

# Different Models of the Curriculum for the Higher Education of Surveying & Mapping in China

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**Key words:** curriculum, common foundation, distinguished feature and superiority compulsory course, elective course, Bachelor program.

## ABSTRACT

It is very important to well design the curriculum for the 4-years bachelor program of surveying & mapping in the universities, in order to produce more talents with wide knowledge, solid foundation, strong ability and nice personality. We should pay more attention not only to the common foundation, but also to the distinguished features and superiorities, especially for the universities (colleges) with different backgrounds on surveying & mapping. Under the direction of the Educational Guiding Committee of Surveying & Mapping of China, there are some different models with the same core courses and distinguished features and superiorities, especially under 9 sub-directions. More detail about these in this paper.

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## 1. INTRODUCTION

With the rapid development of the economy and society in China, more and more well-qualified talents of surveying & mapping are required in many sectors, units, institutes and universities, especially in the units which can be beneficial from the application of surveying & mapping techniques. Based on the data by the National education Ministry in 1998, there are 29 universities having BSc programs on Surveying & Mapping. And more than 100 universities offer such courses as Surveying and Cartography.

Each year, we will meet at least once to discuss the general concern points about improving the courses and developing the discipline of surveying & mapping, and share the experiences and achievements on the education reform, directed by the Educational Guiding Committee of Surveying & Mapping of China which is chaired by prof. Ning Jinsheng. We have concentrated on designing scientifically and rationally the curriculum for the 4-years bachelor program and paid more attention to the models with basic common foundation and distinguished features & superiorities by stressing on different techniques and their applications in different fields. And we have made some achievements on this.

## 2. BACKGROUND OF THE DISCIPLINE DEVELOPMENT AT UNIVERSITIES

In the middle 1950's, there were only two universities carrying out the 4-years programs of surveying & mapping, one for civilians (Wuhan Technical University of Surveying & Mapping) and one for military. There are 4 specialties: Geodesy, Photogrammetry, Cartography and Engineering Surveying, involving in 3 kernel techniques and 1 main application. With the development of the techniques and their integration and applications--incarnating the development in merging & infiltration of Sciences & Technologies, more and more universities are involved in this field.

The original two universities are still leading the way to refresh the old specialties and expand to create new specialties in this field, such as from Geodesy to Geodesy with GPS, Photogrammetry to Photogrammetry & Remote Sensing, Cartography to Cartography & GIS and new Cadastral Surveying & Land Management etc. And these two are also the first ones to have all the programs of surveying & mapping at all levels such as MSc, PhD and Post PhD etc.

Most universities started to run the programs on surveying & mapping, mainly due to their successful combination of surveying & mapping techniques with their original sciences (application fields). Here, we would like to mention 3 main typical universities.

China Mining University in Jiangshu Province has strong superiority on Mining and it made

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TS2.7 Descriptions of Curricula

2/8

Ning Jinsheng, Liu Yanfang and Liu Yaolin

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more efforts on introducing surveying & mapping techniques into mining and then expanded to be strong enough to run the programs of surveying & mapping at the levels of BSc, MSc and PhD. Tongji University in Shanghai is outstanding in Construction Engineering and Urban Planning and it is beneficial from combining surveying & mapping techniques with the construction engineering and urban planning specialties to carry out the programs on surveying & mapping at all different levels. Dalian College of Naval vessels in Liaoning Province has strong background in Navigation and Naval Vessels, and based on Hydrography and Chart Design it has also developed the programs of surveying & mapping at different levels.

### 3. THE COMPREHENSIVE CLUSTER OF MULTIPLE DISCIPLINES WITH THE KERNEL OF SURVEYING & MAPPING AT UNIVERSITIES

With the development of intersection and infiltration in related disciplines, the comprehensive cluster of many disciplines taking the discipline of surveying & mapping as a kernel is formed in many universities which is featuring with supported development each other, especially in Wuhan university.

