Conference H M Martin and R. Rhoades in A.M. of 2/21/50 Rhoades decision to file this draft and not complete the report. The number was cancelled by J. Smith 2/21/50 CW Thomas 2/21/50

PAP-30

DRAFT CWThomas:cah-s

feb. 17, 1950

~~Research and Geology Division Field Trip Report No. 725, November 10, 1949~~

Memorandum

~~Field Trip Report~~

To: Files ~~Chief Engineer~~ ~~Through Head, Research and Geology Division~~

From: C. W. Thomas

Subject: Hydraulic Laboratory for the University of New Mexico, Albuquerque, New Mexico.

1. Upon completion of the inspection of Conchas Canal and formulation of a seepage loss program at Tucumcari, New Mexico, I proceeded to Albuquerque, New Mexico, on October 27, 1949, arriving about 2:00 p.m. the same day. The remainder of the 27th and the major portion of the 28th were spent in the office of the Area Planning Engineer and at the University of New Mexico in Albuquerque. This stopover was arranged in accordance with letter of October 18, 1949, to you from Area Planning Engineer, Albuquerque, New Mexico, transmitting a letter of September 28, 1949, from Mr. C. B. Thompson, Assistant Professor of Civil Engineering, University of New Mexico, to Mr. John Mutz, Area Planning Engineer, Albuquerque, New Mexico. Copies of these letters are appended to this report.

Purpose of Trip

2. The purpose of the stopover was to advise and assist interested personnel at the University of New Mexico in the design of a hydraulic laboratory for student instruction, to be included in proposed plans for a building expansion program on the campus.

Personnel Contacted and Conferences Held

3. Upon arrival at Albuquerque I proceeded to the Area Planning Office at 723 North Second Street and conferred briefly with Mr. William S. Gookin,

who was in charge of the office in the absence of Mr. Mutz. Mr. Gookin stated that the relationship between the Planning Office and the University of New Mexico had been excellent and much helpful information and assistance had been obtained from them. He was especially desirous of complying with Mr. Thompson's request for information relative to the design of a hydraulic laboratory.

4. After this brief discussion Mr. Gookin and I proceeded to the University and contacted Mr. C. B. Thompson. A brief tour of the present laboratory facilities followed, after which Mr. Gookin returned to his office. Mr. Thompson and I spent the remainder of the day in the office of Mr. W. C. Wagner, Head of the Civil Engineering Department at the University. At this meeting the proposed building program including the laboratory was discussed. At the close of this meeting I accompanied Mr. Thompson to the office of Mr. H. B. Mathany, Dean of Men.. Mr. Mathany expressed his gratitude for the kindly interest being shown by the U. S. Bureau of Reclamation in connection with the activities of his University.

5. During the evening of October 27, I formulated an outline plan of basic requirements for a hydraulic laboratory to meet the needs of the University. The points included in this outline were discussed with Mr. Thompson and Mr. Wagner on October 28. I then visited the Area Planning Engineer's office and outlined briefly to Mr. Gookin the results of the discussion at the University, after which I returned to Denver.

Present Status of Plans for the University Laboratory

6. Plans are being developed for construction of new engineering buildings on the campus of the University of New Mexico. A hydraulic laboratory will be included in the Civil Engineering building. ~~Floor space has not been~~

~~allocated.~~ It is intended that adequate information will be assembled and preliminary plans for the laboratory drawn up by Mr. John J. Vandertulip, a civil engineering graduate student before June 1950. Spanish architecture has been followed in all the buildings on the campus and the new buildings will conform to this motif. This fact limits the height of the building to two stories on three sides of the blocks and 3 stories on the one side only. By considering a location for the hydraulic laboratory in the 2-story portion of the building but adjacent to the 3-story wing, adequate head can be obtained for placing a constant head tank on top of the taller building, thus providing head for flow into the hydraulic laboratory. Other than this, little consideration had been given to a definite location and to the limits of the floor space for the laboratory.

Principal Points of Discussion

7. The principal points discussed with Mr. Thompson and Mr. Wagner in regard to the design of the laboratory were as follows: It is intended that the hydraulic laboratory will be used for instruction of civil engineering students only. The mechanical engineering students have a fluid mechanics laboratory that is utilized for instruction in courses included in the mechanical curriculum. The registration at the school at present is around 5,000 of which 900 to 1,000 are engineering students, and about 300 of these are civil engineering students. It is intended that the laboratory will be used primarily for instruction in undergraduate hydraulics courses. This school year the University has only 6 graduate students in civil engineering, and only one of these is majoring in hydraulics. This particular student will formulate the initial plans for the laboratory as a part of his graduate work. ~~It was also pointed out that~~ the laboratory might possibly be used for industrial and

research work by Government agencies, consulting engineers, and any ~~manufacturing~~ industry that might at some later date be located in the vicinity of the University. Although the laboratory may be used principally for instruction in the fundamentals, some research of a graduate and undergraduate nature may be done and some industrial research.

