

System of Road Building and Types of Roads

In order to get under way as rapidly as possible with its road building program and to insure definite results at an early date, the Highway Commission began its operations by granting contracts on the "cost plus" basis. This system, however, was soon abandoned in favor of the more efficient and economical method of awarding road contracts to the lowest responsible bidder on a unit price basis. The unit price contracts have been used since 1927 and the results of this system have been eminently satisfactory.

In a country like Mexico where the population in a very large part of the country is very thinly spread and where the development of "road consciousness" is difficult to achieve, the problem of creating a national system of highways presents educational as well as economic aspects.

The National Highway Commission, fully aware of these two aspects of the problem, and profiting by the experience of other countries, has adopted the so-called "progressive" or "stage" construction plan. Under this plan any given road in the national highway system is "carefully located with a view to its improvement over a period of years and in accord with traffic increase and requirements to a high standard of alignment, width, grade and surfacing. Upon this located line the initial work is so distributed that the entire route is made passable and open to travel within a minimum time limit and at a minimum cost."

Fortunately there are available in Mexico a variety of low cost surfacing materials. Land-clay, "tepetate" and "tezon-tle", to mention a few materials, have already given excellent

results on roads where the traffic is relatively small.

Where the traffic has increased rapidly, it has been necessary to pass on to the final stage in the progressive-construction plan and certain of the principal highways leading out of Mexico City are now ranked as of the best quality hard-surfaced macadam roads.

Roads Completed and Under Construction in the National Highway System

At the end of the year 1930 the National Highway Commission according to one of its former Presidents ¹⁶ had, in round numbers, achieved the following results:

National Highways opened to traffic..	2,500 kilometers
Municipal and state highways opened to traffic.....	800 "
Highways under construction.....	1,300 "
Amount expended in the construction of national roads.....	35,000,000.00 pesos
Amount expended in the purchase of machinery.....	5,000,000.00 "
Average cost of construction per kilometer of road in 1926.....	10,000.00 "
Average cost of construction per kilometer of road in 1930.....	7,000.00 "

As these figures show, despite limited funds, several political disturbances, and the general economic depression, the Highway Commission has, during the last five years, made tremendous strides in the direction of furnishing the nation with a system of roads adequate to its needs. The following paragraphs are devoted to a more or less detailed consideration of the principal roads in the national system which have been built or are definitely in process of construction.

NUEVO LAREDO -- Monterrey -- Ciudad Victoria -- MEXICO CITY

For many years there has been a tremendous amount of

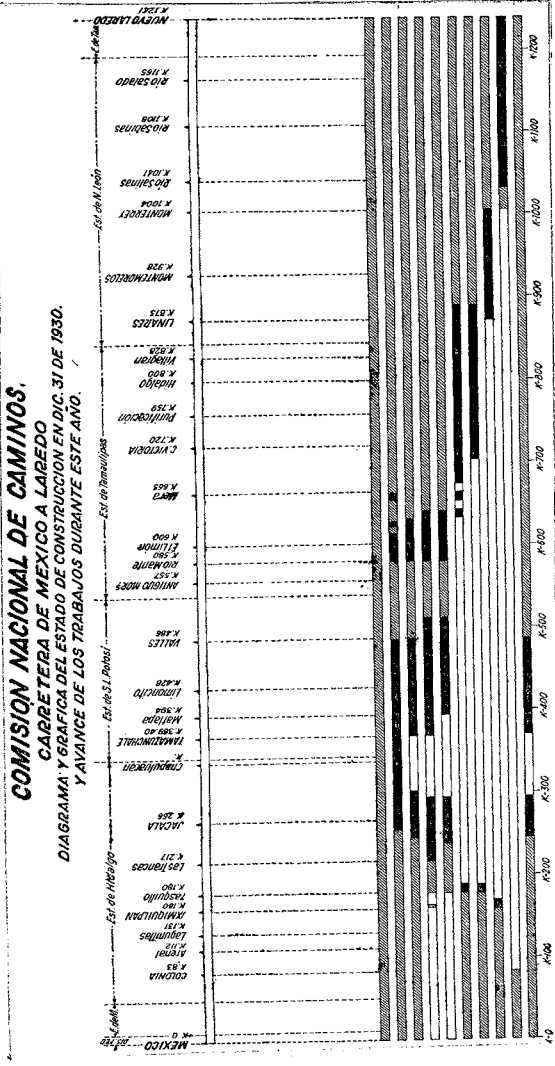
agitation on both sides of the Rio Grande for the building of a first class road between Nuevo Laredo and Mexico City. Because of this agitation and because of its obvious importance in stimulating both national and international tourist trade the Laredo-Mexico City road was one of the first projects to which the National Highway Commission turned its attention and since 1925 the work on this great project has been pushed to the limit of the resources available.

As may be noted on Map No.2 (in attached envelope) where the route is marked (1) the Nuevo Laredo-Mexico City road roughly parallels the Gulf coast at a distance inland of, on the average, around 200 kilometers. The principal cities which it passes through after it leaves the border at Nuevo Laredo are Monterrey (kilometer 236), Linares (kilometer 360), and Ciudad Victoria (kilometer 522). Between the last named place and Mexico City where the road traverses territory large sections of which have practically been isolated from the rest of the country, the villages all have less than 3,000 inhabitants. (See Map No.3 and 3a)

The total length of the Nuevo Laredo-Mexico City highway is 1242 kilometers (approximately 770 miles). In Chart No.1 are given in detail the data relating to the stages reached in the construction of the highway as of December 1930. These same facts are also presented in colors on Map No.2. At the present time (June 1931) only one section of the road, of about 60 kilometers between Tamazunchale and La Culebra, is completely impassable. Other sections of the road are only open to traffic during the dry season. In 1930 over 6,800,000 pesos were spent on the Laredo road and at the present time there are some 6,000 men at work on the project; the Commission hopes to have at

CHART NO. 1

1
NUEVO LAREDO-MEXICO CITY HIGHWAY
CONSTRUCTION AS OF DEC. 31, 1930



Construction to December 1929

Construction during year 1930

least a provisional road open from the border to Mexico City before the end of the present year. The table given below is the summary of the conditions encountered by the Secretary of the American Chamber of Commerce in Mexico who recently made a trip by automobile and horseback over the entire route which the highway will follow.

