

# LAND SURVEYING

## Department of Geography, Geology and Planning Missouri State University

Surveying is the art, science and technology of locating, establishing, defining and describing property boundaries, lines for construction, and the nature of the natural and artificial characteristics of the land. The results of today's surveys are being used to map the earth both above and below sea level. These maps include navigational maps and charts for use in the air, on the land, and at sea. Data gathered through surveying procedures is used to create data banks for land use and natural resources information which can aid in the management of our environment. As technology improves, surveying is helping us know more about the physical measurements of our planet as well as the moon and other planets.

Surveying is not the profession for everyone. If you enjoy mathematical computation which is associated with obtaining practical information, if you're interested in maps or map making and enjoy detailed measurements or exploration of the land, then surveying could be for you.

### Career Opportunities

College trained surveyors are currently in demand because of their broader background in mathematics, computer science, English composition and speech, and many other skills. College trained surveyors are new because degrees in surveying are new. The majority of today's practicing surveyors gained their knowledge by apprenticeship and extensive on-the-job training. These professionals and their employers now recognize that future surveyors need a broader background and better education to deal with the challenges that are now found in the field. Modern electronic and digital surveying equipment is now coupled with computers and plotters. A knowledge of computer applications is essential in today's market.

Professional surveyors work with attorneys, engineers, architects, community and regional planners, geologists, environmentalists, and the public in general. About half the surveying professionals are in private practice, either as the owners or the employees of private surveying firms. Outside of this consulting field, surveyors are employed by federal and state agencies.

The following are currently employers of surveyors:

U.S. Forest Service  
U.S. Geological Survey  
Bureau of Land Management  
U.S. Coast and Geodetic Survey  
State and Federal Departments of Transportation  
National Geospatial and Imaging Agency  
Independent Surveying Firms  
Independent Engineering Firms

The surveying profession can provide an opportunity for a pleasant indoor-outdoor balance in working conditions. In addition, there are many opportunities for travel to interesting localities.

### High School Preparation

Preparation in high school should include four years of mathematics including algebra, trigonometry and geometry; English; and a year each of chemistry and physics. In addition, courses in drafting, earth science, geography, and photography would be beneficial.

### Academic Program

The Department of Geography, Geology and Planning offers a comprehensive major in Geospatial Sciences for the Bachelor of Science (B.S.) degree with an emphasis in land surveying. With this major, a minor is not required. The curriculum consists of courses carefully selected in consultation with professionals from the National Geospatial and Imaging Agency, the United States Geological Survey, the Missouri Board for Architects, Professional Engineers and Land Surveyors, and map making companies. Students who major in this program will obtain professional training in cartographic drafting, analysis of available resource material, map planning and design, photogrammetric compilation, computer graphics, aerial photography interpretation and interpretation of remotely sensed imagery, practical land surveying, legal aspects of boundary surveying, surveying computations, projections and astronomical observations. Students who select this program will take courses that will prepare them for admission to the Land-Surveyor-in-Training program leading to qualification as a registered land surveyor.

**Rules of the Missouri Board For Architects, Professional Engineers, and Land Surveyors:**

According to Missouri statute No. 327.312, a person who wants to become a registered land surveyor must apply for the Land Surveyor-in-Training Program first. The rules are as follows:

**327312. Land Surveyor-in-Training applicant for examination and enrollment, qualification - certificate issued when.**

1. Any person may apply to the board for examination and enrollment as a land surveyor-in-training who is over the age of twenty-one, who is of good moral character, who is a high school graduate, or who holds a Missouri certificate of high school equivalence (GED), and either:

(1) Has graduated and received a baccalaureate degree from an approved curriculum as defined by board regulation which shall include at least twelve semester hours of approved surveying work as defined by board regulation of which at least two semester hours shall be in the legal aspects of boundary surveying; or

(2) Has passed at least sixty hours of college credit which shall include credit for at least twenty semester hours of approved surveying course work as defined by board regulation of which at least two semester hours shall be in legal aspects of boundary surveying and present evidence satisfactory to the board that in addition thereto he has at least one year of combined professional office and field experience in land surveying projects under the immediate supervision of a registered land surveyor; or

(3) Has passed at least twelve semester hours of approved surveying course work as defined by board regulation of which at least two semester hours shall be in legal aspects of land surveying and in addition thereto has at least two years of combined professional office and field experience in land surveying projects under the immediate supervision of a registered land surveyor. Under this provision, not more than one year of satisfactory post-secondary education work shall count as equivalent years of satisfactory land surveying work as aforementioned.

