AD NUMBER: AD0389671
CLASSIFICATION CHANGES
TO: Unclassified
FROM: Confidential
AUTHORITY
C to U per GP-3 dtd 26 Jul 1979

AD NUMBER: AD0389671
CLASSIFICATION CHANGES
TO: Confidential
FROM: Secret
LIMITATION CHANGES
TO: Approved for public release; distribution is unlimited.
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S to C per GP-3 dtd 1 Jul 1961; ST-A per OCE D/A ltr dtd 26 Jul 1979

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MP-3700
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DEPARTMENT OF THE ARMY MIDDLE EAST LINES OF COMMUNICATION REPORT (U) ENGINEER ANNEX

Prepared by

Military Plans Division, Troop Operations

Office of the Chief of Engineers

July 1958

SECRET

DEPARTMENT OF THE ARMY

MIDDLE EAST LINES OF COMMUNICATION REPORT (U)

ENGINEER ANNEX

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ENGINEER ANNEX

DEPARTMENT OF THE ARMY

MIDDLE EAST
LINES OF COMMUNICATION REPORT

I. PROBLEM

To estimate engineer support required to provide lines of communications for US logistical support of forces operating in the vicinity of BAGHDAD.

II. ASSUMPTIONS

A. GENERAL

Various assumptions of a nature related specifically to areas under consideration are contained in the development of each route in the respective appendices. Assumptions general to all routes under consideration:

1. Duration of operations will be approximately 180 days.

2. Forces will build up over a period of 60 days.

3. Neither atomic weapons nor CBR will be employed by either side; however, US will maintain in the area a capability for employment.

4. US will provide combat support units for Turkish forces equivalent to 50% of normal US combat support.

5. The local government will be responsible for hospitalization of its own people (military and civilian); however, emergency medical care will be provided local civilians to extent necessary to prevent interference with military operations.

6. Approximately 25% of existing LOC capacity will be required for the local economy.

7. Air Force will provide inter-theater aero-medical evacuation, including care enroute, except that normally provided by organic Army Aviation.

8. Army will provide Air Forces (to wing base level) with Class I, III and IIIa (package and bulk) supply.

9. Sufficient intra-theater airlift will be available to lift 10% of the tonnage requirement.

B. FORCES:

Forces will consist of approximately 120,000 troops comprised of:

US: 1 Division Force - 30,000

British: 1 Division Force - 30,000

Turkish: 5 Divisions - 60,000

C. TONNAGES:

Initial equipment - 180,000 short tons

Daily maintenance - 4,000 short tons per day

Peak tonnage load - 7,000 short tons per day

D. ROUTES:

Routes to BAGHDAD under consideration for this study:

ROUTE A: ISKENDERUN-ALEPPO-MOSUL-BAGHDAD (Appendix B)

ROUTE B: BEIRUT & HAIFA-MAFRAQ-RUTBA-BAGHDAD (Appendix C)

ROUTE C: BASRA-BAGHDAD (Appendix D)

III. DISCUSSION

A. INTELLIGENCE:

See Appendix A for general information. Most of the general descriptive data in Appendix A was obtained directly from latest published NIS's. Detailed data in the other appendices was updated from working files of the Engineer Strategic Intelligence Division, Army Map Service.

B. ROUTE A:

See Appendix B for complete description and full discussion of considerations, requirements, critical features and critical items.

1. Summary.

a. Approach route A provides good ports and beaches in the ISKENDERUN area with requisite throughput capacity, including

bulk POL tanker discharge and storage facilities. Two airfields (ADANA and INCERLIK) can each accommodate a composite tactical wing without initial rehabilitation. Other airfields at DIYARBAKIR MOSUL, K-1 and KIRKUK can support sustained usage by medium cargo aircraft and jet fighters, and limited heavy cargo aircraft utilization without initial rehabilitation.

b. Available bulk POL transmission facilities consist of NATO pipeline extending ISKENDERUN to BATMAN in TURKEY. This line is complete except for pump stations which are scheduled for completion in third quarter calendar year 1959.

c. Dry cargo transportation facilities to the objective area, consisting of one single-track railway and two highway routes, provide, after initial rehabilitation and with continual maintenance, a combined throughput capacity of 5,000 ST per day.

d. The upper reaches of the EUPHRATES and the TIGRIS RIVERS are not suitable waterways on this approach route.

2. Implications of utilization of this route.

a. POL pipeline must be provided to support operation either by extending NATO pipeline (570 miles) or entirely new construction for approximately 830 or 600 miles depending on route selected. Movement of POL by highway or rail is not considered practicable due to the distance involved and excessive transport requirements.

b. Existing dry cargo land-line transportation capacity is 5,000 ST per day, 2,000 ST short of the peak requirement of 7,000 ST per day. Railway expansion is not considered feasible, but reasonable expansion of the highway system within nominal time limits would provide total throughput capacity of 7,000 ST per day. However, military throughput capacity will be limited to 5,250 ST per day after deductions for needs of civilian economy.

c. The railway and the best existing highway routes are generally parallel, complementary, and mutually supporting, and

can provide 73% of required capacity. The remaining highway route diverges widely from axis of other routes, and after expansion can support 27% of total capacity required. Utilization of all routes will require division of tactical forces to assure supply support during movement on objective area.

C. ROUTE B:

See Appendix C for complete description and full discussion of considerations, requirements, critical features and critical items:

1. Summary.

a. Approach route B provides an interconnected complex of fair to excellent major and minor ports on MEDITERRANEAN coasts of ISRAEL, LEBANON and SYRIA with more than required capacity. Beaches will permit over-the-beach operations. Facilities at HAIFA and BEIRUT can each meet dry cargo capacities required, but only HAIFA has POL tanker discharge and storage facilities.

b. Ten of the available airfields (three each in LEBANON, ISRAEL and JORDAN and one in SYRIA) individually or in combination with another can accommodate a composite tactical wing without rehabilitation and only nominal maintenance. Airfields included in the foregoing, at BEIRUT, AMMAN and LOD (ISRAEL) can each accommodate a composite tactical wing.

c. Dry cargo transportation facilities to the objective area consist of one single-track railroad which joins the Route A railway at ALEPPO and one primary through-highway. The latter is connected by coastal highway to all ports and other routes through mountain belt facilitating flexibility in use of ports and alternate routing through any blocks which may develop in mountain rimland.

d. Crude oil pipelines from IRAQ and SAUDI ARABIA terminating at TRIPOLI and HAIFA are unidirectional (east to west) and could not be converted in time to support operations in progress.

e. Approach route B does not provide any natural waterway suitable for use or expansion to support military operations.

2. Implications of utilization of this route.

a. A 6-inch POL pipeline must be constructed from port (preferably HAIFA) to objective area, a distance of 650 miles, plus approximately 150 miles of 4-inch pipeline feeders to airfields. Movement of POL by highway or rail is not practicable due to length of LOC and excessive transport required.

b. Since the railroad in route B is limited to the coastal area, the general alignment of highway system and railway will preclude alternate and complementary usage in other areas. Although the combined capacity of rail and highway systems is sufficient for peak tonnages, the railway cannot contribute to support of operations in progress unless proportionate share of supported force advances along railway axis; or until objective area is seized and secured, including the 470 mile section of railroad from Turkish border to BAGHDAD.

D. ROUTE C.

See Appendix D for complete description and full discussion of considerations, requirements, critical features and critical items.

1. Summary.

a. Approach route C provides port facilities in the BASRA area with more than adequate dry cargo unloading capacity. However, bulk POL tanker berthing and discharge facilities are not available and terminal storage is adequate only for needs of local economy. Port throughput capacity is limited by capacity of inland transportation system. In addition, extensive and continuous dredging is required to maintain sufficient draft for ocean going vessels. Landing beaches are not available.

b. Available land lines of communication consist of inland waterways of the EUPHRATES-TIGRIS DELTA, a single-track narrow-gage railway and a highway which generally parallel the EUPHRATES River and a second highway which parallels the TIGRIS River.

Combined capacity of inland transport system after initial rehabilitation and with continual maintenance is 5,600 ST per day using one highway route and 6,100 ST per day using both highways. However, during the rainy season (December-May) all land lines may become completely inoperative for periods of several weeks due to flooding by major rivers and to poor soil trafficability in wet weather.

c. Five airfields (ABADAN, RASHID, BAGHDAD WEST, HABBANIYA PLATEAU and SHAIBAH) are available in this approach area which are suitable for development but must be expanded in order to accommodate a composite tactical wing.

2. Implications of utilization of this route.

a. Dry cargo land line transportation capacity is insufficient for peak throughput required for the operation. Ninety per cent of the current capacity is borne by the railway and inland waterways. The former includes many critical bridges, while the latter is affected by seasonal levels in water and vulnerability of dams which control water levels throughout the delta.

b. All of the existing inland land lines of communication lie within the flood plain and drainage system of the TIGRIS-EUPHRATES DELTA and are subject to seasonal flooding, and inundation through destruction of dams. Terrain contiguous to existing roads and railroads affords little or no capacity for cross-country movement or by-passing of obstacles.

c. Rail and highway expansion is feasible and necessary to support operations. In addition, all bulk POL unloading and transmission facilities must be provided from port of BASRA to objective area.

E. COMPARATIVE EVALUATION OF PHYSICAL CHARACTERISTICS:

1. Evaluation of the routes should include, political considerations and operational requirements as related matters. However, this study was made without political guidance and with

combat operational situations only sketchily defined; therefore, the evaluation which follows is restricted basically to the physical characteristics of the routes. Evaluation factors are:

a. Effort required for maintenance of capacity.

b. Effort required for expansion of capacity.

c. Vulnerability.

d. Capacity.

e. Reliability.

2. Comparison of engineer effort to sustain current capacity. Since none of the routes under consideration include existing through POL pipeline to objective area all routes are equally affected by this evaluation factor. However, it is emphasized that ports of ISKENDERUN and HAIFA have if not an immediate, at least an earlier capability to unload and store POL products, and pump to an advancing pipehead. The following summaries presents engineer effort in manpower and construction material required to provide initial rehabilitation and sustain current capacity.

ROUTE	CONSTR BN MONTHS	MATERIAL ST	CURRENT SYSTEM CAPACITY ST/DAY
A	23	65,616	5,000
B	29	78,764	8,500
C	22	63,930	6,100

3. Comparison of engineer effort for expanded capacity. Summary below presents the engineer manpower and material required to expand each route to capacity indicated. Capacity data includes 1,900 ST per day POL products for all routes. The data presented includes the effort presented in preceding paragraph plus the additional effort required to provide the most feasible and practical expansion within reasonable time frame for operations (approximately 60 days). Requirements for bulk POL facilities are included.

ROUTE	CONSTR BN MONTHS	PIPELINE CO MOS	MATERIALS ST	EXPANDED SYSTEM CAPACITY ST/DAY
A	37	5	102,453	8,900
B	39	4	112,179	12,400
C	34	3	85,459	11,600

4. Comments on estimates of engineer effort.

a. It is to be emphasized that statements of engineer effort are essential very rough estimates. By coincidence for all three routes in the preceding paragraphs, estimates of effort are generally of the same magnitude for all 3 routes, and the percentage of difference in battalion months between routes for the capacities indicated, are probably less than the accuracy of individual estimates. For this reason effort estimates must be supplemented by judgement and by consideration of other factors.

b. The problem is illustrated by route C in which one road parallels the TIGRIS and one road parallels the EUPHRATES. The TIGRIS road is shorter and has less unsurfaced sections. It is probable that the TIGRIS roadbed itself can be more easily improved for initial operations - at least the quantities of each to be worked will be less and hence effort estimates will be lower. Yet much of the TIGRIS road is in essence a causeway with no bypass possibilities, whereas the EUPHRATES road will permit bypassing of trouble spots and offers adjacent cross-country possibilities. Hence the EUPHRATES road is much more suitable from a point of view of engineer support, and effort estimates above, do not reflect the relative suitabilities of the two roads.

5. Comparative vulnerability of routes.

a. The comparative concentration of port facilities available for route C (BASRA, ABADAN and KHORRAMSHAHR), and the ease with which channels of the SHATT AL ARAB can be blocked coupled with lack of beaches for over-the beach operations and with longer sailing time from CONUS or European ports favors selection of routes originating at MEDITTERANEAN coastal ports.

Routes A and B permit greater flexibility and alternatives in selection and use of ports, airfields, and inland transportation facilities.

b. Flooding of the TIGRIS-EUPHRATES DELTA would undoubtedly interrupt all inland transportation facilities of route C. Except in the mountain rimland, rail and highway routes originating at MEDITERRANEAN coast will not be particularly susceptible to interruption caused by natural phenomenon. Shorter length of railroad favors utilization of railway system originating at ISKENDERUN (ROUTE A) over points of origin for railway in Route B. The Route B highway system allows greater flexibility than Route A for inland clearance past the mountain rimland.

6. Comparative capacity of routes. Unloading capacities of ports available to each route are more than adequate for support of the projected operation and are therefore not major factors influencing selection of route. However, lack of POL tanker discharge and terminal storage facilities in the BASRAH area favors selection of routes connecting to HAIFA and/or ISKENDERUN. Following subparagraphs summarize initial (rehabilitation) and feasibly expanded (rehabilitated, expanded and new construction) capacities of the inland transportation facilities available for each route:

a. Initial capacity: (Short tons per day)

Route	Hwy	RR	Waterway	Total Dry Cargo	Bulk POL
A	1,000	4,000	0	5,000	0 1/
B	5,500	3,000	0	8,500	0
C	1,000	3,100 2/	2,000	6,100	0

1/ Completion of NATO pipeline will provide bulk POL throughout of 1,900 ST/day for approximately half the length of LOC.

2/ Narrow-gage railway.

b. Expanded Capacity: (Short tons per day)

Route	Hwy	RR	Waterway	Total Dry Cargo	Bulk POL
A	3,000	4,000 1/	0	7,000	1,900
B	7,500	3,000 1/	0	10,500	1,900
C	1,500	6,200 2/	2,000 1/	9,700	1,900 3/

1/ Expansion not considered feasible or practicable.

2/ Narrow-gage railway. Expanded capacity based on TC estimate of 10 trains daily @620 ST per train.

3/ Requires new construction of POL tanker berthing, discharge and terminal facilities. Subject to interruption during rainy season.

c. Comparison of inland transport capacities and POL tanker discharge facilities available to each route favors selection of Route B.

7. Comparative reliability of routes. Reliability of routes are affected by such factors as alternative means to support at least maintenance tonnages, comparative length and condition of facilities, security of facilities incident to their alignment, and sensitivity to interruption as result of natural phenonemon or hostile actions. Consideration of these factors favors utilization of the railway and NATO pipeline of Route A and the highway of Route B. The inland transport facilities of Route C, although shorter are all in an area sensitive to flooding, and are linked to one port. Generally, the factors of initial condition, flexibility, vulnerability and location favor selection of Route B.

F. COMPARATIVE EVALUATION OF OPERATIONAL INFLUENCES.

1. Analysis of the routes cannot be based solely on physical characteristics. Despite the lack of definitive guidance as to political and combat operational situations, certain operation influences are obvious area, and must be considered.

2. Origin of combat forces.

a. The five Turkish divisions represent 50% of the supported force. It is reasonable to assume that Turkish elements would be directed to move from concentration areas in their homeland by best and most direct route available. In this instance, the most logical axis of advance would follow the highway and railway of Route A from Turkish border at NUSAYBIN to BAGHDAD. US assistance to support such movement could be limited to material and equipment required to rehabilitate and maintain railway and highway, and manpower and material to complete the NATO pipeline to Turkish ground forces, and support USAF operations in TURKEY.

b. With the foregoing deployment of Turkish forces, the US and British elements may then utilize any of the remaining routes. However, it is believed that worldwide disposition of US and UK forces favors their entry into target area through a MEDITERRANEAN coastal port, or staging through US airfields of the MEDITERRANEAN area. The facilities of Route B, less railway, can readily accommodate such a force without expansion, assuming highway transport of bulk POL. However, in the latter respect, the interests of economy in personnel and equipment are better served by construction of POL pipeline for ultimate support of total force in the objective area.

3. Optimum balance of requirements and means.

a. The peak capacity required of the inland transportation system is 7,000 ST per day plus 1,900 ST per day of POL, for a total of 8,900 ST's. In developing the required system it is desirable that a balance in the capacity of the various means be obtained to preclude costly losses resulting from the interruption of any one facility. For this reason, it is neither practicable or desirable to expand or place principal reliance on one transportation element.

Furthermore, a balance must be obtained in which maximum capacity is obtained with both flexibility and with minimum effort.

b. In addition, up to this point, analysis has been confined to capacities of facilities within a particular approach route. However, as developed above, the origin of combat forces will have appreciable bearing on routes or facilities necessary. It would therefore appear that combination of certain facilities of Routes A and B is indicated to form an alternate LOC. Such an alternate designated as Route B-1, consisting basically of the railway, a highway section, and NATO pipeline of Route A, and the facilities of Route B less railway, has been combined and analyzed. Since Route B-1 clearly identifies the axis of Turkish movement, US support is based on 100% of material required and 50% of combat support units required to support Turkish advance over facilities south of TURKEY. It has been assumed for Route B-1 as in Route A, that TURKEY as host nation will rehabilitate and maintain land lines, excluding POL pipeline, within her borders. The following summary presents the engineer manpower and material requirements to attain a capacity of 8,900 ST per day (including bulk POL pipeline), or as near such capacity as practical considerations permit for each route including B-1. Footnoting explains capacity of system and elements thereof, and nature of work to be done.

ROUTE	CONSTR BN MONTHS	PIPELINE CO MOS	MATERIALS ST
A 1/	37	5	102,453
B 2/	30	4	111,709

1/ Capacity in ST per day: HWY 3,000, RR 4,000. Pipeline 1,900, Total 8,900. Expansion of HWY, Rehabilitation only of RR and extension of pipeline.

2/ Capacity in ST per day: HWY 5,500, RR 3,000, Pipeline 1,900, Total 10,400. No expansion of HWY or RR. Original pipeline construction required.

ROUTE	CONSTR BN MONTHS	PIPELINE CO MOS	MATERIALS ST
B-1 3/	26	5	116,007
C 4/	43	3	61,589

3/ Capacity in ST per day: HWY BEIRUT-BAGHDAD 5,500 Turkish Border-BAGHDAD 1,500; RR ISKENDERUN BAGHDAD 4,000; Pipeline ISKENDERUN-Turkish Border 1,900 and HAIFA-BAGHDAD 1,900. Final and total throughput tonnage to BAGHDAD 12,900. Rehabilitation of RR and HWY only south of Turkish Border. Complete NATO pipeline in TURKEY, new pipeline HAIFA-BAGHDAD.

4/ Capacity in ST per day: HWY 3,000, RR 3,100, Pipeline 1,900, Inland Waterway 2,000, Total 10,000. Expansion of HWY, rehabilitation only of RR and original pipeline construction. No effort on waterway. This estimate varies from other estimates of Route C in effort required because it does not expand the railroad and it utilizes both roads.

F. DEVELOPMENT IN ADVANCE OF DEPLOYMENT.

1. It is believed that a significant amount of pre-emergency engineer support in the Middle East area can be obtained through the offices of the Mediterranean Engineer Division and the US contractors engaged under Corps of Engineers supervision on construction work for US Forces, NATO, and other Allies. In general, these construction forces have been engaged around the periphery of the area under consideration rather than in the objective area. However, one contractor, Morrison-Knudsen has been working extensively in IRAQ for the Iraqi government on developmental projects, including the roads under consideration in Route C.

2. The Mediterranean Division has major District Offices at LEGHORN (Southern District); TEHRAN (Gulf District) and KARACHI (Trans-East District). In addition, it has numerous smaller area and project offices in GREECE, TURKEY, NORTH AFRICA, and WESTERN IRAQ. A new project office is being established at DAHRAN to construct a large terminal facility for the Saudi Arabian government.

3. The US personnel employed by the civilian contractors are primarily engineers, supervisors, job foreman, and maintenance personnel. Equipment operators and mechanics are generally trained

native personnel. The US personnel, accustomed to working conditions and problems of handling natives, provide a potential effective nucleus for supervision of construction activities.

4. For support of combat operations it is probable that only a few of the contractor's personnel could be utilized in an active theater. However, for construction prior to hostilities (such as an AQABA-AMMAN pipeline) use of civilian contractors provides many advantages. In addition to on-the-spot availability and familarity, they have a capability to mobilize by bringing in trained personnel by air from US. Furthermore, construction by civilians as opposed to troops may offer political advantages. All things considered, it is probable that in a prehostilities emergency, US civilian contractors under the Mediterranean Division could, for example, build a LOC from AQABA to AMMAN faster and cheaper than US troops deployed from either CONUS or EUROPE.

5. Stocks of construction materials available to US contractors in the MIDDLE EAST are probably quite limited as they generally program their projects so as to utilize building materials as they are shipped in. The amount of construction equipment under US contractor control which would be utilized in an emergency is unknown, but could be significant in terms of a single LOC. ARAMCO has an extensive pool of construction equipment in DAHRAN (a list of this equipment is included in USAREUR's EP 201 plan).

6. It is probable that the most feasible LOC elements for development by civilian assistance in advance of deployment are completion of NATO pipeline, railway and highways in SOUTHERN TURKEY.

IV. CONCLUSIONS

A. The routes from most to least favorable are:

1.. Route B-1.

2. Route B

3. Route A

4. Route C

B. Route C for support of the whole assumed force is of uncertain feasibility and should be considered only in the event of overriding political or combat operational considerations.

C. Consideration should be given to pre-deployment development which could be accomplished by the Mediterranean Engineer Division and Districts, with US and other national contractors.

D. Completion of NATO pipeline as currently planned and aligned will materially contribute to expeditious support of forces operating in the BAGHDAD area. Its completion in advance of military operations will permit reduction in combat support units and materials required.

APPENDIX A

GENERAL INTELLIGENCE

MIDDLE EAST

1. INTRODUCTION

For the purpose of this study, the MIDDLE EAST area is defined as consisting of IRAQ, JORDAN, LEBANON, SYRIA, ISRAEL and the adjoining peripheral sectors of southern TURKEY, southwestern IRAN and the northeastern segment of the ARABIAN Peninsula. The area is irregular in shape with a maximum north-south dimension of approximately 600 miles and an east-west dimension of approximately 800 miles. The entire area, approximately 330,000 square miles, is slightly larger than the state of TEXAS. It is particularly important from a military standpoint: (1) as a major source of petroleum upon which WESTERN EUROPE is so highly dependent, (2) as strategic land bridge connecting EUROPE, ASIA, and AFRICA, and (3) for its proximity to the SUEZ CANAL. The distance from BAGHDAD, the capital of IRAQ, to MOSCOW is 1,800 miles, to BAKU 600 miles, to CARIO 800 miles, and to KARACHI 1,500 miles.

AREA BRIEFS

IRAQ

LAND: About 170,000 square miles; approximately 15% under cultivation or fallow; most of the remainder, grassland or desert.

PEOPLE. Population - 6,500,000 (estimate)

Religion - Muslim 95%; Christian 4%, other 1%

Ethnic Composition - Arabs 77%; Kurds 18%
Turkomans 2%, other 3%

Literacy - Approximately 10%

Sanitation - Poor

Males - Age 15-49: 1,007,000; about 50% fit for military service, about 50,000 reach military age annually.

ECONOMY: Food - Sufficient except for tea and sugar

Major Industry - Crude petroleum (fourth largest producer in NEAR EAST).

Exports - Crude petroleum, wheat, barley, and dates.

Imports - Capital goods, sugar, tea, and textiles

COMMUNICATIONS: Railroads - 1,060 route miles, about 30% standard gage (4'8½"), 70% narrow gage (3'3-3/8")

Highways - 4,300 miles; 35% bituminous or bituminous treated surface, 65% earth or gravel surface.

Inland Waterways - SHATT AL ARAB navigable by maritime traffic for about 80 miles; TIGRIS and EUPHRATES partially navigable by shallow-draft steamers and barges.

Ports - 1 principal, 1 secondary, 1 minor

Airfields - 10 principal, 16 others

JORDAN

LAND: About 37,500 square miles; approximately 10% under cultivation; most of remainder, grassland or desert.

PEOPLE: Population - 1,400,000 (estimate)

Religion - Muslim 87%; Christian 12%; other 1%

Ethnic Composition - Arab

Literacy - Information not available

Sanitation - Better than average in NEAR EAST

Males - No information available

ECONOMY: Agriculture - Arable land only, 12% of total; 80% of population in agriculture

Manufactures - Negligible

Imports - Consumer goods and machinery

Exports - Very limited

COMMUNICATIONS: Railroads - 209 miles; all narrow gage (3 5-3/8")

Highways - 350 miles surfaced; 270 miles improved road; 900 miles unimproved roads

Ports - Only port, AQUABA

Airfields - 4 principal, 7 others

LEBANON

LAND: About 4,000 square miles; about 25% cultivated

PEOPLE: Population - 1,417,000 (estimated)

Religion - Christian 54%, Muslim 46%

Ethnic Composition - Arab 92%, Armenian 6%, other 2%

Literacy - 65%

Sanitation - Better than NEAR EAST average

Males - Age 15-49: 344,000; about 50% fit for military service; about 20,000 men reach military age annually.

ECONOMY: Agriculture - Moderate quantities of olive oil, citrus and deciduous fruits

Imports - Food, textiles, petroleum products, and machinery.

Exports - Fruits, hides, olives

Oil pipeline terminals from IRAQ and PERSIAN GULF fields.

COMMUNICATIONS: Railroads - 252 route miles; about 80% standard gage (4'8½"), 20% narrow gage (3'5-3/8")

Highways - About 2,224 miles; about 51% bituminous surfaced, 30% crushed stone, 19% unimproved roads.

Ports - 1 principal, 2 secondary

Airfields - 3 principal, 4 others

SYRIA

LAND:	About 72,000 square miles; approximately 19% cultivated.
PEOPLE:	Population - 4,107,000 (estimated)
	Religion - Muslim 87%, Christian 13%
	Ethnic Composition - Arab 91.2%, other 8.8%
	Literacy - 35%
	Sanitation - Poor
	Males - Age 15-49: 970,000; approximately 50% fit for military service; about 55,000 reach military age annually.
ECONOMY:	Predominantly agricultural
	Imports - Petroleum products, steel and equipment, vehicles.
	Exports - Cotton, wheat, barley
	Manufactures - Cotton and rayon textiles, cement, vegetable oils. Oil pipelines from IRAQ and PERSIAN GULF fields.
COMMUNICATIONS:	Railroads - 528 route miles; 64% standard gage (4'8½"), 36% narrow gage (3'5-3/8")
	Highways - About 10,250 miles; approximately 20% surfaced roads, 25% crushed stone, 55% unimproved roads.
	Inland Waterways - 280 miles (extremely shallow draft only).
	Ports - 2 secondary
	Airfields - 8 principal, 9 others

ISRAEL

LAND:	About 8,000 square miles
PEOPLE:	Population - 1,750,000 (estimate)
	Religion - Judaism 89%, others 11%
	Ethnic Composition - 89% Jewish, 11% Arab
	Literacy - About 90%
	Sanitation - Better than average in MIDDLE EAST
	Males - Age 15-65: 450,000
ECONOMY:	Agriculture - Chiefly citrus fruits
	Manufactures - Accounts for almost 30% of national income in 1953
	Imports - Food products, industrial machinery
	Exports - Chemical products, citrus fruits, textiles
COMMUNICATIONS:	Railroads - 350 miles; 65% standard gage (4'-8½"), 35% narrow gage (3'6-3/8").
	Highways - 2,500 miles, about 50% surfaced, first-class; remainder secondary.
	Ports - 1 principal, 2 secondary, 2 minor ports
	Airfields - 9 principal, 14 others.

IRAN

LAND:	628,000 square miles, about 10% to 15% cultivated; 50% mountainous; remainder salt and sand deserts; extensive absentee landlord ownership.
PEOPLE:	Population - 19,500,000 (estimate)
	Literacy - 10%
	Religion - 95% Muslim, 3% Judaism, 2% Christian
	Males - Age 15-49: 4,000,000; 50% physically fit; 180,000 annual increment.
ECONOMY:	Food - Sufficient foodstuffs for domestic requirements, except sugar and tea.
	Oil - 240,000,000 barrels crude production in 1950
	Coal - 200,000 tons; iron, 10,000 tons annually

COMMUNICATIONS: Railroads - 1,580 route miles, single track, majority is standard gage; low capacity with numerous bridges and tunnels.

Roads - 1,000 miles hard surfaced; 5,000 miles gravel or broken stone.

Ports - Largest cargo, KHORRAMSHAHR

Airfields - About 45, mostly abandoned; 4 in general use.

TURKEY

LAND: 296,185 square miles, 25% arable; 45% meadow and pasture land, 15% forest, 15% waste.

PEOPLE: Population - 25,000,000 (estimate)

Religion - Muslim 98%, Christian and Judaism 2%

Literacy - 40%

Sanitation - Poor, but better than NEAR EAST average

Males - Age 15-49: 6,145,000; about 69% fit for military service; about 260,000 men reach military age annually.

ECONOMY: Food - Sufficient

Industries - Textile, food processing, chemical, mineral processing.

Export - Tobacco, dried fruit and nuts, cotton, grain, minerals.

Imports - Machinery, iron and steel, petroleum, vehicles, textiles, and medical supplies.

COMMUNICATIONS: Railroads - 4,790 route miles, mostly single track, standard gage (4'8½").

Highways - 30,500 miles, about 36% all weather serviceable roads.

Inland waterways - 1,050 miles navigable, including LAKE VAN and streams navigable only by small boats and rafts.

Ports - 2 principal, 7 secondary, 57 minor

Airfields - 11 principal, 45 others

2. RELIEF

The study area may be divided on the basis of relief characteristics into three parts: (1) the tableland of JORDAN and SYRIA in the southwest and south which is a continuation of the ARABIAN PLATEAU and which slopes gently downward toward the northeast, (2) a plain in the northeast and southeast which includes the broad alluvial valley of the TIGRIS and EUPHRATES RIVERS, and (3) marginal mountains which parallel the MEDITERRANEAN coast in the west, and other highlands in the north, and northeastern parts of the area (Exhibit A-3). Some of the high mountains of KURDISTAN, as well as one of the foothills of these mountains, are in northeastern IRAQ.

The mountains in the western part of the area, forming the high edge of the tableland of JORDAN and SYRIA, consist of two parallel ranges. The higher mountains on the eastern side of the depression are the ANTI-LEBANON and MOUNT HERMON: elevations here reach over 8,000 feet above sea level. On the western side from north to south are the JEBEL EN NUSEIRIYE, the LEBANON, the GALILEE hills, and the hills of SAMARIA, JUDEA, and NEGEB. Two important gaps through the mountains are used by roads, railroads, and oil pipelines to connect the interior with the coast; the HOMS - TRIPOLI GAP and the PLAIN OF ESDRAELON.

Despite the variety of its hinterland, the MEDITERRANEAN coast is an almost straight line, little influenced by the changes between sandy dune coasts and rocky cliffs. Few spurs protrude far enough to form good harbors, as at HAIFA and BEIRUT, and to a lesser degree at TRIPOLI and LATAKIA. The famous ports of antiquity were generally located on tiny islands and not only are too small for modern traffic but are largely silted up. JAFFA is protected by reefs and is dangerous to approach. TEL AVIV has a small artificial harbor. The MEDITERRANEAN coast has numerous good landing beaches and landing places, although heavy surf is common. A paved coastal road affords good north-south movement. The short PERSIAN GULF coast in IRAQ consists of mud flats and lacks usable beaches. The beach in the GULF OF AQABA however is suitable for landing.

3. DRAINAGE AND WATER RESOURCES

A general shortage of water is characteristic of the study area. The two large rivers, TIGRIS and EUPHRATES, and their few perennial tributaries, receive most of their water from outside the area (Exhibit A-4). There are some short, permanent streams in the MEDITERRANEAN zone, but even the longest of these, the JORDAN, the NAHR EL LITANI, and the ORONTES are better known for their historical associations than for their length and volume.

All of the principal rivers drain into the open seas, with the exception of the JORDAN which empties into the DEAD SEA. Aside from this inland sea and LAKE TIBERIAS which are part of the JORDAN RIVER system, and the lakes in the course of the ORONTES RIVER, the only significant water bodies associated with the rivers are the large, shallow lakes and seasonally flooded marshes of the lower TIGRIS - EUPHRATES PLAIN.

All the rivers of the desert and many in the drier parts of the MEDITERRANEAN mountain belt are ephemeral streams. Most streams of the western slopes of the MEDITERRANEAN mountain belt reach the sea, whereas, most of those of the interior desert and steppe, flow into enclosed desert basins.

Nearly 75% of the area is critically deficient in surface water. Potable surface water is scarce throughout the desert areas; a small potable supply is available for short periods immediately after infrequent heavy rainfall between December and February. Abundant potable surface water is available only along the courses of the major rivers and their tributaries, along spring-fed mountain streams of northeastern IRAQ, and to a lesser extent on the western slopes of the LEBANON mountains and JEBEL EN NUSEIRIYE. The quality of the surface water is good except near the larger population centers in the northern portions of the EUPHRATES RIVER, and near the DEAD SEA.

Ground water supplies vary considerably in quantity, quality, and availability (Exhibit A-5). Abundant supplies of good water are obtainable at shallow depths in the coastal plains of ISRAEL, LEBANON, and SYRIA, in the alluvial plain south of the TURKISH border, and in the many intermontane valleys of the KURDISTAN highlands. Ground water is

difficult to obtain in the large desert interior. Between the former and latter areas is an irregular transitional zone in which adequate water can be found locally.

4. SOILS AND ROCKS

The soils are shallow and stony in the mountains, and in most of the desert regions. Unconsolidated materials, primarily sand, gravel, silt, and clay are found on the coastal plains, interior basins, the valleys and the dune areas. The soils of the TIGRIS and EUPHRATES delta consist of sand and silt, grading into mud near the SHATT AL ARAB. The wadies and inland basins contain sand and gravel.

Hard rocks include: (1) limestone in the MEDITERRANEAN mountain belt and lower ranges of the KURDISTAN MOUNTAINS, (2) sandstone in southern JORDAN, the LEBANON MOUNTAINS, JEBEL EL BISHRI and broad bands adjacent to the TIGRIS and EUPHRATES delta, (3) granite on the eastern side of the southern part of the WADI EL ARABA, and (4) basalt in the JEBEL ED DRUZ and plateaus of northern SYRIA.

Softer rocks consisting of chalky and clayey limestone are widely exposed in the desert areas of southern ISRAEL, southern JORDAN, the SYRIAN steppes and southwestern IRAQ. A broad band of gypsum rock is found along both sides of the upper EUPHRATES, and in a broad belt extending southeast to the ARABIAN border.

5. VEGETATION

Three major types of vegetation dominate the study area; the drought-resistant plants, the Mediterranean brush or maquis, and the open mountain forests (Exhibit A-6). Most of the area is occupied by the drought-resistant plants, which comprise grasses (including wild cereals), bulbous perennials, and dry, thorny bushes. In the desert areas across the southern part, plants are very widely spaced and trees are virtually absent except for date palms in the irrigated oases. Toward the north and west, desert vegetation gradually grades into the steppe, which is essentially similar to the vegetation of the desert, except that the plants form a continuous ground cover and include a greater variety of species. Extensive areas are used for

grazing, or temporarily left unused. Both desert and steppe are green for short periods in winter, (commonly for 3 to 4 months in the steppe and for 3 to 4 weeks in the desert). Because of wide variations in annual rainfall, plants may remain dry and brown all year for several consecutive years. During the long dry season, yellow-brown colors prevail, except where the color of the soil or rock in the desert is more conspicuous than that of the plant cover. Salt marshes are green throughout the year.

The second type of vegetation, the maquis, is common to all areas bordering the MEDITERRANEAN SEA; it somewhat resembles the chaparral of some coastal areas in CALIFORNIA. It is a mixture of evergreen bushes, grasses, and stunted trees, which has resulted from severe cutting, burning and over-grazing of the original forest. Plains areas near the MEDITERRANEAN coast are, for the most part, intensively cultivated. Wheat, barley, vines, olive trees, citrus fruits, apricots, and other fruits occupy most of the cultivated land. In the hills and mountains, agriculture is possible only locally. In a few sections, especially in the north, the original forests have been preserved. But even in the wooded tracts, pine has commonly replaced cedar and evergreen oak. Most of the uncultivated land is occupied by plant associations of bushes and stunted trees, largely evergreen, which, according to composition, height, and density, are called maquis, garigue, or batha.

The third zone of vegetation, limited to the higher parts of the mountains of KURDISTAN, consists of open forests of the type common to the high mountains of interior ASIA and is similar to the forests of EUROPE. Various types of oaks are characteristic.

6. WEATHER AND CLIMATE

The study area lies in the latitude of the MEDITERRANEAN type of climate and is affected by the wet winter-dry summer regime of that climate. In winter the cyclonic storms which characterize the westerly wind belt deposit their moisture, some on the coastal plain, but mostly on the western slopes of the mountains bordering

the JORDAN-DEAD SEA trench. Winter storms also yield substantial precipitation to the southern and western slopes of the mountains of southeastern TURKEY, the mountains of KURDISTAN, and the strip of plains and foothills immediately adjoining these slopes. Taken together these relatively well-watered areas form a belt known as the "fertile crescent" which borders the arid and semiarid inland plateau and plain of JORDAN, SYRIA, and IRAQ on all sides except the south. For agricultural purposes water from winter precipitation is supplemented by irrigation from rivers which rise in the mountains. Most of the study area except the mountain fringes on the west, north, and northeast, receive less than 10 inches of precipitation annually. Within this dry part of the area, crop raising is possible only in irrigated oases. The aridity is accompanied by high temperatures during approximately eight months of the year, as would be expected in a latitude just north of the Tropic of Cancer. Except in the mountains, snow is unknown over most of the area, although temperatures at night may often be below freezing for several hours. In summer most of the area is rainless and very hot.

