A Study and Report of the Memphis Airport, 1928

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THE MEMPHIS AIRPORT
A STUDY AND REPORT

THE MEMPHIS AIRPORT

by

THE ENGINEERING COMMITTEE

of

THE MEMPHIS CHAMBER OF COMMERCE

AVIATION DIVISION

GEORGE W. FOSTER, CHAIRMAN
STUART C. GODFREY, MAJOR, C.E., U.S.A.
HORACE C. ROSSON
ANKER F. HANSEN
MEMPHIS, TENN.

May 10, 1928

Mr. R. M. Dozier, President,
Union Railway Company,
Memphis, Tennessee.

Dear Mr. Dozier:

We are handing to the Memphis Airport Commission a complete report of the Engineering Committee of the Aviation Division of the Chamber of Commerce on the subject of the possibility of the location of an airport on Mud Island. The completeness of the report speaks for itself.

This report is made possible through the untiring efforts and thoughts of the following gentlemen who compose the Engineering Committee of the Aviation Division of the Chamber of Commerce: Captain George Foster, Chairman, Major S. C. Godfrey, Captain Horace G. Roason and Mr. Anker Hansen.

Each one of these gentlemen is an expert in his particular line and the report is particularly practical because each member of this Committee has spent uncounted hours in the air as observers or pilots. They were actuated in their efforts to make this report complete by the desire to promote aviation in the City of Memphis, to serve their Chamber of Commerce and to dutifully assist the administration in anything which they believe is for the betterment and improvement of the City of Memphis.

We are very glad to turn a copy of this report over to you and to remind you that at any time, in any way, the Aviation Division of the Chamber of Commerce is delighted to serve the Airport Commission.

Yours very truly,

MEMPHIS CHAMBER OF COMMERCE

[Signature]

Robert Haverty, Chairman
AVIATION DIVISION
Mr. Robert Haverty, Chairman,
Aviation Division, Memphis Chamber of Commerce,
Memphis, Tennessee.

My Dear Mr. Haverty:-

Pursuant to your request, made at the time of our appointment as a special engineering committee for the study of that one particular subject, we have made a study of the island in front of the city with a view to determination as to its adaptability for development as a municipal airport.

We have pursued this study to the best of our abilities, and have combined the results in the report which is incorporated herein.

Our whole aim in our work has been to advance the cause of aeronautics. All of our efforts have been solely in the nature of a voluntary contribution, and should be so regarded. Since we began our work the City of Memphis has established an airport commission. That commission has extended to us the courtesy of postponing definite action tending toward the development of a municipal port until such a time as we had finished our work. It is our suggestion that our report be turned over to them, not in any sense as a program for them to follow, but in the hope that the results of our study may be of some assistance to them in the solution of the problem with which they are confronted.

Yours very truly,

Chairman of the Engineering Committee.
PROLOGUE

The troglodite with his knotted cudgel, stalking the crawling saurian thru the tangled rank-ness of the marshy jungle, descried the eagle soaring in majesty aloft, and fell a-day-dream-ing that he too might wing his way among the sunlit clouds above him. The boy of yesterday, you or I, at utter loaf, fishing in the deep pool below the mill dam, leaned back lazily against the sunwarmed trunk of the willow tree and dreamed the same age-old dream.

From the dawn of the first creation this dream has been the common heritage of all mankind: the savage in the jungles cowering from the winged nocturnal flights of fearsome demons; the child in the nursery breathless in fancied flight on his winged steed to the rescue of the fairy princess; old age awaiting the release from pain and sorrow to peaceful flight on golden wings thru all eternity; it is the one common vision of us all. It is woven into the very warp and woof of our being, intangible and alluring, 'til, thwarted in its attainment in this life, we have woven it into the fabric of our religion, with the vision of celestial flight the crowning hope of our hereafter.

Thruout the ages the realization of this dream has enticed yet baffled all races and creeds until the day of our own generation. We, the first of all mankind, have seen the unfolding of the wings, and ours is the priceless heritage of the realization of the age-old dream. The sudden revelation, following the countless years and centuries of unconsummated dreams, finds us still aghast at our temerity, and slow to realize fully that mankind, now possessed of powers of flight beyond the wildest dreams of our boyhood days, will go on and on to greater heights, never again to
revert to its earthbound status of the past.

It is not going too far to say that he who has never seen the miracle of the dawn from aloft, with the soft light of the morning stealing over earth, or who has not felt the joyous lilt of a swift wing-sweeping swoop thru a rift in storm tossed clouds, or seen the mirrored lakes, the fair acres and the mountain peaks in the dying amethyst of the eventide, has never really lived.

These things that are as miracles to us will be but the commonplace heritage of our children and our children's children. Our own days here are numbered, and we must be jealous of our opportunities if we are to gain the full measure of their realization in the fleeting spans of our lives. To be niggardly in the grasp of our advantage will penalize but our own time and place, for the magnificent achievements of our pioneers are blazing the trail to avenues of flight for tomorrow that are as far ahead of today as today is ahead of our boyhood dreams.

Those of us who are intrusted, in a measure, with the responsibility of providing for the advancement of this phase of the progress of our own generation in our own city are deeply and humbly appreciative of this responsibility. We have honestly studied every phase of the question to the fullest extent of our ability to do so, and know, in our own minds, that the solution which we have evolved for the Memphis Airport question is fundamentally sound. That it is not a little plan which we are offering we are fully aware; but we are equally aware that we are not dealing with a little question. Ultimately the whole world will be traversed and retraversed with air lines, but this generation will see more largely the development of areas peopled by those with the vision to recognize the greatness of the present opportunity to seize and hold the industrial and commercial supremacy offered only to those with the vision and courage to lead instead of follow.

We of this Engineering Committee are, most frankly, in what might be a delicate position if we were
dealing with men of lesser stature than the heads of the present City Administration and the Airport Commission, for our work as a voluntary contribution toward an objective very dear to us had started before the City took definite steps toward the establishment of a Municipal Airport. We cannot express too fully our appreciation of the gracious courtesy of the City Commission and the Airport Commission in awaiting the completion of the report on our findings, and but hope that they will feel that their waiting has not been in vain.
THE STORY

Benefits received from study of the country's existing airports are predominantly negative rather than positive. Enthusiastic citizens will tell you that "our city has a model airport." This is too true to be even funny when you consider that one definition of "model" is "a small sized imitation of the real thing." All in all, when you honestly study about any field in the country you can find more things to avoid than to copy.

