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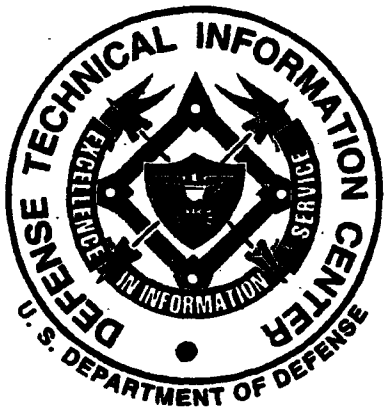

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WSEG STAFF STUDY 125

DESCRIPTION OF THE HO CHI MINH TRAIL (U)

August 1966

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WEAPONS SYSTEMS EVALUATION GROUP
400 ARMY-NAVY DRIVE, ARLINGTON, VA.

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STUDY 125

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(6) DESCRIPTION OF
THE HỒ CHI MINH TRAIL (U) (8)

(10) P. J. Schweitzer

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August 1966

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FOREWORD

This study is an integral part of WSEG Report 103, Interdiction of the Ho Chi Minh Trail, (U), August 1966, SECRET, prepared by the Weapons Systems Evaluation Division of the Institute for Defense Analyses in conjunction with the Weapons Systems Evaluation Group. The project was under the leadership of R. N. Schwartz.

This paper was prepared by P. J. Schweitzer.

PREFACE

This study describes the complex of roads, trails, and waterways in the Laotian panhandle known as the Ho Chi Minh Trail. It also describes the complex of roads and trails in southernmost Laos (the Sihanouk Trail, designated Route 110) over which supplies move northward and eastward from Cambodia into central South Vietnam (SVN). The study is based on intelligence data obtained mostly from the Defense Intelligence Agency (DIA) and the National Photographic Interpretation Center (Confidential Title), and from the Pacific Command Weekly Intelligence Digest (PACOMWID). These intelligence data were primarily derived from analyses of aerial photography, aerial observations, and reports from trained Royal Laotian roadwatchers and friendly guerrilla units operating in the area. The intelligence cutoff date is 1 July 1966. Other sources used in this study are indicated in the list of general references.

This description is intended as a general overall view of the system and as a guide to the road net, general character of the system, and rough order of magnitude for the logistic operation.

CONTENTS

APPENDIXES

I. DESCRIPTION OF THE SYSTEM AND ENVIRONMENT

A. GENERAL

The Ho Chi Minh Trail complex consists of a series of waterways, truckable roads and trails, in the eastern half of the Laotian panhandle over which supplies and personnel are moved southward from North Vietnam (NVN) to Communist forces in Laos and South Vietnam (SVN).

The trail complex traverses the western slope of the Chaine Annamitique and the adjacent hilly country. In this area many narrow valleys lie between rugged mountain passes at elevations from 1400 to 2000 meters. Roads generally follow the valleys and therefore may parallel navigable rivers, which are also used as alternate routes for movement of supplies. Since there are no railroads in Laos, supplies must be moved by road, trail, or water.

In addition to the north-south backbone system extending the length of the Laotian panhandle to the Cambodian border, there are several east-west lateral routes over which supplies are moved into South Vietnam.

B. TRUCKABLE ROUTES

All of the major north-south truck roads and east-west lateral roads have a limited all-weather capability for truck traffic. The roads are generally single lane, improved earth, or gravel surface with some bituminous treatment and fair to good condition. Widths vary from 10 to 12 feet with shoulders ranging from 0 to 3 feet. In low saturated areas, logs are

often used to form corduroy roads and increase truck flotation. In addition to many small wooden bridges, numerous fords (underwater bridges) are used as motorable stream crossings.

During the past year the enemy has worked intensively to improve existing roads and to build new ones to increase the flexibility for truck movement of supplies or shorten the lines of communication. It is estimated that currently three to four North Vietnamese engineer units are engaged in this effort, supervising 15,000 to 25,000 North Vietnamese and Laotian laborers organized into numerous construction and labor battalions. These forces are continuously active in road maintenance, construction, improvement, and realignment for better drainage, and short haul portering as well as in repairing damage due to bomb cratering and bridge and ford destruction caused by our interdiction efforts. Laotian villagers are often pressed into service, and, in addition, North Vietnam Army troops are often diverted to road repair activity while en route southward.

The major north-south truck routes have been identified from aerial photography, as have the major east-west laterals. Near the South Vietnamese border, the feeder roads branch into extremely numerous trails, which are not as well known. Supplies are offloaded and held at supply points within several miles of the border. These are later portered into SVN by an estimated 6,000 to 10,000 Viet Cong (porters) and NVA transportation (porter) companies.

C. FOOT TRAILS

An extensive trail system supplements the truckable routes. These narrow trails (typically about three feet wide) are generally not visible from the air except at isolated spots such as stream crossings. They are used by North Vietnamese troops infiltrating into SVN, and by porters, pack animals, carts, and bicycles carrying supplies as well as local traffic among the

villages. There is little knowledge about the extent of use of the trails. A well-balanced bicycle can carry up to 200 pounds; a porter can pack 40 to 60 pounds. It is possible that the supply movement over certain segments of the trail system may be comparable in magnitude to that trucked over the road system. The very rugged terrain and stepped portions of part of the foot trails restrict the throughput in many places.

D. GEOGRAPHIC FEATURES

The most important geographical feature in the eastern half of the Laotian panhandle is the Chaine Annamitique. These extremely rugged mountains, ranging up to 2,000 meters, run north-south along the Laos-NVN border and the Laos-SVN border. The Chaine must be crossed by westward-moving supplies as they enter Laos from NVN and crossed again as the supplies move from Laos to SVN.

Long-standing principal accesses over the Chaine are:

- The Nape Pass on Route 8.
- The Mu Gia Pass on Route 12.
- The Lao Bao Pass on Route 9.

Other roads that cross the mountains and give access to Laos from NVN are discussed below.

E. EXTENT OF COMMUNIST CONTROL

The extent of Communist control in the Laotian panhandle is variable but indicated in general by the shaded area in Figure 1. The eastern half of Laos is dominated by Communist forces in the Pathet Lao (PL) and the (People's) Army of North Vietnam (NVA). The towns of Saravane and Attopeu are in friendly (Royalist) hands, while the surrounding countrysides are hostile. There is a small area on Route 9 east of junction of Route 92 which is occupied by a Royalist battalion which denies the enemy access to SVN by Route 9. Parts of

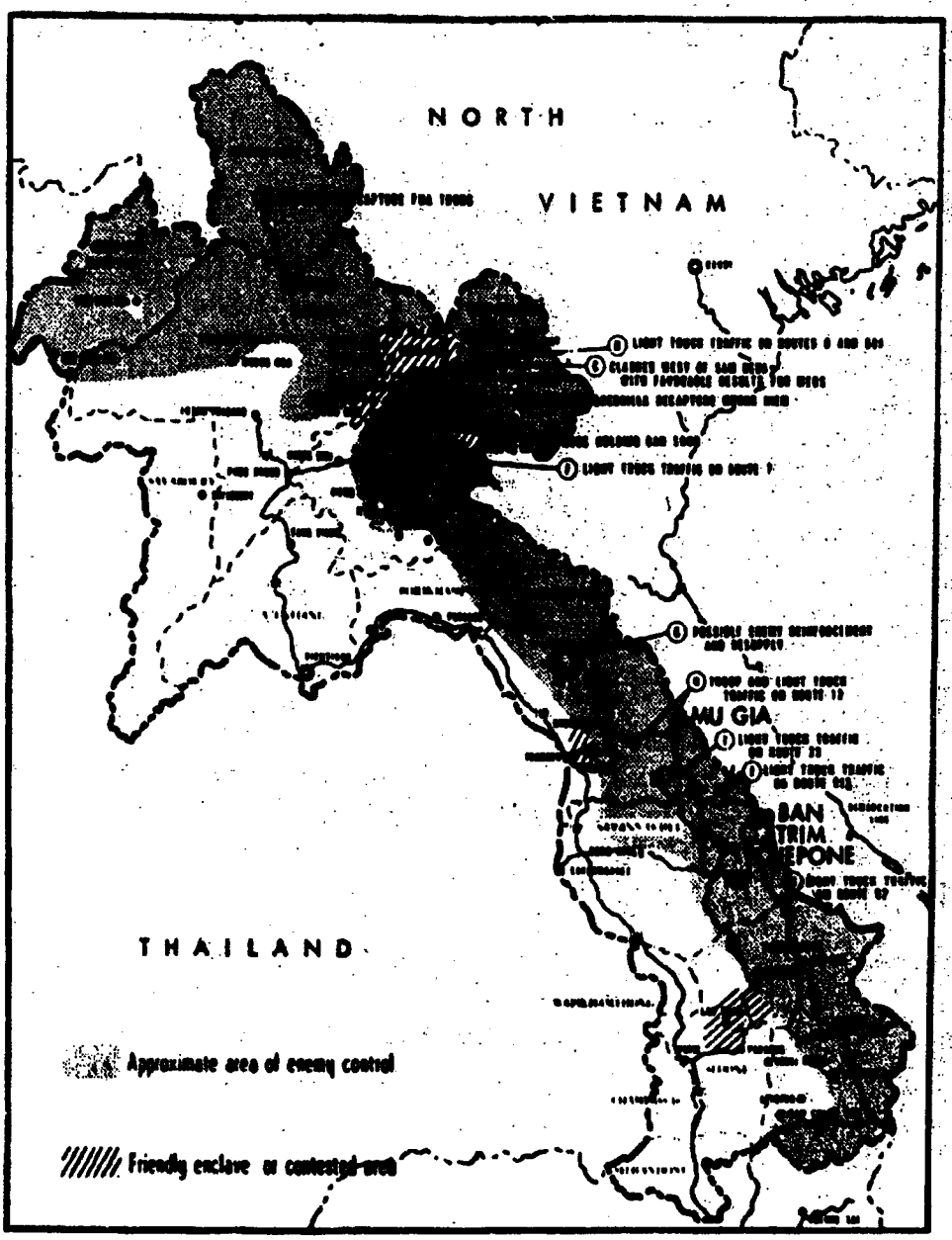

FIGURE 1. Communist Control in Laos

of Route 23, in the Saravane area, are either in friendly hands or subject to Royalist harassment. Hence the southern part of Route 23 is not a secure logistic route for the Communists.

There are several thousand NVA troops distributed along the road net in the panhandle. While they can launch surprise attacks against the Royalists, their prime task has been the static defense of the main corridor against Royalist penetration.

It is presently impossible to determine accurately what fraction of the supplies from NVN are used to support the PL/NVA in the Laotian panhandle, and what fraction continues on to SVN to support the VC/NVA. Rough estimates indicate that up to two-thirds of the 70 to 100 tons of supplies entering Laos daily in the (1965/66) dry season were possibly consumed or held in Laos while the remainder continued on to South Vietnam.

Until recently the Communists in the Laotian panhandle have had no antiaircraft weapons larger than 37mm machine guns. Recent reports indicate 57mm radar-directed guns in the Mu Gia Pass and Tchepone areas.

Control of the trucking operation and infiltration system in the Laotian panhandle is in North Vietnamese, not Pathet Lao, hands. Truck drivers, for example, are NVA personnel. The PL are occupied in fighting the Royalists, while the NVA have the greater interest in maintaining their LOCs into SVN.

F. WEATHER

Seasonal and Local Variations

The climate of Laos is monsoonal in nature and similar to that of Burma or Thailand. It is characterized by two major seasons - the southwest monsoon from mid-May to mid-September and the north-east monsoon from mid-October to mid-March. The

monsoon seasons are separated by short transitional periods - the spring transition, mid-March to mid-May, and the autumn transition, mid-September to mid-October.

The southwest monsoon season is a period of heavy and frequent precipitation throughout the area. Humidity is high, cloudiness is at a maximum, and, except at higher elevations, temperatures are tropical in nature. In contrast, the northeast monsoon season is one of little or no precipitation. The coolest temperatures, lowest relative humidities, and clearest skies are experienced in the area at this time of year. The spring transition is characterized by an increase in frequency and amount of precipitation and also an increase in relative humidities. Temperatures attain their annual maximum in this season, generally near the end of April. The autumn transition is characterized by more rapid weather changes than occur during the spring transition. The precipitation decreases and the relative humidities and temperatures decline as the southwest monsoon retreats and is replaced by the northeast monsoon.

There are many local variations in climate throughout the area, but they are not sufficiently important to justify discussion of separate climatic areas. The great majority of these minor variations are created by differences in elevation and exposure. The country can generally be treated as climatically homogeneous, with local differences considered where necessary.

Southwest Monsoon Season (May to September)

The southwest monsoon season is initiated by the northward migration of the intertropical convergence zone (ICZ).[1] This

[1] The intertropical convergence zone is a boundary region between the flow of highs from the North Pacific region during the northeast monsoon season and the flow of lows from the equator during the southwest monsoon. The ICZ moves across Laos during the transition seasons.

season brings much low cloudiness, heavy rainshowers, and thunderstorms to the entire country. The first surges of this southwesterly flow are marked by heavy cumulonimbus clouds, severe thunderstorms, and squalls. By June, the weather follows a fairly regular daily pattern, with torrential showers during the afternoon and night. On occasion, these heavy showers are followed by less intense but longer lasting rains. In squalls and heavy showers, cloud bases are often quite low and visibilities are greatly reduced for short periods. Except during showers and morning fogs in the river valleys, surface visibilities are fairly good during the southwest monsoon; however, excellent visibility is unusual because of persistent haze. Intervals of precipitation-free weather with scattered clouds occasionally occur, but clear days are rare.

Autumn Transition (September and October)

The weather during the early part of the transition is similar to that of the southwest monsoon. Locally, there may be some increase in cloudiness, precipitation, and local storms as the ICZ passes over in its southward migration. On occasion, a disturbance moving westward along the ICZ may bring about an increase in rainfall, sometimes resulting in extremely heavy showers in the mountains. By mid-October the ICZ has usually retreated south of the area and a relatively drier and cooler northeasterly flow begins to dominate Laos.

Northeast Monsoon Season (October to March)

Starting in northern Laos in mid-October the relatively cooler and drier air of the northeast monsoon moves southward and usually dominates all of the area by mid-November. Cloudiness, in general, is considerably less than during the southwest monsoon. Clear days are much more frequent, although cumulus-covered skies are still common in mid-afternoon. Morning fog is frequent during this season, particularly in the deep narrow river valleys in the northern half of the country.

Spring Transition (March to May)

By March, the force of the northeast monsoon has dissipated and the northeasterly flow is no longer dominant over Laos. During this period of weak and variable circulation and just prior to the onset of the southwest monsoon, temperatures soar to their annual maximum. Cloudiness is low and skies remain relatively clear. Rainfall becomes heavier, but humidities are fairly low. Thunderstorms become quite prominent during this season, and some are extremely violent. Generally they travel from northwest to southeast causing low ceilings, heavy precipitation, and strong winds that last for only an hour or two. By May, with the approach of the ICZ and the southwest monsoon, the humidity becomes oppressive.

Flying Weather

Ceiling

A prime consideration for low-level air operations is whether sufficient space exists between the surface and the base of the lowest clouds in which to maneuver and accomplish the missions. This becomes most important in areas such as Laos, where the terrain is hilly or mountainous and low clouds are frequent, particularly during the southwest monsoon. The extensive low cloudiness of this season, and to a lesser degree of the spring and autumn transition seasons, which obscures the slopes of the Chaine Annamitique and the northern mountains, is a serious hazard to low-level aircraft operations.

Visibility

Visibility is usually fairly good over Laos during all seasons. Visibility appears to be better in the southern part of the area and away from the rivers and deeper valleys. The best daily air-to-ground visibilities are between 0800 and 1000 hours LST, after most of the ground fog and haze have burned off and prior to the growth of afternoon cumulus. After 1000 LST,

convective activity leads to low-level cloud formations and a resultant decrease in slant-range visibility. The poorest slant-range visibility is experienced during mid-afternoon, particularly near rainshowers and thunderstorms and in the ICZ as it passes over the area during autumn transition. After 1700 LST until sunset, there is a secondary period of good air-to-ground visibility.

Combined Ceiling and Visibility

For many air-to-ground operations, including landings and takeoffs, the distribution and frequency of certain combinations of ceiling and visibility criteria are of major importance. The entire area shows a high percentage of favorable ceiling and visibility combinations. Poor conditions are most frequent in the morning, when visibility is reduced below 2-1/2 miles by fog; however, the fog seldom lasts later than 1000 LST. During the southwest monsoon, cloud bases are frequently lowered below the critical altitude by rainshowers, but they rarely last longer than an hour or two.

Tables in Appendix A, prepared by the USAF Environmental Technical Applications Center (ETAC), present ceiling and visibility data for Laos by time of day for January, April, July, and October. Frequency of combined ceiling and visibility were determined from these data. Summaries giving the duration of poor flying conditions (ceiling less than 5,000 feet and visibility less than 5 miles) at a number of stations lead to the following general conclusion: at least once in a 24-hour period, the combined ceiling/visibility should be at least 5,000 feet/6 miles over any given location in the Laotian panhandle.

Existing computer programs in ETAC were used to develop probability curves of the cloud-free line-of-sight visibility to a target on the ground from an observer at specified altitude and ground range from the target for selected portions of weather data.

Effect of Weather on Surface Operations

Approxi·ately 70 percent of the yearly rainfall occurs during the southwest monsoon, less than 10 percent during the northeast monsoon, and the remainder during the two transitional seasons. July and August are the rainiest months almost everywhere, and December and January are the driest.

In general, there is an increase in precipitation received with an increase in elevation; however, above the usual level of the precipitation-source cloud bases, the amounts received gradually decrease to the crest.

The majority of locations have annual rainfalls ranging from 50 to 100 inches. In general, the greatest rainfall occurs along the southwestern slopes of the Chaine Annamitique; the least amount is found in the sheltered valleys of the northern half of the area. The ability of vehicles to traverse the surface is a primary function of soil type and soil moisture content. Tractionability maps of the Laotian panhandle are given in Appendix A for each month of the year.

II. FOOT TRAILS

The trails used for infiltration of personnel are distinct from the roads used for the truck system. The two operations are administered by different parts of the communications-liaison organization and have, for example, separate rest areas along the routes. The foot trails are narrow paths, about three feet wide; however, this is wide enough to support bicycle portage traffic where the trails are not stepped or very steep. In most instances, the trails are nearly invisible from the air in the areas of heavy foliage but are quite visible in the savanna areas (open grassland and brush with scattered trees).[1]

Reports indicate an infiltration rate of approximately 5,000 to 7,000 men per month during the 1965-1966 dry season. The infiltration is almost entirely by foot. The route proceeds by truck inside NVN to just above the Demilitarized Zone (DMZ). For infiltration to areas other than the northernmost province of SVN, it then crosses through part of the DMZ into Laos and proceeds south to the vicinity of Ban Dong on Route 9. From there the foot trails generally parallel Routes 92 and 96, moving south, and lie in the area between these routes and the Laos-Vietnam border. At intervals the foot trails branch eastward towards the Vietnam border. Of principal note in this respect is the trail network in the vicinity of Routes 922 and 165. It is believed that these are staging areas and major points of entry for infiltrating personnel. Because of the

[1] This statement is corroborated independently by WSEG Staff Study 124.

dense jungle growth, their exact locations are difficult to determine, but aerial photography indicates an extensive network of trails in these areas as well as areas that appear to be final staging centers before crossing the border. It has been impossible to determine whether most of the trails are used for native traffic among the villages or whether they are used primarily for troop traffic. Although the trail network discovered by ground and aerial means is most extensive at the termini of 165 and 922, it appears to extend all along the border. The north-south trail continues along the border at least as far south as the tri-country area, where an eastward extension of Route 110 connects with it.

During 1964-1965, roads were used almost exclusively for trucking supplies. Infiltrators usually entered Laos through the DMZ and used foot trails. Recent reports indicate the first first large southward truck movement of line troops in Laos. This movement occurred between February and March of 1966, when a regiment or more of NVA troops were moved southward on 911/91 to the Tchepone area. Unidentified artillery and AA weapons were towed by motor convoy elements. Later reports indicated that trucks carrying troops used no canvas covers, while cargo-carrying trucks used canvas covers and most were camouflaged.

The infiltration routes from NVN into Laos generally proceed as follows. Troops are trucked down to an important transition point near Vit Thu Lu by the DMZ. There uniforms are exchanged and food and equipment provided. Infiltrators then set off southward on foot, around Vang Vang Mountain, to the headwaters of the Se Ban Hieng River, then west to Ban Trim at the western edge of the DMZ. Alternate personnel routes lead out of Ban Trim. One leads southwest through a karst region[1] to the vicinity of Ban Dong on Route 9. Trails then

[1] Karst regions are difficult to traverse as they have sinkholes, abrupt, irregular protuberances, caverns, and underground streams, where water has eroded limestone.

lead south from Ban Dong toward Muong Nong. A second route (which is part of what is now called Route 92) which circumvented the worst of the karst, went west along the Se Bang Hieng River and down to the supply and distribution area of Muong Phine and Tchepone. There have been reports of up to 300-man coolie teams and porters pushing heavily loaded bicycles on this trail. Although canoes have been observed along the Se Bang Hieng, no precise estimate of the extent of water traffic is available. Mail is also carried along this general route.

