



# GUIDELINES FOR MAPPING OF BUILDINGS AND UNITS



Geomatics and Logistics Division  
Department of Human Settlement  
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DEPARTMENT OF HUMAN SETTLEMENT  
THIMPHU: BHUTAN

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### FOREWORD

With rapid influx of population to the urban centers over the last few decades, Thromdes such as Thimphu and Phuentsholing and bigger Dzongkhags, have been experiencing burgeoning pressure on housing, and public facilities & amenities. Currently, Thimphu houses about 40% of the total urban population of the country. The migration trend, as reported in the Population and Housing Census of Bhutan 2017, indicates that Thimphu Thromde accounted for a net gain of 48,214 migrants. Further, the revised Thimphu Structure Plan (TSP) 2023 indicates that by 2047, there will be a net gain of 81,300 people in Thimphu taking the projected population to a staggering 189,000.

While meeting adequate service demand is already a huge concern, efficient service delivery coupled with informed and data driven decision making has been further impeded by the lack of a proper database for housing, public facilities & amenities. In addition, the lack of a proper City Addressing System in majority of the towns has also made service delivery a huge challenge.

Thus, to address the abovementioned issues, the Department of Human Settlement instituted the Building Information System, also called the Zhichar System, to develop a comprehensive set of databases for buildings, apartments and dwellings for both urban centres and rural areas. Until the time systems such as the Construction Approval System (CAS) and Tenancy Database are in place to update the building data and household details automatically, field data collection will have to be carried out periodically.

Therefore, the Guidelines for Mapping of Buildings and Units is intended to serve as a guide for the enumerators while carrying out mapping of buildings and units. The Guideline comprises seven chapters covering the scope, objectives, and the methodology to be followed while assigning QR codes to map the buildings and units. The Guideline is intended to: i) facilitate registration and mapping of each unit and building; ii) establish a common standard for floor and unit numbering; iii) ensure that numbering is carried out throughout the building in a consistent, comprehensible and user-friendly manner; and iv) enable the users to locate places easily.

The Guideline has been formulated by a team of Urban Planners and GIS Analysts from the Geomatics and Logistics Division under the Department of Human Settlement. The Department would like to acknowledge the team for their contribution. In addition, the Department would also like to express our gratitude to the National Land Commission, Ministry of Finance, Thimphu Thromde, and the National Statistics Bureau for their assistance and valuable contributions in the review and finalization of the Guidelines. The Guideline is a working document and will be revised based on future requirements and changing scenarios.

(Tashi Penjor)  
Director

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# Guidelines for Mapping of Buildings and Units

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## 1. Background

With rapid influx of population to the urban centers over the last few decades, Thromdes such as Thimphu and Phuentsholing, have been experiencing burgeoning pressure on housing, and public facilities & amenities. Currently, Thimphu houses about 40% of the total urban population of the country. The migration trend, as reported in the Population and Housing Census of Bhutan 2017, indicates that Thimphu Thromde accounted for a net gain of 48,214 migrants. Further, the revised Thimphu Structure Plan (TSP) 2023 indicates that by 2047, there will be a net gain of 81,300 people in Thimphu taking the projected population to a staggering 189,000. The TSP also estimates that the projected home requirement by 2047 would be 50,700 for the additional population.

While meeting adequate service demand is already a huge concern, efficient service delivery coupled with informed and data driven decision making has been further impeded by the lack of a proper database for housing, public facilities & amenities. In addition, the lack of a proper City Addressing System in the majority of the towns has also made effective service delivery a huge challenge.

To address these issues, and to institute City Addressing System in all urban centers, the Department of Human Settlement under the Ministry of Infrastructure and Transport initiated the development of a comprehensive database for buildings, apartments, and dwellings for all the local governments. The database for Thimphu was developed in 2020 and the remaining Thromdes, Dzongkhag Thromdes, and Yenlag Thromdes in 2021. However, the database that was developed could not be updated periodically which has resulted in data redundancy and lack of a mechanism to ensure data currency.

Therefore, in 2023, a second round of data upgradation as well as development of geodatabase for new areas covering 64 Census Towns and plinth area mapping for all structures in rural areas was carried out. Until the time systems such as Construction Approval System (CAS) and Tenancy Database are in place to update the building data and household details, field data collection will have to be carried using this Guidelines.

### 1.1. Objectives of Developing Building Geodatabase

The main objectives of having a comprehensive database for buildings are to:

- i) Create a centralized database for buildings, apartments, and dwellings;
- ii) Ensure effective and efficient service provision;

# Guidelines for Mapping of Buildings and Units

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- ii) Promote and enhance evidence based or data driven decision making;
- iii) Facilitate formulation of affordable housing strategies;
- iv) Standardize City Addressing System; and
- v) Facilitate taxation, and property transfer.

To ensure consistency and uniformity, a set of standard guidelines is required for data collection as well as for building and unit numbering convention. Therefore, in order to standardize the process, this guideline has been formulated, primarily to facilitate registration of each unit and building by mapping them using QR codes.

## 1.2. Objectives of the Guidelines for Mapping of Buildings and Units

The objectives of this guideline are:

- i. To facilitate registration and mapping of each unit and building;
- ii. To establish a common standard for floor and unit numbering;
- iii. To ensure that numbering is carried out throughout the building in a consistent, comprehensible and user-friendly manner; and
- iv. To enable the users to locate places easily.