17

Kilometer

1-84 (Colonia).....	32 feet, paved; skirting Lake Texcoco; few slight grades
85-187 (Xhita).....	32 feet, fine gravelly; well-drained, excellently banked; smooth
188-225.....	12-15 feet, old road unimproved but all-weather; bed rock foundation
226-294 (La Culebra).....	12 feet, untopped but all-weather; bed rock foundation; 6% grades; sharp drops unguarded; sharp turns
295-352 (Tamán).....	Under construction, no passing
353-360 (Tamazunchale)....	16 feet, untopped; dry-weather
361-490 (C. de Valles)....	32 feet, graded, fair drainage; dry weather only; ferries at Kilometer 394, 455, and 469; bridges and culverts rapidly being completed
491-720 (Victoria).....	32 feet, graded, impassable after rains; numerous fords and ferries
721-875 (Linares).....	32 feet, graded, well drained; graveling proceeding rapidly; dry-weather
876-1,006 (Monterrey).....	32 feet, graveled, all weather; smooth, few grades and turns
1,006-1,242 (N. Laredo)...	32 feet, paved, splendid condition

MEXICO CITY-Puebla-Oaxaca-Tuxtla-SUCHIATE

The road from Mexico City to the town of Suchiate across the border from Guatemala taken together with the Nuevo Laredo-Mexico City road forms the Mexican link in the proposed great Pan American Highway, which, when completed, will extend from Canada to Chile.

As now planned the principal cities through which the

Mexico City-Suchiate road will pass are Puebla (K.132), Oaxaca (K.592), Juchitan (K.835), Tuxtla (K.1065), San Cristobal, Comitán and Tapachula (K.1407). When finished the road will traverse a distance of over 1400 kilometers. (See Route (2) on Map No.2; for detail of route and profile of country traversed as far as Oaxaca see Maps Nos. 4 and 5.)

The first section of this road, from Mexico City to Puebla, covering a distance of 132 kilometers, was one of the earliest roads to be completed by the National Highway Commission. Work on this section was begun in 1925 and by the end of 1927 the whole stretch was paved. With the exception of the Mexico City-Puebla section, however, for the most part, as may be noted on Map No.2 and Chart No.2, the Mexico City-Suchiate road is little more than a project. Under very favorable conditions during the dry season it is possible to go as far south as Oaxaca over the provisional road which has been opened up by the simple process of joining the existing old roads together. But from Oaxaca on there are many long stretches where the roads either do not exist or are in such bad condition as to be impassable. In 1930 the Highway Commission expended 118,000 pesos on various sections of the Mexico City-Suchiate road.

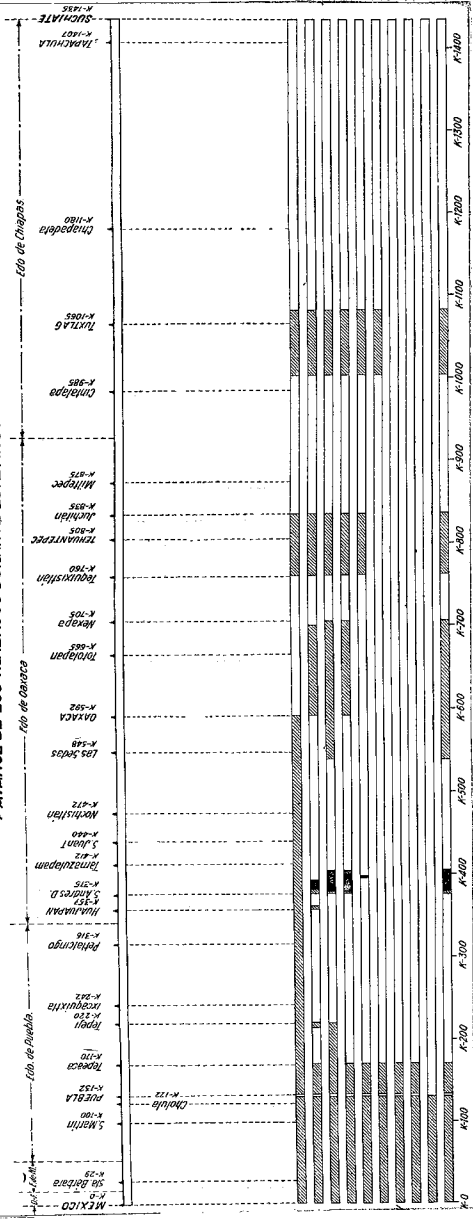
MATAMOROS-Monterrey-Torreón-Durango-MAZATLAN

A number of special features characterize and give interest to the proposed road connecting Matamoros with Mazatlan. In the first place the road joining, as it will, many of the most important cities of northern Mexico, should serve to open up a territory hitherto notoriously lacking in adequate means of communication. It is expected, when the road is completed, that it will not only serve to stimulate directly the economic

CHART NO. 2

1
MEXICO CITY-SUCHIATE HIGHWAY
CONSTRUCTION AS OF DEC. 31, 1930

COMISION NACIONAL DE CAMINOS.
CARRETERA DE MEXICO A SUCHIATE-
DIAGRAMA Y GRAFICA DEL ESTADO DE CONSTRUCCION EN DIC. 31 DE 1930
y AVANCE DE LOS TRABAJOS DURANTE ESTE AÑO.