8. The capacity of the laboratory ~~in discharge~~ water relative to quantity of to be handled was discussed at some length. ~~It was pointed out that~~ Small pumps and piping could be used for demonstration and teaching but not for industrial or commercial work. ~~There should be at~~ By providing at least two pumping units ~~in order to provide more~~ flexibility ~~of~~ the plant could be improved and the ~~The reason for using these~~ smaller pumps and piping ~~was to~~ would conserve floor space, reduce cost in initial installation and maintenance, and ~~to~~ permit use of smaller equipment throughout the laboratory. Let provide a total capacity adequate to meet the needs.

9. Considerable discussion of the floor space requirements for the laboratory entered the conference at different times. The consensus appeared to be that basically the floor space should be approximately 40 by 60 feet and 2 stories high. The best utilization of the head room was not definitely determined but it was felt that consideration should be given to a balcony effect or mezzanine for the second floor, leaving some of the area with a total head room extending the two stories in height. The arrangement of this mezzanine ~~of course~~ would depend upon the location of the permanent ~~arrangement decided for~~ the installations ground floor.

10. In regard to the permanent installations in the laboratory it was ~~it~~ suggested that the operating equipment should definitely consist of pumps and a sump or water supply for the laboratory. The use of city water or water from a reservoir or similar outside source would probably not be satisfactory. It was ~~also~~

suggested that the permanent piping ~~system~~ should probably be run around the outside of the building ~~and~~ at about the height of the mezzanine. This arrangement would permit ~~in order to best load down into~~ the pipe Connections to the models or demonstrations on the main floor, and could also be tapped for any similar installation on the mezzanine. By placing the laboratory adjacent to the 3-story portion of the building a constant head tank could be provided on the roof of that portion of the building. The main difficulty is that the fire-wall on top of the building will only be approximately 3 feet in height and any constant head tank should ~~be kept below the top of the fire wall in order not to~~ not extend above and break the architectural appearance of the building. #11. The permanent measuring equipment for the laboratory should not be vested in ~~any one~~ a single method. Volumetric equipment should be included as well as a means of weighing discharge. ~~and~~ Permanent installations such as meters, orifices, flow nozzles ~~flow meters~~ etc. should also be used ~~alone~~ in conjunction with weirs. #12. Mr. Thompson was very receptive to ideas that would provide more or less permanent demonstrations in the laboratory and still depart from the conventional weir and orifice that are included in most college laboratories. It was suggested that the weir and orifice could be used to demonstrate many basic hydraulic phenomena, but for a practical phase of the teaching of hydraulics, measuring devices such as commercial meters, etc., might very well be included. The trend and study ~~apparently~~ currently being given to measuring devices by our bureau was outlined by Mr. Thompson. Some thought was given to providing a ~~so-called~~ "cascade" down one side of the building to permit installation of various types of measuring devices in series.

12. In view of the fact that most of the civil engineering graduates from the University of New Mexico are employed by the Bureau of Reclamation, Mr. Wagner and Mr. Thompson felt that the Bureau should express some of their

views on what might be taught to the students in order to better qualify them for jobs with the Bureau upon graduation. In this regard it was suggested that demonstrations of the natural hydraulic phenomena should be included either in the lecture course or in the hydraulics laboratory course. A thorough grounding in open and closed conduit work should also be included. If it is intended that pump and turbine specialties would be taught considerable more equipment would need to be included in the laboratory. ~~It was also pointed out that~~ Dynamometers, ~~ometers~~, electric meters, etc., would be rather expensive and would require considerable outlay in initial expenditure. However, it would provide an excellent opportunity for the ~~whole~~ entire engineering school to cooperate on a laboratory project in that the civil students could participate with the mechanicals and the electricals in testing ~~some~~ pump and motor or turbine and generator setups. This would indicate to the students the problems in coord. data It was ~~also~~ pointed out that a number of small demonstrations could be prepared for use in the classroom such as flow nets, electric analogies, activated bentonite models and even possibly small air models. to be expect after Gradua tion.