## 1.3. Scope of work

The scope of activities includes:

- i. Desktop review of international best practices;
- ii. Review, revision of the current Guidelines on data collection for housing geodatabase development;
- iii. Consultation with relevant stakeholders, and finalization of the Guidelines; and
- iv. Enhancement of the existing data collection application and system.

## 1.4. Frequency of Data Collection/Updating

The concerned Local Governments are required to update the building database for their respective jurisdiction as and when new structures are built. For those areas where there is no existing data, new database has to be developed. Till the time, other systems for integrated database development is in place, the building database has to be updated at least once every two years to maintain data currency.

## 2. Guideline for Buildings and Unit Registration/Numbering

The building registration starts with identifying the location of the buildings and collecting the location information or building geometry. The building can be identified as just a single point data or a polygon of the building footprint.

### 2.1. Building Mapping

#### 2.1.1. Areas with City Addressing System

If the City Addressing System (CAS) is in place for a particular area, then the building numbers will be pre populated as per the assigned building number in the CAS.

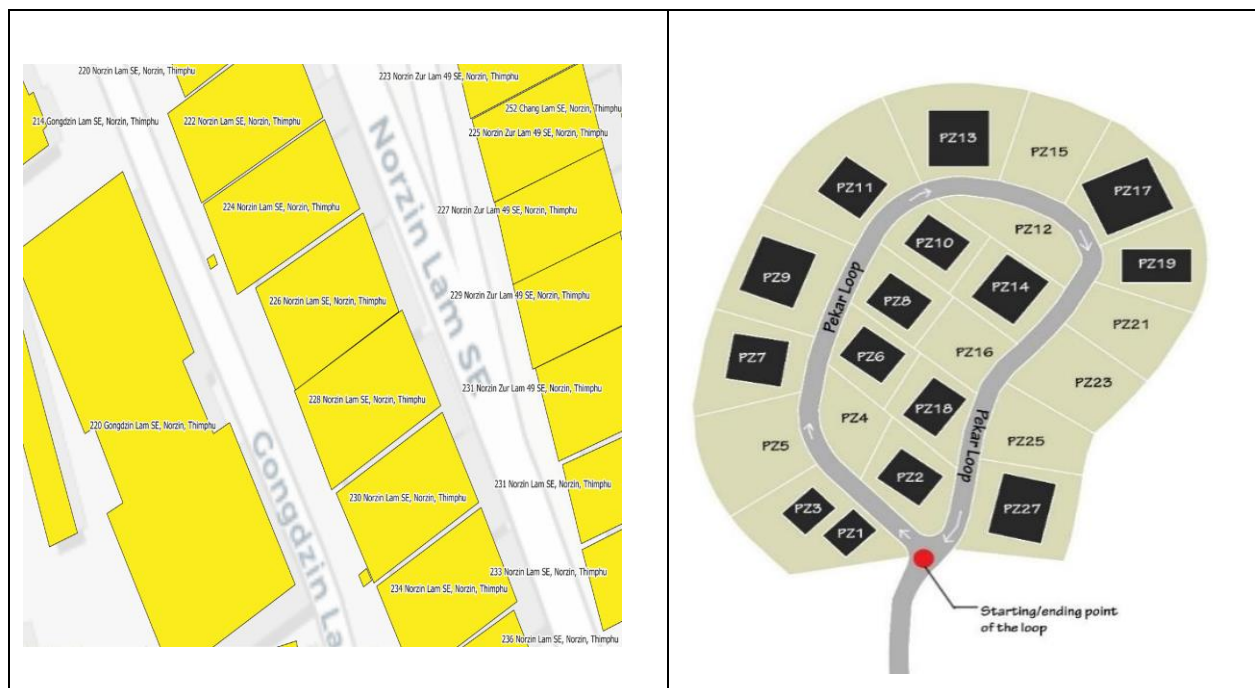


Figure 1: City Addressing System for Thimphu and Phuentsholing Thromdes ( Source: CAS, Thimphu & Phuentsholing Thromdes)

#### 2.1.2 Areas without City Addressing System

For those areas where there is no CAS, every building will be given a unique ID number. As and when the building numbers are assigned after the completion of the CAS, the building numbers will be updated in the database. This is also applicable for rural areas.

#### 2.1.3 Mapping using QR Codes

The use of QR codes to map each unit and building is being proposed to facilitate:

## Guidelines for Mapping of Buildings and Units

- i) Data currency by enforcing the tenants and owners to update the tenancy details as and when there is a change in tenancy in line with the Tenancy Act of Bhutan 2015;
- ii) Mapping of units and buildings;
- iii) Integrated data collection of various agencies where any agency can use the codes for their survey; and
- iv) Integrate service provision, where possible, using the codes.



Figure 2: Building QR Code(right) and Unit QR Code(left) Sample

### 2.1.4 Pasting of QR Codes

The QR shall be pasted on the building at a level from where it can be scanned easily. The code shall be properly laminated/protected so as to avoid damage. In case of damage or loss, the house owner/tenant shall report immediately to the concerned authority for replacement.

