

What to study for FS exam

A Topographic Survey locates all surface features of a property, and depicts all-natural features and elevations. In essence it is a 3-dimensional map of a 3-dimensional property showing all natural and man-made features and improvements.

A Break Line: is a three-dimensional line in a digital mapping environment used to represent a sudden or abrupt change or break in the terrain's smoothness.

A Contour Line: is a line connecting places of equal elevation.

Easements: are shown on the survey and are usually delineated by dashed lines. Easements are not ownership, but are "Rights", usually for a specific use.

Utility Easements: is one that has been given in writing to a utility company

Private Easement: a property owner may sell an easement to someone else- for example to use as a path or driveway or for a sewer or solar access.

Prescriptive Easement: someone can acquire an easement over another's land for a particular purpose, such as accessing their home

If there are two manholes within 5 feet of a property line why do you pick them up? **Because it is evidence that there is an easement**

Levelling: is a process of determining the height of one level relative to another. It is used in surveying to establish the elevation of a point relative to a datum, or to establish a point at a given elevation relative to a datum

The **"Priority of Calls"** should be considered as the road map for the practicing surveyor when creating descriptions of land boundaries, when retracing descriptions of land parcels and when attempting to evaluate conflicting elements in land descriptions of parcels being surveyed

The **"Priority of Calls"** can be applied in at least two instances:

- 1) When new legal descriptions are created to define new parcels of land.
- 2) When retracing parcels that were previously created in written descriptions

Priority of calls

- 1) Lines actually run in the field and proven from evidence
- 2) Monuments and/or Boundaries set and called for in the description
 - A. Natural Monuments
 - B. Artificial Monuments
- 3) Ad joiners (if Senior)

- 4) Courses
 - A. Bearings then Distances (Metes and Bounds States)
 - B. Distances then Bearings (GLO States)
- 5) Recitation of Area A. May be controlling B. May be evidentiary
- 6) Coordinates

Hierarchy of Evidence

- 1) **Senior Rights**: the formation of a parcel prior to another
- 2) **Writings**- deeds or other written forms of conveyance
- 3) **Intent of conveyances**- written intent of transference
- 4) **Calls for surveys**-Reference to surveys in written documents
- 5) **Monument**-physical markers called for in written documents
 - a. Natural-stream, ridges, trees
 - b. Artificial-Fences, posts, iron pins, pipes
 - c. Record-Monuments called for that no longer exist but whose location is readily identifiable
- 6) **Measurements**-Those that are called for on writings
 - a. Direction-Bearings or angles
 - b. Distance-Feet, meters, rods
 - c. Area, Acreage, SQ Feet, hectare

Encumbrances include liens, deed restrictions, easements, encroachments, and licenses

Liens can come from a variety of directions. If you don't pay your property taxes or your income taxes, you can have a lien placed against your property.

Deed restrictions: the name implies, are written into deeds. They pass from owner to owner forever. So, if a property owner decides to sell and has a restriction placed in a deed as to what future owners can or cannot do on the property, it's an encumbrance.

Encroachments: suppose a neighbor is unclear about a property line and places a fence a foot into another's property. That's an encroachment. It will be noted in surveys and title insurance policies until removed.

Fee Ownership- means the person who owns the fee simple title to the real property leased under a property development and the person's heirs, successors, legal representatives, and assigns.

Random Errors- usually result from the experimenter's inability to take the same measurement in exactly the same way to get exact the same number. Systematic errors, by contrast, are reproducible inaccuracies that are consistently in the same direction.

What type of scale does not change when an aerial photo is enlarged or reduced?

Engineers scale, graphic scale, architect scale

National Geodetic Survey (NGS): provides Information about survey marks (including bench marks) in text datasheets or in GIS shapefiles.

Data Sheet: is an ASCII text file which contains data for a survey control station. Datasheets for horizontal control stations show precise latitude and longitude. Datasheets for vertical control stations show precise orthometric heights. Other data includes geoid height, state plane coordinates, description of how to reach the mark, and recovery information.

NOAA's National Geodetic Survey (NGS) provides the framework for all positioning activities in the Nation. The foundational elements of latitude, longitude, elevation, and shoreline information impact a wide range of important activities.

Non-navigable Stream Boundaries

If the boundary between two properties is a non-navigable stream, the property runs to the "thread" or center of the main current. Each property owner would control essentially half. This is presumed to be the intent of the deed unless otherwise is specifically stated.

