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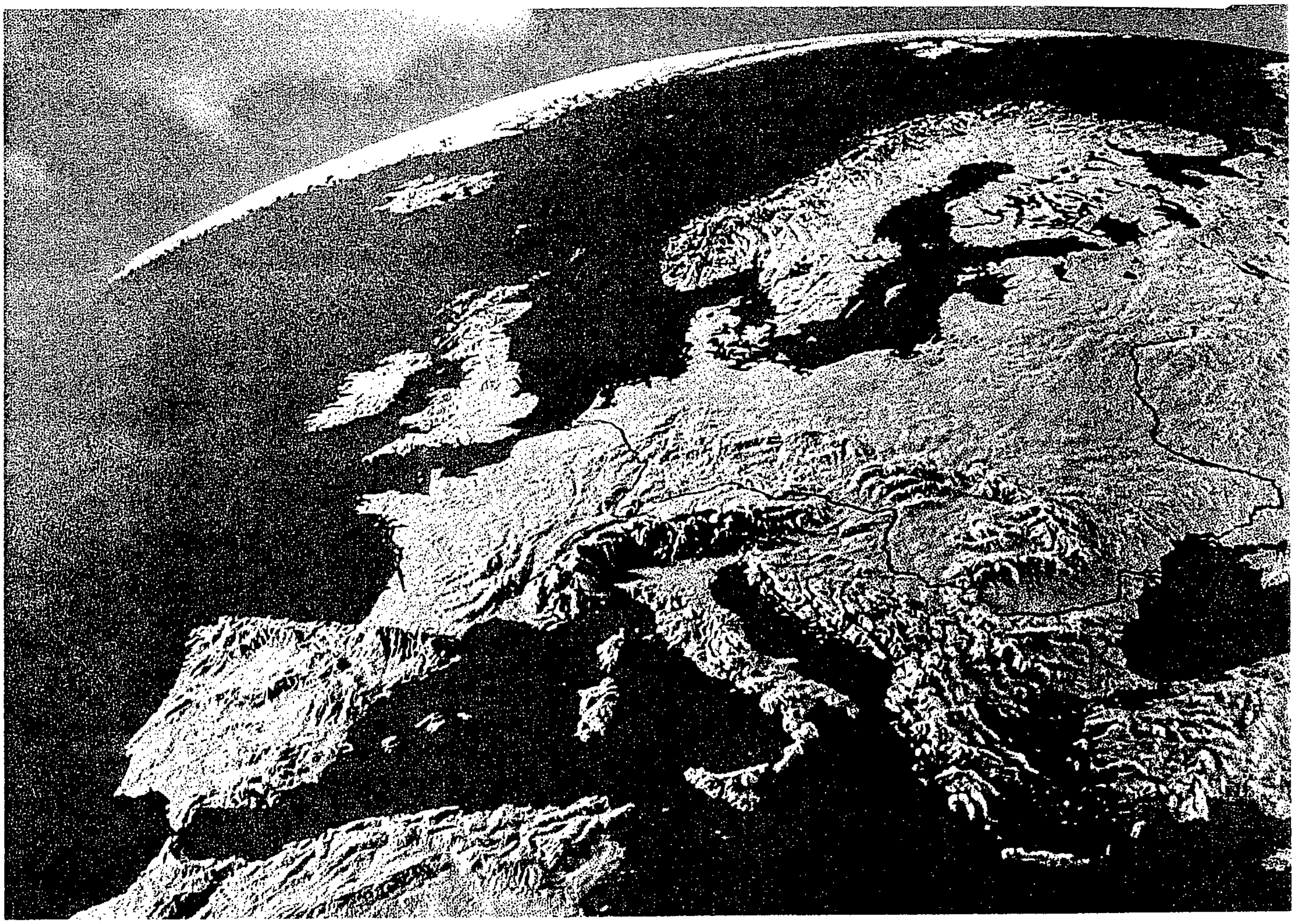
HUNGARIAN INTELLIGENT ROAD INFORMATION SYSTEM (IRIS) TECHNICAL DEVELOPMENT AGENCY (TDA) PROJECT

INCEPTION REPORT



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Section 1
EXECUTIVE SUMMARY

1. EXECUTIVE SUMMARY

1.1 INTRODUCTION

The Hungarian Intelligent Road Information System (IRIS) is a major international project. It is designed to apply the latest technologies and transportation management skills to provide Hungarians and international road users with the best road service possible on the Hungarian network. The IRIS program will provide the essential information for road users to choose the best and safest routes throughout Hungary, and provide effective communications amongst those operational groups working towards this end.

The imminent implementation of the IRIS is timed to lessen problems caused by heavy seasonal traffic on the Hungarian road network. While programs are underway to provide more roads, there is a worldwide phenomenon that the cost of needed road improvements for both commercial and private road transportation exceeds the national transportation budget. This reality has increased the need to maximize use of the existing highway network by using Intelligent Transportation System (ITS) to its fullest extent. The IRIS is a commitment to fully integrate traffic management services throughout the total highway network.

Early IRIS implementation is an important preventative measure. To be most effective, the IRIS must be adopted throughout the total highway network and provide the means to integrate the efforts of those agencies and corporations now managing the operating highway system.

1.2 CENTRAL EUROPEAN SETTING

Hungary is in an excellent position to be a major participant in the expansion of the European Community, and in the trade with eastern and central Asian countries as indicated in Figure 1-1. Hungary provides a year-round transportation system for goods traveling across Europe. The proposed highway plan shows new roadways, but funds are constrained. The challenge is to operate the existing roads in the most efficient fashion while the highway network is expanding. Hungary's motorway development plans, UKIG organization and need for maximum efficiency of its highway system support the appropriateness of examining the feasibility of an IRIS.

1.3 TRANSPORTATION ISSUES

A transportation issue now facing Hungary is a growing demand for highway travel to serve the increase in private car ownership and growing international freight transit movements. The proposed plan for 2010 shows added highways, but in the present financial climate of Hungary it is not possible to finance these roads at the needed rate. This presents a challenge for government to operate the existing roads in the most efficient fashion while the highway network is expanding. The Hungarian government has also taken the initiative to develop a favorable climate to encourage investment and concessions to accelerate the development of the highway system.

The Road Department has developed a long range plan for the expanded national highway system in Hungary. This plan envisages completion of the already committed motorway system out to the borders of the neighboring countries, and to complement this with the circumferential highway system starting with M0 and possibly two additional circumferential roadways between Budapest and the border. The planned highway network is responsive to the capacity constraints now experienced on the existing highway system, in conjunction with the plan to complete the motorways with the support of concession agreements.

1.4 HUNGARIAN HIGHWAY NETWORK

Hungary is committed to a system of motorways. Amongst these routes, concessionaires are selected for parts of M1 and M5 and toll concessions for M3 and M7 are under development. Operation of the other motorways will depend on the traffic growth on those facilities and the ability of the Concessions Bureau of the State Motorway Corporation to award concession agreements to prequalified companies to operate them as tollways. The important distinction already made by the Hungarian Ministry of Transport, Communications, and Water Management, Road Directorate, is that regardless of the status of the motorway, tolls or free of tolls, the motorway system will be operated under a common operational plan for all motorways serving the domestic and international transit traffic through Hungary. This is an important stipulation since it will facilitate the implementation of IRIS. Concession agreements must permit the introduction of IRIS on the tollways so that all travel in Hungary can be coordinated under the same operational IRIS plan. In those cases where the motorways are already completed, IRIS features will need to be added to the existing system. New concession agreements may include provisions to include IRIS features for the designated motorway.

1.5 PROJECT APPROACH

The approach proposed and developed with UKIG is the implementation of a national IRIS program in Hungary to assure the safe and efficient operation of the highway network. IRIS is planned for implementation on selected portions of the 30,000 km national public roads network and will provide road management information and operational communications within the nineteen counties, the State Motorway Company, the UKIG, the police and other involved agencies.

The Hungarian IRIS will build on and integrate the ongoing IRIS functions already developed in UKIG. The IRIS will integrate ongoing functions, expand or add new features, provide expanded communications between groups and expand the system geographically throughout Hungary.

It is realized that the implementation of such a system will take time to accomplish and that funding limitations may require phased implementation of the project. Recognizing the impact of phased implementation of a National IRIS System, two working premises are assumed.

1. Each phase will enhance communication and operation among existing groups and planned activities.

2. Each phase will show immediate benefits to the motoring public.

3. System design will allow for phased expansion.

4. The initial phase will be designed for future expansion to the planned completed IRIS.

Phased implementation allows for system integration and installation to be dictated by available funding. Three major component categories to be phased are:

a. Electronic communications
b. Computers and software
c. Traffic and other yield equipment

Phased implementation of the electronic communications may be accomplished on a geographic basis, by major highway corridors, and by component levels, i.e., fiber optic or wireless, in the County Road Directorates for operations and maintenance and the State Motorway Company. Fourteen of the County Road Directorates are along the major highway corridors. The prioritization and phased implementation may be structured along six motorway corridors connecting the County centers, or on a regional basis with later expansion to subregional centers. Interim operations may be accomplished using limited wireless communication that may be upgraded in subsequent phases.

These and other design decisions will be made in close cooperation with UKIG and will be balanced between technology and public service needs. Computer and software requirements have lower costs and every effort will be made to implement a sound first phase that includes most of the features needed to fully operate the IRIS and handle expansion of the IRIS. The traffic and field equipment are expandable on a per unit basis as the system grows. The software can serve the complete IRIS throughout Hungary.

The project is to be completed in eight months.

1.6 REPORT ORGANIZATION

The body of the Inception Report contains six sections and one annex. Sections 2 and 3 summarize existing conditions in Hungary and provide background on the development of the Highway Network and the evolving IRIS. Section 4 includes reports from the first stage, on-site investigations conducted by the WSA team. Sections 5 and 6 present the proposed Work Plan and

Schedule to complete the study in eight months. Section 7 reviews procurement procedures in Hungary and the Annex reproduces some facts and figures about highway transportation in Hungary, previously prepared for the Ministry.

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Section 2
PROJECT CONTEXT

2. PROJECT CONTEXT

Hungary is in an excellent position to be a critical participant in the expansion of the European Community, and in the trade with eastern and central Asian countries. Hungary provides a year-round transportation system for goods traveling across Europe. The proposed highway plan shows new roadways, but funds are constrained. The challenge is to operate the existing roads in the most efficient fashion while the highway network is expanding. Hungary's motorway development plans, UKIG organization and need for maximum efficiency of its highway system support the appropriateness of examining the feasibility of an Intelligent Road Information System (IRIS).

This section provides an overview of the transportation system that would be the setting for IRIS. Section 3 provides more detail on the potential structure of an expanded system.

2.1 CENTRAL EUROPEAN SETTING

Hungary is politically and geographically in the center of Europe. It is now in the buffer zone between the European Community and the Russian sphere of influence. Historically, Hungary has been at the turbulent edge of many of the political developments in Central Europe. It was on the edge of the Turkish (Ottoman) Empire, the edge of the Russian Empire and part of the historic Austro/Hungarian Empire. Hungary today is proudly independent in the center of Europe.

The Hungary of today is about one-third of its previous size in its premier Austro/Hungarian period. This reduction in size followed the fall of the Austro/Hungarian Empire after World War I (WWI) when Hungary was punitively reduced to its present size by the Treaty of Trianon in 1920. This treaty constrained Hungary to a smaller central core and forced many Hungarians to live in neighboring countries as an ethnic minority.

Today, Hungary is bordered by seven countries -- Austria, Slovakia, Ukraine, Romania, Serbia, Croatia and Slovenia. Most of these countries are small and of modest political influence. Their politics are influenced heavily by the conditions in the Balkans on Hungary's troubled southern flank. In the northern and eastern areas, Hungary abuts Slovakia and Ukrainia; these are nations who want to establish their own identify after years of domination in the system.

Numerous Hungarians live in many of the neighboring areas previously part of the Austro/Hungarian Empire. Today, there continues to be close ties amongst all the ethnic Hungarians living in the border regions of the seven neighboring countries. In some cases, these Hungarians are experiencing increased civic and legislative pressure designated to expel them from their home and prohibit use of their language.

Hungary is a crossroads for eastern and western European travel and commerce. **As the crossroads, it is in an excellent position to be a major participant in the expansion of the European Community and in the trade with eastern and central Asian countries.** Hungary has managed to develop a stable government and economy and has great expectations of being invited to join the European Community soon. Most Hungarians look westward to their historical ties with Austria, affinity for the Austro/German society, and expanded trading relationship with the European Community. Unlike most of central European countries, Hungary has its own distinct language and does not share common linguistic roots with its neighbors. The Hungarian language has remained independent of Slavic, Germanic and Romance influence. Its language and its location allow Hungary to maintain a distinct and separate identity.

2.2 TRANSPORTATION SYSTEM OVERVIEW

2.2.1 Highway Transportation

Geographically, most of Hungary is a plain edged by the Carpathian Mountains. The major barriers to transportation in Hungary are not the adjacent mountain ranges but instead the two large rivers, the Danube and the Tizia. The Danube is the historic transportation route from Central Europe to the Black Sea. Now it is connected to the North Sea and Atlantic Ocean through new canals on the Rhine River. The Tizia River is a major river in the eastern part of Hungary and flows southward from the Ukraine across the plain of Hungary, down through Romania.

The Danube River is a mature river which follows a fixed course through Hungary. The Tizia River in contrast is a meandering river which flows across the eastern Hungarian plain causing considerable flooding, making transportation crossings more difficult. One of the most famous historic transportation facilities of eastern Hungary is the Nine Arch Bridge across the Tizia flood plain.

The domestic transportation of goods and people within the country is made relatively easy because of the flat terrain. This topography also means that Hungary provides a year-round transportation system for goods traveling across Europe. There are two major European corridors -- one provides ties to the major Asiatic routes connecting Vienna to Beijing and the other joins the Adriatic ports to the Ukraine and Russia.

The National Transportation System must serve not only the two major European corridors across Hungary, but also the transportation demands within Hungary itself. This domestic travel is concentrated along a radial highway system with Budapest as its hub. Travel within the country is focused around Budapest so that traffic needs to go from one city to Budapest and then travel from Budapest to the final destination. Travel between countries that neighbor Hungary often also requires travel through Budapest. These demands are served by radial corridors formerly connecting to circumferential routes in the pre WWI Hungary. These routes are the traditional corridors that have developed in Hungary and are numbered one through eight.

Future transportation plans address the need for a concentric circumferential highway system within Hungary. If traffic grows considerably, the highway network will require two or three circumferential roads further out from Budapest. One such route is located between the M0, the motorway around Budapest, to a new circumferential motorway halfway between Budapest, and the border. Another such route would be an arc through the midsection of the Nation. The third circumferential major highway would be closer to the border and join the major outlying cities in the rest of Hungary. Both routes would serve local travel between Romania, Serbia and Croatia without needing to travel through Budapest.

In Europe's competitive commercial environment, it is crucial that the Hungarian transportation system should provide safe and efficient travel for freight movements on its highways. It should also be competitive in attracting traffic through Hungary due to the flat terrain and moderate climate. In Hungary the traveler occasionally experiences freezing weather during the winter season from November to February when icing occurs. However, most of Hungary does not experience very cold weather and large snowfalls.

In summary, Hungary is well positioned to serve east-west highway traffic between Europe and Central Asia and between the Adriatic and Russia through the Ukraine, as well as north-south traffic to the Balkans. The stable political climate of Hungary also make it an attractive routing for transit vehicles; and the courtesy and security of the Hungarian people make the Hungarian transit routes favored choices.

2.2.2 Railway Transportation

Hungary is served by a nationwide electrified railroad system serving predominantly passengers. The travel distances in Hungary are so short that there has been little opportunity or necessity to develop major freight movements on the railroads. The railway system provides passenger service consisting of local trains and ***InterCity*** trains which serve major cities. The ***InterCity*** rail network follows a pattern similar to the highway network, with a radial system linking the four main stations in Budapest to other cities in Hungary. The Budapest stations serve the northwest, the eastern plains and southern Hungary. The ***InterCity*** trains provide effective passenger service to the major cities closer to the borders of Hungary.

2.2.3 River Transportation

The Danube River is a major international transportation artery in Europe. It forms the northwestern border of the nation, turning south through Budapest and beyond toward Belgrade. The river handles bulk freight movements and provides cruise ship and ferry passenger service popular with tourists. Four principal services are:

- Danube - Rhine Barge Service
  This service connects Western Europe to Budapest. New ports and freight handling facilities are planned for the Budapest area.

- International Boat Service

  A hydrofoil service operates on the Danube between Budapest and Vienna. Service operates from April to November with daily morning departures from Vienna and Budapest. Service is doubled to one morning and one afternoon departure in July and August. The trips are scheduled for about 5 hours with a stop in Brakislava.

- International Ferry Service

  Between Sturoro and Esgtergom May through September

- Inland Boat Service

  Promenade cruises on the Danube from Budapest

2.2.4 Air Transportation

Budapest is an active international airport served by MALEV, the Hungarian national carrier, and other international carriers. Direct flights serve New York, southeast Asia and Europe. There is no scheduled air service within Hungary. Recent deregulation of regional air travel in Europe may provide the incentive to develop regional air service in Hungary.

2.2.5 Key Issues

A transportation issue now facing Hungary is a growing demand for highway travel to serve the increase in private car ownership and growing international freight transit movements. The proposed plan for 2010 shows added highways, but in the present financial climate of Hungary it is not possible to finance these roads at the needed rate. This presents a challenge for government to operate the existing roads in the most efficient fashion while the highway network is expanding. The Hungary government has also taken the initiative to develop a favorable climate to encourage investment and concessions to accelerate the development of the highway system.

It can be seen that the national highway network in Hungary will have to serve the growth and development of travel demand within Hungary itself, and serve the increasing demands for transit traffic across the country. In particular, Hungary and its neighbors depend on truck traffic to handle the major portion of the goods movements. This pattern of an increasing number of trucks in the traffic stream is aggravated because there is competition amongst private cars and trucks for use of the same roadway. The trend in Europe is towards larger trucks, particularly tractor-trailer combinations which are replacing some of the old style trucks familiar in eastern Europe. These new tractor trailer combinations are, however, well built, well equipped, well powered and much safer.

The Hungarian automobile fleet is becoming dominated by compact automobiles which are more fuel efficient and more price competitive. This results in clashes between the much larger tractor-trailer truck combinations entering Hungary and the smaller domestic car fleet.

Concern about the presence of more large trucks during summer weekends resulted in changes in the law. When Hungarians and visitors began to make extensive use of the highway system in the summer, it became necessary to curtail truck traffic throughout the summer weekends. This was planned as a necessary 'temporary' institution but now it must continue until the road network in Hungary has expanded to provide motorways on the seven major corridor routes crossing the country. Traffic demands are still growing on the Hungarian motorway network, and the traffic growth is expected to outstrip the ability of the Hungarian government to provide more motorways to serve this heavy traffic. Having set up the plans for the development of the national highway network, and related its costs to the potential revenues in Hungary, it is clear that the major management task of UKIG is to manage the existing highway system to provide safe and timely travel throughout all of Hungary. The major problems addressed relate to the highway system are:

- how to sustain the growth in highway capacity on the major routes;
- how to provide safe and timely movements on the existing system of a partially developed National Highway Network.

The transportation demand problem is further aggravated by the high seasonal demands experienced in Europe. Hungary is an attractive tourist and holiday area and during the summer months there is a large influx of foreign visitors who wish to spend some of their vacation in

Hungary. This seasonal trend is coincident with the national travel patterns where Hungarians themselves travel throughout Hungary to such places as Lake Balaton to enjoy their summer breaks. The challenge is to meet its own domestic needs and to provide high levels of service to transit and tourist visitors crossing the country.

It is necessary for the Hungarian government to develop projected highway budgets sufficient to cover the major costs of maintaining the existing system. These costs take up most of the Road Fund monies, making completion of the motorway network dependent not only on the ability to interest foreign investors in the toll-concessions, but also in the long run for growth in the economy to support new road development in the outer regions of the country.