Way stations are the key to the personnel infiltration system. Infiltrators are escorted by "commo-liaison" personnel from one way station to the next, about one to three days march. The way stations are usually small groups of native huts that house the liaison personnel and provide resupply for the infiltration groups, who are normally billeted within or near the way station. From 10 to 30 liaison personnel are assigned to each way station. Coolie teams of up to 100 men may be attached for shuttling supplies originating in South Vietnam, Cambodia, and North Vietnam to the stations from supply areas. The liaison personnel, many of whom are native to the area, escort infiltrators between the way stations. They probably are also responsible for local security, procurement and storage of rice, feeding the infiltrators, and operating dispensaries.

At least the first five way stations are in NVN, with almost all interrogated infiltrators reporting passage through the first station at Hill 1001 at the DMZ. More than 32 way stations have been reported in Laos, but only 16 to 20 stations are believed to be in use.

Infiltrators travel by day, movement continuing four days in succession followed by one day of rest. However, there are frequent interruptions of this schedule. The infiltration is kept inconspicuous -- villages are avoided and infiltrators are generally forbidden to talk to natives. The liaison personnel may have a choice of several alternate trails between way

stations. Attacks against a way station may result simply in rebuilding of the huts a few tenths of a kilometer away, with no need to create new trails.

Infiltration groups range in size from 15 to 500, but usually are 100 to 200. Cadres might travel in smaller groups of 25 to 50. Large groups may be broken into serial components. The infiltrators suffer from debilitation due to malaria, dysentery and weather. Up to one-third of a combat unit may be temporarily lost. Most of these personnel would stay behind and recover at a way station, continuing down the trails later. There is a possible 10 percent permanent loss of infiltrators.

Infiltrators may carry a nominal 10-day supply (15-20 pounds) of rice, and since only a few day's travel is required between way stations, they need not depend on resupply at every way station. Since their initial rations are inadequate for the entire trip, extra food is brought to the way station either by the 100-man coolie teams mentioned above or by portering from nearby caches supplied by trucks. Garden crops, including manioc, and animals are thought to be raised at some way stations for troop supply. Infiltrators carry loads weighing up to 40 pounds, with rice and salt, a weapon, ammunition, and personal equipment including mess gear, canteens, and nylon sheets for ground cloth and tent. The infiltrators may carry an extra rifle or ammunition but are not used as porters. Nevertheless, their fairly heavy loads, carried over rugged stepped trails and the hazards of travel contribute to the debilitation mentioned above.

The normal day's march is about 12 hours, during which personnel average 9 to 12 miles. Transit times may range from two weeks (to the northern part of SVN) to three months (to the tri-country area). Nominal transit times are quoted as 30 to 60 days. These transit times are longer than hiking speeds would indicate due to the practice of diverting infiltrating

troops to road repair, providing security, growing rice and manioc, and helping the Pathet Lao while en route. Infiltrators are also held up for training or by weather. Delays of as much as five to six months have been reported.

Infiltration during 1965 is estimated at 22,000 personnel consisting primarily of a large number of groups during the first quarter of the year and a second large number during the last quarter. While infiltration also occurs during the rainy season, walking is more difficult.

III. ROAD NET AND WATERWAYS

A. INTRODUCTION

This section describes the primary roads and waterways of the route complex. The road net and some waterways are shown in Figure 2. A more detailed segment-by-segment description of the roads and their condition, canopy, capacity, and gradient, is given in Appendix B.

The road surfaces are generally unimproved or improved earth or gravel, and some crushed rock or bituminous surface treatment. Roads are typically one lane, 8 to 12 feet wide, with narrow or no shoulders. Consequently, bypasses and turnarounds are provided at frequent intervals. During the rainy season, route sections lying in low areas are frequently inundated, and fords and small bridges are washed out. However, during the past year, the Communists have intensified their efforts to upgrade the primary truck routes, and it is believed that these roads now have a limited all-weather capability for truck traffic.

There are approximately 1400 miles of land routes that are predominantly under Communist control in the panhandle of Laos. These include motorable roads, major tracks, and trails known to be in extensive use. About 600 miles of the truckable roads comprise the main supply route (MSR) through the movement corridor in the eastern portion of the Laos panhandle stretching from North Vietnam to Cambodia. Another 300 miles of motorable roads serve as feeders to the MSR and support the NVA/Pathet Lao forces in the Laos panhandle. The remaining 500 miles, mostly unnumbered routes, are used by oxcarts, bicycles, animal pack trains, and porters.

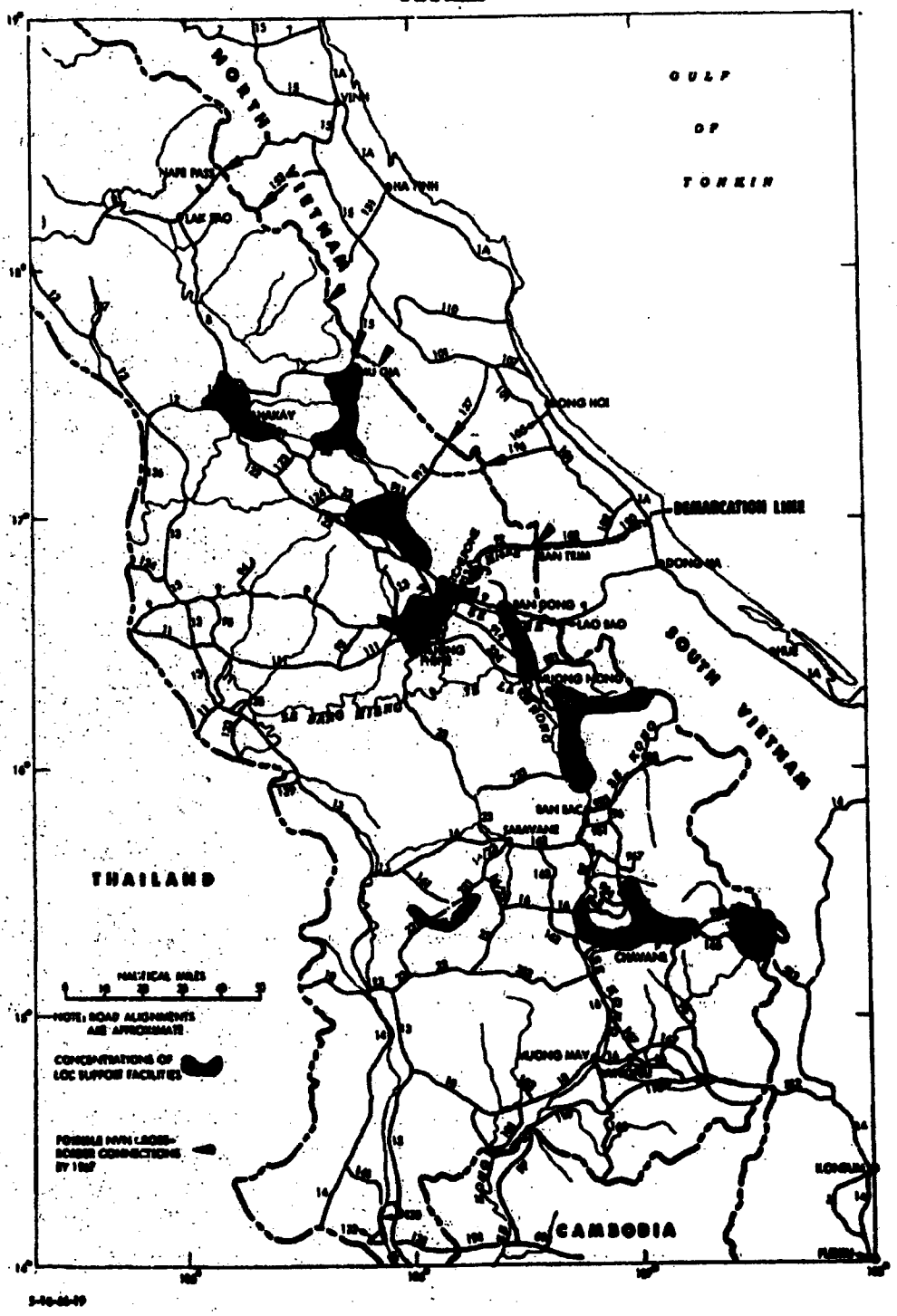

FIGURE 2. Lines of Communications in Southern Laos

Road capacities in short tons per day (STPD) are computed by a standard international methodology. While calculated for a 24-hour period without interdiction, the daily capacities are only slightly reduced if truck movement occurs only at night: the capacities are based on (so-called 50 percent operational phasing factor) 12 hours of truck usage per 24-hour period, the rest of the time being devoted to refueling, truck maintenance, truck stops and road maintenance. The capacities are 90-day averages for forward movement over one-lane roads with three-ton loads per truck and with empty trucks returning over the same route. While tonnage throughput could be double or triple the quoted figures for periods up to a few days, the severe damage to the earth roads would require so large a time for repair that the quoted average capacities are believed to hold. It should be noted that wet season capacities are averages over intermittent deliveries.

For the most utilized of the component routes in the infiltration corridor, the normal dry/wet season capacities range from 750/150 STPD to 100/0 STPD. The throughput capacity for the MSR to storage areas west of the South Vietnam border is estimated at 400/100 STPD. Yearly average capacity is taken as 270 STPD, based on seven dry months at 400 STPD and five wet months at 100 STPD. The current (wet season) practical capacity is estimated at 50 to 70 STPD.

The main supply route (MSR) in the Laotian panhandle refers collectively to the main Routes 12, 121, 23, 911, 91, 9, 912, 914, 92, 96, and 110. Routes 110, 921, 922, 923, and 165 are the primary lateral routes feeding from the MSR.

The MSR actually consists of a latticework of roads normally fed at its northern end by Route 12 through Mu Gia Pass, Route 912 south of Mu Gia Pass that was added in 1966, and potentially by Route 8 through Nape Pass (this route has fallen into very poor condition and is currently not capable

of supporting through shipping). These join with Routes 121, 23, and 911, the latter two taking the bulk of known motor traffic to the Muong Phine-Tchepone area along Route 9. Route 23 continues south of Route 9 with motor traffic terminating in the vicinity of Ban That Hai where the 850-foot bridge over the Se Bar Hieng River has been destroyed. Also leading south of Route 9 are Routes 914 and 92. These are the current principal roads serving NVA logistic traffic connecting with Route 96 east of Saravane. Route 96 now facilitates MSR traffic all the way to Cambodia in the Laos/South Vietnam/Cambodian tri-border area. Since February 1966, development of Route 110 for truck traffic has provided a link between Route 96 and the Cambodian highway network. The combined Routes 92 and 96 have several branches leading eastward to supply and service areas just west of the South Vietnamese border. These, along with the principal corridor routes, are described in some detail below.

The MSR may be compared to a ladder, in which the enemy has endeavored to maintain two parallel sidepieces (north-south backbone routes), with bypasses, plus numerous rungs (east-west laterals) for flexible rerouting if a segment of one of the backbone routes is interdicted. In addition, laterals feed off eastward of Routes 92 and 96 towards SVN, and westward to support the PL in Laos.

B. ROUTES NORTH OF ROUTE 9

While Route 8 from NVN is used to support the PL in the Lak Sao area, the road south of Lak Sao has fallen into disuse and has deteriorated. Furthermore, the Nape Pass is under frequent air attack and subject to numerous landslides. Hence Route 8 plays only a minor role in the movement of supplies into the Laotian panhandle.

The principal significant truck movement of supplies into the Laotian panhandle has been via Route 12 through the Mu Gia Pass. To obtain other routes across the Chaine Annamitique from NVN into Laos, the enemy has recently completed Route 912 and is improving several trails over the Chaine. The most significant expected development of the LOC in the Laos panhandle is relief from heavy dependence on Route 12, formerly the only motorable through route over the Mu Gia Pass. Because of the extremely limited motorable capacity over Route 8 through the Nape Pass, these two pass routes form a sensitive bottleneck. This is apparent from the installation of additional routes to provide less vulnerable linkages between the North Vietnam and Laos road nets. Including the current development of North Vietnamese Route 137 and the westward extension of North Vietnamese Routes 196, 151, and 153, as many as eight cross border connections may be in service by 1967 to dissipate interdiction efforts (these are shown by arrows in Figure 2):

- Route 8 via Nape Pass.
- Extension of NVN Route 153, about 10 km southeast of the Nape Pass, over the Chaine.
- Extension of NVN Route 151 west of Route 15 and about 10-20 km northwest of Mu Gia Pass.
- Route 12 via Mu Gia Pass.
- A trail 10 km southeast of Mu Gia, which crosses the Chaine and joins one of the three roads leaving the Mu Gia Pass near Ban Xonne. It is not reported truckable, but could bypass Mu Gia.
- Route 912.
- Extension of NVN Route 196, now a trail across the Chaine, possibly into 915 trail, Laos.
- Route 92, from NVN Route 102 at the DMZ, to Route 913 and southwest towards Tchepone.

Once through the Mu Gia Pass, supplies move on either 23 or 911 toward Route 9 and the supply areas of Tchepone and Muong Phine. Or, supplies move west on 12 or 23/121 to support

the PL in the Mahaxay area. Trucks return to Mu Gia the same way, or continue south from Mahaxay via either 122 or 121/23 to Route 9. These routes, along with the three roads flaring out of the south end of the Mu Gia Pass, indicate the ladder arrangement leading south of Mu Gia down to Route 9.

With Route 911 replacing 23 as the main road from Mu Gia down to Route 9, and with the expected extensive use of Route 912 next year, the Tchepone area takes on great importance as a major supply and distribution center. Muong Phine, also on Route 9, fed by 23, takes on lesser importance as a distribution center to the PL west (via Route 9) and south (via 23). Route 23 cannot be used far south due to the interdiction of the 850-foot Ban That Hai highway bridge across the Se Bang Hieng and to the surrounding Royalist territory near Saravane.

C. ROUTES SOUTH OF ROUTE 9

South of Route 9, the ladder arrangement continues. The backbone routes are either east on 9 to Ban Dong then south on 92, or south on 914 (the Tchepone bypass which avoids Tchepone, 9 and part of 92), or southeast on 234. Of these alternatives, only the first was in significant use until recently, with 914 not yet developed and traffic only occasionally sighted on 234 (a road in poor condition). With the opening in March 1966 of 914, the enemy now has an alternate route expected to relieve congestion, allow flexibility and decrease vulnerability.

The area further south is considered a vulnerable one, since there is only one north-south route, namely 92, between 922 and 923. It is expected that a parallel route will be built to the west of 92.

South of Route 923, the backbone routes are 96, and either 92 or the Se Kong River. Route 96 is predominant, being better developed than the poorly drained 92 that it was intended to replace. However, Route 92 is being improved from the intersection with 923 at Ban Bac south to the intersection with

Route 16. Route 96, on the other hand, is further east and more convenient to lateral roads into SVN.

South of Route 165, the two backbone routes are Routes 167 and 96 both connecting with Route 110 in southernmost Laos. Connecting laterals are 165 and 110 with a potentially redeveloped Route 16 now in deteriorated condition.

The main trucking route from the Tchepone-Muong Phine area incorporates eastward movement on Route 9 to Ban Dong and Route 92, then south along 92 for about 110 km to Ban Bac and to a short lateral connecting route (923) to Route 96. Route 96 is a new route apparently constructed to expedite the southerly movement of goods and to avoid using the older Route 92 or the Se Kong River south of their junction. The trip along 96 is approximately 180 km and terminates near the tri-country border.

South of the town of Ban Bac there is a river transshipment point for water movement of supplies headed south towards Attopeu and the lateral Routes 165 and 16.

The principal lateral roads into SVN are 921, 922, 923, 165, and 110. Routes 921 and 923 appear to have been allowed to deteriorate to tracks with 922 and 165 carrying the truck traffic. The relative importance of 922 and 165, the two significant laterals, is not easy to estimate, but each may carry about 40 percent of the traffic. The remaining 20 percent is dispersed over numerous feeder roads. The nominal distances from Mu Gia via the MSR to supply areas along 922 or 165 just west of the border are taken as 240 to 300 miles. The lateral routes terminate several miles from the SVN border and cross-border portering brings supplies into SVN.

Waterways associated with the Route 92 complex may be used reliably only in the wet season. They are:

- The Se Bang Hieng River, which begins at the DMZ and flows past Tchepone, paralleling 92 in part. Sections of the river form an alternate infiltration route from Ban Trim at the DMZ (where canoes have been observed) to Tchepone. Rock croppings are serious hazards upstream.

- The Se Pone River, which originates along the Laos-SVN border, then parallels Route 9 and flows into the Se Bang Hieng at Tchepone (the confluence of the two rivers at Tchepone, along with the confluence of 91 and 9, indicates the strategic importance of this area). Only sections of this river are usable.
- The Se Kong River which originates at the Laos-SVN border, crosses Laos to Ban Bac (at 923) and then flows south (parallel to 92 and 16) to Cambodia, eventually entering the Mekong River. The main obstacle between the origin and Ban Phone (by Route 16) is a waterfall northeast of Ban Phone requiring portage. The Se Kong is navigable only south of Route 162. It has been used for the movement of foodstuffs from Cambodia up to several offloading points on Route 110.

As an infiltration route, personnel could proceed by foot down 92 to the intersection with 162 south of Ban Bac, then go downstream on the Se Kong into Cambodia and take Cambodian LOCs into SVN. That is, sectionally, the Se Kong can be an alternate to 92 (between Ban Bac and Ban Phone) and to 923.

As roads wash out in monsoon rains, the rivers rise to better navigability and serve as alternate routes. Pirogues can navigate rapids, while sampans are used on quieter river sections. Surveillance of water traffic is difficult, for the boats are small, river facilities are dispersed and hard to identify, and the native commerce and military logistics use the same facilities.

D. FEEDER ROADS

An extensive secondary road system branches off from the arterial roads to communicate with the multitude of hamlets dotting the Laotian countryside. Other feeder roads appear to have been generated to serve areas of concentrated military activity.

These roads are not usually shown on maps but are often identified from aerial photography. Their importance stems from the fact that they provide flexibility to the Communist

forces in dispersal of supply dumps, support facilities, truck parks, etc., and in some instances can be used to bypass interdicted sections of the numbered routes. Feeder roads occur throughout the Laotian panhandle although their density appears to be directly proportional to the density of human habitation. An example of a relatively dense feeder road network identified from aerial photography is shown in Figure 3.

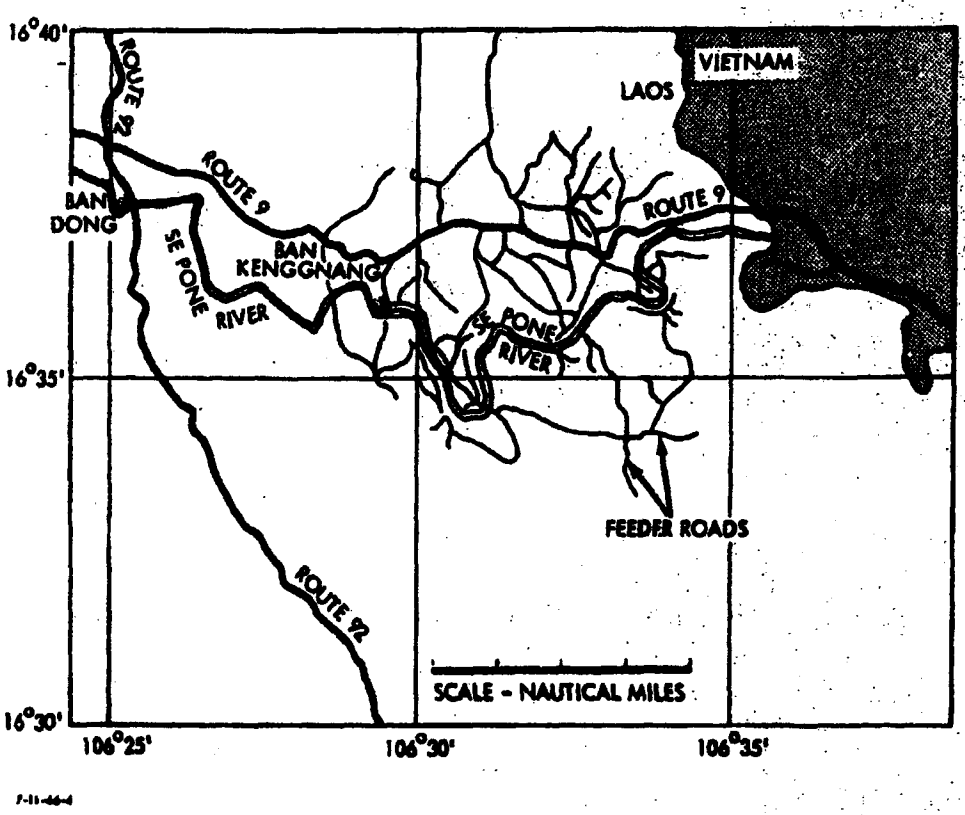

FIGURE 3. Example of Feeder Road System

IV. ROAD CONSTRUCTION AND IMPROVEMENT

A well-defined motorable net with lattice-like structure has been developed in the Laotian panhandle to transmit supplies from NVN to supply bases west of the Laos-SVN border. From there portering is used to bring goods into SVN. Selected roads previously limited to dry season traffic have been given a limited wet season capability. Road equipment such as bulldozers and graders has been introduced to Laos. Large manpower resources have been committed to maintain the net and to construct new roads. The enemy has matched his repair manpower to our interdiction program so that loss of road capacity is not nearly severe enough to restrict the present amount of supplies flowing. Bypasses have been built. The enemy has become more experienced in building fords and filling in or bypassing craters, and other expedient repairs.

