

STUDY REPORT ON ROAD TRAFFIC IN TRIPOLI, LIBYA

August 1976

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

The Libyan Government requested the Japanese Government to conduct survey and render consulting services by experts on the mitigation of traffic congestion in Metropolitan Tripoli as it gave much credit to the world's foremost traffic control system practised in Japan.

In response to this request, the Japanese Government entrusted the Japan International Cooperation Agency with the task of undertaking a survey in Libya.

The Japan International Cooperation Agency, fully realizing the significance of the mission assigned to it, organized a survey team consisting of three experts of the National Police Agency and dispatched it to Libya to conduct field investigations for some twenty days from mid-May this year.

The report submitted herewith is an outcome of the survey, which contains the findings, and fundamental yet material suggestions in the interest of Metropolitan Tripoli.

It is my sincere hope that this report will prove to be useful in some way for the improvement of road traffic in Tripoli and for the promotion of friendship between Japan and the Libyan Arab Republic.

On behalf of the Japan International Cooperation Agency, we would like to take this opportunity to express our deepest appreciation to the Libyan Government, Embassy of Japan and other authorities concerned for their unlimited cooperation and assistance and warm hospitality extended to the team during their stay in Libya. Our indebtedness is also great to the Ministry of Foreign Affairs and the National Police Agency which have provided a strong support to our activities.

August, 1976

Shinsaku Hogen
Director General
Japan International Cooperation Agency

Table of Contents

CHAPTER 1.	GENERAL	1
1.1	Purpose of the Survey, Survey Period and Formation of Survey Team	1
1.2	Summary of Study Activities	1
CHAPTER 2.	FUNDAMENTAL PROBLEMS	2
2.1	Introduction	2
2.2	Basic Approach to Urban Transportation	3
2.3	Administration for Traffic Control and Management	4
2.4	Suggestions on Some Basic Problems for the Promotion of Traffic Management Measures	10
1.	Formation of road networks, maintenance of roads, etc.	10
2.	Protection of "the weak" in traffic	13
3.	Parking problems	15
4.	Road markings	17
5.	Road signs	18
6.	Control of construction work on and around roads	19
7.	Traffic signals	21
8.	Traffic control system	26
9.	Others	28
CHAPTER 3.	CONCRETE PLANS FOR THE ARRANGEMENT OF TRAFFIC CONTROL FACILITIES IN MODEL AREAS	30

3.1	Block on Zawia Street between the Intersection in front of the Police Academy and the Intersec- tion in front of the Theater	30
3.2	Triangle intersection Area of New Zawia Street and Sports City Street	34
3.3	Intersection of Ring Road and Swani Street, and its neighborhood	36
3.4	Intersection of Swani Street and Sports City Street, and Its Neighborhood	43
3.5	Intersection of Ring Road and Airport Road, and Its Neighborhood	46
3.6	Rotary on Coastal Road Leading to Al Homs	47
3.7	Downtown Area	49
CHAPTER 4.	CONCLUSIONS	54
	POSTSCRIPT	56

CHAPTER 1. GENERAL

1.1 Purpose of the Survey, Survey Period and Formation of Survey Team

In response to the request of the Libyan Arab Republic addressed to the Japanese Government concerning the introduction of traffic control system, the Japan International Cooperation Agency (JICA) debated the matter with the Ministry of Foreign Affairs and the National Police Agency, and dispatched the following survey team. The main purpose of the survey is to offer suggestions pertaining to concrete measures for the arrangement of the road traffic control in Tripoli.

Period of survey: May 20 to June 13, 1976

Members of the survey team:-

Chief	Hiroyuki Okamoto, D.E.	Technical councillor, Traffic Bureau, National Police Agency
Member	Moriichi Hanada	Administrative Officer, Traffic Division, Tokyo Metropolitan Police Department
	Takeshi Ogawa	Administrative Official, Driver's License Section Traffic Bureau, National Police Agency

1.2 Summary of Study Activities

With the help of the Central Traffic Department, Ministry of Interior, the Libyan Arab Republic, the aforesaid survey team could conduct a minute fact-finding survey of traffic conditions in and around Metropolitan Tripoli, along with some measurements. According to the results of the survey, this report is compiled to put together fundamental problems and, for the purpose of presenting what the urban traffic control facilities should be, to suggest concrete traffic control measures for each of selected seven areas.

CHAPTER 2. FUNDAMENTAL PROBLEMS

2.1 Introduction

The road is used as a means of transportation. In considering the measures for road traffic, we must start with identifying the position of the road traffic within the total transportation system. The road traffic is mainly borne by vehicles, which provide a convenience of door-to-door transportation. Motorization, in this context, is highly conducive to the promotion of socio-economic activities and the growth of national economy as a whole.

On the other hand, the motorization, the degree of which is assessed in terms of per capita car holding ratio which tends to rise sharply with increase in the economic sinews of people of a nation, has a vicious phase as most of motorized nations represent; namely, there are many countries which have been afflicted with serious traffic congestion because of concentration of people in the cities and because the resultant increase in traffic volume in specific areas overshadows the efforts of road construction and reconstruction.

Besides, the vehicles are a highly potential cause of traffic accidents and environmental pollution due to emission, noise and vibration. For these reasons, achievement of all-encompassing measures for traffic flow control - that is, proper management of vehicular traffic and most effective use of existing road networks - has become one of major problems in every cockpit city in the world.

It is a world-wide conviction that proper traffic flow control presupposes the so-called 3-E (meaning Education, Enforcement and Engineering). In Japan, for example, the incidence of traffic accident has remarkably been decreased in recent years (in five consecutive years since 1971; the incidence is still on the decline this year), owing no doubt to the persistent cooperation of the

government and the people for more than a decade in promoting the various measures including the 3-E.

Here, then, the following fundamental problems may be pointed out in regard to the traffic management in Metropolitan Tripoli.

2.2 Basic Approach to Urban Transportation

In the world today, the transportation of people and goods has been changing at a rapid pace from the so-far dominant railways and ships to the automobiles. It is therefore of great importance to push forward the amplification of transportation system with center on the vehicular traffic. It should be borne in mind, however, that expansion of a city in both area and population generates, without exception, a violent increase in vehicular traffic demand and the problems of traffic congestion and concentration. In order to cope with these problems, many countries have been pushing forward the decentralization of traffic-generating facilities (such as factories and wholesale markets) toward suburbs, amplification of mass transit system, establishment of privileges for bus and other mass transit, and rationalization of marketing system.

As for Metro Tripoli, construction of large housing complexes is actively under way in the outlying areas, and the passengers going to and leaving there are likely to count much upon cars. Also, the wholesale markets are located at the center of Tripoli. All these are suggestive of a great likelihood of developmental stages many advanced cities in the world have followed. It is well known that once private cars have been popularized it is hard for their owners to take mass transit instead of their own cars. Whether the traffic management in Tripoli will go well in future will largely be dependent not only on the construction of roads, but also on how the current and future city development plans consider

and tackle such important problems as amplification of subways, bus route and other mass transit systems and suburbanization of goods distribution centers.

The "park and ride" system which has been highly talked about in recent years will be worth considering for commuters purposes as Libya has a vast tract enough to accept it.

2.3 Administration for Traffic Control and Management

As already discussed in 2.1 "Introduction", the traffic control and management are mainly supported by safety education, drivers control and training, vehicle control, enforcement of laws and regulations, campaigns, and traffic engineering and so on, all being put into practice in close relation with each other and not independent of one another. Traffic and transport have become increasingly important in our society; so much serious have become their problems. Since administrative authorities and responsibilities are usually intertwined among many ministries and agencies, the traffic problems are in most cases very hard to be dealt with under a single, unified administration.

There are few countries, if any, in the world where the traffic control and management are undertaken by a single integrated body. It is worth admiration that Libyan police is intending to take above-mentioned duties, responsibilities and authorities as far as possible, because it is the police that watches on the spot and manages the traffic flow and that has first-hand knowledge about the traffic flow.

The way of the administration of traffic control and management is diversified from country to country. In Japan, the police took the initiative in the traffic control and management in close cooperation with the authorities of road management (Ministry of Construction) and vehicle management (Ministry of Transport), but

to make it better in 1970, "Basic Law for Traffic Safety Measures" was established, and the Central Traffic Safety Promotion Council presided over by the Prime Minister was set up. Its secretariat was also set up in the Prime Minister's Office. Since these arrangements were made the administration were on the more smooth track.

Although, to our admiration, Libyan police seems to be going to take over even the vehicle control and management, it should be added that, if the police take a leading part in the promotion of traffic control and management, the point to see is the problems of finance and traffic control engineering.

The police is an administrative body of law-enforcement per se. Thus, it too often happens that the police takes too much a recourse to manpower (force of policemen) while taking little account of the attitudes toward solving the matters by entrepreneurship or technology. While in Libya safety education, licensing, administrative handling of vehicles, traffic law enforcement is felt to have been well in operation in compliance with the customs and social conditions, it is much to be regretted that the traffic control facilities are left almost untapped. It should be noticed here that in order to educate and ask the people to observe the traffic rules, the administration is under obligation to make up socially favourable traffic milieu which will hypostatize the rules and in which the rules will be well understood and observed.

Similarly important is that the safety education, traffic police activities, etc. should be supported by equipment as much as possible for improved efficiency and accuracy, and also for the safety of police officers themselves. It is hoped to this effect that the information submitted by the team will be of help to you.

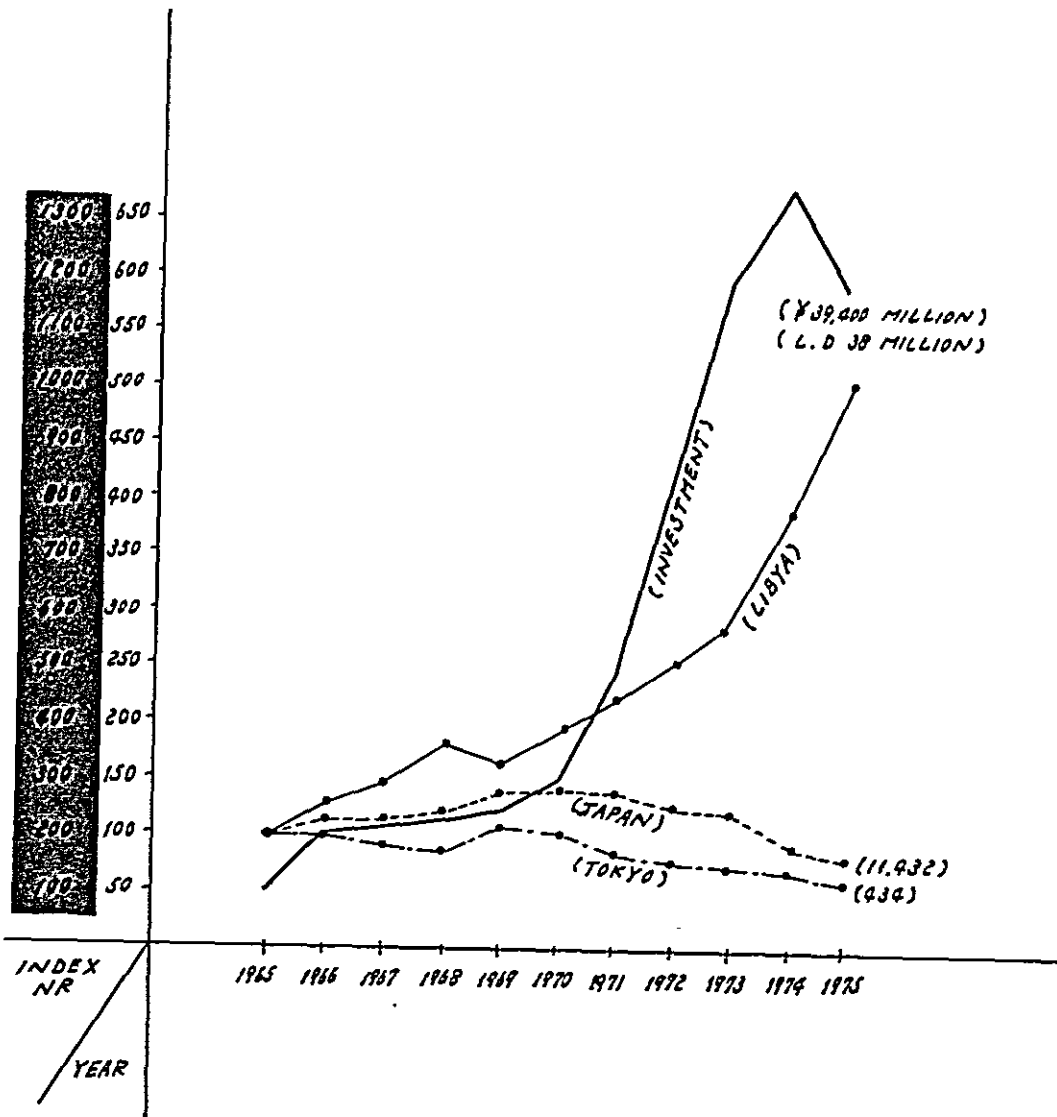
In this report, we will propose traffic control facilities in not conceptual but material form, embodying the topmost technology

now available from Japan. It is greatly concerned however that the procurement of monetary sources will appear as one of the most pressing problems in the implementation of the proposal because the proposed facilities call for a vast sum of money.