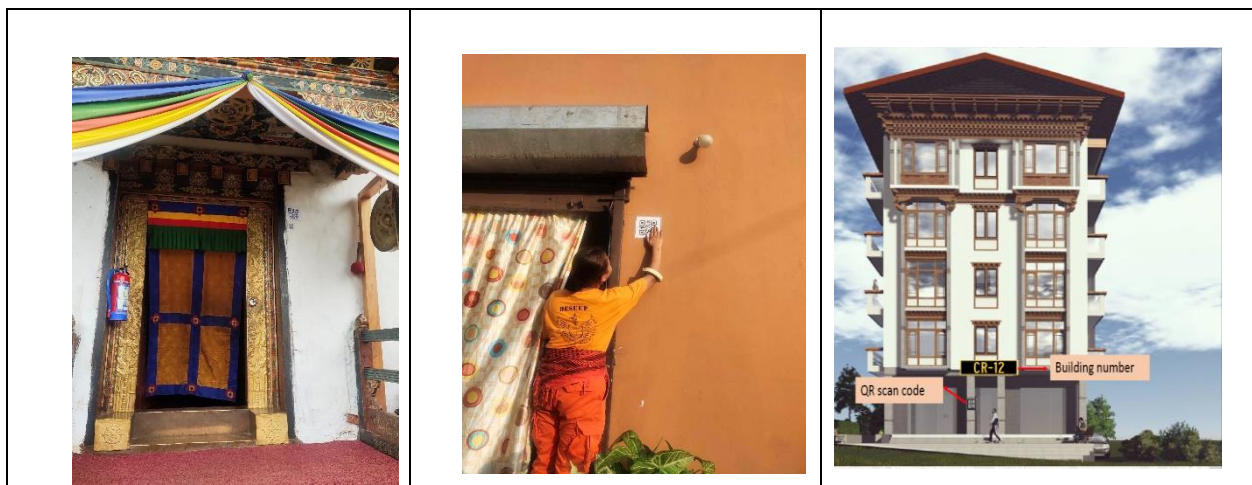


Figure 3: Pasting of QR Codes

## 3. Building Typology

### 3.1 Building Type

The buildings have been categorized based on the typology and construction methodology. For the purpose of segregation during mapping, the following four categories of buildings have been identified:

- i) **Traditional Building:** Houses which are constructed using locally sourced materials such as wood, stone, and earth and follow traditional Bhutanese architectural style.

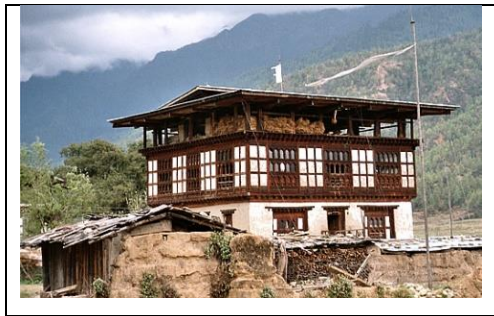


Figure 4: Traditional Building

- ii) **Contemporary Building:** A structure designed and constructed in accordance with the latest trends, technologies, and materials of the current era.



Figure 5: Contemporary buildings

- iii) **Temporary Building:** Any structure which is made of makeshift materials.



Figure 6: Temporary structures

## Guidelines for Mapping of Buildings and Units

- iv) **Protected Buildings:** In certain areas, there are buildings with cultural significance which are not allowed to be demolished or renovated without prior approval from the authorities. These are preserved buildings and therefore eligible for certain incentives. These buildings usually fall under Traditional village precincts or are designated as protected heritage sites. These buildings will assigned “protected” status in the building database. Eg: The Trong heritage village in Zhemgang.



Figure 7: Protected Buildings

### 3.2. Building based on household and Uses

#### 3.2.1. Single households

Single units such as a bungalow or a duplex/triplex occupied by one household shall be assigned *a single building code and a single unit code.*



Figure 8: Single Household Examples

#### 3.2.2. Combined/Jointly Owned Buildings

- These includes joint construction by two or more plot owners. Usually, one wall is common between two structures but they are built on one plot;

For such structures, since the buildings are owned by two or more separate owners, *either side of the building should be mapped with one building code and all units should be given one unit*

## Guidelines for Mapping of Buildings and Units

*code each.* For instance, if the building is jointly occupied as in the case of twin duplex, then a *single building code and two separate unit codes* will be assigned.



Figure 9: Joint construction on one plot (Eg. In Paro Town)



Figure 10: Example of two households/units in one building

### 3.2.3. Institutional Buildings, Hotels, and Resorts

- i. *One building QR Code* will be assigned to *each building* within the premises of the institution so that all structures are captured in the database.
- ii. Every unit such as classrooms in a school, divisions in an office or wards in a hospital **will not be assigned** a separate unit number; and
- iii. Staff quarters and structures in the institutional premises used for residential/commercial or units that are rented out by the institution shall be assigned separate unit numbers.

# Guidelines for Mapping of Buildings and Units



Figure 11: Institutional area with mixed uses (Source: Royal Thimphu College Website)

### 3.2.4. Ancillary Structures and Open Areas

- Ancillary structures such as stores or kitchen or a garage that are part of a household shall not be assigned separate QR codes; and
- Ancillary structures such as connecting shops, residential units or a store on lease that are used for commercial and residential purposes will be assigned separate unit QR codes. These structures will be numbered at the end so that their demolition in future will not affect the numbering convention of the remaining units.

