

DESIGN OF
OWOSSO MUNICIPAL AIRPORT

THESIS FOR THE DEGREE OF B. S.

J. A. Webb

R. F. Ludwig

1934

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Airports

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**Design of
Owosso Municipal Airport**

A Thesis Submitted to

**The Faculty of
MICHIGAN STATE COLLEGE
of
AGRICULTURE AND APPLIED SCIENCE**

By

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DESIGN OF THE OWOSSO MUNICIPAL AIRPORT

It is the purpose of this thesis to re-design the Owosso Municipal Airport and to make it one of higher rating according to the specifications issued by the United States Department of Commerce, Aeronautics Branch.

Boundaries of the airport consist of the following: M-21 on the north, Shiawassee river on the south, and farmland on both the east and west. The present ground conditions are rolling and with a slope southward toward the river. There are no high objects near the field which would interfere with the landing and take-off of planes. The river and road on two sides of the airport will aid the pilots in locating the field.

The airport is on a direct route from Lansing to Saginaw and Bay City, and also on the line between Milwaukee, Grand Rapids, Flint, and Port Huron. Its central location with regard to these large cities make a high class airport desirable. Being only a five minute drive from the downtown district makes it very convenient for the people of Owosso and transients.

The rating of the Airport can be raised to an A-1-A by lengthening of the runway in the direction of the prevailing wind and by the removal of a house. A course of concrete would also be necessary over the present design for runways. However, it can never receive a transport rating because of the limitations imposed by the river and highway. The offered design is an A-2-C rating.

Basic Requirements

In order to receive a rating from the Secretary of Commerce, airports shall meet at least the following basic requirements:

(a) Suitable landing area. - The airport shall afford a smooth, well-drained landing area, sufficiently firm to permit the safe operation of air-

craft under all ordinary weather conditions, approximately level, and free from obstructions or depressions presenting hazards in the taking off or landing of aircraft. The landing area, whether turf, artificial surfacing, or a combination of the two, shall be sufficiently smooth to permit driving over any part thereof in a light-weight automobile at a speed of at least 50 miles per hour without discomfort to the occupants. In case the landing area is not sufficiently firm and well drained to permit safe landing and taking off under ordinary weather conditions, or if severe conditions are encountered at certain seasons of the year, such as heavy rains or frost coming out of the ground, which render the surface temporarily unfit for continued use, such artificial drainage shall be provided and/or suitable runways constructed as local conditions may necessitate. The maximum slope of the landing area shall at no point exceed 3 inches in 10 feet, which corresponds to a grade of $2\frac{1}{2}$ per cent. The mean slope of the landing area shall not be more than 2 per cent in any direction. If sufficient area is not available for landing and taking off in all directions, there shall be at least two landing strips 500 feet or more in width crossing or converging at an angle of not less than 60° . Roads shall not cross any part of the landing area, whether open field or landing strips; and stock and unauthorized persons and vehicles shall not be allowed on the landing area, as this area must be kept clear and ready for use at all times.

(b) Obstructions. - The effective landing area of airports is influenced by the height of surrounding obstructions and the location thereof with respect to the edge of the landing area. The degree to which the usability of the field is affected by such obstructions depends upon the climbing angles of the aircraft using the airport. In rating airports located at altitudes up to and including 1,000 feet above sea level, the effective landing lengths as fixed by surrounding obstructions shall be determined by using an allowable

safe climbing ratio (the number of feet of horizontal distance traveled for each foot of height in climbing) of 7 to 1 for all ratings on size of effective landing area, excepting the "T" or transport rating, in which case an allowable safe climbing ratio of 10 to 1 shall be used in order to provide for heavily loaded transport airplanes. Thus, excepting in the case of the "T" rating, surrounding obstructions will diminish the landing lengths for airplanes landing or taking off over these obstructions by amounts equal to seven times the height of the obstructions above the landing area, said distances being measured, in each case, horizontally from vertical lines passing through the critical points of the obstacles. In the case of the "T" rating, said obstructions will diminish the land lengths by ten times the height of the obstructions above the landing area.

The presence of obstacles in the approaches of landing strips will fix the effective lengths of the landing strips in accordance with the foregoing. Where obstacles lie alongside the landing strips, so that planes landing pass parallel to and not over them, the obstacle rule will not apply, providing that no landing strip shall be less than 500 feet wide, in accordance with paragraph (a) of these basic requirements. (However, the location of buildings or other obstructions in the V formed by landing strips or runways is subject to a number of objections. Furthermore, it is important that the entire area in the vicinity of the airport be as free from obstructions as possible.)

For airports located at altitudes in excess of 1,000 feet above sea level, the allowable safe climbing ratios for clearing obstructions shall be increased from the values of 7 to 1 and 10 to 1 used at altitudes up to and including 1,000 feet above sea level to the values shown in Figure 1. (At altitudes above sea level, airplanes land and take off at higher speeds and climb at flatter angles than at sea level because of the decreased density of the atmosphere.)

The Secretary of Commerce may require the adequate day marking of any obstructions in the vicinity of the airport if, in his opinion, such marking is essential for the safe operation of aircraft from the port.

The day marking of obstructions, such as electrical supply and communication line poles and towers, radio towers and masts, and flagpoles, which are located in the immediate vicinity of the airport and which it is impracticable to remove, shall be accomplished by painting these obstructions throughout their height with either alternate bands of chrome yellow or international orange (yellow No. 4 and orange yellow No. 5, respectively, of Color Card Supplement to United States Army Quartermaster Corps Specifications No. 3-1) and black, or alternate bands of international orange and white, terminating with either chrome-yellow or international-orange bands at both top and bottom, depending on color combination used. The width of the chrome-yellow or international-orange bands shall be one-seventh the height of the structure for all structures less than 250 feet in height and from 30 to 40 feet for structures over 250 feet in height. The black or white bands shall be one-half the width of the chrome-yellow or international-orange bands. The posts of landing area fencing shall be painted chrome yellow, international orange, or white.

(In the case of structures where sufficient surface is presented to permit painting with a checkerboard pattern, this method of marking is recommended. If checkerboard marking is used, the colors should be a combination of either chrome yellow or international orange and black, or international orange and white. The dimensions of the blocks used in marking water tanks should be in general not more than one-half the vertical face of the tank in height and one-eighth the circumference in width. In addition, the conical top of the tank should be divided into eight segmental elements and painted alternate colors, the segmental element above a chrome-yellow block being painted black and the element above an international-orange block being painted

black or white, depending upon the color combination used. For other areas the checkerboard blocks should, so far as practicable, be not less than 10 feet square.)

(c) Accessibility. - The airport shall be situated on an all-weather road leading to the nearest city or town.

(d) Wind-direction indicator. - The airport shall be equipped with a wind-direction indicator as hereinafter specified.

(e) Markings. - The landing area shall be marked by means of a circle at least 100 feet in diameter having a band not less than 4 feet wide, constructed of crushed stone, gravel, or other wear-resisting material, used in conjunction with a suitable binder to prevent displacement under traffic. The circle shall be finished flush with the surrounding surface and, unless constructed of a bright white material, shall be kept witewashed, or painted chrome yellow or international orange. In case the circle is constructed of concrete or other similar material, either transition strips of some granular material, such as crushed stone or crushed slag, or other suitable means shall be provided on both the inside and outside of the circle in order to insure the safe landing and taxiing of planes across the circle in any direction. (See paragraph (f) of these basic requirements for recommendations regarding beveling of edges of concrete and construction of transition strips.)

Section 75 (b) of the Air Commerce Regulations, which apply to all aircraft in flight, requires that aircraft circling a landing area for any purpose, if flying within 3,000 feet horizontally of the nearest point of the landing area, shall circle to the left (counterclockwise), unless otherwise specified by the Secretary of Commerce and unless flying at a height in excess of 2,000 feet.

Counterclockwise (left) turns will prevail at the majority of the air-

ports of the country. In a few instances, however, local conditions may require that the direction of turn be established as clockwise. At a few other airports it may be advisable to circle in a counterclockwise direction under certain wind conditions and in a clockwise direction under other wind conditions. As indicated in the foregoing, it is necessary to obtain authorization of the Secretary of Commerce if other than counterclockwise turns are to be made. In such cases the airport shall display suitable markings to indicate the direction of turn in accordance with the following requirements.

