

Teaching & Learning :

Step by-Step Guide:

# Development Guide Plan



**Amila Jayasinghe**

**Nethmi Wanigasinghe**

**Samith Madusanka**

# **Teaching & Learning Step by -Step Guide: Development Guide Plan**

## **Authors**

Amila Jayasinghe  
Nethmi Wanigasinghe  
Samith Madusanka

## **Publisher**

University of Moratuwa

## Author contribution

1. Amila Jayasinghe (Supervision, Conceptualisation, Methodology, Validation), Department of Town & Country Planning, University of Moratuwa, Sri Lanka.
2. Nethmi Wanigasinghe (Formal Analysis, Writing—original draft preparation), Department of Town & Country Planning, University of Moratuwa, Sri Lanka.
3. Samith Madusanka (Project Administration, Review and Editing), Department of Town & Country Planning, University of Moratuwa, Sri Lanka.

All authors have read and agreed to the published version of the book.

**Contact authors** [amilabj@uom.lk](mailto:amilabj@uom.lk)

This book was produced with the valuable support of the Erasmus+ Capacity Building in Higher Education (CBHE) project ‘Curricula Enrichment for Sri Lankan Universities delivered through the application of Location-Based Services to Intelligent Transport Systems’ (LBS2ITS <https://lbs2its.net/>)

Project Number: 618657-EPP-1-2020-1-AT-EPPKA2-CBHE-JP

Programme: Erasmus+

Key Action: Cooperation for innovation and the exchange of good practices

Action Type: Capacity Building in Higher Education

Co-funding: Erasmus+ Programme of the European Union

This book was reviewed as an Open Education Resource for University students by Mr. Jonas Krombach (Technische Universität Dresden — TU Dresden, Germany) under the LBS2ITS project.



**lbs2its.net**

**LBS2ITS**  
Curricula Enrichment delivered through  
the Application of Location-based Services  
to Intelligent Transport Systems



Co-funded by the  
Erasmus+ Programme  
of the European Union



**Edition**

First Edition - May 2025

**Copyright**

Teaching & Learning Step-by-Step Guide: Development Guide Plan © 2025 by Amila Jayasinghe, Nethmi Wanigasinghe, Samith Madusanka is licensed under Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc-nd/4.0/>

Some Rights Reserved

ISBN 978-955-9027-89-8 (ebook)

**Citation**

Jayasinghe, A., Wanigasinghe, N., & Madusanka, S. (2025). *Teaching & learning step-by-step guide—Development guide plan* (1st ed.). University of Moratuwa.

**Disclaimer**

This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. The contents and views in this publication do not necessarily reflect the views of the publisher.

**Publisher**

University of Moratuwa

## PREFACE

This book serves as open educational material for several figures namely planning professionals, authorities, political leaders, planning and related students, citizens, and any parties that are related to urban planning, and analytical background, which offers a detailed guidance for them to undertake and follow the process of Development Guide Plan and developing guidelines for the DGP. This book is more focused on quantitative and technical analysis rather than solely depending on the book and theoretical methods of developing the Guide Plan.

The book has been designed to bridge the gap between theoretical knowledge, practical application, and new analytical methods. This guide is structured in a way that anyone can understand simply. Within the book, the reader will find comprehensive guidance regarding the process of developing a Guide Plan while they are encouraged to refer to the mentioned other guidebooks to get knowledge regarding the analysis and additional theories that have been incorporated into the book.

Therefore, this book includes several other guidebooks that will be more meaningful when referred to and sometimes the steps might be new or additional since the DGP is an extension of a Local Development Plan. Despite all this, any user who is referring to this book when creating a Development Guide Plan can follow the steps mentioned have a clear understanding what are the main components of a DGP, and gain new knowledge as well.

Importantly, this book was developed based on the knowledge gained from the Train-the-Teachers course on “Transportation System Planning for Smart and Liveable Cities,” which took place from 28 March to 1 April 2022 at the University of Moratuwa (UoM) in Sri Lanka. This workshop was jointly organized by the LBS2ITS team from UoM and TU Dresden as part of the LBS2ITS project. The insights and innovative methodologies shared during the workshop have been integrated into this book, ensuring that it reflects up-to-date strategies and tools for transportation planning, making it a valuable resource for developing smart and liveable urban spaces.



***5-day Train-the-Teachers Course on “Transportation system planning for smart and liveable cities”, April 2022 @ UoM***

This book also draws from further experience gained through the implementation of the Land Use Planning Studio module and the Urban Planning & Design Studio module during the 2023/24

academic year. These studio modules provided practical insights into applying the methodologies outlined in this book, ensuring that the guide is both grounded in real-world application and continuously refined through contemporary academic and practical experiences. The integration of these modules further enhances the book's relevance for users involved in urban planning, enabling them to develop a robust, data-driven Development Guide Plan.



***Presenting the Dambulla Development Guide Plan (DGP) to external examiners (urban planning experts) during the Land Use Planning Studio module and the Urban Planning & Design Studio module.***

## **ABBREVIATIONS**

DGP – Development Guide Plan

MC – Municipal Council

UC – Urban Council

TOD – Transit Oriented Development

UDA – Urban Development Authority

# TABLE OF CONTENT

|  |            |
|--|------------|
| <b>LIST OF FIGURES .....</b>   | <b>x</b>   |
| <b>LIST OF TABLES .....</b>  | <b>xii</b> |
| <b>1. INTRODUCTION .....</b>   | <b>1</b>   |
| 1.1 Why This Book? .....   | 1          |
| 1.2 What does it provide? .....  | 2          |
| 1.3 Objectives of the book.....  | 3          |
| <b>2. UNDERSTANDING DGP AND THE COMPONENTS .....</b>   | <b>4</b>   |
| 2.1 What is DGP? .....   | 4          |
| 2.2 Components .....   | 5          |
| <b>3. HOW WILL THIS HELP YOU?.....</b>   | <b>7</b>   |
| <b>4. INTRODUCTION TO THE CASE STUDY AREA.....</b>   | <b>9</b>   |
| <b>5. PROCESS OF DGP .....</b>   | <b>11</b>  |
| <b>6. LOCAL DEVELOPMENT PLAN AT A GLANCE.....</b>  | <b>12</b>  |
| 6.1 Identified needs and issues in Dambulla in the process of deriving a vision for the area. .... | 12         |
| 6.3 Vision of Dambulla Local Development Plan.....   | 14         |
| 6.4 Goals and Objectives .....   | 14         |
| 6.5 Formulated Strategies for the Goals.....   | 15         |
| <b>7. STEP-BY-STEP GUIDE FOR DEVELOPING DEVELOPMENT GUIDE PLAN .....</b>                           | <b>16</b>  |
| 7.1 Step One.....  | 16         |
| 7.1.1 Need of the DGP & Boundary Delineation.....  | 16         |
| 7.2 Step Two.....  | 23         |
| 7.2.1 Vision for the DGP Boundary .....  | 23         |
| 7.3 Step Three .....   | 25         |
| 7.3.1 Existing Situation of DGP Boundary.....  | 25         |
| 7.4 Step Four .....  | 28         |
| 7.4.1 Development Guide Plan.....  | 28         |
| 7.4.2 Improvement of the Road Network and Blocks .....   | 29         |
| 7.4.3 Land Readjustment Framework.....   | 33         |
| 7.4.4 Changes of the Blocks with New Road Network.....   | 36         |
| 7.4.5 Zone Factor .....  | 39         |
| 7.5 Step Five.....   | 42         |
| 7.5.1 Evaluating Land Use According to Tactical Urbanism .....                                     | 42         |
| 7.5.2 Improvements of Proposed Blocks .....  | 43         |
| 7.6 Step Six .....   | 46         |

|   |           |
|---|-----------|
| 7.6.1 Zone Identification .....   | 46        |
| 7.6.3 Future Smart City Framework .....   | 68        |
| 7.6.4 Proposed Open Spaces.....   | 69        |
| <b>8. COMPARISON OF EXISTING SITUATION AND PROPOSED GUIDELINES IN REAL<br/>GROUND .....</b> | <b>73</b> |
| 8.1 Urbanity Changes .....  | 73        |

## LIST OF FIGURES

|  |    |
|--|----|
| Figure 1: Location of Dambulla .....   | 9  |
| Figure 2: Ward Map of Dambulla MC .....  | 10 |
| Figure 3: The Process of DGP .....   | 11 |
| Figure 4: Boundary Delineation Step 1 .....                                    | 20 |
| Figure 5: Boundary Delineation Step 3 .....                                    | 21 |
| Figure 6: Boundary Delineation Step 2 .....                                    | 21 |
| Figure 7: Boundary Delineation Step 4 .....                                    | 22 |
| Figure 8: Land use Map DGP Boundary .....                                      | 25 |
| Figure 9: Accessibility Map DGP Boundary .....                                 | 26 |
| Figure 10: Building Height Map .....   | 27 |
| Figure 11: Plot Type Map .....   | 27 |
| Figure 12: Mixed Use Index .....   | 27 |
| Figure 13: Proposed Road Network .....   | 32 |
| Figure 14: Existing Road Network .....   | 32 |
| Figure 15: Proposed Blocks with the New Roads .....                            | 36 |
| Figure 16: Existing Blocks .....   | 36 |
| Figure 17: Block Guidelines .....  | 37 |
| Figure 18: Block Guidelines .....  | 37 |
| Figure 19: Block Guidelines .....  | 38 |
| Figure 20: Favorable & Non-favorable uses according to Tactical Urbanism ..... | 42 |
| Figure 21: Existing & Proposed Constitutedness .....                           | 43 |
| Figure 22: Existing & Proposed Zone Factor .....                               | 44 |
| Figure 23: Existing & Proposed Land Use Mix .....                              | 45 |
| Figure 24: Low Dense .....   | 53 |

|   |    |
|---|----|
| Figure 25: Medium Dense.....                        | 53 |
| Figure 26: High Dense .....                         | 53 |
| Figure 27: Road Categories.....                     | 55 |
| Figure 28: High Traffic Roads Priority Levels ..... | 56 |
| Figure 29: High Traffic Roads.....                  | 56 |
| Figure 30: Existing Cross Section.....              | 57 |
| Figure 31: Proposed Cross Section.....              | 57 |
| Figure 32: Low Traffic Roads.....                   | 58 |
| Figure 33: Existing Cross Section.....              | 59 |
| Figure 34: Proposed Cross Section.....              | 59 |
| Figure 35: Work Business Road .....                 | 60 |
| Figure 36: Proposed Cross Section.....              | 61 |
| Figure 37: Local Connector Roads .....              | 62 |
| Figure 38: Proposed Cross Section.....              | 63 |
| Figure 39: Existing Cross Section.....              | 63 |
| Figure 40: Green Residential Streets .....          | 64 |
| Figure 41: Proposed Cross Section.....              | 65 |
| Figure 42: Water Based Roads .....                  | 66 |
| Figure 43: Proposed Cross Section.....              | 67 |
| Figure 44: Smart Facilities .....                   | 68 |
| Figure 45: Open Space Map.....                      | 70 |
| Figure 46: Existing Urbanity.....                   | 75 |
| Figure 47: Proposed Urbanity.....                   | 75 |
| Figure 48: Urbanity Level Changes .....             | 76 |

## LIST OF TABLES

|   |    |
|---|----|
| Table 1: Basic Information of Dambulla.....                     | 10 |
| Table 2: Comparing Characteristics of Existing Urban Form ..... | 18 |
| Table 3: Comparing Characteristics of BAU Scenario .....        | 18 |
| Table 4: Comparing Characteristics of Proposed Urban Form ..... | 18 |
| Table 5: Derived Benchmarks for Guideline Development .....     | 31 |

# **1. INTRODUCTION**

## **1.1 Why This Book?**

Development Guide Plan is a main component of detailing specific areas in a development plan. Creating a such guide plan requires human capital, physical capital, money, and technological resources and also, and it is also time-consuming. Therefore, to ease that process, this book has been introduced. The “Teaching & Learning Step-by-Step Guide for Development Guide Plan” book is a reference document for facilitating planning professionals and students as a step-by-step guidebook to follow when planning for development guidelines. This book contains the instructions on how to prepare a development guide plan, supported with the evidence of a case study area in Sri Lanka to showcase the effective applicability and the effective deliverability of the process of DGP which contribute to placemaking of an area.

Flowing this provided guidance may be directly applicable only in some areas with the relevance of visions and the place that needs to be created in that specific area, yet this guidebook can be a facilitator to refer to when understanding new methods and quantification analysis of approaching to a Development Guide Plan in different contexts as well.

---

## **1.2 What does it provide?**

To achieve the before mentioned purpose of this book , this book provides detailed step-by-step guidance to planning professionals, young planners, and planning students to be involved in preparing a Development Guide Plan coupled with derived guidelines to proceed with the guideline creation and zone identification and as an overall process of development guide plan creating process to follow up.

We have tried to create this book to be easy to refer to and understand for any individual, whether they know about planning or not. Therefore, this book provides clear guidelines regarding,

### **The overall process of DGP creation**

- Preliminary analysis and other analysis of the existing situation at the local plan level
- Identifying the need for the DGP, vision, main component incorporated, and principles
- Case study area
- Boundary delineation
- Development Guide Plan
- Zone Identification
- Future Frameworks or roads, open spaces, and smart facilities
- Testing proposed guidelines in the real ground through predictions

### **1.3 Objectives of the book**

The ultimate objective of the book is to provide step-by-step guidance for the preparation of a Development Guide Plan for teaching and learning aims for planning professionals, young planners, and student planners in simplified terms with illustrative examples.

The book has combined a case study area (Local area) in Sri Lanka namely the Dambulla locality for a better understanding of the book with references and illustrations.

The main goal of this DGP is to create a DGP while encouraging the below components in a selected spatial area.

- Transit Oriented Development (TOD)
- Connectivity
- Compact
- Convenient
- Colorful
- Conserved

Therefore, through this, the planning figures will be directed and encouraged to create connected and compact cities where it provides more walkable cities with a higher variety of uses for the communities while preserving the particular towns' existing natural and cultural importance. Instead of urban sprawl, vertical developments and infill development will be highlighted and encouraged here in this DGP creating book.

## 2. UNDERSTANDING DGP AND THE COMPONENTS

### 2.1 What is DGP?

Development Guide Plan (DGP) is a detailed strategic framework designed to guide the growth revitalization, and sustainable development of specific urban areas. Or else, can be identified as a detailed short-to-medium-term spatial plan. Typically, incorporating in a smaller boundary compared to National, Regional, and local levels. Within those planning levels, we can observe several Development Guide Plans. For instance, in the Colombo City Development Plan 2022 – 2031 (Local Level), we can observe 2 development guide plans namely the Beira Lake Development Guide Plan and the Independence Square and Surrounding Development Guide Plan.

DGP has a deep and detailed consideration of developable areas compared to development plans. It provides guidelines, zoning, strategies to address identified issues, and new frameworks. To prepare a development guide plan also, the strategic approach can be adopted. There, the need for the development plan, visioning, and strategy formulation can also be seen as similar to the process of the development planning process.

Strategic Planning Process according to Urban Development Authority Sri Lanka -

[https://www.uda.gov.lk/attachments/strategic\\_plan/Strategic%20Plan%20-%20Final.pdf](https://www.uda.gov.lk/attachments/strategic_plan/Strategic%20Plan%20-%20Final.pdf)

- Where are we now? – Analyzing existing situations and problem framing or identifying the need for the DGP
- Where do we want to be? – Visioning and identifying the future direction
- How do we get there? – Solutioning and strategizing to address the issues or needs of the area.

To transform a vision into a strategy in a DGP, several tools can be incorporated, those are concept plans, guidelines, regulations, incentives, and strategic projects. Each of these steps can be identified more comprehensively in DGP.

## 2.2 Components

### Transit Oriented Development (DGP)

Transit Oriented Development (TOD) is a widely used planning approach that focuses on creating compact, mixed-use communities around public transportation hubs, such as train stations, bus stands, or terminals. The main goal of TOD is to encourage walking, cycling, and the use of public transit while reducing private vehicle consumption. TOD will create cities that are more liveable, and connected for the residences while connecting the place of work with the place of residence and providing a place to relax as well. The word TOD can be described as below,

**Transit** – especially referring to public transportation systems, such as buses and trains which help the movement of people or goods from one place to another. It comprises a complete network facilitating these peoples' movements while ensuring higher accessibility.

**Oriented** – in the means of TOD, oriented can be described as directed or aligned towards a particular purpose or direction. Within the locality, peoples' jobs, education, health, and commercial needs, and also, residences are aligned with public transit networks and in various directions. These various orientations or directions are covered by the transportation network. It provides access to people to reach for those directions, which originate from various other locations. The transit system covers all these networks to provide access for the people.

**Development** – Creating development including transit-oriented implementations, requires regulations, and strategies that encourage improvements. Development, therefore, is a multifaceted concept that encompasses various dimensions of progress and improvement, aimed at creating better communities including transit-oriented developments.



**Connectivity**

In the context of an urban area, connectivity refers to the ease with which people, goods, or information can move between different locations within one place to another, one town to another, one locality to another, one region to another, and likewise between places. It involves the availability and efficiency of transportation infrastructures such as roads, highways, expressways, railways, and public transit systems. Good transportation connectivity enhances accessibility, mobility, and economic activity by reducing travel times, costs, and barriers to movement.

**Compact**

Compact means in the area of urban planning is land use and design concept which promotes relatively high residential developments with mixed land uses. It aims for more efficient use of lands through closely packed and dense development. Compact urban development refers to the design of cities with high building density, high population density, and high mixed land uses often characterized by multi-story buildings and efficient land allocation.

**Convenient**

Here, the term convenient refers to easiness of use and access. It is easy to use the town area for people with various needs with easy access. All the services are located closer to each other within walking distance. Constitutedness of roads and buildings (Direct access from roads to buildings) is ensured. The land use mix of the area is in a level of 8 to 9 (Mixed Land use (Live/Work/Visit)). Both commuters and pedestrians will have their prioritized roads to use. Such characteristics can describe the term convenient which we mean here in the DGP book.

**Colorful**

Multi of buildings, color-themed buildings, pattern streets, water-based streets, and green streets will represent the term colorful here. Therefore, a vibrant city with many uses, colors, and many varieties of people and their different movements will make the city colorful. The word “colorful” refers to the visual vibrancy and diversity of the town’s architecture, culture, and atmosphere. A colorful town that is visually appealing and lively.

### 3. HOW WILL THIS HELP YOU?

#### Political Leaders

As key decision makers in the planning and governance of our nation, political figures play a vital role in shaping our cities to be more liveable, commuter-friendly, sustainable, and inclusive. With this objective, the teaching and learning book acts as a blueprint to facilitate the creation of development guide plans for localities under political leaders' oversight. In the DGP creating process, consulting various stakeholders can be crucial. In such scenarios, as political leaders of the country, they can play an important role bridge those stakeholders and ensuring trust in them. To do so understanding the process of DGP might be valuable.

#### Planning Authorities

This book demonstrates a model and derived benchmarking for development guideline creation. Which will assist in creating more integrated, connected connection between roads, land uses, and communities. The process demonstrates all the steps which complete a DGP that were followed here for creating a DGP for the selected case study area. As an authorized partners which responsible for carrying out planning, the planning authority's role is to enabling planning initiations and reaching the different stakeholders and conducting the planning process while providing necessary resources. To this end, this book will be a technical guidance to those planning authorities to refer as they proceed in the planning process.

#### Citizens

Citizens of the country are the ones who benefitted from or affected by these developments of their living environment. Also, their movements, behaviors play a crucial role in building the spatial patterns of the grounds. Therefore, having some understanding on the process and the way the DGP is creating, as citizens it might be useful and advocating.

### **Planners**

This book can be mostly beneficial for planners since this provides step-by-step guidance on creating DGP where they can apply for similar context or purposes. The steps followed in this book can be incorporated to carry out a development plan in the stage where they derive development guideline. These steps can be helped to create a DGP with the foundation of analytical background and a well justification for the decisions they are making.

### **Students**

For an any planning student, urban planning, transportation planning, environmental related sustainability planning students can refer this book when creating DGP since this book includes important components namely connectivity, compact (Density), colorful (Diversity – Land Use Mix), conserved (Sensitivity). Therefore, as planning students also, this guidebook will direct students to learn how to plan for a DGP based on derived benchmarking and analysis and will provide a thorough understanding on the subject matter.

## 4. INTRODUCTION TO THE CASE STUDY AREA

Teaching & Learning Book Step-by-Step Guide for Development Guide Plan has been developed incorporating a real ground trial for Dambulla locality which locates in Matale District, Central Province, Sri Lanka.

Dambulla town is significant in several areas namely tourism, agriculture, and its connectivity in the national and local level. Dambulla Cave Temple, Golden Temple, Sigiriya, Pidurangala, Ibbankatuwa Tombs, Kandalama Reservoir are some important tourism destinations. While Dambulla Dedicated Economic Centre functions as the main distributor of vegetables all over the country benefitting from its transportation network which connects main towns namely Colombo, Kurunegala, Matale, Kandy, Trincomalee, Jaffna, Anuradhapura, Polonnaruwa and other small towns as well.