The motorable roads in the Laos infiltration corridor amount to 900 miles, including about 200 miles placed in service in 1965 and another 200 miles opened since January 1966. The ladder network is nearing completion, with the exception of the MSRs along 92 and 96. Although some additional increase in road mileage is expected, particularly on the North Vietnam/Laos border access routes, analysis of the existing network indicates a shift in emphasis to the hardening of the present network to provide improved all-season trafficability.[1]

[1] Many route segments have only improved earth and laterite surfacing with weak subgrades that break down from wet season saturation and require extensive maintenance at the beginning of each dry season. Heavy deployment of labor along critical routes during the 1965 wet season apparently could not maintain continuous traffic over the weak roadways for at least one to two months, particularly in September 1965. A similar result is occurring in the present wet season.

During the 1963-1964 dry season the century-old tracks and trails between Routes 12 and 9 (23, 121, 91, 92) were improved to poor fair-weather roads. Road improvement over the 1964-1965 dry season opened the Route 92 complex to truck traffic in the spring of 1965. The route complex, while an advance over the older trail network, is still rudimentary.

A. ROAD CONSTRUCTION

The 1965-1966 dry season saw five major additions to the road net. Route 96, developed during the preceding dry season as a track and possibly a jeepable road, was made truckable all the way down to Cambodia, allowing truck support of southernmost Laos. Route 911 was opened, providing a better and shorter route from the Mu Gia Pass to Tchepone. Route 912 was completed, ending the complete reliance on 12 as the only LOC with NVN. Route 914 was opened, bypassing Tchepone and Route 9. Route 110 was made motorable, thereby connecting the MSR with LOCs in Cambodia.

Some limited rainy-season capability now exists for most of the roads. The southern extent of motorability has reached all the way to Cambodia. Poorer routes, such as 23 and 92, have been replaced by better ones, like 911 and 96. The recent development of 911, 912, and 914 is the latest example of extensive diversification of the road network. The Communist intent seems to be the development of a parallel (ladder-like) system of roads down the entire Laotian panhandle, to have flexibility of operation and relative invulnerability to air interdiction. The presence of heavy road equipment (bulldozers, earthmovers, road graders) on 96 and 23, and in the 911 and 912 areas (observed this year for the first time despite an urgent need for this equipment in NVN) indicates the priority given to this road development campaign in Laos. The importance is also indicated by the large manpower resources assigned to the system.

B. ROAD MAINTENANCE AND IMPROVEMENT

The roads are under continuous maintenance and improvement. An estimated 15,000 to 25,000 laborers are located along the entire network, broken down into small groups assigned to short segments. When not diverted to repair of cuts from air interdiction, these men are engaged in a continuous effort to maintain and improve road capacity. Road sections are realigned and moved to higher ground to improve drainage and prevent inundation. Logs are laid across the roadway (so-called corduroy roads) to increase flotation/tractability in low areas during the wet season. The wet-season capacity is improved, so that the major routes now have a limited wet-season capacity for all but a few months. The alignment of the road keeps changing to bypass deteriorated and heavily interdicted segments. Along with some ferries, fords (sometimes called underwater bridges) and timber bridges are extensively used to cross streams, although they may wash out in the wet season. Coolies also work on the laborious task of camouflaging sections of routes with bamboo trellis, especially those under construction as 911 and 912.

C. ROAD REPAIR

There are repeated observations of felled trees being cleared and of craters being filled within a few hours after an attack. A significant portion of the repairs are carried out by indolent villagers who are pressed into service. Based on interrogation, filling a large crater may take 20 people eight hours, the work being supervised by North Vietnamese.[1] With coolie densities of 30 to 60 men per mile along

[1] RAND Report RM-3512-PR (Figure 11) gives crater hand-fill-in time as 90 manhours for a 750-lb bomb and 120 manhours for a 1000-lb bomb, in rough agreement with the 160 manhour figure quoted above.

much of the MSR, laborers can be assembled quickly. Sufficient numbers of repair crews have apparently been positioned in critical locations to prevent more than temporary delays or decreases in capacity. In addition, important road segments are permanently assigned to the regular construction battalions for maintenance, repair, and security.

These remarks indicate that a single crater that must be filled will hold up traffic for a few hours or one evening at most.[1] Repair times would be shorter if heavier equipment were available. It appears that multiple craters are needed if the road is to be closed for an entire night, and that cratering should be as close to dusk as possible.

A good example of the capability for response to road repair requirements is given by the two B-52 bombings of the Mu Gia Pass.[2] The first, on 11 April 1966, dropped 1389 750- and 1000-lb bombs. There were 189 craters and possibly a small landslide in the target area, but the large work force in the area reopened the road within 18 hours. The second raid, on 26 April 1966, dropped 720 750- and 1000-lb bombs and interdicted the road (by crater or throwout) in at least 27 places. The road was open (tracks observed over filled-in craters) within 24 hours.

The soil in this pass is reportedly loosely packed and our bombs create gravel for the enemy, so that crater fill-in material is abundant. At 100 manhours to fill in each crater and half the craters requiring fill-in, 9500 manhours of labor were needed for crater repair for the first strike, ignoring the landslide repair time. With 500 laborers available, the

[1] Seeding with antipersonnel mines or delayed-fuzing bombs might cause longer delays in reopening the roads.

[2] DIAAP-1 Briefing Boards 4-66-16, 5-66-5.

repair could be done in 19 hours, in agreement with the observations. The presence of several hundred repairmen in the Mu Gia Pass area is not unreasonable considering the importance to the enemy of keeping this road open. If adequate personnel were not already in the pass, trucks could have transported laborers there within a few hours.

V. FIXED FACILITIES

In addition to highway structures such as bridges, ferries and fords, the NVA and the Pathet Lao have fixed facilities along the Ho Chi Minh Trail to support the shipment of supplies by truck and porters, the passage of military personnel on foot, and the maintenance of defenses. Actually these are semi-fixed facilities consisting generally of truck parks -- rest and refuel areas, vehicle support areas, and maintenance areas; troop areas -- bivouacs, way stations, staging areas, and infiltration camps; and military facilities -- strong points, trench systems, and general defensive systems. Most of these facilities have a second use such as truck parks or way stations doubling as storage areas. The total numbers of these support facilities which have been targeted by the 7th Air Force and classified as validated Royal Laotian Air Force targets are shown in Table 1. There are believed to be many more facilities of each type that have either not been found or not been validated as targets.

Table 1. NUMBER OF VALIDATED RLAF TARGETS FOR SOUTHERN LAOS
(15 May 1966 Target List)

Truck Parks	157
Storage Areas	263
Troop Areas	127
Defense Areas	39
Caves	25

The majority of these targets are very simple consisting of open areas under the canopy and a few wooden structures. The primary items of value are the men or supplies flowing through, not the buildings or open areas. Then when a target is struck or destroyed, the only items of significant value lost are the men or supplies, and the target may be put back in action merely by bringing in more men or supplies. These targets have a quick recovery time. With the possible exception of the defenseive areas, the enemy can abandon his target areas with very little loss and construct new ones easily.

A. SUPPLY SHIPMENT

Truck Parks

Table 1 shows the number of truck parks that have been detected and classified as targets; there are probably an equal number of undetected facilities. These support an estimated fleet of 400 to 600 trucks. The mean size, obtained by averaging the sizes of 10 typical truck areas on the RLAF target list, is 5.5×10^5 ft^2 with variations from 2×10^5 to 2×10^6 ft^2. The parks are located in wooded areas with moderate to heavy canopies to reduce detection and may be as far as one to three miles from the main road. The majority of the truck parks probably have minimal maintenance and POL facilities; several of the parks on the northern portion of 911, 12, and 23 around Mu Gia Pass have extensive maintenance and repair facilities. The usual truck park requires only a small track leading off the main road into a clump of trees. Under the canopy are open areas for parking. Apparently very few of the parks have bunkers or revetments.

The parks are detected by the tracks leading off the main roads into the woods. Bamboo trelliswork over the road can conceal the vehicle tracks and make detection more difficult.

Storage Areas

Table 1 shows the large number of storage areas the enemy has been known to possess. Figure 2 in Section III shows locations of the known areas; the gaps in the figure between the general groupings of supply areas probably indicate inability to find targets in the area rather than the absence of targets. An average storage area is 1.2×10^6 ft^2 (with variations from 9×10^4 to 3×10^6 ft^2) and contains a number of small single story wooden frame buildings about 8x12 ft to 20x30 ft, presumably for storage of goods easily damaged by the elements. Ammunition and other weather-resistant supplies are believed to be dispersed in the open throughout the area. The area may be used for the storage of transient supplies, or in the cases of those along the SVN border, as depots where supplies are stored until needed for battle. Medical supplies and ammunition are believed to be the principal stores coming from NVN headed for SVN. Food, locally grown and imported from Cambodia, SVN, and NVN, is stored for local consumption by the infiltrating troops and LOC personnel. Tunnels and caves have also been used for the storage of supplies; 25 cave suspected-storage areas have been detected.

Troop Areas

The enemy has a large number of way stations among his troop areas to support the flow of troops along the personnel infiltration routes; however, he is reported to use only 16-20 of them. The typical way station target area is 1.7×10^6 ft^2 with variations from 4×10^5 to 4×10^6 ft^2 and contains up to 20 small wooden buildings presumably for storage, and as many as 100 commo-liaison personnel who provide food and guidance for the 100 to 200 troops infiltrating daily. They may replenish their food stores with food portered into the way station or in some cases with food raised at the way station. The troops bivouac in the vicinity of the buildings but keep far enough

away for safety if the huts are attacked by air. They sleep at night under the canopy using a nylon sheet for protection. The way stations are approximately 8 to 25 miles apart corresponding to a one to three day march and serve as storage areas as well; they are mostly inaccessible by truck.

Defense Areas

Only a few structures remain at defensive positions, most having been either damaged or dismantled. The typical area of these targets is 2.6×10^5 ft^2 with variations from 4×10^4 to 3×10^6 ft^2 and they contain a few large, wooden, barracks-like structures; gun emplacements frequently surround the site.

Of approximately 400 to 500 AAA and AW gun positions in the Ho Chi Minh Trail region, perhaps only 75 to 100 are occupied at one time. There are also approximately 50 radar and communication facilities, as well as numerous trench systems and fences around the facilities for air defense and local defense.

Other Facilities

There are estimated to be a total of 30,000 or more porters, construction engineer troops, road maintenance, and LOC support facilities personnel along the trail. They require very few fixed facilities to support them, since they are either local villagers impressed by the NVA, in which case they can live at home or they are outsiders who are either accommodated by the village or who camp out. They do require supply facilities but it is believed that these are represented at least in part by the facilities listed in Table 1.

VI. OPERATION OF THE SUPPLY SYSTEM

A. GENERAL

Administrative control and maintenance responsibility for both infiltration routes and roads are in North Vietnamese hands who have the greater interest in maintaining their LOCs to SVN. The Pathet Lao in the panhandle may help but are mainly concerned with containing the Royalists.

Truck cargoes include food (rice, dried meat and fish), medical supplies, clothing, ammunition, demolitions, and gasoline (mostly in 55-gallon drums but recently POL truck tankers were introduced), however, relative proportions are unknown. Southbound trucks usually have canvas covers over the cargo and are camouflaged with foliage. Since late January 1966 isolated reports have occurred of troop movement southward by truck (25-30 troops/truck) on 911/91.

Trucks headed north are either empty or loaded with timber (for construction lumber, wood pulp or for corduroying), bamboo, and salvage items such as worn tires, empty gasoline drums, etc. Recent reports have indicated that troops also have been carried north by truck. These might be reinforcements for Mahaxay, troop rotations back to NVN, or wounded.

Material brought up the Sihanouk Trail (Route 110) from Cambodia by truck and bicycle is believed to consist of subsistence items such as rice, dried fish, and clothing. Flow of military materiel down Route 110 into Cambodia has also been indicated.

Truck shipment into Laos from NVN was estimated at an average of 25 to 35 trucks per day over the 1965-1966 dry season. With loads of three tons, this comes to 70 to 100 tons per day. The roads are being used only to a fraction of their rated daily capacity (300 to 400 tons per day) during the dry season. Road improvements have increased wet-season truckability to the point where, on the average, 50 tons/day are estimated to be truckable as far south as Cambodia. This wet-season road capacity is not far below the present dry season flow rate, and represents considerable achievement.

Truck convoys are probably split-loaded, containing supplies for both the PL/NVA in Laos as well as for Communist forces in SVN. The fraction split-off for Laos is not known, but is estimated at one-third to two-thirds of the total throughput. The estimate of trucking into Laos is made possible by road-watch teams in the area between Routes 12 and 9. It is much more difficult to estimate the residual amount entering SVN without any more local ground observation capability.

Estimation of supply movement over the waterways is more difficult than for trucking estimates, since it is hard to keep track of the numerous watercraft and difficult to distinguish normal commerce from military support. In general, the waterways are not properly oriented, are only sectionally usable, and are considered to only supplement the road net.

Daily dry-season shipments into the Laotian panhandle were estimated at 17 trucks (30 to 50 tons) in 1964-1965 and 25 to 35 trucks (70 to 100 tons) during 1965-1966. Despite the aerial interdiction campaign in Laos, truck shipment has doubled.

The principal enemy reaction to the interdiction campaign has been to shift to night movement, primarily in convoy. It is believed that over 90 percent of all truck traffic moves at

night, between 1700 and 0600 hours, for 10-12 hours travel per 24 hours. Movement at dawn might consist of stragglers headed for truck parks. Daytime movement is thought to be conducted for local or administrative transportation, high priority supplies, or for general operations in areas protected by tall trees from aerial detection. Convoy average speeds in Laos are estimated to have been reduced from the previous 15 to 20 mph to 5 to 8 mph with largely night operation. This is a nominal figure since some stretches of road may permit speeds up to 12 to 20 mph. For example, dust on foliage along Route 911 indicates rapid movement in some areas. Winding roads generally forbid higher speeds with poor illumination. The reduction in average speed is due partly to night operation with restricted use of vehicle lights and partly to delays incurred in rest stops and in waiting, sometimes up to a day, for repair of road interdictions.

Trucks can nominally go 50 to 80 miles in a single night. The distance from Vinh to Tchepone via Route 23 is 230 miles and would require at least four nights travel time. The 85 miles from Mu Gia Pass to Tchepone via Route 911, a new road in good condition, would require one or two nights. High priority supplies could traverse the 240- to 300-mile nominal distances from the Mu Gia Pass to supply depots along 922 or 165 in four to six nights. Normally cargo would be offloaded along the way, but no estimate is feasible for the delays incurred.

B. MODES OF TRUCK MOVEMENT

It seems highly probable that a large portion of the supplies are carried by trucks operating in recurring shuttles. Increased widespread interdiction effort would force operations toward this mode to minimize loss of forward movement during road repairs. The distribution of supply areas has been taken as evidence of extensive shuttle operations.

Several supply areas, each spread for about 20 miles along the MSR, have been located. These are shown in Figure 2. Supply areas are separated by a nominal distance of 10-20 miles and supplies are widely dispersed within each area.

Movement of trucks is believed to occur as follows: truck convoys take supplies from one area to the next, 30 to 50 miles distant. A one-way trip per night is possible for longer hauls, one or two round trips per night for shorter hauls, or a convoy might move supplies past the adjacent supply area to the next one. Due to loading delays, offloading, and shuttling over short distances forced by delays due to road interdiction, the shuttling operations would not be entirely routine. The supply system would operate like a series of catch-basins, with supply depots further north filling requests of those further south. Such operation is like a warehouse system, not a continuous flow.

The advantages to the enemy of a short-haul shuttle system operating over definite links, as opposed to through-trucking, include the following:

- Greater driver familiarity with the road.
- Simpler scheduling.
- Flexibility of operation, such as in having trucks available to exploit periods of poor flying weather.
- Reduced delays from interdicted road segments by offloading at the nearest cache and shuttling over a shorter distance.

High priority supplies can move south faster by being offloaded at one supply area directly onto other trucks which carry them on the next leg of their journey south. Staples might remain at a supply depot for some days before continuing south. This, along with the reported occasional use of trucks to carry NVA troops south, may indicate that the requirements for supplies are not urgent. Delays of a few days might be tolerated in the event of road repairs. Also, a cut link

further north may not hinder operation of the catch-basin further south. Trucks on the more southern links can continue shuttling until stockpiled reserves are used up. Thus the effectiveness of a temporary cut on one link may be (a) difficult to deduce from the activity further south and (b) nonexistent if the cut is repaired before stockpiles further south are depleted.

A small penalty is paid by the enemy for link-shuttling instead of through-trucking in lost time due to extra handling at the numerous transfer points. Consider a truck making one round trip per night -- five hours south, one hour of unloading, and five hours north -- for 11 hours of activity (loading can be done the next day while parked). Only one hour out of 11 has been lost to handling, when compared to through-trucking. Extra transfer points and storage depots may be required, but these would be part of the enemy's attempts at dispersal.

Large concentrations of more than 100 trucks have occasionally been observed moving down the panhandle. The southward progression of such a mass of trucks is usually extremely slow, at most five miles per day, perhaps due to interdiction efforts. Such concentrated truck movements might be associated with major military unit movements.

C. SIZE OF TRUCK FLEET

With a flow rate of 25 to 35 trucks/day along the MSR, each of the six or seven supply areas must have 50 to 100 trucks assigned to it (for a one-way trip per day). This leads to an estimated truck fleet in southern Laos of 400 to 600 trucks,[1]

[1] An alternate calculation leading to the same estimate of fleet size proceeds as follows. With 90 tons/day traveling to a nominal distance of 240 miles, the throughput is (90)(240) = 21,600 ton-miles/day. Each truck can carry three tons for 50 miles per night, implying a capacity of (3)(50)/2 = 75 ton-miles per truck-night (dividing by two for the empty return trip). The required number of trucks is 21,600/75 = 288. The Truck utilization is estimated at two-thirds so that, upon adding another 50 percent, the required truck fleet is 432.

where the higher figure includes the observed large concentrations.

The NVN fleet was estimated at 6000 trucks in 1962. NVN has no truck-manufacturing capability but is estimated to have imported 7700 trucks between 1962 and May 1966. With 2000 trucks retired, the fleet is 11,700. With nearly 2000 trucks destroyed in Laos and NVN through May 1966, the estimated Communist fleet is over 9000,[1] of which 500 have been assigned to the Laotian panhandle.

With an evaluated destruction[2] of 1196 trucks in Laos, mostly in the panhandle, from 1 January 1966 through May, this means that the Laotian fleet has turned over completely every month and a half. (Drastic downturn in destruction recorded by the end of June due to worsening weather conditions and reduced sightings.) The North Vietnamese have apparently used imports and reserves to replenish losses in Laos. This rapid turnover, 10 percent of the entire NVN fleet during the first five months of 1966, is putting a strain on NVN and adding administrative problems to the logistic control in Laos. Truck destruction has been running about 50 trucks/week in Laos (for 25 weeks from January-May, this is 1200 trucks). With a base of 500 trucks and an attrition of seven or eight trucks per 24-hour day, the attrition rate is about 1.5 percent per day. As long as NVN replenishes the eight trucks per day, a steady-state situation will prevail.

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[1] An additional transport vehicle inventory of approximately 2,000 is estimated to be an integral part of regular units of the NVA, giving a total NVN truck inventory of approximately 11,000.

[2] DIA evaluated destruction is 75 percent of pilot estimate of 1899 destroyed plus 25 percent of pilot estimate of 2250 damaged; it is intended to account for cannibalization and not pilot optimism.

D. MANPOWER

A large amount of manpower is associated with the logistic effort along the Ho Chi Minh Trail:

- With two drivers per truck plus backup, over a thousand drivers are present in addition to administrative/control personnel.
- An estimated four NVA engineer battalions (2000-3000 men) are involved in construction and improvement of the road net. Two battalions are located in the Route 911-23 area, two more along Routes 92 and 96. These may form the 152nd Engineer Regiment. Another regiment may possibly be located in Laos as well. These military personnel supervise construction and possibly serve as operators of construction equipment. They are not the main labor forces.
- An estimated 15,000 to 20,000 men are organized into labor units of probable battalion size. They are likely deployed by company elements which are assigned to small sections of roads with concentrations along the MSR reaching as much as 30 to 60 men per mile. These men are involved in road construction, road improvement and realignment, repair of interdiction efforts (crater fill-in, rebuilding timber bridges and fords), corduroying or camouflaging road sections, guarding supplies, loading and unloading supplies, local portering, and also for constructing and maintaining the LOC support facilities. Up to 2000 commo-liaison personnel are assigned to the personnel infiltration routes as guides and porters/bicycle transport units.

