قطر QATAR
دليل معدل الرحلات و المواقف
TRIP GENERATION & PARKING RATES MANUAL

وزارة المواصلات
MINISTRY OF TRANSPORT

إجراءات وإرشادات دراسات النقل
GUIDELINES AND PROCEDURES FOR TRANSPORTATION STUDIES

2022

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تنويه

قامت وزارة المواصلات بإعداد هذا التقرير ضمن اختصاصتها وصلاحيتها وفقاً لأحدث الممارسات العالمية في هذا المجال وبناءً على المعلومات، والإحصائيات والبيانات المتوفرة عند إعداد هذا التقرير. لذا إن استخدام هذا التقرير لأي عمل، لا يعفي المستخدمين من استخدام أحدث الممارسات العالمية، وإتباع الأساليب الهندسية الصحيحة والمتبعة وفقاً لأحدث التقنيات العالمية المتبعة.

وعليه وجب التأكيد على أن وزارة المواصلات لا تتحمل أي مسؤولية مالية أو قانونية يمكن أن تُعزى إلى هذا الاستخدام، كما أنه لا يحق للمستخدمين المطالبة أو استلام أي نوع من التعويض عن أية أضرار أو خسائر.

وللحصول على نسخة من هذا التقرير، يجب التقدم بطلب رسمي إلى وزارة المواصلات في دولة قطر والذي يعد موافقة على ماورد في هذا التنويه. ويجوز للمستخدمين عرض محتويات التقرير ونسخها وطباعتها للاستخدام الخاص فقط، شريطة أن تحمل جميع النسخ والمطبوعات الخاصة بالمحتويات حقوق النشر وإشعارات الملكية وإخلاء المسؤولية الأخرى المعروضة على التقرير. كما لا يجوز للمستخدمين الإعلان أو النشر أو الإفصاح عن البيانات و / أو الكشف عن أي معلومات مدرجة في هذا التقرير على الإطلاق دون موافقة كتابية مسبقة من قبل وزارة المواصلات.

وفيما يخص التغييرات أو الإصدارات المستقبلية، ستقوم الوزارة بتوفيرها ويمكن الحصول عليها من خلال الاتصال بالإدارة المخولة في الوزارة، وعليه يتوجب على المستخدمين التحقق بشكل متواصل بأن لديهم أحدث إصدار من هذا التقرير.

ملاحظة: ستقوم وزارة المواصلات بمواصلة تحديث وتعديل هذا التقرير مع الأخذ بعين الاعتبار النظريات الجديدة وأحدث الأساليب التكنولوجية والمواضيع المُستجدة التي تتعلق بتخطيط وتحليل وتصميم أنظمة النقل والمرور. إن وزارة المواصلات تشجع المستخدمين على تقديم الملاحظات والاقتراحات والتعليقات وردود الأفعال وذلك من خلال قنوات الاتصال الخاصة بالوزارة. وسيتم مراجعة هذه الملاحظات والاقتراحات ومن ثم تقييمها للنظر في إمكانية إدراجها ضمن الإصدار القادم من التقرير.

Foreword

Land transportation is one of the key sectors that helps improve all aspects of life and ensures the delivery of goods and services to individuals and communities. It also underpins the growth of other sectors, such as energy, industry, mining, agriculture, and trade and drives the sustainable development of cities, societies, and the economy in step with the objectives of the Qatar National Vision 2030.

It is with this understanding that the Ministry of Transport (MOT), in compliance with its responsibilities, has revised the Guidelines and Procedures for Transportation Studies (GPTS). The GPTS provides a framework for the analysis, review, and approval of transportation studies for projects of all sizes.

Importantly, the GPTS also provides a mechanism for identifying and apportioning the cost of off-site transportation infrastructure, public transport, and community car parking facilities as mandated by the Qatar National Development Framework 2032 Integrated Public Transport Network Policy (M4) instruction to "Ensure developers identify, quantify and contribute to the cost and provision of off-site transport infrastructure, public transport and parking management".

The GPTS now places significantly more emphasis on the identification and mitigation of impacts to all modes of transportation. In addition to Qatar's motorized vehicle roadway network, the GPTS multimodal impact analysis requirements now consider pedestrian facilities, bicycle facilities, public transport, and shared-use spaces. In some cases, the new Site Travel Plan requirements will provide for ongoing monitoring of the implementation and performance of recommended mitigation measures.

MOT encourages everyone to familiarize themself with the GPTS and stresses its commitment to continuously improving programs to deliver a land transportation system that satisfies the pillars of the Qatar National Vision 2030, which strives to place Qatar at the forefront of the most advanced nations, under the leadership of the Emir of Qatar, His Highness Sheikh Tamim Bin Hamad Al Thani.

مقدمة

يعتبر قطاع النقل البري أحد القطاعات الرئيسية التي تساهم في تطوير مختلف جوانب الحياة وضمان نقل السلع والخدمات لجميع شرائح المجتمع. كما وتساهم في نمو القطاعات الأخرى، مثل قطاعات الطاقة والصناعة والتعدين والزراعة والتجارة، مما يدفع باتجاه دعم التنمية المستدامة للمدن والمجتمع التنمية الاقتصادية بشكل يتواءم مع أهداف رؤية قطر الوطنية 2030.

ومن هذا المنطلق والتزاماً بمسؤولياتها، قامت وزارة المواصلات بمراجعة وتحديث دليل إرشادات وإجراءات دراسات النقل، والتي توفر إطارَ عملٍ شاملاً لمراجعة وتحليل واعتماد دراسات النقل بمختلف أنواع وأحجام هذه الدراسات.

ومن الجدير بالذكر أن دليل إرشادات وإجراءات دراسات النقل المحدثّ يوفر آلية لتحديد كيفية المساهمة في تكاليف التحسينات اللازمة للبنية التحتية لشبكات النقل وخدمات النقل العام ومواقف المركبات العامة ومرافقها، وذلك عملاً بالإجراءات المنصوص عليها في سياسة شبكة النقل العام المتكاملة (السياسة رقم M4) ضمن الإطار الوطني للتنمية لدولة قطر 2032، والتي تنص على "التأكد من أن المطورين لمشروعات التنمية الجديدة على دراية كاملة بتحديد وحساب والإسهام في تكاليف البنية التحتية للنقل، وإدارة مرافق النقل العام، وانتظار السيارات خارج حدود مشروع التنمية الجديد".

إنّ دليل إرشادات وإجراءات دراسات النقل بشكله الحالي يولي اهتماما كبيرا على تحديد الآثار السلبية وتقليلها على جميع وسائط النقل البري. فبالإضافة الى شبكة الطرق المخصصة للمركبات، فإنّ دراسات الأثر حاليا تصنف بمتعددة الوسائل، حيث يعتبر تحليل الأثر على مرافق المشاة والدراجات الهوائية والنقل العام والمرافق المشتركة جزءاً من المتطلبات الحالية لهذا الدليل. ومن المتطلبات الجديدة لخطة التنقل في الموقع توفير آلية متابعة و تطبيق لإجراءات تقليل الأثر الموصى بها ومراجعة أداء هذه الإجراءات حيثما يلزم.

ولهذا، فإنّ وزارة المواصلات تشجع الجميع على الإلمام التام بتحديثات دليل إرشادات وإجرءات دراسات النقل، كما تؤكد وزارة المواصلات على الالتزام بدورها المستمرّ وبرامجها التطويرية لتقديم نظام نقل بري يدعم ركائز رؤية قطر الوطنية 2030 التي تطمح إلى أن تكون دولة قطر في طليعة الدول المتقدمة، في ظل القيادة الرشيدة لحضرة صاحب السُّموِّ الشَّيخ تميم بن حمد آل ثاني أمير البلاد المُفدَّى.

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Abbreviations

AM	Morning
ATC	Automatic Traffic Count
ATS	Areawide Transportation Study
CBD	Central Business District
DTS	Detailed Transportation Study
GCC	Cooperation Council for the Arab States of the Gulf
GPTS	Guidelines and Procedures for Transportation Studies
HCS	Highway Capacity Software
ITE	Institute of Transportation Engineers (USA)
ITS	Intelligent Transportation Systems
LOS	Level of Service
LTPD	Land Transport Planning Department
LTS	Limited Transportation Study
MCC	Manual Classified Count
MD	Midday
MSDP	Municipal Spatial Development Plan
MM	Ministry of Municipality (Qatar)
MME	Ministry of Municipality and Environment (Qatar)
MOT	Ministry of Transport (Qatar)
MOTC	Ministry of Transport and Communications (Qatar)
NCHRP	National Cooperative Highway Research Program (USA)
PERS	Pedestrian Environment Review Software (UK)
PHF	Peak Hour Factor
PM	Afternoon
PT	Public Transit/Transport
PTAI	Public Transport Accessibility Index
QFMP	Qatar Freight Master Plan
QHDM	Qatar Highway Design Manual
QNDF	Qatar National Development Framework
QNV	Qatar National Vision 2030
QNMP	Qatar National Master Plan
QNRSS	Qatar National Road Safety Strategy
QPCM	Qatar Pedestrian Crossings Manual
QPMP	Qatar Parking Master Plan
QSTM	Qatar Strategic Transportation Model
QTCM	Qatar Traffic Controls Manual
QTGPRM	Qatar Trip Generation and Parking Rates Manual

QUDC	Qatar Urban Design Compendium
TCRP	Transit Cooperative Research Program (USA)
TDMS	Transportation Data Management System
TfL	Transport for London (UK)
TMC	Turning Movement Count
TMIP	Travel Model Improvement Program (USA)
TMPQ	Transportation Master Plan for Qatar
TPTAPQ	Transportation Planning and Traffic Analysis Parameters for Qatar (part of TMPQ)
TRB	Transportation Research Board (USA)
STS	Special Transportation Study
TOD	Transit-Oriented Development
TRL	Transport Research Laboratory (UK)
TMPQ	Transportation Master Plan for Qatar
V/C	Volume-to-Capacity Ratio

UNITS OF MEASUREMENT

h	hour(s)
km	kilometer(s)
m	meter(s)
min	minute(s)
pce	passenger-car-equivalent
pce-vkt	passenger-car-equivalent vehicle-kilometers of travel
sec	second(s)
vkt	vehicle-kilometers of travel
vph	vehicles per hour

Terminology Used in GPTS

For the purposes of the Guidelines and Procedures for Transportation Studies:

1. The term "MOT" shall mean the Ministry of Transport. Throughout this document, and unless otherwise stated, MOT refers specifically to the Land Transport Planning Department.
2. The term "Department" shall mean the Land Transport Planning Department of the Ministry of Transport.
3. The term "Section" shall mean the Land Transport Studies Section of the Land Transport Planning Department.
4. The terms "PWA" or "Ashghal" shall mean equivalently the Public Works Authority.
5. The term "Applicant" shall mean any developer (or their representative) applying for a development permit that is subject to the GPTS.
6. The term "Consultant" shall refer to the consultant performing a transportation study.
7. The term "transportation study" shall refer to any of the four categories of study defined in **Chapter 2** of this document, namely Areawide Transportation Study, Detailed Transportation Study, Limited Transportation Study, or Special Transportation Study.
8. The term "trip" shall refer to the movement of a person or vehicle from an origin to a destination. While each trip necessarily includes both an origin "trip end" and a destination "trip end", the terms "trip generation" and "trips generated" shall refer only to the total of the trip ends associated with a given project site during a given time. Thus, 10 vehicles entering a project site and 20 vehicles exiting a project site during a one-hour period is equivalent to a trip generation of 30 trip ends per hour (10 inbound, 20 outbound). Practitioners should be aware that confusion may result from the more casual usage of the word "trips" where "trip ends" is more accurate.
9. The terms "vehicle trip generation", "vehicle trip ends", and similar shall be construed in terms of the number of passenger car equivalent (pce) vehicles.
10. The term "roadway segment" shall refer to a link and an adjacent intersection. A roadway segment is specific to a direction of travel and it is always the downstream intersection that is combined with the link.

CHAPTER

1

Introduction

Chapter 1 Introduction to the GPTS

1.1 Purpose of the Manual

This document, Guidelines and Procedures for Transportation Studies (GPTS), describes the processes and procedures to be followed by applicants who are required to submit a transportation study to the Ministry of Transport, Land Transport Planning Department, hereafter referred to as MOT.

The main intent of GPTS is to establish a common understanding of the evidence to be provided for a given transportation study type, and the format in which that evidence should be presented. GPTS provides the legal basis upon which MOT will rely in assessing development permit applications.

GPTS applies to any proposed project likely to impact the transportation system. For example:

- Proposed expansion or enhancement of road or public transport networks (PT).
- Creation of a new transportation asset.
- Measures to improve the reliability of the existing transport network.
- Measures addressing safety issues arising from the use of the existing transport network.
- Measures to improve access to transportation services.
- Land development projects or changes.

To that end, the following four types of transportation study have been defined for the State of Qatar:

1. Areawide Transportation Study (**ATS**)
2. Detailed Transportation Study (**DTS**)
3. Limited Transportation Study (**LTS**)
4. Special Transportation Study (**STS**)

The remainder of this document is structured as follows:

Chapter 2 – Defines the four types of transportation study recognized by MOT, the objectives that need to be met for each of them, and the minimum conformity requirements for transportation studies.

Chapter 3 – Describes the stages involved in preparing a transportation study, and identifies stages that are mandatory and stages that are optional for a given type of transportation study.

Appendix A – Provides guidance on the types of data required to support a transportation study, and on suitable methods for collecting that data.

Appendix B – Provides guidance on use of the Qatar Strategic Transport Model (QSTM) and on standalone microsimulation models.

Appendix C – Defines the Public Transport Accessibility Index (PTAI).

Appendix D – Provides guidance on preparing a site travel plan.

Appendix E – Contains copies of the submission forms to be used for each study stage.

Appendix F – Provides examples of transportation study report design drawings.

CHAPTER

2

General Guidance

Chapter 2 General Guidance

2.1 Definitions

A transportation study involves a systematic assessment of the anticipated transportation impacts of a proposed land use development or transport-related project. The purpose of the assessment is to ensure that development projects submitted to MOT for review will integrate well with their surroundings without imposing undesirable effects on quality of life, in general, or on transportation levels of service (user safety and convenience), in particular. Where mitigation strategies or measures are needed to ensure this, the transportation study will prepare and present the evidence needed to justify them.

All applicants for projects expected to impact the transportation system within the State of Qatar are required to submit a transportation study prepared by a suitably qualified consultant.

Each transportation study shall be conducted at a level of detail consistent with the scale and complexity of the project concerned. In this way, the benefits of conducting the transportation study will be distributed proportionately to developers, to the project end users, to the general public, and to the State of Qatar.

MOT recognizes the following four types of transportation study:

1. **Areawide Transportation Study (ATS).** An ATS is required in support of land use developments that require planning approval/building permits and that are estimated to generate more than 300 vehicle trip ends per hour during the peak hour of the generator.
2. **Detailed Transportation Study (DTS).** A DTS is required in support of land use developments that require planning approval/building permits and that are estimated to generate at least 100 and not more than 300 vehicle trip ends per hour during the peak hour of the generator.
3. **Limited Transportation Study (LTS).** An LTS is required in support of land use developments that require planning approval/building permits and that are estimated to generate fewer than 100 vehicle trip ends per hour during the peak hour of the generator.
4. **Special Transportation Study (STS)**. Any transportation study commissioned by or submitted to MOT, that is not classified as an ATS, DTS, or LTS but that has a distinct transportation element (e.g., campus circulation, public transport, etc.), a defined transportation policy objective (e.g., demand management, impact fees, etc.), or that is part of a design study for large-scale transportation infrastructure, shall be referred

to as an STS. An STS will typically be used to help secure capital funding, to inform policy decisions, or to support ministerial decision-making. The scope of an STS will vary according to the scale, nature, and objectives of the study. Consequently, the GPTS does not present a set of STS requirements. However, the GPTS should be used to confirm that analyses used to support an STS meet MOT minimum assessment standards.