Navigable Stream Boundaries

If the boundary is a navigable river or stream, the boundary line only extends to the low-water mark of the riverbed. The term "navigable stream" means a stream which is capable of transporting boats loaded with freight in the regular course of trade either for the whole or a part of the year. This provision is not applicable to ocean tidewaters, nor to any bay, estuary, or arm of the sea.

Moving Channels

If the current changes gradually, then the boundary line changes as well. On the other hand, if the channel changes suddenly, the boundary remains where it was. See the discussion of accretion and avulsion, below.

Lakes and Ponds

Boundary at edge

Lakes and ponds differ from streams in not have currents. Therefore, the boundary line is considered the low water mark. This is a presumption, and may be modified by more explicit grants.

Temporary Ponds

If the pond is created by damming a stream, it is possible that the property underneath will continue to run to the former boundary. If the artificially pond has existed for many years, it can come to be considered permanent.

Currents in Ponds and Lakes

Problems have arisen when there is a detectable current in a lake or river. In such cases, there is an argument to use the rule for streams, rather than the rule for lakes.

Ownership of Bed

If a lake or reservoir is created on particular persons' property, those persons own the bed of the lake, and can fence it off and exclude others. The boundary would accord with the boundary of the submerged lands.

Ocean and Tidewaters

This category of boundary includes bays, estuaries, harbors, marshes, beaches, tidelands and the open sea. This boundary is the high-water mark. The general interpretation is that the area between high and low tide, including coastal marshes, is held by the state in trust for the public. That area is called the "foreshore" and is defined as the "strip of land that lies between the high and low water marks and that is alternately wet and dry according to the flow of the tide." The State Department of Natural Resources determines the rights of coastal landowners for water access.

Riparian Rights refers to the rights of owners with property adjacent to streams, lakes and other waters.

1. Generally

Every riparian owner is entitled to a reasonable use of the water in the stream, as it flows naturally across his property, subject to the disturbances caused by other owners' reasonable use of the water before it gets to him. Riparian proprietors have a common right in the waters of the stream. The natural flow cannot be diverted to, for example, create a new watercourse, but irrigation is a reasonable use.

The question of water rights, that is, the right to use the water, is distinct, from the right to go on the water and boat, fish or swim. Owners with property bordering on a watercourse generally have a right to reasonable use of the water itself, but not necessarily a right to go on the water. Non-riparian owners (i.e., owners owning land not adjacent to the water) can acquire the rights to water from riparian land, and water from riparian land can be used on non-riparian land (land not adjacent to water).

2. Rivers and Streams

For non-navigable streams, the boundary line, as discussed above, goes to the thread of the stream. The owner on either side of a non-navigable river would therefore own the riverbed out to that point, and would have not only the right to use the water, and the riverbed, but would have the right to exclude others from passage, fishing, swimming and boating.

For navigable waters, the riverbed is considered in general to belong to the public, because the boundary is only to the low-water mark. At common law, grants of land from the state bounded on rivers above tide-water, or where the tide does not ebb and flow, were to the thread of the river. Providing that where the river is navigable, the rights of the owner of adjacent land extend only to the low-water mark of the riverbed, became effective with the adoption of the Code of 1863, and therefore does not apply to grants that predate that Code. Hence, as a practical matter, many navigable grants run to the center of the stream, but the public still has a right of passage. Such owners could prevent the taking of minerals from the riverbed, or from fishing the stream, however. Even in a latter-day navigable stream situation, the owner can prevent fishing down to the low water mark--requiring the fisher to use a boat.

3. Title to Islands

Islands in streams and rivers have to be considered carefully, by looking at the original grant. If the grant predates 1863, see above, then it can be read as going to the thread or center of the current, and that may encompass an island on that side of the centerline of the main current. Whether the island is connected at low water to one side effects its ownership as well.

4. Title to Underwater Minerals

The right to mine soil, sand, gravel, minerals and other valuables from the bed of a river, stream or lake belongs to the owner of the bed. In the case of a non-navigable stream, or a navigable stream which grant predates 1963, therefore, ownership is split between the two adjacent property owners.