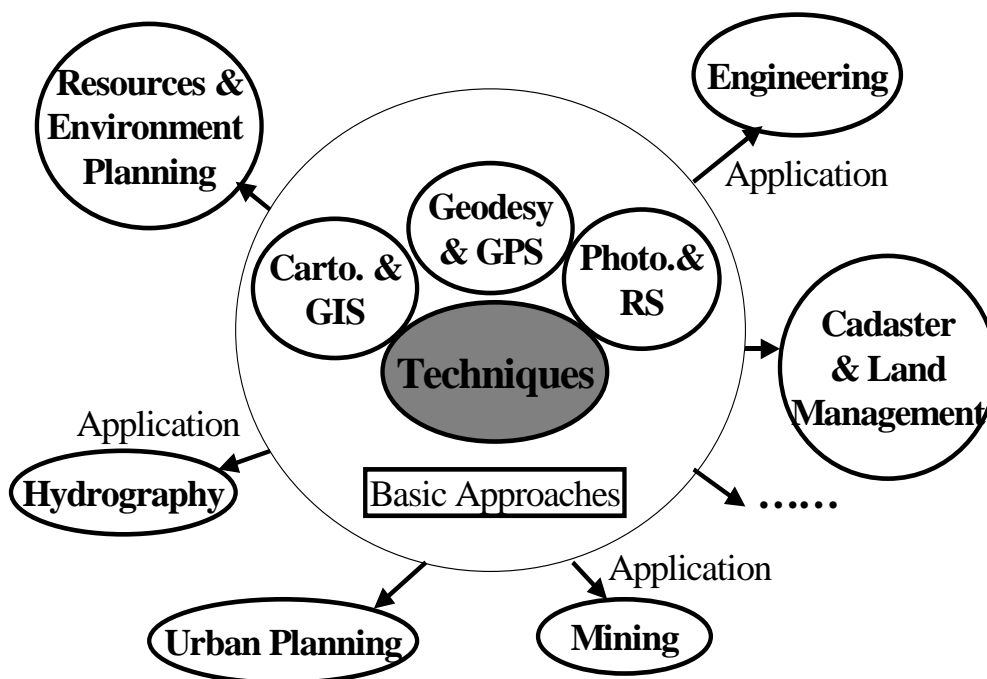


Figure 1. Framework of the Cluster of Multiple Disciplines

As shown in Fig.1, there are 3 main sub-technical fields and 6 main application fields. The techniques of surveying & mapping have played very important role in the social and economic development. As we are aware of, all these development of the techniques and their applications can not be achieved without the support of such basic methods and common approaches as mathematics, computer techniques and foreign languages.

#### 4. BASIC STRUCTURE OF MODELS

In general, there are 2500 teaching ours(45 min.)for lectures and experiments and 32 weeks for practices in the 4-years program. Normally, it accounts for about 160 credits. One credit stands for 16-18 hours for lectures, 32-36 hours for experiments and 64-72 hours / 2 weeks for practices.

All courses can be classified into common basic courses, specialized basic courses and specialized courses and indicated as lecture, or experiment, or practice, as well as characterized by compulsory or elective one. 70% or less of all courses are compulsory and 30% or more are elective. Generally, there are 50-55 courses in total.

Since we all notice that we have to produce professionals with wide knowledge, solid foundation, strong ability and nice personality through all the courses either theoretically or practically( of course, also by some extra-curriculum activities),normally common basic courses such as Philosophy, Elements of Law, Political Economics, Physics, Advanced Mathematics, Linear Algebra, probability & Statistics, Elements of computer Science, Database & its Application, Computer Language and English are designed to contribute to around 55% out of the compulsory courses. And 20% of the elective courses are occupied by such common basic knowledge courses as Music Appreciation, Calligraphy and Public Relationship etc.

So, it is clear that we need to figure out those specialized basic courses and specialized courses for surveying & mapping as the other 45% of the compulsory courses and 80% of the elective courses, which are the real spaces for us, Surveyors and Cartographers to perform, as shown in Fig.2.