2.2 Transportation Study Objectives

Transportation studies shall satisfy the following objectives:

O1	Identify the transportation system requirements of the proposed project, and its impact on the surrounding transportation system.
O2	Assess the needs of all transportation system users and all travel modes impacted by the proposed project.
O3	Seek to enhance connectivity, accessibility, and user convenience in relation to the wider transportation network with an emphasis on promoting sustainable modes of transportation.
O4	Identify and recommend adequate and appropriate measures to balance transportation system capacity and estimated travel demand in a sustainable manner.

Consultants are advised to refer to the documents listed in **Table 2-1** when preparing a transportation study for MOT.

Table 2-1: Key References to be Consulted in Preparing a Transportation Study

Publisher	Document Name
Spatial Planning Policy	
Planning and Statistics Authority	Qatar National Vision 2030 (QNV)
Planning and Statistics Authority	Qatar Second National Development Strategy 2018-2022 (QNDS2)
MM	Qatar National Master Plan (QNMP) Qatar National Development Framework (QNDF) Municipal Spatial Development Plans (MSDP) Urban Centre Plans Zoning Regulations Strategic Plans and Policies
Public Realm Design Standards/Qatar Urban Design Compendium	
MM	Qatar Urban Design Compendium (QUDC)
Highway Engineering and Road Safety Design Standards	
MM	Concept Design Submittal and Review Guidelines, Appendix A
MOT	Qatar Highway Design Manual (QHDM), Qatar Traffic Control Manual (QTCM)
Ashghal	Standard Process for Reviewing and Designing a School Zone
Trip Generation/Parking Rates	
MOT	Qatar Trip Generation and Parking Rates Manual (QTGPRM) Volume 1 – User Manual Volume 2 – Rates Manual Volume 3 – Software User Guide
Strategic Transport Modeling	
MOT	QSTM Software User Guide and Technical Reports
Transport Planning and Modeling Parameters	
MOT	Transportation Planning and Traffic Analysis Parameters for Qatar (part of TMPQ)
Traffic/Travel Survey Methods	
MOT	Survey Methodology Binder (part of TMPQ)
Historical Transportation Data/Format Required for Supplying Traffic Survey Results to MOT	
MOT	Transportation Data Management System (TDMS)
Related Strategies	
MOT	Qatar National Road Safety Strategy (QNRSS) Qatar Pedestrian Crossings Manual (QPCM) Qatar ITS Strategy Qatar Parking Master Plan (QPMP) Qatar Freight Master Plan (QFMP)

2.3 Transportation Study Classification

The peak hour trip generation thresholds defined in **Table 2-2** shall be used to determine the appropriate transportation study level to be followed in support of a development application.

Table 2-2: Trip Generation Thresholds for Defining Transportation Study Level

Transportation Study Level	Gross Vehicle Trip Generation (Peak Hour of the Generator)
Areawide Transportation Study (ATS)	> 300
Detailed Transportation Study (DTS)	100 – 300
Limited Transportation Study (LTS)	< 100

Indicative modeling and capacity analysis requirements for each transportation study level are provided in **Table 2-3**. The precise requirements for each study shall be agreed with MOT during the project scoping meeting.

Table 2-3: Modeling and Capacity Analysis Requirements by Transportation Study Level

Transportation Study Level	QSTM	Vissim Microsimulation	Intersection Capacity Analysis
ATS	Yes	Possibly*	Yes
DTS	Possibly*	Possibly*	Yes
LTS	No	No	No

*subject to agreement with MOT

Other factors that may be considered by MOT in determining the required scope include:

- The project vicinity has existing transportation problems, such as a poor crash record, complex intersection geometry, or intersections that are already over capacity.
- The proposed project is likely to significantly impact roadway levels of service.
- The proposed project is likely to impact existing or planned non-motorized facilities.
- The proposed project is likely to impact existing or planned public transport services.
- The project vicinity is subject to planning restrictions (e.g., heritage, conservation).
- Opportunities for project site access are limited.

2.4 Transportation Study Conformity

A transportation study shall demonstrate both how the study objectives (**Section 2.2**) will be met and how all anticipated transportation system impacts will be addressed.

2.4.1 General Points

The following points apply to any GPTS-compliant transportation study submitted to MOT:

1. When a transportation study commences after the release of new guidelines or a major MOT data release, the most recent guidance and data shall apply.
2. The Consultant shall ensure that documents submitted to MOT comply with the GPTS, in general, and with the agreed project scope/methodology. The submission of incomplete or non-compliant documents may result in their rejection.
3. Quality assurance (QA) and quality control (QC) shall be conducted in accordance with the Consultant's internal procedures, which should be consistent with international standards such as ISO 9001. As a minimum, QA/QC shall include independent validation and verification of key deliverables by qualified senior personnel who were not involved in their preparation.

On submission of the final transportation study report, all intellectual property shall transfer to MOT and all data and written reports provided by the Consultant shall enter the public domain. Complete citations shall be provided for all sources.

2.4.2 Timely Completion of a Transportation Study

Any transportation study that has not been completed, for any reason, within one year of the original transportation study application date, shall be subject to review and possible modification of the agreed scope and methodology and may result in a need to revise and resubmit some or all previously approved deliverables.

2.4.3 Period of Validity for an Approved Transportation Study

Unless otherwise agreed with MOT, an approved transportation study shall remain valid for a period of one year, after which the approval shall lapse. A Consultant may, prior to the lapse of approval, request an extension in writing. MOT may approve or decline a request for extension. MOT will inform the Consultant of its decision in writing, stating the reasons.

A transportation study may need to be revised or updated if any of the survey data on which it relied, become outdated. In central Doha, survey data used to support a transportation study shall be no more than one year old.

CHAPTER

3

Transportation Study Procedures

Chapter 3 Transportation Study Procedures

3.1 Transportation Study Stages

Preparation of a GPTS-compliant transportation study involves progressing through a minimum of three and a maximum of seven stages, as indicated in **Figure 3-1**.

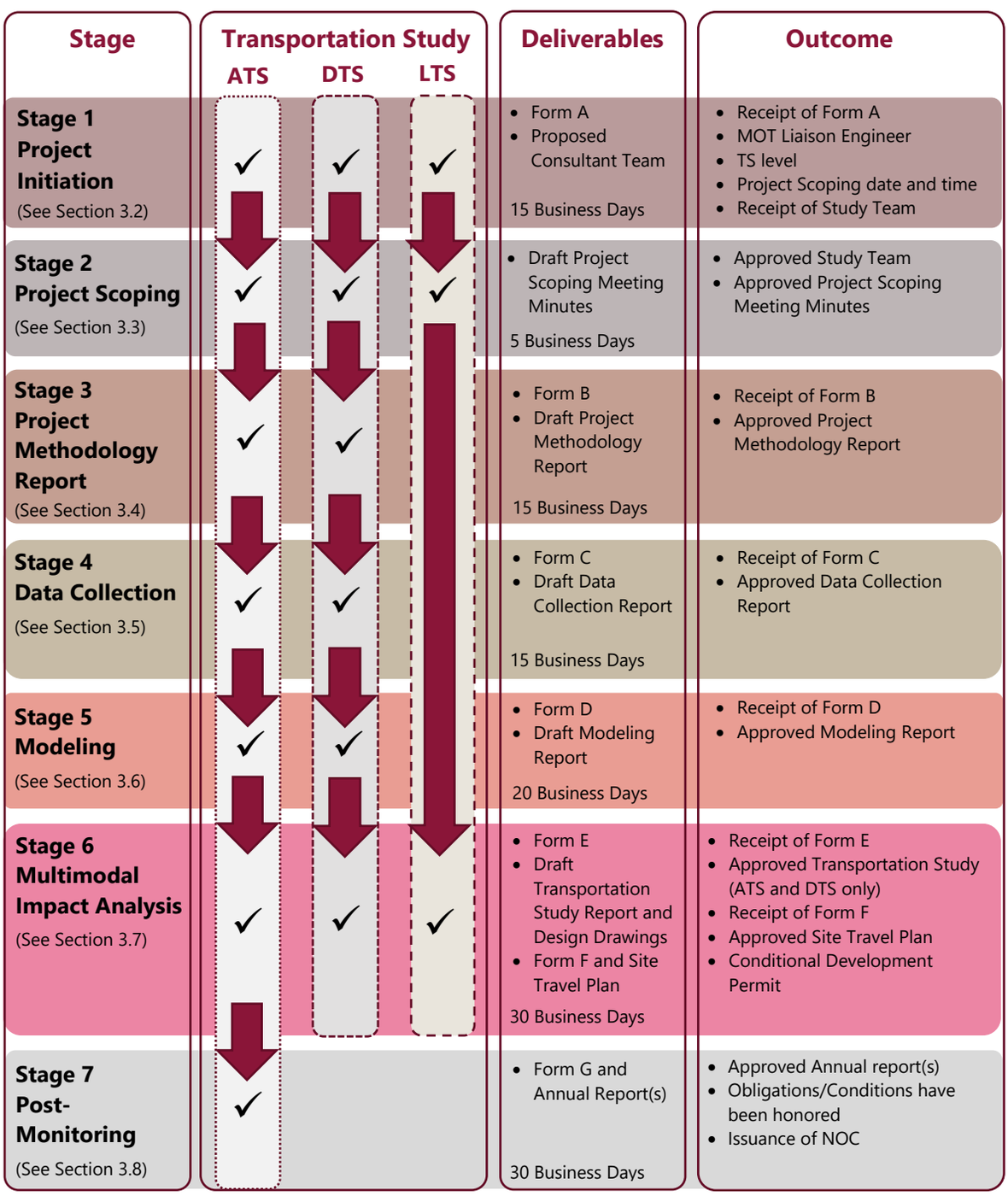


Figure 3-1: Transportation Study Stages and Deliverables

As shown in **Figure 3-1**, deliverables for Stages 1, 2, and 6 are mandatory for all transportation studies.

Indicative MOT review periods are presented in **Figure 3-1**. Additional time may be required to review material submitted for larger or more complex projects.

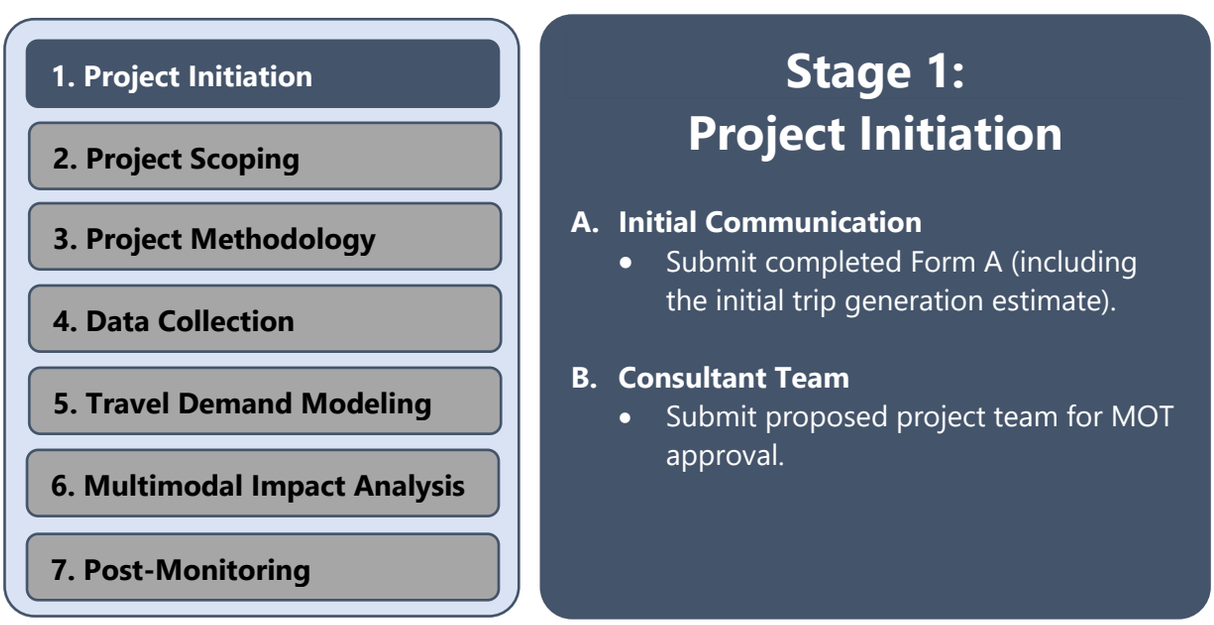
In general, no stage may be initiated until the preceding stage has been satisfactorily concluded, as confirmed by written MOT approval of the required deliverables. Under no circumstances shall the lack of an MOT response be construed as MOT approval.

The individual study stages are described in more detail in the following sections (**Section 3.2** to **Section 3.8**) and supporting guidance is provided in the appendices:

Appendix A – Data Collection
Appendix B – Transportation Study Modeling Requirements
Appendix C – Multimodal Evaluation
Appendix D – Site Travel Plan
Appendix E – Copies of the submission forms to be used for each study stage
Appendix F – Examples of transportation study report design drawings.

3.2 Stage 1: Project Initiation

Mandatory for ATS, DTS, and LTS.



Stage 1 marks formal initiation of a transportation study. To expedite matters, it is important that the Consultant provide MOT with the required information in the required format.

3.2.1 Initial Communication

The formal request for project initiation shall be made by e-mail to MOT, attaching a completed copy of **Form A** (**Appendix E**). The request for project initiation shall include the initial trip generation estimate based on QTGPRM. MOT will use the initial trip generation estimate to help determine the required transportation study level and to frame subsequent scoping discussions.

3.2.2 MOT Responses in Stage 1

After reviewing the submitted application, MOT will:

- Assign a Liaison Engineer to the project.
- Specify the required transportation study level.
- Schedule a scoping meeting.

For larger projects, a pre-scoping inception meeting may be needed. In such cases, it is recommended that the Consultant discuss the project with the nominated MOT Liaison Engineer as early as possible.

The Consultant may request a meeting with the Liaison Engineer at any point during the transportation study. The purpose of any such meeting and a proposed meeting agenda shall be stated and supplied in advance.

3.2.3 Consultant Study Team

After the transportation study level has been confirmed by MOT, the Consultant shall submit details of the key professionals who will be responsible for preparing the transportation study. Key professionals will need to be approved by MOT.

The use of multidisciplinary teams—including, but not limited to, city/urban planners, transportation engineers/planners, civil engineers, architects, and geographers—is highly recommended for any transportation study, but particularly for an ATS.

Note: Only a Professional Engineer certified/registered with the State of Qatar Ministry of Municipality (MM) – Committee for Accreditation of Engineers and Consultancy Offices may sign off on the engineering design elements of a transportation study.

MOT requirements for professionals engaged to undertake a transportation study for MOT include but are not necessarily limited to:

1. Transportation engineer/planner with at least 15 years of professional experience on similar projects, and a minimum of 5 years of professional experience in the GCC.

2. Road design engineer with at least 8 years of professional experience on similar projects, and a minimum of 3 years of professional experience in the GCC.
3. Traffic/transportation modeler with a minimum of 5 years of professional experience with Visum, Vissim, Synchro, Sidra Intersection, and HCS, and a minimum of 3 years of professional experience in the GCC.

The proposed roles and responsibilities of key team members should be clearly stated, and a summary CV provided, in the format indicated in **Table 3-1**.

Table 3-1: CV Template for Key Team Members

Name	FIRST NAME, LAST NAME
Education	HIGHEST DEGREE – Conferring University (Country), Year
	SECOND HIGHEST DEGREE – Conferring University (Country), Year
	LIST ALL OTHER – Conferring University (Country), Year
Language	Arabic/English proficiency: Native/Bilingual, Professional Working, None
Employment History	DATES, FROM/TO: Role, Organization, Country (most recent)
	DATES, FROM/TO: Role, Organization, Country
	DATES, FROM/TO: Role, Organization, Country
	DATES, FROM/TO: Role, Organization, Country
Relevant Experience and Expertise	PROJECT NAME (Country): Brief description of how this is relevant to transportation studies. Project Budget. For major projects use bullets to separate relevant items. Include details on: • Data collection, data processing. • Analysis of safety, traffic, mobility, accessibility. • Planning, evaluation, operation, development, and management of safety performance functions.
	RELEVANT EXPERTISE Include details on: • Academic publications, technical manuals, books, guidelines, policies, legislation. • Technical design experience. • Software expertise.