7. AREAS OF SPECIAL MILITARY SIGNIFICANCE

a. IRAQ OIL FIELDS. The rich oil fields in the KIRKUK area of northeastern IRAQ are of primary importance. The producing fields are located north of KIRKUK on a long, narrow ridge which is low near the city and which separates two plains or basins. The basins are connected by wide gaps with the level plains between the TIGRIS and EUPHRATES RIVERS in northern IRAQ and SYRIA, known as AL JAZIRA. Surrounding the oil fields is the cultivated steppe. On the north and east the oil fields are flanked by the KURDISTAN MOUNTAINS, which would make an advance from these directions rather difficult, except by air (Exhibit A-7). The mountains are neither sufficiently wide nor high to hamper aircraft seriously. KIRKUK and the oil fields could be used as a base area for large bodies of troops because of the ample water supply, moderately large cities and access to important food producing areas.

b. BASRA-KUWAIT AREA. The BASRA-KUWAIT strategic area consists of the lands adjoining the head of the PERSIAN GULF. The southeastern end of IRAQ, the SULTANATE of KUWAIT to the south, and the petroleum producing and refining areas of southwestern IRAN are included. Particular value lies in the oil deposits of KUWAIT, probably the richest in the world; the oil fields of southwestern IRAN, also very important, and the city of ABADAN, a major refinery center.

BASRA is the focal point for the most important inland transportation routes of the southeastern part of the area namely: (1) the TRANS-IRANIAN railroad and the highway which parallels it in part, (2) the rail, road, and river, and (3) the desert track to the landing beaches of KUWAIT and to the oil fields and refineries of the PERSIAN GULF coast of the ARABIAN PENINSULA. ABADAN is the focus of the pipelines from nearby oil fields.

c. BAGHDAD AREA. BAGHDAD, a city of approximately 300,000 population, is the capital of IRAQ and has a rich food-producing area nearby. The city is located near the head of the delta above the point where the EUPHRATES and TIGRIS spread into branches, lakes, and marshes. Here two rivers are close together and create a long irrigable area between. BAGHDAD is the focus for the meter-gage railroads to the delta, the oil fields of KIRKUK and KHANAQIN, and the standard-gage line along the TIGRIS to MOSUL and TURKEY. In addition, the important desert road to SYRIA begins there.

d. DAMASCUS OASIS. The DAMASCUS oasis bears the same relationship to the western zone of relatively dense population that the fertile delta bears to the eastern zone. DAMASCUS, the capital of SYRIA, is a city of 275,651 population (1942), approximately the same size as BAGHDAD. The oasis, despite its small size, is one of the more important food surplus areas of SYRIA. DAMASCUS is a focal point for roads and railroads. The narrow gage railroad toward the north crosses the ANTI-LEBANON range over a relatively easy pass and then branches into the line to BEIRUT and the standard-gage line which leads via

HOMS, HAMA, and ALEPPO to TURKEY. In a similar fashion, the railroad toward the south crosses the difficult lava terrain of the HAURAN district before it splits into the two branches, one through the PLAIN OF ESDRAELON to the coast of HAIFA and one to JORDAN (Pilgrim's railroad). DAMASCUS is the eastern terminus of the desert road from the EUPHRATES. A road toward the north crosses the QALAMUN RANGE and there meets the railroad. The road to HAIFA is more direct than the railroad but the road to BEIRUT parallels the railroad rather closely.

e. MOSUL AREA. The plains of MOSUL provide a food producing and potential base area close to the KIRKUK oil fields. The natural center is the town of MOSUL (approximate population 100,000), a river port on the TIGRIS. The three river bridges permit easy crossing at all seasons. The BAGHDAD railroad passes through MOSUL.

f. HOMS-TRIPOLI GAP. The interruption between the mountains of LEBANON on the south and the JEBEL EN NUSEIRIYE on the north, leads across the rift valley and through the second row of mountains along the eastern side of the valley, and affords an easy route from the MEDITERRANEAN coast inland to the plateau beyond HOMS. This corridor is used by road, railroad (standard gage) and the oil pipeline from KIRKUK. The road and railroad continue along the coast southward, but TRIPOLI (57,000 population in 1936) is the western terminal of the pipeline. The harbor and refinery of TRIPOLI are thus of greater strategic importance than that of the larger city of BEIRUT (232,000 population in 1942), the terminal of the railroad from DAMASCUS. North of TRIPOLI is the fertile, populous, and well-cultivated PLAIN OF AKKAR.

g. PLAIN OF ESDRAELON. The PLAIN OF ESDRAELON is somewhat comparable to the HOMS-TRIPOLI GAP. Population figures for this plain would be meaningless because of the flight of the ARAB population, the return of all, or part of them, and the influx of immigrants during the establishment of the state of ISRAEL. HAIFA,

immediately west of the plain, is located on a good, natural bay protected by the spur of MOUNT CARMEL. During the mandate period, the BRITISH improved the bay and created one of the best harbors of the eastern MEDITERRANEAN. A separate oil harbor adjoins the refineries. The railroad from TRIPOLI passes southward through HAIFA, which is also the terminus of the narrow-gage line from DAMASCUS, leads across the gentle hills of lower GALILEE which, together with the PLAIN OF ESDRAELON, may be considered a part of the corridor.

h. THE ALEPPO TRANSPORTATION CENTER. The following three principal rail lines join a short distance north of the city of ALEPPO: (1) the line northward to TURKEY, ultimately to WESTERN EUROPE, via the BOSPORUS and the BALKAN states and to the USSR, (2) the BAGHDAD route to the east and southeast, and (3) the line southward to EGYPT via some of the principal cities of SYRIA, LEBANON, and ISRAEL.

i. LATAKIA AREA. A potential lodgment area. Good roads connect the small port of LATAKIA to ALEPPO and to ISRAEL via TRIPOLI and BEIRUT. Rail connections are lacking.

8. CONSTRUCTION MATERIALS

Basic developed construction materials are generally in short supply and most countries in the area are heavily dependent on imports. Steel production is meager. ISRAEL, however, has a small rolling mill, and an ingot steel producing plant. Production of cement nearly satisfies the limited demands of most of the area. Supplies of bituminous products are inadequate in most areas; only KUWAIT has moderate surpluses. Bitumen imports are received from IRAN and various EUROPEAN countries. Timber is almost nonexistent in all countries. Most countries within the study area produce adobe brick, burned brick, and tile, but the quality varies from very poor to good.

9. TRANSPORTATION

Surface transportation throughout most of the study-area is geared to the undeveloped economy of that area and is not well suited for the logistical support of large-scale military operations (Exhibit A-8).

Dominating overland transportation in the MIDDLE EAST is a connected system of standard gage (4'8 1/2") railroads that affords international routes from the TURKISH-GREEK border to BAGHDAD (IRAQ), to the GULF of SUEZ, and (with two changes of gage) to the TURKISH-SOVIET border. For some time, however, no international traffic has passed over the ISRAELI railroad. Highway transport is becoming increasingly important in the MIDDLE EAST and is the only means of traffic movement in many regions. The area's only waterway with potential for the support of military operations is the TIGRIS-EUPHRATES-SHATT AL ARAB waterway in IRAQ.

a. RAILROADS. A major rail artery extends from TURKEY, through SYRIA, to BAGHDAD, IRAQ where it connects with a narrow-gage line to the port of BASRA near the PERSIAN GULF. Another potentially important rail route, currently interrupted within the borders of ISRAEL, extends from TURKEY, through SYRIA, LEBANON and ISRAEL southward.

SYRIA is entered at two separate points by the standard-gage railway route between TURKEY and IRAQ. The other major international route extends generally north and south through SYRIA. Of a total 530 miles of railroads in SYRIA, about 340 miles are standard-gage and 190 miles are 3'5 3/8"-gage. Track structure is in generally poor condition, and there are numerous bridges of low axle load limits. Railway operations are also handicapped by a scarcity of water and by heavy grades and sharp curves.

The approximately 200 miles of standard-gage railroads in LEBANON are a continuation of a main rail route from TURKEY. A 50-mile 3'5 3/8"-gage line in LEBANON is part of a rail route from

BEIRUT to SYRIA, JORDAN, and ISRAEL. The general condition of the track structure in LEBANON is poor, and major improvements would be necessary before any substantial increase in traffic could be effected. Railway operations in LEBANON are also hampered by a shortage of water and by sharp curves, steep grades, and numerous bridges and tunnels.

ISRAEL has about 225 route-miles of standard-gage railroads and 125 miles of 3'5 3/8"-gage rail lines. The narrow-gage railroad is currently out of operation, however, the standard-gage line is used for internal traffic only. When the ISRAELI borders with LEBANON are re-opened, the north-south standard-gage line will again link international railway traffic. The ISRAELI railroads have undergone considerable improvement in recent years.

The main international railway connection in IRAQ is a standard-gage route that proceeds generally northward for 335 miles through the valley of the TIGRIS RIVER from BAGHDAD to the IRAQ-SYRIAN border. Through this important rail artery, IRAQ is connected with TURKEY and EUROPE. A 725 mile 3'3 3/8"-gage line proceeds northward from BASRA through BAGHDAD to KIRKUK in the oilfields in northeastern IRAQ. Weaknesses of the IRAQ railroads include inferior road beds, light and deteriorating track structure, and antiquated equipment. Seasonal floods from late March to mid-May impose further restrictions on railway operations in IRAQ.

JORDAN has 209 miles of 3'5 3/8"-gage railroads that extend from the southwestern part of the country to the SYRIAN border. This route continues on through SYRIA and LEBANON to the port of BEIRUT. Railway operations in JORDAN are hampered by a shortage of equipment and poor condition of equipment now in use.

b. HIGHWAYS. In areas served by railway systems or by waterways, highways are used as short-haul feeder routes. Highway routes in desert regions frequently consist only of caravan trails or tracks. Through the employment of vehicles designed for desert travel, however, these areas could be readily used.

Highway transport is the most important mode of overland traffic movement in SYRIA, and the highway system is normally adequate for the national economy. SYRIA has about 2,150 miles of bituminous surfaced roads, 2,560 miles of crushed stone or gravel surfaced roads, and 5,540 miles of earth roads. Surface widths vary from 12 to 32 feet, and surface conditions range from poor to good. Traffic restrictions include: narrow and poorly constructed roads; narrow and low-capacity bridges; narrow streets in towns; sharp curves and steep grades in the west; dust and sandstorms in the desert regions; flash floods causing landslides and washouts; and intense heat in the deserts.

LEBANON also depends mainly on highway transport for overland traffic movement. It has approximately 2,200 miles of highways, including about 1,120 miles of bituminous surfaced roads. Surface widths vary from 12 to 32 feet, and surface conditions range from good to poor. Principal traffic restrictions are: narrow roads of inferior construction; narrow and low-capacity bridges; sharp curves and steep grades in mountainous areas; heavy rains and flash floods (from October to May); snow blockage in the mountains; and intense summer heat.

ISRAEL has a well developed highway system consisting of about 2,500 miles of roads, about one-half of which are surfaced. The major routes generally have a macadam base with a bituminous surface 14 to 25 feet in width and usually have a light bituminous surface. Along the roads are many small bridges with roadway widths of 12 to 15 feet. Restrictions to highway traffic consist of some steep grades and curves on the east-west highways across mountain ranges, and of stream crossings on most of the tracks.

Highway transport in IRAQ is tertiary to the railway and inland waterway networks. Of the total 4,300 miles of roads, only about 1,400 miles are surfaced, the remainder consisting of unsurfaced earth roads or desert tracks. The few arterial routes have a bituminous or gravel surface ranging from 12 to 20 feet in width. Restrictions

to highway transport in IRAQ include: narrow, poorly constructed roads; narrow, low-capacity bridges; flash floods (from November to March); sandstorms, soft sand, and intense heat in desert regions; and steep grades and sharp curves in the mountains.

Having relatively few miles of railroads and no navigable inland waterways, JORDAN depends mainly upon its highway system for overland traffic movement. JORDAN has about 1,520 miles of roads, not more than 25% of which are surfaced. The more durably surfaced routes generally have a macadam base and a bituminous surface, are 12 to 18 feet wide, and are located mostly in northern and eastern JORDAN. Restrictions to traffic include the numerous one-lane roads and dry-weather tracks east of the JORDAN RIVER and the heavy rainfall in some areas resulting in landslides and washouts.

10. PORTS

Within the study area are several maritime bases possessing effective potential for the logistical support of military operations.

HAIFA is the only port in ISRAEL with alongside berthing accommodations for oceangoing vessels. That port has an estimated military unloading capacity of 5,500 long tons a day, but shipping operations are sometimes interrupted during winter by heavy rains and winds. TEL AVIV and JAFFA are lighter ports with much lower capacities.

Along the 99-mile coast of LEBANON are two ports, BEIRUT, and TRIPOLI, with potential for logistical support. BEIRUT, the nation's leading seaport, has alongside berthing accommodations for 7 standard oceangoing vessels and has an estimated military unloading capacity of 5,500 long tons a day. TRIPOLI is important chiefly as the terminus of the northern branch of the IRAQ-MEDITERRANEAN pipeline. Its military unloading capacity is estimated to be about 3,000 long tons a day. Port operations at both of these maritime terminals are sometimes interrupted by heavy swells resulting from strong winds.

SYRIA has only one seaport of any consequence. LATAKIA, an open roadstead with a small adjoining artificial tidal basin, has

an estimated military unloading capacity of 3,800 long tons a day. The port lacks proper facilities, but a major improvement program is currently underway.

JORDAN has only 5 miles of coastline and only one port, AQABA. This port has no wharves suitable for oceangoing vessels but depends upon lighters to transfer cargo. The only access route to the interior from the AQABA area is a deteriorated hard-surfaced road. Lighterage operations at the port are frequently interrupted by heavy seas and swells. AQABA has virtually no normal commercial capacity but has an estimated potential military unloading capacity of 2,000 long tons a day.

The only port in IRAQ suitable for logistical support is BASRA, situated approximately 70 miles up the SHATT AL ARAB RIVER. This port has relatively good accommodations for standard oceangoing vessels and is generally well equipped. Its estimated military unloading capacity is 8,900 long tons a day.

ABADAN is the major port of IRAN. It is 45 miles inland from the open waters of the PERSIAN GULF on the SHATT AL ARAB. It is handicapped by silting of the river and shifting of the delta banks, requiring pilotage. The port has alongside berths for oceangoing vessels, and has handling facilities for off-loading. Although the port has an estimated military capacity of 5,800 short tons/day, clearance is restricted to roads and inland waterways. Further upstream, and 70 miles from the Gulf is KHORRAM SHAHR, IRAN's other port. Although its depth is less, its clearance by single-track standard gage rail and by road is advantageous. It has an estimated military capacity of 5,700 short tons/day.

The principal port of TURKEY on its south coast is ISKENDERUN (ALEXANDRETTA) approximately fifty miles from the SYRIAN border. Although a secondary port, ISKENDERUN has alongside accommodations for oceangoing vessels. The harbor is an open roadstead of 60 foot

depth. There is also a breakwater enclosed lighterage basin of 9 to 11 foot depth. Estimated military port capacity is 4,400 long ton /day. Highway and single-track standard gage rail ance is available from the port. ISKENDERUN is being developed as a principal maritime oil terminal for NATO. A modern training and repair center has been added to the naval base at the port.

11. AIRFIELDS

At the request of DCSLOG, a detailed study is currently bei g conducted, by the Chief of Engineers, to b ing together the most recent information on airfields in the MIDDLE EAST. Within SYRIA, LEBANON, IRAQ, ISRAEL, JORDAN, and SAUDI ARABIA are 105 airfields with runway lengths of 2,000 feet or more. Of this total, 15 with runway lengths greater than 5,000 feet are considered major facilities. Most of these airfields have bitumiuous or concrete runways and are suitable for medium to heavy cargo aircraft such as the C-119, C-118, and C-124.

The majority of the balance of these airfields can be expanded to provide facilities to support tactical and cargo aircraft. Airfields to support jet tactical aircraft are limited.

12. POL

The study area contains some of the world's largest proven oil reserves and is one of the principal suppliers of petroleum for WESTERN EUROPE. Those countries which have not developed petroleum resources still are integral to the industrial complex either for transit of pipelines or for terminal facilities.

Principal dev lopers of oil resources are: (1) the ANGLO-IRANIAN Oil Co., Ltd., 60% British Government owned, and with the concession in IRAN, (2) IRAQ Petroleum Co., a grouping of Shell, Anglo-Iranian, C.I.E. Francaise, Standard of New Jersey, Socony Vacuum, and Gulbenkian. All oil concessions belong to either of these groupings although corporate instrumentalities may vary.

Although exploration has identified other sources, major producing fields are located in IRAQ and IRAN, with reserves estimated at 57 billion barrels or 24% of the world's reserves.

Oil produced at the head of the PERSIAN GULF is collected and processed through ABADAN and FAO which, as ports, serve also as marine terminals for export. However, oil produced in fields not connected to these systems, must be transported by pipeline carriers to refineries or marine terminals for export. As the MEDITERRANEAN is closer to western markets, dependence has been placed on coastal ports as principal terminals for these fields and pipelines have been laid to them. Because pipelines are vulnerable to interference, national and international disturbances have played havoc with carrier systems. Arab refusal to allow product to transit ISRAEL, has closed off the marine export terminal at HAIFA. IPC's outlets at TRIPOLI and BANIYAS can be isolated by the UNITED ARAB REPUBLIC through denial of SYRIAN transit. The converging and rerouting of pipelines to SIDON is vulnerable for the same reason. A NATO product line has been built from the marine terminal at ISKENDERUN to BATMAN. The port has also been considered as an outlet for IRAQI and IRANIAN products via TURKEY.

The pipelines to the MEDITERRANEAN from the PERSIAN GULF and KIRKUK areas are shown (thin black line) on the general orientation map (Exhibit A-1).

Refineries have been established at:

HAIFA, ZAHRANI, SIDON, TRIPOLI, AZ ZARQA, BATMAN, BANIYAS, HOMS, QAIYARAH, KHANAQIR, KERMANSHAH, MASJID-I-SULAIMAN, ALWAND, DAURAH, ISFAHAN, BASRA, and ABADAN.

APPENDIX B (ROUTE A, ISKENDERUN-BAGHDAD) TO ENGINEER ANNEX TO DCSLOG MIDDLE EAST LOC REPORT

1. DESCRIPTION.

a. Military geography (See also Appendix A).

(1) General. The area covered by approach Route A traverses southeastern TURKEY, northern SYRIA and northern IRAQ.

(2) Terrain.

(a) The area in the vicinity of ISKENDERUN is in the south central portion of the TURKISH mountain rimland region, and borders the southeastern plains region of TURKEY.

(b) The Mountain Rimland in the area of concern has few basins and valleys, and numerous rugged and sharp crested peaks 4,000 to 10,000 feet above sea level. Open coniferous forests are characteristic on the seaward-facing slopes, but elsewhere the mountains are barren or brush covered. The area in the immediate vicinity of ISKENDERUN is part of the CILICIAN PLAIN, which is characterized by steep-sided narrow valleys and large areas of exposed bedrock. Most beaches in the area are long, narrow and sandy. Off-shore approaches are clear, and near-shore approaches are obstructed only by shoals in the vicinity of river mouths. Beaches suitable for amphibious operation or over the beach operations are located in the GULF of ALEXANDRETTA and vicinity of ANTIOCH and MERSIN to ISKELE.

(c) The southeastern plains of TURKEY are part of a much larger region that extends into SYRIA and IRAQ. The region consists of nearly flat plains compartmented by hills. In the eastern and western parts, mountains with crests between 3,000 and 5,000 feet reach up to 6,000 feet above sea level. The hills and mountains are 1,000 to 4,000 feet above adjacent plains and many of the mountain slopes are rocky and deeply dissected. Vegetation consists of scattered areas of deciduous brush in the eastern part of the region and elsewhere consists of short tufted grasses or low shrubs with cultivated fields of grains and vegetation near villages and along the boundary. The EUPHRATES and TIGRIS Rivers

cross the eastern and western parts of the region. Most of the rivers and their tributaries are in steep-sided valleys or gorges. Small streams are dry from early June through September.

(d) The northern part of SYRIA includes portions of the steppe and desert region and the Mediterranean mountain region. Starting in the west (at the TURKISH border) the communications zone would traverse both regions.

(e) The north-south trending mountain ranges (of the Mountain Region) form a barrier to movement from the MEDITERRANEAN coast to the east. Avenues of approach to the east are restricted almost entirely to the low mountain pass on the route ANTIOCH (TURKEY)-HARIM-AL ATARIB-ALEPPO which requires traverse into SYRIA. In the higher elevations of this region there are forested areas, chiefly evergreens.

(f) The steppe and desert region of SYRIA and IRAQ away from the EUPHRATES is extremely dry and except in a few cases, very sparsely populated. Most of the region has level to gently rolling surfaces covered with short tufted grass in the north and west, mostly barren in the south and east. The land is intensively cultivated along the EUPHRATES RIVER and major perennial streams. Surface conditions in the region are generally favorable for mobile ground operations. Although existing roads are poor, cross-country movement of both wheeled and tracked vehicles is possible and in general, direction of movement is unrestricted. Little grading and almost no cutting and filling would be required to provide roads with straight alignments.

(g) The EUPHRATES and TIGRIS RIVERS in northern IRAQ flow between steep banks. Numerous wadies in eastern SYRIA and northern IRAQ are in the EUPHRATES drainage system. The wadies flow after winter rains, but water flow may terminate in salt lakes or percolate into the ground.

(3) Weather and Climate.

(a) There are two major climate types characteristic of the area of operations; the MEDITERRANEAN type which

extends inland for about 60 miles and the continental (desert) type which is generally characteristic of the rest of the area.

(b) The MEDITERRANEAN type weather and climate is characterized by warm dry summers, and mild rainy winters. Mean daily maximum temperature in August is 88° F and the mean daily minimum in January is about 45° F. Temperatures in the mountains are generally about 15° lower than temperatures along the coast. Summer precipitation is usually less than one inch. In winter, numerous storms passing into the eastern MEDITERRANEAN bring the greatest amount of precipitation, with as many as 11 inches a month from early December through March.

(c) The desert type climate applicable to southeastern TURKEY and northern SYRIA and IRAQ is characterized by high temperatures and scanty precipitation. In these areas maximum temperatures generally exceed 100° F during July and August. January is usually the coldest month. Temperatures will vary widely through the desert and plains area. Winter temperatures are usually above freezing, commonly in the upper 40's and 50's in the afternoon and about 35° F at night. However, at times night temperatures have been as low as 0° F. Precipitation in this region is seldom more than 10 inches annually and is usually less than 4 inches. Duststorms may occur at anytime in this region, but are most frequent in the summer months. Such duststorms may cover vast areas and reach altitudes of several thousand feet, and in the more severe cases reducing visibility to 20 yards or less.

(3) Water.

(a) Surface and ground water supply is generally plentiful in the MEDITERRANEAN coastal plains.

(b) Water supply in the steppe and desert region is poor. Wadies generally flow only during rainstorms. Unlimited supplies of water may be obtained from the EUPHRATES and TIGRIS RIVERS, and their tributaries. Ground water sources, except for the TIGRIS and EUPHRATES areas, are limited and considerable drilling (100 to over 500 feet) is required.

(4) Military Implications.

(a) Landing facilities available in the ISKENDERUN area permit either port or over-the-beach operations, or both.

(b) Mountains bordering Mediterranean coastal plains are barriers to movement into the interior of TURKEY and SYRIA and thence into IRAQ.

(c) Except for the mountainous area bordering the Mediterranean in the west and the fringes of the TIGRIS-EUPHRATES DELTA in the east, approach Route A provides surface conditions generally favorable for ground operations.

(d) High summer temperatures, dust, and water supply shortages would be handicaps to military operations in this area. All year round water sources are generally limited to the EUPHRATES and TIGRIS RIVERS and their principal tributaries.

(e) Supply of rock and gravel for road metals and railroad ballast will be reasonably plentiful throughout the LOC area, except in the immediate vicinity of BAGHDAD. Limited quantities of timber will be available in TURKEY and western SYRIA. Structural steel for construction must be transported to the objective area.

b. TRANSPORTATION.

(1) Roads (See Tab 1)

(a) In approach Route A there are two principal highway routes from ISKENDERUN to BAGHDAD, referred to here as North and South Routes.

(b) The North Route extends from ISKENDERUN to BAGHDAD via DIYARBAKIR (TURKEY) - MOSUL, ERBIL, KIRKUK. In the vicinity of MOSUL and alternate route to BAGHDAD may be used via BAIJI and SAMARRA. The North route covers a distance of approximately 880 miles with an average bridge gap of 18 feet per mile, including 32 major bridges. Road width on this route range from 8 feet to 22 feet, with approximately 25% (220 miles) classed as 1½ lane road and the remainder as 2 lane. Except in mountainous areas, terrain conditions along narrow roadway sections permit turning-out

for passage of 2-way traffic. Surfacing characteristics and conditions vary widely, including an earth track section of approximately 100 miles. Rehabilitation and continuous maintenance will be required to sustain continued military use. Available intelligence indicates that most major bridges are in good condition, predominantly 2-lane, and capable of sustaining US tactical and LOC weight-class vehicles.

(c) The South route goes from ISKENDERUN to ALEPPO, and then generally follows the valley of the EUPHRATES RIVER to BAGHDAD. This route covers a distance of approximately 640 miles with an average bridge gap of 8 feet per mile, includes 21 major bridges. Surfaced road widths range from 15 feet to 20 feet. Less than 10% of the route is classed as 2-lane. However, except in mountainous areas, terrain will permit turning-out for passage of 2-way traffic. The western half of this route (approximately 300 miles) is predominantly bituminous-surfaced macadam. The remainder of the route has intermittent sections of gravel, bituminous surface, earth surface and desert track, with the two latter type surfaces totaling a length of approximately 120 miles. Rehabilitation and continual maintenance will be required for continued military use. Portions of the road pass through small villages with narrow streets and overhanging buildings which may create bottlenecks. Available intelligence indicates most major bridges are in fair condition, predominantly single-lane, and inadequate to sustain US tactical and LOC weight-class vehicles.

(2) Railroads. (See Tab 2)

(a) Approach Route A provides only one railway route to BAGHDAD, one which traverses through southern TURKEY, northern SYRIA and IRAQ. This rail line is single-track, standard-gage (4'-8½") for the entire route distance of approximately 800 miles.

(b) There are 19 tunnels on this railway of which 18 occur in the 85-mile distance between TOPRAKKALE and ALEPPO. In the same section the rail line traverses deep gorges and mountainous

runs with steep grades and sharp curves which reduce train speeds to 12-15 MPH. Five of the 19 tunnels are located in SYRIA and IRAQ, the balance being within TURKISH borders.

(c) The railway crosses 26 major bridges all with lengths over 100 feet and one with a length of 2600 feet. All but 8 major bridges are located in TURKEY.

(d) Operational efficiency and throughput capacity are restricted by light track structures, steep grades, sharp curves and interruptions caused by snow and rock slides in mountainous areas, inadequate maintenance, insufficient fueling points, improperly equipped water points, and shortages of fuel. The line will sustain a daily average of 10 trains in each direction hauling 400 short tons each for a daily throughput capacity of 4000 short tons.

(3) POL Pipeline (See Tab 3)

(a) POL tanker discharge facilities are available at ISKENDERUN and are adequate for the operation. Bulk POL storage facilities available in the ISKENDERUN area provide a capacity of 1,366,000 barrels. Other storage facilities are available at KIRKUK (3,500 bbls), MOSUL (5,000 bbls). The latter are commercial types normally required to support local economy.

(b) ADANA (INCIRLIK) military airfield is connected to ISKENDERUN port by an 8-inch pipeline.

(c) A NATO pipeline is under construction along line ISKENDERUN-MALATYA-ELAZIG-DIYARBAKIR-BATMAN to supply TURKISH airfields. The line is initially 8-inch, tapering to 6-inch at ELAZIG, then to 4-inch from ELAZIG to BATMAN. The line is complete except for pumping equipment. Utilization and extension of the pipeline is dependent upon NATO commitments, and provision of 8-inch as well as 6-inch pump station equipment. The estimated date of completion of pump stations is the third quarter of calendar year 1959.

(d) Major crude oil pipelines located in the area are not suitable for support of military operations. Small refineries in IRAQ cannot provide militarily significant quantities of POL.

Refineries in ISRAEL (HAIFA) and LEBANON(TRIPOLI) have the capability to produce POL to support military operations.

(e) Movement of bulk POL by highway or rail to objective area is not considered feasible due to length of LOC, and the large amount of highway transport and/or tank cars which would be required.

(4) Airfields (See Tab 3)

(a) There are seventeen important airfields which are in proximity to approach route A. Ten airfields are located in TURKEY, three in SYRIA and four in IRAQ. TURKISH airfields are generally superior in construction, ancillary facilities and navigation aids. Airfields at ADANA and INCERLIK can each support a composite tactical wing (heavy cargo and jet fighter air craft) under sustained operations without rehabilitation. DIYARKABIR, MOSUL, K-1 and KIRKUK MILITARY can accommodate medium cargo aircraft and jet fighters under sustained operations, and heavy cargo type aircraft for limited operations, without initial rehabilitation.

(5) Ports (See Tab 4)

(a) Three ports are considered to be applicable to approach Route A: ISKENDERUN, MERSIN, and LATAKIA(SYRIA). These ports have highway and rail clearance, except for LATAKIA which has highway clearance only.

(b) At ISKENDERUN controlling depth in outer harbor is 60 feet and the inner harbor 11 feet. Peak through-put capacity of ISKENDERUN under military operations is estimated at 7,150 short tons per day. Current capacity is 4,600 short tons per day.

(c) MERSIN is a minor port with open roadstead and an estimated through-put capacity of 1,680 short tons per day. Controlling depth at wharfage is 7 feet. Unloading is accomplished by lighter.

(d) LATAKIA (SYRIA) has a military through-put capacity of 5,600 short tons per day and provides 3200 feet of quayage for Liberty-type vessels plus mooring for 5 additional ships, and turning basin for lighterage and coaster craft.

(e) ISKENDERUN is the most suitable or primary port for approach route A and can be supplemented by over-the-beach operations and lighter operations at MERSIN.

(6) Inland Waterways (See Tab 4)

The upper reaches of the EUPHRATES and TIGRIS RIVERS are navigable only by small boats, which cannot contribute significant tonnages for the supported force. Expansion of waterways is not feasible.

c. Local Resources

(1) Manpower. No reliable figures are available on the number of indigenous laborers which would be utilized to augment the military construction effort. However, in the study area, there has been a steady drift of unskilled labor from rural to urban areas, where they might be available in significant numbers depending on local attitudes to US military operations. In rural areas, available labor will be limited to agricultural workers inhabiting small villages along routes of LOC. Approximately 45,000 skilled and semi-skilled laborers are employed in the operation and maintenance of the railroad system.

(a) Skills. The average MIDDLE EAST laborer, particularly in urban areas,shows some aptitude for acquisition of mechanical skills. However,he requires considerable forceful supervision, particularly in maintenance of equipment.

(b) Effectiveness. In general, laborers of the area are estimated to be 50% as effective as the average US soldier.

(2) Resources. Road metal for construction of highways and ballast for railways are available in adequate quantities, except in the immediate vicinity of BAGHDAD. Availability of timber is

limited to mountain ranges bordering the MEDITERRANEAN coastal plain. Production of cement is only adequate for local requirements. Structural steel production is insignificant.

2. OPERATIONAL CONSIDERATIONS.

a. General.

Three major features of the LOC are ports, land lines, and airfields. Operational considerations as concerns ports and airfields are discussed in Tabs 3 and 4. Summarization here is not believed necessary in view of the facts that construction effort for ports and airfields for the LOC are relatively small compared to the land lines because there is not a wide choice in port and airfield development. However, alternatives are possible in the selection of land lines for routing and expansion which are discussed below.

b. Land Line Considerations.

The three major land lines under consideration (railroad, north and south road routes) have a combined capacity of 5,000 short tons per day. This assumes the railroad operating capacity expanded to the maximum extent feasible and roads at current capacity. The combined transport capacity is 2,000 tons per day short of the peak requirement of 7,000 short tons of dry cargo per day. Alternatives to overcome this deficiency are:

(1) Increase the build up time.

(2) Increase the capacity of both roads.

(3) Concentrate expansion effort exclusively on either the north or south road.

The POL problem must be considered with each of these alternatives and not as a divorced consideration. There are two main aspects to the POL problem which have serious implications for the entire transport problem. First of these is the requirement to transport by pipeline the 2,000 short tons per day of POL which is not included in the 7,000 ton figure above. Secondly, although tonnages of Class IV pipeline construction material are considered to be included in total tonnages referred to above, movement of this

material along a selected route is likely to cause serious imbalance in types of tonnages hauled unless the total capacity of the route is sufficiently high.

c. Alternatives.

(1) Increase the build up time. In view of the envisioned short total time of the operations of approximately 180 days, a stretchout of the build up time beyond 90 days is not considered practical. Accordingly, with build up time the same as originally considered in the basic assumptions, peak tonnage requirement remains at 7,000 short tons per day.

(2) Triple the capacity of each road. Assuming that Turkish forces will rehabilitate, expand and maintain that portion of the northern route in TURKEY, expansion of the balance of the northern and all of the southern route will require the effort and material summarized below:

ROUTE	CONSTRUCTION BN/MONTHS	EQUIP	MATERIAL
North (Turkish border to BAGHDAD)	6	6,000 ST	13,130 ST
South Route	14	12,000 ST	11,823 ST
TOTAL REQUIREMENT	20	18,000 ST	24,953 ST

(a) The overall throughput capacity provided by expansion of highways and the railway system will meet peak tonnage requirements of 7,000 short tons of dry cargo per day.

(b) Considerations affecting location of pipeline along either route are discussed in succeeding paragraphs.

(3) Concentrate expansion effort exclusively on either the north or south road.

(a) Expansion of north route and maintenance of southern route with pipeline along the northern route. If this alternative is selected it would be advantageous to consider completion and incorporation of the existing NATO pipeline from ISKENDERUN to DYARBAKIR into a system to BAGHDAD since the line is required in any event to support major airfields in TURKEY and

additionally could support any build up of forces in the vicinity of DYARBAKIR for the approach to BAGHDAD. Implications of the choice of this route for expansion and pipeline are as follows:

1. Effort:

a. Road: 16 construction battalion months

b. Pipeline: 2 construction battalion and 5 pipeline company months.

2. Material

a. Road: 22,068 ST

b. Pipeline: 32,300 ST

3. Resulting capacity of route system will be:

a. Highway north route	1,500 ST
b. Highway south route	500 ST
c. Railway	4,000 ST
d. Total dry tonnage	6,000 ST
e. Bulk POL	1,900 ST

4. Security and assistance. Location in TURKEY provides greater security for the LOC, permits host nation support in LOC development and permits pre combat staging closer to the objective area.

5. Transport. The railroad can be used to haul some of the pipeline tonnages thus relieving the road system along the entire route.

6. Pipeline Construction. Orientation of the extension pipeline permits construction in two directions simultaneously: north from MARDIN to DYARBAKIR to connect to the NATO system and south from MARDIN along the railroad towards BAGHDAD.

(b) Expand the south route and maintenance of northern route with pipeline along this route. Some implications of choice of this route are as follows:

1. Effort:

a. Road: 18 construction battalion months

b. Pipeline: 2 construction battalions and 5 pipeline company months.

2. Material:

a. Road: 22,991 ST

b. Pipeline: 37,400 ST

3. Resulting capacity of route system will be:

a. Highway, north route	500 ST
b. Highway, south route	1,500 ST
c. Railway	4,000 ST
d. Total dry tonnage	6,000 ST
e. Bulk POL	1,900 ST

4. Security. Both the road and pipeline cross IRAQI territory for a major portion of their lengths. With the attitude of the local populace in doubt, a serious problem may arise in policing both the road and pipeline, particularly the latter, to insure uninterrupted movement of dry cargo and POL. Adoption of the alternative of expanding south route and installation of parallel pipeline will expose a greater length of each facility to attack than does the northern alternative.

5. Transport. The railroad cannot be used to transport the large tonnages of pipeline construction material involved. Accordingly, the road must be used to transport the tonnage while the road itself is being expanded. During the period of road expansion and pipeline construction the usable throughput is mainly consumed by these activities with the result that only small tonnages of other supplies can be made available to a combat force. For example, on this route, considered as 500 tons per day, the pipeline construction material may aggregate 200 to 300 tons per day to keep pace with construction rate. Consumption by construction and transportation units is likely to reduce the remaining 200 to 300 tons to almost insignificant quantities for support of combat forces. However, there is some flexibility in road capacities during the dry season so that the estimated capacity could be considerably exceeded for short periods of time.

(4) Considering both operational and logistic problems, the optimum solutions appears to be to concentrate effort on the northern route (road, railroad, pipeline) and to utilize the southern route as a secondary LOC route, to be utilized to the maximum extent which minimum effort and expediency permit.

3. CRITICAL FEATURES OF OPERATION.

Three features of the operation as concerns logistical support are considered to be of a critical nature:

a. Seizure of ALEPPO.

The rail and highway center of ALEPPO is the key to the land line of communication for route A. Regardless of routing chosen within the general route A, ALEPPO must be included in the route. Feasibility of route A is therefore critically dependent upon securing this city.

b. Railroad.

The large number of long tunnels (19 tunnels for a total length of 37,000 feet), concentrated in a short distance of the mountain rimland is a feature of great concern. The destruction of any one of the tunnels would effectively deny for a long period of time use of the railroad which is the main contributor to the transport system. Unhampered use of the tunnels, therefore, must constitute a critical feature of the operation. Fortunately, 14 of the tunnels are located in TURKEY where security should be relatively easy to provide. Five of the remaining tunnels are in SYRIA and IRAQ where security is uncertain.

c. Pipeline.