Conclusions

14. The following conclusions are a result of the conferences:

a. Salient points ~~of discussion~~ covered in the conferences with Mr. Thompson and Mr. Wagner would be further discussed with the staff of the Hydraulic laboratory upon my return to Denver and a summary would be sent him by letter. This letter has been prepared and a copy is ~~attached~~ included to this report in the appendix of

b. Upon receipt of this information Mr. Thompson and Mr. Vandertulip would draft initial plans for the laboratory and upon completion would ~~send~~ attempt to bring these plans to Denver ~~so~~ in order that they might be discussed further with the staff of our Hydraulic laboratory ~~here in Denver~~.

c. All personnel contacted at the University of New Mexico were very grateful for the interest shown in the solution of their current problems by the Area Planning Office and by my visit ~~in order to assist them in solving their current problems.~~

d. Since essentially all civil engineering graduates from the University of New Mexico have been employed by the Bureau of Reclamation, in the past, the University's interest in what we require in our prospective employees exemplifies splendid cooperation on the part of the University and should result in ~~better students and graduates and~~ better material for the staffs of our various offices.

Copy to: Commissioner Attention: 200
Regional Director, Amarillo, Texas
Area Planning Engineer, Albuquerque, New Mexico
Blind to: W.H.Nalder
R.F.Blanks 2
H.M. Martin 2
C.W. Thomas 2

Appendix 1

To accompany Field Trip of Nov 10 1949

By C. W. Thomas.

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Planning

166.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Post Office Box 95
Albuquerque, New Mexico.

GENERAL

	Name or Room to	Date Out	Initial
1	200		
	201	10/19	WEB
2	290		

October 18, 1949

Information copy of this letter sent to:

OCT 19 11 10 AM '49

To: Chief Engineer, Denver
Attn: Hydraulics Laboratory

From: Area Planning Engineer

Subject: Hydraulic Laboratory for the University of New Mexico.

1. There is enclosed herewith copy of letter from C.B. Thompson, Assistant Professor of Civil Engineering, University of New Mexico, Albuquerque, concerning his desire to obtain assistance in establishing a hydraulic laboratory at that institution.

2. During my visit to Denver on September 22, 1949, I discussed this matter with one of your Hydraulics Laboratory Technicians and he indicated that it might possibly be arranged for some one to visit the University of New Mexico and discuss the matter with Professor Thompson.

3. Anything that you can do in connection with this matter will aid in our relationship with the University of New Mexico and engineers concerned with hydraulic problems in the area. It is suggested that you contact Professor Thompson direct concerning this matter and we would appreciate receiving a copy of correspondence relative to the above.

RECEIVED
OCT 19 1949

John L. Mutz

John L. Mutz

Ence.(1)

Enclosures Received
Correspondence & Records

OCT 19 11 61 100

43805 OCT 19'49

The University of New Mexico
Albuquerque

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Y

September 28, 1949

U. S. Department of Interior
Bureau of Reclamation
723 North Second Street
Albuquerque, New Mexico

ATTN: Mr. John Mutz
Area Planning Engineer

Gentlemen:

Reference is made to a letter from this office, dated September 15, 1949, and to a telephone conversation between Mr. Mutz and the writer on September 27, 1949, relative to the planning of a new hydraulic laboratory for the University of New Mexico.

In the aforementioned conversation, it was learned that the Hydraulic Laboratory of the Bureau in Denver has been of considerable assistance to other institutions in the past in the planning of laboratories for student instruction as well as for research work.

This institution would certainly welcome any assistance which could be rendered by the Denver Laboratory and would be especially appreciative if representatives of the Bureau's Laboratory could make a visit to the University for consultation relative to the above.

If it is possible for a trip of the Denver representatives to be arranged, it would be greatly appreciated if the writer could be advised about a week in advance in order that his teaching schedule may be appropriately modified.

Very truly yours,

/s/ C. B. Thompson
C. B. Thompson
Assistant Professor of
Civil Engineering

IN REPLY REFER TO:

Attention: 293

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
DENVER FEDERAL CENTER
DENVER, COLORADO

Mr. C. B. Thompson
Assistant Professor of Civil Engineering
University of New Mexico
Albuquerque, New Mexico

DEC - 1 1949

Dear Mr. Thompson:

Reference is made to your letter of September 28, 1949, to Mr. John Mutz, Area Planning Engineer, for this Bureau at Albuquerque, requesting technical assistance in the design of a hydraulic laboratory, and to the visit of Mr. C. W. Thomas of my office on October 27 and 28, 1949, relative to the same subject.