2.3 HIGHWAY SYSTEM

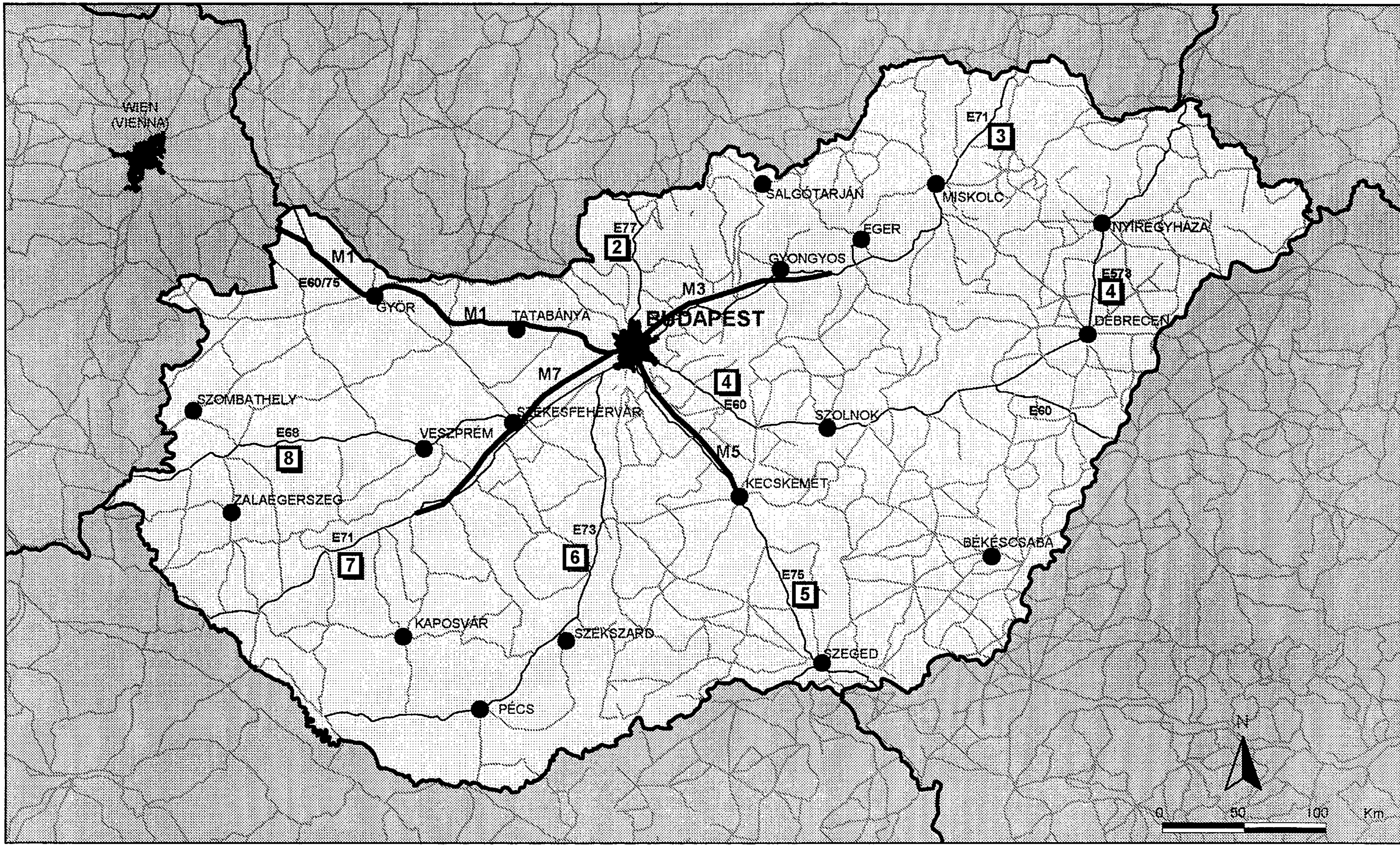
2.3.1 Existing Corridors

The existing highway system in Hungary, illustrated in Figure 2-1, connects all of the major cities in the country with two-lane paved highways. As Hungary moves into a new development era, it has experienced a growing demand to expand the vehicle capacity on many of its major links in the highway network. This increased capacity is provided through the development of a motorway system. These are four-lane divided highways and are expandable to six-lane divided highways to handle heavy traffic in the Budapest area. As part of the funding of the motorway system, concessionaires operate toll roads on some motorways in Hungary.

The Hungarian highway network has two parts: the National Road Network and the Local Road Network. These are approximately 30,000 km in the National Road Network and 105,000 km in the Local Road Network for a total of 135,000 km. In Table 2-1, there is a breakdown of the existing toll roads, motorways/tollways, free motorways and other National Roads in Hungary. This tabulation shows the expected dominance of the two-lane roadway in the Hungarian network. A motorway has strict access control to assure safety and efficient operations along their length. The four-lane divided motorway has two lanes in each direction with shoulders on the right hand side of sufficient width to allow a parked vehicle to stand free of moving traffic. The left hand shoulder,

Figure 2-1

Republic of Hungary - Major Road Corridors



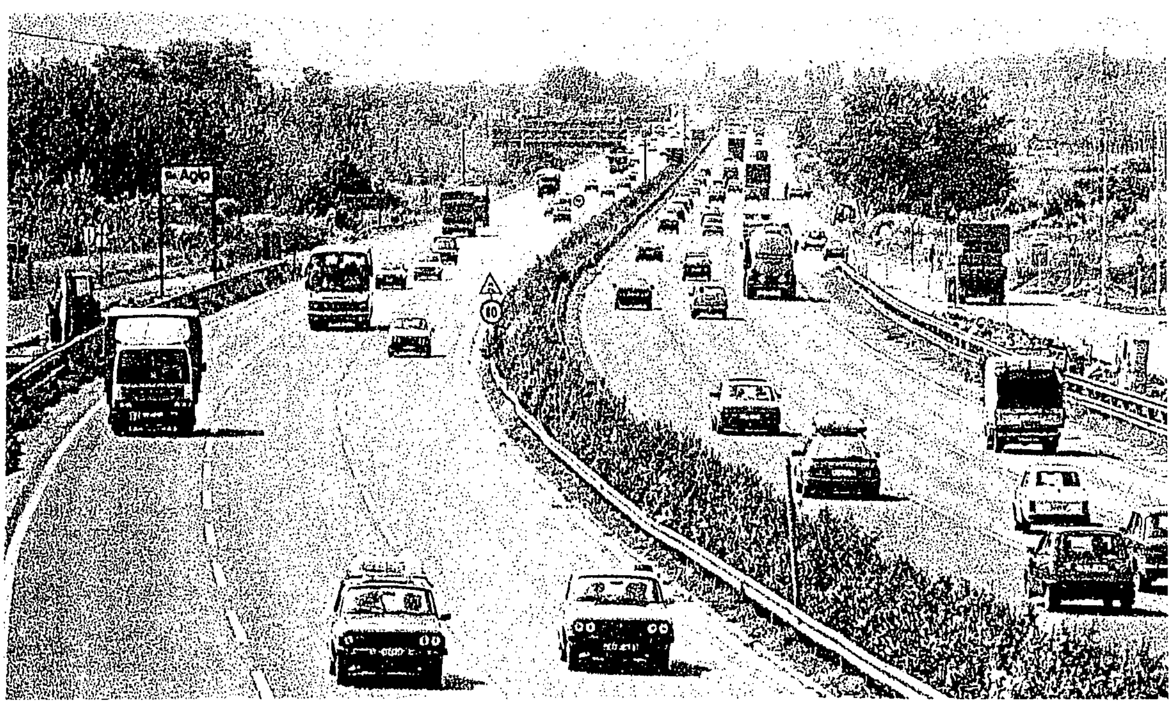
in contrast, is smaller. Disabled or stalled vehicles are expected to travel to the right hand shoulder. Where the motorways are widened to six lanes to accommodate heavier urban traffic, the left hand shoulder should be fully developed to allow a vehicle to stand on the shoulder free of disruption to the moving traffic. For safety purposes, the motorways should have a steel guard rail in the median. This median design results in a smaller right-of-way taking.

Table 2-1
NATIONAL PUBLIC ROADS (1995)

Motorways	293 km
Expressways	85 km
Primary Main Roads	2,042 km
Secondary Main Roads	4,383 km
Secondary Roads	23,228 km
TOTAL NATIONAL PUBLIC ROADS	**30,031 km**

Pictures of the roadway are shown in Figure 2-2, showing the general layout of the roadway shoulder and median for the typical Hungarian motorway.

Figure 2-2
HUNGARIAN SIX-LANE URBAN MOTORWAY



The configuration of the motorway system is in a star pattern around Budapest. There are eight motorway corridors designated in Hungary. These designations are M1 through M8, plus M0, the inner ring motorway around Budapest. To date only one motorway (M1) goes to the border. The designation of motorway does not define the toll status of these roadways.

Hungary is committed to a system of motorways. Amongst these routes, concessions are in operation on parts of M1 and M5 while M3, and M7 are under review for future toll operations. Operation of the other motorways will depend on the traffic growth on those facilities and the ability of the Concessions Bureau to award concession agreements to prequalified companies to operate them as tollways. **The important distinction already made by the Hungarian Road Directorate is that regardless of the status of the motorway, tolls or free of tolls, the motorway system will be operated under a common operational plan for all motorways serving the domestic and international transit traffic through Hungary. This is an important stipulation since it will facilitate the implementation of an Intelligent Roadway Information System (IRIS).** Concession agreements must permit the introduction of IRIS on the tollways so that all travel in Hungary can be coordinated under the same operational IRIS plan. In those cases where the motorways are already completed, IRIS features will need to be added to the existing system. New concession agreements may include provisions to include IRIS features for the designated motorway.

The Hungarian Highway System appears well maintained and there is a smooth surface of asphalt concrete. There are, however, some older sections of roadway which have concrete pavement surfaces that are uneven and give a noisy and bumpy ride over the deteriorated reinforced concrete surface. In general, all paved roads in Hungary are flexible pavement designs using bituminous materials that offer a smoother ride.

From an IRIS point of view, the asphaltic concrete pavements provide a good opportunity to include IRIS traffic detectors throughout the highway length. While the smooth pavement has been successful at installation, there are signs in many areas that heavy truck traffic is causing rutting in the pavement surface. It is controversial as to how much roadway damage is ascribed to trucks. Some would argue that growth in total traffic contributes as much as overweight trucks to pavement deterioration. What is notable, however, is that Hungary permits overweight trucks on its system. It allows these trucks to continue on their routes across Hungary by paying a modest permit fee. Border stations, at international entry points, charge individual trucks for overweight axle loads and excess total weight.

The operation of the motorway is also strongly influenced by the mix of large tractor-trailer combinations moving freight and the small compact cars used for private transportation. This conflict problem between types of vehicles is further aggravated by the remaining number of old style trucks that are underpowered, often heavily overloaded, and mechanically deficient. These old trucks have very slow operating speeds and experience frequent mechanical breakdowns. These trucks pose a critical problem on a two-lane highway where other trucks need to pass these slower trucks. The side by side operation of trucks passing each other causes a moving lane blockage on the motorway. This condition is aggravated by the regulatory speed differential for vehicles on the motorway.

Trucks on motorways share a common speed limit of 120 km/hr with automobiles. On other main roads speed limits are lowered to 80 km/hr for trucks and 80-100 km/hr for automobiles depending on traffic conditions and safety performance. On the busy motorways fast vehicles make frequent lane changes to pass slower traffic. These are a combination of slow automobiles, such as the TRASANT, and some very slow trucks of older designs. The Police have hope of introducing minimum speed limits on the motorways. The freedom of the motorway induces some automobile traffic to travel at speeds of 180-200 km/hr. This extreme speed differential increases the hazard of motorway travel and results in more serious injury accidents.

The Hungarian government is striving to fund capacity and safety improvements in the road network. However, it has to share its funding of new roads with the cost of maintaining and operating the existing system. This funding is covered from the Road Fund and accounts for most of the expenditures in the annual budget. The Hungarian public road network of national and local roads exceeds 105,000 kms. It is the demands on maintaining and keeping these roadways in good condition that puts a strain on the national budget for highway maintenance and operation.

2.3.2 Planned Highway Network

The star configuration of the highway network, with Budapest as the hub, connects Budapest to the seven neighboring countries at the international borders. The motorways that attract most of the traffic are the M1 to Vienna, M7 to the Balaton area, M5 southeast of Budapest connecting with the city of Kecskemet, and M3 to Gyongyos.

Development of the eastern motorway system has been slower because of limited funding and also the lower traffic volumes experienced in this area. The traffic volumes on the motorways to the south connecting with Serbia, the former Yugoslavia, fluctuate considerably depending on the embargoes or other restriction in place. Most travel within Hungary focuses on Budapest as a hub.

In the long range highway plan there is a need to develop a circumferential highway system centered at Budapest. The first step has already been undertaken with the M0 motorway, the motorway on the southern side of Budapest, about 20 or 30 kms from the city center. Another circumferential roadway would be halfway between M0 and the border and another outer circumferential roadway would join the outer cities parallel to the Hungarian border to the east, south and west. With a national population of over 10 million people, the eight major motorway corridors represent a strong commitment to the motorway network. The expansion of this network to include the circumferential roadway form the basis of the future highway network in Hungary.

The Road Department has developed a long range plan for the expanded national highway system in Hungary. This plan envisages completion of the already committed motorway system out to the borders of the neighboring countries, and to complement this with the circumferential highway system starting with M0 and possibly two additional circumferential roadways between Budapest and the border. The planned highway network is responsive to the capacity constraints now experienced on the existing highway system, in conjunction with the plan to complete the motorways with the support of concession agreements. The circumferential roadway system is expected to have difficulty in attracting enough traffic to attract concession agreements. The M0 motorway does have high volumes because it connects the M1, M5 and M7 motorways to each other. The outer circumferential roadway will primarily serve the internal traffic in Hungary rather than major through movements.

The European Highway Network has two major European corridors through Hungary, the Vienna-Budapest-Serbia corridor and the corridor from the Adriatic through Budapest into the Ukraine. The first corridor is served by M1 and M5 with the M0 connection and the second corridor is the M7 and M3 with an M0 connection. This places heavy traffic volumes on the M0 and accounts for the active introduction of a MARABU project to coordinate traffic operations on M0 and the city of Budapest.

The circumferential roadways, particularly the outer roadway paralleling the border, are not well suited to traffic traversing Hungary, but they provide access between neighboring countries, such as movements between Romania, Serbia and Croatia, and would also connect Austria with Serbia and Croatia. The circumferential roadway may attract some international transit traffic but these would be shorter trips joining neighboring or close-by countries. The development of the circumferential roadways would play a major role in the relief of traffic congestion around Budapest. As the motorways are completed, the topology of the motorway network would cause very heavy traffic loading on the M0 motorway and on its interchanges with the motorways around Budapest.

One missing component in the motorway network is a complete ring road around Budapest. This is not controversial in terms of need but it is controversial as to which sections of the ring road will be developed first. As the traffic on M0 increases, it would make the northern ring around Budapest more attractive, directly connecting M1 to M3. At the same time, there is traffic from Budapest due north into Slovakia. This would be served by the future M2 motorway and a complete ring road around Budapest. The future plan envisages a complete ring road around Budapest. Typically, a ring road around a major metropolitan area is expensive because of the urban development and it is difficult to get agreement amongst the local communities to have the motorway in their area. There has been negative reaction by smaller communities to having a new motorway around Budapest. On the other hand, there are some areas of the country that need the motorways to support economic development. The terrain around Budapest is also complicated due to the high bluff on the Buda side of the city and the Danube River itself which flows through the center of the city. The motorway ring road is required to bridge the Danube River twice.

The challenge for the Hungarian government is to find the funding for the timely implementation of the motorway system in an effort to keep up with the growth in traffic as the economy grows. With more political and economic stability in neighboring countries, traffic movements throughout Hungary could be expected to expand dramatically. The highway plan priorities include the completion of those parts of the motorways experiencing high traffic volumes, and concurrently the completion of the motorway ring road around Budapest and the long range future development of the circumferential motorways. The completion of the M3, M5, M7 and M1 to the borders represents a commitment to the European corridor plan and provides good motorway connections throughout Hungary.

2.4 MOTORWAY DEVELOPMENT

In 1989 the Hungarian State Motorway Company was created by the Ministry of Transport to manage motorway development in Hungary through three administrative divisions.

1. Division for Public Works
2. Division for Maintenance and Operations; and
3. Concessions Bureau.

The State Motorway Company shares planning functions with the UKIG and is jointly responsible for the National Roads Development Plan. The Motorway Company generally contracts out the works required for land acquisition, engineering design and supervision and tendering for construction. The Concessions Bureau is responsible for dealing with all aspects of Concession Agreements and has a permanent staff. It also contracts small other advisers. The Bureau was created in order to coordinate at one level the concession-awarding process.

The Bureau has now successfully awarded two concessions: one for the construction (now complete) of the M1/M15 from Budapest to the Austrian border, and the second for the M5 towards the southwest. A two-stage concession awarding procedure was adopted:

(a) **Prequalification** - an advertisement for potential concessionaire consortia in which it was stated that the intention was to draw up a short list of three to five bidders. This prequalification procedure required organizations to demonstrate capability, willingness to undertake the works, reliability and credit worthiness; and

(b) **Full Tender** - the successfully pre-qualified candidates were asked to bid on the basis of a technical scope of works, a model contract, and a financial plan.

The tender documents did not define the tolls. These were to be specified by the bidders themselves in their financial proposals. A minimum of 20 percent equity was also required. The intention was that the "best bid" would then be further negotiated. The leader of the negotiating team was a specially appointed civil servant. Although some traffic forecasting information was supplied it was incumbent on the bidders to make their own estimates of future traffic.

The final agreements specified maximum tolls, the ratio in tolls that could be charged for various categories of vehicle and the method for allowing increases in tolls (these were to be tied to the Retail Price Index).

One of the most important aspects of the negotiations was the division of risks:

- The State guaranteed vacant possession of the land, the timely availability of necessary building permits and the satisfactory prior solution of any environmental issues;
- for the M1/M15 concession all traffic risks were borne by the concessionaire but on the M5 some of the risks were absorbed by Government; there being the facility to use 13 semi-annual installments;

- the concessionaires were required to put some money from the tolls into an escrow account as guarantee that the tollway was returned to the Government at the end of the concession period (35 years) in good condition;
- the concession agreement permitted the extension of the concession agreement by 50 percent providing there were no major objections;
- compensation would be payable by the Government to the concessionaire in the event of: late delivery of the site; archaeological discoveries hindering construction progress; and materially adverse actions by the Government; and dangerous dump sites unknown at the time of contract signing, found on the alignment and causing eventual delay; and
- Government guaranteed not to build any competitive facilities or to upgrade existing parallel roads. They also undertook to instigate some traffic "calming" measures on the parallel roads as an inducement for traffic to use the motorway.

It should be noted that Hungarian Law does not allow the State to take equity in a "private" company. There was, therefore, no State equity in the consortium. The EBRD did, however, contribute to the equity.

Hungary is now constructing a third motorway, the M3, towards the Ukrainian border. This route does not have the traffic generating capacity of the first two routes and is being constructed by Government. It will still, however, be tolled.

2.5 UKIG ORGANIZATION

The Ministry of Transport, Communications, and Water Management through its Road Directorate has developed a more decentralized administration through the UKIG and a group of separate corporations. UKIG directs the overall plan of transportation development in Hungary and administers and directs the Road Fund. It operates in concert with the State Motorway Company and the nineteen County Road Directorates for Operations and Maintenance. Technical services are provided by separate corporations operating in coordination with AKMI. AKMI is responsible to the Ministry and receives its funding from the UKIG administered Road Fund annual budgets.

The County Road Directorates operate as corporations and function as cost centers in the execution of the maintenance and operating of the highway network. These counties are not responsible for construction costs of the national road system. The expansion of the motorway system is managed by the Hungarian State Motorway Corporation which is responsible for the implementation and construction costs of the motorway system and this is complemented by an independent concessions authority that negotiates the toll road terms with concessionaires on candidate sections of the motorway system. In this way, the motorway system is expanded in two levels: by the direct construction of the motorway by the UKIG funded by the Road Fund, and by the concessionaire system where sections of the motorways are implemented and operated under concession agreements. New motorway sections are either: 1) funded directly by the Road Fund; or 2) funded by a concession agreement. All concession motorways will be tollways. UKIG has the option to develop the motorways with road funds and then it may on its own volition fund or implement tolls on the motorway system at a later date when traffic volumes can support a tollway. To a visitor to the country, this is an unfamiliar arrangement and sometimes difficult to absorb that there are two or three levels of separation between motorways funded by concessions and funded by the road fund, and by tollways operated by the concessionaires and also by the Hungarian State Motorway Corporation. As the pressure to fund new motorways increases and the road fund revenues are limited in their growth, the long term expectation is that major portions of the motorway system will be concessionaire operated. The ability to attract concessions to the country depends on traffic forecasts and the willingness to pay tolls. So far it has been difficult to balance any financial needs of the concessionaires with the toll pricing strategy to attract more traffic to the motorways.

In most parts of the world, the initial traffic volumes on a toll road are too low to generate enough revenue. When this happens, there are two choices to change revenue; either to increase the toll rate sufficient to increase revenue or to marginally lower tolls to attract more traffic, thereby increasing the market share of the toll traffic. For international travel, particularly commercial freight traffic, it is sensitive to the transit toll rates, however, for domestic traffic, both freight and passenger travel, the toll rates are critical in attracting traffic away from the alternative national highway system onto the toll concessions. This interaction between tolls, financing and motorway operations is complex. It involves the willingness of the community to pay tolls and the willingness of international traffic to choose a Hungarian transit route across Europe. This issue has been critical in the development of traffic patterns along the M1 corridor from Budapest to Vienna. In a 43 km section, the travel time was reduced, however, the imposition of tolls on the previously free motorway caused traffic to divert to other local roads and caused considerable local resentment of the toll system. The ideal is to have lower tolls when the tollway opens and increase tolls when the tollway traffic grows. However, at lower toll rates it is impractical to attract new concessionaires to Hungary. The original concessionaires set the toll rates on the basis of the financial needs. These selected toll rates were a deterrent to travel on the tolled motorway and overloaded the small community roads. The government is now resolving these issues and is developing new standards to attract concessionaires on the remaining sections of the motorway system.

