

# Research on the Course Arrangement and Teaching Method of Field Investigation Based on Environmental Design

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**Abstract**—Field professional investigation course is a core course for environmental design specialty. The purpose of this course is to provide students with practical measurement and experience of space environment. Based on the collation and analysis of the investigation process in Western Hunan, and combined with the characteristics and requirements of environmental design, the process and method of field professional investigation and mapping have been sorted out. It provides a theoretical and practical basis for the field investigation and mapping course of environmental design specialty.

**Keywords**—environmental design; field professional investigation; working methods and processes

## I. INTRODUCTION

The major of environmental design covers all aspects of the internal and external environment of buildings. Field investigation and mapping is one of the core courses for students. This course enables students to have more intuitive access to the objects being investigated, understanding the design background of the objects under investigation, and the relationship between objects and their surroundings. By observing and mapping the objects, the student's perception of space scale, the cognitive ability of design materials and the application ability of design elements are enhanced. In addition, the course is also conducive to a more comprehensive understanding of what is reasonable design, what is unreasonable design. And it also provides a strong basis for the follow-up design practice

## II. CURRENT SITUATION OF FIELD PROFESSIONAL INVESTIGATION COURSES

The undergraduate field study course is usually set in the second semester of the sophomore year. After a period of professional courses, students in this stage have some basic knowledge of environmental design. At this time, the school provides field study courses for students, which can not only use and consolidate the basic knowledge learned before, but also accumulate material and experience for the following professional courses. In curriculum planning, it is generally divided into three stages, pre-preparation, mid-term investigation and post-summary. Preliminary preparation

content will be determined according to the students' professional learning situation. Whether the contents of the preliminary preparation are adequate or not will directly affect the efficiency of field investigation. Later summary is to collate and analyze the data recorded in the process of investigation. In the process of the course, students will encounter some problems at all stages due to inadequate preparation or lack of experience. This paper will also put forward some specific suggestions and methods to solve the problems, which will provide reference for field professional investigation courses.

## III. METHODS OF INVESTIGATION AND MAPPING

### A. Preparation in Advance

Preparations for the investigation include choosing the destination, sorting out the contents, planning time, and preparing tools, etc.

1) *Choosing a destination*: Destination of field investigation should be related to environmental design. For example, excellent buildings and landscapes in modern and contemporary times, or traditional Chinese folk buildings and ancient villages with reference value, etc. In addition, the cultural background, geographical environment and seasonal climate of the destination should be considered comprehensively.

2) *Survey and mapping content*: The contents include the internal structure and external environment related to architecture. It specifically includes the following points, such as building structure, building components, the doors, windows, stairs, etc. Architectural colors, facade decorations, patterns, etc. It also includes interior space layout, interior furniture and decorative materials. The exterior of the building includes landscape layout, landscape sketches, plants, ground pavement and so on. Surveying and mapping are based on the object of investigation. It is necessary to measure the size of the object in detail, and then draw it on the drawings according to the contents of plane, elevation and section, which can clearly show the characteristics of the object.

3) *Planning time*: Reasonable travel plans are made by adjusting and coordinating different time such as traffic time, open time of investigation destination, rest time and time of data collation. At the same time, it is necessary to adjust the time arrangement according to the local environment. For example, if a village is more suitable for students to do surveying and mapping, it is necessary to stay for three to four days, to have enough time for students to complete surveying and mapping, data checking and so on. If the area under investigation is small or the content of investigation is not enough, one- or two-days' stay may be considered.