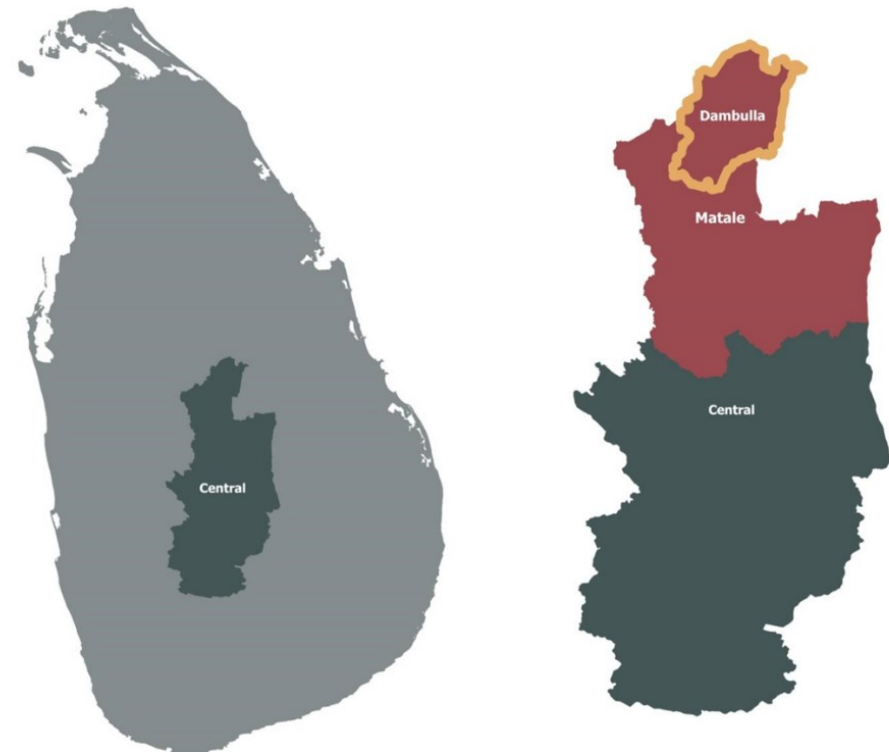


Figure 1: Location of Dambulla

Considering the administrative composition of Dambulla, it has a Municipality area and Pradeshiya Sabha within its locality. Dambulla Municipal Council consists of 12 wards. When considering the characteristics of Dambulla, even though it is ruled by the municipality, when compared to other municipalities in Sri Lanka, the urbanized levels are at a low level. Also, the density levels of Dambulla are at a low level compared to the national level (Page 24). This book has provided step-by-step guidance to develop and DGP for Dambulla selected boundary within the Dambulla Municipality. As mentioned earlier, the DGP is a detailed extension of the Local Development Plan. Therefore, the boundaries, scenario analysis, and strategies introduced in the Local Development Plan phase have also been incorporated into the process of DGP as well.

|                     |  |
|---------------------|--|
| Area                | 1070.87 km <sup>2</sup>  |
| Population          | 27 000   |
| Commuter Population | 170 000 – 200 000  |
| GDP                 | 1: 0.58  |
| No. of DSDs         | 06   |
| Total Houses        | 73 708   |
| Literacy Rate       | 88.3%  |
| Sex Ratio           | 102.94   |
| Government Schools  | 5  |
| Industries          | Manufacturing Industries & Agri Based Industries   |
| Tourism Sector      | Sigiriya Rock Fortress and Dambulla Cave Temple, Pidurangala Rock, Minneriya National Park, Hot air balloon rides, Kandalama Reservoir |
| Climate Zone        | Dry Zone   |

Table 1: Basic Information of Dambulla

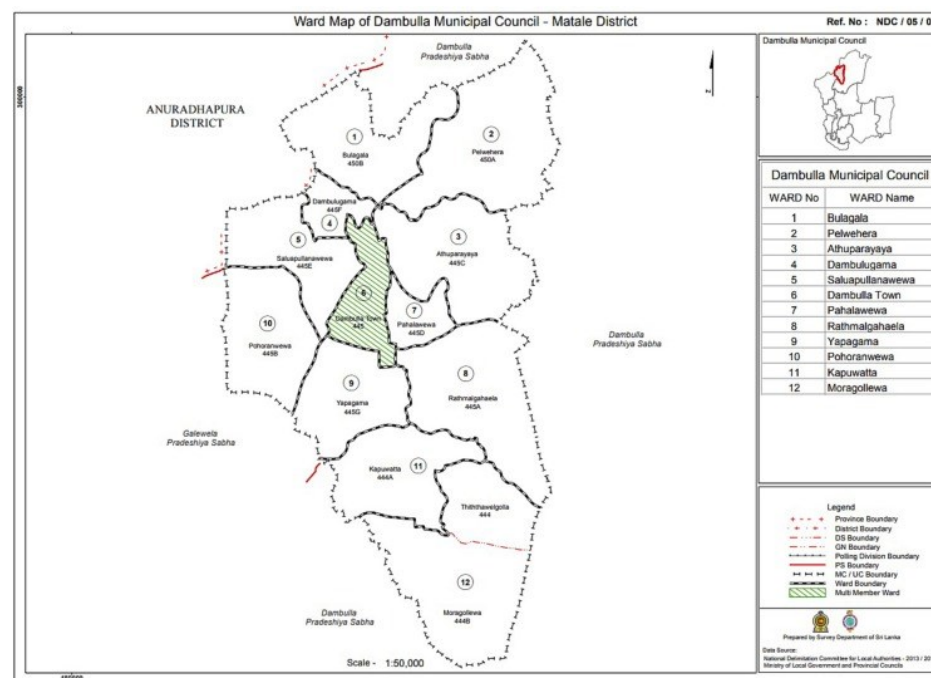


Figure 2: Ward Map of Dambulla MC

## 5. PROCESS OF DGP

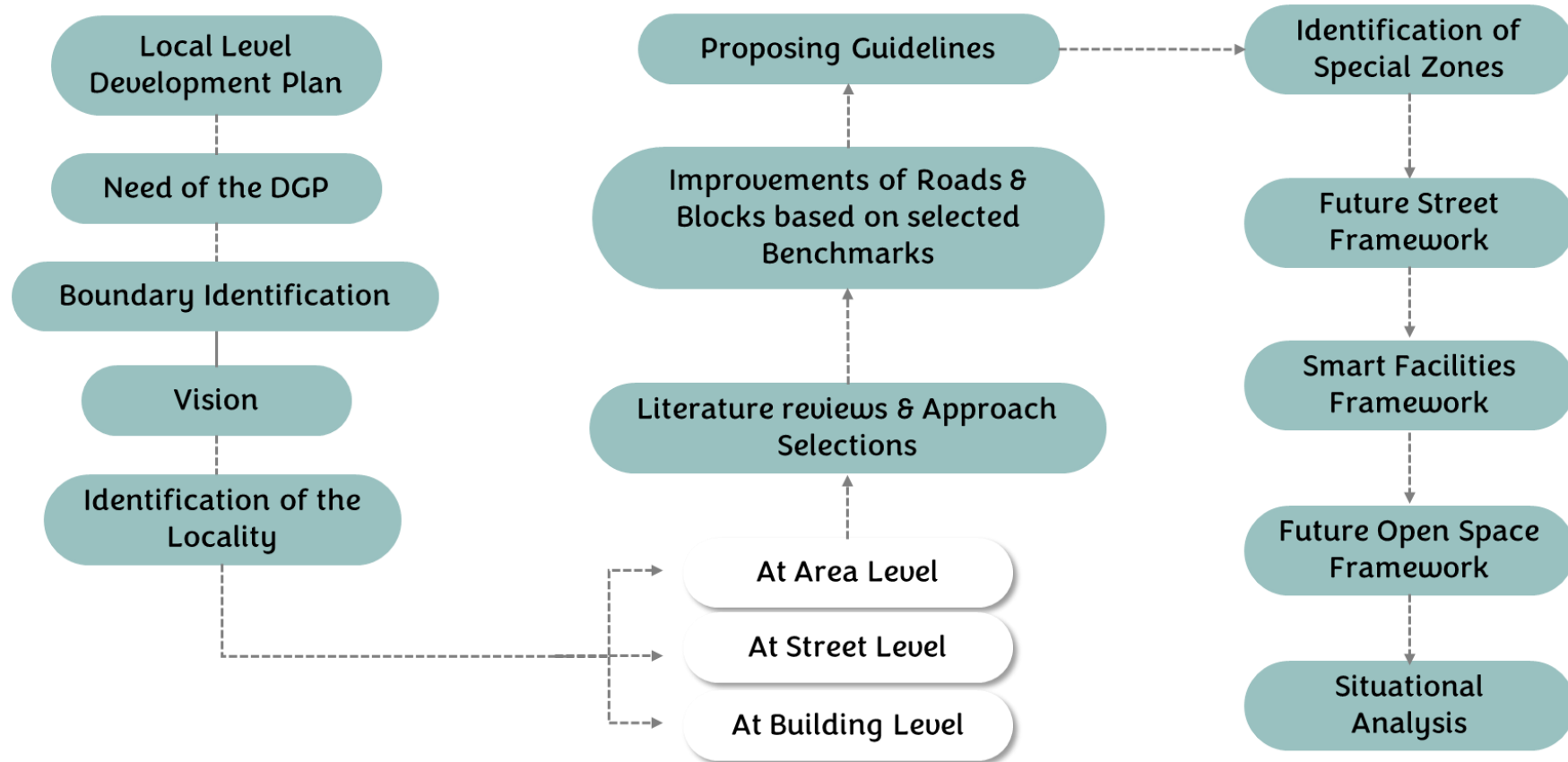


Figure 3: The Process of DGP

\*\*In this book the process of DGP has been presented after developing the Local Development Plan. The key derivatives from the local development are mentioned below.

## **6. LOCAL DEVELOPMENT PLAN AT A GLANCE**

### **6.1 Identified needs and issues in Dambulla in the process of deriving a vision for the area.**

To Mitigate Negative Internal and External Effects

- Reduction of Agricultural Land Uses.
- Establishment of Individual Projects without an Overall Plan.
- The Urban-Rural Population Distribution gap.
- Unavailability of Land Ownership Data.
- Low Living Contenance

To Enhance the Existing Potential

- The Junction town (Transit Point) with the higher connectivity
- Availability of Vacant Lands
- The existing & possible cultural and natural tourist destinations
- Possibility of adapting new technologies to agriculture
- Ongoing projects like railway expansion and expressway

To Elevate the Existing Physical and Socioeconomic Status of the Town

- Potential for further increases in density or morphological improvements
- Possibility of increasing population within the town without increasing the residential land use
- The Unbalanced Employment Sector Composition

To Ensure the Supply of Public Goods for All

- Lack of Public Sanitary facilities
- Seasonal Traffic & Parking Issues
- Need for Public Recreational Spaces
- Low quality of water supply

To solve these issues and provide necessary needs while enhancing the area's potential, relevant vision, goals, objectives, and strategies are developed.

## 6.2 SWOT Analysis

After identifying the issues and needs of Dambulla, the strengths, weaknesses, opportunities, and threats were identified through a SWOT analysis.

|   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. Availability of suitable lands for housing within the immediate City Core.</li> <li>2. The solid waste management system in Digampathaha has enough capacity.</li> <li>3. Availability of well-connected road network (Including A6 and A9).</li> <li>4. No natural disasters within the planning area.</li> <li>5. Dambulla's DDEC: 30% land for Agri, 40% population agro-involved, 1M kg daily collection, Palwehera Agro Park</li> <li>6. Agro-climatic conditions, Rich soil, Diversity of crops</li> <li>7. Cultural &amp; Natural Tourist Attractions of the Area</li> <li>8. Availability of developable land</li> <li>9. Availability of Natural Resources</li> <li>10. Irrigation infrastructure</li> </ol> | <ol style="list-style-type: none"> <li>1. Workforce Imbalance</li> <li>2. Land Ownership Conflicts</li> <li>3. Lack of safe pedestrian pathways, recreational parks, public parks, restaurants, accommodations</li> <li>4. High Vegetable Wastage at DDEC. Lack of private investors in agriculture limits the expansion of the sector (Only CIC-Palwehara, Bio Foods Pvt. Ltd.).</li> <li>5. Lack of Agro-based value addition industries within the area.</li> <li>6. The unemployment rate among youth (ages 18-25)</li> </ol> |
| <ol style="list-style-type: none"> <li>1. The proposed highway connecting Colombo port and Dambulla (The travel time will be 90 min).</li> <li>2. The proposed Expressway interchange and the railway network via Dambulla.</li> <li>3. The proposed Asian superhighway via Dambulla will increase the international connectivity.</li> <li>4. Identification of Dambulla as a metro city in NPPD.</li> <li>5. The presence of a strong physical planning policy at national level &amp; Regional Level to guide the overall urban system within the region.</li> </ol>   | <ol style="list-style-type: none"> <li>1. Yearly Deduction of Employees in the Agricultural Sector in the Country.</li> <li>2. Out-Migrations towards Anuradhapura, Matale, Kurunegala due to higher level of facilities. Human-Elephant Conflicts in Rural Areas.</li> <li>3. Political Instability</li> <li>4. Impact of Global Emergencies towards Tourism.</li> </ol>   |

### 6.3 Vision of Dambulla Local Development Plan

The vision for Dambulla Local Development Plan which is mentioned below, and the goals, objectives, and strategies were the initial foundation and direction for the vision deriving for the Development Guide Plan for Dambulla and its introduced future frameworks.

**Vision - “The connected, compact, convenient, and conserved, city”.**

The 5C Dambulla envisions a vibrant and sustainable urban center where modern connectivity seamlessly integrates with the surrounding natural environment. Through compact design and convenient access, the city serves as a hub of innovation, commerce, and culture, while also preserving and enhancing its natural heritage. Residents and visitors alike experience the convenience of urban living amidst lush greenery and conservation efforts, fostering a harmonious balance between human activity and the natural world.

*\*\*The vision for Dambulla in local development has been derived after analyzing various aspects mainly focusing on the town’s morphological characteristics such as accessibility, diversity, density, livability, land use efficiency, urbanity levels, and sensitivity and also coupled with stakeholder ideas and opinions as well.*

### 6.4 Goals and Objectives

#### Goal 01 - Fostering Urban Life in the Compact City while Harmonizing the Natural Systems

- To increase the Urban Population from 27 000 to 100 000 Providing New Urban – Rural Lifestyle by 2050
- To provide an innovative strategy to solve the land ownership issues to develop the town by 2050
- To create the city core as a 15-minute walkable city for all facilities by 2050.
- To increase living convenience by changing the urban structure by 2050.
- To Shift 12.29% In-between Urbanity Levels to a Moderate Urbanity Level Thus Shift Current Fourth Order Urban Hierarchy to Third Order.
- To Increase 3.16% of Recreational Areas up to 7% While Providing Social Infrastructure by 2050
- To provide efficient public transportation facilities for both locals and visitors by 2050

## **Goal 02 - Diversifying the Economy for Better Living Standards**

- To Introduce Smart Agricultural Practices Coupled with Industry 5.0 to Maintain the Existing 36.36% of Agriculture Lands.
- To Facilitate Value Added Industries to increase Employment opportunities from 2617 to 10,000 by 2050.
- To Increase the Current 20% of tourist attractions up to 50% while Extending Their Duration of Stay and providing Activities By 2050.
- To provide 100% Coverage within the area to Facilitate Smart Infrastructure by 2050

## **6.5 Formulated Strategies for the Goals**

### **Accessibility and mobility strategy**

- New road development from A9 road by shifting the roads.
- Transportation corridor as a multi-modal hub.
- Pedestrian priority grids
- Proposed new routes and interchanges for the expressway and railway

### **Density and land use strategy**

- Different density areas (High dense urban core, medium dense urban area, low dense residential area)
- Joint Development Projects & Revenue Sharing Models through Mediation & Facilitation

### **Invest to Earn Strategy**

- New Industrial Cluster
- City Tourism Strategy

### **Tourism & Recreational Uplifting Strategy**

- Introduce Nature Trails (Pedestrian & Cycling)
- Agri Tourism

The main foundation for the DGP is the above-derived vision, goals, objectives, and strategies from the local development plan while the main 3 principles (**Connectivity, Density, Diversity**) – Page No. 27 - were initially considered in the vision formulation process at the Local Development Plan phase.

## **7. STEP-BY-STEP GUIDE FOR DEVELOPING DEVELOPMENT GUIDE PLAN**

### **7.1 Step One**

#### **7.1.1 Need of the DGP & Boundary Delineation**

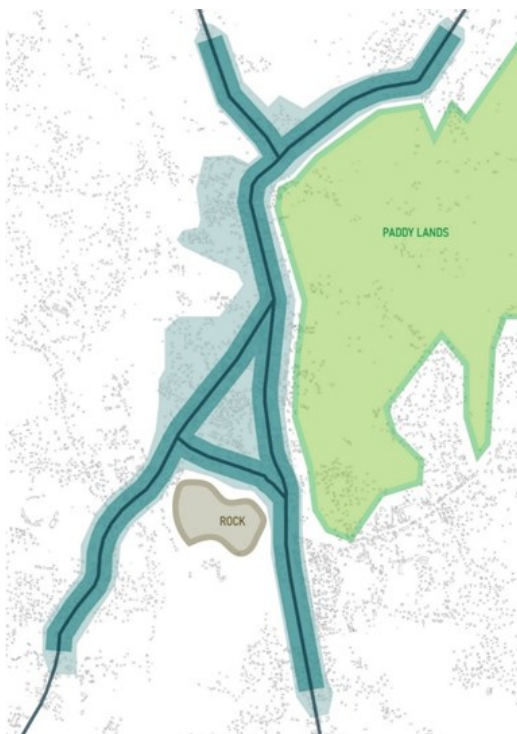
The first step of developing DGP is to identify the need to develop a detailed guide plan for the particular locality. This can vary based on the context of the study area and its characteristics. After identifying the need then is to proceed with the boundary delineation.

The need of the DGP is to identify the need for a Development Guide Plan to the Dambulla locality, the scenario analysis of urban form from the Local Development Plan was incorporated here. There, 3 scenarios of urban form were examined. These are Existing Urban Form, Business as Usual Scenario, and Proposed Urban Structure. There the positives and negatives of the urban form were analyzed based on a weighted ranking method and the results below were taken.

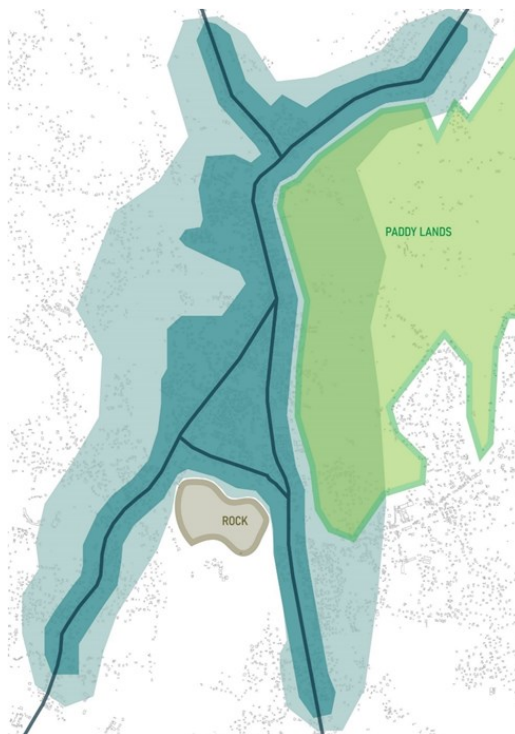
**\*\*This scenario analysis was developed based on illustrative ideas and experiences of real ground in Dambulla. Before selecting the final proposed structure for Dambulla, several designs were created. After the weighted score for the characteristics of the selected designs best alternative designs were selected.**

## Spatial Illustration of Dambulla Municipal Area

Existing Urban Form



Business as Usual Scenario



Proposed Spatial Structure

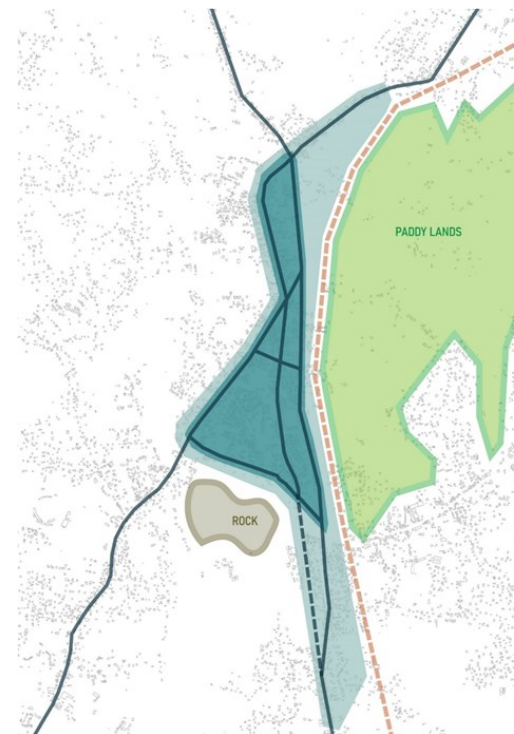


Figure 4: Existing Urban Form Dambulla

Figure 5: BAU Scenario Dambulla

Figure 6: Proposed Spatial Structure Dambulla

Spatial Illustration of Dambulla area was an arbitrary analysis done by considering the town's current patterns, status, characteristics, and peoples' opinion that was collected during the field visits. After identifying the current spatial structure of Dambulla MC area when developed the Business-as-Usual Scenario assuming without any internal or external forces how the town will grow according to above mentioned considerations. Then several future prediction scenarios (Proposed Spatial Structure) were created and conducted weighted scored analysis for all structures and among the proposed scenarios the best alternative was selected.

## Scoring

### Existing Urban Form

|                 |                                  |
|-----------------|----------------------------------|
| Accessibility   | Local level connectivity         |
|                 | Regional level connectivity      |
|                 | National level connectivity      |
|                 | Walkability                      |
| Density         | Space to growth                  |
|                 | Ease of providing infrastructure |
| Diversity       | Functional mix                   |
|                 | Good social mix                  |
| Affordability   | Reduce transferring cost         |
|                 | Agglomeration of services        |
| Design          | Ease of managing sprawl          |
|                 | Structural stability             |
|                 | Spatial identity                 |
| Natural systems | Optimum land use                 |
|                 | Potential for zero emission      |
|                 | Harmony with eco-systems         |
| Invest to earn  | Dealing with cultural politics   |
|                 | Social equity                    |

Table 3: Comparing Characteristics of Existing Urban Form

### Business as Usual Scenario

|                 |                                  |
|-----------------|----------------------------------|
| Accessibility   | Local level connectivity         |
|                 | Regional level connectivity      |
|                 | National level connectivity      |
|                 | Walkability                      |
| Density         | Space to growth                  |
|                 | Ease of providing infrastructure |
| Diversity       | Functional mix                   |
|                 | Good social mix                  |
| Affordability   | Reduce transferring cost         |
|                 | Agglomeration of services        |
| Design          | Ease of managing sprawl          |
|                 | Structural stability             |
|                 | Spatial identity                 |
| Natural systems | Optimum land use                 |
|                 | Potential for zero emission      |
|                 | Harmony with eco-systems         |
| Invest to earn  | Dealing with cultural politics   |
|                 | Social equity                    |

Table 2: Comparing Characteristics of BAU Scenario

### Proposed Spatial Structure

|                 |                                  |
|-----------------|----------------------------------|
| Accessibility   | Local level connectivity         |
|                 | Regional level connectivity      |
|                 | National level connectivity      |
|                 | Walkability                      |
| Density         | Space to growth                  |
|                 | Ease of providing infrastructure |
| Diversity       | Functional mix                   |
|                 | Good social mix                  |
| Affordability   | Reduce transferring cost         |
|                 | Agglomeration of services        |
| Design          | Ease of managing sprawl          |
|                 | Structural stability             |
|                 | Spatial identity                 |
| Natural systems | Optimum land use                 |
|                 | Potential for zero emission      |
|                 | Harmony with eco-systems         |
| Invest to earn  | Dealing with cultural politics   |
|                 | Social equity                    |

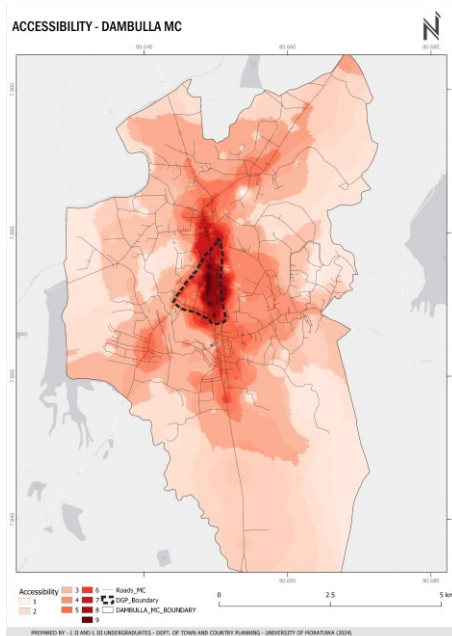
Table 4: Comparing Characteristics of Proposed Urban Form

|           |      |          |      |          |
|-----------|------|----------|------|----------|
| Excellent | Good | Moderate | Poor | Critical |
|-----------|------|----------|------|----------|

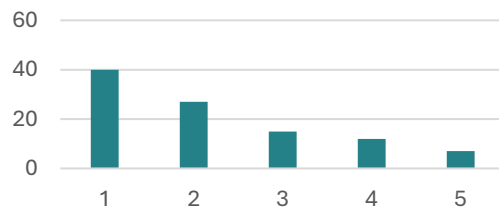
With this scored scenario analysis, the pros and cons of each spatial structure can be understood. The proposed spatial structure is not a direct output. After designing several forms for the city in the process of Local Development Plan, the best alternative structure was selected. Therefore, the proposed structure is excellent in local level connectivity, national level connectivity, agglomeration of services, and harmony with the eco-systems. This scoring is an arbitrary study which require a better understanding of the study area and done to all the designed structures and the most advantaged structure was selected.

With the scenario analysis, a triangular area was identified in the strategy formulation at the Local Development Phase (Page 23 – Density & Land Use Strategy). To identify the need for the DGP accessibility, the density, and diversity of the Dambulla Municipal boundary were studied.

