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Mining — Vocabulary —

Part 1: Planning and surveying

Exploitation minière — Vocabulaire —

Partie 1: Planification et levé

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Foreword

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This document was prepared by Technical Committee ISO/TC 82, *Mining*.

A list of all parts in the ISO 22932 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 22932 series has been prepared in order to standardize and to co-ordinate the global use of technical terms in mining, for the benefice of the experts working on different types of mining activities.

The need for the ISO 22932 series arose from the widely varying interpretation of terms used within the industry and the prevalent use of more than one synonym.

Mining — Vocabulary —

Part 1: Planning and surveying

1 Scope

This document specifies the commonly used terms in mine planning and surveying. Only those terms that have a specific meaning in this field are included.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Planning

3.1.1 General terms

3.1.1.1
mining plan
integration of all information about a mining project, from geology, mining and metallurgy, to environment, security, society, etc., with the specific goal to define a project's feasibility

3.1.1.2
contingency plan
strategy and set of actions for responding to a specific situation in which something goes wrong (spill, fire, natural disaster, and other emergencies)

Note 1 to entry: Contingency plans prepare companies to respond to all possible worst-case scenarios.

[SOURCE: Guidebook for Evaluating Mining Project EIAs — Glossary, 2010]

3.1.1.3
plan
mostly large-scale drawing showing features, such as mine workings, geological structures, and outside improvements, on a horizontal plane

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.1.4
planning
predesign of the detailed *layout* (3.1.4.2), main *roadways* (3.1.6.24), and workings of a mine or group of mines

Note 1 to entry: The scheme usually involves the introduction of mechanical equipment for the working and transport of the coal or mineral. The selection of mining methods and machines properly adapted to the local conditions is part of planning.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.1.5
planning engineer
mining engineer responsible for mine *planning* (3.1.1.4), who is attached to the planning department of a large mine or a group of smaller mines and is qualified by training, experience, and technical qualifications to envisage new development work and coordinate the ideas of other experts such as a mechanization engineers, ventilation engineers, mining geologists

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.1.6
projection
<underground mining> *plan* (3.1.1.3) showing the proposed *direction* (3.2.12.7) and location of entries, rooms, shafts, fans, and watercourses

Note 1 to entry: Such projections commonly cover the entire property to be worked.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.1.7
project plans
series of plans of a proposed new colliery or *reconstruction* (3.1.6.23) which are drawn up for the purpose of obtaining approval of the project

[SOURCE: BS 3618-1:1969]

3.1.1.8
working papers
field and office notes and calculations relating to the plans, drawings and sections of a mine which are required by law to be preserved

Note 1 to entry: The working papers are sent to the district inspector of mines on the *abandonment* (3.1.5.2) of the mine.

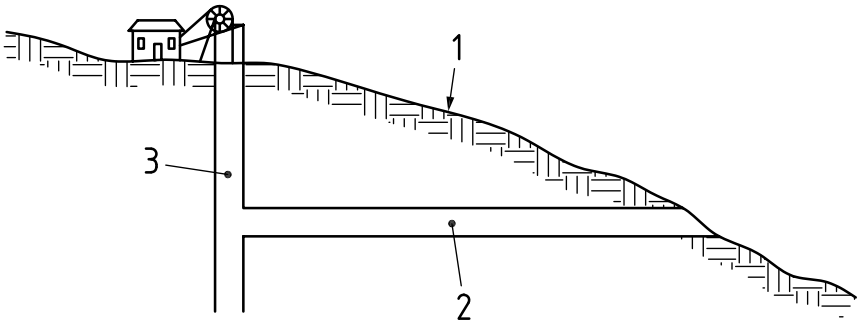
[SOURCE: BS 3618-1:1969]

3.1.2 Prospecting

3.1.2.1
adit
horizontal opening to an *underground mine* (3.1.6.32) from the surface

Note 1 to entry: See Figures 1 and 4.

[SOURCE: Glossary of Mining Terminology, Indigenous and Northern Affairs Canada, 2007]



Key

1 surface line
2 adit
3 shaft

NOTE SOURCE: Reference [22].

Figure 1 — Adit

3.1.2.2
isoresistivity plan
plan (3.1.1.3) showing lines of equal resistivity at a certain selected depth

Note 1 to entry: It is prepared from data obtained by the resistivity method of geophysical prospecting.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.3 Exploration

3.1.3.1
bore journal
tabular record of the characteristics and thicknesses of strata intersected by a borehole

[SOURCE: BS 3618-1:1969]

3.1.3.2
marketability test
test determining whether or not a discovered mineral deposit is "valuable" under the meaning of the law, i.e. whether or not the mineral can be extracted and marketed at a profit

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.1.3.3
reserve
quantity of mineral calculated to lie within given boundaries and described as the total (or gross), workable or probable working, depending on the application of certain arbitrary limits in respect of deposit thickness, depth, quality, geological conditions and contemporary economic factors

Note 1 to entry: See also *possible reserve* (3.1.3.3.1), *probable reserve* (3.1.3.3.2) and *proven reserve* (3.1.3.3.3).

[SOURCE: BS 3618-1:1969]

3.1.3.3.1
possible reserve
valuable mineralization not sampled enough to accurately estimate its tonnage and grade, or even to verify its existence

Note 1 to entry: See Reference [20].

3.1.3.3.2
probable reserve
area of mineral believed to lie beyond the developed reserve but not yet proven by development

Note 1 to entry: See Reference [20].

3.1.3.3.3
proven reserve
reserves that have been sampled extensively by closely spaced diamond drill holes and developed by underground workings in sufficient detail to render an accurate estimation of grade and tonnage

Note 1 to entry: See Reference [20].

3.1.3.4
sterilized coal
part of a coal seam which, for various reasons, is not mined

[SOURCE: BS 3618-1:1969]

3.1.4 Construction

3.1.4.1
alignment
act of laying out or regulating by line, of adjusting to a line

Note 1 to entry: See also *co-planning* (3.2.3.8).

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.4.2
layout
<planning> design or pattern of the main *roadways* (3.1.6.24) and workings

Note 1 to entry: The proper layout of mine workings is the responsibility of the manager aided by the *planning* (3.1.1.4) department

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.4.3
layout
<disposition> diagram showing disposition of machines in a mill's flow line

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.5 Mine closure

3.1.5.1
abandoned mine
abandoned workings
area formerly used for mining or mineral processing where closure has not occurred or is incomplete

[SOURCE: ISO 20305]

3.1.5.2
abandonment
abandonment of a mining claim, that can be by failure to perform work, by conveyance, by absence, and by lapse of time

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.5.3
mine closure planning
process that extends over the mine life cycle and that typically culminates in property relinquishment including planning for decommissioning and reclamation

[SOURCE: ISO 20305]

3.1.6 Exploitation

3.1.6.1
barrier
mineral or ground left unworked so as to separate workings from each other or from a natural hazard

[SOURCE: BS 3618-1:1969]

3.1.6.2
colliery plan
plan (3.1.1.3) of the mine workings, and sections of the shafts and seams being worked, which the colliery manager must keep at the pithead office in accordance with the regulations

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.6.3
composite plan
mine *plan* (3.1.1.3) showing the working in more than one work station

Note 1 to entry: Different working activities are usually distinguished by colors.

[SOURCE: BS 3618-1:1969]

3.1.6.4
contour plan
plan (3.1.1.3) drawn to a suitable scale showing surface contours or calculated contours of deposit seams to be developed

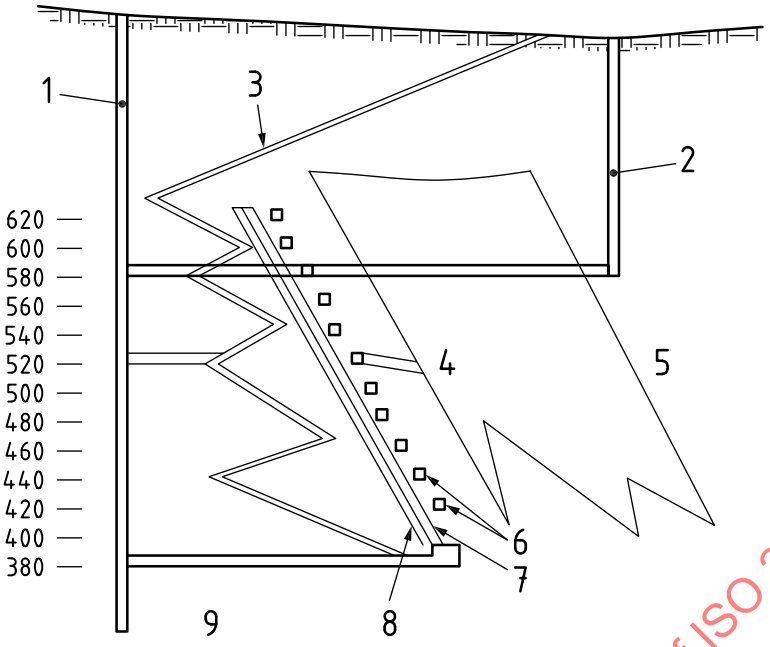
Note 1 to entry: These plans are important during the planning stage of a project.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.6.5
crosscut
small passageway driven at right angles to the main entry to connect it with a parallel entry or air *course* (3.2.12.4)

Note 1 to entry: See Figures 2 and 3.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]



Key

1	main shaft	4	crosscut	7	ore pass
2	ventilation shaft	5	ore body	8	waste pass
3	ramp	6	drifts	9	main level

NOTE SOURCE: Reference [23], reproduced with the permission of the authors.

Figure 2 — Crosscut

3.1.6.6
density
<seam spacing> *indication* (3.2.3.3) of the spacing of seams in the strata

Note 1 to entry: The seam density is said to be high if the seams are close together, or low if they are widely separated.

[SOURCE: BS 3618-1:1969]

3.1.6.7
density
<seam thicknesses> ratio of the sum of the thicknesses of a number of adjacent seams to the thickness of an arbitrarily chosen sequence of strata

[SOURCE: BS 3618-1:1969]

3.1.6.8
deputy's district plan
plan (3.1.1.3) required by law showing the limits of each deputy's district and the meeting stations

[SOURCE: BS 3618-1:1969]

3.1.6.9
development plan
plan (3.1.1.3) showing the proposed development of the mine workings, kept for operational purposes

[SOURCE: BS 3618-1:1969]

3.1.6.10
disused working
working which is no longer in operation but which is not classified as abandoned

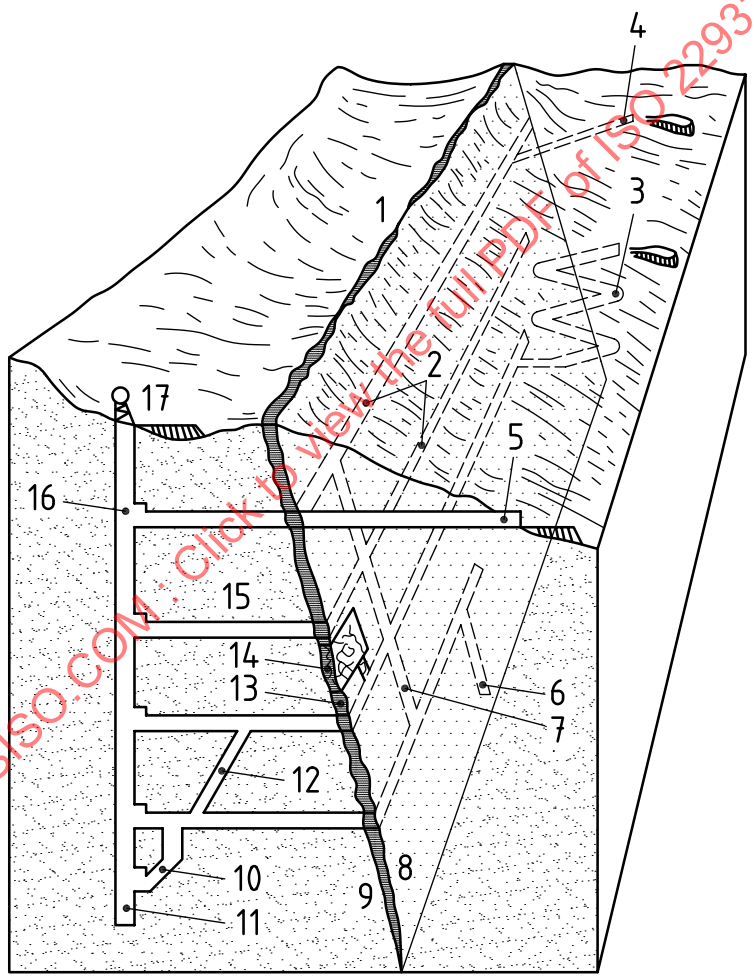
[SOURCE: BS 3618-1:1969]

3.1.6.11
drift
horizontal opening in or near a mineral deposit and parallel to the *course* (3.2.12.4) of the vein or long dimension of the deposit

Note 1 to entry: See Figure 3.