This does not mean that the builders of these fields are not deserving of absolutely unqualified praise. For the most part they were faced with a dire lack of anything exchangeable at a bank for real money, and all of them were pioneering in the sense that there were few if any precedents to guide them in the selection or the determination between good practice and bad practice. Most of them appear to have been quite well aware of the defects or handicaps of their fields even while they were building them, but were forced to do and accept things which they did not like or else see their whole program fall.

This is particularly true in the matter of the selection of sites. Nearly every man who has been instrumental in the establishment of a field recognizes the extreme desirability of having a location as close as possible to the heart of town, but has had to locate anywhere from five to fifteen miles out from sheer financial inability to get property closer in. The same thing applies to locations too close to industrial districts with their high stacks, their pole lines, railroads, and other hazards. All told, most of them have taken the best that they could get and have done the best that they could with it, Highly commendable, but not wholly worthy of copying in detail.
One mistake seems to have been common to most every group looking for a site: that of believing that a field must be dead level to be good. Time and again you see a man who will tell you that they have a field of certain size and shape, not exactly what they might have wished to get, maybe, but with other objections offset by the fact that it is AS LEVEL AS A FLOOR. Under questioning he will admit that they do have a little trouble with drainage during a wet spell, and if you stay around long enough to be there during such a spell you will generally find that the field ranges anywhere between daintily muddy and a hopelessly plowed up morass after a few heavy ships have done their best for it. One member of this committee recently had the not too uncommon privilege of seeing a big tri-motored ship being yanked by a tractor out of a young bog in the geometric center of a model airport.

This may be countered by opinion that such a field can be drained by properly installed sub-drainage systems. Undoubtedly true in part, but not wholly so unless the field is reshaped to lead the surface water to the drains before the whole surface gets saturated, and such a treatment of a large area is mighty expensive, and doubly so if attempted after the field is in operation. Add to this, too, the hazards presented by a torn-up field. Thus it is that this committee feels that a "dead-level" field, as such, should be avoided except as a last resort.

Somewhat short sighted selection of these extremely level fields is believed to have been the parent of the "runway" systems later developed and even adopted as the fundamentally practicable thing in many instances. The drift to such a system was a perfectly normal and natural process. A field originally intended for all over service gradually became worse and worse with each succeeding rain. One rain would soak it; while soaked, a ship or ships would land or take off with wheels or tail skid cutting in or plowing out ruts in the field surface, destroying what may have been an excellent stand of turf; repair of the damaged area after the rains could never fully reproduce the original homogeneous structure of soil and turf, but would leave
softer spots or streaks more susceptible to recurrent damage during the next spell of bad weather. After this had occurred a few times conditions would get beyond remedy thru use of the original materials and a few loads of gravel or cinders would be dumped and rolled in the worst spots. Breaking down of the interstices between such stretches would occasion the placing of more such material until continuous strips, or runways, had been constructed.

If the fields had had slopes or grades adequate to have prevented the original ponding of the water, and had had goods stands of turf, the saturation that led to the destruction of the surface would not have occurred; provided, of course, that intercepting lines of subsoil drainage had been placed at close enough intervals to have prevented concentration of sufficient flowing water to have caused saturation at any point. Wherever this was allowed to happen the crossing of a ship over such a point would have caused a high sided rut which would have ponded the water back a lesser or greater distance and would have occasioned saturation there. Therefore, it is our opinion that all portions of a field should have sufficient slope or grade to preclude the presence of ponded water, even for short periods; and that subsoil drainage lines traversing such slopes laterally should be installed at close enough intervals to prevent any substantial sheets of water from flowing over any portion or portions of the field.

More study has probably been given this, by this committee, than to any other one phase of the problem. From this study we have formed the conclusion that the best type of such subsoil drainage is perforated metal pipe in slag or broken stone filled trenches. The efficiency of and maintenance upon such pipe is such as to lead us to its adoption over other materials now on the market. The single objection to it is found in the fact that the metal is subject to corrosion from certain acids. Such acids are found in cinders and in some slags, so that the former is not recommended and the latter only when virtually free from such acids. Further, this pipe is not recommended for use in marshes containing
much underlying decayed vegetable matter, or other substances productive of seepage of carbon dioxide gases.

In clean rock or non acid-bearing slag-filled trenches in clean silt, this pipe may be said to be practically permanent. Of course, these open drain lines, and also the outfall lines from them, must be laid with good grades, and must be so constructed as to permit subsequent inspection and the flushing out of the silt which will inevitably accumulate in them.

Returning to the question of the runways. These have many objections, the principal one being that of hazardous congestion. Formation flying, with any real consideration for safety, is out of the question on them. In fact, it is in the bounds of reasonable statement to say that more than one ship cannot be in motion on a runway at the same time with safety. There was never a flyer yet - unless he was doing it on a bet - that would attempt to land on an ordinary runway anywhere except right down the middle of it, and with good reason, for a ship under reduced speed for landing will drift sideways as quick as a flash on encountering a sudden cross wind down near the ground, and a good pilot, with only one good neck to his name, will not take undue chances in being whisked off into the rough or the mud if he can help it. Thus it is that there are only about one or two strips a few yards wide out of a hundred and sixty acre field in actual use in a port of the runway type.

Another objection is found in the very virtue of the runway - its hardness. A little misjudgement or a slight shift in headwind velocity while setting a ship down on a hard runway will smack it down so hard that it will hop like a scared rabbit, while, in taking off, the bump of the tail skid on a hard lump or projection will certainly take your mind off of your other troubles, for the time being, at least. These difficulties are much lessened on a good turf field.

In some instances concrete runways have been constructed for the takeoff only of ships with rear wheels.
instead of tail skids, and have been found very satisfactory for that purpose alone. They are not, however, popular for landing. They are just simply too hard and utterly devoid of any resilience.

The most of the runways in the country, tho, are of cinders or gravel rather than concrete. Wheels pulling and skids dragging along at seventy miles an hour give lots of trouble with ruts, and loosen and displace the aggregate of the runways. This, flipped up by the blast of a propeller travelling 2000 revolutions, is as vicious as buckshot strolling out of the business end of a muzzle loader, and occasionally wreaks real havoc on wing and fuselage fabric.

All said, runways are but the expedient solution of the problem when all else fails, and should not be selected as the fundamentally desirable feature around which to develop a field. The magazine "AIR TRANSPORTATION", in its issue of March 24th makes the following pertinent observations on the subject:

"With planes maneuvering for position and all requiring the same runway to use for landing and taking off the danger of accidents is greatly increased.

"Then too, planes must be immediately removed from the runways to permit other planes to land in safety. In case of a forced landing, planes might conceivably have difficulty in making one of the runways, and should it fail, the plane might be badly smashed in landing on unimproved ground about the airport.