Land lines, other than pipeline, even after expansion are just barely adequate to support dry cargo tonnage requirements. Therefore, successful installation and continued operation of the line to deliver the approximately 2,000 tons per day bulk POL requirement must be considered critical.

4. CRITICAL ITEMS.

a. Manpower. Construction effort for course of action requiring least effort will require 32 construction battalions and 5 pipeline company months. Accomplishment of the same task in 60 days will require 17 augmented construction battalions, 5 pipeline companies and appropriate supporting elements and coordinating headquarters.

b. Material

(1) POL equipment

(2) Railroad rails, cross-ties, and auxiliary items.

(3) Fixed and floating tactical bridging

(4) Heavy timber for bridging

(5) Heavy engineer construction equipment

(6) Pierced steel plank

(7) Corrugated metal culvert pipe

TAB 1 TO APPENDIX B

ROADS

1. GENERAL

a. See Exhibit B-1

b. Approach route A, contains two principal routes from ISKENDERUN to BAGHDAD indicated as North and South routes. The North route extends from ISKENDERUN to BAGHDAD via MOSUL, ERBIL, KIRKUK and is 883 miles long. The South route extends from ISKENDERUN to BAGHDAD via ALEPPO and is 637 miles long. An alternate route from MOSUL to SAMARRA to BAGHDAD, 254 miles in length, parallels the MOSUL-KIRKUK-BAGHDAD route. Numerous desert tracks parallel both principal routes. An example of such a track is one along the TURKEY-SYRIAN border (See photo on Exhibit A2). Road characteristics are tabulated in Tables I, II and III.

c. Highway Bridges. Characteristics of principal highway bridges are shown in table B-1-a. A summary of the number of bridges on each route follows:

ROUTE	NUMBER OF PRINCIPAL BRIDGES
NORTH	32
SOUTH	21
SECTION OF NORTH ROUTE, TURKEY BORDER TO BAGHDAD	17

d. Terrain. Route A traverses terrain varying from low to high mountains in TURKEY, low mountains in northwestern SYRIA, to the arid steppe and desert terrain in SYRIA and IRAQ, to hills and plains in SYRIA, to the objective area (BAGHDAD) on the TIGRIS-EUPHRATES DELTA. The EUPHRATES VALLEY is deeply incised and intrenched in the desert and steppe uplands. The right (south) side of this valley is a cliff averaging 200 to 300 feet in height and reaching 800 feet in a few places. Soil varies from sand and fine gravel along the EUPHRATES VALLEY to large gravel, gypsum and limestone (chalk and clayey limestone)

in the bordering regions. Most of the area is barren desert terrain with water critically deficient except along the EUPHRATES and the TIGRIS Rivers from which unlimited potable water may be obtained. The area is devoid of vegetation except for trees in the low mountains in TURKEY. Crops are cultivated only along the waterways. Conditions in this area are favorable for the construction of roads because of the firm ground conditions and availability of road construction materials. Only the narrow deeply dissected areas along the major streams and small swamps are unfavorable for road construction. Steep sides of the numerous wadies are obstacles to off road movement in any direction across the plain. Sand and stretches of salt marsh will slow down movement. Motor traffic raises dense clouds of dust. This dust is hazardous to ground equipment because of greatly increased wear caused by the abrasive action of fine sand particles.

e. Weather and Climate. In TURKEY highway traffic will be limited primarily by snowfall in the winter months, which will halt traffic for short periods of time. Spring snow melt and rainfall will cause road and small bridge washouts, thereby, interrupting traffic for short periods of time. In the arid desert and steppe region of SYRIA and IRAQ rainfall averages 4" per year and is rarely more than 10" per year. Motor transport both on and off road, will be primarily limited by duststorms and heat in the spring, summer, and fall seasons. October - May have the highest frequency of thunderstorms with two to four storms often accompanied by flash flooding. Flash floods will cause earth roads to become impassable for short periods of time. The frequency of duststorms increases rapidly in the southern SYRIAN STEPPE, reaching 8 days in the month of June.

f. Health and Sanitation. Water in the EUPHRATES and TIGRIS Rivers is potable but requires treatment, chlorination and sometimes filtration and sedimentation. Malaria is common in the TIGRIS-EUPHRATES DELTA.

g. Local Resources.

(1) Manpower

(a) Skills. The population in small towns and villages is predominantly illiterate and unskilled in modern road construction techniques. However, a limited number of skilled laborers can be located in the major urban areas i.e., BAGHDAD, MOSUL, ALEPPO, KIRKUK.

(b) Effectiveness. Unskilled indigenous labor, under the direction of effective native supervisors, is estimated to produce as much as 50% of the work performed by an American soldier.

(c) Availability. In time of hostilities availability of labor is uncertain. Under other than hostile condition it is also unlikely that the population from small towns and villages could be relied upon. However some of the larger cities like BAGHDAD, which has a population of about 900,000, could be relied upon to furnish considerable labor.

(2) Materials. Road construction materials are available in quantity along nearly the entire length of the two road systems from ISKENDERUN to BAGHDAD. In TURKEY and northwest SYRIA hard limestone and gravel are available. In the rest of the approach route limestone, sandstone, and gravel are available in quantities sufficient for large road building projects.

(3) Equipment. Local road building equipment is outdated and in short supply.

2. OPERATIONAL CONSIDERATIONS

a. Vulnerability. Roads are subject to interruption by demolition of bridges over the unfordable TIGRIS and EUPHRATES RIVERS, landslides in mountain passes, and road cratering where the road traverses salt marsh, swamps or dense networks of irrigation ditches.

b. Logistical

(1) Supply. All road construction equipment for use by U. S. forces will have to be shipped into the theater. Road construction

materials can be locally procured from gravel pits and limestone and sandstone quarries.

(2) Transportation. Desert conditions of high temperatures, high winds and fine sand will adversely affect all vehicles and machinery. Greater maintenance will be required, and more frequent replacement and overhaul will be made necessary on all equipment as a result of operations in this area. It is expected that attrition of equipment resulting from the above causes will be about 50% greater than that expected from similar operations in Western Europe.

(3) Maintenance. To sustain the initial throughput capacity expected of the road system, road maintenance will be necessary along nearly the entire road system.

(4) Construction. Extensive road construction will be required to widen and surface, with gravel, sections of unimproved earth road and desert track to sustain 1,500 short tons per day capacity.

3. CURRENT OPERATING CAPACITY. Initially, the North and South routes (or that section of the North route from the Turkish border to Baghdad) will each support a forward throughput capacity of 500 short tons per day. Tables IV, V and VI show the effort and significant materials and tonnages required to maintain the current operating capacity for a sustained period for the above routes. A summary of the above tables follows:

ROUTE	MAN HOURS	BN MO	ST	MT
NORTH	701,722	8	22,374	34,287
SOUTH	461,631	5.2	9,448	15,644
Section from TURKEY BORDER to BAGHDAD	291,565	3.2	11,168	18,781

Engineer Construction Battalions assigned to road tasks will be augmented with additional road building equipment. Table VII provides for equipment augmentation as indicated in the Engineer Functional Component System.

4. EXPANDED OPERATING CAPACITY

a. North Route. This route can be expanded to support a daily forward throughput capacity of 1,500 short tons by widening and surfacing 89 miles of unimproved earth road to a two lane gravel road. Table VIII indicates effort and tonnages required for the expansion of this route.

b. South Route. This route can be expanded to support a daily forward throughput capacity of 1,500 short tons by widening and surfacing 114 miles of desert track and earth road, and 16 miles of one lane bituminous road to a two lane gravel road. Table IX indicates effort and tonnage required for the expansion of this route.

c. North Route (Section from Turkish border to Baghdad only). This route can be expanded to support a daily forward throughput capacity of 1,500 short tons per day by widening and surfacing 54 miles of unimproved earth road to a two lane gravel road. Table X indicates effort and tonnages required for the expansion of this route.

d. A summary of the effort and tonnages required to accomplish expansion on the above routes follows:

ROUTE	MAN HOURS	BN MO	ST	MT
NORTH	850,166	9.5	1,962	2,413
SOUTH	1,240,236	13.7	2,375	2,976
Section from TURKEY BORDER to BAGHDAD	560,448	6.2	1,169	1,450

5. CRITICAL FEATURES OF THE OPERATION

a. Roads. The capacity of the road net is basically limited by the unimproved sections of earth road on the northern and southern routes. These are:

(1) North Route. A 35 mile stretch of unimproved single lane earth road north of the SYRIAN Boundary that extends to the IRAQ Boundary and a 54 mile stretch of one lane unimproved earth road from

the TURKEY to IRAQ borders. These sections of route reduce throughput supply tonnage capacity to 500 tons per day.

(2) South Route. From MEYADIN to ANA, 114 miles of desert track and earth road reduces supply tonnages to 500 tons per day.

b. Bridges. Present intelligence implies that the 32 bridges on the North Route are capable of supporting from 24 to 70 ton loads. However information on the exact loads that many of these bridges are capable of supporting is not available. Intelligence also implies that the 21 bridges on the South Route are capable of supporting anywhere from 18 to 80 ton loads but the exact load capacity of many of these bridges is not available. Table B-1-a summarizes characteristics and load capacities of existing bridges. From a tactical viewpoint many of the bridges on the North and South routes will not constitute bottlenecks, except those that cannot be bypassed and those located at BAGHDAD. Initially it is planned to replace existing bridges not capable of supporting class 50 loads with tactical bridges and at a later date to replace these bridges with LOC type bridging.

c. Road Construction Materials. Gravel is available at numerous points along both the NORTH and SOUTH ROUTES.

6. CRITICAL ITEMS

a. Manpower. Provision of requisite number of augmented construction battalions is essential. It is anticipated that indigenous labor will be lacking in modern skills and can therefore be used only as an unskilled force of considerable less productive capacity than U. S. Troops.

b. Material. Critical items are:

(1) Corrugated metal culvert pipe

(2) M4T6 floating bridge

(3) Bailey bridges

(4) Steel girders for fixed bridging

(5) Timber

TABLE I, NORTH ROUTE, ISKENDERUN-MOSUL-KIRKUK-BAGHDAD

LOCATION	MILES	SURFACE	WIDTH FEET	CAPACITY (TONS/DAY)	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
ISKENDERUN to TOPRAKKALE	73	Bituminous	18½	8,000	Excellent	Fair to Good	Coastal area
TOPRAKKALE to FEVZIPASA	42 (20) (22)	Bituminous Crushed Stone	22 19½	1,300 1,300	Good Good	Restricted Restricted	Mountainous, forested terrain
FEVZIPASA to BIRECIK	87	Crushed Stone	19½	1,000	n.a. (All Weather Road)	Unsuitable	Mountainous, steep grades, sharp turns.
BIRECIK to URFA	63	Crushed Stone	19½	1,000	n.a. (All Weather Road)		Low mountains, hills and very winding, steep grades, forested
URFA to DIYARBAKIR	106	Crushed Stone	19½	1,000	Poor	Poor	Steep hills, stony slopes, plain area in vicinity of DIYARBAKIR, off road movement good.
DIYARBAKIR to 35 Mi. NW of SYRIAN boundary	57	Crushed Stone	14 to 20	1,000	Fair	Poor	Same as above
35 Mi. NW of SYRIAN boundary to SYRIAN boundary	35	Earth	1½ Lane	700	n.a.	Poor	Same as above

Note: n.a. - Information not available

TABLE I, NORTH ROUTE, ISKENDERUN-MOSUL-KIRKUK-BAGHDAD (cont'd)

LOCATION	MILES	SURFACE	WIDTH FEET	CAPACITY (TONS/DAY)	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
TURKEY boundary to IRAQ boundary	54	Earth	8-16	500	Poor	Excellent (Desert)	Alignment good. Drainage, foundation, and surface poor.
SYRIAN boundary to MOSUL	60	Asphalt	20	3,500	Good	Excellent (Desert)	Surface broken in many sections, steep grades, sharp curves, numerous potholes. Stone quarry 5 mi. W of MOSUL.
MOSUL to ERBIL	55	Asphalt	20	3,500	Good	Excellent (Desert)	Few curves and slight grades.
ERBIL to KIRKUK	62	Asphalt	20	3,500	Good	Excellent (Desert)	Few curves and slight grades.
KIRKUK to BAGHDAD	189 (151)	Asphalt	20	1,500	Poor	Excellent (Desert)	Surface broken many places. During bad weather this road becomes impassable.
	(38)	Asphalt	20	1,500	Good		Few grades and curves, gravel available along DIYALA RIVER.

TOTAL MILEAGE 883

Note: n.a. - Information not available

TABLE II, SOUTH ROUTE , ISKENDERUN-ALEPPO-BAGHDAD

LOCATION	MILES	SURFACE	WIDTH FEET	CAPACITY (TONS/DAY)	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
ISKENDERUN to SYRIAN border (via ANTAKYA)	45	Bituminous	16-18	3,100	Good	Poor	Steep slopes, often forested. Off road characteristics unsuited in entire area Nov. through July.
SYRIAN border to Rd. Jct. 15 miles East	15	Crushed Stone	17	700	Poor	Poor	Hills and low mountains; Rough, rocky ground with steep gradients.
Rd. Jct. 15 Mi E. of SYRIAN border to ALEPPO	29	Bituminous	20	1,500	Poor	Fair	First half of sector has rough ground and steep gradients. Second half has suitable characteristics.
ALEPPO to MASKANAH	58	Bituminous	15	1,500	Fair	Good	Smooth, firm ground with easy gradients and few surface obstacles.
MASKANAH to Rd. Jct. 61 Mi E.	61	Bituminous	15	1,500	Fair	Fair	Unsuited for cross-country movement near the road. Frequently suitable terrain for cross-country movement a few hundred yards from the road.
Rd. Jct. 61 Mi E. of MASKANAH to DAYR AZ ZAQR	83	Bituminous	15	1,500	Fair to Poor	Fair	Same as above

TABLE II, SOUTH ROUTE, ISKENDERUN-ALEPPO-BAGHDAD (cont'd)

LOCATION	MILES	SURFACE	WIDTH FEET	CAPACITY (TONS/DAY)	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
DAYR AZ ZAWR to IRAQ border	84						
Mi. 0-Mi. 12	(12)	Gravel	Approx. 16	800	n.a.	Fair	Same as above.
Mi.12-Mi. 28	(16)	Bituminous	13	800	n.a.	Fair	do
Mi.28-Mi. 84	(56)	Desert Track	Approx. 13	500	n.a.	Fair	do
IRAQ border to ANA	58	Earth	15	500	Poor	Fair	do
ANA to HADITHA	48	Gravel	Approx. 16	1,500	Poor	Fair	do
HADITHA to RAMADI	88	Gravel	Approx. 16	1,500	Poor	Fair	do
RAMADI to BAGHDAD	68	Bituminous	17	5,500	Fair	Fair	do
TOTAL MILEAGE	637						

Note: n.a. - Information not available

TABLE III, ALTERNATE ROUTE, MOSUL-BAGHDAD

SECRET

LOCATION	MILES	SURFACE	WIDTH FEET	CAPACITY (TONS/DAY)	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
MOSUL to BALJI	119	Earth	1 Lane	500	Poor	Fair	Off road movement is possible. Much of W. bank of TIGRIS R. is very steep. Ground sufficiently firm to support vehicles. Excellent conditions prevail on plain outside the TIGRIS Valley.
BAIJI to SAMARRA	55	Earth and Gravel	20	800/	Poor	Fair	Same as above
SAMARRA to BAGHDAD	80	Asphalt	20	2,000/	Good	Fair	Same as above
TOTAL MILEAGE	254						

SECRET

TABLE IV

NORTH ROUTE

CURRENT OPERATING CAPACITY-500 SHORT TONS PER DAY

TASK	QUANTITY	MAN HOURS	BN MO.	ST	MT
1. ROAD MAINTENANCE					
One lane (earth)	54 mi.	5,346	.06	0	0
Two and one half lane (gravel)	380 mi.	75,240	.84	380	445
Two lane (bituminous)	449 mi.	29,634	.33	449	526
2. ROAD REHABILITATION					
One lane (gravel)	6 mi.	30,000	.33	30	30
Two lane (gravel)	38 mi.	247,000	2.7	418	532
Two lane (bituminous)	23 mi.	165,600	1.84	253	322
3. TACTICAL BRIDGING					
Floating Bridge (M4T6)	9,869 L.F.	21,000	.23	6,475	14,350
Fixed Bridge (Bailey Type)	11,838 L.F.	17,352	.19	7,964	9,812
4. LOC FIXED BRIDGING (Replaces Floating)	9,869 L.F.	110,550	1.2	6,504	8,270
TOTAL		701,722	8	22,374	34,287

TABLE V

SOUTH ROUTE

CURRENT OPERATING CAPACITY-500 SHORT TONS PER DAY

TASK	QUANTITY	MAN HOURS	BN MO.	ST	MT
1. ROAD MAINTENANCE					
One lane (earth)	56 mi.	5,544	.06	0	0
One lane (bituminous)	16 mi.	1,056	.01	9	12
One and one half lanes (gravel)	221 mi.	43,758	.49	221	259
Two;and one and one half lanes (bituminous)	344 mi.	22,704	.25	344	403
2. ROAD REHABILITATION					
One lane (gravel)	6 mi.	30,000	.33	30	30
One lane (bituminous)	1 mi.	5,000	.05	5	5
Two lane (gravel)	22 mi.	146,250	1.63	244	308
Two lane (bituminous)	18 mi.	129,600	1.44	198	252
3. TACTICAL BRIDGING					
Floating Bridge (M4T6)	5,436 L.F.	11,490	.13	3,543	7,852
Fixed Bridge (Bailey Type)	4,074 L.F.	5,929	.07	1,360	2,012
4. LOC FIXED BRIDGING (Replaces Floating)	5,436 L.F.	60,300	.67	3,494	4,511
TOTAL		461,631	5.13	9,448	15,644

TABLE VI

NORTH ROUTE (SECTION FROM TURKEY BORDER TO BAGHDAD ONLY)

CURRENT OPERATING CAPACITY-500 SHORT TONS PER DAY

TASK	QUANTITY	MAN HOURS	BN MO.	ST	MT
1. ROAD MAINTENANCE					
One lane (earth)	54 mi.	5,544	.06	0	0
Two lane (bituminous)	366 mi.	24,156	.26	366	428
2. ROAD REHABILITATION					
One lane (gravel)	6 mi.	30,000	.33	30	30
Two lane (bituminous)	19 mi.	136,800	1.5	209	266
3. TACTICAL BRIDGING					
Floating Bridge (M4T6)	6,320 L.F.	14,400	.16	4,440	9,840
Fixed Bridge (Bailey Type)	2,494 L.F.	3,615	.04	1,659	2,453
4. LOC FIXED BRIDGING (Replaces Floating)	6,820 L.F.	77,050	.86	4,464	5,764
TOTAL		291,565	3.23	11,168	18,781

TABLE VII

ENGINEER CONSTRUCTION BATTALION EQUIPAGE AUGMENTATION

TASK	OCE FUNCTIONAL COMPONENT	NO.		ST	MT
1. CURRENT ROAD CAPACITY					
a. NORTH ROUTE					
Bridging, Highway	E-08101*	2		1,400	4,320
Road	E-08109	6		4,200	12,960
			TOTAL	5,600	17,280
b. SOUTH ROUTE					
Bridging, Highway	E-08101	1		700	2,160
Road	E-08109	4		2,800	8,640
			TOTAL	3,500	10,800
c. NORTH ROUTE (TURKEY BORDER TO BAGHDAD)					
Bridging, Highway	E-08101	1		700	2,160
Road	E-08109	2		1,400	4,320
			TOTAL	2,100	6,480

TABLE VII (Contd)

ENGINEER CONSTRUCTION BATTALION EQUIPAGE AUGMENTATION

TASK	OCE FUNCTIONAL COMPONENT	NO.		ST	MT
2. EXPANDED ROAD CAPACITY					
a. NORTH ROUTE					
Bridging, Highway	E-08101	2		1,400	4,320
Road	E-08109	8		5,600	17,280
			TOTAL	7,000	21,600
b. SOUTH ROUTE					
Bridging, Highway	E-08101	2		1,400	4,320
Road	E-08109	10		7,000	21,600
			TOTAL	8,400	25,920
c. SOUTH ROUTE(TURKEY BORDER TO BAGHDAD)					
Bridging, Highway	E-08101	2		1,400	4,320
Road	E-08109	4		2,800	8,640
			TOTAL	4,200	12,960

*Number refers to equipage list in Engineer Functional Component System

TABLE VIII

NORTH ROUTE

EXPANDED OPERATING CAPACITY, 1500 SHORT TONS PER DAY IN 30 DAYS

TASK	QUANTITY	MAN HOURS	BN MO.	ST	MT
1. ROAD MAINTENANCE					
Two lane (gravel)	380 mi.	85,932	.95	380	445
Two lane (bituminous)	449 mi.	29,634	.33	449	526
2. ROAD REHABILITATION					
One and one half lane (bituminous)	4 mi.	28,800	.32	44	56
One and one half lane (gravel)	10 mi.	65,000	.72	110	140
3. ROAD CONSTRUCTION					
One lane gravel to 2 lane gravel	54 mi.	388,800	4.32	594	756
One lane earth to 2 lane gravel	35 mi.	252,000	2.8	385	490
TOTAL		850,166	9.5	1,962	2,413

TABLE IX

SOUTH ROUTE

EXPANDED OPERATING CAPACITY, 1500 SHORT TONS PER DAY IN 30 DAYS

TASK	QUANTITY	MAN HOURS	BN MO.	ST	MT
1. ROAD MAINTENANCE					
One lane (bituminous)	16 mi.	1,056	.01	9	12
Two; and one and one half lanes (gravel)	277 mi.	44,946	.50	221	259
Two; and one and one half lanes (bituminous)	344 mi.	22,704	.25	344	403
2. ROAD REHABILITATION					
Two lane (gravel)	22 mi.	146,250	1.63	244	308
Two lane (bituminous)	12.4 mi.	89,280	.99	136	174
3. ROAD CONSTRUCTION					
Widen one lane to two (gravel)	114 mi.	820,800	9.12	1,254	1,596
Widen one lane to two (bituminous)	16 mi.	115,200	1.28	176	224
TOTAL		1,240,236	13.7	2,375	2,976

TABLE X

NORTH ROUTE (SECTION FROM TURKEY BORDER TO BAGHDAD ONLY)

EXPANDED OPERATING CAPACITY 1,500 SHORT TONS PER DAY IN 30 DAYS

TASK	QUANTITY	MAN HOURS	BN MO.	ST	MT
1. ROAD MAINTENANCE					
Two lane (gravel)	54 mi	10,692	.12	0	0
Two lane (bituminous)	366 mi	24,156	.26	366	428
2. ROAD REHABILITATION					
Two lane (bituminous)	19 mi	136,800	1.5	209	266
3. ROAD CONSTRUCTION					
One lane earth to two lane gravel	54 mi	388,800	4.32	594	756
TOTAL		560,448	6.2	1,169	1,450

TABLE B-1-a

SELECTED HIGHWAY STRUCTURES

TURKEY, SYRIA, IRAQ HIGHWAYS

NORTH ROUTE

BRIDGE NUMBER	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
A 19	Approx 25 mi N of ISKENDERUN	Combination causeway & concrete slab	292	21.6	Unlimited	
A 20	Approx 25 mi N of ISKENDERUN	Combination causeway & concrete	481	22.6	Unlimited	
A 21	Approx 25 mi N of ISKENDERUN	Concrete girder	92	20	Unlimited	
A 22	Approx 50 mi N of ISKENDERUN	Reinforced concrete cantilever slab	105	17	n.a.	Very good condition
A 23	Approx 60 mi N of ISKENDERUN	Masonry arch	130	20.3	n.a.	Excellent condition
A 24	At FEVZIPASA	Tunnel	112	12	n.a.	Vertical clearance 19'8"; Horizontal clearance 13'6"
A 25	Approx 20 mi E of FEVZIPASA	Steel	180	12	10	
A 26	Near GAZIANTEP	Masonry arch	125	20	n.a.	Very good condition
A 27	At BIRECIK	Reinforced concrete, cantilever girder	2,267	26.4	n.a.	Over FIRAT NEHRI RIVER
A 28	Approx 25 mi NE of URFA	Reinforced concrete girder	164	18	n.a.	Very good condition
A 29	Approx 5 mi E of SIVEREK	Masonry arch	115	15.8	n.a.	Very good condition
A 30	Approx 25 mi W of DIYARBAKIR	Masonry arch	175	23.25	n.a.	Very good condition

NOTE: n.a. - Information not available

TABLE B-1-a (Cont.)

SELECTED HIGHWAY STRUCTURES

TURKEY, SYRIA, IRAQ HIGHWAYS

NORTH ROUTE BRIDGE NUMBER	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
A 31	Near DIYARBAKIR	Reinforced concrete girder	192	18	n.a.	Good condition
A 32	Approx 5 mi E of DIYARBAKIR	Masonry arch	251	18.75	n.a.	Very good condition
A 33	Approx 25 mi SE of DIYARBAKIR	Steel stringer	107	26	n.a.	Very good condition
A 34	Near MARDIN	Masonry arch	94	17	n.a.	Good condition
A 35	At MOSUL	Steel through truss	960	18	50	Over TIGRIS RIVER
A 36	At MOSUL	Masonry arch	450	n.a.	n.a.	Over flood canal
A 37	25 mi E of MOSUL	Steel through truss and beam	320	16	70	Over KHAZIR RIVER
A 38	21.5 mi W of ERBIL	Steel through truss masonry arch	1,320	18	70	Over GREATER ZAB RIVER
A 39	At ESKI KELLEK	Reinforced concrete slab	200	n.a.	n.a.	Dry run-off of GREATER ZAB RIVER
A 40	At ESKI KELLEK	Steel through truss	103	10	60	GREATER ZAB RIVER
A 41	At ERBIL	Steel beam	111	24	40	
A 42	At ALTUN KUBRI	Reinforced concrete	1,400	n.a.	n.a.	Lesser ZAB RIVER
A 43	4 mi SE of ALTUN KUBRI	Steel through truss	122	10.75	40	Over JOLAK RIVER

NOTE: n.a. - Information not available

TABLE B-1-a (Cont.)

SELECTED HIGHWAY STRUCTURES

TURKEY, SYRIA, IRAQ HIGHWAYS

BRIDGE NUMBER	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
NORTH ROUTE						
A 44	7 mi S of KIRKUK	Reinforced concrete slab	132	n.a.	70	
A 45	29 mi S of KIRKUK	Masonry arch, steel through truss	613	10	60	Over TAUG CHAI RIVER
A 46	At TAZA KHURMATLI	Reinforced concrete slab	143	24	n.a.	
A 47	2 mi S of TUZ KHURMATU	Steel deck girder	1,012	11	40	Road and rail bridge; new bridge under constr. 1 mi S
A 48	6.5 mi E of BAGHDAD	Steel and concrete slab	150	20	40	One way traffic; twin bridge 30 ft away
A 49	6.5 mi E of BAGHDAD	Steel and concrete slab	150	20	40	One way traffic; twin bridge 30 ft away
A 50	5.8 mi NE of BAGHDAD	Steel and concrete slab	225	20	40	One way traffic; twin bridge 30 ft away
A 51	5.8 mi NE of BAGHDAD	Steel and concrete slab	225	20	40	One way traffic; twin bridge 30 ft away
NORTH ROUTE (West Alternate)						
A 52	18.2 mi N of QAIYARA	Concrete beam	139.5	10	40	Curved approaches
A 53	3.6 mi N of QAIYARA	Steel truss	110	10.8	24	Stream fordable downstream

NOTE: n.a. - Information not available

TABLE B-1-a (Cont.)

SELECTED HIGHWAY STRUCTURES

TURKEY, SYRIA, IRAQ HIGHWAYS

BRIDGE NUMBER	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
NORTH ROUTE (West Alternate)						
A 54	8.5 mi N of SHARGAT	Steel truss	128	19	24	
A 55	3 mi SW of SAMARRA	Reinforced concrete deck girder	1,673	n.a.	n.a.	THARTHAR flood control regulator carries RR and highway. Two way traffic, will support medium tanks.
SOUTH ROUTE						
A 1	Near BEDIEKE (mi 24)	Concrete girder	158	15.2	n.a.	18.7 Horizontal clearance
A 2	In ANTAKYA (mi 36)	Masonry arch	157	29.7	n.a.	Demolition wells installed by-pass impossible
A 3	26 mi E of ANTAKYA (mi 62)	Masonry arch, concrete slab	197	16	n.a.	By-pass impossible
A 4	35 mi NW of HADITHA	Steel beam	188	12.75	18	Curved approaches
A 5	9.2 mi NW of KHAN BAGHDADI	Steel beam	137	9.1	24	Bridge in poor condition, undergoing repair
A 6	Over WADI AL ASID	Steel beam	167	24	n.a.	Newly constructed
A 7	3 mi S of HADITHA (mi 486)	Masonry arch, viaduct	225	13.8	18	Curved approaches
A 8	1 mi N of SAHILIYA	Concrete slab	n.a.	n.a.	n.a.	Probably over 100 ft long, has 4 concrete piers

NOTE: n.a. - Information not available

TABLE B-1-a (Cont.)

SELECTED HIGHWAY STRUCTURES

TURKEY, SYRIA, IRAO HIGHWAYS

SOUTH ROUTE

BRIDGE NUMBER	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
A 9	At SAHILIYA	Steel pony truss	99	10.5	18	No alternate crossing
A 10	2 mi W of RAMADI	Reinforced concrete arch	552	n.a.	n.a.	Vertical clearance limited; two way traffic, can support a medium tank.
A 11	7 mi E of RAMADI	Concrete slab	865	n.a.	30	
A 12	1/2 mi S of HABBONIYA	Reinforced concrete arch	115	n.a.	n.a.	Can handle two way traffic only with difficulty; probably can support a medium tank.
A 13	5.5 mi SW of FALLUJA	Reinforced concrete	289	n.a.	60	
A 14	3.6 mi SW of FALLUJA	Reinforced concrete	198	19.75	60	
A 15	At FALLUJA	Steel truss	910	12	20	Single lane
A 16	Mile 30	Masonry, stone arch	140	20	n.a.	Causeway with arch openings. No by-pass
A 17	Mile 30.3	Masonry, stone arch	600	20	n.a.	Causeway with arch openings. No by-pass
A 18	At MUSERFIYE (mi 44)	Concrete girder	159	13.3	20	17'11" horizontal clearance. Stream fordable 600 ft upstream.

NOTE: n.a. - Information not available

SECRET

TABLE B-1-a (Cont.)

SELECTED HIGHWAY STRUCTURES

TURKEY, SYRIA, IRAQ HIGHWAYS

SOUTH ROUTE BRIDGE NUMBER	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
* SHOWN ON ROUTE "C"						
C 18	3 mi SW of BAGHDAD	Steel truss	167	10	12	KHIRR BRIDGE
C 23	At BAGHDAD	Steel deck plate girder	1,000	24	80	KING FAISAL II BRIDGE
C 24	At BAGHDAD	Steel deck plate girder	1,050	n.a.	n.a.	KING GHAZI BRIDGE

* NOTE: See Exhibit D-1

NOTE: n.a. - Information not available

SECRET

TAB 2 TO APPENDIX B

RAILROADS

ISKENDERUN - BAGHDAD

1. GENERAL:

a. See Exhibit B-2

b. One standard gage (4' 8½") single-track railroad with 75 pound per yard rail is available to support an LOC on approach route A. This line starting at ISKENDERUN traverses a distance of 807 miles through TURKEY (generally paralleling the TURK-SYRIAN border), SYRIA and IRAQ terminating at BAGHDAD.

c. The railway crosses 26 critical bridges totaling 7779 feet. All of these bridges are over 100 feet in length. The bridge at KARKAMIS in TURKEY with a length of 2,630 feet is most critical. There are 19 major tunnels on this route, of which 18 occur between ISKENDERUN and ALEPPO a distance of 165 miles. Motive power is predominantly oil or coal-fired steam locomotive.

2. CURRENT OPERATING CAPACITY:

a. The present rail traffic on this line is limited by economic factors to two trains each way per week with a net load of 300 short tons per train. It is estimated that under military operation or supervision the railway capacity would be 10 trains per day each way at 400 short tons per train.

b. It is assumed that TURKEY will accomplish rehabilitation and maintenance of the railway for that portion which is within her borders. US effort would be necessary for only that section (470 miles) which traverses SYRIA and IRAQ. To rehabilitate and maintain the latter portion of this line and its related facilities in 30 days, the estimated engineer effort would be approximately 12 engineer construction battalion months and 45,000 short tons of material. This estimate assumes an average combat damage or demolition factor of 15% prior to acquisition for LOC use.

3. EXPANDED OPERATING CAPACITY:

The present line with the estimated rehabilitation effort is sufficient to handle an optimum of 10 trains per day with a net load of 400 short tons per train. Expansion of the existing facility would require installation of an additional through track which is not considered feasible in the time available. Such construction would require approximately 167 construction battalion months and 510,400 ST of material.

4. OPERATIONAL CONSIDERATIONS:

a. Vulnerability

(1) The absence of an alternate route in any of the countries increases the significance of the vulnerability of the line to attack at critical points, such as bridges and tunnels.

(2) The critical structures (bridges and tunnels) would require time-consuming effort to rehabilitate if destroyed. The majority of such structures are located in TURKEY, but it is assumed that Turkish armed forces would insure the security of these facilities. Special effort should be made to capture such structures in SYRIA and IRAQ.

b. Resources

(1) Manpower

It is estimated that 6000 railway personnel are presently required to operate and maintain this railroad. The rail line is of international importance. Each of the 3 governments attaches considerable importance to efficient operation of the railway. Within the 3 countries there is a combined pool of approximately 45,000 skilled and semi-skilled railroad personnel which could be available. Indigenous common labor would be adequate and readily available from the towns and villages located along the railway route. Skilled laborers may be located in limited numbers in the major urban areas, i.e. BAGHDAD, MOSUL, ALEPPO, KIRKUK, ISKENDERUN.

(2) Materials

(a) Lumber. Timber stands are scarce throughout the study area, presenting critical lumber problem for the railroads. Almost all wooden cross ties have to be imported. Approximately 50% of the initially placed wooden cross ties on this rail line have been replaced with steel cross ties.

(b) Ballast. Construction material necessary for the rehabilitation of the railroad bed is available in quantity along the entire route of the rail line. In TURKEY and northwest SYRIA hard limestone and gravel may be found. Along the remainder of the approach route, limestone, sandstone, and gravel will be available.

(c) Steel. Bridge components, rails, spikes, and track fittings as well as ancillary tools, must be imported. TURKEY, if furnished the materials, is capable of manufacturing a limited amount of its railway requirements.

5. CRITICAL ITEMS

a. Manpower. Twelve augmented construction battalions are required to rehabilitate and maintain the railway from the Turkish border to BAGHDAD. Availability of indigenous labor in SYRIA and IRAQ to appreciably reduce unit requirements is uncertain and cannot be estimated at this time.

b. Meterial.

(1) Railroad cross-ties

(2) Railroad rail, 85 pound per yard

(3) Corrugated metal culvert pipe

(4) Construction steel and timber

(5) Special LOC railroad bridging

TABLE B-2-a

SELECTED RAILROAD BRIDGES

TURKEY-SYRIA-IRAQ STATE RAILWAYS

BRIDGE NO.	LOCATION	TOTAL LENGTH FT.	TYPE	SPANS NUMBER	SPANS LENGTH FT.	REMARKS
1	About 5 miles N. of ISKENDERUN	113	Reinforced Concrete deck girder	3 1	30 23	Over DEREBAHI DERESI
2	2 miles WSW of DORTYOL	198	Steel truss	3	66	Over OZERLI CAYI
3	2 miles W of DORTYOL	198	Steel truss	3	66	Over DELI CAY
4	At TOPRAKKALE	198	Steel truss	3	66	Over KARASU
5	Approx. 12 miles NE of TOPRAKKALE	126	Stone Masonry deck arch	2 1	39 46	Over KARANLIK DERESI
6	Approx. 14 miles NE of TOPRAKKALE	131	Steel deck truss	1	131	Over Tributary of HUMUSUYU
7	Approx. 15 miles NE of TOPRAKKALE	230	Steel truss	2 1	33 164	
8	Approx. 10 miles NW of FEVZIPASA	300	Reinforced Concrete deck girder	10	30	Over HUMUSUYU
9	Approx. 15 miles S of FEVZIPASA	240	Reinforced Concrete deck arch	6	40	Over KARASU

TABLE B-2-a (Contd)

SELECTED RAILROAD BRIDGES

TURKEY-SYRIA-IRAQ STATE RAILWAYS

BRIDGE NO.	LOCATION	TOTAL LENGTH FT.	TYPE	SPANS NUMBER	SPANS LENGTH FT.	REMARKS
10	Approx. 16 miles S of FEVZIPASA	132	Steel truss	2	66	Over tributary of KARASU
11	3.3 miles N of RAJU	906	Steel trestle	1 3 1	131 243 46	DERE RIVER(prepared for demolition.)Approx. 3,000 feet from a 541 foot tunnel.
12	11.8 miles S of MEIDAN EKBES	565	Steel viaduct	1 1 1	300 165 100	
13	0.3 miles N of QOURTE QUALQ	105	Steel truss	1	105	AAFRINE RIVER(prepared for demolition.)
14	1.3 miles S of QOURTE QUALQ	164	Steel lattice girder	1	164	AFRIN SU RIVER.
15	9.7 miles N of MUSLIMIYA	104	Steel & Concrete lattice girder	2 1	32 40	QUWEUQ RIVER
16	Approx. 25 miles WSW of KARKAMIS	107	Steel girder Reinforced Concrete girder	1 1	69 38	Over NAHR SAJUR (SADJOUR)
17	At KARKAMIS	2,630	Steel through truss	10	263	Over NAHR AL FURAT (EUPHRATES). Longest railway bridge in TURKEY.

