,14	291.81 29,18	72.97 72,97	49.09 49,09	394.55 39,45	162.33 16,23	10.72 10,72	0.00 —	0.00 —	0.00 0.00
26 27	ALL	122.02 12,20	111.68 11,16	10.34 10,34	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 0.00
27 28	ALL	820.40 82,40	59.83 59,83	0.00 —	0.00 —	40.56 40,56	660.30 66,30	59.70 59,70	0.00 —	0.00 —	0.00 0.00
28 29	ALL	1957.77 19,57	267.35 26,73	49.28 49,28	73.45 73,45	391.66 39,16	1220.57 12,20	15.47 15,47	0.00 —	0.00 —	0.00 0.00
29 30	ALL	1523.31 15,23	62.21 62,21	2.25 2,25	98.18 98,18	79.38 79,38	1275.18 12,75	6.12 6,12	0.00 —	0.00 —	0.00 0.00
30 31	ALL	1455.20 14,55	227.76 22,76	2.30 2,30	2.26 2,26	19.85 19,85	1162.49 11,62	40.55 40,55	0.00 —	0.00 —	0.00 0.00
31 32	ALL	2204.24 22,04	1534.19 15,34	0.00 —	0.00 —	0.00 —	603.62 60,36	66.43 66,43	0.00 —	0.00 —	0.00 0.00
32 33	ALL	836.49 83,64	216.63 21,66	9.13 9,13	1.54 1,54	0.00 —	602.63 60,26	6.56 6,56	0.00 —	0.00 —	0.00 0.00
33 34	ALL	910.37 91,03	7.47 7,47	0.00 —	21.85 21,85	0.44 0,44	879.36 87,93	1.25 1,25	0.00 —	0.00 —	0.00 0.00
34 35	ALL	656.13 65,61	106.68 10,66	5.28 5,28	0.00 —	0.00 —	542.89 54,28	1.28 1,28	0.00 —	0.00 —	0.00 0.00

35 ٤٥	ALL	1859.76 ١٨٥٩,٧٦	369.13 ٣٦٩,١٣	1.19 ١,١٩	0.00 —	0.00 —	1455.20 ١٤٥٥,٢٠	34.24 ٣٤,٢٤	0.00 —	0.00 —	0.00 —
36 ٤٦	ALL	1345.65 ١٣٤٥,٦٥	54.91 ٥٤,٩١	5.85 ٥,٨٥	0.00 —	37.59 ٣٧,٥٩	1174.99 ١١٧٤,٩٩	72.31 ٧٢,٣١	0.00 —	0.00 —	0.00 —
37 ٤٧	ALL	989.85 ٩٨٩,٨٥	493.35 ٤٩٣,٣٥	0.00 —	0.00 —	0.00 —	469.05 ٤٦٩,٠٥	27.44 ٢٧,٤٤	0.00 —	0.00 —	0.00 —