If clockwise (right) turns are to be made at all times, the letter R shall be displayed in the center of the landing-area marker circle, and, in case the airport is lighted for night operations the letter R shall also be displayed upon the roof of an outstanding airport building or on other suitable area and shall be illuminated every night from sunset until sunrise with exposed incandescent lamps, gaseous-discharge lamps, or other equivalent apparatus, in accordance with the provisions of paragraph (e) of section 7 "A" rating. If left-hand and right-hand turns are to be made at different times, depending upon wind conditions, the letter X shall be displayed in the center of the circle marker and the letters R and L shall be placed upon the roof of an outstanding airport building, or on other suitable area, and shall be so arranged that either the R or the L may be displayed, depending upon the direction of the turn. In case the airport is lighted for night operations, the letter displayed shall be illuminated in the manner herein provided for the letter R.

Plain vertical gothic or block capital lettering shall be used for all such letters, and said letters shall be so placed as to be readily visible from any direction of approach to the airport. The letters R or X displayed within the landing-area marker circle shall be constructed in accordance with the requirements governing the construction of the marker circle, shall be the

same color as the circle (chrome yellow, international orange, or white), and shall be 30 feet in height for circles 100 feet in diameter. For larger circles the letter height shall be increased in proportion to the diameter of the circle. The letter X shall be a true X and not a cross. The letters H and L displayed upon an airport building roof, or on other suitable area, shall be at least 20 feet in height and shall be located at or near the control tower or other building from which the airport traffic is controlled.

No markings of any kind shall be placed within the landing-area marker circle other than those for which provision is made in the foregoing.

The name of the airport and of the city or town shall be placed on the roof of at least one outstanding airport building, or near the marker circle, or on other suitable area, in such manner as to be legible from an altitude of at least 2,000 feet. It is recommended that plan vertical gothic or block capital lettering be used, and that the lettering be from 10 to 30 feet in height as space may permit, but in no case shall the height of the lettering be less than 6 feet. If suitable area is not available to accommodate the complete names in letters of ample size, it is more desirable that a clear abbreviation be used than to reduce the size of the lettering. No abbreviations shall be used, however, that are likely to be misunderstood. In the case of municipal airports, the letter M may be used in lieu of the name of the airport, providing the height of this letter exceeds the height of the lettering used in the name of the city or town by at least 50 per cent and providing the letter is placed either above or in front of the name of the city or town.

(It is recommended that, wherever practicable, a combination of either chrome yellow or international orange (yellow No. 4 and orange yellow No. 5, respectively, of Color Card Supplement to United States Army Quartermaster

Corps Specification No. 3-1* and dead black be used in air marking roofs and other similar areas, and that, particularly in cases where the markings are to be illuminated, the chrome yellow or international orange be used for the lettering and other symbols, and the dead black for the background.)

In localities subject to snow it is important that roof markings be so constructed that snow will not interfere with the legibility of the markings.

In case the name of the airport, city, or town or any other marking is placed on the landing area, it shall be constructed and maintained in the manner hereinabove required for the market circle.

The outline of the entire area available for landing and taking off shall be marked by means of painted cones, constructed of sheet metal or other suitable material, not less than 30 inches in diameter at the base by 22 inches in height, or solid 4-foot white, chrome yellow or international orange circles constructed of crushed stone, gravel, or other suitable material, or by means of other markers of equivalent effectiveness, placed not more than 500 feet apart and kept painted or whitewashed. In case the landing area is boundary lighted, the markers shall be constructed around the boundary lights. In case cones or other similar markers are used, it is recommended that they be painted in accordance with the following standard system of marking: For cones installed around either white or yellow boundary lights, chrome yellow or international orange with a 6-inch horizontal dead-black stripe 9 inches from the base of the cone. These figures are for cones measuring 30 inches in diameter at the base by 22 inches in height; if cones of larger dimensions are used, the width of horizontal stripe and height of stripe above base of cone should be increased accordingly. For green lights, eight equal segmental elements, alternating chrome yellow or international orange and dead black, each element covering a 45° segment of the surface. In lieu of said standard

system of marking, cones may be painted solid chrome yellow or international orange. Boundary markers shall be kept clear and surrounding vegetation shall be trimmed in such a manner as to insure no interference with the visibility of the markers.

Any part of the landing area temporarily unsafe for use, or which is not available for any cause, shall be clearly marked with chrome yellow, international orange, or red flags, or a combination thereof, said flags being at least 2 feet square and so placed as to show the boundaries of the danger area. In case the airport is lighted for night operation, the boundaries of such danger area shall be clearly marked throughout the hours of the night (from sunset until sunrise) either with red electric lights with weatherproof fittings or with red lanterns.

(f) Runways. - Runways shall be constructed of crushed stone, crushed slag, or other wear-resisting material, used in conjunction with a suitable binder, in such a manner as to give a smooth, firm, uniform surface. (This includes such types of construction as bituminous macadam, bituminous concrete, Portland cement concrete, etc.) Runways shall be so designed and constructed as to withstand safely the loads to which they will ordinarily be subjected. They shall permit safe landing and taking off of airplanes under all weather conditions and shall be not less than 100 feet in width. The distance from the center line of any runway to the nearest paralleling edge of the landing area shall be at least 200 feet. The runways may be given a slight crown, either positive or negative as may be desired to facilitate surface drainage. (It is recommended that crown not exceed 6 inches per 100 feet of width. Generally 3 or 4 inches per 100 feet of width will suffice.) The edges of the runways shall be flush with the adja-

cent surfaces of the field and either transition strips of some granular material, such as crushed stone or crushed slag, used in conjunction with a proper binder, or other suitable means shall be provided to insure the safe landing and taxiing of planes across the runways in any direction.

(In the case of concrete runways, unless the edges are finished with an inclined strip extending under the adjoining surface of the field, it is recommended that the edges be given a bevel of about 45° extending back a distance of at least 3 inches, in order not to present a sharp edge should material of the transition strip be displaced. Where runways are constructed of cinders, bituminous macadam, or other dark materials and the airport is being used for night operations, it is recommended that the edges of the runways, unless outlined with some light colored material or with suitable flush-type lights, be kept whitewashed or painted a light color. The outlining of dark-surfaced runways is important in order that pilots landing at night may be able to discern the edges of the runways.)

Temporary modification (2). - In the case of the "2", "3" and "4" ratings on size of effective landing area, the temporary modification of the requirements permits the issuance of ratings on the basis of landing strips having a minimum width of 300 feet instead of the 500-foot minimum width specified. It should be noted, however, that there has been no modification of the requirements for the "T" and "I" ratings.

(g) Drainage. - The entire landing area shall, so far as practicable, be so drained as to meet the requirements set forth in paragraph (a) of these basic requirements, whether runways are used or whether the entire field is available for landing and taking off at all times. If the natural drainage is sufficient, no artificial drainage system will be required. Any catch basins or surface intakes used on the airport shall be constructed and installed

in such a manner as in no way to interfere with or jeopardize the safety of operations.

(h) Fuel, communication, transportation, and personnel. - The airport shall be provided with facilities for supplying aircraft with fuel, oil, and water; also drinking water shall be available. Proper means shall be provided to insure delivery of fuel free from water, means shall be provided to insure delivery of fuel free from water, dirt, or other foreign material. Fueling equipment shall be such as to afford a continuous metallic contact between the discharge nozzle, metal lining or other metal conductors of fueling hose, main fuel tank or fuel lines, and the ground, and the discharge nozzle shall have securely attached thereto an adequate bonding cable terminating in a suitable metal clip.

If there are no rest rooms on the airport, a suitable latrine shall be provided. The airport shall have dependable telephone communication and transportation facilities to the nearest city or town. Airport personnel shall be in attendance by day or available on call by telephone at the airport. In the latter case a directory and full instructions for reaching such personnel shall be available in the telephone booth or receptacle.

RATING ON GENERAL EQUIPMENT AND FACILITIES

Sec. 5. "A" Rating. - In addition to the facilities named in the basic requirements, airports receiving an "A" rating on general equipment and facilities shall have the following:

(a) At least one hangar measuring not less than 80 by 100 feet in the clear inside with doors open, with 18-foot overhead clearance, and with a door opening of at least 80 feet in the clear. In localities where freezing temperatures are experienced the hangar shall be heated sufficiently to prevent

freezing of water, and safe provision shall be made for heating water and oil.