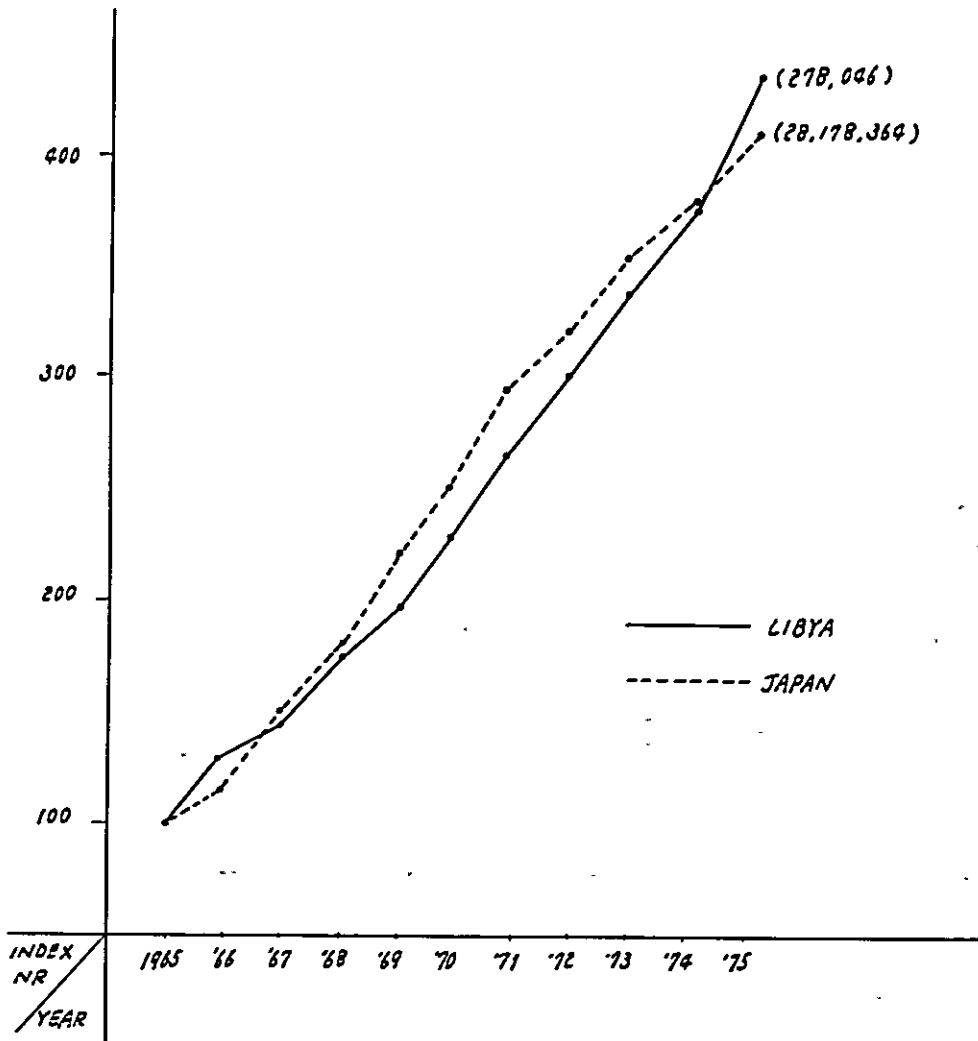
Japan was no exception; in the past, the police was always destitute of budgetary allocation for the adjustment of traffic control facilities and experienced hardships in materializing its ideas. In 1970, the then minister in charge of police laid before a Cabinet council a motion that 4% of the budget for the road construction should be allocated to the police for traffic control facilities, and the purport was adopted at the Diet by a large majority. Following this, the First Five-Year Plan for the Arrangement of Traffic Safety Facilities was started under the joint efforts of the National Police Agency and the Ministry of Construction (the Second Five-Year Plan has been under way since 1976) pursuant to the Law concerning Emergency Measures for the Arrangement of Traffic Safety Facilities. As a consequence, the police has become able to outlay much for the traffic control facilities, giving a drive to the amelioration of traffic control and management. All these antecedents will be represented by a macroscopic data given in the following.

Yearly Inclination of Index Number of "Fatal Traffic Accidents in Libya and Japan"

Additional Information: "Investment in Traffic Safety and Control Facilities Installation by Japanese Police"



Reference (1): Yearly Transition of Car Holdings
in Libya and Japan



Reference (2): Fatal Traffic Accidents in Libya and Japan

Place \ Item	Population	Incidence per 100 cars	Number of deaths per 100,000 of population
Libya (all)	(1972) 2,095,787	(1974) 0.343	(1972) 26.3
Tripoli	(1972) 544,842	(1974) 0.273	
Japan (all)	(1972) 106,363,000	(1974) 0.041	(1972) 14.8
Tokyo	(1972) 11,575,141	(1974) 0.016	(1972) 4.7

Note: In Libya, the traffic accidents of pedestrians and bicyclists have not been clarified. In Japan, 36.2% of the total number of deaths reported in 1972 was accounted for by pedestrians and 11.4% by bicycle users. In Tokyo, 43.8% was pedestrians and 13.1% bicycle users.

Reference (3): Number of Traffic Signalized Intersections in Tripoli and Tokyo

Place	Area, km ²	Number of traffic signals	Number of traffic signals per km ²
Tripoli	Approx. 90	32	0.36
Tokyo	2,141	6,980 (1974)	3.26

2.4 Suggestions on Some Basic Problems for the Promotion of Traffic Management Measures

The following is a generalized view of the actual status of traffic observed in Tripoli and some comments on it.

1. Formation of road networks, maintenance of roads, etc.

(1) Rotary (Roundabout)

First of all, there are many rotaries in Tripoli used as junctions of main roads.

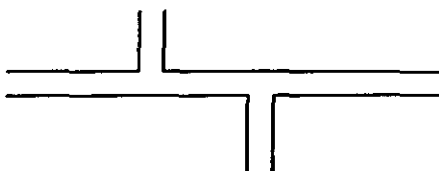
The rotary system has long been used in many countries, particularly in Europe; it is a convenient means to accommodate any number of roads for a high degree of freedom of route combinations. But, it has also demerits in that it is obliged to handle all the traffic of all the roads connected. Naturally, all the traffic flows converge into and diverge from the rotary which when overtaxed will easily turn out to be a bottleneck rather than the machinery rising to the occasion. As the traffic volume increases, the rotary will soon be clotted. Worse, the dangerous weaving is incidental to the traffic flow within the rotary. It is technically hard, if at all possible, to marshall the vehicles by traffic signals to prevent weaving to perfection. On the other hand, the center island of the rotary is used as a flower bed or monument giving a touch of relief to the city scape or sometimes providing a place of recreation for citizens. In fact, it is not altogether worthless. Ultimately, therefore it is up to the people to choose between the two - improved efficiency of traffic or appearance of the city. Nevertheless, it may also be said that installation of additional rotaries will be a matter to moot as modern Tripoli has come to rest greatly upon vehicular traffic in the livelihood of its citizens.

It is observed from the road construction now under way in Tripoli that there are some trunk roads which are going to be connected to the existing rotaries for all that the rotary is all too problematic in view of channelization, and this kind of road network configuration should immediately be discarded.

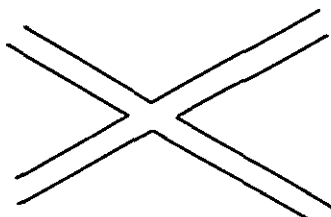
(2) Intersection

The intersection is a spot where two roads or more meet, and not only involves a high risk of traffic accident, but is also prone to hamper, rather than rectify, the traffic flow. Utmost attention should therefore be exercised when making up an intersection. In Tripoli where construction of new roads is actively in progress, the design and location of the intersections should be made in a manner not to leave much to be desired in the future, by overcoming various impediments resulting from road construction and acquisition of rights-of-way. The most ideal form of the intersection is of the four-way right-angled type. Empirically, the following types are found unfavourable.

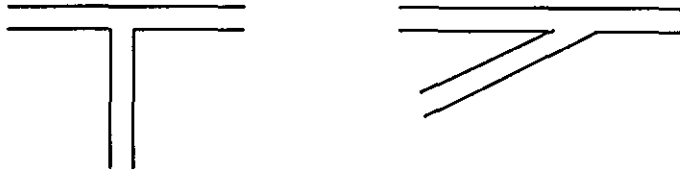
- o Staggered intersection (composed of two T-lettered intersections located close to each other).



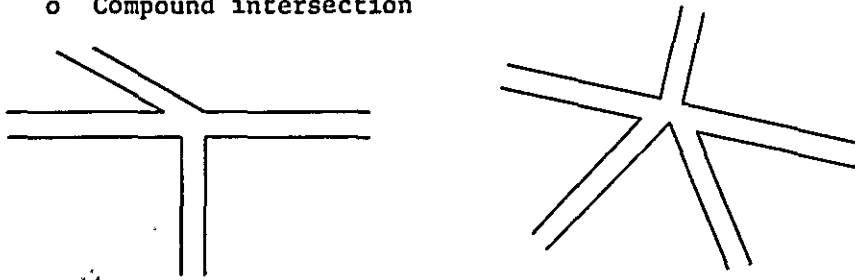
- o Four-way oblique intersection (the angles between two lines are not 90°).



o T-lettered or Y-lettered intersection



o Compound intersection



The intersections in Tripoli are characterized in that they are too wide in space and that triangle channelizing islands are provided for right-turning vehicles. As will be discussed later, these are disadvantageous to the pedestrians; if the intersection is too wide, the traffic flow will be liable to be disturbed and thus to cause traffic accidents.

In Japan, there was once a time when the designing of an intersection with triangle channelizing islands was in fashion when the disposal of vehicular traffic was taken much of. Now, it is sent quickly into oblivion.

(Refer to design examples for model areas in the next chapter.)

(3) Road maintenance

Although, new roads being constructed here and there in Tripoli, environmental disorder may have to be connived at to some extent, keeping the roads clean is very significant in letting the driver feel braced up and maneuver his car in a safe way. So sweeping and draining on road should be done more actively. It is desired that at least the trunk roads should be cleaned at every night.

To say more, the street lighting goes a long way toward the prevention of traffic accidents during the night.

2. Protection of "the weak" in traffic

In the field of traffic, pedestrians and bicyclists are absolutely weak compared with motorists. They will never collide with cars without being hurt.

For this reason, special protection measures should be provided for them.

In Tripoli, there are few, if any, bicycles, while there are a great number of pedestrians. Lamentably enough, protective measures for the pedestrians are meagre. Children being precious jewels that are the support and driving force of future Libya, special protective steps should be taken for them through safety education and installation of suitable facilities.

What should be taken into account for the protection of pedestrians is enumerated below.

- o Although sidewalk have been constructed to a considerable extent, their surfacing should be prompted.
- o Wholesale arrangement of pedestrian crossings is required. In principle, signalized intersections should have pedestrian crossings. For other parts, particularly for those where pedestrian crossing demand is high, the pedestrian crossing should be installed at an interval of at least 200 m. By increasing the number of pedestrian crossings in this way and thus forbidding the pedestrians to cross the road at other undesignated places, the pedestrian traffic will be put in order.
- o Protection of pedestrians by traffic signals explained later should be promoted.

- o Two-level pedestrian crossing facilities (footbridge, underpass, etc.) can perfectly protect the pedestrians who use them. But, those who neglect their use will experience all the more higher risks of traffic accident for the installation of such facilities.

It is therefore mandatory that such facilities should be so designed and arranged as to be easily available to the pedestrians and not to excruciate them.

In addition, necessity to use the footbridge, underpass or other designated place should be brought home to every citizen by education or campaign.

As regards the two-level pedestrian crossing facilities, there still are many controversies in Japan about their relationship with the urban beauty and about whether the footbridge or underpass is agreeable, and there is no established theory commanding everyone's agreement.

It is encouraging to know that a large number of footbridges installed in Japan have contributed much toward the prevention of traffic accidents. Where they are installed at broad-road intersection which have to manage a large volume of right- and left-turning vehicular traffic together with pedestrians, they have proved to be effective in making the vehicular traffic flow smooth as well as protecting the pedestrians from traffic accidents.

In Libya, as it is found that most of trunk roads in the suburbs run at grade, and there are many houses along them, some two-level pedestrian crossing facilities would be useful along at least these roads.

- o In downtowns in large cities in Japan and Europe, a move for providing special blocks which are open to pedestrians for designated hours of the day or all the time by traffic regu-

lations or by arranging the roads themselves for the purpose has been promoted actively. Along with other traffic control measures, this kind of traffic control will also be worthwhile in Tripoli.

Although Tripoli, at the moment, has a small number of bicycles, some European countries (e.g., Netherlands, Denmark) have many bicycles since old days and provide special lanes for bicycles independent of carriageways. In Japan, in recent years, the biking has been encouraged as one of measures for discouraging the use of car through promotion of "park and ride" system for commuting workers, institution of a right for the bikers to run on sidewalk, provision of biking lanes, and prohibition of cars for limited hours in order to open the carriageways to bikers, and also the construction of bicycle roads. Against this backdrop, the population of bikers has much increased.

In promoting the use of bicycles, the following precautions should preferably be observed.

- o Traffic rules for bicycles should clearly be established.
- o In case of mixed traffic with motor vehicles, measures for protecting bikers from traffic accident with right-turning vehicles and large-sized vehicles should be considered.
- o Consideration should also be given to providing parking lots for bicycles.

3. Parking problems

To put it a little exaggeratively, the parking of cars in Tripoli is almost in an unlawful state. This laissez-faire state of parking is a cause of traffic accidents, and is suppressing the original road capacity seriously.

This will run down the efforts for nurturing public spirit that the traffic rules should be observed strictly and that the roads

belong to the public. Also, unrestrained parking will disrupt the city scape. Every country is stricken with serious parking problems. Japan is no exception. Many ideas for parking measures have come and gone. It is not until recently that full-scale parking measures have been pushed forward according to the principle that the parking control is one of the mainstays in controlling the traffic volume in urban areas.

In Japan now, major municipalities are promoting the parking control measures according to the following ideas behind which the above principle stands.

- o The vehicle can display its ability to the full when it goes and stops at any place its driver want to. It is therefore important to satisfy such parking demand that are considered a minimum requirement for social activities. However, it should also be borne in mind that, if the parking are permitted without limitation, it will invite too much increase in urban traffic, which in turn will paralyze urban traffic functions and augment evils caused by the traffic.

Thus, it is concluded that adjustment and amplification of parking facilities should be made in a planned manner in keeping with the traffic handling capacity of each specific area.

- o The way to supply the parking facilities is as follows:

A legal obligation should be established so that buildings and facilities should have a parking facility each; installation of toll parking places (of building type or lot type under private or public management); it may be worth considering the installation of parking meters along the roads whose traffic volume is comparatively small or has been moderated by say one-way regulation.

Supervision is indispensable to the parking meter. In Japan, a parking meter of a unique type has been developed. For

its details, refer to the document already submitted.

- o Once the parking places have been provided as above, other places should in principle be designated as no-parking zones while promoting strict parking control including the enforced withdrawal of cars of wicked or habitual violators.
- o Car owners should be put under obligation to prepare their own garage.