Construction to December 1929
Construction during year 1930

1 Comisión Nacional de Caminos -- Anuario 1931.

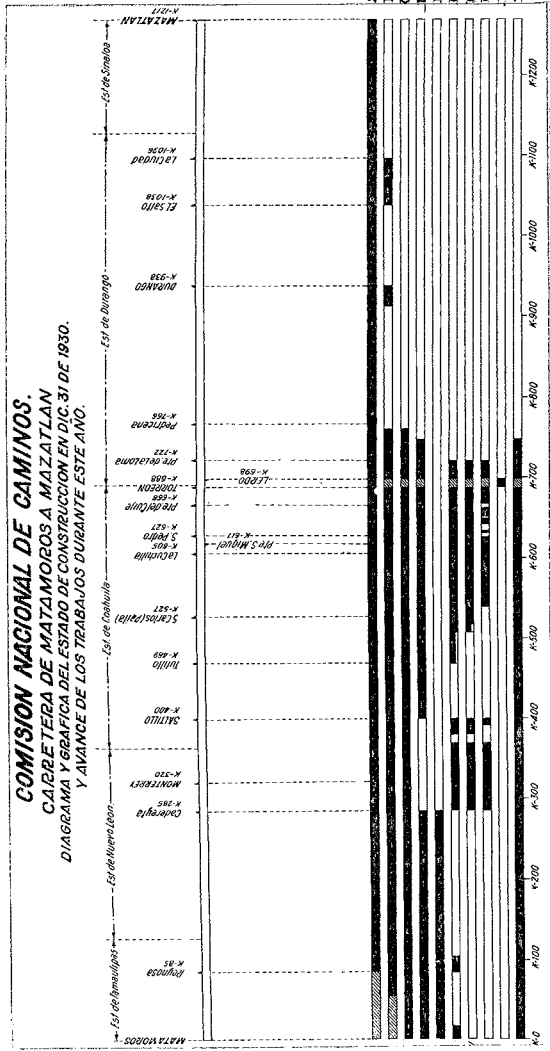
life of north central Mexico by giving more towns and farm areas access to the markets in the larger cities along the route, but that it will also attract many tourists from the United States.

In the second place the road as it is now being built furnishes an excellent illustration of cooperation between the Federal Government (National Highway Commission), private organizations, and municipal and state governments. In each state through which the road passes plans have been made whereby a majority of the interested private groups and local governmental bodies have agreed to contribute definite sums of money to the project. The National Highway Commission has undertaken to furnish the technical direction of the work and to provide the funds for those sections of the road which are most difficult and expensive to build.

The principal cities which will be linked together by this highway are Matamoros, Monterey (K.320), Saltillo (K.400), Torreon (K.688), Durango (K.938), and Mazatlan. The total length of the highway will be 1217 kilometers. (See Route No.3 on Map No.2; also Map No.6.)

Although the official plans for the highway were finally completed only last year (1930), due to the relatively good condition of large stretches of the old roads already in existence, it has been possible to progress very rapidly in the improvement of certain of the central sections of the highway between Monterey and Gomez Palacio. On the sections offering the greatest difficulties (i.e. where the road must cross the mountains paralleling each coast) the work has of course proceeded more slowly. At the eastern end a provisional road over the mountains has been opened as far as Monterey; at the western end (between Gomez Palacio and Mazatlan), however, for the most

CHART NO. 3
 1
 MATAMOROS-MAZATLAN HIGHWAY
 CONSTRUCTION AS OF DEC. 31, 1930



Construction to December 1929
 Construction during year 1930

1 Comisión Nacional de Caminos -- Anuario 1931.

part, only the preliminary surveys have been completed. (See Chart No.3.)

PIEDRAS NEGRAS-Monclova-HIPOLITO

The National Highway Commission is still in the process of surveying the Piedras Negras-Hipolito highway. A road, which is passable only in the dry season, has been opened up provisionally by connecting the already existing roads in this area. (See Route No.4 on Map No.2.)

When completed this road will connect still another border point (Piedras Negras) with the Matamoros-Mazatlan highway and thus also with the Nuevo Laredo-Mexico City highway. (See Map No.7 for detail of route.)

MEXICO CITY-Toluca-Morelia-GUADALAJARA

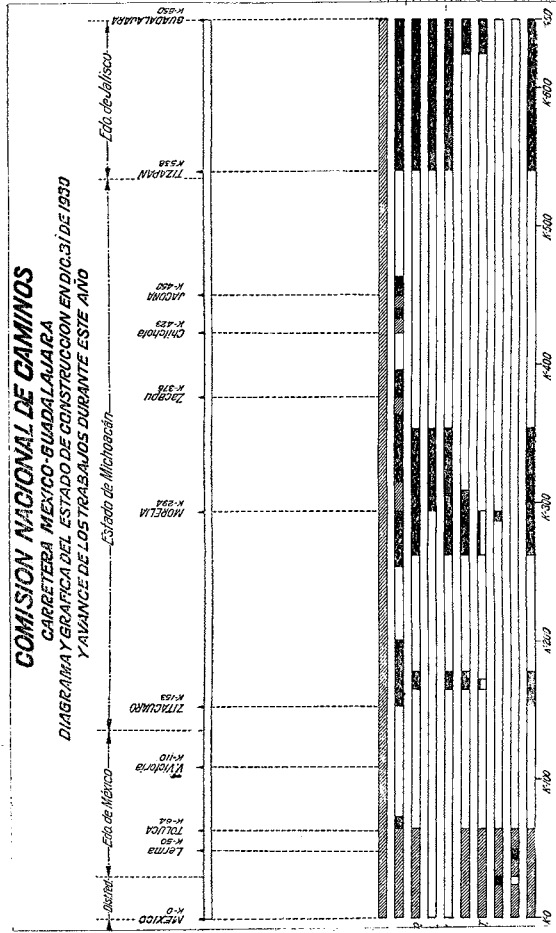
Work on this important addition to the internal highway system of Mexico has been prosecuted with considerable vigor during the past two years. In 1930, over 1,500,000 pesos were spent, of which 300,000 were contributed by the state of Jalisco. A good part of this money went into improvements on the two short stretches, from Mexico City to Toluca and from Guadalajara to Chapala, at the eastern and western terminuses of the highway. (See Route 5, Map No.2). The rest of the road, which passes through the important city of Morelia, is still largely in the process of being surveyed and located. Even in the dry season, therefore, it is impossible to traverse the entire route as now planned, without the necessity of making long detours over very rough and unsatisfactory trails. (See Map No.8 and Chart No.4.)

MEXICO CITY-Guernavaca-Iguala-Chilpancingo-ACAPULCO

This highway, justly famous for its scenic beauty, is,

CHART NO. 4

1
 MEXICO CITY-GUADALAJARA HIGHWAY
 CONSTRUCTION AS OF DEC. 31, 1930



Construction to December 1929
 Construction during year 1930

1 Comisión Nacional de Caminos -- Anuario 1931.

both because of its many historical associations and the very considerable engineering feats involved, one of the most interesting roads built by the National Highway Commission. For hundreds of years, over approximately the same route which is now occupied by a modern automobile road a constant stream of pack mules carried thousands of pesos of merchandise from the far east and hundreds of thousands of pesos worth of silver from the mines of the state of Guerrero to Mexico City.