Note 2 to entry: Also an inclined haulage road to the surface[11].

[SOURCE: Surveying, theory and practice, Chapter 20: Mining surveys, 1966]



Key

1	vein outcrop	7	raise	13	pillar
2	drifts	8	hanging wall	14	stope
3	decline spiral (ramp)	9	footwall	15	crosscut
4	incline	10	loading pocket	16	shaft station
5	adit	11	sump	17	shaft collar
6	winze	12	ore pass		

Figure 3 — Drift

3.1.6.12
dust plan
plan (3.1.1.3) kept with the book in which stone-dust samples are recorded

Note 1 to entry: It shows the sampling zones in each *roadway* (3.1.6.24), distinguished by color, letter, number, or mark, and identified with that roadway.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.6.13
electrical plan
plan (3.1.1.3) required by law showing the position and details of certain electrical apparatus in the mine

[SOURCE: BS 3618-1:1969]

3.1.6.14
end line
<mining law> end lines of a claim, as platted or laid down on the ground, that mark its boundaries on the shorter dimension, where it crosses the vein

Note 1 to entry: If the claim as a whole crosses the vein, instead of following its *course* (3.2.12.4), the end lines are still the boundaries of the shorter dimension, even though they are along the course of the vein.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.1.6.15.1
entry
coal heading
underground horizontal or near-horizontal passage used for haulage, ventilation, or as a main way

[SOURCE: Glossary of Mining Terms. Kentucky Mining Institute]

3.1.6.15.2
entry
gate
working place where the coal is extracted from the seam in the initial mining

Note 1 to entry: It is not in an ore to be removed.

[SOURCE: Glossary of Mining Terms. Kentucky Mining Institute]

3.1.6.16
heading
<coal mining> passage leading from the gangway, commonly at right angles

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.6.17
holing
thirling
meeting of two *roadways* (3.1.6.24) driven expressly to intersect each other

[SOURCE: BS 3618-1:1969]

3.1.6.18
location plan
map (3.3.9.1), drawn to a suitable scale, showing the proposed mine development, shafts, works, etc., in relation to existing surface features

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.6.19
manager's plan
plan (3.1.1.3) of the workings kept at the office of the mine, in addition to the *working plan* (3.1.6.33), for everyday use by the manager

[SOURCE: BS 3618-1:1969]

3.1.6.20
pumping plan
plan (3.1.1.3) showing, in addition to the workings of a mine and the *seam contours* (3.1.6.25), the position of pumps, dams and waterlogged areas

[SOURCE: BS 3618-1:1969]

3.1.6.21
raise
secondary or tertiary inclined opening, vertical or near-vertical, driven upward from a level to connect with the level above, or to explore the ground for a limited distance above one level

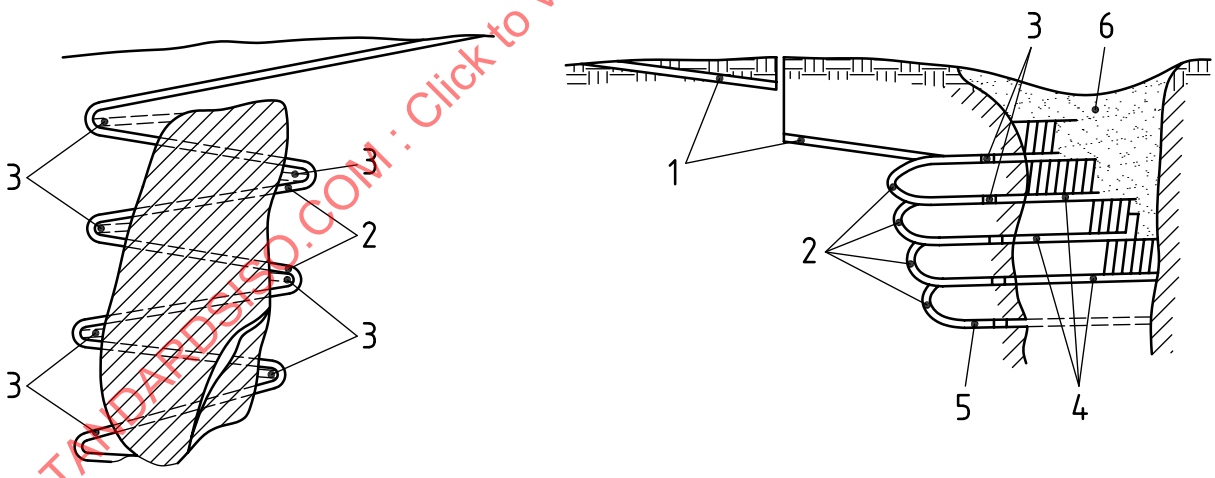
Note 1 to entry: See Figure 4.

[SOURCE: Glossary of Mining Terms. Kentucky Mining Institute]

3.1.6.22
ramp
secondary or tertiary inclined opening, driven to connect levels, usually driven in a downward *direction* (3.2.12.7), and used for haulage

Note 1 to entry: See Figure 4.

[SOURCE: Glossary of Mining Terms. Kentucky Mining Institute]



Key

1	decline	4	haulage drift
2	ramp	5	drifting
3	crosscut	6	caved rock

NOTE SOURCE: Reference [23], reproduced with the permission of the authors.

Figure 4 — Ramp

3.1.6.23
reconstruction
re-organization of the underground workings, improvement of surface facilities and/or re-equipment of an existing colliery to improve its efficiency and/or increase output

[SOURCE: BS 3618-1:1969]

3.1.6.24
roadway
road
gallery
underground passage driven and maintained to provide access to the mineral deposit or for haulage or ventilation purposes, or for men to travel in the mine

[SOURCE: BS 3618-8:1974]

3.1.6.25
seam contour
line, drawn on a *plan* (3.1.1.3), joining points on the floor of a seam which have the same height above a prescribed *datum* (3.2.2.12)

[SOURCE: BS 3618-1:1969]

3.1.6.26
sketch plan
plan (3.1.1.3), required by law to be posted in covered accommodation at the mine, showing telephone stations, means of egress from the workings to the surface, and the main roads

[SOURCE: BS 3618-1:1969]

3.1.6.27
supplementary plans
plans that can be required by law to show in greater detail information not easily depicted on the *working plans* (3.1.6.33)

[SOURCE: BS 3618-1:1969]

3.1.6.28
surface mine
mine in which the ore lies near the surface and can be extracted by removing the covering layers of rock and soil

[SOURCE: Guidebook for Evaluating Mining Project EIAs — Glossary, 2010]

3.1.6.29
surface plan
plan (3.1.1.3) of the surface *layout* (3.1.4.2) of a mine

[SOURCE: BS 3618-1:1969]

3.1.6.30
take
parcel
mineral *bearing* (3.2.8.6.1) area which a mine is permitted to work

[SOURCE: BS 3618-1:1969]

3.1.6.31
unconsolidated surface deposits
surface deposits such as moss, peat, sand, gravel, silt or mud

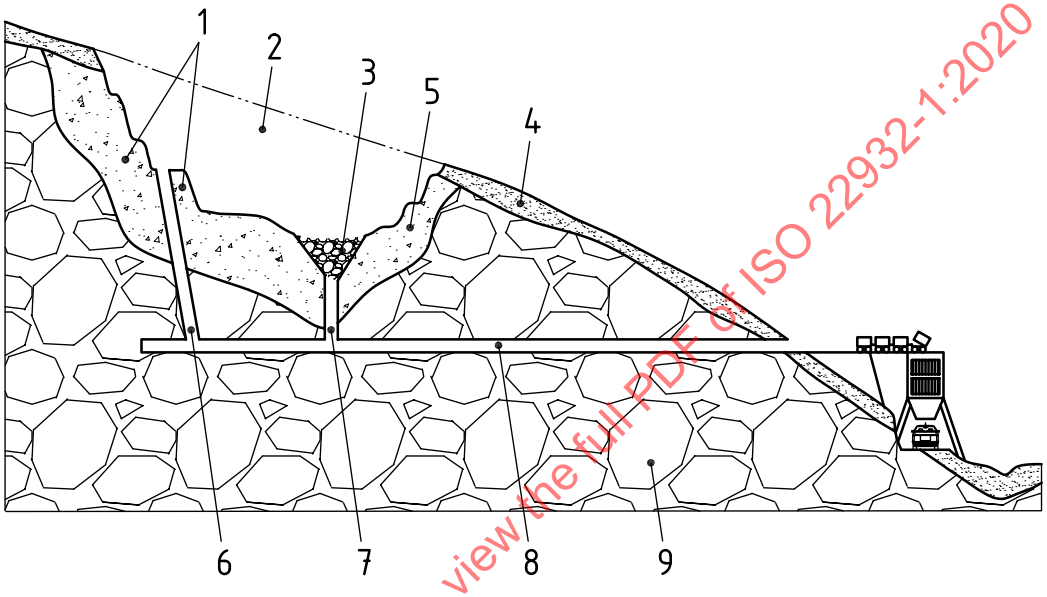
[SOURCE: BS 3618-1:1969]

3.1.6.32
underground mine
mineral extraction project where ore is extracted from the subsurface via underground mine workings such as *adits* (3.1.2.1), shafts, *drifts* (3.1.6.11), stopes.

Note 1 to entry: See Figure 5.

Note 2 to entry: An underground mine's ore is removed mechanically and transferred by shuttle car or conveyor to the surface.

