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Lincoln

Chief of Station, Guatemala

Info; Chief, WHD

Sabotage Studies

Part I - Electrical System
Part II - Railroads

References: (1) HGG-A-792
(2) -828
(3) -833

Foreword to Part I - Electrical System

1. The Empresa Electrica de Guatemala, S.A. supplies electric power to the towns of Guatemala, Antigua, Ciudad Vieja, Escuintla, Amatitlan, Villa Canales, Palin, Villa Nueva, San Miguel Petapa, Mixco, San Jose Pinula, and Santa Catarina Pinula. In addition, light and electric power is furnished to a great number of farms and other private installations located in the vicinity of the power lines.

2. The principal transmission line of the Empresa Electrica is rated at 66,000 volts. This line originates at the power plant at Escuintla and passes through the plants at El Salto, San Luis, Palin and substations at Amatitlan, Villa Nueva and Guatemala. Another section of 66 kilovolt line connects from Palin to Antigua and Guatemala City. There are, in addition, a number of primary lines connecting Guatemala with the villages of San José Pinula, Santa Catarina Pinula, and Mixco; Villa Nueva with San Miguel Petapa and Villa Canales; Antigua with Ciudad Vieja.

3. The total length of the 66 kilovolt transmission lines is 112 kilometers. The total length of the primary distribution lines is 347 kilometers. Primary distribution is rated at 2,300, 4,000, 6,600 and 13,200 volts. The entire system provides alternating current, single-phase and three-phase, 110/220 volt, 60 cycle. Practically all towers are constructed of steel. Copper is universally used as a conductor. Wiring standards follow the National Electric Code approved by the American Standards Association. The plants at Palin, San Luis and El Salto possess a total water power rating of 20, 178 H.P. and a total generating equ pment rating of 12,130 kilowatts; they are served by the waters of the Michatoya River which has its origin in Lake Amatitlan. Lake Amatitlan has an area of 12 square kilometers and is utilized as a reservoir for supplying water to these plants during the dry season. The lake has a reported storage capacity

of 347,000,000 cubic feet of water. The use of the lake as a reservoir permits Empresa Electrica to maintain service at all times by controlling the level of the lake. The locks controlling the level of the lake are located at 14°28'N 90°37'W. The plants at El Zapote and Escuintla do not have reservoirs. El Zapote uses the waters of the Río Zapote, a small river located near Guatemala City. The Escuintla plant uses the waters of the Río Guacalate; the nature of the terrain in that area does not permit the construction of a reservoir.

4. The power plants operated by the Empresa Electrica are located at El Zapote, Palin, San Luis, El Salto, Escuintla, Antigua and Amatitlan. A description of these plants follows:

a. El Zapote (14°40'N 90°29'W). The generating plant at El Zapote consists of a Morgan-Smith turbine rated at 600 HP and a General Electric generator rated at 360 kilowatts. In order to obtain water power, a basin was created on the El Zapote River which is 157 feet long and gives a height of fall of 90.6 feet. Lines of direct transmission from the plant to the substation in Guatemala City are rated at 6,600 volts.

b. Palin (14°22'N 90°42'W). The power plant at Palin is located on the Michatoya River. It possesses a small dam and a sand washer but no reservoir. A penstock pipe 1,275 meters long and 111-131 centimeters in diameter is in use. The generating equipment consists of an Escher-Wyss turbine rated at 1,600 HP coupled to an A.E.G. generator rated at 900 kilowatts; two Pelton turbines rated at 650 HP each coupled to two Siemens-Schuckert generators rated at 457 kva each. The height of fall of the water is 274.24 feet.

c. San Luis (14°20'N 90°44'W). The power plant at San Luis is also located on the Michatoya River. It possesses a dam and a reservoir which is used as a sand washer. Two penstock tubes each 1,596 feet long with a diameter of 53-61 centimeters are in use. The power units proper consist of 2,500 kilowatts and a Morgan-Smith turbine rated at 3,750 HP coupled to a General Electric generator of 2,500 kilowatts. The height of water fall is 298.8 feet.