TABLE B-2-a (Contd)

SELECTED RAILROAD BRIDGES

TURKEY-SYRIA-IRAQ STATE RAILWAYS

BRIDGE NO.	LOCATION	TOTAL LENGTH FT.	TYPE	SPANS NUMBER	SPANS LENGTH FT.	REMARKS
18	2 miles SW of CEYLANPINAR	131	Steel truss	1	131	Over NAHR EL KHABUR
19	4 miles NE of CEYLANPINAR	210	Steel truss	1	210	Over KUC CIRCIPSUYU
20	12 miles NE of CEYLANPINAR	262	Steel truss	2	131	Over WADI JIRDJIB
21	11 miles NW of TALL KUTCHUK station (in SYRIA)	120(est)	Steel deck	3	n.a.	WADI RUMEILEH
22	Near EL QAYARAH (35°51'N., 43°17'E.)	120	Steel lattice girder	1	120	WADI AI QASAB
23	Near EL QAYARAH (35°35'N.,43°14'E.)	120	Steel lattice girder	1	120	WADI S. JARNOF
24	SAMARRAH (34°10'N.,43°50'E)	131	Concrete encased steel	2	n.a.	
25	(33°27'N., 44°17'E.)	120	Concrete encased steel	7	n.a.	
26	North of AL-KADHIMAN RR station (BAGHDAD) (33°23'N., 44°18'E.)	120	Concrete encased steel	7	n.a.	

NOTE: n.a. - Information not available.

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SELECTED RAILROAD TUNNELS

TURKEY-SYRIA-IRAQ STATE RAILWAYS

TABLE B-2-b

TUNNEL NO.	LOCATION	LENGTH (Ft)	NUMBER OF TRACKS	CLEARANCE VERTICAL (Ft)	CLEARANCE HORIZONTAL (Ft)	REMARKS
1	18 miles NE of TOPRAKKALE	3,342	1	18.2	16.4	Masonry lined, natural ventilation and drainage.
2	19.5 miles NE of TOPRAKKALE	623	1	18.2	16.4	" " "
3	20 miles NE of TOPRAKKALE	7,744	1	18.2	16.4	" " "
4	20.5 miles NE of TOPRAKKALE	1,439	1	18.2	16.4	" " "
5	21 miles NE of TOPRAKKALE	482	1	18.2	16.4	" " "
6	21.5 miles NE of TOPRAKKALE	366	1	18.2	16.4	" " "
7	22 miles NE of TOPRAKKALE	751	1	18.2	16.4	" " "
8	22.5 miles NE of TOPRAKKALE	1,423	1	18.2	16.4	" " "
9	9 miles NNW of FEVZIPASA	1,341	1	18.2	16.4	" " "
10	4 miles N of FEVZIPASA	16,062	1	18.2	16.4	Masonry lined, natural ventilation and drainage; longest tunnel in TURKEY.
11	3.5 miles N of FEVZIPASA	220	1	18.2	16.4	Masonry lined, natural ventilation and drainage.

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SELECTED RAILROAD TUNNELS - Cont'd

TURKEY SYRIA IRAQ STATE RAILWAYS

TABLE B-2-b

TUNNEL NO.	LOCATION	LENGTH (Ft)	NUMBER OF TRACKS	CLEARANCE VERTICAL (Ft)	CLEARANCE HORIZONTAL (Ft)	REMARKS
12	3 miles N of FEVZIPASA	501	1	18.2	16.4	Masonry lined, natural ventilation and drainage.
13	2.5 miles N of FEVZIPASA	1,191	1	18.2	16.4	" " "
14	1.5 miles N of FEVZIPASA	1,753	1	18.2	16.4	" " "
15	3.3 miles S of MEIDAN EKBES	426	1	n.a.	n.a.	n.a.
16	2.8 miles W of RAJU	541	1	n.a.	n.a.	n.a.
17	1.7 miles N of RAJU	1,771	1	n.a.	n.a.	n.a.
18	2.7 miles W of KATMA	770	1	n.a.	n.a.	n.a.
19	4 miles S of MOSUL	3,300	1	n.a.	n.a.	Masonry lined, natural ventilation and drainage.

n.a. - Intelligence not available.

Combined total length of all tunnels - 37,046
Average feet of tunnel per mile - 2.3 feet

(NOTE: 14 of the 19 tunnels, totaling 33,538 feet, are located in one section of TURKEY of approximately 20 miles)

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TAP 3 to APPENDIX B

POL AND AIRFIELDS

SECTION I-POL

1. GENERAL

a. This section contains intelligence data and estimated Engineer construction requirements for a petroleum distribution system along three possible routes from ISKENDERUN to BAGDAD: a northern route via MOSUL, a southern route via ALEPPO and a route utilizing existing NATO facilities generally parallel to the northern route. The most favorable terrain for construction of a pipeline is along the southern route; however, this route is the most vulnerable because it crosses through SYRIA.

b. The capability to move POL by tank trucks in large quantities along the southern LOC is questionable because of limited highway capacities. Along the northern LOC POL could be supplied by railroad tank cars provided that sufficient rolling stock is available.

2. CURRENT OPERATING FACILITIES

a. Tanker Discharge Facilities

(1) Facilities for unloading tankers are adequate at ISKENDERUN. Controlling depth of water at low tide is 36 feet. There are two tanker berths at the oil port on the northeast side of ISKENDERUN harbor as follows:

TABLE B-3-a
TANKER DISCHARGE FACILITIES

FACILITY	TANKER ACCOMMODATION
Dock - 525' x 70' (Depth alongside 30')	T-2
Submarine Pipeline (36' - Depth)	T-2 or Supertanker

b. Existing Bulk Storage

(1) At ISKENDERUN a total of 1,366,000 barrels of bulk storage capacity is available for support of a military operation, as follows:

TABLE B-3-b

EXISTING BULK STORAGE

TYPE	BARRELS
NATO (Construction completed)	375,000
US AIR FORCE (leased)	50,000
Commercial	691,000
ADANA Airfield	250,000
TOTAL	1,366,000

(2) Small amounts of commercial storage are also available at the following locations:

TABLE B-3-c

COMMERCIAL STORAGE

LOCATION	CAPACITY (Barrels)
KIRKUK	3,151
MOSUL	5,029
BAGHDAD	55,145
TOTAL	63,325

c. Pipelines

(1) ADANA military airfield (INCIRLIK) is connected to the port facilities at ISKENDERUN by an eight inch pipeline.

(2) A NATO pipeline is under construction along the route ISKENDERUN-MALATYA-ELAZIG-DIYARBAKIR-BATMAN to supply Turkish airfields (See Section II Tab 3). The location of this pipeline from ISKENDERUN to DIYARBAKIR is approximately 50 miles north of the northern highway route under consideration in this study.

(3) Major crude oil pipelines run from the KIRKUK oil fields to TRIPOLI, LEBANON, and HAIFA, ISRAEL. They could not be used to pump refined products for the support of this operation.

d. Petroleum Refineries

(1) IRAQ Refineries

The small refineries at KIRKUK, HADITHA, ALWAND, and DAURA, BAGHDAD (see Tab 3, Appendix D, for capacities) are mainly required to supply needs of the local economy. The straight-

run gasoline produced has a low octane rating. Significant quantities for military purposes will not be available from this source.

(2) Eastern Mediterranean Refineries

The refineries at HAIFA, ISRAEL, and TRIPOLI, LEBANON, have the capability to produce some of the petroleum products to support a military operation. However, the HAIFA refinery has only operated at a capacity of 20,000 barrels per day since 1948 because IRAQ has prohibited movement of crude oil through the pipeline from the KIRKUK oil fields. Similarly, production at the TRIPOLI refinery has been interrupted twice in the last year by sabotage of the crude oil pipelines.

Operating characteristics of these refineries are:

(a) HAIFA

Capacity: 90,000 barrels per day.

Products: MOGAS, kerosene, diesel, & fuel oil.

(b) TRIPOLI

Capacity: 11,500 barrels per day.

Products: MOGAS, kerosene, fuel oil, and diesel fuel.

3. ENGINEER SUPPORT REQUIRED

a. Estimated construction requirements have been computed for alternate petroleum distribution systems over the following routes:

(1) ISKENDERUN - MOSUL -BAGHDAD adjacent to existing railroad. (northern route - 833 miles).

(2) ISKENDERUN-ALEPPO-BAGHDAD(southern route - 600 miles).

(3) Over existing NATO line ISKENDERUN-MALATYA-ELAZIG then new construction ELAZIG-DIYARBAKIR-MARDIN-MOSUL-BAGHDAD(570 miles new construction).

b. Estimates assume that LOC capacity will permit hauling the required tonnages of materials along the selected routes. These are large tonnages and will conflict with other LOC transport requirements.

c. Northern LOC

(1) Tasks

Construction of 833 miles of 6-inch pipeline, eight operating tank farms (150,000 bbls capacity each) at approximately 100 mile intervals along the pipeline, and one 190,000 barrel tank farm at BAGHDAD.

(2) Effort

To provide facilities in 60 days will require:

6 Engineer Pipeline Companies

3 Engineer Construction Battalions

(3) Tonnages

The class IV Tonnage required for materials to construct a petroleum distribution system is 37,630 short tons.

d. Southern LOC

(1) Tasks

Construction of 600 miles of 6-inch pipeline, four operating tank farms (150,000 bbls capacity each) at approximately 100 mile intervals along the pipeline, and one 190,000 barrel tank farm at BAGHDAD.

(2) Effort

To provide facilities in 60 days will require:

5 Engineer Pipeline Companies

2 Engineer Construction Battalion

(3) Tonnages

The Class IV tonnage required for materials to construct this petroleum distribution system is 27,400 short tons.

e. Combination NATO - Northern Route

(1) Tasks

(a) Construction of 570 miles of 6" pipeline, four operating tank farms (150,000 bbl capacity each) and one 190,000 barrel tank farm at BAGHDAD.

(b) Installation of 20 pump stations along NATO line between ISKENDERUN and ELAZIG.

(2) Effort

To provide facilities in 60 days will require:

5 Engineer Pipeline Companies

2 Engineer Construction Battalions

(3) Tonnages

The Class IV tonnage required for materials to construct this petroleum distribution system is 32,300 short tons.

4. CRITICAL FEATURES OF OPERATION

a. NATO pipeline. Latest intelligence indicates that the pipe along this line, programmed to support NATO airbases, is in place. The pumping stations are not yet constructed, thus precluding the full operational use of the supported airfields, unless bulk POL can be transported by rail or highway from ISKENDERUN, or pumping facilities are installed. Full operational usage of those bases along the NATO pipeline (Section II this tab - Airfields) will be contingent on the installation of the pumping facilities. An additional and recommended possibility would be the utilization of the NATO line (after installation of pumping facilities) from ISKENDERUN to ELAZIG, plus extension of this line to BAGHDAD via MARDIN.

b. Proposed pipeline construction.

(1) Construction materials will have to be transported by road or rail to the construction site. This involves the transport of from 27,400 to 37,630 short tons over a 60 day period.

(2) All three routes cross SYRIA. This could be a critical factor and should be considered in the overall evaluation of preferred route. The pipeline using NATO facilities plus the new extension would be the least vulnerable of the three insofar as exposure to possible enemy or dissident action is concerned.

c. Transportation

Transportation of the substantial tonnage to support pipeline construction is a serious problem regardless of the route finally chosen. Tonnages vary from 27,400 to 37,630 short tons depending on

(2) Effort

To provide facilities in 60 days will require:

5 Engineer Pipeline Companies

2 Engineer Construction Battalions

(3) Tonnages

The Class IV tonnage required for materials to construct this petroleum distribution system is 32,300 short tons.

4. CRITICAL FEATURES OF OPERATION

a. NATO pipeline. Latest intelligence indicates that the pipe along this line, programmed to support NATO airbases, is in place. The pumping stations are not yet constructed, thus precluding the full operational use of the supported airfields, unless bulk POL can be transported by rail or highway from ISKENDERUN, or pumping facilities are installed. Full operational usage of those bases along the NATO pipeline (section II this tab - Airfields) will be contingent on the installation of the pumping facilities. An additional and recommended possibility would be the utilization of the NATO line (after installation of pumping facilities) from ISKENDERUN to ELAZIG, plus extension of this line to BAGHDAD via MARDIN.

b. Proposed pipeline construction.

(1) Construction materials will have to be transported by road or rail to the construction site. This involves the transport of from 27,400 to 37,630 short tons over a 60 day period.

(2) All three routes cross SYRIA. This could be a critical factor and should be considered in the overall evaluation of preferred route. The pipeline using NATO facilities plus the new extension would be the least vulnerable of the three insofar as exposure to possible enemy or dissident action is concerned.

c. Transportation

Transportation of the substantial tonnage to support pipeline construction is a serious problem regardless of the route finally chosen. Tonnages vary from 27,400 to 37,630 short tons depending on

routing. For a 30-day completion time, this is approximately 1,000 tons per day which is a significant percentage of total support tonnages. The requirement for land transport of POL while the pipeline is under construction adds to the seriousness of the transport problem. Transport capability may be the over-riding consideration in choice of route of the pipeline and consequently the line would follow the route of maximum transport capability.

5. CRITICAL ITEMS

All pipeline construction materials should be considered as critical items.

TAB 3 to APPENDIX B

POL AND AIRFIELDS

SECTION II AIRFIELDS

1. GENERAL.

There are seventeen airfields in proximity to Route A which are significant in connection with support of combat operations in the study area. Ten of these airfields are in TURKEY, three in SYRIA and four in IRAQ. The Turkish airfields are generally superior in construction and support facilities, such as POL storage and supply, and modern navigation aids. Table B-3-d summarizes the current facility status of these airfields. Exhibit B-3 shows the location of these airfields.

2. CURRENT OPERATING CAPACITY.

a. Capacity. All current operational cargo and tactical aircraft can be accommodated by one, or a combination of airfields in this area. INCIRLIK and ADANA (Civil) can accommodate heavy combat cargo aircraft and jet fighters under sustained operations without any initial rehabilitation. DIYARBAKIR, MOSUL, K-1, and KIRKUK MILITARY can accommodate medium cargo aircraft and jet fighters under sustained operations, and heavy cargo type aircraft for limited operations without initial rehabilitation. A summary of the aircraft accommodation characteristics for the airfields considered in this study area is as follows:

TABLE B-3-d

AIRFIELD ACCOMMODATION CHARACTERISTICS

AIRFIELD	TYPE AIRCRAFT
ADANA	Heavy cargo - Jet Fighters
INCIRLIK	Heavy cargo - Jet Fighters

TABLE B-3-d cont'd

AIRFIELD ACCOMMODATION CHARACTERISTICS

AIRFIELD	TYPE AIRCRAFT
ISKENDERUN	Light cargo - Liaison
GAZIANTEP	Light cargo - Liaison
MALATYA (NEW)	Medium cargo - Jet Fighters
MALATYA	Light cargo - Jet Fighters
ELAZIG	Light cargo - Jet Fighters
URFA	Light cargo - Liaison
DIYARBAKIR	*Med cargo - Jet Fighters
BATMAN	Med cargo - Jet Fighters
ALEPPO	Med cargo - Liaison
RASIN EL ABOUD	Light cargo - Liaison
QAMICHLIYE	Light cargo - Liaison
AIN ZALAH	Med cargo - Liaison
MOSUL	*Med cargo - Jet Fighters
K-1	*Med cargo - Jet Fighters
KIRKUK MILITARY	*Med cargo - Jet Fighters

* These airfields can currently accommodate heavy combat cargo aircraft for limited periods.

b. Maintenance. Maintenance at airfields will not require major effort within 15 days, unless utilization of the airfields is in excess of the limitation as shown in Tables B-3-d and B-3-e. Required maintenance can be adequately performed by one engineer construction company per operational airfield. Assuming an average of about five airfields will be in use during any given period, two engineer construction battalions are sufficient to accomplish the required maintenance tasks under the conditions listed above.

3. EXPANDED OPERATING CAPACITY

All of the airfields which have been indicated to support combat operations along Route A, can be expanded. Two of these airfields, ADANA and INCIRLIK, can each presently support a composite tactical fighter wing under sustained operations. There are four airfields, DIYARBAKIR, MOSUL, K-1, and KIRKUK MILITARY which could be expanded by increasing runway thickness to support heavy cargo aircraft under sustained operations. One augmented engineer construction battalion at each field could accomplish this expansion in six weeks. However, due to the number of airfields which are available in the study area, this operation can be adequately supported through maximum use of existing facilities with minimum engineer effort expended on limited rehabilitation and routine maintenance.

4. CRITICAL FEATURES OF OPERATIONS

There are six airfields in TURKEY which have been connected by a POL pipeline (NATO) (See Section I this Tab). Arranged in order along the line they are ISKENDERUN, MALATYA (NEW), MALATYA, ELAZIG, DIYARBAKIR and BATMAN. The pipeline is currently non-operational since pumping equipment has not been installed. Full utilization of the airfields listed above is dependent upon the operational availability of this line.

As combat operations approach the objective area, proceeding southward in IRAQ along the main LOC, the density of major airfields decreases and a gap of 180-200 miles exists between BATMAN in TURKEY and MOSUL in IRAQ.

The airfields in IRAQ which are near this route, have a shortage of POL storage which seriously restricts air operations in this area. A planned pipeline will support ground forces operational in IRAQ, (see Section I this Tab) and the airfields in IRAQ.

SYRIA is deficient in major airfields. Accordingly, efficient Air Force tactical and cargo support to forces operating along the southern route poses a difficult problem.

5. CRITICAL ITEMS

Pierced steel plank

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CURRENT FACILITY STATUS

AIRFIELDS

TABLE B-3-e

MAP REFERENCE NUMBER	NAME	RUNWAY DIMENSIONS LENGTH (FT)	RUNWAY DIMENSIONS WIDTH (FT)	RUNWAY TYPE CONSTRUCTION	RUNWAY CONDITION	RUNWAY CAPACITY LBS	POL STORAGE	OTHER FACILITIES
24	ADANA CIVIL	9030	150	11 in to 14 in concrete on 9 in Gravel Base	n/a	200,000	205,300 gal surface tanks	60 ft wide concrete taxiway w/270,000 SF concrete apron space. ALL NAVAIDS
23	INCIRLIK	10,000	200	12 in to 14 in Rein concrete	n/a	290,000	3,743,000 gal avgas & jet fuel connected w/8 in pipeline from ISKENDERUN GULF.	2,300,000 SF concrete apron space. ALL NAVAIDS including GCA. 3-steel & concrete 200x194 ft. hangars.
22	ISKENDERUN	4360 3580	115 120	Compacted Earth Compacted Earth	n/a n/a	30,000 30,000	Projected	Small concrete parking apron. No taxiways. Radio & telephone available
20	GAZIANTEP	4300 3280	130 130	Clay Clay		30,000 30,000	None	No taxiways or parking aprons.
18	MALATYA (NEW)	11,000	150	Asphalt w/concrete ends	Good	60,000	450,000 gal underground under const. 4"pipeline from ISKENDERUN.	11,000 ft. of 75 ft. wide taxiway 530,000 SF concrete apron space, 3 hangars w/shops attached 155 x 135 ft.

NOTE: n/a - Information not available

SECRET

CURRENT FACILITY STATUS

AIRFIELDS

TABLE B-3-e (Contd)

MAP REFERENCE NUMBER	NAME	RUNWAY DIMENSIONS LENGTH (FT)	RUNWAY DIMENSIONS WIDTH (FT)	RUNWAY TYPE CONSTRUCTION	RUNWAY CONDITION	RUNWAY CAPACITY LBS	POL STORAGE	OTHER FACILITIES
1	ALEPPO	6000	150	3 in. asphalt on stone base	n/a	66,000	None	Asphalt taxiway, Apron 300x190 ft, 10 stone & 5 covered revetments. Radio & telephone. Lights projected.
9	RASIN EL ABOUD	6000	150	Asphalt on 18" rock base	n/a	40,000	15,000 gal capacity 3 small tanks	45' wide asphalt taxiway w/10 stone revetments 60'x69', Four aprons about 300x95ft. No NAVAIDS
		4500	150	Asphalt on 18" rock base	n/a			
8	QAMICHLIYE	4260	160	Asphalt on crushed stone	-	40,000	None	One apron, asphalt 260ft x 190ft.
7	AIN ZALAH	4500	150	Earth, graded, oiled	Fair	60,000	None	Radio, telephone & weather. One hangar.
		4500	150	Earth, graded, oiled	Fair	60,000		
		4200	150	Earth, graded, oiled	Closed	60,000		
4	MOSUL	7000	160	3 in. bitum-mac on crushed stone	-	93,200	Projected	65 ft. wide concrete-bituminous taxiway. 200,000 SF concrete apron space Radio, telephone & weather.
3	K-1	6000	150	Asphalt on crushed stone	-	100,000	Projected	3 asphalt hardstands & 1600 ft x 750ft parking area. All NAVAIDS
		5000	150	Asphalt on crushed stone	-	100,000		
2	KIRKUK MILITARY	5910	160	Bitumin-mac w/concrete ends	-	93,000	None	45' wide bitumin-mac taxiway, radio and telephone

NOTE: n/a - Information not available

CURRENT FACILITY STATUS

AIRFIELDS

TABLE B-3-e (Contd)

MAP REFERENCE NUMBER	NAME	RUNWAY DIMENSIONS LENGTH (FT)	RUNWAY DIMENSIONS WIDTH (FT)	RUNWAY TYPE CONSTRUCTION	RUNWAY CONDITION	CAPACITY LBS	POL STORAGE	OTHER FACILITIES
17	MALATYA	7570	160	4 to 5 in. concrete	Rough	33,000	147,000 gal surface tanks	Approx 100,000 SF concrete parking. ALL NAVAIDS
15	ELAZIG	4460 4400	130 130	5 in. concrete 5 in. concrete	n/a n/a	44,000 44,000	Projected Projected	Approx 100,000 SF concrete apron space. Radio & telecom.
16	URFA	5000 5000	150 150	Earth Earth	n/a n/a	33,000	None	Radio, telephone, weather sta.
14	DIYARBAKIR	10,000	150	Asphalt w/concrete ends crushed stone base	Good	100,000	575,890 gal avgas & jet in underground tanks. 4 in.pipeline to ISKENDERUN.Projected 2,641,700 gal additional tanks.	10,000 x 75 ft taxiway,66 concrete hardstands, 365,000 SF concrete apron space, all NAVAIDS, six hangars.
13	BATMAN	10,000	150	Asphalt w/concrete ends	Good	60,000+	100,000 gal under const. 2,641,700 stge capacity & 4"pipeline to ISKENDERUN proposed.	500,000 SF concrete apron space. 10,000 ft.x75ft. asphalt & concrete taxiway. Radio & lighting.

NOTE: n/a - Information not available

TAB 4 to APPENDIX B

PORTS & WATERWAYS

SECTION I - PORTS

1. GENERAL.

Three ports are considered as possible base section areas for the route. Two ports, ISKENDERUN and MERSIN, are secondary ports in the ADANA strategic area of the southeastern coast of TURKEY. The third port, LATAKIA, SYRIA, is a secondary port approximately 30 miles south of the TURKISH-SYRIAN border and 70 miles south of ISKENDERUN. All of these ports have alongside facilities for ocean going vessels and are generally in good condition. Except for LATAKIA, the ports have railroad clearance (See Tab 2 to this Appendix). All three ports are served by good two-lane roads (See Tab 1 this Appendix).

2. OPERATING FACILITIES.

a. ISKENDERUN.

(1) Current Operating Facilities

(a) General. (Table B-4-a) ISKENDERUN is located in a small bay. The harbor, an open roadstead is almost semi-circular in shape. Adequate protection from westward and southward is provided by mountains. The facilities consist of six anchorages in the open roadstead, and one basin, a lighter basin, protected by western and northern moles. Approaches to the harbor are free clear. There is no definite entrance channel to the [illegible] portion of the harbor. The entrance to the lighter basin, between the western and northern moles, has a width of about [illegible] controlling depths of 11 feet. ISKENDERUN primarily is a [illegible] port for agricultural products of southeastern TURKEY. A well developed petroleum terminal and naval base adjoin the commercial port (Tab B, Section I - POL).

(b) Berths. Wharves provide a total of 5,180 linear feet of berthing space of which 4,170 feet could be utilized for handling general cargo. The following lists usable berthing space and depths alongside:

Usable Berthing Space (feet)		Depths Alongside (feet)
	General and Bulk Cargo	
1,205		26 to 32
490		12 to 20
1,925		8 to 10
3,620		
	Petroleum Products	
100		Less than 7
1,100	Naval Vessels	Probable 14 to 21
360	Miscellaneous	8 to 10

(c) Mechanical Handling Facilities. There are five 5- to 6-ton portal jib cranes; seven 2- to 10-ton locomotive cranes; 3 fixed jib cranes - on of 2 tons, one of 3 tons, and one of unknown capacity; and twelve 5-ton automotive cranes. There are no floating cranes in the port.

(d) Storage. Covered storage space totals 273,750 square feet. Cold storage totals 6,350 cubic feet. Open storage space is unlimited in the ISKENDERUN area.

(e) Clearance. A standard-gage, single-track railroad clears the town northward; east of CEYAN, it turns southward to ALEPPO. Yard facilities in the port area include a 6-track classification yard (containing 2.25 statute miles of track). A 7-track double-ended yard and railroad station are located about 0.25 miles southwest of lighter harbor with about 2.5 statute miles of track. An 8-track single-ended classification yard is located about 140 yards south of lighter harbor and contains 1.25 miles of track.

The port area is backed by wide roads which connect with roads clearing the town (30 feet wide, all-weather).

The roads clearing the wharf are believed capable of heavy traffic. In the town, most of the streets are paved and connect with the principal roads.

(f) Estimated Military Port Unloading Capacity. The present estimated maximum unloading capacity is 4,600 short tons of general cargo handled at wharf berths per 20-hour effective working day.

(2) Expanded Operating Capacity. This port would be required to discontinue most of its civil functions to handle this size military operation in its entirety. However, major expansion of port facilities to provide for both requirements is not recommended in view of the availability of portions of unloading capacities at other ports in the area and the possibility of over-the-beach operations in the favorable stretches of coast in this area.

c. MERSIN

(1) Current Operating Capacity. (See Table B-4-a) MERSIN is a minor port with an estimated military throughput of 1,680 short tons. Total wharfage is approximately 2,286 lineal feet. Any extensive usage of these limited facilities would result in a critical reduction in capacity available for support of the civilian economy.

(2) Expanded Operating Capacity. No expansion of port facilities is recommended at MERSIN. If major expansion of port facilities is required for Route A, the effort should be applied at ISKENDERUN.

d. LATAKIA. (See Table B-4-a). The SYRIAN government is currently expanding the port facilities at LATAKIA. Latest intelligence indicates that approximately 3,200 feet of berthage and 1,017 feet of wharfage are available. The maximum military throughput capacity is 5,600 short tons per day. No major expansion of port facilities is recommended for the reason indicated above for MERSIN (Superiority of ISKENDERUN).

3. ENGINEER SUPPORT REQUIRED.

A portion of the capacity of each port can reasonably be expected to be reserved for military purposes. Since the combined capacity of the three ports is adequate to support the operation, major engineer effort should not be required for port work, unless major damage results from enemy attack. Assuming limited damage, one Engineer port construction company should be adequate to support each port developed. If all three are used in order to provide dispersion, 3 companies or one battalion would be required. If major damage is sustained, an additional one or two battalions would be required for rehabilitation and for assistance in over-the-beach operations.

4. CRITICAL FEATURES OF OPERATION.

The barely adequate total throughput capacity for both military and civil purposes of the three ports is a critical feature. Any major damage sustained by the port facilities reduces capacity below that required and forces immediate repair effort, resort to less efficient over-the-beach operation, or reduction of the capacity serving local economy needs.

5. CRITICAL ITEMS.

a. Labor. Since areas concerned are urban, no difficulty is anticipated in securing indigenous labor to assist in maintenance operations.

b. Material. Construction materials in the port area are limited. Timber and piles must be included in support tonnages.

6. CONCLUSIONS.

ISKENDERUN should be considered the primary port supplemented as required by operations at MERSIN and LATAKIA. Beaches are suitable for development of additional capacity.

TAB 4 TO APPENDIX B

PORTS AND WATERWAYS

SECTION II - WATERWAYS

1. GENERAL

Inland waterways are of minor importance in this area. Streams such as the upper reaches of the TIGRIS and EUPHRATES Rivers are navigable only by small boats.

2. CONCLUSIONS

Inland waterways should not be included in the logistic network on this route.

TABLE B-4-a

PORTS

FACILITIES	ISKENDERUN, TURKEY(P-5)	MERSIN, TURKEY (P-4)	LATAKIA, SYRIA(P-6)
HARBOR	Open roadstead with depths of 60 feet. Breakwater enclosed lighter basin with depths 9 to 11 feet	Open roadstead with 18 and 30 foot depths 800 to 1200 yds. offshore.	Breakwater enclosed outer basin approx. 80 acres. Turner basin approx. 21 acres.
BERTHS & SAFE DRAFT	2 class B(length 460,depth 26'-32') 2 class D(length 250,depth 12'-20') 28 class F(length 100 depth 8'-10'(2355 LF wharf 30'-25'depth, 2573 LF wharf depth 4'-10') Petroleum and Naval Facilities	20 class F(100 ft long,7ft depth)(2286 LF)	OUTER BASIN-3200' of quayage for Liberty type vessels plus mooring for 5 ships. Turner basin used for lighterage and coaster craft.
MECHANICAL HANDLING EQUIPMENT	5 Portal Jib Cranes Capacity 6tons 7 Locomotive Cranes Capacity 2 to 10 tons. 3 Fixed Cranes.Capacity 2 to 3tons 2 Submarine Pipelines,8" 4 Submarine Pipelines,6"	1 ea 25 ton, and 1 ea 10 ton locomotive cranes. 1 ea 5,and 4,and 2 ea 3 ton Portal Jib cranes 3 ea 2 ton Fixed Cranes 1 ea ½ ton Hand Crane 2 ea 2½ ton Mobile Cranes.	8 ea 3 ton cranes 1 ea 15 ton crane 3 ea floating cranes (60,40,20 tons)
STORAGE	Covered: 216,800 sq ft Cold: 6,350 cu ft	Covered: 82,500SF Cold: 15,885 cu ft	Covered: 550,000SF Open-available Cold-none

TABLE B-4-a

PORTS

(cont.)

FACILITIES	ISKENDERUN, TURKEY (P-5)	MERSIN, TURKEY (P-4)	LATAKIA, SYRIA (P-6)
CLEARANCE	RAILROADS Single track standard gage (4'8½") Rail road N to TOPRAKKALE to connect with Turkish system. ROADS: Double lane bituminous surfaced road N to PAYAS. Crushed stone road SE to ALEPPO and ANTIOCH, COASTAL ROAD SW to ARSUZ.	RAILROADS Single track standard gage (4'8½") line NE to VENICE. ROADS: Good highway NE to TARSUS. Poor to fair road SW to SILIFKE.	RAILROADS: None ROADS: Three
ESTIMATED MILITARY CAPACITY	7150 short tons per day	1680 short tons	5600 short tons

APPENDIX C (ROUTE B, BEIRUT AND HAIFA-BAGHDAD) TO ENGINEER ANNEX TO DCSLOG MIDDLE EAST LOC REPORT

1. DESCRIPTION:

a. Military Geography. (See also Appendix A)

(1) General. The area encompassed by approach route B includes portions of LEBANON, ISRAEL, JORDAN, western SYRIA, northern IRAQ and southeastern TURKEY. Area intelligence of SYRIA, IRAQ and TURKEY applicable to this route as well as routes A and C are detailed in Appendices B and D respectively, and are not repeated herein.

(2) Terrain.

(a) Relief characteristics divide the LOC area into three regions. These are: the MEDITERRANEAN COASTAL PLAINS, the MEDITERRANEAN MOUNTAIN BELT, and the STEPPE and DESERT REGION. The latter is an extension of similar terrain in SAUDI ARABIA and IRAQ.

(b) The MEDITERRANEAN Coast is an almost straight line, with few spurs protruding to form good harbors as at HAIFA, BEIRUT and to a lesser degree at TRIPOLI and LATAKIA. JAFFA is protected by reefs and dangerous to approach. The coast has numerous good landing beaches, although heavy surf is common. The narrow coastal plain is limited to four strips by the hills and mountains of the mountain belt which extend to the shore in most of the area.

(c) Mountains in the western part of the area form the high edge of the tablelands (Steppe and Desert) of JORDAN and SYRIA, and are in two parallel north-south rows separated by a narrow depression. Two important gaps through the mountains are used by roads, railroads and pipelines to connect the interior with the coast: the HOMS-TRIPOLI (TARABULUS ESH SHAM) gap and the PLAIN OF ESDRAELON (HAIFA-NAZARETH BEISAN). Other mountain passes are on the routes: LATAKIA-ANTIOCH-ALEPPO and BEIRUT-ZAHLE-DAMASCUS. Mountain ranges are generally about 5,000 feet above sea level, but the highest peaks reach slightly more than 10,000 feet in the LEBANON MOUNTAINS and slightly less than 10,000 feet in the ANTI-LEBANON MOUNTAINS. Most of the higher parts of the mountain area are bare rock, with some slopes covered with shrubs

and small stands of trees, most of which are evergreen.

(d) In the STEPPE and DESERT REGION, surface conditions are generally favorable for mobile ground operations. However, lava belts strewn with boulders in southwestern SYRIA and northwestern JORDAN are virtually impassable to off-road movement. Vegetation is limited to scattered areas of brush, short tufted grass and completely barren ground.

(3) Weather and Climate. There are two major climate types characteristic of the area of this approach route; the MEDITERRANEAN type and the continental type. These are described in paragraph 1a (3), Appendix B.

(4) Water.

(a) Surface and ground water supply will be adequate in the MEDITERRANEAN COASTAL PLAINS.

(b) Water supply in the mountain belt varies widely, but in the area traversed by this approach route, almost unlimited supplies of potable surface water may be obtained from major rivers (NAHR EL LITANI, the ORONTES) and their tributaries. Springs are numerous in the mountain and plateau sections of the belt. Yields from wells vary from very small to 275 gallons per minute at depths ranging from 50 to 700 feet.

(c) Water supply in the STEEPE and DESERT REGION is poor. Wadies generally flow only during rainstorms. Unlimited supplies of water may be obtained from the EUPHRATES River and its tributaries. Ground water sources, except for EUPHRATES area, are limited and considerable drilling (100 to over 500 feet) is required.

(5) Military Implications.

(a) Beaches along MEDITERRANEAN shoreline will permit amphibious or over the beach operations as supplement to or substitute for port operations.

(b) Mountains bordering MEDITERRANEAN COASTAL PLAINS restrict north-south movement and are barriers to movement into the interior of SYRIA and JORDAN, and thence into IRAQ.

(c) Except for the mountain belt and lava areas of the desert region, which channelize movement, approach route B provides surface conditions generally favorable for mobile ground operations.

(d) High summer temperatures, dust, and water supply shortages would be handicaps, but would not stop military operations in the desert region.

(e) Supply of rock and gravel for road metals and railroad ballast will be reasonably plentiful throughout the LOC area. Timber for military construction is not available in significant quantity. Structural steel needed for military construction must be transported to the objective areas.

b. Transportation. (See Tab 1)

(1) Roads

(a) In approach route B, the highway net provides a high degree of flexibility for clearance of required tonnages to the interior but reducing to one road into BAGHDAD which has a throughput capacity of 5,500 ST per day. One route originating at BEIRUT with a capacity of 7,500 ST a day reduces to 5,500 ST in the vicinity of ZAHLE and remains at this capacity through DAMASCUS, AR RAMTHA to BAGHDAD. The highway covers a distance of 688 miles with an average bridge gap 9 feet per mile of road including 13 major bridges. Road widths on this route range from 16to 32 feet with widths of 17 feet and 2-lane capacity predominating. Terrain conditions and road shoulders along narrow sections permit turning out for passage of 2-way traffic. Road is bituminous surfaced macadam or asphalt generally in good condition for all weather use; however, some rehabilitation and continual maintenance will be required to sustain heavy military use. Available intelligence indicates many bridges

capable of sustaining 2-way traffic and supporting US tactical and LOC weight-class vehicles. However, military bridging will be required to provide a through 2-lane capacity and/or replacement of structure to meet required load-class, or to replace bridging damaged by combat action.

(b) At AR RAMTHA the above route is joined by a road from HAIFA which has an estimated throughput capacity of 2,500 ST per day. Highway distance from HAIFA to Road Junction vicinity AR RAMTHA is approximately 95 miles. Road widths on this route range from 16 to 40 feet. Except in mountainous areas, which include sharp curves and steep grades, terrain conditions and road shoulders will permit turning out for passage of 2-way traffic. Road way is predominantly bituminous surfaced macadam in good condition. Available intelligence indicates 6 major bridges which must be supplemented or replaced for military operations to provide requisite traffic lanes or load class for military movements.

(c) The ports of TEL AVIV, HAIFA, BEIRUT and TRIPOLI are linked by a MEDITERRANEAN Coastal Road which traverses a distance of approximately 200 miles. This roadway is bituminous surfaced macadam in good condition with road widths ranging from 16 to 38 feet. Capacity between HAIFA and BEIRUT is estimated as 8,000 ST per day, and other sections as 6,200 ST per day.

(d) Connecting routes to the interior (eastward) from TRIPOLI and TEL AVIV link-up with principal highway route to BAGHDAD at DAMASCUS and MAFRAQ respectively. These routes are bituminous or gravel surfaced macadam throughout their length with average width of 16 feet. Minimum estimated capacity of either of these routes is 2,500 ST per day.