38 ٤٨	ALL	32.09 ٣٢,٠٩	32.09 ٣٢,٠٩	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
39 ٤٩	ALL	1105.64 ١١٠٥,٦٤	904.91 ٩٠٤,٩١	22.53 ٢٢,٥٣	0.00 —	0.00 —	157.77 ١٥٧,٧٧	20.43 ٢٠,٤٣	0.00 —	0.00 —	0.00 —
40 ٥٠	ALL	467.98 ٤٦٧,٩٨	76.12 ٧٦,١٢	17.07 ١٧,٠٧	0.00 —	0.00 —	356.22 ٣٥٦,٢٢	18.58 ١٨,٥٨	0.00 —	0.00 —	0.00 —
41 ٥١	ALL	234.87 ٢٣٤,٨٧	15.50 ١٥,٥٠	0.00 —	0.00 —	0.00 —	219.39 ٢١٩,٣٩	0.00 —	0.00 —	0.00 —	0.00 —
42 ٥٢	ALL	1032.40 ١٠٣٢,٤٠	1032.40 ١٠٣٢,٤٠	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
43 ٥٣	ALL	1137.57 ١١٣٧,٥٧	0.00 —	0.00 —	0.00 —	12.93 ١٢,٩٣	1024.53 ١٠٢٤,٥٣	100.11 ١٠٠,١١	0.00 —	0.00 —	0.00 —
51 ٥٤	ALL	2260.38 ٢٢٦٠,٣٨	1655.89 ١٦٥٥,٨٩	167.59 ١٦٧,٥٩	29.89 ٢٩,٨٩	207.61 ٢٠٧,٦١	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
45 ٥٥	ALL	1936.19 ١٩٣٦,١٩	589.65 ٥٨٩,٦٥	390.79 ٣٩٠,٧٩	1.62 ١,٦٢	660.50 ٦٦٠,٥٠	291.19 ٢٩١,١٩	3.45 ٣,٤٥	0.00 —	0.00 —	0.00 —
46 ٥٦	ALL	1569.00 ١٥٦٩	1541.47 ١٥٤١,٤٧	0.00 —	0.00 —	0.00 —	24.17 ٢٤,١٧	2.36 ٢,٣٦	0.00 —	0.00 —	0.00 —
47 ٥٧	ALL	299.42 ٢٩٩,٤٢	138.85 ١٣٨,٨٥	44.05 ٤٤,٠٥	0.00 —	0.00 —	116.52 ١١٦,٥٢	0.00 —	0.00 —	0.00 —	0.00 —
48 ٥٨	ALL	1015.90 ١٠١٥,٩٠	449.12 ٤٤٩,١٢	19.88 ١٩,٨٨	0.00 —	205.06 ٢٠٥,٠٦	338.66 ٣٣٨,٦٦	2.98 ٢,٩٨	0.00 —	0.00 —	0.00 —
49 ٥٩	ALL	435.56 ٤٣٥,٥٦	305.89 ٣٠٥,٨٩	6.85 ٦,٨٥	0.00 —	0.00 —	122.82 ١٢٢,٨٢	0.00 —	0.00 —	0.00 —	0.00 —
50 ٦٠	ALL	2492.97 ٢٤٩٢,٩٧	1865.58 ١٨٦٥,٥٨	627.40 ٦٢٧,٤٠	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —