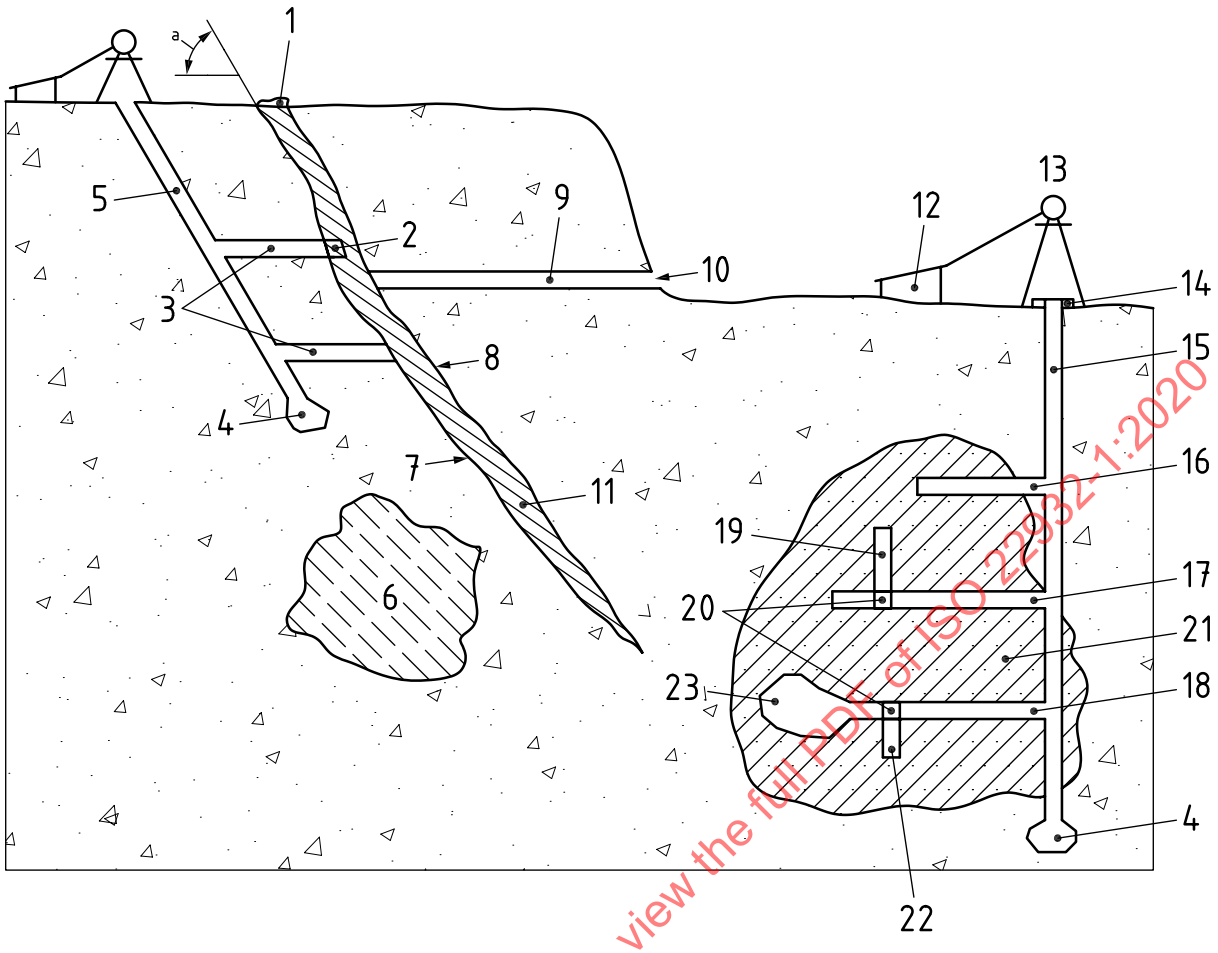
[SOURCE: Guidebook for Evaluating Mining Project EIAs — Glossary, 2010]



a) Underground mine

Key

1	bench	4	soil	7	ore pass
2	glory hole	5	ore	8	adit haulage way
3	broken ore	6	raise	9	wall rock



b) Cross section of an underground mine

Key

1	outcrop	9	adit	17	level 2
2	drift	10	portal	18	level 3
3	crosscut	11	vein	19	raise
4	sump	12	hoist house	20	drift
5	inclined shaft	13	head frame	21	massive or deposit
6	undiscovered ore	14	collar of shaft	22	winze
7	footwall	15	vertical shaft	23	stope
8	hanging wall	16	level 1	a	Dip.

NOTE SOURCE: Reference [14].

Figure 5 — Underground mine

3.1.6.33
working plan
plan (3.1.1.3) required by law showing all the current, disused or *abandoned workings* (3.1.5.1) within the boundaries of the mine and within a stipulated zone adjacent thereto

[SOURCE: BS 3618-1:1969]

3.1.7 Safety and rescue

3.1.7.1
cautionary zone
zone in which unworked coal lies at a specified distance or less from unconsolidated deposits or other sources of danger

[SOURCE: BS 3618-1:1969]

3.1.7.2
firefighting plan
plan (3.1.1.3) or chart showing the positions of items of firefighting equipment

Note 1 to entry: Separate plans are used for surface buildings and underground workings.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.1.7.3
rescue plans
sets of plans required by law that are suitable for use by rescue workers

[SOURCE: BS 3618-1:1969]

3.1.7.4
warning line
line drawn on *working plans* (3.1.6.33) to indicate the limit beyond which workings should not extend, e.g. because of the proximity of disused or *abandoned workings* (3.1.5.1)

[SOURCE: BS 3618-1:1969]

3.1.8 Ventilation

3.1.8.1
ventilation plan
plan (3.1.1.3) or drawing required by law showing the ventilation air currents in a mine and the means of controlling them

[SOURCE: BS 3618-1:1969]

3.1.8.2
ventilation planning
plans for a new projected mine or a new seam to be worked from an existing mine, showing the proposed ventilating system, including the quantities of air and pressures and the principal appliances to control and distribute the air

Note 1 to entry: Investigations and calculations are made to select a fan of the necessary type and size for the ventilation required.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2 Surveying

3.2.1 General terms

3.2.1.1
approved survey
survey (3.2.1.31.1) that has the *field notes* (3.2.1.11) approved and the *plat* (3.2.1.20) accepted by the organization official that has been delegated the authority for such action

Note 1 to entry: The terms *"approved survey"* and *"official survey"* are often incorrectly used as being synonymous with *"accepted survey."*

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.2
check survey
verification survey
survey (3.2.1.31.1) made to confirm the positions of established survey stations

[SOURCE: BS 3618-1:1969]

3.2.1.3
colliery surveyor
surveyor appointed to carry out *surveying* (3.2.1.32) work and to prepare plans and sections of a mine, but who is not the surveyor for the mine

[SOURCE: BS 3618-1:1969]

3.2.1.4
compass survey
survey (3.2.1.31.1) executed using the magnetic compass

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.5
conflicting evidence
contradiction or disagreement of the actual ground conditions compared to the record, usually regarding topographic calls or characteristics of *corner* (3.2.2.8) monumentation

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.6
control lines
primary control of the surveys consisting of *baselines* (3.2.11.1), standard parallels, principal *meridians* (3.2.2.31.1) and guide meridians

Note 1 to entry: Among field surveyors a control line is a *survey* (3.2.1.31.1) line to the nearest identified *corner* (3.2.2.8) in *directions* (3.2.12.7) necessary for restoration of a corner.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.7
control survey
survey (3.2.1.31.1) that provides horizontal or vertical position data for subordinate surveys or mapping

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.8
coordinates
one of a set of numbers designating linear and/or angular quantities that specify the position of a point on a line, in space, or on a given plane or other surface in relation to a given reference system

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.1.9
coordinate system
mathematically defined method for specifying the locations of points

Note 1 to entry: Distances or angles from suitable references locate the points within the system.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.10
corrective resurvey
survey (3.2.1.31.1) made to correct an erroneous omission of original *corner* (3.2.2.8) evidence discovered after a survey has been approved

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.11
field notes
official written record of the survey, certified by the field surveyor and approved by proper authority

Note 1 to entry: Originally, field notes were prepared by hand, but they are now typewritten.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.12
field returns
field notes (3.2.1.11), reports and plats submitted for acceptance or approval

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.13
floor station
survey (3.2.1.31.1) station secured in the floor of a mine roadway or working face

[SOURCE: BS 3618-1:1969]

3.2.1.14
geodesy
science of *measurement* (3.2.3.10) on or in the vicinity of the ground to determine form, dimensions and the distribution of mass and fields of gravity on the Earth or parts of it

Note 1 to entry: Surveying is the science of measurements necessary to determine the locations of points (features) on or beneath the surface of the Earth.

Note 2 to entry: Where measurements cover such a large part of the Earth's surface that the curvature cannot be ignored, then the operations are termed *geodetic surveying* (3.2.13.2) or measuring.

[SOURCE: ISO 7078:1985, 1.4]

3.2.1.15
global positioning system
GPS
satellite-based navigational system permitting the determination of any point on the Earth with high accuracy

Note 1 to entry: See Reference [20].

3.2.1.16
linesman
assistant to a surveyor

[SOURCE: BS 3618-1:1969]

3.2.1.17
meander
one of a series of regular, freely developing sinuous curves, bends, or loops in the *course* (3.2.12.4) of a stream

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.1.18
mine surveyor
official at a mine who periodically surveys the mine workings and prepares plans for the manager

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.1.19
overlap
that portion of area which one *survey* (3.2.1.31.1) extends over and covers a part of a different survey as is shown by the evidence on the ground

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.20
plat
map (3.3.9.1) of a *survey* (3.2.1.31.1) in horizontal *projection* (3.3.11), such as of a mine, townsite, etc.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.1.21
point
position or location in a reference system determined by *survey* (3.2.1.31.1)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.22
point of beginning
first station
starting point of the *survey* (3.2.1.31.1)

[SOURCE: Standard Surveying Terms — Clinton County GIS — Clinton County, Ohio, 2008]

3.2.1.23
point of discovery
precisely indicated position at which a valuable mineral is exposed to view

Note 1 to entry: In the absence of proof to the contrary, the discovery point is held to be the center of the vein on the surface.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.24
protect the plat
responsibility of the surveyor to examine, weigh and interpret the available evidence in respect to the execution of a resurvey, looking to the protection of the valid rights acquired under the *original survey* (3.2.13.7) as shown by the plat

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.25
record
all of the documents pertaining to title and boundaries including status, group files, county surveyor information as well as *field notes* (3.2.1.11) and plats

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.26
restoration of meanders
reestablishment of original *meanders* (3.2.1.17)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.27
resurvey
term applied to the reestablishment or restoration of land boundaries and subdivisions by the rerunning and remaking of the lines that were represented in the field note record and on the *plat* (3.2.1.20) of the previous official *survey* (3.2.1.31.1)

Note 1 to entry: This includes, as in the *original survey* (3.2.13.7), a field note record of the retracement data, observations, *measurements* (3.2.3.10) and *monuments* (3.2.3.14) descriptive of the work performed, and a plat that represents such resurvey, all subject to the approval of the directing authority.

Note 2 to entry: The above definition is intended or implied unless modified as in an independent resurvey or in some other appropriate manner.

Note 3 to entry: The adjective *"dependent"* applied to the term *"resurvey"* is for emphasis, and specifically to suggest the recovery and restoration of the prior official survey.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.28
retracement
survey (3.2.1.31.1) made to ascertain the *direction* (3.2.12.7) and length of lines and to identify *monuments* (3.2.3.14) and marks of an established prior survey

Note 1 to entry: Recovered *corners* (3.2.2.8) are rehabilitated, but *lost corners* (3.2.12.15) are not restored and lines through timber are not reblazed.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.29
returns
official reports including the *field notes* (3.2.1.11), report and approved *plat* (3.2.1.20) of a *survey* (3.2.1.31.1)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.30
solar attachment
auxiliary device mounted on a surveyor's instrument which mechanically solves the pole-*zenith* (3.2.1.41)-sun spherical triangle

Note 1 to entry: When the sun's *declination* (3.2.2.13), the *latitude* (3.2.2.26) of the station and hour angle of the sun are correctly set off on the solar attachment, the instrument on which it is mounted can readily be oriented to the astronomic *meridian* (3.2.2.31.1).