"It is true that very little flying is actually done over the field, but most accidents happen near the field because of engines going dead soon after taking off or because a green pilot tries too steep a climb. With the open field planes can land in any part. Thus with the greater amount of available space many planes can use the field at once and the danger of accidents or collisions is greatly lessened.

"Each plane can have plenty of room on the field
and various parts of the field can be used for different operations. Many airports have flying schools in conjunction with their regular flying activity and the stages of learning to fly require plenty of space, especially the 'ground class' where planes are operated only on the ground by students.

"It is because of this better arrangement and the easier facilitating that the Department of Commerce recommends the open or all over type of field for the airport."

Another feature of port development, as a whole, that has not received any too much consideration is in the matter of general appearance. Go onto almost any field in the country and you will find a heterogeneous assortment of shops and hangars of general characteristics ranging from kennels to three-ring tents:—war babies, orphans of the A. E. F.; old barns sans Dobbin and the cow but still faintly redolent of their memory; corrugated iron boxes of shanty-town ancestry; all set at indiscriminate angles and in all stages of senile decrepitude.

As with the other phases of airport development, any very great amount of criticism of this is both unjust and is indicative of mighty poor taste, for most of the chaps who have actually gotten the industry to its present stage have had to dig out their dollars singly with nutpicks, and the utmost of praise should be given them for having done as well as they have; but now, after ten years of astounding postwar development, the whole project has attained status worthy of dignified treatment, and any community that does not feel that money put into airports is an investment put into a going concern had better withhold public support still longer and let their few poor flying fools carry the burden for a few years more.

Another phase in which the national development has not achieved much success as yet is in placing airports near enough to the hearts of the cities which they serve. Any way you look at it, a field remote from the heart of things is under great handicap in comparison with others.
"close in". Commercially - mail, passenger or express carrying over established routes - the value of the service is reduced directly in proportion to the inconvenience and loss of time occasioned in getting from and to town before and after the actual flights; and this is the unfortunate situation in most cities. For instance, the San Francisco municipal field is 14 miles from the downtown district, Chicago 10, Atlanta 10, Cleveland 8, and so on thru the list.

Regardless of how one views the flying industry, the center of its activity remote from the major center of the activity of the city which it serves is not good business. With mail, there is a time and space element between a central post office and a flying terminal that makes for or against speedy handling of mail from the one to the other. With express or passengers, this service is becoming more and more competitive with existing agencies, and the absorption of time and expense between field and city will play increasing part in the ability of the air service to grow - picture a ten mile express haul from field to business district against a few blocks from railroad station to consignee. Considered as an amusement feature, such as many people still persist in considering it, from the only angle from which they have actually viewed it in seeing their friends "take a hop" for the thrill or the pleasure, and the same analogy abides. If you doubt it, just try to visualize theatre patronage at a site adjacent to an outlying airport.

In this matter, as in the others, previous selection of site as well as of detail has been largely a matter of expediency rather than ultimate advantage; and it is felt that the day is not far distant when cities will face the necessity of getting closer-in sites at terrifically increased prices; and the relocation will, of course, mean more or less abandonment of the fixed improvements on the earlier sites. It therefore behooves cities to attempt, at least, to look ahead a few years and visualize as best they can the trend of the whole industry, thereby to save as many false steps as possible.

Just what the next few years may bring forth literally
transcends human conception. A boy born on the memorable day when the dauntless Wright Brothers first succeeded in flying a heavier than air ship will not cast his first vote for the president of his country until next November. The aeronautical accomplishments of the few fleeting years between that day and this beggar and utterly dwarf any and all accomplishments of mankind thru any period of equal duration in all history.

An old Texas rancher once told the writer that "nobody but a d----d fool or a d----d tenderfoot ever attempts to prophesy the weather around here". The aptitude of the phrase recurs to mind again and again when either optimistic or pessimistic forecast of the future of aeronautics is heard. We just do not know, and about the best that we can do is to view what has been done and is being done. With a fairly definite setup of this before one, the feeling that we have but scratched the surface of the ultimate possibilities persists.

Unquestionably, the most outstanding feature of the development of the industry is the degree to which safety has been assured. The popular misconception as to the non-safety of flying is due largely to failure to recognize the fact that there are four different kinds of flying:— established commercial flying; test flying incidental to the development and production of aircraft; military flying; and "barnstorming":— stated in the inverse order of their hazards.

It is in the last group that most of the fatalities occur. Put a more or less inexperienced flyer in an obsolete "Jenny" and let him run it without competent maintenance, and the local paper can pen his obituary and put it up on the shelf with better than reasonable assurance that they will get a chance to use it before it has a chance to collect overly much dust. The real tragedy is that he generally carries some more or less innocent passenger out with him on the long trail.

Military flying is next in line with its hazards
in that the fundamental design of a fighting ship deliberately sacrifices stability for maneuverability, and the value of a fighting pilot lies in his relative ability to do more insane contortions in a split second than can his adversary. Training for perfection of this ability takes its toll.

Test work has fewer hazards than either of these, but still involves risks not too freely assumed by insurance companies.

The Ford Motor Company recently made a survey that revealed that there were only two fatalities in five million miles of flight by one hundred concerns operating licensed ships with licensed pilots; while the two largest of the air mail contractors with a combined mileage of some two and a third million miles have had but one serious accident and no loss of mail or express nor any injury to passengers.

That flying is not wholly safe as yet must be recognized freely, but the record of the last few years points to a time in the near future when it will be as safe as any other established transportation medium.

The next impressive thing about the whole industry is the extent to which it has developed. An air mail map incorporated herein shows the astounding extent of the extension of these lines. We of Memphis, to use a political expression, can hardly "point with pride" to this map which shows lighted and marked routes from Coast to Coast and from Canada to the Gulf but leaves our own territory untouched. Look at this map carefully - and then weep. We are on direct line from Chicago to New Orleans and on the most direct line from New York to Texas and the West Coast, in addition to being on a potential line that would be free from the impeding blizzards encountered on the Northern Plains and the Northern mountain route. There is but one place to look for the reason for our failure to have this service, and that is in our looking glasses, for it is our own neglect to provide proper landing facilities.
that has left us out of the picture.

A current issue of an aeronautical magazine, purchased at a local news-stand, bears fifteen solid pages of established airline schedules, similar to those found in railroad guides; and has a directory listing one hundred and eighty-six Air Taxi Companies, located in all parts of the country. The service and maintenance of schedules on the established lines is nearly 100 percent. In fact, turn where you will and you are convinced more and more that air transportation is not coming, but that it is here. You can go from St. Louis to Chicago in three hours and fifteen minutes; from Chicago to Minneapolis in five hours; from Detroit to Cleveland in one hour and thirty minutes; from Cleveland to Pittsburgh in one hour and thirty minutes, or to Buffalo in two hours and thirty minutes; from Dallas to Chicago in twelve hours and thirty minutes; from Chicago to San Francisco in twenty-two hours and forty minutes; from New York to Chicago in seven hours and forty-five minutes; and so on down thru the list between all of the points shown on the air routes. We have quite excellent train accommodations in and out of Memphis.