ALL	ALL	45376.69 ٤٥٣٧٦,٦٩	16167.76 ١٦١٦٧,٧٦	1845.35 ١٨٤٥,٣٥	1724.22 ١٧٢٤,٢٢	7548.21 ٧٥٤٨,٢١	17790.63 ١٧٧٩٠,٦٣	733.95 ٧٣٣,٩٥	64.57 ٦٤,٥٧	0.00 —	0.00 —
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اشهد ان المعلومات المدونة اعلاه صحيحة وواقعية ومطابقة للمواصفات الواردة بجدول الكميات
شارلي ل. ميلر - مهندس مسجل ومستقل

I hereby certify that the above information is accurate, actual and identical with the specifications set forth in the B.O.Q.


CHARLIE L. MILLER
Registered Independent Engineer

120/9/88

12-FEB-85

10:16:39

ARABIAN CLEANING ENTERPRISE LTD.

JEDDAH, SAUDI ARABIA

BILL OF QUANTITIES C

شركة لخدمات نظافة
جدة / المملكة العربية السعودية
محول التأسيس ج

GRAND TOTALS REPORT

نصير طامع السليبي

امران السراي - كسبتون - جب نفق راسي
STREET LENGTH (KILOMETERS) - BY KIND OF STREET

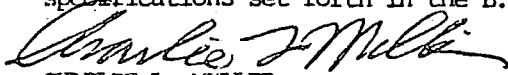
DISTRICT	SECTOR	TOTAL	21	22	23	24	25	26	27	28	29
			SA	SC	SY	SL	SO	ST	SL	SA	SA
1	ALL	10.88	2.03	0.00	2.06	0.84	5.95	0.00	0.00	0.00	0.00
1		١,٨٨	٢,٠٣	—	٢,٠٦	٨٤	٥,٩٥	—	—	—	—
2	ALL	1.54	0.71	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.00
2		١,٥٤	٧١	—	—	—	٨٤	—	—	—	—
3	ALL	1.44	0.55	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.00
3		١,٤٤	٥٥	—	—	—	٨٩	—	—	—	—
4	ALL	8.12	1.90	0.00	3.48	0.92	1.82	0.00	0.00	0.00	0.00
4		٨,١٢	١,٩٠	—	٣,٤٨	٩٢	١,٨٢	—	—	—	—
5	ALL	2.80	0.00	0.00	1.50	0.00	1.30	0.00	0.00	0.00	0.00
5		٢,٨٠	—	—	١,٥٠	—	١,٣٠	—	—	—	—
6	ALL	4.95	0.00	0.00	2.49	0.00	2.46	0.00	0.00	0.00	0.00
6		٤,٩٥	—	—	٢,٤٩	—	٢,٤٦	—	—	—	—
7	ALL	7.93	0.00	0.00	4.90	1.15	1.89	0.00	0.00	0.00	0.00
7		٧,٩٣	—	—	٤,٩٠	١,١٥	١,٨٩	—	—	—	—
8	ALL	14.29	2.59	1.09	0.62	9.32	0.66	0.00	0.00	0.00	0.00
8		١٤,٢٩	٢,٥٩	١,٠٩	٦٢	٩,٣٢	٦٦	—	—	—	—
9	ALL	10.90	0.00	0.00	7.94	1.58	1.38	0.00	0.00	0.00	0.00
9		١٠,٩٠	—	—	٧,٩٤	١,٥٨	١,٣٨	—	—	—	—
10	ALL	19.76	0.00	1.18	3.50	4.10	10.38	0.50	0.00	0.00	0.00
10		١٩,٧٦	—	١,١٨	٣,٥٠	٤,١٠	١٠,٣٨	٥٠	—	—	—
11	ALL	4.39	0.90	1.35	0.00	0.00	2.14	0.00	0.00	0.00	0.00
11		٤,٣٩	٩٠	١,٣٥	—	—	٢,١٤	—	—	—	—
12	ALL	4.54	1.41	0.00	0.00	2.39	0.65	0.09	0.00	0.00	0.00
12		٤,٥٤	١,٤١	—	—	٢,٣٩	٦٥	٠٩	—	—	—
13	ALL	8.61	0.00	0.00	0.00	3.39	3.17	0.53	0.00	0.00	1.52
13		٨,٦١	—	—	—	٣,٣٩	٣,١٧	٥٣	—	—	١,٥٢
14	ALL	5.32	0.00	0.00	0.00	0.54	5.23	0.00	0.00	0.00	0.00
14		٥,٣٢	—	—	—	٥٤	٥,٢٣	—	—	—	—