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.31.1
survey
<process> orderly and exacting process of examining and delineating the physical or chemical characteristics of the Earth's surface, subsurface, or internal constitution by topographic, geologic, geophysical, or geochemical *measurements* (3.2.3.10); especially the act or operation of making detailed measurements for determining the relative positions of points on or beneath the Earth's surface

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.1.31.2
survey
<plat> associated data or results obtained in a *survey* (3.2.1.31.1); a *map* (3.3.9.1) or description of an area obtained by *surveying* (3.2.1.32)

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.1.32
surveying
science or art of making the *measurements* (3.2.3.10) necessary to determine the relative position of points above, on, or beneath the surface of the Earth, or to establish such points

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.33
survey restoration
purpose of a *resurvey* (3.2.1.27)*;* the recovery of one or more lines or *corner* (3.2.2.8) positions, or both, of a prior *approved survey* (3.2.1.1); or the replacement of one or more *lost corners* (3.2.12.15) or obliterated *monuments* (3.2.3.14) by approved methods, including the substantial renewal of one or more *monuments* (3.2.3.14), as required for the purpose of a survey

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.34
suspended survey
suspended plat
accepted *survey* (3.2.1.31.1) that is the object of questions or doubts, whose actions related to the area covered can be held in abeyance until the matter is resolved

Note 1 to entry: The survey can be corrected, reinstated or cancelled, either in whole or in part, but no action based on the plat can be initiated or completed while the survey is suspended.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.35
swing
<correction> correction applied to an observation made to an eccentric signal

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.36
swing
<rotation> rotation of a photograph in its own plane around the photograph perpendicular

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.37.1
tie in, verb
<point> to make a connection to a previously determined point

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.37.2
tie in, verb
<survey> to connect *corner* (3.2.2.8) accessories, topographic and cultural features to the survey

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.38
tie line
survey (3.2.1.31.1) line that connects a point to other surveyed lines

[SOURCE: Standard Surveying Terms — Clinton County GIS — Clinton County, Ohio, 2008]

3.2.1.39
tie point
point to which a *survey* (3.2.1.31.1) connection is made

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.40
unapproved survey
survey (3.2.1.31.1) that has not, for whatever reason, reached the status of an accepted survey

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.1.41
zenith
point of the celestial sphere that is directly overhead from the observer

[SOURCE: Glossary of Surveying Terms — Topographic Surveys, Inc., Bob Morris]

3.2.2 Reference

3.2.2.1
arbitrary line
reference line, the *direction* (3.2.12.7) of which does not necessarily coincide with *cardinal* (3.2.2.3) *direction* (3.2.12.7)

[SOURCE: BS 3618-1:1969]

3.2.2.2
assumed north
direction (3.2.12.7) assumed to be north for reference purposes

[SOURCE: BS 3618-1:1969]

3.2.2.3
cardinal
directions (3.2.12.7) north, south, east and west

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

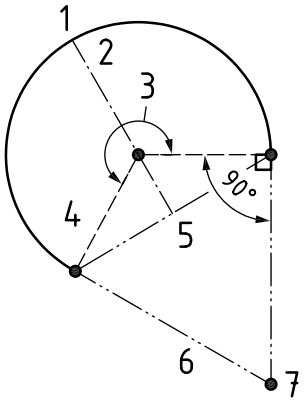
3.2.2.4
cardinal point
one of the four principal "points" of a compass

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.2.5
chord
<surveying and geometry> straight line joining any two points on an arc, curve, circumference, or surface

Note 1 to entry: See Figure 6.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]



Key

1	arc	5	chord
2	chord height	6	negative tangent
3	angle	7	point of intersection
4	radius		

Figure 6 — Chord

3.2.2.6
conditional line
agreed line between neighbors that has not been surveyed, or which has been surveyed but not granted

[SOURCE: Standard Surveying Terms — Clinton County GIS — Clinton County, Ohio, 2008]

3.2.2.7
connecting line
survey (3.2.1.31.1) line connecting one survey to another, generally used on the older *plats* (3.2.1.20) and in mineral surveys

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.8
corner
point on the surface of the Earth, determined by the *surveying* (3.2.1.32) process, which defines an extremity on a boundary

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.9
corner accessories
nearby physical objects to which *corners* (3.2.2.8) are referenced for their future identification or restoration

Note 1 to entry: Accessories include *bearing* (3.2.8.6.1) trees, mounds, pits, ledges, rocks and other natural features to which distances or *directions* (3.2.12.7) (or both) from the corner or *monument* (3.2.3.14) are known. such accessories are actually a part of the monumentation.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.10
corner description
specific data (both old and new) about a *corner* (3.2.2.8) *monument* (3.2.3.14) and its accessories which include marks, positions, and physical characteristics

Note 1 to entry: Corner monument markings letters, numerals, lines, grooves or *notches* (3.2.12.18) used to mark corner monuments. The markings usually indicate the location of the corner.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.11
corner move
computed *directions* (3.2.12.7) and distances from a temporary point to the true point for a *corner* (3.2.2.8) as computed from the retracement data

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.12
datum
<ordinary survey usage> defined reference for *survey* (3.2.1.31.1) *measurements* (3.2.3.10)

Note 1 to entry: The plural form is datums.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.13
declination
difference between magnetic north and *geographic (true) north* (3.2.2.22)

Note 1 to entry: Surveyors use a compass to determine the *direction* (3.2.12.7) of *survey* (3.2.1.31.1) lines. Compasses point to magnetic north, rather than true north. This *declination* (3.2.2.13) error is measured in degrees and can range from a few degrees to 10°or more.

Note 2 to entry: Surveyors can have been instructed to correct their surveys by a particular *declination* (3.2.2.13) *value* (3.2.4.10). The value of declination at any point on the Earth is constantly changing because the location of magnetic north is drifting.

[SOURCE: Standard Surveying Terms — Clinton County GIS — Clinton County, Ohio, 2008]

3.2.2.14
due
directly or exactly in a *cardinal* (3.2.2.3) *direction* (3.2.12.7) with the usual *precision* (3.2.3.17) of that *survey* (3.2.1.31.1)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.15
easting
easterly component of a national grid co-ordinate

[SOURCE: BS 3618-1:1969]

3.2.2.16
existent corner
corner (3.2.2.8) whose position can be identified by verifying the evidence of the *monument* (3.2.3.14), or its accessories, by reference to the description that is contained in the *field notes* (3.2.1.11), or where the point can be located by an acceptable supplemental *survey* (3.2.1.31.1) record, some physical evidence or testimony

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.17
geodetic control
system of monumented stations having known, precise positions established by geodetic methods

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.18
geodetic coordinates
quantities which define a horizontal position on an ellipsoid of reference with respect to a *geodetic datum* (3.2.2.19)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.19
geodetic datum
reference for *geodetic survey* (3.2.13.2) *measurements* (3.2.3.10) consisting of fixed *latitude* (3.2.2.26), *longitude* (3.2.2.27) and *azimuth* (3.2.12.1) *values* (3.2.4.10) associated with a defined station as well as two constants for an ellipsoid of reference

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.20
geodetic position
position of a point on the surface of the Earth expressed in terms of geodetic *latitude* (3.2.2.26) and geodetic *longitude* (3.2.2.27)

Note 1 to entry: A geodetic position implies an adopted *geodetic datum* (3.2.2.19). In a complete record of a geodetic position, the *datum* (3.2.2.12) must be stated.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.21
geographic coordinates
both *geodetic coordinates* (3.2.2.18) and astronomic *coordinates* (3.2.1.8)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.22
geographic north
true north
northerly *direction* (3.2.12.7) of the geographic *meridian* (3.2.2.31.1) at any terrestrial point

[SOURCE: BS 3618-1:1969]

3.2.2.23
geographic position
coordinates (3.2.1.8) of a point on the surface of the Earth expressed in terms of *latitude* (3.2.2.26) and *longitude* (3.2.2.27), either geodetic or astronomic

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

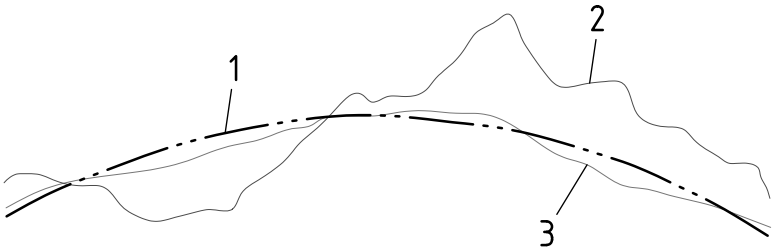
3.2.2.24
geoid
figure of the Earth considered as a sea level surface extended continuously through the continents

Note 1 to entry: See Figure 7.

Note 2 to entry: It is a theoretically continuous surface that is perpendicular at every point to the *direction* (3.2.12.7) of gravity [the *plumb line* (3.2.11.3)].

Note 3 to entry: It is the surface of reference for astronomic observations and for geodetic leveling

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]



Key

1 ellipsoid surface
2 topographic surface
3 geoid surface

Figure 7 — Geoid

3.2.2.25
grade lines
lines that define the intended grade of a *roadway* (3.1.6.24) that is being driven

Note 1 to entry: Such lines are used to control the gradient of a roadway.

[SOURCE: BS 3618-1:1969]

3.2.2.26
latitude
distance on the Earth's surface, north or south of the equator, expressed in either linear or angular *measurements* (3.2.3.10)

Note 1 to entry: See also *latitude* (3.2.7.9).

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.27
longitude
distance on the Earth's surface, east or west of a defined *meridian* (3.2.2.31.1), usually the *meridian* (3.2.2.31.1) of Greenwich (0° longitude)

Note 1 to entry: Quantities can be expressed in either angular measure, such as 90° west longitude, or in time, such as 6 h west of Greenwich.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.28
magnetic variation
regular or erratic change in magnetic *declination* (3.2.2.13)

Note 1 to entry: Not interchangeable with *declination* (3.2.2.13) but old *field notes* (3.2.1.11) use variation as the *declination* (3.2.2.13) of the compass.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.29
medial line
particular line that is determined by the consideration of various factors, or the weighing of evidence, as well as the use of *measurement* (3.2.3.10) and/or calculation

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.30
median
<surveying> plane dividing something into two equal parts, especially one dividing a thing into left and right halves

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.31.1
meridian
<Earth line> north-south line from which *longitudes* (3.2.2.27) (or departures) and *azimuths* (3.2.12.1) are reckoned

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.31.2
meridian
<Earth plane> plane, normal to the *geoid* (3.2.2.24) or *spheroid* (3.2.2.40), defining a *meridian* (3.2.2.31.1) line

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.31.3
meridian
<surveying> flag or sight near a *survey* (3.2.1.31.1) camp used to test solar *transit* (3.2.8.22) for adjustment

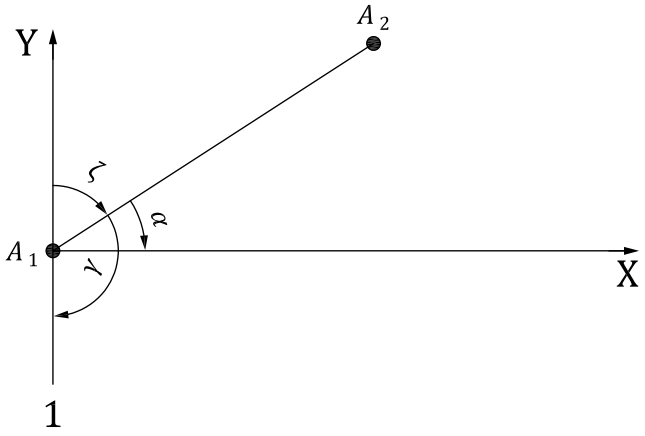
[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.32
meridional line
north-south line or a line along a *meridian* (3.2.2.31.1) of *longitude* (3.2.2.27)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.33
nadir
point on the celestial sphere that is directly beneath the observer and directly opposite the *zenith* (3.2.1.41)

Note 1 to entry: See Figure 8.