The task of connecting the old colonial mining road from Mexico City to Taxco and the old trade route from Iguala to the coast and of converting the whole stretch into a modern highway was first attacked by the National Highway Commission in 1925. Due to lack of funds, however, very little was accomplished until 1927 when the completion of the Mexico City-Puebla and the Mexico City-Pachuca roads released additional money and engineers. Since the last mentioned date, the work on the Mexico City-Acapulco project has been rapidly carried forward. At the end of 1930, the whole road had been opened to traffic during all seasons and only about 60 kilometers had not been surfaced. (See Chart No.5 and Route 5 on Map No.2; also see Map No.9.) The road has been paved between Mexico City and Cuernavaca (75 kilometers) and it is planned to pave the remaining sections as fast as the increase in traffic warrants.

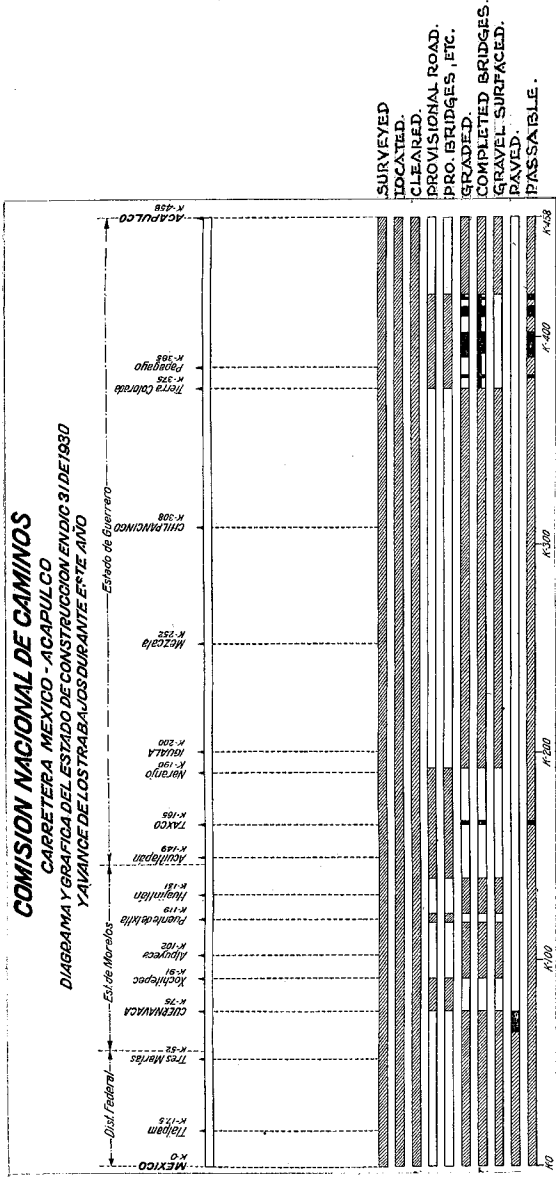
MEXICO CITY-Puebla-Orizaba-VERACRUZ

Passing through Puebla, Orizaba, and Cordoba and following more or less the route of the old colonial stage coach road built by the Tribunal of Commerce of Mexico City (see above p.) the Mexico City-Vera Cruz highway will be an extremely interesting and valuable addition to the National highway system. Not only

CHART NO. 5

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MEXICO CITY-ACAPULCO HIGHWAY
CONSTRUCTION AS OF DEC. 31, 1930



Construction to December 1929
Construction during year 1930

1 Comisión Nacional de Caminos -- Anuario 1931.

will it give the Capital a highway connection with Vera Cruz, but it will also, by joining on to the Mexico City-Suchiate road, and the Mexico City-Acapulco road furnish a two-branched coast to coast highway in the southern part of country similar to the Matamoros-Mazatlan highway in the north.

Very appreciable progress has been made since work was begun in 1928 on this road. Although the surfacing is not yet completed, it is possible without great difficulty to go by automobile from Puebla to San Juan de la Punta, a distance of 194 kilometers, or 329 kilometers from Mexico City. Starting from Mexico City, the total length of the road will be about 448 kilometers. Thanks to the interest and financial assistance of local private organizations the section of most advanced construction is that between Orizaba and Cordoba. During 1930 a total of 470,000 pesos was spent on the Mexico City (Puebla)-Vera Cruz highway, of which 100,000 pesos was provided from unofficial sources. (See Route 7, Map No.2; also Chart No.6 and Maps Nos. 10 and 11.)

MEXICO CITY-Tezmelucan-TLAXCALA

This is a relatively short road of only 114 kilometers. Branching off from the Mexico City-Puebla road it will join Mexico City with the capital of the state of Tlaxcala. For 91 kilometers the road is the same as that to Puebla. The greater part of the highway is, therefore, already paved. Of the remaining 23 kilometers, 16 have been surfaced and 7 are in the process of being graded. (See Route No.8, Map No.2.)

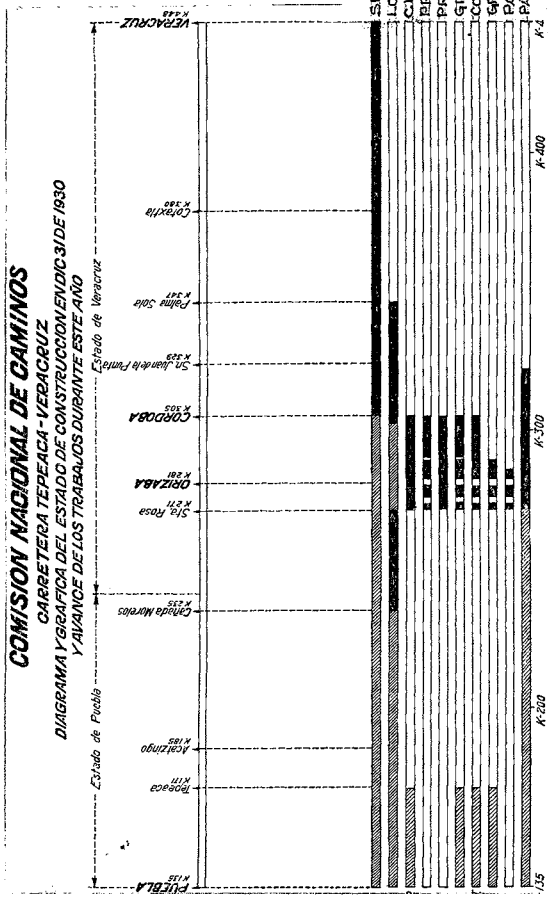
MEXICO CITY-Amecameca-Cuautla-CUERNAVACA