15 10	ALL	40.03 8,72	0.00 —	0.99 2.99	0.00 —	0.00 —	5.13 0,14	2.06 0,17	0.00 —	0.00 —	31.84 41,82
16 17	ALL	6.04 7,2	0.00 —	0.00 —	0.00 —	3.85 4,80	2.20 0,20	0.00 —	0.00 —	0.00 —	0.00 —
17 18	ALL	12.00 10,00	0.81 2,81	0.00 —	0.00 —	6.85 7,80	4.36 4,47	0.00 —	0.00 —	0.00 —	0.00 —
18 19	ALL	3.64 4,72	0.00 —	0.00 —	0.00 —	0.00 —	3.64 4,72	0.00 —	0.00 —	0.00 —	0.00 —
19 20	ALL	16.71 17,71	3.84 4,82	0.00 —	0.00 —	12.47 10,27	0.40 2,40	0.00 —	0.00 —	0.00 —	0.00 —
20 21	ALL	15.82 10,82	5.24 0,24	0.00 —	4.17 2,17	4.40 2,40	1.35 1,40	0.65 2,60	0.00 —	0.00 —	0.00 —
21 22	ALL	9.64 8,72	0.00 —	0.00 —	9.38 7,48	0.26 2,26	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
22 23	ALL	24.76 24,76	3.21 4,21	2.32 0,32	6.52 7,00	6.33 7,44	2.00 0,00	0.00 —	0.00 —	0.00 —	4.58 2,08
23 24	ALL	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
24 25	ALL	0.63 0,63	0.00 —	0.00 —	0.29 2,29	0.00 —	0.34 2,42	0.00 —	0.00 —	0.00 —	0.00 —
25 26	ALL	10.11 1,11	0.00 —	0.00 —	6.34 7,42	3.77 4,47	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
26 27	ALL	11.62 11,70	3.49 4,49	0.00 —	5.10 0,10	3.03 4,03	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
27 28	ALL	37.52 40,00	3.11 4,11	5.52 0,00	0.00 —	28.23 28,23	0.65 2,60	0.00 —	0.00 —	0.00 —	0.00 —
28 29	ALL	21.65 21,70	1.65 1,77	4.87 2,87	3.42 4,42	10.30 10,30	0.90 2,90	0.00 —	0.00 —	0.00 —	0.00 —
29 30	ALL	21.42 21,42	1.87 1,87	4.30 2,30	4.09 2,09	9.28 9,28	1.87 1,87	0.00 —	0.00 —	0.00 —	0.00 —
30 31	ALL	29.49 29,49	6.08 7,08	4.49 2,49	5.82 0,82	4.27 4,27	8.79 8,79	0.00 —	0.00 —	0.00 —	0.00 —
31 32	ALL	49.37 49,40	7.94 4,94	2.61 0,61	1.26 1,26	5.01 0,01	31.54 41,02	0.00 —	1.01 1,01	0.00 —	0.00 —
32 33	ALL	24.06 24,06	0.54 2,02	5.11 0,11	2.22 0,22	9.57 9,07	7.62 4,72	0.00 —	0.00 —	0.00 —	0.00 —
33 34	ALL	19.89 19,89	0.00 —	4.38 2,38	4.74 2,74	4.75 2,07	6.02 7,02	0.00 —	0.00 —	0.00 —	0.00 —
34 35	ALL	15.59 10,09	0.00 —	2.79 0,79	5.85 0,80	1.56 1,07	3.50 4,00	0.00 —	0.00 —	0.00 —	1.89 1,89

