

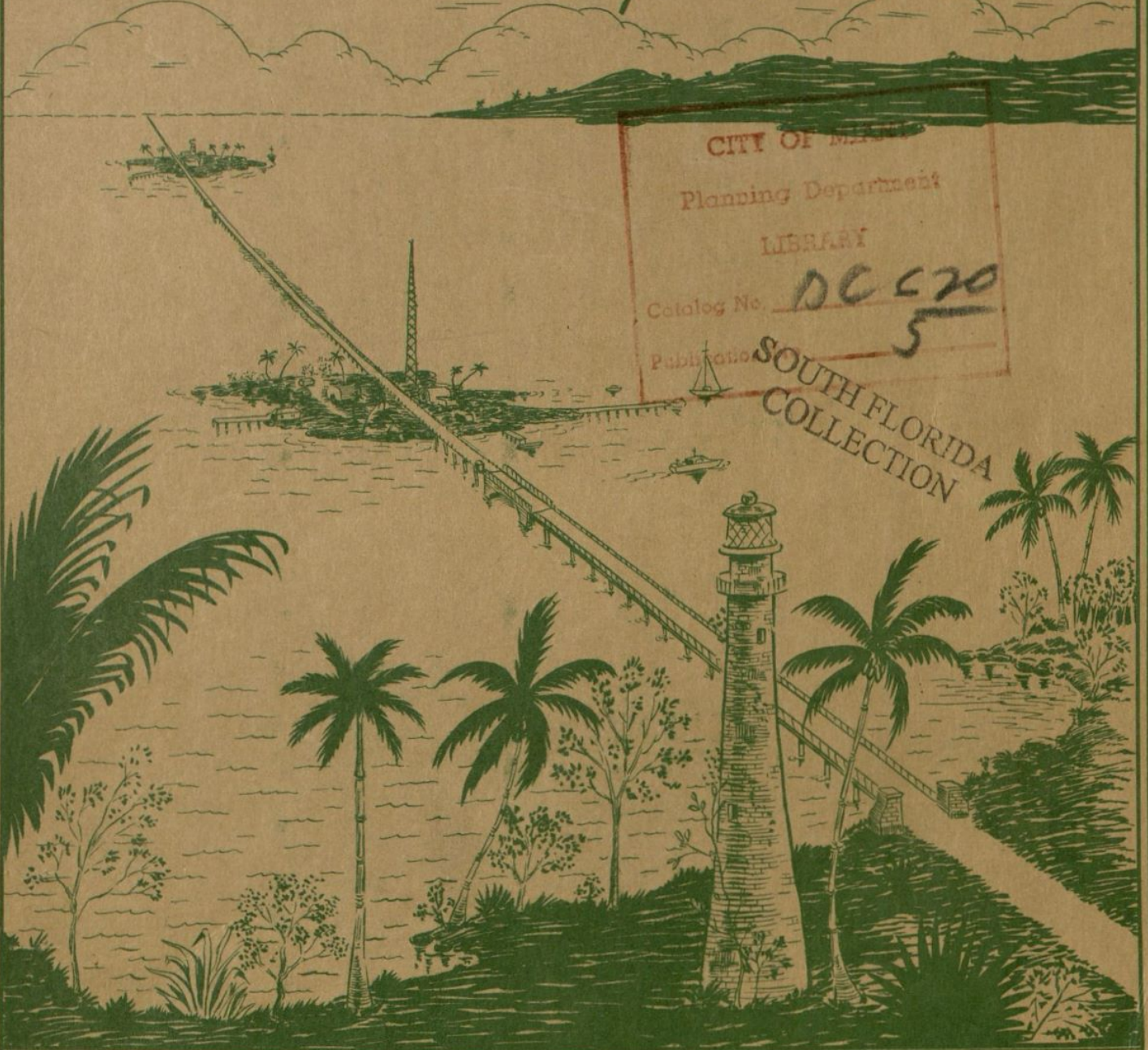
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The CITY PLANNING BOARD PROPOSED CAUSEWAY
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PRELIMINARY REPORT
ON
PROPOSED CAUSEWAY
FROM
KEY BISCAIYNE SOUTH TO KEY LARGO

Mrs. T. A. Stevens, Chairman

Earle W. Rader, Vice Chairman

W. E. Flett Adams

John A. Bowler, Jr.

James J. Bright

Ray A. Gaster

Prepared for the
Board of County Commissioners
of
Dade County, Florida

Robert F. Cook, Director

of the

Planning, Zoning & Building Department

by

The Dade County Planning Board

with the assistance of

Rader Knappen Tippetts Engineering Co.

Being made

**SOUTH FLORIDA
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December 1950

Rader Knappen Tippetts Engineering Co.

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Miami, Florida

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DADE COUNTY

OFFICE OF
ZONING DEPARTMENT
1203 COURT HOUSE
PHONE 9-7611
MIAMI 32. FLORIDA

December 27, 1950

Board of County Commissioners
Dade County
Florida

Gentlemen:

At your request the Dade County Planning Board has made a preliminary study of a project for a causeway extending from Key Biscayne southward to Key Largo and submits the following report.

I. SCOPE OF REPORT

This report is of a preliminary nature based on a study of available maps and data and on personal interviews. It is not a complete economic and engineering study, but is intended to supply sufficient information to support a decision as to whether or not further investigation and detailed studies of the proposed Causeway should be authorized. In making this study and report the Planning Board has received extensive assistance from the Rader Knappen Tippetts Engineering Co.

III. THE FLORIDA KEYS

A short distance off the southeast mainland of Florida begins a crescent-shaped string of islands - the Florida Keys. This string of islands swings in a southwesterly direction along the southern tip of Florida into the Gulf of Mexico for a distance of about 200 miles.

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On the ocean side, the Florida Keys are protected by a series of reefs extending into the Atlantic Ocean for several miles. Between the reefs and the Keys runs a channel, known as Hawk Channel, with a varying depth of from 12 to 35 feet. This channel is navigable for small craft.

In the protected waters between the Keys and the mainland a navigable channel has been cut for boats of smaller draft. This channel is part of the Intracoastal Waterway and has an available depth of from 5 to 10 feet. Its improvement to a minimum depth of 7 feet has been authorized by Congress. Between the Keys are numerous shallow channels, shoals, reefs, and rock outcroppings with many places awash at low tide and with an average depth of about 2 feet at mean low water. At intervals there are narrow tidal channels with depths of 7 to 15 feet.

For this particular survey we are considering only that portion of the Keys extending from the south end of Key Biscayne to the Overseas Highway on Key Largo. In this group are Key Biscayne, Soldier Key, Ragged Keys, Sands Key, Elliott Key, Old Rhodes Key, Broad Creek Key, Palo Alto Key, Angel Fish Key, Key Largo and numerous other smaller keys.

Along this group of Keys are many cross channels connecting Hawk Channel with Biscayne Bay. Of these Cape Florida Channel, Biscayne Channel, Caesar Creek, Broad Creek and Angel Fish Creek are at present of some importance to small boat navigation. The improvement of some of the smaller ones may be found desirable in the future. Where the proposed Causeway crosses these channels suitable provision for navigation must be made either by drawbridges or by fixed spans of suitable length and vertical clearance.

III. THE DEVELOPMENT OF DADE COUNTY

Miami ceased to be a frontier town when the Florida East Coast Railway was extended to south Florida shortly after the City was incorporated on July 28, 1896. Its population then was 300. Despite the collapse of the boom in 1926, the destructive hurricane that same year, and the economic depression of the late twenty's and early thirty's, Miami and the surrounding area continued to grow at a phenomenal rate.

The increasing influx of permanent settlers, winter residents and tourists can be attributed to the warm sunny climate, tropical flora and proximity to the ocean, Gulf Stream and inland waters. Population has increased with even greater rapidity since World War II and Dade County has developed faster than the City of Miami. The incorporation of many new suburban municipalities and the construction of large housing and apartment developments and busy new shopping centers have made Dade County an area of thriving and fast-growing communities. At the same time, this area has ceased to be merely a winter tourist paradise. The year-round population of the County increased from 267,739 in 1940 to 488,689 in 1950. Also Metropolitan Miami is becoming more popular as a summer tourist resort and is thus providing much more uniform business and employment conditions throughout the year.

Studies of the future population growth for Dade County have been made by the Florida Power and Light Company, the Southern Bell Telephone Company and the South Florida Statistical Exchange, which serves a large group of business interests in the area. These surveys have resulted in estimates that the population of Dade County in 1956 will be approximately 650,000 and approximately 800,000 in 1966. These are considered conservative figures. Added to this increasing permanent population will be the correspond-

ing increase in the number of winter and summer visitors.

It is estimated that over 2,000,000 people now visit the Metropolitan Miami area yearly, and the development of the area has been so rapid that the amount of available unimproved ocean front and bay front property is rapidly diminishing.

In recognition of the need of providing for this future population growth and for the development of more ocean and bay front property, the Dade County Planning Board has investigated the feasibility of constructing a causeway from Key Biscayne south to Key Largo connecting with the Overseas Highway on Key Largo. A large portion of the undeveloped ocean and bay front acreage now available in Dade County is located on the islands between Biscayne Key and Key Largo, over which the proposed causeway would extend.

Such a causeway will not only open up this land to development, but will also create a new scenic highway along the ocean between Crandon Park and the Overseas Highway at Key Largo. This Highway would undoubtedly be an outstanding addition to existing tourist attractions.