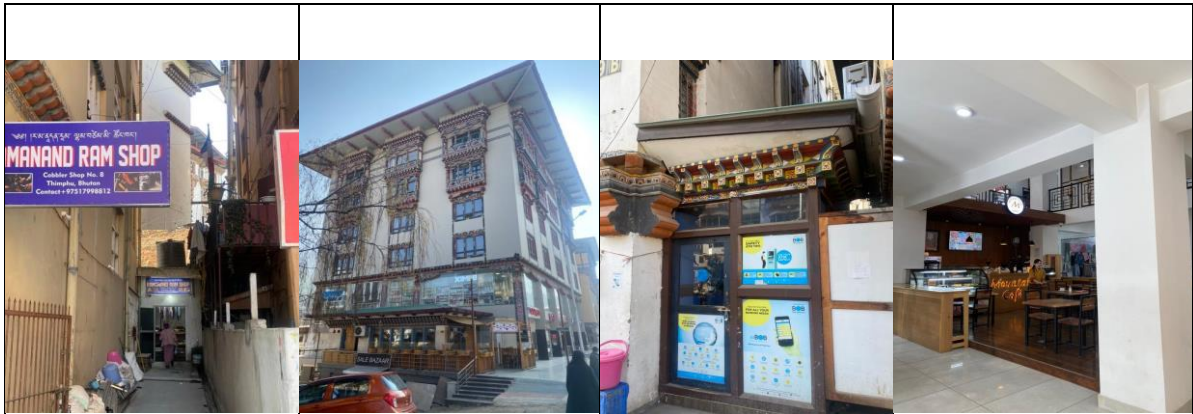


Figure 12: Types of Ancillary Structures

### 3.2.5. Vegetable Stalls

- Only **one building code and one unit code** will be allocated for the whole market if it comprises only vegetable stalls. Individual unit code for each stall **will not be** allocated

## Guidelines for Mapping of Buildings and Units



Figure 13: Vegetable market with single use

- However, if there are other **separate** buildings/uses within the area such as meat shops, mills, and cafes, then every structure will be allocated separate building and unit codes. For instance, the KaJa Throm in Thimphu has multiple uses such as vegetable stalls, cafes, exhibition hall, office etc. Therefore, **one building code and multiple unit codes** will be required since all units are inside one building.
- In the case of Punakha KaJa Throm, there are several structures for vegetable stalls, meat shop, cafes and toilets. So, all structures will require **one building and one unit code** each.



Figure 14: Vegetable market with multiple uses (Eg. KaJa Throm in Thimphu and Punakha)

# Guidelines for Mapping of Buildings and Units

## 4. Floor/Level Type

Different levels of a building including basements, attics, and jamthogs will be captured at the building level. **Mapping for the purpose of developing the database does not mean that the illegal uses or floors will be formally legalized. The mapping is done only to ensure that all units are captured in the database including illegal units and those not mentioned in the occupancy certificates in order to have a comprehensive set of data.**

### 4.1. Basement

A floor will be labelled as a basement if:

- i) If three sides are underground and only one side of the floor is open for access;
- ii) If approximately 75% of the floor is underground; and
- iii) If the entire floor is underground. Sometimes, even more than one floor can be underground.



Figure 15: Examples of different types of Basements (Source: DHS and CAS, Thimphu Thromde)

### 4.2. Stilt Floor

Stilt floors are those floors above the basement or the first level above the ground which are predominantly used as parking spaces.

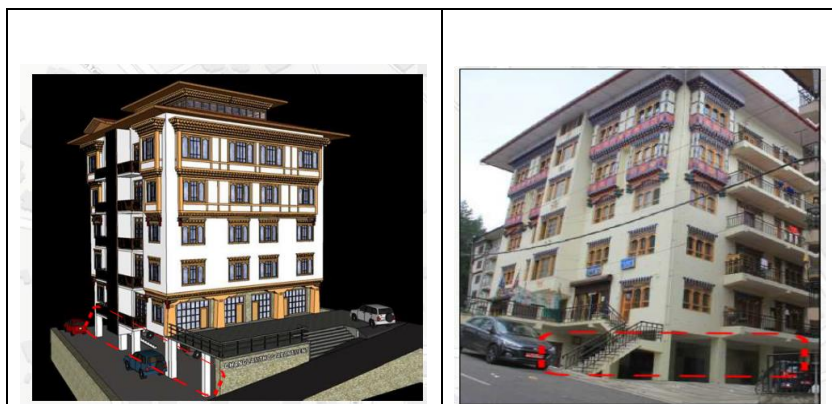


Figure 16: Types of Stilt Floor (Source: DHS and CAS, Thimphu Thromde )

# Guidelines for Mapping of Buildings and Units

## 4.3. Attic

Attic refers to any floor above the phana and below the main roof. Units in the attic which are used as water storage tanks are not required to be registered. However, if the units are being used for residential purposes, they need to be registered.



Figure 17: Examples of Attic

## 4.4. Jamthog

Jamthog refers to any floor above the main roof. Most Jamthogs are single but there are few structures with double Jamthog. Similar to attics, any unit in the Jamthog used as water storage area will not be assigned unit code.