5. Lakes, Ponds and Submerged Lands

a. Lake and Ponds

The boundary owner has rights to use the water, but not to boat, fish or swim, because he has no rights to the bed of the lake. Those rights belong to the owner of the bed of the pond or lake, who has an action in trespass against one who fishes, boats or swims without permission. However, if the grant of land convey the entire pond or lake, or all property surrounding the lake, that property owner owns the entire bed. That owner has the right to fish, boat and swim on the lake. *Lanier v. Ocean Pond Fishing Club*, supra.

b. Permanency

Permanency of the pond is relevant, because if it has just been created by damming a stream, each side's owners can claim the boundary to the middle. If it has long existed, the more common rule can said to apply, absent clearer deeds. The practical advice when creating a lake,

is to properly reflect the intent of ownership on the deeds, whether it includes some specific portion of the bed, based on the prior lines, whether it includes some common interest in the bed, as might be wise in a subdivision, or whether it is merely the boundary.

Tidal Areas

Ownership in tidal areas (beaches, marshes, estuaries, bays, harbors, etc.) extends only to the high-water mark, and the State has the right to the foreshore. A 1902 Act granted to adjoining landowners the exclusive right to harvest shellfish (e.g., oysters) from the foreshore in navigable tidewaters.

FLOOD PLAINS

Flood plains do not raise a boundary problem, but they can impact title issues. Not until relatively recently had Georgia Courts considered the issue as to whether location of a property in a flood plain was a defect on the title. The Supreme Court concluded that a difference exists between economic lack of marketability, which relates to physical conditions affecting the use of the property, and title marketability, which relates to defects affecting legally recognized rights and incidents of ownership. One can hold perfect title to land that is valueless; one can have marketable title to land while the land itself is unmarketable. The Court concluded that although location of part of the property in a flood plain may affect its market value, it does not affect the marketability of title to the property, and therefore is not a title defect.

ACCRETION, AVULSION AND EROSION

1. Accretion

Accretion is the process of growth or enlargement by a gradual buildup, and in boundary law, the relevant concept is the increase of land by the action of natural forces. The gradual accretion of land, and the gradual change of the water's thread, can change the boundary line.

The gradual accretion of sand between an island and the mainland, to the point where it connects to the mainland, would vest title in that island with the adjoining property owner. Similarly, to the extent accretion alters the thread of a current to go around the other side of an island, the ownership would change.

The gradual accretion of land by the effect of tides and so forth, is treated the same way--to the extent it moves the high-water mark further out, it adds property to the adjoining landowner.

2. Avulsion

Avulsion is a sudden cutting off of land by flood, currents, or change in course of a body of water. Relevant to boundary disputes is when the change in the flow of a watercourse separates land from one person's property and joins it to another's property. Avulsion leaves the boundary in the center of the former channel, even if no water is flowing therein. *James v. State, supra*.

Avulsion in a coastal area, of course, simply destroys property and moves the boundary, as there is no opposite bank to gain.

3. Erosion

Erosion is the gradual diminution of property, and is essentially accretion in reverse. To the extent the thread of the current moves gradually, the boundary line moves. This would occur at the bend in the river, as one side accreted sand and the other side, absorbing the force of the river, eroded away.

Erosion in a coastal area, to the extent it moves the high tide area back (for example, after a hurricane), can be said to move the property line back. Of course, the state can acquiesce in efforts to restore destroyed beaches and move the high tide area further out.

Man-made erosion is a different story. If an upper riparian landowner alters the watercourse to cause damage and erosion to another landowner, he can be liable in nuisance and trespass.

WETLANDS

Wetlands do not impose traditional water boundary issues, in that wetlands are essentially treated like any other property. If the issue is marshy areas that experience a tide, that property is property of the state. If the issue is an extremely swampy area that is completely on one parcel, that owner would have the rights to the use of the water and the bed. A more complex issue might result from a situation where the boundary is a very watery swamp that divides several property owners. Of course, if a current could be determined, as sometimes occurs, then the river boundary law could be logically applied. The difficulty would come depending on the description in the deed. If the deed referred only to the boundary of a river swamp, it would be difficult to determine what was meant.

It is doubtful that any current could be discerned, in which case it would likely be treated as a lake. Of course, as a side note, with any wetlands, the Federal Clean Water Act and other acts will apply and constrict what actions can be taken. That level of federal control probably explains the dearth of cases disputing the land in swamps, which can no longer easily be drained and filled.