Starting almost in the heart of central Miami and extending over the Keys like the Overseas Highway, this new route would save approximately 3 miles in actual car mileage for those traveling from that city to Key Largo, Key West and intermediate points and would considerably lessen the traffic congestion on U. S. Highway No. 1 by furnishing an alternate route for north and south bound traffic.

IV. TIDES AND HURRICANES

Normal tidal fluctuations in the Straits of Florida and in the bays and

sounds of southeast Florida are not great. The mean range of the ocean tide at the lower end of Miami Beach is 2.5 feet and the range of spring tides about 3.0 feet. The tidal range decreases gradually as one passes down the Keys but is not materially less than this at the north end of Key Largo. Behind the Keys in Biscayne Bay and Card Sound the range is somewhat less, the mean range at various points within these bays being reported as follows:

Miami City Yacht Basin	2.0 feet
West side of Cape Florida	1.7 "
Coconut Grove	1.5 "
West side of Ragged Keys	1.5 "
West side of Adams Key	1.3 "
West side of Pumpkin Key (Card Sound)	0.8 "

The range of spring tides is about 20 per cent greater. From this, it will be seen that normal tidal phenomena will offer no obstacle to the construction of the causeway.

In theory, obstruction of the channels between the various keys and reefs would diminish the tidal range in the interior waters. No attempt can be made to compute the extent of this effect until a preliminary design of the causeway has been made. However, normal engineering practice would require that the causeway would consist of solid fill only along the reefs and shallow waters across which no great amount of water ebbs and flows. In the deeper channels, which carry nearly all of the tidal flow, open trestle construction or truss or girder bridges will be used. The reduction of tidal flow resulting from such construction will be trifling. Under these conditions it can be confidently stated that the reduction in tidal range resulting from the construction of a properly designed causeway will be insignificant and probably undetectable and will cause no adverse or undesir-

able effects anywhere.

The foregoing relates to normal tides. The area under discussion is visited from time to time by tropical hurricanes which may be accompanied by abnormal and dangerous tides. Hurricanes approaching this area from any point of the compass between south and east are accompanied, and sometimes preceded, by exceptionally high tides. These are highest in the part of the storm's path lying to the right of the center. Tidal effects are greatest when the maximum wind is southeast, east or northeast. Under these conditions the highest ocean tide actually measured was 5.5 feet above mean low water. This measurement was made at the south end of Miami Beach on September 17, 1947. While measurements at other points on the ocean front are not available it is believed that tidal conditions are probably not much different anywhere along the causeway route between Key Biscayne and Key Largo. The hurricane of September 18, 1926 probably caused higher ocean tides but no exact measurements were recorded. Competent authorities familiar with the available data agree that this tide probably reached a height of nearly or quite 7 feet. It is not impossible that future storm tides may reach somewhat greater elevations and the causeway must be designed to be safe against tides of such magnitude as well as against the accompanying wind and waves.

When violent easterly winds occur during hurricanes they have two effects upon the waters of Biscayne Bay. Under the influence of the high tides in the ocean, very strong inward currents are set up in Bakers Haulover, Government Cut, Cape Florida Channel and all the minor channels between the various keys and also over the reefs and bars and the low keys which have been submerged by the tide. This great inflow of water makes the average level of the Bay somewhat higher than it would normally be. At the same time the wind

tilts the water surface so that it is much higher on the west or mainland side of the Bay and lower on the east or key side. North of the MacArthur Causeway direct tidal inflow occurs only at Bakers Haulover. Tidal circulation is limited by three causeways and the width of the Bay is less than it is further south. In this area the magnitude of hurricane tides is substantially less.

In 1926, when the actual tide on the Atlantic side of the Keys and beaches probably did not exceed 7 feet, considerably higher elevations occurred along the Miami water front. The height reached varied somewhat with the configuration of the shore but elevations between 9 and 12 feet appear to have been reached at many places on the west side of the Bay between the MacArthur Causeway and Dinner Key. While no records are available, there can be no doubt that at this time elevations on the Bay side of the Keys were not only lower than on the Miami shore but were also lower than those on the ocean side of the Keys.

Any obstruction of the reefs and channels between the Keys will have no effect upon the tilting of the Bay surface by the wind. It will tend to reduce the inflow of water from the ocean to the Bay and thus reduce the water elevations on both shores of the Bay but it seems improbable that this effect can be great enough to result in any important benefit. There is no truth whatever in the theory occasionally advanced that the intervals between the Keys serve as a "safety valve" to permit the escape of water from the Bay and thus to protect the Miami shore. At the time when high water occurs on the Miami shore water is flowing into the Bay through these openings and not out of it.

V. TRAFFIC DATA AND ESTIMATES

Traffic on the proposed causeway would consist of three principal classes:

- a) "Through traffic" between Metropolitan Miami and Key West and other points on the Florida Keys. This includes, of course, traffic passing through Miami to and from points further north and west and traffic which might develop to or from Cuba by way of the proposed Key West - Havana automobile ferry.
- b) "Local traffic" between Metropolitan Miami and the residences, hotels, restaurants, bathing beaches, fishing camps and other developments on the Keys served by the causeway.
- c) What may be called "sightseeing traffic", consisting of people who drive out in the causeway and back merely in order to view the ocean and other attractions.

"Through traffic" between Metropolitan Miami and points on the Keys by way of the proposed causeway would have to be developed in competition with the existing route to Key Largo by way of U. S. Route No. 1. The new route would have several advantages in such competition. In the first place, it would be about three miles shorter. U. S. No. 1 runs through a succession of small cities and villages with necessary traffic lights, urban speed limits and conflicts with local village traffic. It is estimated that the total saving in time resulting from the shorter distance and the better traffic conditions would amount to at least 30 minutes.

U. S. No. 1 between Miami and Key Largo is generally quite unattractive from the scenic point of view. Between South Miami and Homestead the rural sections of the route pass largely through sandy pine sections, areas of prairie with scattered patches of brush and small trees, and cultivated fields which are fallow and weed grown during many months of the year. Southeast of Florida City the land is mostly marsh. In contrast, the new causeway route would offer views of the Atlantic Ocean and the Gulf Stream, ships, beaches, coconut palms, and fine residences. Experience on toll roads elsewhere has amply demonstrated that both the traffic advantages and the scenic attractions are very effective in diverting traffic to new routes even when the payment of tolls is involved. The diversion of traffic from U. S. No. 1 to the Key Causeway can be expected to occur as soon as the causeway is completed and opened for use. Thereafter it will grow with the increasing development of the Florida Keys.

"Local traffic" between Metropolitan Miami and the Keys along the causeway would commence with the opening of the causeway at which time it would serve the existing residences and facilities on the Keys, now accessible only by boat, and also the large amount of new construction on these islands which would follow immediately. This traffic would continue to grow at a rapid rate as residential and recreational development of the new areas took place. What this would mean is best shown by considering the parallel case of the development of the City of Miami Beach. When the first causeway connecting the mainland with Miami Beach was built in 1913, this city was about as undeveloped as the Keys north of Key Largo are at present. The growth of the city was immediate and rapid as is shown in the following table.

<u>Census Year</u>	<u>Permanent Population</u>	<u>Percent Increase Over Previous Year</u>
1920	644	-
1925	2,342	264
1930	6,494	177
1935	13,330	105
1940	28,012	110
1945	32,256	15*
1950	45,541	41

*War period

The land area within the city limits of Miami Beach is 7.05 square miles. This includes two isolated islands which are entirely undeveloped and Fishers Island on which development is quite limited because it can only be reached by boat. Forty years ago this 7.05 square miles consisted of sand dunes and mangrove swamps with some coconut groves and other attempts at agriculture. It was almost uninhabited. Now this area supports a city with a permanent population of more than 45,000 which, at the peak of the winter resort season, is increased by the presence of tourists, winter residents and seasonal employees to perhaps three times that number. The real and personal property in this area was assessed in 1950 at \$289,754,300.

The area of the Keys which will be opened to development by the new causeway, exclusive of Key Biscayne and Key Largo but including 1,000 acres of proposed new land, is 8.68 square miles or 23 per cent more than the land area of Miami Beach. When provided with a suitable connection with the mainland, this area should be able to accommodate a community 23 per cent more populous than Miami Beach and to support an ultimate permanent population

in excess of 55,000 with a proportionate number of winter visitors. This development should be accelerated by the fact that Miami Beach is now approaching a saturation point. Little undeveloped property remains in the city and future increases in population must be accommodated chiefly by increased height of buildings and greater density of population per square mile. Because of this, the recent growth of Surfside and other communities immediately north of Miami Beach has been proportionately much more rapid than that of the city itself and the same factors should produce a similar rapidity of development in the Keys to the southward as soon as they are made accessible to vehicular traffic.

The traffic described above as "local" includes not only that serving permanent residents and seasonal visitors but also recreational traffic in the form of people visiting the Keys for a day or less to enjoy the restaurants, bathing beaches, fishing facilities and other attractions. This project will, however, also develop a different sort of traffic which may be called "sight-seeing traffic". Experience shows that visitors from inland parts of the United States usually are keenly desirous of seeing the ocean and that even those from the northern seaboard want to see the "tropical beaches", the Gulf Stream, and other features not found at home. Because of the high value of ocean front property, Dade County now has few extended reaches of highway from which the motorist has a near view of the ocean. Even where highway locations are quite close to the beach there are usually sand dunes between the road and the water. In the entire length of U. S. Route No. 1 from Boston to Miami there is only one spot where such a view is obtained, a reach of three or four miles near Juno, Florida. The only such place in Dade County, except for a few glimpses of the ocean between hotels or at

street ends, is in the County Park at Bakers Haulover. The new Keys Causeway will provide miles of good highway directly adjacent to the ocean, much of it also having a view of Biscayne Bay on the other side. Stabilized shoulders will permit cars to park off the pavement. During the year large numbers of visitors will use the causeway merely to get this view and permanent residents of Miami will come to bring their friends and to enjoy the ocean's cooling breezes on summer evenings.

