SELECTION OF MODERN EQUIPMENT FOR GEODETIC PRODUCTION NEEDS

STEPANENKO Anastasiia Olehivna
2nd year student of the
specialty "Geodesy and Land Management"
National University "Yuri Kondratyuk Poltava Polytechnic"

Scientific supervisor
NESTERENKO Svitlana Viktorivna
PhD in Technical Sciences,
Associate Professor of the
Department of Highways,
Geodesy and Land Management,
National University "Yuri Kondratyuk Poltava Polytechnic",
Poltava, Ukraine
ab.Nesterenko_SV@nupp.edu.ua

For various geodetic works, appropriate measurement accuracy is required, which is a determining criterion when choosing geodetic equipment. Accuracy requirements can differ significantly; for example, for the construction of a multi-story building, monitoring the settlement of a hydroelectric dam, or installing high-precision industrial equipment, accuracy down to a fraction of a millimeter is necessary. At the same time, for laying utilities, landscape planning, or general construction work, accuracy of a few millimeters or even centimeters is sufficient. Incorrect choice of instrument can lead to critical errors in the project, budget overruns, or time losses.

The modern market offers a wide selection of geodetic equipment with various technical characteristics, covering products from leading global and regional manufacturers such as Leica (Switzerland), Topcon (Japan), Sokkia (Japan), Trimble (USA), FARO (USA), Stonex (Italy), South (China), and Riegl (Austria). The cost of instruments from these manufacturers can range from $230 to $75,000. The price is influenced by a number of factors: brand, accuracy, technical specifications, etc.

The budget segment is represented by optical levels and simplified digital solutions. Optical instruments like the Leica NA2 [1] (approximately $3,500) remain precision instruments, while construction models such as the Topcon AT-B2, Sokkia B20, or South NL-32G, costing from $250 to $1,500, are mass-market tools for general construction work. The situation is similar in the digital sector: the South DL-2007 and Stonex D2 levels, priced at $1,500–$2,000, allow automated measurements with 0.7 mm accuracy, making them a rational choice for companies that need digital data recording without excessive investment in the ultra-high precision of premium brands.

The final choice of level always depends on the specific task, as each instrument finds its optimal application: from high-precision engineering measurements requiring the Leica DNA03 to daily monitoring on construction sites with the simple and reliable South NL-32G.

The middle category in terms of accuracy and cost includes digital angular and vertical measuring instruments. Electronic theodolites such as the Topcon DT-209L (around $3,500) and Leica Builder T106 [2] (from $2,000) provide high accuracy in angular measurements (2"–6"), but are limited in distance measurement compared to total stations. In the same price range, digital levels like the Trimble DiNi03 (around $8,000) and Leica DNA03 [3] (from $4,000) offer reference-grade vertical accuracy of 0.3 mm, making them indispensable for structural deformation monitoring. Japanese counterparts Topcon DL-501 and Sokkia SDL30 (around $4,000) are somewhat more accessible and faster in operation, providing 0.4–0.6 mm accuracy for industrial construction.

Total stations have become an indispensable tool of modern geodesy, combining the functions of a theodolite, rangefinder, and digital data collector. Basic models typically cost from $10,000 to $25,000 [4] and offer fundamental surveying functions, while mid-range models, costing from $25,000 to $50,000, integrate additional automated data processing capabilities. The premium segment is represented by robotic total stations priced from $50,000 to over $100,000 [5], equipped with active tracking and 3D scanning capabilities.

For topographic and geodetic work, optimal solutions are chosen when the stated technical characteristics match the type of work, while the product cost is not inflated. GNSS stations such as the Leica GR50 and Trimble R10 (from $8,000 to $20,000+) provide centimeter-level positioning accuracy in global coordinates, which is critical for establishing the geodetic foundation for all other measurements.

In the highest price segment are 3D laser scanning systems. The Leica ScanStation P50 and Trimble TX8 are flagships of terrestrial scanning, where the price of over $80,000–$115,000 [6] is justified by the ability to collect millions of points per second with millimeter accuracy at distances up to 1 km. In contrast, the compact Riegl VUX-1 sensor (approximately $50,000–$75,000) is optimized for drone mounting, offering high-accuracy aerial data collection. The FARO Freestyle 2 [7] handheld scanner (around $15,000) completes this segment as a mobile solution for complex interiors, where speed and portability are more important than long range.

The selection of geodetic equipment today is a strategic decision that takes into account project specifics, operational costs, and integration capabilities with geographic information systems. Investments in robotic systems and GNSS technologies justify themselves through time savings, staff reduction, and increased accuracy. At the same time, the budget segment remains relevant for typical construction work without the need for sub-millimeter precision.

The future of geodesy lies in the integration of artificial intelligence, drone technologies, and cloud solutions. Companies that invest in modern equipment and personnel training today will gain significant competitive advantages in a rapidly

evolving market. The right balance between accuracy, functionality, and equipment cost remains a key success factor in the geodetic business.

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У збірнику матеріалів конференції подано результати сучасних наукових досліджень за секціями: землеустрій та кадастр в умовах воєнного стану та повоєнного відновлення, оцінка земель, врахування збитків та управління ризиками, геопросторові технології та ДЗЗ. Розраховано для науково-педагогічних працівників, представників науково-дослідних установ, науковців, спеціалістів установ та фахівців землевпорядного напрямку, аспірантів, студентів.

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