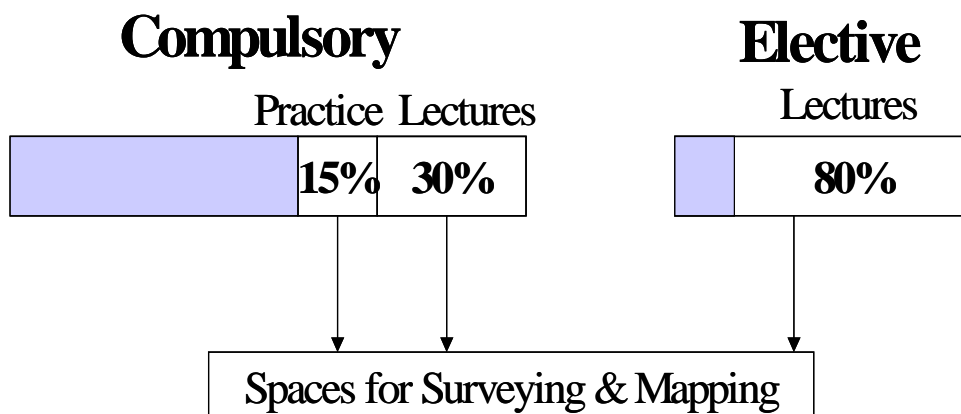


Figure 2 Spaces for Surveying & Mapping on the Curriculum

In general, within these spaces on the curriculum for surveying & mapping, each university can well design its own specialized basic courses and specialized courses according to its background, which is symbolized as different models with different distinguished features and superiorities.

## 5. DISTINGUISHED FEATURES AND DIFFERENT MODELS

For the 30% compulsory lectures, under the instruction of the Educational Guiding Committee of Surveying & Mapping of China, we have made great efforts on discussion and finally figured out 10-12 core courses as basic theories and knowledge that graduates entitled as the specialty of Surveying & Mapping must learn and grasp, which are accepted by almost all universities with surveying & mapping 4-years program, as shown in Table 1.

Table 1 Core Courses of Surveying & Mapping

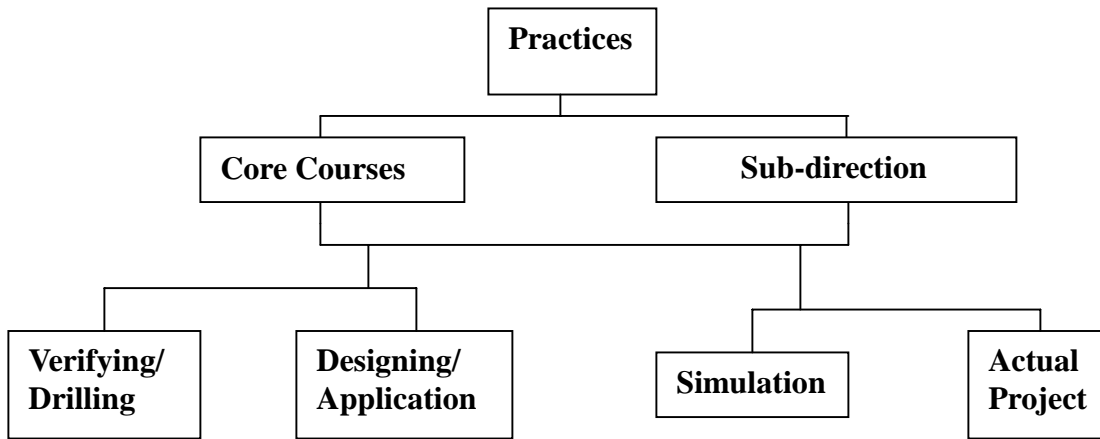
<b>Core Techniques</b>	<b>Basic Knowledge</b>	<b>Main Applications</b>
<b>Elements of Surveying &amp; Mapping</b> <b>Surveying</b> <b>Error Theory in Surveying</b> <b>Photogrammetry &amp; RS</b> <b>Geodesy</b> <b>Cartography</b> <b>Spatial Positioning Theory (GPS)</b> <b>Geography Information System</b>	<b>Geography</b>  <b>Computer Graphics *</b>	<b>Cadastral Surveying &amp; Land Management</b>  <b>Surveying Management *</b>

\* which are excluded by some universities.

9 main sub-direction courses on Geodesy & GPS, Photogrammetry & RS, Cartography & GIS, Engineering Surveying, Cadastral Surveying & Land Management, Mine Surveying, Urban Surveying & Urban Planning, Hydrographic Surveying, and Resources & Environment Planning are approved by the committee and most universities. Some universities can offer several sub-direction courses and some are regarded as compulsory ones.

All practices could be attached to either core courses or sub-direction courses, according to the actual situation of each university. And they also can be classified into verifying/drilling practice or designing/comprehensive applications of theories, as well as simulated ones or actual projects involved, as shown in Fig.3.

Here are some examples, as shown in Table 2, 3, 4, and 5



**Figure 3 Framework of the Practices**

Table 2 Courses for sub-direction of Mine Surveying in China Mining Univ.