Attempting to reduce these three classes of traffic to statistical estimates, it appears reasonable to assume that, if toll rates are equitable and good traffic conditions are provided, at least 60 per cent of the traffic now using the Overseas Highway between Key Largo and Key West will use the new causeway. Available statistics on amount of traffic and tolls collected on various highways and causeways in Dade and Monroe Counties are shown in the Appendix. From these, it appears that in 1949 total traffic paying toll on the Overseas Highway amounted to 334,130 vehicles, or 915 vehicles per 24 hours and that this traffic is still increasing rapidly. As this count is made at the toll stations and excludes considerable traffic between points in Dade County and those on Key Largo and the other Keys north of Lower Maticumbe, the average traffic at the point on Key Largo critical to our discussion is now well above 1,000 vehicles in 24 hours. This traffic has tripled in six years and the average rate of annual growth since war conditions ceased has been nearly 20 per cent. The rapid development now going on in the lower Keys and the fact that the Overseas Highway will become toll free within a few years should maintain this rate of growth. Applying the 60 per cent factor and allowing for a very much lower rate of future annual growth, it appears that "through

traffic" on the proposed causeway would amount to 600 vehicles per 24 hours under 1950 conditions, 900 vehicles in 1955 and 1200 in 1960.

"Local traffic" should be considerable from the start. The existing developments will supply some but the bulk of it during the first year will come from the grading, paving and construction operations which will be required by the rapid development of this area as satisfactory access is provided. Such traffic need not wait for the completion of the entire project but will reach substantial proportions as soon as the new causeway reaches Elliott Key. Ultimately the magnitude of this traffic will be governed by the extent of development of the Keys.

A study of traffic counts made by the City Engineer of Miami Beach indicates that in 1949 the total traffic on the three causeways connecting that city with the mainland averaged more than 50,000 vehicles per 24 hours. This traffic is practically all of the nature which we have called "local traffic" and is supported almost entirely by the developments on the city's land area of 7.05 square miles. The area of the Keys which will be opened to development by the new causeway is 23 percent greater than this. If it should reach an intensity of development as great as that now obtaining in Miami Beach it would support 23 per cent more "local traffic" on its causeway or causeways than is supported by Miami Beach, or 62,000 vehicles per day.

Under present conditions, the peak of growth might well be reached within less than 20 years from the completion of the causeway. Evaluating all these factors, and assuming an ultimate density of development on the Keys only one-half as great as that now existing on Miami Beach, it is estimated that "local traffic"

Total One-Way Traffic (Annual 24-Hour Average)

on the causeway would average 1,000 vehicles per 24 hours during the first year that the project is open to traffic and increase to 3,000 vehicles in the fifth year of operations and 6,000 in the tenth year.

There is no statistical basis for evaluating the amount of "sightseeing traffic" but judging from observed conditions at Juno, Bakers Haulover and the Overseas Highway it could hardly amount to less than 50 round trips daily. This number could be expected to increase gradually with the growth of Dade County in population and in the size of its tourist business.

If the year 1951 is spent in necessary preliminary legislative, engineering and financial work, and construction contracts are awarded at the beginning of 1952, it might be possible to open this project to "local" and "sightseeing" traffic as far south as Elliott Key in January 1954 and to "through" traffic in January 1955. Summarizing the estimates of traffic given in the preceding paragraphs results as follows:

By 1955 the total traffic will be approaching the limit that can be adequately accommodated on a two-lane highway of this character and it will become necessary to consider the provision of two additional lanes.

VI. DESIGN AND LOCATION OF PROPOSED CAUSEWAY

Several different types of construction will be used on the proposed causeway. On the larger keys ordinary highway practices will be followed. Probably only two traffic lanes will be constructed originally but provision should be made for eventual widening to four lanes with medial parkway strip and generous shoulders. No part of the causeway should be permitted to be used as a

Total One-Way Traffic (Annual 24-Hour Average)

<u>Year</u>	<u>Through Traffic</u>	<u>Local Traffic</u>	<u>Sight Seeing Traffic</u>	<u>Total Traffic</u>
1954	-	500*	100	600
1955	840	1500	110	2450
1956	900	2000	120	3020
1957	960	2500	130	3590
1958	1020	3000	140	4160
1959	1080	3550	150	4780
1960	1140	4100	160	5400
1961	1200	4700	170	6070
1962	1260	5350	180	6790
1963	1320	6000	190	7510
1964	1380	6700	200	8280

* Reduced 50% because Causeway only open as far as Elliott Key.

By 1964 the total traffic will be approaching the limit that can be adequately accommodated on a two-lane highway of this character and it will become necessary to consider the provision of two additional lanes.

VI. DESIGN AND LOCATION OF PROPOSED CAUSEWAY

Several different types of construction will be used on the proposed causeway. On the larger keys ordinary highway practices will be followed. Probably only two traffic lanes will be constructed originally but provision should be made for eventual widening to four lanes with medial parkway strip and generous shoulders. No part of the causeway should be permitted to be used as a

village street, all purely local traffic being accommodated by separate service roads or other suitable arrangements.

On very low land and on shallow tidal flats hydraulic fill will be used. This must be carefully designed to avoid damage by severe storms. The finished grade of the roadway will be put at about elevation 7.5 feet above mean low water. It is important that the side slopes be very flat. A slope of 1 vertical on 16 horizontal is recommended. With two 11-foot paved traffic lanes and 15-foot stabilized shoulders the width at mean low water will be nearly 300 feet. Subsequent widening to provide four lanes with medial parking strip will present no difficulties if the original alignment and right-of-way are designed with such widening in view.

The resulting structure will be very similar to the corresponding sections of Rickenbacker Causeway. The roadway will be well above all ordinary tides. The flat slopes will be, in effect, beaches on which ordinary storm waves can break without doing any damage. Extremely high tides occur only with hurricanes and adequate warning of their occurrence is available. At such times the causeway will be closed to traffic. Experience with similar structures has shown that the waves will pass right over such a causeway without any serious destruction although, following the storm, there will be some extra maintenance cost for cleaning up debris and repairing minor erosion.

The hydraulic fill design is suitable only for shallow water. Where the water is more than two or three feet deep it is desirable to avoid obstructing the normal tidal flow and to have a structure under which fishing skiffs can pass in calm weather. Also, in deeper water the bottom width of the fill and the yardage and cost become excessive. Therefore, in these areas a viaduct

of trestle construction will be used with either precast reinforced concrete piles or concrete-encased steel H-beam piles and with reinforced concrete caps and deck. The roadway grade will be higher than in the hydraulic fill sections, perhaps as high as 20 feet above M.L.W. Where the causeway crosses minor channels in which small craft navigation is important, more ample vertical clearance can be provided. This type of structure has been found satisfactory in many places in Florida, and is in current use at equally exposed locations on the Overseas Highway and where Rickenbacker Causeway crosses Bear Cut.

At four points the causeway will cross important navigable channels where provision must be made for the passage of masted vessels. At these points movable bridges will be required. The accompanying estimates have been based on the construction at these points of modern bascule bridges having a span of 90 feet and a vertical clearance of 25 feet above mean low water. This span meets the recent requirements of the Corps of Engineers, U. S. Army, for horizontal clearance in similar bridges along the Intracoastal Waterway. The large vertical clearance proposed will be of the utmost value in permitting passage of large numbers of boats under the closed span, thereby greatly reducing the number of bridge openings and the resulting interference with highway traffic. The bridges will be built to provide for two lanes of traffic. When the causeway is enlarged to provide for four lanes a duplicate bridge will be built at each site. This will have a great advantage over a 4-lane bridge in that emergency repairs can be made on one bridge while traffic is detoured over the other.

A detailed location for the causeway must of course be preceded by surveys

and engineering studies. A tentative location which has been used as a basis for preliminary cost estimates is shown on the attached maps (Plates I and II) and is briefly described in the following paragraphs.

From the south end of Crandon Park to Cape Florida the various land owners on Key Biscayne have reserved a suitable right-of-way 120 feet wide. Plans are under way for the subdividing and development of much or all of the privately owned land on this key. It is presumed that the road along this right-of-way will be a part of the county's ordinary highway system. It will hardly be practicable to charge tolls for passage over this section of the route. For these reasons this section has been excluded from the preliminary cost estimates and economic studies of the causeway project.

From the vicinity of Cape Florida, the causeway will start as a concrete trestle viaduct of the form described above, extending south and southwesterly about one mile to Biscayne Channel. This channel will be crossed by a bascule bridge. Following this, will come some $3\frac{1}{2}$ miles of concrete trestle. Then the route reaches shallow water and the next $4\frac{1}{2}$ miles to the head of Ragged Keys will consist mostly of the standard hydraulic fill section but there will be a number of short concrete trestles to permit normal tidal flow through the deep channels which intersect these flats. Soldier Key lies near the middle of this section. Except for the tidal channels mentioned, the depth of water at low tide in this reach varies from nothing to about 3 feet at mean low water.

At the north end of Ragged Keys a natural deep water channel runs nearly across the flats. It is proposed to open this by dredging so as to provide a good

navigable connection between the Bay and the Ocean. Such a channel will be needed here to accommodate the greatly increased number of boats which will be based in this vicinity when the causeway is completed and 1,000 acres of new fill provided south of Soldier Key. This channel will require the provision of a second bascule bridge.