  These support and labor personnel are both indigenous (some paid, some impressed) and from NVN (including women). Some live in indigenous villages, many others bivouac in the open.
- Several thousand PL/NVA troops are present for static defense of the MSR from Royalist attacks. If needed, they are put to work on road repair along with conscripted Laotian villagers.
- Six thousand to 10,000 VC laborers are available for cross-border portering or portaging (bicycle, cart) from the caches at the termini of the lateral routes inside Laos. This portering is over a distance of at most 50 miles, to base areas inside SVN and is adequate to move all supplies estimated to be entering SVN over the network.[1] From these

[1] With porter loads of 50 pounds and speeds of 10 miles per day, capacity is (dividing by two for the empty return trip) (50)(10)/2 = 250 pound-miles/man-day = 0.125 ton-miles/man-day. A force of 10,000 porters can move, over a distance of say 40 miles, a quantity (10,000)(0.125)/40 = 31 tons/day.

base areas, supplies move within SVN to staging and assembly areas in preparation for NVA/VC attacks.

E. PIPELINE CAPACITY

It is difficult to estimate the pipeline capacity of the HCMT and output to SVN because of lack of knowledge about the number of supply caches and tapoffs to the Communist forces in Laos. By making reasonable assumptions about these last two factors, USARPAC has arrived at estimates of the first two quantities.

According to Ref. (3), 7500 short tons of supplies were trucked into the Laotian panhandle during the 1964-1965 dry season.[1] Allowing a split-off of 4000 tons for 8000 PL/NVA in food-scarce southern Laos and a small split-off of 500 tons for road-improvement coolies and infiltrators, this leaves as much as 3000 tons of supplies going into SVN during 1965. A similar calculation in Ref. (5) estimates that 7 to 14 tons per day of supplies above corridor requirements were trucked into Laos during the 1964-1965 dry season. This comes to 1250 to 2500 tons available for movement into SVN during the 1964-65 dry season (December to May).

A USARPAC analysis[2] estimated Communist stockpiling possibilities for a major thrust into Southeast Asia. With supplies averaging 88 cubic feet per ton, a "small" cache of 20 tons might be 6'x15'x20' while a "large" cache of 100 tons might be 8'x30'x40'. These amounts can be concealed in a small grove of trees.

While denser concentrations may be possible, a stockpiling capability of 100 tons per mile is taken as reasonable. This

[1] Seventeen trucks/day for a 180-day dry season at two and one-half tons/truck.

[2] This analysis is summarized in PACOMWID 52-65, 24 December 1965.

might be one 100-ton cache every mile without excessive track activity. While not every mile of road would be used, some road sections have greater capabilities for concealment than others.

A stockpiling capability of 100 tons per mile indicates that the 250 miles of road between Mu Gia Pass and Saravane could potentially hold 25,000 tons. This is far in excess of the storage ability needed for 7500 tons per year entering the MSR. No information is currently available on the number, size, and distribution of individual supply caches, or the average length of storage of stores in each supply area along its path.

One of the most important missing pieces of information is the amount of stockpiled supplies, since large reserves (say several weeks) will permit the lower parts of the system to operate properly despite an erratic delivery pattern from further north. Large stockpiles would also tend to reduce the effects of an interdiction campaign. Interdiction during the dry season progressively reduces capability for stockpiling or replenishment of the stockpile.

F. AERIAL TRUCK SIGHTINGS

Table 2 contains a count of the vehicles sighted in southern Laos from the air. The dropoff in traffic in June is due to the reduced use of the roads during the rainy season and limited observation. Routes 912 and 914 were opened during the spring and so do not have sightings during the winter months.

Table 2. AERIAL TRUCK SIGHTINGS IN SOUTHERN LAOS BY ROUTE

Route Number	4 August - 29 Dec. 1965	1966 January	February	March	April	May	June	Cumulative Totals
8	60-73	64-87	47-59	13-17	26-28		2-4	212-268
9	8	58-70	202-224	220-282	44-57	35-43	12-14	579-698
12	234-289	97-125	5-7	27-31	5-7	4-6		372-465
23	3"-52	36-56	14-16	33-37	44-54	55-67	17-19	236-301
91	7	3	5-7	12-20	34-44	10-12	20-22	91-115
92	12	53-57	74-88	382-479	541-633	344-417	119-134	1525-1820
96	6	71-77	164-197	63-73	232-279	54-60	21-27	611-719
911	4	16-17	13-17	54-72	178-222	155-173	157-173	577-690
912	N/A				19-27	25-31	23-25	67-83
914	N/A			35-49	57-61	43-53	8	143-171
923	37-42	64-80	11-20	5-7	7	4	1	129-161
Other	69-71	76-91	67-87	127-173	133-149	111-135	150-170	733-876
Total	474-564	538-663	602-724	971-1240	1320-1568	840-1001	530-609	5275-6367

VII. TRUCK DESCRIPTION AND CONVOY DISCIPLINE

A. TRUCKS

An extensive list of the vast assortment of trucks used on the HCMT is contained in Table 3. Included are tankers that have been reported in the Laotian panhandle.

The use of 28 types of trucks from seven Communist nations has led to a spare parts problem. Cannibalization is common, and damaged trucks are quickly stripped and pulled off the road. The most common truck[1] is the 2-ton 4x4 Gaz-63.[2] Another seen regularly is the 4-ton Maz-200. Large trucks observed less frequently are the ZIL-131, ZIL-157, YAAZ-210, YAAZ-214 and the Polish STAR-66 4-ton 6x6 diesel. New vehicles of the last type have been recently observed on Route 911. While the larger trucks may have 6-ton load capacities, three or four tons is thought a more likely load due to the terrain.

Most of the cargo trucks for military logistic support in Laos are green and have green tarpaulins. Many are also garnished with foliage and vegetation, breaking up the outline and further decreasing the chance of detection.

The nominal load is taken as three tons/truck. The increase from the 2-1/2 tons/truck estimate during 1964-1965 is due to the introduction of 6x6 cross-country trucks and to improvement of the road net.

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[1] PACOMWID 11-66, 25 March 1966, and 12-66, 1 April 1966.

[2] An i by j vehicle has i wheels and j driving wheels. For example, a passenger car is a 4x2.

Table 3. TRUCK TRANSPORTS IN NORTH VIETNAM INVENTORY

Country of Origin	Designation	Type	Drive	Normal Highway Capacity (Tons)[a]	Type Fuel[b]
USSR	Gaz-51	Cargo	4x2	2.5	Gas
USSR	Gaz-63	Cargo	4x4	2	Gas
USSR	Laz-690	Crane Truck	4x2	3	Gas
USSR	Kraz-214	Cargo	6x6	7	Diesel
USSR	Kraz-219 (210)	Cargo	6x4	10-12	Diesel
USSR	Kraz-222	Dump Truck	6x4	10	Diesel
USSR	Maz-200	Cargo	4x2	7	Diesel
USSR	Maz-205	Dump Truck	4x2	5-6	Diesel
USSR	Maz-502	Cargo	4x4	4	Diesel
USSR	Maz-525	Dump Truck	4x2	25	Diesel
USSR	Uaz-450	Light Truck	4x4	.8	Gas
USSR	URAL-355M	Cargo	4x2	3.5	Gas
USSR	ZIL-130	Cargo	4x2	4	Gas
USSR	ZIL-131	Cargo	6x6	3.5-5	Gas
USSR	ZIL-157	Cargo	6x6	2.5-4.5	Gas
USSR	ZIL-164	Cargo	4x2	4	Gas
USSR	ZIL-150	Cargo	4x2	4	Gas
USSR	ZIS-5	Tanker			
USSR	ASTM4-150	Tanker	4x4	1000 gal.	Gas
Czechoslovakia	V3S	Cargo	6x6	3.5-6	Diesel
Czechoslovakia	TATRA-138	Cargo	6x6	12	Diesel
Hungary	D-450	Cargo	4x2	4.5	Diesel
Poland	STAR-27	Cargo	4x2	6	Diesel
Poland	STAR-66	Cargo	6x6	4	Diesel
Rumania	SR-131	Cargo	4x2	3	Gas
Rumania	SR-132	Cargo	4x4	2.3	Gas
East Germany	W-50L	Cargo	4x2	3.5	Diesel
Comm. China	Liberator	(Similar to ZIL-150)			

[a] Capacity figures given here are for normal movement over standard roads and would have to be reduced for roads on the Ho Chi Minh Trail. For example, the Polish STAR-66 is estimated to carry 2.5 tons plus in the Laotian environment.

[b] The truck fleet is predominantly gasoline-powered at present. It is significant to note an increased emphasis on diesel-powered equipment with projected sizeable imports for 1966 of the East German W-50L and Polish STAR-27 models.

B. CONVOY DISCIPLINE

Trucks travel largely in convoys averaging about 10 trucks/convoy. Convoy sizes are usually not greater than 50 for control and safety. Some convoys reportedly are accompanied by unidentified maintenance vehicles. Infrequently, as many as 100 trucks/night will pass a given point. Trucks are reported to have small bicycle-type lights mounted under the bumpers, and they attempt to maintain about 30- to 100-meter spacing.

Trucks usually have two drivers with the alternate serving as lookout for aircraft or convoy signals.

Truck parks and transfer points are usually displaced up to 5 km from the main road, often in wooded areas with extensive canopy. In normal halts, vehicles are widely dispersed into well-concealed groups of three or four.

Although no antennas or electronic devices have been reported mounted on trucks, use of radio to alert truck drivers of impending air attack is suspected. This is an inference based on overhearing radio traffic in a STAR-66 (radio is not integral to truck) and on sightings in which the whole convoy pulled off the road simultaneously.

All vehicles halt immediately upon signal of special anti-air monitors when aircraft approach. When any of numerous turnouts are available, the convoy is often scattered off the main route and halted for as long as an hour even if the aircraft promptly leave the area.

Recent reports[1] frequently indicate the use of armored car escorts for truck convoys in the Laotian panhandle. One observation was of at least 14 BTR-40 armored cars used almost nightly on Route 911. These had mounted ZPU-2 dual 14.5mm AA machine guns.

[1] PACOMWID 1[illegible]-66, 25 March 1966.

Potential congestion at ferry crossings is apparently controlled by a priority system with convoys escorted across in small groups from truck parks deployed on both sides of the ferry point.

VIII. GENERAL REFERENCES

(1) CIA Memorandum No. 3907/65, Directorate of Intelligence. SECRET, Communist Road Development in Laos, 9 December 1965.

(2) Infiltration and Logistic Study (U), USARPAC, Special Report No. 451, 15 November 1965, SECRET.

(3) USARPAC Intelligence Bulletin (U), January 1966, SECRET.

(4) Southeast Asia Route Survey (U), DIAAP-1-345-1-5-66-INT, March 1966, SECRET.

(5) United States Intelligence Board Memorandum, USIB-D-24.7/4A, Infiltration and Logistics - South Vietnam, 28 October 1965, SECRET.

Appendix A

FLYING WEATHER AND SURFACE TRACTIONABILITY IN THE LAOTIAN PANHANDLE

CONTENTS

FLYING WEATHER AND SURFACE TRACTIONABILITY IN THE LAOTIAN PANHANDLE

GENERAL

The climate of Southeast Asia is monsoonal in nature.[1] It is characterized by two major seasons - the southwest monsoon from mid-May to late September and the northeast monsoon from early November to mid-March. These two major seasons are separated by two short transitional periods - the spring transition from mid-March to mid-May and the autumn transition from late September to early November.

The term "monsoon" refers to the pronounced annual variation in the wind circulation over this part of the world. The names of the major seasons are derived from the prevailing wind direction observed during the particular season. The trajectory of the wind over the adjacent oceans and the north-south orientation of the Annam Mountain range, whose ridge line in general lies along the Vietnam-Laos border determine the character of the weather during each season.

In the Laotian panhandle the southwest monsoon is the period of heavy and frequent precipitation, high humidity, maximum cloudiness, and most adverse flying weather. During the northeast monsoon there is relatively little precipitation, lower humidity, less cloudiness, and the best flying weather.

FLYING WEATHER

Tables A1 through A4 give the percent frequency of having the ceiling, visibility, and ceiling-visibility combination

[1] Material in this appendix was prepared by the USAF Environmental Technical Application Center (ETAC) in June 1966.

equal to or greater than the values specified in the tables. Table A1 is based on observations made in January, but is indicative of the conditions which prevail during the northeast monsoon. Table A2, based on April, is valid during the spring transition period. Table A3, based on July, is typical of the southwest monsoon season; while Table A4, based on October, applies to the autumn transition period.[1]

The meteorological records of the weather stations in the highlands of the Laotian panhandle and adjacent South Vietnam have only daylight observations. Of the stations considered, only Pleiku had a satisfactory period of three-hourly observations throughout the daylight hours, the others were limited to 0700 and 1300 LST. The evening and nighttime frequencies given in the tables are subjective estimates based on a qualitative evaluation of the diurnal variations of ceiling and visibility.

The following statement is quoted from "Climate of Republic of Vietnam," First Weather Wing Special Study 105-3, April 1965:

> "Diurnally, in all seasons, the best air-to-ground visibilities occur between 0800 and 1000 LST, after any ground fog and haze present has burned off and prior to the growth of afternoon cumulus. After 1000 LST and until 1700 LST, convective activity leads to low level cloud formation and a resultant interference or decrease in slant visibility. In consequence, the poorest slant visibilities are found during mid-afternoon in the southwest monsoon, particularly in and around rainshowers. After 1700 LST and until complete darkness slant visibility again improves slightly as low level clouds begin to dissipate."

The percent frequency of combined ceiling and visibility were determined by use of Figure A1 which was derived by graphical regression from the data used in this study. This graph is valid only for the stations used in this study.

Summaries showing the duration of ceiling less than 5000 feet and/or less than six miles were available for Pleiku,

[1] Tables A1 through A6 are on Pgs 62-67.

South Vietnam and Seno, Laos. The results presented in the summaries are pessimistic in that whenever an observation was missing, the ceiling and/or visibility was assumed to be below 5000 feet and/or five miles and the run was continued. The longest run observed was 16 consecutive hours of below 5000 feet and/or five miles. Based on these summaries it can be concluded that at least once in 24 hours the ceiling and visibility can be expected to be at least 5000 feet and six miles over a single location in the Laotian panhandle.

TRACTIONABILITY

Figures 2 through 13 present the climatological mean tractionability by month. The tractionability of an unimproved surface is determined by four characteristics of the surface: the bearing capacity, shearing strength, surface friction coefficient, and stickiness. This report does not go into the details of these four characteristics, but presents the results in general terms of the ability of men and machines to move over the surface.

The state of the ground is primarily a function of the soil type and the soil moisture content. The soil type must be determined by the user in terms of a plastic soil and nonplastic soil. When a soil mixture is largely sand with only minute amounts of clay the soil is termed nonplastic. When the amount of clay in the soil exceeds 15 percent then the soil is considered to be a plastic soil. The figures have considered only the moisture content within the soil mixture.

Listed below are the effects of tractionability which may be expected from each tractionability class shown on the figures:

- DD (Very Dry) - All parts of the relief with plastic soils, except swampy areas, are sufficiently hard and firm to support vehicles and transport of all kinds. When the soil moisture remains in this class for extended periods, heavy

traffic may grind the surface to fine dust. The tractionability in sandy soils is very poor except in depressions where some moisture may have accumulated.

- D (Dry) - Plastic soils tend to soften somewhat but not enough to impede movement of even the heaviest equipment. No appreciable improvement is noted in the tractionability of sandy soils except immediately after heavy showers. The surface of plastic soils becomes definitely slippery during and just after such showers.
- M (Moist) - The soil becomes softer and offers considerable difficulty for heavy wheeled vehicles. Track-laying vehicles have no trouble except under heavy showers when the surface is muddy and slippery. Tractionability of sands and other nonplastic soils is good and continues to improve with additional moisture.
- MM (Very Moist) - Traffic of practically every kind is extremely difficult on bare soil, but men and light animal-drawn vehicles can travel over grassed areas without too much difficulty until the surface is cut up. The tractionability of sands and nonplastic sandy soils are excellent.
- W (Wet) - Free water begins to appear on or near the ground surface. Power-driven transport is nearly impossible on plastic soils. The tractionability of most sandy soils remains fair, although sands with certain grain sizes exhibit quicksand characteristics.

The subject of tractionability is discussed in more detail in Air Force Surveys in Geophysics No. 94, "Estimating Soil Moisture and Tractionability Conditions for Strategic Planning," March 1958.

CONCLUSIONS

This appendix, drawing upon all available data on hand at ETAC, provides an insight into the environmental problems which exist in the highland area of the Laotian panhandle. Because of the rugged terrain in the area of concern, local situations may not be adequately described by this report. The estimated evening and nighttime frequencies may be used until such time as sufficient weather information and/or operating experience is obtained to warrant an objective evaluation of these frequencies.

Table A1. PERCENT FREQUENCY OF SPECIFIED CEILINGS AND VISIBILITIES DURING JANUARY

Station (time -LST)	Ceiling (feet) ≥ 8000	≥ 5000	≥ 3000	Visibility (miles) ≥ 6	≥ 3	≥ 8000 and ≥ 6	≥ 5000 and ≥ 6	≥ 3000 and ≥ 3
Nape, Laos								
[a]01	80	90	95	100	100	80	90	95
07	61	62	62	54	60	36	37	40
13	77	79	88	94	99	73	74	88
[a]19	80	85	95	99	100	80	85	95
Sepone, Laos								
[a]01	75	75	80	100	100	75	75	80
07	71	71	74	70	75	49	49	69
13	57	57	73	79	98	52	52	72
[a]19	60	60	80	90	100	58	58	80
Seravane, Laos								
07	97	98	100	100	100	97	98	100
Dak To South Vietnam								
[a]01	95	98	100	98	100	94	97	100
07	95	95	98	94	98	89	89	97
13	91	91	95	100	100	91	91	94
[a]19	91	93	98	100	100	91	93	98
Pleiku, South Vietnam								
[a]01	80	90	100	90	100	74	82	100
07	81	83	90	56	80	47	48	73
10	81	81	84	98	100	79	79	84
13	55	55	61	98	100	55	55	60
16	58	60	78	100	100	58	60	78
[a]19	61	75	90	100	100	61	75	90

[a]Estimate - see text

Table A2. PERCENT FREQUENCY OF SPECIFIED CEILINGS AND VISIBILITIES DURING APRIL

Station (time -LST)	Ceiling (feet) ≥ 8000	≥ 5000	≥ 3000	Visibility (miles) ≥ 6	≥ 3	≥ 8000 and ≥ 6	≥ 5000 and ≥ 6	≥ 3000 and ≥ 3
Nape, Laos								
[a]01	75	85	90	100	100	75	85	90
07	54	55	59	65	73	41	42	48
13	51	52	72	98	99	49	50	71
19	65	70	85	100	100	65	70	85
Sepone, Laos								
[a]01	65	65	70	95	100	62	62	70
07	65	65	65	69	86	54	54	60
13	59	59	60	95	100	57	57	60
[a]19	65	65	70	95	100	62	62	70
Seravane, Laos								
07	83	85	90	90	95	77	79	84
Dak To, South Vietnam								
[a]01	93	95	97	95	98	90	92	96
07	71	74	83	78	80	59	62	67
13	93	93	93	100	100	93	93	93
[a]19	90	93	95	100	100	90	95	95
Pleiku, South Vietnam								
[a]01	80	90	95	70	95	58	64	91
07	67	70	73	47	76	33	34	60
10	58	62	64	51	89	28	32	57
13	46	46	46	68	97	23	23	43
16	77	77	77	48	89	36	36	70
[a]19	80	80	85	50	90	43	43	79

[a]Estimated - see text

Table A3. PERCENT FREQUENCY OF SPECIFIED CEILINGS AND VISIBILITIES DURING JULY

Station (time -LST)	Ceiling (feet) ≥ 8000	≥ 5000	≥ 3000	Visibility (miles) ≥ 6	≥ 3	≥ 8000 and ≥ 6	≥ 5000 and ≥ 6	≥ 3000 and ≥ 3
Nape, Laos								
[a]01	70	73	85	100	100	70	73	85
07	22	23	26	54	79	19	19	21
13	14	14	22	88	96	14	14	20
[a]19	70	70	75	95	100	68	68	75
Sepone, Laos								
[a]01	25	25	25	95	100	24	24	25
07	11	11	11	56	81	7	7	7
13	9	9	9	88	97	9	9	9
[a]19	25	25	25	95	100	24	24	25
Seravane, Laos								
07	46	48	51	54	91	32	34	48
Dak To, South Vietnam								
[a]01	80	87	90	95	100	77	85	90
07	29	33	51	77	88	20	20	45
13	73	75	77	93	98	67	69	75
[a]19	80	80	85	95	100	77	77	85
Pleiku, South Vietnam								
[a]01	80	80	85	50	70	43	43	62
07	10	15	18	17	26	2	3	8
10	18	18	18	47	65	16	16	16
13	33	33	33	75	91	31	31	33
16	65	65	65	66	86	55	55	62
[a]19	75	75	90	70	85	56	56	79

[a]Estimated - see text

Table A4. PERCENT FREQUENCY OF SPECIFIED CEILINGS AND VISIBILITIES DURING OCTOBER

Station (time -LST)	Ceiling (feet) ≥ 8000	≥ 5000	≥ 3000	Visibility (miles) ≥ 6	≥ 3	≥ 8000 and ≥ 6	≥ 5000 and ≥ 6	≥ 3000 and ≥ 3
Nape, Laos								
[a]01	79	75	90	100	100	70	75	90
07	45	45	47	62	72	35	35	37
13	50	50	62	92	96	50	50	62
[a]19	65	70	80	100	100	65	70	80
Sepone, Laos								
[a]01	50	50	60	100	100	50	50	60
07	43	43	43	73	78	37	39	38
13	42	42	48	96	97	40	40	47
[a]19	50	50	60	100	100	50	50	60
Seravane, Laos								
07	77	77	78	78	91	69	69	76
Dak To, South Vietnam								
[a]01	90	93	95	98	100	90	93	95
07	78	80	81	80	88	70	71	73
13	83	87	89	99	100	83	87	87
[a]19	86	88	90	100	100	86	88	90
Pleiku, South Vietnam								
[a]01	75	80	85	75	85	60	63	75
07	50	52	61	51	70	38	39	55
10	56	59	65	85	95	53	54	64
13	33	33	40	77	86	31	31	39
16	60	60	64	75	91	55	55	63
[a]19	75	75	80	75	95	60	62	76

