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ANALYSIS OF AREA OF OPERATION

for the

REPUBLIC OF BOSNIA-HERCEGOVINA

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INTRODUCTION

1. Aim. The aim of this report is to provide a Strategic Geographic Intelligence Report of the Republic of Bosnia-Hercegovina in support of OP HARMONY.
2. General. This document provides a basic description of the geographic characteristics of Bosnia-Hercegovina with special interest in the ground routes between Daruvar and Sarajevo and the area surrounding the Sarajevo Airport. This report is divided into three specific parts: Terrain, Weather, and Sociology. Clarification or amplification of specific aspects of the terrain may be requested from Mapping and Charting Establishment Terrain Analysis Section through the Director of Geographic Operations (D Geo Ops-3).
3. Limiting Considerations. This report was prepared using primarily historical reference material, documents, maps, charts, and various technical references. Because the material available is dated some of the details enclosed could be inaccurate or incomplete. The Mapping and Charting Establishment Terrain Analysis Section will welcome any comments that could update or improve this report (613 995-0135).

PART I - TERRAIN

GENERAL DESCRIPTION OF THE AREA

4. General. Bosnia-Hercegovina is a newly independent republic of the former Federal Republic of Yugoslavia. It is located between N45°20' and N43°15', and E15°40' and E19°40' (see Figure 1). Situated in the central south-western part of the former Yugoslavia, it is bordered by Croatia to the north and west, Serbia to the east, and Montenegro to the south-east (see Figure 2). Bosnia-Hercegovina covers an area of 51,129 sq kms which is slightly smaller than the province of Nova Scotia.

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Figure 2

Bosnia-Herzegovina

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TERRAIN - NATURAL FEATURES

5. Physiographic Regions. Bosnia-Hercegovina can be divided into three distinct regions (see Figure 3). The following is a description of each:

- a. Slavonian Hills and Plains. This northern lowlands region covers approximately 10% of Bosnia-Hercegovina, encompassing the Sava River flood plain along the northern border. It is part of a more extensive physiographic region known as the Hungarian Basin. It has tertiary deposits with an accumulation of river gravels. These gravel deposits stand out between the river valleys as little-dissected, flat-topped plateaus, which are steppe-like in character. Hilly areas are characterized by sharp relief, due to partially buried crystalline rocks which resist erosion under the sedimentary rock that covers most of them. Isolated crystalline uplands are linked by lower ridges of tertiary hill country.
- b. Western Dinaric Mountains. The region covers approximately 30% of Bosnia-Hercegovina. It is an 80km wide karst mountain range extending northwest to southeast. These mountains rise sharply from the Dalmatian coast into three plateau levels, two of which are in Bosnia-Hercegovina, to a maximum elevation of about 2400m. The mountains have a barren dry nature due to predominately internal drainage. Main characteristics of karst topography are:
 - (1) deep isolated solution basins;
 - (2) steep, narrow gorges;
 - (3) underground caves and rivers;
 - (4) lakes which rise and fall with the water table, which may disappear during the dry season;
 - (5) barren rocky uplands; and
 - (6) fertile, but restricted lowlands.

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Figure 3

Physiographic Regions

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- c. Eastern Dinaric Mountains. This region covers approximately 60% of Bosnia-Herzegovina. This area is also dominated by a succession of mountain ranges and longitudinal valleys which run north-west to south-east. They are made up of formations of impermeable crystalline rocks (quartz-type), with lesser amounts of sandstone, shale, and limestone. The highest of these areas is north-west of Sarajevo, with a maximum elevation of about 2,000m. Vast tectonic basins are situated where the limestone and impermeable rocks meet, with Sarajevo located in the largest of these.

6. Drainage. Bosnia-Herzegovina has two main drainage systems. Of the total surface area, about 70% drains to the Sava River in the north and about 30% of the surface area drains into the Adriatic Sea to the south-west (see Figure 4). Most of the tributaries to the main rivers are short and angular in nature, due to the harsh terrain. In the north the tributaries take on a more regular pattern.

- a. Sava River Drainage Basin. This river system is influenced by the Eastern Dinaric region. The river valleys are spaced approximately 70 kms apart. The Sava River itself usually has a steady flow through this relatively flat terrain. Major tributaries of the Sava River are the:

- (1) Una;
- (2) Vrbas;
- (3) Bosna; and
- (4) Drina rivers.

- b. Adriatic Drainage Basin. The porous limestone in the Western Dinaric region causes most of the drainage to be underground. The pattern therefore appears sparse and disintegrated. The rivers that do exist occupy short, steeply-graded valleys, due to the swift descent to the sea. There are some disappearing streams fed from underground sources. The only major river that gets from the interior

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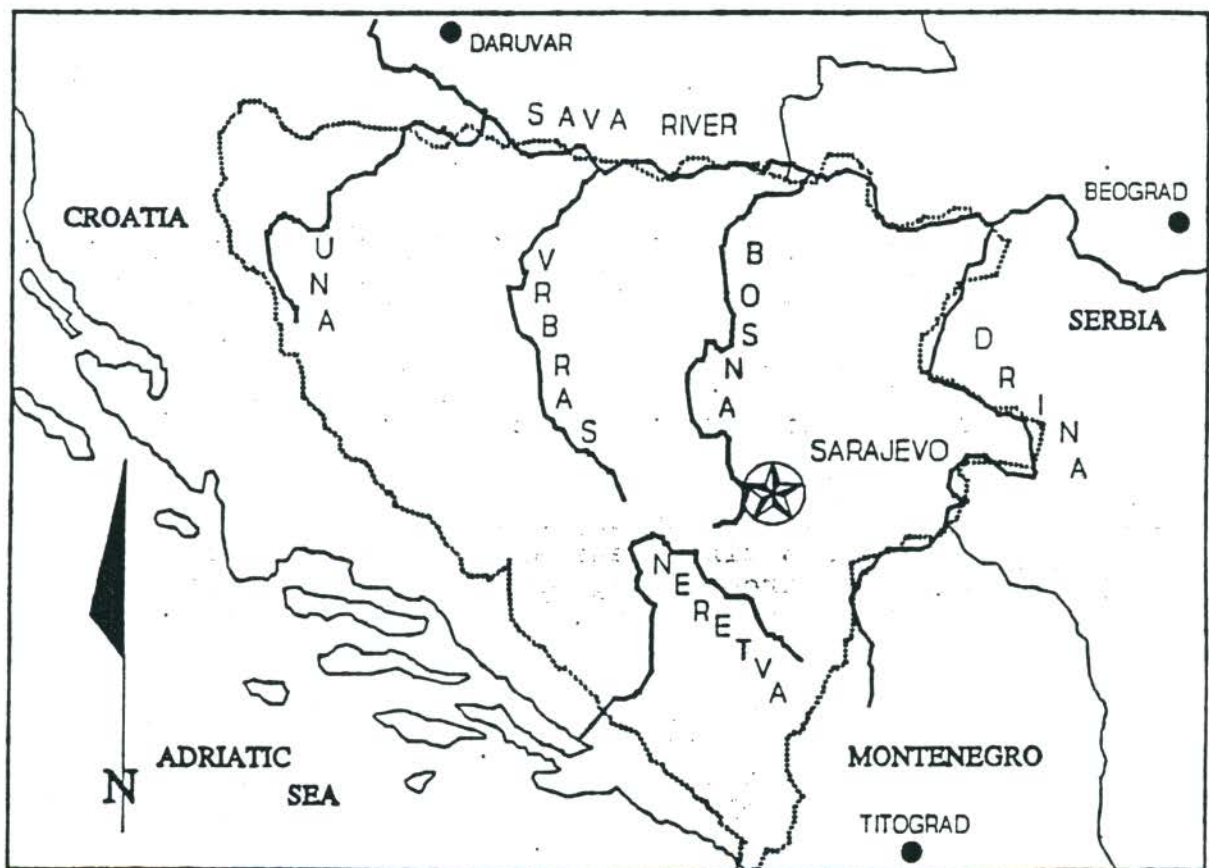


Figure 4

Drainage

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to the sea is the Neretva. Many of the karst lakes exist only seasonally.

7. Surface Materials. The soils in Bosnia-Hercegovina vary significantly between the different regions:

- a. Slavonian Hills and Plains. Podsollic soils (usually infertile) have developed under the cool, humid climatic conditions in the north-east valleys. Gravel deposits can be found on the plateaus between the valleys.
- b. Western and Eastern Dinaric Mountains. Development of deep, mature soils has been hindered by steep gradients and destruction of forest cover in past centuries, resulting in soil erosion. For the most part the soils are skeletal in nature; shallow layers of humus or partially weathered rock surfaces. Mountain areas in the Eastern Dinaric Region have numerous isolated fertile basins, which when added up together have a significant area and therefore importance. There are also areas where the soil has been reclaimed through conservation procedures.

8. Vegetation. Most of Bosnia-Hercegovina is in the Central European Forest Region, consisting mainly of a deciduous-coniferous mix. Generally, forests cover less than half the land area throughout the region. The mountainous areas lack extensive fertile soils, therefore, they are either forest-clad or given over to poor pasture. The coniferous trees found here are silver fir and spruce. The deciduous trees are mostly pedunculate oak, birch and beech. Considering the extent of mountainous terrain in Bosnia-Hercegovina there is a considerable amount of agricultural land, including land that has been reclaimed by drainage and irrigation in the fertile valleys and poljes. Field crops are mostly found in the Sava valley to the north. Grassy plateaus can be found east of Sarajevo, and also north of it (near Tuzla). Around Sarajevo the crops that can be found are:

- a. tobacco and maize in the valleys;
- b. wheat on the slopes; and
- c. oats, flax and hemp on the mountains.

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MANMADE FEATURES

9. Population Centres. The highest population density is found along the fertile river valleys and in some karst basins (poljes), and the least dense in the higher elevations of the Dinaric mountains. Average population density is about 80 people/sq km. The capital of Bosnia-Hercegovina is Sarajevo, with a population of 449,000. It is located at N43°52' E18°26', on the lower reaches of the Miljacka River where it flows into the Bosna River (see Figure 5 for major towns).

10. Rural Areas. People living in rural areas are mostly concentrated in villages of less than 500 people. The major occupation is farming. These villages are ordinarily found in the fertile river valleys in the Dinaric Mountain regions, and scattered throughout the Slavonian Hills and Plains.

11. Transportation - Ground.

a. Roads. Bosnia-Hercegovina has a sparse and irregular road network. The road pattern is governed by the Dinaric mountains in the south, following the main river valleys, and is less constrained as the Northern Lowlands are approached. There is one major south-east/north-west route in Bosnia-Hercegovina. E761/M5 goes from Serbia in the east to Croatia in the west (it goes roughly through the centre of the republic). There are four major north-south routes which are approximately 50 kms apart and go from Croatia and Serbia in the north toward the Adriatic coast (see figure 6). (See Annex A for route information between Daruvar and Sarajevo). They are as follows:

- (1) M16 - This route goes from Daruvar, north of the border with Croatia to Split, south of the border with Croatia, through Banja Luka;
- (2) M17 - This route goes from Osijek, north of the border with Croatia to the mouth of the Neretva River on the Adriatic, through Mostar;

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Figure 5

Population Centres

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Figure 6 Transportation Network - Ground

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- (3) M17 (secondary)-M16-M18 - This route goes from Vudovar, north of the border with Croatia, to meet M17, west of Sarajevo, through Tuzla;
- (4) M19 - This route goes from Zvornik, near the border with Serbia, south to Dubrovnik on the Adriatic coast.

b. Railroads. The railroads are also governed by the terrain, sticking mainly to river valleys and resulting in winding routes. There are only two major lines (both standard gauge, 1.44m), and they are as follows (see Figure 6):

- (1) from Sibenik on the Adriatic coast it follows the border with Croatia. It then swings north-west, following the Una River to Bosanski Novi. From there it heads east, passing north of Banja Luka and on to Tuzla; and
- (2) from Osijek, north of the Croatian border, to the mouth of the Neretva river. It follows the Bosna River southwards to Sarajevo, and then swings southwest to meet up with the Neretva River. From there on it follows the river to the Adriatic coast.

12. Transportation - Air. In Bosnia-Hercegovina there are nine airports with hard-surfaced runways, and 13 airfields with soft-surfaced runways. (See Table 1 and Figure 7).

13. Transportation - Water. The only navigable inland waterway with ports is the Sava River which flows along the northern border of Bosnia-Hercegovina.

14. Communications. The communications facilities in Bosnia-Hercegovina are as follows:

- a. Television. There are two or three TV stations in the republic. Cable is not available. With a good antenna, TV stations from other counties can be picked up. Satellite receivers are becoming quite popular.