Another good index to the extent of the national development is found in a study of the map, incorporated herein, showing the number of licensed pilots and mechanics in the country, and the states in which they are located. The same is true of the flying schools and the locations of the factories. To our certain knowledge, the lists from which these were taken are incomplete, and we had no authentic information from which to complete it so have copied it verbatim and given credit to its origin. That the list - or lists - were not complete is not a matter of any discredit whatsoever to those who compiled it. The industry is just simply growing so fast that you cannot keep up with it.

The matter of factories is, or should be, a matter of deepest concern to Memphis. Another decade will unquestionably see the airplane manufacturing industry ranking among the greatest in the country. This city has everything in the world
but one - a good airport - to offer. It is at the
greatest concentration of railroads and twelve-months-
a-year river transportation service in the Middle
West or the South. It has a climate offering three
hundred and sixty-five days a year for out of door
testing, in comparison with the days and weeks of win-
ter weather that preclude this in locations further
North. It has a permanent humidity to guarantee air
stability and buoyancy far in excess of that found
in the rarer atmosphere of the flat plains country.
It has a landing field a thousand miles long in each
direction for hydro-aeroplanes, with every foot of
it free from tides and surf. In fact, Memphis has got
IT when it comes to the things needed for successful
and profitable aeroplane construction; but it has
not the factories and is not going to have them until
it demonstrates that it realizes that air transporta-
tion is here to stay and to grow.

With this, then, for the background of our
hypothesis, we set out to project an airport on the
island in front of the city. That an airport was an
essential need of the city we were the more thoroly
convinced as we progressed with our general study.
What not to do in the projection of such an airport
had become quite definitely established in our minds;
we had profited most materially from observation of
other developments and had come to recognize as most
fundamental that the successful field of the future
must be an "all over" rather than a runway field,
that the finest drainage available was not only de-
sirable but essential, that proximity to the heart of
the city determined in great measure the ultimate suc-
cess of the project, and that orderly and attractive
development would be possible only with the adoption
of certain standards of building construction.

The first problem in this particular study
was to determine whether or not the site under con-
sideration was of sufficient size and proper shape for
a good airport, and whether or not its development
could be consummated within the limits
of economy and safety; for we
already knew that the location
offered proximity to the city
incomparably greater than that
of any other airport in the
country, if not in the world. Study showed almost immediately that the area was of sufficient size and of most satisfactory shape. Further study brought the conviction that proper steps taken for the stabilization of the adjacent river banks, and those above, would unquestionably insure the structural security of a port constructed there.

The next step in the study was the determination as to the flying safety to and from the port. Here we found that no industrial or other obstructions were close enough to reduce the effective area of the field; that the area was adequate to permit of the development of an emergency landing area nearly a thousand feet wide outside of and virtually surrounding the field proper; that the humidity produced by proximity to the river made for rather than against air stability; that the directions of the prevailing winds gave clarity of atmosphere far in excess of that found in any other direction from the city; and that these prevailing winds were from directions that would make ingress to or egress from the field, directly over the city, very rare.

Of particular interest was the question of the visibility on and over the field. Day after day the wind hung in the Southwest or the Northwest and blew across the island clear and clean. Morning after morning, particularly on the sunny days with light airs, we would look down on the island from the river front and see every tree and branch sharply outlined, while trees, vehicles, buildings and curb lines were hazily obscured in the city itself, and for some considerable distance out to the South and East or the North and East; for the light winds from off the river allowed the smoke from homes, commercial buildings and factories to drift slowly and heavily over and away from town on the other side. Of particular assistance to us in the determination of the potential safety of the area were the Memphis flyers, who flew above it and around it in all sorts of weather, and told us that it was good.

The next question was as to the shape and contour of the field itself. Two major considerations were involved in this: the best shape for a
field from the viewpoint of the flyer, and how to get the most stable development at the lowest cost.

A field circular in shape, raised above the flood level of the river, appeared to offer more resistance to scour and erosion than one with angles and corners, and could also be constructed with less material than any other giving the same distances for landing or taking off. Consideration of this shape from the viewpoint of the flyer developed that it had no disadvantages over a square field other than that a circular field with a diameter equivalent to one side of a square field would not permit of simultaneous take-off or landing of ships abreast in formation flying with each having a full length path on the field. The Department of Commerce gives its highest rating to a field 2500 feet long in each dimension. A circular field offers this when it has such a diameter. We increased this diameter to three thousand feet, or 20%. This insures having a field of the highest classification in the event the standards are raised to such an extent, and gives a field 1600 feet wide and 2500 feet long with its long axis in any direction for the most exacting of formation flying.

Another advantageous feature is that this circular shape affords higher distinctive visibility than would any other shape.

In the earlier consideration of the development of such a field we thought only of raising the whole area. The cost was literally staggering in view of the immense yardage required, so, for reasons of economy, a field shaped like a gigantic saucer was given consideration. One with its rim well above the highest recorded floods, with broadly sloping sides on the exterior, and with its interior sweeping down to the center in a long parabola. Structurally it would be both feasible and economical, for the broad slopes, both inside and out, would be far beyond the limits of saturation from a standing flood surrounding it. This led to the question of just how much it would lessen its desirability as an airport. As we got deeper and deeper into study of this phase of it, it began to come over us that we had
unwittingly stumbled upon something close to the ideal.

In taking off the thing to be desired is quick acceleration of velocity, while the converse is true in landing. We found that this bowl-shaped field aided in the attainment of both. Starting from the rim of the field the flyer would be aided by a gradually flattening gentle slope extending for 1500 feet to mid-field, and any ship that has not left the ground in 1500 feet - with the exception, possibly, of one loaded to the limit with fuel for a transoceanic or an endurance flight - had better be stopped and inspected before it tries further to get up. Similar advantage is gained in landing. With the newer ships, and the increase in tendency toward those with a flat gliding angle, a ship normally enters a field on a long, flat glide with sufficient altitude at the edge of the field to relieve the hazard of being set down by an unexpected gust of wind before reaching the field itself. This glide is continued to midfield where landing is made. Good practice demands that landings be made under power and at good velocity. On a level field or one with a descending grade a ship has a tendency to roll for quite a distance before coming to rest. Here the gradually increasing ascending slope aids in checking and stopping the ship.