35 40	ALL	26.44 ٢٦,٤٤	2.00 ٢,٠٠	2.88 ٢,٨٨	4.54 ٤,٥٤	16.96 ١٦,٩٦	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
36 47	ALL	20.25 ٢٠,٢٥	0.00 —	4.24 ٤,٢٤	2.37 ٢,٣٧	10.21 ١٠,٢١	2.35 ٢,٣٥	1.16 ١,١٦	0.00 —	0.00 —	0.00 —
37 48	ALL	28.00 ٢٨	0.00 —	5.03 ٥,٠٣	2.63 ٢,٦٣	15.34 ١٥,٣٤	3.51 ٣,٥١	0.00 —	0.00 —	0.00 —	0.00 —
38 48	ALL	8.07 ٨,٠٧	1.33 ١,٣٣	1.51 ١,٥١	0.00 —	0.00 —	2.88 ٢,٨٨	0.00 —	0.00 —	0.00 —	2.35 ٢,٣٥
39 49	ALL	56.68 ٥٦,٦٨	11.85 ١١,٨٥	28.69 ٢٨,٦٩	2.56 ٢,٥٦	5.75 ٥,٧٥	7.72 ٧,٧٢	2.11 ٢,١١	0.00 —	0.00 —	0.00 —
40 50	ALL	7.04 ٧,٠٤	7.54 ٧,٥٤	0.00 —	0.00 —	0.00 —	3.16 ٣,١٦	0.00 —	0.00 —	0.00 —	0.00 —
41 51	ALL	4.14 ٤,١٤	0.00 —	2.78 ٢,٧٨	0.00 —	0.00 —	1.44 ١,٤٤	0.32 ٣,٣٢	0.00 —	0.00 —	0.00 —
42 52	ALL	19.88 ١٩,٨٨	4.71 ٤,٧١	4.44 ٤,٤٤	0.00 —	0.00 —	0.00 —	31.12 ٣١,١٢	0.00 —	0.00 —	0.00 —
43 53	ALL	11.25 ١١,٢٥	3.60 ٣,٦٠	0.00 —	1.22 ١,٢٢	5.32 ٥,٣٢	1.12 ١,١٢	0.00 —	0.00 —	0.00 —	0.00 —
51 54	ALL	40.37 ٤٠,٣٧	12.59 ١٢,٥٩	2.87 ٢,٨٧	0.00 —	0.00 —	0.00 —	18.92 ١٨,٩٢	0.00 —	0.00 —	0.34 ٣,٣٤
45 55	ALL	17.44 ١٧,٤٤	8.25 ٨,٢٥	0.00 —	0.97 ٩,٩٧	18.27 ١٨,٢٧	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
46 57	ALL	63.41 ٦٣,٤١	11.37 ١١,٣٧	10.29 ١٠,٢٩	0.00 —	0.00 —	3.75 ٣,٧٥	13.35 ١٣,٣٥	0.00 —	0.00 —	1.41 ١,٤١
47 58	ALL	25.42 ٢٥,٤٢	7.04 ٧,٠٤	17.96 ١٧,٩٦	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.43 ٤,٣٣
48 58	ALL	30.74 ٣٠,٧٤	10.06 ١٠,٠٦	7.33 ٧,٣٣	2.83 ٢,٨٣	2.18 ٢,١٨	3.59 ٣,٥٩	0.00 —	3.74 ٣,٧٤	0.00 —	0.00 —
49 59	ALL	18.03 ١٨,٠٣	7.54 ٧,٥٤	0.00 —	0.00 —	2.03 ٢,٠٣	2.85 ٢,٨٥	4.04 ٤,٠٤	0.00 —	0.00 —	1.55 ١,٥٥
50 60	ALL	95.00 ٩٥,٠٠	41.03 ٤١,٠٣	0.00 —	0.00 —	0.00 —	0.00 —	44.42 ٤٤,٤٢	0.00 —	0.00 —	0.00 —
ALL	ALL	947.57 ٩٤٧,٥٧	177.01 ١٧٧,٥١	127.37 ١٢٧,٣٧	100.37 ١٠٠,٣٧	214.16 ٢١٤,١٦	157.57 ١٥٧,٥٧	139.44 ١٣٩,٤٤	4.75 ٤,٧٥	0.00 —	45.91 ٤٥,٩١

اشهد ان المعلومات المدونة اعلاه صحيحة وواقعية ومطابقة للمواصفات الواردة بجدول الكميات
شارلي ل. ميلر - مهندس مسجل ومستقل

I hereby certify that the above information is accurate, actual and identical with the specifications set forth in the B.O.Q.


CHARLIE L. MILLER
Registered Independent Engineer

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12-FEB-85
10:16:39

ARABIAN CLEANING ENTERPRISE LTD.