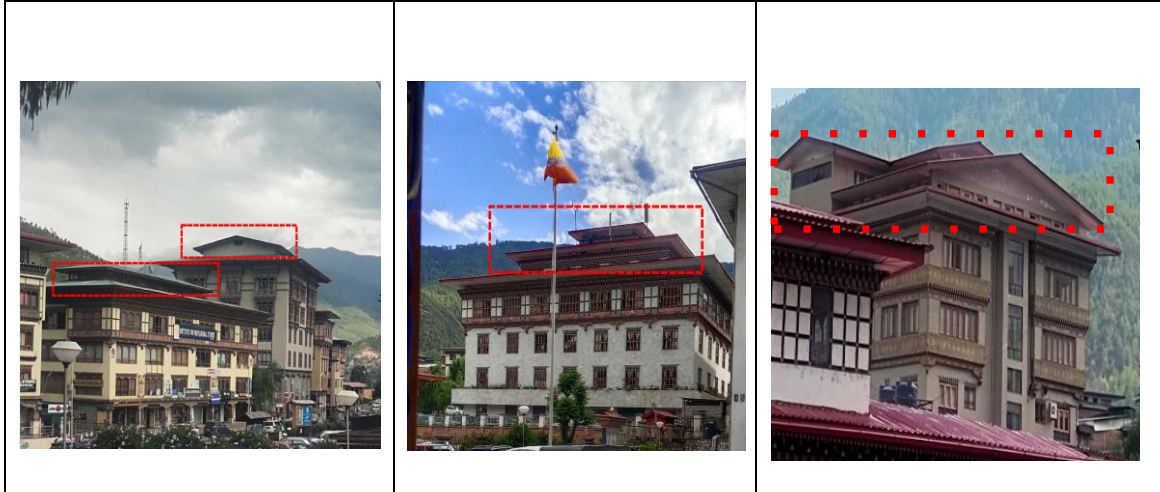


Figure 18: Examples of Jamthog

## 5. Unit Numbering Convention

### 5.1. Numbering prefixing style

The numbering style can be only alphanumeric such as B01, 2B02 or may contain both alphanumeric and special characters such as 1-01 or 2B-02. In the numbering of units, the first digit or alphabet (red colour) shall indicate the level (floor) of the building and the two digits after it will be the unit number.

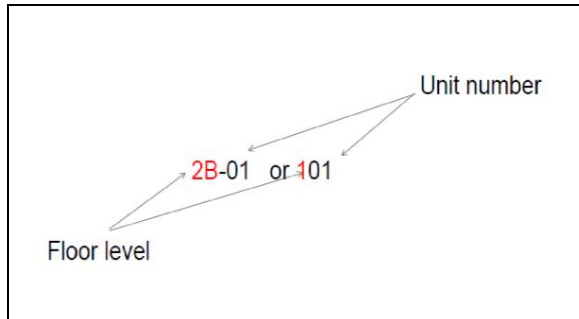


Figure 19: Unit Numbering format

### 5.2. Unit Numbering Convention

#### 5.2.1. Assigning Floor Number

This guideline recommends that the first level of a building above the ground level be numbered as first floor and the remaining floors be numbered consecutively. Any floor below the ground level and fulfilling the conditions of a basement shall be numbered as a basement only.

The numbering convention has been recommended for the following reasons:

- To avoid complications during assigning a number at the time of enumeration. If the units are to be labeled as jamthog, ground floor, attic, or a stilt as is the current trend of numbering, then there is a possibility of numbering a floor wrongly due to confusion when an enumerator is inside a building;
- If the uses of a floor changes due to policy changes or plan changes in future (such as stilt floor being converted to a residential or other uses), then there will be no need to assign another unit numbers for the floor; and
- To avoid same numbering convention as in case of a split-level building where the ground floor on the upper level of a spilt is on the same level as the first floor of the lower level. In the current trend, there could be two ground floors in a building. However, with the new numbering convention, such duplication and confusion could be avoided.