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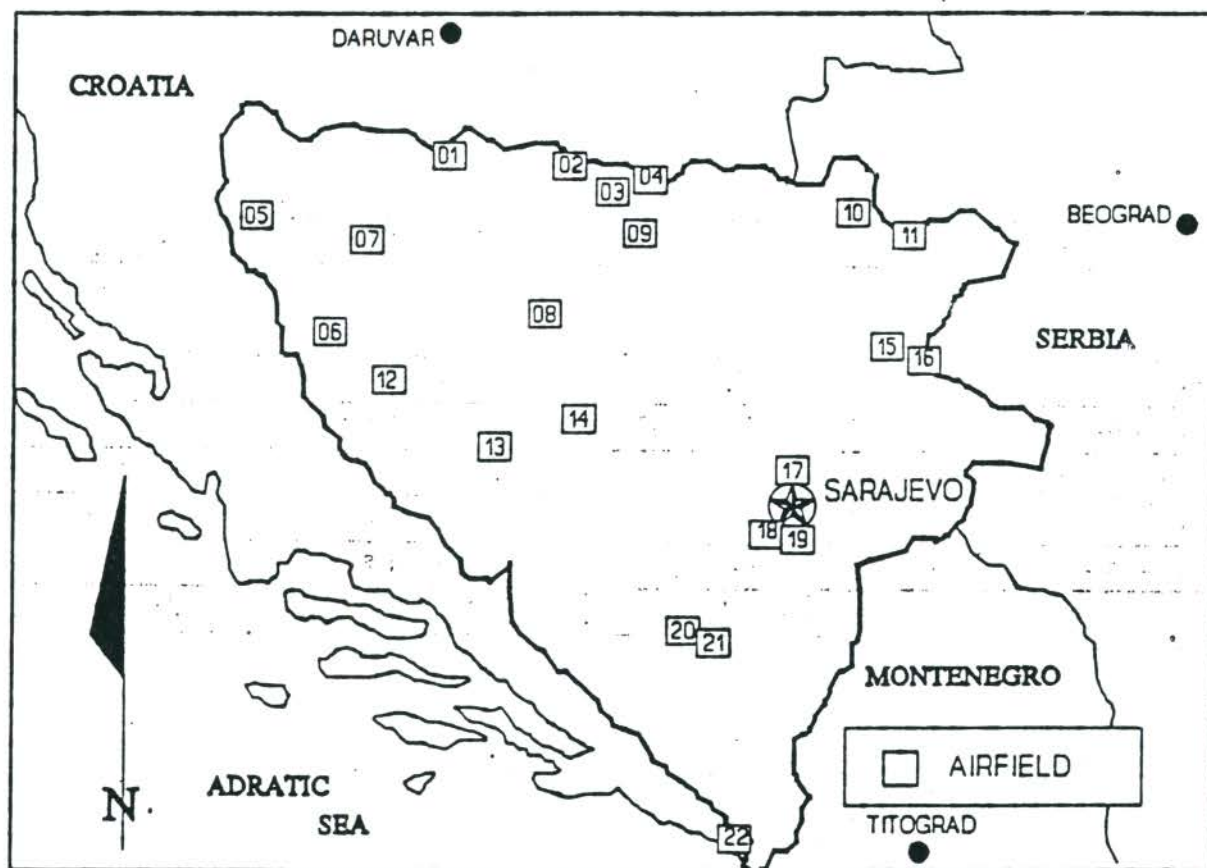


Figure 7

Airfields

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MAJOR AIRFIELDS

SER	NAME	LAT	LONG	EL	AZ	LEN	SURFACE	VALIDITY
01	Gredani	45°13'	16°53'	93	?	?	Soft	May 87
02	Kolanija	45°06'	17°14'	99	?	?	Soft	May 87
03	Seferovci	45°01'	17°20'	107	?	?	Soft	May 87
04	Sredani	45°04'	17°29'	94	?	?	Soft	May 87
05	Bihać	44°50'	15°47'	345	140°	2750	Hard	May 87
06	Bosanski Petrovac	44°34'	16°17'	701	?	1524	Soft	May 87
07	Prijedor	44°59'	16°34'	183	?	?	Soft	May 87
08	Kolanska Planina	44°42'	17°	594	?	?	Hard	May 87
09	Banja Luka	44°58'	17°28'	119	175°	3000	Hard	May 87
10	Gornji	44°56'	18°36'	94	55°	1000	Hard	May 87
11	Brčko	44°51'	18°46'	108	?	?	Soft	May 87
12	Drvar	44°41'	16°24'	600	?	1128	Soft	May 87
13	Glamoc	44°04'	16°50'	922	154°	2000	Hard	Apr 88
14	Novo Selo	44°04'	17°09'	1189	?	?	Soft	Apr 88
15	Tuzla	44°28'	18°43'	238	97°	2500	Hard	May 87
16	Tuzla East	44°28'	18°48'	299	?	1097	Soft	May 87
17	Sarajevo/Rajlovac	43°53'	18°18'	494	?	?	Soft	Apr 88
18	Sarajevo	43°49'	18°19'	521	116°	3000	Hard	Apr 88
19	Sarajevo/Butmir	43°48'	18°19'	517	?	1189	Soft	Apr 88
20	Mostar/Soko	43°27'	17°50'	50	?	1463	Soft	Apr 88
21	Mostar	43°18'	17°51'	161	122°	3500	Hard	Apr 88
22	Uskoplje	42°34'	18°16'	48	160°	2500	Hard	Apr 88

All Linear Measurements are in Metres

Table 1

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- b. Radio. Aside from the few stations transmitting from within Bosnia-Herzegovina, there are a lot of French, German, English and Italian stations that can be picked up.
- c. Newspapers. Newspapers are an important part of life in this part of the world. There are a number of journals published in Bosnia-Herzegovina in several languages. The Bosnian BH news agency appears to be the official publisher.
- d. Telecommunications. Telephone, telegraph, and wireless services for national and international use are generally adequate. Most pay phones require tokens and pay phones that accept cash are becoming rare.

PART II - WEATHER

GENERAL

15. The climate is influenced appreciably by the continental air movements of eastern and northern Europe and to a lesser degree by the Mediterranean air masses from the south and south-east. Snow and cold weather accompany north and north-easterly winds in the late fall and early winter. In the summer the country is warmed by winds from the south and south-east. In the more elevated areas cool summers and long snowy winters prevail. Valleys generally enjoy a more temperate climate.

PRECIPITATION

16. The average annual precipitation is 128cm, most of which occurs at the beginning of summer.

TEMPERATURE

17. The average monthly temperature ranges from a low of 0°C in January, to a high of 20°C in July.

WINDS

18. The predominant winds are north and north-westerly in the winter months, and change to south and south-easterly during the summer.

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LIGHT DATA

19. Daily light data can be made available by contacting the Mapping and Charting Establishment Terrain Analysis Section.

PART III - SOCIOLOGY

GENERAL

20. Bosnia-Hercegovina is as diverse as any of the former Yugoslavian Republics. Centuries of being fought over and occupied by Eastern and Western Empires have left their mark on the land and its people. There is a distinct mixture of cultures, religions, ethnic groups, and languages. The majority of the population however, are peasant farmers and craftspeople, with little education.

HISTORICAL NOTES

21. Background. The territory known as Bosnia-Hercegovina was conquered completely by the Ottoman Turks in 1483. From 1688 to 1878 this territory was the scene of many conflicts between the Turks and Austria-Hungary. The Hapsburg Empire (Austria-Hungary) occupied Bosnia from 1878 until 1908, at which time it, and the province of Hercegovina were annexed. By the end of World War I, the provinces became part of the Kingdom of Serbs, Croats and Slovenes (since 1929, Kingdom of Yugoslavia and since 1945 The Federal Republic of Yugoslavia).

22. Recent History. In April of 1992, ethnic Serbian militia from both Bosnia and neighbouring Serbia seized more than 70% of prewar Bosnia and proclaimed an autonomous Serbian state there. Slavic Muslims, who account for 40% of the republic's 4.4 million population, are providing the resistance to the Serbians in the war-torn region, especially in and around Sarajevo. In May of 1992, the United Nations Security Council imposed economic sanctions on the new Serbian-controlled Yugoslav state. United Nations Peacekeeping forces are attempting to secure Sarajevo airport for humanitarian relief flights.

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PEOPLE

23. Population. The population of Bosnia-Hercegovina is estimated at 3,746,000. The population density is approximately 80/sq km. Most of the populace is located in the fertile valleys and poljes.

24. Language. Serbo-Croatian is the common language.

25. Religious and Ethnic Divisions. The religious breakdown corresponds to that of the ethnic divisions as follows:

- a. Moslem - 40%, mostly ethnic Bosnians;
- b. Roman Catholic - 30%, mostly ethnic Croats;
- c. Greek Orthodox - 30%, mostly ethnic Serbians.

DEVELOPMENT

26. Public Health. Health care is widely available under normal circumstances and there is a more than adequate medical infrastructure. However, local strife will have some effect on medical facilities. In Bosnia-Hercegovina there are good hospitals in all major towns and cities.

27. Education. The percentage of the GNP spent on health and education is six percent. Bosnia-Hercegovina has compulsory education up to grade eight, about 14 years of age (with 99% attendance) and the literacy rate is only 19.5%. Education at the elementary level is free and predominantly public.

28. Economy. The economy of Bosnia-Hercegovina is based on primary resource industries and agriculture:

- a. major resources are as follows:
 - (1) petroleum;
 - (2) iron ore (south of the Sava River and north-west of Sarajevo);
 - (3) lignite;
 - (4) antimony;

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- (5) bauxite;
- (6) copper;
- (7) lead;
- (8) zinc;
- (9) manganese; and
- (10) salt.

b. main agricultural interests include:

- (1) raising livestock especially sheep and pigs;
- (2) fodder crops such as oats, barley, and rye (mostly in the south);
- (3) maize (mostly in the Sava valley);
- (4) tobacco (industry crop in the south);
- (5) rice (in the lowlands);
- (6) temperate fruits (east of the Bosnian River); and
- (7) garden crops (income and dietary supplement for most peasants); and

c. there is some mineral processing such as the steel works at Zenica.

29. Power Sources. The main source of power in Bosnia Hercegovina is hydroelectric. Major power stations are located on the Neretva River at Jablanica and Rama.

Annexes:

Annex A Routes to Sarajevo
Annex B Bjelo Polje

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ANNEX A

ROUTES TO SARAJEVO

GENERAL

1. Aim. The aim of this annex is to describe the main routes from Daruvar, Croatia to Sarajevo, Bosnia-Hercegovina.
2. General. This annex identifies 3 ground routes from Daruvar to Sarajevo.
3. Limiting Considerations. This annex was prepared using primarily historical reference material. Because the material available is dated, some of the details enclosed could be inaccurate or incomplete. The Mapping and Charting Establishment Terrain Analysis Section will welcome any comments that could update or improve this report. The following constraints were used:
 - a. the roads were an international, or national highway; and
 - b. that they were reasonably direct to Sarajevo.

PART I - PRIMARY ROUTE

DARUVAR TO SARAJEVO - VIA ZENICA

4. General. This route is approximately 350 kms in length.
5. Description. This route is broken down into four stages, as follows:
 - a. Daruvar to Okucani. From Daruvar, proceed south on the E661/M16. This highway skirts the foothills of the Papuk Mountain Range to the east, passing through Badljevina and then Pakrac, which has forests to the west of it. After passing through Lipik you cross a long ridge, and then go through Okucani to the E70/M1 (Autoput).

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ANNEX A

- b. Okucani to Samac Slav. Go east on E70/M1 along fairly flat terrain through the Sava River valley. This highway is surfaced in concrete and asphalt, which may be quite worn along some stretches. To the south, between the highway and the Sava River, from Nova Gradiska to Slavonski Brod, are areas of forest and marshland. The highway does not pass directly through any towns, but there are some level crossings. As you pass by Nova Gradiska, the forested mountain of Psunj (1,000m) to the north can be well-observed. Next, you pass by Staro Petrovo Selo and Luzani, which is to the north and in a forested valley. Further on, there is a turn-off for Slavonski Brod, which is an industrial town and important port on the Sava River. About five km south of Kopanica is where you turn southwards towards Sarajevo, onto the E73/M17. You will then pass through the village of Samac Slav.
- c. Samac Slav to Zenica. Once through Samac Slav you approach Bosanski Samac (an important river port) via a large bridge over the Sava River. Proceed along the right bank of the Bosna River on an unsurfaced road to the large village of Modrica. This village is surrounded by many orchards. Modrica is where you leave the Sava valley and enter the Bosna valley. Passing by Podnovlje, you enter a plain and go through Kotorsko. When you pass through Doboj, the valley becomes constricted and increases in elevation, with many defiles to the west and east. In succession, you will pass through Maglaj, Zepce, Begov Han, Vranduk, and then pass by Zenica.
- d. Zenica to Sarajevo. When you pass through the large town of Zenica, the road becomes paved. South of Zenica turn eastwards on the E73-E761/M5. This is a winding route that drops in elevation as you proceed towards Sarajevo. You pass in succession the towns of Kakanj, Visoko and Podlugovi. From here you can take the M18 and approach Sarajevo from the north, or the M5 and approach the town from the southwest. The northern route will take you through Vogosca, to

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ANNEX A

north-central Sarajevo. The southern route will take you through Ilidza, at the foot of Mount Igman (1,500 m). After crossing the Bosna and Zeljeznica rivers, and going through Ilidza, the road goes down into the narrow valley of Sarajevo from the west.

ALTERNATE ROUTE - 1

6. General. This route is approximately 330 kms in length.

7. Description. Along much of this route it becomes very constricted. Throughout the second half of the route there are at least three tunnels and 1 steep grade (ascent and descent). From Daruvar take the E661/M16 south, through Banja Luka to Jajce. From there take the E661-E771/M5 through Donji Vakuf to Sarajevo.

ALTERNATE ROUTE - 2

8. General. This route is approximately 350 kms in length.

9. Description. There are at least two tunnels along this fairly hilly route. From Daruvar, take the E661/M16 south to the E70/M1 and proceed east. Take the M16 south through Tuzla to the M18. Staying on the M18, turn east to get to Sarajevo.

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ANNEX B

BJELO POLJE

GENERAL

1. Aim. The aim of this annex is to describe the Bjelo Polje (basin) that the Sarajevo airport is in.
2. General. This annex will briefly identify natural and man-made features around the basin. It is written in two parts:
 - a. the interior of the basin; and
 - b. the surrounding area of the basin.
3. Limiting Considerations. This annex was prepared using primarily historical reference material. Because the material available is dated, some of the details enclosed could be inaccurate or incomplete. The Mapping and Charting Establishment Terrain Analysis Section will welcome any comments that could update or improve this report. The constraints used were that only the area in the basin and that which surrounds the basin be described.

PART I - BJELO POLJE (INTERIOR)

AREA OF INTEREST

4. General. The Bjelo Polje is a fairly flat basin southwest of Sarajevo. It measures approximately eight km west to east, and 11 km north to south. The Sarajevo airport is at an elevation of approximately 517m, and is located in the south-central part of the basin.
5. Description. The M5 highway approaches Sarajevo from the west, going through the centre of the basin and north of the Sarajevo Airport. Considering the relatively even terrain, the road pattern is very irregular. The main influencing factors appear to be the drainage pattern, the surrounding relief and location of the airport. There are five major tributaries of the Bosna River going through this basin, including the head-waters of the Bosna River itself. The tributaries in the west have some intermittently-spaced

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ANNEX B

levees along their course, as well as some drainage ditches leading into them. There are also some drainage ditches just north of the M5 near Ilidza. Aside from some scrub, there is very little forest cover in the basin. Around the Sarajevo airport there are some open areas to the south and east, but otherwise it is encircled by built up areas. To the south of this airport is a fighter aircraft dispersal area.

PART II - BJELO POLJE (SURROUNDING AREA)

1. General. The area around the Bjelo Polje is dissected due to the karst topography to the south and the impermeable rocky hills to the north. The meeting of the Western Dinaric Mountains and the Eastern Dinaric mountains is very evident here.