For the next 12 miles the causeway will be largely on land, crossing Ragged Keys, Sands Key and Elliott Key. Its grade will be built up to ∇ 7.5 feet above mean low water where the natural ground surface is lower than this, using the standard hydraulic fill cross section with side slopes of 1 on 16 as previously described. Where the ground surface of the Key is above elevation ∇ 7.5 ordinary highway practice will be followed. In the intervals between the Keys the standard hydraulic fill causeway will be used where the water is less than three feet deep and concrete trestle where the water is deeper. Adequate provision will be made to take care of any existing or prospective navigation but no expensive bascule bridges will be required. Along the length of Elliott Key the location will be approximately along the existing county road.

South of Elliott Key the causeway will cross Caesar Creek to Old Rhodes Key by a concrete trestle with a bascule bridge to take care of navigation. Old Rhodes Key will be crossed by highway construction similar to that on Elliott Key for a distance of about 3 miles.

From Old Rhodes Key to Key Largo, a distance of about 2 miles, all the keys are low, mostly mangrove swamp. The causeway will consist partly of hydraulic fill and partly of trestle. At the crossing of Angel Fish Creek another bascule bridge will be required.

From the head of Key Largo there will be about $13\frac{1}{2}$ miles of highway construction similar to that on Elliott Key. This will follow the general line of existing State Road No. 905 and will connect with U. S. Route No. 1 (The Overseas Highway) at its intersection with State Road No. 905 in the unincorporated village of Key Largo. Like the part of the route on Key Biscayne, this section will be outside of the toll limits.

The general course of the causeway will be south-southwest throughout its length. Curvature along the route will be very moderate. The distance between the toll gates at Cape Florida and at the north end of Key Largo will be about 25 miles. With the addition of Rickenbacker Causeway, Crandon Park Road and State Road No. 905, this will make the total distance from the intersection of U. S. No. 1 with Brickell Avenue on the north to the intersection with the new causeway route on Key Largo $46\text{-}\frac{3}{4}$ miles, which is $2\text{-}\frac{3}{4}$ miles less than the distance between these same points by way of U. S. No. 1.

VII. RIGHT-OF-WAY

The causeway project would be of such great value to owners of land on the keys along the route that they could, in general, be expected to contribute to the right-of-way. Along the southern part of Key Biscayne the local property owners have already reserved a 120 foot strip for this purpose.

On Elliott Key the county owns the right-of-way along an existing county road, much of which can be used for the new project. Similarly on Key Largo most of the right-of-way of State Road No. 905 will be available.

Much of the route lies over lands under water which are the property of the State of Florida and are in the custody of the Trustees of the Internal Improvement Fund of the State. It has heretofore been the policy of these Trustees to make such lands available for important public projects without charge or, at least, at nominal expense.

For the foregoing reasons, no item of right-of-way has been included in the estimates of the cost of this project. The allowance included for "Contingencies" should be adequate to cover any minor costs of this nature which may be incurred.

VIII. PUBLIC NATURE OF THE PROJECT

The proposed causeway will serve as a connection between two publicly owned causeway projects of similar nature; the Rickenbacker Causeway, owned and operated in the public interest by Dade County, and the Overseas Highway, similarly owned and operated by the Overseas Bridge and Toll Road District. In each case, the Board of Commissioners in charge sets the tolls at rates most advantageous to the public and makes provision for amortizing the capital cost of the causeway and ultimately transforming it into a free public highway. It is considered very important that the proposed Key Biscayne-Ley Largo Causeway should similarly be publicly owned and administered. Experience with other toll roads and bridges under private control have shown that the owners are usually reluctant to relinquish a profitable enterprise and tend to postpone for many years the opening of the project to free public use. The most suitable public owning agency would be Dade County since the County's excellent credit rating and enviable record in the administration of

public projects involving transportation, recreation and the opening of new areas for development would make it possible to finance the project at a low rate of interest.

At the south end of the route, about 15 miles between Broad Creek and the intersection with U. S. Route No. 1 lies in Monroe County. This section includes the bascule bridge across Angel Fish Creek. If the project is to be handled by Dade County some special arrangement would be necessary in this section. Several possible methods can be suggested. This reach might be handled by Monroe County or by the State Road Department. Legislative authority might be obtained for putting the ownership and operation of the entire project in the hands of the Board of Commissioners of Dade County without making any change in the County boundaries. In any event, it is believed that the northern toll gate will probably be located at the southern tip of Key Biscayne (Cape Florida) and the southern toll gate at the Dade-Monroe County line or, perhaps better, $1\frac{1}{2}$ miles south of that line at the northern end of the firm land of Key Largo. The part of Key Largo south of the latter point is now accessible by way of State Road No. 905 and it will be hardly practicable to charge tolls on vehicles coming to this area from the south.

There is another very important reason why this causeway project should be developed by Dade County rather than by any private and profit making interest. Engineering and economic investigations indicate that it is desirable to include in it the filling and developing of about 1,000 acres of new land in Biscayne Bay adjacent to the causeway and south of Soldier Key. It is known to be the well established policy of the Board of County Commissioners, supported by public opinion, that further exploitation of bay bottom lands by

individuals or corporations for private gain will not be tolerated within Dade County. This ban would not apply to a suitably located development made by the county itself, carefully planned to avoid all of the features which have made certain private developments of this sort objectionable and undertaken for the purpose of making possible a project of great public value in providing new recreational features, in increasing the value of taxable property in the county, and as a stimulus to the tourist trade and the business and prosperity of the residents of the county.

IX. CREATION OF NEW LAND

Because of the large capital cost of the causeway and of the fact that several years may elapse before traffic will develop sufficiently to carry the fixed charges and operating costs, it was considered desirable to find some other source of income to aid in financing the project. The most suitable source seemed to be the construction of new land along the causeway. Such land, if located at a point in the project not too remote from the City of Miami, would find a ready sale. The location selected must be one which does not interfere with or depreciate the value of existing property. It must be in comparatively shallow water where the cost of bulkheading and filling will not be excessive. It must be at a place where comparatively large areas can be developed without blocking any of the deep channels through which the bulk of the tidal flow takes place.

Examination of the charts indicated that these conditions would best be met in the region between Soldier Key and the north end of Ragged Keys. This is only about six miles south of areas on Key Biscayne where rapid development of hotel and residential property is already taking place. In the other

direction it is separated by three-quarters of a mile from existing land on Ragged Keys and will not encroach upon the view, affect the tidal currents, cause erosion, or otherwise adversely influence property there.

On Plate II is shown a tentative layout for two islands at this site. the total area proposed is about 1000 acres, of which 600 acres are in the northern island and 400 acres in the southern. The islands are planned to lie entirely west of the causeway so as not to interfere with the view of the ocean from the roadway and to avoid the possible formation of any projection seaward from the general line of beach formed by the causeway, since such projections might create erosion problems. The islands will not close any important tidal channel.

The cost of this development is estimated as follows:

<u>Item</u>	<u>Unit Price</u>	<u>Total</u>
15,000,000 Cubic Yards of hydraulic fill	25¢	\$ 3,750,000
28,000 Linear Feet of bulkhead	\$20	560,000
1,000 Acres of grading	\$50	50,000
180,000 Linear Feet of street paving, 20 Feet Wide	\$ 2	360,000
Planting and Miscellaneous		<u>250,000</u>
		\$ 4,970,000
Engineering and contingencies, 10%		<u>500,000</u>
Total Estimated Cost		\$ 5,470,000

The cost of installing service facilities for water supply, electricity, telephone, etc., has not been included in the foregoing estimate because

experience indicates that such services can be supplied on a self-liquidating basis by public agencies or by commercial utility companies.

After suitable provision has been made for streets and other public needs there will be a net usable area of about 700 acres for division into lots. Zoning regulations should divide this into areas for single residences, apartments and hotels, and business. The business area should be strictly limited to use by appropriate retail operations such as restaurants, cocktail lounges, package stores, boat and automobile liveries, service stations, public swimming pools and establishments for the sale of food, drugs and sundries, wearing apparel, bait and fishing tackle and other stores necessary for a resort community. The area zoned for business purposes should be kept as small as possible.

A brief preliminary study of the areas which should be zoned for each purpose and consultation with real estate interests as to values resulted in the following estimate of the net sales value of the project:

Zoning	Approximate Acreage	Number of Lots	Average Size of Lots, Sq. Ft.	Average Price of Lots	Total
Business	35	305	5,000	\$ 5,000	\$ 1,525,000
Hotel & Apt. (1)	30	118	11,000	15,000	1,770,000
Hotel & Apt. (2)	215	850	11,000	10,000	8,500,000
Residence (1)	45	218	9,000	5,000	1,090,000
Residence (2)	<u>375</u>	1815	9,000	1,600	<u>2,904,000</u>
Totals	700				\$ 15,789,000

(1) Water front lots.

(2) Interior lots.

X. ESTIMATED CONSTRUCTION COST OF THE PROJECT

Accurate estimates of the cost of a large engineering project must, of course, be preceded by detailed surveys and at least outline designs of the structures. In this preliminary study, designed primarily to determine whether or not the project for a causeway from Key Biscayne to Key Largo is worthy of further study, it has been possible only to scale distances from the County map, estimate depths and elevations from the published charts of the U. S. Coast and Geodetic Survey and compute the approximate quantities of the major items involved.