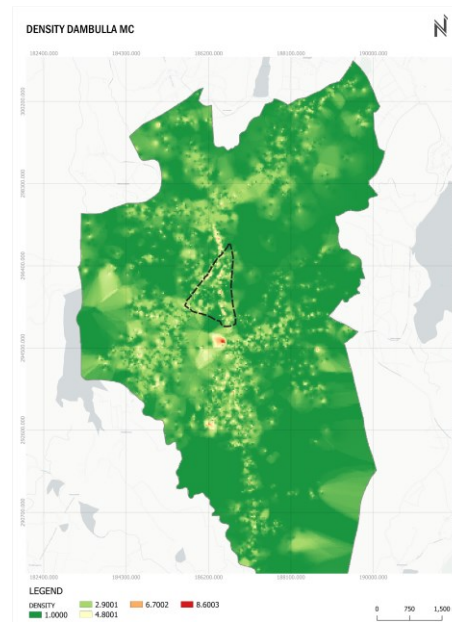
Accessibility of Dambulla MC



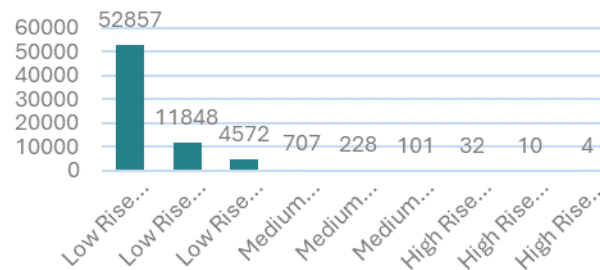
Accessibility MC



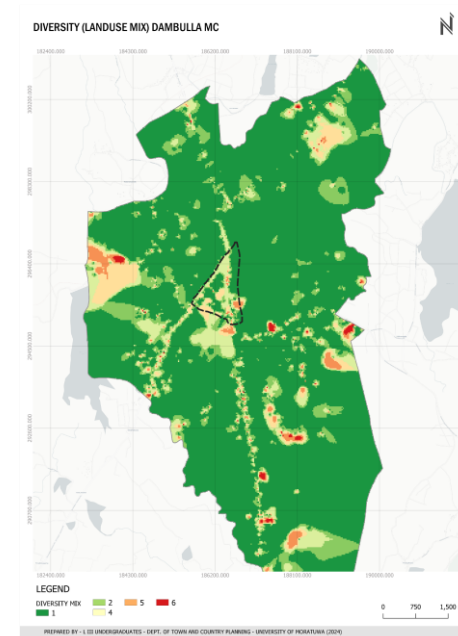
Density of Dambulla MC



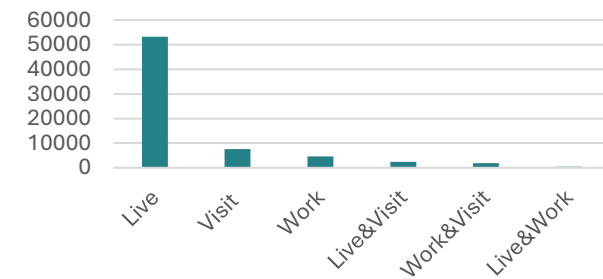
Building Density - Dambulla MC



Diversity (Land Use Mix) of Dambulla MC



Land Use Mix MC



*For more information in the above maps refer to these books – Teaching & Learning Book Step-by-Step Guide: Land Use Mix, Density, Urbanity using QGIS*

The results of these maps show higher connectivity levels within that identified triangle area in Dambulla town. At the same time, it has resulted in low levels of high-density areas and high land use mixed within the triangle. Theoretically, if an area has a higher connectivity level, it tends to attract more activities, people, and agglomeration of economies as well as high density, high diversity, and high demand. Yet that has not happened in Dambulla. To minimize this physical imbalance of Dambulla, the area requires detailed development guidelines to enhance its potential and minimize its negativities. Therefore, the need for the Development Guide Plan for Dambulla is to enhance its existing possibilities about connectivity and attract developments there to increase the density and diversity of the area.

**Combining previous illustrated scenario analysis and these analytical maps, a significant triangular area was identified. Therefore, that area was developed as the boundary of the DGP with the below justifications.**

#### **Existing Main Road Network**

Through Dambulla town, two main highways are going along. Those are A6 (Colombo – Trincomalee) Road and A9 (Kandy – Jaffna) Road. From one of the entrances to Dambulla from south to the town, these roads relate to the AB24 Linked Road and from north A6 and A9 roads are connecting at Dambulla Clock Tower junction creating a triangle shape vehicular flow to the town.

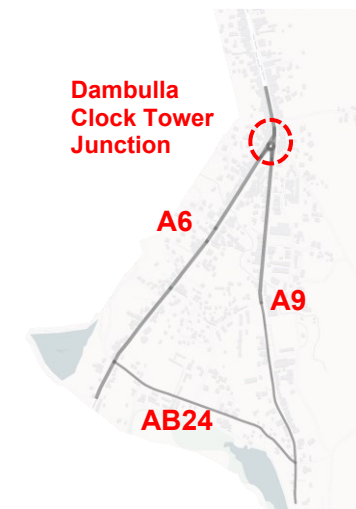
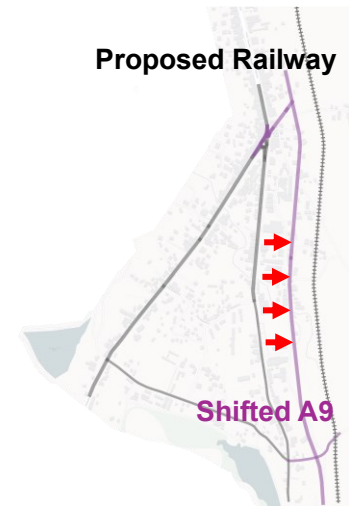


Figure 4: Boundary Delineation Step 1

### Shifted A9 Road with the strategy identification in Local Development Plan and Future Railway Line to be

Above identified triangle area created with the roads are being extended with the proposed new shifted A9 road and future railway line. Collectively a new triangular area has created. Above connectivity analysis (Page No. 27) shows the accessibility levels of Dambulla with the new shifted A9 road. (Strategy – Page 23)

Figure 6: Boundary Delineation  
Step 2



### New Triangular Area

Then the skeleton or the road network was observed with the building layout of Dambulla triangular area. There we identified that since this triangle area is created with combining two main highways, if we only provide guidelines to one side of the roads which means inside the triangle there will be possibilities of creating an imbalance of the road and building structure as well as conflicts among its citizens as well. Considering all those criteria, we decided to take the very first building line of the other side of the triangle area as well.

Figure 5: Boundary Delineation  
Step 3



### **Dambulla Development Guide Plan Boundary**

After considering all the criteria, the boundary for Dambulla Development Guide Plan was decided. This boundary is significant since it is bounded by two main highways and also the development of A9 roadside has controlled with the future railway line.

*Figure 7: Boundary Delineation  
Step 4*



\*\*The method of delineating a boundary can vary with the different contexts of studying. There can be various types of boundaries that can be incorporated into a Development Guide Plan namely Legal Boundaries, Physical Boundaries, Functional Boundaries, Geographical or Environmental Boundaries, and Technical Boundaries using different analytical methods. Here for the DGP Dambulla, we have created a physical boundary in terms of an artificial boundary created based on the road network of the area.

## 7.2 Step Two

### 7.2.1 Vision for the DGP Boundary

Based on the identified need for the DGP boundary, the vision should be developed. Therefore, considering the characteristics of High connectivity, low density, and low diversity of Dambulla, what direction the development should be carried out. Thus, the below vision for the Dambulla DGP boundary has been derived. \*\*The DGP Boundary was selected within the Dambulla Local Development Plan area. (Town center of Municipality)

#### Vision

### “The Connected, Compact, Convenient, and Colorful City Centre”

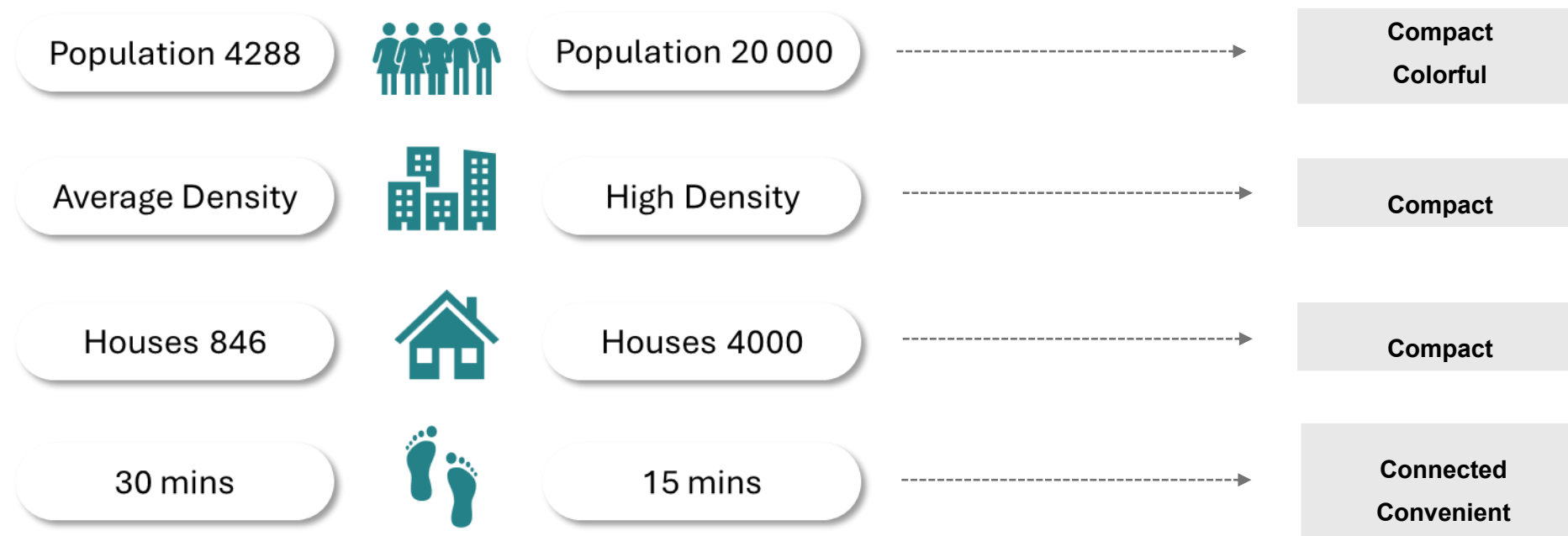
These 5 C components emphasize urban life in a compact city while harmonizing the natural system. These components can be further described below. (*The Vision for Dambulla Local Development Plan can be referred from page No. 22*)

- **Connected** – to pursue optimum advantages from existing high connectivity in the town at the Local Level and National Level, connected means to create a more connected town for both passengers and pedestrians and also for dwellers and commuters. Increasing walkability, providing the shortest possible path, and connecting all public transportation are the main concerns here.
- **Compact** – in scenario analysis, the urban form of Dambulla has been identified as a linear one along the main roads namely A6 (Colombo – Trincomalee) and A9 (Kandy – Jaffna). Once strategies were formulated at the phase of the Local Plan, a triangular area was identified to develop as a new town area and that area became the DGP boundary as well. To develop this triangular area as a highly dense area the component of the compact was incorporated.
- **Convenient** – the term convenient here in the book refers to the easiness of accessing services and places. Work, Live, and Visit uses are situated closer to each other, and walkability has improved.
- **Colorful** – to increase the mixed land use index, the component of color has increased. Also, to create an urban life with a mix of Grey-Green-Blue and to add more other colors through guidelines, the component of colorful will be focusing on that.
- **City Centre** – collectively, a connected, compact, convenient, and colorful urban area will create a city center where a huge number of people are attracted to various needs and will become a thriving urbanity in the area.

Now let us see how these components can align to the Dambulla context.

#### Present Situation 2024

#### Future Targets 2050



Here, in the visioning for DGP area, first – a suitable need for the DGP was identified, and then according to that need a vision was derived adding suitable components to the vision and its meaning.

## 7.3 Step Three

### 7.3.1 Existing Situation of DGP Boundary

After the identification of a suitable boundary and a vision for that boundary, the next step is to understand the selected boundary in detail according to the vision. Here, we do not have to conduct every analysis, since we have a kind of understanding from the local plan and the direction for DGP is set, planners should mindfully select what analysis to conduct and what not to conduct.

Therefore, to understand the existing situation of the DGP area of Dambulla, the study was conducted under three levels which was,

- At area level
- At street level
- At building level

#### At Area Level

At area level all the land uses of Dambulla DGP boundary were identified to see how the land has been occupied and how it differs spatially. Also, this study showed how the various land uses have been arranged within this boundary and what are the dominant uses.

Therefore, the majority of the land use takes place in Dambulla urban triangle as residential and commercial. Green areas such as paddy, scrub, home gardens, and water bodies are also situated within the triangle making possibilities to achieve above components mentioned in the vision. Even to a smaller extent quite good variation of the land use can be seen.

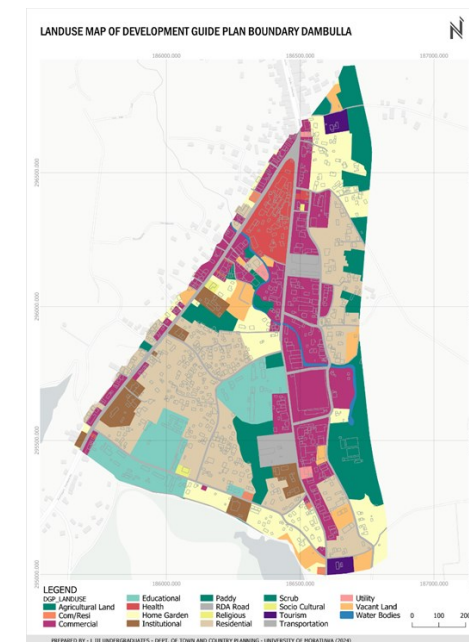


Figure 8: Land use Map DGP Boundary

## At Street Level

A connectivity analysis was undertaken to identify Dambulla DGP boundary at street level. In both national and local level Dambulla has a high connectivity and integration level. There in this connectivity map for DGP boundary, it has resulted higher accessibility values for main A6 and A9 roads and AB24 road named Linked Road. Since the DGP is to develop this triangular area as the city centre it is important to consider the connectivity of the inner areas of the triangle as well.

As shown in the map, low and moderate connectivity levels have resulted for the inner areas of Dambulla urban triangle. Therefore, at street levels it was identified that to improve the connectivity within the triangle is important and necessary.

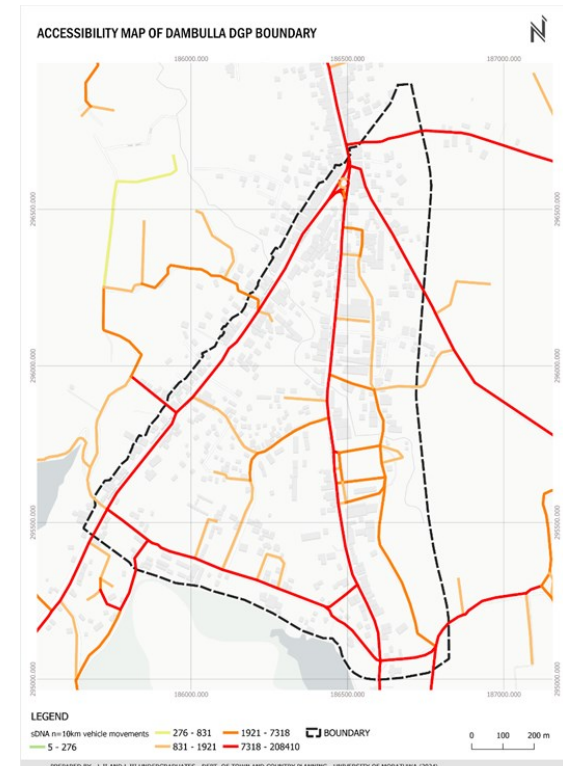
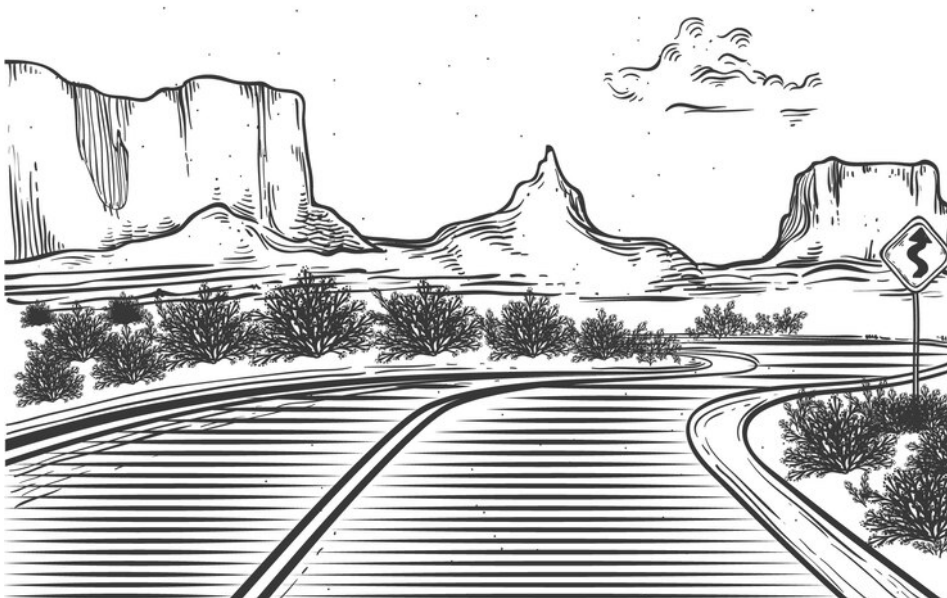


Figure 9: Accessibility Map DGP Boundary

## At Building Level

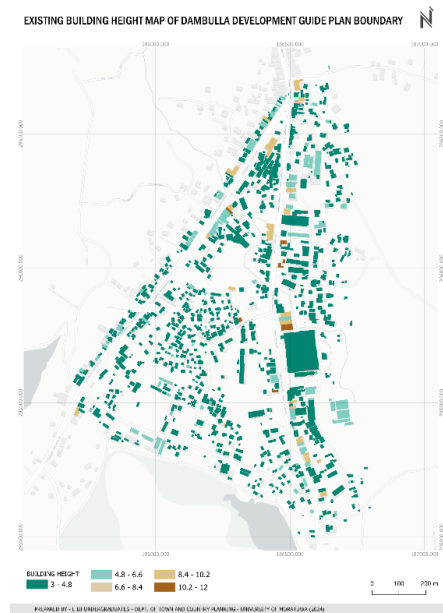


Figure 10: Building Height Map

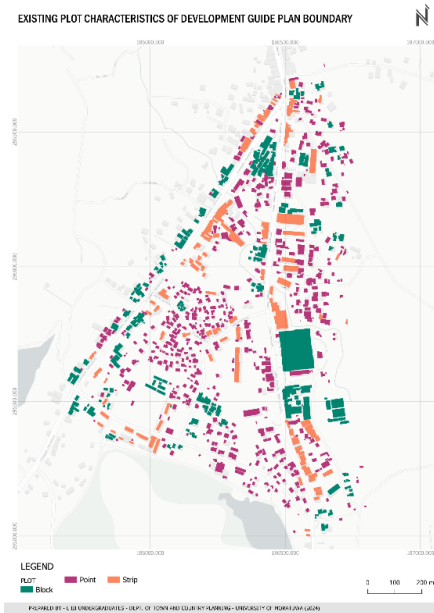


Figure 11: Plot Type Map

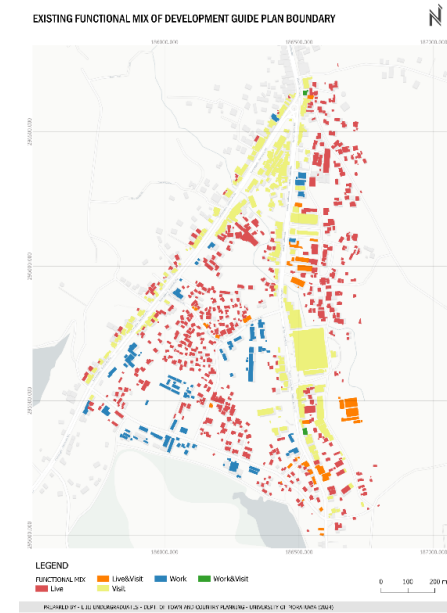


Figure 12: Mixed Use Index

Several aspects were studied at building level. Those were, building height, plot characteristics, and functional mix. The data for these maps were obtained through a survey done by using Google Street View and Satellite Images. Some of the details were confirmed during the filed visits.

- Building Height – shows how the buildings with different height have been spatially located in the boundary. Majority of the buildings are in 3m height indicating more 1 story buildings. Within 4.8 – 8.4 m height buildings can also be seen in several places and only few buildings with height more that 10m are located. The low building density of the area can be understood with this map.
- Plot Characteristics - plot characteristics map shows how the different plot shapes namely point, stripes, and blocks are being located within the DGP boundary.
- Functional Mix – functional mix shows the levels of Live, Work, Visit composition of Dambulla DGP boundary. Majority uses has resulted as mono functions in the map.

Studying these aspects will help creating suitable guidelines for building regulations such as building height, plot coverage, FAR, and allowed uses as well.

## 7.4 Step Four

### 7.4.1 Development Guide Plan

After identifying the existing situation of the DGP area, suitable guidelines were created to achieve the decided vision for the area. This whole process of developing a DGP for the Dambulla Urban Triangle was done by referring to several important readings and research papers. Before introducing guidelines directly, several benchmarking was derived for the Dambulla area to decide on suitable guidelines.

Therefore, it is important to mention the guidelines that were introduced to Dambulla were not arbitrarily decided. They were a result of these benchmarking and further calculations.

Referred readings

- *Responsive environments – a book for designers by Ian Bently, Alan Alcock, Paul Murrain, Sue McGlynn, Graham Smith*
- *Local Area Planning for Transit Oriented Development - An Illustrated Handbook for Indian Cities by Rutul Joshi, Prasanth Narayanan, Anshula Menon, Ananya Ramesh, Siddhartha Godbole*

Referring to the above reading, three principals were selected to move forward with the introduction of guidelines. Within those principles, several components were selected. Those are,

- **Accessibility** – Average Length of Block Section, Density of Intersections, Area Under Roads, Dedicated Walking Width, Least PCA Ratio, Control Values, Local Integration, Global Integration
- **Density** – Zone Factor, Dwelling Unit Density, Desired Job density
- **Diversity** – Non-Residential Use, Land Entropy Index, Land Use Mix

During the studying of the existing situation of Dambulla Urban Triangle, it was witnessed that within the inner areas of the triangle connectivity and accessibility are low. To increase accessibility within that area, improvements to the road network and blocks are essential. For that, the components of the accessibility principle were incorporated.

Several principles of responsive environment were also considered when proposing the new road network.

- **Permeability (Physical/Visual)** – where people can/cannot go the quality.
- **Variety** – range of uses available to people.
- **Legibility** – how easily people can understand the available opportunities that the town offers.
- **Visual appropriateness** – awareness of the choices available to people.

#### 7.4.2 Improvement of the Road Network and Blocks

##### **Benchmarks**

##### ***Accessibility***

**Average Length of Block Section (<28m)** – Lengths of the Block Sections can be identified as a better tool over conventional methods as a measure of walkability. A block section of 280m or less is usually associated with better walkability.

**The density of Intersections (>80sqkm)** - Intersection density is closely related to block section. The smaller the average block size, the more intersection density. An intersection density of around 80/sq. km is ideal for walkability.

**Area Under Roads (>15%)** - A minimum 15% of road area can be identified as a measure of good network planning.

**Dedicated Walking Widths** - A micro measure of walkability can be measured by providing adequate walking widths, usually more than 1.2m, ideally which should be 1.5 m. (\*\*Addressed Under Future Street Framework)

**Least PCA Ratio (>60%)** – Pedestrian catchment areas (PCA) are theoretically walkable zones that can be mapped to show the actual area that can be accessed via the road network from a fixed point of interest.

**Control Values (>3)** – The control value represents the degree to which a line is important for accessing neighborhood lines. A high control line indicates that a street is very important for the connectivity of the area.

**Local/Global Integration** – Integration is an indicator of how easily one can reach a specific line of the axial map. The higher the integration value of the line, the lower the number of axial lines required to reach that line.

After improving the road network and blocks in the Dambulla Urban Triangle, guidelines for the blocks, density, and diversity principles and their components were incorporated.

### ***Density***

**Zone Factor (<4)** – Expected Intensity of the area

**Dwelling Unit Density (>4000)** – Dwelling units are around 4000 per sq.Km ensures focused density.

**Desired Job Density (>17000)** - Jobs available (formal & informal) being around 17,000 contributes towards focused density.

### ***Diversity***

**Non-residential use (>30%)** - Facilitating non-residential uses of at least 30 - 50% should be maintained to improve land use mix.