The parking control measures involve complications as touched upon above, but should not be omitted so far as smooth traffic control is envisioned.

It is therefore proposed to, as a first realistic step, do the strict parking control in the model areas explained in the next chapter along with the arrangement of ordinary traffic control facilities, and then to expand the no-parking areas.

4. Road markings

The road markings are very effective in letting drivers perceive and understand the information on which they maneuver their cars. In fact, the road markings are one of the most important traffic control facilities.

The late Mr. Barnes, the former Commissioner of Traffic Bureau, New York City, who practised the methodology of traffic engineering for the first time in the world and was called the father of traffic engineering, ten-odd years before, was earnestly invited by the Municipal Government of Baltimore which was notorious for the worst traffic conditions in the United States, and took office as Director General of Traffic Bureau. In a few years, he modified the city into a well-groomed one, and his achievements were highly acclaimed in the United States. One secret of his success was the adjustment of road markings, and he became an institution dubbed "Painter".

There are various kind of road markings, and those used in Japan are as shown in the document already submitted by way of reference.

What must be pointed out from the viewpoint of the current state of Libya is the adjustment of traffic lanes. Lane marks on the surface of carriageway are used for guiding and controlling traffic for orderly and rectified flow. They not only are quite useful for improving the driver's manner, but also are indispensable for the prevention of traffic accidents and effective and efficient use of roads. But provision of road markings strains much effort, and their maintenance is also a painstaking business. In Japan, use is being made of highly durable synthetic resin paints containing a reflecting agent in the baking after application. The application is mechanized. The marking of center line and lane lines should preferably be linked to any road construction work or paving work. In order to let the road markings demonstrate their functions fully, it is important to keep the roads in good condition as stated under 1-(3).

The adjustment of the road markings on the existing roads alone will be a huge undertaking. For the time being, however, it will be practical to start with providing ordinary markings, including lane lines, in the model areas referred to in the next chapter and then to expand the coverage step by step. The lane width should be determined depending on the road conditions and traffic requirements such as vehicle speeds. In Japan, the ordinary street has lanes of 3.25 m as standard and 2.75 m as a minimum, and highway has a standard lane width of 3.5 m.

5. Road signs

It is felt that the traffic regulations in Tripoli will be arranged more carefully, though they, in their nature, should be promoted in keeping with the progress of other traffic control measures.

One immediate problem that is noticed is that the installation method of road signs is inconsistent. It is therefore recommended

to establish national road sign installation standard so that the installation of road signs can be pushed forward under the same principle all over the country. It should be added by the way that every country in the world has been making increasing use of large-sized signs (overhead or overhang type) and illuminated signs for better visibility and of automatic changeable message signs for traffic regulations during predetermined hours of the day.

Here it is worth commenting on the speed regulation. The speed limitations in Libya are not so high as compared with the world level. The speed limitation has a great bearing on the prevention of traffic accidents. Nevertheless, drivers and road constructors generally show a hatred for speed limitations. For the purpose of traffic safety, the speed limitations should preferably be as low as possible, and it is in this that the administrative agency is always racking their brains.

In Japan, considerably tight speed limitations are enforced (in Tokyo, all and any roads but expressways have been limited to a speed of 40 km/hr since the beginning of this year), and have proved to be one of major contributors to the reduction of traffic casualties. In the world, also, there is a tendency that the speed limitations become tighter. This general tendency should also be borne in mind in implementing traffic control measures in the future.

6. Control of construction work on and around roads

The construction work on the road adversely affects the traffic flow. Accordingly, it is important to minimize the evil effects of construction work by attaching carefully designed collateral conditions to it. It seems likely that the construction work in Tripoli leaves to be desired in this respect. In particular, the following may be pointed out.

(1) Disorderly construction site

In Tripoli now, various kinds of construction work are extensively under way at places. And some of the sites are left in a litter, seriously disturbing the traffic flow to an almost dangerous degree.

The neighborhood of the construction site should be kept in order, and the place allocated for the construction work should be separated clearly from that for traffic. The constructors should be guided to keep at least the carriage-way free of any obstacles, and their doings should be put under strict supervision and control.

(2) Proper control of construction hours

It is highly desirable that the construction work will be carried out in a manner not to hamper the traffic flow of the existing roads. Where the construction work inevitably causes traffic disturbance, it should be carried out in the hours when the traffic demand is least or retreat resignedly for midnight work if the noises will not be annoying to the neighborhood. Namely, the construction hours should be determined as the case may be.

(3) Arrangement of signboards, etc.

The constructor should be granted a permit with the proviso that he is obliged to install signboards giving a forewarning to the driver sufficiently early that the construction site is approaching or to install detour signs or to provide other pertinent information to the driver depending on the circumstances.

If it is not until the driver has come to the construction site that he finds he cannot go through, the traffic flow will plunge into a turmoil, sending up the risk of traffic accident.

(4) Hazard preventive measures at construction site

At the construction site, traffic control men should be properly deployed for the prevention of traffic hazards. Also, flashlights, warning signs and other aids such as cones should be installed to give necessary information to the driver.

If the construction site has a constricted path, portable traffic signals may be used conveniently to allow alternate passing. It needs to be emphasized that special measures should be given to the safe passage of pedestrians after due consideration of geometry and traffic conditions of each specific spot.

Remarks:

The loading of the trucks should be touched upon here. It is noticed to be found in Tripoli that there are many overloaded trucks, and that the loading method is not always proper.

The overloaded truck is liable to cause a traffic accident, and is also responsible for damage of road surfaces. Thus, the overloading of trucks should strictly be controlled.

The survey team met, more often than not, the scenes of cargo falling from running trucks. Falling cargo directly involves fatal hazards and the scatterings of the cargo on the road may also cause serious traffic disorder and accident. Overloading and loading method should strictly be controlled, accordingly.

7. Traffic signals

Traffic signal provides an easy means for the prevention of traffic accident and rectification of traffic flow. It can be best applied to traffic control at intersection and the resultant surplus of traffic police force may be appropriated for other important traffic police activities. In this way, the activities of traffic

police will be amplified and repleted effectively. It is hoped therefore that a good deal of traffic signals will be installed.

The traffic signal should be increased in number and at the same time improved in quality. Traffic control techniques by traffic signal have made a marked progress in recent years. For details, refer to the document already submitted. The following is an introductory explanation of the traffic signal control techniques used in Japan.

(1) Isolated traffic signal control

This controls traffic at a specific intersection or pedestrian crossing independent of others.

o Fixed-time signal

This works at a fixed cycle (time in seconds required for the signal to complete a cycle of green, yellow and red periods) and a fixed split (the ratio in % of the green period to the cycle time) around the clock.

o Automatic multi-pattern-controlled signal

This signal is able to change the cycle time and split automatically for the specific hours of the day by the function of a timer.

In Japan, the so-called three-pattern type has been most widely used which changes the cycle time and split in three steps by time (time to change can be adjusted arbitrarily) - that is, for the rush-hours in the morning and evening (maximum traffic demand), daytime (medium traffic demand) and nighttime (minimum traffic demand). This is standardized, the most commonest and the largest in number of all used in Japan.

o Isolated traffic-actuated signal

This signal automatically changes the green period according

to the traffic count taken by a vehicle detector (an equipment capable of counting the number of vehicles running on a road; it is available in various types, including supersonic type, induction loop type and acoustic type). One in which all the phases are controlled by the traffic count is called the full-traffic-actuated signal, while another, which is installed at an intersection of a small road and a large road and in which the phase related to the traffic demand of the small road has the actuation function and the green period is assigned to the large road unless demand arises from the small road, is called the semi-traffic-actuated signal.

o Pedestrian-controlled signal

Mainly used for pedestrian crossings. Pushbuttons are installed at both ends of a pedestrian crossing, and are actuated by the pedestrian who wants to cross the road. The signal is usually green for the vehicular traffic, and when actuated by the pedestrian is turned red to check the vehicular traffic in order to allow him to cross the road.

(2) Coordinated (interconnected) signals control

A mere increase in the number of traffic signals makes little sense if they work independent of each other, rather might it be disagreeable from the viewpoint of traffic accident prevention and rectification of traffic flow.

To cope with these problems, a linked system of local traffic signals has been put to practice. In it, a master controller controls the beginning of the green period of each local controller in the system, and the beginning of the green period of each signal may be changed from that of the other. The difference is called "Offset".

Through traffic streams on a main traffic route can be controlled with a maximum efficiency by this coordination. Like

the isolated system, the linked system is divided into the following three.

- o Fixed-time linked type
- o Automatic multi-pattern-controlled linked type
- o Automatic traffic-adjusted linked type

(3) Area control of a group of traffic signals

Main roads are woven into a net in the central area of a city, and they cannot be controlled felicitously by the line linked system explained under item (2) above.

In such a case, the vehicular traffic at a number of spots within the network is measured by vehicle detectors and the results are processed through a highly sophisticated logic circuit to generate traffic signals for integrated control of the network traffic. Naturally, a computer is indispensable for this network control.

It should be borne in mind that the cost for the signal control system will rise at a tremendous rate with increase in the degree of complexity of control contents, and that the gain does not increase so much. It is therefore important to make choice of various alternatives conceivable in order to balance between the investment and effect after taking general account of traffic conditions, installation density of traffic signals and feasibility of construction and reconstruction of road networks, and other various factors in a city for which the network control is considered.

The above is a general brief description about the traffic control by signals and the following basic problems will be pointed out with respect to Tripoli.

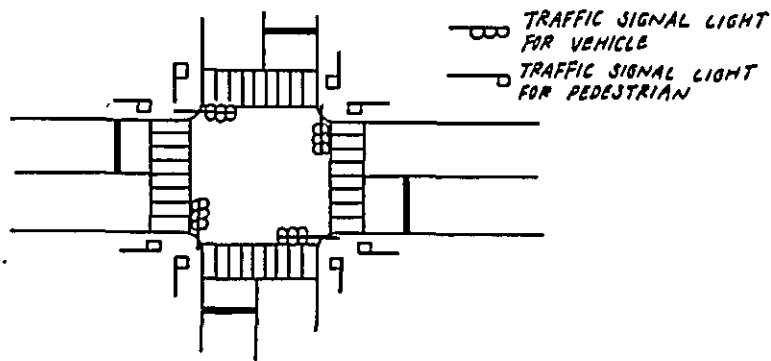
- o Almost all of traffic signals now installed disregard the pedestrians. It is therefore hoped that the traffic signal light for pedestrian will be designated separate of that for

the vehicle and installed as soon as possible.

- o As the arrangement of traffic signals will be promoted in the near future, there is no time but now to standardize the installation of traffic signals as to whether they are to be located on the near side or far side of the intersection. In Tripoli, the installation seems to be inconsistent; some traffic signals are located nearside and some others farside. Since the installation is a basic point of the traffic control technology by signals, it must be standardized as soon as possible.

The installation scheme is largely classified into two; Japan and the U.S.A. locate the traffic signal farside of the intersection, and European countries nearside. Each has merits and demerits, and there is no established theory about which is better. The nearside installation provides a clear stop position, but its inevitably small-sized height degrades visibility or visual perception from a distant driver. Also, pedestrians are totally denied watching it. In addition, this scheme of installation generally gives a poor appearance. On the other hand, the farside installation provides a high visibility because of increased height. The pedestrians can watch it even if signal light for them is not provided. However, this scheme requires a stop line for vehicles which can be done away with in the nearside installation.

In Japan, the installation of two signal lights for vehicle has been pushed forward in principle for each through way. (See the illustration below.)



- o The timing of traffic signal (in Tripoli now, isolated traffic signals alone are installed to control traffic with cycle time and split, but when the linked system is introduced, offset will join as a control item) should be set finely in keeping with the actual status of traffic. For details of setting method, refer to the concrete plans proposed in the next chapter for the selected model areas.

For practical purposes, it is recommended to start with the replication of the model areas explained in the next chapter and then step up the implementation for wider areas taking recourse to the basic technology acquired over the model areas.

8. Traffic control system

As discussed in the preceding paragraphs, it is a general tendency in the world that urban traffic is controlled as an integral whole for toutensemble; namely, the so-called traffic control system is gaining popularity.

Now let us take the methods of preparing traffic control systems now prevailing in the world in perspective. In the United States, the line and area signal control systems are predominant, but there has been no traffic control system including centralized supervisory control center which watches the traffic conditions on a wall map. In recent years, Washington, D.C., and other municipalities are considering the introduction of this kind of control system.

In Europe, where the control system has long been practised, a great majority is occupied by traffic signals controlled in a systematic way in which a supervisory center can watch the events and intervene in the operations of traffic signals when anomalous traffic conditions are observed. In Paris, a special system likely to have been developed from the concept of a traffic supervisory center is used; in this system, traffic police and patrol car collect traffic information at spots which are then gathered up for providing traffic control instructions to respective spots.

In Japan, a traffic information center similar to Paris was installed in 1963. Later, the system control technology of traffic signals made a marked progress and, in 1970, the basic technology for practical traffic signal area control was established. Then, the overall supervisory and management operations and the systematic traffic signal control system was combined with the automatic real time traffic measuring network, the core function of the area control technology, into an integrated traffic control system which has now been developed into a nation-wide popularity. For details, refer to the document already submitted.

The integrated traffic control system can exhibit its real worth only when safety education, traffic regulations and enforcement, traffic facilities and other basic measures have been heightened to some degree. So the introduction of the integrated traffic control system should be made step by step in keeping with the progress of basic measures.

The computer-aided system such as this has an outstanding feature in that it is very pliable to modify its control modes. It finds itself mighty power as a social system vis-a-vis particularly traffic problems in which wheels within wheels run quickly in a whirl. Japan's traffic control system is proving to be a major drive in response to fluid policies which have been changing from those dedicated to safety and smoothness of traffic to a new one proclaiming the abatement of evils caused by traffic and optimization of traffic flow.

9. Others

The following is a list of facilities used in Japan for safe and smooth traffic which have not been described in the foregoing.

(1) Center line translator (Reversible lane control facility)

Where the in-bound and out-bound traffic demand changes largely by hours, the center line is shifted for making the efficient use of road capacity. The use of this facility is proposed for one of the model areas discussed in the next chapter.