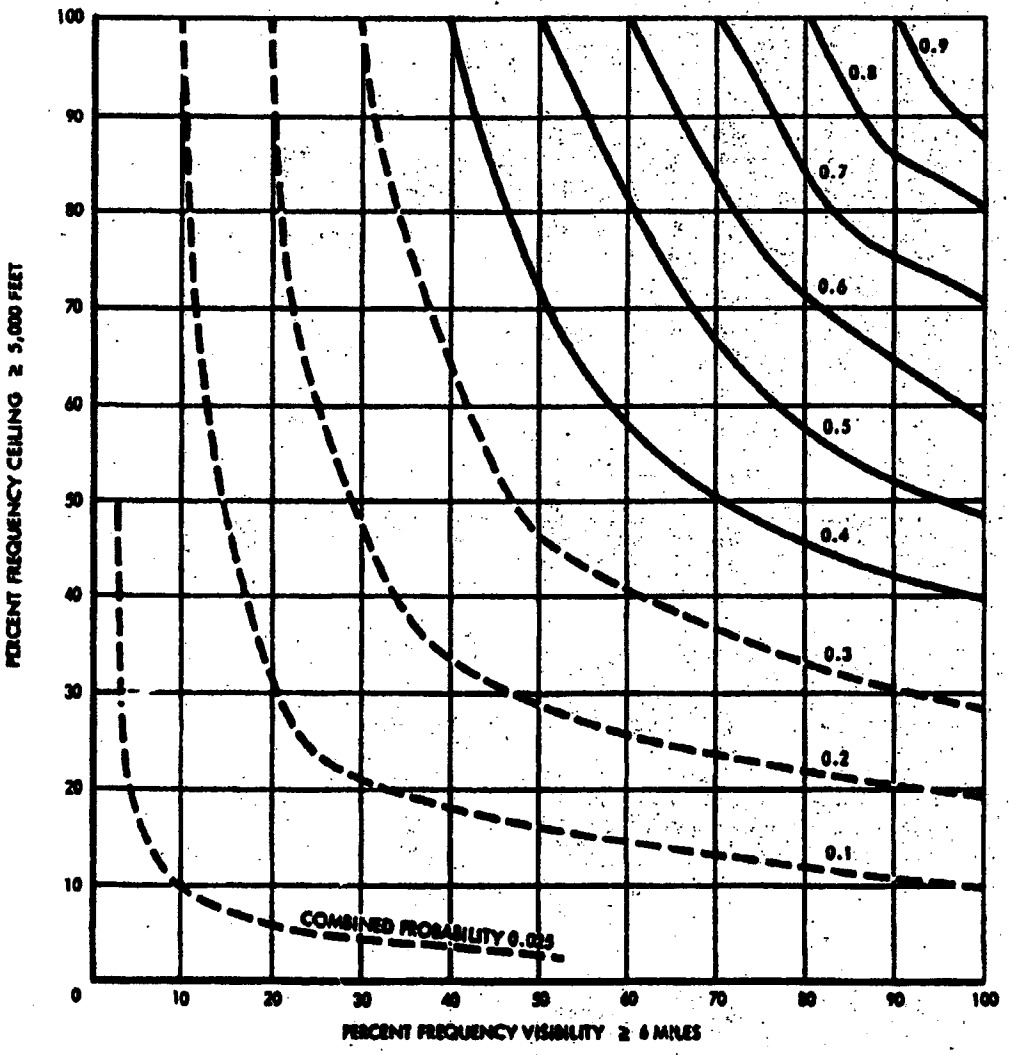
[a]Estimated - see text

Table A5. PERCENT FREQUENCY OF FAVORABLE TERMINAL FLYING WEATHER (CEILING/VISIBILITY)

Station Time (LST)	Ceiling ≥ 500' and Visibility ≥ 1 mi. Jan	Apr	Jul	Oct	Ceiling ≥ 1000' and Visibility ≥ 3 mi. Jan	Apr	Jul	Oct
Danang AB, South Vietnam								
0100	99	98	98	98	83	91	96	88
0700	96	95	99	96	80	85	99	85
1300	98	99	100	97	88	98	99	84
1900	99	99	99	97	88	96	98	88
Banmethuot, South Vietnam								
0700	97	98	92	93	82	92	85	90
1000	99	100	100	99	96	98	95	91
1300	100	100	98	98	95	99	92	92
1600	100	99	98	97	97	98	89	90
Nha-Trang, South Vietnam								
0100	100	100	99	99	96	98	99	97
0700	97	100	99	100	93	96	98	93
1300	99	99	100	99	97	99	99	96
1900	100	99	99	99	97	99	99	95
Tansonnhut AB, South Vietnam								
0100	100	100	100	99	100	99	98	96
0700	94	96	97	98	81	90	88	87
1300	99	99	98	99	99	98	96	96
1900	99	99	98	99	99	99	96	96

Table A6. PERCENT FREQUENCY OF FAVORABLE TERMINAL FLYING WEATHER (CEILING/VISIBILITY)

Station Time (LST)	Ceiling ≥500' and Visibility ≥ 1 mi.				Ceiling ≥ 1000' and Visibility ≥ 3 mi.			
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct
Udon, Thailand								
0100	91	92	97	97	40	44	90	83
0700	36	72	97	89	11	25	82	56
1300	98	95	98	97	85	76	93	93
1900	98	91	97	99	75	62	91	95
Ubon Ratchathani, Thailand								
0700	92	94	97	97	81	83	92	96
1000	100	100	98	100	100	98	97	96
1300	100	99	99	98	100	95	96	97
1600	100	100	99	98	99	99	97	94
Korat AB, Thailand								
00-05	100	100	100	99	100	100	100	98
06-11	100	99	99	98	99	98	98	87
12-17	100	99	100	99	100	98	99	94
18-23	100	100	100	99	100	98	99	97
Don Muang, Thailand								
00-05	98	99	99	99	95	99	99	97
06-11	95	100	99	99	75	98	98	95
12-17	100	99	99	99	99	99	98	97
18-23	100	100	99	99	99	100	98	97



7-11-66-6

FIGURE A-1. Combined Visibility and Ceiling for Specified Stations

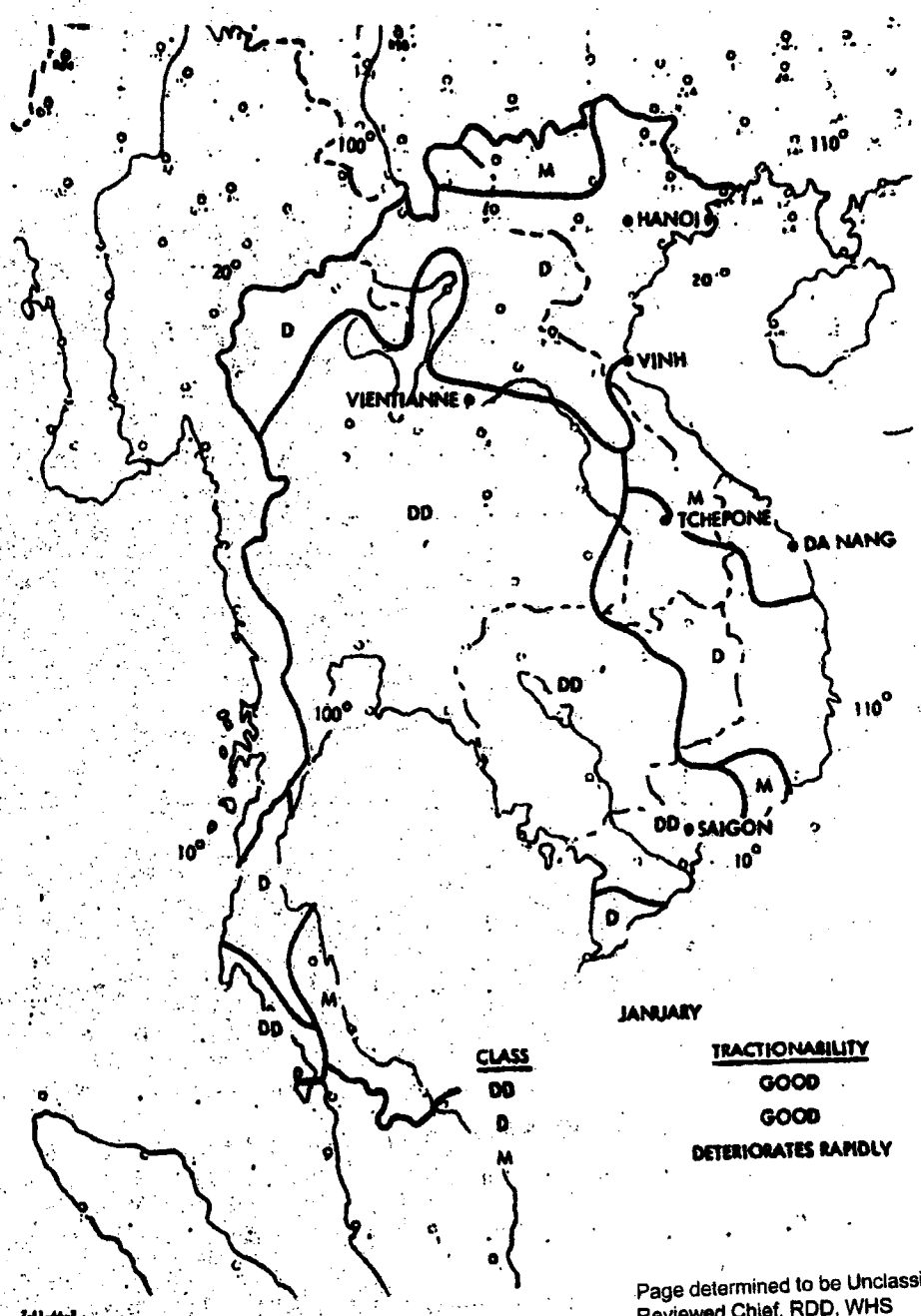


FIGURE A-2.

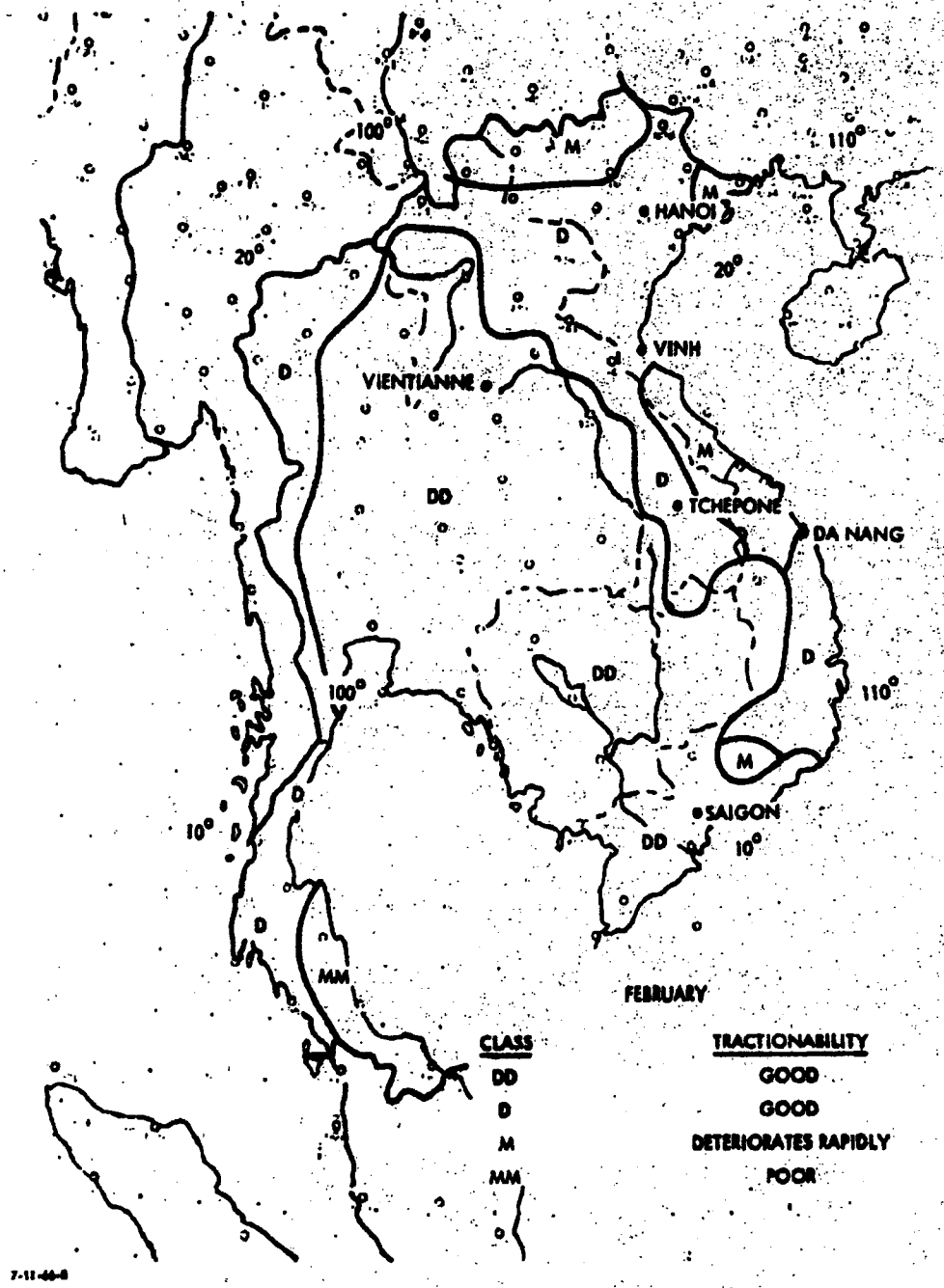


FIGURE A-3.

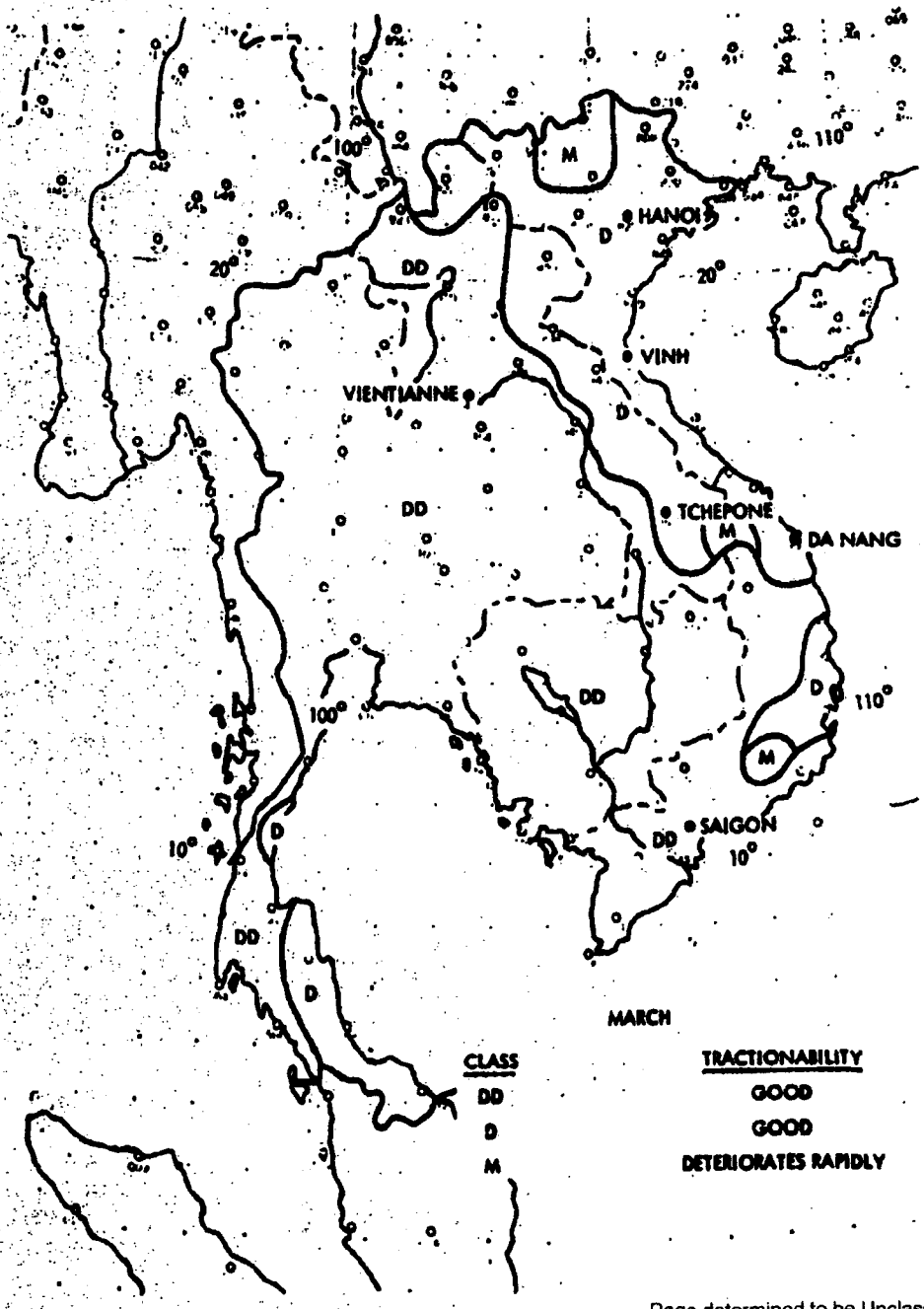


FIGURE A-4.

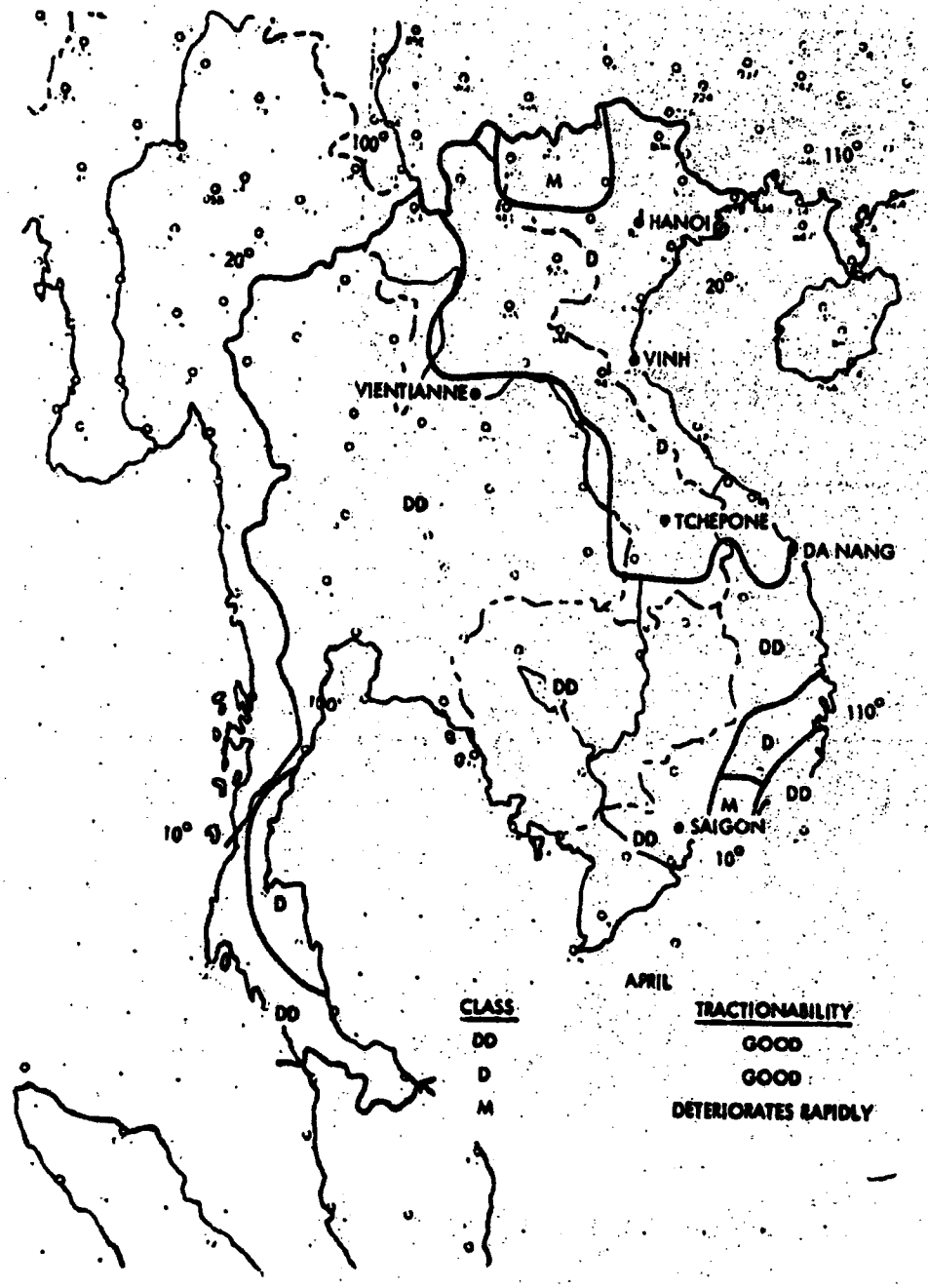


FIGURE A-5.