In the discussions between you and Mr. Thomas, there were several pertinent questions raised in regard to the general layout of the proposed laboratory. These questions have been discussed with members of my staff, and the following suggestions may be helpful to you.

a. The proposed area of approximately 40 by 60 feet should provide ample space for a student hydraulic laboratory where only a minimum of industrial work is proposed and where utilization will be only casual insofar as graduate instruction is concerned.

b. The discharge capacity of the plant should be about 5 cubic feet per second. The pumps necessary to provide this discharge could be small and should consist of two or three units. Additional portable pumps for operating single demonstrations can be located at different points in the laboratory. The discharge from these pumps should be considered above the 5-second-foot capacity of the plant. By using the 5-second-foot discharge as basis for the plant, the overall size of the equipment will be small and will require less floor space than larger capacity pumps. The cost of two or three smaller units will probably be less than one large pump and motor, and will provide more flexibility in the plant.

c. Providing a balcony in the second floor area would add greatly to the available floor space. A section of the floor of this balcony could be designed of subway grating with a sheet-metal underside to prevent objects from falling through.

The grating could be removed should additional head room for experiments on the first floor be required. It is suggested that this removable floor be left across one end of the balcony area. This balcony should prove very useful for installing small portable demonstrations and work tables for the students to make computations. It is also possible that the balcony could be used for a combination lecture and demonstration room. The idea in making a portion of the balcony floor removable would be to provide head room for high models that might be placed on the ground floor and yet give a maximum of floor space on the balcony if the room is not needed for high models. In the Denver laboratories the use of subway grating in removable sections has contributed a great deal to the flexibility of the available space.

d. In regard to the permanent pump installations in the laboratory, it is believed that two or three pumps should provide the water for the entire plant. This water should be pumped into a constant head tank which can be designed to be located on top of the three-story section of the architectural building. Ample return capacity should be provided from the constant head level to the sump to negate the possibility of overflow from the tank onto the roof of the building. The piping leading from the constant level tank should be made in three or four tubes rather than a single large tube. This will probably prove to be more convenient in operating a number of demonstrations on the laboratory floor. It is believed that the available width in the laboratory would not permit a header to be run down each side of the floor space with the flow toward a sump in the middle. This arrangement would probably cause complications in providing access from one end of the floor space to the other. A better arrangement might be to install one main header down the side of the building and feed toward a sump located along the opposite side ofthe building. The location and design of this sump will be covered later.

e. It is believed that the measuring equipment for the laboratory should be diversified. It is probable that a calibrated Venturi meter should be used for measuring the discharge from part of the demonstrations; a volumetric tank located under the floor could be used for measuring the discharge from other demonstrations, and serious consideration should be given to one or more portable weighing tanks for use

as measuring devices. The use of more than one means to measure the discharge from the demonstration projects would serve to demonstrate to the student the various means of accomplishing calibration of hydraulic equipment. It would also serve to decentralize the activities in the laboratory.

f. An open flume with glass inserts at intervals on the sides should be provided along one side of the laboratory and extending for the greater portion of the 60-foot length. This flume will provide space to install a number of different types of demonstrations of basic hydraulic phenomena. It is possible that the flume should be broken up into sections, or at least means provided for breaking the flume into sections so that more than one demonstration might be run in the same flume at the same time. It is felt that with some thought given to the design of the flume, the sump for discharging the water from the various demonstrations could be placed underneath this flume, thereby saving floor space. Probably some depressions approximately 3 feet wide by 3 feet deep, extending across the laboratory from the sump and covered by subway grating, should be included. These two or three, or more, laterals added to the sump would provide space for placing the weighing tanks below demonstrations and would provide sumps for discharging water from different models that might be placed on the floor space. It might be possible to place the contemplated cascade of weirs and measuring devices in the flume rather than in a sloping flume along the side of the building. If the idea of placing one weir immediately downstream from another and building the flume at different levels proves more satisfactory, the stairway, or means of access to the balcony, could be combined with this sloping flume, thereby saving floor space.