(2) Railroads. (See Tab 2)

(a) Approach route B provides one principal railway route to BAGHDAD. This is a single-track standard gage (4'-8½") railroad which traverses generally north-south through ISRAEL, LEBANON

and SYRIA linking at ALEPPO with the railroad through TURKEY, SYRIA and IRAQ which is presented and analyzed in Appendix B (Route C). Route distance from ALEPPO to BAGHDAD is approximately 550 miles. Distance from significant points on coastal route to ALEPPO and BAGHDAD are summerized below:

INITIAL POINT	MILES TO ALEPPO	MILES TO BAGHDAD
1. TEL AVIV	411	961
2. HAIFA	330	880
3. BEIRUT	241	791
4. TRIPOLI	188	738

(b) There are 7 tunnels on above route of which 6 occur between HAIFA and ALEPPO. In the latter section the railroad crosses 22 major bridges with lengths over 100 feet. A ten-mile section of track between HAIFA and ISRAEL-JORDAN border was removed in 1948 during border disputes and has not been replaced. Train speeds are slow averaging 15 to 20 mph. The general condition of track structure is poor; however, the line is adequage for the light traffic carried by present operators. An increase in train density and tonnage hauled will require improvements and renewals. It is estimated that throughput capacity on this line under military operation or supervision would be 3,000 ST per day.

(c) In addition to above standard-gage railway there is a narrow gage (3'-5 3/8") line which connects the port of BEIRUT with DAMASCUS and continues south to AL MAFRAQ (JORDAN) linking with another line to HAIFA (ISRAEL). However, through traffic on latter section has been interrupted since 1946 following destruction of critical bridge over NAHR EL YARMUK (river) by Israelies. Under military operation or supervision the line from BEIRUT to MAFRAQ can sustain 7 trains per day at 30 tons each for total daily throughput capacity of 210 ST.

(3) POL Pipeline. (See Tab 3)

(a) Adequate bulk POL tanker discharge and terminal storage facilities are available at HAIFA. However, there are no pipelines in the area which can be used for the logistical support of the contemplated operations. Conversion of crude oil pipelines from IRAQ and SAUDI ARABIA is not feasible in less than six months.

(b) Refineries at HAIFA and TRIPOLI are capable of providing all of the POL products required to support this operation except AVGAS and jet aircraft fuel.

(c) Bulk storage facilities must be provided at airfields and along main highway route.

(d) Movement of bulk POL by highway or rail to objective area is not considered feasible due to length of LOC and large amount of highway transport and/or railway tank cars which would be required.

(4) Airfields. (See Tab 3)

(a) There are twenty-six airfields which are significant in support of combat operations along approach route B. Ten of these airfields (three each in LEBANON, ISRAEL and JORDAN, and one in SYRIA) individually or in combination with another are capable of supporting a composite tactical wing (heavy cargo and jet fighters) without initial rehabilitation, and would require only nominal maintenance. Airfields at BEIRUT, AMMAN and LOD (ISRAEL) can each support a composite tactical wing.

(5) Ports (See Tab 4)

(a) Ports considered to be applicable to support of approach route B are the major ports at BEIRUT and HAIFA, and the lesser or secondary ports at TRIPOLI, TEL AVIV and JAFFA. TEL AVIV and JAFFA have alongside highway clearance only, other ports have both rail and highway clearance.

(b) HAIFA is a breakwater enclosed port with a controlling depth of 24 feet. Peak throughput capacity is estimated at 7,100 ST per day, not including POL products.

(c) BEIRUT is a breakwater enclosed port. Depths in harbor range from 56 to 8 feet. Controlling depth for majority of berthing is 27 feet. Throughput capacity is estimated as 7,100 ST per day.

d. Other ports (TEL AVIV, JAFFA and TRIPOLI) are open roadteads or breakwater protected anchorages for vessels. Unloading is accomplished by lighterage. Daily throughput capacities are estimated as: TRIPOLI-3,360 ST, TEL-AVIV-900 ST and JAFFA-2,240 ST.

(6) Inland Waterways: Rivers and streams on the axis of this approach route are not suitable for utilization as inland waterways to support the projected operation.

e. Local Resources

(1) Manpower. No reliable figures are available to determine the amount of indigenous labor which could be obtained in the LOC area to augment the military construction effort. Generally, urban areas have an abundant supply of unskilled workers, where they may be available in significant numbers depending on local attitudes to military operations. Available labor in rural areas will be limited to agricultural workers inhabiting small villages along LOC. It is anticipated that Israeli and Lebanese governments with materiel assistance from US could contribute 50% of the manpower requirements for rehabilitation and maintenance of railroad and highway routes within their border, while TURKEY, could provide 100% of the manpower necessary to rehabilitate and maintain its portion of the railway.

(a) Skills. The average MIDDLE EAST laborer, particularly in urban areas shows some aptitude for acquisition of modern technical skills. The Lebanese, because of higher incidence of literacy than in other Arab states have a better capacity for

training in modern techniques and mechanical skills.

(b) Effectiveness. In general, laborers of the area are considered to be 50% as effective as the average US soldier.

(c) Resources. Road metal for highways and ballast for railways is available in adequate quantities, except in the immediate vicinity of BAGHDAD. Small quantities of timber are available in the mountain ranges bordering the MEDITERRANEAN coastal plain. Local production of cement is adequate for military construction requirements. Moderate quantities of bituminous products are locally available for military construction. Structural steel production is insignificant.

2. OPERATIONAL CONSIDERATIONS

a. General

With the exception of bulk POL pipeline, the major LOC facilities (ports, airfields and land lines) available on approach route B are adequate for the support of operations to, and in the objective area. However, as is the case in approach route A, utilization of the railway is necessary to provide capacity to meet peak tonnage requirements, but in contradistinction to route A, the highways of route B will sustain the major portion (71%) of the capacity required. POL pipeline construction will be necessary since combined capacity of railroad and highway is inadequate and would in any event require a prohibitive number of tank trucks and/or railroad tank cars.

b. Land Line Considerations

(1) Railway. It is reasonable to assume that ISRAEL, TURKEY and possibly LEBANON can and will provide adequate security for their portion of the railway system. However, it is believed that combat operations will be necessary to seize and secure elements of the railway which traverses SYRIA and IRAQ. In addition, the railway cannot contribute to support of operations until supported force closes on BAGHDAD unless a proportionate share (about 40%) of

the supported force moves on the objective area from positions along TURKISH border in the vicinity of NUSAYBIN.

(2) Highway. The coastal road net facilitates flexibility in utilization of ports, and provides adequate capacity for clearance of peak tonnages to primary highway, which however, can only sustain maintenance tonnage required. Rehabilitation and maintenance of these routes is essential to sustain current capacity. In addition, as adduced in above paragraph, if the entire supported force moves on the highway axis, then it must be expanded to handle peak tonnage, unless the build-up time is increased, or transport of tonnages in excess of maintenance requirements is deferred until the objective area and railway are secured.

(3) Since expansion of the highway and rehabilitation of the railway with nominal engineer effort would each require approximately sixty days it appears reasonable and logical to defer tonnage build-up phase for sixty days, with the exception of POL pipeline material. In addition, there is some flexibility in highway capacities in that planning factors assume only 50% availability to regulate LOC movement. Therefore it is believed that highway capacities could be considerably increased for short periods of time.

(4) It is assumed that material for POL pipeline and railway rehabilitation are included in maintenance and peak tonnages. Therefore, in the case of railway material, the tonnages required can be moved by rail, apace with railway rehabilitation, which can proceed from at least three points, i.e., NUSAYBIN (TURKEY) to BAGHDAD, ALEPPO to LEBANON border and vice-versa. In the case of pipeline, the recommended alignment would parallel the crude-oil TRANS-ARABIAN pipeline, (TAPLINE) from HAIFA. Consequently, pipeline material tonnages could most logically be moved over the HAIFA-AR RAMTHA route and would not conflict with other highway movement or tonnages for at least the first 15 days of the operation after material is landed and construction is started.

c. Ports and Airfields. Considerations affecting ports and airfields are presented in Tabs 3 and 4. There is some choice and flexibility as regards selection of ports and airfield for rehabilitation and maintenance. Since only HAIFA has POL tanker discharge facilities in addition to the requisite dry tonnage capacity it appears logical to develop and operate HAIFA as the primary port. However, as developed in foregoing paragraphs, the interests of flexibility and maximum utilization of existing land lines would be best served by utilization of BEIRUT as well. In any event, the effort for ports and airfields in this instance are relatively small in comparison to the land lines, and port capacities are not critical.

d. Engineer Effort Implications. Some factors bearing on courses of action are outlined below:

(1) Rehabilitation, but not expansion of railway and highway routes from BEIRUT and HAIFA to BAGHDAD.

(a) Effort

1 Highway		
a BEIRUT-BAGHDAD	8.5 construction battalion months	
b HAIFA-AR RAMTHA	1.0 construction battalion months	
2 Railway	17.5 construction battalion months	
3 Pipeline	3.0 construction battalion months, and 8.0 pipeline company months	
4 Ports		
a BEIRUT	0.5 construction battalion months	
b HAIFA	0.5 construction battalion months	
5 Airfields	3.0 construction battalion months	
6 Total Effort	34.0 construction battalion months, and 8.0 pipeline company months	

(b) Material

1	Highway	
a	BEIRUT-BAGHDAD	14,494 ST
b	HAIFA-AR RAMTHA	470 ST
2	Railway	63,766 ST
3	Pipeline	33,415 ST
4	Ports	250 ST
5	Airfields	1,000 ST
6	Total material	113,395 ST

(c) Capacity of System

1	Highway	
a	BEIRUT to BAGHDAD	5,500 ST
b	HAIFA to BAGHDAD	2,500 ST
c	BEIRUT and HAIFA to BAGHDAD	8,000 ST
2	Railway	3,000 ST
3	Ports	
	BEIRUT to AR RAMTHA (dry cargo only)	14,200 ST
4	Airfields (tonnage not applicable)	
5	Total Dry Tonnage to BAGHDAD	8,500 ST
6	Bulk POL	1,900 ST

(2) Rehabilitation of railway and rehabilitation of highway routes BEIRUT and HAIFA to AR RAMTHA and expansion of highway AR RAMTHA to BAGHDAD.

(a) Effort

1	Highway	
a	BEIRUT to AR RAMTHA	2.5 construction battalion months
b	HAIFA to AR RAMTHA	1.0 construction battalion months
c	AR RAMTHA to BAGHDAD	13.0 construction battalion months

2	Railway	17.5 construction battalion months
3	Pipeline	3.0 construction battalion months, and 8.0 pipeline company months
4	Ports	1.0 construction battalion months
5	Airfields	3.0 construction battalion months
6	Total Effort	41.0 construction battalion months and 8.0 pipeline company months

(b) Material

1	Highway	16,708 ST
2	Railway	63,766 ST
3	Pipeline	33,415 ST
4	Ports	250 ST
5	Airfields	1,000 ST
6	Total Material	115,139 ST

(c) Capacity of System (In approximately 60 days)

1	Highway	7,500 ST
2	Railway	3,000 ST
3	Ports (Dry Cargo)	14,200 ST
4	Total Dry Tonnage to BAGHDAD	10,500 ST
5	Bulk POL	1,900 ST
6	Airfields (Tonnage not applicable)	

e. Evaluation of the logistic and operational considerations, and the engineer implications involved, indicates that optimum solution would be as follows:

(1) Utilize HAIFA and BEIRUT as ports

(2) Rehabilitate and maintain highway routes to AR RAMTHA from bEIRUT and HAIFA (5,500 and 2,500 ST per day capacity respectively)

(3) Rehabilitate and maintain highway AR RAMTHA-BAGHDAD (5,500 ST per day capacity)

(4) Defer throughput of peak tonnages for 60 days then increase peak tonnage to 8,500 ST per day.

3. CRITICAL FEATURES OF OPERATION

The following features of the operation are considered to be of a critical nature:

a. Seizure of ALEPPO, HOMS and HAMA

The rail and highway centers of ALEPPO, HOMS and HAMA all located in SYRIA, are key points in the railway system for this approach route. Seizure and security of these centers must be included in operations plans.

b. Railroad

The railway system cannot contribute to required support tonnages, except maintenance for combat and combat support forces moving or operating along railway axis and railroad rehabilitation material, until the line is secure and rehabilitated into BAGHDAD.

c. Pipeline

Land lines after expansion would nearly meet tonnage capacity required, including bulk POL. However, operations in progress must be supported from the outset, and a pipehead can be advanced more rapidly than can road expansion. In addition, the railway axis diverges widely from the logical tactical axis. Therefore, installation and operation of the pipeline must still be considered critical.

4. CRITICAL ITEMS

a. Manpower. Construction effort for maintaining existing capacity and construction of pipeline in 60 days will require 17 augmented construction battalions and 4 pipeline companies.

Accomplishment of the same task plus expansion of highway system in 60 days will require 20 augmented construction battalions and 4 pipeline companies. Appropriate supporting elements and coordinating headquarters in addition to the primary work elements cited.

b. Material

(1) POL Equipment

(2) Railroad rails, cross-ties and auxilliary items

(3) Fixed and floating tactical bridging

(4) Heavy timber for bridging

(5) Heavy engineer construction equipment

(6) Corrigated metal culvert pipe

(7) Pierced steel plank

TAB 1 TO APPENDIX C

ROADS

1. GENERAL.

a. See Exhibit C-1

b. Approach route B contains one principal two-way bituminous surfaced road extending 545 miles from AR RAMTHA to BAGHDAD. All-weather 2-lane feeder roads lead to AR RAMTHA from the ports of BEIRUT, HAIFA, TEL AVIV, and TRIPOLI. Two of the more important roads to AR RAMTHA are from the ports of BEIRUT and HAIFA, distances of 143 and 94 miles respectively. A narrow 2-lane, all weather, bituminous-surfaced road, about 200 miles long, in good condition, traverses the coastline and interconnects the 4 major port areas. Tonnages from TEL AVIV or TRIPOLI can be moved either along the coastal route to HAIFA or BEIRUT, or inland to AR RAMTHA or DAMASCUS via narrow two lane, all weather, hard surfaced roads. Numerous desert tracks parallel the road from MAFRAQ to BAGHDAD. One in particular, 259 miles long, of which 219 miles is good desert track suitable for motor traffic, extends southeastward from DAMASCUS to a point west of RUTBA on the AR RAMTHA-BAGHDAD road. Road characteristics are shown in Table C-1-b.

c. Highway Bridges. There are 13 principal highway bridges on the BEIRUT to BAGHDAD road and 2 principal bridges on the HAIFA to AR RAMTHA road where it joins the road to BAGHDAD. In BAGHDAD there are 5 major highway bridges across the TIGRIS River. Characteristics of these bridges are shown in Table C-1-a.

d. Terrain.

(1) The road network from the ports of BEIRUT, HAIFA, TEL AVIV, and TRIPOLI traverses the steep high MEDITERRANEAN mountain belt, which ranges in elevation from sea level to 5,000 feet. From a point about 20 miles east of MAFRAQ to a point about 160 miles east of MAFRAQ, the road traverses a region of volcanic uplands. Beyond this point the roadway traverses the southern and western

IRAQ desert region to BAGHDAD on the TIGRIS-EUPHRATES DELTA. Soil varies from hard rock, predominantly limestone in the MEDITERRANEAN mountain belt, to sandstone in the volcanic uplands, to a chalk and clayey limestone in the desert, to sandstone west of BAGHDAD. Except for the mountain belt and the area around BAGHDAD most of the area is desert, devoid of vegetation, and critically deficient in water. Conditions are favorable for road construction in the desert areas because of the availability of road construction metals, firm earth surfaces with little cutting and filling required. The mountain belt restricts road construction to low mountain passes and gaps requiring extensive cutting and filling for new routes or widening existing routes.

(2) Off Road Movement. In the desert region off road movement is excellent, particularly in IRAQ and along the desert track from RUTBA to DAMASCUS in SYRIA. In JORDAN extensive areas of volcanic uplands will restrict traffic to the road. Similiarly, traffic is restricted to roads in the mountain belt. Motor traffic on or off road in the desert raises dense clouds of dust, which will be detrimental to motor vehicle operations because of the greatly increased wear caused by abrasive action of fine sand particles. Motor transport both on and off road, will be mainly limited by duststorms and heat in May through October, and infrequent road washouts in November through April.

e. Weather and Climate. This approach route has a wide range of climatic variations. The coastal areas of ISRAEL and LEBANON and the MEDITERRANEAN mountain belt have a climate similar to that of southern CALIFORNIA with warm, dry summers, and mild moist winters. Inland from the coastal mountains a continental type of climate prevails. This area is desert with extremely hot summers and very little rainfall. In the JORDAN rift valley, a considerable part of which is below sea level, conditions are semi-tropical, like those of the IMPERIAL VALLEY of CALIFORNIA. Throughout

the area almost all rainfall is concentrated in a rainy period, November through April. The coastal plain and mountain fringes receive 15 inches to 40 inches of rain annually and the desert receives less than 10 inches of rain annually, usually averaging 4" of rain. The dry period extends from May through October. Temperatures range from 30° to 90° in the coastal plain; from 0° to 75° in the mountains and from 25° to 125° in the desert. A summary of rainfall and temperature follows:

	RAINFALL		TEMPERATURE	
	Nov - April (Rainy Period)	May - Oct (Dry Period)	Winter (Rainy Period)	Summer (Dry Period)
MEDITERRANEAN COASTAL PLAINS	15" - 30"	None	30°	90°
MEDITERRANEAN MOUNTAIN BELT	40" - 50"	Small amount	0°	75°
SYRIAN DESERT	Less than 10" (average 4")	None	(many warm days)	110°

In the desert, sandstorms may block or obliterate sections of road with drifting sand. Rainfall is intense at times and may interfere with road traffic because of temporary flooding of wadies and flash floods which damage roadbeds and cause earth roads to become impassable for short periods.

f. Local Resources.

(1) Manpower.

(a) Skills. The population in small towns and villages is predominantly unskilled in modern road building techniques. A limited amount of skilled indigenous labor may be obtained from the major cities of HAIFA, BEIRUT, DAMASCUS, and BAGHDAD.

(b) Effectiveness. Unskilled indigenous labor, under the direction of effective native supervisors, are capable of producing up to 50% as much work as an American soldier on comparable unskilled tasks.

(c) Availability. In time of hostilities availability of indigenous labor is uncertain except in allied nations.

Under other than hostile conditions it is also unlikely that laborers in sufficient numbers from small towns and villages can be relied upon. Considerable numbers of unskilled laborers are available in HAIFA, BEIRUT, DAMASCUS, and BAGHDAD.

(2) Materials. Road construction materials are available in quantity and are sufficient for large road construction projects along almost the entire length of the road net from HAIFA or BEIRUT. Hard limestone, gravel, and sandstone are available in LEBANON, southwest SYRIA and ISRAEL. In JORDAN and IRAQ road metals are limited to sandstone and gravel. Cement plants exist near TEL AVIV, BAGHDAD, AMMAN, HAIFA and DAMASCUS with a total output of over one million tons per year.

(3) Equipment. Local road building equipment is old and in short supply.

2. CURRENT OPERATING CAPACITY.

The principal road, BEIRUT to DAMASCUS to AR RAMTHA to BAGHDAD will initially support a forward throughput capacity of 5,500 short tons per day. The HAIFA to AR RAMTHA road has a forward throughput capacity of only 2,500 short tons per day. The highway from TRIPOLI to DAMASCUS via HOMS has a forward throughput capacity of 2,500 short tons per day and TEL AVIV to MAFRAQ road provides forward throughput capacity of 4,000 short tons per day. Tables I, II, and III indicate the type of effort and tonnages required to maintain the current operating capacity of the roads from the ports of BEIRUT and HAIFA to BAGHDAD. Effort and tonnages required to maintain the roads from the ports of TRIPOLI and TEL AVIV are not detailed since these roads are in the nature of a bonus. If the primary roads considered for use are interrupted and traffic blocked it will be possible to divert available road effort to the highways extending from TRIPOLI and TEL AVIV. A summary of Tables I, II, and III follows:

ROUTE	MANHOURS	BN MO	ST	MT
BEIRUT-DAMASCUS-AR RAMTHA	206,680	2.3	1,768	2,353
HAIFA-AR RAMTHA	68,439	0.8	470	657
AR RAMTHA-BAGHDAD	562,227	6.2	12,526	19,444

Engineer Construction Battalions assigned to road tasks will be augmented with additional road building equipment. Table V provides for equipment augmentation as indicated in the Engineer Functional Component System.

3. EXPANDED OPERATING CAPACITY.

a. The AR RAMTHA to BAGHDAD road can be expanded to support a daily forward throughput capacity of 7,500 short tons per day by rehabilitation and maintenance of existing roadway and reconstruction of gravel and earth shoulders to provide higher passing capability for heavy 2-way military traffic. Table IV indicates effort and tonnages required for the expansion of this route.

b. A summary of the effort and tonnages essential to accomplish expansion of the above route from 5,500 to 7,500 short tons per day follows:

ROUTE	MANHOURS	BN MO	ST	MT
AR RAMTHA To BEIRUT	1,208,090	13	1,744	2,068

4. OPERATIONAL CONSIDERATIONS

a. Vulnerability. Bridges across the JORDAN, NAHR EL LITANI, EUPHRATES, and TIGRIS RIVERS are possible bottlenecks. If these bridges are destroyed, traffic will be halted until tactical floating bridges can be erected. The mountain pass east of the port of BEIRUT is a possible bottleneck. All routes can also be blocked temporarily by cratering wherever the road traverses a hairpin turn in mountains, salt marsh in desert terrain or a dense network of drainage and irrigation ditches as on the TIGRIS - EUPHRATES DELTA.

b. Logistical.

(1) Equipment. Desert conditions of high temperatures, high winds and fine blowing sand will adversely affect all vehicles and machinery. More frequent maintenance, overhaul and replacement of equipment will be necessary as a result of operations in this area. It is anticipated that attrition in equipment resulting from desert conditions will be 50% greater than that which would be experienced in engineer operations of comparable magnitude in WESTERN EUROPE.

(2) Construction. Existing highways cannot sustain heavy military traffic without initial rehabilitation and continuous maintenance.

5. CRITICAL ITEMS.

a. Manpower. Provision of requisite number of augmented construction battalions is essential. It is anticipated that indigenous labor will be lacking in modern skills and can therefore be used only as an unskilled force of considerably less productive capacity than U.S. troops.

b. Material. Critical items are:

(1) Corrugated metal culvert pipe

(2) M4T6 floating bridge

(3) Bailey bridges

(4) Steel girders for fixed bridging

(5) Timber

TABLE I

BEIRUT, DAMASCUS, AR RAMTHA ROUTE

CURRENT OPERATING CAPACITY 5,500 SHORT TONS PER DAY

TASK	QUANTITY	MAN HOURS	BN MO	ST	MT
1. ROAD MAINTENANCE Two lane bituminous	143 miles	59,202	.66	143	167
2. ROAD REHABILITATION (5%) Two lane bituminous	7 miles	145,600	1.6	763	919
3. TACTICAL BRIDGING Fixed Bridge (Bailey Type)	1,310 LF	1,878	.02	862	1,276
TOTAL		206,680	2.3	1,768	2,353

TABLE II

HAIFA, NAZARETH, IRBID, JCT. S. OF AR RAMTHA

CURRENT OPERATING CAPACITY - 2,500 SHORT TONS PER DAY

TASK	QUANTITY	MAN HOURS	BN MO	ST	MT
1. ROAD MAINTENANCE Two lane bituminous	94 miles	38,916	.43	94	110
2. ROAD REHABILITATION (5%) Two lane bituminous	4 miles	28,800	.32	44	56
3. TACTICAL BRIDGING Fixed Bridge (Bailey Type)	460 LF	723	.01	332	491
TOTAL		68,439	.76	470	657

TABLE III

AR RAMTHA, MAFRAQ, BAGHDAD ROUTE

CURRENT OPERATING CAPACITY 5,500 SHORT TONS PER DAY

TASK	QUANTITY	MAN HOURS	BN MO	ST	MT
1. ROAD MAINTENANCE					
Two lane bituminous	545 miles	225,630	2.5	545	638
2. ROAD REHABILITATION (2%)					
Two lane bituminous	11 miles	228,800	2.54	1,199	1,430
3. TACTICAL BRIDGING					
Floating Bridge (M4T6)	5,074 LF	10,710	.12	3,302	7,319
Fixed Bridge (Bailey Type)	3,206 LF	4,627	.05	2,123	3,140
4. LOC FIXED BRIDGING					
(Replaces Floating)	8,148 LF	92,460	1.03	5,357	6,917
TOTAL		562,227	6.2	12,526	19,444

TABLE IV

AR RAMTHA TO MAFRAQ TO BAGHDAD

EXPANDED OPERATING CAPACITY 7,500 SHORT TONS PER DAY IN 30 DAYS

TASK	QUANTITY	MAN HOURS	BN MO	ST	MT
1. ROAD MAINTENANCE Two lane bituminous	545 miles	225,630	2.5	545	638
2. ROAD REHABILITATION (2%) Two lane bituminous	11 miles	228,800	2.54	1,199	1,430
3. ROAD CONSTRUCTION Grade, 4 "gravel, and compact 4 foot shoulder	477 miles (along both sides of road)	753,660	8.37	0	0
TOTAL		1,208,090	13.4	1,744	2,068

TABLE V

ENGINEER CONSTRUCTION BATTALION EQUIPAGE AUGMENTATION

TASK	OCE FUNCTIONAL COMP.	NO.		ST	MT
CURRENT ROAD CAPACITY					
BEIRUT, DAMASCUS, AR RAMTHA					
Bridging Highway	E-08101	0.5		350	1,080
Road	E-08109	1.5		1,050	3,240
			TOTAL	2,400	4,320
HAIFA, NAZARETH, IRBID, AR RAMTHA					
Bridging Highway	E-08101	0.5		350	1,080
Road	E-08109	0.5		350	1,080
			TOTAL	700	2,160
AR RAMTHA to BAGHDAD					
Bridging Highway	E-08101	1		700	2,160
Road	E-08109	5		3,500	10,800
			TOTAL	4,200	12,960
EXPANDED ROAD CAPACITY					
AR RAMTHA to BAGHDAD					
Road	E-08109	6		4,200	12,960

TABLE C-1-a
SELECTED HIGHWAY STRUCTURES
LEBANON, ISRAEL, JORDAN, SYRIA, AND IRAQ HIGHWAYS

BRIDGE NO	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
B-1	7.3 miles SE of HAIFA	Stone masonry, deck arch	110	20	70	Over HAQISHON River
B-2	East of BEIT SHEAN	Steel through truss	120	12	50	Over JORDAN River (west abutment out)
B-3	16 miles NE of MAFRAQ	Concrete T-beam	106	23	100	Over unnamed stream
B-4	3.5 miles N of MAFRAQ	Concrete T-beam	90	23	100	Over unnamed stream
B-5	2 miles N of MAFRAQ	Concrete T-beam	90	24	100	Over unnamed stream
B-6	6 miles NE of H-4 Pumping Station	Reinforced concrete slab	180	10	70	Over WADI RUWEISHID. Bottleneck because of narrow roadway
B-7	0.5 mile W of RUTBA	Steel beam	210	13	24	Concrete slab deck. Piles 10-12 ft. high on concrete foundations
B-8	At AR RAMTHA	Concrete T-beam	96	26	100	Over unnamed stream
B-9	3 miles N of TEL AVIV	Reinforced concrete girder	140	12.5	n.a.	Over YARQON River, 4 lane bridge under construction
B-10	23.7 miles N of TEL AVIV	Reinforced concrete	213	33	n.a.	Over ALEKSANDER River
B-11	3.5 miles N of HAIFA	Reinforced concrete girder	102	25	70	Over HAQISHON River

NOTE: n.a. - Information not available

TABLE C-1-a (Cont'd)
SELECTED HIGHWAY STRUCTURES
LEBANON, ISRAEL, JORDAN, SYRIA, AND IRAQ HIGHWAYS

BRIDGE NO.	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
B-12	13 miles N of HAIFA	Reinforced concrete arch	100	23	70	Ford 1 mile dowstream
B-13	23.7 miles N of HAIFA	Reinforced concrete girder	102	21	70	Over QARN (stream). Ford 2.5 miles downstream
B-14	20.4 miles N of ISRAEL Boundary	Steel girder	232	20	70	Over LITANI River
B-15	34.5 miles N of ISRAEL Border	Masonry arch	105	n.a.	n.a.	Over ZAHRANI River
B-16	2 miles S of SIDON	Masonry arch	111	n.a.	n.a.	Over NAHR SATARIQ
B-17	1.8 miles N of SIDON	Reinforced concrete T-beam	360	19	80	Over NAHR AQUALI
B-18	18.6 miles S of BEIRUT	Masonry and concrete	194	17	70	Over NAHR ED DAMOUR
B-19	At BEIRUT	Reinforced concrete beam	234	36	n.a.	Over BEIRUT River
B-20	At BEIRUT	Concrete T-beam	273	55	70	Over BEIRUT River
B-21	5 miles N of BEIRUT	Masonry arch	159	19.5	60	Over NAHR EL KELB
B-22	19 miles N of BEIRUT	Concrete T-beam	185	18.5	70	Over NAHR EL FIDAR

NOTE: n.a. - Information not available

TABLE C-1-a (Cont'd)
SELECTED HIGHWAY STRUCTURES
LEBANON, ISRAEL, JORDAN, SYRIA, AND IRAQ HIGHWAYS

BRIDGE NO.	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
B-23	21.8 miles N of BEIRUT	Masonry arch	232	18	60	Over NAHR EL JOURA
B-24	26 miles S of TRIPOLI	Concrete T-beam	99	26.5	60	Over ODI BECHTA
B-25	23 miles S of TRIPOLI	Reinforced concrete T-beam	245	19.5	80	Over NAHR MADFOUN
B-26	16.4 miles S of TRIPOLI	Reinforced concrete T-beam	138	26.5	60	Over ODI SOUR
B-27	16 miles S of TRIPOLI	Reinforced concrete T-beam	102	26.5	60	Over intermittent stream
B-28	15 miles S of TRIPOLI	Tunnel	1,384	24.5		By pass road has been built
B-29	8 miles N of TRIPOLI	Reinforced concrete T-beam	102	26.5	60	Over NAHR EL BARED
B-30	17.1 miles NE of TRIPOLI	Concrete slab	150	26	60	Over NAHR OSTOUENE (USTAWANI)
B-31	21.9 miles NE of TRIPOLI	Steel truss	150	19.5	70	Over NAHR EL KEBIR
B-32	28.6 miles NE of TRIPOLI	Masonry and reinforced concrete	198	18	n.a.	Over NAHR ABOU FALLATE
B-33	2.5 miles W of HOMS	Masonry and reinforced concrete	150	n.a.	n.a.	Over ORONTES River

NOTE: n.a. - Information not available

TABLE C-1-a (Cont'd)
SELECTED HIGHWAY STRUCTURES
LEBANON, ISRAEL, JORDAN, SYRIA, AND IRAQ HIGHWAYS

BRIDGE NO.	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
B-34	2.5 miles W of HOMS	Masonry causeway	600	n.a.	n.a.	Over ORONTES River, overall bridge width 20 feet
B-35	Approx. 30 miles E of JERUSALEM	Steel and reinforced concrete girder	525	n.a.	n.a.	New bridge over JORDAN River 2-way all military vehicles
B-36	10 miles NE of AMMAN	Concrete and steel T-beam	101	20	100	Easily by-passed
A-10	2 miles W of RAMADI	Reinforced concrete arch	552	n.a.	n.a.	Vertical clearance limited, two-way traffic, can support a medium tank
A-11	7 miles E of RAMADI	Concrete slab	865	n.a.	30	
A-12	0.5 miles S of HABBONIYA	Reinforced concrete slab	115	n.a.	n.a.	Can handle 2-way traffic only with difficulty. Probably can support a medium tank.
A-13	5.5 miles SW of FALLUJA	Reinforced concrete	289	n.a.	60	
A-14	3.6 miles SW of FALLUJA	Reinforced concrete	198	19.75	60	
A-15	At FALLUJA	Steel truss	910	12	20	Single lane

NOTE: n.a. - Information not available.

TABLE C-1-a (Cont'd)
SELECTED HIGHWAY STRUCTURES
LEBANON, ISRAEL, JORDAN, SYRIA, AND IRAQ HIGHWAYS

BRIDGE NO	LOCATION	TYPE	LENGTH FEET	WIDTH FEET	CAPACITY CLASS	REMARKS
C-18	3 miles SW of BAGHDAD	Steel truss	167	10	12	KHIRR Bridge
C-23	At BAGHDAD	Steel deck, plate girder	1,000	24	80	KING FAISAL II Bridge
C-24	At BAGHDAD	Steel deck, plate girder	1,050	n.a.	n.a.	KING GHAZI Bridge
C-25	At BAGHDAD	Steel deck, plate girder	1,037	40	n.a.	
C-26	At BAGHDAD	Steel deck	1,487	40	n.a.	QUEEN ALIYAH Bridge
C-27	At BAGHDAD	Steel truss girder	1,000	18	50+	SARRARHIYAN Bridge

NOTE: n.a. - Information not available

TABLE C-1-b

HIGHWAY CHARACTERISTICS

LOCATION	MILES	SURFACE	WIDTH FT	CAPACITY	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
BEIRUT TO BAGHDAD							
BEIRUT to SHUTURAH	27	Bituminous	23-32	7,500	Good	Fair	All bridges are class 60 and over. Sharp curves and steep grades in LEBANON mts. Snow removal equip. required in winter.
SHUTURAH to DAMASCUS	38	Bituminous	19	5,500	Good	Fair	Between DAMASCUS and SYRIAN LEBANESE Border are 8 road blocks as well as casements for demolition charges located at defiles.
DAMASCUS to JORDAN Border	71	Bituminous	16	5,500	Poor	Good	All-weather road, bridges have 20-ton capacity.
JORDAN Border to Rt. Jct. South from AR RAMTHA	7	Bituminous	16	5,500	Fair	Fair-Good	

TABLE C-1-b (Cont'd)

HIGHWAY CHARACTERISTICS

LOCATION	MILES	SURFACE	WIDTH	CAPACITY	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
BEIRUT TO BAGHDAD (Cont'd)							
Jct. South from AR RAMTHA to MAFRAQ	15	Bituminous	17	5,500	Good	Poor	All weather road; 3'-5' earth shoulders.
MAFRAQ to IRAQ Border	180	Bituminous	17	5,500	Good	Poor	
IRAQ Border to Jct W. of RUTBA	87	Bituminous	17	5,500	Fair	Fair	Off road movement is possible from RUTBA to RAMADI during dry weather.
RUTBA to RAMADI	195	Bituminous	17	5,500	Fair		
RAMADI to BAGHDAD	68	Asphalt	20	5,500	Excellent	Fair	Section from RAMADI to FALLUJA reported to be still under construction; however, construction is complete for the most part.
TOTAL MILES	688						

TABLE C-1-b (Cont'd)

HIGHWAY CHARACTERISTICS

LOCATION	MILES	SURFACE	WIDTH FT.	CAPACITY (TONS/DAY)	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
HAIFA TO RD JCT S. OF AR RAMTHA							
HAIFA to NAZARETH	26.6	Bituminous	16-40 (see remarks)	2,500	Good	Good except in vicinity of NAZARETH	From HAIFA TO NESHER the width is 40'. The remainder is 20' except last 3.3 mi. to NAZARETH which is 16'. There is a 14' wide underpass at 0.3 mile from HAIFA.
NAZARETH to BEIT SHEAN	26	Bituminous	16	2,500	Good	Conditions good	First 4 miles south from NAZARETH has sharp curves and steep grades.
BEIT SHEAN to JORDAN BORDER	5	Paved	16	2,500	Poor	Conditions good	Not used or maintained - probably badly deteriorated.
JORDAN BORDER to IRBID	26.	Bituminous	17	2,500	Good	Difficult to impossible	All weather road. Thru town of IRBID, section 46' wide.
IRBID to RT JCT S. of AR RAMTHA	10.5	Bituminous	19	4,500	Excellent (new)	Easy South of route; difficult to impossible North of route.	3' - 5' earth shoulders
Total Miles	94						

NOTE: For data on section from AR RAMTHA to BAGHDAD see BEIRUT to BAGHDAD table.