(2) Guard rail and guard fence

For those roads which have definite sidewalks or not, the guard rails or guard fences are useful for providing a shelter for pedestrians or preventing pedestrians from running into carriageway. Also, guard rail and guard fence are installed along the shoulders to protect the vehicles from falling hazards.

(3) Median

This is installed in the center of a both-way road to prevent the vehicles from running beyond the center line.

(4) Curve mirror

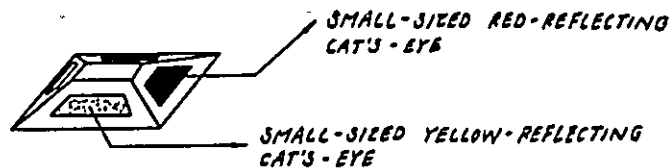
This is a convex mirror to be installed at the corner of an intersection or curved road of poor visibility or a narrow road in order to mirror the vehicles coming across or approaching ahead.

(5) Delineator

This is to be installed along a bend on the roadside for the purpose of informing the driver of the contour of the road extending ahead. This is useful, particularly at night.

(6) Point block

The point block is one as illustrated below. This is installed at the center of a small intersection which is hardly recognized.



(7) Chatter bar

The chatter bars are small metal projections to be installed on the center lines or sidelines of safety zone, etc. to give chattering shocks to the vehicle when running on them in order to warn the driver. Recently in Japan, a yellow runout control road marking has been provided on the center of the two-lane both-way road for the purpose of preventing collision. A method in which this road marking is combined with the chatter bars has also been increasingly used for more effects.

(8) Seat belt

The seat belt is very effective in minimizing the fatalities of drivers and fellow passengers when they meet traffic accident unfortunately. Many countries in the world have instituted a law that every one in a running car must wear the seat belt.

(9) Helmet for motorbicycle rider

In many cases, the motorbicycle rider gets hurt in the head in a traffic accident. It is significant to encourage the motorbicycle rider to wear a helmet for the purpose of his own protection.

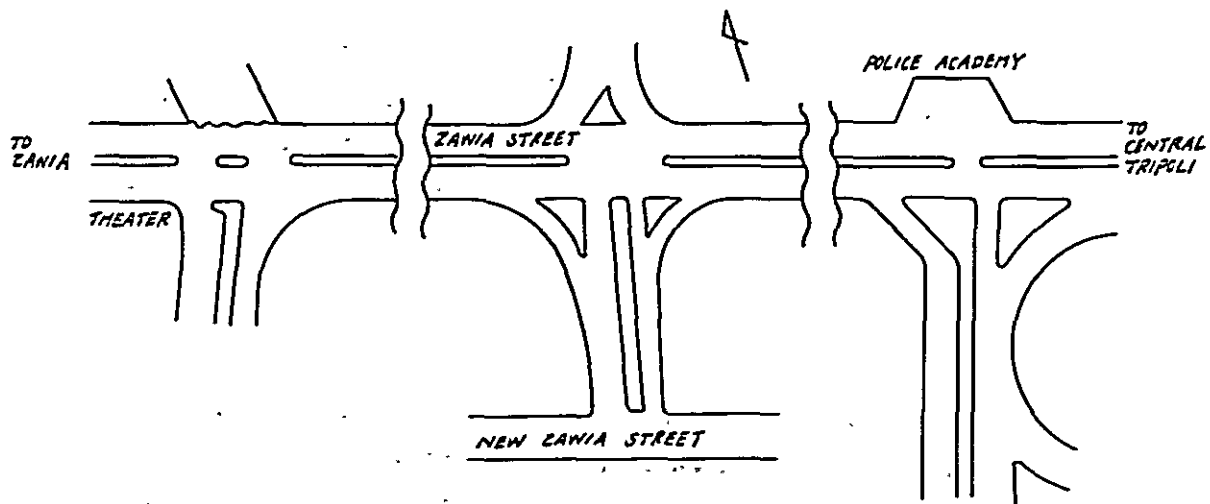
CHAPTER 3. CONCRETE PLANS FOR THE ARRANGEMENT OF TRAFFIC CONTROL FACILITIES IN MODEL AREAS

In order to promote overall traffic control measures with center on the improvement of traffic control facilities, what must be done first is to rake the current traffic status in Tripoli for problems. The next thing to do is to set up model areas into which the expertise available from Japan is poured intensively. With these areas as a kick, the improvement of the traffic control in the entire city will be promoted in a comparatively easy way.

According to this idea, twelve areas were selected for field investigations, and seven were singled out for providing concrete amelioration measures based on the findings.

Dealt with in this chapter are the concrete measures proposed for these seven selected areas.

3.1 Block on Zawia Street between the Intersection in front of the Police Academy and the Intersection in front of the Theater



1. Current problems in this block

- o Pedestrians are insecure in crossing the road.
The pedestrians, particularly the students going to and leaving the school located to the east of the police academy, are crossing the intersection and its neighborhood obliquely or running across the road immediately before and after vehicles. This is very dangerous.
- o The structure of the intersections is improper.
- o The road markings are insufficient.
- o The structure of the median at the intersection is irrelevant. This is particularly the case with the intersection facing the theater, where heavy impediment is imposed on the left-turning vehicles.
- o The split of the traffic signal is poor. It is noticed that the green period assigned to the legs crossing to Zawia Street is too long for the traffic volume. The wiring between the controller and traffic signal is poor; our survey team witnessed some traffic signals which were out when ought to come alight.

Reference (1)

A method of determining the optimum cycle time and split of a traffic signal:

For the determination of the cycle time and split of a fixed-time traffic signal, the following formula is used to make a rough estimate, which is then used for trial signal settings of the traffic signal. With this, by making allowances for the actual traffic conditions, the cycle time and split are finely regulated to respective optimum values.

- o Formula for computation of cycle time

$$C_o = (15A + 5)/(1-\rho) \quad (\text{sec.})$$

Where, C_o : optimum cycle time

A: loss time due to phase changeover
(i.e., the sum of yellow times. In Japan, it is practised to take about 2 seconds of all red period in which all signal lights are red immediately after the yellow period for the purpose of preventing accidents in the intersection. In this case, the total loss time is the sum of the yellow period and all-red period.)

f : required phasing ratio (the sum of ρ_i)

$$\rho_i = Q_i/P_i$$

i: phase number

ρ_i : phasing ratio

Q_i : design traffic volume (usually represented by spot counts)

P_i : traffic capacity

Generally, 120 seconds is regarded as an upper limit of the cycle time. Accordingly, when the cycle time deduced from the above formula is turned out to be more than 120 sec., it is usually limited to 120 sec. But, the cycle time may be longer than 120 sec. in special circumstances such as a road having an broad width or an intersection having large volumes of traffic.

o Formula for computation of split

$$\text{Split} = (\rho_i/\rho) \times 100 \quad (\%)$$

By multiplying the cycle time by the split determined by this formula, an absolute value of the green time for a

particular direction can be obtained. If this green time is shorter than the time required for the pedestrian to cross, it must be corrected to that pedestrian crossing time. Thus, if the required green time becomes longer than the calculated, the cycle time as determined in the foregoing paragraph should of course be changed.

In Japan, the pedestrian crossing time is calculated on supposition that the walking speed of a pedestrian is 1 m per sec.

Reference (2)

A count was actually taken of the traffic volume under the current signal settings. The results of count survey at the intersection in front of the police academy alone are shown below by way of reference.

(At about 7:35 a.m.)

Approach	Green time, sec.	Results	
		First 30 sec.	Total green time
Zawia → City	57	35	57
City → Zawia	57	28	41
City → Police academy	57	17	18

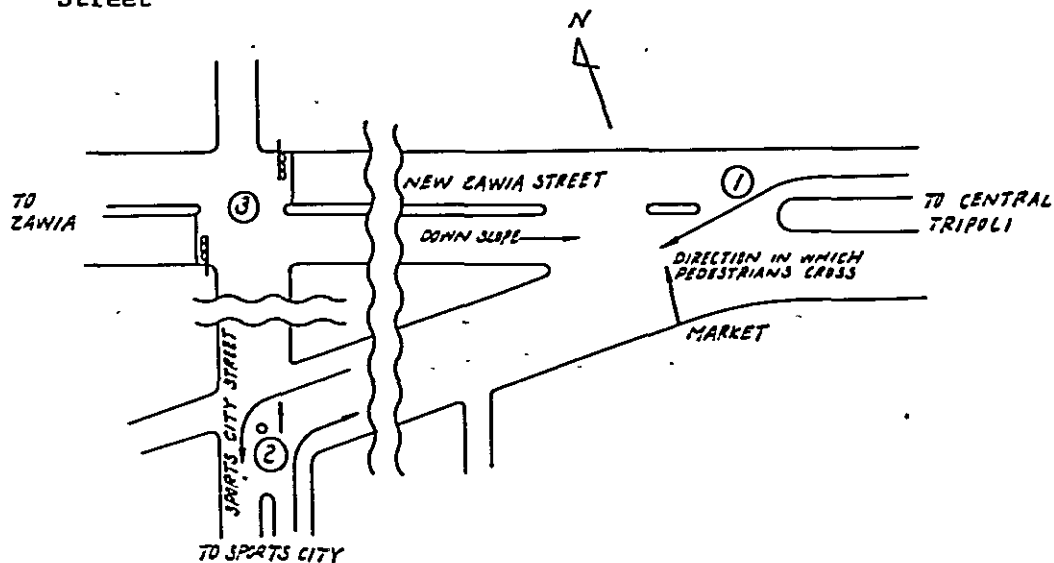
As is clear from the above table, the traffic volume in the latter half of the green time is small, suggesting that the green time efficiency is poor. Approach of "City to Police Academy" is worse in this respect.

2. Measures to be taken

- o A two-level crossing for pedestrian use should be installed in front of the school located to the east of the police academy.

- o Geometric improvement of the intersection in front of the police academy, the intersection on the coastal street and the intersection in front of the theater, partial reconstruction of median, road markings for pedestrian crossings, lanes, directional marks, stop lines and left-turning method designation at the center of intersection, etc. should be provided as illustrated in Fig. 1.
- o The traffic signals for the aforesaid three intersections should be replaced with automatic three-pattern-controlled linked type ones, together with additional installation of pedestrian signal lights. The signal timing should of course be optimized.
- o The regulatory signs should all be of the overhang illuminated type.
- o Over the entire block, pedestrians should be prohibited from crossing the road at other than the places designated for the pedestrian use.
- o The road should be cleaned by a road sweeper in every night.
- o Parking control within the block should be enforced strictly.

3.2 Triangle Intersection Area of New Zawia Street and Sports City Street



1. Current problems in this area

- o The spot ① forms a typical skew intersection. The major traffic flows come across at an acute angle at this intersection, and one of them run down the slope at a violent speed to make the intersection a black spot. No traffic signals are installed, however. Besides, pedestrians daringly risk their way through fast-running vehicles. Also, the vehicles coming from Central Tripoli and turning left toward Sports City Street involve great possibilities of danger.
- o The spot ② is an intersection having a rotary channelizing island at the center which measures 1.6 m in diameter. The vehicles turning left toward Sports City Street are forced to make an awkward turn, which spells a tardy flow. As a consequence, the left-turning or straight forward-running vehicles from or on Sports City Street are also compelled to take a superfluous waiting time.

2. Measures to be taken

- o A two-level pedestrian crossing facility should be installed at the center of the spot ①.
- o The center island of the spot ② should be removed.
- o Road markings for pedestrian crossings, lanes, directional marks, stop lines and the left-turning method designation at the center of intersection should be provided as illustrated in Fig. 2.
- o The spots ① and ② should be equipped with traffic signals, and the traffic signals at the spot ③ should be replaced. All the signals should be of automatic three-pattern-controlled linked type.

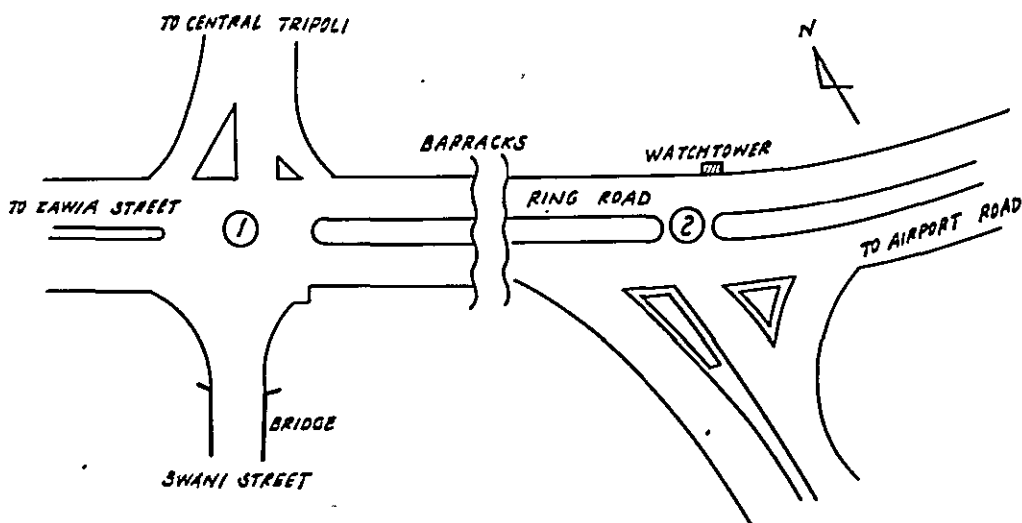
Also, the spots ② and ③ should be provided with pedestrian signal lights.

The signal timing should also be optimized.

The interconnecting of the traffic signals at the above three spots should be made between ① and ③ and between ② and ③.

- o Over the entire area, the pedestrians must be prohibited from crossing the roads at other than the places designated.
- o The area should be cleaned by a road sweeper in every night.
- o Parking within the area should strictly be controlled.

3.3 Intersection of Ring Road and Swani Street, and Its Neighborhood



1. Current problems in this area

The southern approach of the intersection ① at which Ring Road and Swani Street meet has a narrow bridge which provides an out-bound one way. As a result, the traffic running on Swani Street toward Central Tripoli is compelled to enter the intersection ② just to the east of the intersection ① and then enter the intersection ① by way of Ring Road, and finally turn to Central Tripoli again by way of Swani Street.

This section has already been overtaxed by heavy traffic on Ring Road. To make matters worse, it is superimposed with the Swani Street traffic, making the spot the most perilous spot in the city. The survey team found chains of vehicles forming a waiting queue of more than one thousand meters on Ring Road in the most busiest hours.