2. Description. This large basin has sharply rising hills all around, especially to the south and east. The terrain is less harsh to the northwest. The peaks on the surrounding high ground offer very good vantage points of the basin for observation and fire. Some of these vantage points are the Lokva Mountain (1,248m) to the west, two of them in the Borovac area (1,234m and 1,136m) to the southwest, and the Mojmile peak (670m) to the east. The Trebevic Mountain (1,629m) is five km south of Sarajevo. It offers good observation of the town and the surrounding area, however, the area around the airport may not be visible. The major valleys leading into the Bjelo Polje have very shallow grades. Some of the valleys leading into the basin are those of the Zoljevina River to the west, the Moljacka River to the northeast, the Zeljeznica River to the southeast, and the Bosna River to the north. There are also two smaller valleys to the east separating three large spurs. In the higher elevations to the south there are a great number of sinkholes. Except for the major streams in the south, there is very little surface drainage. In the less harsh topography to the north, there is more visible surface drainage. The vegetation on the high ground to the south appears to provide more cover and concealment than the high ground to the north.

PREFACE

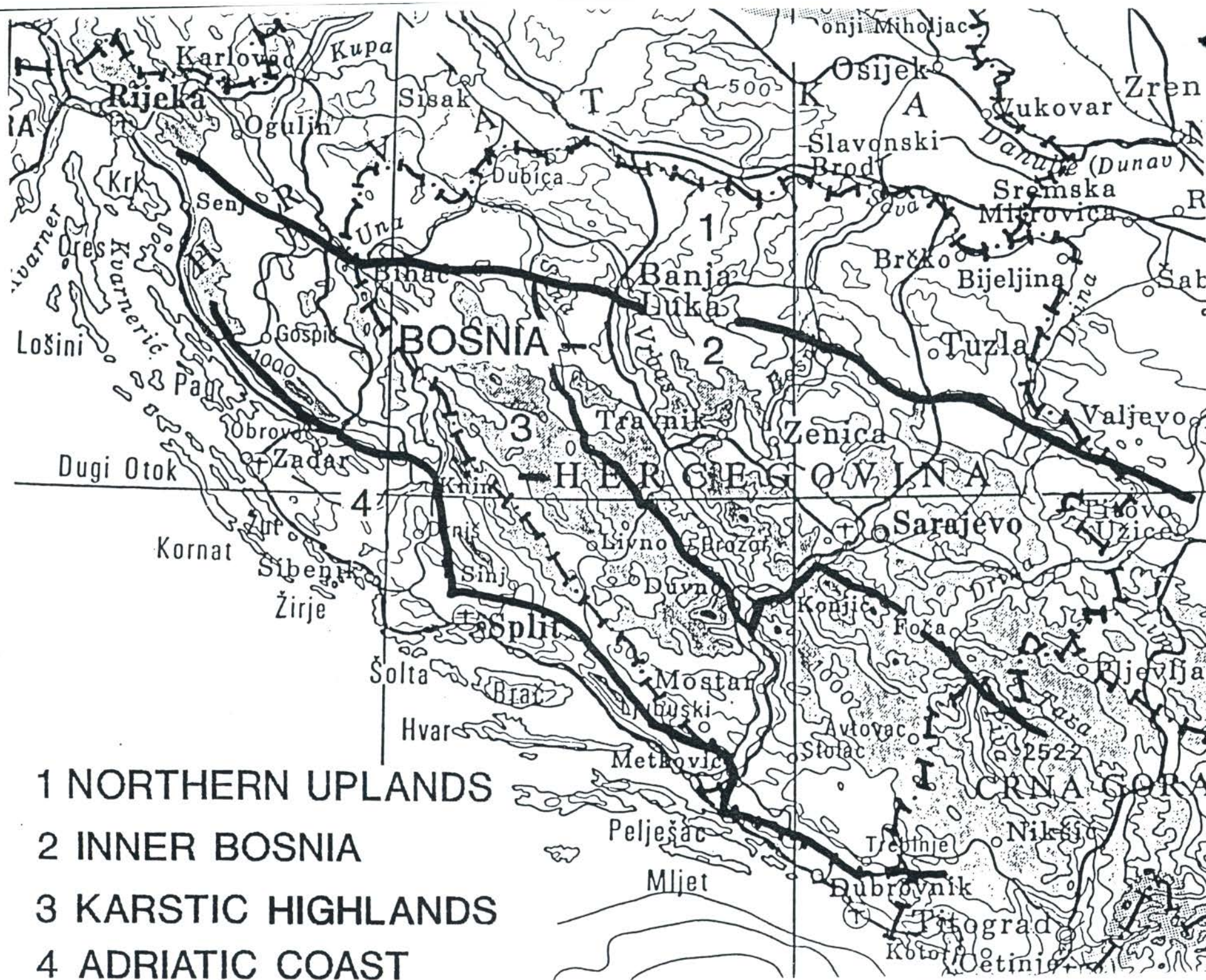
This military geographical description has been written on short notice, evaluating and analysing many different sources, eg. maps 1:50,000 to 1:500,000 and books written between World War I and today.

Despite the fact that the quality of sources may be limited in some cases and therefore some things may have changed eg. some roads may have improved, the terrain in general has been unchanged for the last decades.

The area is split into four groups as shown on a map, and the features mentioned in the paper are listed with UTM coordinates at the end of the document.

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DESCRIPTION OF BOSNIA-HERZEGOVINA (B-H) AND SOUTH DALMATIAGENERAL

1. The area to be described is mainly covered by the DINARIC ALPS which reach from the SLOVENIAN-AUSTRIAN border as far as the north-west to the ALBANIAN ALPS in the south-east and from the river SAVA-valley (the border with CROATIA) in the north-east to the slope near the ADRIATIC COAST. The foothills of the DINARIC ALPS reach the coast in many places. The lowlands between are very narrow but extend to larger plains around PLOCE by the NERETVA mouth and between ZADAR and SIBENIK in the north of the area concerned. The DINARIC Bloc is very difficult to reach from the adjacent regions. Narrow basins and valleys which are mostly in a NW-SE direction allow traffic parallel to the coastline but increase the difficulties when crossing the mountains. The access from the coastal plain which belongs mainly to CROATIA and from the SAVA-valley (the border zone with CROATIA) to the DINARIC mountains is very steep and therefore difficult to cross although a little easier in the north. The main routes from the coast to the inner areas start (from NW to SE) at ZADAR, SIBENIK, SPLIT, PLOCE (former KARDELJEVO) and DUBROVNIK while the access from the SAVA-valley to B-H goes mainly via BOSANSKI NOVI, SLAVONSKI BROD and BRCKO, towards BANJALUKA, DOBOJ and TUZLA. In the south west of the DINARIC ALPS there are several basins and plains often in valleys which may extend up to 10 kms in length but decrease in number to the north-east. These areas are the only ones which allow concentrations of larger formations.

CLIMATE

2. The climate in the coastal area (DALMATIA and the islands) is mediterranean with heavy rain in spring and autumn (mainly March and October), hot and dry summers but mild winters. Contrary to that is the climate in the highlands of Croatia and Bosnia-Herzegovina. These mountains are one of the most rainy areas in Europe with 2000-3000mm in precipitation/year. The winters are very cold and have plenty of snow. Spring starts late and often has night frosts. Summer is dry and at times very hot. In the northern upland the climate changes to a more continental one with a hot summer, a winter with less snow, a rainy spring and a sunny autumn. The lowlands along the rivers are often foggy, especially in autumn and spring.

RAINFALL (mm)

<u>TOWN</u>	<u>HEIGHT (ASL)</u>	<u>TOTAL/YEAR</u>	<u>MIN</u>	<u>MAX</u>
BANJALUKA	163	1070	FEB 57 AUG 83	MAY 125 OCT 112
BEOGRAD	163	655	FEB 36 SEP 46	JUN 77 OCT 60
BIHAC	236	1354		
GOSPIC	565	1810	JUL 93 AUG 93	OCT 230

TEMPERATURE

<u>TOWN/AREA</u>	<u>HEIGHT(m)</u>	<u>AVERAGE (°C)</u>			
		<u>JAN/FEB</u>	<u>SPRING</u>	<u>JUL</u>	<u>AUTUMN</u>
BEOGRAD	163	0.5	-	21.5	-
BJELASNICA Mts (S SARAJEVO)	2066	-7.0	-	9.0	-
CETINJE	671	0.5	-	21.5	-
MOSTAR	59	6.0	-	26.0	-
SIBENIK	5	-	14.0		18.0
SPLIT	5	5.0	14.0	25.0	18.0
ZADAR	5	5.0	13.0	25.0	16.0
ZAGREB	163	0.5	-	21.5	-

THE NORTHERN UPLANDS

3. This area reaches about 300 km NW-SE from the KORANA valley to the river DRINA and about 60 kms from the SAVE valley (which is the border with CROATIA) in the north to the slope up to the KARSTIC ALPS and the INNER BOSNIAN MOUNTAINS approximately along the line : BIHAC - BANJALUKA - South of DOBOJ - ZVORNIK - TITOVO UZICE.

4. Main Rivers:

a. BOSNA. A tributary of the SAVA. Its valley is the main access to BOSNIA-HERZEGOVINA which goes as far as SARAJEVO giving access to the coastal area using the NERETVA valley and the pass between. The BOSNA, a total obstacle, with the character of a mountain river except for the SAVA lowlands, has its high water mainly in spring and autumn but with its lowest level in December/January. Its width varies between 80 and 185m, with a depth of 3-6m and with a current velocity of 1-2m/sec. The bottom is mostly gravel, with rocks in some parts. The banks are 2-8m high. The width of the valley varies greatly from some 100m north of MAGLAJ to some kilometers (KOTORSKO plains) but is generally up to 1km in the area north of DUBOJ, and 2-4km from KOSTAJNICA to MODRICA with two narrow passes of 1km; one west of KOPRIVNA and the other north of VRANJAK. From MODRICA downstream to its mouth on the River SAVA the BOSNA has a 4km wide floodplain which dries out in 2-3 weeks after flooding. Road bridges are at MAGLAJ(2), DOBOJ, MODRICA and BOSANSKI SAMAC; the railway BOSANSKI SAMAC - SARAJEVO travels through the BOSNA valley (bridge at MAGLAJ) with connections from DOBOJ, west to BANJALUKA and east to TUSZLA.

b. DRINA. A tributary of the SAVA and the river forming the border with SERBIA. Its width varies between 80-180m, while the mouth at RACA widens to 360m; its normal depth is

1.7-4.5m, although from LJUBOVIJA downstream it is 1.7-2.8m, with a current velocity which varies from 1.2-2.2m/sec. High waters, which mostly last only a couple of days, are mainly in April, October and November. In the SAVA lowlands the DRINA valley often floods. The valley is approximately 2km wide but narrows north to the BRATUNAC plain and around ZVORNIK. The lower reaches, especially from LOZNICA to the mouth, are split in several areas by small islands or reefs.

c. KORANA. A tributary of the KUPA, which flows into it at KARLOVAC (CROATIA). For about 20kms it borders on CROATIA. Crossing, other than by bridges, are hindered by a 3km long gorge in the BUGAR mountains south of TRZACKA RASTELA and may be hampered north of that, where the valley widens to 2-3kms by several small streams and possible wet ground, especially in bad weather.

d. SANA. A tributary of the UNA. From PRIJEDOR downstream it becomes an obstacle, with a width of 75-130m, a depth of 1.5-3.5m and in some places it runs in a 100m wide valley. Upstream around PRIJEDOR and the artificial RIBNJAK lake the valley widens to the PRIJEDOR plain (30 x 10km) which has a branched drainage system, while further on there are swampy parts in between, so making off-road movements difficult. From PRIJEDOR the SAVA travels south in a valley approximately 2km wide without any bridges as far as SANSKI MOST (about 30km).

e. SAVA. A tributary of the DONAU and one of the most important rivers in the former Yugoslavia. From JASENOVAC/UNA mouth to near BREZOVO POLJE it borders with CROATIA/SLAVONIA and from there to BOSNASKI RACA/DRINA mouth it borders with SERBIA/VOJVODINA. It is a lowland river in a valley several kilometers wide with a branched drainage system and large swamps. Along the river the vegetation consists mostly of dense bushes or forests. Off-road movements are very limited; the floodplain is often wet until late spring. Dependant on high waters the course of the river may change. It is up to 100m in width with a depth of 4-12m and a current velocity which varies from 1-2.7m/sec. The river flows mainly close to the northern slope of the BOSNIA-HERZEGOVINA foothills but opens to the south like triangular gaps at the estuaries of major tributaries.

f. UNA. A tributary of the SAVA and from RUDICE to the mouth borders on CROATIA. A military obstacle; a wild mountain river downstream to BOSANSKA KOSTANJICA with several gorges or clefts, especially from UNA Klisura north of BIHAC plain to BOSANSKI KRUPA. The bottom is mainly gravel with rocks in parts, while the banks are 2-8m high. The water level is more or less constant except in the spring (thaw) and October/November. The depth varies although has a normal water level of 2-4m. The valley around BIHAC consists of a large basin (6 x 4km approx) with a smaller one at BOSANSKI KRUPA (1 x 2km approx) and widens from OTOKA downstream up to 2kms, while the width of the river varies from 80-175m. From BOSANSKA DUBICA to the mouth, the UNA - SAVA lowland plain is

often flooded and cross-country movement in the banklands are difficult, this also being the same in dry weather.

g. VRBAS. A tributary of the SAVA which allows access deep into the inner Bosnian mountains. A military obstacle; with a width of 60-110m and a depth of 1.5-3m. The bottom is generally of gravel with rocks in parts. High water is in spring and autumn with flooding in the SAVA lowland plains. The valley around BANJA LUKA and the VRBANA mouth opens up into a wide basin which narrows to 2km downstream, around KLASNICE, and widens again into the SAVA plain. Its lowest reaches are mostly covered in woods while the roads along the river are situated on dykes.