d. El Salto (14°19'N. 90°19'W). The El Salto plant is also located on the Michatoya River. This plant possesses a sand washer and two penstock tubes each 1,359 feet long and72 centimeters in diameter. The power units consist of a Voith turbine rated at 3,900 HP and a Siemens generator rated at 2,500 kilowatts and a Morgan Smith turbine rated at 4,250 HP coupled to a General Electric generator rated at 3,000 kilowatts, with a gross head of 251.o fee

e. Escuintla (14°18'N 90°48'W). The power plant at Escuintla is located on the Guacalate River. This plant possesses a sand washer and two penstock pipes each 59 feet long and 65 centimeters in diameter. Two separate power producing units are located at this plant: a Morgan-Smith trubine rated at 328 HP coupled to a 160 kilowatt generator manufactured by the Westinghouse Manufacturing

Company; and a Morgan-Smith turbine rated at 700 HP coupled to a 520 kilowatt Electric Machinery generator.

f. Laguna (14°27'N 90°35'W). The Laguna power plant is located at Lake Amatitlan on the south side of the lake. This plant, unlike the others operated by the Empresa Electrica, is powered by steam. Two turbo-generators and condenser units are products of Brown Boveri Company. The condensing turbine generator plants are each rated at 3,500 kilowatts maximum capacity and are designed to function for most economical operation at 3,000 kilowatts with 28.12 kilograms per square centimeter gauge pressure. The steam turbines in use are type D 24 E and are directly connected to alternating current type generators type WTS 522 D which are rated at 4,160 volts producing three-phase, 60 cycle current. Each generator is directly connected to an exciter type GFT special The surface condenser units are type CL 12 and are designed to provide a condensing surface of 4,734 square feet each. The steam generating units in use at this plant were manufactured by the Combustion Engineering Company and are capable of producing 46,000 pounds of steam per hour, each. For transmission, voltage is stepped up to 66,000 volts. A 66 kv transmission line has been constructed between the site and the town of Amatitlan to which point it taps into the transmission line joining Escuintla and Guatemala.

(From IR-60-49, Air Attaché Report)

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1. By GE 905, which was previously submitted, it will beobserved that there are two main electrical lines coming into the capital. In turn, these two main lines join together and become one outside of and near the Palin power plant.

2. The only other source of supply of electrical power is that of the Zapote plant which is located at 14°40'N by 90°29'W. This small plant, which is located not far from the brewery shown on the map enclosed herewith, operates only during moments of peak load and generally from 5-10 O'clock P.M. Furthermore, this plant is tied in with the electric system through the substation Guatemala and it is extremely doubtful that it would be possible to utilize this plant with any degree of efficacy if the main power lines were knocked out.

3. Available information indicates that the Empresa Electrica de Guatemala is operating on a shoe string and that much of the equipment is a bastard conglomeration which would be impossible to repair for between 3 to 6 months if any major destruction should occur.

4. [ ] is employed by the Empresa Electrica de Guatemala as an engineer. He has stated that it would be possible for him to effectively cut all current without a possibility of being detected and without doing any damage whatsoever to the installations

in general. It is worthy of noted that [who]/resides at [ ] and whose legal residence is [ ], is disgruntled.

5. Be all that as it may and whether or not the system would suffer any acute breakdown if more drastic measures should be taken, the following is believed to be a true picture of the electrical system and is based on a personal study made by BANNISTER and ESPERANCE.

6. As previously stated, the source of supply starts at the Escuintla plant, runs along high tension wires to the El Zapote plant, takes on the load from this plant and proceeds to the San Luis plant and from there to a point outside of the Palin plant. The Palin plant is located at 14°22'N 90°42I W. At a point between the Palin plant and the small town of Palin the line divides and one branch goes northwest via Antigua and turns toward the capital. The other branch continues in a relatively straight line from Palin to Amatitlan where it joins up with the lines coming from the steam plant and then proceeds along the Amatitlan highway into the capital. The best place for our purposes that we were able to locate is that at Km. 11 and/or Km. 13 of the road to Amatitlan. This is shown by photographs No. 19 and this place is ideal since, as shown by photograph No. 22, the power and communications lines coming from Amatitlan leave the capital-to-Amatitlan highway at this point and take off across country where there is an abundant supply of natural cover and concealment. A description of the type of post is given in sketch No. 4. Greater damage could be done by blowing one of the towers located along the stretch between Km. 12 and 13, and particularly at Km. 13 on this same road. Close up details of the towers are shown in photographs 20 and 20A. As can be seen from photograph No. 19, there is a police check point located as shown by ~~photograph~~ No. 6 on this photograph, but this can be avoided by taking the cut-off as shown on this photograph and as also shown in better detail on the large scale map. On the map this cut-off is indicated by the red No. 1, this being located in the lower right-hand side of the map. The blowing of two or three of these high line posts and of the adjacent communications lines would effectively cut off all power and communications coming via Amatitlan to the capital.