The roadway operations and maintenance function is implemented through three groups, the Hungarian State Motorway Company, the Concessionaire agreements, and the 19 county administrative districts. The Counties provide a structure which an IRIS can follow. An IRIS project could provide intensive monitoring along the well traveled traffic sections of motorways, typically over 20,000 ADT and the IRIS could provide electronic communications between central offices in Budapest and each of the 19 county districts. Within each district the monitoring of the highway network and the maintenance and operation functions could be coordinated through each of the county directorate centers. These centers would provide two-way communication between the directorate offices and the vehicles and work crews in the area. They would also provide the interface with the police in those areas. The police department is organized on a community by community basis. Offices are assigned to small communities within each of the county districts. In this way, the first level of coordination is between the police and the 19 AKKTs.

IRIS - HUNGARY

TDA

IKIR - MAGYARORSZÁG

Section 3
DEVELOPMENT OF IRIS ON HUNGARIAN ROADS

IRIS TDA Project
Wilbur Smith Associates

3. OVERVIEW OF INITIAL IRIS CONCEPT

There have been element of a complete IRIS functioning in Hungary for more than 20 years. These elements were developed as separate subsystems and are managed separately. There are many subsystems and most are managed independently. The goal of an expanded IRIS is to provide a highly sophisticated information collection and dissemination system that provides real time information to users and managers of Hungary's road system.

3.1 INTRODUCTION

There are information and data collection systems in operation on the National Public Road Network. The establishment of these systems were gradual, often separate from each other. This lack of integration was caused by funding restrictions, lack of a nationwide plan, and the rate of technology developments.

Since the early 1970's a well developed road databank has existed (National Road Databank, OKA), which contains technical, geometric, traffic and accident data. The goal of this system is to satisfy the information demands of professional designers and road managers. The Data Bank stores relevant data and these records are updated as often as three times per year.

There have been elements of a complete IRIS functioning in Hungary for more than 20 years, providing driver information to the public and agencies responsible for the operation and maintenance of the road network. It is called UTINFORM and is working daily. Information is received by telephone and telefax and then a report is prepared on accidents, weather and road conditions. There is an OKA data communications network and computer terminals showing incidents and critical conditions on OKA highway maps. Drivers access this collated information through the telephone or listening to public radio stations.

Besides the traditionally organized road information services, there are several sub-systems, generally managed independently. Many of these are expected to become parts of the new IRIS.

The Hungarian Road Directorate has carefully analyzed the need for IRIS and considers that the goal of IRIS is to provide a highly sophisticated information collection and dissemination system using advanced electronic technology and modern management techniques. Components include:

- electronic information gathering (video, data and voice)
- real time information transfer
- computerization of information processing to provide real time integrated road database
- driver information dissemination using broadcast media
- ready access electronic communications to the real time database throughout Hungary

The real advantage of IRIS will be apparent to both truck and automobile drivers. These advantages include:

- better use of the existing road capacity
- smoother traffic flows
- travel time and fuel savings
- reduced accident hazards
- improved and safer driver behavior
- maintenance and traffic management cost savings

IRIS is not an alternative to an Intelligent Transport Systems (ITS) but it is an ITS element expandable to a future Hungarian ITS. The Hungarian IRIS should conform to international standards and protocols to match the European Community programs.

In the long term, IRIS can be a base for a national broadcast "Traffic Radio" or cable television information program. This may be expanded to other agencies or groups such as railway, air traffic, highway freight companies and the Hungarian Auto Club.

In the future, IRIS may be integrated into in-vehicle navigation and driver information systems now under development in Europe, USA and Japan.

The aim of the this project is to support a future international funding application, which in the first step to expanding the existing road information activities into a technologically advanced national Hungarian IRIS.

3.2 THE PRESENT SITUATION

There has been a group of data gathering programs in AKMI. The biggest problem today is the lack of an integrated system. There is no access to most of the road information as access is through separated subsystem databases. For example, traffic count data and accident data are two user groups that would be better served by a continuously updated integrated database management program envisaged in the IRIS design.

The following list describes the nine on-going activities:

1. **Traffic Counts**
   The method of traffic counting is a national count program conducted every five years and additional counts conducted each year. These reports do not provide measures of current hourly variations. In addition only a few counts are made on weekends. Every five years an origin-destination (OD) survey is conducted. The locations of the OD surveys changes according to the needs of planners.

2. **Accident Data**
   The police collect accident data categorized as light, serious, and fatal injuries.. These data are sent to the National Statistical Institute on a quarterly basis. Only accidents with personal injuries are recorded. Accidents which block traffic and with no injuries are not systematically reported to the road management Counties by the police.

3. **Traffic Signals**
   Most of the 400 intersections controlled by traffic signals operate as isolated signals. These operate with pretimed traffic controllers. Traffic responsive systems can change signals based on detector information gathered throughout the area. In Budapest and

some other Hungarian cities, individual computers determine the optimal signal timing for splits, offsets and cycle lengths based on detected traffic flows. The Hungarians use the "green wave" control strategy on some urban roads.

4. **Other Traffic Control Systems**

This system, which signals hazardous traffic jams is operating on the M7 Motorway at the Erd slope (15 miles from Budapest) on busy Sunday nights. The center of the system is at the control center at Martonvasar. With the help of traffic detectors it automatically controls speed limit illuminations. This slows down traffic, approaching the congestion jams.

Another traffic signal system uses changeable speed limit signs to show the advisory speed limit. It envisions smooth flow at complex intersections along a route. This system can be found on the belt of Road 8 around Veszprem, but is seldom used today.

5. **Border Stations**

Weigh stations are set up at the 18 busiest border stations. The data from them is sent to the UKIG/AKMI Office using telephone circuits. This data covers only incoming, commercial traffic. It is practical to enlarge the system, with the construction of new weigh stations on the remaining border stations. Also, entering cars and outgoing commercial/vehicles should be recorded. In this way all traffic at a border station could be monitored and analyzed. CCTV video cameras could be used to read license plate numbers at these stations.

6. **Height Checking System**

There is one experimental system in operation. Vehicles have to pass through an infrasensor gate. When a vehicle is higher than allowed, a yellow light changes to red. If the vehicle tries to go on, the system forwards the information to the Border center. If the vehicle turns back seeing the red sign, the event is not recorded.

7. **Meteorological Observer System**

   The observer system collects and stores data from several measuring stations. In these stations temperature of the road, the air, relative humidity, and salt content of road surface is measured continuously. The data goes to the County Road center computer by way of radio communications. Data, grouped by station can be obtained from the computer, its changes analyzed, thus determining the tendency of weather change. In case of ice or fog, warning signs can be activated or notices given.

8. **Precipitation Radar System**

   The radar stations of the National Meteorology Service (Farkasfalva, Nyiregyhaza) and the radar maps used by air traffic control (Ferihegy, Taszar) provide appropriate information based on these radar data. This technique is already used by several road management centers, since one radar can oversee a 200 km diameter circle.

The primary goal of development of IRIS is to increase the information flowing to road users. From a technical point of view it is reasonable to use and build on the existing information systems and gradually extend and modernize them.

The following analytical steps were proposed in prior IRIS studies directed by UKIG:

- Examine how existing systems can be interconnected with error free communications, make sure that they complement each other and reduce all unnecessary duplication
- Determine new information - information sources or recipients. These might include police, clubs, media, meteorological services, the systems must be operated together in an integrated IRIS
- Determine all information levels necessary to operate UTINFORM, the UKIG center
- Designate information providers and collectors, responsible to maintain specific databases
- Determine the necessary enlargements for UTINFORM
- Prepare the compatible computer software/system plan
- Make the technical investments for adequate and accurate data collection

- Provide electronic communications for fast error corrected data flow and media (fiber, wireless, satellites, etc.)
- Organize trainings for IRIS operators
- Prepare the system documentation

While planning the IRIS, several techniques such as GIS and GPS will be considered and used to augment existing mapping sources. This is intended to make the project tender document schematic plans compatible with UKIG requirements.

3.3 IRIS JUSTIFICATION

The information system(s) currently working on the Hungarian roads are considered by UKIG to be inadequate to support the economic transportation development of the country. Some of them have been in operation for over 20 years improving continuously. In some areas, new developments appeared. These are working independently, but cannot be considered a part of an integrated system.

In view of the current situation, an IRIS can be developed. This IRIS would expand and integrate the existing working system. Combined with international experience, evaluation results, regulations and existing technology, Hungary has the resources and capacity to develop a pioneering effort in establishing a national, fully integrated IRIS to serve as a model for future development in Central Europe and the European Community.

3.4 EUROPEAN CONNECTIVITY

Hungary is at the critical crossroads of east and western Europe. It anticipates joining the European Communication (EC) in the next few years.

In anticipation of this development it has carefully coordinated its long range planning with the European Community (EC). The highway network includes two major European corridors and includes sections of "E" designated highways crossing Hungary. Members of the Ministry of

Transport Roads Directorate serve on many policy and technical committees usually with observer status. In the day to day planning EC policies and standards are reviewed and widely used.

Joining the EC will mean that only one country, Austria will be an EC member, Hungary will still have borders with six countries that are not EC members. In spite of this preponderance of non EC neighbors Hungary is committed to fully implementing the EC standards and policies to provide conformity and consistency with the EC.

The standards affecting IRIS include communication protocols and other standards for highway signing. Active participation in the technical committee has resulted in Hungary being fully aware of and actively implementing standards in equipment and communications architecture and protocols, such as digital radio developed in the EC.

The IRIS will be designed to be compatible with its neighbors in the EC and will extend these standards to the borders of its non-EC neighbors. In some cases treaty agreements with neighboring countries affect some designs or procedures. Also, Hungary is bound by its own constitution and key international treaties in Central Europe.

3.5 IRIS GOALS AND GENERAL CONCEPT

The goal of IRIS is to provide electronic communications between each of the County Road operations centers, the State Motorway Company operations center planned along M0 and the Tollway Concession operations centers along the tollways to the IRIS Center in the Budapest area. This IRIS communication system would provide access to the real time integrated database to all AKKTs. Within each county area, communications with IRIS would be accomplished by two-way wireless between vehicles and information kiosks located within each county.

In concept, an individual vehicle or a traffic manager within any county throughout Hungary could communicate with the IRIS and receive selected information as requested from any other AKKT or the State Motorway Company. The person requesting the information would access the database and receive an automated reply on status from that database. They would not need any human intervention or communication between individual operators. Individual operators traveling in an area would receive communications and information from an in-vehicle device. In some cases the in-vehicle devices could receive full motion video. Any traffic operator in Hungary could request a picture of traffic operations along the motorways and at major incidents where a TV camera is available. Each group would be responsible for maintaining their own database within the national integrated real time database, and in return for their contribution to the database, they would have access to other data in the system.

To manage the volume of data and data transfers, a priority system would be established and it may limit the type of information given out to each requesting person. This interorganization communication system would provide the same real time traveler information made available to the motoring public at information kiosks located in all areas. The Database Management concept is that whenever road data is collected or available it would be entered into the real time traffic database so that other users in any part of Hungary could access that database or observe the data in diverse forms, video, printed document and digitized voice information.

3.6 ONGOING IRIS ACTIVITIES

As part of the Ministry of Transportation's reorganization many of the functions of the traditional highway department were broken out as separate cost centers and set up in the form of private corporations. Selected members of the original staff were reassigned to create new corporations. This streamlines the administration of the Ministry's organization so that the work responsibilities and tasks of the day to day operation and running of the transportation directorate can be staffed by fewer people. Each of the separated corporations acts as a cost center and perform their work according to guidelines and budgets established by the UKIG central management.

As part of the ongoing review of IRIS activities, it was convenient to visit the separate corporations individually and talk with their staff and review their present work assignments. The results of these visits and general summary of the interviews are reported in Section 4, First Stage On-Site Investigations, which was the first visit to Hungary for the IRIS project. In each case members of the staff of these corporations including the management director and other project staff were readily available to talk with the IRIS team and offered both summaries of their present assignments, the difficulties they experience in their day to day work, and the hope and expectations they would see in the future IRIS program.

These exists a keen interest in IRIS activities in the Ministry related corporations and the visits to these corporations showed that they are enthusiastic and industrious in trying to push forward the IRIS concept in times of small budgets. They were committed to providing the safest and best operating motorway system in Europe. The present IRIS operations in the UKIG may be characterized by the following groupings: 1) traffic monitoring, 2) route choice information, 3) accident and incident response and diversions, and 4) the monitoring of freight movements crossing Hungary itself and the borders with the neighboring countries.

Monitoring the existing highway network has been a continuous operation in Hungary throughout 30 years between 1960 and 1990. This monitoring includes traffic counts on the major highway network throughout Hungary, traffic growth trends on various sections of roadway, and the classification of vehicles using those roadways. The monitoring made full use of loop detectors for counting purposes. These counts are augmented by manual counts and weighing in motion (WIN) detectors to classify commercial vehicles by axles and total weight. There are detailed historical files of traffic volumes, classification of automobile and truck by category of axle combinations. The trucks can be classified in over 20 categories. For day to day operations in the IRIS the number of truck classifications could be greatly simplified and this is easily achieved with the automated traffic data collection system. The FHWA, for instance, has a classification system of 13 categories used in the design requirements for pavements and bridges.

Some of the key IRIS activities now being undertaken by AKMI and the private corporations include the following. The central IRIS information service has its prototype in the UTINFORM system which receives data from various sources including the weather service and makes this available to the weather forecast media and to individuals making personal trips. This service can easily form a major function of the IRIS which collects information from various sources and distributes it to media and travelers in Hungary.

The AKMI group check the entry of trucks into Hungary. They weigh these trucks, give them permits for overweight or oversize and give them routings throughout Hungary. This group has a well established truck weighing program at 18 entry points and in the near future plan to expand this to 20 locations. These scales are mechanical and give an accurate measure of axle and total weight for trucks entering Hungary. This function can be readily integrated into the IRIS program not only to provide the weight and truck classification data, but also provide some origin and destination information so that vehicles can be traced through Hungary. Potentially, these trucks could serve as travel probes to establish travel time on the Hungary Highway Network.

Another private company is conducting an experiment to conduct truck weighing and classification throughout Hungary on the public road network. These data would be source information for the IRIS system providing monitoring of vehicles on the national highway system including counts of vehicles, speeds of vehicles and other operational traffic characteristics. In addition, they can monitor discontinuities in traffic flow and detect incidents on the highway. These data collected on the national highway system can be input to the real time integrated data base being developed in IRIS. The existing systems are prototypes of the various subsystems. These can be expanded for distribution throughout the main highway network. These data then can be integrated in the information system to be released to the broadcast media for TV and radio.

Expanding these services is inhibited by cost constraints and the capacity of both the computer systems and the electronic communications. One of the major functions of the IRIS is to provide enhanced electronic communications and computer capabilities to perform these services on the national highway system throughout Hungary. Additional electronic features may be developed by concessionaires on the tollway system. These systems will include automated vehicle identification at toll collection places and this system can be expanded and integrated within the IRIS system. This will allow the IRIS to monitor volumes, speeds, and travel times along the tollways using electronic reading and automatic vehicle identification tags on the vehicles. The phased implementation of the IRIS will incorporate all the future electronic systems provided by the concessionaires on the expanded motorway network. A summary of the existing IRIS components is shown in Table 3-1.

Table 3-1
EXISTING IRIS COMPONENTS

IRIS FUNCTION	CANDIDATE ELEMENTS	EXISTING COMPONENT	TECHNOLOGY OPTIONS
Route Guidance	Diversion Signs Trail Blazers GIS/Navigation GPS	MARABU MARABU	Variable Message Signs (Fiber/LED) GPS - Satellite
Information	KIOSK Call-in-Service Roadside Radio Broadcast TV/Radio Voice Synthesis Mapping	 UTINFORM UTINFORM	Mapping (GIS) Voice Synthesis Radio - Digital Television
Monitoring	Weather Traffic Detection Video Surveillance Classification WIMS AVI Reading License Plates	 MERFOLDKO MERFOLDKO MERFOLDKO	Radar Measurement Detectors CCTV/CODECS Loop/Piezo Detection AVI/AVL Digital Camera
Control	Speed Limit Vehicle Restriction Lane Use Work Zones Border Crossing Toll Collection	MARABU MARABU MARABU MARABU AKMI Concession	Detection-Loop/Radar Modular Symbol Matrix Sign Scales ETC/Manual
Ancillary	Traffic Signals Railroad Crossings Parking Systems		Traffic Responsive Automation Automation
Operational Centers	Central Counties	UTINFORM/Motorway Budapest 19 Counties	Information & Management Center Regional Centers
Management Systems	Pavement Maintenance Data Bank Accidents	UKIG UKIG UKIG Police Reports	
Patrols	Police Traffic/Maintenance	Police/Motorway AKKT	

In review, there are important IRIS activities ongoing in Hungary. These are suitable for expansion and adaption into the IRIS system. There exists a staff familiar with these devices and capable of maintaining them in mechanical and electronic order to the required accuracy of an IRIS system. Each of the separate corporations has an experienced staff to expand and monitor the operation of this expanded system.

Each of the private corporations is conducting its own evaluation of equipment and procedures. This information will be an important input in specifying the equipment and operational modes for the future IRIS system. The expansion for the future IRIS is discussed in the next section.

3.7 FUTURE IRIS

The future IRIS system envisages a complete communication system that will connect the UKIG main office directly with the State Motorway Company and each of the nineteen counties and Concessionaires. This high level of communications will encourage coordination between these groups. Direct communication would be practical between the 19 counties where they can share the real time integrated traffic information database without requiring communications with Budapest. This will allow the individual county road directorates to seek information on additional roads in their area and in the operation of roads in the adjacent counties. At the county level, wireless communications will join the central office of the county with the individual vehicles operating in the county, both police and highway department personnel and it will allow the individual vehicle operators in the area to access the integrated real time traffic data of the IRIS system.

Individual vehicles will receive information distributed by the IRIS system such as UTINFORM and will allow the vehicles to interrogate the system for specific information. One example would be the police from their vehicle communicating through the county headquarters back to the Budapest offices, would be able to check a transit vehicle's weight based on its license plate and its recent entry into the country. This will give the police officer sufficient information to know that this vehicle is operating with a permit and is allowed to drive on the route on which is was observed. In addition, the police would know of any other restrictions placed on wide loads or over height loads so that they can be checked for the provision of police escorts, or other requirements set out in the permits.

Use of new electronic communication will allow the introduction of security codes on data transfers or voice communications between police vehicles and county traffic vehicles with their local headquarters. These data will then be sent to the IRIS real time data system and to the agency headquarters in Budapest for both highway, police, weather and other involved parties.

The future IRIS program will concentrate on the following items: 1) a complete information system to dynamically route vehicles through the Hungarian Highway Network, making the route choice sensitive to traffic operating conditions, weather conditions and any preplanned road works occurring in the system. This system would also provide a recommended routing between city pairs throughout the country based on real time traffic data; 2) The IRIS will monitor in real time the traffic operating conditions on the major highway links. The monitoring, both through traffic sensors and television (CCTV), will verify operational deficiencies such as closing a lane of the roadway. The IRIS would designate a candidate alternative route and provide directional signs to reach them and confirmation signs along the route to reassure the driver that they are still on the alternative route, eventually returning to the original route that they were on. The extensive monitoring of the highway system will allow the IRIS to identify incidents causing lane blockage and delays throughout the Hungarian Highway Network; and 3) Detection of these incidents and estimates of their expected duration will allow the system to dynamically reroute traffic through the network through the use of radio broadcast and route guiding system. Complementing this would be the nationwide May Day system which would allow vehicles in distress or stopped on the roadway shoulder to communicate their needs in a secure fashion to the appropriate local agency. These calls from the roadside using roadside or cellular phones or other techniques would be received by the county, distributed to the police and the response need of the caller. In all cases the information transfer can be secured and coded so that people tempted to take advantage of a stalled vehicle would not have access to the reporting and the needs of the stranded motorist.

Future IRIS would expand at the border crossing to include continuous origin destination monitoring and where practical, to use specified vehicles for travel probes within the network. These vehicles would be automatically monitored at points along the roadway and their real time travel information integrated directly into the IRIS system. The real time traffic information system developed in the IRIS would complement the data available in the data management system and would be used to assist the individual counties in more efficiently using their staff to respond to incident and weather-related problems.

The future IRIS will incorporate the existing IRIS functions and expand them throughout Hungary. The intent is to make the fullest use of the experience and developments made to date by UKIG.

IRIS - HUNGARY

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Section 4
FIRST STAGE
ON-SITE INVESTIGATIONS

IRIS TDA Project
Wilbur Smith Associates

4. FIRST STAGE, ON-SITE, INVESTIGATIONS

4.1 INTRODUCTION

This section presents the summary observations of the first stage visit to Hungary. The body of this section comprises two elements:

a. Summary Report of the Initial IRIS project visit to Hungary proposed by, and
b. Comments generated by EUROSATCO to reflect the Hungarian viewpoint of this project issue, status and goals.

These two documents were prepared prior to the completion of the Inception Report, and are included in their original form or as a summary of the translation from the original Hungarian.

4.2 SUMMARY REPORT FOR THE INITIAL IRIS PROJECT VISIT TO HUNGARY

The Hungarian Intelligent Road Information System (IRIS) is a major international project. It is designed to apply the latest technologies and transportation management skills to provide Hungarians and international road users with the best road service possible on the Hungarian network. The IRIS program will provide the essential information for road users to choose the best and safest routes throughout Hungary, and provide effective communications amongst those operational groups working towards this end.