5. Upland areas. The uplands are broken in parts from NW to SE by the rivers UNA, VRBAS and BOSNA.

a. From KORANA to UNA. West of the UNA river numerous steep valleys with extended plains which have loamy soils with sinkholes are covered by dense bushes. Movements away from roads are not easily undertaken. Junctions are BIHAC and BOSANSKI NOVI, which are connected by a 6m asphalt road and a railway in the UNA valley which run closely together north of the BIHAC plain and around BOSANSKI KRUPA halfway to BOSANSKI NOVI. The hills surrounding the valley are up to 250m higher. BIHAC and BOSANSKI NOVI are connected by a 6m asphalt road to KARLOVAC and SISAK with a 4-5m asphalt road to NOVSKA respectively, all towns in CROATIA, and have connections to the motorways around ZAGREB. A secondary road (6m asphalt) connects BIHAC to VELIKA Kladusa in the north crossing the hills directly, but using small river valleys where possible.

b. From UNA to VRBAS. Between the rivers UNA and VRBAS the terrain is in generally more open but structured by some higher foothills eg. PASTIREVO (465m) and PROSARA (363m), a 20 x 6kms large isolated hill in the SAVA valley. Off the hills the country is easily passable. North of BANJALUKA the KOZARA PLANINA MOUNTAINS (976m) separate the SAVA lowland plains and the PRIJEDOR BASIN, a 30 x 10 kms wide plain with many streams, the artificial RIBNJAK lake and numerous isolated woods. The PRIJEDOR basins together with the SANA valley to the west creates a transit zone from BANJALUKA to BOSANSKI NOVI. The SANA valley is east of PRIJEDOR, about 2 kms wide, and becomes narrower some 100m upstream from BOSANSKI NOVI with the hills higher than 100m than the stream.

Main routes:

- (1) BANJALUKA - PRIJEDOR - BOSANSKI NOVI (7m, Asphalt).
- (2) BANJALUKA - BOSANSKI GRADISKA (30km) (7m, Asphalt) until KLASNICE in the VRBAS valley (1-2 kms wide) which then expands to the wide plain between the lower reaches of the VRBAS and the SAVA.
- (3) SANSKI MOST - PRIJEDOR (6m, Asphalt) - BOSANSKI DUBICA (MADZARI Pass 286m) (5m, Asphalt) - NOVSKA (CROATIA) (6m, Asphalt).

(4) PRIJEDOR - BOSANSKI GRADISKA (5m, Asphalt) and north of MRAKOVICA pass (804m) about 10 kms macadam.

c. From VRBAS to BOSNA. This area is quite similar to that between VRBAS and UNA as described above.

(1) Two foothill blocs - the MOTAJICA (652m) and the VUCJAC (368m) - give control of the SAVA valley in the north and the regional centres BOSANSKI BROD and SLAVONSKI BROD (CROATIA), two towns by the river SAVA where the valley is close to the SLAVONIAN foothills in the north. Down the north eastern slope of the MOTAJICA hill lies the small town of BOSNASKI KOBAS with the only bridge crossing the SAVA (to SLAVONSKI KOBAS) between BOSANSKI GRADISKA in the west and BOSANSKI BROD farther east.

(2) Civil ferry traffic crossing the SAVA is possible at:

- (a) MACKOVAC 6 km east of BOSANSKI GRADISKA
- (b) ORUBICA 10 km west of SRBAC.
- (c) SRBAC-DAVOR VRBAS mouth.
- (d) BOSANSKI DUBOCAC north of DERVENTA.

(3) With a shape like a quadrangle the area between VRBAS and BOSNA is surrounded by four major roads which mainly use the valleys of the most important rivers.

(a) In the west, the VRBAS valley from BANJALUKA to the SAVA widens from KLASNICE to its lower reaches to more than 25 kms in the LIJEVCE plain. This lowland is mainly put to agricultural use and has some minor woods. The fluvial plain of the VRBAS itself is covered by woods along the river.

Roads:

- i. BANJALUKA - KLASNICE - LAKTASI - N. TOPOLA - BOSANSKI GRADISKA (7m, Asphalt). As far as KLASNICE there are two parallel roads.
- ii. N. TOPOLA - SRBAC (6m, Asphalt).
- iii. KLASNICE - MILOSAVCI - SRBAC (4m, Asphalt).
- iv. LAKTASI - KUKULJE (4m Macadam) CRNAJA - SRBAC (4m Asphalt) until CRNAJA at the 6m road N. TOPOLA - SRBAC.

(b) In the north, the SAVA is the border between B-H and CROATIA (SLAVONIA). The foothills reach the

river in several places while between them runs the road from SRBAC to DERVENTA.

Roads:

- i. SRBAC - BOSANSKI KOBAS (6m, Asphalt).
- ii. BOSANSKI KOBAS - BJELO BRDO - DERVENTA (5m, Asphalt, from BJELO BRDO onwards 6m)

(c) In the east, the BOSNA is the throughway from the SAVA valley to SARAJEVO. The roads use both sides of the river:

Eastbank:

- i. BOSANSKI SAMAC - MODRICA (Route No 17) (7m, Asphalt).
- ii. MODRICA - KOPRIVNA (5m, Asphalt).
- iii. KOPRIVNA - KOZUHE (4m, Asphalt).
- iv. KOZUHE - DOBOJ (5m, Asphalt).
- v. DOBOJ - MAGLAJ (6m, Asphalt).
- vi. MAGLAJ - ZAVIDOVICI (3m, Macadam).

Westbank:

- i. BOSANSKI SAMAC - JAKES (MODRICA) (6m, Asphalt).
- ii. JAKES - DOBOJ - MAGLAJ (Route No 17) (7m, Asphalt).
- iii. MAGLAJ - ZEPCE (to the LESNIJA valley) (8m, Asphalt).

Roadbridges are at BOSANSKI SAMAC, MODRICA, DOBOJ, MAK LJENOVAC (USORA river), MAGLAJ and ZEPCE; a road tunnel is at MAGLAJ.

(d) In the south, the road from BANJALUKA to DOBOJ can only use the valleys in the west (VRBANJA) and in the east (USORA) while in between the 868m high SOLILA pass, between the UZLOMAK mountains (PRDELJICA 1002m) and the BORJA mountains (V. RUNJAVICA 1078m), has to be crossed. The VRBANJA valley narrows north of CELINAC, between KOTOR VAROS and VRBANJCI, and around DRAHOVA/KRUSEVICA very close to the mouth so there is no space between the mountains and the river except for the road. From DRAHOVA to the east the narrow KRUSEVICA valley widens around MASLOVARE before the road has to climb to the pass. To the east, the USORA valley is mainly open, with several small rivers coming down

from the surrounding hills, but narrows north of TESLIC.

Roads:

- i. BANJALUKA - CELINAC (7m. Asphalt).
- ii. CELINAC - DRAHOVA - MASLOVARE (6m. Asphalt).
- iii. MASLOVARE - PRIBINIC (4m. Macadam).
- iv. PRIBINIC - TESLIC - DOBOJ (7m. Asphalt).

Main bridges at:

BANJALUKA/VRBANJA and KOTOR VAROS(2) in the VRBANJA valley and MAK LJENOVAC in the USORA valley. The hills alongside the road are partly without woods but there are dense woods around the SOLILA pass.

(e) In the middle, the road from KLASNICE to DERVENTA with connections to BOSANSKI BROD and BUKOVAC (DOBOJ) respectively, uses the UKRINA valley and its tributaries as far as possible and separates the MOTAJICA hill in the north from the BOSNIAN mountains. The road KLASNICE - DERVENTA - BOSANSKI BROD is 6m asphalt in total while DERVENTA - BUKOVAC/SESLIJA is 7m asphalt. From KLASNICE to the east the road crosses the hills between the smaller rivers TURJANICA and CRKVENA reaching the LISNJA-UKRINA valley system with many streams and the artificial PRNJAVOR lake northwest of PRNJAVOR town, the junction between the afore mentioned road and minor streets (partly 3m macadam) to TESLIC in the south.

d. From the BOSNA to the DRINA, the countryside continues to be quite similar. The foothills of TREBAVAC (694m) and MAJEVICA (916m) separate the SAVA lowlands in the north from the SPRECA valley which extends NW-SE similar to the SAVA valley and is an excellent throughway from DOBOJ, in the BOSNA valley, to ZVORNIK, in the DRINA valley. Further to the south, the high OZREN hills (915m) and JAVORNIK (1019m) are the transition to the high mountains of Inner BOSNIA. The SPRECA valley itself is cut into the mountains to about 400-800m. In the north, between MODRICA, where the BOSNA flows into the lowlands, BRCKO and around BJELJINA, are large plains from the foothills to the SAVA which are partly covered by woods but with a relatively good net of minor roads. Close to the SAVA are swampy areas which are in danger of flooding being caused by many streams and the old SAVA arms.

Roads:

- (1) BOSANSKI SAMAC - DOBOJ - MAGLAJ. Described above.
- (2) DOBOJ - BUKINJE/TUZLA (7m, Asphalt) on the north side of the valley. 3-4m, Macadam/Asphalt respectively, in the south of the valley. The valley is up to 3 km wide and narrows only close to DOBOJ where the SPRECA flows through a 3 km long gorge and around LUKAVAC and BUKINJE. The SPRECA itself often has high banks.
- (3) BUKINJE/TUZLA - KLADANJ (7m, Asphalt). The road uses the GOSTELJA valley and ascends to the MOSULJ pass (710m) before reaching the small basin around KLAJDANI. The hills along the road are mostly wooded. This road extends to SARAJEVO.
- (4) BUKINJE/TUZLA - ZVORNIK (6m, Asphalt). The road travels along the slope to the wide upper SPRECA valley crossing the southeast end of the MAJEVICA mountains before ascending to the DRINA valley.
- (5) BJELJINA - BANJA KOVILJACA - ZVORNIK has at least a 6m asphalt road which runs mostly on the SERBIAN side in the DRINA valley which has numerous woods along the river and its arms so that crossing off-road bridges is very difficult. This road extends in the upper DRINA valley to BRATUNAC and BAJINA BASTA. The valley is 1-2 km wide with limited connections south into the mountains, most of them 3m wide with macadam.

INNER BOSNIA

6. Like a triangle, the High Mountains of INNER BOSNIA are the centre of BOSNIA-HERZEGOVINA which borders in the north to the NORTHERN UPLANDS, approximately along the line BIHAC - BANJALUKA - ZAVIDOVICI - VLASENICA - BAJINA BASTA and reaches, in the south, to the line SANSKI MOST - KUPRES - JABLANICA - national road 17/PAZARIC - FOCA; the main city is SARAJEVO.

7. INNER BOSNIA is an area mostly higher than 1000m, in the south and southeast to more than 2000m, with its highest peak between SARAJEVO and BUGOJNO, the NADRSTAC (2112m) in the VRANICA mountains. It is very rough country and difficult to pass due to several mountain blocks which stretch NW-SE while numerous rivers also flow in the same direction. These blocks are mostly densely wooded, partly with alpine pasture, while in the main the open parts of the valleys are populated. In the mountains the conditions for both off-road movement and observation are bad. There are numerous small rivers and streams in the Inner Bosnian mountains, some of them followed by minor roads (3m macadam) or tracks.

8. Major basins or plains and are limited in numbers; a 13 x 3 km side swampy one with several rivers is northwest of MRKONJIC - GRAD, and there are others around KUPRES and SARAJEVO. In the western part of Inner BOSNIA the river VRBAS at JAICE has such a narrow valley that the road is very restricted between the river and the

steep face of the mountains and is easy to close. In addition, the rivers PLIVA and UGAR also have very deep canyons in places. In between the rivers are some high Karstic plateaus with limited water resources and are therefore thinly populated.

9. Farther to the east, to the upper reaches of BOSNA and DRINA, are high hills with woods and lower sections between in which movement is better in places. In several wider parts of the valleys there are urban centres eg. BUGOJNO, in the upper VRBAS; ZENICA, TRAVNIK and VISOKO in the BOSNA valley and its tributaries; FOCA and GORADZE in the DRINA valley.

10. In the middle is the large SARJEVO basin with the town on the eastern part in the MILJACKA valley where most of the roads to Inner Bosnia come together. In the south, the TREBEVIC mountain (1629m) towers above the town.

11. Main Rivers:

a. BOSNA. Crosses the middle of Inner Bosnia from the SARAJEVO basin to the north. It is a wild mountain river with a width of 40m from the source and widens to 100m around ZENICA then varies from MAGLAJ downstream, between 80-185m, with banks of 2-8m high. The current velocity is 1-2m/sec. The bottom is gravel and partly rocky. Highwater is mainly in spring and autumn whilst the lowest levels are normally in December/January. The width of the valley varies; the SARAJEVO basin is 10 x 7km wide with several watercourses and partly a danger of flooding. Downstream it narrows to a very close valley which has room for only the river and the road alongside. The river then widens to smaller basins at ILIJAS - VISOKO, around ZENICA and ZEPCE.

b. CEHETINA. In the southeast is a tributary of the DRINA and flows into it at FOCA. Its width is about 50m, but in the lower reaches this expands to up to 150m. The bottom is of gravel and sand respectively at a depth of 0.3-2.5m. Highwaters are in spring and autumn.

c. DRINA. A mountain river with several artificial lakes and which forms the border with SERBIA from north of KAMENICA. Major parts of the valley are without roads. Its width at FOCA is 110m, to USTIPRACA 60-135m and then downstream 80-125m. The depth to FOCA is 2-5m, then downstream it is 1.7-4.5m, not taking into account artificial lakes. The current velocity is 1.2-2.2m/sec. Highwaters, which normally last only a couple of days, are in April, October and November. The banks are mostly rocky and some meters high, but are partly flat and easily flooded.

d. LIM. Its width varies extremely between 20 and more than 100m. Its depth is from 0.6-2m, but in the lower reaches partly up to 6m. Low water is September to November, January and February with highwater mainly in spring. The lower reaches of the LIM valley are very narrow although a little wider upstream from OBRVENA to UVAC/UVAC mouth; it is difficult to pass through.

e. PRACA. A western tributary of the DRINA with a width of up to 40m and a depth of 1.5-3m. The valley is deep, cuts into the mountains with a rocky bottom and steep banks and is used for roads only in a short section in the upper reaches.

f. SANA. In the far west of INNER BOSNIA, it is a tributary of the UNA. It is the border to the Karstic Alps and has from its spring to the transition to the northern uplands at SANSKI MOST a quite narrow valley which widens south of SANSKI MOST to a wide but partly swampy one. Its width is up to 100m with a depth of 1.5-3.5m.

g. VRBAS. In the west it is, besides the BOSNA, the main valley to open INNER BOSNIA, with connections from the SAVA lowlands in the north to the Adriatic Coast at PLOCE using the NERETVA valley and the MAK LJEN pass near PROZOR in between. Also, one major road from SPLIT to SARAJEVO uses the VRBAS valley from BUGOJNO upstream. Its width is about 30-60m with a depth up to around 2m.