The watchtower for the barracks is pushed out to interrupt the sidewalk, and the pedestrians are thus forced to wade their way among waves of vehicles. Also, bicycles and motorbicycles are found to be precarious in passing by this constricted section as large vehicles threaten them.

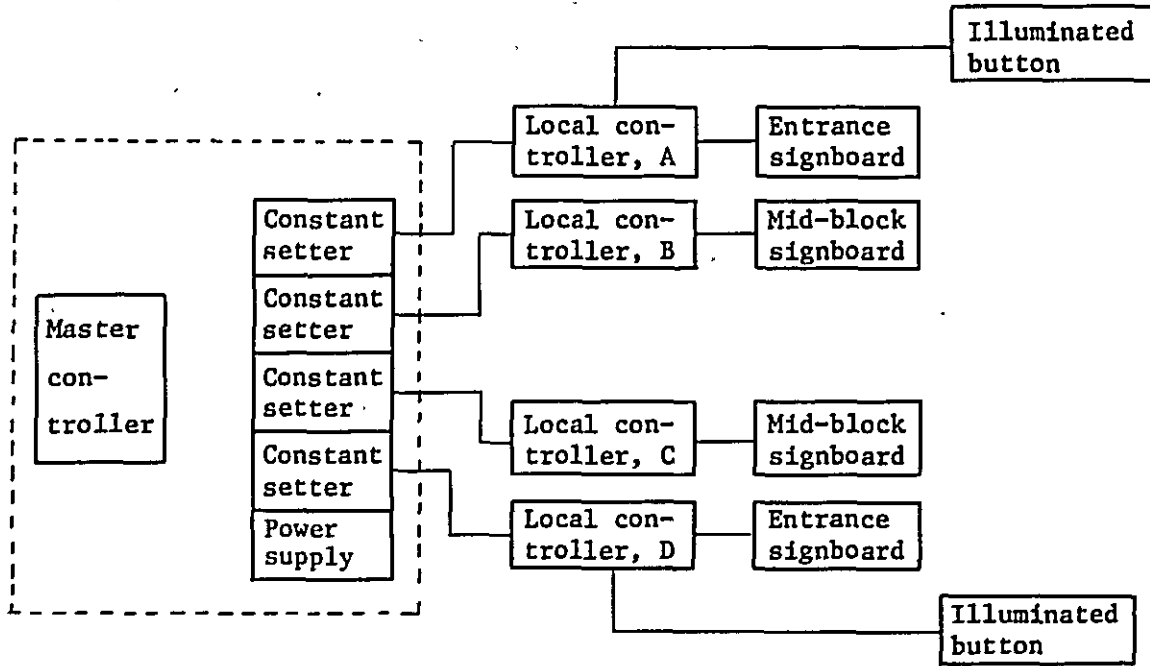
2. Measures to be taken

(1) Introduction of center line translator system

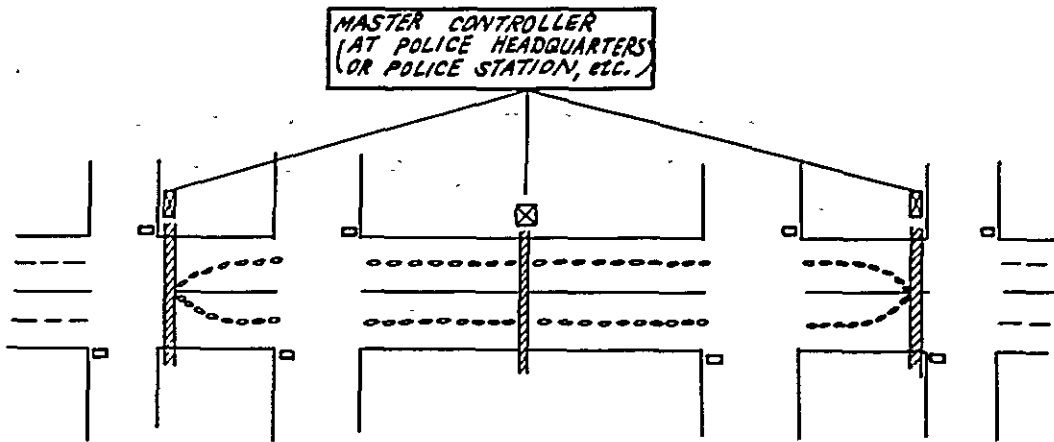
In the rush hours in the morning and evening, the traffic volume in this section is different largely depending on the direction. Then, a center line translator system should be introduced.

In this system, movable center line signs, illuminated lane signs and changeable center line markings such as illuminated buttons are combined. This system can make up for the traffic capacity in the most demanding direction by translating the center line. The system configuration is as illustrated below.

Block Diagram of Center Line Translator System



An Installation Example of Center Line Translator System

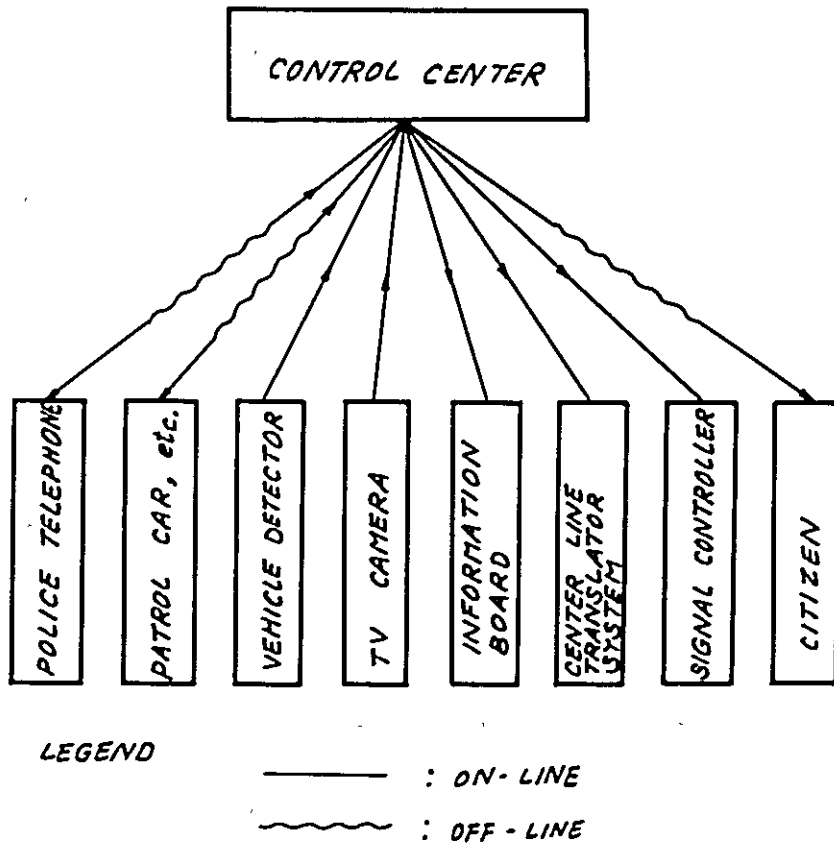


- LEGEND
- ⊗ LOCAL CONTROLLER
 - ▤ OVERHEAD POLE SIGN
 - SIGN
 - ILLUMINATED BUTTON

(2) Introduction of a system for traffic monitoring and distribution of traffic information:

Since the section now under discussion is overcrowded with vehicles, it is recommended to introduce a system for monitoring traffic conditions in the areas related to traffic management in this section and for distributing traffic information.

This system is schematically shown below.



The following is a list of functional components, and a brief explanation of each.

a. Traffic control center

This center is installed at the police headquarters or other suitable place where overall monitoring and dis-

patching for traffic management can easily be accomplished. The traffic control center will be composed of the following. At the moment, the center will handle the traffic for this section only. But, in future, it may provide an embryo of traffic control all over Tripoli, and this should be fully taken into account for the arrangement of traffic control center.

o Traffic display

Live traffic conditions measured by vehicle detectors are automatically displayed on a wall map for the purpose of overall traffic monitoring.

o TV monitor

Whole events at a specific spot are monitored by a TV camera and displayed on a TV receiver for the purpose of traffic control.

o Data display

The measurements of vehicle detectors are numerically displayed in order to get hold of the actual status of traffic.

o Control console

This is a telecommunication dispatching console mainly geared with police telephone system. It is always kept informed of traffic conditions; when abnormalities have happened, it gives instructions to the first-line police officers to take relevant measures and actions. Also, the control console all-embracingly performs planning of various measures and arrangement for them.

o Radio console

This undertakes telecommunication with patrol cars and helicopters, etc. and dispatches instructions to them.

- o Control console for changeable information board

This console controls the display on the changeable information board according to actual traffic conditions.
 - o Main controller for center line translator

The main controller makes operations for translating the center line to meet specific traffic conditions.
 - o Signal setting changeover device

Hardware (computer) will be provided for automatic changeover of traffic signal settings. If manual intervention is required to change the timing of traffic signal, this device is to be operated.
 - o General inquiry telephone

This telephone makes an answer to citizen's inquiry about traffic information.
- b. Terminals
- o TV camera

One unit within the section and about two units on the east of this section will be installed for the time being for the purpose of monitoring traffic mainly in the inner lanes of Ring Road.
 - o Changeable information board

Changeable information boards will be installed on the Ring Road and the radial roads intersecting it in order to disperse the traffic long before it reaches the section and thus decongest the section. Where to install changeable information boards was not identified by this survey, but at least five units will be required for the time being for the purpose.

- o Vehicle detectors

Minimum installation requirement is as follows:

Two units within the section; two units on the east-bound lanes (inner lanes) on Ring Road within the section; one unit on the west-bound lanes (outer lanes) on Ring Road within the section; and two units on Swani Street (inside and outside of Ring Road).

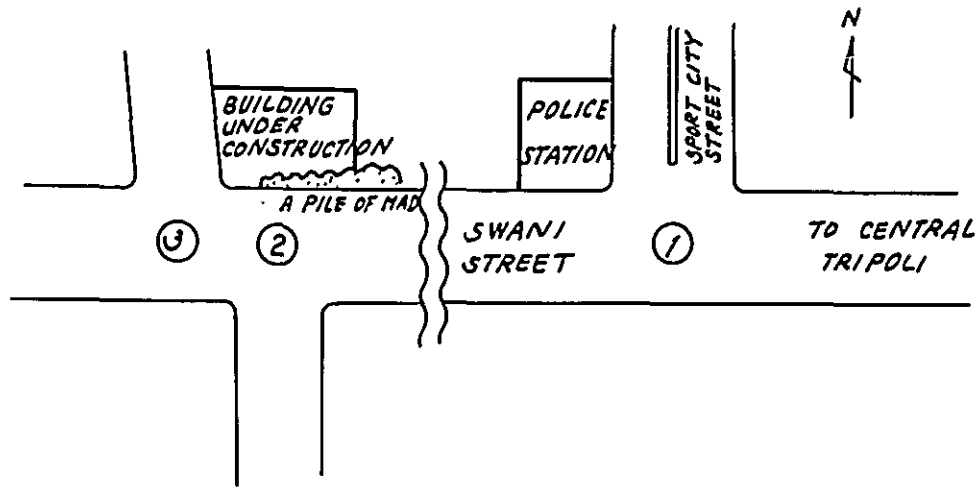
- o Traffic signals

The existing traffic signals at the intersections on both ends of the section should be totally replaced with ones which can be controlled from the traffic control center. Also, the intersections should be provided with pedestrian signal lights.

- (3) Withdrawal of median, geometric improvement of intersections, road markings for pedestrian crossings, lanes, directional marks and stop lines, etc. should be made as shown in Fig. 3.
- (4) The road signs should be improved to be of large-sized, changeable, illuminated type.
- (5) Over the entire section, the pedestrians should be prohibited from crossing the road at other than designated places.
- (6) Sidewalk should be improved. It is recommended to retract the watchtower a little toward the barracks for the continuity of sidewalk now interrupted by it.
- (7) Surfaces of both carriageway and sidewalk should be repaired. This is particularly the case with the bridge part of Swani Street.
- (8) The road surfaces should be cleaned in every night.
- (9) Tight traffic guidance and enforcement on lane use, observance of traffic signal instructions, pedestrian crossing,

etc. should be carried out, to say nothing of the exclusion of illegally parked cars.