<b>Courses Teaching Hours</b>	
<b>Mine Surveying</b>	<b>64</b>
<b>Engineering Surveying</b>	<b>32</b>
<b>Distortion Observation &amp; Subsidence Engineering</b>	<b>80</b>
<b>Resources Informatics</b>	<b>64</b>
<b>Elements of Mine</b>	<b>24</b>
<b>Mine Region Environment &amp; Land Reclamation</b>	<b>32</b>
<b>Assessment on Construction Projects</b>	<b>32</b>
<b>Management on Real Estate</b>	<b>32</b>
<b>Instruments of Surveying &amp; Mapping and Digital Surveying</b>	<b>56</b>
<b>Land Use Planning</b>	<b>32</b>
<b>Resources Economics</b>	<b>40</b>
<b>Software Design for Surveying &amp; Mapping</b>	<b>40</b>
<b>Town Planning &amp; Land Use</b>	<b>32</b>
<b>System Engineering &amp; Optimized Decision-making</b>	<b>40</b>
<b>Principles of Ecologic Environment</b>	<b>40</b>

Table 3 Courses for the sub-direction of Hydrography

<b>Courses Teaching Hours</b>	
<b>Hydrography</b>	<b>60</b>
<b>Ocean Gravity Surveying</b>	<b>50</b>
<b>Ocean Tide</b>	<b>40</b>
<b>Hydrographic Instrument</b>	<b>60</b>
<b>Ocean Engineering Surveying</b>	<b>50</b>
<b>Technical Design in Ocean Region</b>	<b>40</b>
<b>Suppositional topographic Environment</b>	<b>50</b>
<b>Ocean Hydrology</b>	<b>30</b>
<b>Ocean Meteorology</b>	<b>30</b>
<b>Chart Design &amp; Application</b>	<b>20</b>
<b>Automatic System for Hydrography</b>	<b>30</b>
<b>Map Projection</b>	<b>30</b>
<b>Orbit Theory</b>	<b>30</b>
<b>Mapping Aesthetics</b>	<b>40</b>
<b>Maintenance of Water Sonar Instruments</b>	<b>40</b>

Table 4 Practices for Cartography & GIS in Wuhan Univ.

<b>Practice Items Weeks</b>		
<b>Core</b>	<b>Digital Terrestrial Surveying</b>	<b>4</b>
	<b>Computer Operation</b>	<b>1</b>
	<b>Data Processing</b>	<b>1</b>
	<b>Photogrammetry &amp; Remote Sensing</b>	<b>2</b>
	<b>GPS</b>	<b>2</b>
	<b>Computer-aided Mapping</b>	<b>2</b>
	<b>GIS</b>	<b>2</b>
	<b>Graduation Project</b>	<b>10</b>
<b>Sub-direction</b>	<b>Geomorphology</b>	<b>2</b>
	<b>Map Design</b>	<b>4</b>
	<b>GIS design</b>	<b>2</b>

Table 5 Practices for Photogrammetry & RS in Wuhan Univ.

<b>Core</b>	<b>Digital Terrestrial Surveying</b>	<b>4</b>
	<b>Computer Operation</b>	<b>1</b>
	<b>Data Processing</b>	<b>1</b>
	<b>Photogrammetry &amp; Remote Sensing</b>	<b>2</b>
	<b>GPS</b>	<b>2</b>
	<b>Computer-aided Mapping</b>	<b>2</b>
	<b>GIS</b>	<b>2</b>
<b>Graduation Project</b>	<b>10</b>	
<b>Sub-direction</b>	<b>Special Photogrammetry</b>	<b>2</b>
	<b>4D Production</b>	<b>4</b>
	<b>Database Design</b>	<b>1</b>
	<b>Digital Image Processing</b>	<b>1</b>

## 6. CONCLUSIONS

As we can see from above models, both scope and depth, common basic foundation and distinguished features and superiorities for Surveying & Mapping based on techniques and their applications should be taken into account in the design of the curriculum at universities. When thinking about the common foundations, we have to focus on kernel techniques and main applications. We present 10-12 core courses for the 4-years program of Surveying & Mapping as compulsory courses. We have also mentioned 9 main sub-direction courses and each university can design its own and offer several groups of sub-direction courses ,according to their background. All model should pay more attention to the combination of theories with practices, and also to the combination of techniques with applications. We are sure with the well designed curriculum the discipline of surveying & mapping can play a very important role in the development of Economy and society.

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