4) *Tools to be prepared*:

a) *Recording tools*: Camera: Recording the object of investigation and its surroundings, video recorder: Recording the process of investigation and mapping, computer: Recording and collating the data generated in the process of investigation and research.

b) *Measuring tools*: Measuring reel, laser range finder, gradient measuring instrument, compass. Both measuring reel and laser range finders can measure horizontal and vertical distances. Laser range finder can be used to replace the place where the measuring reel cannot be measured in the measurement process. The gradient meter can accurately measure the angle of things, and the level meter can help to find the plane where there is a gradient. Compass is helpful to measure the turning scale of irregular buildings when drawing plan sketches. (See "Fig. 1")



Fig. 1. Measuring tools.

c) *Drawing tools*: Pencils of different colors: Different colors can be used to record different information in drawing. You can quickly find the information you want

while collating the data. Eraser: Correct error information. Technical pen: Technical pen ink keeps for a long time and dries faster, so it is not easy to make notes dirty. Sketch book: With thicker backing board, it is convenient for drawing. Sulfuric acid paper: Sulfuric acid paper has high transparency and moderate hardness. In drawing, it can be used in multi-layer superposition. Ruled paper: when drawing sketches, it can be sure of the scale ratio and avoid too many differences between sketches and reality. In addition, conventional drawing tools such as rulers and triangular plates need to be prepared.

B. *Investigation and Recording*

1) *Investigation methods*: There are many ways to investigate, such as direct observation, or to obtain information through local inquiries. Students can also participate in the daily activities of the local people and experience the local culture. In addition, understand the development history of the investigation area is also a good way.

2) *Recording method*: Taking photos: For the photographs taken by the environmental design profession during the investigation, the content should be different from the photographs commonly used for recording, and should be more professional and targeted. For example, when investigating buildings, attention should be paid to the overall form, structure, partial appearance, various structures and their relationships, facade decoration, color and characteristics of the surrounding environment of buildings. When investigating the landscape, it is need to focus on recording the overall layout form, the relationship between landscape elements, the use of materials and colors, etc.

In addition to being more specific in the content of the photos, there is also a need for professionalism in the way they are taken. Keep your body as upright as possible while shooting, and keep your camera's viewfinder and target level as well (see "Fig. 2"). In addition, when shooting, it is necessary to adjust the shooting distance reasonably, such as close-range photographs mostly for details, which are mainly used to shoot local decorative patterns and structural joints. The middle distance is mainly used to photograph the complete object of investigation. Long distance is mainly used to photograph the relationship between the object and the surrounding environment (see "Fig. 3").



Fig. 2. The correct posture for taking pictures.



Fig. 3. Photo distance.

Recording video: Video recording can be done in two ways: delay photography or normal shooting. The contents of video mainly include working and teaching records, site records, tour guides' explanations, local people's explanations and lifestyle records.

C. Measuring and Mapping

1) Measuring method: The methods of measurement include direct measurement and indirect measurement. Direct measurement can obtain data by directly measuring objects. When measuring, attention should be paid to keeping the measuring tool horizontal, vertical (see "Fig. 4") or parallel to the measuring object (see "Fig. 5").

Indirect measurement is the method used when an object cannot be measured directly. For example, when measuring a higher building, the height of a single-story building could be measured, and then deduce the overall height of the building according to the number of stories. Reference objects can also be used to estimate the size of objects. In addition, triangulation method can also be used to calculate the height of objects that cannot be directly measured. As shown in "Fig. 6" assumes that the height to be measured is  $h_2$ . Choose to find a long stick and place it in front of the measured object (usually an integer is selected for easy measurement). Then the laser pen is irradiated from point A to point C, and the point by which the laser pen passes through the long stick is point B. Finally, the distance between  $L_1$  and  $L_2$  is measured. Because  $h_1/h_2 = L_1/L_2$ ,  $h_2 = h_1 \times L_2 / L_1$ .



Fig. 4. Vertical measurement.



Fig. 5. Parallel to the measuring object.

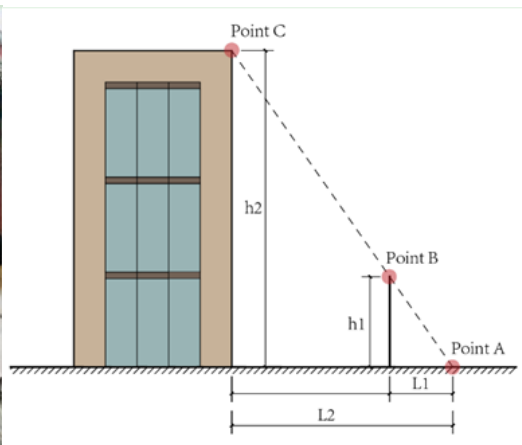


Fig. 6. Triangulation method.