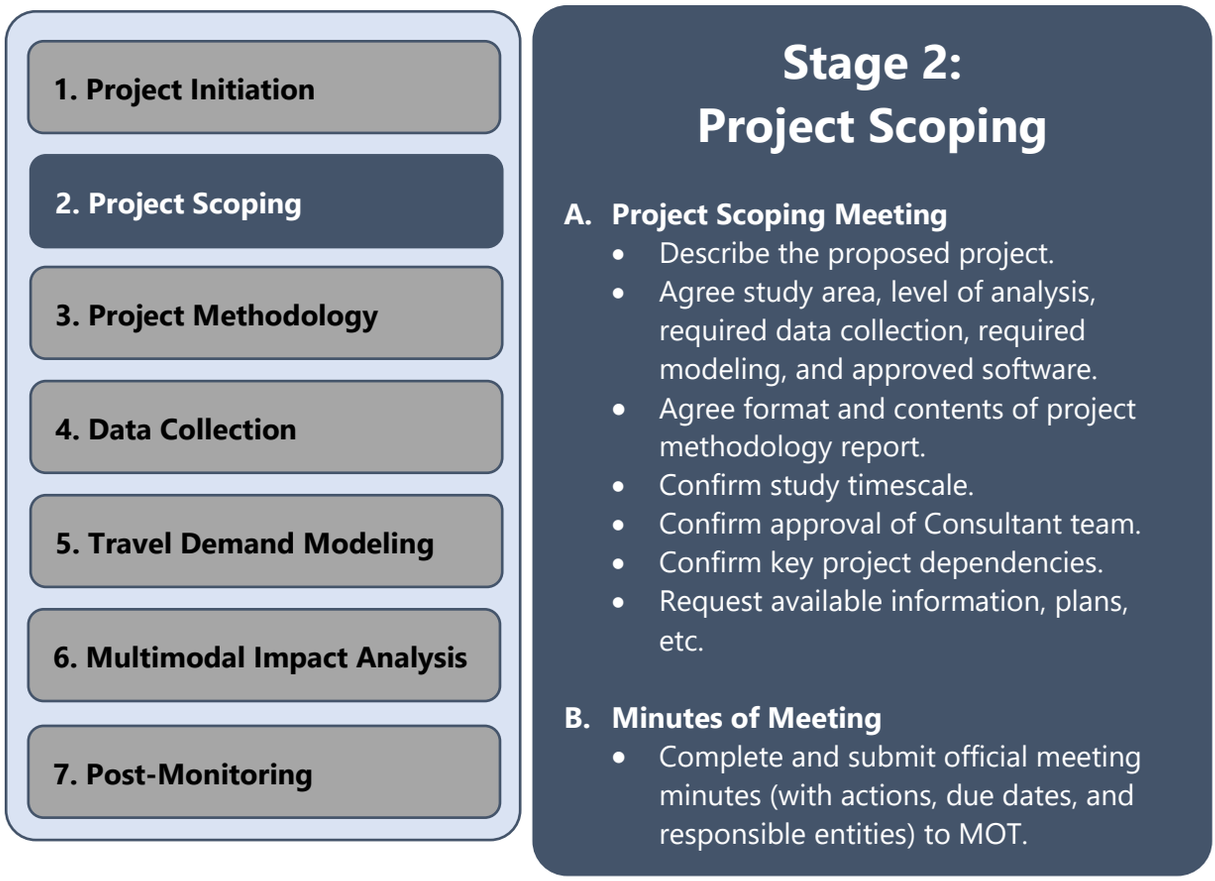
3.2.4 Conclusion of Stage 1

Stage 1 will be concluded when the following tasks have been completed:

1. MOT has received a completed Form A.
2. Consultant has been notified of the assigned MOT Liaison Engineer.
3. Consultant has been notified of the required transportation study level.
4. Project scoping meeting has been scheduled.
5. MOT has received the Consultant study team details in the required format.

3.3 Stage 2: Project Scoping

Mandatory for ATS, DTS, and LTS.



The main purpose of Stage 2 is for both parties to reach a common understanding/agreement on the scale and scope of the proposed project and associated transportation study, and to record the pertinent facts, decisions, and assumptions as a basis for either proceeding to the ATS or DTS project methodology report or to the LTS report.

3.3.1 Project Study Area

The project study area will be defined according to the transportation study level determined by MOT, as indicated in **Table 3-2**.

Table 3-2: Study Area Definitions by Transportation Study Level

Study Level	Study Area Definition
ATS	• The project site. • Circulatory/access roads within the project site boundaries. • All site access connection intersections with external roads • All external roadway segments on which project site generated .peak hour trips would consume at least 5% of the operational design capacity. • All signalized, all-way stop-controlled, and priority-controlled intersections defining the identified study roadway segments. • All public transport, pedestrian, and bicycle facilities within 500 m of the project site boundaries.
DTS	• The project site. • Circulatory/access roads within the project site boundaries. • All site access connection intersections with external roads. • All signalized, all-way stop-controlled, and priority-controlled intersections within 1,000 m of the project site boundaries. • All roadway segments that include the identified study intersections. • All public transport, pedestrian, and bicycle facilities within 500 m of the project site boundaries.
LTS	• The project site. • All site access connection intersections with external roads.

3.3.1 Project Scoping Meeting

The Consultant shall submit to the MOT Liaison Engineer both a proposed agenda and the proposed attendees for the project scoping meeting scheduled in Stage 1. Attendees may include the developer or developer's agent(s). Sufficient time should be allowed in the meeting to cover all relevant matters.

The main objective of the project scoping meeting is for both parties to reach a common understanding/agreement on the items listed in **Table 3-3**.

Table 3-3: Items to be Confirmed in Scoping Meeting

Item No.	Topic
1	The nature and scale of the proposed project.
2	The required transportation study level.
3	The project study area.
4	The required modeling (strategic, microsimulation, and/or intersection capacity analysis), including the design years to be assessed, and the software to be used.
5	The format and contents of the project methodology report (if required).
6	Confirmation of the Consultant study team—if any proposed study team member is not approved by MOT, the Consultant will need to provide a suitable replacement before the study may proceed.
7	Anticipated transportation study time scale, with indicative dates for key deliverables.
8	Critical project dependencies that could impact delivery of key deliverables, including consultation with/approvals from other government agencies.

Relevant information, data, plans, or studies that may have been verbally requested by the Consultant in the project scoping meeting, and documented in the minutes of meeting, or that may be requested in writing at any time. It will be the responsibility of the Consultant to request relevant third-party data.

3.3.2 Assessment Years

Modeling, if required, shall be conducted for the scenarios listed in **Table 3-4**, as a minimum.

Table 3-4: Minimum Forecasting Scenarios to be Tested for ATS or DTS

Opening Year – Without Project	To establish a baseline against which initial project impacts may be measured.
Opening Year – With Project	To quantify the relative impact of the project on horizon year transportation systems as a basis for designing proposed mitigation measures (assumes full build-out and occupancy of the project).
Horizon Year – Without Project	To establish a baseline for assessing the long-term suitability of proposed mitigation measures.
Horizon Year – With Project	To test whether proposed mitigation measures will continue to provide the required level of service over the project's design life and, where they do not, to assess suitable additional mitigation measures.

For larger projects, particularly those likely to affect transportation assets or involving phased implementation, MOT may request that one or more intermediate years be modeled.

Before finalizing the Opening Year – Without Project and Horizon Year – Without Project scenarios, the planning assumptions shall be discussed and agreed with MOT. Typically, the planning assumptions will include all developments or transportation infrastructure/services currently under construction or approved and funded. For larger projects, MOT will confirm during the project scoping meeting whether sensitivity testing will be required. Any required sensitivity testing shall be documented in the project methodology report.

3.3.3 Minutes of Project Scoping Meeting

The Consultant shall be responsible for recording the minutes of all project meetings, including the project scoping meeting. The meeting minutes should identify all follow-up actions, responsible parties, and due dates agreed in the meeting.

3.3.4 Stage 2 Submissions

The draft minutes of the project scoping meeting shall be submitted to MOT within three business days and MOT shall respond within five business days, although additional time may be required for larger or more complex projects. After all meeting attendees are satisfied with the meeting minutes, the Consultant shall issue the final meeting minutes to all attendees and to any other parties specified by MOT.

Consultant study team clarifications or changes requested by MOT shall be addressed prior to conclusion of Stage 2.

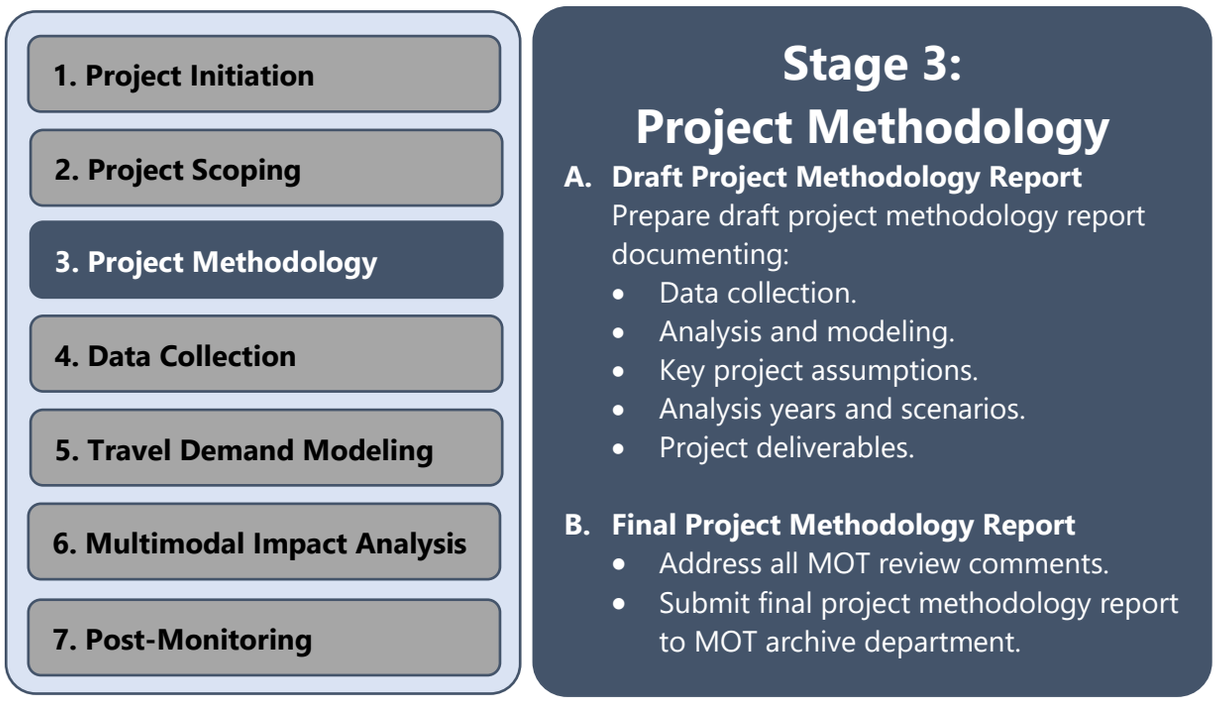
3.3.5 Conclusion of Stage 2

Stage 2 will be concluded when the following tasks have been completed:

1. MOT has approved the proposed Consultant study team.
2. The final minutes of project scoping meeting have been submitted to the MOT archive department.

3.4 Stage 3: Project Methodology Report

Mandatory for ATS and DTS; LTS to proceed to Stage 6 (see Section 3.7).



3.4.1 Project Methodology Report

The main purpose of Stage 3 is to ensure that the methodology of the transportation study is well-defined, documented, and agreed by all parties in advance of commencing the transportation study.

Important Note: A project methodology report is mandatory for studies classified as either an ATS or a DTS. For an LTS, the project scoping meeting final minutes of meeting will typically provide sufficient documentation of the methodology.

The project methodology report should describe the proposed data collection, modeling, and analysis to be used in support of the transportation study, including the following:

- All relevant assumptions.
- The future year scenarios to be assessed.
- A description of the extent of all proposed deliverables, including, as appropriate, data collection report (**Section 3.5**), modeling report (**Section 3.6**), and transportation study report (**Section 3.7**).

For a transportation study relating to a land-use development project, the project methodology report shall include evidence that: a building permit application has been initiated with the relevant government department; that the Ministry of Municipality – Urban Planning Department (MM-UPD) has approved the proposed land use, coverage area, built-up area, density, and parking supply; and that the MM-UPD-approved land uses and development quantities match both those listed in the building permit application and the proposed land uses and development quantities outlined in the project methodology report. The project methodology report shall include an initial trip generation and parking demand estimate per QTGPRM.

For projects that will be developed in phases, the land uses included in each phase and their indicative timings should be reported. For the modeling of phased projects, intermediate milestone checks may be required.

As a minimum, the project methodology report shall contain the items listed in **Table 3-5**.

Table 3-5: Project Methodology Report Minimum Contents

Chapter	Contents
1.	**Project Introduction and Description** • Project location. • Project owner(s) names and contact details. • Name of MOT Liaison Engineer. • Planned project start and completion dates. • Development schedule. • Site plan and layout. • Initial project peak hour trip generation estimates. • Initial parking demand estimate and proposed parking supply.
2.	**Known Issues or Problems** • Any known traffic issues identified by MOT staff that need to be addressed as part of the transportation study.
3.	**Study Objectives** • Statement of study objectives cross-referenced to **Section 2.2** of this document. • Indication of which development components will contribute to each of the named objectives.
4.	**Key Assumptions**
5.	**Data Collection** • Data sources and intended use. • Planned surveys and survey timetable and intended use.
6.	**Modeling Approach** • Project assessment years. • Map of study area plus narrative. • Base year models to be used.
7.	**Multimodal Analysis Methodology**
8.	**Appendices** • Copy of building permit application and the responses of relevant authorities. • Copies of any prior approvals together with supporting drawings, conditions, etc.

3.4.2 Stage 3 Submissions

The draft project methodology report shall be submitted, together with a completed **Form B** (**Appendix E**), to MOT for review.

MOT review comments will be communicated to the Consultant. The Consultant shall address all MOT review comments and incorporate appropriate changes into a revised project methodology report for further MOT review and/or approval. One hard copy of the approved project methodology report shall be submitted to the MOT archive department.

The target MOT review period for each submitted project methodology report is 15 business days after receipt. Additional time may be required for larger or more complex studies.