The imminent implementation of the IRIS is timed to lessen problems caused by heavy seasonal traffic on the Hungarian road network. While programs are underway to provide more roads, there is a worldwide phenomenon that the cost of needed road improvements for both commercial and private road transportation exceeds the national transportation budget. This reality has increased the need to gain the fullest use of the existing highway network by using Intelligent Transportation System (ITS) to its fullest extent. The IRIS is a commitment to fully integrate traffic management services throughout the total highway network.

Early IRIS implementation is an important preventative measure. To be most effective, the IRIS must be adopted throughout the total highway network and provide the means to integrate the efforts of those agencies and corporations now managing the operating highway system.

The Wilbur Smith Associate members of the IRIS project team arrived to start the project work on January 4, 1997. The first work task included two weeks of meetings and briefings on IRIS related work undertaken by technical specialty groups directed by the Ministry of Transportation, Communications and Water Management, and the Directorate of Roads-Management and Operations (UKIG). The following lists the contacts made and the first impressions of the ongoing IRIS related work.

INTRODUCTORY

Ministry:
HÓRVÖLGYI Lajos (Director General)

HOLNAPY László
Dr. LÁNYI Péter

UKIG

CSORDÁS Csaba (Director) and IRIS Project Manager
Dr. RÓSA Dezsö

OUTSIDE VISITS

1. Hungarian Meteorological Service,
   VISSY Károly and NÉMETH Lajos
   This group provides weather forecasts to UKIG. They are part of the national system and preprocess weather information for use by the individual County road directorates. They have access to weather data from three radar stations in Hungary and can use satellite data for cloud cover. They provide a national service (Hungary is relatively small) and are aware of changing weather conditions in some

neighboring countries. The weather forecasts are received by the ÚTINFORM office in AKMI and disseminated by them to the individual AKKTs.

In IRIS context it is essential, particularly for the persistent black icing problems that persist in the winter season. Potential IRIS enhancements could include the use of added local weather sensing, similar to that used on bridges, to refine the local weather alerts and help reduce the salting now used in routine salting of local roads. Direct access to current weather conditions could be provided at individual maintenance yards (3.5) within each County Road Nonprofit Corporation (AKKT). There appear to be opportunities to use added software, sensitive local weather forecasts, and status reports in each AKKT.

2. ÚTINFORM

DÖME István
PALÁDI Ferenc

This is a service orientated group providing traffic and weather conditions to the public and broadest media. They also serve as a coordinating center for the AKKTs. Two of their primary efforts are the preparation of recorded radio reports on highway alerts throughout Hungary and direct telephone requests for recommended trip routing on the primary highway network. They have the resources of a small broadcast booth, similar to those used in Highway Advisory Radio (HAR) applications in other ITS applications. They have two outside cellular phone numbers for direct calls to the ÚTINFORM center.

Within the IRIS context, this function could coordinate numerous media and public information services. The present operation is small with high quality staffing. The IRIS could expand the ÚTINFORM role by greatly expanding its public dissemination role. For instance, giving out preferred trip routings could expand from the present static software to use new dynamic routing and use voice synthesis to give this information to a much larger motoring audience.

The IRIS challenge is to greatly expand the dissemination of real time data. This information service has a high potential to attract corporate sponsorship and/or advertising revenue. Even if the system does not generate new income, the private sector can cost share the major expansion to national and international audiences.

The ÚTINFORM concept needs the integrated real time database of the IRIS. The IRIS can also include a web page on the Internet to include real time data. This type of service is rapidly expanding on the major ITS in the USA. It may be effective to introduce an IRIS web page in the next few months.

3. MÉRFÖLKDÖ
   CSENKI László (Managing Director)
   FEKETE Balázs

This group is directly involved in the use, testing and evaluation of the measuring and detection equipment. They deal with two major equipment devices:

a. Those relating to pavement conditions
b. Traffic detectors and weighing in motion (WIM)

The pavement condition equipment uses vans to traverse individual roadway sections and record the data on-board on 3.5-inch diskettes. These data are subsequently forwarded by mail to the UKIG DATA BANK for use in pavement management programs and HDM 3 software. These data could be transmitted directly to the County Road Directorates.

For traffic detection in each county the loop detector is widely used. Two loop supplies were evident, PEEK and one Hungarian company. They seemed content with the loops although it was not clear to me how they use them on multi-lane road sections. For survey purposes, accuracy above 95% is acceptable. They are pragmatic in realizing that machine vision offers them no cost advantage for counting. They do not like vehicle length as a classification parameter. Vehicle classification is driven by the weighing in motion detection. WIMs. They use the WIMs primarily for survey purposes. They are ready to compromise on weight accuracy because their primary weighing measurements are on scales at the border crossings (eighteen in operations) and on portable scales used in enforcement. Overweight trucks are not banned but simply charged for the overweight on a price schedule established in the 1980s.

The WIMs in use are supplied by Electronique Controle, a French company. They use two loops and a Plezoelectric strip between the loops. The concern is to survey the trucks for classification into twenty eight axle combinations. When these surveys are underway, they prefer to preclude any police checking for overweight axle loadings. The weighing accuracy (perhaps 10% error) is less critical since the piezo device is an axle detector (weigher) and has to classify trucks accordingly.

The IRIS does not usually need more than 4 or 5 vehicle classification types and some simplified classification would suffice. For areawide measures of traffic performance, the WIMs are not essential on all routes.

This group has prepared an interesting video of highway traffic superimposed on an axle weight display. In the IRIS, the WIMs may be used on tollways for tolls based on weight or for seasonal surveys on other roads.

The initiative of this group has to combine a PC with communications in expanding the detector into a stand-alone subsystem. These special purpose systems tend to be more expensive than using general purpose PCS with simple software. The detection and classification systems need the roadside electric power and communication that are a feature of the IRIS.

This group is active with the EC committee 3-2-3 Weigh in Motion devices.

4. ÁKMI - Border Crossings
   BOZÁN György
   PALÁDI Ferenc

There are eighteen existing and two planned weigh station border crossings with the seven neighboring countries of Hungary. Each of these crossings has a balance scale to measure axle loads. The site visited was the crossing at Vámosszabadi on the Hungary/Slovakia border.

The weigh station is self contained in its own housing built in the sturdy style of prior eras. The operational staff were of the highest caliber proud of and knowledgeable of their responsibilities.

The operational procedure is roughly as follows:

> Trucks are separated from autos as they approach the scales at the entry to Hungary. The trucks are in a single lane controlled by a vertical gate that releases them one at a time. At this site the trucks are released by the Slovak customs at a rate based on available parking space in the customs clearance area. A released truck travels to the scale which is about two and a half meters across the lane and about half a meter in width in the direction of travel. The truck is stopped by a red light at the edge of the scale. The scale operator reads the license plate and the axle configuration and then gives a green light for the truck to drive slowly over the scale. The scale records each axle load on

a PC screen. If the weight is within limits, the driver gets out of his truck (on the wrong side from the office) and receives a print out of his weight. If he is overweight he gets a bill for overweight, a modest charge.

This long winded description is intended to convey the slow motion of the border crossing process. It appears to be a golden opportunity to collect more data at no cost or delay to drivers. Ideas such as O-D data and window decals for electronic detection on freight vehicles come to mind.

Overweight vehicles are given a bill and required routing to reach their stated destination. Each weigh station (border crossing) has a map of routes to each of the other seventeen border crossings. In the IRIS context, these are the major transit routes in Hungary and effectively define the primary highway network for transit traffic.

Data from the weigh station are sent overnight to the Budapest office. This same office issues permits for oversize loads and prepares, by hand, a routing to meet the width and height allowed in the permit. These permits are given at no charge to truckers even though they are willing to pay expediters for the permit request application filing.

5. Hungarian State Motorway Company
   Dr. SZAKOS Pál

The Hungarian State Motorway Company complements the nineteen AKKTs within the UKIG organization.

Three years ago the Motorway Company accepted tenders for the implementation of the MARABU system. This program addressed the heavy traffic demands of the crossing of two European Corridors to the south of Budapest on the MO motorway.

This is a farsighted project that incorporates numerous ITS features that will complement the IRIS.

The motorway system will be about one thousand kilometers in length carrying more than half the traffic in Hungary. Important features in MARABU - Motorway advanced parking for Budapest include:

Park-and-Ride for Budapest
Central Center Building in Budapest
Traffic Detectors in the Motor Way Pavement
Communications along the Motorway (Fiberoptic and Multipair Cable)
Coordination with the fiberoptic network around Budapest
Changeable Message Signs for Route Guidance
Changeable Message Signs for Lane Use and Parking Access
Park-and-Ride Facilities
Control Center Building
Roadside Telephones

The system is being installed along the 28 kilometers of the M0 connecting M1 and M5 and includes all the M0 interchanges into Budapest. The MARABU system will direct traffic at successive motorway sections to the next interchange that has clear traffic access to the city. The City of Budapest will provide the arterial street reverse system to direct traffic to the M0 motorway. The control will use changeable message roadside signs at each exit ramp and some overhead signs on the city streets. The system is advisory to traffic entering and leaving Budapest and will be jointly operated by the City of Budapest Traffic Control center and at the Motorway Company maintenance facility on Csepel Island in the Danube River.

From the IRIS perspective the MARABU system can be readily coordinated with the operation of the national system.

6. AKMI-DATABANK

This is the primary repository for highway data from the nineteen AKKTs and the Motorway Company. The DATABANK is complementary to the real-time needs of the IRIS. The DATABANK receives data directly from the individual AKKTs and survey groups. The DATABANK is organized around individual files on such topics as pavement conditions, bridge conditions, accidents and traffic surveys. Each file references roadway sections by route number and stationing from the kilometers or a second system of links and nodes, the nodes defined by DGPS (Differential GeoPositioning Satellites). The DATABANK is used systematically to run a series of highway management programs and other programs using inventory and summary highway and traffic data.

The Danish Government recently conducted a World Bank financed study of the DATA BANK and prepared a final report. From my preliminary reading of this report its recommendations do not appear to change the DATA BANK in ways that impact IRIS.

Separate observations suggest that to date there is no definitive commitment or procedure to integrate both GPS and GIS into the DATA BANK. Both of these systems are integral to a contemporary IRIS and are widely used in ITS applications software.

7. State Police Department
   Motorway Coordination and Management
   SZILAGY Tibor (Lt. Colonel)

The police play a pivotal role in both accident reporting and truck overweight monitoring. They are organized at the community level within any county and work with the county in dealing with black ice conditions. The following comments relate to factors that may be relevant to the IRIS.

- They operate two person patrol cars all with the same national markings
- Their patrol limits are within individual communities (cities, villages, and not counties)
- They use separate police radio frequencies but they do not have secure channel
- They only prepare accident reports on personal injury accidents unless called by drivers to resolve a property damage accident dispute
- Accidents are located by highway number and kilometer stationing
- The police have had a major communications study or proposal prepared by Motorola. They need funds to progress.
- The police would welcome added invehicle equipment to communicate with the local AKKTs and give access to IRIS files on truck permits.
- Tragically there are ten or more officers killed on the roads each year. They would like to use more video surveillance instead of road patrols.
- The Hungarian Defense Force is limited by treaties (post WWII) to a maximum combined number of police and military personnel.
- The police force is not free to expand to meet increased traffic response needs.
- They welcome computer-aided dispatch and GPS or other electronic technologies that may help meet the increasing demand for their services.
- They welcome the IRIS concept of expanded communications at the AKKT level.
- Motorway patrols are organized as a separate responsibility. This parallels the Motorway Company organization.
- On motorways the police would like to remotely monitor heavy traffic sections and check on truck permits.
- They report that efforts are underway to introduce a minimum speed of 60 km/hr on motorways.
- They do not anticipate an imminent change in the truck speed limit of 80 km/hr.

- There is a European theft alarm system on most trucks (tracking radio beacon). Truck hijacking is not a severe problem.

These observations were my own and in no way do I want them to infer any policy positions on behalf of the police. The police are most cooperative but freely admit that they are under very tight budget constraints, therefore, any help from the IRIS is welcome.

Driving on the motorways on various trips did show up the great speed differential between slow old trucks, 40 km/hr or less and newer passenger cars traveling at over 160 km/hr. maintaining these higher speeds required aggressive lane change.

8. Visit to AKKT in ZALAEGERSZEG in Western Hungary

JUHÁSZ Tibor (Director)

This visit provided the chance to see one AKKT headquarters building in Zalaegerszeg and meet the staff. The headquarters building was large and undergoing some renovations. Budgets are tight but step-by-step changes are evident. The AKKT operates a series of maintenance yards within its county. These yards are busy with salting and snow ploughing and removal. The snow and icing are expected to last all winter through February into early March.

Some counties are installing ice warning systems on one or two of their problem bridges. The system comprises a temperature and moisture sensors fixed to the bridge pavement surface. When the system senses the combination of freezing temperatures and moisture on the pavement, it transmits an alarm with a roadside radio transmitter to the AKKT center about 20 to 30 km. away. Once the potential icing condition exists, salting trucks are dispatched to the bridge. The AKKT staff

The ice detection system was on one of the county roads. It was disconcerting that our group was willing to disrupt traffic without taking more traffic safety measures.

FIRST IMPRESSIONS OF THE HUNGARIAN SYSTEM

As preliminary investigations progressed, many areas of support for the IRIS program became apparent. In particular, there are essential ingredients already in place:

- A top management commitment to a world leadership program,
- A series of well established programs already underway,
- A staff of skilled and experienced personnel anxious to move forward,
- A computer literate staff well versed in PC usage,
- An organization of UKIG and the AKKTs and Motorway Corporation in place,
- A national view of the IRIS highway network, and
- A Hungarian reserve favoring realizable goals.

In addition to these attributes there is a shared view in what is needed to realize the IRIS potential.

- An effective electronic communication system throughout UKIG and amongst other operational and management groups.
- An integrated real-time information system with widespread and easy access to operators and users alike.
- A hierarchical IRIS that is spread throughout the country network, and
- A need to implement the first phase of IRIS NOW!!

There are some potential dangers in not moving forward with IRIS quickly:

- Some programs are on the verge of operating independently losing the benefits and expanded capabilities of integration.

- Separate programs will not support a well integrated computer and communications system.
- Piecemeal efforts will make it difficult to generate strong public support.
- System integration may offer a major cost saving in using commercially available software.
- A well integrated national IRIS offers a more equitable distribution of services to all residents and visitors to Hungary.

The success of the IRIS will be helped by several themes:

- Lets make the Hungarian IRIS the best in the world.
- Provide service to all highway users.
- Make sure each step of the implementation show benefits.
- Hungary has the best opportunity to be the first to implement an IRIS using the latest technologies throughout every part of the country.

ACKNOWLEDGMENTS

The support and assistance provided by UKIG has been superb. Everyone has been most helpful and open in expressing their opinions and answering numerous questions. Particular thanks are due to Dr. Rósa who arranged most of the meetings. Throughout this endeavor, EUROSATCO KFT has provide invaluable support and made it practical and pleasurable to carry out this program.

4.3 EUROSATCO

(Summary comments on the initial IRIS project visit to Hungary translated from Hungarian original)

The first three weeks of IRIS work of WSA and EUROSATCO included informative meetings and site visits.

General Statements

The first three weeks of IRIS work of WSA and EUROSATCO included informative meetings and site visits.

General Statements

All the leaders of the state road organizations and the experts of the ITS existing operation had stressed several common themes.

The IRIS project Terms of Reference appear adequate and the detailed program can be developed in an Inception Report.

UKIG and AKMI have been directing the existing IRIS developments. Their knowledge in the theoretical and technical fields of the IRIS is on rather high level.

The timeliness of the IRIS project is reasoned by the following:

- The separate IRIS developments in progress may become so specialized in their own directions, need and spend more and more money so that later on it will be more difficult to integrate them in the Hungarian IRIS.

- Diverse views in Hungary on IRIS ideas and equipments make it a challenge to operate the IRIS project as an integrated system.

- The MARABU ITS project is German oriented and needs to be fully coordinated with IRIS.

Parallel Observations by EUROSATCO

a. The goals of our IRIS project need to reflect the experience of ongoing projects.

b. The interest in the IRIS program by the State Motorway Company/AAKHT is increasing because it can coordination the IRIS among the concessional motorway companies. This company is the cooperative partner for the Authority of Budapest on the MARABU project.

The Hungarian State Motorway Company has its own information and management communication-center in the office building at Fenyes Elek Street.

c. The UKIG AKMI and the 19+1 STATE ROAD MANAGEMENT COMPANIES are working well together. This will be an advantage in building up the IRIS.

d. The MERFOLDKO/ROAD RESEARCH COMPANY. Collects critical traffic data. This work is well organized. The data are available to everybody and for every institute. These data will be very important for the IRIS. But there are some IRIS needs:

- A large amount of their work is manual counting.
- It has taken one year to get those data. Real time data is needed for road management.
- A test is being conducted on M7 at the 'ERD' grade approaching Budapest. Real time data is being sent to the UTINFORM office.

e. THE ROAD DATA BANK is a well organized program with good software and well trained experts. Originally, it was oriented to pavement management and the traffic system needs to be expanded.

f. THE MERFOLDKO KFT have good contacts with the road authorities of Hungary and with the European technical committees.

g. THE UNIVERSITY, through Dr. Fi, is active in research in IRIS and may assist in the IRIS development.

h. UTINFORM is an institute for public information and would be coordinated with IRIS developments.

I. The leaders of the STATE METEORLOGICAL INSTITUTE.

j. MARABU is a joint project of the Budapest Authority and the STATE MOTORWAY MANAGEMENT for the radial roads of Budapest which are connected to the M0 motorway and for the connecting sections of the M1, M7 and M5. The MARABU project is a prototype ITS project to be integrated within the IRIS.

k. THE POLICE proved to be willing and cooperative partners. Continued cooperation with the police in essential for successful road management.

IRIS - HUNGARY

TDA

IKIR - MAGYARORSZAG

IRIS TDA Project
Wilbur Smith Associates

Section 5
WORK PLAN

5. FEASIBILITY STUDY WORK PLAN

5.1 WORK PLAN

This is the updated work plan based on the work plan presented in the original 1996 WSA proposal. It is a list of anticipated tasks necessary to establish the nationwide IRIS for Hungary. Figure 5-1 depicts the approximate study schedule.

TASK 1: EXAMINE AND DOCUMENT EXISTING SYSTEM

1.1 Document Existing Systems and Interrelationships

This task will document existing systems, both in the Traffic Centers and along the highways. These include the nine operational information systems now in use in Hungary. This task will also document existing interconnections to other agencies and users. The WSA Team will research Road Department documentation to gather the needed data, and will perform site-surveys and interviews to validate and update data.

One output of this task will be an updated interconnection diagram of existing systems to be prepared by Ministry Personnel. The WSA staff, with the assistance of the Ministry, will produce documentation of the existing systems to include information such as equipment make, model, age, type, speed, expansion capabilities, reliability, and maintainability. An Interface Control Document (ICD) describing all current interfaces (protocols, speed, cost, type, etc.) will also be developed. A list of current operational requirements will be gathered and documented.

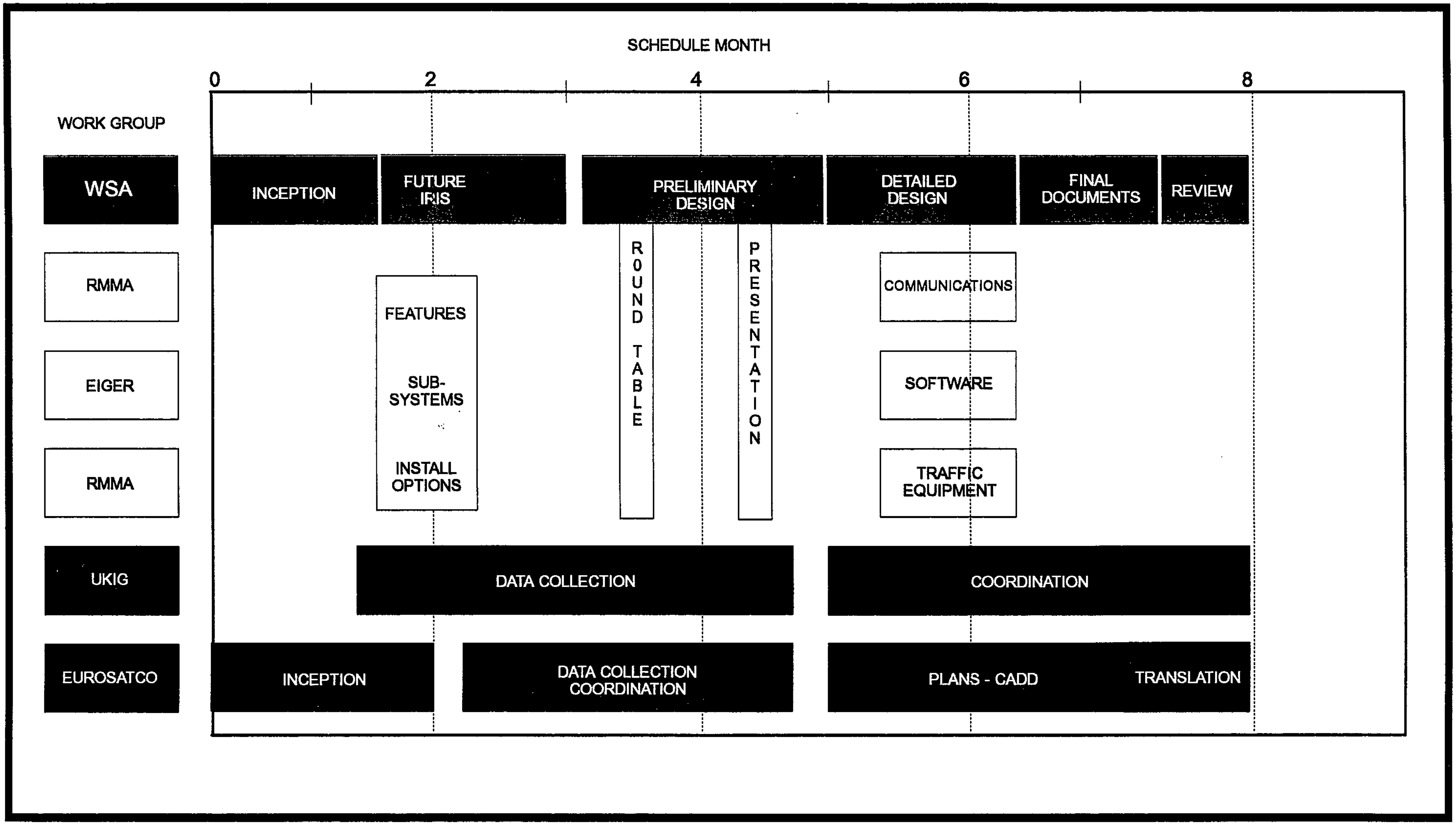
1.2 International IRIS Review

The WSA Team will interview the European Union technical staff to revise ongoing IRIS and ITS projects planned and underway on the European Motorway System.