JEDDAH, SAUDI ARABIA

BILL OF QUANTITIES C

GRAND TOTALS REPORT

شركة النظافة العربية المحدودة
ص.ب. - المدينة المنورة

مركز الحسابات

تقرير كميات الأعمال

الأسفلت، البلاط، الخرسانة، الحديد، الخشب، الخ

PRICES IN SR 000 - BY KIND OF STREET

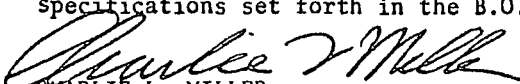
DISTRICT	SECTOR	TOTAL	21	22	23	24	25	26	27	28	29
١	٢	٣	٤	٥	٦	٧	٨	٩	١٠	١١	١٢
1	ALL	355.00	35.70	0.00	92.25	33.89	194.16	0.00	0.00	0.00	0.00
١		٤٥٦	٤٥,٧٠	—	٨٢,٢٥	٤٤,٨٨	١٩٤,١٦	—	—	—	—
2	ALL	39.71	12.46	0.00	0.00	0.00	27.25	0.00	0.00	0.00	0.00
٢		٤٩,٧١	١٢,٤٦	—	—	—	٢٧,٢٥	—	—	—	—
3	ALL	38.80	9.75	0.00	0.00	0.00	29.05	0.00	0.00	0.00	0.00
٣		٤٨,٨٠	٩,٧٥	—	—	—	٢٩,٠٥	—	—	—	—
4	ALL	285.83	33.45	0.00	155.70	37.39	59.30	0.00	0.00	0.00	0.00
٤		٢٨٥,٨٣	٣٣,٤٥	—	١٥٥,٧٠	٣٧,٣٩	٥٩,٣٠	—	—	—	—
5	ALL	109.36	0.00	0.00	66.82	0.00	42.54	0.00	0.00	0.00	0.00
٥		١٠٩,٣٦	—	—	٦٦,٨٢	—	٤٢,٥٤	—	—	—	—
6	ALL	171.54	0.00	0.00	111.26	0.00	80.34	0.00	0.00	0.00	0.00
٦		١٧١,٥٤	—	—	١١١,٢٦	—	٨٠,٣٤	—	—	—	—
7	ALL	326.96	0.00	0.00	219.75	46.61	61.60	0.00	0.00	0.00	0.00
٧		٣٢٦,٩٦	—	—	٢١٩,٧٥	٤٦,٦١	٦١,٦٠	—	—	—	—
8	ALL	519.21	45.54	46.29	27.75	378.19	21.44	0.00	0.00	0.00	0.00
٨		٥١٩,٢١	٤٥,٥٤	٤٦,٢٩	٢٧,٧٥	٣٧٨,١٩	٢١,٤٤	—	—	—	—
9	ALL	463.97	0.00	0.00	354.88	64.10	44.98	0.00	0.00	0.00	0.00
٩		٤٦٣,٩٧	—	—	٣٥٤,٨٨	٦٤,١٠	٤٤,٩٨	—	—	—	—
10	ALL	720.44	0.00	49.89	156.33	166.44	338.57	9.19	0.00	0.00	0.00
١٠		٧٢٠,٤٤	—	٤٩,٨٩	١٥٦,٣٣	١٦٦,٤٤	٣٣٨,٥٧	٩,١٩	—	—	—
11	ALL	142.53	15.88	56.94	0.00	0.00	69.71	0.00	0.00	0.00	0.00
١١		١٤٢,٥٣	١٥,٨٨	٥٦,٩٤	—	—	٦٩,٧١	—	—	—	—
12	ALL	144.21	24.84	0.00	0.00	96.78	21.22	1.37	0.00	0.00	0.00
١٢		١٤٤,٢١	٢٤,٨٤	—	—	٩٦,٧٨	٢١,٢٢	١,٣٧	—	—	—
13	ALL	249.13	0.00	0.00	0.00	137.55	103.44	8.15	0.00	0.00	0.00
١٣		٢٤٩,١٣	—	—	—	١٣٧,٥٥	١٠٣,٤٤	٨,١٥	—	—	—
14	ALL	194.12	0.00	0.00	0.00	21.97	172.25	0.00	0.00	0.00	0.00
١٤		١٩٤,١٢	—	—	—	٢١,٩٧	١٧٢,٢٥	—	—	—	—