(b) One or more wind-direction indicators equivalent in effect to either a wind cone not less than 12 feet long, 36 inches in diameter at the throat, 12 inches in diameter at the tail, constructed of open-weave unbleached yellow muslin and with a suitable cage measuring at least 48 inches in length installed in the throat end to insure proper functioning and prevent fouling, or a 12 by 12 foot wind tee, preferably designed to return automatically to the no-wind landing direction, when the wind velocity drops below 3 or 4 miles per hour, and so mounted as to fly freely with the wind. The wind-direction indicator shall be so located as to give a true indication of the direction of the wind on the landing area and as to be readily visible to aircraft approaching the airport from any direction. In case it is not visible to aircraft approaching from any direction, such additional wind-direction indicators shall be installed as may be necessary.

(c) Repair service sufficient to permit major repairs to be made to both planes and engines shall be provided at the airport and shall be available for all planes using the port. A schedule of charges for such service shall be posted in a conspicuous place. Repair facilities shall include at least the following general equipment: Hand tools for woodwork repair; small tools for machine repair, such as benches, vises, wrenches, etc.; electric soldering iron; two electric drills, one of which shall accommodate bits of sizes up to at least one-half inch; set of universal valve reseaters, or equivalent; valve refacer; power-driven bench grinder with at least an 8-inch wheel; bench or arbor press of not less than 10 tons capacity; welding outfit; battery charger face plate and protractor, or equivalent, for setting angles of propeller blades; chain hoist of not less than 2 tons capacity; and three $2\frac{1}{2}$ to 5 ton jacks.

(d) Weather instruments, including an anemometer, barometer, and thermometer. There shall also be a bulletin board and facilities for giving pilots the most recent weather information. A rating will be issued without requiring the equipment listed above if, in the opinion of the Secretary of Commerce, adequate facilities exist at the airport for furnishing the pilot with current local information in regard to wind direction and velocity, barometric pressure, and temperature.

(e) Radio receiving set and loud-speaker, under certain conditions, as follows: Airports located within a radius of 400 miles of Department of Commerce airways radio stations shall be equipped with suitable radio receiving sets (effective through the frequency range of 200 to 400 kilocycles) with loud-speakers, in order that those using the airport may avail themselves of the hourly weather reports broadcast from said stations. As additional airways radio stations are installed by the Department of Commerce, airports located within a radius of 400 miles of such stations and previously granted an "A" rating on general equipment and facilities shall provide themselves with suitable radio receiving sets and loud-speakers in order to retain this rating. An airport may be exempted from this requirement if it is served by one of the Department of Commerce airways tele-typewriter circuits.

(f) Adequate equipment shall be available for removing or packing snow sufficiently to permit safe landing and taking off of aircraft. (This equipment will not be required at airports where snowfall is never sufficient to cause difficulty in operation.)

(g) First-aid equipment consisting of an ambulance, or some vehicle which can be used as an ambulance, available at all times and equipped with the following: First-aid kit, fresh drinking water, crowbar, wire cutters,

hack saw, ax, cloth-cutting shears, fire extinguisher, and two litters.

The first-aid kit shall contain at least 12 assorted bandages, 12 sterile dressings, 2 tourniquets, a supply of first-aid dressings for burns, adhesive tape, a supply of either tincture of iodine or mercurochrome, aromatic spirits of ammonia, and a glass cup or a supply of paper cups.

The litters should preferably be of the Stokes Navy type. If they are of the ordinary type, the vehicle shall also carry an assortment of splints.

Airports located in close proximity to existing ambulance service may be exempted from the ambulance requirement if, in the opinion of the Secretary of Commerce, such airports can be adequately served by these facilities.

(h) A register of arriving and departing aircraft to include the following information:

- (1) License number and model of arriving or departing plane.
- (2) Owner of plane.
- (3) Pilot of plane and his license number.
- (4) Time of arrival and departure.
- (5) Number of crew.
- (6) Number of passengers.
- (7) Space for remarks covering any unusual situation.

(i) All buildings on the airport shall be provided with first-aid fire appliances as required by the National Board of Fire underwriters.

(j) Sufficient personnel in attendance throughout the day to give proper operation of the airport, including servicing aircraft, making major repairs, giving weather service, and operating the fire-fighting equipment.

Rating on Size of Effective Landing Area

"2" Rating. - In addition to meeting the basic requirements, an airport receiving a "2" rating on size of effective landing area shall qualify under one of the following classifications;

(a) It shall provide at least 2,000 feet of effective landing area in all directions with clear approaches.

(b) It shall have not less than four landing strips, each of which shall be at least 2,000 feet in effective length with clear approaches and not less than 500 feet in width, and no two strips shall cross or converge at an angle of less than 40°.

(c) It shall have three landing strips, each of which shall be at least 2,500 feet in effective length with clear approaches and not less than 500 feet in width, and no two strips shall cross or converge at an angle of less than 55°.

(d) It shall have two landing strips, one aligned with the general direction of the prevailing wind, each of which shall be at least 3,000 feet in effective length with clear approaches and not less than 500 feet in width, and said strips shall not cross or converge at an angle of less than 60°.

The dimensions of the effective landing area and the effective lengths of the landing strips shall be increased at altitudes in excess of 1,000 feet above sea level to the corresponding values shown in Figures 2, 3, and 4.

Rating on Aeronautic Lighting Equipment

(a) Airport beacon. - The airport beacon may be of either the rotating type or the fixed type with flashing light source. If of the rotating type, the beacon shall have a color characteristic consisting of either clear flashes or a combination of clear and aviation green flashes and shall be so operated

as to show six clear flashes per minute in addition to any green flashes it may show. If of the flashing light source type, the beacon shall have a color characteristic consisting of either clear or aviation green flashes or a combination of the two and shall have a definite international Morse code characteristic. The vertical distribution of light and the location of the beacon shall be such as will insure the beacon being visible in all directions and at all vertical angles from the horizontal to within at least 45° of the zenith for altitudes of from 500 to 2,000 feet above the light source. In no case shall the luminous period be greater than 60 per cent nor less than 1 per cent, nor shall the duration of flashes be less than one-tenth second, nor shall the duration of eclipse periods exceed 10 seconds. For beacons of less than 50,000 candlepower, the luminous period shall be at least 35 per cent and the color characteristic shall be aviation green.

The beacon shall qualify under one of the following classes:

(1) Beacons having a maximum candlepower of not less than 1,500,000 candles and luminous period of not less than 1 per cent.

(2) Beacons having a maximum candlepower of not less than 750,000 candles and luminous period of not less than 2 per cent.

(3) Beacons having a maximum candlepower of not less than 100,000 candles and luminous period of not less than 10 per cent.

(4) Beacons having a maximum candlepower of not less than 50,000 candles and a luminous period of not less than 20 per cent.

(5) Beacons having a maximum candlepower of not less than 10,000 candles and luminous period of not less than 35 per cent and that are aviation green in color.

In the case of beacons having a single lamp as the light source, an automatic lamp changer for bringing a spare lamp into the focal position shall be provided, or else there shall be an auxiliary beacon having a maximum candle

power of not less than 10,000 candles and a luminous period of not less than 35 per cent which is either kept in operation with the major unit or so designed as to be turned on automatically without interruption of service.

An auxiliary double-light-source beacon, aviation green in color and flashing a definite international Morse code characteristic, shall be installed on the airport in addition to the main beacon unless the main beacon is green in color or unless the characteristic of the main beacon includes one or more green flashes having a maximum candlepower of not less than 10,000 candles. Said auxiliary green beacon shall have a maximum candlepower of not less than 5,000 candles, a luminous period of not less than 35 per cent, and shall be so designed and erected that the light will be visible in all directions and at all vertical angles from the horizon to within at least 10° of the zenith. This auxiliary beacon may be a 300-millimeter airways electric code beacon equipped with aviation-green color shades and two 500-watt, 110-volt, PS-40 clear incandescent lamps with C-7A filaments, or other equivalent apparatus. (On the Federal airways system, red auxiliary flashes are used at beacons where no landing fields are located, and green auxiliary flashes are used at beacons where intermediate fields have been established. The uniform use of red and green auxiliary flashes to indicate landing conditions will add materially to the safety of night flying.)