Key

1	nadir	ζ	zenith angle
Y	zenith	γ	nadir angle
X	horizontal	α	angle of inclination

NOTE SOURCE: Reference [27].

Figure 8 — Nadir

Note 2 to entry: In aerial-camera applications, the point on the ground vertically beneath the perspective centre of an aerial-camera is named "nadir".

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.2.34
plane coordinates
<general> *coordinates* (3.2.1.8) specifying the location of points on a plane

Note 1 to entry: In *surveying* (3.2.1.32) use, the "plane" is usually a *projection* (3.3.11) of the Earth's surface such as a developed cone or cylinder.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.35
random line
trial line run from one *monument* (3.2.3.14) toward the next monument so that the difference in *latitude* (3.2.2.26) and departure between monuments can be determined and the *true line* (3.2.8.23) can be computed

Note 1 to entry: On the trial line, temporary intermediate *corners* (3.2.2.8) are set. Offsets can then be computed from the temporary corners to the correct positions on the true line.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.36
referenced
bearings (3.2.8.6.1) and distances from a *monument* (3.2.3.14) to described or identified points to be used for future *corner* (3.2.2.8) point determination

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.37
reference monument
iron post (3.2.12.13) or rock cap accessory used where the point for a *corner* (3.2.2.8) *monument* (3.2.3.14) is such that, for practical purposes, a permanent corner monument cannot be established, or if monumented, a full complement of *bearing* (3.2.8.6.1) trees or *bearing* (3.2.8.6.1) objects are not obtainable

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.38
rhumb line
loxodrome
line on the surface of the Earth making the same angle with all *meridians* (3.2.2.31.1)

Note 1 to entry: A loxodrome or loxodromic curve spirals toward the poles in a constant true *direction* (3.2.12.7).

Note 2 to entry: Parallels and *meridians* (3.2.2.31.1), which also maintain constant true *directions* (3.2.12.7), can be considered special cases of rhumb lines.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.39
solar line
line run along an astronomic *bearing* (3.2.8.6.1) with a solar attachment

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.40
spheroid
mathematical figure closely approaching the *geoid* (3.2.2.24) in form and size

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.41
straddle stakes
in determining the point of intersection of two lines, stakes usually lined-in on both sides of the point of intersection

Note 1 to entry: The term is derived from the fact that such stakes straddle the point.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.42
survey line
straight line, marked or sighted by a measuring telescope, from which points can be set out (e.g. position points) or measured

[SOURCE: ISO 7078:1985, 6.17]

3.2.2.43
tack line
straight line projected from point (tack) to point as opposed to a *solar line* (3.2.2.39) run along an astronomic *bearing* (3.2.8.6.1) with a solar attachment

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.44
tie
survey (3.2.1.31.1) connection to an existing station from a point whose position is desired to be referenced

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.45
witness corner
monumented *survey* (3.2.1.31.1) point usually on the line of survey near a *corner* (3.2.2.8) established as a reference when the corner is so situated as to render its monumentation or ready use impracticable

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.2.46
witness point
monumented station on a line of the *survey* (3.2.1.31.1), employed to perpetuate an important location without special relation to any *regular corner* (3.2.14.5), except that the *bearing* (3.2.8.6.1) or distance can be known

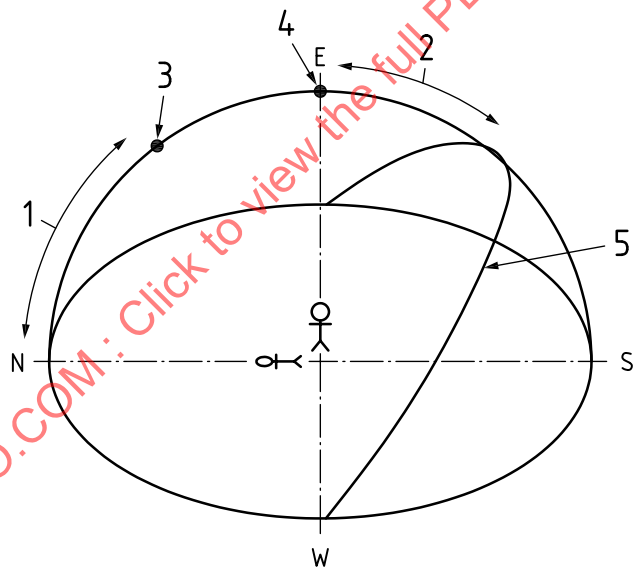
[SOURCE: *Glossary* of BLM surveying and mapping terms, 1980]

3.2.2.47
zenith
<transit or theodolite> point directly above the vertical axis of the instrument

Note 1 to entry: See Figure 9.

Note 2 to entry: See also *nadir* (3.2.2.33).

[SOURCE: Glossary of Surveying Terms — Topographic Surveys, Inc., Bob Morris]



Key

1	latitude	4	zenith
2	latitude	5	celestial equator
3	north celestial pole		

NOTE SOURCE: Reference [28].

Figure 9 — Zenith

3.2.3 Measurement

3.2.3.1
accuracy of measurement
closeness of agreement between a measured *quantity value* (3.2.4.10) and the *true value* (3.2.4.6) of the *measurand* (3.2.3.9)

Note 1 to entry: "Accuracy" is a qualitative concept and cannot be expressed in a numerical value.

Note 2 to entry: "Accuracy" is inversely related to both *systematic error* (3.2.5.10) and *random error* (3.2.5.11).

[SOURCE: ISO 17123-1:2014, 3.2.1]

3.2.3.2
direct measurement
determination of a distance by physical comparison or accumulation of distance using a device calibrated in some unit of measure

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.3.3
indication
quantity value (3.2.4.10) provided by a measuring instrument or measuring system

Note 1 to entry: An *indication* (3.2.3.3) and a corresponding *value* (3.2.4.10) of the quantity being measured are not necessarily values of quantities of the same kind.

[SOURCE: ISO 17123-1:2014, 3.1.9]

3.2.3.4
indirect measurement
determination of a distance using a method, i.e., triangulation or *traverse* (3.2.7.16), which employs both *direct measurement* (3.2.3.2) and calculation

Note 1 to entry: Also, determination of distance by use of *photogrammetry* (3.2.3.16), or timed travel of light or sound waves.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.3.5
instrument station
survey (3.2.1.31.1) point at which a *surveying* (3.2.1.32) instrument device, such as a compass, *transit* (3.2.8.22) or theodolite, is set up for making *measurements* (3.2.3.10)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.3.6
closure
process of *measurement* (3.2.3.10) in a closed figure for a check on horizontal or vertical *precision* (3.2.3.17)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.3.7
compliance measurement
measurement (3.2.3.10) carried out to verify compliance with the specified permitted deviation of a completed stage of the construction process (for example, building components, setting out and constructed work)

[SOURCE: ISO 7077:1981, 4.1]

3.2.3.8
co-planing
process of moving the head of a theodolite laterally until its vertical axis lies in the produced vertical plane common to two *plumb lines* (3.2.11.3)

Note 1 to entry: See also *alignment* (3.1.4.1)

[SOURCE: BS 3618-1:1969]

3.2.3.9
measurand
quantity intended to be measured

[SOURCE: ISO/IEC Guide 99:2007, 2.3]

3.2.3.10
measurement
process of experimentally obtaining one or more *quantity values* (3.2.4.10) that can reasonably be attributed to a quantity

Note 1 to entry: Measurement implies comparison of quantities and includes counting of entities.

[SOURCE: ISO 17123-1:2014, 3.1.5]

3.2.3.11
measurement accuracy check
set of *measurements* (3.2.3.10) carried out to check the accuracy of a compliance measuring method

[SOURCE: ISO 7077:1981, 4.2]

3.2.3.12
measuring tape
graduated tape, steel or linen, usually in 15 m or 30,4 m lengths, used by e.g. engineers, builders, surveyors

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.3.13
measuring plate
metal plate used to provide a stable measuring point of a temporary nature

[SOURCE: BS 3618-1:1969]

3.2.3.14
monument
permanent point
permanent mark
measuring point of a permanent character, whose *coordinates* (3.2.1.8) have been determined and which can thereafter be used as a reference point for other *measurements* (3.2.3.10)

[SOURCE: ISO 7078:1985, 6.43]

3.2.3.15
occupy, verb
to set a *surveying* (3.2.1.32) instrument over a point for the purpose of making observations

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.3.16
photogrammetry
technique of *measurement* (3.2.3.10) using photographs, for example aerial photographs, to determine, primarily, geometrical properties such as size, location and form of objectsNote1 to entry: Photogrammetric *measurement* (3.2.3.10) is often used for mapping and also has some engineering applications.

[SOURCE: ISO 7078:1985, 1.5]

3.2.3.17
precision
measurement precision
closeness of agreement between measured *quantity values* (3.2.4.10) obtained by replicate *measurements* (3.2.3.10) on the same or similar objects under specified conditions

Note 1 to entry: Measurement *precision* (3.2.3.17) is usually expressed by measures of imprecision, such as experimental standard deviation under specified conditions of *measurement* (3.2.3.10).

[SOURCE: ISO 17123-1:2014, 3.2.3]

3.2.3.18
proportionate measurement
measurement that applies an even distribution of a determined excess or deficiency of measurement, ascertained by retracement of an established line, so as to give concordant relation between all parts

Note 1 to entry: That is, the new *values* (3.2.4.10) given to each of the several parts, as determined by the measurement, bear the same relation to the record lengths as the new *measurement* (3.2.3.10) of the whole line bears to that record.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.3.19
proration
proportionate measurement (3.2.3.19), division, distribution or adjustment

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.3.20
remeasurement survey
survey (3.2.1.31.1) made for the purpose of verifying or determining distances

Note 1 to entry: As opposed to a retracement survey, which is done to verify or determine both *bearings* (3.2.8.6.1) and distances.

Note 2 to entry: It also differs from a resurvey, which is the rerunning and remarking of lines represented in the *field notes* (3.2.1.11) and on the *plat* (3.2.1.20) of a previous official *survey* (3.2.1.31.1).

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.3.21
repeatability condition
repeatability condition of measurement
condition of *measurement* (3.2.3.10), out of a set of conditions that include

Note 1 to entry: Conditions of measurement include

— the same measurement procedure,

— the same observer(s),

— the same measuring system,

— the same meteorological conditions,

— the same location, and

— replicate measurements on the same or similar objects over a short period of time.

[SOURCE: ISO 17123-1:2014, 3.2.4]

3.2.3.22
reproducibility conditions of measurement
condition of measurement, out of a set of conditions

Note 1 to entry: Conditions of *measurement* (3.2.3.10) include

— different locations,

— different observers,

— different measuring systems, and

— replicate *measurements* (3.2.3.10) on the same or similar objects.