3.4 Intersection of Swani Street and Sports City Street, and Its Neighborhood



1. Current problems in this area

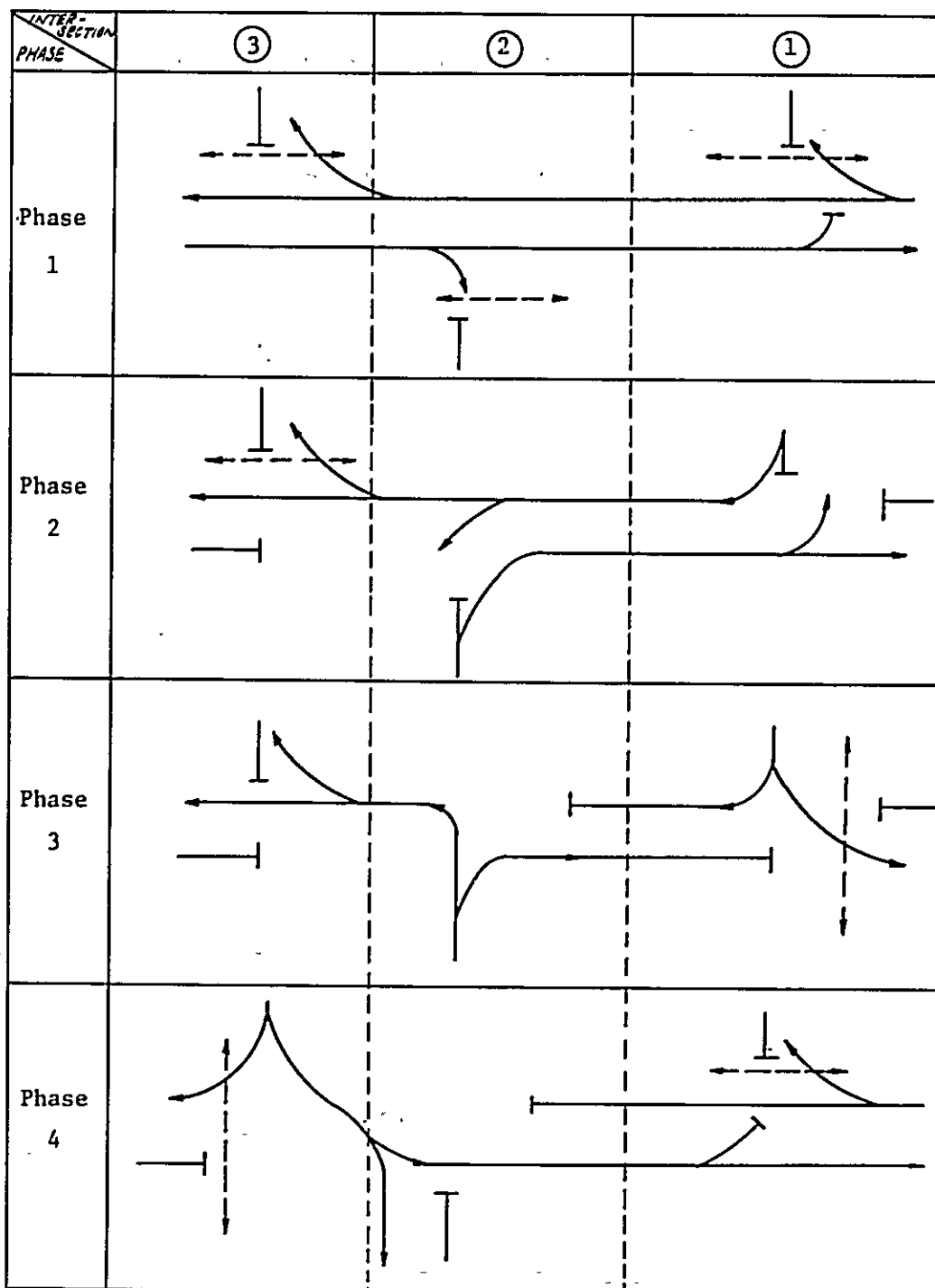
This area is congested with vehicles including those running on Swani Street toward the suburbs after passing through Sports City Street, those running on Swani Street toward Central Tripoli, and those running on Swani Street toward Central Tripoli by way of two roads intersecting Swani Street at points (2) and (3). Many of the vehicles are large-sized ones, and the road pavement is poor. The effective carriageway width is limited to 8 to 11 m. A series of a T-lettered intersection and staggered intersections characterizes this area.

No traffic signals, and the police officers are working hard in dealing with traffic in clouds of dust. It was noticed that cargo, such as cement bags and lumber, which were probably thrown away from running vehicles were left on the road.

2. Measures to be taken

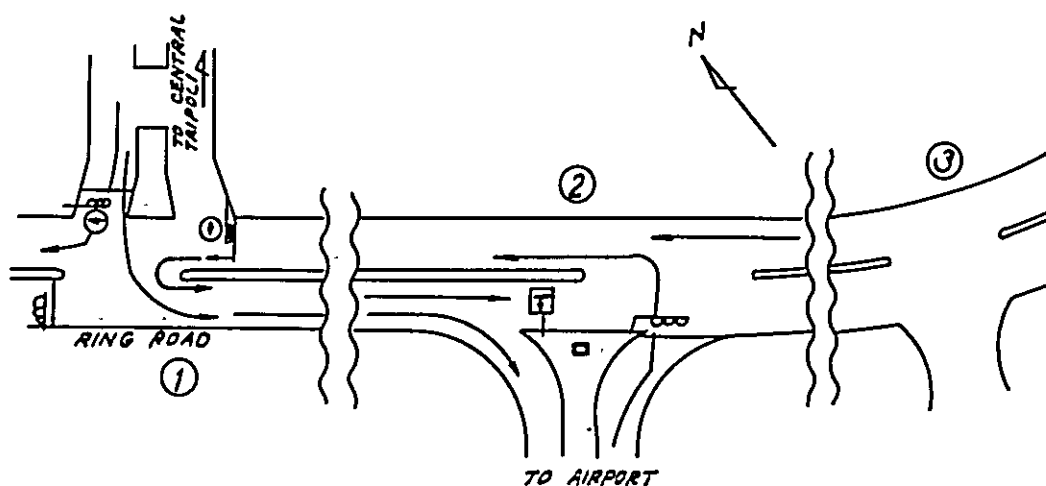
- o The pavement in this area should be improved. Along with this, the effective carriageway width should be enlarged so as to provide four lanes each measuring at least 3 to 3.5 m.
- o Sidewalk should be constructed on either side of the carriageway.
- o Geometric improvement of intersection, road markings for pedestrian crossings, lanes, directional marks, stop lines and left-turning method designation at the center of intersection, etc. should be made as proposed in Fig. 4.
- o At intersection ③, the left-turning of vehicles running on Swani Street from the suburbs should be prohibited.
- o The three intersections illustrated should be provided with automatic three-pattern-controlled linked traffic signals. In addition, pedestrian signal lights should be installed. For reference, a phasing plan of these traffic signals is shown below.

Signal Phasing for Swani Street



- o Over the entire area, the pedestrians should be prohibited from crossing the roads except at the designated places.
- o The roads should be cleaned in every night.
- o Parking control in this area should be enforced strictly.

3.5 Intersection of Ring Road and Airport Road, and Its Neighborhood



1. Current problems in this area

- o At intersection (2), a median and a channelizing island are used to prevent the vehicles from turning Ring Road left toward the airport. A considerably large number of vehicles, however, are turning round back toward the airport at the intersection some 100 m ahead. Since the traffic has many large-sized vehicles, this turnabout flow is very tardy, preciously hampering east-bound straight forward traffic on Ring Road.

2. Measures to be taken

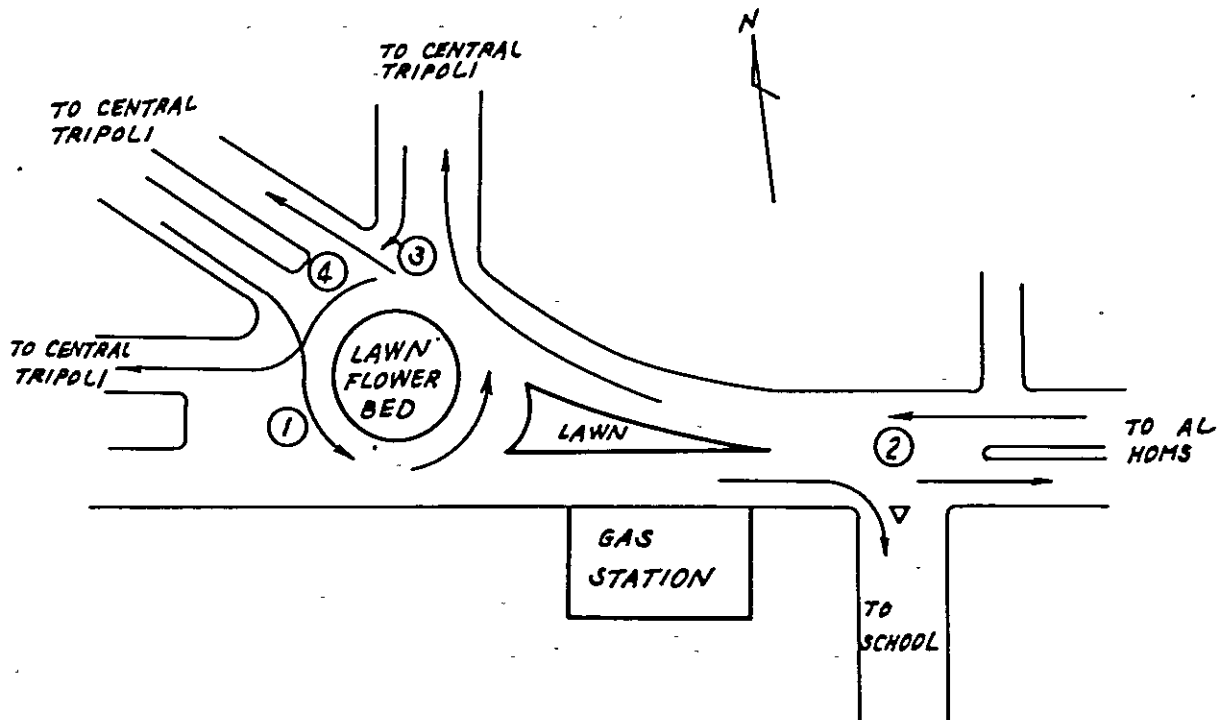
- o Geometric improvement of intersections, partial reconstruction of median, road markings for pedestrian crossings, lanes,

directional marks, stop lines, and the left-turning method designation at the center of the intersection, etc. should be made as proposed in Fig. 5.

The intersection ③ is not rendered on the figure because its measurement was not completed. But, it will be improved in suit with the proposal.

- o The road signs should be of the overhang illuminated type.
- o Traffic signals at ① and ② should be replaced with automatic three-pattern-controlled linked type ones. Also, traffic signal of the same type should be newly installed at intersection ③. Pedestrian signal lights should be installed, too.
- o Over the entire area, the pedestrians should be prohibited from crossing the roads except at designated places.
- o The roads should be cleaned in every night.
- o Parking control in this area should be enforced strictly.

3.6 Rotary on Coastal Road Leading to Al Homs



1. Current problems in this intersection

A large traffic from Al Homs toward Central Tripoli meets within this rotary the traffic from Central Tripoli toward approaches, creating a turbulence to a dangerous degree.

2. Measures to be taken

- o Partial reconstruction of median, road markings for pedestrian crossings, lanes, directional marks, stop lines and the left-turning method designation at the center of intersection, etc. should be made as proposed in Fig. 6.
- o The intersections ①, ② and ③ should be provided with traffic signals. The traffic signals should be interlinked between ① and ② and between ② and ③. In addition, pedestrian signal lights should be provided.
- o A stop sign should be installed at intersection ④ at the entrance of the rotary.
- o Parking control should strictly be enforced.
- o Important as an access to the highway, it is hoped that existing the central flower bed would be withdrawn and this spot would be of grade-separation type.

3.7 Downtown Area



1. Current problems in this area

In this area, intra-city vehicles converge at Ashuhada Square. Also, the area swarms with pedestrians. Nevertheless, there are quite few traffic signals and pedestrian crossings. Road markings are also meagre. Double parking is found everywhere in this area. Meshing and weaving are also seen at places in the rotary type Ashuhada Square. To make the matters worse, pedestrians walk across the roads at large. As such, the area presents a disorderly yet dangerous traffic state.

Traffic conditions around the bus terminal are also out of order. It is fully realized that drastic traffic control measures be provided for the entire area.

2. Measures to be taken

All-pervasive yet radical measures should be provided for the area. It is hard to choose which method should be applied, but it is proposed to provide basic measures explained in Chapter 2 intensively into the model area shown in the foregoing. The implementation of the basic measures presupposes due consideration of its effects on the outlying areas. The survey conducted this time leaves much to be desired in this respect, but the following will provide something of a basis upon which to more detailed, realistic plans will be established.

(1) Parking control measures

The most important thing is to establish the order for parking. Taking much of the existing conditions, something of parking facilities should be provided first. With this as leverage, strict parking control should be enforced within the area within which such facilities are available. Then, the controlled area should be expanded little by little by additional installation of parking facilities.

It should be noted however that the parking facilities to be installed are to be limited to a necessary minimum; namely, that they need not always meet the existing parking demand fully. As large-scale parking facilities will take much time in procurement, efforts should be focused on preparing off-street parking lots by making use of open spaces to begin with. It is also recommended to install parking meters on the roads (especially of secondary importance) where traffic demand is less and on the roads which are given a parking space by the enforcement of one-way system.

It is unconditionally required that the installation of parking meters should be accompanied by their monitoring system.

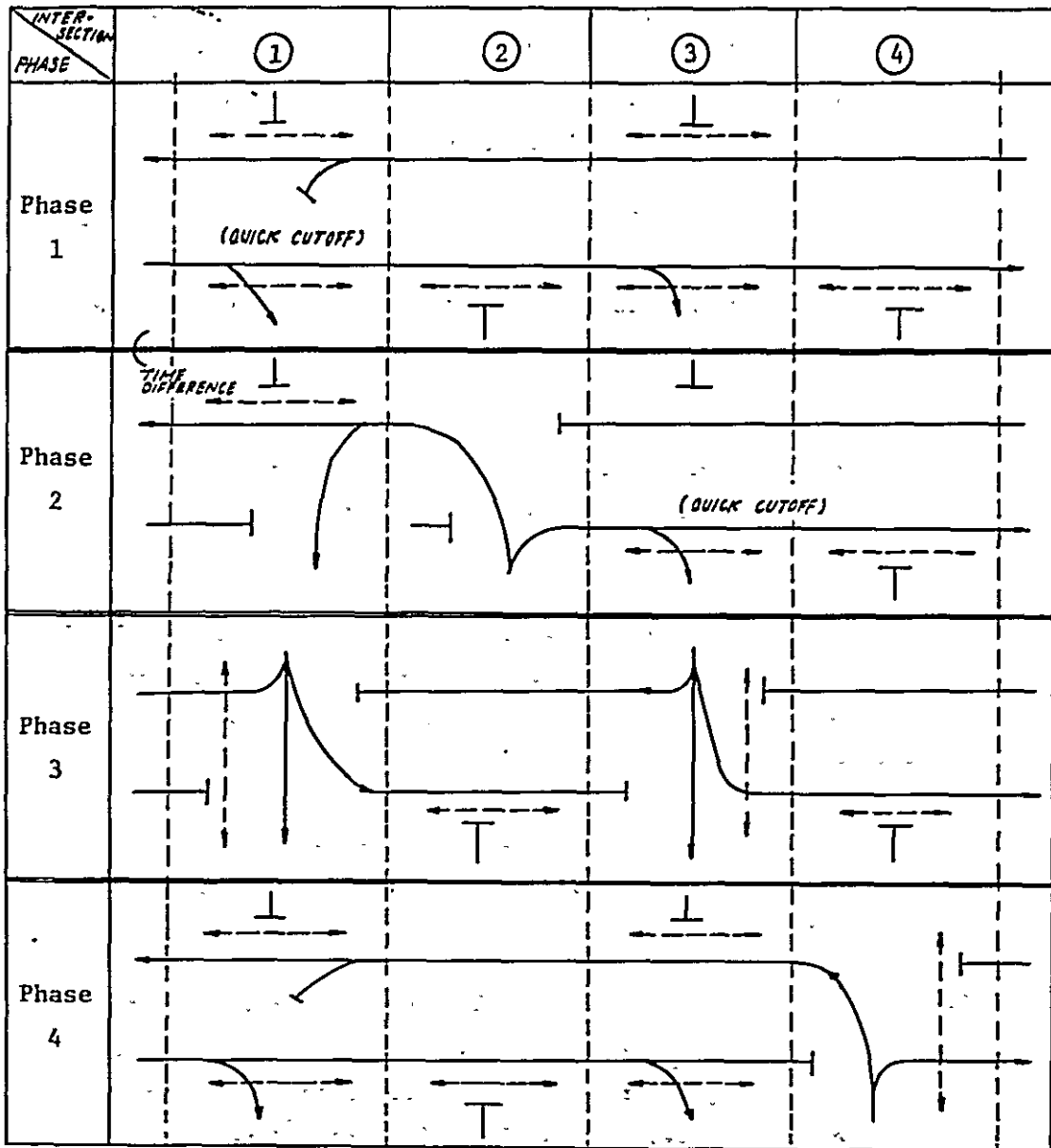
For the purpose of parking control, A street (OMAR EL MUKTAR STREET) and Ashuhada Square should be taken up to start with. Then, major roads should be tackled at the earliest possible convenience.