Another excellent feature is that a ship landing in a direction away from the hangars can turn about with the advantage of the terrain in its favor, for any turn beyond the center of the field will be with the outside wheel higher than the inside one in the same manner as the outside rail on a railroad curve is elevated.

The projected difference in elevation between the rim and the center of the bowl is slightly under twenty feet. Picturing a field with a diameter equal to the distance between the Auditorium and the Gayoso Hotel, this becomes insignificant. As stated above, the detail of the rise is that of a parabolic curve, very flat in the center of the field and growing gradually sharper as the rim is reached. An idea of the extreme slope at the very edge of the field can be obtained by observation.
of the grade of Monroe Avenue between Front Street and the railroad, and this is only for the last few feet at the very rim.

In construction by the methods contemplated this can be worked out perfectly, but must be done with extreme nicety. To paraphrase the expression of the old drill sergeant, it is awfully simple to do it right, but will be simply awful if it is done wrong.

Even with this aid to both takeoff and landing, tho, we were not wholly satisfied by the security offered by the field itself; but have projected an additional emergency landing in the form of a ring 1000 feet wide outside of the field proper. This will not be graded very much, but will merely have the roughness ironed out by clearing, grubbing, plowing, and a minimum of shaping and then seeded with alfalfa or some other forage crop. The product harvested from this outside area should more than pay for the cost of its production and will afford about the maximum of safety that can be attained around the field.

The method contemplated for the making of the fill is to use hydraulic dredges. The material would be taken from the west bank of the Wolf River and from the lower end of the island, with some specially selected material near the towhead outside of the mouth of the Loosahatchie River. Taking material from the first mentioned source would also serve to give a much to be desired widening of the navigable section of the Wolf River, while material from the other sources could be gotten without endangering the stability of the whole project.

Something in excess of two and one-half million yards of material would be required. The costs included in this estimate are in line with those paid commercial dredging companies on similar work, with recognition that part of the yardage might be gotten at lesser cost by utilization of materials pumped out of the Wolf River channel by the government in the widening project there.

All of this material would be deposited initially in virtually its final position.
and then "fine graded" by mechanical means.

The whole field, including the outside slopes, would then be "spot-sodded" and seeded with Bermuda grass, or such combination of grasses as might be selected after competent study. This method consists of setting out rows of live plants at close intervals and then sowing seed between the rows. A full year would be required for the spread of the roots of the plants to make a good stand of turf. Sodding of the whole area with a solid sheet of live turf would shorten this time somewhat, but even then several months should be allowed for the growth of a tough network of roots, and the cost would be five times as great as for the spot sodding method. This proposition of keeping off of the field for this length of time is going to be hard to enforce, but the initial stand of turf must be secured before the field is put into service or it will never be gotten.

The construction of a field of this sort would of course place the center of it about fifteen feet below the maximum flood plane of the river, and would present something of a problem for the disposal of rainwater and some possible subterranean seepage during flood times. This is met by having a drain line running from the center of the field to the Wolf River. This would be drained by gravity until the water reached a stage of about 27 feet on the Memphis gage, and thereafter by pumps similar to those by which New Orleans disposes of its sewage, rainfall and seepage water.

The whole field would drain toward the center but to preclude the concentration of the surface water at any point in the field we have projected a series of concentric rings of subsoil drains placed at intervals from the rim to the center of the field. These are to be of the perforated metal pipe previously discussed and would be drained to the main outfall sewer by radial collecting lines. This feature has been given study not only by this committee but also by the association of the manufacturers who produce this pipe. These people sent a representative from the North to study this feature with us, and we know that the solution is workable.

When it came to the
consideration of the hangars, the administration building and the shops we profited quite extensively from the mistakes of others who had failed to work to a comprehensive plan, and so had unsightly groups of unrelated structures.

The first step was to establish or select the type, or motif, of architecture best adapted to this character of development. We selected the Spanish with its white walls and red tile roofs as most adaptable and most pleasing for the massive outlines and the green setting of the closely clipped field. Located, as these will be, away from the drifting smoke of the city, they will not present the problem of being easily soiled that would be the case within the city proper, or on the North, East or South sides. In addition to this they will present the very highest degree of visibility from the air, both by daylight and when illuminated by flood lights at night.

The general construction will be of fire-proof materials with masonry walls, steel roof-trusses and tile roofs. Study of existing buildings elsewhere revealed one common fault. Most of them have their doors in the ends of the buildings, requiring the removal of all of the ships near the ends to get out one from the center of the building. These buildings here are projected with their long sides parallel to the edge of the field, and with doors continuous from one end to the other to permit the virtual opening of the sides from end to end to allow the taking out of any ship without displacing any others. This same feature is developed on both sides of the building to permit of access from either side.

The same designs were retained for both hangars and shops, with full latitude for the subdivision of the interiors in any way desired. Future buildings would follow the same general design, with possible increase in size for larger ships which may be built in the future. The ones projected for the initial development are of ample size for any ships now being built in the country.

The administration building, in the center of the...
group, would contain the offices of the field executives; those of the commercial companies operating out of the field; rest rooms, locker rooms, baths and toilets for the pilots; public rest rooms, waiting rooms and toilets; radio room; weather bureau; restaurant; lighting control room; and other necessary facilities.

The center portion, or pavilion, would be surmounted by a tiled promenade from which to review the activities of the field.

The environs of all buildings would be sodded between the concrete roadways or aprons along either side, and would be landscaped with shrubs and vines.

The lighting problem has not been worked out to our complete satisfaction as yet. Very rapid strides have been made in the development of airport lighting during the last twelve months, and most of the laboratories of the larger manufacturers are engaged in the development of newer and better types. The general scheme which we have projected is this:

Place the main beacon of the city and the field on the top of the Columbian Mutual Tower.
Place the ceiling light and the searchlight on the administration building.
Place border lights at intervals of 250 feet around the rim of the field.
Place flood lights in position to illuminate the exterior of the buildings.
Provide illuminated wind-cone or other device to show wind direction.
Mark all adjacent hazards as well as church spires and towers in west portion of the city.
Provide one portable flood light for the general illumination of the field.

The three types of fixtures with which we are not satisfied to the extent of believing that distinct improvement will not be made in the near future are the border lights, illuminated wind indicator and the big flood light for general field illumination. Border lights now in common use are little better than makeshift adaptations.
of materials and fixtures developed as standards for other general purposes, and we know that their general design can be improved. The purpose of these lights is not to furnish any illumination whatsoever but merely to outline the area of the field. Those now in common use frankly resemble a bottle on a stick, being a little elaboration over a simple light globe on the end of a section of conduit projecting about four feet out of the ground. Why these are believed to have any visibility from the air over lights flat on the ground is hard to see, and they are certainly unsightly and penalize the field to the extent of about 30 feet by their projection above ground. We have tentatively developed a scheme involving the use of markers resembling the mushroom type of illuminated street traffic lights. These would be of cast iron with long visibility lenses similar to those in use in railroad signals, and would be flat on the ground to permit a ship to skim or roll over them without hazard.