12. Main Roads:

a. BANJALUKA - JAICE - BUGOJNO - JABLANICA (6m, Asphalt). Partly in the very close VRBAS valley, crossing the RADUSA mountains north of PROZOR (MAK LJEN pass 1129m) and descending to the NERETVA valley.

b. MAGLAJ - ZENICA - SARAJEVO (8m, Asphalt). Main connection from the SAVA valley in the north to SARAJEVO in the BOSNA valley; some tunnels in the northern part, partly parallel roads (5m, Asphalt).

c. ZVORNIK - MILICI - VLASENICA - POGLED pass (1193m) - PODROMANIJA - SARAJEVO (6m, Asphalt). From the DRINA valley (SERBIAN border) to the Bosna crossing there are mountains with enormous differences in altitude and some narrow defiles e.g. north of SOKOLAC.

d. PODROMANIJA - USTIPRACA - VISEGRAD (6m, Asphalt). Crossing the mountains to the DRINA valley in the southeast and further to SERBIA.

e. ZENICA - TRAVNIK - BUGOJNO (6m, Asphalt). Using partly the LASVA valley but crossing the heights via the KOMAR pass (927m) between the KOMAR mountains (KAMENJAS 1510m) and the RADALJ mountains (1310m).

f. BUGOJNO - KUPRES (7m, Asphalt). The road continues to LIVNO - SINJ - SPLIT.

g. JAICE - KLUC (6m, Asphalt). The connection to BIHAC in the west using the JASEVKA and partly the SANA valley and crossing the mountains via 2 passes (see next chapter).

KARSTIC ALPS

13. The KARSTIC ALPS are the next to the southwest, a highland separating the High Mountains of Inner Bosnia from the narrow

strip of the coastal lowlands. The rugged Karstic Highlands alternate between plateaus, some of them very extensive, and many smaller valleys. Surface water is very rare and limited to smaller basins, however these have plenty of water. There are no major rivers except the CETINA. The ground is partly covered with loamy soils but wide areas have chalky rocks only or debris. Woods are rare but have well spread dense bushes. The western part of the highlands consists of numerous long karstic plateaus with an average height of 1300-1500m. On top of them are several crests and mountains up to 2000m. Between these plateaus are long basins between 700m and 1100m approximately with gravel and alluvial soils covered by pasture and often flooded in wintertime.

14. Main basins are:

- a. LIVAJNSKO POLJE (approx 50 x 10 km).
- b. GLAMOČKO POLJE (approx 30 x 5 km).
- c. KUPRESKO POLJE (approx 25 x 5 km).

15. As well, the southeastern highlands, the HERZEGOVINA, stretch NW-SE. The karstic plateaus between deep basins are difficult to cross, too, but are not so high as in the west. Contrary to that the NERETVA valley crosses the highlands to the Adriatic Sea and is of great importance for the traffic to the coast. However the road can be blocked in several areas because of the narrow valley. In the lower reaches of the NERETVA and around the rivers TREBIZAT and BREGAVA are several floodland plains between the plateaus. The vegetation is poor, mostly bushes and undergrowth, some meadows; larger timber woods are missing. Several basins have smaller rivers which have no surface mouth but disappear into sink holes. To the north, the Dinaric Alps connect the highlands with the Inner Bosnian mountains. This is not a single massive block but several smaller mountains, some higher than 2000m, and plateaus between them at heights of 1400-1700m which can be used for crossing.

16. Main rivers:

- a. BREGAVA. Tributary of the NERETVA. The bottom is stony, in the lower reaches muddy. The banks are often steep but swampy if low. The width is 40 to 50m, the depth varies between 0.6 and 1.5m.
- b. BUNA. Tributary of the NERETVA. Width 60 to 80m, depth 0.6 to 1.5m.
- c. CETINA. Inflow to the Adriatic Sea. Bottom quite different of rock, gravel and mud, the banks partly swampy. The width in the upper reaches is 30-50m with an artificial lake near VRLIKA and widening to 75-90m upstream of TRILJ, and downstream of TRILJ narrowing to approximately 20m. The depth is 0.6-1.6m in the upper reaches and 1.6-2.5m in the lower ones. Highwater occurs in spring and autumn.
- d. NERETVA. Inflow to the Adriatic Sea. The bottom is rocky (upper reaches) of gravel (middle part). The banks are

high in the upper reaches but flat and swampy in the lower ones. Around MOSTAR the banks are steep and 6-12m high.

e. TARA. One of the source rivers of the DRINA and the border with MONTENEGRO having a width of approximately 30m and depth of 1m or more. The bottom is of gravel; the valley is very narrow and deep; the banks are the mountains alongside (300m-700m high).

f. TREBIZAT. A tributary of the NERETVA. The bottom is of rocks and gravel respectively while the lower reaches are muddy. The rocky banks are often high. The width is up to 50m with a depth up to 1.3m. Highwater is after thaw and heavy rain.

g. UNA. The UNA flows from the spring to BIHAC through the Karstic Highlands. Its valley is swampy in the upper reaches around SRB but downstream becomes very narrow then widens again south of BIHAC. The width varies (some 100m) with a depth of 2-4m approximately.

17. Main roads:

a. BIHAC - RIPAC - BOSANSKI PETROVAC - KLJUC (National road No 5) (6m, partly 7m Asphalt). Parallel 4m Macadam. BRUSOVAC Pass (791m), SRNETICA (797m) and LANISTE Pass (717m).

b. BOSANSKI PETROVAC - KNIN (6m, partly 7m Asphalt). North of KNIN from the BUTIZNICA valley to BOS GRAHOVO series of bends and also around TITOV DRVAR. Crossing the mountains via three passes: OSTRELJ (1031m), KORITA (985m) and DERALA (965m).

c. RIPAC - KNIN (6m Asphalt). From SRB to KNIN 4m Macadam. From SRB connection to RESANOVCICI in the east (major road to KNIN) with 3m Macadam. BIROVACA Pass (775m).

d. KUPRES - SINJ (7m Asphalt). Part of main route SPLIT - SARAJEVO crossing the mountains. VUKIC (731m) and MALOVAN Pass (1144m).

e. BOSANSKE GRAHOVO - LIVNO (6m Asphalt). Crossing the large LIVANSKO POLJE plain.

f. JABLANICA - METKOVIC (6m Asphalt). In the part narrow NERETVA valley. Main connection from SARAJEVO to the Adriatic Coast.

g. FOCA - DUBROVNIK (6m Asphalt). From FOCA in the valley of the DRINA and the SUTJESKA respectively and crossing farther south several mountain ridges with passes up to 1293m (CEMERNO).

h. (SINJ) - TRILJ - CISTA - IMOTSKI - KOCERIN - MOSTAR - NEVESINJE - GACKO (7m Asphalt). Between CISTA and KOCERIN 4m Macadam. Mainly in the NW-SE basins between the mountain ridges. Crossing the NERETVA at MOSTAR, passing the BUNA

basin south of MOSTAR and crossing the mountain ridges to the east (GREBAK pass 1093m, VRANIC Pass 715m).

j. PLUZINE - ULOG - DOBRO POLJE. To ULOG 4m Macadam followed by 6m Asphalt. Bypassing the NERETVA gorge north of MOSTAR. MORINE Pass 1255m.

THE ADRIATIC COAST

18. The Karstic mountains reach the Adriatic Coast in most places and generally tower very steeply above the surrounding areas. Between ZADAR and SIBENIK (KOTARI peninsula) and at the NERETVA mouth are coastal lowlands which are surrounded by hills before the steep transition to the highlands.

19. Only a few rivers break through to the coast, but with very steep gorges. The major road traffic is limited to the main road following the coastline, some minor roads in the coastal lowlands and a few roads sufficient in construction into the highlands.

20. Main rivers:

a. CETINA. Flows into the Adriatic Sea by OMIS. Mainly in the highlands it only flows for a few kms in the coastal areas. It has a width of up to 25m and a depth of up to 2.5m. There are main road crossings in OMIS and ZADVARJE.

b. CIKOLA. A tributary of the KRKA. The bottom in the upper reaches is sandy-muddy while downstream of DRNIS it is of gravel with banks of up to 150m high. Its lower reaches are dammed with a width up to 15m (highwater up to 25m); the depth is generally about 1m but varies and the river may dry up in summer.

c. KRKA. A coastal river from the KNIN basin to the wide estuary at SIBENIK. Between there and SKRADIN it widens to a lake which is dammed upstream of SKRADIN. The valley in the upper reaches is very narrow. At KNIN the width is 35-50m and with a depth of approximately 1m; in the lower reaches this becomes 2-6m.

d. ZRMANJA. Flows into the NOVIGRAD bay NE of ZADAR. It is a river in a steep valley (sides up to 300m high) with a width downstream to OBROVAC of up to 40m extending to 80m. In the upper reaches it is very shallow but in the lower areas it is 3-4m deep.

21. Main Roads:

a. ZADAR - SPLIT - DUBROVNIK (6m, partly 8m Asphalt). Coastal road connecting the main ports.

b. ZADAR - OBROVAC - GRACAC (7m Asphalt). Main road to ZAGREB.

c. SIBENIK - DRNIS - KNIN (6m Asphalt).

- d. SPLIT - SINJ (8m Asphalt). Main road to SARAJEVO. Pass 355m.
- e. PLOCE - METKOVIC - MOSTAR (5m, from METKOVIC 7m Asphalt). Main road to SARAJEVO BANJALUKA respectively using the NERETVA valley.

Subject: Main aspects of terrain and Climate conditions

Introduction:

Aim - the aim of this report is to provide a general view of the terrain and climate conditions in CROATIA, B-H and MACEDONIA.

General - This document provides the reader with a basic understanding of geographic characteristics of former Yugoslavia.

This report is divided in two specific parts:

1. Main aspects of terrain
2. Climate conditions

I. Main aspects of terrain:

a) UNPROFORs area of operations comprise the Republic of Croatia, the Republic of Bosnia and Herzegovina as well as the former Yugoslavian Republic of Macedonia. It therefore offers various types of landscapes varying from broad river valleys (Sava in Croatia) to rugged mountains in Bosnia and Herzegovina.

Very briefly the most important aspects to determine the effects on the deployment of troops are:

b) Significant regions = (see fig 1)

- The Julian Alps to the North consist of impermeable bedrock which has resulted in steep mountains with deep valleys or gorges giving a rugged nature. These mountains are high, the highest being at 2393 m above sea level.

- The Dinaric Alpine region is a series of transverse mountain ridges that parallel the Adriatic coast line (the Karst) this region is characterised by numerous disappearing streams and ponors; vegetation filled depressions or sinkholes that can sink as much as 10 m into the ground; and an extensive network of caves and caverns. This rough and generally barren area of hills and ridges ranging from 300 to 2500 m in height cover 60% of the country.

Volcanically unstable, some volcanic rock is also interspersed in this region. The mountains that face the Adriatic are steeper than those that face the Pannonian Plain, as they "taper off" towards the east.

- The South Eastern Serbian highlands, which are an extension of the Balkans, are rolling mountains.

- The Pannonic Plains of northern Yugoslavia and southern Hungary were formed by the draining of the ancient Pannonic Sea. This extension of Rumanian Plain consist of low rolling hills and sand dunes.

- The Macedonian Plains are a low lying flatland.

- The Vardar River valley, being less rugged than the highlands in both sides, cuts a path between the Dinaric and East Serbian highlands, helping form a national trade route through the mountains joining the plains with the coast.

- The Adriatic coastal zone (Dalmatia) is characterised by deep gulfs, bays and inlets with limestone spurs forming capes. They are over 1000 islands off the coast.

c) **Drainage:** (see fig 2)

Former Yugoslavia has more lakes and rivers than any other country in Europe. The rivers can be divided into two groups: those whose entire course is normal and continuous from source to mouth and those which flow above ground for some way and disappeared underground. The latter are mostly found in the Karst region.

d) **Vegetation:**

The vegetation in Yugoslavia is as varied as any other aspect country. Differences in climate, topography, soils and people all affect vegetation. Generally one half of the country is used for agriculture, one third is forest covered and the remaining land is barren.

e) Surface Materials:

In general the surface is made up of bedrock and thin soils in the highlands and deeper fertile soils in the flatlands. Throughout the ground is littered with boulders and rocks.

II. CLIMATE

The climate in the area of operations will also confront the troops with a number of aspects that are of great influence on living and operating conditions.

- Yugoslavia lies in the Southern part of the Northern Temperate Zone and experiences three different types of climatology:

- Mediterranean along the west Adriatic coast;
- Alpine in the high altitude Julian and Dinaric Alps; and
- Continental across the Pannonian Plain.

a) PRECIPITATION

Including rain and snow varies considerably from one part of the country to another. Annual precipitation ranges from 500 mm, on the inland plains, to 1900 mm, on the higher mountains. On the coast, the maximum precipitation occurs during the winter season between October to April. Overall, the Alpin region experiences the maximum precipitation for the country and is steady throughout the year. The Pannonian Plains experience their maximum precipitation during the late spring or early summer.

b) TEMPERATURE

Temperatures throughout the plains can vary from over 33° C to -25°C and they are greatly affected by the prevailing winds in this area. The Mediterranean coast receives a much more stable climate that ranges from 37°C to -8°C. Finally, in the Alpine region the temperatures stay mostly cool in the summer and cold during the long winter that this region experiences.

c) WINDS

Prevailing winds during the winter are from the north and north-east bringing with them cold weather and snow. In the spring, the country is warmed by south and south-westerly winds.

d) STORMS

Reinfall during the fall and snowstorms during the winter are experienced in the highlands. Snowstorms across the Pannonian Plains are light but frequent throughout the winter.

CONCLUSION

In general the manoeuvring on the plain is easy but reduced by rivers and streams and it is difficult to deploy units in coastal zone Adriatic and in Vardar River Valley due to the narrowness of these zones.

In mountains zones (Alps Dinaric, Macedonian and East Serbian highlands) it is difficult or impossible to deploy units due to the steep mountains, deep valleys or gorges, sink holes, depression filled by vegetation, altitude and climate very cold in winter.