The following estimates cover approximately 38 miles of causeway from the southern tip of Key Biscayne (Cape Florida) to the junction of State Road No. 905 and U. S. Route No. 1 (The Overseas Highway) on Key Largo. This includes about 25 miles of graded and paved road on the higher keys, nearly 8 miles of concrete trestle viaduct, about 5 miles of paved hydraulic fill causeway, and four double leaf bascule bridges of 90-foot span. In setting unit prices it has been assumed that a bond issue would provide sufficient funds to do the work by means of a few large contracts, thus obtaining the economy resulting from large quantities and the use of heavy plant.

Estimates follow for a two-lane causeway with a pavement width of 22 feet and for a four-lane causeway having two 22-foot pavements separated by a medial parkway strip. In the case of the four-lane project duplicate two-lane bridges are provided at each bridge site so that in emergencies when one bridge is closed for repairs all traffic may be routed over the other bridge. The cost of the four-lane causeway is about three-quarters greater than that of the narrower one. The design is such that the narrower structure

can be built first and the additional lanes and bridges added when justified by increased traffic.

ESTIMATE FOR TWO-LANE CAUSEWAY

<u>ITEM</u>	<u>UNIT PRICE</u>	<u>TOTAL</u>
41,000 linear feet of concrete trestle viaduct	\$300.	\$12,300,000.
2,400,000 cubic yards of fill and grading	30¢	720,000.
500,000 square yards of highway pavement	\$1.50	750,000.
4 bascule bridges, double leaf, 90-foot span	\$400,000.	<u>1,600,000.</u>
		\$15,370,000.
Engineering and contingencies, 10%		<u>1,537,000.</u>
Total Estimated Cost		\$16,907,000.

ESTIMATE FOR FOUR-LANE CAUSEWAY

<u>ITEM</u>	<u>UNIT PRICE</u>	<u>TOTAL</u>
41,000 linear feet of concrete trestle viaduct	\$500.	\$20,500,000.
3,200,000 cubic yards of fill and grading	30¢	960,000.
1,000,000 square yards of highway pavement	\$1.50	1,500,000.
8 bascule bridges, double leaf, 90-foot span	\$400,000.	<u>3,200,000.</u>
		\$26,160,000.
Engineering and contingencies, 10%		<u>2,616,000.</u>
Total Estimated Cost		\$28,776,000

XI. ESTIMATED ANNUAL COST OF OPERATION AND MAINTENANCE

The present cost to the County of operating and maintaining the Rickenbacker Causeway as shown in the Budget Report has been taken as the basis for estimating the cost for the Key Biscayne-Key Largo project. Costs for the Rickenbacker Causeway are as follows:

<u>General Administrative Expense</u>		\$14,000.
Drawbridge operators, 4 @ \$1,875.	\$7,500.	
Toll house personnel	30,500.	
Power and miscellaneous supplies	7,100.	
Tickets and printing	<u>3,000.</u>	
<u>Operating Expense</u>		48,100.
<u>Maintenance Expense</u>		2,700.
Reserved for painting	4,000.	
Reserved for repair and replacement of structures and equipment	2,500.	
Reserved for insurance	<u>16,700.</u>	
<u>Reserves for accumulating expense not currently liquidated</u>		<u>23,200.</u>
<u>TOTAL ANNUAL EXPENSE, RICKENBACKER CAUSEWAY</u>		\$88,000.

In estimating from these figures the annual expense of the Key Biscayne-Key Largo Project, it has been assumed that the project would be operated by the same county organization as the Rickenbacker Causeway and that this would scarcely double the general administrative expense.

The continuous operation of the drawbridge on the Rickenbacker Causeway requires three regular operators and one relief operator. It is believed that

the four drawbridges of the new project can be operated with 12 regular and 2 relief operators. Because of the distant location of these bridges the salary of the operators has been set slightly higher. Other costs connected with the drawbridges such as power, painting, etc., have been multiplied four times. The new project will require two toll booths instead of one and toll booth salaries and other costs connected with tolls have therefore been doubled. Costs chargeable to the roadway and trestles have been increased five times in approximately the ratio of the length of roadway involved. At present, on the Rickenbacker Causeway, about 1,100 round trip tolls are collected per day. For the new project vehicle movements are estimated to grow from 850 each way daily during the first year of operation to 3,700 during the 10th year. Cost of tickets and printing has therefore been multiplied by $2\frac{1}{2}$ for this estimate. Insurance costs have been increased in the approximate ratio of the cost of the two projects or 1 to 2.

The application of the various factors described above to the budgeted expenses of the Rickenbacker Causeway results in the following estimate of the annual cost of operation and maintenance of the Key Biscayne-Key Largo Causeway Project. Individual items have been "rounded somewhat.

KEY BISCAYNE-KEY LARGO CAUSEWAY PROJECT

ESTIMATED ANNUAL OPERATION AND MAINTENANCE EXPENSE

<u>General Administrative Expense</u>		\$13,000.
Drawbridge operators, 14 @ \$2,000.	\$28,000.	
Toll house personnel	61,000.	
Power and miscellaneous supplies	28,500.	
Tickets and printing	<u>7,500.</u>	
<u>Operating Expense</u>		125,000.
<u>Maintenance Expense</u>		14,000.
Reserved for painting	15,000.	
Reserved for repair and replacement of structures and equipment	10,000.	
Reserved for insurance	<u>33,000.</u>	
<u>Reserves for accumulating expense not currently liquidated</u>		<u>58,000.</u>
 Total Annual Expense of Operation and Maintenance, Key Biscayne-Key Largo Causeway		 \$210,000.

XII. ESTIMATED ANNUAL INCOME

On the Overseas Highway the toll schedule is as follows:

Passenger car with driver	\$1.00
Additional passengers, each	0.25
Light trucks, according to weight . . .	\$1.00 to \$5.00
Busses and heavy trucks, according to weight	\$6.50 to \$7.50

These charges are for passage in one direction. Trucks and busses make up about 15 per cent of the traffic and pay nearly one-quarter of the tolls. The number of passengers per vehicle averages about three. The average receipts for the years 1947-1949 amounted to \$1.81 per vehicle.

For the Key Biscayne-Key Largo Causeway Project it is estimated that "through traffic" would save about 3 miles of distance and half an hour of time on an average one-way trip. The saving in operating costs would be about 3 cents per mile for a passenger car and 10 cents per mile for the average of all trucks and busses. The weighted average saving for the 3-mile reduction of distance for all traffic would be about 12 cents per one-way trip. In these days an estimate of one dollar per hour for the average value which all passengers would place upon their time is very low. Allowing three passengers per vehicle the total of these savings from the use of the new causeway amounts to \$1.62 per vehicle. Consequently, we have assumed that users of the project would be willing to pay according to a toll schedule which would return from "through traffic" an average of \$1.50 per one-way trip. This schedule would be about 17 per cent lower than that now in effect on the Overseas Highway.

The permanent residents on the islands between Cape Florida and Key Largo should receive a commutation rate for their personal cars payable quarterly or annually and which should be substantially lower than the toll rate on through traffic, perhaps half as much. The other part of the so-called "local traffic", that is the movement of hotel guests and other transients to and from the islands, and the movement of taxicabs, busses and commercial vehicles serving the islands, should be given a round trip rate which might be set at 175 per cent of the one-way rate. For this preliminary study, it has been assumed that the rate of tolls from all types of "local traffic" would average 60% as great as that from "through traffic" or 90 cents per vehicle.

For the "sightseeing" traffic the round trip rate has been taken at 175 per cent of the toll on "through traffic" or \$1.30 cents per one-way trip.

The following tables show the annual income resulting from the application of these rates of toll to the traffic estimates in Section V.

INCOME FROM "THROUGH TRAFFIC"

<u>Year</u>	<u>Average Vehicles Per Day (Both Directions)</u>	<u>Annual Income at \$1.50 per Vehicle</u>
1954	-	-
1955	840	\$460,000
1956	900	493,000
1957	960	526,000
1958	1020	559,000
1959	1080	592,000
1960	1140	625,000
1961	1200	658,000
1962	1260	691,000
1963	1320	724,000
1964	1380	757,000

INCOME FROM "LOCAL TRAFFIC"

<u>Year</u>	<u>Average Vehicles Per Day (Both Directions)</u>	<u>Annual Income at \$0.90 per Vehicle</u>
1954	500	\$164,000
1955	1500	493,000
1956	2000	657,000
1957	2500	821,000
1958	3000	986,000
1959	3550	1,167,000
1960	4100	1,347,000
1961	4700	1,544,000
1962	5350	1,758,000
1963	6000	1,972,000
1964	6700	2,202,000

INCOME FROM "SIGHTSEEING TRAFFIC"

<u>Year</u>	<u>Average Vehicles Per Day (Both Directions)</u>	<u>Annual Income at \$1.30 per Vehicle</u>
1954	100	\$ 47,000
1955	110	52,000
1956	120	57,000
1957	130	62,000
1958	140	67,000
1959	150	71,000
1960	160	76,000
1961	170	81,000
1962	180	86,000
1963	190	90,000
1964	200	95,000

The gross return from the sale of new land was estimated in Section IX at \$15,789,000. Allowing 15 per cent to cover the cost of sales, the net return will be \$13,421,000. If the sales period extends over five years the average net income from sales will be \$2,684,000 annually.

Adding the income from tolls on the three classes of traffic to the net

income from the sale of new lands gives the following net income for the first eleven years of operation of the project.