The WSA Team shall be responsible for conducting a review of similar Multimodal Traveler Information System efforts underway within Europe, Asia and USA.

Figure 5-1

HUNGARY IRIS
WORK PLAN SCHEDULE



1.3 Private Sector Involvement

Identify opportunities to involve private vs partners in the IRIS. The WSA Team shall identify opportunities to involve private sector partners in the distribution of information contained in the IRIS data files.

TASK 2: DATA COLLECTION

2.1 Inventory

An inventory of the existing system in Hungary to establish its composition and available resources is an important early activity. Properly defining the characteristics of the system is vital to identifying problems and opportunities and to formulating possible action plans. A system's definition should include all possible information pertaining to the available resources and the environment within which it operates. This would include such information as the system's purpose, physical components and structure (e.g., roads, travelers, buses, rail, control centers, etc.), and organizational components and structure (e.g., operating agencies, funding sources, political and agency jurisdictions, etc.). The end products of this step in the IRIS study are an inventory of the current motorway IRIS systems, and a list of the system needs that must be fulfilled in the future IRIS. This inventory will be provided by the Ministry and documented by EUROSATCO.

2.2 Document Existing Weather Detection Systems

The WSA Team shall inventory existing weather detection systems throughout the IRIS. This inventory shall include the identification of existing weather detection locations, capabilities and deficiencies, along with the corresponding information for operations, maintenance, future plans, etc.

The WSA Team shall be responsible for identifying the need to integrate existing weather detection systems and determining how these systems could be integrated within the IRIS. This task shall also include identifying the coverage area and density of weather sensing devices required to provide a nationwide integrated weather information system.

2.3 Establish Institutional Framework

To convene a roundtable meeting of agencies, it is necessary to involve appropriate organizations of government working on IRIS in Hungary. Agencies may possess differing agendas, priorities and policies. However, while instilling the need for close cooperation each agency will seek as much autonomy as possible in carrying out its own responsibilities. The WSA Team has a good working relationship with the Hungarian organizations and expects to maintain this cooperation throughout the feasibility study.

TASK 3: IDENTIFY FUTURE IRIS ELEMENTS

Each service offered or planned for the IRIS is achieved through the application of various technologies which perform one or more of the following system functions:

- Motorway Surveillance
- Traveler Information Interface
- Navigation/Guidance
- In-vehicle Information
- Communications
- Control Strategies
- Data Processing

3.1 Review and Document Future Systems and Services

In this subtask, WSA will develop a questionnaire for agencies using or developing IRIS to document planned services and requirements of the IRIS at the operations centers and at the roadside. These upgrades may include expansion of system coverage, upgrades to field equipment, interfaces to additional information resources and providers, and new operational requirements. The WSA Team will gather documentation held by the Ministry and will validate these data with the questionnaire results.

The WSA Team will develop an interconnection diagram documenting any future services and will produce a technical report which documents the capabilities of future systems to include information such as equipment make, model, type, and speed. An ICD that describes future interfaces (protocols, speed, cost, type, etc.) will be developed. A list of future operational requirements will be gathered and documented.

3.2 Assess Emerging ITS Environments, Platforms, Standards, and Trends

The WSA Team will review ongoing ITS proposals in Europe and will consider coordination with active projects in adjacent countries. The Ministry will provide documentation of the European Union Committee reports and standards now in use in Hungary.

TASK 4: ASSESS EMERGING TECHNOLOGIES

The objective of this task is to define the specific functions that will be performed by the system as well as the information flow and processing, staff support, and other requirements necessary to support those functions. Definition of the interaction between subsystems is to be performed by the WSA Team and the initial IRIS architecture developed.

The identified architecture alternatives will be assessed in subsequent trade-off analyses.

4.1 Define Requirements to Support Functions

The purpose of this analysis is to determine what system attributes are required to achieve the desired level of operation for each system function identified in Task #5. Some important determinations in defining a communications subsystem, for example, include what information needs to be transmitted, what the origins and destinations of the transmissions are, how often and how fast information must be sent, and how important specific pieces of information are to the operation of the system.

4.2 Define System Architecture

At this stage, enough information is available to begin a preliminary architecture definition. Grouping of resources and required activities and resources to various subsystems will take place. The required interaction among the subsystems and with other systems will be defined. This task develops a high-level flow-chart upon which technology selection and more detailed system design is based. The system architecture provides the framework around which detailed functions, technologies, and interfaces are defined.

The key is to define an architecture from the start which meets the functional requirements of the system and can rationally provide for change, evolution, and growth. A well developed architecture will provide the IRIS with the flexibility necessary for future upgrades and system expansion. It is also important that an architecture be "open" to allow specific components to be supplied by several manufacturers. Similarly the Susven Architecture incorporates ISO or other relevant standards.

Once the technologies to be used have been selected, the specific activities needed to implement and operate the project can be defined in greater detail. The project operations plan should discuss in detail how and when the project design, procurement, installation, start-up, operations and maintenance will take place. It should also discuss project evaluation and expansion, as well as the legal and institutional considerations in implementing the project.

The WSA Team will establish an IRIS road network in concert with the Ministry and UKIG. A communications system will be used to share information in the Motorway corridors.

Tasks necessary to complete this initial communications network will include:

- Review the results of the inventory of IRIS activities with access to the IRIS services and associated service providers/software utilized.
- Identify short-term communication and information sharing needs throughout the IRIS and other projects.

- Determine the types of information required to be shared and distributed among the IRIS activities to allow the effective management and development of IRIS projects and programs.
- Identify agencies with immediate communication needs.
- Identify service providers that can meet the initial communication needs of the IRIS.
- Identify options available for services to be provided and identify the level of effort to support and distribute Clearinghouse information.
- Analyze costs and benefits of implementing different communication services and information distribution options.
- Analyze options to meet the costs for various communication services.
- Identify and select preferred communication services alternatives and equipment required.
- Assist in the establishment of IRIS information files.

TASK 5: OPERATIONS PLAN

5.1 Document Current IRIS Operational Concept

One critical source of information that is needed for the evaluation of the current IRIS System is to document the operational concept that is being used to operate the system. The operational concept is a description of how the people and systems interact to achieve these objectives. These descriptions include operators and management position descriptions, traffic centers and field equipment, external interfaces, and descriptions of the processes followed in normal (and extraordinary) operations. The WSA Team will document and conduct interviews with key Road Department staff (managers, operators, and technicians) and will develop an Operations Plan based on written descriptions provided by the Ministry and associated IRIS group activities which describes the current information system concepts and procedures.

5.2 Develop New Operational Concept

This sub-task will be used to document changes to the current operational concept required as a result of the future system requirements, and emerging IRIS technologies. The WSA Team will expand or modify the documentation developed in 5.1 by the Ministry and WSA.

5.3 Perform Requirements Analysis and Decomposition

The WSA Team will take the new Operational Concept, along with the current and future IRIS requirements, and will further analyze and break out (decompose) and document the more detailed requirements that will drive changes to the current IRIS system. The output of this subtask will be a list of IRIS requirements.

5.4 Operations and Maintenance

Providing adequate technical staff and budget resources for system operations and maintenance is critical for a successful system. A commitment to providing the necessary personnel must be made, followed by the hiring of the additional staff and their training. Coordination with all involved agencies and organizations is also very important for successful operations and maintenance. Documentation must be provided in sufficient detail to fully describe the maintenance requirements, methods of operation, and the expansion/modification procedures. Maintenance personnel should be consulted throughout the design phase as to their needs and concerns. The successful performance of any system depends on an effective maintenance management program. Lack of maintenance drastically reduces equipment service life. Contract maintenance may be beneficial for agencies which have difficulty in recruiting, training, and retaining skilled personnel to maintain a sophisticated system.

TASK 6: EVALUATE ALTERNATIVE DESIGNS

The performance, reliability, and availability in Hungary should be assessed in meeting the IRIS functional requirement. EUROSATCO will determine the availability and performance of supplies in Hungary. This would include hardware (e.g., computer; surveillance equipment - loop detectors, video equipment, etc.; traffic control devices - computerized signals, etc.; traveler information equipment - Highway Advisory Radio (HAR), Changeable Message Signs (CMS), etc.; and communications channels - wireless, fiber optic software, personnel, etc.

This Ministry will provide cost estimates to allow a trade-off analysis of competing alternative IRIS functions. EUROSATCO will solicit additional information where needed.

The cost of alternatives are evaluated against each other through economic analysis studies. An economic trade off analysis should take into account the total cost of the system over its assumed life cycle. Initial construction costs relating to operations and maintenance, replacing system components during the life-cycle of the system, system expansion, and other costs should also be included with the initial expenses.

Incorporation of International Standards, allows the option of using compatible new products and services, and can provide compatibility between neighboring traffic operations systems. When planning and designing an international system, there needs to be an awareness of current ISO standards and developing standards.

Existing system components should be examined to determine how or if they should be incorporated into the future national system. Incorporating existing components (i.e., computers, controllers, communications cable, changeable message signs, etc.) can save money. However, if the existing components are not suitable for the intended purpose, the system may end up costing more and functioning less effectively.

The operations and maintenance requirements of the alternative technologies must be in balance with the availability of personnel and budget resources. Identification of the maintenance and operations requirements might include an assessment of the existing operations and maintenance capabilities in terms of personnel, skills, and equipment; determining the necessary skills and work load impact of each alternative; comparing the existing conditions with what is required for the various alternatives; analyzing the deficiencies; and establishing the feasibility of providing the additional operational and maintenance capabilities (personnel, skills, equipment, etc.) required for each system alternative.

An important related issue are considerations of the environmental impacts associated with various technologies as well as the potential effects of implementing integrated systems on an nationwide level. For example, are the operating frequencies of a particular Automatic Vehicle Identification (AVI) transceiver safe for human beings that may be exposed? Is the IRIS applications being considered for the transportation system conducive to attaining air quality improvement, or is there a potential that what is being considered may actually exceed acceptable levels? These types of environmental issues must be addressed.

A particular nationwide system can also incorporate emerging ITS technologies as they become proven in field operational tests and are available for implementation. In addition, monitoring of the US and European effort to develop a national ITS architecture will be beneficial even though the implications of this effort may not be felt for a few years.

6.1 Evaluate Alternative System Architectures

The WSA Team will develop two computer and communications system architectures which meet the IRIS requirements. These alternatives will assess new alternatives that can serve existing IRIS activities and meet the new IRIS requirements. The two alternatives will be based on communications network options with complementary computer hardware and software.

These options will be explored based on the hardware and software market trends along with the compatibility and data interchange trends and requirements identified and detailed in sub-task I.3. Software options, including custom developed components will be evaluated for requirement coverage, maintainability, and risk using an evaluation matrix scaled to place importance on those requirements which are more critical, such as seamless transition. part of this matrix will also rate the ability of the new system architecture to reuse data and portions of the existing system to minimize the probability of error on the part of operators or the reentry of base or background data for the system.

6.2 Analyze and Recommend Designs

The WSA Team will perform a benefits/cost analysis for each of the alternative designs. The benefits/cost analysis will include items such as initial and life-cycle costs, maintainability, expandability, and functionality. The results of this analysis will be used to identify the most cost effective architecture which best meets current and future IRIS requirements. The WSA Team will document the results of this analysis and will present the alternative and recommended architectures to the Roads Department.

6.3 Perform Current Systems Analysis

The WSA Team shall analyze the current and anticipated future information available in the IRIS plans and explore the difficulty in making the information available along autoplays. This includes identifying location of the information, information conversions required to transmit the information to external sources, interface requirements, frequency of updates required, and volume. The WSA Team shall determine how information will be made available to users as information systems and architectures are implemented incrementally in the region.

TASK 7: DEVELOP DETAILED DESIGN

The WSA Team will develop a detailed design of the new IRIS using the recommended system architecture. The WSA Team will prepare detailed plans, specifications, and cost estimates that will allow the Road Department to conduct competitive procurement. Plans will include a title sheet, general notes and symbols, key plans, general plans, and electrical and miscellaneous details. A specification document will be prepared for each subsystem or component. Detailed cost estimates will be developed including procurement, installation, integration and project management costs.

7.1 Develop Architecture Requirements

The WSA Team shall be responsible for developing requirements specifications for the IRIS information and communications system. Anticipated steps are as follows:

- Incorporate information from the European and US architecture currently being developed.
- Identify IRIS program information requirements.
- Identify criteria, constraints, dependencies, redundancies, priorities, and other factors that affect the identified information.
- Identify and evaluate current information resources and uses of information (location, information flows, automated and manual systems) as a baseline.
- Conceptualize changes and enhancements for gathering existing information, with alternatives in terms of approaches, benefits and costs.
- Identify communication system objectives, functions, performance and needs, including failure contingency needs.

7.2 Plans, Specifications, & Estimate

Final plans should be developed for the IRIS. Specifications will include standards incorporated in the design. Specifications should include all system hardware:

- Computers (e.g., processing speed, memory, storage, video display, number and type of units, etc.)
- Surveillance Equipment (e.g., number and quality of sensors, number and type of surveillance cameras, etc.)
- Traffic Control Devices (e.g., number and type of sign and signal controllers)
- Traveler Information Equipment (e.g., number and type of HAR transmitters, VMS, etc.)
- Electronic Communication - Cable and Wireless.

Specifications should include software required for the operating system(s), software needs (commercial off-the-shelf software packages), and software programming needs (traffic operations system specific). Specifications should also include personnel required for the development stage (engineers, laborers, computer programmers, communications experts, technicians, architects, etc.) as well as personnel required for the operations and maintenance stage (engineers, computer programmers, technicians, communications specialists, etc.). Initial funding and ongoing funding should be considered. Documentation should be identified which is necessary for development plans, implementation plans, evaluation plans, and operation and maintenance plans. A time line for the development of the project system should also be prepared.

TASK 8: IDENTIFY TRAINING REQUIREMENTS

Training requirements will be noted by the full staff as work on all items progresses. While in Hungary, the team will discuss with the Ministry officials their need for certain types of IRIS training. This training may include traffic engineering, electronic communications and computer hardware and software.

TASK 9: PREPARE AND SUBMIT ALL REPORTS

Reports and technical memorandums will be produced as the work progresses. Briefing meetings will be conducted during the conduct of the work. All participants will assist with the preparation of the final documentation and reports.

5.2 PROJECT TEAM MEMBERS

The staff to conduct this project will be drawn from the following sources that combine the resources of UKIG, Wilbur Smith Associates and EUROSATCO.

UKIG will provide professional services and technical review throughout the eight month project schedule. UKIG will provide this continuous support through a combination of central management and technical skills from individual professionals and individual corporations. UKIG will provide and collect the data to be used in this study.

The UKIG project staff will be diverted by Mr. Czordas from his office in Budapest.

5.2.1 Wilbur Smith Associate

The technical work of the WSA project team will be diverted by Dr. P. Athol the project manager. Mr. R. Miller is the associate-in-charge for the project and provides the corporate diversion of the project.

5.2.2 Specialty Staff

The WSA team includes technical specialists experienced in IRIS and ITS projects. Dr. A. Eiger is a software specialist in real time database management systems. Mr. R. Mancuso is a traffic control specialist responsible for the implementation in computer controlled traffic management programs. He is very familiar with European and US traffic control equipment and wireless communications. Mr. Shel Leader is an electronic communication specialist experienced in fiber optic, cable, wireless, and satellite communications.

This is a professional team of highly skilled technical specialists with extensive experience in implementing and operating ITS/IRIS programs.

5.3 ROUND TABLE DISCUSSION

The purpose of the Round Table Discussion is to provide critical input to the project work plan by those technical and management specialists who have directed prior IRIS activities within UKIG. It is anticipated that UKIG would arrange for a group of staff members, perhaps 10-15 people, to meet with 5 or 6 IRIS project members and discuss the critical study parameters and guidelines that would offer to the project team on important development issues and technical trade-offs to be considered in developing the IRIS.

The Round Table agenda will be developed jointly by UKIG and the project team. One possible scenario is for the project team to present options and assumptions to be made in the project work plan. Discussion on these primary options would allow UKIG to set key study parameters and generate a set of technology features to be evaluated in the IRIS design.

In close coordination with UKIG the project team will produce an agenda for policy and technology review and discussion. The purpose of the Round Table is to bring together those with keen interest in and responsibility for operating the existing and future IRIS. The discussion will be framed to address a limited set of key issues rather than a long list of specific design details.

In several key areas, 3 or 4, the project team will summarize the design choices and consequence of those choices on the operational success of the IRIS. These major design options will be supplemented by a series of questions related to each key topic that refine the scope of the project analysis and implementation of the system.

The candidate key issues can be addressed by function and technology. The major issues may include:

- Systemwide Issues
  - Electronic Communications
  - Data types - video, data and voice
  - Transmission media - cable, fiber optics, microwave, radio and satellite
  - Existing Resources - Telephone Network, Fiber Optic Network, wireless systems, and the cellular communications in-vehicle radios, broadcast media radio and television and the Internet system.

- Real time integrated database management
  - Candidate sub-systems
  - Commercial database software
  - Hardware options - servers, etc.
  - System architecture - data file organization
  - Protocols, and standards
  - Computer systems - distributed and central

- Field Equipment
  - Detection - vehicle detector

- Closed Circuit Television
- Information displays
- Local radio broadcasts
- Global positioning systems (GPS)
- Automatic vehicle tag readers (AVI)
- License plate photography
- Vehicle weighing
- Vehicle probes

These topics may be addressed by major category. There are numerous other features and parameters that are established on an IRIS areawide basis. Examples include:

- System Size
  - 6,803 km of main roads
  - 19 county directorates
  - Added state companies
  - UKIG fleet size
  - Police staffing
- System Features
  - Route Guidance
  - Video surveillance
  - Vehicle detection
  - Weather detection
  - Weighing and vehicle classification
  - Border monitoring of passenger and freight vehicles
  - Emergency calls
  - Information kiosks

- Phased implementation - priority for locations and device types

5.3.1 Proceedings

The Round Table discussions will be focused to prepare project guidelines following a two or three page presentation of an issue. The group will develop concise policy guidelines for conduct of the IRIS study.

The project staff will prepare a concise summary of a set of the guidelines and system parameters to be used in the conduct of the IRIS study. From these guidelines the project team will develop the conceptual design of the IRIS. The results of the conceptual design will be presented at a May meeting in Budapest showing the recommended IRIS design developed with the aid of these guidelines.

5.4 TENDER DOCUMENTS

The planned deliverables for this project are a set of tender documents to install the first phase of the Hungarian IRIS. The tender documents will be prepared in English and in a format conforming to the requirement of EBRD projects. This documentation will reference the appropriate and applicable standards and protocols to be used in the development of the IRIS.

The placement of IRIS field devices, detectors, cameras, signs, etc. will be shown on schematic plans referenced by km markers. The location of devices and placement conduit and power connections will be shown diagrammatically by symbols and lines of general placement for conduits.

The schematic layout maps will be prepared on computers and stored on magnetic storage devices as required by the funding agency or by UKIG.