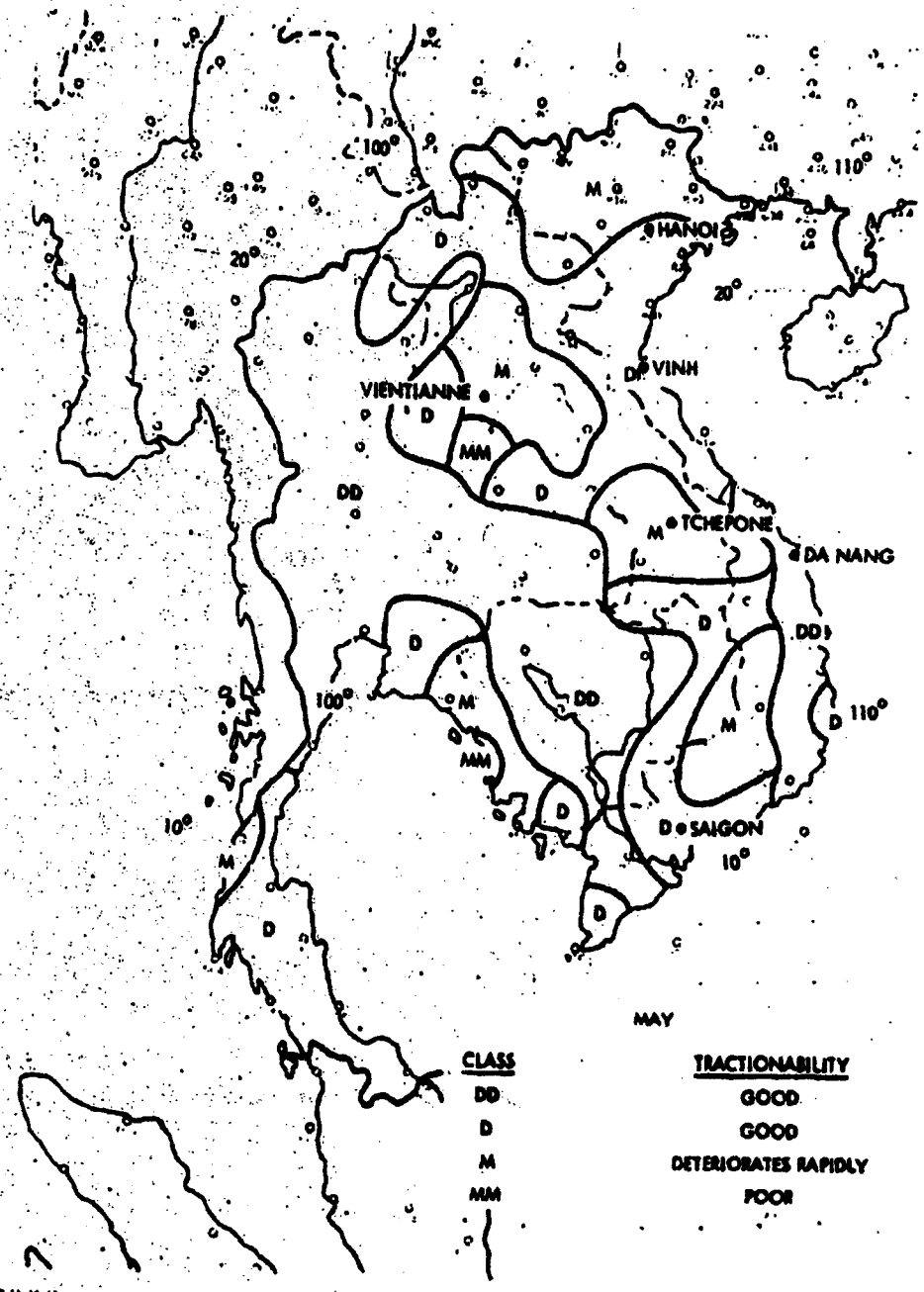


FIGURE A-6.

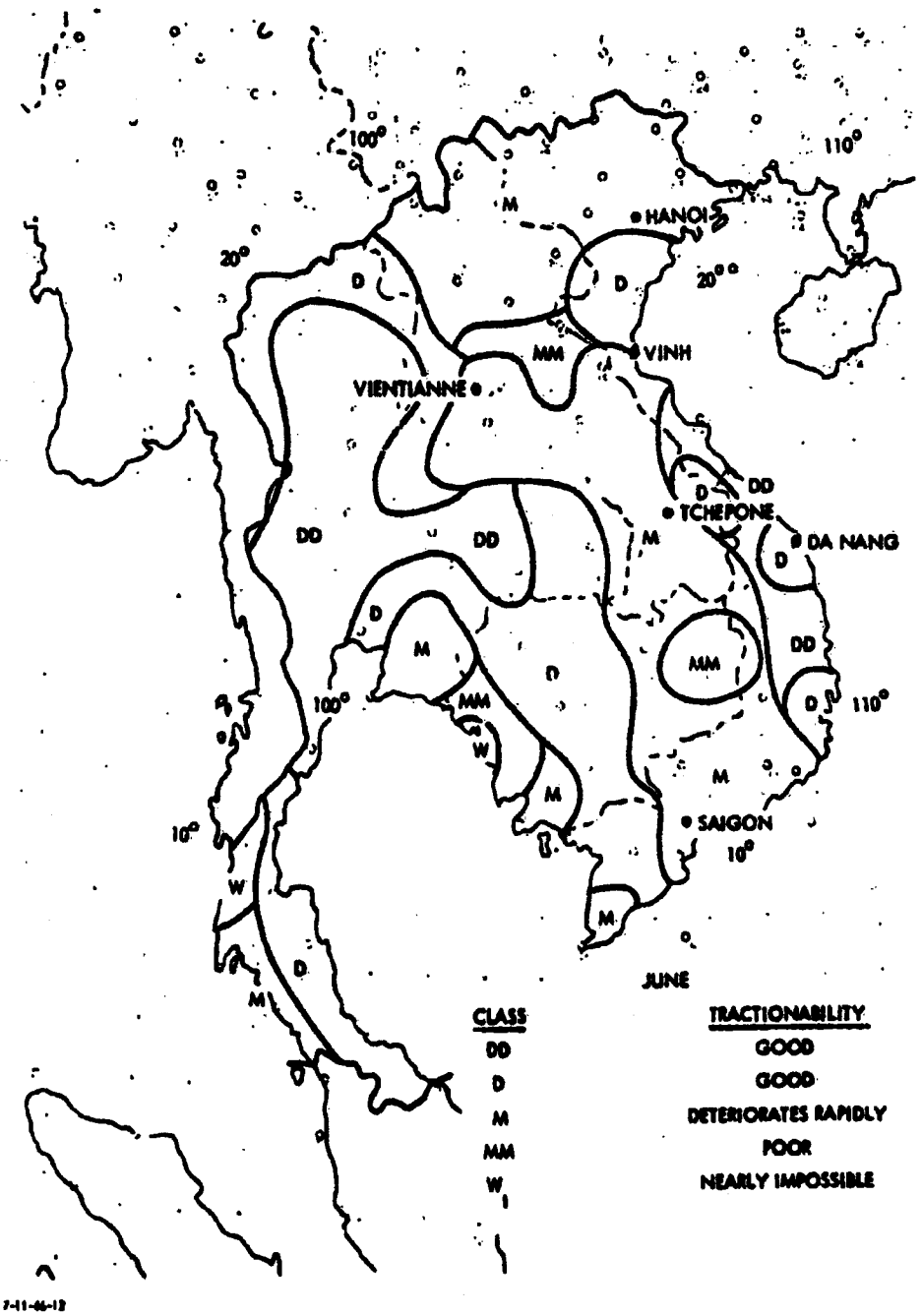
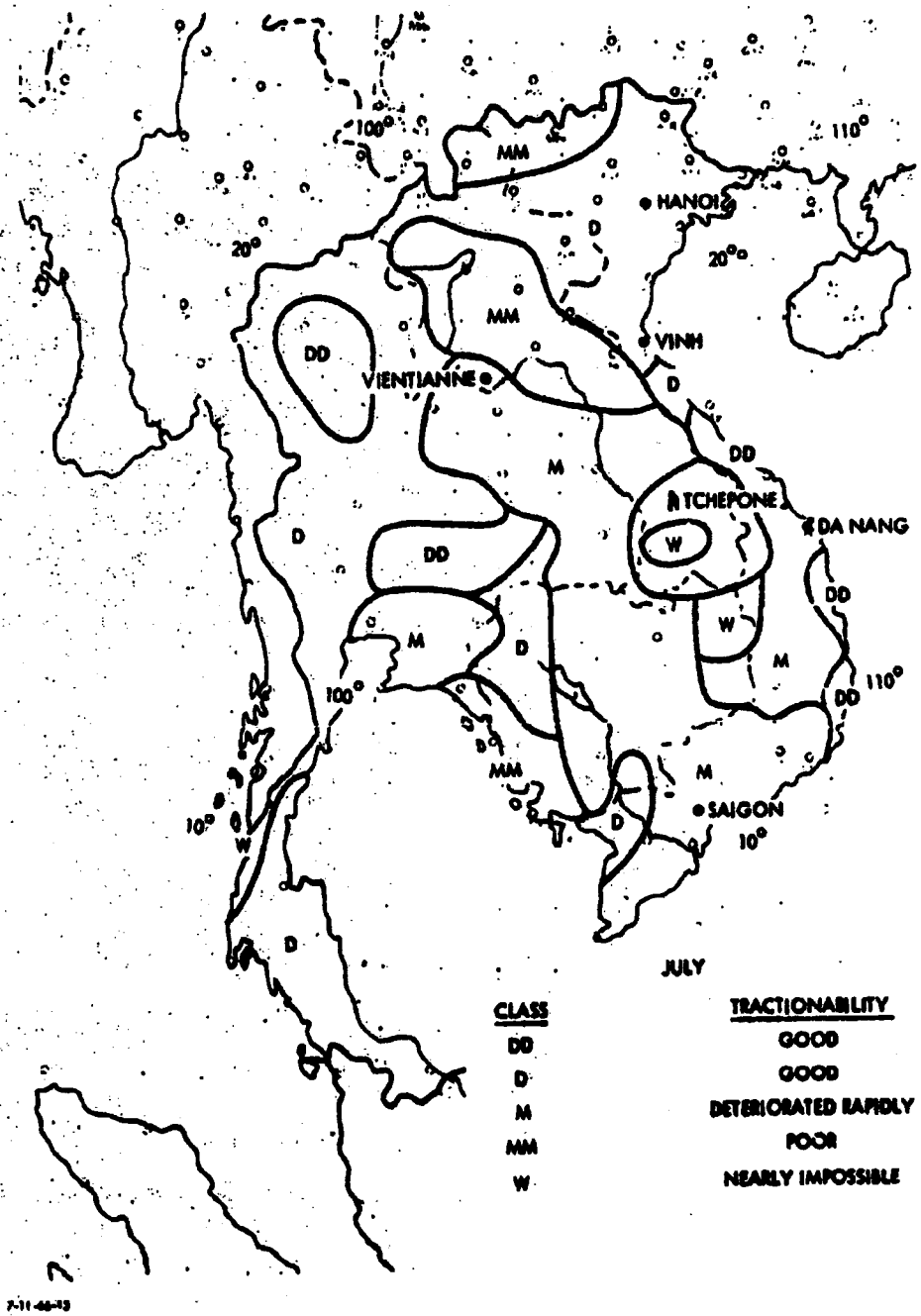


FIGURE A-7.



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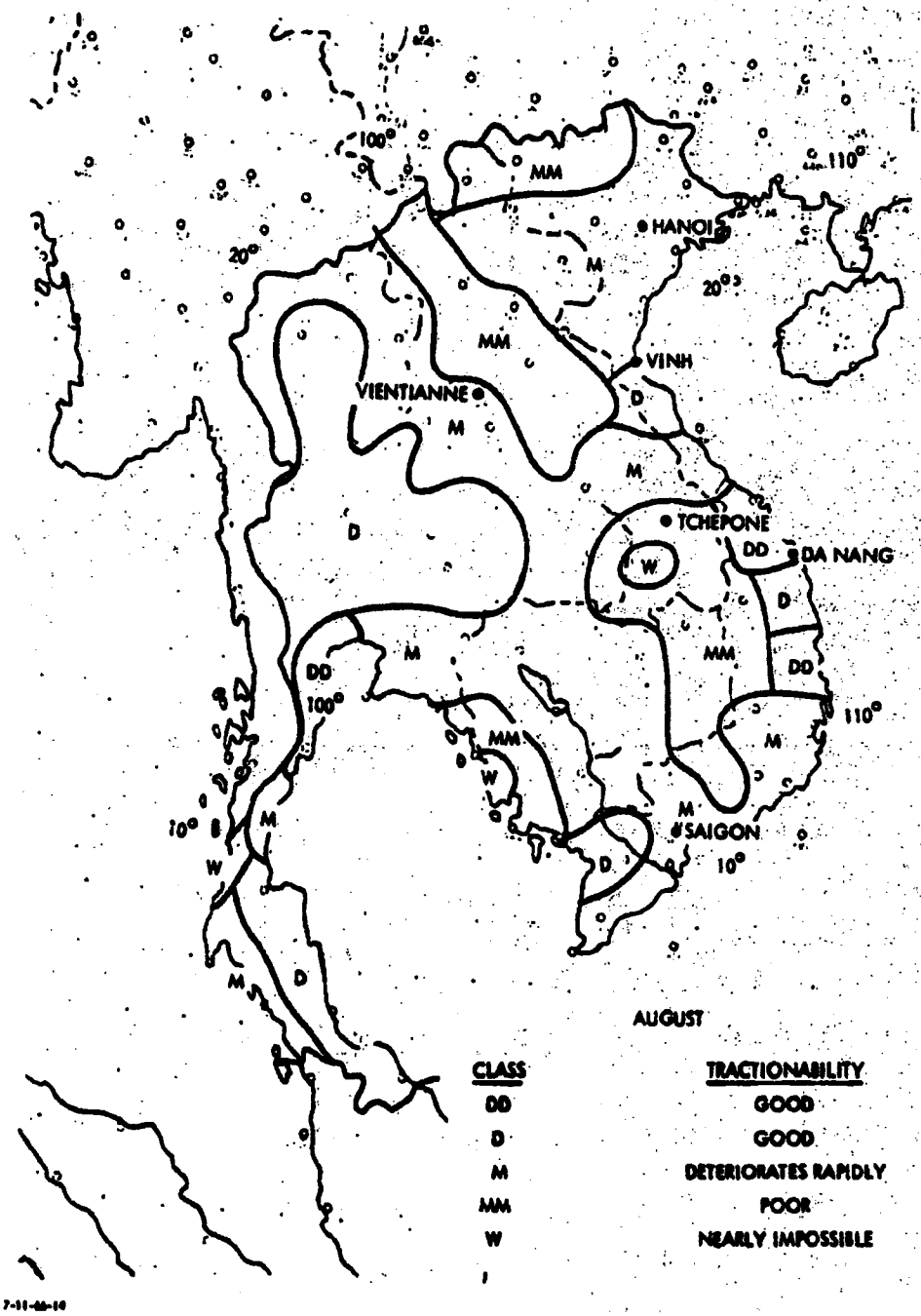

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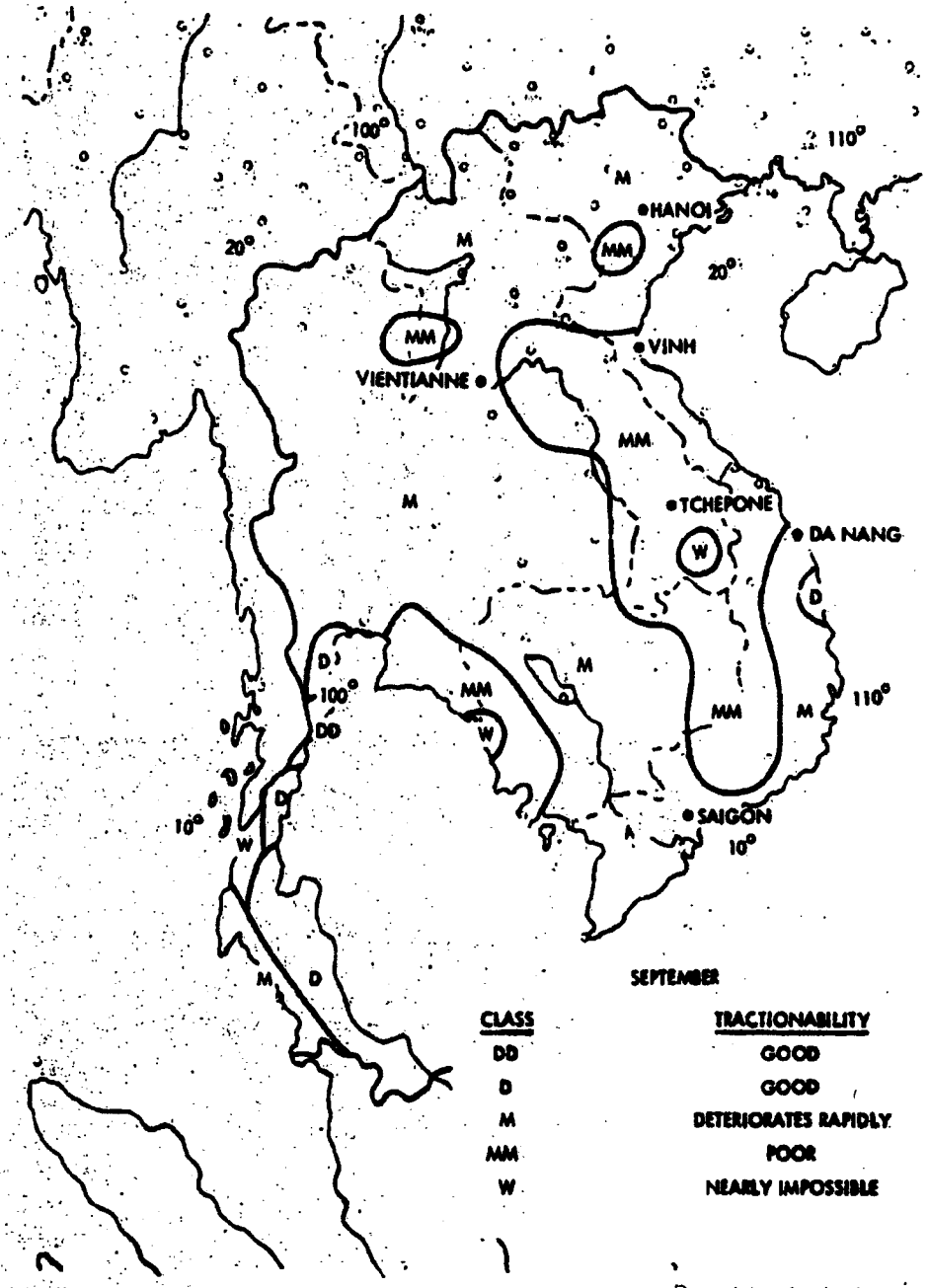