We have discussed the feasibility of combining these marker lights in a comprehensive scheme of landing control in this general manner: each marker would have three lenses, white, orange, and green. A wind-vane on the administration building would exercise magnetic control over an automatic switchboard in the electric control room below. Assuming that the wind is from the north so that a ship would land from the south, this automatic control would light the green lenses of the three units on the south rim and the orange lenses of the three units directly across the field to the north. All of the other units would show white. By field regulations, the ship would pass over the green lights and head toward the orange. In case of light winds these could be controlled manually to direct the landing of ships in any desired direction. This general scheme would be desirable only upon acceptance by the Department of Commerce and the general standardization of a similar control throughout the country. It is indubitable that some such scheme will be adopted ultimately, for the present system, or lack of system cannot long endure.

Regardless of this, however, we feel that an illuminated wind cone should be installed to aid the flyer in
judging wind velocity.

Ultimately the field should have a permanently installed high-power flood light for general field illumination at each of the four compass points. We do not recommend this at the present time as we feel that a satisfactory light of this type has not yet been developed. The best of those now in use have but a single lighting unit within them. The last year has shown a change from the arc light type to the incandescent in many instances. No light bulb is everlasting, and one is as apt to fail in an emergency as at any other time. We feel that the ultimate light will have multiple units where the failure of one will not mean absolute loss of the whole until replacement of the globe has been effected. We recommend, therefore, the purchase of but one portable unit at first, with the subsequent purchase and installation of four permanent ones when better ones are perfected.

Access to the field would be by a drawbridge over the Wolf River. A drawspan of the double-leaf bascule type has been tentatively accepted as the best for this particular location. This would cross at an elevation just above high water stages. In the lower stages of the river motor boats, small tugboats and barges could pass beneath the structure, while the draw span would permit the passage of the larger boats at all times, and the smaller ones in high water.

Another advantage not yet mentioned which this location possesses is it availability for hydro-aeroplanes. It is planned to dredge out a basin, probably on the Wolf River just below the proposed bridge, in connection with the work of raising the field. This would be available, also, for a motor boat basin, something which is much needed in the Memphis Harbor.

The whole scheme has been projected with the ultimate view of the valuable reclamation of the whole island. Residents and visitors alike all seem to have vague recognition that the day cannot be far distant when this will be changed from a municipal liability to an asset. Just what could or should be done with the balance of the area is not
a matter for our determination, but we must confess that we have been vastly intrigued by the vision of a park with a boat-club, open air swimming pool, tennis courts, hand-ball courts, and the like on the lower end; and an industrial area adjacent to the heart of the city with both railroad and direct river service available on the upper end up as far as the North Second Street Highlands.

As to man's ability to protect this field and any future developments from the ravages of the Mississippi River. It can be done, and unquestionably will be done before many years. It is primarily an economic problem. That it will cost money, big money, is unquestionable. That it will be worth more money when so protected and the city has grown to the point of needing it for its expansion is again unquestionable. At the present time there is a tendency on the part of the river to take it away. The sooner steps are taken to secure the whole, the more land will be ultimately saved to the city. As a matter of general interest a map is incorporated herein showing the shore lines here at intervals during the last century. From this it will be noted that this area has been a hundred years in its forming. It can be taken out much quicker, and if the City of Memphis believes that it will ultimately need it the reasonable course might seem to be to secure it as early as possible.

Further discussion of whys, ways, and means for the attainment of this security are given in subsequent pages of this report.

This, the foregoing, gives our observations upon which we based the detail of our own projection and also gives the details of what we propose to do. The following pages give our conclusions as to its desirability and stability, and our resultant recommendations.
indeterminable retention costs coupled with unequalled proximity to the heart of the city.

To the vague and superstitious feeling that the Mississippi River has malign and vindictive personality, and will ultimately destroy any of the works of man erected in her domain, we do not subscribe; but we do recognize that the river in its meandering course to the sea follows certain immutable laws of gravity, hydraulics and physics. Continued flow of water of certain velocity grinding at the alluvial banks of the river react on these banks in accordance with their inherent abilities to resist such erosion. Increase in such velocity under flood or the shortening of the channel above increases this erosion. Departure from a bed of toughly resistant bank material to an adjacent bed of sand or sandy silt will mark sudden and rapid increase of this erosive action.

The area upon which this port is projected was occupied by the river a century ago. During the lapse of this century this area has gradually risen from the bed and the surface of the river, with the shore line ever receding from the early bank until, within the last few years, it has started back again. Whether or not this backward movement will be checked, or whether it will continue in this latest trend to wear away the island which it itself formed, no man can prophesy with assurance; nor can one express well grounded opinion as to whether or not such recession will come with great rapidity, or will extend over as long a period as did the forming.

Close and continued observation of the slowly changing conditions there are irresolutely disquieting. The water immediately adjacent is swift and deep and comparison of periodical surveys of the shore line shows a recession, virtually imperceptible from daily observation, but very evident from comparison of observations taken at greater intervals. The point at Hopefield, across the river and slightly below the projected airport site, is strongly revetted and paved, and juts out into the main river sufficiently to form a distinct "bottle neck" in the low water channel there. This insures
deeper, swifter water there than in the wider reach above. The present rate of bank cutting is not unduly disturbing, but if the river should continue its shortening tactics begun up at Island 35 during the last flood and should shorten its course still more with a corresponding increase in its slope and velocity, it is conceivable that the rate of cutting might be greatly accelerated. So far, there is no particular evidence of any such definite tendency, but this site is at the lower end of several frankly un-stabilized reaches, and such a point is always vulnerable.

That it can be held, we state not as an opinion but a quite generally established fact. Broadly speaking, you can hold any one selected point along the river; but, to present a military analogy, you cannot be bivouacked without guards posted and come out more than second best in the face of a surprise attack from a substantial enemy force. There is no particular evidence of any strong potential attack at that point today, but next month, next year, or some time ten years from now, may witness a direfully disastrous assault there, unless its formation is detected, anticipated and thwarted by the erection of carefully planned and placed defensive works.