g. The more or less permanent demonstration of measuring devices should probably include an orifice, a flow nozzle, a Venturi meter, various shapes of weirs, and probably a Parshall flume. Some thought might also be given to including propeller-type meters of commercial manufacture in order to provide a means of demonstrating calibration of such equipment. In all probability samples of these meters could be obtained from the manufacturer without cost to the University. An orifice is very valuable in demonstrating particular hydraulic phenomena in addition to demonstrating their use as a means of measuring discharge. It is felt that inclusion of a constant head tank, probably located on the roof of the architectural building, would be the best means of insuring an ample, constant

flow to the various demonstrations in the laboratory. Very little information is available as to the design of these constant head tanks. The coefficient of discharge of the skim weirs seems to be quite questionable. Prints of a constant head tank previously used in our laboratory are enclosed. These designs will need to be modified considerably for adaptation to the location on the roof of a building. However, the length of skim weirs in these drawings is adequate to handle the 5 second-feet without overflowing, provided trash, leaves, ice, or other extraneous material do not seriously interfere with the flow patterns. If the constant head tank is placed in the open on the roof, it would probably be advisable to provide some sort of cover in order to exclude leaves and other material from blowing into the tank. Some difficulty may also be experienced in providing adequate stilling devices for the water before it reaches the skim weirs due to the shallow depth of the constant head tank if the height is kept below the fire wall on top of the building. The pipes leading from the constant head tank to the demonstration models should be of ample size so that they will flow only partially full. If these pipes, especially in the vertical reaches, flow full, a siphon is formed, and the discharge will vary at the demonstrations. It is possible that some thought might be given to putting the constant head tank near the roof inside the laboratory and changing the dimensions to a long, narrow trough.

i. In regard to placing the sump for water storage and the volumetric tank beneath the floor level, it is believed that the sump should be of such a depth that the volumetric tank could be drained into the sump by valves when desirable. Therefore, the floor of the volumetric tank should be somewhat above the floor of the sump. This will cause some waste space in the sump area and some additional pumping head but will eliminate the necessity of pumping the water from the volumetric tank into the sump or storage area. Great care should be exercised to insure that the volumetric calibration tank is water tight. It is understood that considerable trouble was experienced at the University of Colorado with the volumetric tank because of leakage through the concrete walls. In the hydraulic laboratory in the Customhouse in Denver a lead seal was provided throughout the concrete channels to prevent leakage into the areas adjacent to the building footings.

j. Return lines from the various demonstrations may be either of a permanent nature or of a temporary nature. The cross channels in the floor, suggested previously, should permit easy access of these return lines to the sump or channel extending the length of the laboratory floor. It may be advisable to consider burying a pipe in the floor with blind flanges at frequent intervals to permit dumping water below the floor level.

In summarizing the discussion relative to the design of the laboratory, there are several salient points to be considered. First, a decision must be made early as to just what will be taught in the laboratory, and how much will be covered in the lecture room or by demonstration units either in the laboratory or in the lecture room. The textbook being used in the classes should be definitely determined, and the laboratory built so that the principal points covered by the text may be demonstrated. Second, any plan adopted for the laboratory should be quite flexible. It may be possible that textbooks will be changed or new demonstrations will be desired, and if the plant is too inflexible, it will not be possible to readily alter it to provide for the new demonstrations or to provide space for a limited amount of industrial work that might be contemplated. Third, a number of small demonstrations can be built and put on a table top with casters provided to wheel it into the lecture room. This may eliminate some of the possible demonstrations that would ordinarily be provided in the laboratory. In this respect, the proposed balcony would provide an adequate area for setting up either electric analogue models, simple hydraulic models, or fluid polariscope demonstrations. Fourth, the total capacity of the plant insofar as water discharge is concerned, should be kept at a minimum and still be consistent with the number of demonstrations that are being proposed. By keeping the total discharge capacity of the plant down, the pumps and piping system may be smaller, and the initial cost will be somewhat less. Additional capacity can be provided by two or more small movable pumps and motors that may be set in the line to lead into any model that would require a discharge slightly above the maximum design capacity of the plant. Fifth, it should be borne in mind that the students should be working in different areas in the laboratory. Therefore, the demonstrations should be physically separated to provide floor space for a student group to work around each of the demonstrations being tested.

There is enclosed a copy of Hydraulic Laboratory Report No. 164 giving details of construction of the fluid polariscope, a copy of Hydraulic Laboratory Report No. 239, and prints of the constant head tank.

It is hoped that the foregoing suggestions will be of assistance in the design of your laboratory. When Mr. G. G. Vandertulip has the preliminary plans completed, my engineers would be glad to review and discuss them here in Denver. A cordial invitation to participate in these discussions is extended to Mr. W. C. Wagner, the head of your department, yourself or others interested in the laboratory design.

Sincerely yours,

R. F. Blanks

R. F. Blanks, Head
Research and Geology Division

Enclosures

Blind to: Area Planning Engineer, Albuquerque, New Mexico
Regional Director, Amarillo, Texas
H. M. Martin

Record
Reading
C. W. Thomas

CWThomas:awh-s