7. Since another branch of this power line enters the city via Antigua, it would also be necessary to effect a secondary operationand it is believed that the best place for this is the point shown by photographs Nos. 18 and 18 A,B,C,D, and E. The exact location of this is not shown on the large map but is somewhere around the red No. 2 shown on the large scale map. The blowing of one of the towers, construction details of which are shown in 18 D,E, and in 20A would

would effectively sever all main power entrances to the capital. At the same time it would be recommended that the line from the capital to Mixco, and which is located at approximately 50 yards from the target power tower mentioned, should be blown and the communication lines located within a few feet should also be cut. Pictures Nos. 11-17 give close up details and it will be noticed that the wall in the background of 11 and 12 is the compound wall shown in pictures 18, 18A and B. This is also shown in No. 10. In photograph 18B it will be observed that the point of attack is located near a police check station but this should not cause undue difficulty since the attack against the power tower would be masked by the compound wall.

8. A successful operation against the two points mentioned above would cut off all electrical supply except that derived from El Zapote.

9. I believe that the Zapote plant could be ignored since available information indicates that it is so tied in with the over-all system that it would be impossible to devote power from this plant for specific emergency use. However, Sketch No. 7 and photographs Nos. 1 and 27 indicate where the power lines could be easily cut. Details of the type of post can be observed in No. 28. These posts are railroad rails, light gauge, and of the type used by the IRCA. It would be recommended in this particular case that thermite-time bombs be used although I do not believe that undue difficulty would be encountered in entering and leaving through the brewery. On the other hand it would be possible to pass behind the church, cutting across a playground, across a deep ravine, and then on to 6th Avenue if such were necessary. If so, details will be furnished upon request.

PART II - Railroad System

1. By Lincoln 1346 details were requested concerning one bridge each exit. To date we have not found any bridge on the south exit better than the Lake Amatitlan bridge. The bridge is comparatively small although the fill connecting this bridge to the line is very long. However, the bridge portion could be seriously weakened by putting two charges, one in each end, and while this would destroy all traffic for days it would not cause permanent damage.

2. The situation on the north exit leading to Puerto Barrios is much better. We have located two bridges or overpasses. The first is located 1,000 feet from Puente de las Vacas and toward Puerto Barrios. Details of this are given in photographs 29 A,B,C,D, E, 30, 31, 32 and 33 and by sketches Nos. 8 and 9.

3. Bridge No. 2, which is located at 14 kilometers out of the city, is shown by sketch No. 8 and details of it are shown by sketch No. 10. Photographic details are included in No.s 34-42. It is

believed that it would be a relatively simple matter to damage these bridges in such a manner that it would not be possible to use them.

4. The mounted photographs are captioned and self-explanatory -- I hope. All other details required will be furnished upon request.

[Earle N. Bannister]

Enclosures:
Set of mounted photographs
10 sketches
Set of numbered photographs
Map
Key to numbered photographs (in dup)
Notes on RR Bridge and Power Line

6 April 1954

ENB/cmh
Distribution:
2-Linc w/encls
2-Wash w/encl (key to photos)
1-Files w/encl " "

Key to Photographs

Photo No. 1. Church at brewery from football field looking NW (see sketch No. 7).

No. 2.& 3. Road to Amatitlan looking SE along power line (sketch No. 1).

No. 4. Power tower at kilo 13 Amatitlan road (sketch No. 3).

No. 5. Post No. 31 looking at posts No. 31, 32, 33, etc. Zapote power line looking south (sketch No. 7).

No. 6 & 7. Avenida Santa Elena and 9th St. showing entrance power line from Antigua to city.