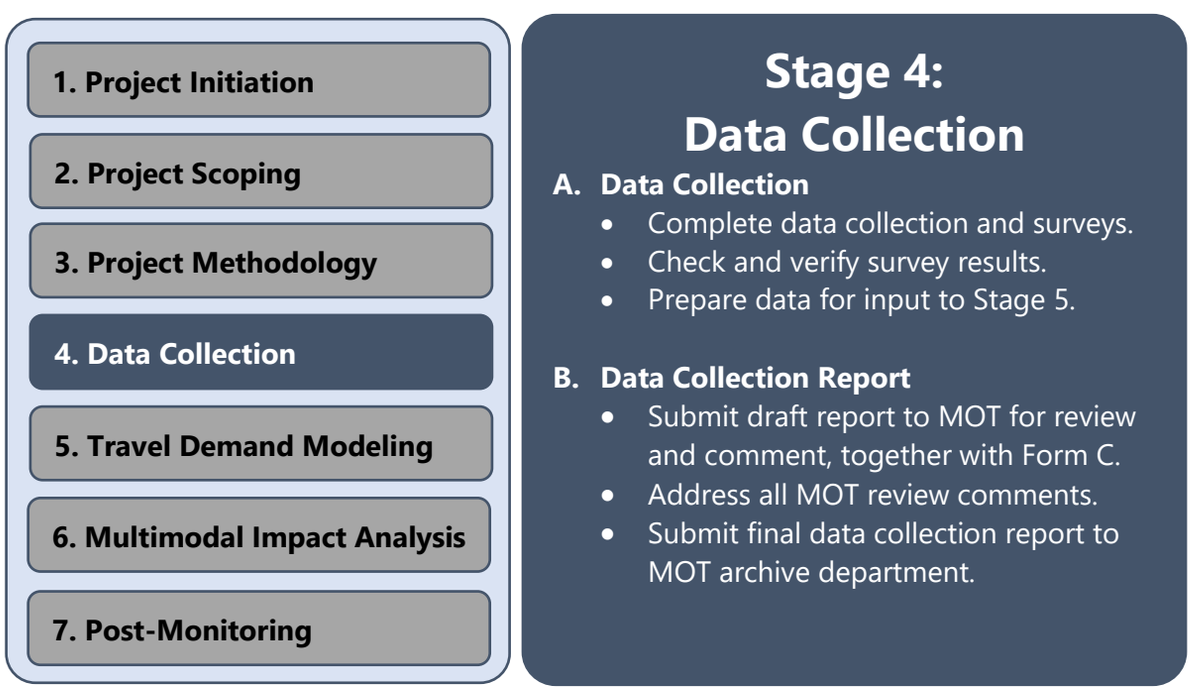
3.4.3 Conclusion of Stage 3

Stage 3 will be concluded when the following tasks have been completed:

1. MOT has formally approved the project methodology report.
2. A copy of the approved project methodology report has been submitted to the MOT archive department.

3.5 Stage 4: Data Collection

Mandatory for ATS and DTS; LTS to proceed to Stage 6 (see Section 3.7).



3.5.1 Data Collection Report

The main purpose of Stage 4 is for the Consultant to collect all data needed to support the transportation study and to ensure that the collected data are fit for purpose. MOT will not typically be directly involved with the actual data collection but will carefully review the data collection procedures and the collected data, as summarized in the data collection report.

Important Note: A data collection report is mandatory for studies classified as either an ATS or a DTS, and may be required, on a case-by-case basis, for an LTS.

Data collection surveys shall be carried out in line with advice provided in **Appendix A.** All data to be used in the transportation study, whether received from third parties or collected specifically for the study, shall be checked and verified by the Consultant prior to being used in the study. Data found to be deficient may need to be replaced with results from fresh surveys. The Consultant should coordinate with MOT regarding data collection impacts on the study schedule.

Should inspection of the study data justify changes to the documented assumptions, the Consultant should notify MOT at the earliest opportunity.

After all checks have been concluded and the data deemed fit for purpose, the data may be used in Stage 5.

The Consultant shall draft a data collection report to concisely document all data collected, provide evidence of the quality checks undertaken, and confirm the suitability of the data for use in the transportation study. As a minimum, the data collection report shall include the items listed in **Table 3-6**.

Table 3-6: Data Collection Report Minimum Contents

Chapter	Contents
1.	**Project Description**
2.	**Third Party Data** • Summaries, sources, and proposed uses.
3.	**Project Surveys** • Georeferenced photographs of the project site and study area. • Plan(s) with survey date(s) and survey type. • Site conditions during the survey period, general observations, etc. • Correction factors applied (e.g., seasonal variation, matching short-term counts to long-term averages, etc.). • Data quality checks and findings. • Survey data summaries including key statistics (e.g., mean, standard deviation, confidence intervals). • Interpretation of survey results and comparisons with suitable benchmarks. • Proposed use of data in transportation study.
4.	**Peak Traffic Hours/Design Hours** • As agreed in the scoping meeting or in subsequent discussions with MOT.

3.5.2 Stage 4 Submissions

The draft data collection report shall be submitted, together with a completed **Form C** (**Appendix E**), to MOT for review.

MOT review comments will be communicated to the Consultant. The Consultant shall address all MOT review comments and incorporate appropriate changes into a revised data collection report for further MOT review and/or approval. One hard copy of the approved data collection report shall be submitted to the MOT archive department.

The target MOT review period for each submitted data collection report is 15 business days after receipt. Additional time may be required for larger or more complex projects.

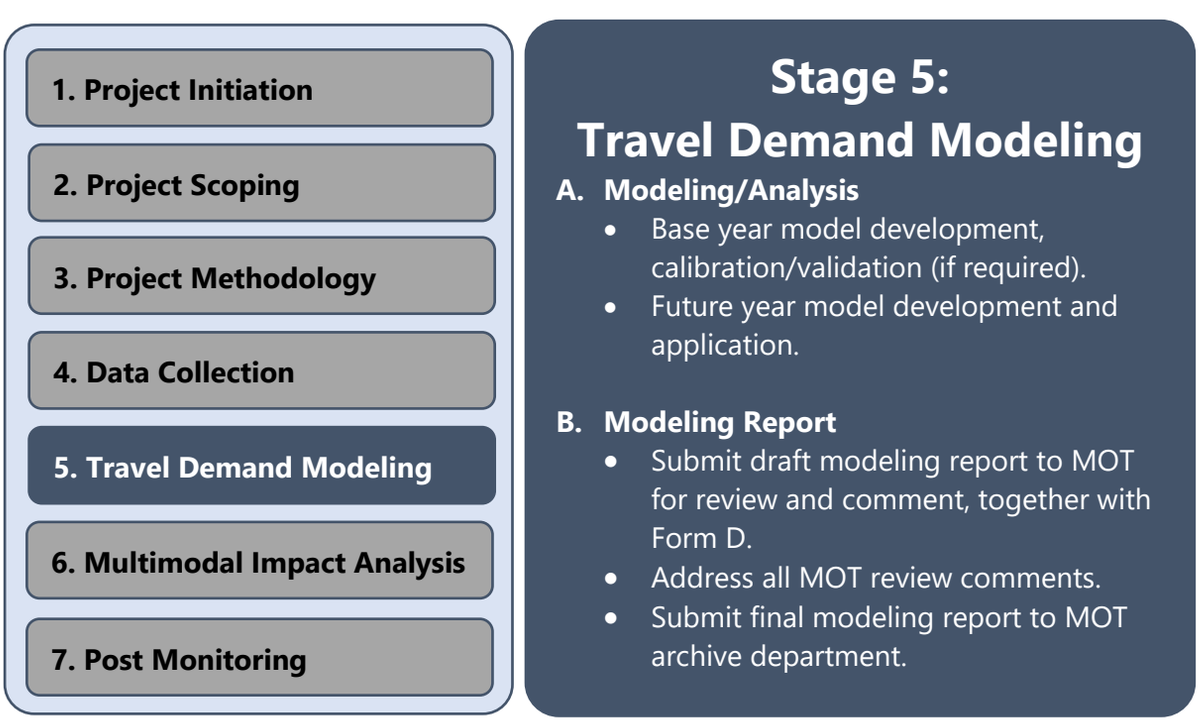
3.5.3 Conclusion of Stage 4

Stage 4 will be concluded when the following tasks have been completed:

1. MOT has formally approved the data collection report.
2. A copy of the approved data collection report has been submitted to the MOT archive department.

3.6 Stage 5: Travel Demand Modeling

Mandatory for ATS and DTS; LTS to proceed to Stage 6 (see Section 3.7).



3.6.1 Travel Demand Modeling

The purpose of Stage 5 is to conduct travel demand modeling using the Qatar Strategic Transportation Model (QSTM), as required to support the multimodal impact analysis stage of the transportation study.

A modeling report is required for transportation studies classified as either an ATS or a DTS but is not required for an LTS.

After the data collection report has been approved by MOT, the Consultant may proceed to the Stage 5 travel demand modeling steps defined in the methodology report. All travel demand modeling shall be carried out in accordance with **Appendix B**. For larger studies, intermediate model checks may be required. The need for intermediate checks will be confirmed during Stage 3 and documented in the methodology report.

Where a base year model has been requested by MOT, the Consultant shall obtain base year model approval from MOT before beginning work on the future year models for the agreed scenarios. The Consultant shall, in turn, obtain future year model approval from MOT before proceeding to Stage 6.

The approved future year model(s) shall be used to assess the performance of the proposed project against the study objectives set out in the methodology report, to devise and test proposed mitigation measures, to develop a preferred option, and—for the purpose of computing the transportation impact fee (**Section 3.7.9**)—to assess the number of project-generated passenger-car-equivalent vehicle-kilometers of travel during the peak hour of the generator.

3.6.2 Modeling Report

The Consultant shall prepare a draft modeling report to document all work undertaken to prepare the models, to demonstrate that they are fit for purpose (including any calibration/validation results), and to describe how the models will be applied to test the required development scenarios. The modeling report shall contain, as a minimum, the items listed in **Table 3-7**, as documented in the methodology report.

Table 3-7: Modeling Report Minimum Contents

Chapter	Contents
1.	**Introduction** • Site plan. • Proposed land uses and development staging/phasing. • Existing and future transportation network. • Models used. • Study area. • Model years. • Vehicle types and peak periods/peak hours modeled.
2.	**Base Year Models (where required)** • Screenshots of model networks showing the following link attributes: - Number of travel lanes (per direction for divided roads). - Free flow speed. - Link capacity (per direction for divided roads). • Data used to calibrate/validate or benchmark the base year model, presented in summary form • How the data were used to develop the model. • Changes to the base year model supplied by MOT (zone disaggregation, network refinement, etc.) • Results of the model calibration/validation or benchmarking.
3.	**Future Year Models** • Screenshots of model networks showing the following link attributes and, where a base year model is required, any differences from the base year model: - Number of travel lanes (per direction for divided roads). - Free flow speed. - Link capacity (per direction for divided roads). • Input planning data for the future year models. • Checks carried out to confirm the reasonableness of the models. • Opening year and Horizon year model input and output summaries for, as a minimum: - Without Project. - With Project – No Mitigation. - With Project – Preferred Option.

3.6.3 Stage 5 Submissions

The draft modeling report shall be submitted, together with a completed **Form D** (**Appendix E**), to MOT for review. MOT review comments will be communicated to the Consultant. The Consultant shall address all MOT review comments and incorporate appropriate changes into a revised modeling report for further MOT review and/or approval. One hard copy of the approved modeling report shall be submitted to the MOT archive department.

The target MOT review period for each submitted modeling report is 20 business days after receipt. Additional time may be required for larger or more complex projects.

3.6.4 Conclusion of Stage 5

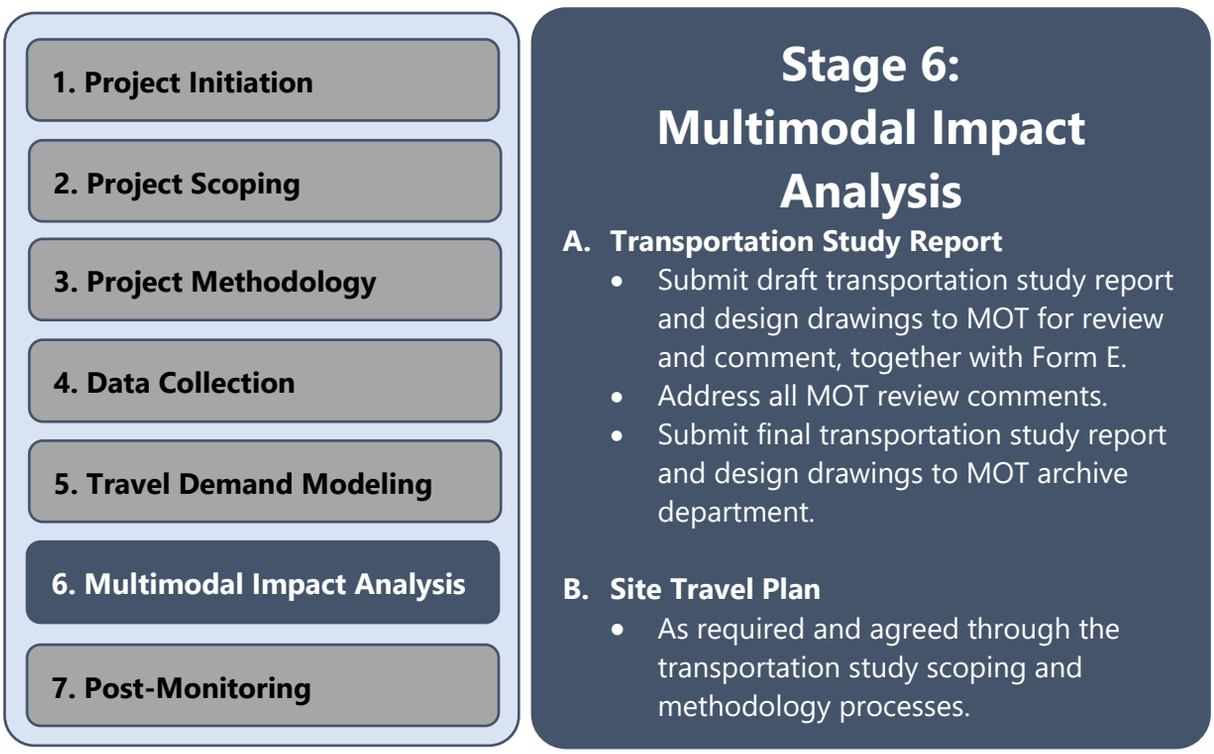
Stage 5 will be concluded when the following tasks have been completed:

1. MOT has formally approved the modeling report.

2. A copy of the approved modeling report has been submitted to the MOT archive department.

3.7 Stage 6: Multimodal Impact Analysis

Mandatory for ATS, DTS, and LTS.



3.7.1 Multimodal Analysis Methodology

The multimodal analysis methodology shall be agreed with MOT, in principle, during Stage 3, Project Methodology, for an ATS or DTS, and in Stage 2, Project Scoping, for an LTS.

3.7.2 Evaluation Scenarios

The agreed future year model scenarios, both without-project and with-project, shall be evaluated. Unless otherwise agreed with MOT, all default parameters shall be retained. Where appropriate, an evaluation of the existing conditions scenario may also be required. As agreed in the approved project methodology report, capacity, operational, and/or level of service analyses shall be completed for roadway segments and intersections; parking, pedestrian, and bicycle facilities; and public transport.

Proposed mitigation measures should be discussed with MOT prior to analysis and evaluation. The preferred option shall be agreed with MOT prior to submission of the final transportation study report.

Mitigation measures should not be restricted to roadway capacity enhancements as the goal is to deliver a balanced transportation solution that supports the objectives outlined in **Section 2.2**. Before proposing candidate mitigation measures, the Consultant shall refer to the following guidance:

1. Qatar Urban Design Compendium
2. QHDM Volume 3, Part 20 (Context Sensitive Design)

Mitigation options should be tested in terms of the project objectives identified in the project methodology report. Performance measures should consider the recommended critical success factors contained in QHDM Volume 3, Part 20 (Context Sensitive Design). Where a site travel plan is required, the performance measures should include suitable tests for identifying and testing longer term site travel targets, as defined in **Appendix D**.

3.7.3 Roadway Performance Criteria

All study area roadway segments and intersections shall achieve, as a minimum, the peak hour level of service standards listed in **Table 3-8**.

Table 3-8: Peak Hour Roadway Segment and Intersection Level of Service Standards*

Road Class (QHDM)	Urban			Rest of Qatar
	Inner CBD	Outer CBD	Non-CBD	
Freeway/Expressway	LOS E	LOS E	LOS D	LOS C
Arterial	LOS E	LOS E	LOS D	LOS C
Collector	LOS E	LOS E	LOS D	LOS C
Local	LOS E	LOS E	LOS D	LOS C

** For intersections, the level of service standards apply to the worst lane group movement.*

For each roadway segment and intersection where the level of service standards are not expected to be met under future without-project conditions, the transportation study shall identify two sets of mitigation measures:

1. One set of mitigation measures that allows level of service standards to be met under future with-project conditions; and
2. A second set of mitigation measures that allows forecast without-project levels of service to be met under future with-project conditions.