- (2) On the major roads, the pedestrian crossings should be provided at an interval of 200 m to 250 m, and the pedestrians should be controlled not to cross the roads at other than the crossings designated for them.
- (3) The pedestrian crossings in great demand should be provided with traffic signals for pedestrian use. Risky intersections should also be provided with traffic signals for the prevention of traffic accidents.
- (4) When the number of traffic signals on a major road has become great, their coordination should be promoted. For A street (OMAR EL MUKUTAR STREET), automatic three-pattern-controlled linked system should be considered.
- (5) D street (AWAL SEPTEMBER STREET) and E street (EL MIGHARIEF STREET) should be considered as one-way roads bound for Ashuhada Square, and should be provided with three-lane markings.
- (6) Streets, B (OMAR BEN EL AS STREET), C (MIZRAN STREET) and F (BALADIA STREET), should also be provided with three-lane markings.
- (7) A street (OMAR EL MUKTAR STREET) should be provided with markings for two or three lanes. Its intersection in front of the Ministry of Interior should be partially deprived of the median in order to translate the center line for right turning vehicles.

- (8) For the purpose of improved traffic management at Ashuhada Square, road marking, traffic signal installation, installation of median and modification of divisional island should be carried out as proposed in Fig. 7-1.

A phasing plan for traffic signal is shown below.

A Phasing Plan for Ashuhada Square



- (9) The traffic signal and road markings at the intersection on A street (OMAR EL MUKTAR STREET) at the entrance of the bus terminal should be improved as proposed in Fig. 7-2.
- (10) The major streets should be cleaned in every night.
- (11) Key spots should be monitored with TV cameras in order to consolidate the traffic monitoring at the traffic control center discussed in 3.3.

CHAPTER 4. CONCLUSIONS

We have put forth our findings and traffic control measures for Tripoli. There is no specific cure-all so long as traffic problems are concerned. There is no way but to pile each piece of measure upon another steadily.

It is therefore of primary importance to set up a system which puts together the ideas of wide-varied implementing departments and in which people, goods and money can be handled rationally and efficiently to meet purposes. Second, it is more important to do, overcoming difficulties.

Ways to take for traffic measures are much talked about. Say, "traffic measures are a series of trial and error". "It is enough to put an idea to practice if it is given 80 points." It should also be noticed that measures taken for a specific part will hard be taken without influencing its neighboring area. In order to prevent this, every measure should be considered from a broader point of view for the purpose of offsetting evil effects. It is not only difficult but also takes much time to envisage a plan in wide perspective, and it is often required to do things boldly winking at the evil effects which may or may not happen.

These difficulties in promoting traffic measures are well said in the above-mentioned. It is also worth mentioning that in Japan it has been successfully promoted for the prevention of traffic accidents to analyze traffic accident statistics to clarify the types and places of accidents, to carry out spot diagnosis jointly by executive bodies concerned, to blueprint a required all-encompassing plan and then put it to practice. Namely, this is an exemplary method in which the defining of duties and responsibilities and the employing of the so-called pin-up map are fully combined.

Anyway, improvement of traffic control facilities should be promoted as soon as possible in Libya.

We are very happy if this report will play a kick-off role.

POSTSCRIPT

This study report could not have been completed without help of the Ministry of Interior of the Libyan Arab Republic. Our indebtedness in this respect is great to the Central Traffic Department of the same. Our thanks are also due to the Japanese Embassy in Libya which has supported our activities to a success.

FIG. 1
 BLOCK ON ZAWIA STREET BETWEEN THE INTERSECTION IN FRONT OF
 THE POLICE ACADEMY AND THE INTERSECTION IN FRONT OF THE THEATER