10	88	CE,AC	—	21,81	—	—	170,2.	41,71	—	—	—
15	ALL	240.82	0.00	41.81	0.00	0.00	157.40	31.61	0.00	0.00	0.00
17		CEU,AL	—	—	—	107,1A	5,74	—	—	—	—
16	ALL	227.01	0.00	0.00	0.00	156.18	71.63	0.00	0.00	0.00	0.00
10		CE,CL	12,00	—	—	244,49	12,00	—	—	—	—
17	ALL	434.31	14.25	0.00	0.00	277.79	142.27	0.00	0.00	0.00	0.00
1A		11A,84	—	—	—	—	11A,84	—	—	—	—
18	ALL	118.73	0.00	0.00	0.00	0.00	118.73	0.00	0.00	0.00	0.00
19		0A7,70	20,77	—	—	0.0A.	14,11	—	—	—	—
19	ALL	586.67	67.66	0.00	0.00	505.90	13.11	0.00	0.00	0.00	0.00
20		011,44	25,0A	—	1A7,1.	10A,0A	22,0.	2,2A	—	—	—
20	ALL	511.33	92.58	0.00	186.10	178.58	44.29	9.88	0.00	0.00	0.00
21		25A,02	—	—	21A,94	1,7.	—	—	—	—	—
21	ALL	429.54	0.00	0.00	418.93	10.60	0.00	0.00	0.00	0.00	0.00
22		07A,04	07,1A	2A,01	291,2.	007,1.	70,42	—	—	—	—
22	ALL	738.23	56.48	98.21	291.40	256.80	65.34	0.00	0.00	0.00	0.00
23		—	—	—	—	—	—	—	—	—	—
23	ALL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24		04,80	—	—	10,09	—	11,7	—	—	—	—
24	ALL	23.35	0.00	0.00	12.79	0.00	11.06	0.00	0.00	0.00	0.00
25		047,01	—	—	0A4,11	104,1.	—	—	—	—	—
25	ALL	436.21	0.00	0.00	283.11	153.10	0.00	0.00	0.00	0.00	0.00
26		210,00	71,49	—	004A	104,1A	—	—	—	—	—
26	ALL	412.35	61.39	0.00	227.28	123.08	0.00	0.00	0.00	0.00	0.00
27		1200,00	02,17	044,24	—	1120,00	01,09	—	—	—	—
27	ALL	1455.05	54.86	233.43	0.00	1145.47	21.29	0.00	0.00	0.00	0.00
28		1000,01	04,00	0.0,0.	100,0.	24A,01	04,00	—	—	—	—
28	ALL	855.41	29.22	205.80	152.90	438.21	29.27	0.00	0.00	0.00	0.00
29		140,1A	44,1	1A1,7.	1A5,10	407,7A	71,2	—	—	—	—
29	ALL	835.18	33.01	181.60	182.95	376.68	61.04	0.00	0.00	0.00	0.00
30		11A,70	10,1.	1A9,20	07,0A	104,14	0A7,79	—	—	—	—
30	ALL	1018.67	107.00	189.87	261.78	173.13	286.89	0.00	0.00	0.00	0.00
31		104,07	14A,07	11,24	07,00	0A4,10	104,1A	—	1,91	—	—
31	ALL	1549.56	139.76	110.43	56.22	203.17	1029.08	0.00	10.91	0.00	0.00
32		1A1,2	4,0A	017,1	2A,00	40,0A	0A7,74	—	—	—	—
32	ALL	921.03	9.58	216.01	99.22	347.58	248.63	0.00	0.00	0.00	0.00
33		1A0,0.	—	1A0,02	011,02	1A0,07	1A7,47	—	—	—	—
33	ALL	795.90	0.00	185.24	211.74	192.56	195.36	0.00	0.00	0.00	0.00
34		000,1	—	114,90	071,02	74,01	112,40	—	—	—	—
34	ALL	557.01	0.00	117.92	261.54	63.21	114.35	0.00	0.00	0.00	0.00