Due to the fact that the really disastrous river changes are generally incidental to, or the aftermaths of floods, a view of what is really happening under the surface of the water where the real damage is occurring is not obtainable until the damage is done. As a typical illustration: the present river may have a widely sweeping course between two points, say from the head to the foot of an island several miles long. The present channel may follow a long bend thru a distance twice that of the air line measurement from the head to the foot of the island. A "chute", or an old partially silted-up channel may run along the back side of the island, dry until the river gets up to a certain stage, or, at best, carrying but little water. This chute may be but half or two-thirds the length of the main channel. A flood comes along and overflows down thru the chute. There is a difference in elevation of three feet
in the surface of the water between the head and the foot of the island. Water coming down thru the chute has a shorter distance to travel than that coming down the outside channel, and has a correspondingly steeper slope and a correspondingly greater velocity. This greater velocity scours out deeper and deeper and wider and wider until it has established the main channel there rather than in its former location. Resultant shortening of the river has the effect of increasing the slope and the velocity for a considerable distance down the river, and this increased velocity has erosive force capable of cutting banks that were reasonably stable under the earlier regime.

Even tho this is discovered during the process of its forming, one is powerless to combat it until the flood has receded to a point to permit treatment of the threatened area by the sloping of the banks and the application of mattresses, revetment and paving; and then a certain amount of time is required to organize and consummate the remedial work. In the meantime a very substantial section of the bank may be irretrievably lost. In this particular case no loss at all can be well afforded, for the outer rim of the emergency area surrounding the port is now quite closely adjacent to the bank.

Thus it is that ultimate and permanent security of the development, if made, demands that immediate stabilization of the banks be attained. It may be contended that no such contingency will ever arise, but that if it does there will be plenty of time to meet it when it does arise. Our honest feeling in the matter is that we would not invest our own capital (if we had any to invest) in the airport enterprise without protecting it by the stabilization of the banks in front of it and for some distance above. Neglecting to do this might be a reasonably good bet with the apparent odds in our favor, but nevertheless a gamble, and one that we would not be willing to take.

As to the extent to which we would go on the start:— probably about "half-way". From the study which we have been able to give it in the limited time at our disposal we feel that the
permanent security of the site could be attained for a figure of approximately one million dollars. This, however, should be given more study after the river has receded to lower stages than have been available for observation since this detailed study was started. All other estimates given in this report are carefully evolved, and are believed to be very conservative. This figure, for the bank protection, should be given some more study, although believed to be very closely in line with what further study will establish.

From the study which we have been able to give it we feel that work to the extent of about half a million dollars would afford immediate security within the bounds of better than reasonable safety, but that there should be absolute assurance that an equal reserve would be immediately available if channel changes above threatened an attack there.

All of this, then, gives a final set-up something like this: -

A field that would be given the highest possible rating by the Department of Commerce can be built structurally secure with its edge less than a mile from the Memphis postoffice.

Such a field in such a location would have inherent value over fields more remote from town by the reduction of the time and space factor in transfers of any sort between field and town.

Such a field would have an extrinsic value from the community prestige gained from having such a field closer to the heart of the city than is, or can be the case without an infinitely greater expenditure, in any of the larger cities of the country.

All things considered, it is probable that no field could be developed in a location easier to find. Practically every rail line and major highway in the area converges within sight (from the air) of the field, and the principal river of the area flows contiguous to it, so that a strange flyer following any of these would come into
direct sight of the port. In like manner, a night flyer approaching the city in heavy weather would be guided directly to city and to the port by the reflected glow of the city's lights, whereas, in an outlying area, it would be necessary to locate the field by reckoning its position in its relation to the city.

In rebuttal, this might be said:

Another location may be amenable to development on a scale and of detail equal to this, and for less money.

Such a location may be close enough in and sufficiently easy of access to reduce the relative advantages of this location over those in other large cities located ten or fifteen miles from the heart of things.

Partial development of the river protection works, appearing to be the economic thing to do at this time - if such is the case after more study - might result in future neglect on the part of future administrations to the extent of the loss or the curtailment of the whole.

Attempt to balance the two leads to this difficulty:

There is nothing with which to compare it. This particular plan is concrete, all others are abstract; and no fair comparison can be made between the concrete and the abstract.

Our conclusion and resultant recommendation is, therefore, this. Except under somewhat extraordinary procedure, funds will not be available for this or any other major project until legislative enactment and popular vote have been consummated. It will be some eight months before the Tennessee legislature will again convene. Selection of airport site and detail will determine, almost irrevocably, the aeronautical future of the city. Between now and the time that the leg-
islature meets is sufficient time to permit of study of other sites to the extent and detail to which this one has been studied. Such continued study might or it might not result in the projection of the development of other fields worthy of comparison with this one, or might result in the working out of greater refinement of this one.

With two or more concrete projects, comparison of their merits or deficiencies would be definitely possible. That we have evolved a field second to none now in existence, we are honestly convinced. That we have confined our general efforts to the development of a port on a specified location is but a statement of facts.

We therefore recommend that the Airport Commission make, or have made, generally similar study of such other sites as may give appearance of being worthy of such study. So plan this study as to have it completed on or by the first of December of this year, then, with all studies figuratively side by side, weigh the comparative advantages of each with consideration and without bias, and select the one that, in their judgement, will be the best for the City of Memphis of both today and tomorrow.

With such a selection made, the commission can then institute the proper legal steps to present the matter of its financing to the legislature and to the people of the city, with about all of the assurance humanly attainable that - in the vernacular - "no bets are being overlooked".

If this plan which we have evolved for this particular site assays higher than the rest under the acid test of competent comparative analysis it will be accepted. If it does not, it should not be accepted.
# Estimate of Cost

**Clearing and Grubbing** .......................... $50,000.00  
**Grading** ........................................... $495,000.00  
**Sodding and Seeding** ............................... $45,000.00  
**Drainage** ........................................... $85,000.00  
**Lighting** ........................................... $50,000.00  
**Buildings** .......................................... $235,000.00  
**Paving** ............................................. $70,000.00  
**Bridge Across Wolf River** ......................... $100,000.00  
**Engineering and Contingencies** .................... $120,000.00

**Total, Exclusive of Real Estate and Bank Stabilization** .......................... $1,250,000.00

**Initial Bank Stabilization** ........................ $500,000.00

**Reserve for Possible Future Bank Stabilization** ......................... $500,000.00

**Grand Total, Exclusive of Real Estate** $2,250,000.00

**Note:** All estimates except those for bank stabilization are carefully evolved from computed quantities and unit prices. Figures for bank stabilization are based on cost comparison with similar, or generally similar requirements. They are believed to be approximately correct, but should be studied further.
MAP
SHOWING LOCATION OF
THE NATIONAL GUARD AIR UNITS