# Guidelines for Mapping of Buildings and Units

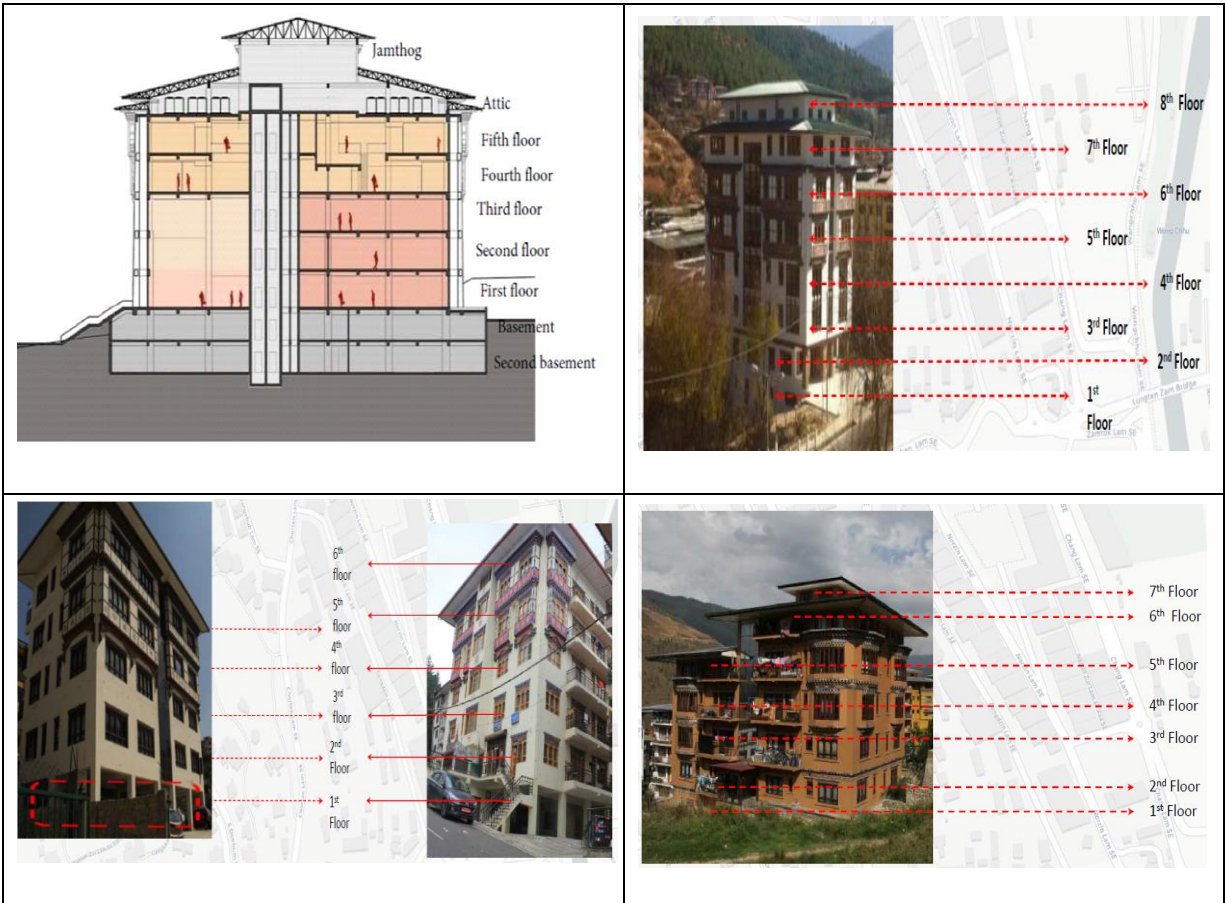


Figure 20: Proposed Unit Numbering Convention for different types of buildings

## 5.2.2. Building with single entry and staircase

For buildings with a single entry, the numbering of the units shall start clockwise from the entry.

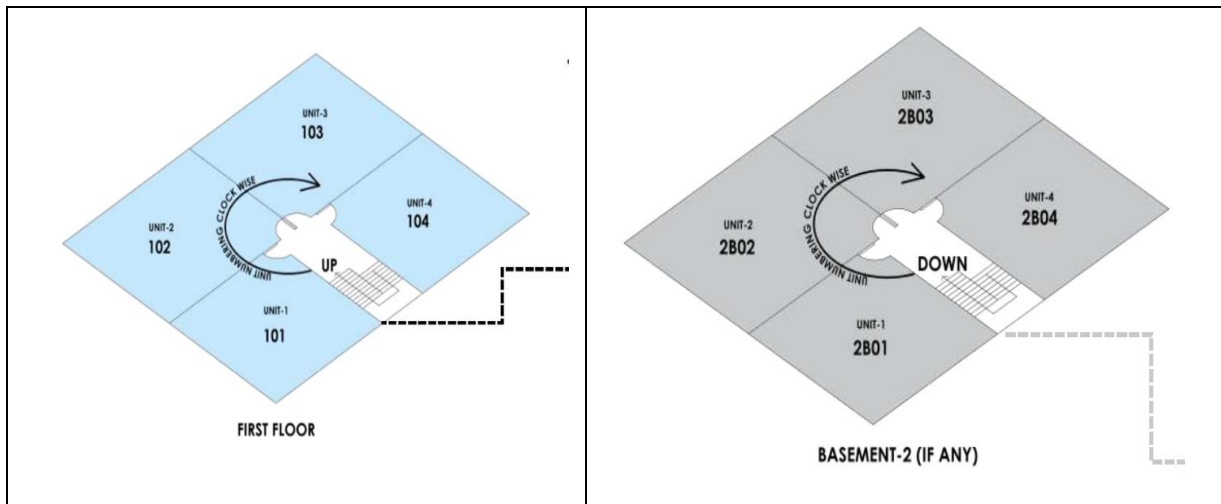


Figure 21: Numbering in a clockwise direction (Source: CAS, Thimphu Thromde)

## Guidelines for Mapping of Buildings and Units

### 5.2.3. Building with dividing corridor/Hallway

For buildings with a dividing corridor, the numbering of the units shall start clockwise from the side facing the primary access street or the side from main building face.

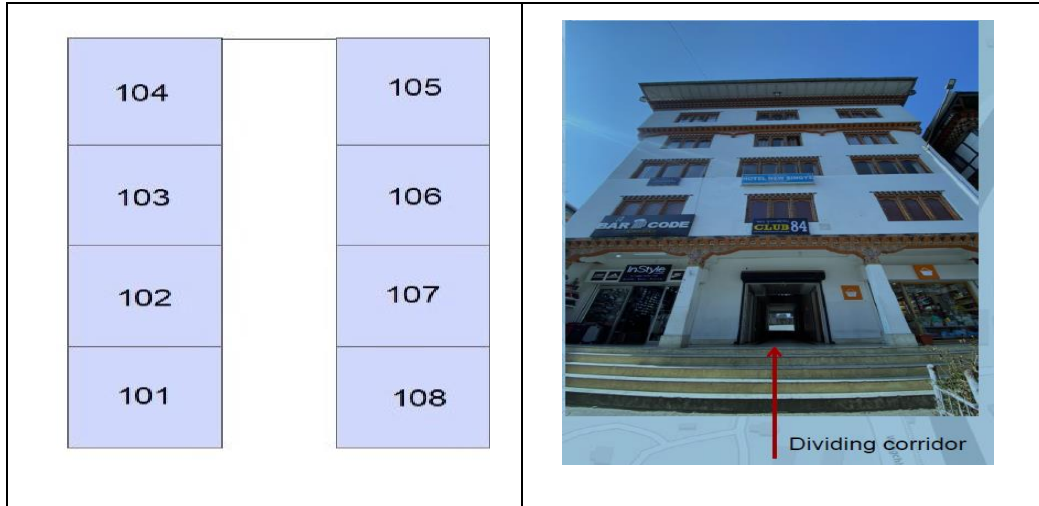


Figure 22: Direction of unit numbering with dividing corridor

### 5.2.4. Buildings with two or more entrances.

If the building has two or more entrances, unit numbering shall start from the first entrance in the direction of the traffic flow in a clockwise direction.