The roads are mainly narrow and in bad conditions except in plains. The mountains are a good area for ambushes and skirmishes, favourite type of combat for natives.

Concerning air operations, except the problem of steep mountains and deep valleys it maybe difficult to fly in winter with rain, snowstorm and in plain with the fog. In summer the heat in plain maybe also a problem.

All units operating in this terrain require heavy equipment and material in order to operate in these cold and rugged conditions during the winter. The ability to pass units and equipment through the area is dictated by the terrain and climatic conditions.

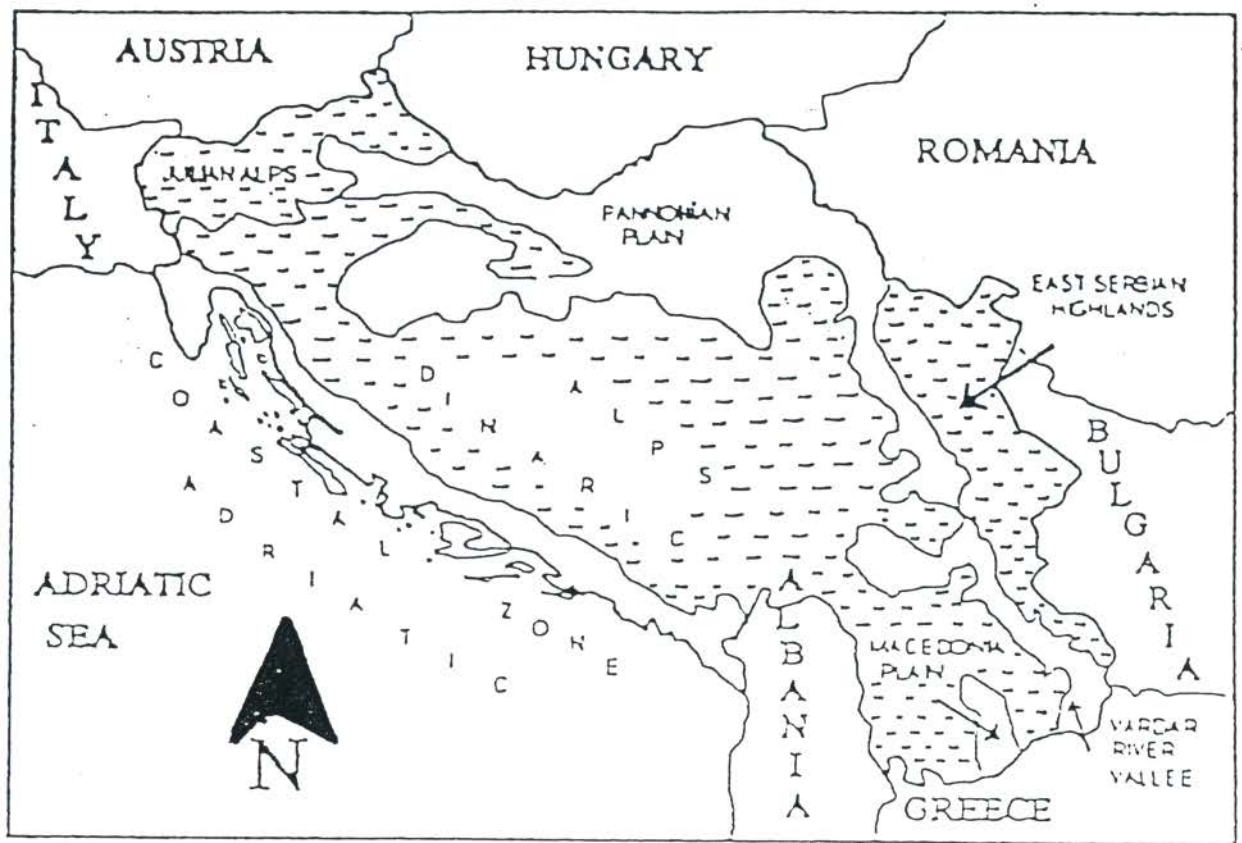


Figure1 Physiographic Regions

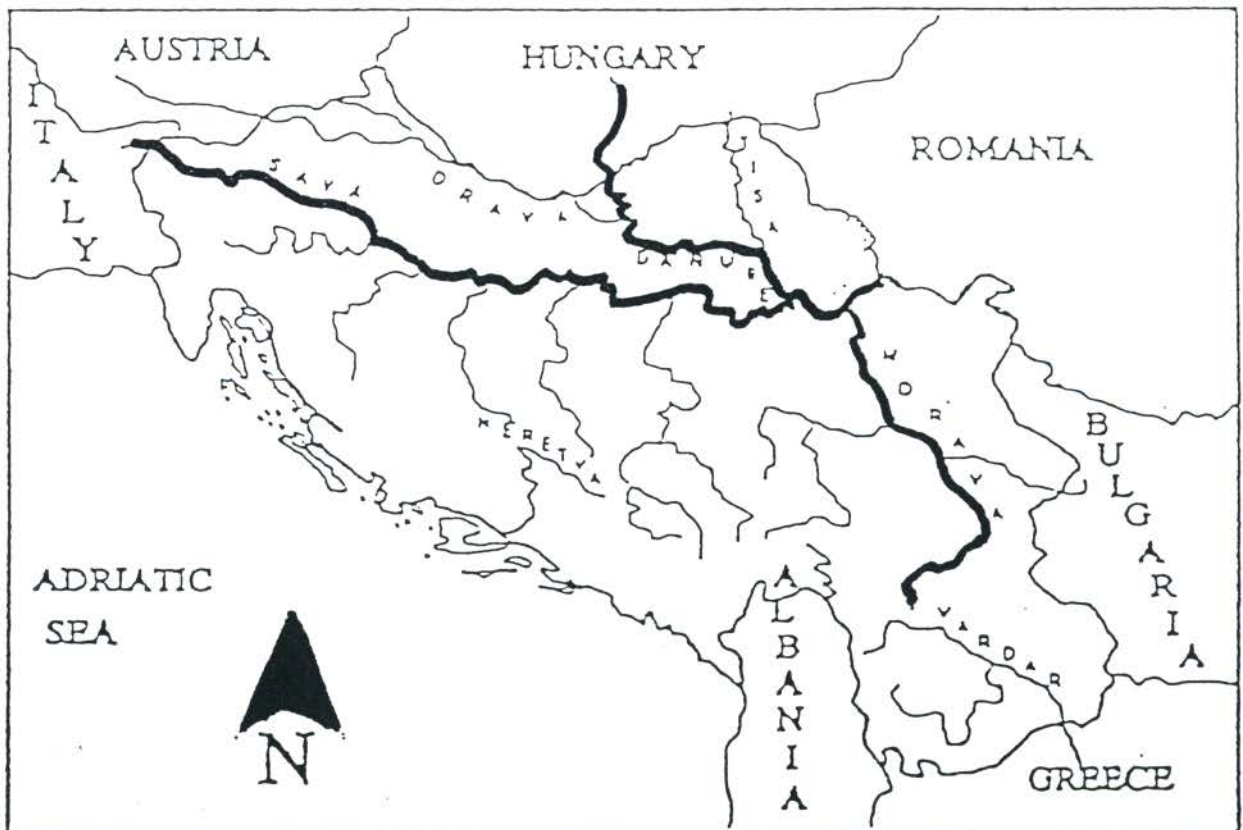


Figure2 Drainage

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MAPPING AND CHARTING ESTABLISHMENT

TERRAIN ANALYSIS SECTION

ANALYSIS OF AREA OF OPERATION



FEDERAL REPUBLIC OF YUGOSLAVIA

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TOPOGRAPHIC SQUADRON

TERRAIN ANALYSIS SECTION

ANALYSIS OF AREA OF OPERATION

FOR THE FEDERAL REPUBLIC OF YUGOSLAVIA

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INTRODUCTION

1. Aim. The aim of this report is to provide a Strategic Geographic Intelligence Report to support contingency planning for Yugoslavia.
2. General. This document provides the reader with a basic understanding of the geographic characteristics of Yugoslavia. This report is divided into three specific parts: Terrain, Weather and Sociology.

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3. Limiting Considerations. This report was prepared using primarily historical reference material, documents, maps, charts and various technical references. Because the material available is dated, some of the details enclosed could be inaccurate or incomplete. The Mapping and Charting Establishment Terrain Analysis Section will welcome any comments that could update or improve this report.

PART 1 - TERRAIN

GENERAL DESCRIPTION OF THE AREA

4. General. Yugoslavia is a Federal Republic in south-eastern Europe, on the eastern shores of the Adriatic Sea. It is located between the Latitudes N42° and N47° and Longitudes E12° and E24° (see figure 1). Situated in the north-western part of the Balkan peninsula, it is bounded by Italy in the north-west, Austria and Hungary in the north, Romania and Bulgaria in the east and Greece and Albania in the south. Yugoslavia covers an area of approximately 255,804 km (one quarter the size of Ontario).



Figure 1

YUGOSLAVIA

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TERRAIN - NATURAL FEATURES

5. Physiographic Regions. Yugoslavia is an earthquake prone area and is one of Europe's most mountainous countries with two major alpine systems covering 60% of the region. The Julian Alps in the north-west corner contain Yugoslavia's highest elevations and are a direct extension of the Italian and Austrian Alps. Continuing south-east along the Adriatic



Figure 2 Physiographic Regions

through Albania to Greece are the Dinaric Alps or Dinaric Alps which are known for their Karst topography. The topography which was named after this region is characterized by underground drainage and a network of caves and cavities caused by the dissolution of sedimentary limestone bedrock. These Dinaric Alps (see figure 2) divide the western Adriatic Coastal Zone from the north-eastern Pannonian Plains which cover 20% of Yugoslavia. The East Serbian Highlands in the south-east form a natural barrier with Bulgaria and a watershed for the Vardar River valley. The valley is a natural

passage which links the Pannonian Plains in the north with the Macedonian Plain in the south. The significant regions are as follows:

a. mountain ranges include:

- (1) Julian Alps, at the top, north-west corner of the country, high mountains (all over 1000m in height) comprising 20% of the country;
- (2) Dinaric Alps, form the spine of Yugoslavia, from the Julian Alps in the north-west to the Macedonian Plain in the south-east;
- (3) East Serbian Highlands, on the south-east border with Bulgaria;

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b. plains include:

- (1) Pannonian Plains, including the lower reaches of the Sava and Morava rivers, at the north-east corner of the country; and
 - (2) Macedonian Plains, at the southern end of Yugoslavia bordering on Greece;
- c. the Vardar River Valley which links the Pannonian and Macedonian Plains; and
- d. the Adriatic Coastal Zone, which is a narrow strip of land on the western edge of Yugoslavia between the Dinaric Alps and the Adriatic.

6. Surface configuration. Yugoslavia's landmass is a mixture of steep rugged alpine mountains and highlands, rolling plains, and wide river valleys.

- a. The Julian Alps to the north consist of impermeable metamorphic bedrock which has resulted in steep mountains with deep valleys or gorges giving a rugged nature. These mountains are high, the highest being at 2393 m above sea level.
- b. The Dinaric Alpine region is a series of transverse mountain ridges that parallel the Adriatic coastline. This area is also known as the Karst. Karst topography was named after this region and it is characterized by numerous disappearing streams and ponors; vegetation filled depressions or sinkholes that can sink as much as 10 m into the ground; and an extensive network of caves and caverns. This rough and generally barren area of hills and ridges ranging from 300 to 2500 m in height covers 60% of Yugoslavia and contains venomous snakes. Volcanically unstable, some volcanic rock is also interspersed in this region. The mountains that face the Adriatic are steeper than those that face the Pannonian Plain, as they 'taper off' towards the east.
- c. The south-eastern Serbian Highlands, which are an extension of the Balkans, are rolling mountains.

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- d. the Pannonic Plains of northern Yugoslavia and southern Hungary were formed by the draining of the ancient Pannonic Sea. This extension of the Romanian Plain consists of low rolling hills and sand dunes.
 - e. The Macedonian Plains are a low lying flatland.
 - f. The Vardar River valley, being less rugged than the highlands on both sides, cuts a path between the Dinaric and East Serbian highlands, helping form a natural trade route through the mountains joining the plains with the coast.
 - g. The Adriatic Coastal Zone (Dalamatia) is characterized by deep gulfs, bays and inlets with limestone spurs forming capes. There are over 1,000 islands off the coast. These were formed when the water level of the Adriatic sea rose, flooding the valleys and leaving just the peaks of the mountains exposed. This is one of the best examples of "drowned" topography in the world.
7. Drainage. Yugoslavia has more lakes and rivers than any other country in Europe (see figure 3 for major drainage pattern). The rivers can be divided into two groups: those whose entire course is normal and continuous from source to mouth and those which flow above ground for some way and suddenly disappear underground. The latter are mostly found in the Karst regions.

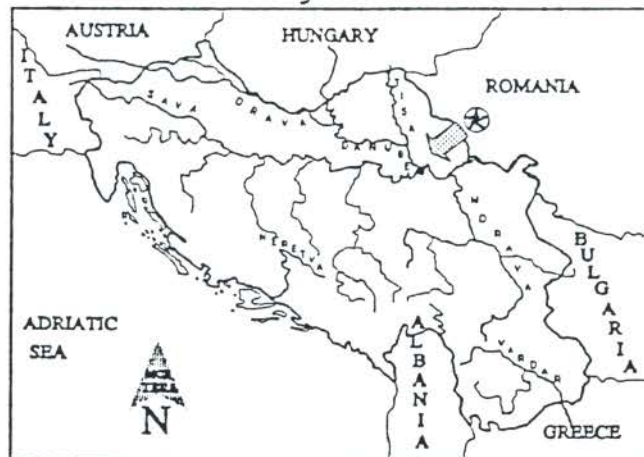


Figure 3 Drainage

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- a. The majority of precipitation on the impermeable bedrock of the Julian Alps is dispersed as surface run-off. The water flows quickly through deep and often very steep gorges, causing rapids and waterfalls. There are a number of small glacial lakes in this region.
- b. The watershed of the Dinaric region is a complex combination of fast moving surface streams that twist and turn their way down the mountain slopes and underground channels that have cut their way through the limestone bedrock. Several main tributaries of the Danube River have their sources in this area. Generally these have swift and irregular courses. During the wet season, a fair amount of surface water will collect in the ponors where impermeable clays have collected and plugged the underground channels. It eventually seeps into the underground network occasionally emerging in springs near the Adriatic shore but usually emptying into the Adriatic below the surface.
- c. The Serbian Highlands have characteristics similar to, but less severe than, the Julian Alps.
- d. The Pannonian Plain contains the Danube River, the largest river in Yugoslavia, draining two thirds of the country's area to the east out of Yugoslavia and eventually into the Black Sea. It is a wide river, ranging from about 900 m to 3 km, and can have depths of 15 m or more. Its flow is regular. The tributaries of the Danube normally also have normal flows through this relatively flat terrain. The major tributaries are:
 - (1) the Sava with its large south shore tributaries that drain the greater part of the Dinaric Alps:
 - (a) Kupa,
 - (b) Una,
 - (c) Vrbas,
 - (d) Bosna, and

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- (e) Drina;
 - (2) the Morava that reaches deep into central Serbia;
 - (3) the Drava, which forms part of the boundary with Hungary; and
 - (4) the Tamis that reaches into Romania.
- e. The Vardar river drains the eastern part of the Dinaric Alps and the western part of the Serbian Highlands into the Aegean Sea. This river and its tributaries generally have fast moving courses especially in the upper reaches.