ANNUAL NET INCOME OF THE PROJECT

<u>Year</u>	<u>Gross Income from Tolls of all Classes</u>	<u>Operation and Maintenance Expense (Section XI)</u>	<u>Net Income from Tolls</u>	<u>Net Income from Sale of New Land</u>	<u>Total Net Income of Project</u>
1954	\$211,000	\$185,000*	\$26,000	\$2,684,000	\$2,710,000
1955	1,005,000	210,000	795,000	2,684,000	3,479,000
1956	1,207,000	210,000	997,000	2,684,000	3,681,000
1957	1,409,000	210,000	1,199,000	2,684,000	3,883,000
1958	1,612,000	210,000	1,402,000	2,684,000	4,086,000
1959	1,830,000	210,000	1,620,000		1,620,000
1960	2,048,000	210,000	1,838,000		1,838,000
1961	2,283,000	210,000	2,073,000		2,073,000
1962	2,535,000	210,000	2,325,000		2,325,000
1963	2,786,000	210,000	2,576,000		2,576,000
1964	3,054,000	210,000	2,844,000		2,844,000

* During 1954 little or no maintenance would be required, only two bascule bridges will be systematically operated throughout the year. This is estimated to reduce normal expense of maintenance and operation by \$25,000.

XIII. FINANCIAL ANALYSIS

An income producing public project of this nature can properly be financed by an issue of revenue bonds, secured solely by the income of the project. The useful life of the structures in the project would be in excess of 30 years for the drawbridges, 50 years for the concrete viaducts, and 100 years for the hydraulic fills. Provision for necessary re-surfacing of the paved roads is made under "Maintenance". Under these conditions the term of the bonds might properly be 20 years but provision should be made for calling of the bonds at any time when the accumulation of surplus income permitted. It

should be provided that the project become toll-free as soon as the bonds are paid off. This will terminate the rather considerable item of toll collection cost. By that time the great increase of taxable values along the route will justify the County in carrying the remaining costs of operation and maintenance from its ordinary tax revenues. The credit of Dade County is excellent and if this project is thoroughly investigated and is supported by a sound engineering and economic report there should be no difficulty in floating an issue of 20-year, callable, revenue bonds at an interest rate no greater than 3 per cent.

In estimating interest during construction, it has been assumed that considerations of marketability would require that the entire issue be sold prior to the beginning of construction. The amount of the bond issue should be sufficient to provide funds to meet interest payments until net earnings have become great enough to meet these payments and to provide some reserve. Studies of the estimated growth of revenue indicate that about \$1,440,000 will be required for this purpose. Adding this to the construction costs gives the following determination of the total amount of the bond issue:

Construction Cost of 2-Lane Causeway Project	\$16,907,000
Construction Cost of 1000 Acres of New Land	<u>5,470,000</u>
Total Construction Cost	22,377,000
Bond Interest during Construction	<u>1,440,000</u>
Total Capital Cost to be covered by Bond Issue	\$23,817,000

In round numbers, a bond issue of \$24,000,000 will be required.

In estimating the total earnings of the project the following assumptions have been made: the year 1951 will be devoted to preliminary legislative, engineering and financial work; construction will begin in January 1952; the construction of new land will be sufficiently advanced so that the sale of lots can begin in January 1954; their sale can be completed by 1958; the causeway will be sufficiently completed in January 1954 so that it can be used from its northern end to the new islands and to Elliott Key, thus producing some revenue; the entire project will be sufficiently completed in January 1955 to be opened to full operation. The earnings from tolls and from the sale of new land have been taken from Section XII.

For the purpose of this preliminary report a very simple financial set up has been considered. It is assumed that all issues would be of serial revenue bonds, secured only by the earnings of the project, and that none of them would mature before December 1954 when the project would be earning substantial revenues. There would be \$6,000,000 of "new land bonds", the longest maturities of which would be 7 years. This involves the retirement of about one-fifth of the total on the last day of each year, from 1954 to 1958, inclusive, the exact schedule of retirements being set to fit anticipated receipts. The \$18,000,000 of "causeway bonds" would mature at the rate of \$1,000,000 annually from 1954 to 1962.

For the protection of the bond holders a reserve fund would be set up to which at the end of each year all excess of net income over the payments required for bond interest and retirements would be transferred until this reserve fund became equal to twice the amount required to meet next year's requirements for these purposes. Thereafter the reserve fund would be held at this level. As the bonded debt is gradually reduced the amount required

to be held in the reserve fund will also diminish and the accumulated excess will be transferred to the "surplus fund." The money in the surplus fund will be available for further improvement or additions to the project such as widening the causeway to four-lanes, providing county parks or other recreational facilities or it can be used to call outstanding bonds, thus hastening the day when the project can be made toll free. The table on page 38 shows for the earlier years of the project the manner in which the net earnings of the project will be distributed to interest payments. It was not considered worth the labor required to extend this table to cover the complete retirement of all bonds in 1972, particularly as the estimates of future traffic extend only to 1964. The very rapid growth of the surplus shows that under the assumptions used the project would be an extremely successful one. In the course of the more detailed and exhaustive engineering and economic study which will be required prior to starting this project the financial set up should be revised by persons thoroughly familiar with modern practice in the financing of publicly owned revenue producing projects. Such revision would probably result in a more complex series of bond issues and a more rapid amortization of the entire bonded indebtedness.

FINANCIAL ANALYSIS OF CAUSEWAY PROJECT

Year	Net Income of Project (Section XII)	Bonds Outstanding Jan. 1	Bond Interest at 3%	Net Earnings After Interest Payments	Bonds Retired Dec. 31	Net Earnings Transferred to Reserve Fund	Total in Reserve Fund Dec. 31	Net Earnings Transferred to Surplus Fund	Transferred From Reserve to Surplus	Total in Surplus Fund Dec. 31
1952	None	\$24,000,000	\$720,000	-\$720,000*	None	None	None	None	None	None
1953	None	24,000,000	720,000	- 720,000*	None	None	None	None	None	None
1954	\$2,710,000	24,000,000	720,000	1,990,000	\$1,600,000	\$390,000	\$390,000	None	None	None
1955	3,479,000	22,400,000	672,000	2,807,000	2,000,000	807,000	1,197,000	None	None	None
1956	3,681,000	20,400,000	612,000	3,069,000	2,400,000	669,000	1,866,000	None	None	None
1957	3,883,000	18,000,000	540,000	3,343,000	2,600,000	743,000	2,609,000	None	None	None
1958	4,086,000	15,400,000	462,000	3,624,000	2,400,000	171,000	2,780,000	\$1,053,000	None	\$1,053,000
1959	1,620,000	13,000,000	390,000	1,230,000**	1,000,000	None	2,720,000	1,230,000	\$60,000	2,343,000
1960	1,838,000	12,000,000	360,000	1,478,000	1,000,000	None	2,660,000	1,478,000	60,000	3,881,000
1961	2,073,000	11,000,000	330,000	1,743,000	1,000,000	None	2,600,000	1,743,000	60,000	5,684,000
1962	2,325,000	10,000,000	300,000	2,025,000	1,000,000	None	2,540,000	2,025,000	60,000	7,769,000
1963	2,576,000	9,000,000	270,000	2,306,000	1,000,000	None	2,480,000	2,306,000	60,000	10,135,000
1964	2,844,000	8,000,000	240,000	2,604,000	1,000,000	None	2,420,000	2,604,000	60,000	12,799,000

* DEFICIT. To be paid out of proceeds of bond issue.

** Net earnings drop because sale of new land was completed the preceding year.

XIV. FINDINGS AND RECOMMENDATIONS

In view of the foregoing, the Dade County Planning Board finds:

THAT a causeway from Key Biscayne to Key Largo as outlined in the foregoing report constitutes a sound and attractive public project. This project presents no unusual engineering difficulties. If properly designed, it will in no way increase the height of hurricane tides on the waterfronts of Miami, Coral Gables or points further south. On the contrary, any slight effect which it might have on such hurricane tides would be beneficial. The causeway, if designed as suggested in Section VI, will be usable during ordinary gales. It will have to be closed to traffic during periods when hurricane winds actually prevail and perhaps during a brief cleanup period thereafter. Hurricanes might cause some additional maintenance costs but no extensive destruction of properly designed structures is to be feared.

THAT this project, connecting two heavily traveled toll routes, the Rickenbacker Causeway and the Overseas Toll Road, will furnish a shorter and more direct route from Metropolitan Miami and northern points to the Florida Keys, a region in which business and residential expansion is proceeding at an accelerated rate. If properly designed and operated, the traffic lights, interference by local traffic, bottle necks and other annoyances which now obstruct traffic on the existing route by U. S. Highway No. 1 can be kept to a minimum on this new through route. The causeway will have

scenic attractions superior to those of any main highway northward along the whole Atlantic Coast. It will make possible the intensive development of residential, hotel and resort property equal in magnitude, natural advantages and potential value to the entire City of Miami Beach, thus increasing the population of Dade County by tens of thousands and its assessed valuation by scores of millions of dollars. It will draw many additional tourists to this county and increase the income of the resort business and of the many services and industries dependent on it.

THAT it is against sound public policy to allow a project of this nature to be undertaken by private interests desiring to make a profit from its operation. Rather should it be undertaken as a public project by the Board of County Commissioners of Dade County, who can see that all its details are properly adjusted to the public interest. If the project is developed in this manner, this Board sees no objection to including in the project the filling of a limited area of marginal shoals and reefs on the west side of the causeway to provide about 1000 acres of new land, as shown on Plate II. The addition of this land will substantially increase the benefits set forth above, while its sale, under proper zoning and other restrictions, will provide a net profit to be applied to the cost of constructing the project, thereby greatly assisting in the financing of the necessary bond issue. As far as possible this new real estate should be sold directly to persons planning to build on it.