High/Low Tides and How Stations Relate: The alternation of high and low tides is caused by the daily (or diurnal) rotation of the solid body of the Earth with respect to these two tidal bulges and the tidal depression. The changing arrival times of any two successive high or low tides at any one location are the result of numerous factors. Fundamental tide producing forces have two components due to the Sun (solar) and the Moon (lunar).

GIS

Attribute data can be store as one of five different field types in a table or database: **character**, **integer**, **floating**, **date**, and **BLOB**.

The Character Property: is for text based values such as the name of a street or descriptive values such as the condition of a street. Character attribute data is stored as a series of alphanumeric symbols.

Numerical Values: within the integer type, there is a further division between short and long integer values. As would be expected, short integers store numeric values without fractional values for a shorter range than long integers.

Floating point: attribute values store numeric values with fractional values. Therefore, floating point values are for numeric values with decimal points (i.e numbers to the right of the decimal point as opposed to whole values).

Date/Time Data: Date fields contains date and time values.

BLOB Data: BLOB stands for binary large object and this attribute type is used for storing information such images, multimedia, or bits of code in a field. This field stores object linking and embedding (OLE) which are objects created in other applications such as images and multimedia and linked from the BLOB field

Attribute - A characteristic of a geographic feature, typically stored in tabular format and linked to the feature in a relational database. The attributes of a well-represented point might include an identification number, address, and type.

Base Layer - A primary layer for spatial reference, upon which other layers are built. Examples of a base layer typically used are either the parcels, or street centerlines.

Buffer - A zone of a specified distance around a feature.

Computer Aided Design (CAD) - An automated system for the design, drafting and display of graphically oriented information.

Coordinate - An x,y location in a Cartesian coordinate system or an x,y,z coordinate in a three dimensional system. Coordinates represent locations on the Earth's surface relative to other locations.

Database - A logical collection of interrelated information, managed and stored as a unit. A GIS database includes data about the spatial location and shape of geographic features recorded as points, lines, and polygons as well as their attributes.

Digital Elevation Model (DEM) - Terrain elevation data provided in digital form.

Digitize - To encode map features as x,y coordinates in digital form. Lines are traced to define their shapes. This can be accomplished either manually or by use of a scanner.

Geocode - The process of identifying a location by one or more attributes from a base layer.

Geographic Information System (GIS) - An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.

Global Positioning System (GPS) - A satellite based device that records x,y,z coordinates and other data. Ground locations are calculated by signals from satellites orbiting the Earth. GPS devices can be taken into the field to record data while walking, driving, or flying.

Layer - A logical set of thematic data described and stored in a map library. Layers act as digital transparencies that can be laid atop one another for viewing or spatial analysis.

Metadata – Information about a data set. It may include the source of the data; its creation date and format; its projection, scale, resolution, and accuracy; and its reliability with regard to some standard.

Ortho Imagery - Aerial photographs that have been rectified to produce an accurate image of the Earth by removing tilt and relief displacements, which occurred when the photo was taken.

Scale – The ratio or relationship between a distance or area on a map and the corresponding distance or area on the ground.

Spatial Analysis - The process of modeling, examining, and interpreting model results. Spatial analysis is useful for evaluating suitability and capability, for estimating and predicting, and for interpreting and understanding.

Structured Query Language (SQL) - A syntax for defining and manipulating data from a relational database. Developed by IBM in the 1970s, it has become an industry standard for query languages in most relational database management systems.

Theme – An ArcView theme stores map features as primary features (such as arcs, nodes, polygons, and points) and secondary features such as tics, map extent, links, and annotation. A theme usually represents a single geographic layer, such as soils, roads, or land use.

Polygons: are used to represent areas such as the boundary of a city, lake, forest, they're 2d

Point: is a discrete location on the surface of the planet, represented by an x-y coordinate pair.

Lines: are used to represent the shape and location of geographic objects, such as street centerlines and streams, too narrow to depict as areas.

Raster Images: are created with pixel-based programs, JPG, GIF, PNG, and are widely used on the web

Vector Graphics: are created with vector software, used in CAD, engineering, and 3d graphics
CLEARER

A Subdivision or Resub division Map: is a type of survey intended to depict and/or note the layout of lots and the associated public or private highways, easements and lands and is intended for submission to applicable regulatory entities.

Peg tests: The two-peg test is very simple, but provides a way to test the accuracy of a level

Snell's law: Fermat's Principle of optics says that light rays always follow a path between two locations that is a minimum, maximum, or stationary point (though usually a minimum) with respect to time.