[SOURCE: ISO 17123-1: 2014, 3.2.6]

3.2.3.23
reproducibility
measurement reproducibility
measurement (3.2.3.10) *precision* (3.2.3.17) under *reproducibility conditions of measurement* (3.2.3.22)

[SOURCE: ISO 17123-1:2014, 3.2.7]

3.2.3.24
tolerance
permitted variation of the size

Note 1 to entry: It is an *indication* (3.2.3.3) of the accuracy and the *precision* (3.2.3.17) of a *measurement* (3.2.3.10).

[SOURCE: ISO 7078:1985, 2.26]

3.2.4 Results

3.2.4.1
result
determination after having carried out a process

3.2.4.2
gradient
rate of rise or fall, as "5 % gradient," meaning a 5[dimension] vertical rise in a 100[dimension] horizontal distance (also recorded as 0,05)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.4.3
quantity
measurable quantity
property of a phenomenon, body or substance, where the property has a magnitude that can be expressed as a number and a reference

EXAMPLE 1 Quantities in a general sense: length, time, temperature.

EXAMPLE 2 Quantities in a particular sense: length of a rod.

[SOURCE: ISO 17123-1:2014, 3.1.1]

3.2.4.4
reference value
reference quantity value
quantity value (3.2.4.10) used as a basis for comparison with values of quantities of the same kind

Note 1 to entry: A reference quantity value can be a *true quantity value* (3.2.4.6) of the *measurand* (3.2.3.9), in which case it is normally unknown. A reference quantity value with associated *measurement* (3.2.3.10) *uncertainty* (3.2.4.9) is usually provided by a reference measurement procedure.

[SOURCE: ISO 17123-1:2014, 3.1.4]

3.2.4.5
repeatability
measurement repeatability
measurement (3.2.3.10) *precision* (3.2.3.17) under a set of *repeatability conditions of measurement* (3.2.3.21)

[SOURCE: ISO 17123-1:2014, 3.2.5]

3.2.4.6
true value
true value of a quantity
true quantity value
value (3.2.4.10) consistent with the definition of a given quantity

Note 1 to entry: This is a value that would be obtained by perfect *measurement* (3.2.3.10). However, this value is in principle and in practice unknowable.

[SOURCE: ISO/IEC Guide 99:2007, 2.11]

3.2.4.7
type A evaluation
<uncertainty> method of evaluation of *uncertainty* (3.2.4.9) by the statistical analysis of series of observations

[SOURCE: ISO/IEC Guide 98-3:2008, 2.3.2]

3.2.4.8
type B evaluation
<uncertainty> method of evaluation of *uncertainty* (3.2.4.9) by means other than the statistical analysis of series of observations

[SOURCE: ISO/IEC Guide 98-3:2008, 2.3.3]

3.2.4.9
uncertainty of measurement
uncertainty
parameter, associated with the result of a measurement, that characterizes the dispersion of the *values* (3.2.4.10) that could reasonably be attributed to the *measurand* (3.2.3.9)

Note 1 to entry: The parameter can be, for example, a standard deviation (or a given multiple of it), or the half-width of an interval having a stated level of confidence.

Note 2 to entry: Uncertainty of *measurement* (3.2.3.10) comprises, in general, many components. Some of these components can be evaluated from the statistical distribution of the results of series of *measurements* (3.2.3.10) and can be characterized by experimental standard deviations. The other components, which also can be characterized by standard deviations, are evaluated from assumed probability distributions based on experience or other information.

Note 3 to entry: It is understood that the result of the *measurement* (3.2.3.10) is the best estimate of the value of the *measurand* (3.2.3.9), and that all components of *uncertainty* (3.2.4.9), including those arising from systematic effects, such as components associated with corrections and reference standards, contribute to the dispersion.

[SOURCE: ISO/IEC Guide 98-3:2008, B.2.18]

3.2.4.10
value
value of a quantity
quantity value
number and reference together expressing the magnitude of a quantity

EXAMPLE Length of a rod: 3,24 m.

[SOURCE: ISO 17123-1:2014, 3.1.2]

3.2.5 Errors

3.2.5.1
adjustment of error
method of distributing the revealed irregularities over a series of results

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.5.2
distortion
greater than usual change in *bearings* (3.2.8.6.1) and distances of the *original survey* (3.2.13.7) which is reflected by a retracement or *resurvey* (3.2.1.27)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.5.3
error
measurement error
error of measurement
measured *quantity value* (3.2.4.10) minus a *reference quantity value* (3.2.4.4)

Note 1 to entry: The concept of "measurement error" can be used both

a) when there is a single reference quantity value to refer to, which occurs if a calibration is made by means of a *measurement* (3.2.3.10) standard with a measured quantity value having a negligible measurement *uncertainty* (3.2.4.9) or if a conventional quantity value is given, in which case the measurement error is known, and

b) if a *measurand* (3.2.3.9) is supposed to be represented by a unique *true quantity value* (3.2.4.6) or a set of true quantity values of negligible range, in which case the measurement error is not known.

Note 2 to entry: Measurement error should not be confused with production error or mistake.

[SOURCE: ISO/IEC Guide 99:2007, 2.16]

3.2.5.4
erroneous meanders
error (3.2.5.3) or mistake in position rather than in procedure

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.5.5
final returns
corrected and/or completed *field returns* (3.2.1.12) of a field work after some *error* (3.2.5.3) or omission has been found

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.5.6
index correction
correction applied to a reading to compensate for displacement of the zero mark

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.5.7
latitude correction
north-south correction made to observed magnetic-field intensity in order to remove the Earth's normal field

Note 1 to entry: The remainder is the anomalous field.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.5.8
m and p factors
tabulated factors used to convert short distances expressed in seconds of *latitude* (3.2.2.26) (meridional) and seconds of *longitude* (3.2.2.27) (parallel) into meter, at various *latitudes* (3.2.2.26)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.5.9.1
misclosure
closing error
error of closure
<sum of errors> amount by which a series of *survey* (3.2.1.31.1) *measurements* (3.2.3.10) fail to yield a theoretical or previously determined *value* (3.2.4.10) for a survey quantity; hence a measure of the accumulated *errors* (3.2.5.3) and blunders in the work

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.5.9.2
misclosure
closing error
<excess of limits> *error of closure* (3.2.5.9.1) in excess of specified limits, as in “out of limits”

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.5.10
systematic error
systematic error of measurement
component of *measurement error* (3.2.5.3) that in replicate measurements remains constant or varies in a predictable manner

Note 1 to entry: Systematic error, and its causes, can be known or unknown. A correction can be applied to compensate for a known systematic measurement error.

[SOURCE: ISO 17123-1:2014, 3.1.14]

3.2.5.11
random measurement error
random error
component of *measurement* (3.2.3.10) error that in replicate *measurements* (3.2.3.10) varies in an unpredictable manner

Note 1 to entry: Random measurement errors of a set of replicate *measurements* (3.2.3.10) form a distribution that can be summarized by its expectation, which is generally assumed to be zero, and its variance.

[SOURCE: ISO 17123-1:2014, 3.1.13]

3.2.5.12
residual error
difference between an observed *value* (3.2.4.10) of a series and its corresponding adjusted value

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.6 Chain surveying

3.2.6.1
chain
measuring instrument that consists of 100 links joined together by rings and is used in *surveying* (3.2.1.32)

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.6.2
chain carrier
assistant to the surveyor, moving the *surveying* (3.2.1.32) *chain* (3.2.6.1) from one location to another under the *direction* (3.2.12.7) of the surveyor

[SOURCE: Standard Surveying Terms — Clinton County GIS — Clinton County, Ohio, 2008]

3.2.6.3
chaining
operation of measuring a distance on the Earth, using a *chain* (3.2.6.1) or tape

Note 1 to entry: The corresponding operation, in private surveys, is taping.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.6.4
chainman
operator who measures and records the distances in *chaining* (3.2.6.3)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.6.5
chordal effect
effect produced by the *chain* (3.2.6.1) joint centers being forced to follow arcs instead of *chords* (3.2.2.5) of a sprocket pitch circle

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.6.6
slope chaining
process of *direct measurement* (3.2.3.2) of an inclined distance and vertical angle for reduction to its horizontal equivalent

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.7 Traverse

3.2.7.1
baseline
line established underground, usually in an area where ground movement is negligible, the length and *bearing* (3.2.8.6.1) of which is determined with *precision* (3.2.3.17)

Note 1 to entry: Such lines are used for the control of *traverses* (3.2.7.16) through unstable areas where it is impossible to establish permanent *surveying* (3.2.1.32) stations.

[SOURCE: BS 3618-1:1969]

3.2.7.2
closed traverse
<angle> *surveying* (3.2.1.32) *traverse* (3.2.7.16) whose accuracy can be checked by the fact that, when it is closed, the angles add up to 360°, and which ends at its starting point

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.7.3
closed traverse
<station> *surveying* (3.2.1.32) *traverse* (3.2.7.16) that starts and terminates upon the same station or upon a station of known position

Note 1 to entry: See *open traverse* (3.2.7.12).

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.7.4
connecting line
line calculated from beginning to end of a *traverse* (3.2.7.16)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.7.5
continuous azimuth method
method of traversing by which the *azimuth* (3.2.12.1) of the *survey* (3.2.1.31.1) lines is obtained from the instrument

[SOURCE: BS 3618-1:1969]

3.2.7.6
deflection angle
angular difference from a straight line at an *angle point* (3.2.8.4) in a *traverse* (3.2.7.16)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.7.7
direct angle
angle measured directly between two lines, as distinguished in *transit* (3.2.8.22) *traverse* (3.2.7.16) from a *deflection angle* (3.2.7.6)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.7.8
draft
leg
survey (3.2.1.31.1) line in a *traverse* (3.2.7.16)

[SOURCE: BS 3618-1:1969]

3.2.7.9
latitude
north-south component of a *traverse* (3.2.7.16) *course* (3.2.12.4)

Note 1 to entry: See also *latitude* (3.2.2.26).

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.7.10
loose-needle traversing
needle traverse
swinging needle traverse
method of traversing in which the magnetic *bearings* (3.2.8.6.1) of *survey* (3.2.1.31.1) lines are separately obtained by reference to the magnetic needle

Note 1 to entry: The opposite is a fast needle *traverse* (3.2.7.16) or work, that refers to the use of a dial as in traversing with a theodolite, where proximity of iron might deflect the needle. Systems can be combined, using needle readings where iron is absent.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.7.11
offset staff
rod, usually 10 links (0,201 2 m) long, used in measuring short *offsets* (3.2.12.20.1)

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.7.12
open traverse
surveying (3.2.1.32) *traverse* (3.2.7.16) that starts from a station of known or adopted position but does not terminate upon such a station and therefore does not completely enclose a polygon

Note 1 to entry: See also *closed traverse* (3.2.7.3).