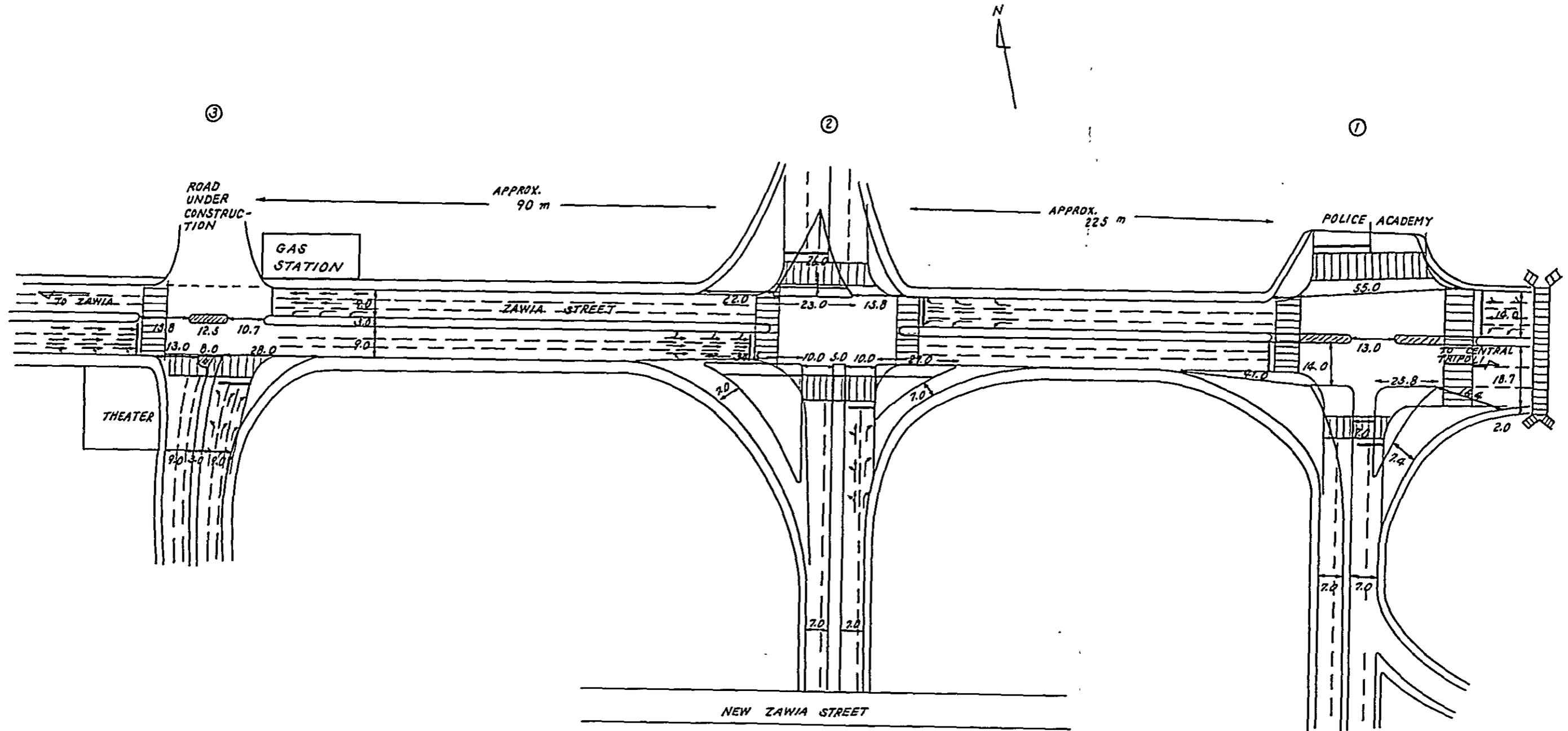


FIG. 2 INTERSECTION OF NEW ZAWIA STREET AND SPORTS CITY STREET

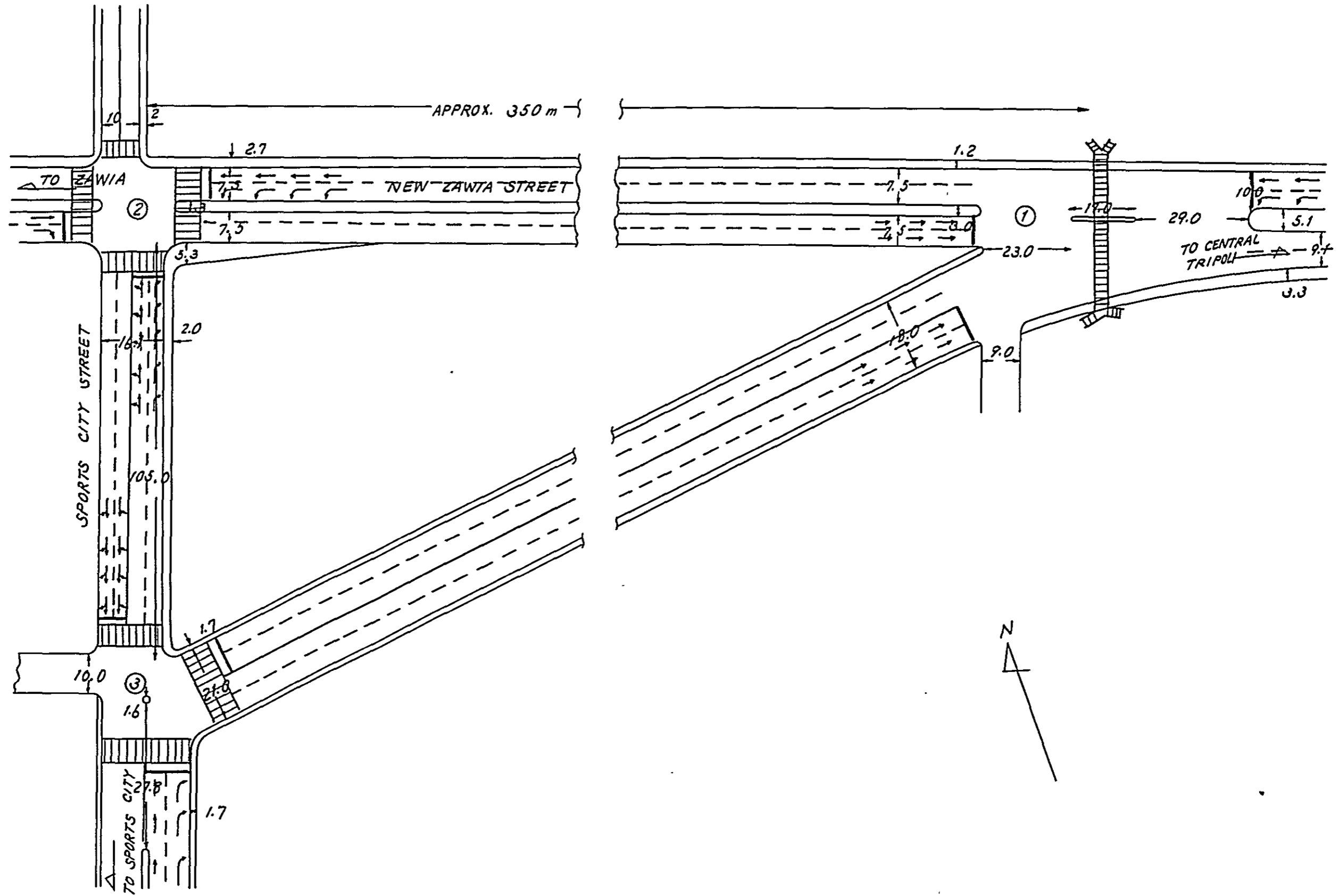


FIG. 3 INTERSECTION OF RING ROAD AND SWANI STREET, AND ITS NEIGHBORHOOD

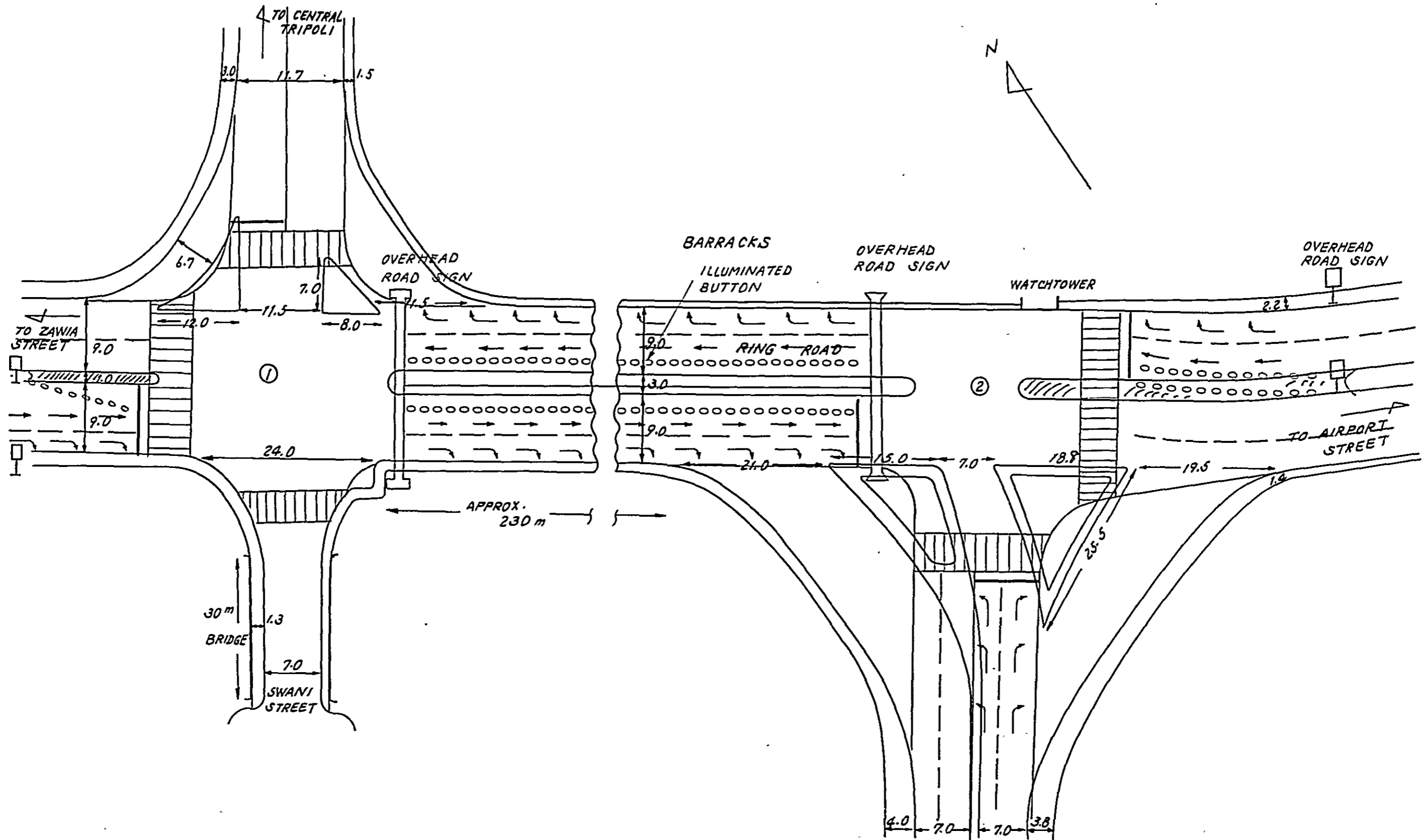


FIG. 4

INTERSECTION OF SWANI STREET AND SPORTS CITY STREET, AND ITS NEIGHBORHOOD

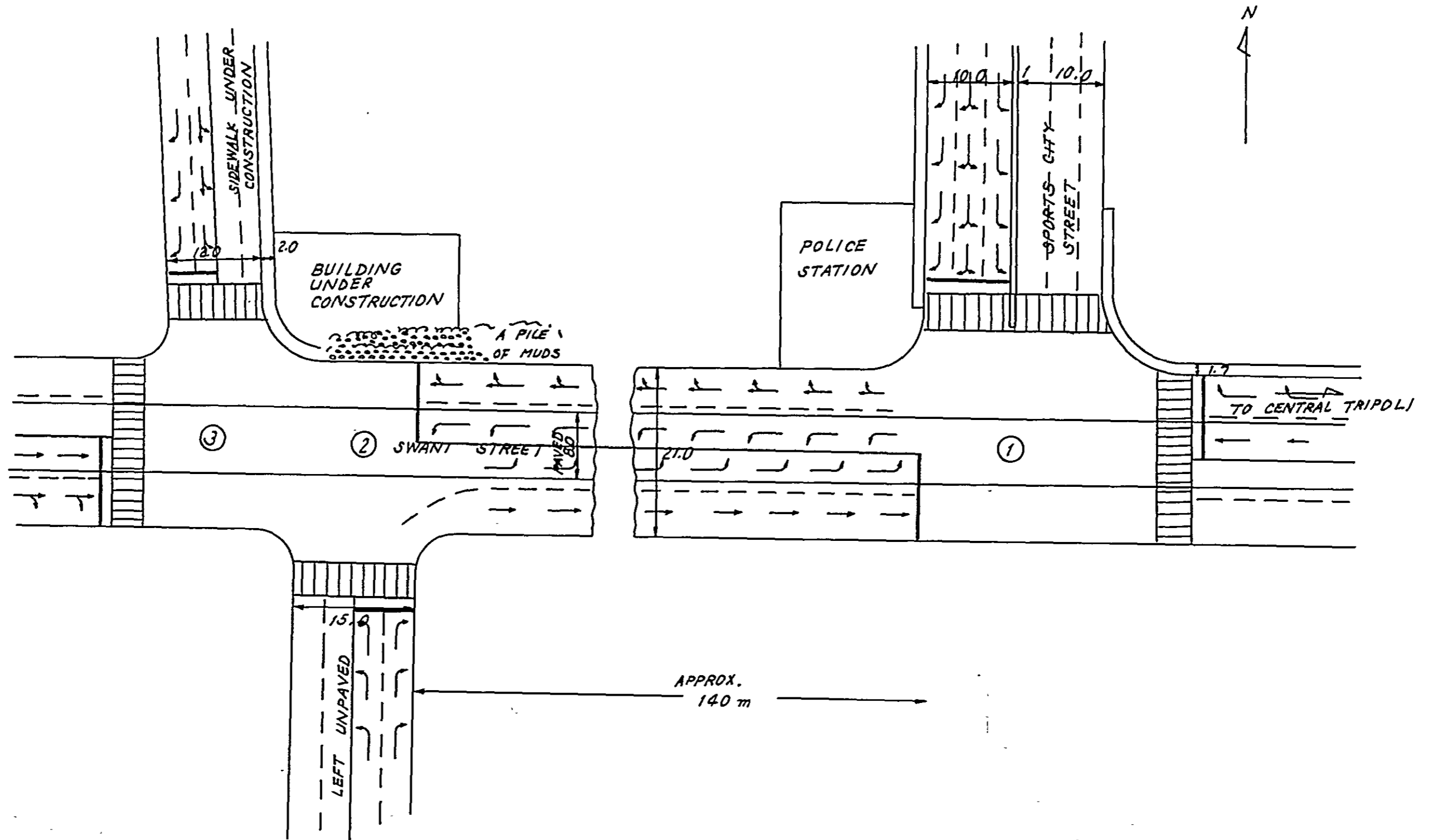


FIG. 5 INTERSECTION OF RING ROAD AND AIRPORT ROAD, AND ITS NEIGHBORHOOD

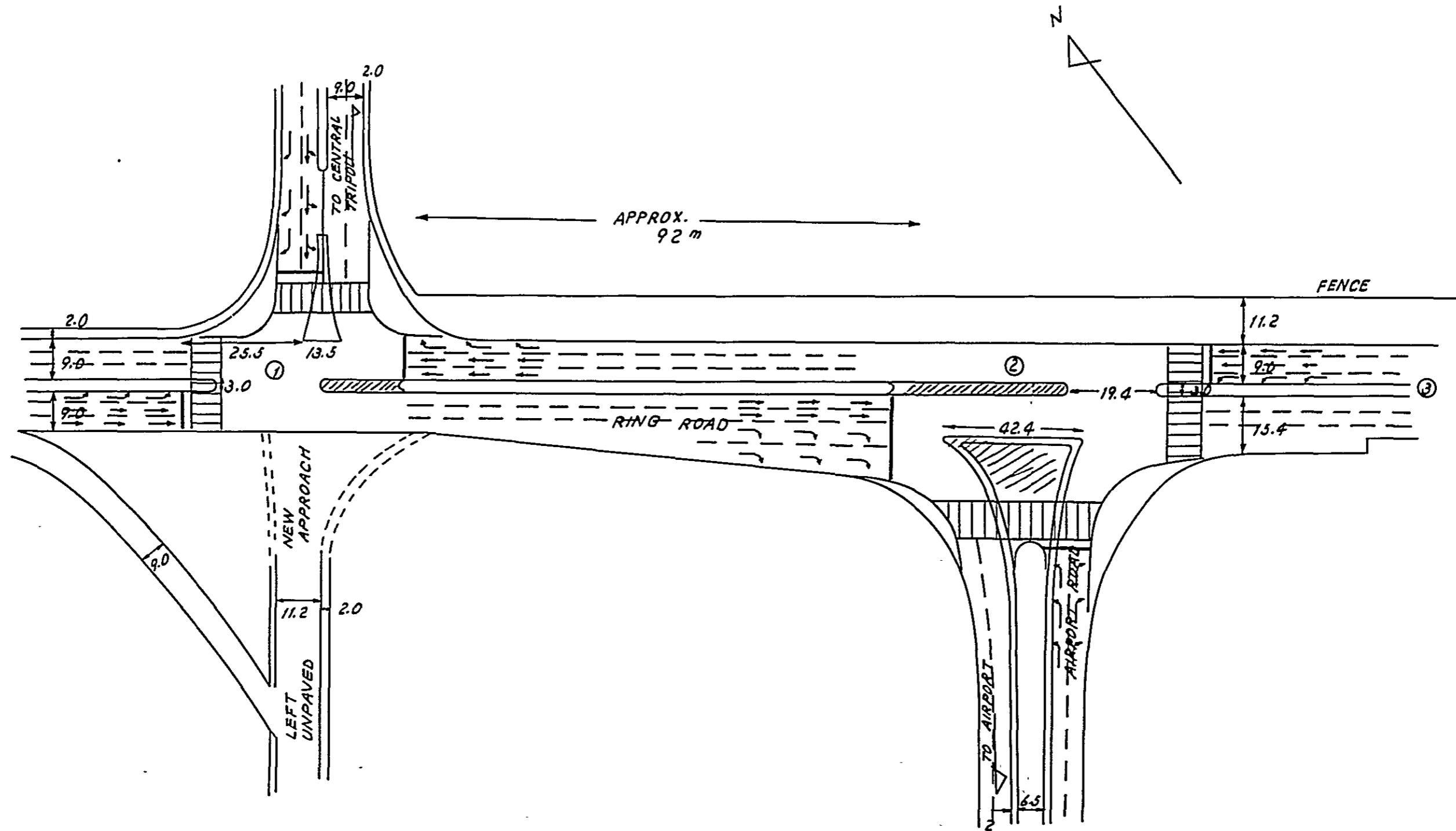


FIG. 6

ROTARY ON COASTAL ROAD LEADING TO AL HOMS

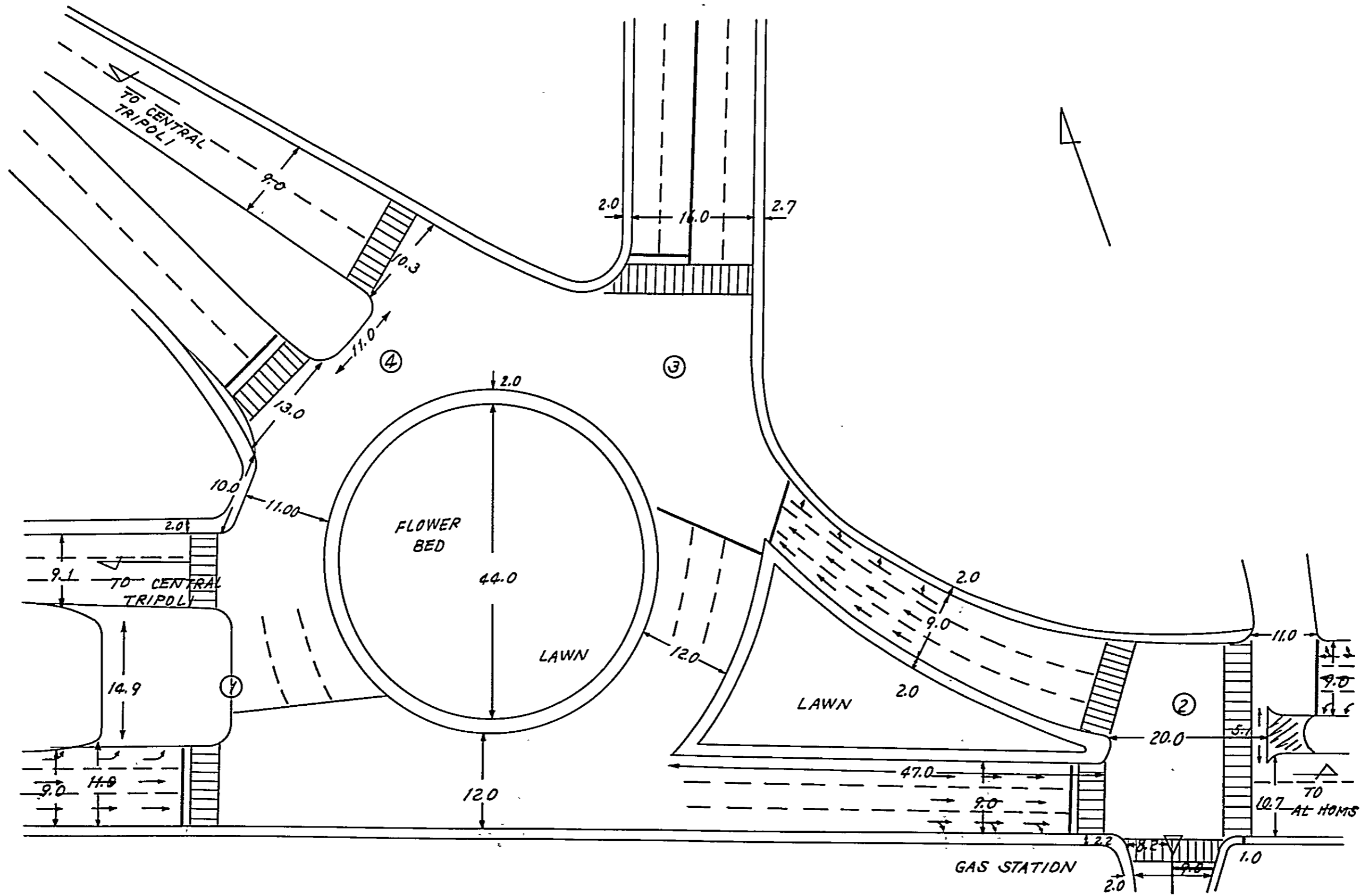


FIG. 7-2 DOWNTOWN AREA (INTERSECTION AT THE ENTRANCE OF BUS TERMINAL)