No. 8. View of power lines coming from Antigua. In foreground the compound, etc. (sketch No. 6).

No. 9. Showing power lines from Antigua, compound in center.

No. 10. Same as No. 9.

No. 11, 12 & 13. Closeup of pole beside wall of compound shown in 8, 9 & 10.

No. 14 & 15. Shot from near 13 including part of wall and showing three-line power supply going to Mixco from the capital (looking north).

No. 16 & 17. Shot from same position but showing communications lines from capital to Mixco.

No. 18. Aerial view of compound shown in Nos. 8 and 9.

No. 18A. Looking east toward capital showing compound and power lines.

No. 18B. Aerial view looking west showing compound in center and location of police check point.

No. 18C. Looking east toward junction on old Antigua road and San Juan Sacatepequez road showing three-line power line on right of road and communications line on left. Also end of adobe wall. Compound is immediately to the right of picture above shallow bank (sketch No. 6).

No. 18D-F. Views of tower by compound wall facing towards city (east), this line coming from Antigua.

No. 19. Road to Amatitlan showing (1) Coca Cola plant (2) essential oil plant (3) electric power substation (4) Radio Nuevo Mundo (5) little house (6) police check point (7) route to avoid police check point (sketch No. 2).

Photo No. 20 & 20A. Closeup of tower showing details of construction.

No. 21. Tower located across barranca from 9th Street substation showing branch of Antigua line. Tothe left leading off to cement plant. Straight ahead lading to substation.

No. 22. View of Amatitlan highway looking south. (1) Kilo 11 (2) subdivision with no houses (3) sign which is referred to in No. 23 (4) place where power and communications lines cut away from road. The power lines to this point have followed the left side of the road and the communications lines on the right side. They then jump a great ravine labelled (5) and then go on towards Amatitlan (sketches 1 & 3).

No. 23. Power lines leaving road at Kilo 11 and going across country as explained in No. 22 and sign shown as (3) in photo No. 22.

No. 23A-D. Details of power line posts at Kilo 11. The man shown in 23A and 23B is 5'10½" tall. The higher posts are I-beams.

No. 23E-F. Approach to Kilo 11 showing power lines on left side of road to Amatitlan.

No. 24. Continuation of power lines shown in No. 22. The Villalobos Bridge is at Kilo 13. It will be noted that at this point the power line coming from Amatitlan to the city makes a series of great leaps across ravines. There is a road leading to the tower shown by (1) which is on a flat mesa.

No. No. 25. Towers and power line jumping a ravine at Kilo 13. Exact location of Kilo 13 shown by (1). It will be seen from the photograph that the road at this point drops sharply. This is another view of that shown in photo No. 24.

No. 26. Marker at Kilo 13.

No. 27. Aerial view showing location of posts leading from Zapote plant to brewery. It will be seen that posts 317 to 352 cut across woods whereas road makes a bend. The power line consisting of three strands is supported by a railroad rail running 30 pounds per foot. An idea of this can be seen in picture No. 28 (sketch No. 7).

Photo No. 28. Zapote electric line.

No. 29. Railroad overpass on Puerto Barrios road showing railroad leading out of town to overpass (sketches 8 and 9).

No. 29A-E. Ground views of bridge No. 1 located 1,000 feet from Puente las Vacas (sketch No. 9).

No. 30. Another view of bridge or overpass looking east (sketch No. 9).

No. 31. Another view of bridge or overpass.

No. 32. Another view of same bridge or overpass. It will be seen that it is 1,000 feet from Puente las Vacas which is right next to the city itself.

No. 33. Another view of Puente las Vacas (1) and of the bridge or overpass. The city can be seen in the upper foreground.

No. 34. Aerial photograph of another bridge (No. 2 shown on map) located approximately 8 miles from Puente lasVacas on route to Puerto Barrios. (1) on the picture shows road leading to main highway (sketches No. 8 and 10).

No. 35. Another view of same bridge. It will be observed that though of the same type as bridge No. 1 this is of stronger construction and longer but located in a more secluded spot.

Nos. 36 and 37. Bridge No. 2 (sketch No. 10).

Nos. 38-41. Ground views of bridge No. 2 (sketch No. 10).