Wherever practicable the main airport beacon shall be installed directly on the airport or immediately adjacent thereto and in such manner as to be visible in all directions. In case the topography of the surrounding terrain is such as to necessitate installing the beacon at some distance from the airport, there shall be installed on the airport a green, flashing, double-light source, auxiliary beacon conforming to the foregoing requirements, even though the main beacon is green in color or has green flashes in its characteristic.

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In no case, however, shall the distance from the main beacon to the nearest edge of the landing area of the airport exceed 1 mile.

Flashing mechanism used in connection with airport beacons shall be so designed as to cause no interference with radio reception.

(In code signals the duration of dashes should be three times the duration of dots, and the duration of eclipse periods between parts of the same letter should be not less than the duration of the dots. The eclipse between two letters should not be less than the duration of three dots and the eclipse between cycles should be not less than the duration of five dots. With flashing electric lights it is important that the time of heating and cooling the lamp filaments be taken into consideration.)

The code characteristics for airport beacons may be selected in each case by the airport, but shall be submitted to the Department of Commerce for approval in order to avoid duplication in any particular section of the country and consequent confusion.

On account of possible confusion with established nautical lights and a consequent interference with shipping, lighting plans for airports located in the vicinity of navigable waters should be submitted to the Department of Commerce, Washington, D. C., for consideration before the system is installed, in order to avoid any conflict between the proposed lighting system and existing lights established as navigational aids for water craft.

Under the provision of the air commerce act and the regulations promulgated pursuant thereto, all lights of an aeronautical character (including airport beacons), excepting these lights established and maintained by the Federal Government, are required to be certified by the Secretary of Commerce

if, in his opinion, such lights serve as true aids to air navigation. The regulations governing such certification are published in Aeronautics Bulletin No. 9, Regulations Governing Establishment and Certification of Aeronautical Lights and Recommended Standards for Marking Obstructions to Air Navigation, copies of which may be obtained without charge upon request from the Aeronautics Branch, Department of Commerce, Washington, D. C.

(b) Illuminated wind-direction indicator. - There shall be at least one illuminated wind-direction indicator, internally or externally lighted, equivalent in effect to either the wind cone or the wind tee described in paragraph (b) under the requirements for an "A" rating on general equipment and facilities. A lamp of not less than 200 watts with suitable reflector and weather proof fittings will be required for the internal lighting of this wind cone. For external lighting a suitable system of reflectors with at least four 100-watt lamps and weatherproof fittings, or the equivalent, shall be so mounted above the wind cone as to make it readily visible in every direction. The wind tee may be illuminated by outlining with either exposed incandescent lamps or gaseous-discharge lamps, such as neon tubes, preferably placed along the center lines of the strokes of the tee or by flood lighting using a suitable system of reflectors with at least four 100-watt lamps with weatherproof fittings or the equivalent. For outlining with incandescent lamps, lamps of not less than 25 watts with weatherproof hoods (green recommended) spaced on not more than 12-inch centers shall be used. For outlining with gaseous tubes, either 11-millimeter by 18-milliampere or 15-millimeter by 25-milliampere tubing (green recommended) shall be used. (It is recommended that the illumination of the wind tee be by either exposed incandescent lamps or gaseous tubes.)

(c) Boundary lights. - The outline of the entire area available for landing shall be shown at night by boundary lights spaced not more than 300 feet apart. Either series or multiple circuits may be used in electrical distribution systems serving boundary lights, and such supply circuits shall be installed underground.

The cable used for boundary-light circuits shall be rubber-insulated moisture-proof underground cable, with either metallic or moisture-resisting nonmetallic sheathing and with jute or other suitable fiber serving, and shall be insulated for at least the maximum open-circuit voltage obtainable on the circuit. The cable conductors shall be of copper, and for multiple circuits they shall be of such size that the voltage drop will not exceed 5 per cent of the normal operating voltage of the circuit, but in the case of neither series nor multiple circuits shall they be less than No. 10 B and S. Gage. In the case of multiple circuits using either a 3-wire closed ring circuit or a straight 3-wire circuit, No. 10 B and S. gage bare copper wire may be used for the third conductor. Such cable and wire shall be installed at a depth of at least 10 inches unless otherwise protected by suitable mechanical means. (In laying the cable it should be unreeled in place along or in the trench and not pulled in.)

For series circuits having normal operating voltages in excess of 310 volts, a series transformer (safety coil) shall be installed at the base of each boundary-light standard to prevent accident through high-tension current in event of collision with the light. However, in case the boundary light units are constructed so that the light socket or receptacle does not extend above the surrounding surface or so that the portion of the fixture above the surface will be knocked over and disconnected in event of collision, the circuit being automatically reestablished below the surface and the exposed receptacle

automatically closed, or if other equivalent arrangement is provided, the series transformers are not required. In the case of series circuits with operating voltages of 310 or less the use of such series transformers is not required, providing the maximum open-circuit voltage does not exceed 450 volts. A series circuit using two constant-current transformers with the secondary windings of these transformers connected in series and with both the point of connection between these two secondary windings and a suitable point in the circuit effectively grounded, or other equivalent installation, may be used without the series transformers (safety coils) providing the operating voltage and the maximum open-circuit voltage at any part of the circuit do not exceed 310 and 450 volts, respectively. (A grounded circuit should not be installed without first finding whether it is in keeping with the practice of the power company supplying the current.)

Suitable weatherproof units with either plan or prismatic globes are required for the boundary lights. Such units shall be so constructed and installed that the light will be visible in all directions and at all vertical angles from the horizon to the zenith with no blind spots and shall be so designed as to prevent moisture entering the fixture and either grounding or short-circuiting the unit. On all series circuits these units shall be provided with cut-out sockets. In event of lamp failure such sockets are necessary to reestablish the circuit in the case of straight-series circuits, and in the case of series circuits with series transformers (safety coils), to short-circuit the series transformer secondary. (An open-circuited secondary sets up electromagnetic waves of such a frequency as to interfere with radio reception in the immediate vicinity.) The extreme height of the light source of boundary-light units above the adjoining surface of the landing area shall not exceed 3 feet.

Either clear or yellow lights shall be used in the boundary-light system, excepting as follows: Where the entire field is not available for landing in all directions at all times, green lights shall be so placed in the system as to indicate clearly the ranges of each landing strip or runway.

On multiple circuits, lamps of not less than 25 watts shall be used for clear and yellow lights and lamps of not less than 50 watts for green lights. In the case of series circuits, S-24 $\frac{1}{2}$, 6.6 -ampere, 600-lumen lamps shall be used for clear and yellow lights, and 1,000-lumen lamps for green lights. Diffusing globes or frosted lamps shall be used for all clear lights to prevent glare. Gaseous-discharge units, such as neon lamps, showing an intensity in all directions in the upper hemisphere at least equal to that of said incandescent units may be used in lieu thereof. Said gaseous-discharge units shall conform to the color requirements set forth in the preceding paragraph, and shall be so designed that the color will be permanent regardless of any low temperatures that may be encountered in service.

Boundary-lights shall be so constructed as not to collect rubbish and shall be day marked in the manner described in section 4 (e) under Basic Requirements. Said units shall be kept clear and surrounding vegetation shall be trimmed in such a manner as to insure no interference with the visibility of either the lights or the markers.

Obstruction lights marking pole lines or similar obstructions adjacent to the landing area will not be accepted in lieu of boundary lights. (In making night landings many pilots rely on the boundary lights to a certain extent to indicate the plane of the landing area, hence it is important that the height of boundary lights be not more than 3 feet. Also, the low boundary lights are of material assistance in preventing collision with fences and other obstacles when planes are taxiing near the edge of the landing area.)

