

## 3.3 Road Location Survey

In forestry road applications, there are two general types of surveys: a field traverse and a location survey. To determine which survey type and level is required, consider the physical characteristics of the terrain, the design complexity, and the desired road prism geometry.

The two terms most commonly associated with survey and design are P-line (the Preliminary Line) and L-line (the Location Line). Despite a common assumption, the P-Line is not the original, flagged reconnaissance line, but a traversed survey based on the results of the reconnaissance. The P-line is established in the field and shown as a plotted line on a drawing to provide the horizontal and vertical control for the roadway centreline.

The L-line, is the designed roadway centreline shown on a drawing with tangent Point of Intersection (PI), Beginning of Curve (BC), and End of Curve (EC) chainages. The L-line is often established in the field as offsets to the P-line based on the road centreline design. Where close control of cut and fill slopes are required, the L-line is established after grubbing and stripping operations by setting grade stakes.

### 3.3.1 Types of Survey

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#### **Field traverse**

Carry out a field traverse for road layout and design to collect data and measurements for the road location. A field traverse is also sometimes referred to as Survey Level 1, see Survey Levels following. This level of survey is appropriate only for roads with no geometric road design, such that the road layout is tied down and can be mapped and reproduced in the field.

#### **Location survey**

Carry out a location survey to obtain information and measurements necessary for a detailed design, or to obtain information when geometric road designs are required. Compared with a field traverse, a location survey is carried out at a higher level of survey (i.e., Survey Level 2, 3, or 4) to capture more information at a level suitable for detailed drawings.\*

If as-built surveys are required for volume determination or to check conformance to the design, use a location survey level that is suitable for accurately re-establishing the road centreline location.

If construction surveys are required, use a location survey level that is suitable for accurately re-establishing the construction control points.

The accuracy achieved with any survey level depends, in part, on the type and condition of survey equipment used, the competence of the crew, and the field methods used. Global Positioning System (GPS) receivers, like other survey equipment, are acceptable when they can achieve the required horizontal and vertical accuracy for the appropriate survey level.

Stream crossings require special consideration. Site information requirements for bridge and culvert planning and design are provided later in:

- [Road Design Criteria](#)
- [Site Data & Survey Requirements for Bridges & Major Culverts](#)
- [Site Survey for Stream Crossings](#)

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**\*Note:** APEGBC discourages the use of the terms "as-built drawings" or "as-constructed drawings" as they imply that the drawings show exactly what was built or constructed. The terms may also suggest a level of certification or impose inappropriate liability. For this reason, APEGBC recommends and uses the term "record drawings." For more information:

- [APEGBC Quality Management Guidelines "Use of the APEGBC Seal"](#)

## 3.3.2 Survey Levels

This section outlines practices for field traverses and location surveys. Although considerable gains have been made in survey instrumentation technology, use of the technology does not preclude the need to follow standard survey practices as outlined in the Manual for Roads and Transportation (BCIT 1984).

Use Global Positioning System units only where the specified accuracy can be achieved to establish GPS waypoints and tracks necessary to accurately locate the road centreline and stream culvert crossings.

Use the following criteria to determine the appropriate survey level for a field traverse (Survey Level 1) or location survey (Survey Levels 2, 3, or 4). Note the equipment may be appropriate for the level but, more importantly, the skill of the surveyor is paramount in achieving the accuracy required. Geo-reference any survey that is carried out on an FSR.

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### **Survey Level 1 (for field traverses)**

**Application:** Where a low likelihood of landslides, and for situations where geometric road design, construction surveys, and as-built surveys are not required. Equipment may include hand compass, recreational GPS and hip chain.

**Horizontal accuracy:** Turning points are to be established to a relative accuracy of 1:100.

**Vertical accuracy:** Within equipment precision for slope corrections.

### **Survey Level 2 (for location surveys on stable terrain)**

**Application:** For location surveys on stable terrain with a low likelihood of landslides and for situations where a geometric road design, construction surveys, or as-built surveys are desired. Equipment may include hand compass, clinometer and steel or fiberglass chain.

**Horizontal accuracy:** Turning points are to be established to a relative accuracy of 1:300.

**Vertical accuracy:** =  $1.0 * \sqrt{\text{total distance in kilometres, expressed in metres}}$ . For example, the vertical accuracy for a 1km road is 1m. For a 2km road, the vertical accuracy is 1.41m.

### **Survey Level 3 (for location surveys within areas of moderate or high likelihood of landslides)**

**Application:** For location surveys, construction surveys, geometric road design, and as-built surveys in areas of moderate to high likelihood of landslides, as determined by a terrain stability field assessment. This is also the appropriate level of survey for material volume determination and detailed-engineered estimates. May also be used for bridge and major culvert planning and design, but greater vertical accuracy might be necessary. Equipment may include staff compass, rod and steel chain.

**Horizontal accuracy:** Turning points are to be established to a relative accuracy of 1:1,000.

**Vertical accuracy:** =  $0.5 * \sqrt{\text{total distance in kilometres, expressed in metres}}$ . For example, the vertical accuracy for a 1 km road is 0.5 m. For a 2 km road, the vertical accuracy is 0.71 m.

### **Survey Level 4 (for high-order survey requirements)**

**Application:** A high-order survey for location surveys, construction surveys, construction contracting on a cost-per-unit basis, check surveys, placement of permanent bridges, as-built surveys through Crown leases, mineral and placer claims, and leases, private property, and surveys to re-establish private property lines. Equipment may include transits, rod and steel chain, or total station instruments.

**Horizontal accuracy:** Turning hubs are to be established to a relative accuracy of 1:5,000.

**Vertical accuracy:** =  $0.3 * \sqrt{\text{total distance in kilometres, expressed in metres}}$ . For example, the vertical accuracy for a 1 km road is 0.3 m. For a 2 km road, the vertical accuracy is 0.42 m.