1 SPOKANE WASH.  10 NASHVILLE TENN.
  41 ST. DIV. AIR SERVICE  30 TH. DIV. AIR SERVICE

2 LOS ANGELES CAL.  11 BIRMINGHAM ALA.
  40 TH. DIV. AIR SERVICE  31 ST. DIV. AIR SERVICE

3 DENVER COL.  12 DETROIT MICH.
  45 TH. DIV. AIR SERVICE  32 ND. DIV. AIR SERVICE

4 HOUSTON TEXAS  13 CLEVELAND OHIO
  36 TH. DIV. AIR SERVICE  37 TH. DIV. AIR SERVICE

5 LITTLE ROCK ARK.
  154 TH. OBSERVATION SQUADRON (ARMY)

6 ST. LOUIS MO.  14 BALTIMORE MD.
  35 TH. DIV. AIR SERVICE  29 TH. DIV. AIR SERVICE

7 MINNEAPOLIS MINN.  15 PHILADELPHIA PENN.
  34 TH. DIV. AIR SERVICE  28 TH. DIV. AIR SERVICE

8 CHICAGO ILL.  16 STATEN ISLAND N.Y.
  33 RD. DIV. AIR SERVICE  27 TH. DIV. AIR SERVICE

9 INDIANAPOLIS IND.  17 HARTFORD CONN.
  38 TH. DIV. AIR SERVICE  48 RD. DIV. AIR SERVICE

18 BOSTON MASS.  26 TH. DIV. AIR SERVICE
THE LOCATION BY STATES
OF
LICENSED PILOTS & MECHANICS
IN THE UNITED STATES
AS OF 1928 APRIL ISSUE OF AIR TRANSPORTATION

LEGEND
P - PILOTS
M - MECHANICS
LOCATION OF AVIATION SCHOOLS
AS GIVEN BY
THE 1928 APRIL ISSUE OF AIR TRANSPORTATION

1. SPokane WASH.
2. Portland Ore.
3. Sacramento Cal.
4. Oakland Cal.
5. San Mateo Cal.
6. Fresno Cal.
7. Los Angeles Cal. (4)
8. Santa Ana Cal.
9. San Diego Cal.
10. Denver Colo.
11. Oklahoma City Okla.
12. Austin Tex.
15. Lawrence Kan.
16. Kansas City Mo.
17. Marshall Mo.
18. Anglum Mo.
22. Sioux Falls S. D.
23. Bismarck N. D.
24. Minneapolis Minn.
25. Marshfield Wis.
26. Milwaukee Wis.
32. Chicago Ill.
33. Hinkley Ill.
34. Elmhurst Ill.
35. Forest Park Ill.
36. Rockford Ill.
37. Morton Grove Ill.
38. Moline Ill.
40. Quincy Ill.
41. Momence Ill.
42. Gary Ind.
43. Fort Wayne Ind.
44. Kokomo Ind.
45. Muncie Ind.
46. Indianapolis Ind. (2)
47. Cincinnati Ohio (2)
48. Dayton Ohio (2)
49. Russell Point Ohio (2)
50. Cleveland Ohio (2)
51. Pittsburgh Pa.
52. Conyngham Pa.
54. Rochester N. Y.
55. Pittsburgh N. Y.
56. Schenectady N. Y.
57. New York City N. Y.
60. Concord N. H.
61. Hartford Conn.
62. Port Washington L. I.
63. Garden City L. I. (2)
64. Newark N. J.
65. New Brunswick N. J. (2)
66. Madison N. J.
67. Atlantic City N. J.
68. Baltimore Md.
70. Richmond Va. (2)
71. Pinehurst N. C.
72. Atlanta Ga.
73. Tampa Fla.
74. Miami Fla.
THE ROUTES OF THE U.S. AIR MAIL
AND
THE AIRPORTS THEREON

1 VICTORIA B.C.
2 SEATTLE WASH.
3 TACOMA WASH.
4 PORTLAND ORE.
5 MEDFORD ORE.
6 SAN FRANCISCO CAL.
7 FRESNO CAL.
8 BAKERSFIELD CAL.
9 LOS ANGELES CAL.
10 LAS VEGAS NEV.
11 CONCORD CAL.
12 SACRAMENTO CAL.
13 RENO NEV.
14 ELKO NEV.
15 PASCO WASH.
16 BOISE IDAHO
17 SALT LAKE CITY UTAH
18 POCATELLO IDAHO
19 BUTTE MONT.
20 HELENA MONT.
21 GREAT FALLS MONT.
22 ROCK SPRINGS WYO.
23 CHEYENNE WYO.
24 DENVER COL.
25 COLORADO SPRINGS COL.
26 PUEBLO COL.
27 NORTH PLATTE NEB.
28 OMAHA NEB.
29 DES MOINES IOWA
30 IOWA CITY IOWA
31 CHICAGO ILL.
32 MILWAUKEE WIS.
33 MADISON WIS.
34 LACROSSE WIS.
35 MINNEAPOLIS MINN.
36 ST. PAUL MINN.
37 MOLINE ILL.
38 ST. JOSEPH MO.
39 KANSAS CITY MO.
40 WICHITA KAN.
41 PONCA CITY OKLA.
42 OKLAHOMA CITY OKLA.
43 FORT WORTH TEXAS
44 DALLAS TEXAS
45 WAGO TEXAS
46 SAN ANTONIO TEXAS
47 LAREDO TEXAS
48 HOUSTON TEXAS
49 GALVESTON TEXAS
50 ST. LOUIS MO.
51 SPRINGFIELD ILL.
52 PEORIA ILL.
53 INDIANAPOLIS IND.
54 CINCINNATI OHIO
55 LOUISVILLE KY.
56 DAYTON OHIO
57 COLUMBUS OHIO.
58 AARON OHIO
59 CLEVELAND OHIO
60 DETROIT MICH.
61 MT. CLEMENS MICH.
62 ERIE PA.
63 BUFFALO N.Y.
64 ROCHESTER N.Y.
65 SYRACUSE N.Y.
66 SCHENECTADY N.Y.
67 ALBANY N.Y.
68 YOUNGSTOWN OHIO
69 PITTSBURG PA.
70 BOSTON MASS.
71 HARTFORD CONN.
72 NEW YORK CITY N.Y.
73 NEW BRUNSWICK N.J.
74 MINEOLA L.I.
75 PHILADELPHIA PA.
76 WASHINGTON D.C.
77 RICHMOND VA.
78 GREENSBOROUGH N.C.
79 SPARTENBURG S. CAR.
80 ATLANTA GA.
81 BIRMINGHAM ALA.
82 MOBILE ALA.
83 NEW ORLEANS LA.
84 PILOTOWN LA.
85 JACKSONVILLE FLA.
86 MIAMI FLA.