2) *Measuring sequence*: The measurement should be completed in the following order: drawing sketch — measuring data — collating data — on-site checking — supplementary data — checking

When sketching, students need to observe and familiarize themselves with surveying and mapping areas or objects and grasp their basic characteristics. Students need to drawing the sketch by visual measurement, measuring step length and grasping the general size of the area, in order to prepare for dimensioning in measurement. When composing a sketch, it is necessary to set aside the appropriate position for dimensioning. The sketch should include plane, elevation and section.

When measuring data, students should first measure the whole data and then measure the detail data. After the datum point is determined, the data of plane, section and elevation are measured by extending to horizontal and vertical directions in turn. When data cannot be obtained directly, indirect measurement method can be used.

When collating data, it is necessary to distinguish the marked color from the sketch color. The measured data should be in millimeters and the related dimensions should be marked centrally.

On-site data checking is a very important step in the measurement process. When the data is measured to a certain stage, it is necessary to check the existing data on the spot. Modify the wrong sketches, unclear explanations and confused dimension in the manuscript. If necessary, it needs to be re-measured, redrawn and dimensioned. The standard is whether the size is readable. Checking the missing size side by side should begin with the important control size, and then check the detail size.

Finally, according to the data measured in the field, the data are summarized and mapped.

#### IV. SUMMARIZATION AND INDUCTION

The data obtained from field investigation and measurement are sorted out and summarized according to text, pictures, audio and video, drawings and other parts.

#### A. The Text Sections

Students need to sort out the recorded text content, draw mind maps, find relevant information, screen and analyze keywords. Comparing the past and present of the research object, students can find out which part is abandoned, which part is inherited and which part is developed.

#### B. The Photo Sections

Classify photos by location and category. The advantage of photographs is to keep pictures for the research objects, and to leave image samples for complex patterns and characteristic buildings, which is helpful for later data collation and analysis.

#### C. The Video Sections

Video can retain all the information in the research and record the workflow completely. In the later analysis, students can find the missing information through the video.

#### D. Drawing and Drawing Arrangement

At the drawing stage and sorting stage after the investigation, it is necessary to redraw the sketches recorded during surveying and mapping into formal drawings. Including the plane, elevation and section maps drawn in proportion, and detail drawing if necessary. On the drawing, the size and proportion need to be marked. After the completion of this part of work, students also need to use computer to make the three-dimensional model of the object of investigation according to the drawings.

### V. PRACTICAL APPLICATION

Gaoyi Ancient Village, located in the west of Hunan Province, China, is a village with a long history of 600 years. It is one of the ten best ancient villages in China, and it is also a large-scale and well-preserved ancient village found in Hunan Province so far. The architecture of Gaoyi Ancient Village has its own characteristics. It is a two-story building with a wooden bucket-like structure surrounded by a high Horsehead wall, forming a relatively closed courtyard. Such an environment is very suitable for the course of investigation and mapping (see "Fig. 7").



Fig. 7. Gaoyi Ancient Village.

Before the start of the study, the students were divided into several groups, each group of about 6-7 people. Under the guidance of the teacher, the students quickly browse the buildings in the village, and then determine the objects and key points of each group. After determining the object of each group, the teacher will give a detailed explanation to the object of investigation, such as the structural characteristics of the building, the scope of measurement, the difficulties of measurement and the problems needing attention in drawing, etc. After that, the students begin to measure the subjects. (see "Fig. 8") Generally, one or two students measure the subjects and one student records them (see "Fig. 9"). After the preliminary survey is completed, the team members need to gather the survey data on the spot, conduct verification, and complete the sketch of the field survey and mapping (see "Fig. 10").



Fig. 8. Students are measuring and recording.



Fig. 9. Students are drawing sketches.