**Land Entropy Index (>0.3)** - Quantify the degree of diversity or heterogeneity in land use.

Where:

$$H = - \sum_{i=1}^n p_i \cdot \log_2(p_i)$$

- n is the number of land use types
- pi is the proportion of each land use type

**Land Use Mix (>6)** – More the land use mix, more the variety

\*\*The desired benchmark values were decided in several ways for these components considering their applicability. Those several ways were,

- Taking the exact values from the reading itself (Local Area Planning for Transit Oriented Development) – Average Length of Block Section, Density of Intersections, Area Under Roads, Dedicated Walking Width, Least PCS Ratio, Non-Residential Use, Land Entropy Index.
- Calculating suitable values for the Dambulla context considering the existing context of similar areas that we need Dambulla to become. – Zone Factor, Dwelling Unit Density, Desired Job Density, Land Use Mix
- By undertaking relevant analysis – Control Values, Local Integration, Global Integration

| Principles    | Derived Benchmark               | Existing | Proposed | Desired     |
|---------------|---------------------------------|----------|----------|-------------|
| Accessibility | Average Length of Block Section | 49-767m  | 55-279m  | <280m       |
|               | Density of Intersection         | 45       | 83       | >80/sqkm    |
|               | Area Under Roads                | 9%       | 20%      | >15%        |
|               | Dedicated Walking Width         | 0-2.4m   | 1.2-2.4m | >1.2m       |
|               | Least PCA Ratio                 | 33%      | 89%      | >60%        |
|               | Control Values                  | 1.9      | 3.9      | >3.00       |
|               | Local Integration               | 0.7      | 2.3      | >1.2        |
|               | Global Integration              | 3.3      | 3.4      | >3.5        |
| Density       | Zone Factor                     | 2        | 2 - 4    | <4          |
|               | Dwelling Unit Density           | 846      | 4000     | >4000/sqkm  |
|               | Desired Job Density             | 1900     | 6000     | >17000/sqkm |
| Diversity     | Non-Residential Use             | 37.96%   | 42%      | >30%        |
|               | Land Entropy Index              | 1.56     | 1.83     | >0.325      |
|               | Land Use Mix                    | 1 - 3    | 7 - 8    | >6          |

Table 5: Derived Benchmarks for Guideline Development

These derived criteria is to implement to create a connected and compact city. These desired benchmark values for accessibility can be and diversity can be applied for any context despite of their unique changes of town to town. Yet considering environmental, social, and most importantly the Vision and the Direction a particular DGP is following, the benchmark values for the principal "Density" can be amended necessarily. Also, another important thing is that the way of enhancing accessibility its strategies and actions for town to town can be different.

## Existing roads and Proposed New Road Network

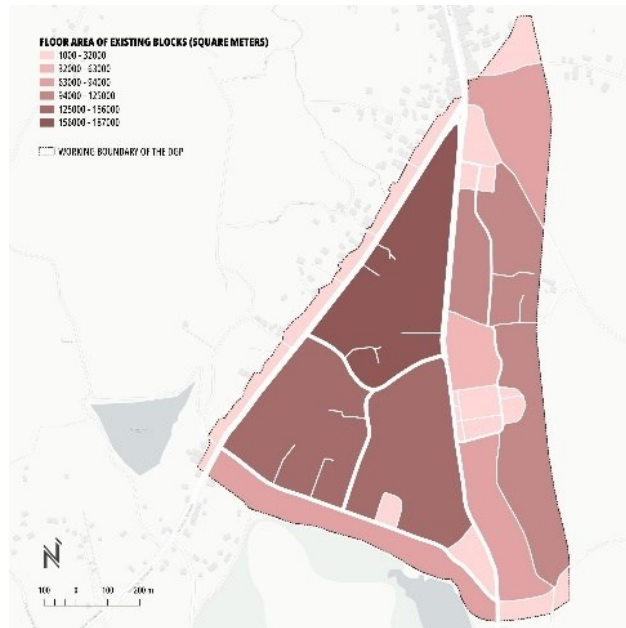


Figure 14: Existing Road Network

The proposed new road network was designed to align with all the desired benchmarking. The above table shows how the existing situation has improved into the proposed situation with the new road network under the principle of accessibility. To achieve the other two principles thereafter relevant guidelines were introduced.

Since we are changing the road network, land plots are (Blocks) also changing. Therefore, a land readjustment framework is crucial in the Development Guide Plan because with the new roads more land will be required for the construction of roads, and with the blocks are begin changing there will be problems with land ownership.

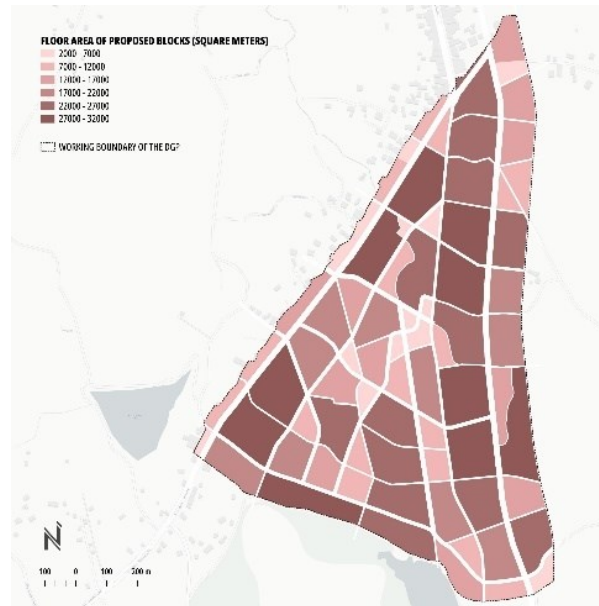


Figure 13: Proposed Road Network

### 7.4.3 Land Readjustment Framework

Under the land readjustment framework, three components have been discussed. Those are,

- Land Acquisition
- Land Readjustment
- Valuation & Compensation

#### **Land Acquisition**

Lands are owned by different owners under different categories. Government Lands, Private Lands, Religious Lands, and some other several types can be there. Land acquisition refers to the process of coming to agreements by making offers to landowners and voluntarily transferring their property through legal mechanisms. To undertake land acquisition in Sri Lanka, the relevant figures should adhere to the regulations of the Land Acquisition Act of Sri Lanka. With the act, the DGP Dambulla has also introduced some necessities for land acquisition with the Guide Plan. Those are,

- DGP area must be legally defined.
- Land ownership of the boundary should be identified & defined.
- A legal body should be established to carry out the land acquisition project (local, prefectural, national government, public corporations, etc.), or a private sector organization (cooperatives of landowners, a land readjustment stock company established by landowners, etc.)
- A precise survey of all the land plots, buildings, and other Features should be made.
- The consent of landowners is solicited. Should have the consent of 66% of the total landowners for the land acquisition.
- Landowners & parties must sign a contract consenting to the project before it can legally proceed.

## **Land Readjustment**

- After acquiring lands, land replotting or land readjustment should be carried out according to the proposed roads. Land readjustment means to alter the shape and land conditions of lots and install or improving public facilities in a city's planning area to provide better public facilities and increase the usage of each lot.
- There are several reasons for land readjustment. Here for the DGP, the purpose of land readjustment should be under the category of use of urban rehabilitation. (For other categories refer to the reading mentioned below). For the land readjustment mechanism below are the introduced guidelines from the DGP.
- Landowners should contribute 10 % of their land for cost-equivalent purposes and 20% for public facilities. Contribution ratios are higher for undeveloped sites and non-subsidized projects, and lower for projects in older, developed areas and for government-assisted projects.
- The re-plotting design, financial plan, project implementation plan, and land contribution of each landowner must be approved by at least 66% of landowners owning 66% of land.

## **Valuation & Compensation**

For land acquisition and readjustment, land valuation and compensation are important for the previous owners. There the valuation should be conducted before and after the readjustment as well. The guidelines under the Dambulla DGP for valuation and compensation are as below.

For compensations, incremental values and betterment charges the values of original plots and final plots should be identified.

Should provide clear guidelines for the valuation of plots.

### **1. Location**

- Proximity to developed area
- Proximity to Natural Feature
- Proximity to Man-made Features

### **2. Access (1 or more)**

- 3. Frontage**
- 4. Shape (regular/irregular shape)**
- 5. Size/Area (large/small)**
- 6. Zoning (based on development potential)**
- 7. Level of plot concerning the road category & width**

For approval of the project and to apply for the national subsidy, the project area must be designated as an urban redevelopment promotion area in urban planning or must satisfy several other conditions such as:

For approval of the project and to apply for the national subsidy, the project area must be designated as an urban redevelopment promotion area in urban planning or must satisfy several other conditions such as:

- Designation as a high-intensity land use area
- Improving the efficiency of land use

Referred reading - Book for Preparation of Town Planning Schemes - GUJARAT REAL ESTATE REGULATORY AUTHORITY

## 7.4.4 Changes of the Blocks with New Road Network

### Existing Blocks and Proposed Blocks with New Road Network



Figure 16: Existing Blocks

After identifying the block's developable land extent, zone factor, land use mix, and width of the access road of each block were decided.

*\*\*The above blocks were designed while accomplishing above mentioned benchmarks (Page No. 37 – 39)*



Figure 15: Proposed Blocks with the New Roads

Developing guidelines and introducing new frameworks were not a linear process. For instance, while creating the new road network according to the derived benchmarks, a new street framework which was mentioned later in this book was also carried out. To follow up and describe the steps simply this order is created.

Therefore, the decided guidelines for the blocks are as below.

## Dominant Land Use Mix

| <b>1 – LIVE</b><br><br><b>2 – VISIT</b><br><br><b>3 - WORK</b><br><br><b>4 – LIVE/VISIT</b><br><br><b>5 – WORK/VISIT</b><br><br><b>6 – LIVE/WORK</b><br><br><b>7 – LIVE/WORK/VISIT</b><br><br><b>8 – LIVE/WORK/VISIT</b><br><br><b>9 – LIVE/WORK/VISIT</b> | Block No. | Area (sqm) | Developable Land Area | Zone Factor | Land Use Mix | Road Width (Access) | Block No. | Area (sqm) | Developable Land Area | Zone Factor | Land Use Mix | Road Width (Access) |
|--|-----------|------------|-----------------------|-------------|--------------|---------------------|-----------|------------|-----------------------|-------------|--------------|---------------------|
|  | 1         | 13032.523  | 9122.766              | 3-3.5       | 2            | 23                  | 15        | 8686.1     | 6080.27               | 2-3         | 1            | 23                  |
|  | 2         | 6818.512   | 4772.958              | 3-3.5       | 1            | 23                  | 16        | 20575.51   | 14402.86              | 2-3         | 2            | 23                  |
|  | 3         | 14968.84   | 10478.19              | 3-3.5       | 1            | 23                  | 17        | 22785.09   | 15949.56              | 2-3         | 2            | 23                  |
|  | 4         | 15781.09   | 11046.76              | 3-3.5       | 1            | 23                  | 18        | 28569.32   | 19998.52              | 3-3.5       | 5            | 23                  |
|  | 5         | 11126.42   | 7788.493              | 3-3.5       | 1            | 23                  | 19        | 30215.18   | 21150.62              | 3-3.5       | 7            | 23                  |
|  | 6         | 7257.748   | 5080.424              | 3-3.5       | 1            | 23                  | 20        | 7046.414   | 4932.49               | 3-3.5       | 7            | 14                  |
|  | 7         | 21580.94   | 15106.65              | 3-3.5       | 5            | 23                  | 21        | 25028.17   | 17519.72              | 3-3.5       | 7            | 23                  |
|  | 8         | 17081.82   | 11957.27              | 3-3.5       | 4            | 23                  | 22        | 29425.92   | 20598.15              | 3-3.5       | 8            | 23                  |
|  | 9         | 20369.15   | 14258.41              | 3-3.5       | 5            | 23                  | 23        | 27816.02   | 19471.21              | 3-3.5       | 7            | 23                  |
|  | 10        | 14171.24   | 9919.865              | 3-3.5       | 6            | 23                  | 24        | 24387.84   | 17071.49              | 3-3.5       | 5            | 23                  |
|  | 11        | 30444.6    | 21311.22              | 3-3.5       | 5            | 23                  | 25        | 23016.9    | 16111.83              | 3-3.5       | 5            | 23                  |
|  | 12        | 16003.16   | 11202.21              | 2-3         | 3            | 23                  | 26        | 23991.33   | 16793.93              | 3-3.5       | 5            | 23                  |
|  | 13        | 21674.18   | 4730.588              | 2-3         | 2            | 23                  | 27        | 7931.445   | 5552.012              | 3-3.5       | 5            | 23                  |
|  | 14        | 6757.983   | 15171.93              | 2-3         | 2            | 23                  | 28        | 30649.65   | 21454.75              | 3-3.5       | 7            | 23                  |

Figure 18: Block Guidelines

Figure 17: Block Guidelines

| Block No. | Area (sqm) | Developable Land Area | Zone Factor | Land Use Mix | Road Width (Access) |
|-----------|------------|-----------------------|-------------|--------------|---------------------|
| 29        | 5343.133   | 3740.193              | 3-3.5       | 7            | 18                  |
| 30        | 25251.8    | 17676.26              | 3.5-4       | 7            | 19                  |
| 31        | 2203.591   | 1542.514              | 3.5-4       | 8            | 19                  |
| 32        | 9778.335   | 6844.835              | 3.5-4       | 4            | 19                  |
| 33        | 27130.79   | 18991.55              | 3.5-4       | 7            | 23                  |
| 34        | 2796.365   | 1957.456              | 3.5-4       | 5            | 19                  |
| 35        | 6789.298   | 4752.509              | 3.5-4       | 5            | 19                  |
| 36        | 3639.188   | 2547.432              | 3.5-4       | 5            | 19                  |
| 37        | 4116.588   | 2881.612              | 3-3.5       | 6            | 19                  |
| 38        | 13262.23   | 9283.558              | 3-3.5       | 6            | 18                  |
| 39        | 20790.69   | 7875.067              | 3.5-4       | 5            | 19                  |
| 40        | 11250.1    | 14553.48              | 3-3.5       | 6            | 19                  |
| 41        | 8341.376   | 5838.963              | 3-3.5       | 5            | 19                  |
| 42        | 9017.453   | 6312.217              | 3-3.5       | 5            | 19                  |

| Block No. | Area (sqm) | Developable Land Area | Zone Factor | Land Use Mix | Road Width (Access) |
|-----------|------------|-----------------------|-------------|--------------|---------------------|
| 57        | 24237.41   | 16966.18              | 3-3.5       | 4            | 19                  |
| 58        | 7873.093   | 5511.165              | 3-3.5       | 4            | 18                  |
| 59        | 22850.23   | 15995.16              | 2-3         | 1            | 19                  |
| 60        | 10403.86   | 7282.699              | 2-3         | 1            | 18                  |
| 61        | 13317.07   | 9321.948              | 2-3         | 1            | 18                  |
| 62        | 16792.65   | 11754.86              | 2-3         | 1            | 18                  |
| 63        | 29859.63   | 20901.74              | 2-3         | 1            | 18                  |
| 64        | 21882.57   | 15317.8               | 2-3         | 3            | 18                  |
| 65        | 27094.25   | 18965.97              | 2-3         | 3            | 18                  |
| 66        | 19901.05   | 13930.74              | 2-3         | 3            | 23                  |
| 67        | 3025.594   | 2117.916              | 2-3         | 3            | 23                  |
| 68        | 7780.059   | 5446.041              | 2-3         | 2            | 23                  |
| 69        | 8278.414   | 5794.89               | 3-3.5       | 5            | 23                  |
| 70        | 12722.72   | 8905.907              | 3-3.5       | 5            | 23                  |

| Block No. | Area (sqm) | Developable Land Area | Zone Factor | Land Use Mix | Road Width (Access) |
|-----------|------------|-----------------------|-------------|--------------|---------------------|
| 43        | 19663.21   | 13764.25              | 2-3         | 1            | 19                  |
| 44        | 9187.9     | 6431.53               | 2-3         | 1            | 18                  |
| 45        | 14598.75   | 10219.12              | 2-3         | 1            | 18                  |
| 46        | 12492.45   | 8744.718              | 3.5-4       | 5            | 19                  |
| 47        | 18856.48   | 13199.53              | 3.5-4       | 6            | 19                  |
| 48        | 20342.11   | 14239.47              | 3-3.5       | 5            | 23                  |
| 49        | 4674.768   | 3272.338              | 3-3.5       | 4            | 18                  |
| 50        | 22170.87   | 15519.61              | 3-3.5       | 4            | 19                  |
| 51        | 5693.685   | 3985.58               | 3-3.5       | 4            | 18                  |
| 52        | 15153.93   | 10607.75              | 3-3.5       | 5            | 18                  |
| 53        | 20666.04   | 14466.22              | 3-3.5       | 5            | 19                  |
| 54        | 31098.8    | 21769.16              | 3-3.5       | 1            | 23                  |
| 55        | 8220.567   | 5754.397              | 3-3.5       | 1            | 19                  |
| 56        | 21947.16   | 15363.01              | 3-3.5       | 1            | 18                  |

| Block No. | Area (sqm) | Developable Land Area | Zone Factor | Land Use Mix | Road Width (Access) |
|-----------|------------|-----------------------|-------------|--------------|---------------------|
| 71        | 5770.906   | 4039.634              | 3.5-4       | 7            | 23                  |
| 72        | 5798.716   | 4059.101              | 3.5-4       | 8            | 23                  |
| 73        | 7296.603   | 5107.622              | 3-3.5       | 7            | 23                  |
| 74        | 4049.273   | 2834.491              | 3-3.5       | 5            | 23                  |
| 75        | 7085.581   | 4959.907              | 3-3.5       | 5            | 23                  |

Figure 19: Block Guidelines

\*\*Reference: THE URBAN DEVELOPMENT AUTHORITY LAW, NO. 41 OF 1978 OF THE NATIONAL STATE ASSEMBLY - Urban Development Authority Planning & Development Regulations 2020 Schedule 6 Form A, B, C

#### 7.4.5 Zone Factor

##### **How to Calculate Zone Factor According to the Determinations of Urban Development Authority**

The zones of the planning area have been demarcated based on their expected densities and characters. Accordingly, “Zone Factor” can be described as the extent of development that an area can hold, based on its,

- Environmental/culturally sensitive areas
- The infrastructure availability (Access Road, Water Supply, Surface Drainage, Sewerage Disposal, etc.) to cater to the development
- The carrying capacity in terms of geographic conditions, population density, etc.

The zone factor is calculated based on the space requirement for the future anticipated development which depends on the expected residential and commuter population in the respective zone.

Densification pattern

To identify the future densification of the town required below criteria,

- Carrying capacity (Supply Capacity of Infrastructure, Bearing Capacity of Environment, Human Space Demand)
- Population and Urbanization Trend
- Existing FAR
- Land Value Variations
- Ongoing and Proposed Projects

After creating each layer, the weighted overlay should be done using a raster calculator in any GIS Software and identify the levels of densification. Considering the density distribution and the character that we are aiming to promote there; the area can be divided into different zones. For instance, High-density residential, low-density residential, high-density compact mixed development, high high-density green mixed development can be mentioned.

These zones then be divided into further small zones based on the,

- Road hierarchy
- Level of service of the road
- Node hierarchy and the area considered as the node

After identifying these criteria then the process of determining the zone factor can be done mainly under below aspects,

- The envisioned development in the area
- The limits for development are determined by analyzing sensitivity/ development potential/ carrying capacity
- The expected residential and commuter population (Based on intelligent guesses, calculations, and assumptions)
- Workout the required residential plus commercial floor space to accommodate the predicted population

Then considering these above aspects, the total expected floor area and available developable land area can be calculated. Then those values can be applied to the formula below to calculate the “Zone Factor”.

$$\text{Zone Factor} = \frac{\text{Total Expected Floor Area}}{\text{Available Developable Area}}$$

Residential and non-residential populations can be predicted based on our vision, goal, and objectives and using a suitable formula (Approach – linear, exponential, etc.) for the required period.

Important - commuter population can be taken as the total of non-residential population and 40% of the residential population assuming 40% of the residential population commuting within the city.

### **Estimating space requirement**

Estimate space for residents

- Per capita residential space – 50 sq, estimate space for commuters
- Per capita commuter space – 40 sq, m

Total Space (Total Expected Floor Area) = Total residential space + Total Commuter Space

Available Developable Area = Land area that could be used to build up excluding the environmentally sensitive areas, water bodies, and roads.

**Example (3 Examples from the Colombo Development Plan which included 13 zones)**

| Zone | Character                              | Current Population  |    | Envisaged Distribution 2030 |   |             |                            |     |            |   |             | Zone Factor                                  |                        |            |                        |                              |
|------|--|---------------------|----|-----------------------------|---|-------------|----------------------------|-----|------------|---|-------------|--|------------------------|------------|------------------------|------------------------------|
|      |  | Resident Population | %  | Residential Population      |   |             | Non-residential Population |     | Commuter   |   |             | The ratio of residential and non-residential | Total floor area sq, m | % in total | Developable Land Sq, m | Adjusted Overall Zone Factor |
|      |  |                     |    | Population                  | % | Area Sq, m  | Population                 | %   | Population | % | Area Sq, m  |  |                        |            |                        |                              |
| 1    | High-density compact mixed development | 114, 776            | 11 | 117, 000                    | 9 | 5, 850, 000 | 84, 000                    | 7.6 | 130, 800   | 8 | 5, 232, 000 | 0.58   | 11, 082, 000           | 9          | 3, 420, 000            | 3.2                          |
| 2    | Moderate Density Residential           | 34, 724             | 3  | 52, 000                     | 4 | 2, 600, 000 | 4, 000                     | 0.4 | 24, 800    | 2 | 992, 000    | 0.93   | 3, 592, 000            | 3          | 2, 321, 000            | 1.5                          |
| 3    | Low-density garden                     | 39, 730             | 4  | 52, 000                     | 4 | 2, 600, 000 | 82, 000                    | 7.5 | 102, 800   | 6 | 4, 112, 000 | 0.39   | 6, 712, 000            | 5          | 4, 734, 000            | 1.4                          |

## 7.5 Step Five

### 7.5.1 Evaluating Land Use According to Tactical Urbanism

Tactical urbanism is an approach which is driven by cities and citizens that enables quick and affordable testing and demonstration of changes in our physical environment. This mechanism relies on short-term, low-cost, and scalable interventions to spark long-term transformations.

According to the reading “A Tactical Urbanism Guidebook by the Ministry of Housing and Urban Affairs Government of India.” The favorable land uses that are suitable for the Dambulla Urban Triangle (DGP Boundary) were evaluated.

| Criteria  | Favorable   | Acceptable  | Not Favorable                     |
|---|---|---|-----------------------------------|
| What are the building uses along & within the boundary  | Commercial, School/College/Private University, Heritage Building, Transit Corridor, Park, Open Space, Public Buildings, Water Body, Residential | Shopping mall, Theater, Religious Building,, Liquor store | Cemetery, Industrial Uses         |
| What is the street network type of the boundary   | Loop , Intersections  | Different road types and width                            | Long street without intersections |
| Does the boundary have intersections  | Yes   | Yes   | No                                |
| Is the carriageway surface even? Without potholes, bumps, manhole covers not leveled to grade?                  | Yes – Main Roads  |   | No – in Minor roads               |
| What is the condition of the road shoulder?   | Paved Gutter  | Evenly Compacted  | Dirt/Unfinished/Open Drain        |
| Is there a sidewalk along the stretch?  | Present & Continues in Main road  | Present but not continues in other roads                  |                                   |
| Are there any obstacles along the pedestrian zone?  | No  | Light poles, Utility box, Garbage bins, Street furniture  | Transformers, Ditches, Trenches   |
| Is there a fixed railing along the pedestrian zone?   | Yes   | Yes, but with several gaps                                | Yes, through the stretch          |
| Are there any activity hotspots present along the stretch such as ATM, teashop, eatery, bus stop, vendors etc.? | Yes   | Yes   | No                                |
| Is there a visible conflict between vehicular and pedestrian flow along the stretch?                            | No  | No  | Yes                               |
| Do pedestrians walk on the carriage way due to insufficient/ no sidewalk space?                                 | No  | Yes   | Yes                               |

Figure 20: Favorable & Non-favorable uses according to Tactical Urbanism

After introducing guidelines for the Dambulla DGP area, the possible changes from these guidelines were mapped out. With that, the planners can have a clear understanding of how the introduced guidelines will help to shape the newly redeveloped area.