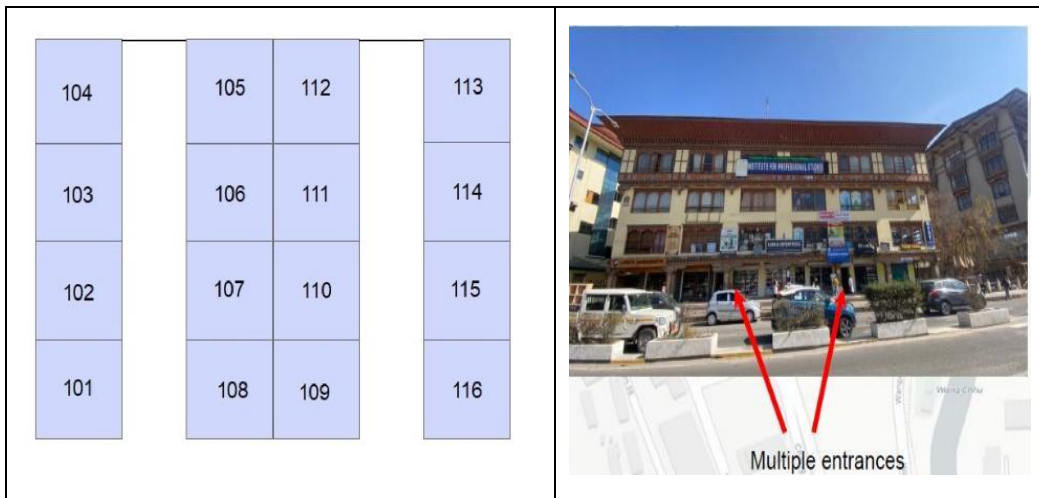


Figure 23: Direction of numbering with multiple entrances

### 5.2.5. Buildings with Entrance from outside

In case the entrance to the shop or the unit is from outside, the numbering will start from the first unit in the elevation side or the first side in the direction of traffic flow.

# Guidelines for Mapping of Buildings and Units



Figure 24 : Direction of numbering for entrances from outside

## 5.2.6. Building with units in a line

The units shall be numbered in the direction of the traffic flow.



Figure 25: Numbering convention for units in a line

## 5.2.7. Building with one or more floors occupied by one entity

If one or more floors are occupied by the same entity such as an office, hotel, institution or a business, then it will be assigned only one unit number. In case, if the uses of any unit changes in future, then the changes should be updated accordingly.

## Guidelines for Mapping of Buildings and Units

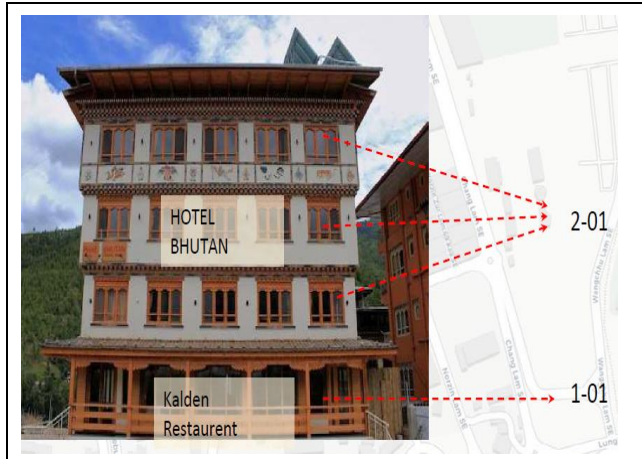


Figure 26 :Numbering convention for one or more floor belonging to the same entity

### 5.2.8. Building with Mixed Uses

If a building has multiple uses such as institutional, restaurants, shops or other different uses, then the *entire building will be assigned only one QR code* but *every unit will be assigned a separate unit QR code* where separate uses will be reflected.

## 6. Unit number plates

### 6.1. Sample Design

The QR code can be printed together with the unit number plate or pasted separately. The sample designs for the unit number plates are given below. However, **the local governments or the building owners have the flexibility to customize the plates.**