(d) Obstruction lights. - All obstructions on and in the vicinity of the airport, including airport buildings and structures, shall be clearly marked with red lights which may be either incandescent lamps with red shades or gaseous-discharge lamps of distinctive red color. Obstruction lights shall meet at least the wattage, lumen, and candlepower requirements specified for green boundary lights. (In the case of high obstructions, the use of more powerful lights is recommended. Special lights are required for marking certain obstructions crossing navigable waters in the immediate vicinity of airports as hereinafter specified.) Suitable weatherproof units shall be used and shall be mounted in each case above the highest point of the obstruction or on poles of corresponding height placed alongside thereof. The use of a flashing mechanism in connection with the standard obstruction lights is not required; however, if such a mechanism is used, it shall be so designed as not to interfere with radio reception in the vicinity. Obstruction lights shall be placed on separate circuits from other field equipment and lighting installations, except that they may be included on the boundary-light circuit.

The obstruction lights marking each individual hangar or other long building contiguous to the landing area shall be placed not more than 300 feet apart. In making a pole line an obstruction light shall be placed on each pole along the airport and on at least three poles beyond the airport in each direction. In case there is more than one pole line along the same side of the airport the obstruction lights shall be placed on the poles of the highest line. Two obstruction lights shall be placed on end poles and on corner poles as the burning out of a single light in such locations may lead to serious results. The spacing of lights marking such obstructions as a row of trees shall be not more than 300 feet.

All tall isolated obstructions in the vicinity of the airport exceeding 100 feet in height, such as radio towers and masts, flagpoles, transmission towers, water towers, chimneys, and other tall structures, shall be marked with at least two red lights placed directly above the obstruction and with red lights mounted on diagonal corners at two-thirds the height and also at one-third the height of the obstruction in such manner as to be visible from all angles of approach. In lieu of such red obstruction lights, chimneys, water towers, and similar structures may be marked by adequate flood lighting. It is recommended, however, that the red obstruction lights be used wherever possible.

Supporting towers of transmission line spans crossing navigable waters in the immediate vicinity of airports shall in each case be marked at the top with a red light visible in all directions and consisting of two 200-watt lamps mounted in a 300-millimeter airways electric obstruction lantern or other equivalent apparatus. In addition, red lights consisting of 100-watt lamps mounted in waterproof globes shall be installed on diagonal corners at the one-third and two-thirds heights of the towers in such manner as to be visible from all angles of approach. The catenary of the transmission line shall be night marked by one or more 24-inch parabolic directional projectors, as conditions may require, mounted on the supporting towers in such a manner as to show the location, direction, and height of the wires. The projectors shall be of sufficient candlepower adequately to mark the crossing by the indirect illumination of the beam, shall use lamps of not less than 1,000 watts, and shall be equipped with lamp changers.

Bridges crossing navigable waters in the immediate vicinity of airports shall, in addition to the lights prescribed by the Commissioner of Lighthouses for marine navigation, be provided with obstruction lights for air

navigation as follows: The highest point of the bridge shall be marked with a red light visible in all directions and consisting of two 200-watt lamps mounted in a 300-millimeter airways electric obstruction lantern, or other equivalent apparatus. Should the bridge have several high spans or towers, such red lights shall be installed on each of the high points forming the obstruction.

The Secretary of Commerce may require the adequate lighting of any obstructions in the vicinity of an airport if, in his opinion, such marking is essential for the safe operation of aircraft from the port.

(e) Illuminated roof markings. - At least one hangar roof, or other suitable area, shall be marked in the manner set forth in section 4 (e). Said markings shall be illuminated by outlining with exposed incandescent lamps, gaseous-discharge lamps (neon tubes, etc.), or other equivalent apparatus, preferably placed along the center line of the strokes of the lettering and other symbols. For outlining with incandescent lamps, not less than 10-watt clear sign lamps shall be used, and lamps shall be spaced from 8 inches apart for 6-foot letters to 12 inches apart for 12-foot letters or larger. In case it is desired to use colored lamps, not less than 15-watt lamps shall be used for yellow and not less than 25-watt lamps for green and red. Gaseous-discharge tubes shall be either 11-millimeter by 18-milliampere or 15-millimeter by 25-milliampere tubing.

A flashing mechanism may be used in connection with the lighting equipment for the roof markings, providing such mechanism is so designed as to cause no interference with radio reception. In case a flasher is used, all parts of such markings shall be flashed in unison. The minimum duration of flash shall be not less than 5 seconds and the maximum eclipse period between flashes shall not exceed 10 seconds.

The presence of illuminated roof markings on an airport building does not eliminate the requirement for marking said building with suitable obstruction lights.

(f) A ceiling projector. - For use as a ceiling projector there is required an incandescent searchlight with a parabolic reflector of not less than 12 inches in diameter and with at least a 250-watt lamp of the concentrated filament type used for spotlight or headlight service and a stray light shield giving a beam spread of not to exceed 7° (preferably not more than 5°), or an equivalent apparatus. (Projectors limited to these minimum requirements will not necessarily be large enough to handle the needs of every airport. In some cases, depending upon local conditions, it may be necessary to use units up to 24 inches in diameter and with 1,000-watt lamps.) The ceiling projector shall be mounted on a yoke with a quadrant or other suitable means for elevating and holding the light at the proper angle. In case the projector is used in such a manner as to necessitate the measuring of vertical angles, an inclinometer, transit, or theodolite shall be provided, or in lieu thereof an alidade so graduated and installed as to give direct readings of the ceiling height.

(g) Landing area flood-light system. - This system, which may consist of one or more units, shall be such as to provide an even distribution of illumination (free from abrupt changes in intensity and from shadow areas) over the entire usable portion of the landing area. There shall be sufficient intensity of illumination to reveal the details of the surface and make depth perception readily possible from an altitude of at least 30 feet in the center of the lighted area. The minimum intensity of illumination over the usable portion of the landing area shall be not less than 0.15 foot-candle, measured

at each point on the vertical plane of maximum illumination.

The flood-light system shall be immediately available for use through the operation of control located at convenient point and shall be sufficiently elaborate or flexible to permit landing under all conditions of wind direction without the necessity of landing directly toward the light source.

There shall be sufficient light to illuminate objects and obstacles in the immediate vicinity of the airport in the direction of the beam, and the flood-light unit or units shall be so designed and installed as to eliminate glare and blinding of the pilot.

Units shall be mounted as low as possible consistent with the contour of the landing area, shall project a beam of small vertical divergence with sharp cut-off at the top and with top of beam as nearly parallel with and as close to the surface of the landing area as practicable. Units using more than one lamp shall be so constructed that the failure of one or more lamps will not interrupt the service of remaining lamps. When more than one unit is used, each unit shall be separately fused or other suitable provision shall be made to prevent a short circuit in one unit from interrupting service of other units. In lighting areas of irregular, wavy contour, the units shall be so placed as to eliminate shadows.

Where the flood lighting is accomplished from a single light source, an automatic lamp changer shall be provided to bring a new lamp into the focal position in case of lamp failure. This lamp changer shall be so designed that the reserve lamp is ready to be placed immediately on the line. In lieu of a lamp changer an auxiliary unit may be provided which will give sufficient light for safe landing of aircraft should the major unit fail, and which will produce a minimum intensity of illumination of not less than 0.035 foot-candle, measured at each point on the vertical plane of maximum illumination, over

the usable portion of the landing area. This auxiliary unit, if not in operation with the major unit, shall be so designed as to be turned on automatically without interruption of service, and shall be located at or near the major unit in order to avoid confusion of the pilot due to sudden and unexpected change of location of the light source. In event said single light source is a high-intensity arc neither an automatic lamp changer nor an auxiliary unit is required, providing the flood-light unit is at all times operated under the care of a competent attendant to see that carbons of sufficient length are in place each time the light is turned on and that the arc is kept functioning properly.

In case the landing area exceeds the size required for a class "1" rating at the altitude in question, the area to be flood lighted in the manner hereinabove specified shall meet at least the size requirements for a class "1" rating, but need not exceed these requirements, except in the case of landing areas receiving a class "T" rating. In such cases, the area to be flood lighted in said manner shall meet at least the size requirements for a class "T" rating, but need not exceed these requirements. It is highly desirable, however, that the entire landing area be lighted.

(Night operations are facilitated by the flood lighting of loading areas, hangar aprons, and taxiways leading from aprons to landing area. While it is not required that the exterior surfaces of airport buildings be flood lighted, the exterior lighting of one or more outstanding buildings will add to the general visibility of the airport. Units for such exterior flood lighting should be so installed as not to produce a glare that will interfere with planes using the port.)