8. Vegetation. The vegetation in Yugoslavia is as varied as any other aspect of the country. Differences in climate, topography, soils and people all affect vegetation. Generally one half of the country is used for agriculture, one third is forest covered and the remaining land is barren.

- a. The mountainous areas support extensive forests. Pine, fir and junipers can be found on the highest areas, beech predominates the middle elevations along with hornbeam, plane and lime, while the lower regions tend to support deciduous types such as oak. Large areas of the Karst are barren and on the gentler northern slopes of the Dinaric ranges large lush pastures support livestock rearing.
- b. The plains and wide river valleys support most of the country's agriculture. The most important crop is maize, however, wheat, sugar beets, sunflowers (primarily for edible oils) fruits and vegetables are also grown. The pannonian plain is the largest fertile farming area and in a good harvest year can feed the entire population. Other predominate farming regions include:
- (1) the Vardar River valley,
 - (2) the Morava River valley,
 - (3) the Kosova lowlands, and

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(4) the Neretva River valley.

- c. Tropical varieties of plants such as cotton, opium poppies and rice are grown on the Macedonian Plains. Tobacco is also grown in the sandy areas of Macedonia.
- d. Along the Adriatic coastline vegetation is sparse, there is however some grapevines, olive trees and citrus fruit orchards.
- e. Vineyards can be found in almost all parts of the country.

9. Surface Materials. In general the surface is made up of bedrock and thin soils in the highlands and deeper fertile soils on the flatlands. Throughout the land the ground is littered with boulders and rocks.

- a. The Julian Alps consist of igneous and metamorphic rock that is covered with a leached podzolic soil.
- b. The Dinaric Alps are made up of exposed limestone bedrock and thin layers of red clay soil. The soil is poor and consists of a heavy clay called Polja.
- c. The Serbian Highlands are composed of igneous and metamorphic rock covered with a granular gravel soil.
- d. The Pannonian Plains features deep soil which were deposited from the ancient Pannonian Sea, and covered with wind blown loess. This type of soil may be difficult to manoeuvre on during the wetter season. Today the Pannonic Plain is the most fertile region of Yugoslavia.
- e. The Macedonian Plains consist mostly of hard alluvial clay deposited from the surrounding highlands with pockets of courser sands and gravels.
- f. The Vardar valley consists of deposited materials eroded from the surrounding mountains that provide useful agricultural areas.

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- g. The Adriatic Coastal area has much exposed limestone with thin clay soil and stony gravel beaches.

MANMADE FEATURES

10. Population Centres. Yugoslavia has a population of 23,700,000 with two-thirds of the population living in the rural areas. There are more than 7,500 settlements with 500 to 2,000 inhabitants, 25 towns with more than 50,000 people and metropolitan Belgrade (capital of Yugoslavia) has a population in excess of 1.4 million people (see figure 4, major towns and cities). The following is a list of the capital cities in Yugoslavia:

- a. Belgrade is located at N44°50' E20°30' and is the capital city of Yugoslavia as well as Serbia and has a population of 1,470,000;
- b. Zagreb is the second largest city with a population of 1,175,000 located at N44°48' E15°58' and is the capital city of Croatia;
- c. Skopje is the capital city of Macedonia with a population of 505,000 and is located at N42°00' E21°28' ;
- d. Sarajevo is the capital of Bosnia-Hercogovina and is located at N43°52' E18°26' and has a population of 449,000;
- e. Ljubljana located at N46°04' E14°30' has a population of 305,000 and is the capital of Slovenia; and
- f. Titograd is the capital of Montenegro located at N42°26' E19°16' and has a population of 35,000.

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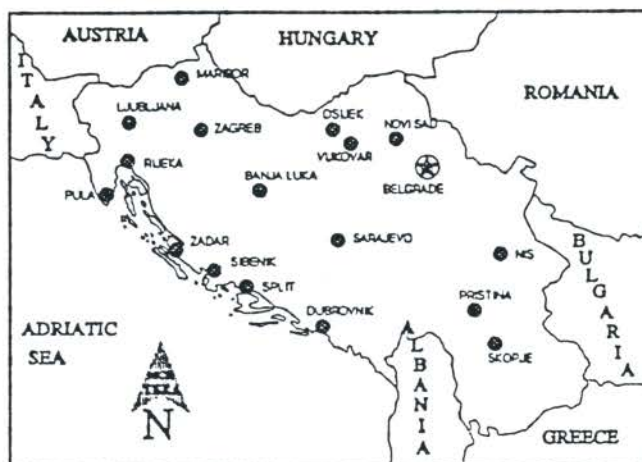


Figure 4 Towns and Cities

11. Transportation - Ground.

- a. Roads. Considering the rugged terrain, which makes natural barriers for communication routes, there is a fair road network throughout Yugoslavia (see figure 5, road network):

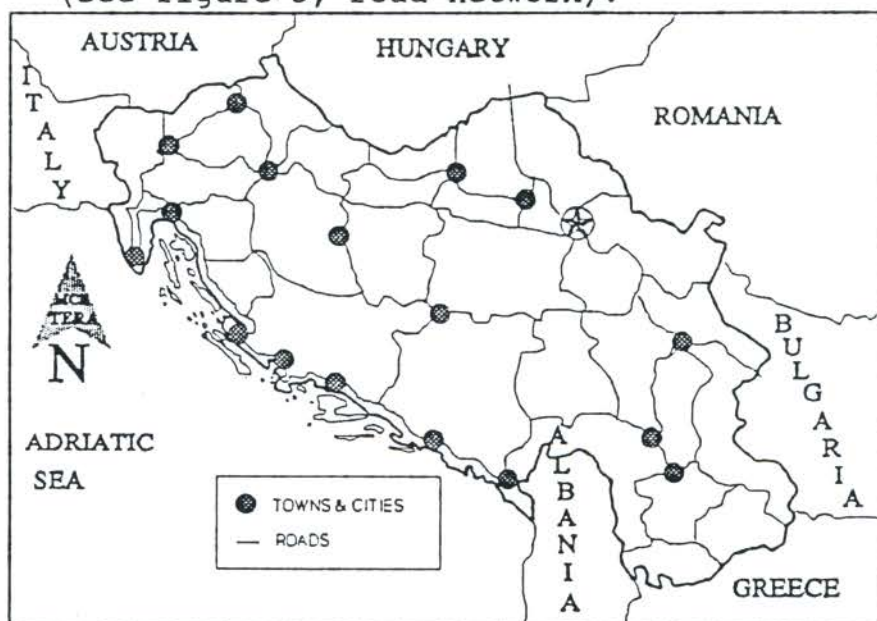


Figure 5 Road Network

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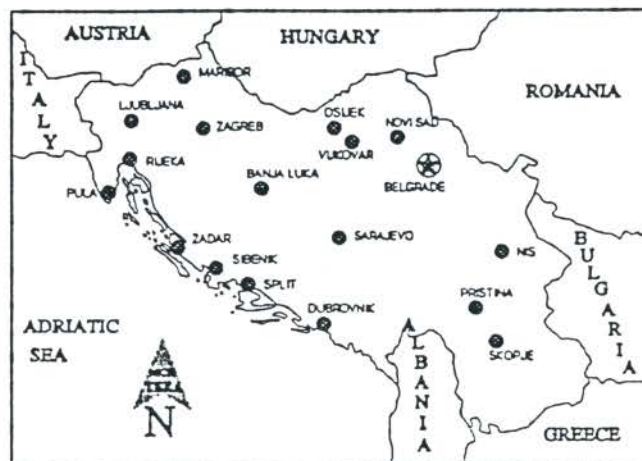


Figure 4 Towns and Cities

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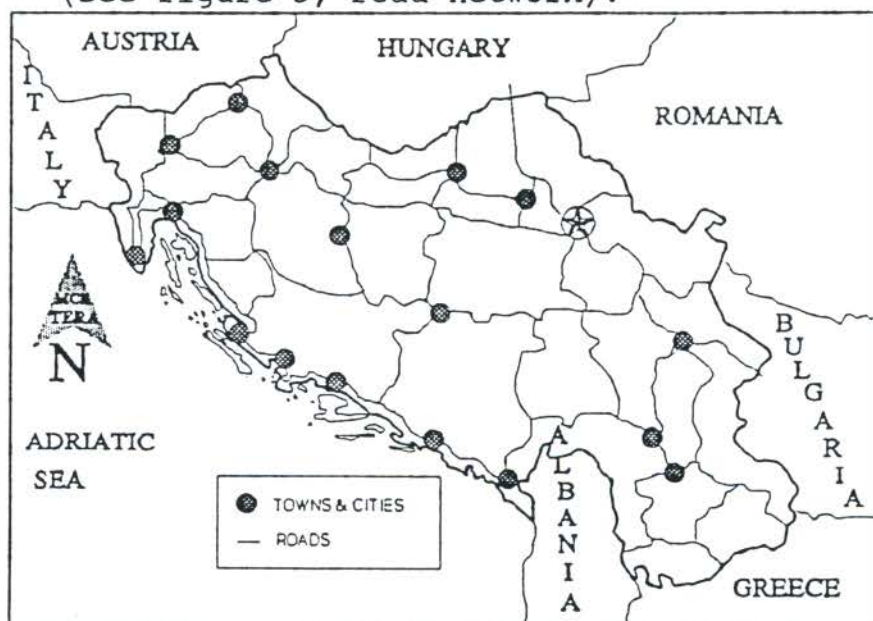


Figure 5 Road Network

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- (1) There are three main highways that run the length of the country in a SE to NW direction:
 - (a) M1 enters the country from the SE border in Greece travelling N to Belgrade where it swings WNW and parallels the north side of the Sava River through Zagreb and Ljubljana to the Austrian border;
 - (b) M2 starts at the border of Macedonia and Serbia at Skopje in the SE proceeds north through Pristina, swings W, then S, and passes through Titograd to the coast after which it hugs the coast, passing through all the major ports, and ends at the Italian border near Trieste;
 - (c) M5 starts in Bulgaria in the E, and goes W to Sarajevo where it turns WNW until it joins with M2 on the coast;
- (2) There is a N-S network of roads joining the major E-W routes at approximately 80 km intervals;
- (3) In the Julian Alps the roads generally follow to the valleys without any regular pattern;
- (4) The road network through the Dinaric Alps is sparse and irregular;
- (5) The road network in the East Serbian Highlands also follows the valleys without any regular pattern;
- (6) There is a regular, dense pattern of roads throughout the Pannonian Plains except where the river valleys dictate the pattern at the extremities of the plain;
- (7) Except for the M1 and M5, roads in the Vardar River valley area are generally local; and
- (8) The M26 and M27 span the Macedonian Plains in

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a N-S direction, while the remaining roads in the area join these from the defiles with no regular pattern; and

- b. Railroads. There is an extensive 9,270 km standard gauge railroad system (with 926 km of double track) and 3,771 km of electrified track (see figure 6, railroads). The complete system can best be described by looking at the individual regions:

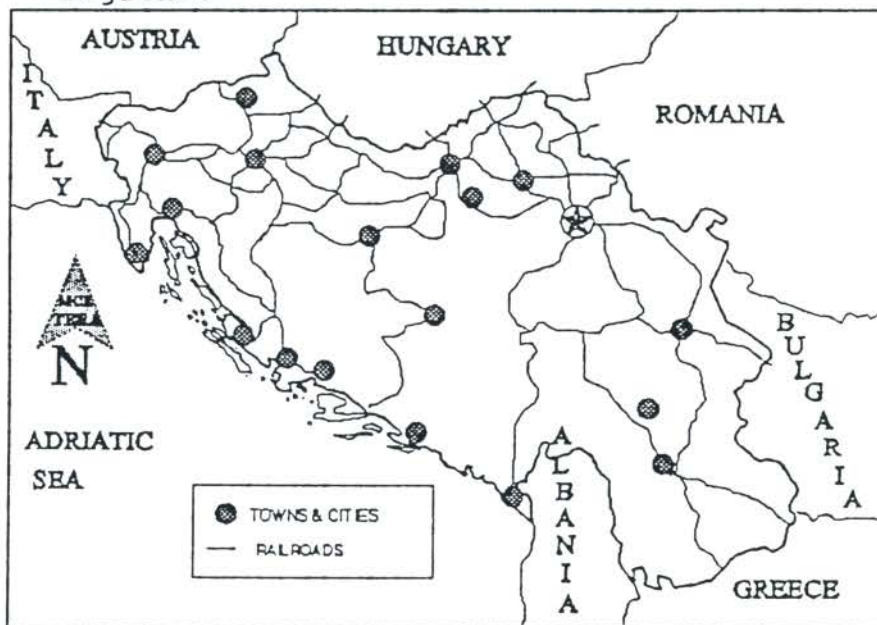


Figure 6 Railroads

- (1) The Adriatic Coastal Zone generally has no rail lines that run parallel to the coast. The lines from the interior stretch to the coast and then join up with the main ports of:

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- (a) Pula
 - (b) Zadar
 - (c) Sibenik
 - (d) Split, and
 - (e) Titograd;
- (2) The Dinaric Alps have a sparse rail network that has a north to south orientation. This system runs from the Pannonian Plain in the north to the Adriatic Coast in the south;
 - (3) The Plains of Macedonia have one rail line that stretches north to south;
 - (4) East Serbian Highlands have two major north to south rail lines, one of which runs along the boundary to the Pannonian Plains. There are also two east/west lines that go into Bulgaria;
 - (5) The Vardar River Valley has two main lines that generally follow the main river valley and its branches; and
 - (6) The Pannonian Plains have a fairly dense railroad network compared to the rest of the country. One of the main lines follows the Sava River towards Zagreb branching out as the plain widens.