### 7.5.2 Improvements of Proposed Blocks

#### Constitutedness

Constitutedness refers to whether the buildings have direct access to the roads. If the building access way is located not facing a road or a direct access way legibility will be less, people cannot find places easily and thus the constitutedness will be less. Here, the existing situation in the Dambulla DGP area shows less constitution of the roads. Only A9 and A6 and some of the other minor roads have that character. If the person is not familiar with the area, for those people it will be hard to access places and find places.

The proposed new road network and guidelines have increased the constitutedness of the roads. The guidelines for buildings are mentioned later in the book.

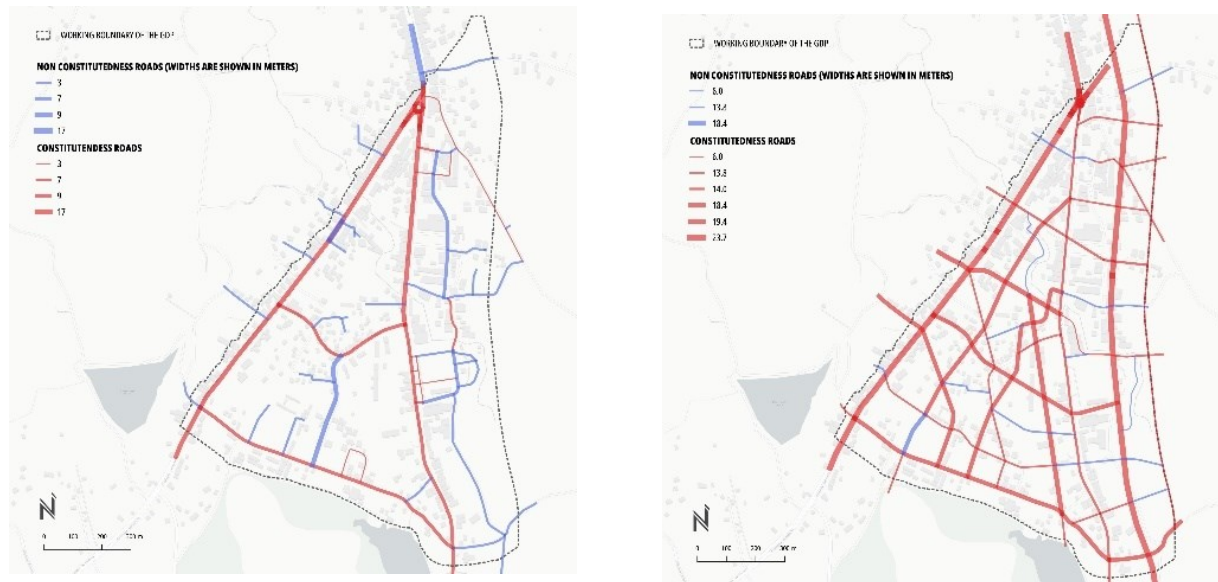
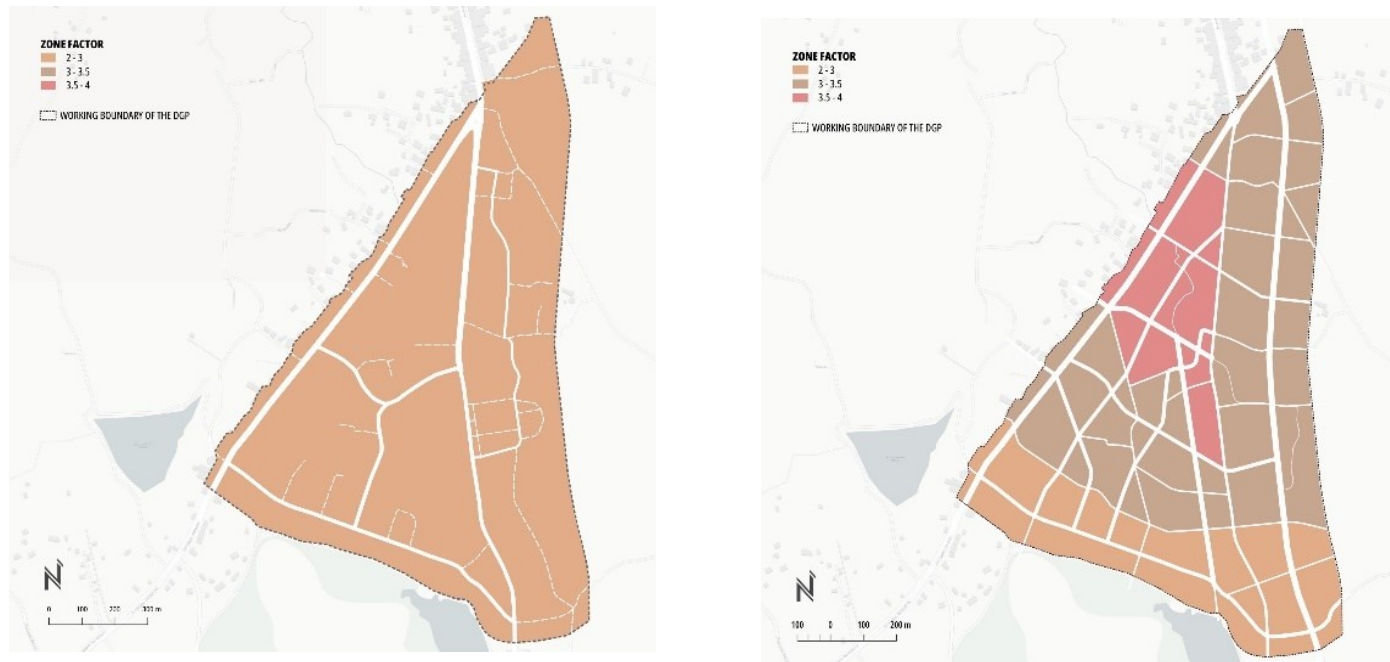


Figure 21: Existing & Proposed Constitutedness

## Zone Factor

Zone factor helps to maintain the land use, building density, height restrictions, and other development controls to maintain and control the growth and character of different areas of the city. Here for the Dambulla DGP area, we have only introduced zone factor, land use mix, and developable land extent. We have not demarcated any FAR, Plot Coverage, and building height specifically to control the developers since the aim of the DGP is to attract people, and residences, and to develop the city as a compact city. Instead, that will be controlled with the zone factor provided for each block earlier in the book.



*Figure 22: Existing & Proposed Zone Factor*

According to the Greater Dambulla, which is a development plan done for Dambulla and surrounding areas, the existing zone factor of the Dambulla Urban Triangle area is 2 (Medium Density). To attract 20,000 people and to develop Dambulla as a Compact City, the zone factor has been calculated to the aimed additional population and their housing and residential needs. Therefore, the zone factor has increased up to a maximum of 4 (Very High Intensity) as needed for the blocks.

## Functional Mix

An existing functional mix of Dambulla DGP boundary records as mono functions dominant area mainly Live and Visit indicating residential and commercial uses. Through the Land Use Mix guidelines introduced for each block, the purpose is to increase the mono functions dominance to a high mixed-use development within the DGP area.

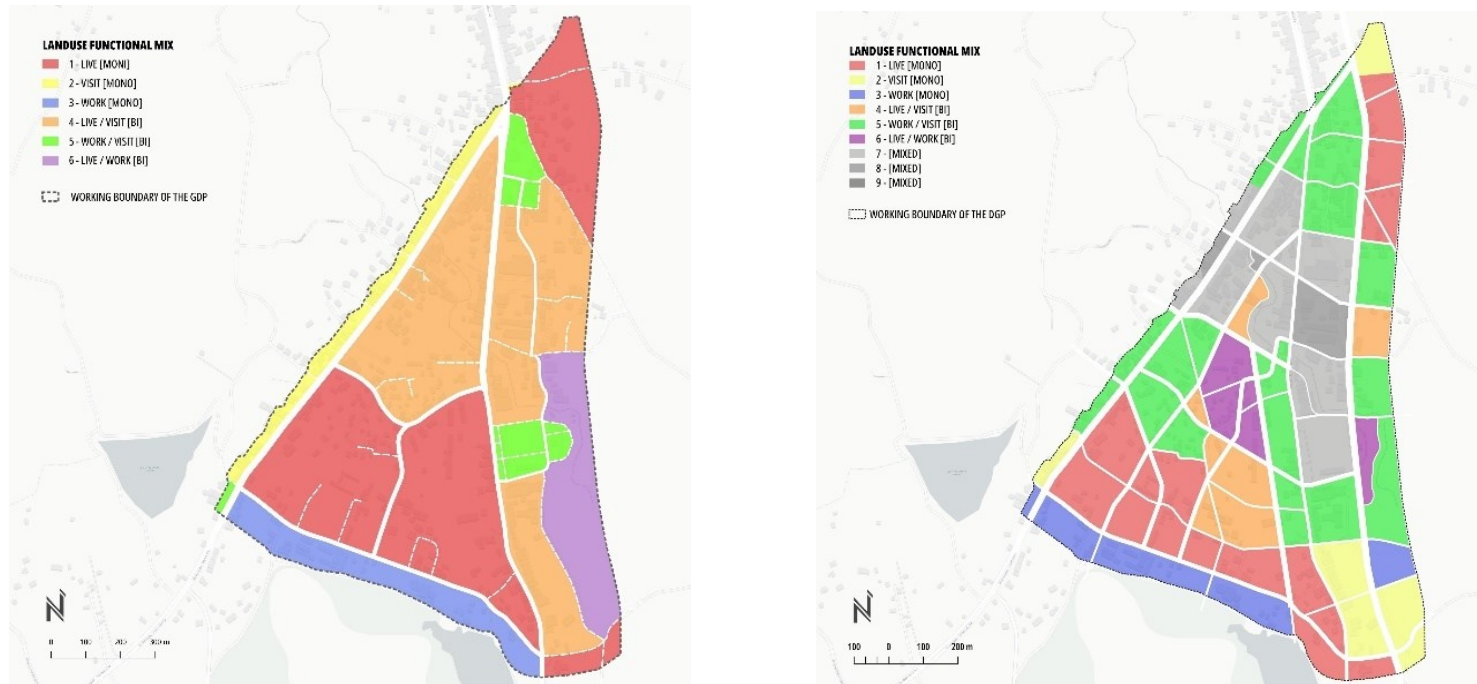


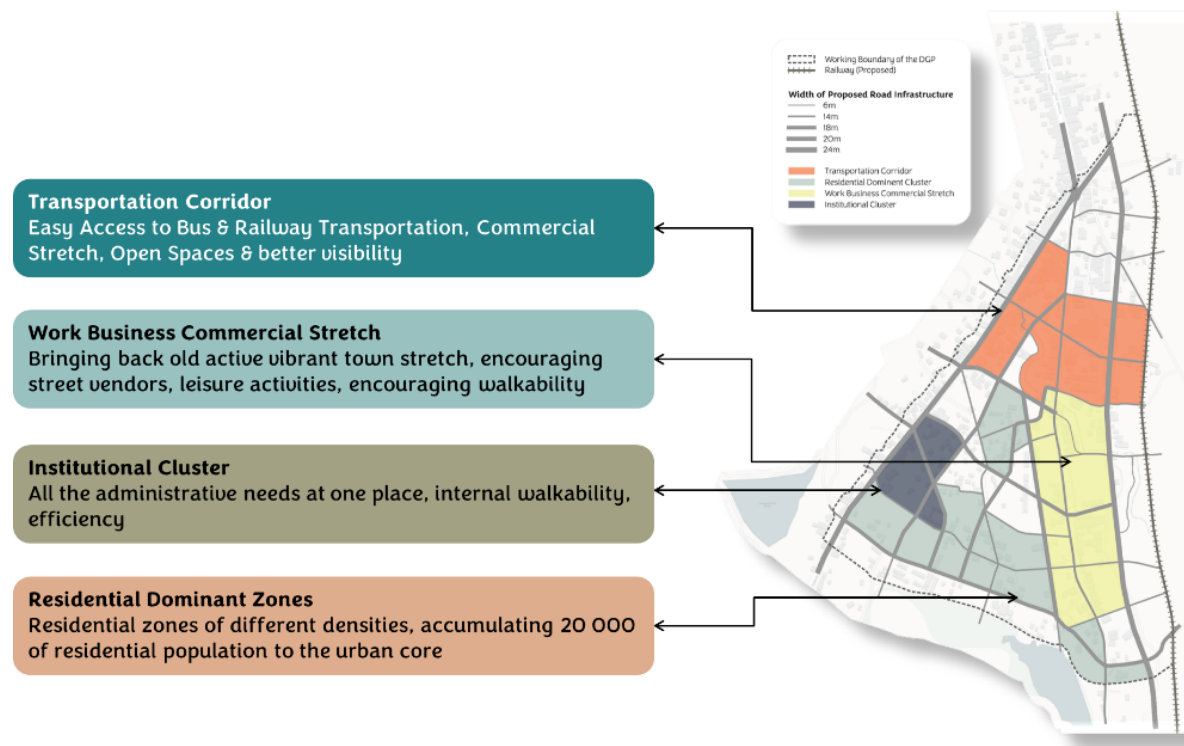
Figure 23: Existing & Proposed Land Use Mix

The proposed Functional Mix map shows how the land use mixes have increased and shows variations and some kind of pattern at the same time. In the city center, there can be a high functional mix within 7 – 8 (Live, Work, Visit). Immediately after the city center, bi-functional can be seen (Live/Work, Work/Visit, Live/Visit). Then after closer to the boundary of the triangle mainly in the corner area to the southwest several mono-function blocks can be observed.

## 7.6 Step Six

### 7.6.1 Zone Identification

The next step is to identify special zones to be further detailed. After introducing the guidelines, an important pattern of the blocks was identified as mentioned above. Based on that pattern and the uses of those blocks coupled with the character that we intended to build in different locations within the triangle several zones were identified.



To build that special character on each zone, guidelines were introduced for each zone after study the selected blocks for each zone. These zones and suitable blocks for the zones were selected after considering several criteria such as current use of the block, proposed future lands use mix, proposed future zone factor and place making characteristics of landscape features of the area such as Dambulla Cave Temple, Dambulla Dedicated Economic Center, Dambulla Police Station, Divisional Secretariat Office and Dambulla Public Market.

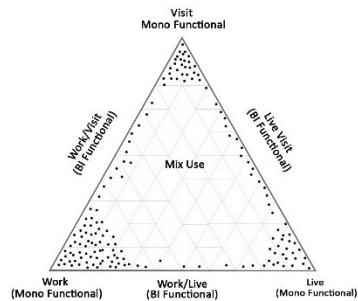
## Transportation Corridor

The purpose of the Transportation Corridor is to provide a convenient public transportation facility coupled with other services for the people of Dambulla. Special features included in this zone are,

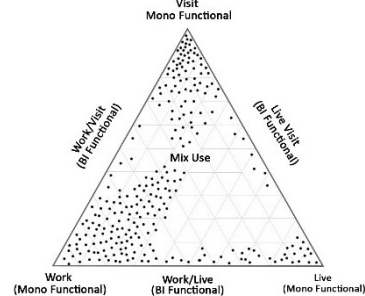
- Bus stands (Two bus stands for A6 and A9 main roads), railway line, and Expressway Interchange all in one line with a minimum walkable distance of 5 minutes.
- Walkable distance to the commercial area and recreational facilities.
- People can easily access the transportation corridor.

Then we studied what is the existing character of this zone in terms of Land use and density and how it can change with the character we are aiming to build in that zone.

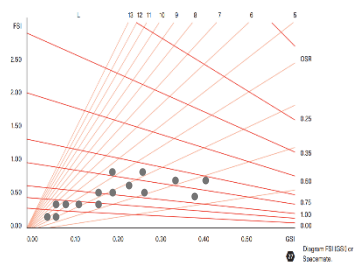
### Existing Land Use Mix



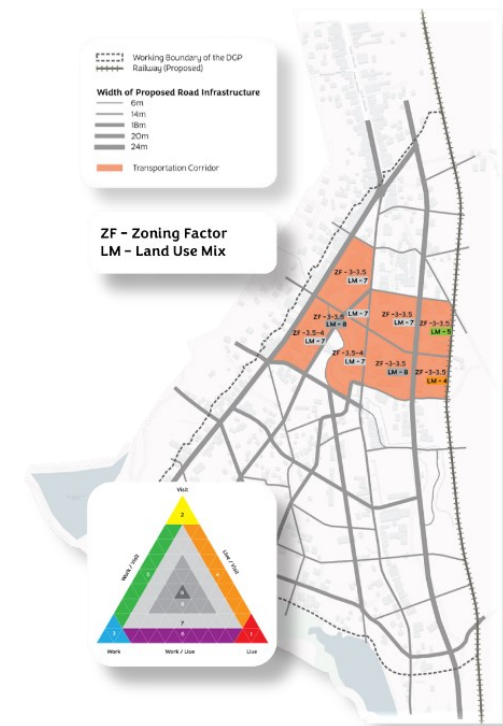
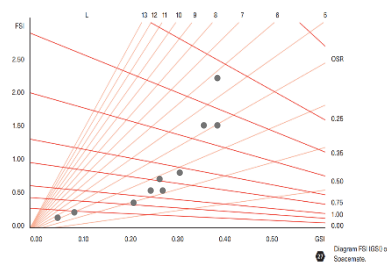
### Proposed Land Use Mix



### Existing Space Matrix



### Proposed Space Matrix



The existing land use mix of the identified blocks for transportation corridor is a work dominant one and it has moved towards higher land use mix with while increasing visits as well.

When consider the Space Metrix of the area it has also increased.

## Guidelines for Transportation Corridor

|                             |   |
|-----------------------------|---|
| <b>Land extent</b>          | <b>181042.6 sqm</b>   |
| <b>Zone factor</b>          | <b>3.5 – 4</b>  |
| <b>Maximum height</b>       | <b>4+G besides the stretch</b>  |
| <b>Building Frontage</b>    | <b>Minimum site frontage should be 6m. Commercial developments shall provide a facade having a minimum of 60% front wall as transparent. Blind walls are not allowed.</b> |
| <b>Plot Coverage</b>        | <b>80% of the uses should be non-residential. Ground floor should be allocated for commercial (Visit) uses besides the stretch.</b>                                       |
| <b>Pedestrianizing</b>      | <b>Adequate space for pedestrian flow should be allocated and 15m building line should be there.</b>  |
| <b>Non-permissible uses</b> | <b>Industrial uses, Religious uses, Cemeteries</b>  |

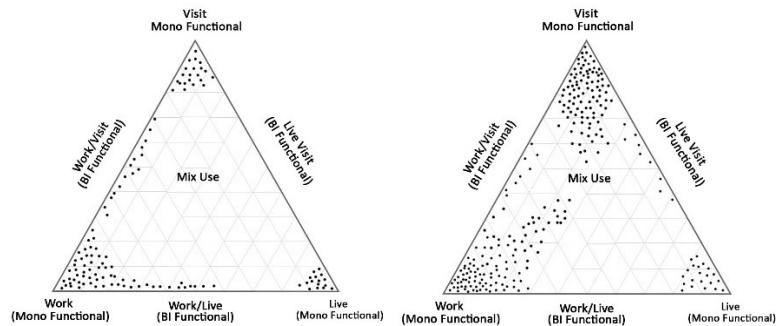
Dambulla Bus stand, Public Market, and majority of the commercial uses are located surrounding this selected zone currently. Therefore, this area holds the possibility to develop it as a Transportation Corridor to combine all the transportation modes to provide a convenient travel experience for the people while providing easy access to commercial services as well. Selecting such zones for different contexts may have different needs of zones and outcomes. *(Regulations were decided according to the gazette of UDA general regulations Page 45 - 46)*



## Work Business Commercial Stretch

Work business commercial stretch is an important zone that adds colorfulness to the DGP boundary. The zone is a pedestrian-prioritized road, and commercial uses and street vendors are encouraged to attract tourists to improve city tourism in Dambulla. Pattern streets will be a prominent character in this street coupled with regulations for building colors.

### Existing Land Use Mix

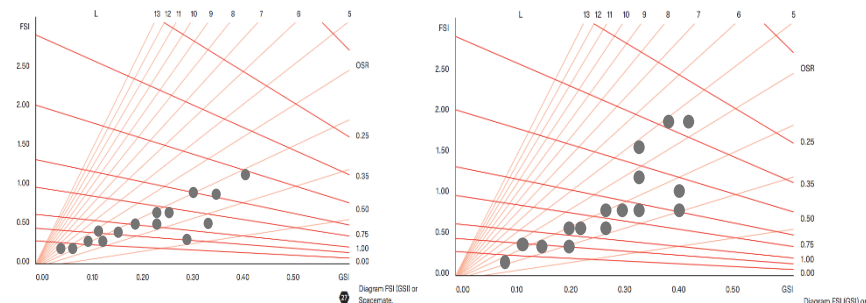


### Proposed Land Use Mix

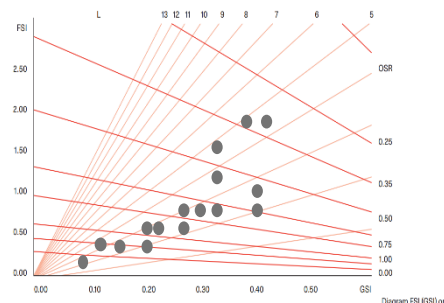


- Pedestrian priority street
- More commercial dominant uses with residences for tourists
- Live, vibrant stretch
- Open restaurants and cafes
- Encouraging small businesses and crafts

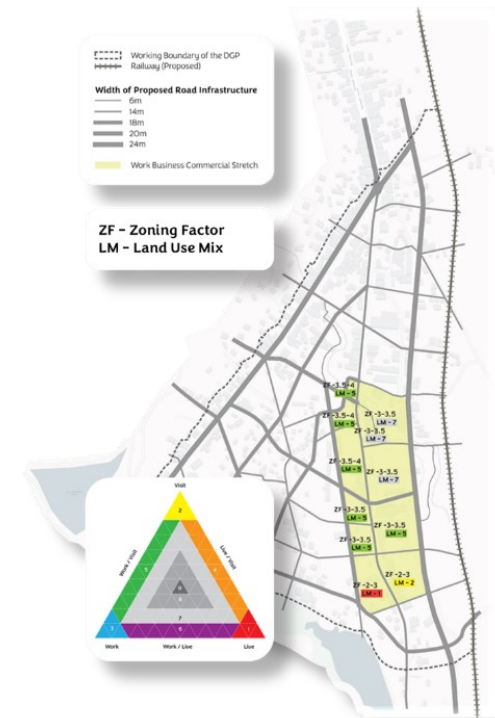
### Existing Space Matrix



### Proposed Space Matrix



### Guidelines for WORK BUSINESS CO



These graphs shows how the land use mix and density of the zone has canged with the character we are aimed to build in this zone. how those characters are going to change is through below guidelines and previously mentioned guidelines for Zone Factor, Access road width and Land Use Mix.

|                             |  |
|-----------------------------|--|
| <b>Land extent</b>          | 51 354.41 sqm  |
| <b>Zone factor</b>          | 3.5 – 4 along the stretch  |
| <b>Maximum height</b>       | 3+G – 4+G along the stretch  |
| <b>Building Frontage</b>    | Minimum site frontage should be 6m. Commercial developments shall provide a facade having a minimum of 60% front wall as transparent. Blind walls are not allowed. |
| <b>Plot Coverage</b>        | 80% of the uses should be non-residential. Ground floor should be allocated for commercial (Visit) uses besides the stretch.                                       |
| <b>Pedestrianizing</b>      | Adequate space for pedestrian flow should be allocated and 15m building line should be there.  |
| <b>Non-permissible uses</b> | Industrial uses, Religious uses, Cemeteries  |

Work Business Commercial Stretch is going closer to the Dambulla Cave Temple. The main purpose of this road is to attract tourists through related tourism activities such as crafts, open restaurants, recreational activities, road games, and such activities. Through that the set, job density will also be achieved. A good part of the components of colorful will be achieved through this zone with relevant guidelines. *(Regulations were decided according to the gazette of UDA general regulations Page 45 - 46)*



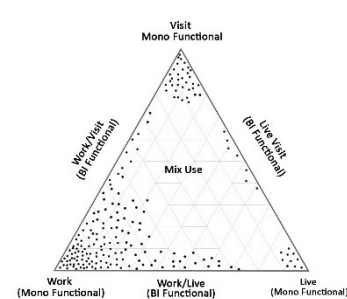
## Institutional Cluster

The industrial cluster has been identified after examining the locations of the current administrative uses of Dambulla. The majority of the administrative offices are located around these selected blocks namely the Divisional Secretariat Office, Dambulla Police, Foreign Labor Office, Agri Office, and so on. Therefore, through guidelines the already existing character will be enhanced and supported to provide convenient service delivery for the people.