(h) All-night operation of lighting equipment. - The airport beacon, wind-direction indicator lights, boundary lights, obstruction lights, and roof-

marking lights shall be kept burning all night (from sunset until sunrise) every night. (It is preferable that this equipment be kept burning from one-half hour before sunset until one-half hour after sunrise.)

(i) Night personnel. - Attendant available upon request.

Earthwork

Through the use of field notes a topographic map of the present field was readily made and it disclosed the fact that in obtaining the future surface no danger existed of exceeding the maximum grade as stated in the specifications. In fact, it was to be a more or less difficult problem to cheaply drain the area, so small were the slopes.

The following is a description of the method used to compute the future elevations of the ground surface, the amount of earth fill. Profiles were drawn of the runways and a grade line established for each, taking care that the intersections were of the same elevation. It was necessary to vary the grade on three runways in order to arrive at approximately equivalent values of cut and fill. On two of the runways the difference of grade was enough so as to necessitate transition curves from one grade to the other. The runways were then laid out in position on the topographic map and future elevations recorded on them. By means of these elevations future contour lines were drawn. The earthwork was then computed by the borrow pit method, the unit being a one hundred foot square. The results were as follows: 89,682 cubic yards of cut, and 90,743 cubic yards of fill making a difference of 1,061 cubic yards. This is ignoring shrinkage factor and runway excess earth cut. The runway cut is 17,167 cubic yards making a total cut equal 106,849 cubic yards. The total fill necessary, using a shrinkage factor of ten per cent, equals 99,817 cubic yards or an excess cut of 7,032 cubic yards. This can easily be disposed of in the south west corner of the field which is not

shown as graded in the sheet of computations.

The Drainage System

Because the soil of the airport location is of a clay loam type, and the fact that there is a clay bed three or four feet below the surface, made a very elaborate and compact drainage system necessary. The laterals which are 5-inch tile are run into the submains at intervals of fifty feet, but since some of the laterals run off from the submains at an angle, the width of field drained is slightly less than fifty feet. However, the fifty foot drainage strip was used in the calculations providing a small safety factor. The laterals were placed on an average of two feet below the surface, and as often as possible angled into the submains to reduce head loss.

A value of 0.25 inches per hour was chosen as the amount of water that would percolate down to the tile placed at an average depth of 2 feet. A heavy sod would probably increase this value a little, but considering the heavy clay soil it seemed a safe value. The field will have a general slope from the north east corner down toward the river, and the submains were laid accordingly. Because of this general slope down toward the river, the runway drains on the north side of two runways were made a little larger to take care of any surface run-off during intense storms.

Runways

An asphaltic concrete runway was chosen and designed for several reasons the principal one being economy. It was felt that as the field was not to receive a transport rating, concrete would be too expensive and asphalt concrete surface would be adequate. This type of surface would also possess to a certain degree a resilient characteristic helpful in easing the impact of landing. A crown was given to the runways to shed rainfall quickly and

completely, the water being caught in ditches immediately alongside of the runways, containing tile at the bottom and completely filled with gravel. These gravel filled ditches also serve as transition strips from runway to sod and as markers of the runway edge. The dark runways are more visible when whitewash is applied to the gravel in the side ditches.

Wind Velocity

Month	: Average miles : per hour	: Maximum : Velocity	: Direction of : Maximum	: Year of : Maximum
January	11.4	28	N W	1911
February	12.4	34	N W	1918
March	10.8	33	W	1929
April	10.7	27	S E	1918
May	9.5	30	N W	1914
June	7.9	27	N E	1911
July	7.1	27	N W	1921
August	7.3	20	N W	1929
September	8.7	21	S	1927
October	9.1	25	N W	1916
November	10.9	30	S W	1918
December	9.6	27	S W	1924

Conditions Affecting Visibility

Month	: Cloudy Days	: Dense Fog
January	18	1
February	14	1
March	14	1
April	12	0
May	11	1
June	7	1
July	6	1
August	7	2
September	9	2
October	12	2
November	18	1
December	20	1

Precipitation

Month	:	Number of days with .01 or more
January	:	14
February		11
March		11
April		11
May		10
June		9
July		7
August		8
September		8
October		9
November		11
December		12

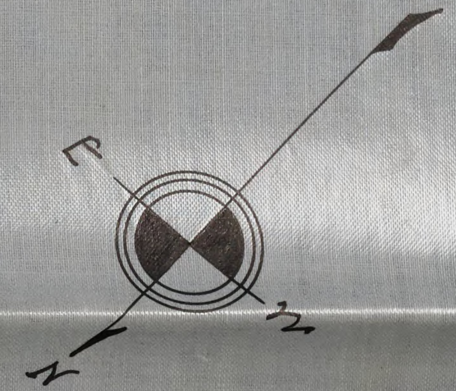
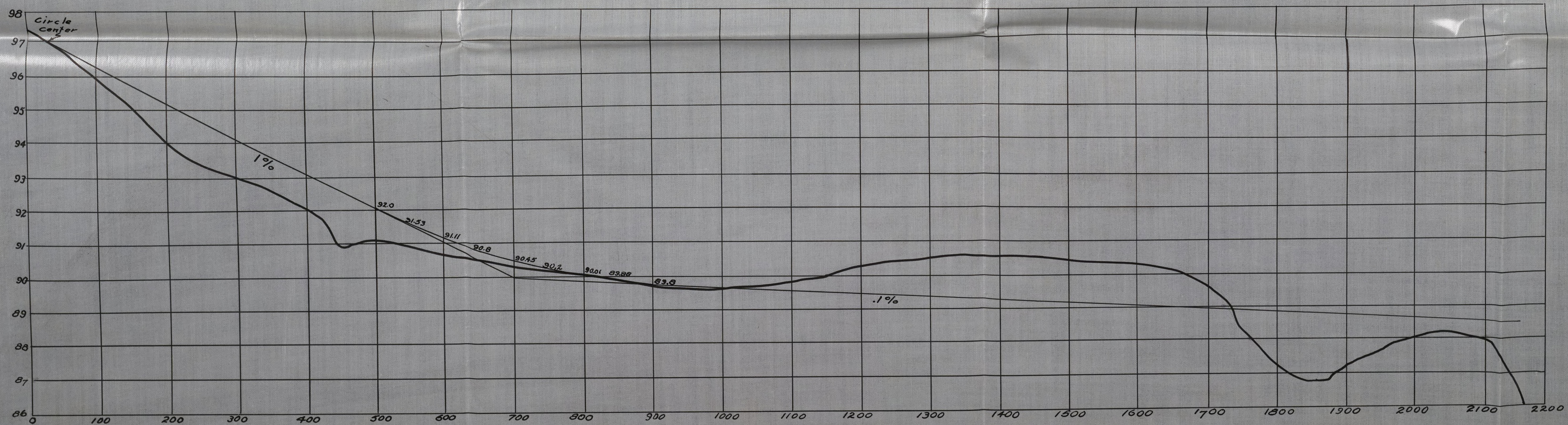
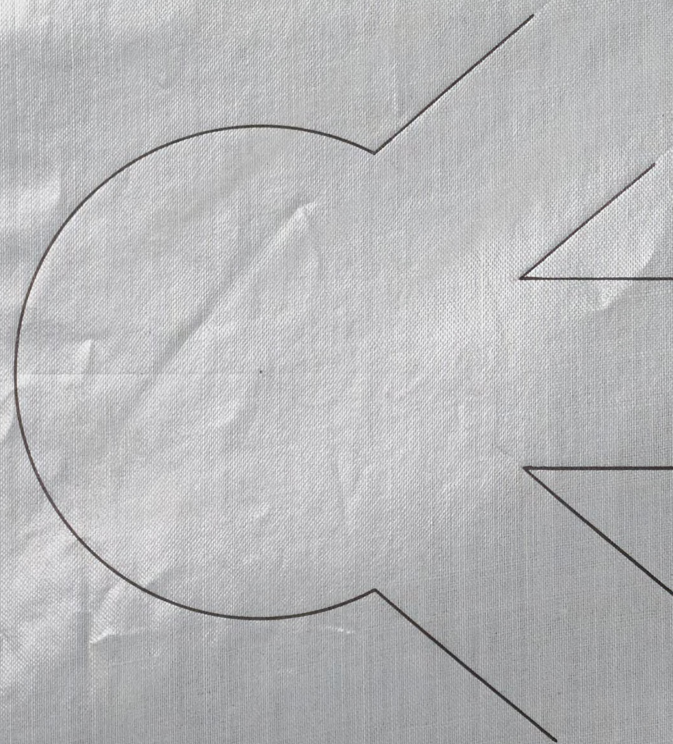
Number of Laterals :	Runway Drains :	Submain :	Area in Acres :	C.F.S. :	Total C.F.S. :	Diameter of tile
-------------------------	--------------------	--------------	--------------------	-------------	-------------------	---------------------