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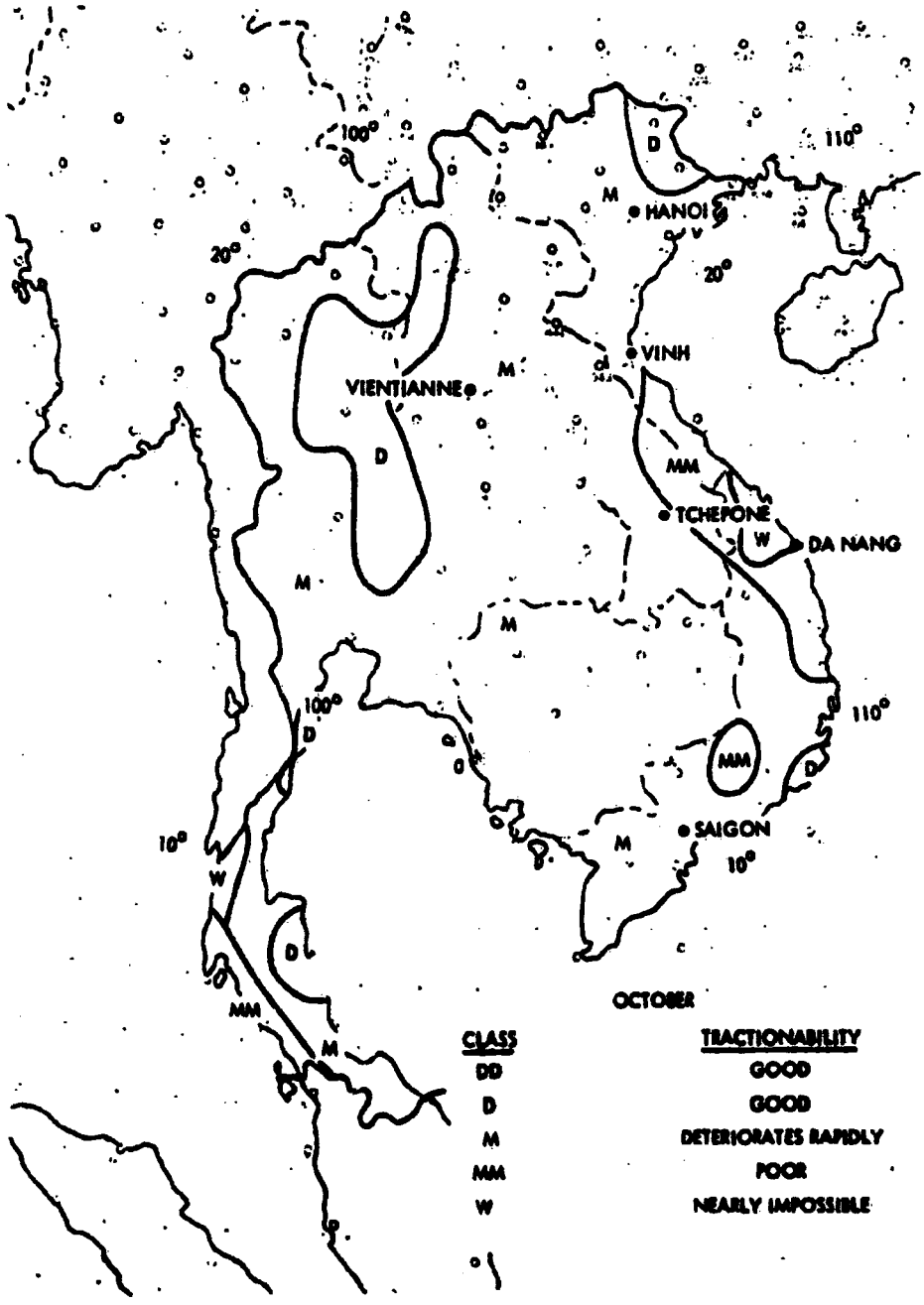

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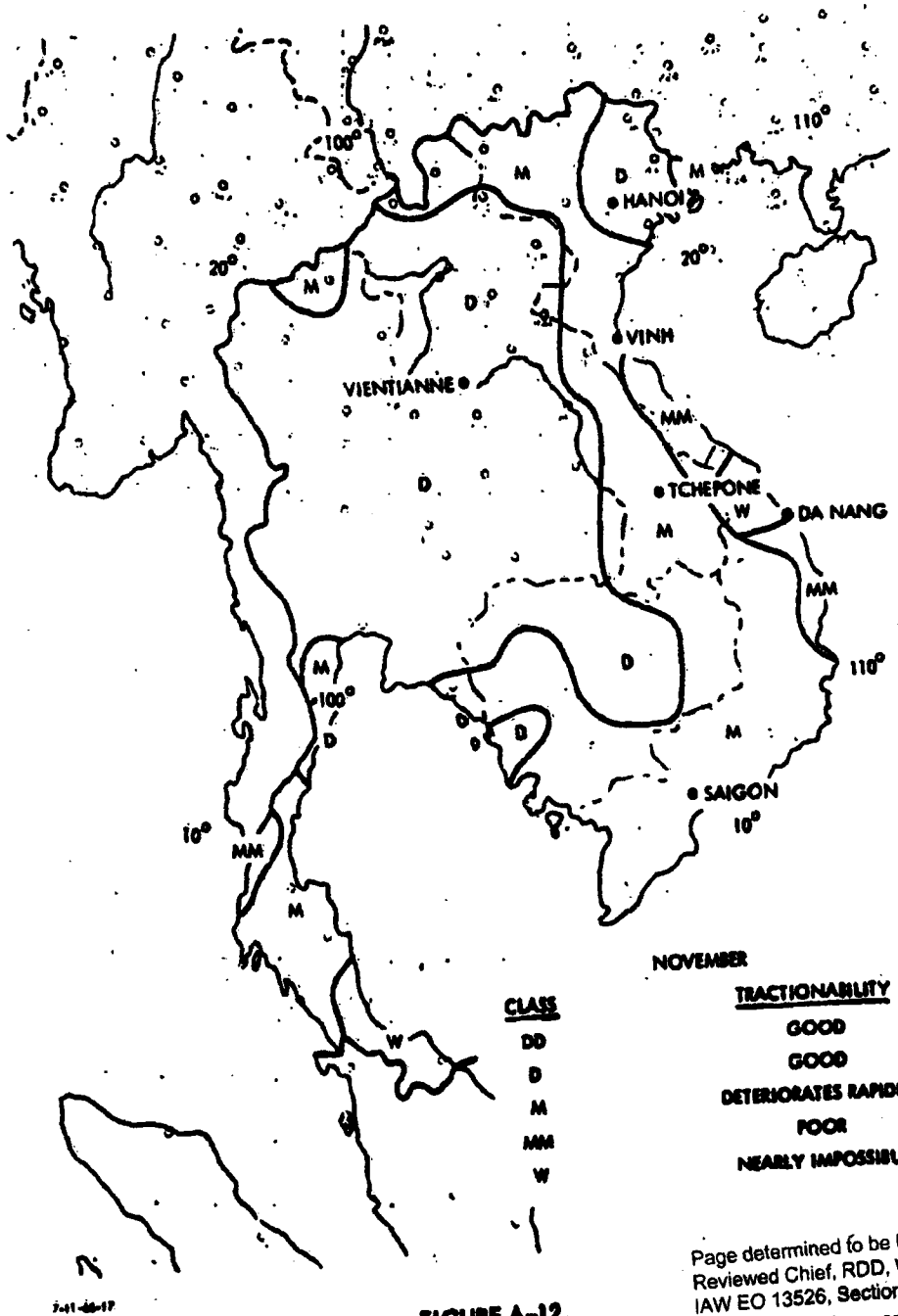

FIGURE A-12.

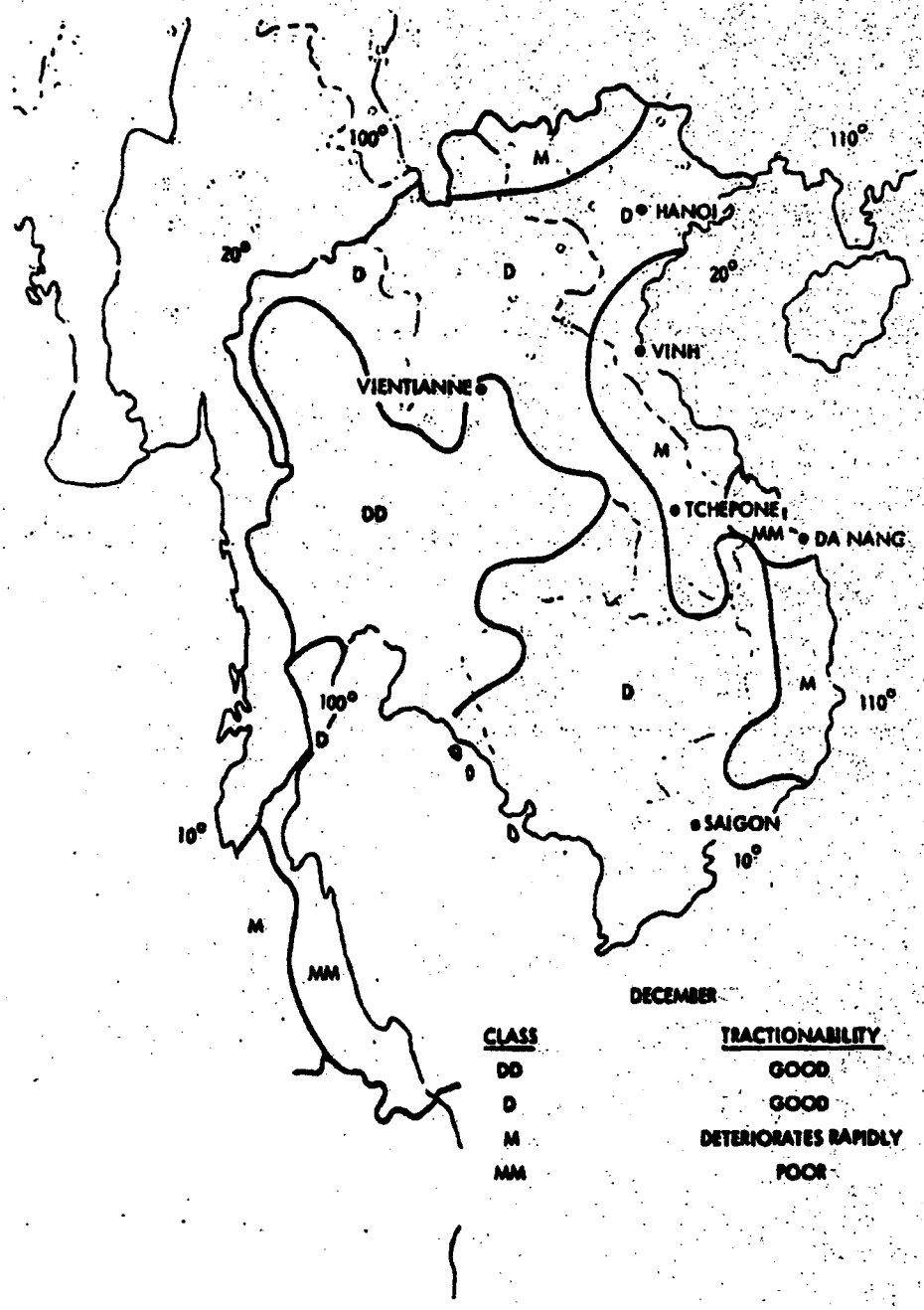

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FIGURE A-13.

Appendix B

DESCRIPTION OF MAJOR ROADS IN THE TRAIL NETWORK

CONTENTS

DESCRIPTION OF MAJOR ROADS IN THE TRAIL NETWORK

This appendix consists of tables and comments giving a detailed segment-by-segment description of the major links in the road net, based on information, photographs and documents supplied by DIA. (See Tables B1 through B5 at the end of the appendix.) The information provided for each road segment includes coordinates, length, type roadbed, trafficability, vegetation and gradients.

This information is believed valid for the 1965-66 dry season. These data may become rapidly outdated as the enemy can rapidly build new roads or upgrade existing ones. If the reader intends to use the data in this appendix, he is advised to consult with DIA to determine if it is still current.

ROUTE 8

Route 8, which is the northernmost route in the Laotian panhandle, extends from North Vietnam via the Keo Neua (Nape Pass) to a junction with Route 12 at Ban Nhommarath. This 73-mile route has a throughput capacity of 450/0 STPD.[1] It has a gravel and improved earth surface, 8 to 16 feet wide, in poor to good condition. Extensive repair, widening, and realignment was reported under way in January 1966. Little attention had been given to the road south of Lak Sao prior to this date and no significant southbound vehicular activity was noted during the 1965 rainy season.

Route 8 south of Lak Sao has deteriorated and is thought to be no longer used to bring supplies south from the Nape

[1] Dry season/wet season short tons per day.

Pass. This is supported by sightings of supplies being moved from the Mu Gia Pass westward on Route 12, then north partway up Route 8 to support the NVA in the Mahaxay-Nhommarath area.

ROUTE 12

Route 12 extends generally west from the Mu Gia Pass area. The Communist-held portion is 58 miles long and has a capacity of 450/100 STPD. The surface is gravel and improved earth, 12 feet wide, in fair condition, and traverses undulating to mountainous alignment. Other than serving the NVA/VC MSR through the Mu Gia Pass area, Route 12 supports the local PL-held area and is a primary feeder to PL/NVA forces in the Mahaxay area.

While only one road goes through the Mu Gia Pass, two roads, 12 and the Mu Gia Pass bypass running east of 12,[1] come out of the south end of the pass. Route 12 soon forks in into 12 and 23. The bypass, lying east of 12, joins Route 23 near Ban Pha Nop. It was developed in the fall of 1965 as an improved earth, 8-foot-wide road, in compensation for the heavy air strikes on the larger capacity Route 12.

ROUTE 912

This route extends northeasterly to the NVN border from Route 911 near Ban Lou Poum at XD 020850. It links up with NVN Route 137, and thereby connects with Routes 1A and 101 in NVN. This road was part of a major road-building effort during the 1965-1966 dry season. The use of bulldozers and other construction equipment indicates the priority attached to obtaining an alternate to Route 12, which was previously the only motorable road through the Chaine Annamitique.

[1] DIAAP-1-66-12.

The road has an improved earth or laterite surface, 8 to 16 feet wide. Construction consisted of pushing 912 north and making motorable a stretch of 137 west of Ban Karai in NVN which was a well-used foot path. Trellis work was used to cover and camouflage 912 and the westward extension of 137. The road was completely open, although construction was continuing, by April-May 1966.

FAC are apprehensive that growth and interweaving of vines and foliage over the bamboo trellis will make FAC location of the road very difficult after the rainy season.

The effort and engineering being put into construction of the road and trellis on this road indicate the importance attached by the enemy on sending supplies thrcugh Laos. Route 912 could well replace the Mu Gia Pass as the primary entry point into Laos. It is being constructed on high ground with crushed rock fill, obtained from located quarries, along the entire length, and avoids easily interdicted points such as rivers and karst passes. The number of automatic weapon emplacements is numerous and increasing.

Route 912 was usable on 13 April, and appeared to be in late stages of construction with limited serviceability. Tracks were observed along its length. Road construction apparently began in mid-January.

A road is being constructed northwest from 912 towards Ban Xonne, with a potential tie up to 23 near the Mu Gia Pass. This would make another bypass south of Mu Gia, motivation probably springing from the desire to circumvent a portion of 911 which deteriorates in the rainy season. The new road will be on higher ground with better drainage.

ROUTE 23

Route 23, a 103-mile route that extends from a junction with Route 12 south to the Muong Phine area, has a segmented

capacity that ranges from 500/100 STPD in the north near Route 12 to 300/0 STPD in the south below Route 9. It has a gravel, improved earth, and laterite surface, 8 to 14 feet wide, in poor to good condition, and traverses undulating to mountainous terrain. This limited all-season road has had extensive repair and reconstruction work including log corduroy surfacing during the 1965 wet season. Route 23 was the principal and only through motorable route in the Laos corridor north of Tchepone prior to December 1965 but has since been augmented by Route 911 to provide more flexibility in motor movement of cargo.

Route 23 just south of Route 12 has until recently been considered normally impassable during the wet season. Extensive corduroying[1] and realignment have now given the road a limited wet-season capability.

ROUTE 121

Route 121, a 27-mile road that extends southeast from Mahaxay to a junction with Route 23, has a capacity of 100/0 STPD. It has an unimproved earth surface, 8 to 10 feet wide, in poor to fair condition, generally traversing rice fields through flat to hilly terrain. This route serves as a secondary support measure to the MSR in the upper panhandle region of the infiltration corridor. In addition, it serves as a connecting road to the local areas held by PL/NVA forces in the Mahaxay region.

ROUTE 91

Extending from a junction with Route 23 at Ban Na Het to a junction with Route 9 at Tchepone, Route 91 is 40 miles long

[1] Corduroying consists of surfacing with bound and anchored saplings or logs, sometimes in several layers, sometimes finished over with sand or packed earth for a better driving surface. Vehicle speeds are limited to prevent destruction. Corduroying is an extremely laborious project.

and has a through capacity of 400/0 STPD. It has an improved earth surface, varies in width from 8 to 10 feet, and traverses undulating to mountainous terrain. Current main use of Route 91 is that portion linking Route 911 with Route 9, which has a limited all-season capability.

ROUTE 911

Route 911 extends generally north-south from a junction with Route 23 at Ban Som Peng to Route 91 at Ban Tha Mo, a distance of 52 miles. The surface is improved earth and some laterite, 8 to 10 feet wide, in fair to good condition; the capacity is 500/100 STPD. This route has been in service since December 1965.

Route 911 appears to have replaced Route 23 as the major LOC from the Mu Gia Pass to the Tchepone area. It is a shorter road with better rainy-season capability. The 85 miles from Mu Gia Pass to Tchepone via 911 would take only one or two nights.

One possibility is the use of 911 and 23 in a circular fashion, with 911 reportedly used predominantly by southbound trucks and 23 by northbound trucks. This mode of operation might be due to the reported narrowness of 911, rendering it suitable for only one-way traffic except for short portions which can handle two-way traffic. Round robin motion is possible between other rungs of the ladder as well.

Route 911 is reported to be in good condition, usable all year round with the possible exception of October, at the end of the rainy season. Construction began in May 1965 and continued during the rainy season. A full battalion of NVA engineers was involved in construction, and some construction equipment was observed. A trellis camouflage was used in an attempt to hide activity. Regular trucking on Route 911 began somewhere around October-December 1965 near the start of the

dry season, and seemed to be accompanied by a decrease of truck traffic on Route 23.

ROUTES 9/23

Routes 9 and 23 join near Muong Phine, extending together for seven miles. This section has a capacity of 750/150 STPD, the highest capacity along the entire MSR. It has a gravel surface, 10 to 16 feet wide, in fair condition, and traverses undulating terrain.

ROUTE 9

That portion of Route 9 in the supply/infiltration corridor running through Tchepone from Muong Phine to a junction with Route 92 at Ban Dong is 36 miles long and has a capacity of 550/100 STPD. It varies in width from 8 to 16 feet and has a gravel and improved earth surface in poor to fair condition. Route 9 serves as an important lateral connection in the Laos corridor. The road funnels PL/NVA vehicular movement and supplies from Routes 23 and 91 from the north into Routes 9/92 and 92 to the south.

Route 92 connects the major supply areas of Muong Phine and Tchepone, and is well traveled between Muong Phine and Route 92. Trucks reach this supply area, travel east on Route 9 to Route 92, and then proceed south on 92. Although there is some movement on Route 9 west of Muong Phine, this activity would be in support of the Communists in Laos, not those in SVN. Route 9 is an old road dating back to the French colonial days, located along the flat area adjacent to the Se Pone River and having a good foundation and limited all-weather capability.

ROUTE 234

Running eastward from Route 23 near Ban That Hoi to Route 92 at Muong Phine, Route 234 is 40 miles long and has a capacity

of 100/0 STPD. The roadway varies in width from 8 to 10 feet over an unimproved earth surface, in poor condition, traversing heavily forested undulating to mountainous terrain. Route 234 may serve as an alternate to the more frequently traveled Routes 9 and 92 in the lower panhandle region.

Route 234 connects the supply areas of Muong Phine, located on Route 9, and Muong Nong, located on Route 92. It could serve as a substitute for Route 9 for trucks traveling southward on 23 toward Route 92; however, its use seems occasional. The junction of Routes 234, 92 and 921 at Muong Nong indicate this town's importance. From here, coolie trains or pack trains can head east on 921 or south on 92. Muong Nong also has a river landing on the Se Lanong River, which is navigable westward to the Se Bang Hieng which, in turn, is navigable to Route 23 at Ban That Hai and to Route 9 at Tchepone.

ROUTE 92

That portion of Route 92 leading southward from the junction of Route 9 to Ban Bac and the Se Kong waterway is approximately 90 miles long and has segmented capacities of 400/100 to 150/0 STPD (vicinity Ban Bac). It has an improved earth, gravel, and unimproved earth surface, 8 to 12 feet wide, and is in fair condition. A corduroy-type surface was used during the 1965 rainy season to keep the road in service. The route was under improvement at its southern end by PL/NVA forces in early 1966, with expected attainment of a full through capacity of 400/150 STPD to the Se Kong. Projecting eastward from Route 92 in the lower panhandle region are Routes 921, 922, and 923 which lead to the South Vietnam border area. The section from Ban Bac terminating at the Se Kong waterway transfer point, now being improved from a seasonal track, was used extensively during 1964-65 prior to development of Route 96. Of current significance to personnel infiltration and potential

significance for cargo movement is the less developed 45-mile portion of Route 92 running from Tchepone northeast to a connection with North Vietnam Route 102 at the DMZ. Excluding a short distance of undetermined characteristics near the DMZ, the current capacity of this northern segment is 150/50 STPD. It has an improved earth, unimproved earth, and graveled surface, 6 to 10 feet wide (mostly 8 to 10 feet wide), in fair condition. Its alignment generally follows the Se Bang Hieng (river) through hilly to mountainous terrain. No significant further development has been noted during the present dry season.

ROUTE 921

The 22-mile segment of Route 921 from the junction of Route 92 at Muong Nong to Sa Moi has a capacity of 50/0 STPD. The surface is unimproved earth and some gravel, 6 to 8 feet wide, in poor condition. Although used extensively through 1964 this route has not been maintained and is believed to be significant only for foot passage by military personnel and porters along with an unknown amount of bicycle transport.

ROUTE 922

Route 922, which covers an approximate distance of 34 miles from its junction with Route 92 to the Laos/South Vietnam border, has a capacity of 200/50 STPD. It is 8 to 10 feet wide, and has an improved earth and unimproved earth surface in fair condition. This road was used by trucks intermittently during the 1965 rainy season with the aid of installed log corduroy-type sections covering several miles near Route 92. The intensive efforts expended to keep this route open indicate that the NVA/VC forces rely heavily on it for logistic support to units in the northern South Vietnam provinces.