Seismic refraction surveys generate seismic waves that are refracted back to Earth's surface from velocity and density discontinuities at depth.

Mineral rights: *are often sold separately from the land they are on.* You may have title to the mineral rights on a property you own, or a previous owner may have sold or leased them – in which case, they may not be yours to sell.

When you own real property, you have certain rights that go along with that ownership, including:

- 1) Right to possession
- 2) Right to control
- 3) Right to use and quiet enjoyment
- 4) Right to allow others a right to use (licenses and leases)
- 5) Right to privacy and to exclude others
- 6) Right to disposition or to transfer the property to someone else by selling, gifting or inheritance
- 7) Right to use property as collateral through a mortgage

Common Law principles

Real property rights are determined according to the laws in effect in the particular locale where the land is located. English common law is the predominant law, and it is described as the *lex loci*.

A deed is a formal written document that has force in law to alter the rights and duties of the parties to it. To be effective a deed has to be signed, sealed and delivered. The following kinds of deeds may have relevance when investigating the position of a boundary or of a right of way.

A Conveyance (or Deed of Conveyance) is the document by which the sale of a parcel of *unregistered* land is effected. The estate agent may sell you a house (which happens to have a garden around it), but your conveyancing solicitor will tell you (if you should ask him) that you are buying a parcel of land (which happens to have a house upon it) together with all the benefits that come with the land but burdened by any easements that affect the land and burdened by any charges (such as the mortgage loan that enabled you to buy the land) that affect the land.

A Transfer Deed is the document by which the sale of a parcel of *registered* land is effected. In practice, the transfer deed is a Land Registry pro-forma.

A Deed of Grant is the deed used to create a new easement, such as a private right of way, or a right to lay pipes or cables beneath neighboring land. In practice, many such easements are granted at the same time as a new parcel of land is created by means of clause in the Conveyance (or the Transfer) that grants the right to the Purchaser (or the Transferee) or reserves the right to the Vendor (or the Transferor).

A Deed of Extinguishment is the deed used to terminate the right to use a private right of way.

A Deed of Variation is used to vary the terms of an earlier deed relating to the same matter. One example of its use is to correct an inaccurate description of the boundary in the parcels clause of an earlier Conveyance that relates to the same parcel of land. Another example is the deliberate re-routing of a private right of way across the servient tenement.

PLSS- Public Land Surveying System: The Public Land Survey System (PLSS) is a way of subdividing and describing land in the United States. PLSS surveys, which are available for portions of land in 30 southern and western states, are made by the Bureau of Land Management (BLM). The PLSS typically divides land into 6-mile-square townships. Townships are subdivided into 36 one-mile-square sections. Sections can be further subdivided into quarter sections, quarter-quarter sections, or irregular government lots. PLSS was created to divide parcels of public land; it is not useful for the accurate location of points and should not be confused with coordinate systems like latitude/longitude, UTM, or the State Plane Coordinate System.

Real Property law: The **legal** definition of **real property** is land, and anything growing on, affixed to, or built upon land. This also includes man-made buildings as well as crops. **Real property** is best characterized as **property** that doesn't move, or that is attached to the land.

Historical methods of surveying

Ancient tribesman used ropes and pegs to plan out where structures were to be built. For early mapping, usually existing physical monuments such as rivers, mountains, and forests marked

borders between tribal territories and kingdoms. As societies grew and it became important to determine what land belonged to which group, natural boundaries no longer sufficed by themselves. Man-made boundaries such as cornerstones, walls, and lines of latitude and longitude become commonplace markers both on maps and in the physical world to establish boundaries.

The Egyptians and Romans both used variations of a tool called a Groma that allowed them to mark out right angles and straight lines for use in developing fields, towns, and roads. Although good at marking out two-dimensional angles, the elevation component—that is, the distance in the height of two points—was a somewhat more imprecise measure until the 15th century with the implementation of the Theodolite, which measures horizontal angles. Combined with the concepts of trigonometry, that is the study of the relationships between angles and their lengths, surveyors could accurately measure both the difference in distance and elevation between two points.