	(1)			.80		10"
	(2)			.80		10"
14		19	2.88	.73	2.33	16"
2		21	.817	.208	.208	6"
2		21	.916	.231	.439	8"
4		21	.916	.231	.670	10"
5 - 5		22	1.225	.309	.309	8"
4 - 4		22	1.705	.43	.739	10"
4 - 4		22	2.10	.528	1.267	12"
4 - 4		22	2.95	.75	2.017	14"
4 - 4		22	3.60	.91	2.927	16"
4 - 4		22	4.22	1.068	3.992	18"
2		20	1.29	.326	4.318	20"
		20	2.649	.670	4.988	20"
		31	1.145	.289	.289	8"
3		30	.722	.182	.182	6"
5		30	.572	.145	.327	8"
		29			.616	10"
2 - 3		29	1.67	.422	1.038	12"
3 - 3		29	2.04	.514	1.552	14"
3 - 3		29	2.37	.598	2.150	16"
3 - 3		29	2.69	.68	2.830	16"
3 - 3		29	3.03	.766	3.596	18"
3 - 2		29	2.87	.720	4.318	20"
3		28	.585	.147	.147	6"
5		28	.515	.130	.277	8"
2		27	.77	.194		6"
3		27	.87	.220	.414	8"
5		27	.69	.173	.587	10"
		26			5.180	20"
4 - 4		26	2.82	.711	5.891	22"
2 - 2		26	2.29	.577	6.468	22"
3 - 3		26	3.57	.910	7.378	24"
3		23		.220		8"
3		23		.316	.536	10"
3		23		.352	.888	12"
3		23		.256	1.144	14"
2		23		.270	1.414	16"
2		23		.288	1.702	18"
	3			.80		10"
	4			.46		8"
	5				1.26	12"
	6			.46		8"
	7				1.72	14"
	8			.46		8"
	9			.80		10"
		24			3.933	18"

Number of		Runway	Submain	Area in	C.F.S.	Total C.F.S.	Diameter
Laterals	Drains			Acres			of tile
2		24	.676	.170	4.103	20"	
5		24	1.68	.425	4.528	20"	
3		24	1.20	.302	4.830	20"	
		25			12.208	28"	
	10			.80		10"	
	11			.46		8"	
	12				1.26	12"	
	13			.80		10"	
	14				2.06	14"	
	15			.46		8"	
	16				2.52	16"	
4		32	.835	.211		6"	
3		32	1.06	.268	.479	8"	
2		32	.915	.231	.710	10"	
4		32	2.35	.592	1.302	12"	
5		32	2.24	.564	1.868	14"	
5		32	2.65	.665	2.533	16"	
			1.77	.448	2.981	18"	

Estimate of Cost

Excavation 106,849 cu. yd. @ 30¢	\$26,904.60
Drain tile:	
5" - 61410 ft. @ 7¢	4,298.70
6" - 800 ft. @ 9¢	72.00
8" - 9430 ft. @ 15¢	1,414.50
10" - 10,980 ft. @ 23¢	2,525.40
12" - 1,330 ft. @ 30¢	399.00
14" - 700 ft. @ 45¢	315.00
16" - 1400 ft. @ 52 ¢	728.00
18" - 750 ft. @ 57¢	427.50
20" - 1320 ft. @ 62¢	818.40
22" - 300 ft. @ 67¢	201.00
24" - 480 ft. @ 72¢	345.60
28" - 30 ft. @ 80¢	24.00
Manholes 9 @ \$40.00	360.00
Trenching 107,470 lin. ft. @ 70¢ per rod	4,559.00
Gravel	274.00
Runway:	
Grading @ 30¢ per cu. yd.	5,150.10
Pavement - asph. concrete	43,260.00
- binder	77,250.00
Grass seeding	500.00
Hangar	12,000.00
Office & fire fighting equipment	6,000.00
Gravel for parking lot 1000 cu. yd. @ \$1.00	1,000.00
Lighting:	
Beacon	550.00
Ceiling projector	350.00
Flood lights	2,500.00
Boundary lights	3,000.00
Wind indicator	300.00
Total	195,426.80



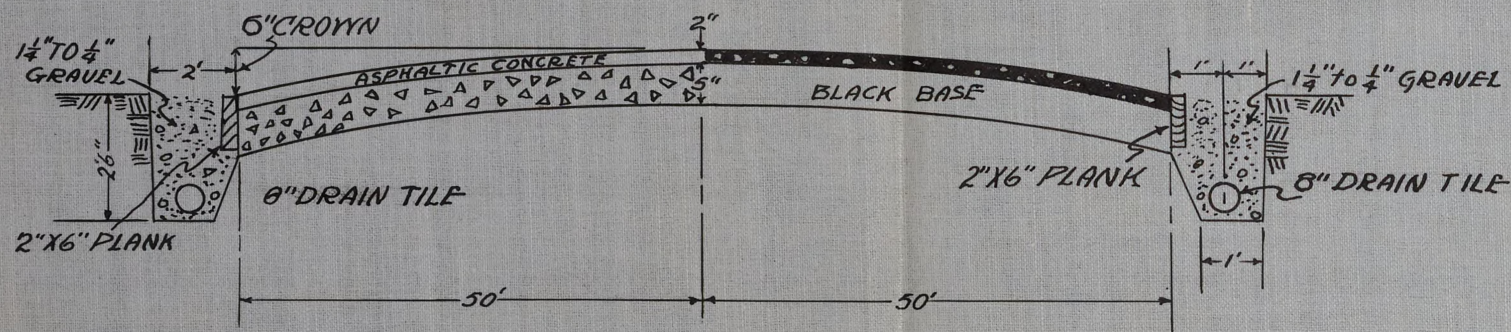
PROFILE VIEW
OF RUNWAY B
FOR
OWOSSO MUNICIPAL AIRPORT
OWOSSO, MICH.

HORIZONTAL SCALE: 1"=100' VERTICAL SCALE: 1"=2'

Designed By:

R. M. Ludwig - J. A. Kelt

5/23/34



ASPHALTIC CONCRETE

Asphalt	6.6 %
Filler	16.35 %
Sand	16.70 %
Stone	60.35 %

BLACK BASE

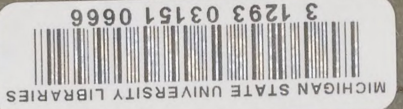
Bitumen	4 to 6 %
Sand (passing ten mesh sieve)	15 to 30 %
Stone (retained on ten mesh sieve)	60 to 80 %

CROSS SECTION OF RUNWAY FOR OWOSSO MUNICIPAL AIRPORT OWOSSO, MICH.

