

Dataset Development of Accessibility of Public Service Facilities among Townships of Qinghai-Xizang Plateau (2020)

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Abstract: Accessibility to public service facilities serves as a critical metric for guiding the planning and development of transportation systems and public infrastructure. In recent years, the construction of roads and public service facilities on the Qinghai-Xizang Plateau has significantly enhanced regional accessibility. This study developed a township-level dataset (2020) to assess the accessibility of public service facilities across the Qinghai-Xizang Plateau. The dataset integrates road network data, points of interest (POI) and slope analyses to quantify the shortest travel time (in hours) from each township to key urban centers (prefecture-level cities and county) and facilities, including stores, banks, hospitals and junior high schools. The results reveal that the average travel times from townships to the nearest prefecture-level city, county, store, bank, hospital, and junior high school are 5.52 h, 1.96 h, 1.45 h, 1.48 h, 2.13 h, and 1.90 h, respectively. Significant regional disparities are observed: accessibility is relatively higher within prefecture-level city jurisdictions but diminishes in peripheral county areas. To further advance research aimed at improving the quality of life for residents on the Qinghai-Xizang Plateau, future studies could expand this dataset by incorporating metrics such as facility capacity and service coverage. The dataset is archived in .shp format, with a total size of 86.4 MB (compressed into one file, 53.2 MB).

Keywords: Qinghai-Xizang Plateau; accessibility; public service facilities

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Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: <https://doi.org/10.3974/geodb.2025.03.04.V1>.

1 Introduction

Public service facilities, including educational institutions, healthcare providers, commercial services, financial infrastructure, community resources, utilities and administrative centers form the basis of societal development. Accessibility, defined as the ease of reaching these facilities from a given location^[1], has emerged as a critical focus in urban planning and

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[2] Guo, K. F., Dai, T. Q., Zhang, L. L. Dataset on accessibility of public service facilities among townships of Qingzang Plateau (2020) [J/DB/ OL]. *Digital Journal of Global Change Data Repository*, 2025. <https://doi.org/10.3974/geodb.2025.03.04.V1>.

regional development. It serves not only as the aim of transportation projects but also as a key metric for evaluating developmental equity. Recent studies further investigate its correlations with demographic patterns, economic productivity and resident satisfaction^[2–5].

The Qinghai-Xizang Plateau, with its extreme climate, complex topography and fragile ecosystems, presents unique challenges for sustainable development. While two decades of infrastructure expansion have significantly improved connectivity and service availability^[6], systematic assessments of accessibility remain scarce. This paper addresses this gap by developing a township-level accessibility dataset that integrates road networks, Points of Interest (POI), and slope-adjusted travel speeds. The dataset quantifies travel times to essential destinations, i.e., prefecture-level city, county, store, shop, bank, hospital, and junior high school and provides a foundation for optimizing resource allocation and supporting interdisciplinary research in economic growth, ecological conservation and tourism planning.

2 Metadata of the Dataset

The name, author, geographic area, data year, spatial resolution, data files, data publishing and sharing service platform, data sharing policy and other information of the Dataset on accessibility of public service facilities among townships of Qingzang Plateau (2020)^[7] are shown in Table 1.

Table 1 Metadata Summary of the Dataset on accessibility of public service facilities among townships of Qingzang Plateau (2020)

Items	Description
Dataset full name	Dataset on accessibility of public service facilities among townships of Qingzang Plateau (2020)
Dataset short name	Qztime_2020
Authors	Guo, K. F., Beijing Normal University, 202431051039@mail.bnu.edu.cn Dai, T. Q., Beijing Normal University, daiteqi@bnu.edu.cn Zhang, L. L., Beijing Normal University, 202221051066@mail.bnu.edu.cn
Geographic area	Qinghai-Xizang Plateau, China
Year	2020
Spatial resolution	Township
Data format	.shp
Data size	86.4 MB
Data files	The accessibility calculation results of townships in Qinghai-Xizang Plateau to cities, counties, stores, banks, hospitals and junior high schools
Foundation	Ministry of Science and Technology of P. R. China (2019QZKK0406)
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	(1) <i>Data</i> are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use <i>Data</i> subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute <i>Data</i> subject to written permission from the GCdataPR Editorial Office and the issuance of a <i>Data</i> redistribution license; and (4) If <i>Data</i> are used to compile new datasets, the “ten percent principal” should be followed such that <i>Data</i> records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset ^[8]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS, GEOSS, PubScholar, CKRSC