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Section 6
SCHEDULE

Figure 6-1

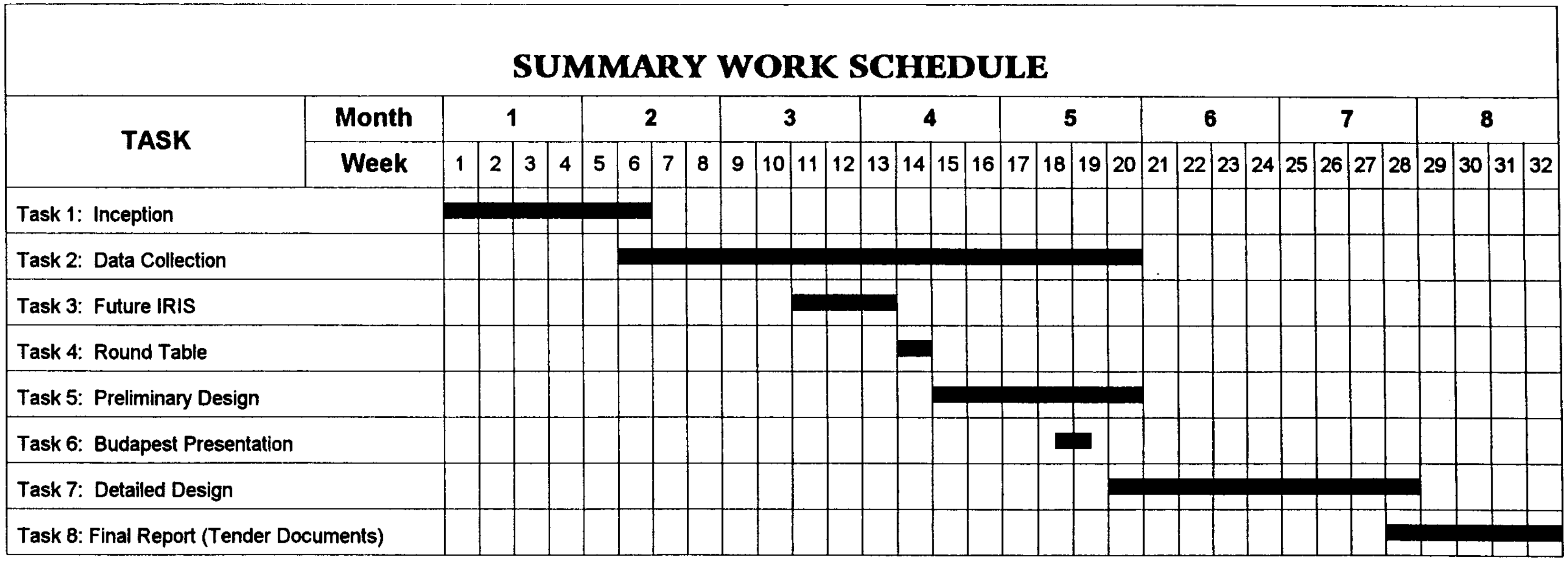
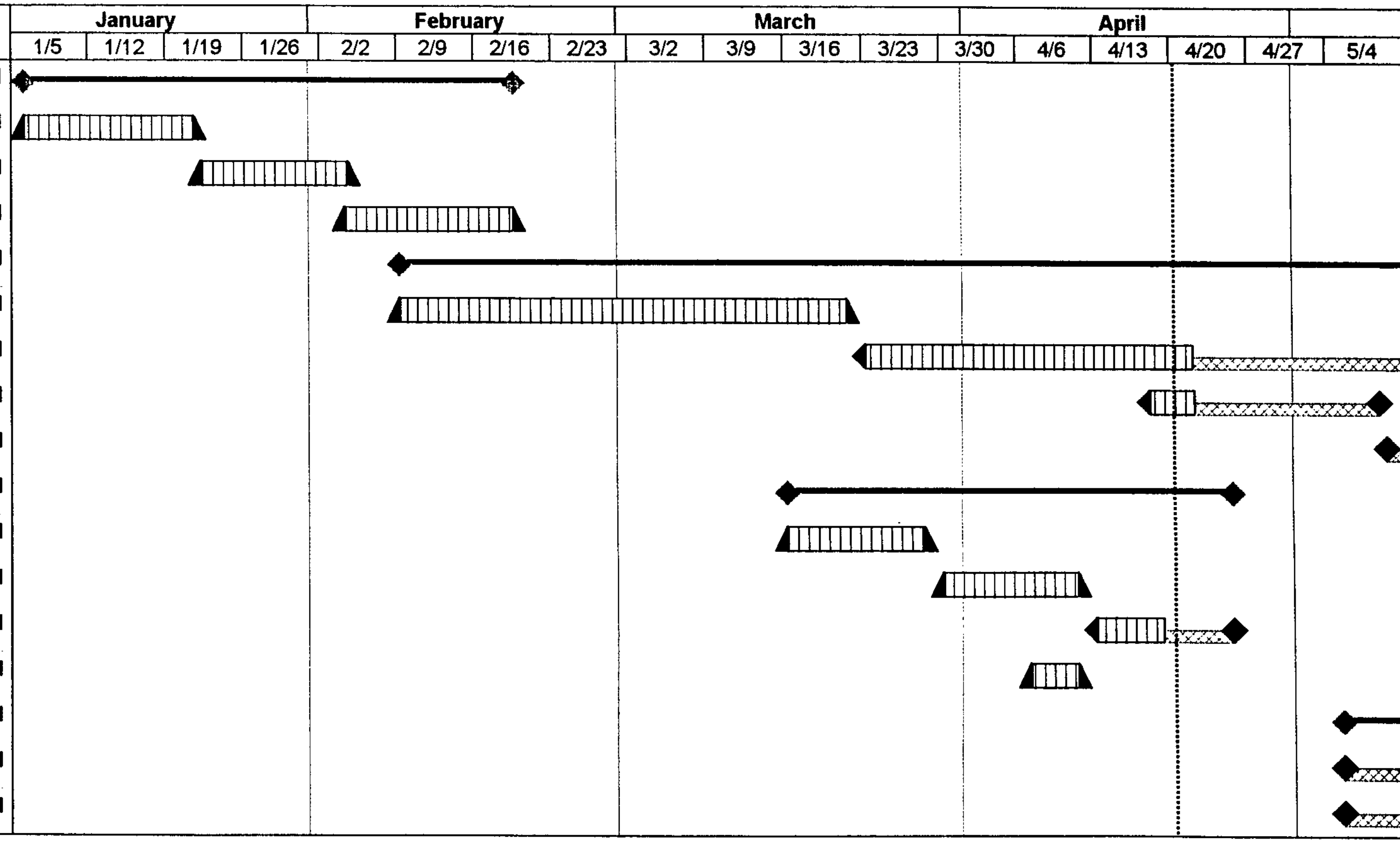

SUMMARY WORK SCHEDULE
TASK
Month
Week
1 2 3 4 5 6 7 8
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Task 1: Inception
Task 2: Data Collection
Task 3: Future IRIS
Task 4: Round Table
Task 5: Preliminary Design
Task 6: Budapest Presentation
Task 7: Detailed Design
Task 8: Final Report (Tender Documents)

Figure 6-2
GANT CHART

HUNGARIAN IRIS

ID	Name	Duration
1	INCEPTION	33d
2	START UP	12d
3	INTERVIEWS	10d
4	INCEPTION REPORT	12d
5	DATA COLLECTION	79d
6	REVIEW EXISTING	30d
7	MINISTRY DATA	48d
8	GIS NETWORK	15d
9	COMB GIS/DATA	15d
10	FUTURE IRIS	30d
11	FEATURES	10d
12	SUBSYSTEMS	10d
13	INSTALL OPTIONS	10d
14	ROUND TABLE	5d
15	PRELIMINARY DESIGN	19d
16	ASSESS TECH	19d
17	ALT DESIGNS	19d



Project: HUNGARIAN IRIS
Date: 4/20/97

Critical | Progress | Summary
Noncritical | Milestone | Rolled Up

Figure 6-2 (continued)

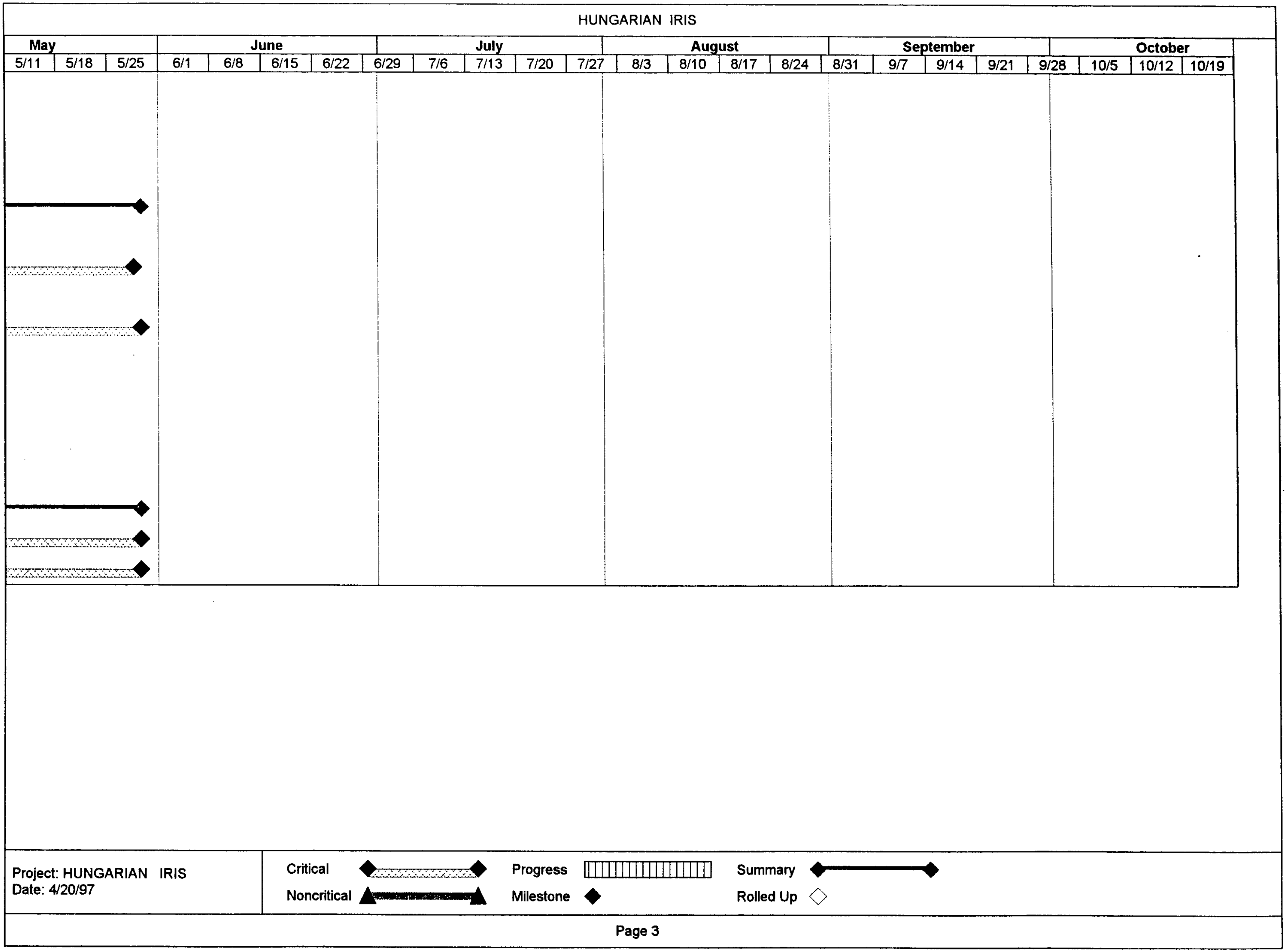
HUNGARIAN IRIS

ID	Name	Duration
18	IRIS COORDINATION	19d
19	BUDAPEST PRESENTATIO	5d
20	DETAILED DESIGN	30d
21	SYSTEMWIDE	30d
22	COMMUNCATIONS	30d
23	SOFTWARE	30d
24	TRAFFIC EQUIP.	30d
25	TRAINING PLAN	10d
26	FINAL REPORT	30d
27	DRAFT FINAL	15d
28	MINISTRY REVIEW	10d
29	REVISIONS	5d
30	PRINT FINAL	3d
31	SUBMIT FINAL	0d

Project: HUNGARIAN IRIS
Date: 4/20/97

Critical — Progress — Summary
Noncritical — Milestone — Rolled Up

Figure 6-2 (continued)



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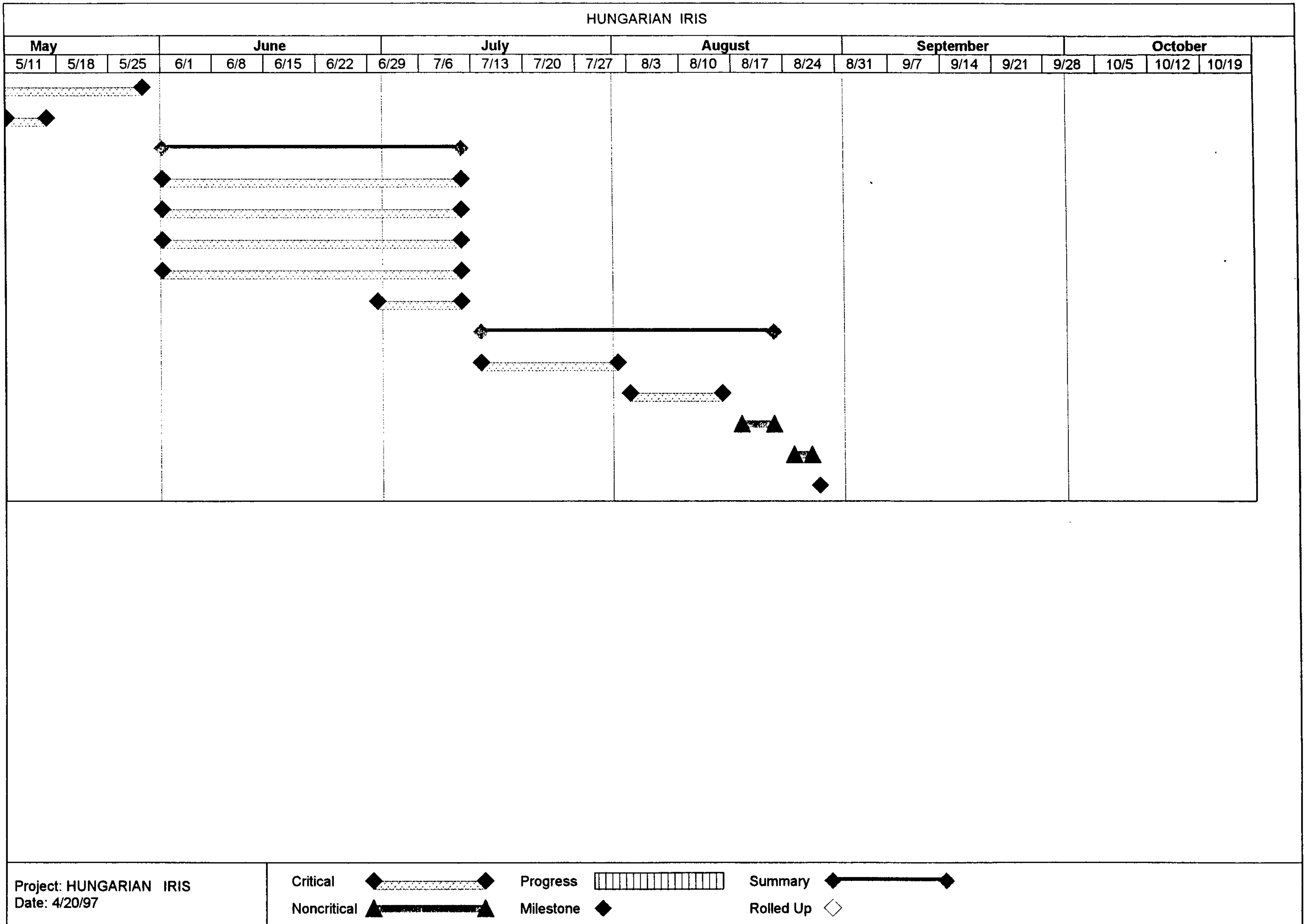


Figure 6-3
PERT CHART

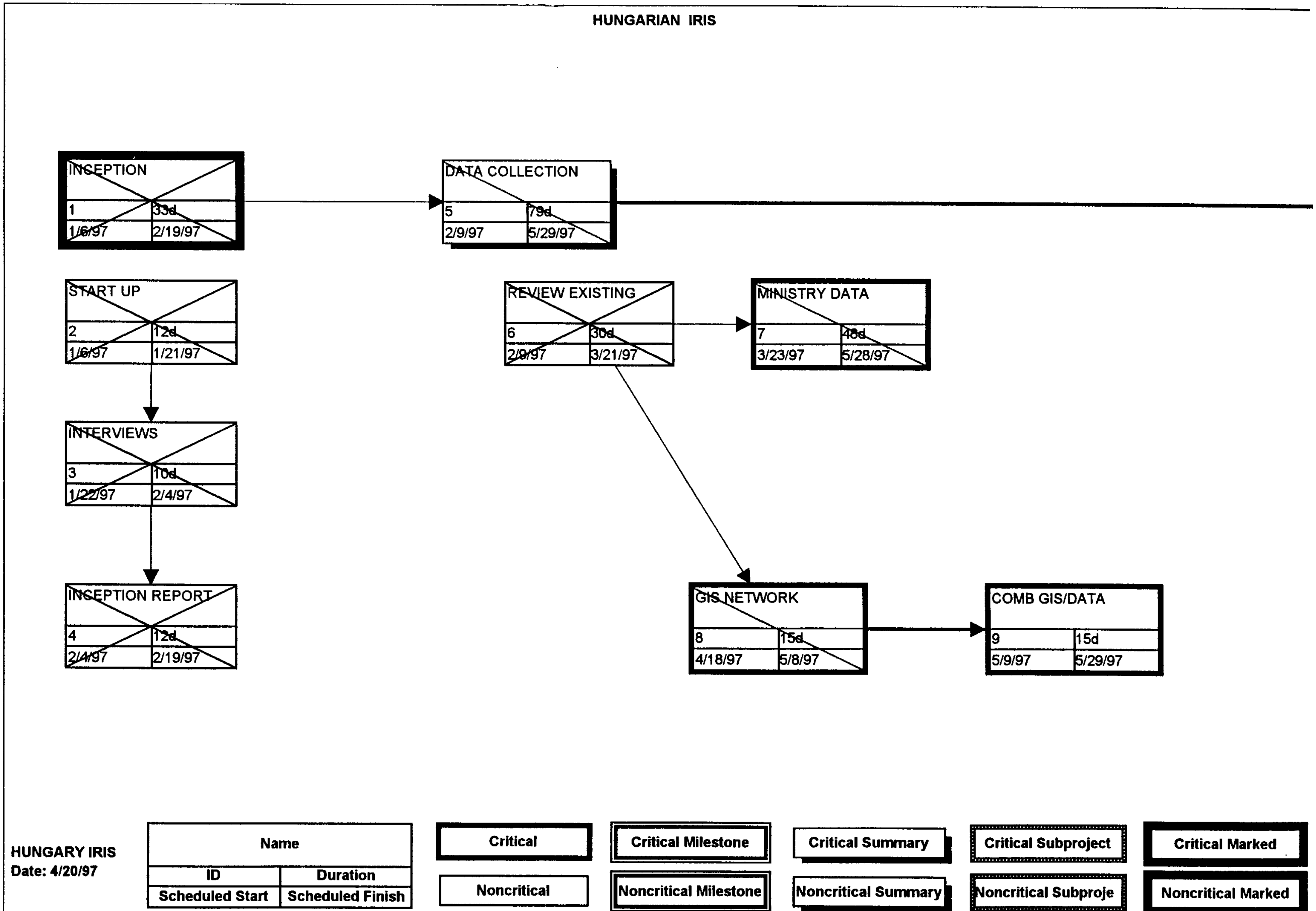


Figure 6-3 (continued)