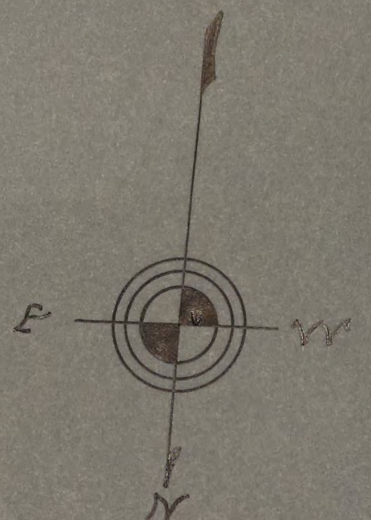
Designed By:

5/24/34

R. F. Ludwig
J. A. Webb

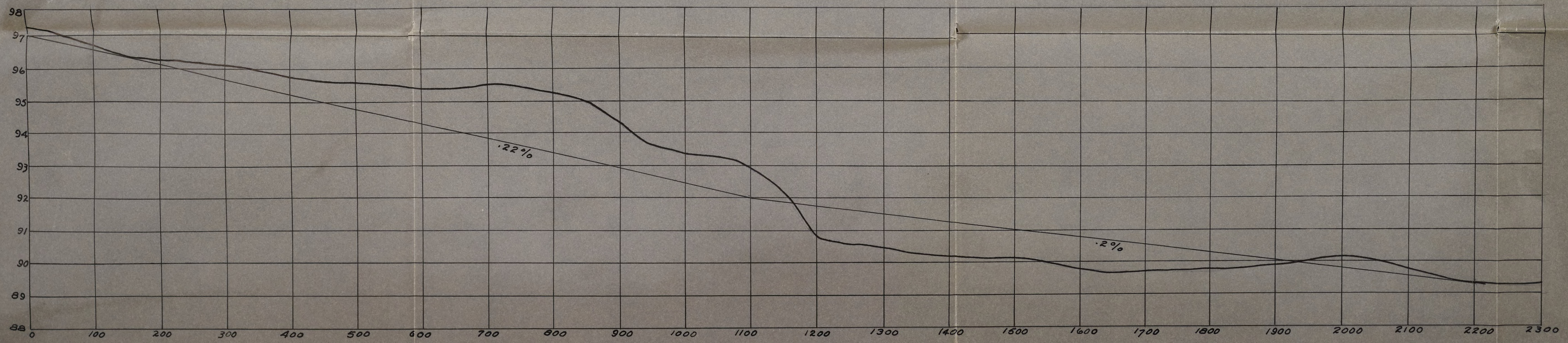


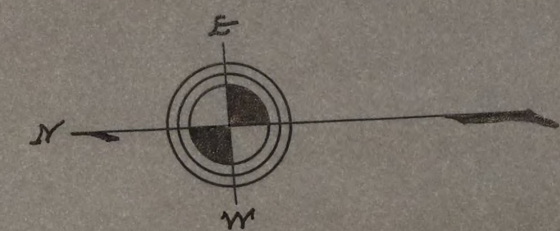
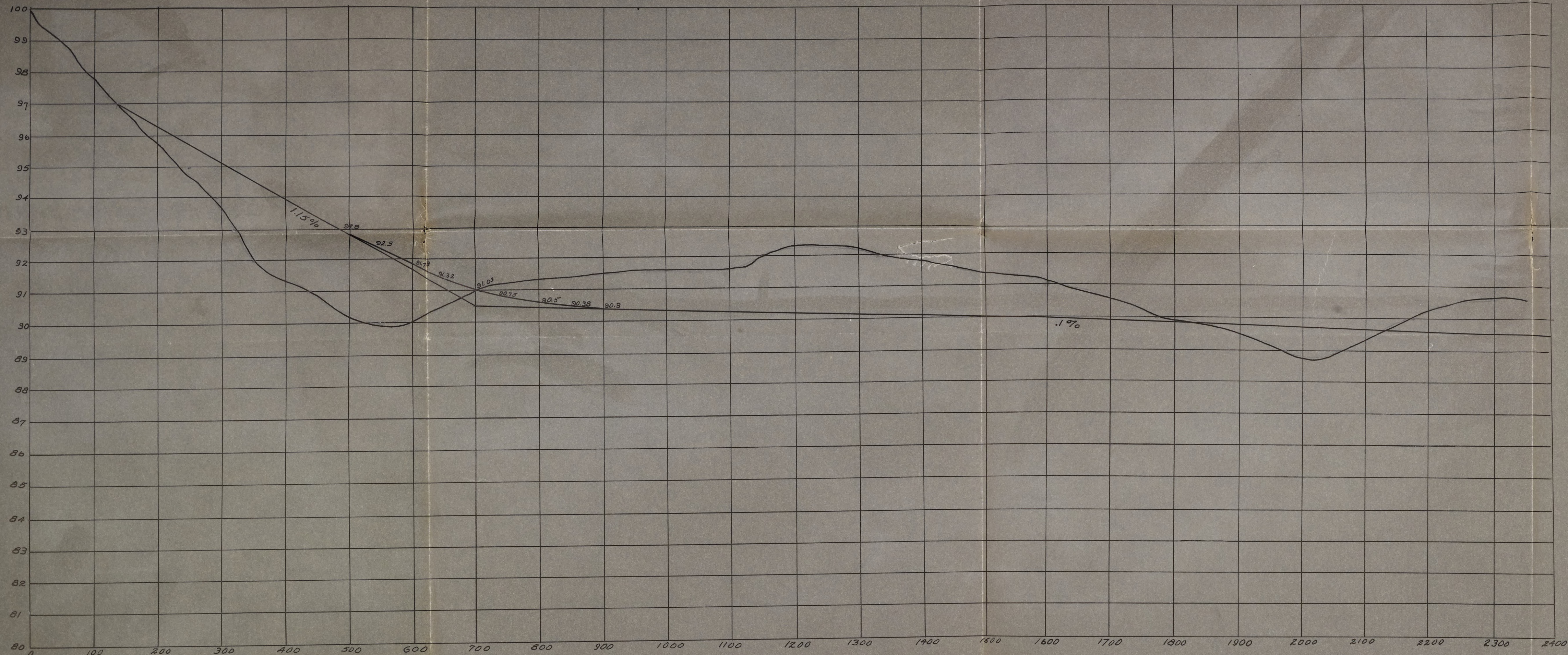
SUPPLEMENTARY
MATERIAL



PROFILE VIEW
OF RUNWAY A
FOR
OWOSSO MUNICIPAL AIRPORT
OWOSSO, MICH.

Scales: Horizontal 1"=100' Vertical 1"=2'
Designed By: R. L. Ludwig J. Q. Webb 5/22/34



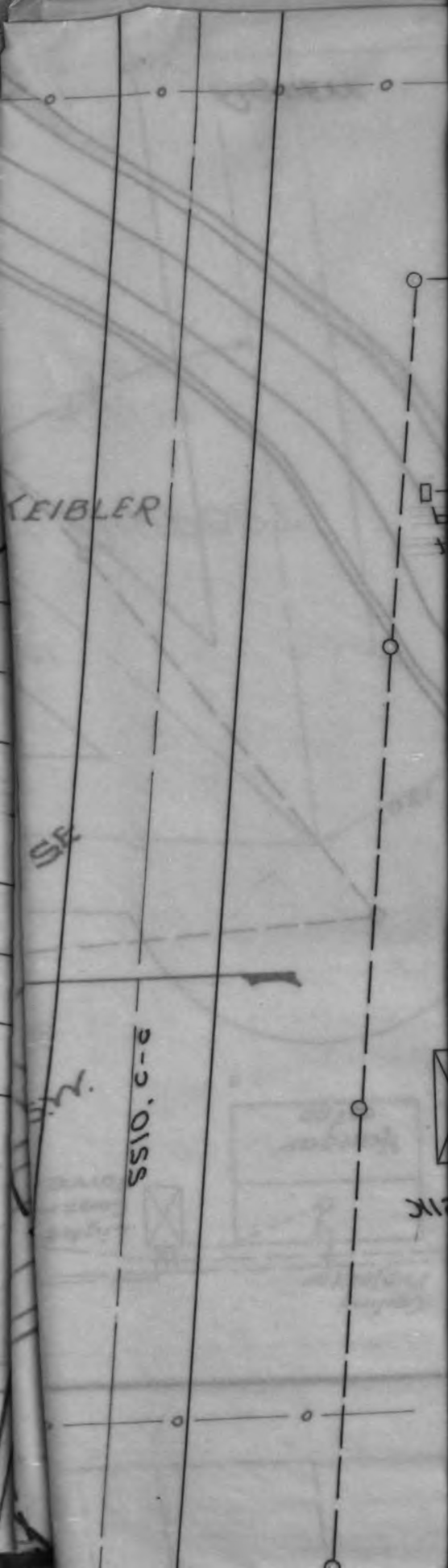


PROFILE VIEW
OF RUNWAY C
FOR
OWOSSO MUNICIPAL AIRPORT
OWOSSO, MICH.

Scales: Horizontal 1"=100' Vertical 1"=2'

Designed By: R. A. Hulding J. A. Webb 5/21/34

Pocket Map of Drawings



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