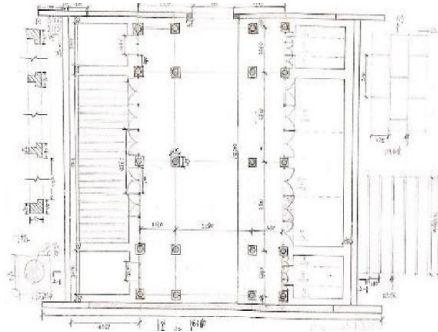
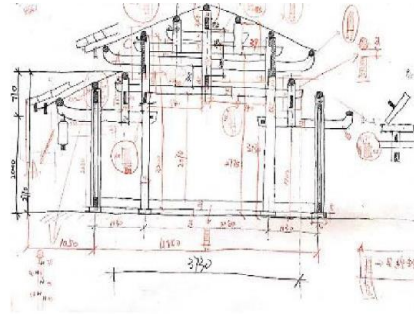


Fig. 10. The sketches.



After field investigation and mapping, students return to school and need to summarize the field data. It is very necessary for students to have group discussion or making mind-map (see "Fig. 11"). According to the sketches drawn

on the spot and the pictures or videos, student can finish the formal plans, elevations and sectional drawing (see "Fig. 12"). And the three-dimensional model of the object (see "Fig. 13").



Fig. 11. Group discussion and making mind-map.

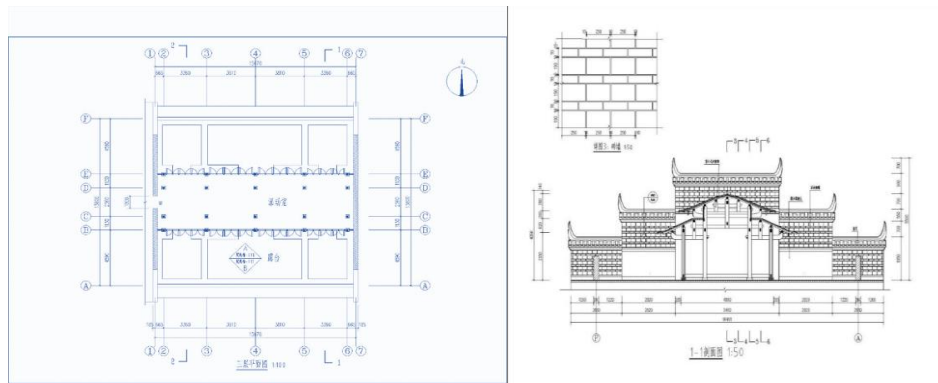


Fig. 12. Formal drawings.

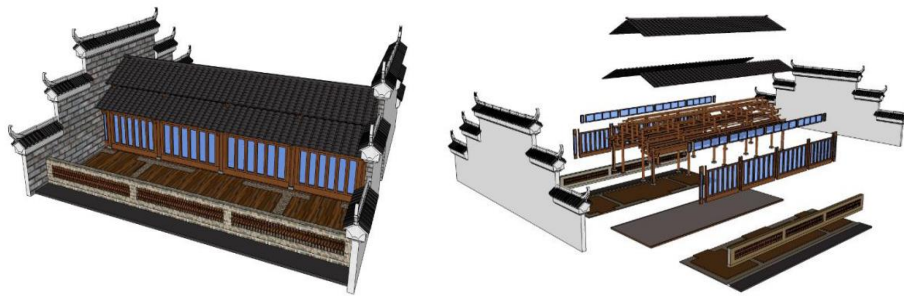


Fig. 13. Three-dimensional model of the object.

## VI. CONCLUSION

As the core course of environmental design, field professional investigation courses provide students with the opportunity to experience the space environment directly. Through on-site surveying and mapping, students' perception of spatial scale and their ability to use basic knowledge are improved. At the same time, the students' ability to express their specialty is also trained by drawing maps and making three-dimensional models. After a period of exploration, teachers can found a suitable teaching method for students. Through the field professional investigation course, students can connect theoretical knowledge with practice, and lay a foundation for professional design.

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