This highway, connecting the Capital with Amecameca, Cuautla and Cuernavaca, forms the two sides of a triangle of which

CHART No. 6

1

MEXICO CITY-TEPEACA-VERACRUZ HIGHWAY
CONSTRUCTION AS OF DEC. 31, 1930



Construction to December 1929
Construction during year 1930

1 Comisión Nacional de Caminos -- Anuario 1931.

the Mexico City-Cuernavaca (Acapulco) road is, roughly, the base. The road, counting in the 20 kilometers or so which it shares with the Mexico City-Puebla highway, measures in all some 80 kilometers. The first 20 kilometers are paved and the rest of the road is surfaced with gravel. (See Route No.9, Map No.2.)

(Map No.12 is a graphic presentation of the principal roads leading out of the Valley of Mexico.)

Other Roads

In addition to the highways which have been described above in some detail, the National Highway Commission in its official publications ¹⁸ also announces certain other roads on which preliminary studies have been made. These roads, however, are still very much in the project stage and, with the exception of the Mexico City-Puebla-Atlixco-Acapulco road (see Route No.6, Map No.2) little more has been done than to plot these roads on the map. For this reason it is perhaps more appropriate to consider them in the following section dealing with the future program of the National Highway Commission.

Projects for the Completion of the National Highway System

During the past six years a number of both official and unofficial projects and plans have been drawn up with a view to mapping out a complete system of national highways for Mexico. In the following pages the most important of these plans are presented in summary fashion without comment. In the last chapter of this monograph an attempt will be made to criticize and evaluate these various proposals for a national highway system in connection with the suggestions and recommendations which have been developed in the course of the study.

National Highway Commission's Five-Year Program

In its official annual report,¹⁹ published Jan. 1, 1930, the National Highway Commission outlined a program for the development of the National Highway System covering the five-year period 1930-34. This program was as follows:

<u>Roads</u>	<u>Approximate Cost</u> <u>(in pesos)</u>
1. Mexico City-Nuevo Laredo	12,000,000
2. Toluca-Guadala jara	9,000,000
3. Puebla-Oaxaca	6,000,000
4. Puebla-Verua Cruz	5,000,000
5. Oaxaca-Tehuantepec-Tuxtla-Suchiate	12,000,000
6. Tuxtla Gutierrez-Merida	10,000,000
7. Ciudad Victoria-Guadalajara	6,000,000
8. Guadalajara-Chihuahua (preliminary work)	6,000,000
9. Construction of roads of minor importance	5,000,000
10. Preservation of roads already constructed	9,000,000
Total	<u>80,000,000</u>

The above program is presented graphically on Map No.13 (in attached envelope). In referring to this map it should be noted that a number of roads now (1931) actually under construction or survey by the Commission are not included in the five-year program as originally outlined in 1929. (See Routes Nos. 9, 10, 11, 12, 13, 14 and 15.) On the other hand up to the present time no work has been done by the Commission on certain other roads projected in the 1930-34 program. (See Routes Nos. 6, 7 and 8.)

The National Highway Commission estimated in 1929 that the following sums would be available from the gasoline tax for financing the 1930-34 program outlined above.

<u>Year</u>	<u>Pesos</u>
1930	12,000,000
1931	14,000,000
1932	16,000,000
1933	18,000,000
1934	20,000,000
Total	<u>80,000,000</u>

Note: With the increase of the gasoline tax to 6 centavos in 1930, the estimates above are subject to revision.

Plan of the Permanent Committee
of the National Highway Commission

A second scheme for the completion of the national highway system has been devised by the Permanent Committee of the National Highway Commission. (See Map No.14 in attached envelope.) This Committee reported to the Second National Road Congress (1929) that in the opinion of its members the following roads should be given preference in the construction program of the National Highway Commission:

20

<u>Roads</u>	<u>Kilometers</u>	<u>Approximate Cost (in pesos)</u>
1. Mexico City-Laredo	600	15,000,000
2. Mexico City-Acapulco		3,000,000
3. Mexico City-Merida	1,700	20,000,000
4. Mexico City-Sonora (Naco)	2,100	32,000,000
5. Matamoros-Chamela	1,150	14,000,000
Total	<u>5,550</u>	<u>84,000,000</u>
6. Pachuca-Tuxpan	250	2,500,000
7. Puebla-Vera Cruz	330	6,000,000
8. Tuxtla Gutierrez-Suchiate	300	6,000,000
9. Tuxtla Gutierrez-Alvaro Obregon	300	3,000,000
10. Durango-Mazatlan	250	4,000,000
11. Galeana-Ciudad Juarez	250	2,500,000
12. Guanajuato-Queretaro	300	4,000,000
Total	<u>1,980</u>	<u>28,000,000</u>
13. Jalapa-Aguascalientes	120	1,200,000
14. Ramal de Tampico	75	1,500,000
15. Ramal a Campeche	50	500,000
16. Tehuantepec-Salina Cruz	25	250,000
17. Tapachula-San Benito	25	250,000
18. Texmelucan-Tlaxcala	25	300,000
Total	<u>320</u>	<u>4,000,000</u>
Principal Roads	5,550	84,000,000
Secondary Roads	1,980	28,000,000
Branch Roads	<u>320</u>	<u>4,000,000</u>
Grand Total	7,850	116,000,000

In the above detailed system of roads certain areas of Mexico -- the territories of Lower California and Quintana Roo and the states of Colima and Nayarit -- are not included. The Committee estimated that about 1,000 more kilometers of roads costing approximately 16,000,000 pesos would be necessary in order

to link these isolated areas up with the general system. Thus the entire system, as envisaged under this plan, would be about 9,000 kilometers at a total cost of approximately 132,000,000 pesos.

Project Formulated by the First Sub-Commission
of the Third National Highway Congress

Holding that the network of highways projected by the Permanent Committee of the National Highway Commission was inadequate in conception and based upon an insufficient amount of data, a special Commission appointed by the Third National Highway Congress undertook to work out a new and more comprehensive plan. This plan was made public in September, 1930.