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.7.13
parallel offset method
method of traversing around obstacles and maintaining a line parallel to, and *offset* (3.2.12.20.1) a measured distance from, the *survey* (3.2.1.31.1) line

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.7.14
residual error
total *error of closure* (3.2.5.9.1) of a *traverse* (3.2.7.16)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.7.15
tangent
part of a *traverse* (3.2.7.16) of *alignment* (3.1.4.1) included between the point of tangency of one curve and the point of curvature of the next curve

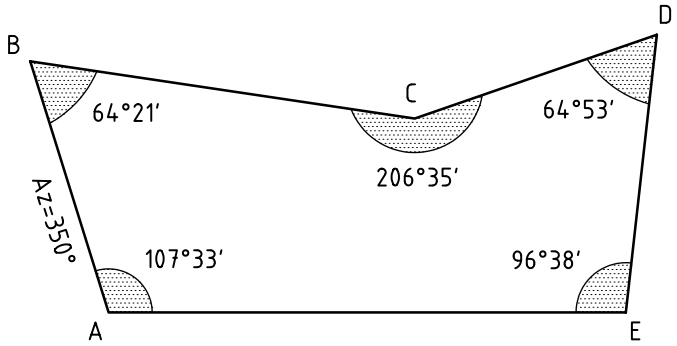
[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.7.16
traverse
series of *survey* (3.2.1.31.1) stations that are located in position by measuring the distances between consecutive stations and the angles of the rectilinear figure formed by the points

Note 1 to entry: See Figure 10.

Note 2 to entry: If the traverse starts and finishes at the same point, or at points which have been located previously, it is called a *closed traverse* (3.2.7.3) (or is said to be closed polygonally), otherwise it is an *open traverse* (3.2.7.12).

[SOURCE: BS 3618-1:1969]



NOTE SOURCE: Reference [24].

Figure 10 — Traverse

3.2.7.17
traverse survey
survey (3.2.1.31.1) in which a series of lines joined end to end are completely determined as to length and *direction* (3.2.12.7), these lines being often used as a basis for triangulation

Note 1 to entry: It is used especial for long narrow strips of land (such as for railroads) and for underground surveys.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.7.18
traverse tape
narrow, long lightweight steel tape for the *measurement* (3.2.3.10) of distances up to 100 m, for example in *traverses* (3.2.7.16)

[SOURCE: ISO 7078:1985, 4.2]

3.2.8 Angular measurement

3.2.8.1
abney clinometer
abney level
hand-held instrument for measuring inclinations

Note 1 to entry: Abney levels are made with square tubular bodies so that they can also be used to directly measure the slopes of plane surfaces by simply placing the body of the level on the surface, adjusting the level, and then reading the angle off of the scale.

[SOURCE: BS 3618-1:1969]

3.2.8.2
acid-dip survey
acid-dip test
acid test
acid-etch tube
method of determining the angular inclination of a borehole in which a glass, test tube-like bottle partly filled with a dilute solution of hydrofluoric acid is inserted in a watertight metal case

Note 1 to entry: When the assemblage is lowered into a borehole and left for 20 min to 30 min, the acid etches the bottle at a level plane from which the inclination of the borehole can be measured.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.8.3
alidade
essential component of the plane table equipment, used for measuring and plotting in *topographic surveying* (3.2.13.17), consisting of the alidade base with the plotting device and the telescope that can be rotated around the horizontal axis, with or without a vertical circle and an optical distance-measuring device

Note 1 to entry: The self-reducing alidade is fitted with the correcting devices usually found in the self-reducing tachometer.

[SOURCE: ISO 9849:2017, 3.2.1, modified - The definition has been reworded; Note 1 to entry has been replaced.]

3.2.8.4
angle point
point in a *survey* (3.2.1.31.1) where the *alignment* (3.1.4.1) or boundary deflects from a straight line

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.5
auxiliary telescope
telescope, fitted parallel to the main telescope of a theodolite, for measuring and setting out horizontal and vertical angles where the main telescope cannot be used

[SOURCE: BS 3618-1:1969]

3.2.8.6.1
bearing
<cardinal> angle measured from either the north or the south point, as can be required, to give a reading of less than 90°, where the proper quadrant is designated by the letter N or S, preceding the angle, and the letter E or W, following it

EXAMPLE N80°E.

Note 1 to entry: See also *azimuth* (3.2.12.1).

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.8.6.2
bearing
<meridian> horizontal angle between the *meridian* (3.2.2.31.1) (true or magnetic) and any specified *direction* (3.2.12.7)

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.8.7.1
bearing
<direction> direction of a mine drivage usually given in terms of the horizontal angle turned off a *datum* (3.2.2.12) direction, such as the *true north* (3.2.2.22) and south line

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.8.7.2
bearing
<mine shaft> part in which a shaft or pivot revolves

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.8.8
clinometer
inclinometer
plain clinometer
instrument used for measuring angles of slope, elevation, or inclination (especially the dip of a geologic stratum or the slope of an embankment)

Note 1 to entry: It can be a simple hand-held device consisting of a tube with a cross hair, a graduated vertical arc, and an attached spirit level so mounted that the inclination of the line of sight can be read on the circular scale by centering the level bubble at the instant of observation

Note 2 to entry: A clinometer is usually combined with a compass.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.8.9
corresponding corners
opposite *corners* (3.2.2.8), such as those of a subdivisional unit which control the subdivision of that unit

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.10.1
declination
<astronomic> angular distance of a celestial body north or south of the celestial equator

Note 1 to entry: Astronomic declination on the celestial sphere corresponds with *latitude* (3.2.2.26) on the Earth. It is noted as positive (+) when north of the celestial equator, and negative (-) when south of the celestial equator.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.10.2
declination
<magnetic> *bearing* (3.2.8.6.1) on a given date [reckoned east or west from the north branch of the celestial *meridian* (3.2.2.31.2) plane] of magnetic north as determined by the positive pole of a freely suspended magnetic needle which is subject to no transient artificial disturbance

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.11
grid bearing
smaller angle in the plane of *projection* (3.3.11) between a line and a north-south *grid line* (3.2.14.2)

Note 1 to entry: grid *bearings* (3.2.8.6.1) are determined only by mathematical computations or by applying corrections to *geodetic azimuths* (3.2.12.1.2).

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.12
graduated circle
disc with a circular scale graduated in degrees that can be subdivided

Note 1 to entry: The disc is usually made of glass.

Note 2 to entry: The disc is sometimes graduated in gons (non-SI unit).

Note 3 to entry: Electronic theodolites have coded circular scales on discs which are scanned electronically.

Note 4 to entry: The horizontal circle for measuring horizontal *directions* (3.2.12.7) is mounted centrally on the vertical axis and securely attached to the base part during *measurement* (3.2.3.10).

Note 5 to entry: The vertical circle for measuring vertical angles is fixed at right angles to and centrally on the horizontal axis.

[SOURCE: ISO 9849:2017, 3.2.7]

3.2.8.13
heavy bearing
strong bearing
bearing (3.2.8.6.1) that departs markedly from *cardinal* (3.2.2.3)

Note 1 to entry: It is a *survey* (3.2.1.31.1) slang term.

Note 2 to entry: A bearing of 2° or more from cardinal can be considered a "heavy" bearing.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.14
mean bearing
<measurement> mean of a series of *bearings* (3.2.8.6.1) obtained by measurement

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.15
mechanical phototriangulation
analogue phototriangulation
instrumental phototriangulation
method of phototriangulation that establishes positions and elevations by use of an instrument viewing a spatial model

Note 1 to entry: Precise connections are made between successive models which in turn are tied to vertical and *horizontal control* (3.2.12.11).

Note 2 to entry: The accuracy of the data obtained by use of the analytical process is usually of a higher order than that obtained by the mechanical methods.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.16
miscellaneous control
mathematical recovery of a *lost corner* (3.2.12.15) by allowing every known *corner* (3.2.2.8) within a reasonable radius which was tied to the missing corner to enter into the control, each control corner being given a weight inversely proportional to its distance from the missing corner

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.17
nonius
scale featuring concentric circles used in determining angles

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.18
oblique offset
distance of a point from a main *survey* (3.2.1.31.1) line measured at an angle to the latter that is not a right angle

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.8.19
perpetuation of corners
establishment of points or other evidence which preserves the location of a corner

3.2.8.20
quadrantal bearing
horizontal angle or *bearing* (3.2.8.6.1) less than 90°, measured to north, south, east, or west from a *survey* (3.2.1.31.1) line

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.8.21
secant
trigonometric function of an angle

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.22
transit
repeating *surveying* (3.2.1.32) instrument for measuring horizontal and vertical angles

Note 1 to entry: The *graduated circles* (3.2.8.12) are usually not graduated as precisely as are those on a theodolite.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.23
true line
DEPRECATED: right line
line of constant *bearing* (3.2.8.6.1) [*rhumb line* (3.2.2.38)] between two *corners* (3.2.2.8) of a survey

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.8.24
tangent
straight line that touches, but does not transect, a given curve or surface at one and only one point

Note 1 to entry: A line that touches a circle and is perpendicular to its radius at the point of contact.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.9 Leveling and centering an instrument

3.2.9.1.1
backsight
<bearing> sight or *bearing* (3.2.8.6.1) on a previously established *survey* (3.2.1.31.1) point (other than a closing or check point), taken in a backward *direction* (3.2.12.7)

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.9.1.2
backsight
<transfer to a new position> reading taken on a level rod held in its unchanged position on a *survey* (3.2.1.31.1) point of previously determined elevation when the leveling instrument has been moved to a new position

Note 1 to entry: It is used to determine the height of the instrument prior to making a *foresight* (3.2.9.7).

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.9.2.1
benchmark
BM
<permanent> permanent marker (usually a bronze disk) at a point of determined location, elevation and possibly horizontal *coordinates* (3.2.1.8)

Note 1 to entry: In a less formal sense, it is a point of fixed location (such as a mark on a bridge abutment, a foundation, or a rock face). It can be used as a reference point for surveys in its locality. Descriptions of benchmark locations and their elevations are published by government agencies.

[SOURCE: Glossary of Surveying Terms — Topographic Surveys, Inc., Bob Morris]

3.2.9.2.2
benchmark
BM
<temporary> point of fixed location that is used as a reference for a short-duration project

Note 1 to entry: Its elevation may or may not be determined with respect to a larger *coordinate system* (3.2.1.9). A temporary benchmark (TBM) could be something like a nail in a tree or fencepost, a mark on a curb, or a sturdy stake driven in an out-of-the-way area of a project site.

[SOURCE: Glossary of Surveying Terms — Topographic Surveys, Inc., Bob Morris]

3.2.9.3
center adjustment
system that allows accurate final centering of the theodolite above (or below) its station by sliding the whole instrument on its stand (tribrach)

Note 1 to entry: Important with short sights where small centering *errors* (3.2.5.3) could introduce serious inaccuracy.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.9.4
centering an instrument
procedure carried out by the operator to bring the vertical (standing) axis vertically over a mark on the ground or under a mark overhead using a *plumb bob* (3.2.11.3) or an *optical plummet* (3.2.9.15).

[SOURCE: ISO 7078:1985, 6.31]

3.2.9.5
double setting
dual setting
leveling procedure whereby observations are duplicated by resetting the instrument to detect *errors of measurement* (3.2.5.3) immediately

[SOURCE: BS 3618-1:1969]

3.2.9.6
electronic level
precise leveling instrument in which a pendulous device (bubble or pendulum) forms part of an electrical alternating current bridge where the deviation from vertical is indicated on a milliammeters

[SOURCE: BS 3618-1:1969]

3.2.9.7
foresight
sight on a new *survey* (3.2.1.31.1) point in connection with a survey, or on a previously established point to close a circuit

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.9.8
leveling an instrument
procedure carried out by the operator to bring the vertical (standing) axis to a vertical position

Note 1 to entry: In tilting levels, the final leveling of the telescope is carried out with the aid of a tilting screw and in compensator instruments with the aid of an automatic compensator.