3.7.3.1 Weaving, Merge, and Diverge Analysis

The transportation study shall include a weaving analysis for all relevant roadway segments within the project study area using software that implements the procedures outlined in the most recent edition of *Highway Capacity Manual*. The parameters to be employed shall be confirmed in advance with MOT.

3.7.3.2 Travel Time, Average Travel Speed, and Delay

Travel time, average travel speed, and delay are standard measures of system performance, all of which should be reported. However, the overriding policy objective shall be to ensure the safe, efficient, and equitable operation of the entire multimodal transportation system.

3.7.3.3 Stops

If microsimulation modeling is used, the number of stops may be reported as an indicator of the quality of signal progression.

3.7.3.4 Density

If microsimulation modeling is used, density may be reported for freeway and highway links. Density is calculated as the length of the link multiplied by the number of lanes, divided by the number of vehicles present on the link when the snapshot is taken. Density should be calculated for a minimum of six snapshots spread evenly across the simulation period.

3.7.3.5 Queues

Queue lengths are important for identifying congestion hotspots and often have a bearing on road safety. Queue overflows (spillback) may indicate locations requiring more storage or the need to adopt effective demand management measures. Intersection capacity analysis and microsimulation software typically report the average, maximum, or 95th percentile queue length. The transportation study shall report the 95th percentile queue length.

3.7.4 Parking Facility Analysis

The transportation study shall demonstrate that proposed parking facilities: meet the parking supply requirements outlined in the *Qatar Parking Master Plan* (QPMP); will operate safely and efficiently; that there will be no detrimental impacts on neighboring streets or properties; that safe access to, from, and within parking areas is provided for pedestrians of all abilities; and that parking area access is provided for emergency vehicles and service vehicles. Where barrier-controlled vehicular access to parking is proposed, a queuing analysis shall be provided to demonstrate that 95th percentile queues do not spill back onto the public right-of-way.

3.7.5 Pedestrian Facility Analysis

The transportation study shall include an analysis of all walkways and sidewalks, crosswalks, on-street pedestrian facilities, and pedestrian waiting and queuing areas. Further guidance can be found in the *Qatar Pedestrian Environment Review System* (QPERS).

3.7.5.1 Pedestrian Infrastructure Provision

As a minimum, the transportation study shall consider the following:

1. Safety and security of pedestrian links in and around the development.
2. Continuity, convenience, and comfort of proposed pedestrian links.
3. Exposure of pedestrians to the elements.
4. Walking distances to public transport nodes.
5. Pedestrian links with existing land uses and existing pedestrian desire lines.
6. The capability of existing and proposed pedestrian facilities (including vertical transport components) to cope with the additional pedestrian demand generated by the development.
7. Accessibility of pedestrian facilities for people of all abilities.
8. Number, type, and nature of pedestrian-vehicle conflicts within and external to the development.
9. Pedestrian delays and risks at pedestrian-vehicle conflict points.

3.7.5.2 Pedestrian Level of Service Assessment

Pedestrian levels of service shall be assessed in terms of average unobstructed area (m^2/person) for walkways and sidewalks, crosswalks, on-street pedestrian facilities, and pedestrian waiting and queuing areas. The average area level of service criteria are defined in QHDM Volume 3, Part 19. Pedestrian waiting areas shall be defined as areas where the mode of travel changes from walking to some other mode (e.g., bus stops, Metro platforms). Pedestrian queuing areas shall be defined as areas where the mode of travel is walking both before and after the queuing area (e.g., signalized crosswalks). Pedestrian levels of service at queuing areas shall be assessed both in terms of average area and in terms of average delay (sec/person). The average delay calculation methodology and level of service criteria are defined in HCM.

3.7.6 Bicycle Facility Analysis

Suitable procedures for assessing bicycle facilities in urban centers are provided in the London Cycling Design Standards (TfL, 2014[1]) and CMAP (2019[2]).

More general advice on the assessment of bicycling schemes is available in Litman (2019a[3]).

The suitability of the above guidance shall be discussed with MOT prior to completion of the methodology report.

3.7.6.1 Bicycle Level of Service Assessment

TRB (2016[4]) provides detailed instructions on calculating bicycle levels of service (**Table 3-9**) and at signalized and give-way intersections. The TRB procedures are integrated into the multi-modal level of service calculations supported by the Synchro software. The TRB procedures are recommended for use in transportation studies classified as an ATS or a DTS. The appropriate level of service standards for a study site will need to be agreed on a case-by-case basis considering the overall project objectives and the target levels of service for all other travel modes within the Study Area.

Table 3-9: Level of Service Criteria for Bicycle Lanes on City Streets

Level of Service	Bicycling Speed (km/h)
LOS A	**≥ 22**
LOS B	**≥ 15, < 22**
LOS C	**≥ 11, < 15**
LOS D	**≥ 8, < 11**
LOS E	**≥ 7, < 8**
LOS F	**< 7**

Source: TRB (2016).

Any assessment of bicycling required for a transportation study shall consider the following, as a minimum:

1. Relationship of existing bicycle networks and facilities to those proposed for the project.

[1] TfL, 2014. London Cycling Design Standards, [online]. Available at https://tfl.gov.uk/corporate/publications-and-reports/streets-toolkit#on-this-page-2 [Accessed 7 August 2019]
[2] CMAP, 2019. Complete Streets Toolkit, [online]. Available at: https://www.cmap.illinois.gov/programs/local-ordinances-toolkits/complete-streets [Accessed 7 August 2019]
[3] Litman, T., 2019 (a). Evaluating Active Transport Benefits and Costs: Guide to Valuing Walking and Cycling Improvements and Encouragement Programs. Victoria Policy Institute.
[4] TRB, 2016. Highway Capacity Manual 6th Edition: A Guide for Multimodal Mobility Analysis.

2. Bicycle network and facility capacity to meet the anticipated or aspirational demand generated by the project.
3. Links to public transport stops, the provision of bicycle storage at public transport stops, and whether bicycles are allowed on public transport vehicles.
4. Connectivity, gradient, and directness of bicycle links.
5. Safety of on-road bicycle facilities.
6. Security and safety of off-road bicycle facilities.
7. Number and nature of bicyclist/vehicle and bicyclist/pedestrian conflicts in and around the project.
8. Adequacy of ancillary facilities proposed by the project (bicycle storage, changing rooms, lockers, showers, etc.).

3.7.7 Shared-Use Space Analysis

Proposals for facilities and spaces intended for ongoing, simultaneous use by multiple modes of transportation (e.g., multi-use recreational paths, mushtaraks) shall be considered individually and subject to a detailed study of the current and forecast future volumes and speeds of each mode and the specific design of the proposed facility.

3.7.8 Public Transport Analysis

The transportation study shall assess the proposed development in terms of the Public Transport Accessibility Index (PTAI). Calculation of the PTAI is detailed in **Appendix C**.

3.7.9 Compute Transportation Impact Fee

The Ministry of Transport (MOT) shall impose the computation of a transportation impact fee to mitigate costs associated with the trip generation, parking demand, transportation system impact (including congestion, safety, or facility deterioration impact), and/or the review or approval of proposed development projects in the State of Qatar[5]. All such transportation impact fees shall be directly proportional to the demand placed on the transportation system by the development, as outlined in this section.

5 A transportation impact fee is not currently approved and will not be implemented prior to final government approval. If approved, the transportation impact fee may be substantially similar to or slightly-to-significantly different from the transportation impact fee described herein. The transportation impact fee shall be computed. Computation of the transportation impact fee prior to final government approval is for information purposes only and does not obligate the applicant to pay (or relieve the applicant from paying) any existing or future government-imposed fees.

3.7.9.1 Transportation Impact Fee Schedule

For any transportation study classified as an ATS or DTS, the transportation impact fee shall be based on the number of project-generated passenger-car-equivalent vehicle-kilometers of travel (pce-vkt) during the peak hour of the generator. The number of pce-vkt shall have been determined in Stage 5 Travel Demand Modeling. For any transportation study classified as an LTS, the transportation impact fee shall be based on the number of project-generated net-new-external passenger-car-equivalent (pce) trips during the peak hour of the generator, without regard to trip length. The transportation study shall report and MOT shall impose a transportation impact fee computed according to the transportation impact fee schedule outlined in **Table 3-10**.

Table 3-10: Transportation Impact Fee Schedule

Transportation Study Classification	Unit Impact Fee	Unit of Measurement
Areawide Transportation Study (ATS)	QAR 4,000	peak hour[a] project-generated pce-vkt[b] * AF[c]
Detailed Transportation Study (DTS)	QAR 4,000	peak hour[a] project-generated pce-vkt[b] * AF[c]
Limited Transportation Study (LTS)	QAR 8,000	project-generated net-new-external peak hour[a] passenger-car-equivalent trip

[a] *"peak hour," for the purpose of transportation impact fee, shall mean the peak hour of the generator.*

[b] *"pce-vkt" shall mean passenger-car-equivalent vehicle-kilometers of travel.*

[c] *"AF" shall mean the attribution factor, as defined in Section 3.7.9.2.*

3.7.9.2 Attribution Factor

For any transportation study classified as an ATS or DTS, and except as outlined in this section, an attribution factor (AF) of 50% shall be applied to account for the fact that one-half of each trip generated by a proposed development is attributable to the proposed development and the remainder to the land use at the other end of the trip. Where the transportation study shows that the calculated future with-project arterial or intersection-as-a-whole level of service is more than two letter grades worse than the future without-project arterial or intersection-as-a-whole level of service, for any facility within the agreed study area, an AF of 75% shall be used.

3.7.9.3 Required Transportation Mitigation Certificate of Compliance

MOT approvals of all transportation studies classified as an ATS, DTS, or LTS, shall include a condition stating that approval may be revoked for any development/establishment that has not received an MOT Required Transportation Mitigation Certificate of Compliance (RTMCC). The issuance of an RTMCC will not relieve the recipient of the need to comply with any other

governmental requirement (e.g., MM Development Control 2 certificate of compliance, Environmental Impact Assessment (EIA) clearance, or other).

MOT may issue an RTMCC for proposed development or transportation projects in the State of Qatar that have demonstrated compliance with the GPTS, including computation of the transportation impact fee described in this section. An RTMCC, if issued, shall be valid for a specific period, as determined on a case-by-case basis, taking into consideration the proposed schedules for site development and construction of required mitigation measures.

3.7.9.4 Transportation Impact Fee Collection and Disposition

As applicable, the transportation impact fee computed under this section shall be collected by a State of Qatar ministry and department, to be determined as and when required, according to the schedule outlined in the MOT Required Transportation Mitigation Certificate of Compliance (RTMCC). The collected transportation impact fee shall be held in escrow until the required off-site mitigation measures have been constructed and become operational, at which time the transportation impact fee funds may be used by the State of Qatar at its sole discretion. If the required off-site mitigation measures, if any, are not constructed and operational according to the schedule outlined in the RTMCC, or if project development does not proceed according to the schedule outlined in the RTMCC, then no project development shall be permitted beyond the point of non-compliance with the RTMCC schedule and the transportation impact fee collected shall be refunded in proportion to the estimated cost of the mitigation measures, if any, not yet constructed.

3.7.10 Site Travel Plan

A site travel plan is required for every transportation study classified as an ATS, and may be required for other transportation studies, as agreed through the transportation study scoping and methodology processes. All targets included in the site travel plan shall be related to the transportation system elements studied and documented in the Stage 6 analysis. Guidance on preparing site travel plans is provided in **Appendix D**.

As a condition of transportation study approval, the site travel plan shall be legally binding on the original developer or the developer's successors or assignees. Enforcement of the site travel plan may involve the imposition of incentives and/or disincentives.

The site travel plan shall include post-opening monitoring of site travel plan progress and achievement and may include a mechanism for periodically adjusting the site travel plan targets. Post-monitoring shall cover a period of no less than three years after the development site has become operational (in the case of a phased development, this condition shall apply to each phase).

The survey methods considered appropriate for measuring post-occupancy conditions are listed in **Table 3-11**. MOT may specify other methods at its discretion.

Table 3-11: Appropriate Post-Monitoring Survey Methods

Survey Method	Effect Measured
Inventory surveys **Facility audits**	To identify the current level of provision of all required facilities (such as bus shelters, bicycle parking, showering facilities, storage lockers) at the start and end of the review period.
Trip generation surveys	To verify current project site trip generation is consistent with the transportation study and to confirm that the preferred option mitigation measures are adequate.
Parking surveys	To confirm current parking supply and demand and to determine whether adjustments (up or down) may be required.
Classified counts	To verify the relative impact of the development on the surrounding transportation system or to gauge the effectiveness of measures implemented to encourage a shift to walk, bicycle, or public transport modes.
General Observations	To identify whether any reported local traffic or safety issues are related to the project and need to be remedied.
Behavioral surveys	To understand why transportation facilities delivered by the project are being over- or under-used relative to the identified mode share targets.

3.7.11 Transportation Study Report

A transportation study report is required for ATS, DTS, and LTS transportation studies. The title of the transportation study report shall reflect the study type.

The transportation study report shall be prepared after the preceding stages have been formally completed, or as agreed with MOT.

For completeness, the transportation study report shall provide concise summaries of the deliverables from preceding stages. However, the main emphasis should be on the results of the Stage 6 multimodal impact analysis and assessment. The preferred option design drawings (**Section 3.7.12**) shall be submitted with the transportation study report.

The transportation study report shall contain, as a minimum, the items listed in **Table 3-12** for the appropriate transportation study level.

Table 3-12: Transportation Study Report Minimum Content

Chapter	Content	ATS	DTS	LTS
1. **Introduction**	• Project description.	✓	✓	✓
	• Project location map.	✓	✓	✓
	• Site plan and layout.	✓	✓	✓
	• Executive summary of methodology report.	✓	✓	✓
	• Proposed land uses (using QTGPRM classification).	✓	✓	✓
	• Development phasing.	✓		
2. **Study Area**	• Derivation and description of study area.	✓	✓	✓
3. **Existing Conditions in Study Area**	• Description of existing land uses (using QTGPRM classes).	✓	✓	✓
	• Description of existing roadways and intersections.	✓	✓	✓
	• Inventory of existing public transport facilities.	✓	✓	
	• Inventory of active travel facilities.	✓	✓	
	• Directional peak hour traffic volumes/turning flows/delays/levels of service, etc.	✓	✓	
4. **Project Traffic**	• Estimated project trip generation (design hour), trip distribution, and traffic assignment, including the derivation of each.	✓	✓	✓
5. **Future Background Traffic**	• Estimated background (non-project) traffic volumes within study area, including derivation.	✓	✓	
6. **Multimodal Impact Analysis**	• Summary of findings for the assessment scenarios detailed in the modeling report.	✓	✓	
7. **Site Circulation Issues**	• Findings.	✓	✓	
8. **Parking Analysis**	• Findings.	✓	✓	✓
9. **Conclusions and Recommendations**	• Summary of preferred option and ability to achieve the agreed study objectives.	✓	✓	✓
10. **Appendices**	• Preferred option design drawings, including site access connections, parking ramps, internal road networks, and external road networks, as appropriate.	✓	✓	✓
	• Model output and calculation sheets.	✓	✓	
	• Proposed site travel plan.	✓		

3.7.12 Preferred Option Design Drawings

MOT will review all design elements relating to development traffic. Swept path analysis design vehicles shall be agreed with MOT in advance. Proposed drop-off/pick-up areas and gated entries shall be clearly marked on the design drawings and accompanied by a 95th percentile queue length analysis prepared in accordance with MOT requirements. It shall be the responsibility of the designer to ensure that all final design drawings have been reviewed by a qualified road safety auditor prior to construction. Each drawing shall be signed by an MM-registered engineer.