In 1620 an English mathematician and astronomer named Edmund Gunter described a surveyor's chain with 100 links, measuring 66 feet (22 yards or 4 poles) overall. By this design, one square chain equals 484 square yards, ten square chains equal an acre, and eighty chains equal a mile. Gunther's design proved extremely popular, especially in English lands. This example belonged to John Johnson (1771-1841), the Surveyor General of Vermont. It is made of steel, with round handles at either end, brass tallies every 10 links, and swivels every 25 links. Each link is joined to the next by three rings, and each unit (link and three rings) is 7.92 inches long.

The theodolite, which significantly advanced over the next hundred years through technology, maintained its status as the primary tool for surveying into the 20th century. At the end of the 20th century, robotic total stations and GPS base stations that connect to satellites have greatly advanced the accuracy and speed of the collection of survey data.

Magnetic declination

The compass points in the directions of the horizontal component of the magnetic field where the compass is located, and not to any single point. Knowing the magnetic declination (the angle between true north and the horizontal trace of the magnetic field) for your location allows you to correct your compass for the magnetic field in your area. A mile or two away the magnetic declination may be considerably different, requiring a different correction. NCEI has an on-line magnetic declination calculator where you can enter your location (or zip code for the USA) and get the Declination value. **Remember: east declination is positive, west negative.**

Fundamentals of Geodesy

To accomplish this, geodesy defines two basic reference surfaces: **reference ellipsoid and geoid.**

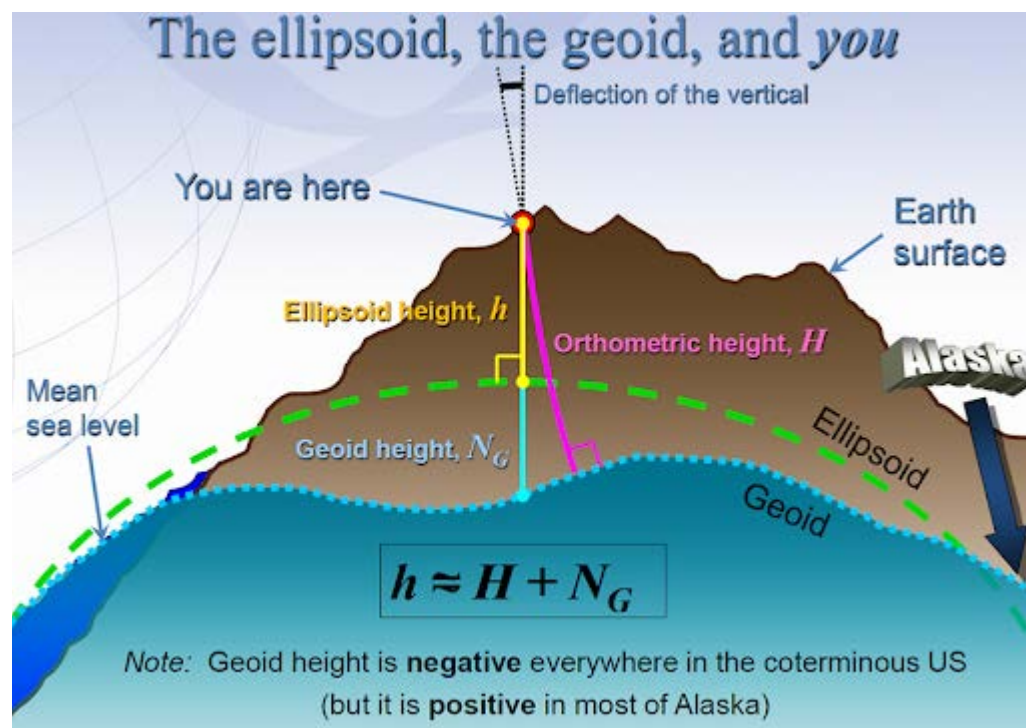
Earth has a spherical shape. However, it is not a perfect sphere, but is instead what is called an ellipsoid. In an ellipsoid, the radius is not constant and depends on the location over its surface. Using an ellipsoid to define the Earth's shape is more precise than assuming it has a spherical

shape, and is needed to create accurate cartography, especially when the represented surface is not too large.

The ellipsoid provides a theoretical expression of the Earth's shape, and the next step is to determine the parameters that define it. In the case of a sphere, the only parameter needed is the radius. In the case of an ellipsoid, two parameters have to be determined: the length of semi-major and semi-minor axis.

The WGS--84 ellipsoid is one of the most popular currently, and it is used by the GPS positioning system.