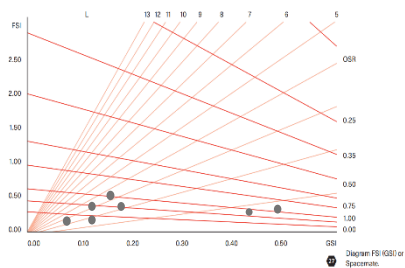
### Existing Land Use Mix



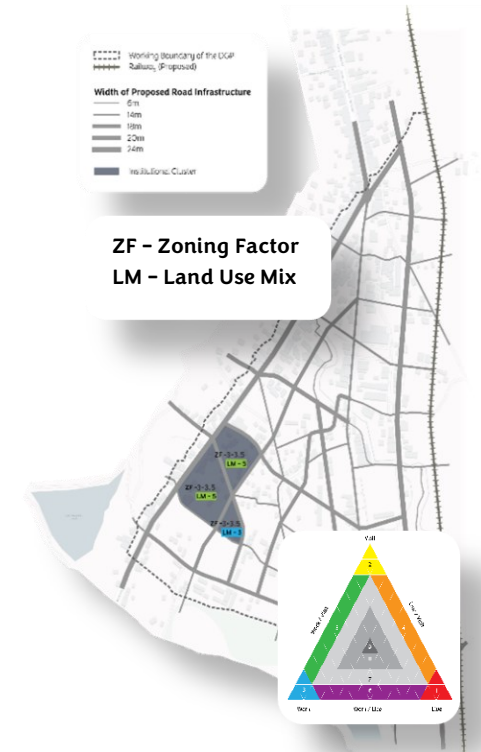
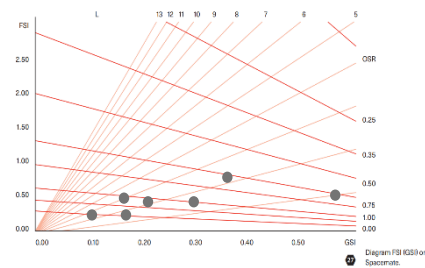
### Proposed Land Use Mix



### Space Metrix



### Space Metrix

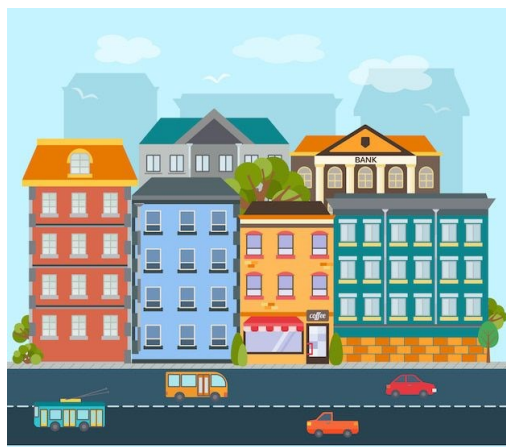


ZF - Zoning Factor  
LM - Land Use Mix

Industrial Cluster will have a administrative uses concentrated there so people can get done there works easily rather than traveling to several places. Which achieve the componant of covinient. At the same time this cluster will not be a mono functioning are. While “Work” be the dominant use there will be other (Live, Visit) uses as well encouraged through the guidelines. *(Regulations were decided according to the gazette of UDA general regulations Page 45 - 46)*

## Guidelines for Institutional Cluster

|                             |  |
|-----------------------------|--|
| <b>Land extent</b>          | 59,985.401 sqm   |
| <b>Zone factor</b>          | 3 - 3.5  |
| <b>Building Frontage</b>    | Government institutional developments and Commercial-oriented developments shall have ideal façade for the comfortability of the pedestrianizing and have a minimum of 50,% front wall as transparent without interrupting existing governmental institutions. For any development, blind walls are not allowed. |
| <b>Pathways and roads</b>   | <ul style="list-style-type: none"> <li>-Minimum 1.5m pedestrian paths for both sides</li> <li>-Minimum 2.5m Parking Lane for both sides</li> <li>-Minimum 3.5m Vehicle Lane for both sides</li> <li>-Street lamps should be provided for every 20ms</li> </ul>   |
| <b>Permissible Use</b>      | This area is having existing government institutions like Divisional Secretariat Office, Labor Office. In this area, other commercial purposes are also permissible.   |
| <b>Non-permissible uses</b> | Industrial uses, Religious uses, Cemeteries  |



## Residential Dominant Zone

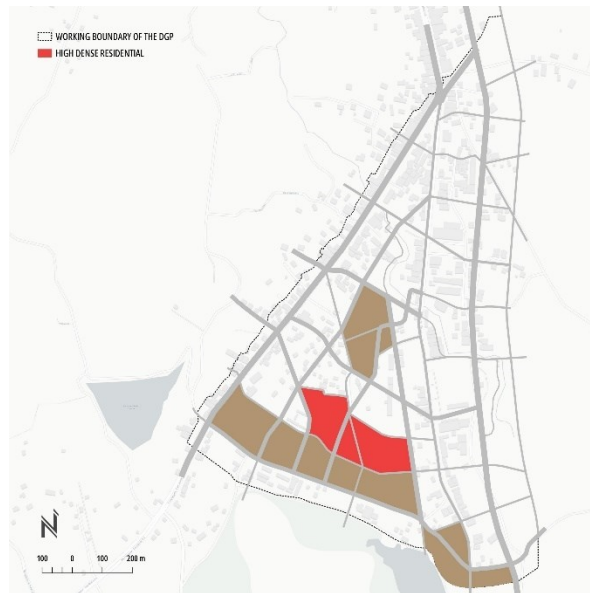


Figure 26: High Dense

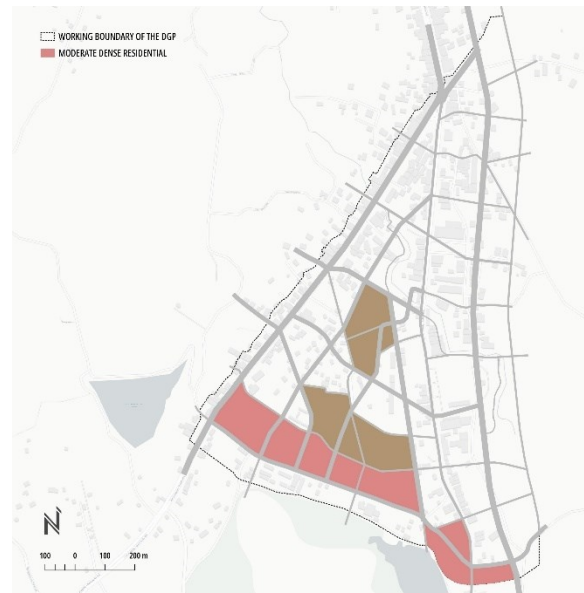


Figure 25: Medium Dense

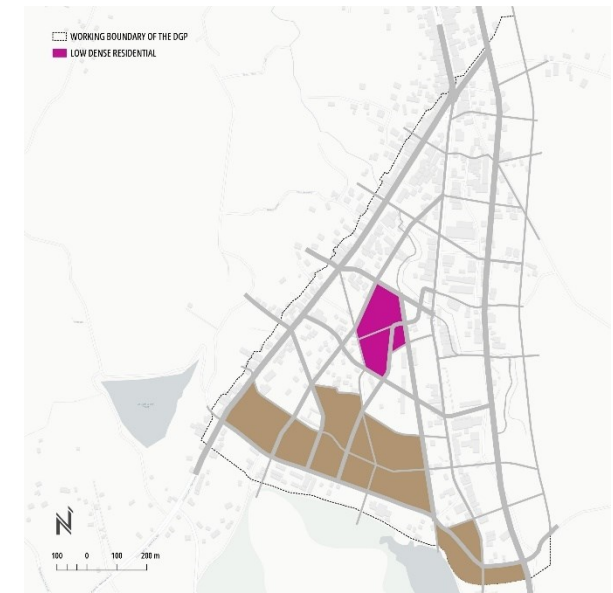
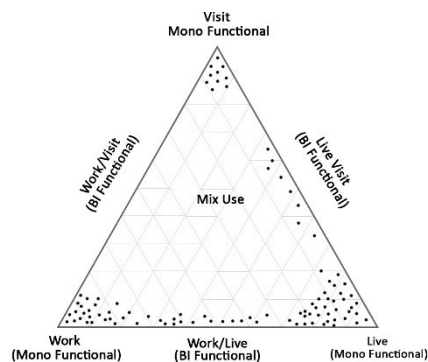
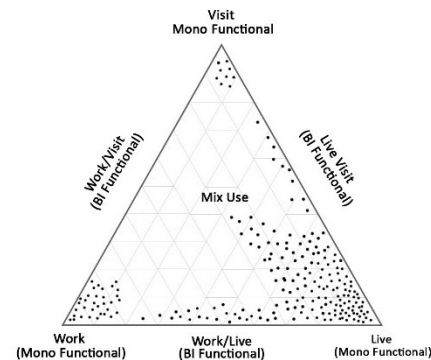


Figure 24: Low Dense

## Existing Land Use Mix



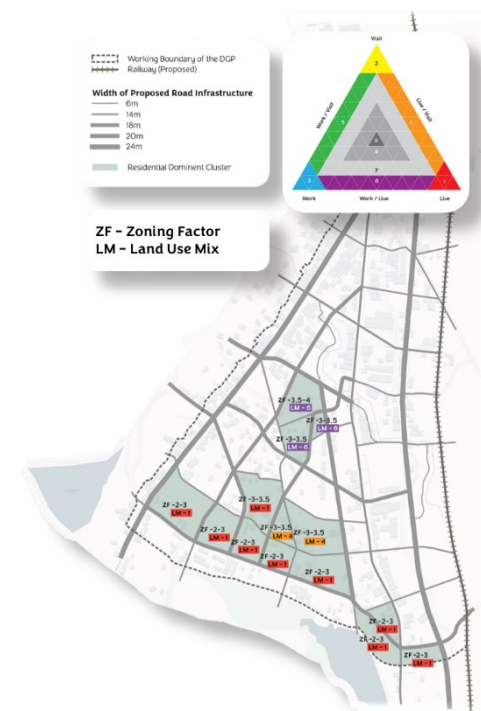
## Proposed Land Use Mix



Attracting 20 000 to Dambulla in the Future is one of the aims introduced at the visioning. Therefore, a residential dominant was specially identified in the DGP. The predicted Land Use Mix changes show how the uses have changed with the guidelines proposed by the DGP. There will be more LIVE which diving towards Mix Use as well. (Regulations were decided according to the gazette of UDA general regulations Page 45 - 46)

## Guidelines for Residential Dominant Zone

|                             | Low Dense  | Moderate Dense  | High Dense   |
|-----------------------------|--|---|--|
| <b>Land Extent</b>          | 36,235.17  | 125,695.9   | 54,057.59  |
| <b>Zone factor</b>          | 3-4 along the stretch  | 2-3 along the stretch   | 3-3.5 along the stretch  |
| <b>Maximum height</b>       | 12m (3+G)  | 7m (1+G)  | 15m (4+G)  |
| <b>Minimum plot size</b>    | 150 sqm  | 150 sqm   | 150 sqm  |
| <b>Building Frontage</b>    | Nonresidential buildings shall provide a facade having a minimum of 40% front wall as transparent. | Nonresidential buildings shall provide a facade having a minimum of 40% front wall as transparent.  | Nonresidential buildings shall provide a facade having a minimum of 40% front wall as transparent.                         |
| <b>Fence walls</b>          | Blind walls are not allowed for residential buildings and nonresidential buildings                 | Blind walls are not allowed for nonresidential buildings. 2m height blind walls will be allowed for residential buildings.                | Blind walls are not allowed for nonresidential buildings. 2m height blind walls will be allowed for residential buildings. |
| <b>Permissible uses</b>     | Retail shops, Pharmacies, Restaurants, Hotels  | Retail shops, Cafes, Pharmacies. On the 1st floor, commercial shall be promoted and other floors also be allocated for residential usage. | Retail shops, Pharmacies, Restaurants, Hotels.   |
| <b>Non permissible uses</b> | Bars, industries and logistics   | Bars, Hotels, industries and logistics  | Bars, Restaurants, Hotels, industries and logistics  |



With the guideline provide a residential friendly, attractive place character has made in the residential dominant zone.

## 7.6.2 Future Street Framework

To enhance connectivity and convenience in Dambulla Urban Triangle a new road network was introduced. This future street framework is to appoint different uses or a unique character to those roads. Creating a new road network, analyzing different road network accessibility levels, and assigning particular uses to those roads was a parallel yet circular process in the DGP process. After deciding on proper benchmarking values for accessibility principle from the reading “Local Area Planning for Transit Oriented Developments” designing alternative road networks, calculating their accessibility levels, and taking the results to the selected benchmark levels by changing the road design was a complex process. After selecting the most suitable road design according to the benchmark values, suitable use for those roads was decided considering the identified new zones as well.

### Street Categories

Selecting suitable use for proposed roads was done according to several criteria. Those are,

- Streets for a safe, accessible & equitable city
- Streets for a thriving economy, colorful & unique experience
- Streets for a cool, green, & diverse ecosystems
- Streets for an intuitive & ever-changing city

To achieve all the above criteria several road categories were selected. Those are,

- High Traffic Roads
- Low Traffic Roads
- Work Business Roads
- Local Connector Roads
- Green Residential Street
- Water Based Streets

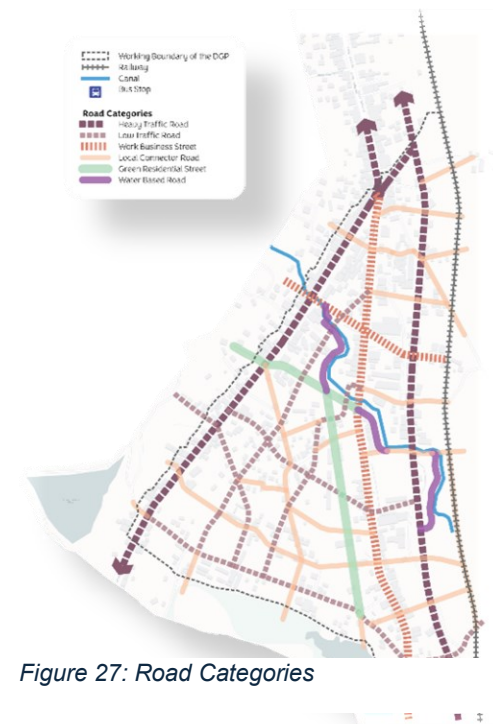


Figure 27: Road Categories

## High Traffic Roads

High-traffic roads are to have a smooth vehicular flow for Dambulla City. People coming to Dambulla and passing by commuters all can access the city easily without any disruption. This category focuses on the main two highways. The priority this road holds for each aspect is mentioned below.

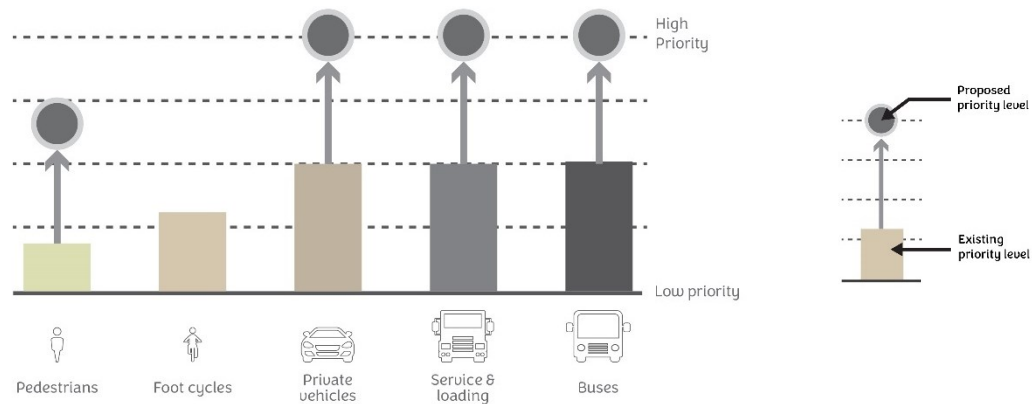


Figure 28: High Traffic Roads Priority Levels

The proposed road cross section for this high traffic road has mentioned in below page. With those improvements how the priority levels for pedestrians, foot cycles, and other vehicles can be seen. To achieve a smooth vehicle flow or a traffic flow a main concern has given to the carriage way. There is not any separate lane for bicycles allocated since the town is within the triangular area. How bicycles are prioritized can be seen in the other road categories were going through the city.



Figure 29: High Traffic Roads

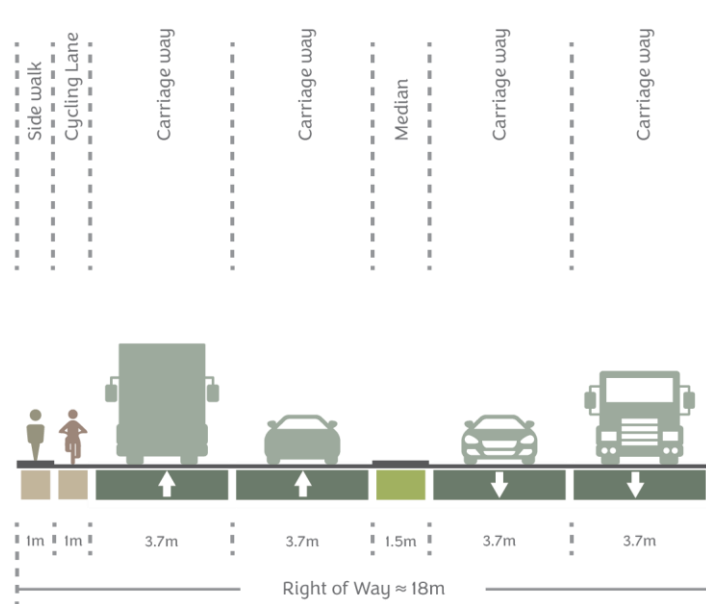


Figure 30: Existing Cross Section

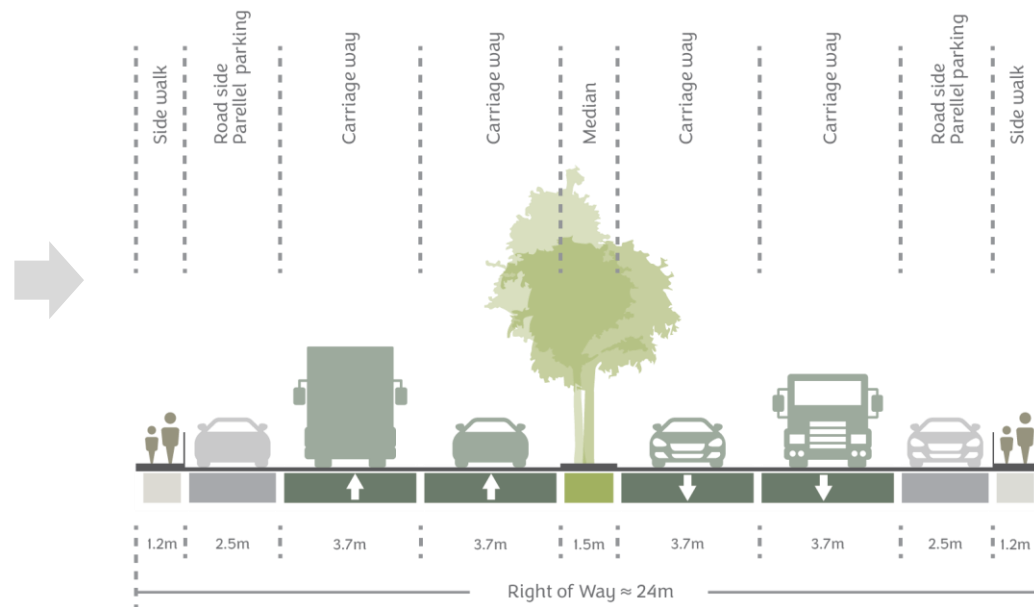


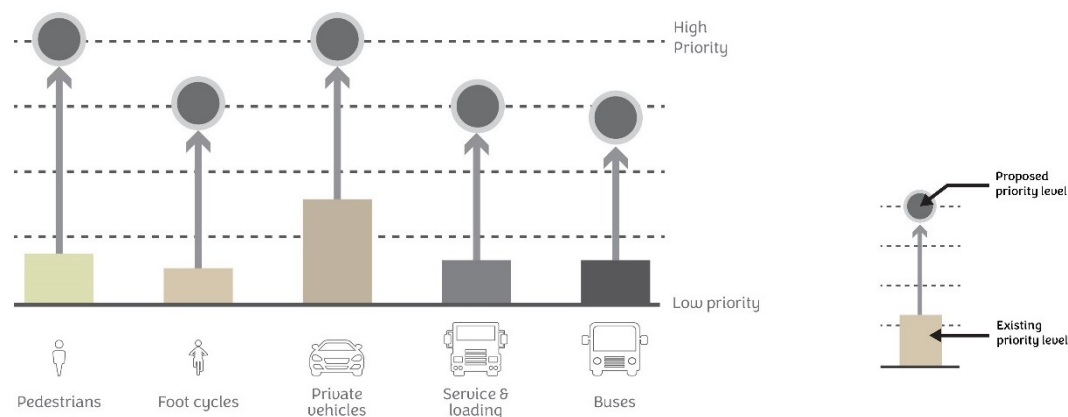
Figure 31: Proposed Cross Section

## Guidelines for High-Traffic Road

|                     |   |
|---------------------|---|
| Street & Sidewalk   | Wide ROW (24m) and Narrow Sidewalk (1.2m)<br>Street should be designed based on the concept of complete street.<br>Tactile strips on the sidewalk should be provided.<br>Transformers, Ditches, Trenches are not acceptable on the sidewalk |
| Road Infrastructure | Drainage should be underground  |
| Parking             | All streets with four vehicular lanes requiring on-street parallel parking should have minimum 2.5 m (U S Standard)   |
| Intersections       | Proposed intersection angle must be between 90° - 60° and not less than 60°<br>Minimum distance between intersections should be 100m  |

## Low Traffic Roads

The low-traffic road is allocated to the people who are using the city with many intersections. These intersections will ease the vehicular flow to access different locations within a shorter period. Since these roads lead to the main zones which are residential dominant, institutional cluster, and transportation corridor, the importance of these roads is clear.



Main priority of this roads is giving for private vehicle flow and for the pedestrians as well as bicycles have also been considered as important in this road category. Therefore, locals can travel easily in different modes conveniently. At the same time bus transportation also given some priority to give access and transportation facilities for the residential population that are going to be there in the future opening doors to create a new public bus route plan. Since the Dedicated Economic Center is also locating within this boundary, service loading vehicles are also considered.