Design drawings, rendered at a scale agreed with MOT, shall be submitted as appendices to the transportation study report. Off-site design elements shall satisfy the requirements of *Qatar Highway Design Manual* (QHDM), *Qatar Traffic Control Manual* (QTCM), and/or other references agreed with MOT. Sample drawings are provided in. **Appendix F** The items listed in **Table 3-13** are likely to be needed.

Table 3-13: Transportation Study Report Design Drawings

No.	Drawing Contents	ATS	DTS	LTS
1.	Development plans, including building footprints, primary uses, building entrances, and proposed development phasing.	✓	✓	✓
2.	External road layouts covering the full study area and clearly identifying proposed geometric changes.	✓	✓	✓
3.	Design drawings for new or modified external intersections.	✓	✓	✓
4.	Parking location and layout plans (including separate plans for each floor, where basement or structured parking is proposed), including total parking spaces, accessible parking spaces, provision for electric vehicles, bicycle parking, and allocation of parking spaces by building, land use, or user group, as appropriate.	✓	✓	✓
5.	Drawings of site access connections and associated sight distances.	✓	✓	✓
6.	Access and routing plans for emergency and service vehicles.	✓	✓	✓
7.	Signage and pavement marking drawings (internal roads and site access connections).	✓	✓	
8.	Roadway cross sections (before and after) for roads requiring mitigation and roadway cross sections for representative internal roads.	✓	✓	
9.	Site circulation, operation plan, drop-off/pick up operation, and access plan.	✓	✓	
10.	Swept path analysis for roads identified by MOT (design vehicles to be agreed in advance with MOT).	✓	✓	
11.	Pedestrian access and circulation plans in accordance with QHDM Volume 3, Part 19, Chapter 2.	✓		
12.	Bicycling layout plans, including proposed routing, in accordance with QHDM Volume 3, Part 19, Chapter 3.	✓		
13.	Public transport layout plans, including stop locations, lay-bys, waiting facilities, dedicated road markings or signage, and proposed vehicle routing, in accordance with QHDM Volume 3, Part 19, Chapter 4.	✓		

3.7.13 Stage 6 Submissions

The draft transportation study report shall be submitted, together with a completed **Form E** (**Appendix E**), to MOT for review. MOT review comments will be communicated to the Consultant. The Consultant shall address all MOT review comments and incorporate appropriate changes into a revised transportation study report for further MOT review and/or approval. One hard copy of the approved transportation study report shall be submitted to the MOT archive department.

The target MOT review period for each submitted transportation study report is 30 business days after receipt. Additional time may be required for larger or more complex projects.

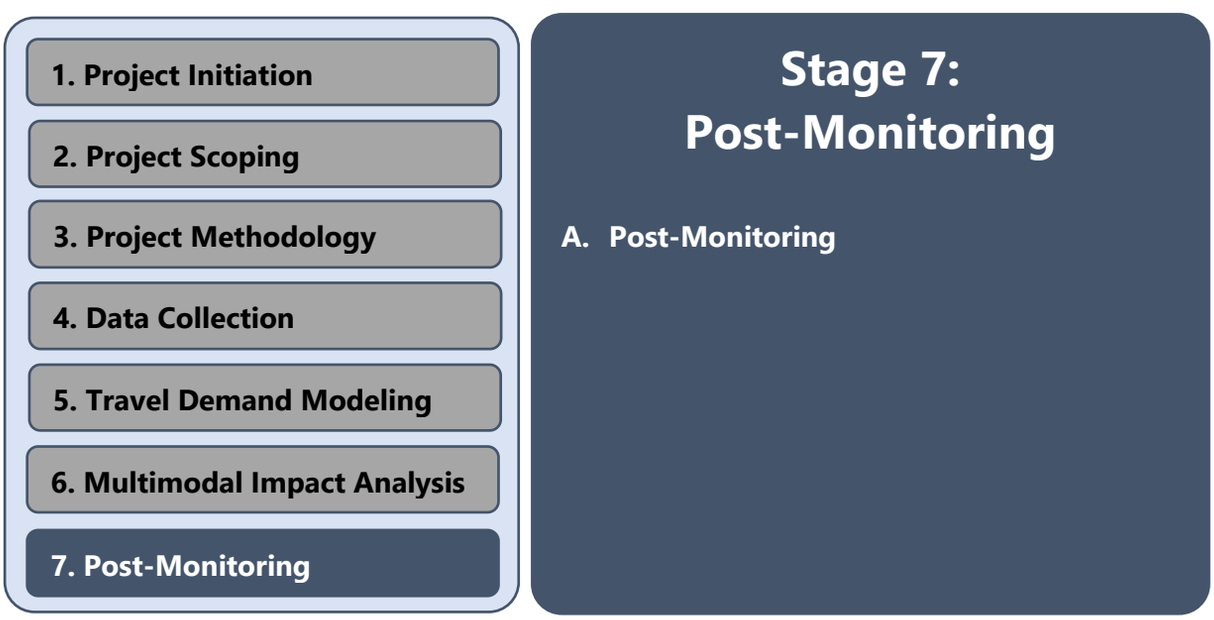
3.7.14 Conclusion of Stage 6

Stage 6 will be concluded when the following tasks have been completed:

1. MOT has formally approved the transportation study report.
2. A copy of the approved transportation study report has been submitted to the MOT archive department.

3.8 Stage 7: Post-Monitoring

Mandatory for ATS.



3.8.1 Post-Monitoring

During the agreed post-monitoring period, annual reviews shall be undertaken based on the approved site travel plan. The first annual review shall be completed no sooner than one year and no later than 13 months after the official opening of the development. Each subsequent annual review shall be completed no sooner than one year and no later than 13 months after completion of the previous annual review.

Each annual review shall be submitted to MOT in the form set out in the approved site travel plan, together with a completed copy of **Form G** (**Appendix E**).

Each element of the post-monitoring review shall result in one of the four outcomes listed in **Table 3-14**.

Table 3-14: Recognized Annual Review Outcomes

Outcome	Description
1	Trigger point for one or more mitigation measures has been reached and the mitigation measure(s) shall be implemented.
2	Additional or alternative mitigation measures are required and shall be implemented.
3	Trigger point for one or more mitigation measures has not been reached and implementation of the mitigation measure(s) is not required at this stage.
4	Trigger point for one or more mitigation measures unlikely to be reached and the mitigation measure(s) shall no longer be required.

3.8.2 Conclusion of Stage 7

The post-monitoring stage shall not be completed until the post-monitoring period defined in the approved site travel plan has elapsed, all intermediate annual reports have been received and approved by MOT, and all obligations or conditions attached to the transportation study approval and the approved site travel plan have been either honored by the developer or rescinded by MOT.

Conclusion of Stage 7 will be formalized through the issuance by MOT of a Non-Objection Certificate (NOC).

APPENDIX

A

Data Collection for a Transportation Study

Appendix A Data Collection for a Transportation Study

A.1 Recording Existing Conditions

The Consultant shall provide data sufficient both to describe existing conditions and to support required analysis. Typical data gathering tasks are presented in **Table A-1**.

Table A-1: Typical Data Gathering Tasks for an ATS or DTS

Survey Method	Indicative Scope
Pre-survey desktop review	Collate and review previous traffic studies, survey reports and/or traffic counts relevant to the Study Area, as-built infrastructure drawings, and any existing topographic surveys. Please refer to Section A.1.1 of this appendix for a list of suitable organizations to contact.
Site reconnaissance/ inspection survey	Inspection of the project site and surrounding road network and transport systems to familiarize study team members with the study area and to gain a sound understanding of current operational conditions. Georeferenced photographs to be supplied with the data collection report as supporting evidence.
Topographic survey	Where necessary, a new topographic survey may be required to establish the current road network geometry and gradients, the site boundary lines, and to identify the location of utilities.
Existing facilities inventory	Inventory of existing public transport services and facilities, pedestrian activity levels and facilities, and bicycling activity levels and facilities.
Traffic/travel surveys	Surveys to identify peak hours of travel demand and to quantify peak travel patterns inside the study area. These shall be conducted in accordance with the guidance provided in Section A.1.2 of this appendix.

Site reconnaissance/inspection surveys should be attended by the senior modeler and the field data collection supervisor.

Data typically required for an ATS or DTS are listed in **Table A-2**. Data mandated for an ATS or DTS are indicated with a **Y** in the final column. The level of detail at which data are recorded should be proportionate to the scale and scope of the proposed development. For inventory data georeferenced photographs will often suffice if features are clearly identified in the data collection report and accompanied by a suitable narrative.

Table A-2: Typical Data Requirements for an ATS or DTS

Study Element	Typical Data Requirements	Mandatory
Traffic	Identification of peak hours and peak hour volumes.	**Y**
	Count adjustment factors (e.g., weekday/seasonal adjustment factors, peak hour factors).	**Y**
	Peak hour turning movements.	**Y**
	Traffic composition (e.g., trucks, buses, cars).	**Y**
	Queues at critical intersections.	**Y**
	Saturation flow rates at critical intersections.	**Y**
	Peak hour traffic speeds.	**N**
	Volume of right-turn-on red traffic (absolute and relative).	**N**
Control Devices	Inventory of traffic control devices (Signal-controlled intersections shall be classified as follows: fixed phase; vehicle-actuated variable phase; pedestrian/bicyclist-actuated variable phase; or coordinated).	**Y**
	Inventory of traffic signs and pavement markings.	**N**
	Traffic signal data including phasing, movement, timing.	**N**
Roadway	Roadway geometry and lane use (including approximate lane widths and size and nature of medians, where present).	**Y**
	Driveways serving sites adjacent to or surrounding the site.	**Y**
	Adjacent land use(s).	**Y**
	Location of key facilities (healthcare centers, schools, food stores etc.)	**Y**
	Posted speed limits.	**Y**
	Safety hazards (including low bridges, obstructions, roadside feature, etc.)	**Y**
	Road safety features (such as speed tables, low speed zones, chicanes, roadway narrowing, crash barriers etc.)	**Y**
	Parking supply inventory.	**Y**
	Public transport stops.	**Y**
	Public transport service patterns and timings.	**Y**
	Inventory of footways and pedestrian crossing facilities (including street lighting, where present).	**Y**
	Key pedestrian desire lines.	**Y**
	Inventory of bicycle facilities (including on-road bicycle lanes, dedicated bicycle tracks, bicycle crossings, and bicycle parking/storage).	**Y**
	Key bicyclist desire lines.	**Y**
	Pedestrian volumes.	**N**
	Bicyclist volumes.	**N**
	Parking regulations and pricing regimes.	**N**
	Pavement condition, including shoulders, presence of soft sand, etc.	**N**
	Road gradient.	**N**
	Sight distances.	**N**
Other	Travel time surveys.	**N**
	Origin/destination surveys.	**N**

All data collection shall be conducted as advised in the TMPQ Survey Methodology Binder (Book Three, Volume 2).

Data requirements for parking and microsimulation modeling are covered in **Section A.2.5** and **Section A.2.6** respectively.

Data requirements for a study shall be agreed with MOT during Stage 2 for an LTS, and during Stage 3 for an ATS or DTS.

A.1.1 Existing Third-Party Data

For any transportation study, the Consultant should first check whether recent data/ information relating to the study area or to current or proposed developments affecting the project site is already available. To assist in this it is recommended that the agencies listed in **Table A-3** be contacted.

Table A-3: Authorities to be Contacted for Data to Support a Transportation Study

Ministry of Transport
Ministry of Municipality
Ministry of Interior
Ashghal
Private Engineering Office
Mowasalat
Qatar Rail
Supreme Committee for Delivery and Legacy
Qatari Diar
Qatar Petroleum
Mwani Qatar
Civil Aviation Authority and Hamad International Airport
Utility companies

Data received from third parties shall be reviewed by the Consultant and documented in the submitted data collection report, identifying the data that will be used for the transportation study.

A.1.2 Current Data

Current data (no more than 12 months old) shall be used. Any corrections or factors that are applied by the Consultant shall be explained and justified in the data collection report. Adjustments should be based on observed variations determined from current (no more than 12 months old) time series analysis of data for similar roadways in comparable environments.

The *Transportation Planning and Traffic Analysis Parameters for Qatar* (TPTAPQ) manual is the recommended source for such factors.

A.2 General Survey Requirements

A.2.1 Prior to Survey

The Consultant shall submit location maps for all proposed surveys. The survey maps shall be supplied in shapefile format (*.shp) using the QND95/Qatar National Grid (EPSG:2932) projection.

The Consultant shall submit a schedule of the proposed survey dates, identifying any public holidays, planned special events, or major roadworks/closures known to coincide with the survey program. Unless otherwise directed by MOT, surveys shall not be scheduled to take place during such events or during the week preceding or the week following them.

A.2.2 Timing of Surveys

Where new surveys are needed, they should be carried out on one or more representative weekdays. A representative weekday is defined as any Monday, Tuesday, or Wednesday that does not coincide with any of the following:

1. School holiday periods
2. Holiday periods/festivals
3. Major events/incidents

Surveys may be carried out on days other than a representative weekday, as directed by MOT.

Surveys limited to peak periods should coincide with the peak periods defined in the QSTM:

i. AM peak 0600 – 0900
ii. MD peak 1200 – 1600
iii. PM peak 1600 – 2000

Since the peak hour of the generator may fall outside of these times and/or outside of standard weekday conditions, the required analysis period for the project will need to be agreed with MOT in advance of undertaking new surveys.

A.2.3 During Survey

The Consultant shall ensure that all traffic surveys are adequately supervised and that suitable QA/QC checks are applied at all survey stages.

To allow independent scrutiny and to allow the data to be incorporated into the MOT Transportation Data Management System (TDMS), electronic copies of the raw data shall be submitted to MOT at the same time as the data collection report. Raw data shall be delivered in the format specified in the TDMS User Guide.

A.2.4 General Traffic Count Reporting Requirements

Minimum traffic count reporting requirements for the data collection report are defined in **Table A-4.** The contents of the data collection report shall be agreed with MOT as part of the Stage 3 methodology report.

Table A-4: Standard Reporting Requirements for Traffic Counts

Reference	Report Item
1	A digital map in shapefile format (*.shp) projected to QND95/Qatar National Grid (EPSG:2932) showing roadway and intersection geometry within the study area, road names, directional peak hour traffic volumes (both adjusted/unadjusted, where applicable), turning movement volumes, and the percentage of each vehicle class.
2	A diagram showing the vehicle classification scheme used.
3	For each peak period, the following traffic count data shall be presented in tabular form showing 15-minute summaries: • Peak period volumes, by travel direction and vehicle class. • Peak period volumes, total two-way. • Peak traffic hour for each peak period, calculated as the highest four consecutive 15-minute volumes within each peak period, taken across all surveyed roads. • Peak hour volumes and vehicle classifications, by travel direction. • Peak hour queue lengths. • Peak hour factor, by travel direction.
4	Where traffic data have been collected over more than a single day, the following summary data shall be provided: • Average weekday traffic (5 days, Sunday through Thursday). • Average weekend traffic (2 days, Friday and Saturday). • Daily traffic volumes, by day and average. • Peak hour traffic volumes, by day and average.
5	Adjustment factors derived from or applied to the raw traffic count data shall be reported.
6	Where required, the following speed data shall be reported for each roadway segment identified by MOT: • Posted speed. • 85^{th} percentile speed. • The proportion of vehicles exceeding the posted speed. • Weekend mean speed.
7	Graphs of daily traffic profiles at each survey site, by travel direction, both for each individual vehicle class and for all vehicle classes combined.

A.2.5 Parking Surveys and Studies

There are three main types of parking data collection commonly used to support a transportation study:

- Parking supply inventories
- Parking accumulation counts
- Parking duration and turnover surveys

Guidelines for conducting parking surveys and studies are provided in the *Qatar Parking Master Plan* (QPMP).

A.2.6 Data Requirements for Microsimulation Models

Where microsimulation modeling is used for a transportation study, the data shown in **Table A-5** will usually be required. The precise data requirements shall be agreed with MOT as part of the Stage 3 methodology report.