2. The board shall issue a certificate of completion to each applicant who satisfies the requirements of the aforementioned land surveyor-in-training program and passes such examination or examinations as shall be required by the board.

Missouri state board defined what constitutes a Baccalaureate Degree as it applies to the land surveyor-in-training program in section 4 CSR 30-14.020 of the Rules of Missouri Board for Architects, Professional Engineers and Land Surveyors as follows:

The approved curriculum for a baccalaureate degree as it applies to admission to the land surveyor-in-training program shall be deemed acceptable if the candidate holding the degree has achieved all of the credits in college level courses in accordance with the following table:

General Title	Representative Course in Semester Hours
Mathematics	Trigonometry, algebra, analytic geometry, statistics (8 hours)
Communication	Technical Writing, Speech (3 hours)
Legal Aspects of boundary surveying	Legal principles of surveying, Missouri surveying law, Legal principal and boundary control, Legal aspects of surveying (2 hours)
Science	Physics, geology, astronomy, dendrology, computer science, remote sensing, graphics (9 hours)
Surveying (A)	Surveying I, Surveying II, Land surveying, Land surveying systems, Fundamentals of Surveying, Advanced surveying, Electronic Surveying, Data adjustment (12 hours)
Surveying (B)	Subdivision Planning and Layout, Hydrographic Surveying, Photogrammetric Surveying, Route and Construction Surveying, Engineering and Geodetic Astronomy, Topographic Surveying, Cartographic Surveying (6 hours)

For the regulations for becoming a registered land surveyor, see section 327.314 of the Missouri statutes.

**Courses Required for the Surveying Option of the Comprehensive Bachelor of Science in Geospatial Sciences at Missouri State University.**

The following courses are required for the Geospatial Sciences Program.

GRY 100 World Regional Geography*	3
<b>or</b> GRY 108 Ecology and Society*	3
GRY 142 Introduction to Physical Geography*	4
<b>or</b> GLG 110 Principles of Geology*	4
<b>GRY 275 Introduction to Plane Surveying</b>	<b>3</b>
GRY 300 Geography of the United States	3
<b>or</b> GRY 301 Geography of the Ozarks	3
<b>or</b> GRY 305 Selected World Regions	3
GRY 360 Interpretation of Aerial Photography	3
GRY 363 Principles of Cartography	4
GRY 367 Research Methods in Geography and Planning	3
GRY 470 Field Study in Geography	2
GRY 498 Placement Seminar in Geography, Geospatial Science, and Planning	1
GRY 551 Remote Sensing	3
GRY 552 Photogrammetry	3
GRY 561 Intro to Geographic Information Systems	3
GRY 562 Internet Geospatial Science	3
GRY 566 Adv. Geographic Information Systems	3
CSC 121 Introduction to BASIC Programming	3
<b>or</b> CSC 125 Introduction to C++ Programming	3
<b>or</b> CIS 260 Application Development I	3
MTH 181 Trigonometry*	3
<b>or</b> MTH 138 Precalculus Mathematics*	5
MTH 340 Statistical Methods	3
<b>or</b> equivalent statistics course	3

In addition to the above courses, the student must take an additional 15 hours from the following list of courses. **(Students selecting the surveying option must include GRY 375, 377 and 379.):**

GRY 300 Geography of the United States	3
GRY 301 Geography of the Ozarks	3
GRY 305 Selected World Regions	3
GRY 320 Cultural Geography	3
GRY 321 Economic Geography	3
GRY 322 Urban Geography	3
GRY 323 World Political Geography	3
GRY 348 Geomorphology	3
GRY 351 Conservation of Natural Resources	3
<b>GRY 375 Advanced Surveying</b>	<b>3</b>
<b>GRY 377 Legal Aspects of Boundary Surveying</b>	<b>3</b>
<b>GRY 379 Surveying Computations</b>	<b>3</b>
GRY 507 Geography of Subsaharan Africa	3
GRY 553 Analytical Photogrammetry and Digital Cartography	2
GRY 560 Thematic Mapping	3