ROUTE 923

The 20-mile segment of Route 923 leading eastward from Route 92 at a crossing of the Se Kong (river) has segmented capacities of 400/100 to 50/0 STPD. It varies in width from 6 to 10 feet. It has a surface of unimproved earth, improved earth and some laterite, in fair to good condition. Only four miles of Route 923 (Ban Bac to the junction with Route 96) has a limited all-season capacity. This segment was improved at the end of 1965 in conjunction with development of Route 96. The remainder is a seasonal track, passable to light vehicles to the vicinity of Ban Tampril. The route is reportedly used as a pack animal trail southeast along the Dak R' Gnan River valley and northeast along the Dac Ka Tene River valley.

ROUTE 96

Leading southward between the Se Kong and the South Vietnam border from a junction with Route 923 to the Cambodian border, Route 96 is approximately 85 miles long and has a segmented capacity of 400/100 to 200/50 STPD to Route 16. The roadway width is 8 to 10 feet and the surface is improved earth, generally in fair condition. The route intersects Route 165 at Chavane and Route 16 to the south near the Cambodian border. The segment below Route 165 leading to the border is in an advanced stage of development. Construction of this road by NVA engineer elements commenced in May 1965. It appears to be currently suitable for through traffic to Route 16. Route 96 is a very significant recent augmentation to the Laos NVA/VC MSR. It replaces the undeveloped and more devious infiltration road/waterway system via Route 92 south of Ban Bac and the Se Kong (river). Route 96 provides a more convenient service road for several VC/NVA facilities reached via lateral Routes 165, 16, and possibly 164.

Route 96 enables trucking to penetrate far south into Laos, offering better support to the PL in the area and feeding VC areas via 165 and 96.

The lower section extends from Chavane, at 165, south to Route 16, to within a few miles of the tri-country border. This section was developed during the 1964-1965 dry season as a track for pack, coolie, and possibly jeep traffic. Improvements to make the road motorable continued through spring 1966. April 1966 saw the first truck sightings on 96 as far south as Route 16.

ROUTE 165

Serving the South Vietnam border area as an east-west link with both the Se Kong waterway and Route 96 north of the 15th parallel, Route 165 is about 85 miles long and has a capacity of 200/50 STPD. The surface is unimproved earth, improved earth, and laterite, 8 to 12 feet wide, in generally fair condition.

ROUTE 16

The PL/NVA-held portion of Route 16 east of Attopeu is estimated to be 48 miles long with a capacity of 50/0 STPD. It has an unimproved earth and gravel surface, 6 to 10 feet wide, in poor to fair condition. This segment of Route 16 is a seasonal track extending to the South Vietnam border in the southeast corner of Laos. Exact alignment is indefinite eastward from its junction with Route 96. Added importance of this section is indicated by its use by the PL/NVA/VC as part of a supply route to and from Cambodia linking Routes 96 and 110.

ROUTE 166

Running directly south from Attopeu into hill country near the Cambodian border, Route 166 is approximately 39 miles long

and has a capacity of 50/0 STPD. It has a roadway width of 6 to 8 feet with an unimproved earth surface in poor to fair condition. Route 166 is a seasonal track with several connecting tracks radiating from Ban Hans Phya Bao southwest and southeast toward the Cambodian border. The route presently does not appear to enter into Cambodia. The significance of this route and prospects for further development are not known since it passes into a mountainous region along the Laos/Cambodian border and would be extremely difficult to exploit. April 1966 had the first truck sightings on 166.

ROUTE 914 (TCHEPONE BYPASS)

Opened in March 1966, Route 914 provides a bypass around the west side of Tchepone and to relieve traffic congestion on 9 east of Tchepone and on 92 from 9 to its junction with 914 north of Muong Nong. Its length is approximately 40 miles.

ROUTE 110 (SIHANOUK TRAIL)

Route 110 is a newly completed motorable road that was constructed from the Cambodian border and roughly followed the course of the Se Kong to a junction with Routes 16 and 96, a distance of 60 miles. It has a natural earth surface, 8 to 10 feet wide, and is in fair to good condition. The capacity is 200/50 STPD. Route 110 is expected to augment or extend the capability of transport through the Se Kong valley. Transportation of supplies was previously restricted to seasonal movement on the Se Kong River and intermittent use of a bicycle and cart-type track over which the new roadway has apparently been developed. The significance of this new cross-border access may be seen in comparison with other routes in the border area. Prior to 1966 there were four highway connections between Laos and Cambodia. From west to east, these were the combined Routes 14/129 and 132/12, west of the Mekong, and Routes 13 and 131/194, all in the vicinity of the Mekong Valley.

The combined Route 14/129 has not been truckable within Laos for some time and Route 132/12 has a bottleneck, and inadequate ferry facilities across the Mekong. Therefore, only two trafficable border connections, Routes 13 and 131/194, existed between the two countries prior to installation of Route 110.

Although Pathet Lao raiding parties are prevalent along principal Route 13, this route cannot be considered secure for regular Communist logistic support. In addition, there have been no indications of steady or extensive use of this and the other routes near the Mekong by Communist-associated elements. Any previous sizable movement of cargo to PL/NVA forces from Cambodia would have been carried along such intermittent water accesses as the Se Kong.

The present use of the southern extension of Route 96 to the east is not clear, but is apparently limited by the severe mountainous terrain in the hill mass in the tri-border region. Further information is needed to gain a better picture of other track and trail accesses, particularly from the vicinity of Route 166 eastward to the South Vietnam border.

Sihanouk Trail was in use by mid-March 1966. In Cambodia, the route extends from the vicinity of Siem Pang on old Route 15 to the Laotian border, a distance of 40 miles along the east bank of the Se Kong. The new road has a 12- to 16-foot-wide natural earth surface in fair to good condition and traverses flat to undulating terrain. This portion contains at least eight fords and one timber deck-type bridge.

The Laotian extension, designated Route 110, extends from the Se Kong/Cambodian border area eastward ~60 miles to a junction with Route 96/16 in the southeast corner of Laos. It has an 8- to 10-foot natural earth surface in fair to good condition, and crosses hilly to undulating terrain. This portion also has eight known fords and one timber bridge.

The estimated maximum capacity (three tons/truck) is 250 STPD (Cambodia) and 200 STPD (Laos). Both estimates fall to 50 STPD in wet season.

Reports indicated that the route in Laos is heavily patrolled by NVN sentries. Additional security is provided by numerous pit traps and punji stakes implanted on trails near the road.

The history of Route 110 illustrates the enemy technique of improving a trail to truckable status. An east-west bicycle path south of Attopeu had been well established by the 1964-1965 dry season, and was used for Cambodian support for the VC. Chinese businessmen purchased subsistence items such as rice, dry fish and clothing from the Cambodians. These supplies moved north up the Se Kong in pirogues (45 feet long, capacity of three tons, probably long shaft outboard motors) to storage depots on the Laos border. Supplies then moved eastward in southern Laos over an improved trail running north of Kong My, which joins the main corridor at 165. Rice was relayed by teams of four bicycles, with two 40-kg sacks (= 176 lb) per bicycle. Bicycles were pushed.

Upgrading of the trail occurred during the 1965-1966 dry season. During February and March 1966, clearing operations along the southern bank of the Se Sou River, eastward toward 965 were disclosed by aerial photography. The road was open by April 1966.

Table B1. NORTH-SOUTH LINES OF COMMUNICATION - LAOTIAN PANHANDLE - NORTH OF ROUTE 9

Route	UTM Coordinates and Daily Dry/Wet Capacity	Approx. Length (km)	Type Roadbed	Trafficability	Vegetation	Gradients	Remarks
8 Vinh - Nape Pass	UF7264-UF1732 450/0	80	Crushed stone. Width 8'-16'; shoulders 0'-3'.	Limited all-weather capacity.	Rice paddies and open areas from Vinh for approximately 60 km; thence heavy forestation to Pass.	Route is level to undulating from Vinh for approximately 60 km; beyond is mountainous with sharp curves and steep grades.	
Nape Pass - Mahaxay	UF1732-UE2226	120	Improved earth. Width 8'-10'; shoulders 0'-3'.	Probable limited all-weather capability.	Majority of route passes through dense tropical rain forest. Portions traversing Nam Phao River Valley south of Nape Pass and Nam Theun River Valley north of Mahaxay Pass through extensive areas of secondary growth, scrub, clearing and cultivation.	From Pass for approximately 18 km terrain hilly with steep grades and sharp curves; next 60 km undulating to hilly; last 90 km to Mahaxay flat to hilly.	Deteriorated roadway south of Kai Sao.
1 Vinh - Ha Tinh and 15 Ha Tinh - Ha Gia	UF7264-UF9728 UF9728-UE8363	186	Macadam and crushed stone from Vinh for approximately 115 km. Width approximately 15'; shoulders 0'-6'. Remainder of road to Ha Gia Pass is crushed stone and earth. Width approximately 12'; shoulders 0'-3'.	Limited all-weather capability.	With the exception of a 25-km stretch near Ha Gia Pass, the entire route passes through open rice growing areas. Near the Pass, dense tropical rain forest is encountered.	From Vinh south on Route 1 for distance of 50 km road is flat. Next 65 km along Route 15 is flat to hilly. Remainder of route is hilly to mountainous as Ha Gia Pass is approached. Some sharp curves along Route 15 and as Ha Gia Pass is approached steep gradients are encountered.	Terrain subject to landslides in Ha Gia Pass area.
23 Ban Lang Khang - Muong Phine	UE7764-UD1627 600/100	150	Improved earth surface. Width approximately 12'; no shoulders.	Recent intensive maintenance has given limited all-weather capability.	Although spotted with rice growing areas along entire length, route traverses dense tropical rain forest primarily.	Undulating to hilly - no difficult grades or curves.	One of the major truck routes for Viet Cong supplies to South Vietnam. Some sections subject to flooding during rainy season.

Table B1. NORTH-SOUTH LINES OF COMMUNICATION - LAOTIAN PANHANDLE - NORTH OF ROUTE 9 (cont.)

Route	UTM Coordinates and Daily UNIT/ Dry Capacity	Approx. Length (km)	Type Roadbed	Trafficability	Vegetation	Gradients	Remarks
911 Ban Na Peng - Ban Thasm	UE7710-UB1960 600/100	100	Improved earth - some laterite; width 8'-10'; no shoulders.	Limited all-weather.	For approximately 70 km south from Ban Na Peng route traverses dense tropical rain forest. This is spotted with open rice growing areas. The last 30 km pass through cultivated areas along the Se Nam Noi River.	Undulating to hilly minimal number of difficult grades or sharp curves.	Primary trunk for movement of supplies south from Mu Gia Pass area. Traffic thought to be one way south. Route developed since May 1965 and is a "short-cut" from Mu Gia Pass to Tchepone.
91 Ban Muang Son - Route 9 (Tchepone)	UB0672-UB2540 400/0	46	Improved earth; width 3'-10'; no shoulders.	Limited all-weather capability from Route 911 junction to Route 9 junction. Remainder of route is primarily fair weather.	Secondary growth, clearing and cultivated areas along entire length.	Undulating - mountainous.	Connecting route between Route 23 and Route 911. Subject to landslides along Se Nam Noi River.
92 Ban Tvie - Route 9 (Ban Dong)	UB0660-UB2240 100/50	50	Unimproved and improved earth; width 8'-10'; no shoulders.	Light vehicles in dry season - all-weather for pack trains, bicycles and porters.	Moderate to heavy jungle growth - difficult for aerial observation.	Hilly to mountainous.	Main corridor for infiltration columns. Route parallels Se Bang Hiang River which is used as an alternate for Route 92.
122 Mahaxay - Ban Se Bpai Tha	UE2220-UB7250 100/0	65	Unimproved earth; estimated width 8'; no shoulders.	Dry season capability.	Route traverses open deciduous forest interspersed at frequent intervals with rice growing areas.	Flat to undulating with few sharp curves or gradients.	Possible alternate route joining Routes 23 and 121.

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Table B2. NORTH-SOUTH LINES OF COMMUNICATION - LAOTIAN PANHANDLE - SOUTH OF ROUTE 9

Route	UTM Coordinates and Daily Wet/Dry Capacity	Approx. Length (km)	Type Roadbed	Trafficability	Vegetation	Gradients	Remarks
23 Muong Phine - Pak Song	[illegible] 300/0	200	Improved earth and gravel; width 8'-10'; no shoulders.	Fair weather - poor condition but under improvement by Communists	Approximately 70 percent of route is open deciduous forest - remainder is open area with rice fields and grass.	Undulating - hilly no difficult sections.	First 25-mile section south of Muong Phine subject to frequent inundation by overflow from Se Bang Hiang and Se Tchepon Rivers. Sections generally marshy throughout the year.
92 Ban Bang (Route 9 Intersection) - Se Kong River	[illegible] 400/100 to 150/0	125	Improved earth with log corduroy in low areas. Width 8'-10'; no shoulders.	Limited all-weather capability.	Moderate to heavy jungle forest throughout.	Hilly to mountainous with steep grades and sharp curves in mountainous regions.	Primary truck route for supplies moving south. Under continuous improvement by Communists.
Se Kong River - Ban Phone at 16	[illegible]	40	Unimproved earth; width 6'-8'; no shoulders.	Fair weather capability for light trucks.	Moderate to heavy jungle forest throughout.	Undulating to hilly - easy curves and grades.	Follows Se Kong River Valley. River may be used as alternate route of communication.
16 Ban Phone - Attopeu	[illegible]	[illegible]	Improved earth and gravel; width 10'-12'; no shoulders.	Limited all-weather.	Moderate to dense jungle forest throughout.	Flat; easy curves.	Route parallels Se Kong River. River may be used as alternate route of communication.
166 Attopeu - Laos - Cambodian Border	[illegible] 50/0	[illegible]	Unimproved earth; width 6'-8'; no shoulders.	Dry season capability.	Primarily dense jungle growth spotted with open areas and cultivation in valley regions.	Flat from Attopeu south for approximately 20 km as route crosses Se Kong River Valley. Thereafter mountainous to border. Steep grades and sharp curves in mountainous region.	Numerous tracks capable of handling light trucks in dry season extend southwest and southeast toward Cambodian border.
96 Ban Pillong - Laos-Vietnam Border	[illegible] 400/100 to 200/50 north of 16	[illegible]	Improved earth; width 8'-10'; no shoulders.	Probable limited all-weather capability.	Dense jungle growth throughout.	Very mountainous. Very steep grades and curves on all except last 40 km prior to border. Terrain levels out in this region and is less tortuous.	Primary truck route for supplies moving south from Route 92. Under continuous improvement since May 1965. Route now being extended from junction with Route 165 south across Cambodian border.

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Table B3. ROUTE 9 - EAST-WEST LINE OF COMMUNICATION LAOTIAN PANHANDLE AND SOUTH VIETNAM

Route	UTM Coordinates and Daily Wet/Dry Capacity	Approx. Length (km)	Type Roadbed	Trafficability	Vegetation	Gradients
Dong Ha - Laos Border	VQ2461-VD7038	85	Macadam from Dong Ha west for 25 km. Thereafter either earth, gravel, or bituminous treated surface. Width ~12' with 2'-3' shoulders.	Limited all-weather.	Mostly scrub clearing and cultivation with some patches of timber.	Undulating to hilly - a few sharp curves on central part of route in hilly section around Dong Kho.
Laos Border - Muong Phine	VD7038-XD1027 550/100	60	Improved earth and laterite. Width ~12'; shoulders 8'-3'.	Limited all-weather.	Mixture of secondary growth and deciduous forest with dense forest along streams. Rice growing areas interspersed along section between Tchepone and Muong Phine.	Mostly flat plain with some hilly sections; grades not excessive and easy curves.
Muong Phine - Savannakhet	XD1027-VD7430 550/100	160	Same as Laos Border - Muong Phine.	Limited all-weather.	Open deciduous forest; patches of cultivation.	Flat plain, easy curves.

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Table 84. EAST-WEST (LATERAL) LINES OF COMMUNICATION - LAOTIAN PANHANDLE - NORTH OF ROUTE 9

Route	UTM Coordinates and Daily Wet/Dry Capacity	Approx. Length (km)	Type Roadbed	Trafficability	Vegetation	Gradients	Remarks
12 Mu Gia Pass - [illegible]	WE0362-WE7225 450/100	100	Improved earth with some macadam - gravel sections. Width 8'-12'; no shoulders.	Limited all-weather capability.	Tropical rain forest with frequent open rice growing and brushwood areas.	Mountainous for first 15 km after Mu Gia Pass - hilly to undulating thereafter. Sharp curves and steep grades in Pass area.	Lateral east-west route connecting Routes 23 and 8.
121 [illegible] - Ban [illegible]	WE2226-WE5016 100/0	40	Unimproved earth; width 8'-10'; no shoulders.	Fair weather capability.	Open deciduous forest inter-spersed with many open rice growing areas.	Flat to undulating.	

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Table B5. EAST-WEST (LATERAL) LINES OF COMMUNICATION - LAOTIAN PANHANDLE - SOUTH OF ROUTE 9

Route	UTM Coordinates and Daily Wet/Dry Capacity	Approx. Length (km)	Type Roadbed	Trafficability	Vegetation	Gradients	Remarks
10 Attopeu - Laos-Vietnam Border	[illegible] 60/0	65	Improved and unimproved earth. Width 6'-18'; shoulders 0'-1'.	Trackable in dry season by light vehicles with winches.	Moderate to heavy jungle growth throughout.	Undulating - hilly.	Connecting trails in vicinity of border could possibly be traversed by light vehicles with winches in dry season. These trails fan out to numerous foot paths leading into the SVN and Cambodian border areas. Because of the dense jungle growth in the area, these trails are ill-defined but are thought to serve the Kontum and Pleiku Province areas of SVN.
236 Muong Peloe - Muong Nong	[illegible] 100/0	55	Unimproved earth; width 8'-10'; no shoulders.	Dry season capability.	Primarily tropical rain forest and open deciduous forest; dense forest along streams.	Primarily flat with exception of mountainous portion of approximately 15 km in center of route.	
921 Muong Nong - Laos-Vietnam Border	[illegible] 60/0	25	Unimproved earth and gravel; width 6'-8'; no shoulders.	Probably trackable during fair weather only. Open all-weather to porters and pack trains.	Moderate to heavy jungle forest throughout.	Hilly to mountainous; steep grades but easy curves.	
922 Route 92 (Junction) - Laos-Vietnam Border	[illegible] 200/50	60	Improved earth with log corduroy in low areas.	Limited all-weather capability	Dense forest and undergrowth spotted with open cultivated areas.	Hilly to mountainous with steep grades.	Near border area route is crossed by north-south trails suspected of being personnel infiltration corridors. Serves as major trunk for distribution of supplies to SVN.
923 Ban Ba-Laos-Vietnam Border	[illegible] 200/50 60/0 East of 96	55	Improved earth; width 8'-10'; no shoulders from Ban Bieng to junction with Route 92. Thereafter unimproved earth; width 6'-8'; no shoulders.	Limited all-weather capability for trucks from Ban Bieng to junction with Route 92. Thereafter to border route is trackable only for pack animals and porters.	Dense forest and undergrowth - little cultivation.	Mountainous with steep grades and sharp curves.	Route parallels Se Kong River to within 20 km of border. River serves as alternate LOC. North-south trails crossing route near border area are believed to be major personnel infiltration routes.

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Table B5. EAST-WEST (LATERAL) LINES OF COMMUNICATION - LAOTIAN PANHANDLE - SOUTH OF ROUTE 9 (cont.)

Route	UTM Coordinates and Daily Wet/Dry Capacity	Approx. Length (km)	Type Roadbed	Trafficability	Vegetation	Gradients	Remarks
233 Ban [illegible] - Ban [illegible]	[illegible]	[illegible]	Unimproved earth; width 6'-8'; no shoulders.	Dry season capability.	Open deciduous forest with dense forest along streams.	Undulating to hilly.	Reportedly under improvement by Communist forces.
162 Saravane - Route [illegible]	[illegible]	[illegible]	Unimproved earth; width 8'-10'; no shoulders.	Dry season only.	Open deciduous forest with patches of cultivation and rice growing areas in vicinity of Saravane.	Flat to hilly.	
16 Ban [illegible] - Ban Phone	[illegible]	40	Improved earth and gravel; width 10'-12'; no shoulders.	Limited all-weather.	Center of route for approximately 10 km is open jungle grass; remainder is open deciduous forest.	Flat to undulating.	
232 Pak Song - Route [illegible]	[illegible]	[illegible]	Unimproved and improved earth; width 8'-10'; no shoulders.	Dry season capability.	Relatively open area from Pak Song east for approximately 25 km; thereafter dense forest as road follows Se [illegible] River Valley.	Undulating.	
164 Ban Phone - Laos-Vietnam border	[illegible]	75			Dense jungle forest throughout.	Hilly to mountainous.	
165 5 km north of Ban [illegible] - Laos-Vietnam Border	[illegible]	90	Improved and unimproved earth; width 8'-10'; no shoulders.	Probable limited all-weather capability.	Moderate to heavy jungle forest throughout.	Hilly to mountainous with steep grades and sharp curves.	Route has two branch roads near border area which serve Communist storage and distribution facilities in this area and additional base areas in Quang Tri Province, SVN. Serves as a major trunk for distribution of supplies to SVN.

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