3 Methods

3.1 Data Sources

The data used in this dataset includes:

- (1) The road network data comes from the Second Tibetan Plateau Scientific Expedition and Research (2019QZKK0406), which is the road network of this region in 2020;
- (2) Use SRTM (Shuttle Radar Topography Mission) Digital Elevation Model (DEM) data jointly measured by NASA and NIMA¹, with a resolution of 90 m;
- (3) The vector boundaries (provincial to county levels) from China’s 1:1 million National Geographic Database, updated to reflect 2020 jurisdictional adjustments²;
- (4) Boundary definitions sourced from the Datasets of the boundary and area of the Tibetan Plateau in the website of the “Global Change Research Data Publishing & Repository”^[9,10], with borders verified against authoritative geographic databases;
- (5) Locations of prefecture-level cities, counties, stores, banks, hospitals, and junior high schools were collected via Amap’s licensed API. Education and medical POI were verified according to the survey data.

3.2 Data Processing

The methodology for constructing the dataset on accessibility of public service facilities among townships of Qinghai-Xizang Plateau (2020) involves 4 phases (Figure 1).

(1) Data collection and integration: Core datasets were aggregated, including road networks, DEM, administrative boundaries, and POI locations for public facilities;

(2) Division of evaluation unit: A 30-km buffer extending beyond the plateau’s boundary was applied to foundational datasets to eliminate edge effects in route calculations, ensuring robust results within the core study area;

(3) Generation of time cost grid: First, DEM-derived slope values were classified into 4 topographic categories: plain (0%–10%), hill (10%–25%), mountain (25%–60%) and steep slope (more than 60%). The road grade determines the upper limit of the speed, but the slope will affect the actual road speed^[11]. Road speeds, i.e., driving speed were dynamically adjusted based on slope-road grade interactions (Table 2). The speed of road class under the grade IV was set at 10 km/h, Roadless areas assumed a walking speed of 5 km/h. The two are combined to get the total speed. Composite speed layers were converted to a unified m/s unit, enabling derivation of a second-per-grid-cell time-cost raster;

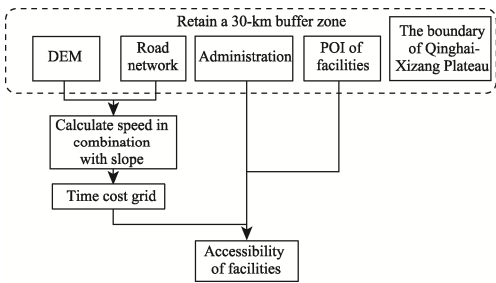


Figure 1 Flowchart of the dataset development

Table 2 Speed reclassification combined with slope (Unit: km/h)

Slope grade	High way	Road Grade I	Road Grade II	Road Grade III	Road Grade IV
Plain (0%–10%)	120	80	80	60	30
Hill (10%–25%)	100	60	60	50	25
Mountain (25%–60%)	80	50	50	40	30
Steep slope (>60%)	60	40	40	30	15

(4) Calculation the accessibility of public facilities: The cost distance tool in ArcGIS was

1 Geospatial Data Cloud, Computer Network Information Center, Chinese Academy of Sciences. <http://www.gscloud.cn>.
2 National Catalogue Service for Geographic Information. www.webmap.cn.

employed to calculate the minimum travel time from each township to the nearest public service facilities. POI locations (including prefecture-level cities, counties, stores, banks, hospitals, and junior high schools) and township centroids were loaded as target and source features respectively. The time-cost grid (generated in Step 3) was used as the friction surface. Results were exported with travel time expressed in hours, rounded to 2 decimal places for consistency.