TABLE C-1-b (Cont'd)

HIGHWAY CHARACTERISTICS

LOCATION	MILES	SURFACE	WIDTH FT.	CAPACITY (TONS/DAY)	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
TEL AVIV to MAFRAQ							
TEL AVIV to JERUSALEM	39	Bitumin.	20	5,000	Fair-Good	Restricted - 10 miles W. of JERUSALEM	Macadam and Telford base.
JERUSALEM to AMMAN							
Mile 0 to 19	19	Bitumin.	17	4,000	Good	Restricted	Five foot usable earth shoulders.
Mile 19 to 53	34	Asphalt	24	4,500	Excellent	Good along center portion, restricted elsewhere.	New road. Three foot earth shoulders.
AMMAN to MAFRAQ	49	Bitumin.	17	4,000	Fair-Good	Good	Macadam base. Five foot usable shoulders.
TOTAL MILES	141						

TABLE C-1-b (Cont'd)

HIGHWAY CHARACTERISTICS

LOCATION	MILES	SURFACE	WIDTH FT.	CAPACITY (TONS/DAY)	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
COASTAL ROUTE							
TEL AVIL to HAIFA	54	Bitum.	21	6,200	Excellent	Unlimited	Macadam base
HAIFA to LEBANON border	31	"	13-20	8,000	Good	Flat-both sides of road	Macadam base
LEBANON border to BEIRUT	72	"	16-23	8,000	Good	Rough ground; steep gradients	Macadam base
BEIRUT to TRIPOLI	56	"	19-32	6,200	Fair-Good	Rough ground; steep gradients	Macadam base
TRIPOLI to DAMASCUS							
TRIPOLI to HOMS	58	Bitum.	14-23	2,500	Poor-Good		Base is poor in many places contributing to deterioration.
HOMS to ADHRA(North of Damascus)	84	Bitum.	20	4,000	Fair	Restricted from EN NEBK to ADHRA	

TABLE C-1-b (Cont'd)

HIGHWAY CHARACTERISTICS

LOCATION	MILES	SURFACE	WIDTH FT.	CAPACITY (TONS/DAY)	CONDITION	OFF ROAD CHARACTERISTICS	REMARKS
PRINCIPAL DESERT ROAD AND TRACK DAMASCUS TO BAGHDAD							
DAMASCUS to ADHRA	15	Bitumin.	17-18	4,000	n.a.	Poor	Narrow streets in DAMASCUS
ADHRA to SAB BIYAR	77						
Mile 0 to 25		Bitumin.	n.a.	2,000	Fair	Fair	Surfaced
Mile 25 to 77				500	Poor	Good	During dry season is actually series of many parallel roads.
SAB BIYAR to IRAQ Border	80	Earth	n.a.	500	n.a.	Good	Not usable between Dec 15 and Mar 12 and at times of heavy rains.
IRAQ Border to Rd. Jct. W. of RUTBA	87	Earth	n.a.	500	n.a.	Good	May be closed for short periods during Nov to Mar due to rain. Desert track.
TOTAL MILES	259						

NOTE: n.a.- not available

TAB 2 TO APPENDIX C

RAILROADS

TEL AVIV -HAIFA-BEIRUT-ALEPPO-BAGHDAD

1. GENERAL

a. See Exhibit C-2 and Table 1

b. One single-track, standard gage (4' 8½") railroad with 60 to 92 pound per year rail is available to support an LOC on approach Route B. This rail line from TEL AVIV, except for a 10 mile break between NAHARIYA and the LEBANON border, parallels the coast for 243 miles serving the major ports of HAIFA, BEIRUT and TRIPOLI. At the LEBANON-SYRIA border, the line continues inland for a distance of 168 miles to ALEPPO an important junction center. From ALEPPO, the line runs northeast into TURKEY where it generally parallels the TURK-SYRIAN border for approximately 230 miles, then reenters northeast SYRIA to the IRAQ border and terminates at BAGHDAD.

c. From TEL AVIV to ALEPPO the railway crosses 33 critical bridges totaling 7,837 feet. All of these bridges are over 100 feet in length. There are numerous other rail crossings over minor bridges and culverts. Along this route there are also 6 major tunnels with a total length of 10,230 feet. Two of the tunnels are over 4,000 feet in length. (See Tables B-2-a and B-2-b for data common to Routes A & B from ALEPPO to BAGHDAD). Motive power is predominantly steam with oil-burning or coal-fired locomotives.

2. CURRENT OPERATION CAPACITY

a. Rail traffic on this line between TEL AVIV-HAIFA and between BEIRUT-ALEPPO is presently limited to an average of 9 trains each way with daily load capacities running between 250 to 270 short tons each train. It is estimated that after

rehabilitation and replacement of 10 mile rail section the railway capacity between TEL AVIV to ALEPPO would be increased to 10 trains per day each way at 300 short tons per train.

b. It is assumed that TURKEY will accomplish rehabilitation and maintenance of the railway for that portion which is within her borders. A major US rehabilitation effort would be necessary for that section of the line (587 miles) which traverses SYRIA and IRAQ. Except for a 10 mile stretch of new rail construction near the ISRAEL-LEBANON border, the US rehabilibatition effort within these countries can be considered minor.

c. To rehabilitate and maintain the rail line and its related facilities, the estimated engineer effort would be approximately 17.5 engineer construction battalion months and 63,800 short tons of materials. This estimate assumes an average combat damage or demolition factor of approximately 15% prior to acquisition for LOC use in SYRIA and IRAQ.

3. EXPANDED OPERATING CAPACITY

The present line with the estimated rehabilitation effort is sufficient to handle an optimum of 10 trains per day with a net load of 300 short tons per train from TEL AVIV to ALEPPO. From ALEPPO to BAGHDAD an optimum of 10 trains per day with a net load of 400 short tons per train can be assumed. Construction of a new single-track, standard gage railroad direct from BEIRUT to BAGHDAD a distance of approximately 560 miles, is not considered feasible in the time available. This construction effort would require approximately 105 construction battalion months and 326,500 short tons of material.

4. OPERATIONAL CONSIDERATIONS

a. Vulnerability

(1) The absence of an alternate route in any of the countries increases the significance of the vulnerability of the line to attack at critical points, such as bridges and tunnels.

(2) The critical structures (bridges and tunnels) would require time-consuming effort to rehabilitate if destroyed. It is assumed that ISRAEL, LEBANON and TURKEY as host nations would insure the security of these facilities within their borders. A special effort should be made to capture and protect all critical rail structures in SYRIA and IRAQ.

b. Resources

(1) Manpower. It is estimated that 5400 railway personnel are presently required to operate and maintain this railroad. Within the limits of the study area there is a combined pool of approximately 50,000 skilled and semi-skilled railroad personnel which could be available. Indigenous common labor would be adequate and readily available from the numerous towns and villages located along the railway route. Limited numbers of skilled laborers required for the operation of heavy construction equipment may be located in the major urban areas, i.e. HAIFA, BEIRUT, TRIPOLI, ALEPPO, MOSUL, and BAGHDAD.

(2) Materials

(a) Lumber. Timber stands are scarce throughout the study area, thus presenting a critical lumber problem for the railroad. Almost all wooden cross ties have to be imported. Approximately 50% of the initially placed wooden cross ties have been replaced with steel. At the present time, only TURKEY can produce its own wooden or steel cross ties requirements.

(b) Ballast. Construction material necessary for the rehabilitation and maintenance of the railroad bed is available in quantity along the entire route of the rail line. In ISRAEL, crushed rock is used for ballast on practically all the lines. In TURKEY and northwest SYRIA, hard limestone and gravel may be found. Along the remainder of the route, limestone, sandstone and gravel will be available.

(c) Steel. Bridge components, rails, spikes, and track fittings as well as ancillary tools must be imported. TURKEY, if furnished the materials is capable of manufacturing a limited number of its railway requirements.

5. CRITICAL ITEMS

a. Manpower. To rehabilitate and maintain the railway from TEL AVIV to LEBANON-SYRIA border and to construct the 10 mile section of disassembled rail line within ISRAEL, would require 2.5 augmented construction battalion months. To rehabilitate and maintain the railway within SYRIA and IRAQ, a distance of 587 miles, would require 15 augmented construction battalion months. Availability of indigenous labor in ISRAEL, LEBANON, SYRIA and IRAQ could reduce unit requirements. Definite numbers are uncertain and cannot be estimated at this time.

b. Material

(1) Railroad cross ties

(2) 85 pound per yard rail

(3) Corrugated metal culvert pipe

(4) Construction steel and timber

(5) Special LOC railroad bridging

TABLE I

CHARACTERISTICS OF THE TEL AVIV - HAIFA - BEIRUT - ALEPPO - BAGHDAD RAILROAD

ROUTE	DISTANCE (MILES)	TRACK AND GAGE	MINIMUM RADIUS CURVATURE (FT)	RULING GRADE (%)	AXLE LOAD (ST)	EFFECTS OF WEATHER	CRITICAL FEATURES	LINE CAPACITY
TEL AVIV - HAIFA	81	SINGLE TRACK AND STANDARD GAGE (4'8½")	400	2.0	18.5	Local flash floods which cause washouts.	Bridges and tunnels	Average of 9 trains each way with daily load capacities running between 250 to 270 short tons per train.
HAIFA - ISRAEL BORDER	24	do	640	1.1	18.5	do.	Bridges and Tunnels (10 mile segment of rail presently disassembled)	
ISRAEL BORDER - BEIRUT	65	do	500	1.0	Out of service	No serious climatic restrictions	Bridges & tunnels	
BEIRUT - TRIPOLI	53	do	576	2.0	14.8	Snowfall in winter and spring floods	Numerous bridges and 2 tunnels	
TRIPOLI - HOMS	64	do	1950	2.0	14.8	do	Bridges	
HOMS - ALEPPO	124	do	950	1.2	14.8	Flash floods during Jan. and May	Numerous bridges	

TABLE I

CHARACTERISTICS OF THE TEL AVIV - HAIFA & BEIRUT - ALEPPO - BAGHDAD RAILROAD (Cont'd)

ROUTE	DISTANCE (MILES)	TRACK AND GAGE	MINIMUM RADIUS CURVATURE (FT)	RULING GRADE (%)	AXLE LOAD (ST)	EFFECTS OF WEATHER	CRITICAL FEATURES	LINE CAPACITY
ALEPPO - JAWBAN BAYK	39	do	1640	1.2	17.0	No serious climatic restrictions	Bridges	Present line load capacities are two trains each way per week with a net load of 300 short tons per train. For military operations this capacity could be increased to 10 trains per day with a net load of 400 short tons per train .
JAWBAN BAYK - TALL KUTCHEK	286	do	1970	1.3	20.9	do	Bridges and 2 rail centers at KARIKAMIS and NUSAYBIN	
TALL KUTCHEK - BAGHDAD	330	do	n. a.	0.8	20.1	Floods between SAMARRA and BAGHDAD may occur during Jan and May	Numerous small bridges, 1 tunnel and transhipment center at BAGHDAD	

NOTE: n. a. Information not available

TABLE C-2-a

SELECTED RAILROAD BRIDGES

ISRAEL-LEBANON-SYRIA-TURKEY-IRAQ STATE RAILWAYS

BRIDGE NO.	LOCATION	TOTAL LENGTH FT.	TYPE	SPANS NUMBER	SPANS LENGTH FT.	REMARKS
1B	0.2 miles N. of TEL AVIV-JAFFA.	est 400	Steel deck truss	9	est 40	Over YARQON River.
2B	4.2 miles S. of HADERA.	126	Steel deck	3	42	Over local road.
3B	1.2 miles NE. of HADERA.	108	Steel deck	3	36	Over HADERA River.
4B	est 6.6 miles W. of RĀS el 'EIN.	206	Steel deck	5	41	Over YARQON River.
5B	0.8 mile W. of RĀS el 'EIN.	180	n.a.	3	60	Over YARQON River.
6B	21.6 miles N. of RĀS el 'EIN.	103	Steel	n.a.	n.a.	Over wadi.
7B	14.2 miles N. of RĀS el 'EIN.	179	Steel deck girder	10	11.9	Over wadi.
8B	40.2 miles S. of HAIFA East Station	656	Reinforced concrete deck arch	n.a.	n.a.	Over valley.
9B	38.7 miles S. of HAIFA East Station	120	Steel deck	6	20	Over wadi.

NOTE: n.a. - Information not available.

TABLE C-2-a (cont'd)

SELECTED RAILROAD BRIDGES

ISRAEL-LEBANON-SYRIA-TURKEY-IRAQ STATE RAILWAYS

BRIDGE NO.	LOCATION	TOTAL LENGTH FT.	TYPE	SPANS NUMBER	SPANS LENGTH FT.	REMARKS
10B	31.8 miles S. of HAIFA East Station.	103	Steel	n.a.	n.a	Over wadi.
11B	31 miles S. of HAIFA East Station.	105	Reinforced concrete deck	1 3	60 15	
12B	3.1 miles E. of HAIFA	163	Steel	1 2	103 30	Over QISHON River.
13B	8.3 miles S. of ACRE	158	Steel	n.a.	n.a.	Over wadi.
14B	0.9 miles S. of ACRE	103	Steel girder	1	103	Over NA AMIN River.
15B	16.2 miles N. of AN NAQOURA	160	Steel girder	4	40	Over NAHR AL LITANI. This bridge was being replaced with a reinforced concrete bridge. Information as to its completion is not available. Width between banks 131 feet.

NOTE: n.a. - Information not available.

SECRET

TABLE C-2-a (cont'd)

SELECTED RAILROAD BRIDGES

ISRAEL-LEBANON-SYRIA-TURKEY-IRAQ STATE RAILWAYS

BRIDGE NO.	LOCATION	TOTAL LENGTH FT.	TYPE	SPANS NUMBER	SPANS LENGTH FT.	REMARKS
16B	1.2 miles S. of SIDON	113	Steel girder	2 2	20 36.5	Over NAHR ES SAITANIQ. Masonry piers and abutments.
17B	2.9 miles N. of SIDON	148	Steel girder	2 1	o2 24	Over NAHR BAROUK(NAHR AWALI). Possibly prepared for demolition.Concrete piers and abutments. Width between banks 105 feet.
18B	13 miles N. of SIDON	248	Steel girder	4	62	El AATIQA Bridge over NAHR ED DAMOUR. Prepared for demolition. Concrete piers and abutments. Width between banks 240 feet.
19B	1 mile S. of Main Station in BEIRUT	315	Steel girder	3	105	Over NAHR BEYROUTH. Prepared for demolition. Concrete piers and abutments. Width between banks 255 feet.

NOTE: n.a. - Information not available.

SECRET

TABLE C-2-a (cont'd)

SELECTED RAILROAD BRIDGES

ISRAEL-LEBANON-SYRIA-TURKEY-IRAQ STATE RAILWAYS

BRIDGE NO.	LOCATION	TOTAL LENGTH FT.	TYPE	SPANS NUMBER	SPANS LENGTH FT.	REMARKS
20B	4.1 miles N. of BEIRUT	114	Steel girder	1 2 1	20 33 28	Over NAHR ANNTELIAS. Concrete piers and abutments.
21B	7 miles N. of BEIRUT	280	Steel girder	2 1	105 70	Over NAHR EL KELB. Prepared for demolition. Masonry faced concrete piers and abutment. Width between banks 270 feet.
22B	12.3 miles N. of BEIRUT	Approx. 100	Steel girder	1 1	60 36	Over MAAMELTAINE Creek. Possibly prepared for demolition. Masonry faced concrete piers and abutments.
23B	17.6 miles N. of BEIRUT	175	Steel girder	1 1	70 105	Over NAHR IBRAHIM. Prepared for demolition. Masonry faced concrete piers and abutments. Width between banks 120 feet.
24B	20.3 miles N. of BEIRUT	300	Steel girder	4	75	Over NAHR EL FIDAR. Prepared for demolition. Masonry faced concrete piers and abutments. Piers are 55 feet high. Width between banks about 300 feet.

NOTE: n.a. - Information not available.

TABLE C-2-a (cont'd)

SELECTED RAILROAD BRIDGES

ISRAEL-LEBANON-SYRIA-TURKEY-IRAQ STATE RAILWAYS

BRIDGE NO.	LOCATION	TOTAL LENGTH FT.	TYPE	SPANS NUMBER	SPANS LENGTH FT.	REMARKS
25B	22.5 miles N. of BEIRUT	240	Steel girder	3	80	Over NAHR EL DJADZ. Prepared for demolition. Masonry faced concrete piers and abutments. Height above water, 80 feet. Width between banks about 280 feet.
26B	1 mile N. of TRIPOLI	Approx. 100	Steel	1	98.5	Over NAHR ABOU AALI(WADI QADICHA).
27B	9.2 miles NE of TRIPOLI	Approx. 100	Steel	1	98.5	Over NAHR EL BARED.
28B	21.5 miles NE of TRIPOLI	Approx. 100	Steel truss	1	98.5	Over NAHR EL KEBIR.
29B	36 miles NE of TRIPOLI	105.2	Masonry arch	4	26.3	Over NAHR EL KEBIR.
30B	3 miles W. of HOMS	Approx. 100	Steel truss	1	98.5	Over branch of NAHR EL ASI (River ORONTES). Masonry abutment.

NOTE: n.a. - Information not available.

TABLE C-2-a (cont'd)

SELECTED RAILROAD BRIDGES 1/

ISRAEL-LEBANON-SYRIA-TURKEY-IRAQ STATE RAILWAYS

BRIDGE NO.	LOCATION	TOTAL LENGTH FT.	TYPE	SPANS NUMBER	SPANS LENGTH FT.	REMARKS
31B	14.5 miles N. of HOMS	Approx. 100	Masonry arch	2 1	19.7 59	Over NAHR EL ASI (River ORONTES).
32B	17.4 miles N. of HOMS	117.4	Masonry arch Steel	2 3	19.7 26	Over Wadi NAFSE.
33B	39 miles N. of HOMS	Approx. 100	Steel truss	1	98.5	Over NAHR EL ASI (River ORONTES).

1/ See Table B-2-a for railroad bridges for continuation of Route B from ALEPPO to BAGHDAD.

NOTE: n.a. - Information not available.

TAB 3 TO APPENDIX C

POL AND AIRFIELDS

SECTION I - POL

1. GENERAL.

a. This section contains intelligence data and estimated Engineer construction requirements for a petroleum distribution system along a route generally paralleling the existing "crude-oil" pipeline and/or highway (as determined in situ to be most desirable) from HAIFA to BAGHDAD

b. See Exhibit C-3 for recommended alignment of pipeline and Appendix A for general area intelligence on topography and POL.

c. Included as part of the estimated effort and tonnage requirements are planned 4-inch feeder pipelines to support the Air Force operations. No specific alignment is shown on Exhibit C-3 because guidance does not specify airfields to be used for this operation.

d. Adequate tanker discharge facilities are available at HAIFA. Bulk storage must be provided at airfields and along the proposed pipeline (par. 3).

e. Crude oil pipelines along this route are not suitable for support of military operations. The refineries at HAIFA and TRIPOLI have the capability to support military operations.

f. Movement of bulk POL by highway or rail along this route is not considered feasible because of the length of the LOC and the limited rail and highway tonnage capacities . The use of the rail route via ALEPPO and TURKEY is too distant from this LOC to support operations.

2. CURRENT OPERATING FACILITIES.

a. Tanker Discharge Facilities. There are four off-shore tanker berths at HAIFA which will accommodate T-2 and super-tankers (40 foot draft). See Tab 4, this appendix, for description of facilities.

b. Existing Bulk Storage.

(1) Tank farm facilities are adequate at HAIFA to provide port POL terminal storage for a military operation, as follows:

OWNER	AVGAS	OTHER CLEAN PRODUCTS*
Shell Co	33,780 bbls.	130,100 bbls.
Consolidated refineries	-	1,608,850 bbls.
TOTAL	33,780 bbls.	1,738,950 bbls.

*MOGAS, Jet Fuel, Kerosene, and Diesel.

(2) The only other bulk storage available for this military operation is at BAGHDAD (55,145 barrels, see Tab 3 to Appendix D).

(3) No storage is available in JORDAN or IRAQ along the LOC. Commercial storage is very limited in JORDAN. It is estimated at 10,000-20,000 barrels for the entire country.

(4) Storage at airfields is inadequate.

c. Pipelines. There are no pipelines in the area which can be used for the logistical support of military operations. There are three crude oil pipelines (1-12" and 1-16" from the IRAQ oil fields near KIRKUK and 1-30" from SAUDI ARABIA to HAIFA). These pipelines are all designed to pump from east to west. Relocation of pump stations and cleaning the crude oil out of the systems by high pressure steam scouring processes would be a major task which could not be accomplished in less than six months.

d. Petroleum Refineries.

(1) The refineries at HAIFA and TRIPOLI have the capability to provide a part (all POL products except AVGAS and jet fuel) of the military requirements in petroleum products needed to support this operation. (See Tab 3 to Appendix B for details).

3. EXPANDED OPERATING FACILITIES.

Military operations along the HAIFA - BAGHDAD axis will require the following construction effort:

a. 100% of proposed pipeline and ancillary equipment.

b. Bulk storage for 1,090,000 barrels POL, plus bulk storage of 250,000 barrels at selected airfields.

c. 4-inch feeder pipelines to selected airfields.

4. ENGINEER SUPPORT REQUIRED.

a. Tasks.

(1) Construction of approximately 650 miles of 6-inch pipeline plus ancillary equipment along HAIFA (or BEIRUT) to BAGHDAD axis with one 150,000 barrel tank farm located at 100 mile intervals along the route (total required; six tank farms) plus construction of a tank farm at BAGHDAD (200,000 barrel capacity).

(2) Construction of five tank farms (50,000 barrel capacity each) and 150 miles of 4-inch pipeline for direct support of Air Force.

(3) It is assumed that maintenance of storage and tanker unloading facilities at HAIFA will be provided by host government or contract labor.

b. Effort. To provide facilities outlined in paragraph a above, the following troop units are required:

4 Engineer Pipeline Companies

1 Engineer Construction Battalion

2 Engineer Construction Companies

c. Tonnages. The Class IV tonnages to supply material for construction of facilities outlined in paragraph a above, follows:

(1)	Pipeline, main LOC	21,216 ST
	Pipeline, Air Force	3,780 ST
(2)	Tank farms, main LOC	6,469 ST
	Tank farms, Air Force	1,950 ST
	TOTAL	33,415 ST

5. OPERATIONAL CONSIDERATIONS.

a. Construction materials must be transported by road or rail to the construction site. This involves the transport of 33,415 short tons over a 60-day period.

b. Pipelines are vulnerable to sabotage and guerilla activities, and this route is especially vulnerable because it crosses through SYRIA. Security measures for lines and facilities along the entire route are required. This could be a critical factor and should be considered in the overall evaluation of Route B.

c. Full operational use of airfields will depend on provision of sufficient POL (See Section II, this Tab).

d. Little utilization of indigenous labor can be contemplated for major portion of pipeline.

6. CRITICAL ITEMS.

a. Manpower. Early arrival of engineer units to begin construction of pipelines and facilities is highly desirable to permit rapid utilization of lines.

b. Materiel. All pipeline construction materiel should be considered as critical items.

TAB 3 TO APPENDIX C

POL AND AIRFIELDS

SECTION II - AIRFIELDS

1. GENERAL.

There are twenty-six airfields in proximity to Route B which can be utilized to support combat operations in the study area. Ten of these airfields are in ISRAEL, six in JORDAN, five in IRAQ, three in LEBANON, and two in SYRIA. Ten of the twenty-six airfields, used individually or in combination are suitable for immediate use by current operational cargo and tactical aircraft. Ten others should only be used in emergencies, with the remainder available for limited use. At the outset of this operation ample suitable airfields are available to support the build-up phase preparatory to a land offensive. However, airfields suitable for operational cargo and tactical aircraft are virtually unavailable east of MAFRAQ except in the objective area itself.

2. CURRENT OPERATING CAPACITY.

a. Capacity. All current operational cargo and tactical aircraft can be accommodated by certain individual airfields or combination of airfields in this area. Certain of the airfields are adequate for sustained operations without initial rehabilitation. The accommodation characteristics and limitations of the existing airfields in this area are summarized in the following list:

BEIRUT INTERNATIONAL	Sustained operations of heavy cargo and jet fighters.
LOD	Sustained operations of medium weight cargo, limited operations of heavy cargo aircraft and jet fighters.

AMMAN	Sustained operations of medium weight cargo, heavy cargo aircraft and jet fighters.
MAFRAQ (NEW)	Sustained operations of heavy cargo aircraft. Current intelligence indicates this airfield is incomplete.
DAMASCUS	Sustained operations of medium weight cargo, limited operations of heavy cargo aircraft and jet fighters
MATZOR	Sustained operations of light cargo and jet fighters, limited operations of medium cargo aircraft.
JERUSALEM	Sustained operations of medium cargo aircraft.
KLEIAT	Sustained operations of medium cargo aircraft.
RIYAQ	Sustained operations of medium cargo aircraft.
RAMAT DAVID	Sustained operations of medium cargo and jet fighters.
EIN SHEMER	Sustained operations of light cargo, and limited operations medium cargo.
KFAR SIRKIN	Sustained operations of medium cargo.
SAHL ES SAHRA	Sustained operations of light cargo.
EQRON	Sustained operations of light cargo.
EL FALUJA	Sustained operations of liaison, limited operations of light cargo.

WADI ESH SHARIA H-5, H-4, H-3 H-2, H-1 and K-3	Sustained operations of liaison, limited operations of light cargo. Heavy maintenance will be required during first 15 days of use.
T-1	Sustained operations of light cargo and liaison.
MAFRAQ	Unserviceable, closed to aircraft.
MEGIDDO	Not currently operational
RISHPON	Construction indefinitely suspended

b. Maintenance

Maintenance at airfields will not require major effort within 15 days, unless utilization of the airfields is in excess of the limitations as shown above and in Table C-3-a. Required maintenance can be adequately performed by one engineer construction company per operational airfield. Assuming that an average of about five airfields will be in use during any given period, two engineer construction battalions are sufficient to accomplish the required maintenance tasks under the conditions listed above.

3. EXPANDED OPERATING CAPACITY

a. Expansion of the airfields located west of MAFRAQ is not necessary since adequate facilities in good condition are available.

b. Expansion of the airfields east of MAFRAQ is not considered feasible (See paragraph 4).

4. OPERATIONAL CONSIDERATIONS.

a. The existing airfields on and near the coast are of sufficient size and number, and generally in adequate condition to support the build-up and initial resupply.

Limited engineer effort will be required for rehabilitation and routine maintenance.

b. As the land offensive proceeds eastward along Route B, the existing airfields are few and inadequate to support combat operations. East of MAFRAQ, seven oil company airfields are the only available facilities before reaching the BAGHDAD area. All of these fields are rolled sand strips capable of supporting light aircraft on a limited basis. They cannot be categorized as "minimum operational" because of this lack of hard runway surfaces. Any usage by C-119's or heavier aircraft will require extended heavy maintenance preceded by an initial construction effort which would require at least a continuous effort of one engineer battalion at each field used. An additional restriction on construction capability is the short time frame of this operation which seems to preclude reconstruction effort indicated. The alternative operational scheme should make maximum use of airfields west of MAFRAQ for all aircraft and use the oil company fields as forward cargo fields on a limited basis. To maintain these fields on a forward cargo status will require one augmented engineer construction company per field used.

c. Existing POL storage at all fields except BEIRUT and RAMAT DAVID is seriously inadequate. To overcome this deficiency, 4-inch feeder pipelines and on-base storage (50,000 barrels per base used) is proposed (See SECTION I, this TAB).

5. CRITICAL ITEMS

a. All pipeline construction materials.

b. Pierced steel plank for supplementing existing deficiency of parking and taxiing surfaces.

SECRET

TABLE C-3-a

AIRFIELDS

CURRENT FACILITY STATUS

MAP REF NO.	NAME	DIMENSIONS LENGTH	DIMENSIONS WIDTH	RUNWAY TYPE CONSTRUCTION	RUNWAY CONDITION	RUNWAY CAPACITY (LBS)	POL STORAGE	OTHER FACILITIES
25	BEIRUT INTERNATIONAL	7,800 7,800	200 200	8" reinforced concrete 12" reinforced concrete	Good Good	270,000 270,000	300,000 gal. AVGAS jet fuel, (BEIRUT 5,400,000 gal AVGAS and 800,000 gal jet fuel)	1,240,000 SF concrete apron space. All NAVAIDS.
26	KLEIAT	6,600	150	Asphalt	Good	100,000	7,100 gal. underground	127,000 SF concrete apron space. All NAVAIDS.
27	RIYAQ	6,000	150	Asphalt concrete on rock base.	Poor	100,000	2,000 gal.	700,000 SF concrete apron space. All NAVAIDS.
28	SAHL ES SAHRA	5,300 2,280	150 150	Bitumen-stone Sandy marl	Fair Unserviceable	40,000 n.a.	None	Stone taxiway. Eight 70' x 30' hardstands. Telecommunications.
29	DAMASCUS	8,360 3,280	200 160	Asphalt w/concrete ends. Asphalt on crushed stone	Rough n.a.	160,000 33,000	132,350 gal AVGAS and jet fuel.	22,500 SF concrete apron space. All NAVAIDS.
30	RAMAT DAVID	7,290 6,000	150 150	Tar-macadam Tar-macadam	Good Good	85,000 85,000	97,066 gal AVGAS underground storage. Bulk storage at HAIFA for 3,000,000 gal AVGAS	1,255,000 SF concrete apron space. All NAVAIDS.

SECRET

TABLE C-3-a (cont'd)

AIRFIELDS

CURRENT FACILITY STATUS

MAP REF NO.	NAME	RUNWAY DIMENSIONS LENGTH	WIDTH	TYPE CONSTRUCTION	CONDITION	CAPACITY (LBS)	POL STORAGE	OTHER FACILITIES
31	MEGIDDO	6,000	150	Tar-macadam	Rough	n.a.	44,800 gal.	10 revetments (med bomber) One large and two small tar-macadam aprons.
		4,500	150	Tar-macadam	Rough	n.a.		
32	EIN SHEMER	6,000	150	Bitumen-stone	Unserviceable	n.a.	43,100 gal underground	Two macadam service aprons totaling 84,000 SF. One concrete ramp 324,000 SF.
		5,250	150	Bitumen-stone	Poor	85,000		
		4,500	150	Bitumen-stone	Poor	85,000		
33	RISHPON	6,230	180	Rolled sand and stone	n.a.	n.a.	None	None
34	KFAR SIRKIN	5,100	150	8" macadam on stone	Good	100,000	13,500 gal underground. Additional storage constructed. Capacity and type unknown.	Three large macadam parking and servicing aprons. All NAVAIDS except weather.
		4,890	150	8" macadam on stone	Good	100,000		
		4,500	150	8" macadam on stone	Good	100,000		
35	LOD	7,740	150	Mac-asphalt on stone	Good	150,000	70,900 gal. underground AVGAS.	1,650,000 SF tar-macadam and concrete apron space.
		5,100	150	" " "	Good	150,000		
		4,200	150	" " "	Good	150,000		
		3,600	150	Macadam and asphalt	Closed	n.a.		
36	EQRON	6,000	150	Asphalt on concrete	Good	66,000	63,000 gal. underground	700,000 SF concrete apron space. 16 hardstands, 13 revetments. All NAVAIDS.
		5,850	150	" " "	n.a.	66,000		
		4,500	150	" " "	Good	66,000		
		3,300	150	Concrete	n.a.	n.a.		

TABLE C-3-a (cont'd)

AIRFIELDS

CURRENT FACILITY STATUS

MAP REF NO.	NAME	DIMENSIONS LENGTH	DIMENSIONS WIDTH	RUNWAY TYPE CONSTRUCTION	RUNWAY CONDITION	RUNWAY CAPACITY	POL STORAGE	OTHER FACILITIES
37	HATZOR	9,000 5,570	150 160	Bitumen-stone Bitumen-stone	n.a. n.a.	66,000 66,000	56,000 gal	1,230,000 SF madacam/concrete apron space. All NAVAIDS.
38	EL FALUJA	6,000 4,950	150 150	Asphalt Asphalt	Fair Fair	n.a. n.a.	None	16 light bomber revetements.
39	WADI ESH SHARIA	7,800 5,800	240 150	Rolled sandy soil Rolled sandy soil	n.a. n.a.	n.a. n.a.	None	None
40	MAFRAQ	9,000 7,500 7,500	600 300 300	Rolled sand and gravel " " " " " "	n.a. n.a. n.a.	80,000 80,000 80,000	72,000 gal. AVGAS and jet fuel.	Fair weather open field dispersal. All NAVAIDS.
41	MAFRAQ (New)	9,000	200	6-inch asphalt on 18 inch crushed stone	Good	250,000	72,000 gal. AVGAS and jet fuel.	138,342 SF concrete apron space and hardstands.
42	AMMAN	8,010	150	Asphalt and concrete on crushed rock.	n.a.	173,000	185,000 gal AVGAS and jet fuel.	8 concrete double hardstands 550,000 SF asphalt and concrete apron space. All NAVAIDS
43	JERUSALEM AIRPORT	6,060	150	Tar-macadam	n.a.	85,000	Under construction	368,000 SF concrete tar-macadam.

TABLE C-3-a (cont'd)

AIRFIELDS

CURRENT FACILITY STATUS

MAP REF NO.	NAME	DIMENSIONS LENGTH	DIMENSIONS WIDTH	RUNWAY TYPE CONSTRUCTION	RUNWAY CONDITION	RUNWAY CAPACITY	POL STORAGE	OTHER FACILITIES
44	H-5	5,050	270	Hard, rolled sand	n.a.	40,000	None	None
		4,990	270	" " "	n.a.	40,000		
		4,800	520	" " "	n.a.	40,000		
45	H-4	3,510	150	Rolled, oiled sand	n.a.	40,000	Drums only	Oiled parking apron. All NAVAIDS.
		3,300	150	" " "	n.a.	40,000		
46	H-3	6,000	150	Rolled, oiled sand	Closed	n.a.	2 small tanks total 750 gal.	No prepared taxiway. Oiled aprons, Radio and telephone.
		4,500	150	" " "	Poor	33,000		
		4,050	150	" " "	n.a.	33,000		
47	H-2	3,600	150	Rolled, oiled sand	n.a.	40,000	Drums only.	No taxiways. All NAVAIDS.
		3,540	150	" " "	n.a.	40,000		
48	H-1	3,600	150	Rolled, oiled sand	Poor	30,000	None	Oiled taxiways and hardstands All NAVAIDS.
		3,600	150	" " "	Poor	30,000		
49	T-1	3,600	130	Rolled, oiled sand	Good	60,000	Drums only	Oiled taxiways. All NAVAIDS.
50	K-3	3,900	150	Stone w/4" gypsum oiled	n.a.	60,000	Drums only	Oiled taxiways. Small tar-macadam apron. All NAVAIDS.
		3,600	150	Stone w/4" gypsum oiled	n.a.	60,000		

TAB 4 TO APPENDIX C

PORTS AND WATERWAYS

SECTION I - PORTS

1. GENERAL.

a. See Appendix A for presentation of general intelligence including geography, climatology and topography as related to military operations.

b. See Table C-4-a for detailed description of port facilities.

c. Description. The Mediterranean coasts of ISRAEL and LEBANON offer excellent port facilities to support this operation.

(1) ISRAEL. Port facilities consist of one principal, two secondary and two minor ports. HAIFA, the principal port is the only one capable of berthing large deep-draft vessels; TEL AVIV and JAFFA, the secondary ports, are open roadsteads in which large vessels must be unloaded by lighters.

(2) LEBANON. Port facilities consist of one principal and one secondary port. BEIRUT, the principal port is capable of berthing deep-draft vessels; TRIPOLI has a breakwater protected anchorage for small vessels requiring lighterage unloading.

2. CURRENT OPERATING FACILITIES.

a. HAIFA.

(1) Harbor. HAIFA is located on the southern shore of HAIFA BAY. The main harbor is roughly triangular in shape and is almost enclosed by two breakwaters of 7,250 feet and 2,410 feet in length. Controlling depth at low water is 36 feet at the entrance channel. Anchorages are provided at the seven wharves, the two jetties, and at the main breakwater. Approaches to the harbor are free and clear. A second harbor (QISHON harbor) is also roughly triangular in shape and is protected by two breakwaters each about 2,000 feet in length. The entrance to QISHON harbor has a controlling depth of 24 feet. Approaches to the harbor are free

and clear. Anchorages are provided at the cargo wharf and at the fishing dock.

(2) Berths. Wharves provide a total of 8,987 linear feet of berthing space of which about 6,075 feet could be utilized for handling general cargo. See Table C-4-a for details.

(3) Mechanical Handling Facilities. Equipment is adequate and in good condition. See Table C-4-a for listing of facilities.

(4) Storage. Covered storage space totals 643,000 square feet in the harbor area, and an additional 424,000 square feet in the town. Cold storage scattered throughout the urban area totals 1.13 million cubic feet. Open storage space totaling 25 acres is available near the main harbor. POL product storage capacity is 1.7 million barrels. Bulk grain storage is provided by a grain elevator which has a capacity of 20,000 tons.

(5) Clearance. The port is cleared by a standard gage coastal and narrow gage inland railroad (See Tab 2). Two wide roads clear the main harbor and connect with two and four lane all-weather highways clearing the town. In the town, most of the streets are paved and connect with the principal roads. (See Tab 1).

(6) Estimated Military Port Unloading Capacity. The present estimated maximum unloading capacity is 7,100 short tons per 20-hour day of general cargo handled at wharf berths.

b. BEIRUT.

(1) Harbor. BEIRUT's harbor, located on the north side of RAS BEIRUT, is roughly triangular in shape and consists of two main basins divided by a mole and enclosed by two breakwaters. Depths in the harbor range from 56 feet at the entrance to 8 feet at the west of the ANCIEN Basin. Anchorage is available in the roadstead northwest of the port; however, the holding ground is poor. Approaches to the harbor are free and clear. The facilities include two basins, 5 quays, and 5 moles.

(2) Berths. Wharves provide a total of 7,813 linear feet of berthing space of which 4,200 feet can be used for handling general cargo. See Table C-4-a for details.

(3) Mechanical Handling Facilities. Equipment is adequate and in good condition. See Table C-4-a for listing of facilities.

(4) Clearance. A narrow-gage single-track railroad clears the town southward and then turns eastward, crossing the LEBANON mountains and on to DAMASCUS. Standard gage lines north to TRIPOLI and south to HAIFA also clear the town (See Tab 2). Although the many narrow and congested streets in the center of town tend to impede traffic, a few wide roads clear the port area. These wide roads connect with four land all-weather roads clearing the town. The roads clearing the wharves are believed capable of handling required military traffic. (See Tab 1)

(5) Estimated Military Port Unloading Capacity. The present estimated maximum unloading capacity is 7,100 short tons per 20-hour day.

c. Other Ports.

See Table C-4-a for details of other ports in the area.

3. EXPANDED OPERATING CAPACITY.

The capacity of these ports (HAIFA and BEIRUT) is sufficient to handle the tonnage required for this operation without expanding existing facilities. In addition to these two ports there are three small ports in the area that could supplement the tonnage clearance. These small ports are:

NAME OF PORT	ESTIMATED CAPACITY
TEL AVIV, ISRAEL	900 short tons
JAFFA, ISRAEL	2,240 short tons
TRIPOLI, LEBANON	3,360 short tons

If expansion is required the tonnage could be landed through these ports without any additional construction being required.

4. OPERATIONAL CONSIDERATIONS.

a. Vulnerability. These ports are vulnerable to sabotage. Capacities could thus be materially reduced. However, good beaches in the vicinity of both the large ports mitigate this problem.

b. Indigenous Labor. Little difficulty should be experienced in securing ample indigenous labor to assist in port maintenance operations.