In the introduction to its report the Commission emphasized its belief: (a) that efficiency and economy demanded a road building program covering a period of from 40 to 50 years; and (b) that this program, once determined, should be enacted into law thus forestalling the construction of roads for purely political reasons. The Commission stated further that the program which it had worked out was based on a careful study of the relation of the national highway system to: (a) the defense of the nation against foreign military aggression; (b) the protection of the country against smuggling; (c) the maintenance of internal order and peace; (d) the development of agriculture, commerce, industry, and the exploitation of natural resources; (e) international communication; and, (f) the development of the tourist industry.

"/In making our program/, our first idea has been to frame the Republic by four roads: two of these roads skirt the frontiers and the other two border the coasts. (See Map 15 in attached envelope, Routes 2, 3, and 4.) After this we have projected a road, starting from a point on the frontier with the

United States, ending at a point on the frontier with Guatemala; parallel to this, a second road was planned from another point on the northern frontier to Mexico City. (Routes 6 and 5) Complementary to these, we planned a road running the length of the peninsula of Lower California. (Route 7.)...

"Every nation seeks access to the sea from the principle points of its territory. Mexico also must be concerned with obtaining such access and with establishing inter-oceanic communications by means of transverse roads which, cutting across the richest areas, will connect the Gulf coast with that of the Pacific. (Routes 8, 9, 10, 11, 12, 13, 14, 15 and 16.)

"With these ideas in mind we have projected the following network of roads...to form the National Highway System:

Routes	Kilometers
1. Tijuana, B.C.-Matamoros, Tamps.	2,300
2. Puerto S. Benito, Chis.-Merida, Yuc.	1,300
3. Sonoita, Son.-Tehuantepec, Oax.	2,700
4. Matamoris, Tamps.-Merida, Yuc.	1,800
5. Ciudad Juarez, Chih.-Mexico City, D.F.	1,700
6. Nuevo Laredo, Tamps.-Zapaluta, Chis.	2,000
7. Tijuana, B.C.-San Lucas, B.C.	1,350
8. Guaymas, Son.-Nuevo Laredo, Tamps.	1,200
9. Mazatlán, Sin.-Matamoros, Tamps.	1,000
10. Puerto San Blas, Nay.-Soto La Marina, Tamps.	800
11. Manzanillo, Col.-Tampico, Tamps.	850
12. Manzanillo, Col.-Tuxpan, Ver.	900
13. La Orilla, Mich.-Veracruz, Ver.	750
14. Acapulco, Gro.-Veracruz, Ver.	550
15. Puerto San Angel, Oax.-Alvarado, Ver.	400
16. San Cristobal, Chis.-Frontera, Tab.	250
17. Punto A., Camp.-Laguna del Carmen, Camp.	100
18. San Felipe, Camp.-Progreso, Yuc.	450
19. San Cruz, Q.R.-Campeche, Camp.	260
20. Morelia, Mich.-Ciudad Victoria, Tamps.	600
21. Tepic, Nay.-Zamora, Mich.	300
22. Chilpancingo, Gro.-Mexico City, D.F.	250
23. Mexico City, D.F.-Orizaba, Ver.	230
Total	<u>22,040</u>
Plus approximately 40% for development	8,816
Total	<u>30,856</u>

"Assuming that the total kilometrage will be, in round numbers, 31,000 and that each kilometer, on the average, will cost

25,000 pesos, the total cost of the system will be 31,000 x 25,000 or 775,000,000 pesos.

"If the National Highway Commission can count on a budget of 20,000,000 pesos a year, it will be able to complete the above detailed system of roads in about 39 years -- and this without taking into account the roads which have already been constructed... Thirty-nine years to construct the system of roads which we propose seems to us insignificant in comparison with the total life of the nation...

"Part of our plan, it should be noted, is for the Federal Government, through the National Highway Commission, to devote its attention and funds solely to construction of the roads in the system which we have proposed. Under no circumstances should the funds of the National Highway Commission be used to aid the road building programs of the states and countries (municipios); for these entities usually solicit funds for purely local political purposes...and they are constantly in bankruptcy and simply wish to use subsidies and aid from the National Highway Commission in order to remedy the errors and deficiencies in their local road systems."

System Proposed by Carlos Contreras

One of the first comprehensive plans for a system of national highways was that worked out by the present chief of the National Planning Department of the Ministry of Communications and Public Works. This scheme was presented in a report on national and regional planning, originally prepared for the then President of Mexico, General Calles, and later published in City Planning, July, 1925. The essential features of the plan are as follows:

"The National System of Highways for the Mexican

Republic must have as a basis the following main highways:

- (1) The Diagonal Trunkline Highway proposed by Engineer Toscano, starting at Ensenada, Lower California, passing through Alotar, Hermosillo, El Fuerte, Culiacan, Sombretete, Zacatecas, Aguascalientes, Lagos, Leon, Guanajuato, Dolores Hidalgo, Queretaro, San Juan del Rio, Mexico City, Puebla, Acatlan, Oaxaca, Tehuantepec, San Marcos, Tuxtla Gutierrez, San Cristobal, Palenque, Balancan, Concepcion, Laguna, Om, Payo Obispo, and Puerto Madero in the Territory of Quintana Roo, and extending over approximately three thousand miles. (See Map No.16, Route 1.)
- (2) A Main Trunkline Highway along the eastern coast of Mexico, starting at Matamoros, Tamaulipas, passing through Tampico, Jalapa, Tuxpam, Vera Cruz, Alvarado, Puerto Mexico, Balancan, Campeche, Merida, and running along the coast to Puerto Madero. (Route 2.)
- (3) A Main Trunkline Highway along the western coast of Mexico, starting at Nogales, Sonora, passing through Hermosillo, Guaymas, Mazatlan, Colima, Acapulco, Puerto Angeles, Salina Cruz, and running along the coast to the Guatemala border. (Route 3.)
- (4) A Main Trunkline Highway starting at Nuevo Laredo, Tamaulipas, passing through Monterrey, Saltillo, San Luis Potosi, Queretaro, Mexico City, Puebla, Juchitan, as far as the Guatemala border thus continuing the Meridian Highway. (Route 4.)
- (5) A Main Trunkline Highway starting at Ciudad Juarez, Chihuahua, passing through Chihuahua, Torreon, Durango, Guadalajara, Chapala, Los Reyes, Uruapam, Chilpancingo, Oaxaca, Tehuantepec, and then following the same route as the Diagonal Highway as far as Puerto Madero. (Route 5.)