4 Data Results

4.1 Dataset Composition

The dataset on accessibility of public service facilities among townships of Qinghai-Xizang Plateau includes a data file in .shp format, in which the attribute fields “city”, “county”, “store”, “bank”, “hospital” and “school” are the shortest time from each township to the nearest city, county, store, bank, hospital and junior high school, respectively, the unit is h.

4.2 Data Results

The results of dataset show that the accessibility of townships on the Qinghai-Xizang Plateau to all types of essential service facilities averages approximately 1.5 h. Specifically, the average travel times for townships to reach the nearest shops, banks, hospitals and junior high schools is 1.45 h, 1.48 h, 2.13 h and 1.90 h, respectively. The average travel times to prefecture-level cities and counties are 5.52 h and 1.96 h, respectively.

Using the natural breaks classification method, accessibility to various facilities was categorized into 5 levels, revealing distinct spatial patterns (Figure 2). It is found that the overall accessibility is quite different in regions. Within the jurisdiction of each city, all kinds of accessibility are relatively good, and in the marginal areas of the county, all kinds of accessibility are relatively poor.

Specifically, the accessibility to the city center shows a trend that the accessibility around city is better (Figure 2), and the accessibility of the fringe of the city and outside the city is getting worse. At the same time, the border area of the Qinghai-Xizang Plateau is also accessible because it is close to the urban areas outside the plateau. Because there is no subordinate municipal district in Ngari Diqu (Region) in 2020, it is a area with poor accessibility. The accessibility to the county is concentrated within 3.42 h, and the city center and its adjacent areas are also good accessibility areas. Due to the large area of some townships, the time for townships to reach the county may be extended accordingly, such as Dongru Township in Rutog Xian (County) in the north of Ngari Diqu (Region) and Rongma Township in Nyima Xian (County) in the west of Nagqu Diqu (Region).

The time from most towns to the store is within 1.27 h, but it takes a long time for some towns located in Gerze Xian (County) in the north of Ngari in Xizang, Amdo Xian (County) and Shuanghu County in the north of Nagqu, Qiemo Xian (County) and Ruoqiang Xian (County) in Bayingolin Mongolian Autonomous Prefecture. The accessibility to the bank is concentrated within 2.95 h, which is similar to the accessibility pattern to the store, showing that some areas in northern Xizang and southern Xinjiang have poor accessibility.

The accessibility to hospitals is mostly within 4.05 h, showing a pattern of good accessibility in the center of cities and counties and relatively poor accessibility in the periphery, and the accessibility in parts of northern Xizang and southern Xinjiang is also poor. The accessibility to junior high schools is similar to that to hospitals, and the accessibility of most townships is within 3.20 h.