5. CRITICAL ITEMS.

a. Manpower. One construction company at each port (HAIFA and BEIRUT) augmented by indigenous labor, will be ample to provide all maintenance likely to be required.

b. Material. No indigenous material will be available. Timber and piles must be included in support tonnages.

TAB 4 TO APPENDIX C

PORTS AND WATERWAYS

SECTION II - WATERWAYS

1. GENERAL.

Inland waterways are of minor importance along Route B in support of the civilian economy. They are of no importance for the support of this military operation.

2. CONCLUSIONS.

Inland waterways should not be included in the logistic network on this route.

TABLE C-4-a

PORTS

FACILITIES	HAIFA, ISRAEL (P-7)			BEIRUT, LEBANON (P-9)		
HARBOR	Breakwater enclosed. Two breakwaters, 7,250 and 2,410 feet long. Controlling depth at low water, 36 feet. Approaches free and clear. QUISHON harbor is triangular with controlling depths of 24 feet.			Breakwater enclosed, depths from 5o to 8 feet. Anchorage in roadstead, poor holding ground.		
BERTHS	USABLE BERTHING SPACE FEET		DEPTH ALONGSIDE FEET	USABLE BERTHING SPACE FEET		DEPTH ALONGSIDE FEET
	1,433	GENERAL CARGO	30	669	GENERAL CARGO	27
	843		36	453		27
	951		29	689		20-27
	1,132		21	432		6.5
	813		13	999		6.5-14
	902		8	958		6.5
		POL			BULK CARGO	
	1,378		32	984		28
		PASSENGER			MAINT. FACILITIES	
	607		36	459		5.6-16
		MISCELLANEOUS			MISCELLANEOUS	
	928		13	2,170		28-35

TABLE C-4-a (cont'd)

PORTS

FACILITIES	HAIFA, ISRAEL (P-7)	BEIRUT, LEBANON (P-9)
MECHANICAL HANDLING FACILITIES	100 Ton crane (1) 15 Ton floating crane (1) 16-30 Ton crawler cranes (3) 15 Ton derrick (1) 2-8 Ton mobile cranes (17) 3-5 Ton cranes (3) 2.5-3.25 Ton crawler cranes (5) 5 Ton railway crane (1)	3 Ton portal crane (1) 6 Ton portal crane (1) 1½ Ton fixed jib crane (4) 1 Ton and 3 ton locomotive cranes (1 each) 50 Ton floating steam jib crane (1) 30 Ton floating steam crane (1) 27 Ton mobile crane (1), 18 ton mobile crane (2) 6-12 Ton mobile crane (7),2-5 ton mobile crane(3) fork lifts 2-8 tons (24)
STORAGE	COVERED: 643,000 SF in harbor area 424,000 SF in town COLD STORAGE: 1,130,000 cubic feet OPEN: 1,089,000 SF	COVERED: 1,000,000 SF COLD : 567,725 cubic feet OPEN : 1,500,000 SF
CLEARANCE	RAILROAD Standard gage coastal RR, single track. Narrow gage inland RR.	RAILROAD Standard gage coastal RR, single track. Narrow gage to DAMASCUS (See Tab 2).
ESTIMATED MILITARY CAPACITY	7,100 short tons	7,100 short tons

TABLE C-4-a (cont'd)

PORTS

FACILITIES	TEL AVIV, ISRAEL (P-8)	JAFFA, ISRAEL (P-8)	TRIPOLI, LEBANON (P-10)
HARBOR	Open Roadstead with adjoining lighter basin.	Open roadstead with adjoining lighter basin.	Breakwater protected inner anchorage for small vessels; lighter basin adjoining.
BERTHS	Lighters (16)	Lighters (45)	Lighters (61)
	WHARFAGE AVAILABLE FEET: 822 / DEPTH FEET: 6	WHARFAGE AVAILABLE FEET: 1,951 / DEPTH FEET: 6.5	WHARFAGE AVAILABLE FEET: 3,282 / DEPTH FEET: 3-10
MECHANICAL HANDLING EQUIPMENT	Cranes of various types (9)	Cargo cranes (5)	Cargo cranes (2)
STORAGE	COVERED: 93,030 SF	COVERED: 241,000 SF	COVERED: 98,000 SF
CLEARANCE	RAILROAD: Single track standard gage railroad to LYDDA. No tracks in port area.	RAILROAD: Single track standard gage railroad to LYDDA. No tracks in port area.	RAILROAD: Single track standard gage coastal railroad, plus single track standard gage to east.
	ROADS: Coastal highway.	ROADS: Coastal highway.	ROADS: Coastal highway plus route to east.
ESTIMATED MILITARY CAPACITY	900 Short tons	2,240 Short tons	3,360 Short tons

APPENDIX D (ROUTE C, BASRAH - BAGHDAD), TO ENGINEER ANNEX TO DCSLOG MIDDLE EAST LOC REPORT

1. DESCRIPTION

a. Military Geography. (See also Appendix A)

(1) Terrain

(a) The TIGRIS EUPHRATES DELTA is an extensive plain which comprises about 20% of IRAQ and includes the delta of the TIGRIS and EUPHRATES Rivers. The area covered by the delta is approximately 350 miles in length and is approximately 150 miles wide for most of its length, narrowing to a width of 26 miles at the PERSIAN GULF.

(b) The nearly flat surface of the delta slopes gently downward to the southeast from a maximum elevation of about 250 feet above sea level in the north (vicinity BAGHDAD). Extensive marshes, lakes, irrigation canals and areas subject to spring flooding are common south of the dam near AL HINDIYAH (EUPHRATES RIVER) and the dam at AL KUT (TIGRIS RIVER); however, these rivers are bordered by marshes and lakes as far north as BAGHDAD.

(c) Maximum flooding of the delta usually occurs during the month of May when melting snow from mountains in northeastern IRAQ and in TURKEY and IRAN causes the rivers to inundate large areas.

(d) Vegetation consists of tall reeds and grasses in the marshes, groves of palms and trees along rivers and cultivated crops.

(e) There are no suitable landing beaches along the 36 mile coastline of IRAQ. Mud flats border the entire coastline; however, amphibious landings could probably be made with considerable difficulty within the entrance of SHATT AL ARAB and the KHNR AZ ZUBAYR. The 5-fathom line lies from 15 to 20 miles offshore and

dredging is needed to maintain a navigation channel into the SHATT AL ARAB for ocean shipping. Continual dredging is also required at the ports of BASRAH and AL FAO because of incessant silting.

(f) The nearest suitable landing beaches are in KUWAIT (SAUDI ARABIA) in the vicinity of the city of KUWAIT proper and along the coast to the south. From these beaches the terrain leading north and west into IRAQ is generally favorable for cross-country movement.

(g) Particularly in the southern reaches of the TIGRIS-EUPHRATES DELTA terrain is very unsuitable for cross-country movement and for military operations involving large forces. This situation is highlighted in Exhibits A-7 (Suitability for Roads and Airfields) and A-8 (Cross-Country Movement). There is a small suitable corridor in a southeast - northwest direction between the TIGRIS and the mountains in IRAQ. However, from a cross-country mobility point of view by far the most suitable general avenue of approach from the head of the PERSIAN GULF to BAGHDAD is west and south of the EUPHRATES, between the river and the SAUDI ARABIA and KUWAIT border.

(2) Weather and Climate.

(a) IRAQ has great daily and seasonal ranges in temperature and receives most of its relatively scanty precipitation during cooler months of the year.

(b) Summers (early June through September) are hot with afternoon temperatures usually between 100° to 112° F. July and August are hottest months.

(c) Winter temperatures are usually above freezing. In January the coldest month, afternoon temperatures are in the 50's and 60's and night temperature between 34° and 44° F. Lows of 19° F and 24° F in the central and southern parts of IRAQ respectively have occured. Frosts may occur at any time from November through February.

(d) Annual precipitation in IRAQ increases from south to north, ranging from 10 inches in the south to about 19 inches

in the plains area. Essentially all precipitation and cloudiness occurs during October or November through May. Showers occur up to 11 days a month during this period, but seldom several days in succession. From June through September skies are generally clear 20 to 30 days a month.

(e) Duststorms may occur at any time during the year but are most frequent in the summer months. Duststorms which reduced visibility to less than 1,000 yards occur seven or eight days a month in June and July in southern IRAQ. Frequency decreases in northern and western IRAQ. Occasionally duststorms are very severe reducing visibility to 20 yards or less.

(3) Water

(a) Unlimited supplies of surface water may be obtained from the main channels of the TIGRIS and EUPHRATES. Treatment of all water obtained from local resources will be necessary.

(b) Large quantities of ground water are easily obtained at depths between 50 and 100 feet. Ground water, though easily obtainable is usually of poor quality, being saline and brackish. The most favorable sources for ground water occur in the central one-third of the delta.

(c) In the arid region between the EUPHRATES and the border with SAUDI ARABIA water supply is a serious problem. There are occasional wells of poor quality and limited quantity and it is probable that water to support operations would have to be trucked over from the EUPHRATES.

(4) Military Implications

(a) Development of an LOC for the PERSIAN GULF - BAGHDAD area must be based on consideration of the general suitability of cross-country movement corridors which militate against operating through the lower reaches of the delta.

(b) Furthermore, the delta serves to disrupt lateral communications so that it would be difficult to coordinate forces operating on opposite sides of the delta.

(c) The entrances into BASRA from the sea are restricted and are potential bottlenecks. Some flexibility could be provided for by considering alternate operations across KUWAIT beaches and hence north and west into IRAQ, although this would add about 80 miles to the LOC.

b. Transportation. The TIGRIS and EUPHRATES influence the IRAQ transportation to the extent that almost all existing and planned land routes parallel the two rivers and their distributory, the SHATT AL ARAB.

(1) Roads. (See Tab 1)

(a) Movement of personnel, equipment, and freight over roads will be restricted by the sparsity and low-type of construction of the road system, large sections of which become impassable during wet weather and the low capacity of major and minor bridges. Almost all bridging must be replaced to provide bridges of requisite capacity (Class 50) to sustain tactical and LOC movement. Overall through-put capacity of major highways is restricted by relatively unimproved or primitive sections of road which limit speed and/or two-way movement. Highway conditions are generally poor due to poor maintenance. Continual maintenance will be required to sustain LOC traffic.

(2) Railroads. (See Tab 2) The only railroad in this area is a single-track meter gage (narrow 3'3-3/8") system approximately 350 miles in length which parallels the EUPHRATES RIVER and AHATT AL HILLAH. Track structure is relatively light and capacity of the system is limited by excessive distance between passing points, and variety of poor and complicated braking and coupling systems. Present capacity is estimated as 620 short tons per train and 5 trains per day, for a total daily tons forward capacity of 3,100 short tons. Through rehabilitation and increasing the number of passing and turn outs it is possible to double the capacity of the system provided availability

of motive equipment and rolling stock is compatible with expanded system.

(3) POL Pipeline. (See Tab 3) Military operations in the BASRA-BAGHDAD area will require construction of approximately 100% of necessary POL facilities including a 6-inch pipeline, tank farms, and a tanker discharge facility at BASRA. Capacities of the railroad and highway are inadequate for movement of required Class II supplies. Movement of bulk Class IV by inland waterway is not considered feasible due to lack of suitable barges and shallow depths of water. Effort required to provide POL system necessary to support contemplated operation is outlined below.

(4) Ports. (See Tab 4)

(a) Three ports, BASRA, KHORRAMSHAHR and ABADAN are located 40 to 70 miles inland from open water on the delta area of the SHATTA AL ARAB. The rate of silting in the delta is so rapid that an intensive dredging program is required to maintain navigable depths in channels and at wharves. Controlling depth for deep draft ocean-going vessels is 19 feet at low water.

(b) BASRA is the principal port and is connected to the interior by rail, highway and inland waterway. Estimated military unloading capacity is 11,500 short tons per day. Electrical power and lighting system is inadequate for current demands, and the terminal is inadequately equipped for movement of cargo between shipside, transit and storage. Heavy lift shore and floating cranes are available with capacities up to 100 tons. Through-put capacity is limited to 5,600 short tons by inadequate rail, highway and inland waterway transportation systems.

(c) ABADAN located about 45 miles above the PERSIAN GULF in IRAN is the site of one of the largest oil refineries in the world. Most port facilities are used exclusively by the National Iranian Oil Company. Military unloading capacity of the port is 5,800 short tons per day. Port clearance to BASRA by way of KHORAMSHAHR can be

accomplished by highway if suitable bridging over SHATT AL ARAB is provided.

(d) KHORAMSHAHR is IRAN's principal general cargo port. All facilities are in poor condition and extensive rehabilitation would be required to sustain continuous heavy service. Good all-weather roads lead from the port to BASRA and ABADAN. Unloading capacity is estimated to be 4,700 short tons per day, but under US operation in 1944 the daily average landed and cleared was 7,200 short tons.

(5) Inland Waterways. (See Tab 4)

(a) The EUPHRATES RIVER is not generally suitable for navigation because of swamps and extensive shallow portions.

(b) The TIGRIS RIVER is the main inland waterway of IRAQ. It is navigable for shallow-draft craft throughout the year to a point 20 miles above BAGHDAD. Controlling depth is 3 feet during low water and 4 feet during highs. The journey upstream BASRA to BAGHDAD requires 4 to 6 days during high water and 8 to 15 days during low water. The downstream trip requires from about 3 days at high water to 10 days at low water.

(c) The upstream tonnage capacity under military operation employing indigenous personnel and equipment is estimated at 2,000 short tons per day. Controlling critical feature for use of this waterway is the dam at AL KUT.

(6) Airfields. (See Tab 3)

There are seven airfields of significance in the study area. These are located at ABADAN, BAGHDAD WEST, BASRA, HABBANIYA, HABBANIYA PLATEAU, RASHID, SHAIBH. Of these fields all but HABBANIYA and BASRA can be made to accommodate a composite tactical wing. A continuing maintenance effort will be required at any of the fields following intensive use in excess of 15 days.

c. Local Resources.

(1) Manpower: Current prosperity and increased urban employment growing out of construction projects have steadily drawn

unskilled labor away from agriculture. This trend has brought about an abundant supply of labor in cities and local shortages in some rural areas.

(a) Skills: The IRAQ labors shows considerable apitude for the acquisition of mechanical skills within the limits imposed by unfamiliarity and wide-spread illiteracy.

(b) Effectiveness: A sense of responsibility toward his job is not very well developed in the IRAQI worker and absenteeism is common. The capabilities of the IRAQI laborer for sustained through not overly hard labor are good.

(2) Materials: Construction materials are generally in short supply. Production of cement is only enough to satisfy limited demands of area. Timber is almost non-existent in the area. Moderate quantaties of bituminous products are available from KUWAIT. Adobe and burned brick and tile are produced in quantities for local use throughout the area.

2. OPERATIONAL CONSIDERATIONS.

a. General.

(1) It is impossible to divorce LOC considerations from operational concepts. Under conditions of little or no combat, it might be feasible to develop an LOC through BASRA and up to BAGHDAD over the northern route. However, it is believed that terrain in the DELTA is so unsuitable that large combat forces cannot operate up through the DELTA, but must swing around to the south and west of the EUPHRATES. It is visualized that the right flank of advancing US forces would be secured along the EUPHRATES and the left flank would be open along the desert plateau area towards the SAUDI ARABIA border. Unfortunately detailed intelligence is not available on obstacles to cross-country movement in this area, particularly as to wadi dimensions. However, it appears that cross-country movement is relatively easy, and it is obviously much superior to the DELTA area. Movement up this suggested route, and development of a corresponding LOC, has other advantages:

(a) It permits link-up with forces coming from JORDAN.

(b) It avoids inhabited areas, an important consideration, particularly in a limited war.

(c) It ties the main road LOC and railroad together. This is much better than trying to develop a railroad along the EUPHRATES and a road along the TIGRIS.

(d) It has an alternate communication line through KUWAIT beaches should the BASRA area be destroyed, bottlenecked, or bogged down.

(2) Critical bridges along the LOC and at least two dams must be seized by airborne operations before they are destroyed. Protection of the dam at ALKUT is critical to almost all transportation facilities since it controls water levels for navigation on the TIGRIS RIVER, and its destruction or rapid release of excessive quantities of water would washout roads and bridges and inundate most areas for a considerable period. In the latter respect, destruction of the dam at AL HINDIYAH would have a similar effect.

b. Logistical

(1) Supply. Engineer units needed to provide support or maintain facilities or elements of the LOC will require equipment augmentation to accomplish required tasks.

(2) Transportation. Engineer Class IV materiel requirements not including equipment augmentation of units will total approximately 56,650 short tons to provide or support facilities indicated below. Expansion of the highway and railroad system will increase tonnage as indicated:

Facility	Tonnage for Initial Facility or to Sustain Current Capacity - S/T	Additional tonnage for Expanded Capacity - S/T
Ports	6,500	
POL	14,760	
Waterways	100	
Highway	5,341	1,430
Railroads	29,960	1,880
	56,661	3,310

(3) Construction.

Transportation facilities in the area, although adequate to move dry cargo daily maintenance tonnages, are in a poor state of maintenance and will require considerable construction effort to sustain current capacities under continued military use. In addition, construction effort will be required to provide or expand dry cargo transportation and bulk POL transmission facilities to meet peak load requirements. Magnitude and scope of effort required for the foregoing is detailed in paragraph 4 below and included.

3. REQUIREMENTS.

a. Current Operating Capacity-Rehabilitation and Maintenance Requirements.

(1) Roads. Routes currently in use between BASRA and BAGHDAD are: BASRA-AL AMARAH-KUT BAGHDAD (northern or TIGRIS route) and BASRA-AL SAMAWAH-BAGHDAD (southern or EUPHRATES route). Analysis of required effort to rehabilitate and maintain these routes to sustain 500 S/T per day capacity theoretically favors utilization of northern route as primary highway LOC. However, significant portions of this route are constructed on earth-filled causeway, which limit ability to by-pass damaged sections

and restrict lateral echelonment of tactical units and development of LOC facilities. It is believed that main effort of tactical force would follows southern route which traverses area permitting a wider deployment, while secondary effort would follow northern (TIGRIS) route for primary purpose of securing critical terrain features such as dam at AL KUT. Although the northern route is at the present time a better road and in itself easier to develop, the LOC as a whole can be more readily supported over the southern route because of better off-road mobility. Comparison of effort for each route is as follows:

(a) Northern Route.

1. Personnel: 4 construction battalions

2. Equipment: 3,840 S/T in addition to TOE

3. Material: 5,341 S/T

(b) Southern Route.

1. Personnel: 6 construction battalions

2. Equipment: 5,260 S/T in addition to TOE

3. Material: 7,269 S/T

(2) Railroads. Assuming only a 15% or combat damage or demolition factor, the engineer effort and materiel required to rehabilitate and maintain the railway system for first 30 days will require as follows:

(a) Personnel: 9.5 Construction battalions

(b) Equipment: 5,950 S/T in addition to TOE

(c) Materiel : 29,960 S/T

(3) Inland Waterways. Rehabilitation only required in event locks are damaged as result of combat or demolition. This is estimated to require effort of one construction platoon for 30 days. No special equipment required, however 100 S/T of material will be required to rehabilitate locks if damaged.

(4) Ports.

(a) Personnel. Two engineer port construction companies or equivalent in other engineer construction units augmented are required for initial rehabilitation of port of BASRA. After rehabilitation on engineer port construction platoon can accomplish required maintenance.

(b) Equipment. 100 S/T in addition to TOE

(c) Materiel: 6,500 S/T

(5) Airfields. None of the available airfields can accommodate a composite tactical wing unless facilities are expanded.

b. Expended Operating Capacity-Rehabilitation and Maintenance

(1) Roads. Rehabilitation and maintenance of routes to provide maximum feasible expanded capacity (1,500 S/T per day) in 30 days, or 60 days will require the following effort and materiel.

(a) Northern Route

1. Personnel

a. 30 day task: 12 construction battalions

b. 60 day task: 5 construction battalions

2. Equipment: 6,000 S/T in addition to TOE

3. Materials: 6,741 S/T

(b) Southern Route

1. Personnel

a. 30 day task: 17 construction battalions

b. 60 day task: 8 construction battalions

2. Equipment 12,000 S/T in addition to TOE

3. Material 8,699 S/T

(2) Railroads. Rehabilitation and maintenance of railway system to double capacity of system in 30 days, or 60 days will require:

(a) Personnel.

1. 30 day task: 11 construction battalion

2. 60 day task: 5.5 construction battalion

(b) Equipment 5,950 S/T in addition to TOE

(c) Material - 31,840 S/T

(3) Inland Waterways. Expansion would require extensive and continuous dredging, and the construction of additional locks. This is not considered logistically feasible in the time available.

(4) Ports. Expansion not necessary to support requirements of contemplated operations.

(5) POL System. The following effort and materiel will be required to provide POL system adequate for operation in 30 days or 60 days.

(a) Personnel.

1. 30 day task: 3 pipeline companies and 1 construction battalion, plus 2 construction companies.

2. 60 day task: 2 pipeline companies and 1 construction battalion.

(b) Equipment: 240 S/T in addition to TOE

(c) Materials: 14,760 S/T

(6) Airfields. Rehabilitation and expansion of one airfield is required to provide suitable facility to accommodate a composite tactical wing. This task will require the following engineer effort and materiel:

(a) Personnel: Minimum 1 construction battalion and maximum of 2.5 construction battalions depending on airfield selected for improvement (See Tab 3).

(b) Equipment: 500 S/T in addition to TOE.

(c) Material: Minimum 1,140 S/T and maximum 2,620 S/T dependent on airfield selected for improvement.

4. CRITICAL FEATURES OF OPERATION.

a. Ports will become congested during peak unloading operations due to inability of rail, highway and inland water transportation systems to clear ports.

b. Lack of alternate waterways and ports enhances vulnerability of entire LOC to attack on critical points.

c. This study has been, of necessity, hastily prepared. Intelligence was being updated while the study was in preparation. As a consequence, estimates of construction requirements are by no means firm. It is the general final impression of those working on the engineer aspects of the study that adequate engineer support cannot be provided for an operation on an LOC through the DELTA or east of the TIGRIS, but that a fast-moving cross-country operation west of the EUPHRATES in desert or semi-desert can be supported, probably with less Engineer effort than estimates herein indicate, particularly if the railroad is eliminated from consideration.

5 CRITICAL ITEMS.

a. Manpower: A minimum of 22 augmented construction battalions and 2 pipeline companies with appropriate coordinating headquarters are needed to provide and maintain Air Force facilities, and to rehabilitate, expand and maintain an LOC in this area.

b. Material:

(1) POL equipment

(2) Bridging

(3) Heavy timber for bridging and wharfage

(4) Deep water dredges

(5) Railroad rails, cross-ties and ancillary items

(6) Heavy engineer construction equipment

(7) PSP (depending on airfield selected for improvement)

TAB 1 to APPENDIX D

ROADS

1. DESCRIPTION

a. Military Geography

(1) Terrain. Route C is centered on the TIGRIS-EUPHRATES DELTA. The DELTA is relatively flat except for local relief up to 50 feet, and is heavily dissected by rivers, streams, and canals. Extensive areas of marsh, shallow lakes, tidal flats, inundated areas, and closely spaced perennial streams including irrigation systems and perennial marshes comprise the southern part of the DELTA. The water table is within 50 to 100 feet of ground surface. Soil is alluvial and is composed of sand and small amounts of clay. The area is mostly barren with crops cultivated only along waterways. Conditions in this area are consequently unfavorable for the construction of roads because of marshy ground, the danger of flooding, and lack of local sources of materials. Off-road movement is very difficult in many places.

(2) Weather and Climate. Highway traffic will be limited primarily by spring floods, summer dust and high temperatures (125° F). Heavy rains are infrequent, but such rain, when it occurs, may render non-hard surfaced roads impassable for short periods in winter.

b. Transportation and Communications.

(1) In approach route C, two roads lead from BASRA to BAGHDAD. One of these roads follows the TIGRIS RIVER through AMARA, and KUT AL IMARA to BAGHDAD. The other road follows the EUPHRATES RIVER through SAMAWA to BAGHDAD.

(2) Characteristics of these Routes follow:

(a) Northern Route (Along the TIGRIS)

Location	Miles	Surface	Width	Capacity
BASRA to AMARA	119	Bituminous	20'	3,500 tons/day
AMARA to KUT AL IMARA	130	Earth	10'	500 tons/day
KUT AL IMARA to BAGHDAD	108	Bituminous	20'	3,500
TOTAL MILEAGE	357			

(b) Southern Route (Along the EUPHRATES)

Location	Miles	Surface	Width	Capacity
BASRA to SHU'AIBA	16	Bituminous	20'	3,500 tons/day
SHU'AIBA to UR	119	Earth	30'	500 tons/day
UR to SUMAWA	60	Earth	30'	500 tons/day
SUMAWA to AD DIWANIYA	60	Earth	30'	3,500 tons/day
AD DIWANIYA to BAGHDAD	117	Bituminous	20'	3,500 tons/day
TOTAL MILEAGE	372			

c. Highway Bridges. Principal highway bridges are shown in the table D-1-a.

d. Health and Sanitation. The lower delta is malarial. Water in the TIGRIS and EUPHRATES is polluted.

e. Local Resources.

(1) Manpower (Indigenous)

(a) Skills. The local population in this area is predominantly illiterate and unskilled in modern techniques.

(b) Effectiveness. Indigenous labor, lacking skills, would be limited to menial tasks, and in such duties would be less than 20% as effective as US personnel.

(c) Availability. A portion of the population is nomadic and it is unlikely that recruiting of indigenous labor could be relied upon.

(2) Materials.

(a) There are no known sources of hard rock or gravel for construction purposes in the delta area. Sand may be obtained from sand bars in the rivers and both sand and gravel may be obtained from the edges of the areas bordering the DELTA.

(b) The Morris Knudsen Corporation is at present doing highway construction work on the Northern route (along the TIGRIS). This company has been reported to have developed sources of highway materials.

(3) Equipment. Equipment to be found locally can be expected to be in very limited quantity, except that which is possessed by the Morris Knudsen Firm.

2. OPERATIONAL CONSIDERATIONS

a. Vulnerability. Roads are subject to interruption at bridge sites over the unfordable TIGRIS and EUPHRATES RIVERS and their major tributaries. See Highway Exhibit D1. In dry weather the roads are not subject to interruption in desert areas since level terrain permits easy by-passing of road obstacles. In the vicinity of the marshes, the highways are subject to blocking by cratering.

b. Logistical.

(1) Supply. Road building materials are scarce and all road building equipment for use by U.S. Forces will have to be shipped into the theater. Lack of locally procured road construction materials intensifies the problem of road maintenance and improvement.

(2) Transportation. Extensive wear to vehicles and equipment will result from desert terrain conditions and the unimproved portions of the road net. Extensive maintenance to vehicles and equipment will be necessary to keep them in operating condition.

(3) Maintenance. Around the clock road maintenance will be required to sustain the throughput capacity of the roads, see Table 2 paragraph 3 for effort and tonnage.

(4) Construction. Extensive construction effort will be required to widen and surface with gravel unimproved earth road sections to sustain a 1500 short ton per day capacity.

3. REQUIREMENTS

a. Current Operating Capacity. (See Highway Exhibit D1) Initially the Northern and Southern routes will each support a forward throughput capacity of 500 short tons per day. Paragraph 3c presents a summary of effort and significant materials required to maintain this throughput capacity for a sustained period.

Engineer Construction Battalions assigned to road tasks will be augmented with additional road building equipment as shown in paragraph 3f.

b. Triple Current Operating Capacity In 30 and 60 Days. The northern route can be expanded to accommodate a daily forward throughput capacity of 1500 short tons by widening and surfacing with gravel the 130 mile 10 foot wide uminproved road between AMARA and AL KUT. The southern route can be brought up to the same capacity by surfacing with gravel the 239 mile 30 foot wide unimproved earth road between SHU'AIBA and AD DIWANIYA. Paragraph 3d and 3e presents a summary of effort and significant materials required to accomplish this task.

SECRET

3.c. CURRENT OPERATING CAPACITY-500 SHORT TONS PER DAY

NORTHERN ROUTE

TASK	QUANTITY	MAN HOURS	Bn MO.	ST	MT
1. ROAD MAINTENANCE					
One lane (earth)	130 mi	12,870			
Two lane (bituminous)	294 mi	19,410			
2. ROAD REHABILITATION					
One lane (earth)	130 mi	130,000		130	130
Two lane (bituminous)	294 mi	108,000		165	210
3. TACTICAL FLOATING BRIDGE					
M4T6 Bridge Cl 60	3,780 LF	13,500		2,523	5,592
4. LOC FIXED BRIDGING	3,780 LF	40,200		2,253	3,258
TOTAL		323,980	3.6	5,341	9,190

SOUTHERN ROUTE

1. ROAD MAINTENANCE					
Two lane (earth)	239 mi	47,322			
Two lane (bituminous)	133 mi	8,778			
2. ROAD REHABILITATION					
Two lane (earth)	239 mi	312,000		528	672
Two land (bituminous)	133 mi	50,400		77	98
3. TACTICAL FLOATING BRIDGE					
M4T6 Bridge Cl 60	4,999 LF	18,000		3,366	7,459
4. LOC FIXED BRIDGING	4,999 LF	56,950		3,298	4,360
TOTAL		493,450	5.5	7,269	12,589

SECRET

TRIPLE CURRENT OPERATION CAPACITY-1500 SHORT TONS PER DAY IN 30 DAYS

3.d.

TASK	QUANTITY	MAN HOURS	Bn MO	ST	MT
ROAD CONSTRUCTION					
1. Northern Route Two lane 6" Gravel Surface	130 mi	1,080,000	12	1,430	1,820
2. Southern Route Two lane 6" Gravel Surface	239 mi	1,530,000	17	2,629	3,356

3.e. TRIPLE CURRENT OPERATION CAPACITY-1500 SHORT TONS PER DAY IN 60 DAYS

TASK	QUANTITY	MAN HOURS	Bn MO	ST	MT
ROAD CONSTRUCTION					
1. Northern Route Two land 6" Gravel Surface	130 mi	450,000	5	1,430	1,820
2. Southern Route Two lane 6" Gravel Surface	239 mi	720,000	8	2,629	3,356

ENGINEER CONSTRUCTION BATTALION EQUIPAGE AUGMENTATION

3.f.

CURRENT TASK ROAD CAPACITY		NO.	ST	MT
Bridging Highway	E 08101	2	1,320	4,200
Road	E 08109	8	10,080	35,040

4. CRITICAL FEATURES OF THE OPERATION

a. Roads. The critical feature of the road network is the 130 mile section of unimproved earth road from AMARA to KUT AL IMARA which is a serious bottleneck on the northern route and similarly the 239 mile section of unimproved earth road on the southern route. These sections of road seriously restrict the throughput capacity, and at least one of the sections must be improved to achieve required highway capacity.

b. Bridges. There are 10 principal highway bridges, each on the northern and southern routes. In BAGHDAD there are 5 principal bridges each over 1,000 feet in length crossing the TIGRIS RIVER. Initially, bridges will not constitute critical features, except those at BAGHDAD, since it will be necessary to replace existing bridges with tactical bridges capable of supporting divisional class 50 loads. Thereafter, bridges become critical, since each constitutes a potential "weak link in the chain".

c. Gravel. Gravel is critical, particularly since it is in short supply, and it is absolutely essential for widening and surfacing the earth road stretches in the north and south routes in order to bring them up to 1,500 short tons per day capacity. The northern route will require 420,000 cubic yards of gravel, and the southern route will require 771,000 cubic yards of gravel. It is conceivable that gravel will have to be hauled over long distances.

5. CRITICAL ITEMS

a. Manpower. Provision of requisite number of augmented construction battalions is essential. It is anticipated that indigenous labor will be lacking in numbers and skills in urban areas.

b. Material. Critical Items are:

(1) Gravel

(2) Corrugated metal culvert pipe

(3) M4T6 floating bridge

(4) Bailey bridges

(5) Steel girders for fixed bridging

(6) Timber

TABLE D-1-a

SELECTED HIGHWAY STRUCTURES

IRAQI HIGHWAYS

BRIDGE NO.	LOCATION	TYPE	LENGTH	WIDTH	CAPACITY CLASS	REMARKS
1	6 mi. N of BASRAH	Steel ponton	680'	9.33'	Cl 7	
2	7.5 mi. N of BASRAH	Steel truss	150'	9'	n/a	
3	46 mi. N of BASRAH	Steel ponton	475'	9'	12	
4	18 mi. S of AL QURNAH	Steel truss	102'	n/a	n/a	
5	25 mi. N of AL QURNAH	Steel truss	103'	10.5'	24	
6	13 mi. S of AMARA	Steel beam	180'	14'	24	
7	AMARA	Steel beam	103'	9'	24	
8.	1 mi. N of AMARA	Steel beam	207'	9'	24	Six span bridge
9	29 mi. E of KUT AL AMARA	Steel truss	131'	9'	n/a	
10	10 mi. SE of BAGHDAD	Steel truss	450'	10'	60	
11	4 mi. SW of BASRAH	Steel & concrete	275'	n/a	50	
12	At SAMAWA	Plate girder	630'	10.5'	n/a	Combined rail and highway bridge 7 spans (Old Pontoon Bridge still in at SAMAWA)
13	SAMAWA	Suspension	527'	26'	25 ton	

TABLE D-1-a - Cont'd

BRIDGE NO	LOCATION	TYPE	LENGTH	WIDTH	CAPACITY CLASS	REMARKS
14	HACHAMA 6 mi. N of SAMAWA	Steel truss	720'	11'	n/a	Rail and highway
15	HUMZA 14 mi. N of SAMAWA	Steel beam	124'	24'	n/a	New construction
16	AR RUMAYTHAI	Plate girder	96.5'	11.3'	n/a	Rail and road bridge
17	AL HASHIMIYAH	Plate girder	159'	n/a	Cl 9	Rail and highway
18	3 mi. SW of BAGHDAD	Steel truss	167'	10'	12	KHIRR Bridge
19	9 mi. N of UR	Ponton-wooden	n/a	9.25'	n/a	Floating
20	ASH SHATRAH	Steel bascule	n/a	n/a		
21	AL KUT	n/a	249' WG	n/a	n/a	
22	AL KUT	Steel plate	700'	n/a	n/a	
23	AT BAGHDAD	Steel deck Plate girder	1,000'	24'	80	KING FAISAL II Bridge
24	BAGHDAD	Steel deck Plate girder	1,050'	n/a	n/a	KING GHAZI Bridge
25	BAGHDAD	Steel deck Plate girder	1,037'	40'	n/a	
26	BAGHDAD	Steel deck	1,487'	40'	n/a	QUEEN ALIYAH
27	BAGHDAD	Steel truss Girder	1,000'	18'	50+	SARRAPHIYAN Bridge

TAB 2 to APPENDIX D

RAILROADS

BASRAH-BAGHDAD RAILWAY

1. GENERAL

a. See Exhibit D-2

b. The BASRAH-BAGHDAD approach route contains the most important rail line in IRAQ and accounts for 70% of all rail traffic. It is 354.2 miles long, single-track, meter-gage (3'3-3/8") except for a 10.7 miles segment of double track between SHU'AIBA JUNCTION and AL MA'QIL. The spur line connecting the main line from SHU'AIBA JUNCTION to the port at UMM QASR, built during WW II has been removed. The connecting branch line from BASRAH across the SHATT AL ARAB River to an Iranian main line also has been removed.

c. The railway traverses the EUPHRATES River valley and in general, parallels the course of the EUPHRATES and SHATT AL HALLIAH Rivers. This region is characterized by the alternation of desert, marsh, and cultivated areas in which winding canals and irrigation ditches abound. The railway is mostly built on embankments with no restrictive grades. Rail crossings over culverts and tracks along the embankments are subject to periodic flooding and washouts caused by combined rain and mountain snow-melt in spring.

d. The railway crosses 17 bridges totaling 10,337 feet. There are five major bridges, four of which are over 600 feet in length; the remaining bridges average 100 feet. There are no tunnels on this route. All rolling stock is powered by oil-fired steam locomotives.

e. Local Resources

(1) Manpower

Latest railroad data indicates a total of 14,000 employees are required to operate the entire rail system in IRAQ.

Of this figure, it may be assumed that approximately 55% or 7,700 employees are assigned to the operation and maintenance of the major BASRAH-BAGHDAD rail line. A few key administrative and operating personnel were trained abroad (ENGLAND) and are considered capable in their respective specialities. However, operational efficiency suffers from a lack of technically trained personnel. Indigenous common labor would be adequate and readily available from the numerous towns and villages located along this particular railway line.

(2) Materials

(a) Lumber. This item is scarace throughout the whole country of IRAQ and is practically nonexistent in the study area. The few stands of forests are located on slopes in the northeast mountains which are remote and difficult of access. All wood cross-ties are presently imported.

(b) Ballast. Stone and gravel is available to some extent in IRAQ. However, this study area is almost devoid of this material and the railroad trackage on this route is laid on the natural surface of the ground with shallow earth ballast.

(c) Steel. Bridge components, rails, spikes, etc., must be imported in their finished state, as well as ancillary tools and equipment. Most of these imports are from the UNITED KINGDOM and INDIA.

(3) Equipment. Motive power and rolling stock on the meter gage lines number 129 locomotives; 6300 freight cars and 260 passenger cars. Much of the rolling stock is old and in poor operating condition.

2. <u>OPERATIONAL CONSIDERATIONS</u>

a. Vulnerability

(1) Rail traffic can be disrupted by the demolition of important bridges on the line. Such demolition would halt all traffic for extended periods during the time that reconstruction was being accomplished.

(2) The lack of an alternate route enhances the vulnerability of the line to attacks at critical points. The possibilities for by-passing disruptions in the line by emergency construction is limited by the scarcity of materials, none of which are locally available.

(3) Since intensive maintenance is constantly required to keep the present line in operation, damage to engine houses and shops would seriously reduce the capacity of the line.