THAT these preliminary studies indicate that the potential receipts from tolls and from the sale of new land will be sufficient to permit the project to be financed by an issue of revenue bonds secured by the income of the project and not pledging the general credit of Dade County. The possibility of obtaining assistance in the form of Federal loans or grants-in-aid should not be overlooked. In order to float such a bond issue it will be necessary to do a substantial amount of preliminary work such as engineering studies, examination of underwater and underground conditions along the route, the preparation of outline designs and estimates, traffic surveys, real estate studies, financial analyses, and so forth, so that the application can be supported by a comprehensive engineering, economic, and fiscal report backed by the prestige of an engineering firm of established reputation.

The Dade County Planning Board therefore recommends that the Board of County Commissioners authorize further study of this project as outlined above and make the necessary funds available.

Respectfully submitted,

DADE COUNTY PLANNING BOARD

Edna C. Stevens

By: Mrs. T. T. Stevens
Chairman

APPENDIX

The following data on traffic counts and toll collections was used in writing Section V of the foregoing report but was considered too voluminous to be incorporated in the test.

RECORD OF TRAFFIC AND TOLL COLLECTIONS
RICKENBACKER CAUSEWAY

<u>From Nov. 9, 1947 to Sept. 30, 1948:</u>	<u>No.</u>	<u>Revenue</u>
Pedestrians and Bicycles	2,945	736.25
Motorcycles	2,713	949.55
Automobiles and Taxicabs	352,493	176,246.50
Light Trucks	9,394	7,045.50
Heavy Trucks and Busses	9,652	9,652.00
Special Equipment	150	319.25
	<u>377,347</u>	<u>\$194,949.05</u>
 <u>From Oct. 1, 1948 to Sept. 30, 1949:</u>		
Pedestrians and Bicycles	1,704	\$ 426.00
Motorcycles	2,367	828.45
Automobiles and Taxicabs	372,306	186,353.00
Light Trucks	9,821	7,345.75
Heavy Trucks and Busses	8,239	8,239.00
Special Equipment	480	724.25
	<u>395,317</u>	<u>\$203,916.45</u>
 <u>From Oct. 1, 1949 to Sept. 30, 1950:</u>		
Pedestrians and Bicycles	1,868	280.40
Motorcycles	2,058	524.10
Automobiles and Taxicabs	509,199	173,398.05
Light Trucks	11,710	8,782.50
Heavy Trucks and Busses	11,802	11,633.50
Special Equipment	2,155	3,073.50
	<u>538,792</u>	<u>\$197,492.05</u>

Note that the tolls listed above are collected at the west end of the causeway from east bound traffic and entitle the paying vehicle to make a round trip. No one way tolls are collected and no tolls are collected from west bound traffic.

RECORD OF TRAFFIC AND TOLL COLLECTIONS
OVERSEAS BRIDGE AND HIGHWAY TOLL DISTRICT

<u>Year</u>	<u>Passenger Cars</u>	<u>Other Vehicles</u> <u>Busses, Trucks,</u> <u>etc.</u>	<u>Persons</u>	<u>Revenue</u>
1944*	46,619	49,675	457,650	\$276,755.00
1945*	72,531	45,350	495,224	292,819.50
1946**	151,555	41,831	626,695	378,836.75
1947	193,529	39,927	708,168	427,618.50
1948	211,916	46,603	797,552	489,990.50
1949	282,603	51,527	936,840	576,231.75
1950-Jan.	38,061	4,840	120,339	71,214.75
Feb.	50,081	5,468	158,076	90,831.50
Mar.	42,260	5,207	133,131	80,556.75

Tolls are collected on south bound traffic at Lower Matacumbe and on north bound traffic at Big Pine Key a few miles west of Marathon. The foregoing table includes traffic on both directions.

TRAFFIC COUNTS ON U. S. HIGHWAY NO. ONE

<u>Location</u>	<u>Year</u>	<u>Annual Average</u> <u>Daily Traffic</u>
Between South Miami and Perrine	1944*	2,500
	1945*	3,500
	1946**	4,700
	1947	4,850
	1948	6,800
	1949	7,150
	Between Florida City and Big Pine Key	1944*
1945*		465
1946**		795
1947		910
1948		1,450
1949		1,750

* War time restrictions materially reduced traffic in 1944 and 1945.

** Traffic still influenced by war conditions in early part of 1946.

TRAFFIC COUNTS ON U. S. HIGHWAY NO. ONE (Concluded)

<u>Location</u>	<u>Year</u>	<u>Annual Average Daily Traffic</u>
Through Toll Area of Overseas Highway	1944*	215
	1945*	335
	1946**	510
	1947	645
	1948	735
	1949	880

The exact source of the data in the foregoing table is unknown. It is said to have been compiled from counts made by the State Road Department. The exact points at which the counts were made are not designated and the figures very likely are averages of counts made at two or more points within the limits indicated. It is not known whether the years are calendar years or other divisions. These figures have not been used in any of the computations in this report. Nevertheless, they are consistent with other information about the magnitude and growth of traffic in this area and have been included in this Appendix as giving a good overall picture of traffic on this part of U. S. Highway No. 1.

* War time restrictions materially reduced traffic in 1944 and 1945.

** Traffic still influenced by war conditions in early part of 1946.

TRAFFIC COUNTS BY STATE ROAD DEPARTMENT
ON U. S. HIGHWAY NO. ONE

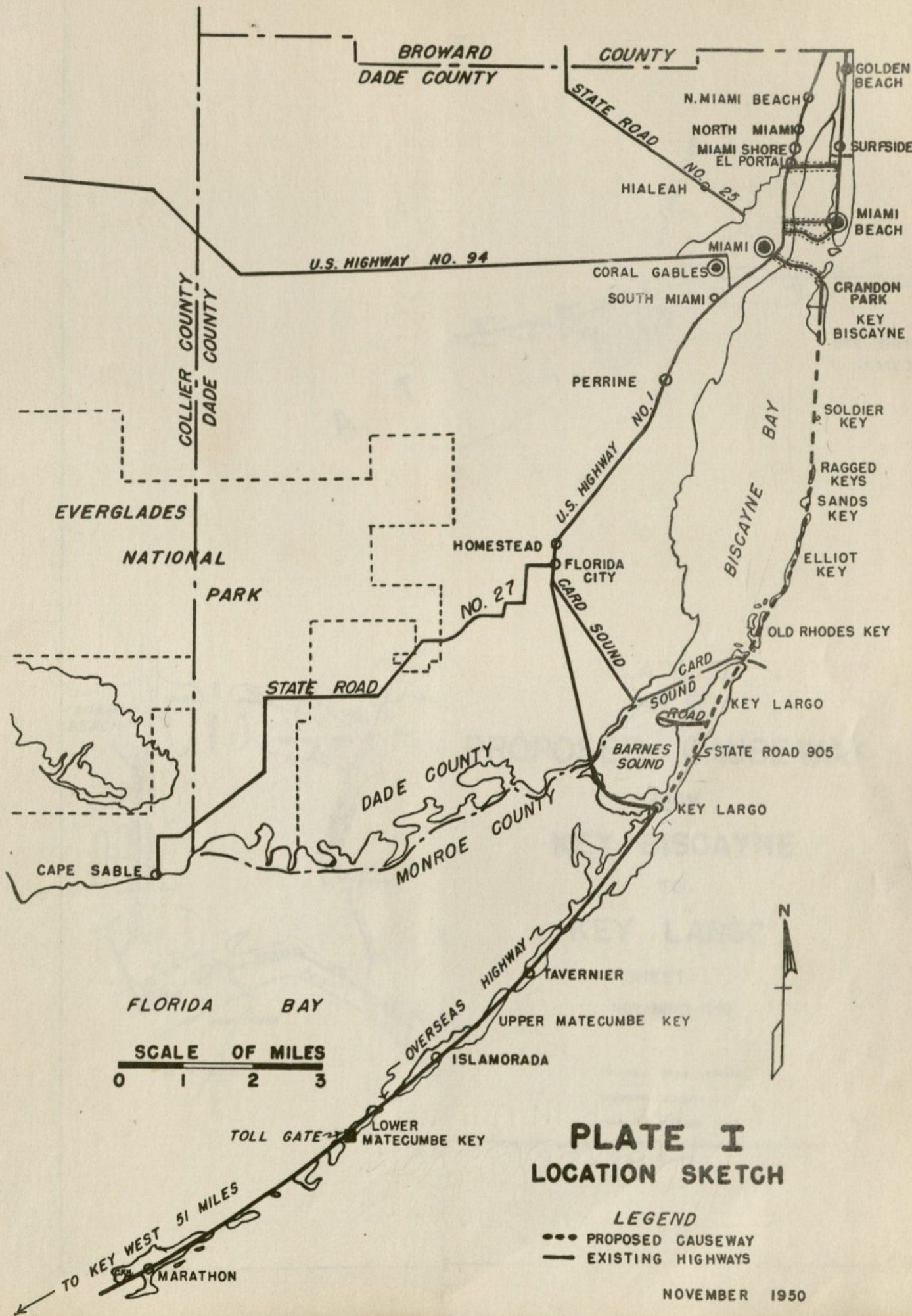
<u>Location</u>	<u>1950-24 Hour Annual Average Traffic Volume</u>
On SR 5, at the south city limits of South Miami, north of SR 5 and South 8th Street.	8790
On SR 5, at the north city limits of Ferrine.	6950
On SR 5, at the south city limits of Florida City.	2530
On SR 5, at bridge over Jewfish Creek.	1925
On SR 5, at drawbridge at Indian Key	1580
On SR 5, through toll area of Overseas Highway.	1095