Figure 32: Low Traffic Roads

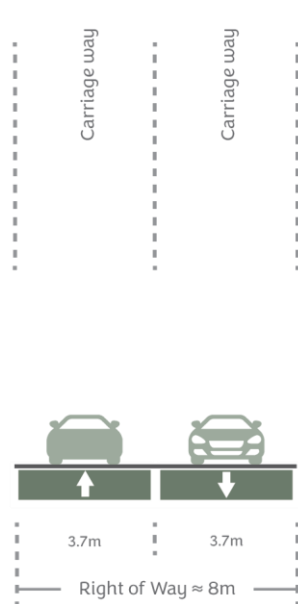


Figure 33: Existing Cross Section

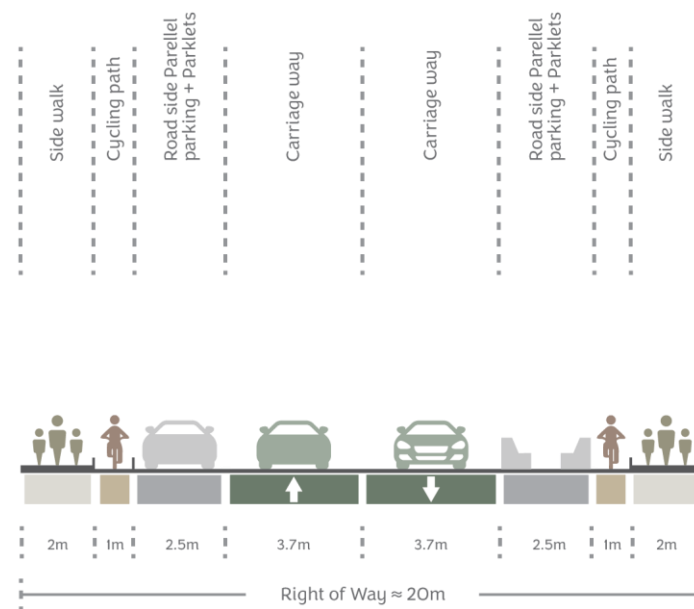


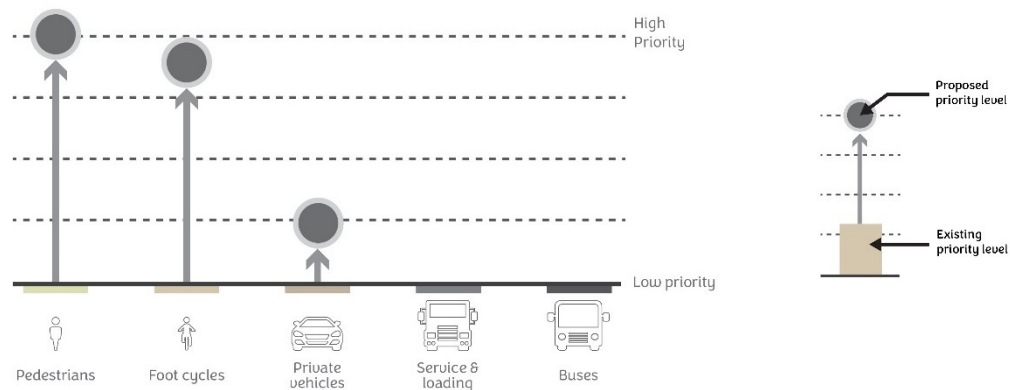
Figure 34: Proposed Cross Section

## Guidelines for Low-Traffic Roads

|                     |   |
|---------------------|---|
| Street & Sidewalk   | Wide ROW (18m) and Moderate Sidewalk (2m)<br>Street should be designed based on the concept of complete street.<br>Tactile strips on the sidewalk should be provided.<br>Transformers, Ditches, Trenches are not acceptable on the sidewalk |
| Road Infrastructure | Underground drainage are encouraged, and open drainage are acceptable   |
| Parking             | All streets with two vehicular lanes requiring on-street parallel parking should have minimum 2 m.  |

## Work Business Road

Work Business Road is a newly introduced road category for Dambulla. Mainly focusing on two zones namely Work Business Commercial Stretch and Transportation Corridor. Considering the characters of those two zones this road category was introduced. In the transportation corridor, there will be more commercial services. Also, in the Work business commercial stretch is mainly a business street for visitors. Therefore, people are encouraged to walk in this road category. Since all the public stations, namely Bus Stands, and Railway Station are going to be located within one of the zones more people will be pedestrians. Doe the commuters there will be paring allocated nearby and that will be in another road category.



Since this is a newly introduced road category, there is not any existing priority levels in the illustration. Pedestrians and bicycles have got the most priority while some level of priority has given to private vehicles in case. Still through guidelines walking will be encourage.

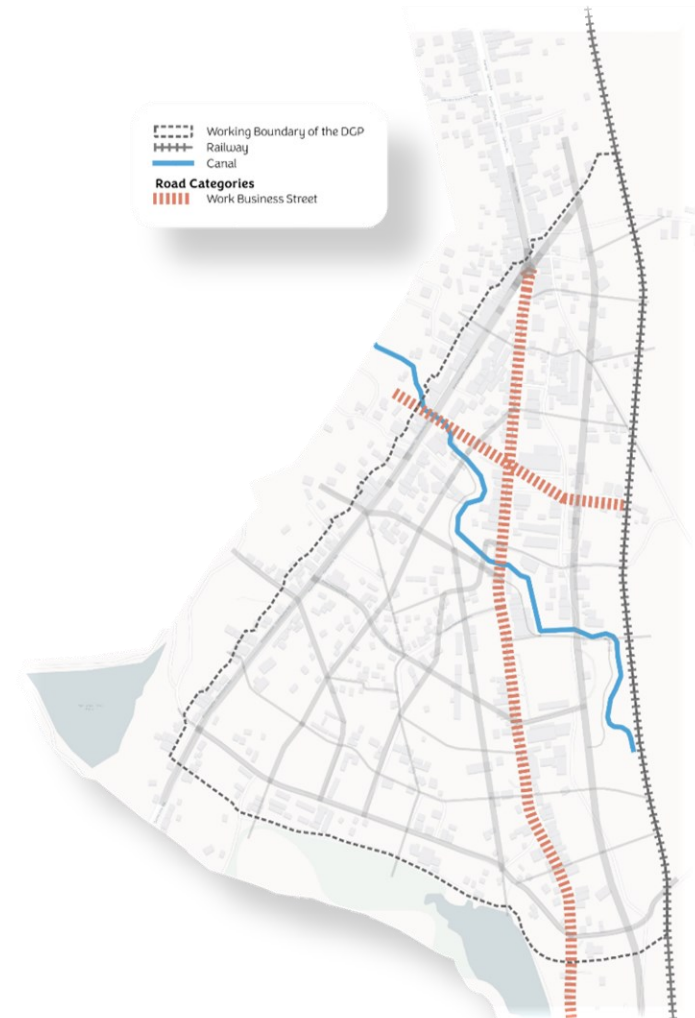


Figure 35: Work Business Road

## Guidelines for Work Business Road

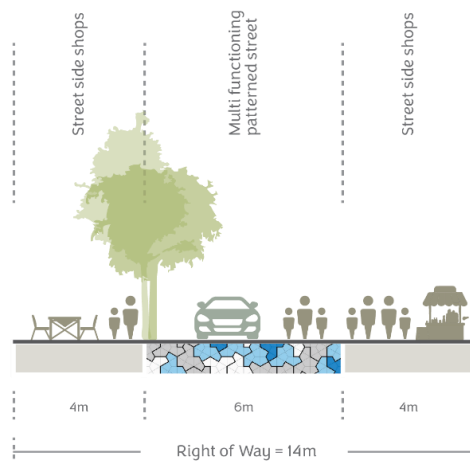


Figure 36: Proposed Cross Section

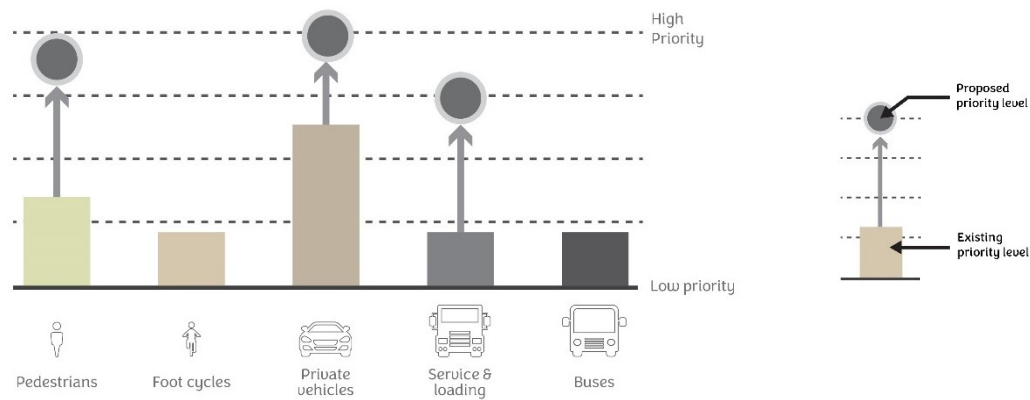


## Guidelines for Work Business Street

|                     |   |
|---------------------|---|
| Street & Sidewalk   | Discouraged vehicular flow and encouraged pedestrians<br>Public Buses and heavy vehicles are not allowed<br>Tactile strips should be there on the stretch at appropriate lanes along the stretch              |
| Road Infrastructure | Drainage should be underground  |
| Signboards          | Necessary sign boards (Safety, Allowed Vehicles etc..) should be displayed accordingly <ul style="list-style-type: none"> <li>• At the entrances</li> <li>• At shops</li> <li>• Beside the stretch</li> </ul> |
| Building Color      | Building colors should be appropriate to the stretch. White colors are discouraged, and colorful color-codes are encouraged.  |
| Informal Activities | Appropriate (4m) space should be allocated for informal activities such as street vending, street games etc..   |

## Local Connector Roads

These local connectors are to connect different types of road categories. There, high-traffic roads, low-traffic roads, work business roads and other road types will be connected. Roads are connecting means people sometimes may have to move from a passenger to a pedestrian considering the different road categories. To fulfill that need selected on-street parking has provided for local connector roads.



The existing structure of minor roads will be improved as the local connector roads. There are pedestrians, private vehicles both will have a same importance and also service and loading vehicles has given a priority since the Economic center is locating at one of these local connector roads.



Figure 37: Local Connector Roads

### Guidelines for Local Connector Roads

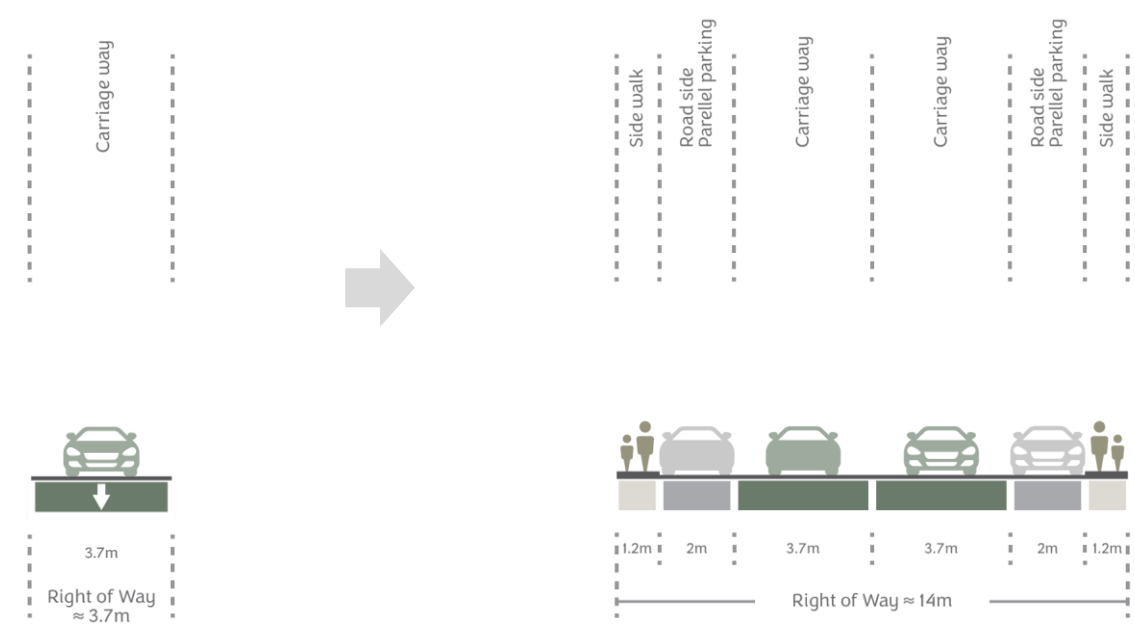


Figure 39: Existing Cross Section

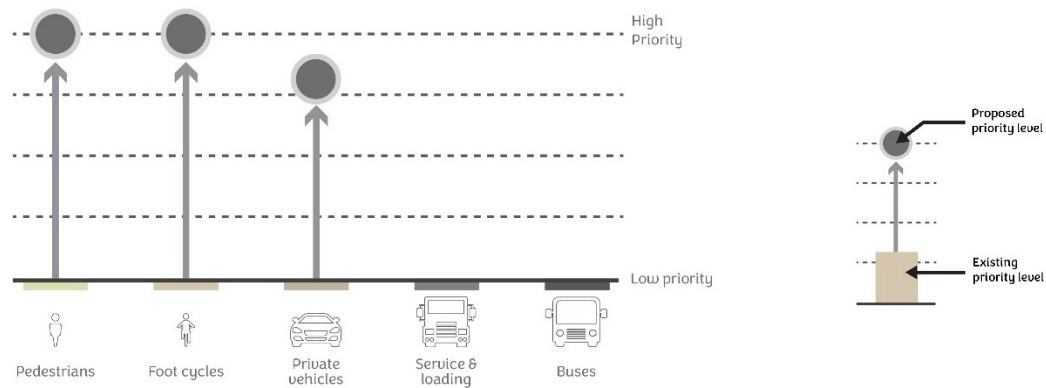
Figure 38: Proposed Cross Section

### Guidelines for Local Connector Roads

|                     |   |
|---------------------|---|
| Street & Sidewalk   | Wide ROW (19m) and Wide Sidewalk (3m)<br>Tactile strips on the sidewalk should be provided.<br>Transformers, Ditches, Trenches are not acceptable on the sidewalk |
| Road Infrastructure | Underground drainage are encouraged, and open drainage are acceptable<br>Appropriate street trees, shade, seating should be provided.                             |

## Green Residential Streets

Since the DGP is aiming to create a compact dense city in the Dambulla triangle it is important to consider the environmental aspects as well. Focusing on that aspect these green residential streets have been introduced. Mainly lying along residential dominant areas this attempt is to provide a comfortable and cool environment to the people while enhancing the green environment in the city.



This road category is also a newly introduced one to Dambulla. Therefore, there will not be existing priorities identify. Pedestrians, foot cycles are highly prioritized while also considering private vehicles at some priority level. Even though the heavy vehicles are discouraged here to maintain a calm environment to the residents and users of this road. with cross section of this road category, it can be observing how the green environment has been included to the sections. There are two main lines of trees to obtain more greenery for the road. Also, seating has provided for people to enjoy the greenery and relax. As well as tactile lanes has included to the pavements to ensure equitable service for every people.



Figure 40: Green Residential Streets

## Guidelines for Green Residential Streets

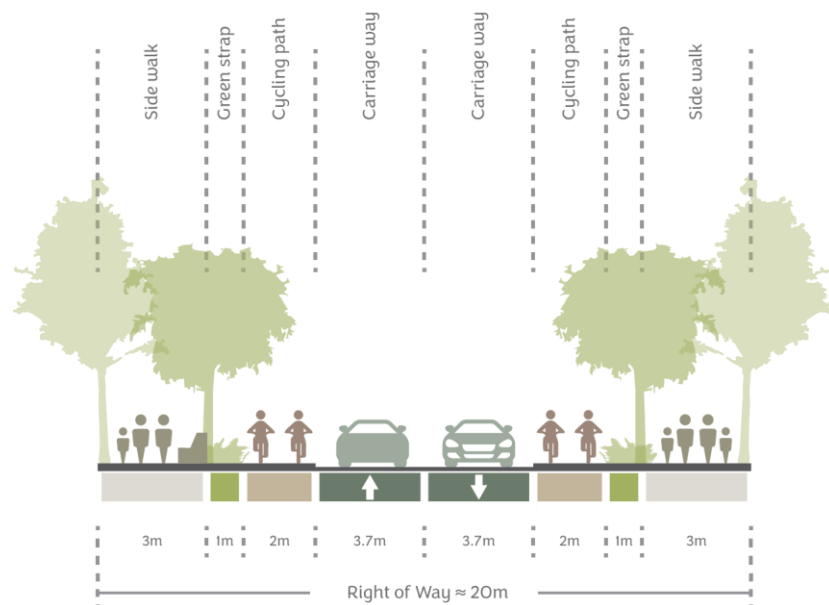


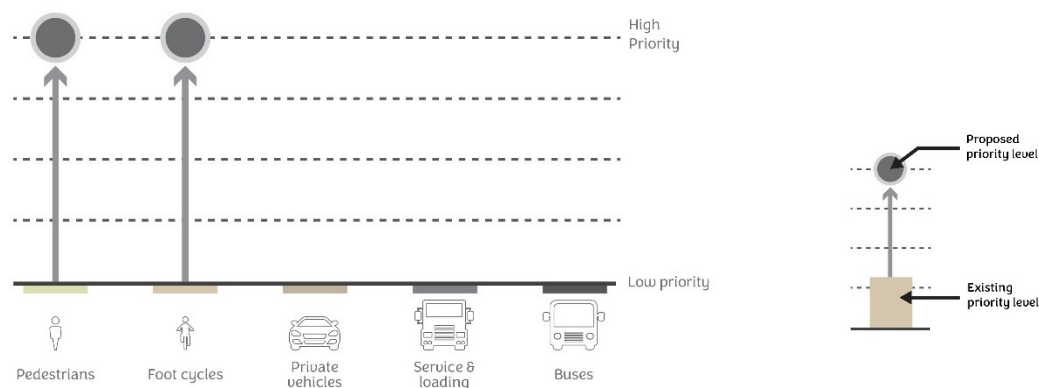
Figure 41: Proposed Cross Section

## Guidelines for Green Residential Street

|                     |   |
|---------------------|---|
| Street & Sidewalk   | Wide ROW (19m) and Wide Sidewalk (3m)<br>Tactile strips on the sidewalk should be provided.<br>Transformers, Ditches, Trenches are not acceptable on the sidewalk |
| Road Infrastructure | Underground drainage are encouraged, and open drainage are acceptable<br>Appropriate street trees, shade, seating should be provided.                             |

## Water Based Streets

There is a canal flowing through the Dambulla triangle. Using that potential water-based streets have developed in several locations up to different lengths. This is more like a linear park while pedestrians and cyclists can use the road for travel purposes and people can use the space for recreational activities. This road category has decided to protect the threatened water-based ecosystems in the town area while enhancing the green spaces as well.



The main and only priority of this road category is pedestrians and cyclists. Other vehicles are restricted here with the road design. The road section has designed enabling maximum potential to take advantages for the water stream to uplift the recreation facilities of the area.

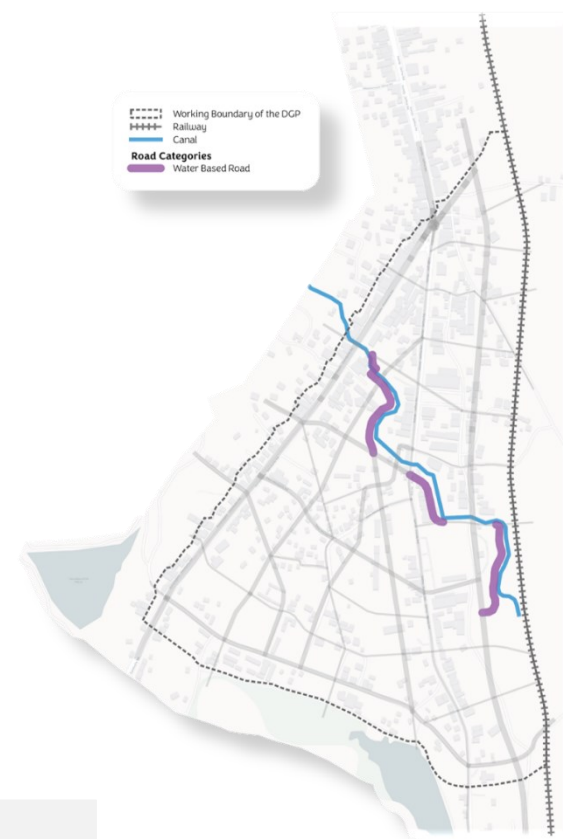


Figure 42: Water Based Roads

## Guidelines for Water Based Street

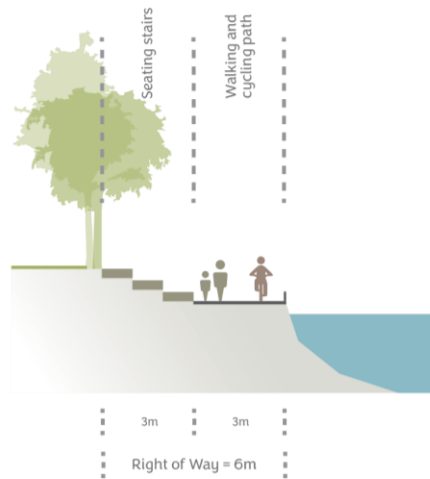


Figure 43: Proposed Cross Section



## Guidelines for Water-Based Streets

|                     |  |
|---------------------|--|
| Street & Sidewalk   | <p>Wide walking and cycling path (3m)</p> <p>Tactile strips on the sidewalk should be provided accordingly.</p> <p>Transformers, Ditches, Trenches are not acceptable on the sidewalk</p> <p>Cycling lanes should be demarcated clearly</p> <p>Non of the motor vehicles, public &amp; heavy vehicles are allowed.</p> |
| Road Infrastructure | <p>Drainage should be underground</p>  |
| Signboards          | <p>Necessary sign boards should (Safety, Allowed Vehicles etc..) be displayed accordingly</p> <ul style="list-style-type: none"> <li>• At the entrances</li> <li>• At shops (If Available)</li> <li>• Beside the stretch</li> </ul>  |

\*\*All these road categories are designed thinking from the peoples' perspective to provide an equitable road and traveling experience for both commuters and pedestrians coupled with differently-abled people as well. Also, to provide more greenery and water spaces while harmonizing with the environment and physical living spaces of Dambulla. When designing such different categories for different contexts it is crucial to understand the character of the area and peoples' needs and should be mindful of the vision that has been selected for the DGP boundary. Then deciding on guidelines aligning to those aspects should be done. The existing priority levels can be calculated by conducting a Book Classified Count survey under traffic impact assessment.

### 7.6.3 Future Smart City Framework

Since we are developing these development plans for the future, planners should think ahead and be ready for the rapidly changing technological world as well. To address that aspect and get Dambulla ready for the future, a future smart city framework has been introduced. Therefore, relevant smart city guidelines developed for Dambulla have been mentioned below.

| Smart Facilities                         | Guidelines  |
|--|---|
| Smart solar panel system                 | Guiding to optimize energy usage and use inverters and smart meters to provide real-time data on their performance. (100 – 250 Square feet of roof space for every kW)  |
| Smart parking sensors                    | Managing parking spaces in a more efficient and user-friendly way in technological approach. (Basic distance 2.5m)  |
| Smart CCTV Cameras with motion detection | Introducing intelligent video surveillance (IVS) systems, combine traditional video recording with advanced features like motion detection, facial recognition, and object recognition. (detect human-sized motion up to 50 –100 feet away) |
| Smart Learning Systems                   | Introducing educational software, online learning platforms, or adaptive learning technologies.   |
| 5G High Speed Networks                   | Offering 20 gigabits per second (Gbps), actual average speeds experienced by users are typically between 1.4 and 14 times faster than 4G. (1.6 – 5 Kilometers)  |
| Adaptive traffic signals (ATCS)          | Optimizing the traffic flow in real-time by adjusting signal timing based on actual traffic conditions.   |
| Autonomous vehicles (AVs)                | Introducing as self-driving cars, are vehicles capable of operating without human input.  |
| Intelligent transportation systems (ITS) | Providing real-time information on traffic conditions, accidents and road closures via integrating sensors, cameras, and communication technology.  |
| Smart lighting systems                   | Utilizing the streetlights those can adjust brightness based on traffic and ambient light conditions, improving visibility and reducing energy consumption.   |



Figure 44: Smart Facilities

| Smart Facilities  | Guidelines  |
|---|---|
| Roadside weather monitoring   | Collecting real-time weather data via sensors, enabling proactive measures like de-icing or managing traffic flow during adverse weather conditions.      |
| Electric scooter-sharing system<br>E-scooter sharing systems work through a mobile app) | Allowing users to rent electric scooters (e-scooters) for short trips within this transportation corridor.  |
| Connected streetlights  | Connecting the streetlights that create more than 50 percent savings on energy costs.   |
| Smart Game zones (AR & VR Experiences)  | Introducing kind of interactive playgrounds, Digital learning gardens, Interactive fitness zones & Community game centers.                                |
| Shops with Smart Technology Integration   | Introducing like Zero-waste shops, Urban farms and vertical gardens, Repair cafes, Pop-up shops & Healthy food stalls and cafes.                          |
| Street parklets, Benches with peddles, Benches turned tables                            | Extending the sidewalks onto the street, often created by repurposing parking spaces to creating pedestrians to relax, socialize, and enjoy the outdoors. |

Through smart city framework, a more secure, convenient, and accessible town can be achieved with the provided guidelines. Applying smart technology for public transportation and other transportation modes will increase the comfortability and save time as well. Since accessing to technology can be limited and might have limitations for the adult people. Therefore, studying literacy level, income levels, as well as providing advocating session for such developments and improvements are also crucial and necessary.