HUNGARIAN IRIS

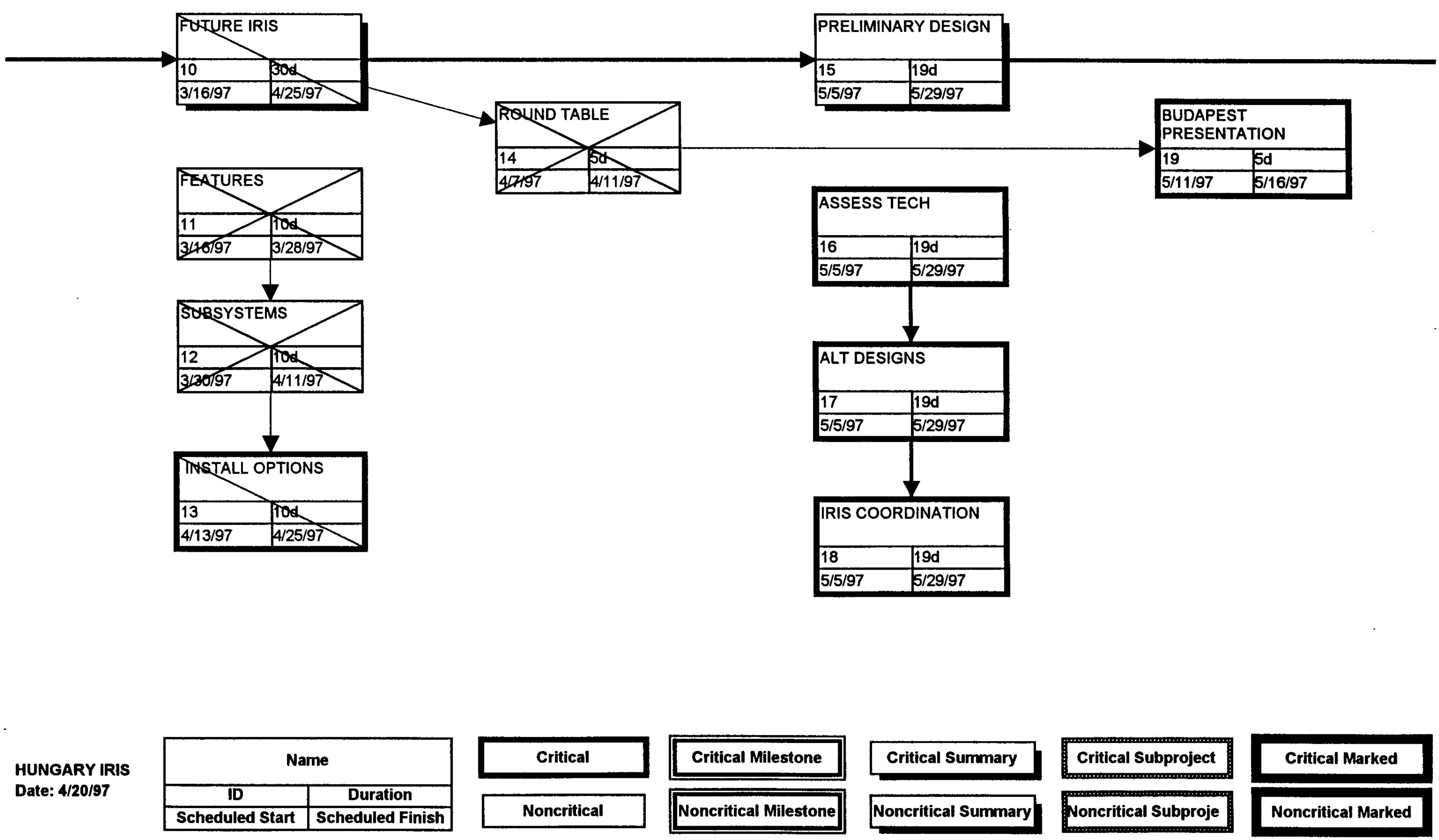
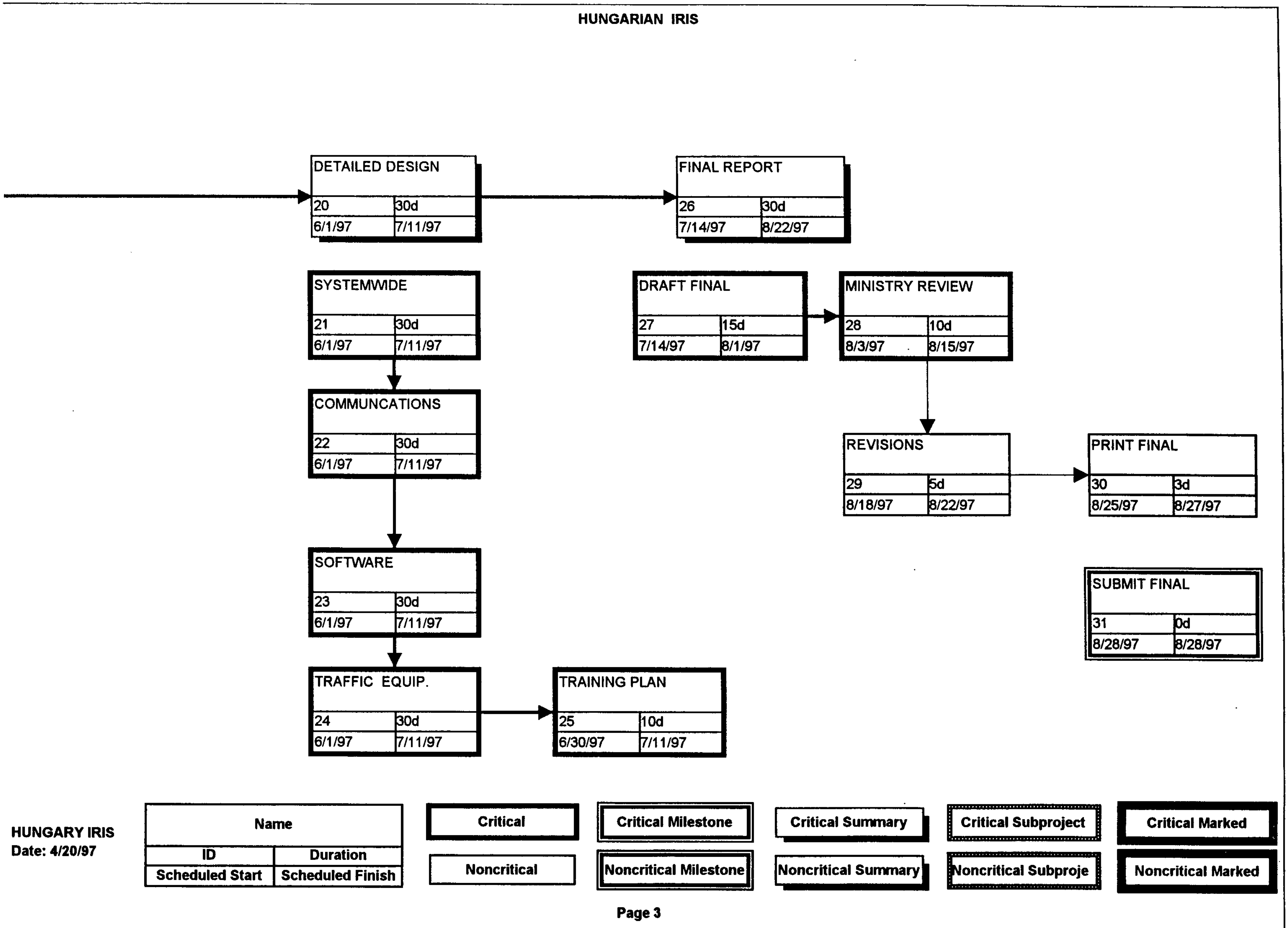


Figure 6-3 (continued)



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Section 7
PROCUREMENT

7. PROCUREMENT

7.1 DEVELOPMENTAL PRIORITY

After the political changes in 1989-1990, the productivity of the economy fell significantly, and so did the transportation traffic. The Ministry had to react to these changing circumstances and had to prepare a long-term Traffic Policy which determines the main objectives of this complex system.

7.2 THE HUNGARIAN "TRAFFIC POLICY"

The Hungarian "Traffic Policy" was written after widespread professional preparation and discussion.

The Policy assume that by the year 2000:

- development of traffic infrastructure will accelerate, so that it can match the optimal speed of economy, therefore, satisfying EC requirements;
- the society's levels of demand and its structure will gradually grow to match citizen's expectations; and
- ability to carry the traffic load.

This statement implies the fulfillment of transportation's leading role, but also takes reality into account. Its not now a goal to achieve the traffic development level of Western countries.

The policy was prepared in 1993, when:

- 87% of all public transportation (people) occurred on the roads (calculated in passenger km's). For freight transportation, the ratio is 45-46% (calculated in product tonnes-km).
- Road transportation had the highest risk of all. The ratio of accidents on the road to the number of motor vehicles were significantly higher than in countries with the same motor vehicle level. Between 1980 and 1990 the number of people dying in car

accidents has doubled. The loss for the economy resulting from these accidents total for more than 50 billion ft.

- In the area of environmental protection, old vehicles are not the only problem, there is the lack of traffic infrastructure, too. (lack of detours, highways, signs, etc.)

The Policy states, that in Western countries traffic infrastructure and services have been developed decades earlier. It also determines that every unit of investment serving traffic development has a 2.5-3 unit worth of effect on the area's private investments. Based on this, transportation industry stands in second place in economy booming effect after telecommunications.

In the long-term, Hungary expects to be accepted as a full member of the European Community. The economic model calculates a 2.8-3.3% annual GDP growth between 1993 and 2005. While in the first period, 1993-1995, there will not be any increase; it is expected to be 3.5-4.0% annually between 1997-2005. Exports are expected to grow 5-6% annually.

Service - export are the most promising areas in foreign trade. Hungary may be a central point based on its geographical location.

The policy states the following four goals, based on the conditions above:

- help European integration;
- help the balanced development of the country;
- protect human life and the environment; and
- help economical development, with effective traffic control.

An important part of the European's integration is the building of the European highway system through Hungary (between Western Europe and the Balkans, and Northern Italy and the Ukraine).

The Policy determines the basic principles for public transportation and the main points of developing the integration of passenger and freight transportation.

In the area of life and environmental protection, it seeks to raise traffic safety and safer transportation of hazardous materials.

Effective traffic control has to contribute to the growth of market economy, to lead to higher competitiveness. Its most cases, this requires modification of the institutional and legal framework to serve market conditions.

The Policy clearly supports the modernization of roadway infrastructure, development of traffic control, improving traffic safety and also, last but not least, the usage of European systems, technics to help achieve European conformity. The development of IRIS would help the succession of all of the above.

7.3 ROAD FUND

The Road Fund was established in 1992 by the Hungarian Parliament. The Fund is a separate government fund for the maintenance and development of the national road system. The Minister of Transport, Communications and Water Issues is in charge of the Fund. The financial transactions of the Fund is managed by a bank chosen in agreement with the Finance Minister.

Resources of the Fund include:

- incomes from gas sales and usage;
- certain part of the vehicle tax;
- several fees, penalties, etc. paid to road operators (e.g., overweight penalty);
- loans, interests on deposits;
- incomes from sales of equipment;
- other incomes and financial support;
- support from the central budget; and
- refund on the AFA (general consumption tax).

In order to preserve the value of incomes above, the rate of gas consumption contribution has to be matched every year to the growth rate of gas consumption tax. It is done in a way so that the own liabilities of the Fund would grow at least the same rate as the consumption tax.

The expenses of the Fund should cover the development, maintenance of the State-owned roads, including bridges, monuments and parts. It also has to finance the:

- interest payments on loans for development and maintenance;
- costs of road control, manager agencies and investment expenses;
- its own expenses;
- all taxes on equipment, asset or service purchases made in connection with road maintenance or development.

The main planned expenses from the Fund between 1996-1999 are as follows:

NAME	1996	1997	1998	1999
Road Service	5,760	6,700	10,000	11,500
Road Maintenance	10,200	18,100	20,300	24,000
Development	10,903	13,485	18,900	16,940
Loan Repayments	13,910	16,020	16,510	16,720
Financial Transactions	13,572	15,150	17,840	19,340
TOTAL	**55,345**	**76,455**	**83,550**	**88,500**

In million ft.

As a summary, the Fund assures a flexible way of doing business. Based on the advice of the road organization, the Minister decides on its usage. This means, that the **Minister, responsible for the success of the Policy, probably supports all projects** which not only adapt the European standards but also help to protect the environment, raise traffic profitability and promote safety.

7.4 BUDGET ALLOCATION

National road maintenance and development is financed by the "Road Fund." The following table shows expenditures by purpose 1990-1995.

NAME	1990	1991	1992	1993	1994	1995
Road Service	2,137	3,392	3,466	4,450	5,355	5,877
Road Maintenance	3,350	2,937	5,283	8,089	12,459	10,058
Development	5,425	5,444	10,682	16,812	24,862	9,029
Credit Payments	--	--	241	2,797	6,180	12,317
Financial Transactions	711	117	1,675	3,309	3,924	6,580
TOTAL	**11,623**	**11,890**	**21,346**	**35,457**	**52,780**	**43,861**

In million forint (ft)

7.5 EXISTING BORROWING AUTHORITY

In the preceding section we have shown that the financial support of the project seems to be insured by the Road Fund, with its continuous, stable value income. The Ministry and other connected organizations are professionally committed to this. Also, many IRIS predecessors are already in operation; they are the future parts of the project.

According to our current knowledge, a loan might not be necessary to finance IRIS. The State will examine the necessity and the possibility of a loan, based on the situation of the Road Fund then, and the connections with other loans. As shown previously, the Road Fund is substantially burdened by the payments of earlier loans. These are loans from IBRD, EBRD, EIB, and from domestic financial institutions. Therefore, the financial and technical schedule of the project is a very key point in the Feasibility Study.

7.6 PROCUREMENT PROCESS

The Parliament created the 1995.XL. Procurement Law in order to shape government expenses. Its most important goal, however, was to improve the visibility and controllability of public monies use, and to keep the procurement competition clean.

The authority of the law includes the certain public companies, such as the County Road Maintenance Company or the State Road Maintenance and Information Company from June 1, 1996. It also covers all purchases in connection with their public activity if the amount exceeds the one determined by the annual budget. It is illegal to separate these purchases to avoid the law.

The law orders that the buyer cannot discriminate among applicants. During the process, foreign-based applicants should be handled according to the principles in international contracts by the Hungarian Republic.

The procurement process can be open by invitation or by negotiation. During the open process anybody interested can make an offer. If the process is invitational, only those can participate invited by the firm asking for offer.

The firm asking for offer can make a summary of all procurements reaching or in excess of the amount determined by the law. This should be made by March 31; its goal is to inform market players. An announcement containing the summary can be issued in a set pattern. It is to be issued in the "Procurement News" (Kozbeszerzesi Ertesito). It can appear in other media only after the issue in the "Procurement News." If a foreign-based firm is allowed to participate, the announcement can be issued in foreign papers, too. In this case, the foreign translation of the summary can also appear in the "Procurement News."

The firm asking for offer can specify the certification of the applicant's financial, economical, and technical suitability; only the way described in the law.

The firm asking for offer can judge the offers conforming the conditions based on:

- the lowest price; or
- the most advantageous one as a whole.

The judging conditions have to be determined in advance. If the firm wants to choose the most advantageous offer, it also has to determine the order of importance of all conditions. These deal with the level of the object, size of the price and its mean and other circumstances.

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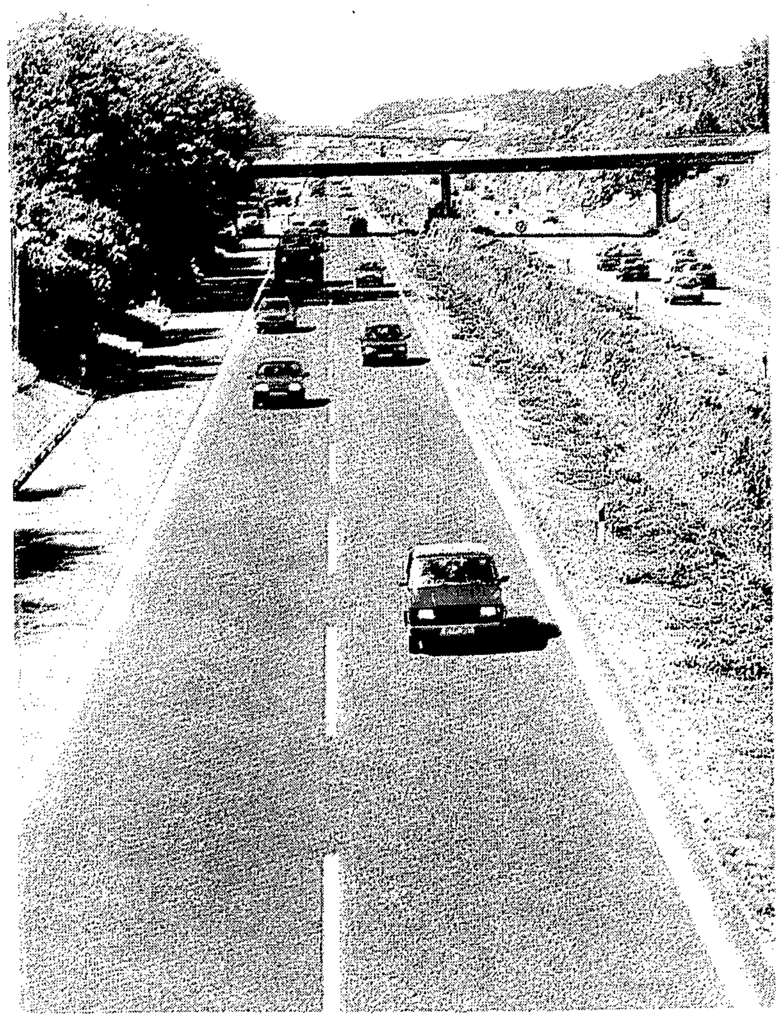
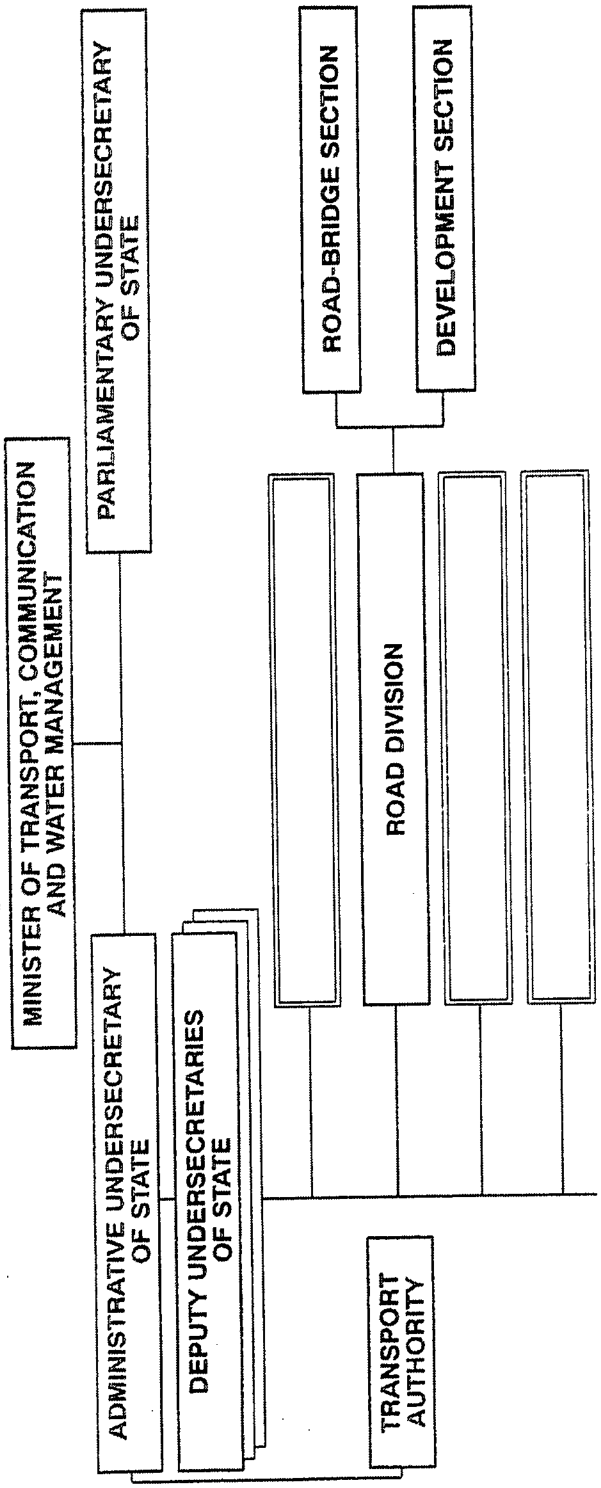
Section 8
ANNEX

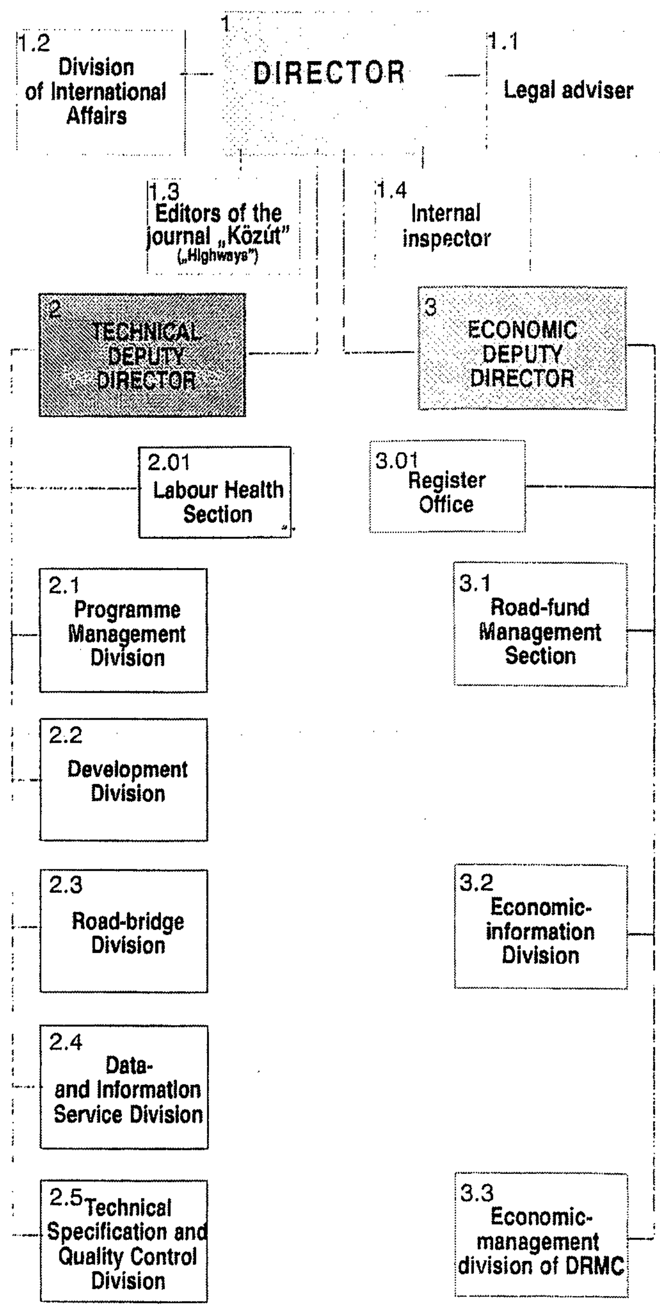
FACTS AND FIGURES ABOUT PUBLIC ROAD TRANSPORT IN HUNGARY – 1995



ROAD ORGANIZATION



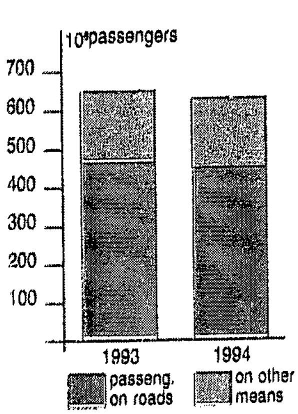
DIRECTORATE FOR ROAD MANAGEMENT AND COORDINATION (DRMC)