12. Transportation - Air. A list of the major airfields and their particulars are in Annex A. According to 1990 sources, there are 184 usable airfields, 54 of which have permanent surfaced runways. Concerning airfield length, of the 54 permanent:

- a. none are over 3659 m in length;
- b. 22 are from 2440 m to 3659 m;
- c. 20 are from 1220 m to 2439 m; and
- d. 12 are under 1219 m.

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13. Transportation - Water. The shoreline of Yugoslavia is dotted with numerous small ports and fishing villages, most of which have limited anchorage and facilities. A detailed list of the major harbours is located at Annex B.

14. Transportation - Inland Waterways. There are 2600 km of inland waterways, mainly along the Sava, Drava and the Danube Rivers and a few canals in the north-east. The rivers can accept barges of up to 1000 tonnes.

15. Communications. The communication facilities are as follows:

- a. Television. There are 50 television stations which serve over 4.1 million television sets.
- b. Radio. There are 199 AM and 87 FM radio stations which broadcast to over 4.7 million radio receivers.
- c. Telecommunication. Telephone, telegraph and wireless services for both national and international use are satisfactory. The international telephone code for Yugoslavia is 38.
- d. Satellite Earth Stations. There is one Atlantic Ocean INTELSAT and one Indian Ocean INTELSAT satellite earth stations.

16. Water Supply. Sources of potable water in Yugoslavia appear to be adequate. However, in the region of the Julina Alps there are some radioactive springs.

17. Pipelines. There are 1373 km of crude oil pipelines that generally start at Rijeka and run east through Sisak to Belgrade. From Sisak there is a branch that runs north to Mursko Sredisce. There are also 2900 km of natural gas pipelines and 150 km of refined products pipelines.

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17 July/AMC

MR STOLTENBERG

SCHEDULE 17-19 JULY

Monday 19 July

10am Meeting with Ambassador Dobrev, Bulgarian Mission, Geneva

Location: A-656

11am Meeting with Ambassador Tarzi, OIC, Geneva

Location: A-656

UNPROFOR

3238/72
29 Mar 72

To: DFC

From: Col J.D. Harries
FE



Subject: NBC DETECTION WITHIN UNPROFOR

1. The Force Engineer has been tasked with coordinating all issues concerning nuclear, biological and chemical contaminants. As you may be aware, the present capability of UNPROFOR on the whole to address this issue, in practice, is severely limited. At present, this Force does not have the capability to conduct survey or identification tasks in a protected state. Furthermore, according to our information sources, the threat, albeit low, is real. We have established that there are 15 chemical plants, oil refineries or plants that use chemicals to a large extent in their production process (see Annex A) within former Yugoslavia that are in areas either close to UNPROFOR locations or in areas where fighting is going on at present. We have also recorded seven incidents where a threat or use of chemicals has been reliably reported. To our knowledge only CS-gases have been used in conflict. We have also recordings of chemical weapons that have been obtained by UNPROFOR forces within the theater (see Annex B).
2. It is my proposal:
 - a. that we establish, through UNNY, contacts with US, UK and French governments to provide information they may wish to make available on the chemical industry within former Yugoslavia;
 - b. that we assemble a "minimum response capability" of equipment to detect industrial chemicals, so that in the event of another accident UNPROFOR is able to detect and quarantine dangerous areas;
 - c. that through UNNY we make arrangements with the US or UK governments for them to be prepared to help train a UNPROFOR cadre who then, like the MAT team could teach to the Force.
3. I believe UNPROFOR should establish a minimum capability in NBC activities, discreetly for two reasons:
 - a. professional duty;
 - b. prelude at very low cost, the embarrassment of a charge that the UN did not prepare to deal with matters.

SECTOR SOUTH
(CHEMICAL)

SIBENIK (ALUMINUM)
SPLIT (POLYVINYL-CHLORIDE)

SECTOR NORTH
(CHEMICAL)

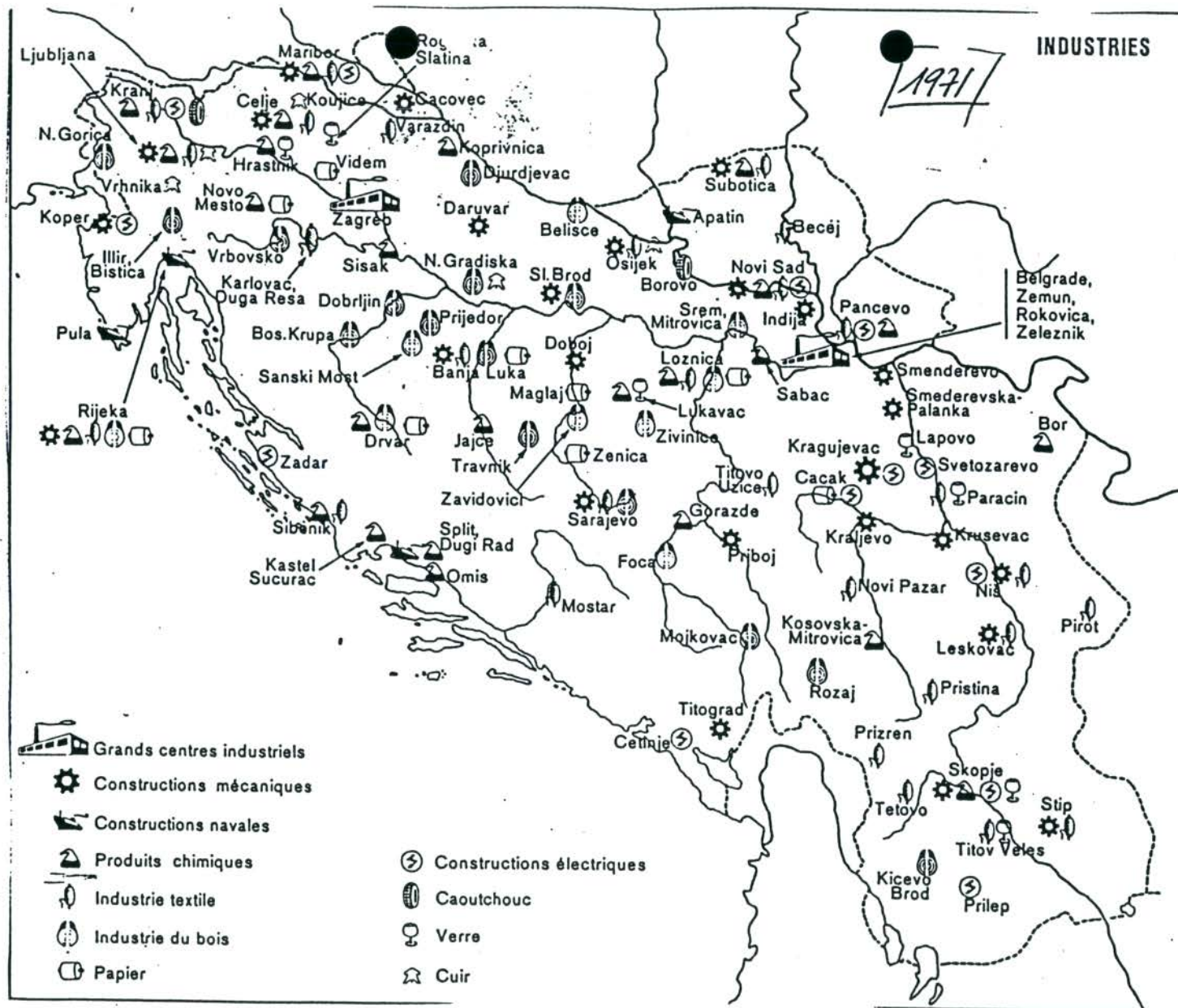
SISAK (OIL REFINERIES)
TOPUSKO (METALLURGICAL INDUSTRY)
KUTINA (NITROGEN PHOSPHATE)

SECTOR EAST

BOROVO (RUBBER)

BH COMD

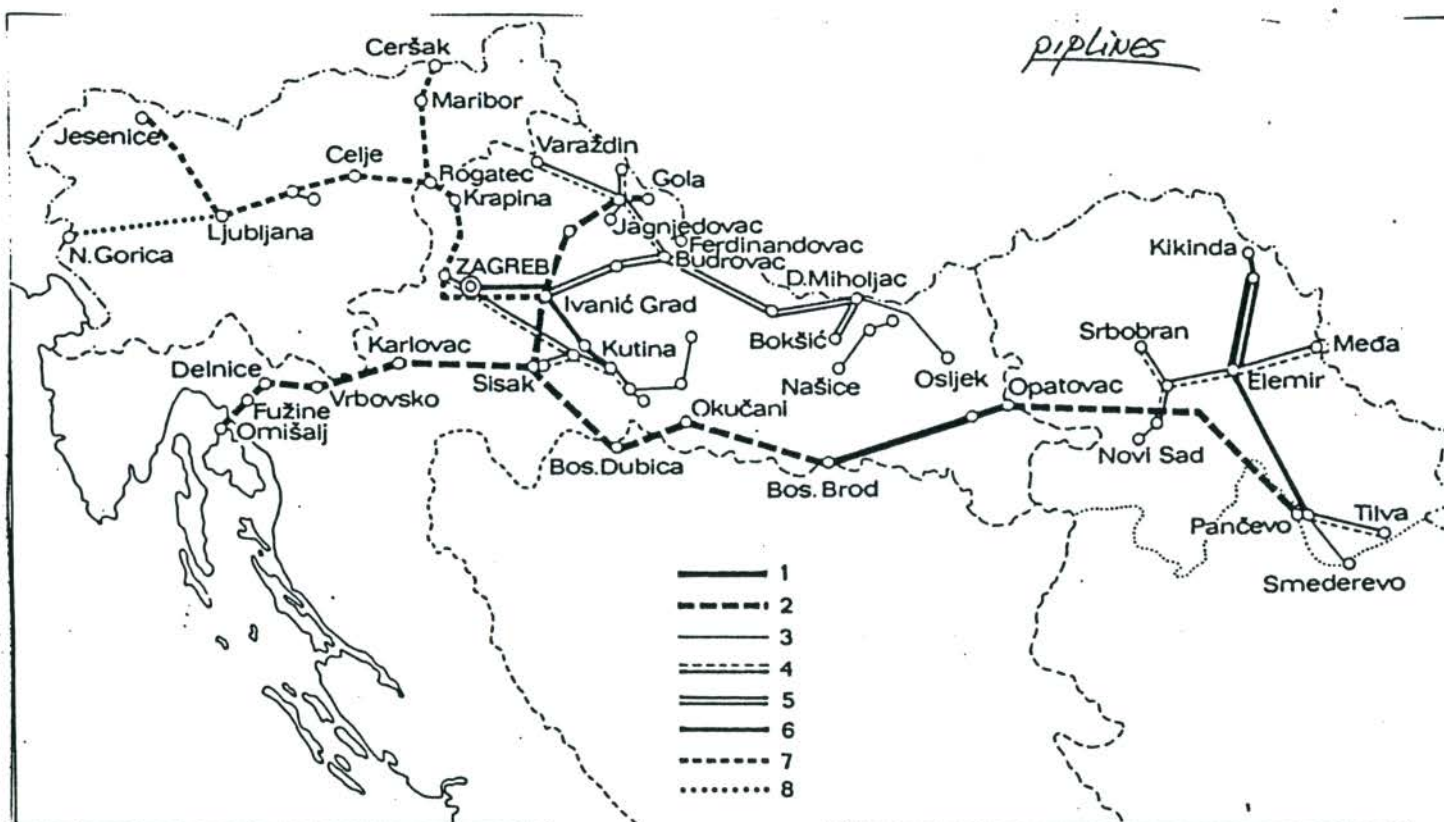
LOZNICA/NEAR TUZLA/ (SULPHATE ACIDS, PAPER, ETC)
LUKAVAC/NEAR TUZLA/ (CHEMICALS, GLASS,...)
MAGLAJ (MAJOR PAPER INDUSTRY)
DRVAR (PAPER, CHEMICALS,...)
JAJCE (CHEMICALS)
BANJA LUKA (SULPHATE ACIDS AND NITROGEN PHOSPHATES, WOOD AND PAPER
INDUSTRY, TEXTILE INDUSTRY)
ZENICA (MAJOR METALLURGICAL INDUSTRY, PAPER INDUSTRY)
GORAZDE (MAJOR INDUSTRY : METHANOL, FORMALDEHYDE, NITRATES,
NITROGEN SULPHATE,...)
MOSTAR (MAJOR ALUMINIUM INDUSTRY)



RESSOURCES MINIÈRES ET INDUSTRIES DE PREMIÈRE TRANSFORMATION

1971





NAFTOVODI I PLINOVODI

1. naftovod, 2. naftovod u izgradnji; *plinovodi*: 3. do 100 000 m³/god., 4. od 100 000 do 200 000 m³/god., 5. od 200 000 do 300 000 m³/god., 6. više od 300 000 m³/god., 7. u izgradnji, 8. projektirani

INCIDENTS WHERE USE OR THREAT OF CHEMICAL WEAPONS EXIST

Date	Location/Incident/Report	Gas/incident
09 Oct 92	Sarajevo	5 canisters - established as training aids
31 Oct 92	BH Command	threat broadcast on radio of possibility to use chemical weapons by BH
02 Nov 92	Sarajevo	c a n n i s t e r s containing phosgene gas, mustard gas and nerve agents
Jan 93	Buzim	presumably CS-gases
13 Feb 93	Meet btw Gen Morillon and Col Siber	alleged use of gases against BH-forces (presumably CS- gases)
27 Feb 93	Tuzla	chlorine gas in tanks
11 Mar 93	Srebrenica	use of gas - type unknown

OIL FIELD IN SECTOR EAST

ops