## 7.6.4 Proposed Open Spaces

Through environmentally friendly road designs, the initial steps for environment protection and convenient life were taken. The open space framework is to further enhance the people's living environment in the city while harmonizing with the grey-green environment. In Dambulla, despite its fame as a tourist destination, there's a noticeable absence and lack of open spaces and recreational activities in the town center. Firstly, we identified suitable locations within the Dambulla urban triangle that could be transformed into vibrant open spaces. These locations include vacant lots or underutilized areas within the town. By repurposing these spaces, we can create accessible green areas for relaxation, recreation, and community gatherings. Likewise, we proposed a number of green paths by planting visually appealing plants and flowers along the road which will be the commercial work business stretch which is the current A9 road to make Dambulla's environment more convenient to both local and foreign tourists.

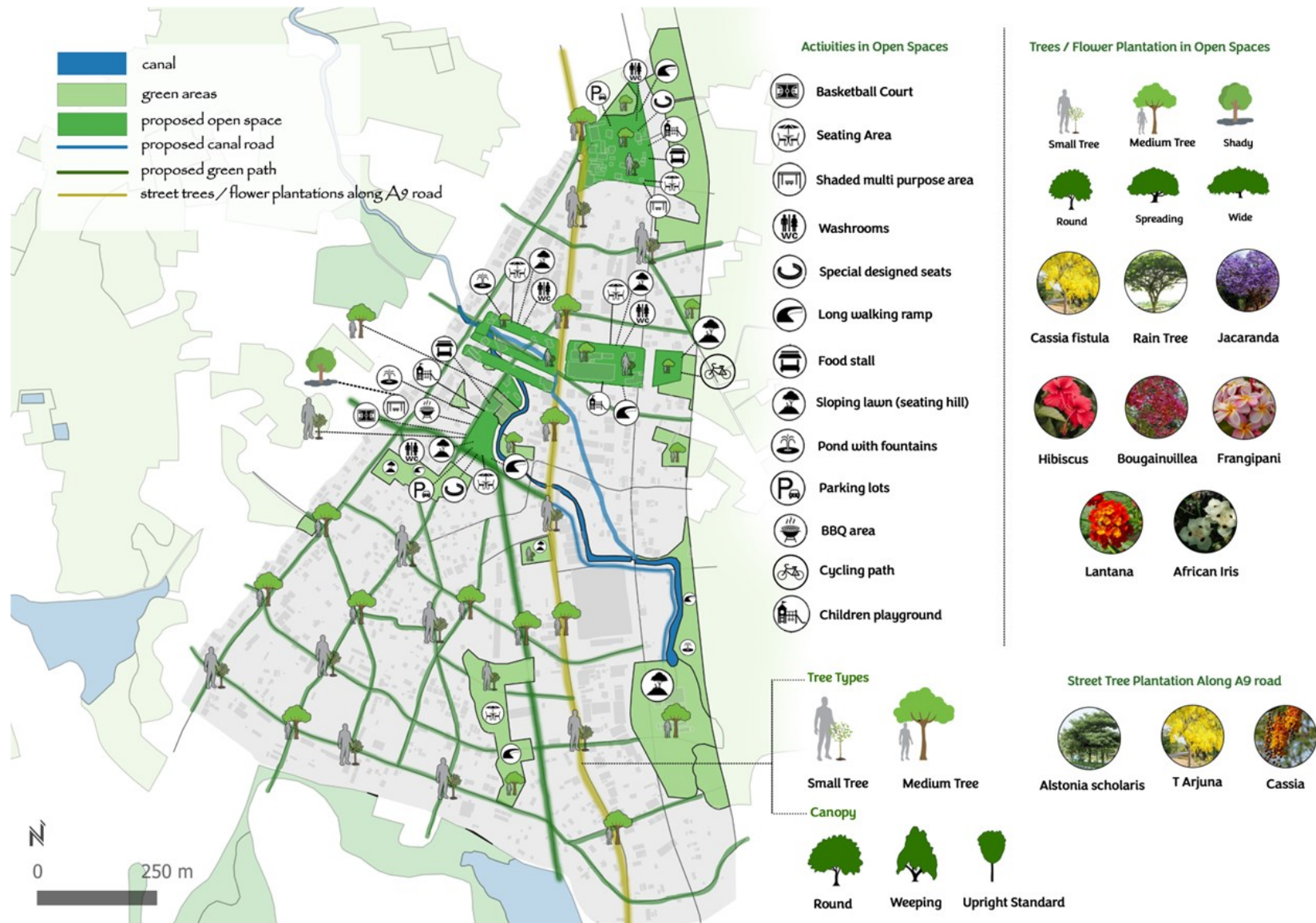


Figure 45: Open Space Map

## Guidelines for Open Spaces

|                         |   |
|-------------------------|---|
| Land extent             | 8000 sqm  |
| Maximum height          | 4 m   |
| Path ways and roads     | Lands shall be open up for free access of pedestrians / long walking ramp / Not Less Than 1.5m – Cycle Path & Not Less Than 1.5m – walking path |
| Trees and Vegetation    | Provide trees along the walking ramp link and surrounding with small to medium height trees, shady, round, spread, weeping canopy               |
| Seating                 | Special design seats / sloping lawn / benches   |
| Building                | Small building shelter Multi purpose area, and food stalls, washrooms   |
| Walls / Fence           | Concrete walls / wooden fence   |
| Parking                 | Separate parking lot  |
| Roof                    | Terrace , Pavilion with open roof   |
| Recreational Activities | Basketball court / children playground, BBQ Area, pond, Multi purposes gathering areas, Ponds, Seating hills                                    |
| Street lights           | Street lights must be provided  |
| Structure / color       | No hard fence are allowed / No color restriction  |
| Floor                   | Decomposed Granite, bricks, Concrete , rubberized surface (children park)   |

**Size:** Trees should be medium in size, hardy, and long lasting.

**Growing habit:** Trees should have a good growing habit and not have frequent falling leaves, twigs, and branches.

**Soil conditions:** Trees should be able to adapt to high moisture conditions in the soil.

Suitable trees *T. arjuna* and *Cassia* spp can intercept dust particles along roadsides. *Cassia* spp has attractive yellow color flowers and *T. arjuna* has brownish pink color bark.

Other trees that may be suitable for planting -

*Adenanthera pavonina*, *Alstonia scholaris*, *Azadiracta indica*, *Barringtonia acutangula*, *Barringtonia racemosa*, *Bauhinia racemosa*, *Bauhinia blakeana*, *Cananga odorata*.

**Seating:**

**Special Design Seating Areas:** These seating areas will be strategically placed throughout the park to offer unique and aesthetically pleasing seating options. Special attention will be given to the design and materials used to ensure both comfort and visual appeal.

**Benches:** Traditional benches will be installed in various locations within the park, providing resting spots for individuals or small groups. These benches will be sturdy, comfortable, and designed to withstand outdoor conditions.

**Sloping Lawns:** Sloping lawns will offer flexible seating arrangements, allowing visitors to relax on the grassy slopes while enjoying the natural surroundings. These areas will provide informal seating options and opportunities for picnics or gatherings.

**Facilities:** Multi-purpose Buildings: Small buildings within the park will serve as multi-purpose areas, accommodating a range of activities and events. These buildings may house community meeting spaces, educational exhibits, or temporary art installations, adding versatility to the park's offerings.

**Food Stalls:** To satisfy visitors' hunger and refreshment needs, food stalls will be strategically located within the park. These stalls will offer a variety of snacks, beverages, and local delicacies, enhancing the overall experience of park visitors.

**Washroom Facilities:** Washroom facilities will be conveniently located within the park to ensure visitors' comfort and hygiene. These facilities will be well-maintained, accessible, and equipped with amenities to meet the needs of all park users.

**Walls/Fence and Parking:** Boundaries will be demarcated using concrete walls or wooden fences, ensuring security without compromising aesthetics. Separate parking lots will be designated to accommodate visitors' vehicles, promoting ease of access.

**Recreational Activities and Amenities:** Various recreational facilities, including basketball courts, children's playgrounds, BBQ areas, and ponds with fountains, will be integrated into the park design. These spaces will cater to diverse interests, encouraging community engagement and social interaction.

**Streetlights and Sustainability:** Street lights will be installed throughout the parks to ensure safety and visibility, particularly during evening hours. Additionally, sustainable design elements such as rainwater harvesting, and native plant landscaping will be incorporated to minimize environmental impact and enhance park resilience.

**Implementation and Management:** The implementation of these open spaces will involve community engagement and collaboration to ensure the parks meet the specific needs and preferences of Dambulla residents. Regular maintenance and management by community committees or volunteer groups will ensure the sustainability and longevity of these recreational spaces.

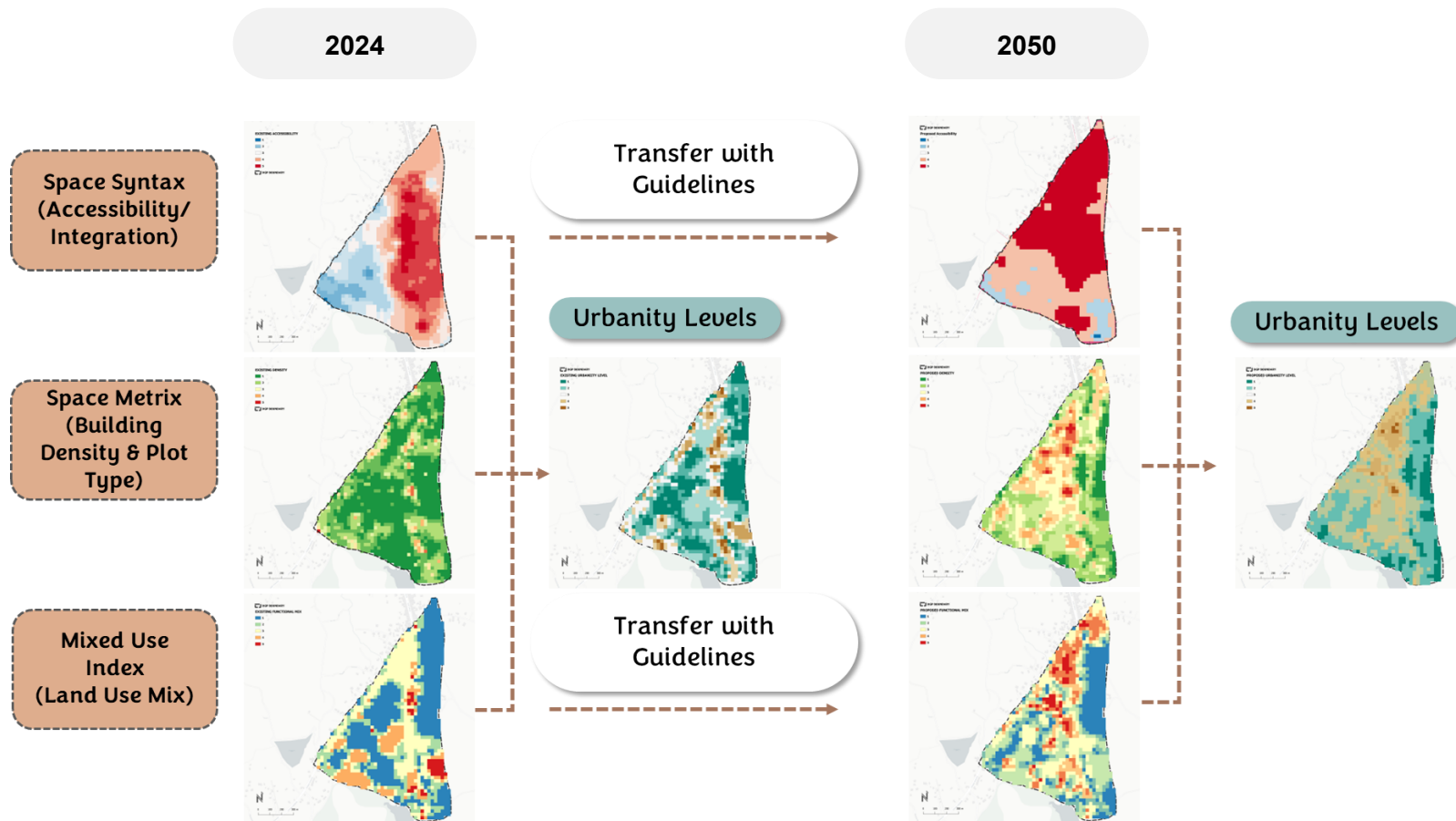
Overall, the proposed open spaces in Dambulla aim to address the current deficiency in recreational areas while fostering community well-being, environmental stewardship, and cultural enrichment. By adhering to these comprehensive guidelines, we envision the creation of vibrant and inclusive spaces that contribute positively to the overall quality of life in Dambulla.

## 8. COMPARISON OF EXISTING SITUATION AND PROPOSED GUIDELINES IN REAL GROUND

The last step of the Development Guide Plan is comparing the existing situation of Dambulla with how future possible changes will affect the urbanity levels of Dambulla. The calculation of urbanity level is a quantitative analysis done by using GIS tools. Further details regarding the urbanity levels can be referred to in the below book.

Teaching & Learning Book, Step-by-Step Guide: Urbanity Level Analysis with QGIS

### 8.1 Urbanity Changes



The above illustration shows the urbanity level changes with the impact of guidelines provided through the Dambulla Development Guide Plan 2050. To conduct this analysis several kinds of data were required.

|  |  |
|--|--|
| Data regarding Accessibility (Road Shapefile Layer)  | Connectivity analysis conducted through QGIS or Arc GIS using sDNA   |
| Data regarding building height, plot type, building use floor-wise   | Can be conducted through book field surveys, satellite images, through street view of Google the data are reliable |
| <p>The data for future scenarios has been bookly digitized into the shape files according to our introduced guidelines.</p> <ul style="list-style-type: none"> <li>• According to the increased zone factor, the possible height of the buildings was digitized.</li> <li>• According to the guidelines provided for the Land Use Mix for blocks, the shape files were updated.</li> </ul> |  |

These data should then be taken as shapefiles and then converted into a raster format for overlying to calculate the urbanity level in QGIS using the raster calculator tool with the appropriate weighted score. After overlying the resulting Tiff file can be obtained and further analysis can be done. The process of this calculation can be referred to from the above-mentioned book (Teaching & Learning Book, Step-by-Step Guide: Urbanity Level Analysis with QGIS).

Urbanity has been calculated by incorporating Space Syntax, Space Metrix, and Land Use Mix. Through the guidelines, these criteria are going to change to achieve a compact, connected, convenient, and colorful city center.

- **Accessibility (Integration, Connectivity)** – Dambulla has a higher connectivity level on main highways within the triangle. The accessibility of inner areas was improved through the proposed new road network. It can be observed from the accessibility map (Space Syntax) of 2050.
- **Space Metrix (Building Density & Plot Type)** - Density levels in the Dambulla urban triangle are currently low. With the provided high zone factor the future density levels will be increased as a result in the building density map 2050.

- **Mix Use Index (Land Use Mix)** – previously in the guidelines provided for blocks, particular land use mix levels were also introduced for each block. According to that the land use mix will also increase as shown in the resulting map 2050.

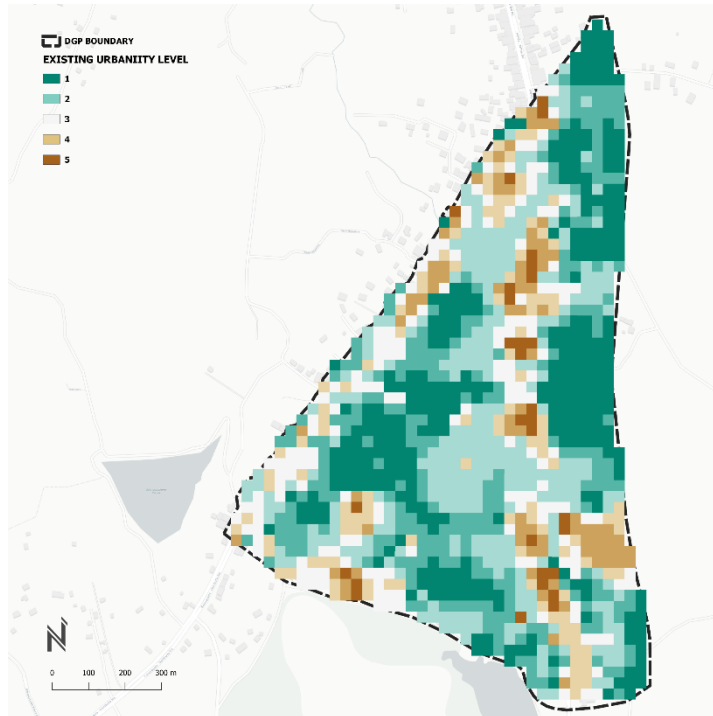


Figure 46: Existing Urbanity

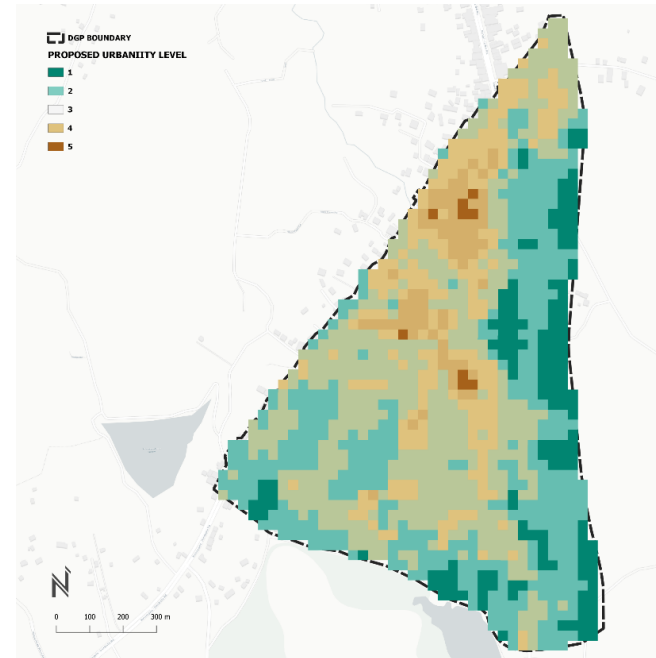


Figure 47: Proposed Urbanity

| Accessibility | Landuse Mix | Space Matrix | Urbanity Levels   | Degree of Balance            |
|---------------|-------------|--------------|-------------------|------------------------------|
| L             | L           | L            | Very Low          | Balanced with low values     |
| L             | M           | M            | Low               |                              |
| L             | H           | M            | In-Between Medium | Unbalanced with mixed values |
| L             | M           | H            | In-Between Medium |                              |
| L             | H           | H            | In-Between High   |                              |
| H             | M           | M            | Medium            | Balanced with high values    |
| M             | H           | H            | High              |                              |

| Accessibility | Landuse Mix | Space Matrix | Urbanity Levels   | Degree of Balance              |
|---------------|-------------|--------------|-------------------|--------------------------------|
| L             | L           | L            | Very Low          | Balanced with moderate values  |
| M             | M           | M            | Low               |                                |
| H             | H           | H            | In-Between Medium | Balanced with high values      |
| M             | M           | M            | In-Between Medium |                                |
| H             | M           | M            | In-Between High   |                                |
| VH            | VH          | VH           | Medium            | Balanced with very high values |
| H             | H           | H            | High              |                                |

According to the existing urbanity result, it shows low unbalanced values, where most of the areas have resulted in high connectivity values yet low density or land use mix values. It has created an unbalanced physical spatial distribution within the area. With the guidelines provided, the urbanity levels have resulted as balanced as well and the level of urbanity has increased up to some values. The above map clearly shows the changes or urbanity in brown color.

This graph numerically shows how the urbanity levels have changed.

The very low urbanity levels have changed from 60 to 40 while low urbanity levels have increased from 25 – 37, also the between, medium, and high urbanity levels have increased up to some levels.

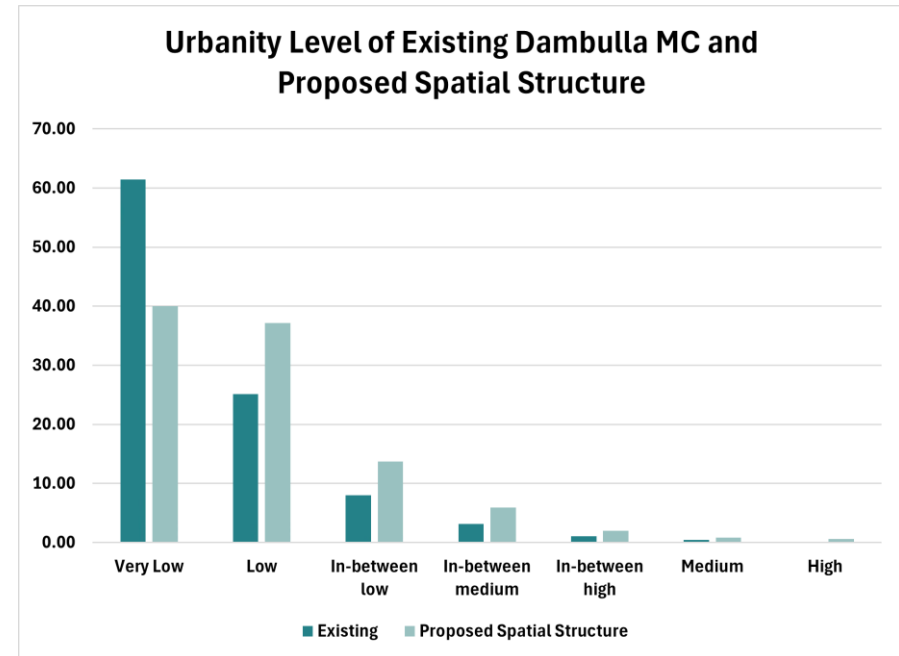


Figure 48: Urbanity Level Changes

This is the process that applied to the Dambulla context when developing the development guide plan for 2050. When considering the vision for DGP, was to achieve a compact, connected, and colorful city. Accordingly, the analysis, studies, and guidelines were created. When applying this process with the same method it is important to understand the needs of your particular and the vision. For a similar context, this study method can be applied easily. But for different scenarios and contexts, it is important to have a better understanding of your study area and your purpose.

## AFTERWORD

This book reflects a concerted effort to make the process of Development Guide Plan preparation more accessible, analytical, and practically grounded. Rooted in the insights gained from international collaborations and hands-on academic studio experiences, it serves not just as a technical book but as a bridge between theoretical frameworks and actionable urban planning practices.

As cities evolve and planning challenges grow more complex, it is essential that planners, students, and stakeholders embrace data-driven, context-sensitive approaches. We hope that this guide empowers users to approach Development Guide Planning with clarity, confidence, and a commitment to creating more liveable, smart urban environments.



**lbs2its.net**

618657-EPP-1-2020-1-AT-EPPKA2-CBHE-JP



ISBN 978-955-9027-89-8