Table A-5: Indicative Data Requirements for Microsimulation Models

Major Category	Data Type
Network Data	Links including georeferenced start and end points.
	Link lengths.
	Number of lanes for each link.
	Lane drops and lane gains.
	Restricted access lanes.
	Loading/unloading bays and on-street parking bays.
	Deceleration/storage length provided for turn lanes.
	Connectors between links to model turning movements.
	Position of signal heads/stop lines.
Traffic Volume Data	Through and turning traffic volumes.
	Vehicle composition.
	Vehicle lengths.
Vehicle and Driver Performance Characteristics	Saturation flow rates.
	Average vehicle spacing/gap acceptance.
	Vehicle acceleration and deceleration rates.
	Queue lengths.
Speed Data	Desired speed.
	Right turning and left turning vehicle speeds.
	Reduced speed areas.
Signal Control Data	Cycle length.
	Offsets.
	Phase sequence.
	Phase duration.
	Priority rules.
Calibration Data	Traffic throughput (counts).
	Section travel time.
	Average link speed.
	Average queue length.
	Maximum queue length.
Public Transportation and Pedestrians	Bus frequencies, boarding, and alighting.
	Bus stop locations, dwell times.
	Bus occupancy.
	Pedestrian flows and crossing distances.
	Frequency of calls at pedestrian signals.

ATCs and TMCs shall be conducted as advised in the TMPQ Survey Methodology Binder (Book Three, Volume 2). Traffic counts upstream/downstream of one another that do not match to within ±10 percent will need to be reviewed and, where necessary, adjusted. Where they cannot be reconciled, those considered to be the least reliable shall be removed from the analysis. It may be acceptable to average counts from nearby sites provided they have first been adjusted to bring them to a common seasonal base.

Differences in counts due to the presence of intervening traffic sinks/sources (such as parking lots) will need to be reconciled unless they have been coded in the model (and input/output flows assigned to them based on the differences in the adjacent count values).

APPENDIX

B

Transportation Study Modeling Requirements

Appendix B Transportation Study Modeling Requirements

B.1 Choice of Modeling Software for a Transportation Study

Modeling that may be needed to support a transportation study in the State of Qatar includes:

1. **Strategic modeling** – using QSTM or as advised by MOT
2. **Microsimulation modeling** – using Vissim and, in some cases, input from QSTM

Use of the Qatar Strategic Transportation Model (QSTM) is mandated for every ATS. Although a Consultant preparing a DTS may not need to use QSTM directly, the Consultant shall provide sufficient information to MOT to enable MOT to incorporate the project in periodic QSTM updates. The information shall be provided in the modeling report and in the transportation study report, although MOT reserves the right to request further information if necessary.

Vissim microsimulation models may be required for more complex studies (ATS or DTS), particularly for those involving novel mitigation measures or where there is significant interaction between adjacent traffic intersections within the project study area.

B.2 Using QSTM

B.2.1 Overview of QSTM

QSTM is the national transport model, developed to support the design and testing of policy and strategy options forming part of the Transportation Master Plan for Qatar (TMPQ). QSTM is regularly updated by MOT to ensure that the base year model faithfully reflects present operating conditions, and that the future year models are consistent with the latest development approvals and national planning projections.

To reflect important differences in household behavior, the demand model divides the population into segments by nationality, gender, income, age, and car availability. For each of those person groups, a series of hourly trip chains and activities spanning a representative working day has been defined. There are 11 land use categories including work, education, leisure, and personal trips.

The trip distribution and mode choice stages consider both desired travel times (determined from the person group activity schedules) and modeled travel costs. These are fed back iteratively from the network assignment stages to the demand model during a full model run.

In the highway assignment stage, road vehicles are divided into six user classes:

- cars.
- school buses.
- company buses.
- restricted heavy vehicles.
- permitted heavy vehicles.
- single unit trucks.

The coding provides for restricted access areas, parking charge zones, and area-based congestion pricing schemes. Toll road options may be coded as additional link-based costs.

The public transport assignment stage includes representations of bus, light rail, heavy rail, and metro, each operating to a simplified timetable. Public transport fares are represented in the demand model, at the mode choice stage.

The following three peak periods are covered in the assignment stages:

1. AM peak 0600 – 0900
2. MD peak 1200 – 1600
3. PM peak 1600 – 2000

Further details of the QSTM components and their underlying assumptions can be found in the technical reports relating to the latest version of QSTM.

B.2.2 Using QSTM for a Transportation Study

The following sections provide a brief overview of the main steps involved in using QSTM for a typical ATS. Detailed instructions on how to use QSTM for a transportation study are provided in the QSTM User Guide.

Whenever QSTM is used, the Consultant shall liaise with the MOT regularly throughout the modeling stage to ensure that all requirements are met in full, and that all key assumptions are approved.

B.2.2.1 *Modeling Milestones*

Suitable modeling milestones shall be identified in the methodology report. **Table B-1** lists indicative modeling milestones.

Table B-1: Indicative Modeling Milestones

Milestone	Description
Study Area Coding	Completion of zone disaggregation inside the agreed study area (including adjustments to zone connectors and network stubs (dummy links for conducting zonal demand)) and updates to the QSTM demand model.
Base Year Coding	Completion of updates to the coding of the QSTM assignment stages and any base year partial recalibration/validation that may be required.
Future Year Coding	Completion of the coding of future year networks, prior to identification of the preferred option, all updates to QSTM, and the calibration/validation steps and results.
Initial Model Runs	Completion of the initial QSTM model runs for each agreed model year and development of forecast person- and vehicle-trip volumes by mode.
Preferred Option	Completion of the final model runs and development and assessment of the preferred option, accompanied by the draft modeling report.

Note that, at the discretion of the Consultant, an intermediate draft modeling report may be submitted for MOT review upon completion of any of the identified milestones.

B.2.2.2 *Principal Modeling Steps Using QSTM*

1. **Model Scoping and Methodology.** The project study area and model forecasting years shall be agreed with MOT as part of *Stage 2: Project Scoping* and shall be recorded in the minutes of the project scoping meeting. The test scenarios, modeling software, modeling approach, and reporting requirements shall be agreed with MOT in *Stage 3: Project Methodology* and shall be documented in the methodology report.

   Update QSTM Demand Model. Updates to the QSTM demand model shall be reviewed and applied, as required, to the future year models (and in some cases to the base year models).

   i. Disaggregate the QSTM zones (and associated planning data) and refine the network coding within the study area to a level of detail suitable for assessing operational traffic performance and impacts (including rerouting effects).

   ii. Review the proposed land uses and development quantities and assign each element to the relevant model zones.

   iii. Estimate population and employment for the study area (including agreed third-party developments) and update the QSTM planning input files.

   iv. Run the QSTM demand model and confirm the results with MOT.

   v. Update the QSTM coding for the agreed model years, as agreed with MOT.

   vi. If base year model calibration/validation is required, proceed to Step 2. Otherwise proceed to Step 3.

2. **QSTM Base Year Calibration/Validation (where required).** Review and apply required QSTM updates and conduct base year model calibration/validation for the study area:
    i. Review and update network coding.
    ii. Refine the intersection coding for the project site access connections.
    iii. Code appropriate public transport network connections.
    iv. Generate the updated road and public transport network files.
    v. Calibrate/validate the base year model for the study area using the project field data. Update the future year models to reflect changes following calibration/validation.
    vi. Evaluate the performance statistics agreed with MOT (traffic volumes, roadway and intersection volume/capacity ratios, modal splits, directional splits, etc.)
3. **With- and Without-Project Model Runs**
    i. Run the Without-Project scenarios for the agreed model years (full model run) and evaluate the performance statistics agreed with MOT.
    ii. Run the With-Project scenarios for the agreed model years (full model run) and evaluate the performance statistics agreed with MOT.
    iii. Assess the impact of the project within the study area.
    iv. Develop, code, and test candidate mitigation measures using the QSTM (assignment stages only).
    v. Discuss initial findings with MOT and agree on a Preferred Option.
4. **Evaluation/Refinement of the Preferred Option**
    i. Code the agreed Preferred Option mitigation measures, rerun the model(s), evaluate the performance statistics agreed with MOT, and refine the Preferred Option, as necessary.
    ii. Where a Vissim model is used, depending on the scale of mitigations proposed, it may be necessary to update the coding and intersection parameters in QSTM based on the findings of the Vissim tests, and to then rerun QSTM (generally only the assignment stages) to check for potential rerouting effects. MOT will advise accordingly. If QSTM forecasts significant reassignment or redistribution, then new sub-area assignment matrices will need to be generated, the Vissim model rerun, and the performance statistics re-evaluated. For larger or more complex projects multiple iterations of these steps may be needed.

B.2.3 General Considerations when using QSTM for a Transportation Study

B.2.3.1 *Zone Disaggregation*

For larger ATS projects, it will be necessary to modify the QSTM zone structure (e.g., to reflect the population/employment forecasts and land use changes for the proposed new development).

In general, zone disaggregation is likely to be needed both for the project site and adjacent zones. Any changes to the zone structure (in particular, changes to existing and proposed access connections for any approved developments inside the study area), shall be accompanied by a detailed review of zone connectors to ensure consistency with the increased spatial resolution.

B.2.3.2 *Adjustments to the Network Coding*

Third-party development zones should ideally be defined so that they require only a single zone connector. This may necessitate disaggregation of the supplied zones. Where more than one zone connector is coded, development trips should be assigned evenly to each connector, unless detailed information on the nature of the modeled developments and their trip distribution/traffic assignment is known (e.g., from an approved transportation study).

For project development sites with an internal road system, the development zones should load onto the internal road system. Where only perimeter access is envisaged, development demand should be loaded equally onto each adjacent external link. The distribution may be refined as part of mitigation testing.

Where model zones need to be disaggregated, the collector road network within the study area should be refined to ensure both realistic assignment of traffic inside the project site, and realistic loading of development traffic onto the surrounding main roads included in the study area.

Care should be taken to ensure that any zone connections to public transport stops/stations provided in the supplied model version are reinstated.

All newly created zones shall be drawn so that their boundaries may be verified using independent sources (digital mapping, aerial imagery, project plans, etc.)

Model development work submitted without the necessary supporting information may be rejected by MOT.

B.2.3.3 *Default Network Parameters*

Local Network Parameters

Unless otherwise agreed with MOT, the following model parameters shall be used:

1. 1,900 vph base saturation flow rate for intersection analysis
2. Link capacity
   - 2,000 vph for freeways/expressways
   - 1,800 vph for arterials
   - 1,000 vph for collectors
   - 800 vph for minor collectors
   - 500 vph local access roads
3. Turn lane capacity
   - 3,500 vph for three lanes
   - 2,500 vph for two lanes
   - 1,500 vph for single lane
4. 0.85 maximum degree of saturation
5. Traffic signal timings
   - 150 sec cycle length for major intersections
   - 120 sec cycle length for minor intersections
   - 4 sec amber
   - 2 sec all-red
6. Where classified counts have not been collected for the project, suitable truck percentages may be taken from *Transportation Planning and Traffic Analysis Parameters for Qatar* (TPTAPQ).

Further details on the default assumptions for QSTM are provided in the QSTM User Manual.

B.2.3.4 *Public Transportation Network*

For development sites that are within a 5 km radius of an existing or proposed metro or tram station and that do not already have bus services available within 400 m, a new feeder bus service shall be coded in the public transport assignment model. The new feeder bus service shall provide a direct (i.e., no transfer required) connection to the nearest station. Pedestrian connections shall be provided from each project site zone to the nearest bus stops. Assumed operating parameters are headways of 15 min, and operating speeds of 10 km/h for urban services and 20 km/h for express buses.

B.3 Microsimulation Modeling for a Transportation Study

When static capacity analysis methods are deemed to be inadequate, microsimulation modeling using Vissim may be proposed, at the discretion of the Consultant, to test intersections with significant traffic interactions or to demonstrate the suitability of novel highway designs or traffic control measures proposed as part of project mitigation.

The following advice relates specifically to the use of Vissim models in testing the Preferred Option(s) for the proposed project Opening and Horizon Year(s). But it is equally relevant to standalone models. Allowance will be made for the level of detail required to support the transportation study, as agreed with MOT during Stage 2 and Stage 3.

Detailed guidance is available in TRB (2011[6]), TfL (2010[7]), Dowling, Skabardonis, and Alexiadis (2004[8]) and in the latest PTV Vissim user manual.

B.3.1 Main Steps – Vissim

The main steps involved in creating a Vissim microsimulation model for a transportation study are outlined below:

1. **Confirmation** of project purpose, scope, and approach.
2. **Site visits** performed by the Consultant prior to setting the data collection plan.
3. **Data Collection** to support coding of the microsimulation model and for model calibration/validation.
4. **Coding of the model** to incorporate the field data.
5. **Error Checking** to verify the accuracy of the coded input data.
6. **Calibration/Validation** to adjust the default behavioral assumptions to match local conditions and to confirm the extent to which this has been achieved.
7. **Option Testing** to assess the operational performance of proposed mitigation measures.
8. **Documentation** of the assumptions, analytical steps, and key findings in the project modeling report, including as a minimum (The information provided should be sufficient to enable decision makers to understand the conclusions and to allow enable replication of the model results):

6 TRB, 2011. Dynamic Traffic Assignment: A Primer, [online]. Available at: http://onlinepubs.trb.org/onlinepubs/circulars/ec153.pdf [Accessed 7 August 2019]
7 TfL, 2010. Traffic Modelling Guidelines: TfL Traffic Manager and Network Performance Best Practice, [online]. Available at: http://content.tfl.gov.uk/traffic-modelling-guidelines.pdf [Accessed 7 August 2019]
8 Dowling, Skabardonis, and Alexiadis, 2004. Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software. Federal Highway Administration.

i. Data collection sources and methods specific to the Vissim modeling.

ii. Vissim base year model calibration/validation results.

iii. Future year assumptions inherited from QSTM, and any modifications made by the Consultant.

iv. Description of the preferred option, as modeled in Vissim.

v. Vissim model results for the required planning years.

B.3.2 Extent of Vissim Model

The links and intersections to be included in a Vissim model shall be agreed with MOT prior to beginning the microsimulation modeling.

B.3.3 Site Visits

When microsimulation modeling is used, the modeler shall conduct site observation surveys for each period to be modeled for the following reasons:

1. To allow the modeler to become familiar with general traffic conditions and the surrounding environment.
2. To confirm the accuracy of as-built drawings.
3. To understand current traffic behavior, capacity, and safety.
4. To confirm the suitability of the proposed extent of the microsimulation model.
5. To aid in checking and interpreting data collected for the study or supplied by third parties.
6. To collect any additional calibration data needed to ensure that current driver behavior is reflected in the base year model.

Site visits may be supplemented (but not replaced) by site video recordings, both as a memory aid for the modeler and to allow independent verification of model assumptions.

B.3.4 Choice of Peak Hour

The peak hours modeled in Vissim should match those adopted in the QSTM unless the peak hour of the generator differs markedly from the peak hour of the adjacent street.

Appropriate simulation warm-up and cool-down periods shall be used to ensure that the peak hour models are fully loaded and that all simulation vehicles are able to discharge at the end of the simulation period. The length of the warm-up and cool-down periods should be determined after the network has been built and an initial analysis of the modeled areas has been carried out, although typically 15 minutes is adequate for both. The applicable peak

hour factor (PHF) should be determined from local survey data but is likely to fall in the range of 0.80 - 0.90.

B.3.5 Traffic Assignment Method

The assignment method (static or dynamic) to be used for the microsimulation model and any modifications to the default Vissim parameters needed to better reflect local driver behavior (e.g., gap acceptance, lane changing, vehicle composition, standstill distance, car following distance) should be agreed with MOT prior to beginning the microsimulation modeling. At least five simulation iterations shall be run using a range of initial seeds and the outputs averaged.

B.3.5.1 *Static Assignment*

This is the preferred approach for most studies since it provides an acceptable level of forecasting precision without undue coding or calibration effort.