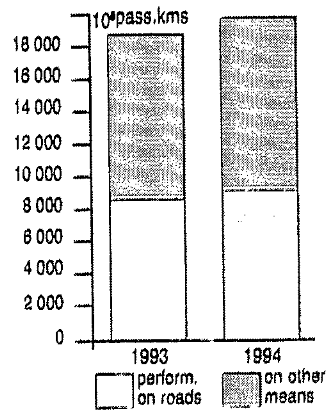


TRANSPORT PERFORMANCES

PASSENGER TRANSPORT

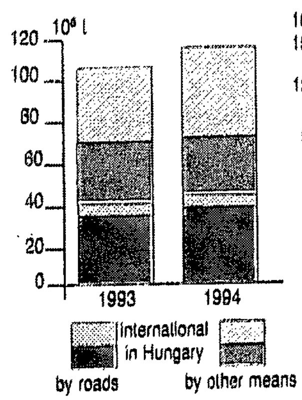
YEAR	PASSENGERS in 10^6			PERFORMANCE 10^6 pass.-kms		
	By roads	By other means	Total	By roads	By other means	Total
1993	487,1	163,8	650,9	8598,0	10 116,8	18 714,8
1994	483,1	162,7	645,8	8640,5	10 847,1	19 487,6

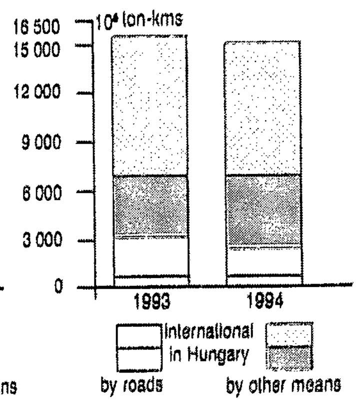




FREIGHT TRANSPORT

Year	Connection	FREIGHT MASS 10^6 t			PERFORMANCE 10^6 ton-kms		
		By roads	By other means	Total	By roads	By other means	Total
1993	Domestic	38,2	31,9	70,1	770,3	3 651,4	4 421,7
	International	1,6	35,7	37,3	2238,7	9 796,4	12 035,1
	Total	39,8	67,6	107,4	3009,0	13 447,8	16 456,8
1994	Domestic	39,6	32,8	72,4	754,9	3 707,9	4 462,8
	International	1,5	38,7	40,2	1901,3	8 916,1	10 817,4
	Total	41,1	71,5	112,6	2656,2	12 624,0	15 280,2

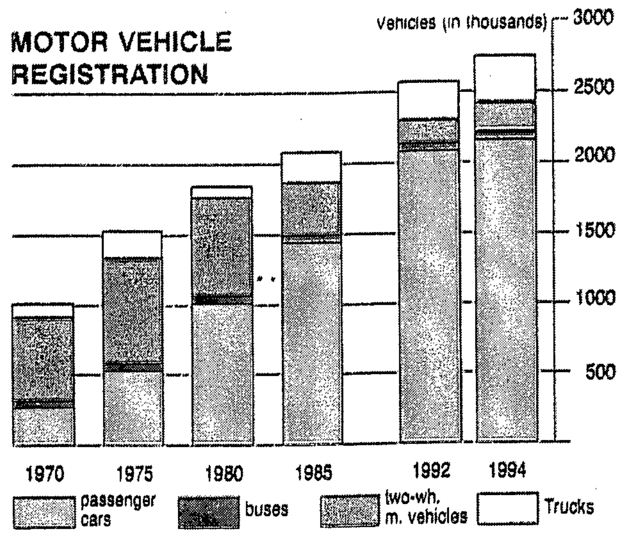




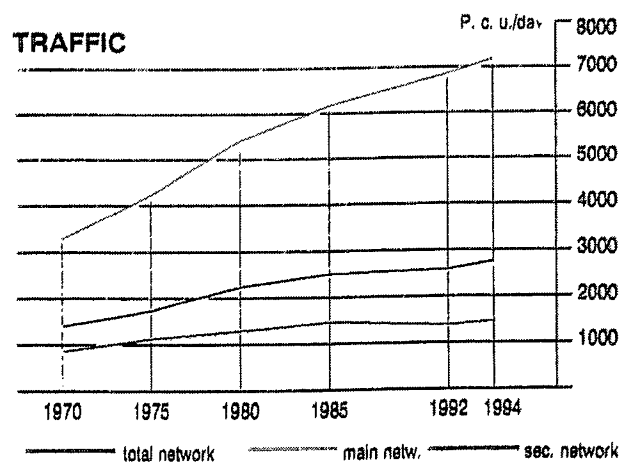
MOTOR VEHICLE REGISTRATION AND TRAFFIC

Year	VEHICLE (in thousands)					TRAFFIC (pass. car u./day)		
	Passenger cars	Buses	Two-wheeled motor v.	Motor tracks	Total	Main network	Second. network	Total network
1970	239	10	611	149	1009	3201	956	1451
1975	590	16	722	190	1518	4158	1027	1749
1980	1013	22	677	141	1853	5412	1275	2221
1985	1436	25	396	199	2056	6077	1462	2502
1992	2058	23	163	266	2510	6843	1398	2624
1994	2177	21	157	298	2653	7092	1443	2717

MOTOR VEHICLE REGISTRATION



TRAFFIC

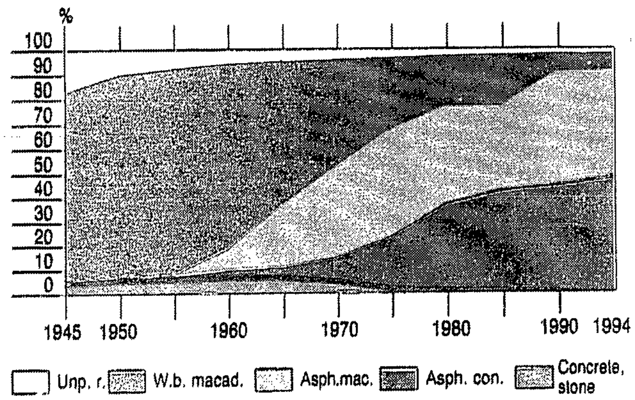


PAVEMENT OF ROADS

km

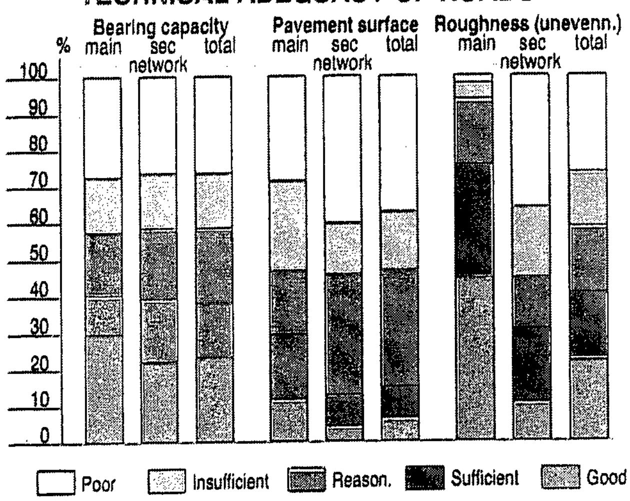
ROADS	Concrete, coble stone	Asphalt concrete	Asphalt mac-adam	Water-bound macadam	Un-paved road	Total
Nat. pub. road	164	14 320	13 117	2075	355	30 031
Local pub. road	1827	11 703	6 874	3665	51 614	75 683
TOTAL	1991	26 023	19 991	5740	51 969	105 714

DEVELOPMENT OF NATIONAL PUBLIC NETWORK BY PAVEMENT TYPES



TECHNOLOGICAL ADEQUACY OF NATIONAL PUBLIC ROADS

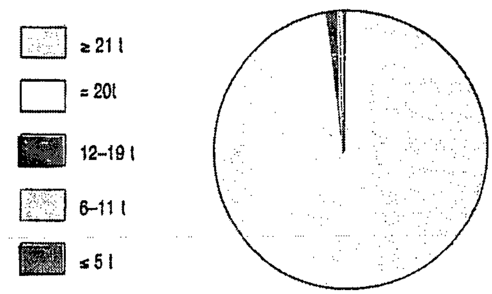
TECHNICAL ADEQUACY OF ROADS



BRIDGES

NUMBER AND SHARE OF BRIDGES

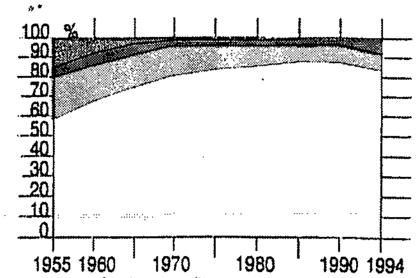
Denomination, units	On main roads	On sec. roads	Total
Number of bridges	1 784	4 092	5 876
Structural length (m)	45 018	46 144	91 162
Deck area (1000 m²)	584,6	382,1	966,7



Road category	≥21 t	=20 t	12–19 t	6–11 t	≤5 t	Total
Main roads	1716	55	4	–	9	1784
Second. roads	3392	583	105	12	–	4092
Total	5108	638	109	12	9	5876

BRIDGE STRUCTURES

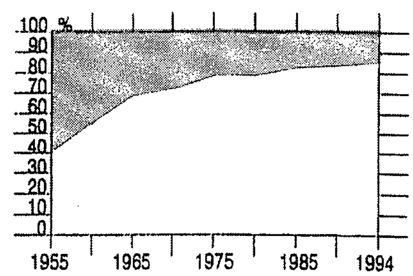
Denomination	pcs
Reinforced concrete	4909
Stone, brick, concrete	506
Steel, composite structures	449
Wood, provis.	12
Total	5876



Reinforc. concrete · Stone, brick, con. · Steel, composite structures · Wood, provisional

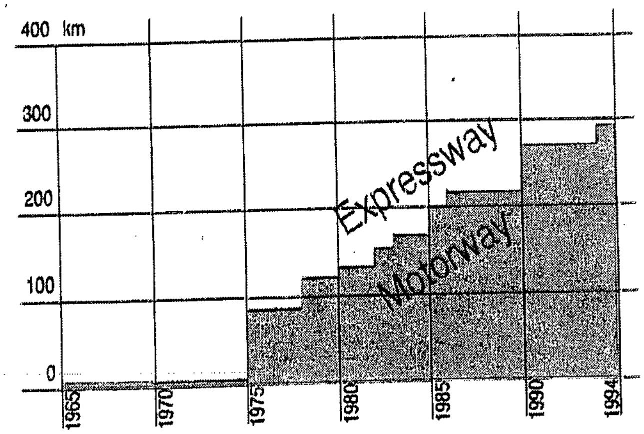
DECK WIDTH OF BRIDGES

Deck width	pcs
<6,5 m	962
≥6,5 m	4914
Total	5876



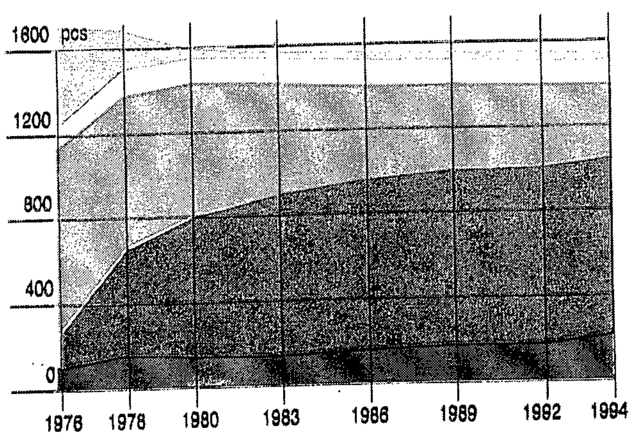
< 6,5 m
≥ 6,5 m

DEVELOPMENT OF THE MOTORWAY NETWORK



ROAD-RAILWAY CROSSINGS ON NATIONAL PUBLIC ROADS

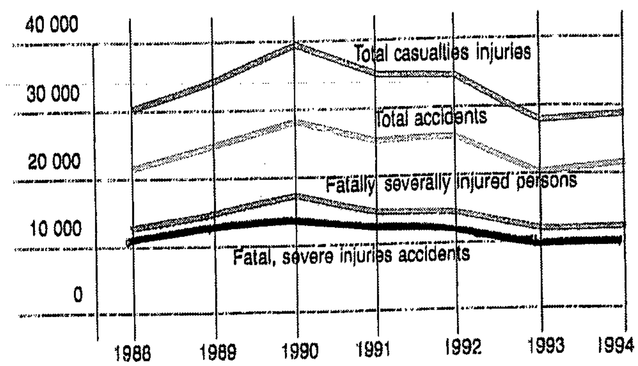
TYPE		Main roads	Second. roads	Total network
Split level cross.		164	90	254
Level crossing	Light+half rail bar.	69	155	224
	Light barrier	154	677	831
	Lift barrier	41	297	338
	Signalman	18	91	109
	Without safeguar.	1	37	38
TOTAL		447	1347	1794



TRAFFIC ACCIDENTS

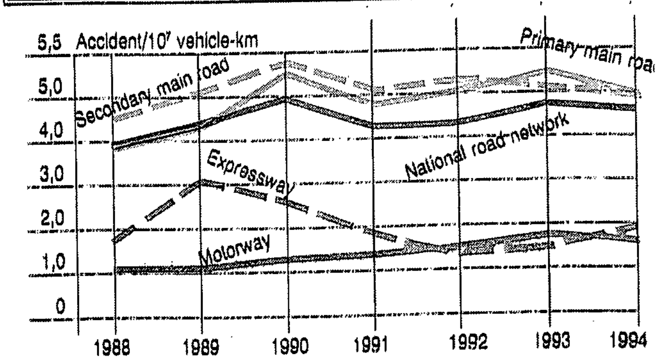
TRAFFIC ACCIDENTS ON PUBLIC ROADS

Year	Number of total accidents	Accidents				
		road type		accident type		
		on nation. p. roads	on local p. roads	fatal	severe injury	light injury
1988	21 320	11 350	9 970	1562	8 801	10 957
1989	24 371	13 347	11 024	1943	10 108	12 320
1990	27 801	15 631	12 170	2185	11 738	13 878
1991	24 511	12 585	11 926	1863	10 042	12 606
1992	24 623	13 422	11 201	1849	9 886	12 888
1993	19 526	10 815	8 711	1462	7 767	10 297
1994	20 723	10 963	9 760	1390	8 054	11 279



INJURED PERSONS

Year	Total inj. pers.	of this value			Ratio of fatality %	Injured persons/accident
		fatality	sev.injured	light inj.		
1988	29 482	1706	10 420	17 356	5,79	1,38
1989	34 214	2162	12 238	19 814	6,32	1,40
1990	39 428	2432	14 316	22 680	6,17	1,42
1991	34 796	2120	12 210	20 466	6,09	1,42
1992	34 678	2101	11 994	20 583	6,06	1,41
1993	27 108	1678	9 328	16 102	6,19	1,39
1994	28 523	1562	9 633	17 328	5,48	1,38

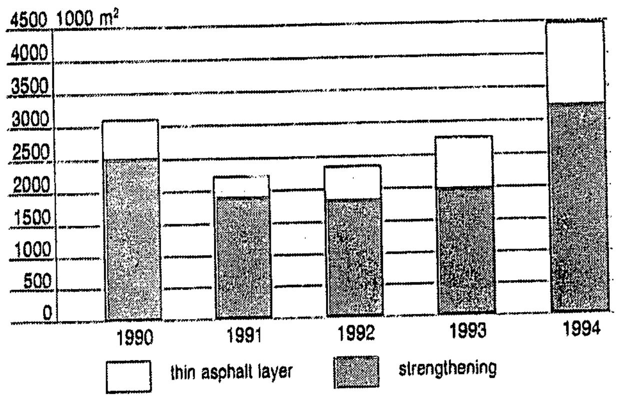


MAJOR PAVEMENT MAINTENANCE WORKS

ASPHALT PAVEMENTS

1000 m²

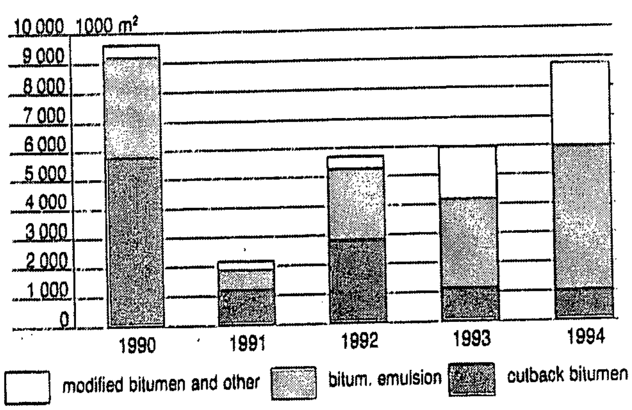
DESIGNATION	1990	1991	1992	1993	1994
Thin asphalt layer	498	296	412	780	1098
Strengthening	2565	1972	1913	2083	3362
TOTAL	3063	2268	2325	2863	4460



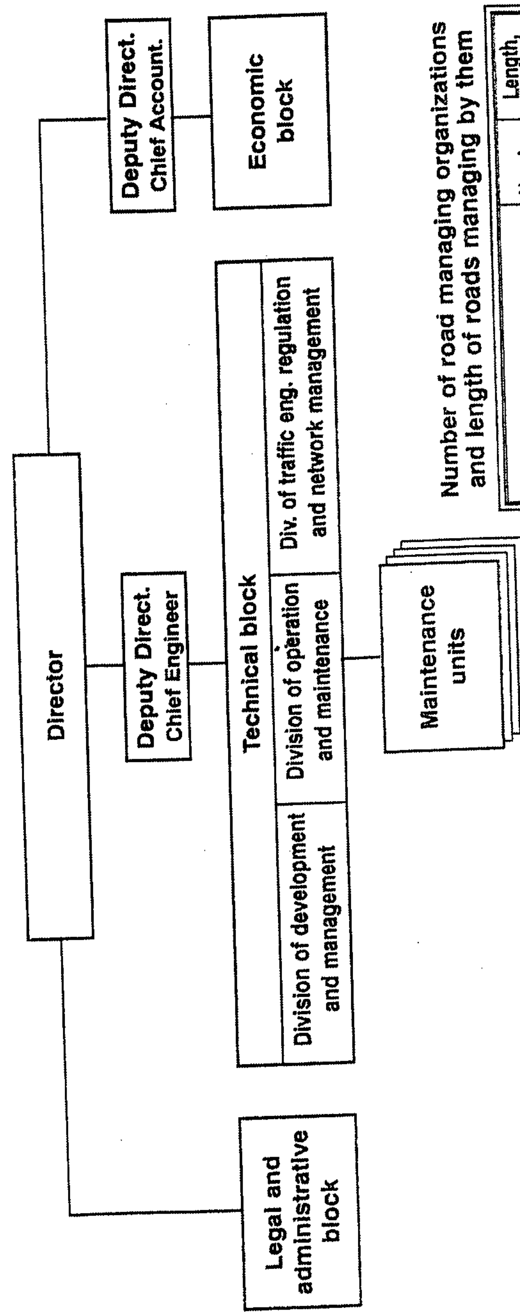
SURFACE DRESSINGS

1000 m²

DESIGNATION	1990	1991	1992	1993	1994
Modified bitumen and other	289	107	411	1771	2726
Bituminous emulsion	3391	649	2458	3002	4993
Cutback bitumen	5889	1280	2994	1299	1154
TOTAL	9569	2036	5863	6072	8873



ORGANIZATIONS OF LOCAL ROAD DIRECTORATES



Number of road managing organizations and length of roads managing by them

Organization	Number	Length, km
Motorway Directorate (MD)	1	450
Road Directorates of counties (RD)	19	900–2500
Maintenance Units	84	300– 500