(4) Destruction of fuel oil storage depots and watering points would halt traffic until such facilities were replaced.

(5) Several of the key bridges would be so time-consuming to replace that every effort should be made to capture them intact by airborne operations.

b. Logistical

(1) Supply

(a) Rails and Ties. The track is considered to be in fair condition although replacement has been inadequate since WW II. The track structure is light by US standards. Several weights of flat-bottom T-section rail are in use, varying from 50 pounds to 75 pounds per yard, with 75-pound rail predominating. Assuming that 30% of the rail is 50 pounds per yard, a 30% replacement would be necessary. The rails are spiked directly to untreated hardwood cross ties which are 6' x 8" x 4½". Rails and ties have been imported, for none are produced in IRAQ. There are approximately 2,200 ties per mile of track; therefore approximately 778,800 ties

are along this line. A replacement of approximately 50% of the ties would be necessary.

(b) Ballast. In many places the track is laid on shallow earth ballast to the contour of the ground. Gravel suitable for ballast is not locally available; approximately 276,000 cubic yards of gravel would be required to place ballast in selected locations.

(c) Corrugated Culvert Pipe. During periodic flooding conditions, culverts are washed out; an assumed replacement requirement is 21,000 linear feet of various sizes of corrugated culvert pipe.

3. REQUIREMENTS

a. Current Operating Capacity

(1) Personnel. Approximately 7,700 civilian employees are presently required to operate and maintain the BASRA-BAGHDAD rail line.

(2) Equipment. Daily line load capacities are 5 trains each way with a net load of 620 short tons per train. This provides a total freight haulage from the port of 3100 short tons per day.

(3) Material. Much of the existing rail is old and badly worn contributing to the overall deterioration of the trackage. Another major maintenance problem confronting the rail line is the scarcity of cross ties which has caused the tie replacement program to fall increasingly behind. Half of the present cross ties are of inferior quality, untreated, and are not expected to last more than a few years.

(4) To rehabilitate and maintain this line and its current facilities in 30 days (without any increase in rolling stock) the estimated engineer effort would be approximately 855,000

manhours, or 9.5 engineer construction battalion months, and approximately 29,960 short tons of materials.

b. Expanded Operating Capacity

To double the current capacity by rehabilitation and new construction in a 30 day period (without any increase in rolling stock) the estimated engineer effort would be approximately 990,000 manhours, or 11 engineer construction battalion months. For a 60 day period the estimated engineer effort would require approximately 495,000 manhours, or 5.5 engineer construction battalion months. Doubling the capacity will require approximately 31,840 short tons of materials.

4. CRITICAL FEATURES OF OPERATIONS

a. Bridges

Five critical bridges on this line are as follows: a deck truss bridge, 600 feet long over the SHATT AL HILLA River, 2.5 miles north of SAMAWA; a deck truss combination railway and highway bridge with draw span 630 feet long over the EUPHRATES River at SAMAWA; a deck truss combination railway and highway bridge over the branch of the EUPHRATES 6 miles north of SAMAWA; a plate girder bridge, 121 feet long with a swing span over the SHATT AL HILLA River at AL HASHIMIYAH; and a through truss combination railroad and highway bridge, 7105 feet long crossing the TIGRIS River at BAGHDAD which connects with the Iraq State railway line No. 2. See Exhibit D-2 in the folio and table D-2-a on the next page.

b. Oil Storage Depots

All locomotives are oil burning steam engines which use fuel oil produced and refined in IRAQ. Oil storage depots for fueling locomotives are located on this route at the following stations. BAGHDAD (WEST STATION), AD DIWANIYA, SAMAWA, UR JUNCTION

and at AL MA'QIL; See Exhibit D-2 in folio.

c. Watering Points.

Water in the area is only fair for boiler use. This requires water treatment which is done at BAGHDAD, SAMAWA, and AL MA'QIL and is often carried with trains on auxilliary tank-cars, especially during the dry season. Water is also chemically treated by the wayside method, i.e., chemical proportioning pumps are used to add soda-ash with sodium aluminate and tannin. Locomotive water supplies are located on the line at 11 stations. See Exhibit D-2 in folio.

d. Road Bed.

The track is laid on the natural surface of the ground with shallow earth ballast. There are no stones - not even gravel coarse enough for ballast. Rivers carry only fine pebbles, sand and silt. The soil in the area is generally unstable and in the delta sections is subjected to flooding in June which causes frequent washouts.

e. The existing facilities of yards, turning points and engine houses are shown on Exhibit D-2 in folio. These facilities are essential to the operations of the line.

f. Brake Limitations

(1) An important factor affecting train operations is speed limitations imposed by poor condition of track, rolling stock, and use of hand brakes and automatic brakes of two different types (air and vacuum) on the same trains.

(2) All trains without automatic brakes must not exceed 20 miles per hour. Maximum permissible speed for freight trains even if equipped with automatic brakes is 30 miles per hour.

g. Dust Storms

The frequency of dust storms along this line is rather

high; 28 to 33 days a year with dust are reported, with the maximum of 8 days a month occurring in June and July. During the frequent dust storms, speed of trains must be reduced to 5 miles per hour.

5. CRITICAL ITEMS

a. Manpower

Availability of common labor along this routeway is adequate; however, there is a lack of technically trained personnel for operations of construction equipment.

b. Material

There is a serious shortage of these items:

Cross Ties

Rails-75 lbs per yard

Gravel for ballast

Corrugated metal culvert pipe

Construction Timber

SECRET

SELECTED RAILROAD STRUCTURES

IRAQI STATE RAILWAYS

TABLE D-2-a

BRIDGE KEY NO.	TYPE OF STRUCTURE	GEOGRAPHIC COORD.	LOCATION	TOTAL LENGTH (FT)	TYPE	NO.	LENGTH (FT)	REMARKS
1	BRIDGE	31° 18' N 45° 18' E	SAMAWA	630	Deck Truss	7	90	EUPHRATES RIVER. Combination railway and highway with draw span.
2	BRIDGE	31° 20' N 45° 15' E	2.5 miles N. of SAMAWA	600	Deck Truss	5 1	108 57	SHATT AL HILLA
3	BRIDGE	31° 22' N 45° 16' E	6 miles NNW of SAMAWA	720	Deck Truss	5 1 1	120 80 20	EUPHRATES RIVER. Combination railway and highway bridge.
4	BRIDGE	32° 23' N 44° 39' E	AL HASHIMIYAH	182	Plate Girder	2 2 1	22 37 39.5	SHATT AL HILLA. One of the 38.5 foot spans is a swing span.
5	BRIDGE	33° 21' N 44° 25' E	BAGHDAD	7,105	Through Truss	1 1 5 2	2,801 2,793 195 268	TIGRIS RIVER. Longest railway bridge in IRAQ. Connects links 1 and 2 combination railway and highway bridge.

All these structure are critical, and their destruction would halt all through traffic on this line because there is no alternate route.

SECRET

TAB 3 to APPENDIX D

SECTION I - POL POL & AIRFIELDS

1. GENERAL

a. Although IRAQ is a major producer of crude petroleum, very little of its production is refined or consumed locally. The major fields are north of BAGHDAD, and therefore not in the area of this report. A military operation along this route will require 100% of the necessary facilities including a pipeline, tank farms, and a tanker discharge facility at BASRAH.

b. Low capacity of routeways and limited hauling equipment of the railroad make it undesirable to plan for the movement of Class III supplies by tank truck and tank car in large quantities. Bulk movement of Class III by inland waterway is not considered practical because of the shallow depths of water (3'-4'), and lack of available tank barges.

2. CURRENT OPERATING FACILITIES

a. Existing Bulk Storage

(1) The only existing tank farms available for use in a military operation in this area are located at BASRAH and BAGHDAD. Additional small storage facilities exist along the railroad to provide fuel for the oil-fired locomotives (See Tab 2 - Railroads) and along the TIGRIS RIVER for river craft.

(2) Available tank farm storage at BASRAH and BAGHDAD is as follows:

TABLE D-3-a
AVAILABLE POL STORAGE (BARRELS)

Product	BASRAH	BAGHDAD*
MOGAS	3,371	6,971
AVGAS	4,171	5,714
Kerosene	6,943	13,107
Diesel Oil	3,257	3,457
Fuel Oil	22,029	25,896
TOTALS	39,771	55,145

* Includes HABBANIYA and AL FALLUJA

b. Pipelines

The only existing pipelines in the area are 3 four-inch lines which run from the ABADAN refinery to the BASRAH tank farm (30 miles). They run along the north bank of the SHATT AL ARAB RIVER and cross under the river at BASRAH. Estimated capacity of each pipeline is 4,000 barrels per day. One pipeline is used exclusively for AVGAS and extends past BASRAH to the AL MA'QIL airport.

c. Petroleum Refineries

(1) IRAQ Refineries

Refining is not an important factor in the IRAQ oil industry. Existing plants serve only local needs and the requirements of the oil companies:

TABLE D-3-b

REFINERY	ANNUAL CAPACITY (TONS)	BARRELS/DAY (EST)
KERKUK	150,000	3,000
HADITHA	320,000	6,400
BASRAH	170,000	3,400
ALWAND	450,000	9,000
DAURA (BAGHDAD)	1,000,000	20,000

(2) PERSIAN GULF Refineries

(a) The following refineries in the PERSIAN GULF have the capability of providing necessary petroleum products to support a military operation in the BASRAH-BAGHDAD area:

1. ABADAN

Capacity - 477,000 Bbls/Day

Products - AVGAS , MOGAS, kerosene, diesel, fuel oil

2. KUWAIT

Capacity - 190,000 Bbls/Day

Products - MOGAS, kerosene, diesel, bunker oil

3. BAHRAIN

Capacity - 190,000 Bbls/Day

Products - AVGAS, MOGAS, diesel, fuel oil

4. RAS TANURA, SAUDI ARABIA

Capacity - 195,000 Bbls/Day

Products - AVGAS, MOGAS, jet fuel, diesel, kerosene

3. CONCLUSIONS

a. Military operations along the BASRAH-BAGHDAD axis will require construction of 100% of necessary facilities.

b. The petroleum refineries at ABADAN, KUWAIT, BAHRAN, and RAS TANURA have the capabilities and necessary catalytic-cracking processes to provide the types and quantities of petroleum products required.

4. ENGINEER SUPPORT REQUIRED

a. Tasks

Construction of 350 miles of 6-inch pipeline, one tanker berth at BASRAH, and 230,000 barrels of storage at BASRAH, and 190,000 barrels of storage at BAGHDAD.

b. Effort

(1) To provide facilities in 30 days will require:

3 Engineer Pipeline Companies

1 Engineer Construction Battalion

2 Engineer Construction Companies

(2) To provide the same facilities in 60 days will require:

2 Engineer Pipeline Companies

1 Engineer Construction Battalion

c. Tonnages

The Class IV Tonnage to supply required Class IV equipment and materiel is 14,760 short tons.

TAB 3 TO APPENDIX D

POL AND AIRFIELDS

SECTION II - AIRFIELDS

1. GENERAL

There are seven airfields which have been considered as significant to Route C. They are ABADAN, BAGHDAD WEST, BASRAH, HABBANIYA, HABBANIYA PLATEAU, RASHID, AND SHAIBAH. Table D-3-c summarizes the current facility status of these fields. Of these fields, all but HABBANIYA and BASRAH can accommodate current tactical and combat cargo aircraft, following expansion of existing facilities. Engineer construction battalion effort required to expand each airfield to accommodate a composite tactical fighter wing runs from 1 to 2.5 battalion months each. This effort is summarized on Table D-3-d. All runways will require rehabilitation, extension, or increase in pavement thickness. All fields will require additional support facilities such as POL storage, shops, and utilities. All facilities provided will not exceed minimum operational requirements unless higher standards already exist. Because of existing subsurface water, HABBANIYA should not be programmed to support any aircraft other than liaison types. Maintenance effort at all fields except HABBANIYA will not require major maintenance within 15 days. BAGHDAD-WEST, HABBANIYA PLATEAU and SHIBAH will require heavy maintenance prior to 30 days use if extensively used, requiring an engineer construction platoon at each base.

2. ABADAN

a. Location - ABADAN Airfield (30° 22'N, 48° 14'E) is located on ABADAN Island about 2.5 miles WNW of the ABADAN refinery

and tank farm.

b. Runway characteristics - The airfield has two asphalt-surfaced runways; both in fair condition. One runway has a length of 7,220 feet and a width of 140 feet, but its capacity is unknown. The other runway is 6,020 feet long and 200 feet wide, and has a capacity of 220,000 pounds.

c. Facilities - POL surface tank storage capacity totals 422,800 gallons. In addition, there is a pipeline to the refinery tank farm.

The airfield has six hangars.

A 50-bed hospital and barracks for 3,000 troops are located at the airfield; however, the barracks are in poor condition.

d. Use - Both military and civilian aircraft use the airfield. It is one of the two main international civil airfields in IRAN and is presently used by constellation aircraft.

3. BAGHDAD WEST

a. Location - BAGHDAD WEST Airfield (33° 19'N,44° 22'E) is located on the outskirts of the city near the railroad station.

b. Runway characteristics - The airfield has four runways, but only two are open. One is 7,050 feet long, 150 feet wide, and has a capacity of 132,000 pounds. Its tar-macadam surface is in good condition. The other runway, which is rolled earth, oiled, and in good condition, has a length of 5950 feet, a width of 150 feet, and a capacity of 60,000 pounds.

c. Facilities - POL storage is available in aboveground tanks for 300,000 gallons of avgas and jet fuel.

The airfield has four hangars.

d. Use - National and international airlines use this airfield. It is one of the two most important in IRAQ. It will not presently accommodate Super Constellation-type aircraft.

4. BASRAH

a. Location - BASRAH Airfield (30° 34'N,47° 46'E) is located 4 miles northwest of BASRAH.

b. Runway characteristics - This airfield has four runways. The best runway is 6,000 feet long, 150/140 feet wide, and has an 8-inch asphalt surface in good condition. The other three runways are between 3,120 and 2,860 feet in length and 180 and 100 feet in width. They have asphalt surfaces which will support 60,000 pounds.

c. Facilities - Available POL storage totals 40,000 gallons of avgas and jet fuel in five surface tanks.

The airfield has one metal hangar, 275' x 140' x 40', with a 200' clear opening on both sides.

There is a 200-room hotel at the airfield which could accommodate personnel.

d. Use - This is one of the best airfields in IRAQ and is used by National and International aircraft.

5. HABBANIYA

a. Location - HABBANIYA Airfield (33° 22'N,43° 34'E) is located at the northeast end of LAKE HABBANIYA.

b. Runway characteristics - The airfield has two runways. The largest is 6,300 feet long, 150 feet wide, and has an 8-inch concrete surface with a two-inch bitumen top in good condition. Due to the water table level in the subsoil, it will not support gross loads over 72,000 pounds on a continuing basis. The other runway has a length of 5,250 feet, a width of 150 feet, and a 3-inch asphalt surface which will support 39,000 pounds; however, this runway presently is closed.

c. Facilities - POL storage facilities total 344,400 gallons in seven aboveground and two underground tanks for avgas. One additional 210,000-gallon tank is not usable. There are six hangars at the airfield.

Personnel accommodations include quarters for 2,464 and a 300-bed hospital. In addition to an administration building and workships, there are fourteen permanent bomb shelters.

d. Use - HABBANIYA is one of two former Royal Air Force bases in IRAQ. It was transferred to the Iraqis in 1955. Expansion possibilities are limited.

6. HABBANIYA PLATEAU

a. Location -HABBANIYA PLATEAU Airfield (33° 20'N,43° 35'E) is located 1.5 miles northeast of LAKE HABBANIYA.

b. Runway characteristics - This airfield has a single runway 9,000 feet long and 150 feet wide. It has a 6-inch limestone base with a 3-inch bituminous macadam surface which has a capacity of 100,000 pounds.

c. Facilities - There are no facilities at the airfield.

d. Use - The airfield is a former Royal Air Force auxilliary to HABBANIYA Airfield. It was transferred to the Iraqi Air Force in 1955. It has one of the most modern runways in IRAQ.

7. RASHID

a. Location - RASHID Airfield (33° 17'N,44° 29'E) is located 5 miles southeast of BAGHDAD.

b. Runway characteristics - The single runway has a length of 6,890 feet, a width of 160 feet, and can support 93,200 pounds. The surface consists of 3 inches of tar-macadam over a gravel base and is in good condition.

c. Facilities - There are no bulk POL storage facilities available at the airfield. Six surface tanks are available for the

storage of motor fuel and oil.

The airfield has eleven hangars; all are corrugated metal.

Permanent barracks are available for 800.

d. Use - RASHID is the home base of the Iraqi Air Force. During 1955, extensive improvements were made, and the runway and taxiway were completed in 1956. The technical maintenance facilities of the Iraqi Air Force are located at the airfield. It is believed that the airfield is suitable for use by jet aircraft as well as transport and light bomber aircraft.

8. SHAIBAH

a. Location - SHAIBAH Airfield (30° 25'N,47° 38'E) is located 10 miles southwest of BASRAH.

b. Runway characteristics - This airfield has four runways. One runway has a length of 6,300 feet, a width of 150 feet, and a tarmacadam surface which will support 33,000 pounds. Two graded, rolled-sand surfaced runways have lengths of 6,000 feet and widths of 300 feet. The fourth runway is only used for emergency. It has a length of 5,400 feet, a width of 150 feet, and a graded, rolled-sand surface.

c. Facilities - POL storage totals 1,211,607 gallons for avgas and jet fuel. There is additional storage in the area for 862,750 gallons of avgas and 137,500 gallons for jet fuel.

The airfield has ten hangars.

There are permanent personnel accommodations for 900 and a 20-bed dispensary.

d. Use - SHAIBAH is used by the Iraqi Air Force. In late 1956, failure of the subgrade of the main runway occurred. Until complete resurfacing can be accomplished, the capacity is reduced to light transport-type aircraft and use by jet aircraft is prohibited.

TABLE D-3-C
CURRENT FACILITY STATUS
AIRFIELDS

Folio Map Reference No.		RUNWAY Dimensions Length(ft)	Width(ft)	Type Constr	Condition	Capacity (lbs)	POL	SUPPORT FACILITIES
1	ABADAN	7,220	140	Asphalt	Fair	n/a [1/]	Surface storage tank cap. 422,800 gal. Pipeline to refinery tank farm	6 hangers; 50-bed hosp; 2,700,000 sq. ft. taxiway; 18 hardstands
		6,020	200	Asphalt	Fair	220,000		
5	BAGHDAD WEST	7,050	150	Tar-macadam	Good	132,000	Surface storage tank cap. 300,000 gal. (AVGAS and jet fuel available)	4 corrugated metal hangers; 50' wide tar-mac taxiways; 8" concrete apron with 20 concrete hardstands
		5,950	150	Earth, rolled and oiled	Good	60,000		
6	BASRAH	6,000	150	8" Asphalt	Good	132,000	5 surface storage tanks w/40,000 gal. (AVGAS and jet fuel available)	8,000 ft. runway planned for jet transports; 50-75 ft. wide asphalt taxiways; 225,000 sq. ft. apron
10	HABBANIYA	6,300	150	8" Concrete w/2" bitum. top	Good	72,000	7 surface and 2 underground tanks total 344,400 gal. (AVGAS). Additional 210,000 gal. tank unserviceable. 2 surface storage tanks w/288,000 gal. diesel fuel	6 steel frame brick hangers; 300-bed hosp; administration bldg; shops; 14 bomb shelters.
		5,250	150	3" Asphalt	Closed	39,000		
11	HABBANIYA PLATEAU	9,000	150	6" Limestone base w/3" bitumin-mac surface	n/a	100,000	None	75 wide bitumin-mac taxiway; 50 wide parallel taxiway under const; apron 300' x 320'
19	RASHID	6,890	160	3" Tar-mac on gravel base	Good	93,200	6 surface storage tanks for motor fuel and oil	11 corrugated metal hangers; permanent barracks; 1 - concrete parking apron, 330' x 120' 7 hanger aprons
21	SHAIBAH	6,300	150	Tar-macadam	n/a	33,000	Storage for 1,211,607 gals. (AVGAS jet fuel); additional storage cap: 862,750 gal. AVGAS and 137,500 gal. jet fuel	10 metal hangers; main runway under repair will be capable of jet support when completed; 50' wide taxiway (3" sand and bitumin); concrete apron 2,100' x 300'
		6,000	300	Rolled sand	n/a	n/a		
		6,000	300	Rolled sand	n/a	n/a		
		5,400	150	Rolled sand	n/a	n/a		

1/ n/a - Not available

SECRET

TABLE D-3-d SECRET

ENGINEER CONSTRUCTION BATTALION AND CLASS IV

TONNAGE REQUIREMENTS

FOR DIRECT SUPPORT TO AIR FORCE COMPOSITE TACTICAL WING

	CONSTRUCTION REQUIREMENTS				CLASS III REQUIREMENTS		
AIRFIELD	RUNWAYS	TAXIWAYS, HARD-STANDS, ETC. 1/	POL	OTHER	CONSTR BN MO REQ.	PSP (SF)	TOTAL TONNAGE
ABADAN	Rehab	70,000 SF	0	Hosp Shops Utilities	1	70,000	1636
BAGHDAD WEST	Increase Capacity	0	50,000 Bbls	Hosp Shops Utilities	1	0	1780
BASRAH	0 3/	0	Dispensing Fac.	Hosp Shops Utilities	1.5	0	1660
HABBANIYA 2/	0	0	30,000 Bbls	0	0.3	0	330
HABBANIYA PLATEAU	Increase Capacity	0	0	Hosp Shops Utilities	1.5	0	2620
RASHID	Increase Capacity	100,000 SF	0	Hosp	1	100,000	1140
SHIBAH	Extension, Increase Capacity	0	0	Hosp Shops Utilities	2.5	0	2000

1/ PSP Surfaced

2/ Because of subsoil conditions, recommend runway be used as is. (See Text)

3/ Runway cannot be lengthened.

SECRET

TAB 4 TO APPENDIX D

PORTS AND WATERWAYS

SECTION I - PORTS

1. GENERAL

Port facilities at the head of the PERSIAN GULF are listed on table D-4-a. Sea access to IRAQ is limited to the delta area of the SHATT AL ARAB RIVER at the head of the PERSIAN GULF. The delta area is the site of three principal and several minor parts. The principal ports are:

a. ABADAN, IRAN

b. BASRAH, IRAQ

c. KHORRAMSHAHR, IRAN

These ports are located 40 to 70 miles inland with constant dredging being required to maintain channel depth. Harbor dredging and control vessels operate from a secondary port near the moth of the AL FAO RIVER. The rate of siltage at various ports in the SHATT AL ARAB, particularly at its mouth, is so rapid that maintenance of navigable depths is possible only by an extensive dredging program. The banks and shoals are constantly changing thereby making pilotage compulsory. The equipment is owned and operated by the PORT DIRECTORATE of IRAN and includes five dredges of 1,250 to 2,000 tons per hour capacity.

2. BASRAH is the principal outlet for the large TIGRIS-EUPRHATES basin area of IRAQ and is connected by road (Tab 1), rail (Tab 2), and inland waterways (Tab 4) with the heartland of the country.

a. General.

(1) The estimated military port throughput capacity is 11,900 short tons per day. The British undertook the development of BASRAH port during WW II when it became the supply base of British forces in IRAQ. BASRAH was used extensively as a base of supply for allied forces in the MIDDLE EAST and transfer point for lend-lease shipments to USSR. Dredging is required at the

wharves to maintain the depth. During the high water period (spring) the heavy flow of water accompanied by the backing up of waters in the PERSIAN GULF results in the inundation of a wide area in the vicinity of BASRAH and heavy silting at all the whaves.

(2) The terminal is inadequately provided with mobile equipment for the movement of cargo between shipside and the transit and storage buildings. Electric power supply would be inadequate to meet military demands. Interruptions in supply, voltage drops and complete failure for several hours are common.

(3) One of the few major airfields in the area is located northeast of BASRAH (Tab 3 AIRFIELDS). POL storage at BASRAH is consumed by the domestic activities of the area primarily for railroad operations and tug fueling (Tab 3 POL). Three 4-inch pipelines carry POL from the ABADAN refinery to the city and the airfield. These lines do not have sufficient capacity to supply fuel to support a military operation.

(4) Clearance of the port is provided by road, railroad and inland waterways. The land egress routes are considered primary clearance routes. Use of the inland waterways critically depends upon certain features along the route outlined Section II of this Tab. Expansion of port facilities is possible. Support of operations from the PERSIAN GULF toward BAGHDAD would necessarily depend on the ability of this port to clear the required LOC tonnages.

b. Current Operating Requirements. Based on the projected through-put capacity, general rehabilitation of existing port facilities should be performed as early in a campaign as possible. This effort should include general pier rehabilitation, replacement of 500 feet of wharfare, and renewal of wharf timber throughout the port.

Maintenance must be continuous and include extensive dredging throughout the harbor on a full time basis during the spring

and approximately 50% of the time during the balance of the year.

c. Expanded Operating Requirements.

No expansion of existing facilities is required (beyond that outlined in paragraph b above) to support assumed tonnage requirements.

d. Safe draft entering the SHATT AL ARAB is limited at ROOKA CHANNEL to 23' at low water with a mean tidal range of 6.1 feet. The safe draft at BASRAH harbor is 19 feet at low water with a 3.3 foot mean tidal range. Vessels entering SHATT AL ARAB with a draft in excess of limitations at BASRAH have a portion of their cargo lightered to the port, then go in themselves and complete the offloading.

e. Conclusions. BASRAH can support the proposed operation. Initial rehabilitation can be performed by two engineer port construction companies of this equivalent in other engineer construction units appropriately augmented. Approximately one engineer port construction platoon can perform the required continuous maintenance. To efficiently utilize the port, mobile material handling equipment is required.

3. OTHER PORTS

Two principal ports ABADAN and KHORRAMSHAHR although located on the SHATT AL ARAB, are located in IRAN toward the east side of the delta area. The only road connecting these ports with BAGHDAD is an excessively long winding road through IRAN in poor condition. No rail connections exist to IRAQ.

a. ABADAN

(1) Located about 45 miles above the PERSIAN GULF, this port is the site of one of the largest oil refineries in the world. Most facilities are used exclusively by the national IRANIAN OIL COMPANY to import supplies and equipment for the oil refinery, and are not available for general cargo consigned to or from the interior of IRAN. Facilities are listed on Table D-4-a.

During the years of normal operation an average of about 1,000 tankers per year were loaded with petroleum products at ABADAN. There is no rail connection with the IRAQ railroads. The military unloading capacity of the port is 5,800 short tons per day.

(2) Current Operating Requirements. This port is in excellent operating condition. If the port were used, indigenous personnel of the oil company could be used for maintenance.

(3) Conclusions. ABADAN should not be included for support of this plan due to the lack of suitable egress into IRAQ.

b. KHORRAMSHAHR. This is IRAN's principal general cargo port and is the major operating base of the Iranian Navy (practically all the vessels of the navy are located here). All facilities (see Table D-4-a) are in poor condition and extensive rehabilitation would be required to place the port into continuous heavy service. The port is usually in a very congested state due to a lack of mobile handling equipment. The port is served by a branch line of the Iranian State Railways, all weather highways, and the RUD E KARUN waterway. The deep water berthing facilities are backed by extensive date groves and irrigation ditches which are traversed by the road and railroad leading from the water front to the open storage areas. There are no bridges or other obstructions in the harbor. Winter floods may cause as much as 11½ feet increase in harbor depths.

(1) Current Operating Requirements. Reconstruction and rehabilitation of 1,500 feet of whargage is required plus extensive rehabilitation of service facilities including warehousing, roads, and material handling equipment to put this port in efficient and safe operating condition.

(2) KHORRAMSHAHR should not be included for support of this plan for two reasons:

(a) Lack of direct egress to IRAQ, and -

(b) Rehabilitation to support continuous military usage would require one engineer construction battalion, augmented, 45 to 60 days.

SECTION II WATERWAYS

1. GENERAL

The navigable waterway system in this route extends north from the PERSIAN GULF to a point beyond BAGHDAD. For this route, the discussion is confined to the PERSIAN GULF-BAGHDAD section. The SHATT AL ARAB River, formed by the confluence of the TIGRIS and EUPHRATES Rivers at AL QURNAH, continues to the PERSIAN GULF and is the entrance to the system. The portion of this river from BASRAH to the gulf was discussed in SECTION I.

Consideration of military requirements precludes planned usage of the EUPHRATES waterway. Sustained navigation is very questionable because of the meandering character of the river, its shallow depth (2½ feet in many stretches), and unmarked channels. The TIGRIS River is the primary inland waterway of IRAQ from its confluence with the EUPHRATES at AL QURNAH. It is navigable for shallow-draft craft from BASRAH to BAGHDAD. Physically, the river is divided into two sections by differing depths. The safe low water draft on the section from BASRAH to AL QURNAH is 6 feet. From AL QURNAH north to BAGHDAD the safe low water draft is 3 feet. Therefore, the limiting safe low water draft over the entire route is 3 feet. See Table D-4-b for detailed description of waterways.

2. RESTRICTIONS

One of the potential sources of trouble that would be encountered in any continuous use of the river to support a military campaign is the fact that the primary use of the waterways by the IRAQI government is for irrigation. When water is pumped or diverted into the irrigation system, the river often becomes too shallow for navigation. Specific points of potential problems are at the AL KUT dam and a floating bridge at AMARA. The control of flow at the AL KUT dam is the

conditioning factor in maintaining the existing level of the stream. Should the dam become inoperative, the water level north of AL KUT would drop to an unnavigable depth. The floating bridge at AMARA, becomes an obstruction at low water. The floats settle into the river bottom and cannot be swung open to permit the passage of vessels.

3. CURRENT OPERATING CAPACITY

a. In addition to the potential restrictions to navigation noted above, the capacity of the locks at the AL KUT dam must also be considered. These locks can pass up to ten barges per day. This restricts the capacity of the waterway from BASRAH to BAGHDAD to a maximum of 4000 short tons per day. Normally, the average daily maximum tonnage through the locks is approximately 2000 short tons per day.

b. The journey upstream from BASRAH to BAGHDAD takes 4 to 6 days during the period of high water, and 8 to 15 days during the period of low water. The downstream trip takes 3 to 4 days at high water and up to 10 days at low water. Navigation above BAGHDAD is very difficult, but small native steamers go from BAGHDAD to MOSUL at high water in an average of 15 days and return in about 4 days.

c. A further restriction imposed on the capacity of this water route is the limited unloading and clearance capability at BAGHDAD of the available equipment and facilities, and the congested narrow city streets.

4. EXPANDED OPERATING CAPACITY

Because of the factors detailed in par 2 and par 3 above, no planned expanded use of this waterway can be expected. Dredging a deeper channel is not considered feasible. Any dredged portion would quickly resilt.

5. CONCLUSIONS.

a. The TIGRIS RIVER with a capacity of 2000 short tons per day can be considered secondary to land communication between BASRAH and BAGHDAD. Control of flow of water is required. The dam at AL KUT must be guarded to insure that locks or barrage are not breeched. No engineer effort is required as long as facilities are not damaged.

b. Terminal facilities at BAGHDAD require expanding to increase clearance capacity of the water front area. One engineer construction battalion working 30 days is required. In the event that the AL KUT lock is not completely destroyed, its operation could be restored by one engineer construction platoon made up of 40 selected men with special skills and equipment in 30 days.

TABLE D-4-a

PORTS

FACILITIES	ABADAN, IRAN (P-1)	BASRAH, IRAQ (P-2)	KHORRAMSHAHR, IRAN (P-3)
Harbor	Natural River Harbor on SHATT AL ARAB, 45 miles above PERSIAN GULF. Least depth in entrance channel (ROOKA CHANNEL) 23 ft., least width 300 ft.	River Harbor on SHATT AL ARAB, 70 miles above PERSIAN GULF, the only general cargo port in IRAQ. Unlimited anchorage is available in the head of the PERSIAN GULF.	Natural river harbor at confluence of SHATT AL ARAB and KHARUN Rivers 70 miles above PERSIAN GULF. Least harbor depth 5 to 33 ft.
Berths	Alongide for 2 large oceangoing tankers (length 600 ft., depth 39 ft. Coaster for 3 standard tankers (length 250 ft., depth 14 ft) and 11 standard ocean-type tankers (length 525 ft., depth 31 ft.) and one small ocean-type tanker (length 450 ft., depth 26 ft.)	Alongside 8 Liberty-type vessels and 8 anchored in stream. Length and depth limitations: 300 ft. and 19 ft. respectively. Lighterage Wharf 1,050 ft.	Alongside 7 standard oceantype cargo vessels (length 460 ft., depth 29-23 ft.)
Mechanical Handling Facilities	18 wharf cranes, 3 to 100 tons capacity. 56 locomotive cranes, 5 to 15 capacity. 8 floating cranes, 3 to 200 tons capacity.	Two floating cranes, one 25 tons capacity at 60 ft. radius the other 60 tons capacity. Ship cargo handling gear is available for loading and offloading any kind of cargo.	19 cranes include: 60 ton Guyer derrick, 3-5 ton Portal jib cranes, 6 mobile cranes, (1 to 15 tons) 9 Portal jib cranes (3 to 5 tons)
Storage	Covered: 364, 500 sq.ft. Open: 7[illegible] acres Cold: Available for European community POL: 28.3 million Bbls.	Covered: 515, 185 sq. ft. Open: Available Cold: None available POL: 39,771 Bbls. (product only)	Covered: 189,000 sq. ft. Open: 40 acres Cold: 86,000 cu. ft. POL: 4,620 Bbls.

TABLE D-4-a

PORTS - (Cont'd)

FACILITIES	ABADAN, IRAN (P-1)	BASRAH, IRAQ (P-2)	KHORRAMSHAHR, IRAN (P-3)
Clearance	Railroad: None Roads: 3 bituminous surfaced Waterway: SHATT AL ARAB and KUD E KARUN (to AHVAZ)	Railroad: Single track, narrow gage to BAGHDAD Roads: Two to BAGHDAD (See Tab 1)	Railroad: One single track to AVAZ (Std gage) Roads: 3 2-lane surfaced roads
Estimate Military Port Capacity	6,800 short tons per day	11,900 short tons per day (NIS 30, Chapter 1, 1957)	6,700 short tons per day
Dredges	8 grab dredges, 8 hopper barges (NIS, 33 Sec 35, July 1955)	5 owned and operated by BASRAH Port directorate to keep channels clear. Capacity 1,250 to 2,000 tons per hour (NIS 30 Sec 35 Aug 1949)	One 18-inch suction, capacity 400 cu. yds per hour, max dredging depth 37 ft. (NIS 33, Sec 35, July 1955)

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TABLE D-4-b

IRAQ

INLAND WATERWAYS

FROM		TO		CHANNEL CHARACTERISTICS						BRIDGES		
MILE STATION	NEAREST TOWN	MILE STATION	NEAREST TOWN	TYPE	RIVER WIDTH	WIDTH (FT)	CONTROLLING DEPTH (FT)	SAFE DEPTH (FT)	NORMAL CURRENT VELOCITY MPH	NUMBER	CONTROLLING CLEARANCE (FT) HORIZONTAL	CONTROLLING CLEARANCE (FT) VERTICAL
SHATT AL ARAB (Mile o.0 at Entrance) ROOKA CHANNEL)												
0.0	AL FAO	5.1	AL FAO	Dredged Channel	200-300 yds	300	23 (LW)	22 (LW)	Variable	0	Unlimited	Unlimited
5.1	AL FAO	10.9	AL FAO	Dredged Channel	NA	300	24 (LW)	23 (LW)	Variable	0	"	"
10.9	AL FAO	17.8	AL FAO	Partially Dredged	NA	300	21 (LW)	2C (LW)	Variable	0	"	"
17.8	AL FAO	34.4	ISABADA POINT	Natural	NA	300	25 (LW)	24 (LW)	Variable	0	"	"
34.4	ISABADA POINT	47.6	ABADAN	Natural	NA	300	26 (LW)	25 (LW)	Variable	0	"	"
47.6	ABADAN	61.4	KHORRAM-SHAHR	Natural	NA	300	20	19	Variable	0	"	"
61.4	KHORRAMSHAHR	86.5	BASRAH	Natural	NA	300	25	24	Variable	0	"	"
86.5	BASRAH	123.7	AS SUWAYB	Natural	NA	300	8 (LW)	7 (LW)	Variable	0	"	"
123.7	AS SUWAYB	127.6	AL QURNAH	Natural	NA	200	7 (LW)	6 (LW)	Variable	0	"	"

TABLE D-4-b

IRAQ

INLAND WATERWAYS - Cont'd

FROM		TO		CHANNEL CHARACTERISTICS						BRIDGES		
MILE STATION	NEAREST TOWN	MILE STATION	NEAREST TOWN	TYPE	RIVER WIDTH	WIDTH (FT)	CONTROLLING DEPTH (FT)	SAFE DEPTH (FT)	NORMAL CURRENT VELOCITY MPH	NUMBER	CONTROLLING HORIZONTAL	CLEARANCE (FT) VERTICAL
TIGRIS (Mile 0.0 at AL QURNAH)												
0.0	AL QURNAH	82.0	AL AMARAH	Natural	200 ft.	NA	3.5 (LW) 4.5 (HW)	4.0 (HW) 2.9 (LW)	2.5 (LW) 5.5 (HW)	1	30+	Unlimited
82.0	AL AMARAH	230.0	AL KUT	Natural	700 ft.1/	NA	6.5 (LW)	6.0 (LW)	2.5 (LW)	1	54.1	"
230.0	AL KUT	422.0	BAGHDAD	Regulated Stream	900 ft.	NA	4.5 (HW) 3.5 (LW)	4.0 (HW) 2.9 (LW)	2.0 (LW) 6.0 (HW)	2	150±	40± (LW) 18± (HW)

1/ One lock at AL KUT DAM is 262' long and 54' wide.