GRY 563 Analytical and Automated Geographic Information Science	3
GRY 575 Satellite Surveying and Navigation	3
IDM 110 Industrial Design with Computer Applications	3
IDM 211 Residential Architectural Drafting	3
MTH 261 Analytic Geometry and Calculus I	5
<b>or</b> MTH 287 Computational Calculus and Analytical Geometry I	3
MTH 280 Analytic Geometry and Calculus II	5
<b>or</b> MTH 288 Computational Calculus II	3
CIS 270 Application Development II	3
CIS 321 Information Systems Analysis and Design	3
CIS 324 Computer Technology I	3
CIS 326 Database Management Systems Concepts and Design	3
CIS 528 Database Management Systems Implementation	3
CSC 131 Introduction to Computer Science I	3
CSC 232 Introduction to Computer Science II	3
CSC 335 Database Systems Concepts	3
CSC 425 Computer Graphics	3

Some other recommended courses would include the following:

GRY 135 Atmospheric Science*	4
GLG 171 Environmental Geology*	4
GLG 472 Geohydrology	3
AST 115 Basic Astronomy*	4
BIO 339 Identification of Woody Plants	2
PHY 123 Introduction to Physics I*	4
<b>or</b> PHY 203 Foundations of Physics I	5
PHY 124 Introduction to Physics II	4
<b>or</b> PHY 204 Foundations of Physics II	5

\* These courses will satisfy general education requirements.

General Education courses will take care of most of the mathematics and communications requirements. We strongly recommend that the student seeking a degree in this program select each semester's courses in close consultation with his/her academic advisor.

**Non degree seeking routes**

Many states now require a Baccalaureate Degree as a requirement to become a licensed land surveyor, and we anticipate that Missouri may adopt such a requirement in the future. However, at the present, it is still possible for an individual to qualify as a land-surveyor-in-training without the B.S. degree according to section 327.312.1(3) of the Rules of the Missouri Board for Architects, Professional Engineers and Land Surveyors. The following four courses at Missouri State are designed to satisfy the

requirement of “*twelve semester hours of approved surveying course work*” specified in that section:

<b>GRY 275 Introduction to Plane Surveying</b>	<b>3</b>
<b>GRY 375 Advanced Surveying</b>	<b>3</b>
<b>GRY 377 Legal Aspects of Boundary Surveying</b>	<b>3</b>
<b>GRY 379 Surveying Computations</b>	<b>3</b>

Each of these four courses is taught by a member of the local professional land surveying community, and each is offered in the evening to accommodate students who are currently employed by local surveying companies.

## **Faculty and Facilities**

The Department of Geography, Geology and Planning is staffed by 21 full-time faculty members. The department occupies lecture and laboratory space in Temple Hall on the University’s Springfield campus.

The surveying portion of the program is housed in Temple Hall where all the surveying courses are taught. Space for instruction is available in several lecture rooms and laboratories. A large portion of the instruction in surveying actually takes place outside of the classroom utilizing courses laid out on and near the University campus where actual surveying projects are conducted by students in the course. Adequate surveying equipment is available for the surveying courses including transits, levels, theodolites, electronic distance measuring equipment, Global Positioning System instruments, alidades, and computers with surveying software.

The cartographic facilities are housed in Temple Hall where most of the core mapping courses are taught. Two laboratories are equipped with modern cartographic equipment and computers. Students have access to two work stations and 16 terminals for automated cartography. The primary software package used for mapping is ARCGIS. A second laboratory with fifteen computers is used mainly for photogrammetry and remote sensing using ENVI and FEATURE ANALYSIS software. A Hewlett Packard LaserJet color printer and a 36 inch color plotter are available as output devices. Large and small digitizing tablets are also available for capturing data.

The Missouri State University library houses a large collection of cartographic materials including topographic maps, aerial photography, and other types or remote sensing imagery for Missouri and portions of other states.

## **Missouri State University Surveying Program and the Surveying Community**

The surveying program at Missouri State University has been developed with the assistance of the Missouri Board for Architects, Professional Engineers and Land Surveyors and the Ozark Chapter of the Missouri Society of Professional Surveyors. This relationship continues through a committee of Professional Surveyors who serve as advisors to our program to ensure that our courses are timely and serve the needs of the profession.

### **For more information:**

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