"In addition to these five main longitudinal highways, the National Highway System of Mexico should comprise the following transversal highways:

- (1) From Puerto Mexico to Salina Cruz along the Isthmus of Tehuantepec. (Route 6.)
- (2) From Vera Cruz to Puerto Angeles through Acatlan and Oaxaca. (Route 7.)
- (3) From Tampico to Acapulco, through Pachuca, Mexico City, Cuernavaca, Iguala, Chilpancingo. (Route 8.)

- (4) From Vera Cruz to Guadalajara, through Puebla, Mexico City, Queretaro, Lagos. (Route 9.)
- (5) From Tampico to Guadalajara, through San Luis Potosi and Aguascalientes. (Route 10.)
- (6) From Tampico to Mazatlan, through Ciudad Victoria, Monterrey, Saltillo, Torreon, Parral, and Culiacan. (Route 11.)
- (7) A transversal highway along the United States border from Matamoros, Tamaulipas, to Ensenada, Lower California, through Nuevo Laredo, Monterrey, Saltillo, Torreon, Ciudad Juarez, Nogales, and Mexicali. (Route 12.)

"In addition to these Main Longitudinal and Transversal Highways, branch roads must be built from the industrial, agricultural and mining centers of the Republic to the ports and principal points on the eastern and western coasts and to the ports of entry on the United States and Guatemala borders.

"Roads must be built to feed the National Railways of Mexico, so that organized cooperation between the railway and other transportation companies may bring benefits to both."

Plan Submitted by Francisco Antunez Echagaray

In a report submitted to the Permanent Commission of the third National Highway Congress in November, 1930, Ing. Francisco Antunez presents a scheme for Mexico's highways which differs in several respects from the various plans summarized in the foregoing pages. ²² The highway plan formulated by Ing. Antunez is designed (a) "to complete and fill out the system of national communications" and (b) to permit "the construction of the largest number of connected roads adequate to traffic demands, but not necessitating excessive expenditures for conservation." In this plan, according to its author, due care has been taken to avoid the building of highways in competition with the existing railway lines.

The following are the highways proposed by Ing. Antunez
 (see Map No.17 in attached envelope):

<u>Routes</u>	<u>Kilometers</u>
1. Mexico City-Guadalajara-Mazatlan-Hermosillo-Nogales, Son.	2,040
2. Mexico City-Guadalajara-Zacatecas-Durango-Chihuahua-Nogales, Son.	2,060
3. Zacatecas, Zac.-Saltillo-Monclova-Piedras Negras, Coah.	720
4. Nuevo Laredo, Tamps.-Monterrey-Ciudad Victoria-Pachuca-Mexico City-Puebla-Oaxaca-Juchitan-Tuxtla-Altamisa, Chis.	2,000
5. Tijuana, B.C.-Purisima-La Paz-San Lucas, B.C.	1,850
6. San Buenaventura, Chih.-Ciudad Juarez, Chih.	310
7. Morelia, Mich.-Guanajuato-San Luis Potosi-Ciudad Victoria, Tamps.	560
8. San Cristobal, Chis.-Merida, Yuc.	680
9. San Felipe, Camp.-Payo Obispo-Puerto Madero, Q.R.	210
10. Merida, Yuc.-Puerto Morelos, Q.R.	290
11. Matamoros, Tamps.-Monterrey-Torreón-Durango-Mazatlan, Sin.	1,300
12. Tampico, Tamps.-Guanajuato-Guadalajara-Chamela, Jal.	850
13. Mexico City-Acapulco, Gro.	458
14. Puebla, Pue.-Orizaba-Veracruz, Ver.	330
15. Morelia, Mich.-Zihuatanejo, Gro.	380
16. Colima, Col.-Coalcoman-Aguililla, Mich.	135
17. Guanajuato, Gto.-Queretaro-Pachuca, Hgo.	240
18. Pachuca, Hgo.-Tuxpan, Ver.	220
19. Mexico City-Jalapa, Ver.	280
20. Huajuapán de León, Oax.-Puerto Minizo, Oax.	300

21. Puerto Angel, Oax.-Oaxaca- Alvarado, Ver.	640
22. San Cristobal, Chis.-Villa Hermosa- Ciudad Alvaro Obregon, Tab.	250
23. Campeche, Camp.-Laguna del Carmen, Camp.	200
24. Chilpancingo, Gro.-Oaxaca, Oax.	180
25. Autlan, Jal.-Colima, Col.	140
26. Vera Cruz, Ver.-Villa Hermosa, Tab.	<u>400</u>
Total Kilometers	17,023

Ing. Antunez subtracts from the above noted total of 17,023 kilometers in his proposed highway system the 4,000 kilometers which he estimates have already been opened up by the National Highway Commission and some 3,000 kilometers which he assumes will be constructed by the state governments. This leaves a total in round numbers of 10,000 kilometers to be constructed by the Federal Government. At an estimated average cost of 20,000 pesos per kilometer, the total cost of constructing the National Highway System would be 200,000,000 pesos.

Project Formulated by Alfredo Becerril Colín

The most recent scheme for a National Highway System is that worked out by Ing. Alfredo Becerril and presented to the Minister of Communications and Public Works in a memorandum dated April, 1931.²³ This plan deals with three aspects of the national highway problem: (a) the roads to be included in the national system and the order of preference in their construction; (b) the best method of financing the national highway system; and (c) the manner in which the Federal Government should cooperate with the states in order to insure "the simultaneous and harmonious development of state and national highway programs."