35 ٢٥	ALL	1046.24 ١٠٤٦,٢٤	35.71 ٣٥,٧١	120.39 ١٢٠,٣٩	203.03 ٢٠٣,٠٣	586.15 ٥٨٦,١٥	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
36 ٢٦	ALL	791.47 ٧٩١,٤٧	0.00 —	179.21 ١٧٩,٢١	106.91 ١٠٦,٩١	414.22 ٤١٤,٢٢	73.35 ٧٣,٣٥	17.76 ١٧,٧٦	0.00 —	0.00 —	0.00 —
37 ٢٧	ALL	1129.31 ١١٢٩,٣١	0.00 —	254.72 ٢٥٤,٧٢	117.37 ١١٧,٣٧	542.80 ٥٤٢,٨٠	114.43 ١١٤,٤٣	0.00 —	0.00 —	0.00 —	0.00 —
38 ٢٨	ALL	181.20 ١٨١,٢٠	23.41 ٢٣,٤١	63.75 ٦٣,٧٥	0.00 —	0.00 —	94.03 ٩٤,٠٣	0.00 —	0.00 —	0.00 —	0.00 —
39 ٢٩	ALL	1969.00 ١٩٦٩,٠٠	268.73 ٢٦٨,٧٣	1128.47 ١١٢٨,٤٧	114.32 ١١٤,٣٢	233.23 ٢٣٣,٢٣	251.94 ٢٥١,٩٤	32.30 ٣٢,٣٠	0.00 —	0.00 —	0.00 —
40 ٣٠	ALL	145.75 ١٤٥,٧٥	44.75 ٤٤,٧٥	0.00 —	0.00 —	0.00 —	101.22 ١٠١,٢٢	0.00 —	0.00 —	0.00 —	0.00 —
41 ٣١	ALL	152.40 ١٥٢,٤٠	0.00 —	100.00 ١٠٠,٠٠	0.00 —	0.00 —	46.84 ٤٦,٨٤	4.95 ٤,٩٥	0.00 —	0.00 —	0.00 —
42 ٣٢	ALL	740.37 ٧٤٠,٣٧	76.15 ٧٦,١٥	187.71 ١٨٧,٧١	0.00 —	0.00 —	0.00 —	475.51 ٤٧٥,٥١	0.00 —	0.00 —	0.00 —
43 ٣٣	ALL	370.34 ٣٧٠,٣٤	63.39 ٦٣,٣٩	0.00 —	54.53 ٥٤,٥٣	215.96 ٢١٥,٩٦	36.46 ٣٦,٤٦	0.00 —	0.00 —	0.00 —	0.00 —
51 ٥١	ALL	730.76 ٧٣٠,٧٦	327.37 ٣٢٧,٣٧	112.78 ١١٢,٧٨	0.00 —	0.00 —	0.00 —	290.61 ٢٩٠,٦١	0.00 —	0.00 —	0.00 —
45 ٤٥	ALL	926.06 ٩٢٦,٠٦	145.25 ١٤٥,٢٥	0.00 —	43.17 ٤٣,١٧	739.54 ٧٣٩,٥٤	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
46 ٤٦	ALL	1373.79 ١٣٧٣,٧٩	200.32 ٢٠٠,٣٢	434.58 ٤٣٤,٥٨	0.00 —	0.00 —	228.15 ٢٢٨,١٥	510.73 ٥١٠,٧٣	0.00 —	0.00 —	0.00 —
47 ٤٧	ALL	881.20 ٨٨١,٢٠	123.91 ١٢٣,٩١	759.29 ٧٥٩,٢٩	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —	0.00 —
48 ٤٨	ALL	963.37 ٩٦٣,٣٧	177.12 ١٧٧,١٢	310.06 ٣١٠,٠٦	37.20 ٣٧,٢٠	88.60 ٨٨,٦٠	215.01 ٢١٥,٠١	0.00 —	40.38 ٤٠,٣٨	0.00 —	0.00 —
49 ٤٩	ALL	370.25 ٣٧٠,٢٥	133.19 ١٣٣,١٩	0.00 —	0.00 —	92.37 ٩٢,٣٧	92.86 ٩٢,٨٦	61.86 ٦١,٨٦	0.00 —	0.00 —	0.00 —
50 ٥٠	ALL	1402.83 ١٤٠٢,٨٣	722.50 ٧٢٢,٥٠	0.00 —	0.00 —	0.00 —	0.00 —	680.23 ٦٨٠,٢٣	0.00 —	0.00 —	0.00 —
=====											
ALL	ALL	29035.10 ٢٩٠٣٥,١٠	3125.31 ٣١٢٥,٣١	5334.99 ٥٣٣٤,٩٩	4506.69 ٤٥٠٦,٦٩	8689.83 ٨٦٨٩,٨٣	5140.81 ٥١٤٠,٨١	2135.18 ٢١٣٥,١٨	51.29 ٥١,٢٩	0.00 —	0.00 —

اشهد ان المعلومات المدونة اعلاه صحيحة وواقعية ومطابقة للمواصفات الواردة بجدول الكميات
شارلي ميلر - مهندس مسجل ومستقل

I hereby certify that the above information is accurate, actual and identical with the specifications set forth in the B.O.Q.


CHARLIE L. MILLER
Registered Independent Engineer

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