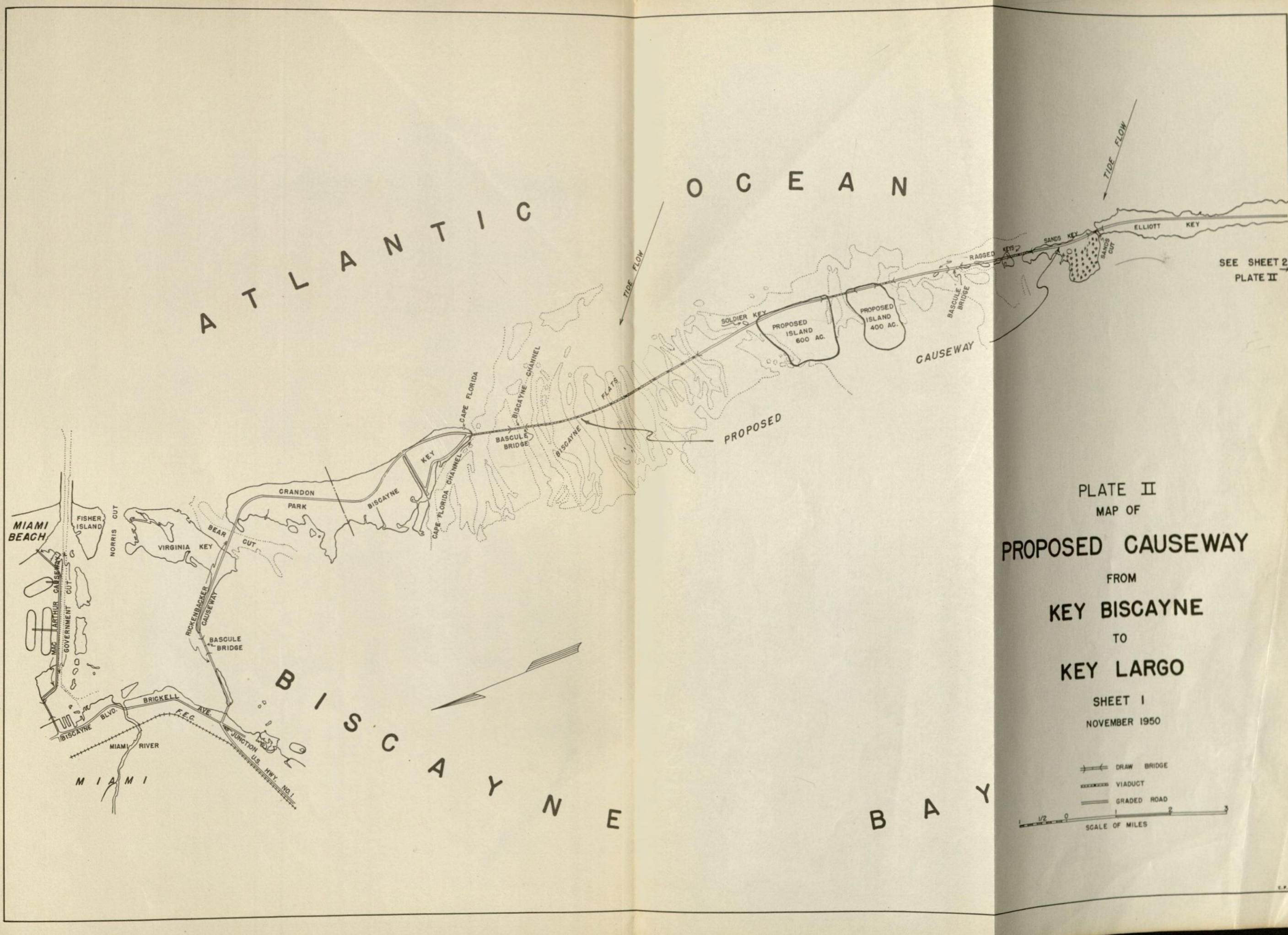
The annual averages shown are based on counts taken from October 1, 1949 to October 1, 1950. Traffic figures for the Overseas Highway toll area are compiled from the toll figures reported to this office by the Overseas Road and Toll District.

TRAFFIC COUNT OF CITY ENGINEER, MIAMI BEACH,
ON CAUSEWAYS ACROSS BISCAYNE BAY

<u>Causeway</u>	<u>East Bound</u>	<u>West Bound</u>	<u>Total</u>
MacArthur	13,809	11,990	25,799
Venetian (Toll charged)	9,685	8,795	18,480
North Bay	9,140	8,334	<u>17,474</u>
Total			61,753

These counts were taken in the middle of February 1950 at about the peak of the winter tourist season. The count extended only from 7:00 A.M. to 7:00 P.M., which accounts for the excess eastbound traffic. A twenty four hour count would doubtless give a total somewhat in excess of double the eastbound figures.





A T L A N T I C

O C E A N

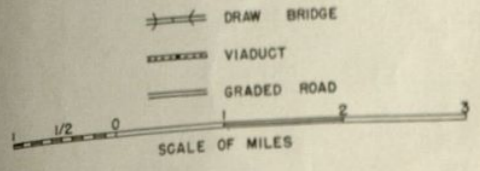
B I S C A Y N E

B A Y

SEE SHEET 2
PLATE II

PLATE II
MAP OF
PROPOSED CAUSEWAY
FROM
KEY BISCAYNE
TO
KEY LARGO

SHEET I
NOVEMBER 1950



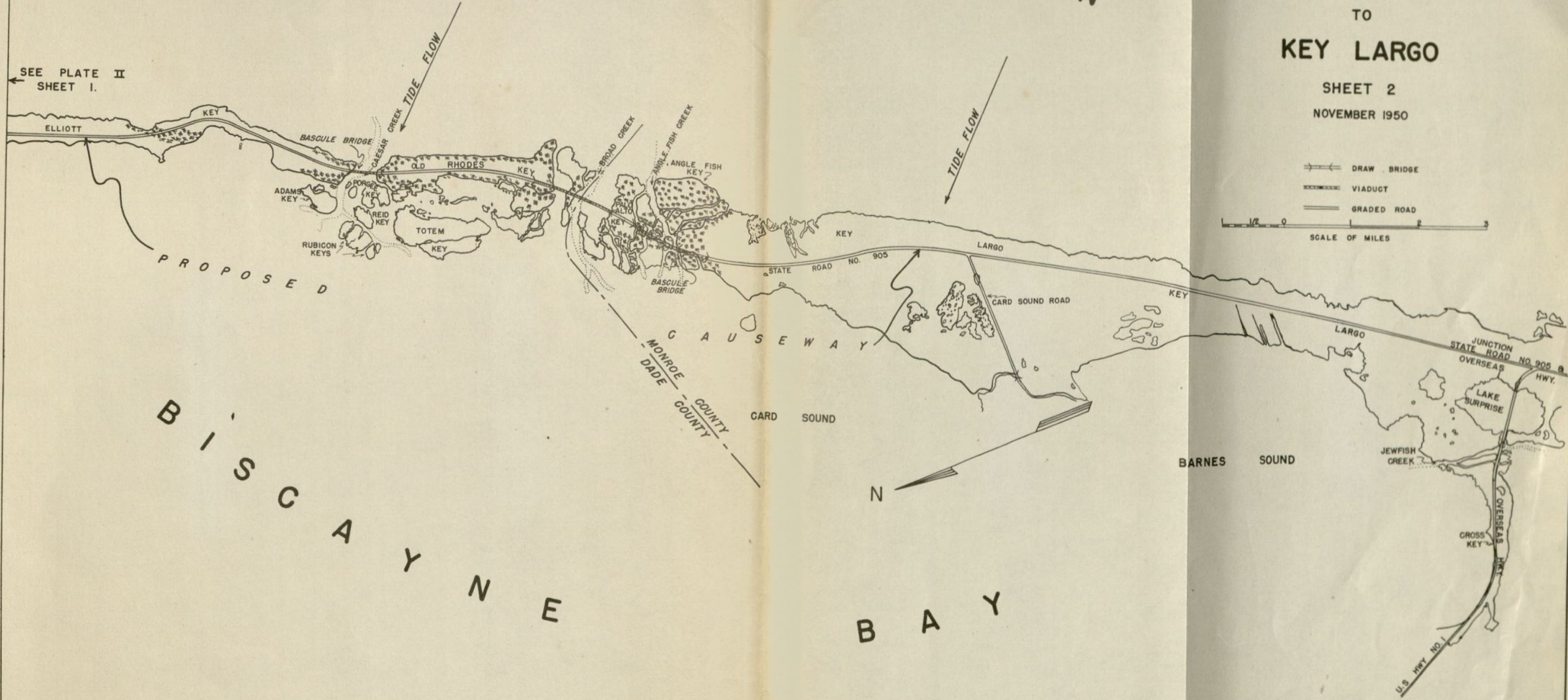
ATLANTIC OCEAN

PLATE II
MAP OF
PROPOSED CAUSEWAY

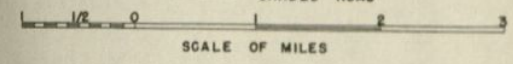
FROM
KEY BISCAYNE
TO
KEY LARGO

SHEET 2
NOVEMBER 1950

SEE PLATE II
SHEET I.



- DRAW BRIDGE
- VIADUCT
- GRADED ROAD



PROPOSED

BISCAYNE

BAY