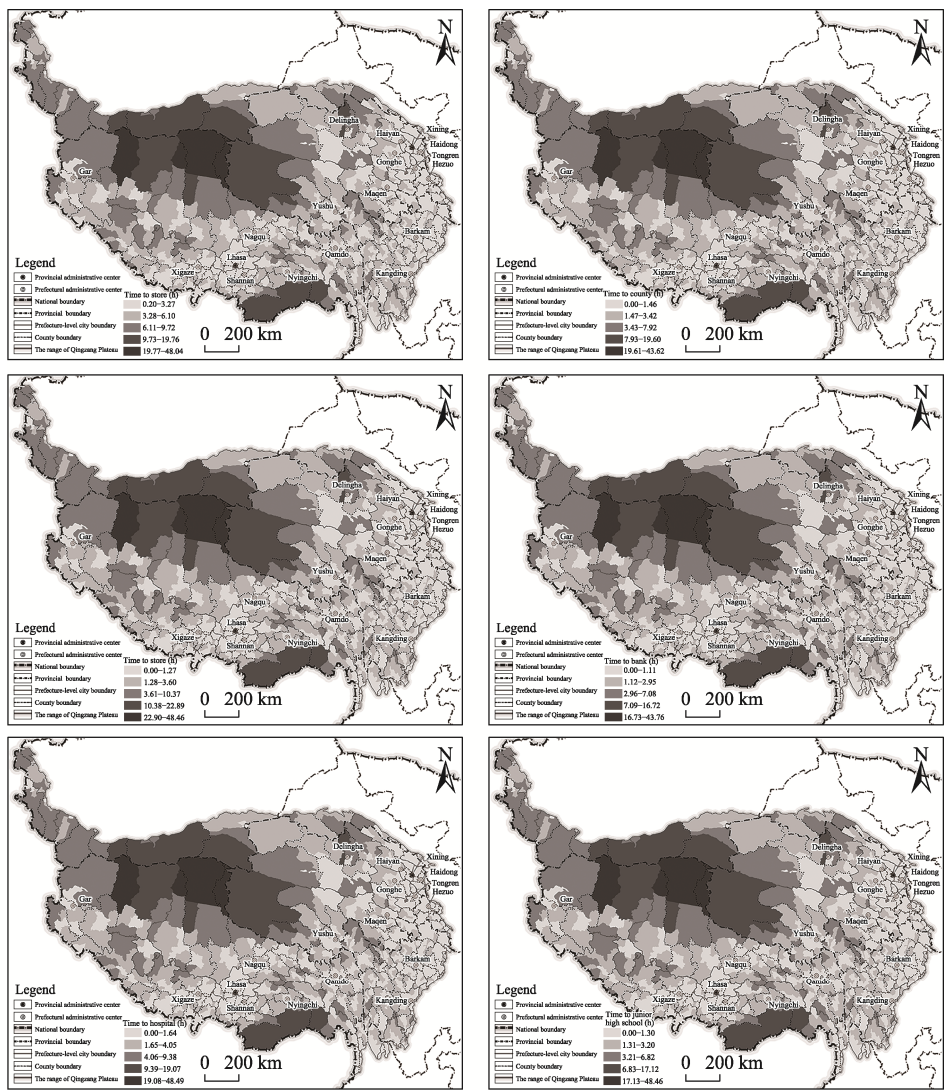


Figure 2 Maps of accessibility of townships in the Qinghai-Xizang Plateau to prefecture-level cities, counties and public service facilities

5 Discussion and Conclusion

Accessibility serves as a key indicator for public service facility planning and development. The accessibility to urban centers (cities and counties) and essential public facilities (including stores, banks, hospitals, and junior high schools) significantly impacts both the daily convenience for residents, and critical aspects such as emergency response capabilities and equitable distribution of educational resources. This dataset is based on road network data collected through the Second Tibetan Plateau Scientific Expedition and Research (2019QZKK0406). It integrates DEM data to account for slope effects and calculates accessibility to various facilities at the township levels. This approach enhances data support for analyzing current infrastructure distribution in the Qinghai-Xizang Plateau. Existing studies widely incorporate slope influence in accessibility calculations^[11–13]. This dataset refines the formula describing the relationship between slope and road speeds during

computation. Compared to accessibility results that disregard slope effects^[6], this dataset reveals longer time to the facility in steep-slope regions of the plateau, such as its northern and northwestern areas. This outcome demonstrates that omitting slope adjustments in accessibility models can lead to overestimated results.

However, current analysis focuses specifically on proximity to the nearest public service resources, the location of public service resources closest to townships, without accounting for variations in facility capacity or service quality. It should be noted that actual utilization patterns for healthcare, education, or commercial services may be influenced by these quality differentials. Future research building upon this dataset could incorporate additional parameters such as hospital beds, school levels, and retail market size to develop more comprehensive accessibility metrics. Such enhanced datasets would enable more targeted recommendations for facility upgrades and spatial optimization, ultimately supporting continuous improvement of living standards across Qinghai-Xizang Plateau.

Author Contributions

Guo, K. F. wrote this paper and processed the data preliminarily. Dai, T. Q. made an overall design for the development of the dataset; Zhang, L. L. completed the calculation of accessibility of various facilities.

Conflicts of Interest

The authors declare no conflicts of interest.

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