[SOURCE: ISO 7078:1985, 6.31]

3.2.9.9
overlay tracing
layover tracing
tracing on which the workings in a seam are shown, a series of such tracings allows the workings in several seams to be seen in their correct horizontal relationship

[SOURCE: BS 3618-1:1969]

3.2.9.10.1
parallax
<surveying> incorrect reading of a graduation on an instrument if the observer's eye is not truly normal to the graduated plate

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.9.10.2
parallax
<bearing> change in *bearing* (3.2.8.6.1) or apparent position of an object produced by a change in the observer's position

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.9.10.3
parallax
<telescope> apparent displacement, or change in position, of the crosshairs of a focusing telescope with reference to the image of an object, as the eye is moved from side to side, when the focus of the eyepiece or objective is imperfect

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.9.11
plumb, verb
to carry a *survey* (3.2.1.31.1) into a mine through a shaft by means of heavily weighted fine wires hung vertically in the shaft

Note 1 to entry: The line of sight passing through the wires at the surface is thus transferred to the mine workings.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.9.12
straightedge leveling
system of leveling using a straight edge and a spirit level in places which are too steep for the convenient use of conventional instruments

[SOURCE: BS 3618-1:1969]

3.2.9.13
theodolite
precision (3.2.3.17) *surveying* (3.2.1.32) instrument for measuring angular distances in both vertical and horizontal planes, whose main components are the horizontal circle and the vertical circle, the telescope and additional devices for reading the *graduated circles* (3.2.8.12) and for setting up the vertical axis

Note 1 to entry: The telescope can be rotated on the horizontal axis and supported on a telescope support which can be rotated on the vertical axis.

Note 2 to entry: A theodolite can also be used for optical distance *measurement* (3.2.3.10).

Note 3 to entry: A theodolite used in astronomical work is usually termed either an astronomical theodolite or a *transit* (3.2.8.22) instrument.

[SOURCE: ISO 9849:2017, 3.1.19, modified - The definition and Note 1 to entry have been reworded.]

3.2.9.14
turning point
intermediate point of known elevation in a level circuit

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.9.15
optical plummet
optical centering device
optical device which enables a theodolite to be accurately positioned over or under a *survey* (3.2.1.31.1) station

[SOURCE: BS 3618-1:1969]

3.2.9.16
phototheodolite
ground-*surveying* (3.2.1.32) instrument used in terrestrial *photogrammetry* (3.2.3.16), combining the functions of a theodolite and a camera mounted on the same tripod

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.10 Photogrammetry

3.2.10.1
aerial survey
survey (3.2.1.31.1) using aerial photographs as part of the *surveying* (3.2.1.32) operation

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.10.2
airborne control survey
abc
control survey (3.2.1.7) using theodolites, electronic distance measuring equipment and a helicopter equipped with a hoversight and flashing light

Note 1 to entry: The helicopter is hovered over a ground station and the position of the flashing light is determined by computations.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.11 Planimetry

3.2.11.1
baseline
DEPRECATED: basis parallel
<control of scale> line, the horizontal length of which has been determined with great *precision* (3.2.3.17)

Note 1 to entry: Such lines are used to control the linear scale of a triangulation system.

[SOURCE: BS 3618-1:1969]

3.2.11.2
planimetry
measurement (3.2.3.10) of plane surfaces

Note 1 to entry: The plan details of a *map* (3.3.9.1); the natural and cultural features of a region (excluding relief) as shown on a map

Note 2 to entry: Planimetry is used e.g. for the determination of horizontal distances, angles, and areas on a map.

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.11.3
plumb line
plumb bob
plummet
device used to produce a vertical line between a *survey* (3.2.1.31.1) instrument and the reference point over (or sometimes under, in underground work) which it is set

Note 1 to entry: Special plumb lines are used in a vertical shaft to transfer a fixed or an *azimuth* (3.2.12.1) angle from the surface to underground workings for the purpose of orientation.

Note 2 to entry: See also *Weisbach triangle* (3.2.11.5).

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.11.4
triangulation station
marked and/or described point whose position has been determined by triangulation

Note 1 to entry: The usage has broadened to include any precise control station.

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.11.5
Weisbach triangle
highly attenuated triangle formed by the *plan* (3.1.1.3) position of two shaft *plumb lines* (3.2.11.3) and one observation station

[SOURCE: BS 3618-1:1969]

3.2.11.6
Weiss quadrilateral
quadrilateral formed by the *plan* (3.1.1.3) position of two shaft *plumb lines* (3.2.11.3) and two observation stations

[SOURCE: BS 3618-1:1969]

3.2.12 Course determination

3.2.12.1
azimuth
direction (3.2.12.7) of a horizontal line as measured on an imaginary horizontal circle, the horizontal direction reckoned clockwise from the *meridian* (3.2.2.31.2) plane of the observer, expressed as the angular distance between the vertical plane passing through the point of observation and the poles of the Earth and the vertical plane passing through the observer and the object under observation

[SOURCE: Dictionary of Mining, Mineral and Related Terms, U.S. Bureau of Mines, 1996]

3.2.12.1.1
astronomic azimuth
at the point of observation, angle measured from the vertical plane through the celestial pole to the vertical plane through the observed object

Note 1 to entry: Astronomic *azimuth* (3.2.12.1) is the terrestrial azimuth which results directly from observations on a celestial body: it is measured in the plane of the horizon and is usually reckoned from south (0°), through west (90°), north (180°), and east (270°) back to south (360° or 0°).

Note 2 to entry: It is affected by the local deflection of the vertical (station error).

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.12.1.2
geodetic azimuth
horizontal angle at station “A” measured from a north south plane (perpendicular to the reference ellipsoid) clockwise to an ellipsoidal normal section passing through station “B”

Note 1 to entry: Geodetic azimuth is determined by applying a correction to *astronomic azimuth* (3.2.12.1.1) or by computations on the reference ellipsoid. The *azimuth* (3.2.12.1) from "A" toward "B" is the forward azimuth while the azimuth from "B" toward "A" is the back azimuth of station "B".

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]

3.2.12.1.3
grid azimuth
angle in the plane of *projection* (3.3.11) between a straight line and the central *meridian* (3.2.2.31.1) (y-axis) of a plane-rectangular *coordinate system* (3.2.1.9)

Note 1 to entry: Although essentially a *map* (3.3.9.1) quantity, a grid *azimuth* (3.2.12.1) can, by mathematical processes, be transformed into a *geodetic azimuth* (3.2.12.1.2).

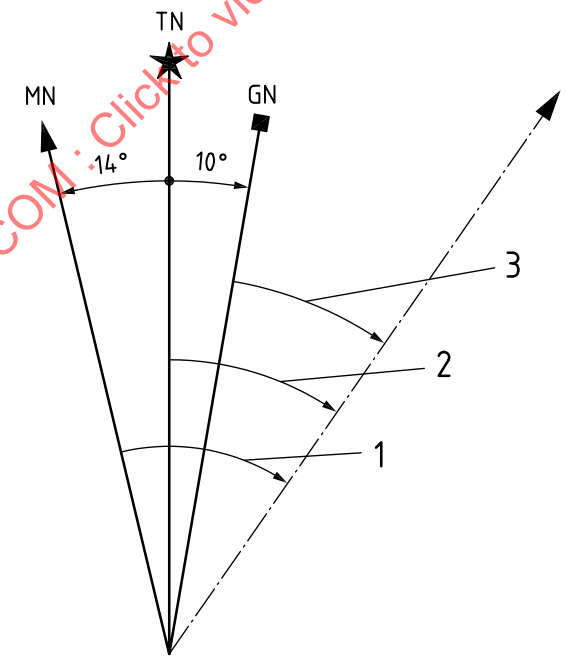
Note 2 to entry: Topographic maps normally have a *declination* (3.2.2.13) diagram drawn on them.

Note 3 to entry: On Northern Hemisphere maps, *declination* diagrams describe the angular difference between magnetic north and *true north* (3.2.2.22). On the *map* (3.3.9.1), the angle of true north is parallel to the depicted lines of *longitude* (3.2.2.27). Declination diagrams also show the *direction* (3.2.12.7) of grid north.

Note 4 to entry: See Figure 11.

Note 5 to entry: This declination diagram describes the angular difference between grid, true, and magnetic north. This illustration also shows how angles are measured relative grid, true, and magnetic azimuth.

[SOURCE: Location, Distance and Direction on Maps, University of British Columbia Okanagan, 2006]



Key

MN	magnetic north	1	magnetic azimuth = 49°
TN	true north	2	true azimuth= 35°
GN	grid north	3	grid azimuth= 25°

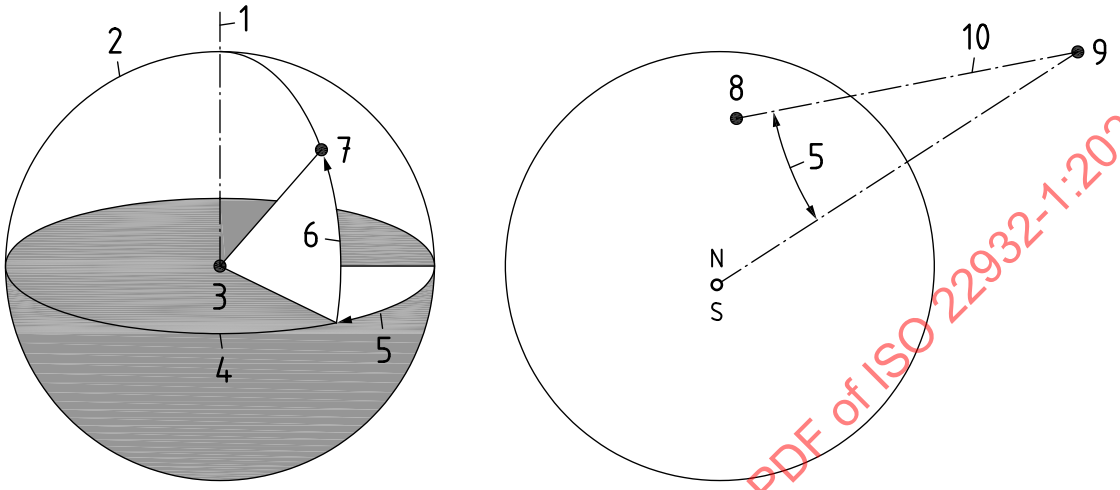
NOTE SOURCE: Reference [26].

Figure 11 — Grid azimuth

3.2.12.2
azimuth of a line
angle measured clockwise from the northerly *direction* (3.2.12.7) of the geographic *meridian* (3.2.2.31.1) to the direction of the line

Note 1 to entry: See Figure 12.

[SOURCE: BS 3618-1:1969]



Key

1	zenith	5	azimuth	9	observer location
2	celestial meridian	6	altitude	10	line of sight
3	observer	7	star		
4	horizon	8	target location		

NOTE SOURCE: Reference [25].

Figure 12 — Azimuth of line

3.2.12.3.1
borehole survey
<course> process of determining the *course* (3.2.12.4) of, and the target point reached by, a borehole, using one of several different *azimuth* (3.2.12.1) and dip recording apparatuses small enough to be lowered into a borehole; also, the record of the information thereby obtained

Note 1 to entry: Note1 to entry: Also called drill hole *survey* (3.2.1.31.1); directional survey.

[SOURCE: BS 3618-1:1969]

3.2.12.3.2
borehole survey
<strata> *survey* (3.2.1.31.1) to obtain information about the strata intersected by a bore hole

[SOURCE: BS 3618-1:1969]

3.2.12.4
course
direction (3.2.12.7) of a line with reference to a *meridian* (3.2.2.31.1)

[SOURCE: Glossary of BLM surveying and mapping terms, 1980]