The net of highways which, in the opinion of Ing. Becerril, should make up the National Highway System are as follows (see Map No.18 in attached envelope):

	<u>Approximate Length</u> <u>in kilometers</u>
<u>Trunk Highways</u>	
1. Mexico City-Pachuca-Ciudad Victoria-Monterrey-Laredo	1,240
2. Mexico City-Toluca-Guanajuato-Aguascalientes-Zacatecas-Durango-Chihuahua-Ciudad Juarez	2,300
3. Mexico City-Toluca-Morelia-Guadalajara-Tepic-Culiacan-Hermosillo-San Luis-Tijuana	2,800
4. Mexico City-Cuernavaca-Oaxaca-Tuxtla Gutierrez-San Cristobal-Tapachula	1,300
5. Mexico City-Puebla-Orizaba-Veracruz	<u>460</u>
Total	8,100

Branch Highways

of Trunk Highway No.1

a. Ixmiquilpan-Queretaro-Guanajuato	280
b. Valles-Tampico	140
c. Ciudad Victoria-San Luis Potosi-Guanajuato	480
d. Monterrey-Matamoros	350
e. Monterrey-Salttillo-Durango	600

of Trunk Highway No.2

a. Guanajuato-Guadalajara	300
b. Durango-Mazatlan	350
c. San Buenaventura-Nogales-Santa Ana	560

of Trunk Highway No.3

a. Guadalajara-Colima-Manzanillo	340
b. Navarrete-San Blas	30
c. Tijuana-Ensenada-La Paz	1,300

of Trunk Highway No.4

a. Cuernavaca-Ciudad Bravos-Acapulco	380
b. Cholula-Matamoros-San Marcos-Acapulco	450
c. Oaxaca-Puerto Angel	230
d. Tapachula-San Benito	25
e. Tehuantepec-Salina Cruz	25
f. Tixtla-Villahermosa-Puerto Alvaro Obregon	290
g. San Cristobal-San Felipe-Merida-Progreso	720
h. Campeche-Payo Obispo	320
i. Santa Barbara-Cuautla-Cuernavaca	120

of Trunk Highway No.5

a. Texmelucan-Tlaxcala-Jalapa-Veracruz	370
Total	<u>7,655</u>

Total of Trunk and Branch Highways..... 15,755

The order of preference in the construction of the above indicated roads should be determined, according to Ing. Becerril, on the basis of greatest probable use and hence the highest income from gasoline and other taxes. The following roads, in the order given, are most likely to fulfill the condition and therefore should be constructed first:

1. Trunk Highway Mexico City-Laredo
2. Trunk Highway Mexico City-Guadalajara-Tijuana
3. Trunk Highway Mexico City-Oaxaca-Tapachula
with the following branch highways:
 - a. San Cristobal-San Felipe-Merida-Progreso
 - b. Tixtla-Villahermosa-Puerto Alvaro Obregon
 - c. Campeche-Payo Obispo
4. Trunk Highway Mexico City-Veracruz
5. Trunk Highway Mexico City-Guanajuato-Durango-
Chihuahua-Ciudad Juarez

In the matter of financing the National Highway program, Ing. Becerril proposes that in addition to the present gasoline tax of 6 centavos a liter, a tax of approximately 80 pesos per month shall be imposed upon each motor vehicle carrying freight

or passengers on the national roads. With the income from these taxes, the author of the plan under consideration, holds that the government will have ample funds for building and maintaining highways without the necessity of contracting loans or taxing owners of property adjacent to the national highways. This assumes, of course, that the proceeds from the taxes in question be actually devoted to road-building and not diverted in large part to other governmental purposes, as in the case for the present year (1931).

In order to insure the proper cooperation and coordination of local and national road building programs, Ing. Becerril proposes that the Federal Government set aside one sixth of the present gasoline tax for distribution among the states: no assistance should be given to any state, however, without the previous approval of the state highway program by the National Highway Commission and without setting up adequate (non-political) machinery for administering the funds granted.

The International Pacific Highway

Although it does not in any sense represent a complete system of highways for Mexico, the project for the so-called International Pacific Highway is summarized at this point because of the fact that the proposed highway is included in several of the projects considered above, and because, traversing as it does a number of Mexican states, the highway performance will be more the concern of the Federal Government than of the local states.

The International Pacific Highway as projected and sponsored by the Automobile Club of Southern California is a proposal for a highway extending from Fairbanks, Alaska, along the

Pacific Coast to Santiago, Chile, and then easterly across the Andes to Buenos Aires, Argentina. The section of the road passing through Mexico enters the country at Nogales and touching Guaymas, Culiacan, Mazatlan, Guadalajara, and Mexico City joins the proposed Pan American Highway at Puebla and continues south and west through Oaxaca to the border with Guatemala. (See Map No.19 in attached envelope.) The entire route of the road in Mexico has been plotted by pathfinding expeditions from the Automobile Club of Southern California sent out during 1930 and 1931.

24

In a report on the expedition of 1930, the Chief Engineer and leader of the expedition, Mr. E. E. East, gives the following estimate of the cost of developing the Nogales-Mexico City section of the International Pacific Highway. The figures given below are based upon the assumption that the roadbed constructed will be of modern grade and alignment with the drainage structures and bridges and surfacing where necessary with gravel or other suitable natural materials.

State of Sonora

Length to be constructed	460 miles -- 736 kilometers
Grading and minor drainage structures	1,610,000 pesos
4700 lin. feet steel truss bridges	1,410,000 "
300 miles gravel surfacing	<u>1,500,000</u> "
	4,520,000 "

State of Sinaloa

Length to be constructed	454 miles -- 726.6 kilometers
Grading and minor drainage structures	1,816,000 pesos
8900 lin. feet steel truss bridges	2,892,000 "
350 miles gravel surfacing	<u>1,750,000</u> "
	6,458,000 "

State of Nayarit

Length to be constructed	185 miles -- 296 kilometers
Grading and minor drainage structures	1,850,000 pesos
3600 lin. feet steel truss bridges	1,170,000 "
185 miles gravel surfacing	925,000 "
	<u>3,945,000</u> "

State of Jalisco

Length to be constructed	160 miles -- 256 kilometers
Grading and minor drainage structures	2,400,000 pesos
160 miles gravel surfacing	800,000 "
	<u>3,200,000</u>

State of Michoacan

Length to be constructed	236 miles -- 377.6 kilometers
Grading and minor drainage structures	3,540,000 pesos
1200 lin. feet steel truss bridges	420,000 "
236 miles gravel surfacing	1,180,000 "
	<u>5,140,000</u>

State of Mexico

Length to be constructed	64 miles -- 102.4 kilometers
Grading and minor drainage structures	960,000 pesos
64 miles gravel surfacing	320,000 "
	<u>1,280,000</u>

Summary

Total length, Nogales-Mexico City	1,599 miles (2,558.4 Kms.)
Total length to be constructed	1,599 miles (2,558.4 Kms.)
Total cost of construction	24,543,500 pesos