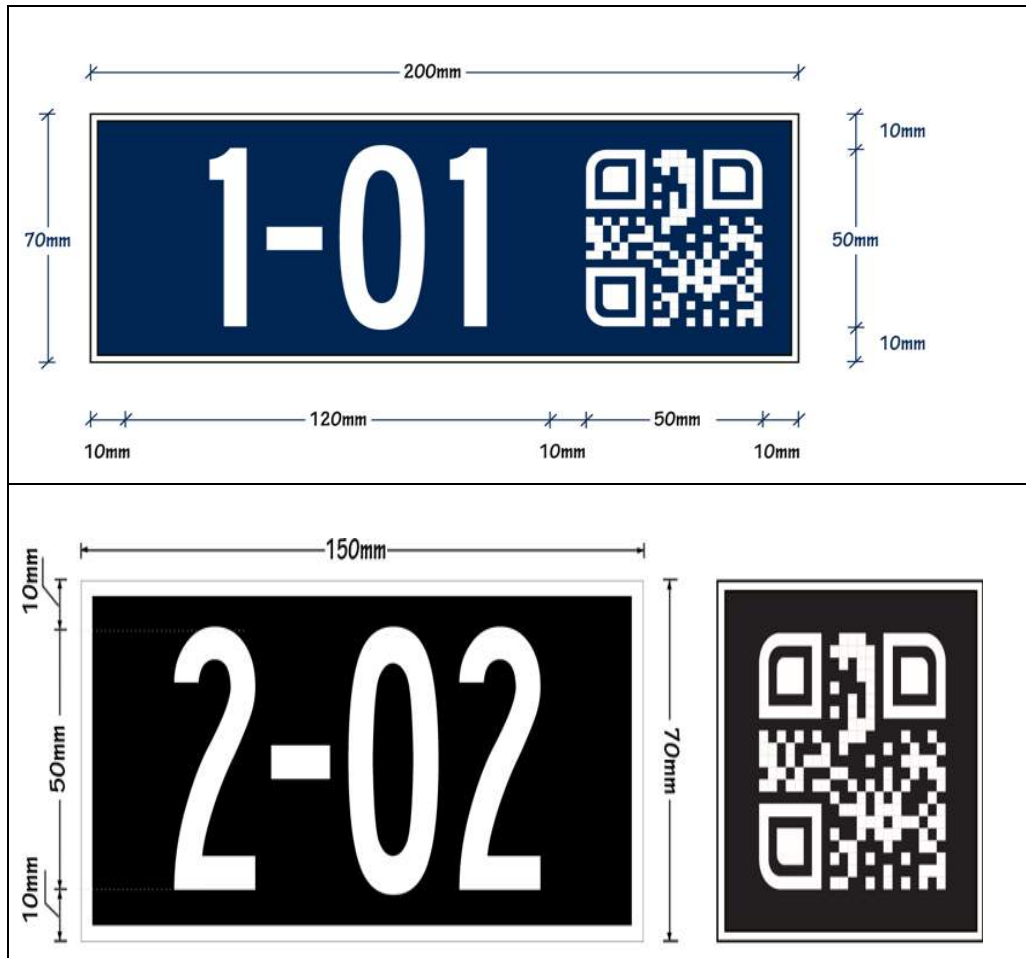


Figure 27: Sample unit plate design

### 6.2. Mounting of the unit number plate and QR code

The unit number plate has to be mounted at a point from where it can be scanned easily (if the QR is pasted together). If the number plate has been mounted already, then the QR code can be pasted next to the plate.

## Guidelines for Mapping of Buildings and Units

The first and second pictures below show the correct way to paste the codes and fix the plates. In the third and fourth pictures, the plates are either inside the shutter or partially enclosed which should not be practiced.



Figure 27: Correct ways to paste the code and mount the plates



Figure 28 : Incorrect way to mount the number plates

# Guidelines for Mapping of Buildings and Units

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## 7. Building/Unit Uses List

The building and unit uses have been listed as under. If there are additional uses not included below, the it can be put under “others” category:

- i) **Residential:** Used solely for residential purpose.
- ii) **Commercial:** Used solely for commercial purpose.
- iii) **Mixed Uses:** When there are multiple uses such as residential, commercial or offices in the same building.
- iv) **Institutional:**
  - **Government Institutes:** Building/Units used as government offices.
  - **Private Institutes:** Buildings/Units used by private entities as offices or institutional use.
  - **Corporations:** Buildings/Units used by corporate entities as offices or institutional use.
  - **Government Schools:** Schools owned by the Government. The different categories are include Primary School, Lower Secondary School, Middle Secondary School, and Higher Secondary School.
  - **Private Educational Institutes:** Educational institutions or owned/leased by private individual (s). There are different types of schools or institutes as listed below:
    - ECCDs
    - Primary School
    - Lower Secondary School
    - Middle Secondary School
    - Higher Secondary School
    - Special institutes
    - College
    - University
    - Academy
    - Shedra
    - Traditional Arts School
- v) **Health Institute (Hospital, BHU):** The health facilities can be further divided as under:
  - Outreach Clinic
  - Sub-post

## Guidelines for Mapping of Buildings and Units

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- Basic Health Unit (BHU II)
- Satellite Clinic
- Basic Health Unit (BHU I)
- Hospital II
- Hospital I
- Regional Referral Hospital
- National Referral Hospital:
- Traditional Medicine Hospital/Units/Services

**vi) Private Health Institute:** Health facilities/clinics owned /run by private individuals.

**vii) Government/Private Recreational Facilities:** Facilities such as parks, sports centres, football grounds, futsal grounds etc either owned by the Government or private individuals.

**viii) Religious:** Used for religious purposes such as Chortens, Lhakhangs etc.

**ix) Heritage:** Structures with cultural significance which is not used as residential purposes or commercial purposes such as Dzongs,

**x) Industrial:** The main administrative building in any Industrial area/precinct will be mapped under Industrial use.

**xi) Hotels, Restaurants/Cafes, Resorts, Homestays, or Serviced Apartments:** These include structures and units used for hospitality services.

**xii) Others:** Any use that has not been covered above.

## 8. References

1. Guidelines for Geodatabase Development, 2020, Department of Human Settlement, Ministry of Infrastructure and Transport.
2. City Addressing System, 2021, Phuentsholing Thromde.
3. City Addressing System Guideline, 2022, Urban Planning Division, Thimphu Thromde.

# Guidelines for Mapping of Buildings and Units

## 9. Appendix

### Stakeholder's Involvement

The Guideline was presented a number of times to all relevant stakeholders including the Local Governments before finalization. Several Rounds of trainings on the use of the Guidelines including field data collection were also carried out.



Figure 29 :Images from Guideline presentation and field work

## Guidelines for Mapping of Buildings and Units

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