The other reference surface is the geoid, defined as the three-dimensional surface where every point has the same gravitational attraction. It is an equipotential surface that results from assuming average ocean levels and extending them under the Earth's surface.



In a general ellipsoid, both the location of its center of gravity and its equatorial plane match those of the Earth. In a local ellipsoid, this does not have to be true, and the ellipsoid by itself is not enough, since we do not know how to place it relative to the real Earth's surface.

The concept of datum solves this problem. A datum is the combination of a reference surface (the ellipsoid) and a point in which it is linked to the geoid. That point is called the fundamental point, and the ellipsoid is tangent to the geoid there. At the fundamental point, a line perpendicular to the geoid is identical to a line perpendicular to the ellipsoid.

Regarding the coordinate system, we have two main alternatives: using the elements of spherical geometry using the concepts of plane geometry. In the latter, we need a projection system to place the elements on the surface of the ellipsoid into a plane.

Geographical coordinates use a spherical coordinates system in which the location of every point is defined by two angular values: latitude and longitude. Lines of equal latitude are called parallels, while lines of equal longitude are called meridians.

Geographical coordinates are of great utility, especially when working with large regions. However, it is not a cartesian system, and it is difficult to perform tasks such as measuring distances or areas. To simplify operations like those, we need cartesian coordinates. To assign a plane coordinate to every point on the Earth's surface (which is not a plane), we must use a cartographic projection.

One of the most widespread projections nowadays is the Universal Transverse Mercator, which is the basis for the UTM coordinate system. This system is not just a projection, but a complete system of many of them. Earth's surface is divided in rectangular regions, and for each of them a different projection and a different set of geodetical parameters are used. It uses a single ellipsoid: WGS-84.

Redundancy means stations being measured more than once. It is a useful thing in trying to evaluate the accuracy or the correctness of a network.

As soon as three or more receivers are considered, the discussion of redundant measurement must be restricted to independent baselines, excluding trivial lines. In the real world, such a project is not done with 14 receivers nor with 2 receivers, but with 3, 4, or 5. The achievement of redundancy takes a middle road. Redundancy is then defined by the number of independent baselines that are measured more than once, as well as by the percentage of stations that are occupied more than once. While it is not possible to repeat a baseline without reoccupying its endpoints, it is possible to reoccupy a large percentage of the stations in a project without repeating a single baseline. These two aspects of redundancy in GPS/GNSS - the repetition of independent baselines and the reoccupation of stations - are somewhat separate.

GROUND TO GRID

When you measure a direction and distance in the map, you are working in grid measurements. If there is a ground to grid correction set, the direction, offset, and distance factors are applied to the grid measurements in reverse order to calculate the ground measurements. That is, the direction offset is subtracted from the grid direction, and the grid distance is divided by the distance factor.

Least squares adjustment is a model for the solution of an overdetermined system of equations based on the principle of **least squares** of observation residuals. It is used extensively in the disciplines of **surveying**, geodesy, and photogrammetry—the field of geomatics, collectively.

It additionally provides post-adjustment statistics such as standard deviations on the adjusted coordinates and observations, as well as error ellipses for the stations that allow the user to analyze the results and determine if the results are within the tolerances of the project.

What Is a Contract?

A contract is a legally enforceable agreement between parties to do something (or to not do something).

Any legal contract must contain certain elements. First, it must contain an offer. **The offer** is what someone is going to do, such as lease you a tractor, sell you a guitar, paint your house, or simply pay you.

Second, the offer must be accepted. **Acceptance** means that you agree to what is offered, without any changes. (If you make changes to the offer, it is typically considered a “counter-offer.” which must itself be accepted)

Third, it must represent the **intent** of both parties to enter into a legally binding agreement. In other words, both parties have to be aware that the agreement could be enforced by law.

Finally, it must contain consideration. **“Consideration”** means something of value, which is usually money, bargained for in exchange for the product or service that is being offered.

The parties have to be competent to enter into this agreement and they have to have entered into it voluntarily. These agreements can be oral, but naturally their enforceability increases if they are written. If the agreement is oral, it is still enforceable, but first you have to prove that it existed, which can sometimes be hard to do.

MATH

- Stadia tachometry
- Horizontal Curve
- Vertical Curves
- Traverse with area
- Cut and fill sections
- Simple Interest
- leveling questions
- Area
- Volume
- Slopes/Grades
- Statistics: Mean, median, mode,