Where the Vissim model network is of sufficient size to encompass genuine route choices, demand matrices and static traffic routes shall be derived from QSTM. If the Vissim geometry is subsequently modified (e.g., to improve or refine the preferred option) then the routes may need to be rebuilt.

B.3.5.2 *Dynamic Assignment*

The use of dynamic assignment is not recommended by MOT. Where the use of dynamic assignment is agreed prior to beginning microsimulation modeling the following requirements shall be met:

1. Traffic matrices should be imported from QSTM.
2. At least 20 model iterations shall be run and a travel time convergence of 15 percent or better shall be achieved.
3. The default values for Kirchhoff exponent, logit scaling, and logit lower limit shall not be changed.
4. The **Store cost**, **Search for new paths**, and **Store paths and volumes** options shall be selected in every run.
5. The **correction of overlapping paths** option shall be selected.
6. The use of the **virtual memory** option shall be selected.
7. The **Avoid long detours** option shall be selected to avoid consideration of routes longer than 2.5 times the shorter path alternative.
8. The Consultant shall discuss the use of the **scale volume to** option with MOT before carrying out model runs.

9. The Consultant should keep the default route guidance settings but, in agreement with MOT, edit the parking lot selection coefficients. The distance from desired zone parameter shall be set to 1.0 to ensure reasonable processing times. If any illogical routing behavior is observed, it shall be discussed with MOT.

B.3.6 Coding the Model

Even if the Vissim model has been developed from a sub-network extracted from QSTM, the Consultant will be required to code further detail to develop a workable model. This shall be done in accordance with the guidance contained in TRB (2011[9]), TfL (2010[10]), Dowling, Skabardonis, and Alexiadis (2004[11]) and in the latest PTV Vissim user manual.

B.3.7 Error Checking

Before proceeding to base year model calibration (where required), it will be necessary to ensure that data have been entered correctly. The Consultant should check that the most suitable version of the software is used (generally, but not always, the most recent including any updates) and that any known program bugs have been addressed. Guidance on appropriate checks are provided in TRB (2011[9]), TfL (2010[10]), Dowling, Skabardonis, and Alexiadis (2004[11]).

B.3.8 Future Year Model Development

After the base year model (where required) has been calibrated/validated and approved by MOT, the future year model shall be coded as follows:

1. **Geometry**
   - Should be updated based on the proposed layout alternatives and preferred mitigation option(s).
2. **Speed and Reduced Speed Areas**
   - Should be updated to match the geometry.
3. **QSTM Traffic Demand Matrices**
   - Should be used wherever possible.

[9] TRB, 2011. Dynamic Traffic Assignment: A Primer, [online]. Available at: http://onlinepubs.trb.org/onlinepubs/circulars/ec153.pdf [Accessed 7 August 2019]
[10] TfL, 2010. Traffic Modelling Guidelines: TfL Traffic Manager and Network Performance Best Practice, [online]. Available at: http://content.tfl.gov.uk/traffic-modelling-guidelines.pdf [Accessed 7 August 2019]
[11] Dowling, Skabardonis, and Alexiadis, 2004. Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software. Federal Highway Administration.

4. **Traffic Control**

   - Should reflect the proposed traffic control plans for the preferred option. Signal timing should be optimized using Synchro and then coded into Vissim.

5. **Driver Behavior Parameters**

   - The future year model shall inherit the driver behavior parameters defined in the base year model, except when QSTM forecasts a public transport share greater than 25 percent, in which case the appropriate settings shall be discussed with MOT.

6. **Assignment Procedures**

   - For static assignment, the assignment procedure parameters should be inherited from the base year model and the route shares adjusted as necessary.
   - Where new routes are introduced, depending on the scale of proposed change, Vissim dynamic assignment may be preferred.
   - Where dynamic assignment is used in the base year model, the same parameters shall be used for the future year model(s). The maximum number of paths to be generated between each origin-destination pair should be limited to no fewer than 20. The criterion for rejecting paths that have a total cost higher than the best path, should be set to 25 percent.

B.3.9 Advanced Microsimulation

Any advanced microsimulation methods, including the use of scripting, shall be discussed with MOT prior to its use.

The capacity of any gate systems (or similar flow regulators) that require coding should be calibrated with field measurements of comparable systems or based on peer reviewed literature.

B.3.10 Parking Microsimulation

Dynamic parking assignment (using abstract parking lots) may be used for parking areas with a capacity not exceeding 700 spaces. For larger parking lots, the use of dynamic parking assignment shall first be agreed with MOT.

B.4 Reporting Model Development

For projects requiring use of both QSTM and Vissim the modeling report should be structured so that each is covered in separate chapters. Information common to both (such as study

scope and objectives) shall be presented in introductory chapters, rather than being repeated throughout the report.

B.4.1 Model Description

This section shall describe essential information about the purpose and scope of the model, including the following:

1. A general description of the model.
2. The location or corridor being modeled and how the extent of the model was determined.
3. The time intervals being modeled (e.g., 1500-1600).
4. The purpose of the model.
5. The software version used.
6. The model completion date.
7. All changes to the default model parameters.

B.4.2 Description of Model Data

Data used to calibrate/validate the model should be presented in summary form (e.g., types of surveys, duration, time, day of week).

B.4.3 Model Network Checks

A summary of the network checks carried out and the main findings shall be provided. This should be accompanied by a screenshot showing the model area (distinguishing between external and internal areas) and the locations of all zone connectors.

B.4.4 Visual Representation of Model Elements

This section should provide a visual summary (using screenshots) of key components of the model including the following:

1. Any background imagery used to develop the model (with the model superimposed) including the scale.
2. Each key intersection (arterial) or interchange (freeway), in both regular and centerline views, with pavement markings shown (for Vissim/intersection models).

B.4.5 Inventory of Model Elements

This section should document the principal model components (as defined under the principal menu and sub-menu options used to define, initialize, and control the model). It should be presented as a series of graphical summaries with accompanying notes.

B.4.6 Calibration/Validation

The objective of model calibration/validation is to obtain an appropriate level of fit between modeled and observed system performance, taking into account the scale and nature of the development/scheme being represented and the degree of variability in observed study area conditions.

Base year calibration/validation will not be required for QSTM but may be required for Visum models derived from it.

For microsimulation models, general guidance can be found in the latest Vissim manual and more detailed advice in Dowling, Skabardonis, and Alexiadis (2004[11]).

B.4.6.1 *Calibration/Validation Strategy*

The recommended strategy is as follows:

1. Decide which model parameters are certain and which are uncertain and may need adjustment.
2. Carry out error checking to ensure all input parameters are correct.
3. Adjust global and link-specific capacity parameters.
4. Adjust global and link-specific demand and route choice parameters.
5. Incrementally refine the model to better match observed travel times, queue lengths, driving behavior, etc.

B.4.6.2 *Calibration/Validation Tests*

Indicative calibration/validation tests are provided in **B.4.6.3** and **B.4.6.4**. The extent to which these tests are met, shall be agreed with MOT prior to beginning microsimulation modeling.

Please note that Vissim output data cannot be replicated when a multicore processor is used. When conducting validation runs, the number of cores specified in the **Simulation Parameters** dialogue shall be set to one.

B.4.6.3 *Model Convergence*

For Vissim models, validation tests should not be run until the base model has achieved a suitable level of convergence, as shown by the following two conditions being met for each peak hour modeled:

1. 95 percent of all path traffic volumes change by less than 5 percent for at least four consecutive iterations.
2. 95 percent of travel times on all paths change by less than 20 percent for at least four consecutive iterations.

B.4.6.4 *Recommended Model Validation Criteria*

1. Modeled link/node capacity within 10 percent of field measurements.
2. Link volumes, for more than 85 percent of cases, to match the following:
    i. Within 100 vph, for volumes less than 700 vph
    ii. Within 15 percent, for volumes between 700 vph and 2,700 vph
    iii. Within 400 vph, for volumes greater than 2,700 vph
3. Link volumes, for more than 85 percent of cases, have a GEH statistic of less than 5 (GEH < 5).
4. Sum of link volumes to be within 5 percent and/or have a GEH < 4.
5. Modeled travel times and average travel speeds on surveyed routes to meet the following criteria:
    i. Average travel time to be within 15 percent or 1 standard deviation of the observed mean value, whichever is lesser.
    ii. Average travel speed to be within 15 percent or 1 standard deviation of the observed mean value, whichever is lesser.
6. Modeled mean and maximum queue lengths on key intersection approaches within ±20 percent of observed.
7. Visually acceptable on- and off-ramp queuing.
8. Visually acceptable lane utilization at any lane drop locations, on HOV lanes, etc.

B.4.6.5 *Model Sensitivity and Reasonableness Checking*

Model forecasts, particularly those involving novel mitigation measures (such as congestion charging or low emission zones) should be subject to sensitivity and reasonableness checking. Suitable guidance is provided in *Travel Model Validation and Reasonability Checking Manual*.[12]

B.5 General Reporting Requirements

Minimum reporting requirements for each of the recognized model types are given in **Table B-2**. The minimum reporting requirements should be provided for each forecasting scenario.

Table B-2: Minimum Reporting Requirements by Model Type

Performance Metric	QSTM/Visum	Vissim	Intersection Models
Link evaluation			
Operating speed (km/h)	Yes	Yes	Yes
Volume (vph)	Yes	Yes	Yes
V/C ratio	Yes	Yes	Yes
Density (veh/km/lane)	No	Yes	Yes
LOS	No	Yes	Yes
Junction evaluation			
V/C ratio	Yes	Yes	Yes
Degree of saturation	No	Yes	Yes
Average delay per vehicle (s)	Yes	Yes	Yes
Average queue length (m)	No	Yes	Yes
95th percentile queue length (m)	No	Yes	Yes
LOS	No	Yes	Yes
Route analysis			
Flow bundle analyses	Yes	No	No
A-B travel times	Yes	No	No

[12] TMIP, 2010. Travel Model Validation and Reasonability Checking Manual, Second Edition. Federal Highway Administration. Washington, USA. [online]. Available at: https://connect.ncdot.gov/projects/planning/TPB%20Training%20Presentations/FHWA%20Model%20Validation%20Handbook.pdf [Accessed 7 August 2019]

APPENDIX

C

Public Transport Accessibility Index

Appendix C Public Transport Accessibility Index

C.1 Public Transport Accessibility Index

The Public Transport Accessibility Index (PTAI) shall be used as a consistent measure of current and proposed levels of accessibility by Public Transport for a development site. It is calculated as explained below.

Note that some components of the PTAI are best computed using a geographic information system (GIS). An online route planner is likely to be less accurate, but could be used, provided it allows the user to specify walking as the access mode. Where GIS is used, the following information will be required:

- A walk network linking the main site entrance (this should be a building within the study site and not a perimeter gate) to nearby Public Transport Service Access Points (SAPs). The walk network will define the pedestrian catchment and is needed to calculate the walk times to all SAPs in the catchment. For Metro/LRT or rail the maximum walk distance is 800 m from the site entrance. For bus the maximum walk distance is 400 m. The walk network should include all unobstructed, publicly accessible pedestrian rights-of-way. The walk network should be stored in the GIS as a vector layer projected to QND95/Qatar National Grid (EPSG:2932).
- The location of each SAP in the pedestrian catchment area of the project site. SAP locations should be stored in the GIS as a point layer projected to QND95/Qatar National Grid (EPSG:2932).
- For each SAP, the peak hour operating frequency (in minutes) of all services that can be accessed from the SAP. The peak hour(s) should match the agreed analysis periods.

Only SAPs served by unique routes and/or public transport modes should be included in the calculations. If there are several SAPs within the pedestrian catchment, and all are served by the same public transport route (including services running in opposite directions), then only the stop or station nearest to the study site should be considered. For stops that are equidistant, the one with the higher service frequency should be used.

The PTAI calculation consists of the following seven steps (Steps 1-5 should be repeated for each eligible SAP):

Step 1. Walking Time(s) to SAP

The Walking Time is calculated by first determining the distance (in meters) between the SAP and the agreed study site entrance. The walking distance is then divided by the average walk speed of 75 m/min (4.0 km/h) to arrive at the estimated walk time in minutes. The calculated walk time may be reduced by 15% for routes that avoid road crossings or may be reduced by 20% for routes that avoid road crossings and are also step-free and shaded or climate-controlled.

Step 2. Service Waiting Time for each service available at the SAP

The Service Waiting Time needs to be calculated for each distinct public transport service accessible from the SAP.

Current service frequencies can be downloaded using the TDMS or obtained from Qatar Rail (Doha Metro) or Mowasalat (Karwa bus). Where they vary across the day or week the frequency reported for each of the study site analysis periods should be used.

The Service Waiting Time assumes a uniform distribution (i.e., people turn up at random to catch a bus or Metro) hence the mean waiting time will be exactly half the expected time between services (in minutes) = 0.5 x (60 ÷ Service Frequency).

Step 3. Average Waiting Time for each service at the SAP

The Average Waiting Time is a combination of the Service Waiting Time and a time penalty used to account for personal preferences between different travel modes. For bus services, a penalty of 1.5 minutes (90 seconds) is added, and for Metro services a penalty of 0.75 minutes (45 seconds) is added.

Step 4. Total Access Time for each service at the SAP

The Total Access Time for the SAP is the sum of the Walk Time and the Average Waiting Time in minutes.

Step 5. Equivalent Doorstep Frequency for each service at the SAP

The Equivalent Doorstep Frequency (EDF) converts the Total Access Time back to a service frequency. It is an estimate of the effective frequency, where the service stops directly outside the study site entrance. EDF = 0.5 x (60 ÷ Total Access Time). As with the previous steps, if there is more than one public transport service available at the SAP, then the EDF should be calculated separately for each one.

Step 6. Aggregate EDFs for each walkable SAP

Where there is more than one service available at an SAP, it is assumed that the one with the highest EDF will be the most popular (the primary service). It therefore contributes most to the final PTAI. To avoid potential double counting between overlapping routes, the EDFs of any other services available at the SAP are halved before being added to the EDF of the primary service.

Step 7. Calculate PTAI for the Study Site

The aggregate EDFs are then summed across all the walkable SAPs (where they are served by different routes and/or public transport modes) to obtain the PTAI. For a site with only one stop or station within walking distance, and which is served by a single public transport route, the PTAI will be equal to the EDF from Step 5.

APPENDIX

D

The Site Travel Plan

Appendix D The Site Travel Plan

D.1 Site Travel Plans

The sustainability goals of Qatar National Vision 2030 and the Qatar National Development Framework imply a need for closer integration between land uses and complementary travel modes.

The adoption of a site travel plan to provide adequate incentives and to monitor progress after the development becomes operational is one means of encouraging the desired integration of complementary travel modes.

The main components of a site travel plan are:

1. A set of realistic and measurable mode share targets.
2. A way to measure the achievement of those targets.
3. A robust monitoring framework.
4. Incentives (or disincentives) for achieving (or failing to achieve) the defined targets.

Progress toward the achievement of all targets documented in a site travel plan shall be monitored formally and reported annually, as explained in **Section 3.8** of this document.

D.2 Goals and Objectives

The main goal of a site travel plan is to encourage a net increase in the use of public transport and active travel modes, and a corresponding decrease in private car trips. This requires the identification and implementation of effective measures to achieve the following objectives:

1. Manage the demand for travel to/from the site.
2. Improve the availability and choice of travel modes to/from the site.
3. Reduce the number of vehicles attending the site, particularly single occupancy vehicles.
4. Provide minimum on-site car parking.
5. Promote increased use of bicycling, walking and public transport.
6. Promote integration between different transport modes.
7. Promote coordination between individual developments on larger sites.
8. Encourage positive changes in attitudes toward non-car travel.
9. Provide clear information to people traveling to/from the site on the available transport options.
10. Improve accessibility for non-car users and the mobility impaired.
11. Promote the development of a public transport system.

D.3 Preparatory Work

A site travel plan shall be fully integrated with the transportation study it supports. Similarly, the measures developed as part of the site travel plan shall be reflected in the final layout of the site or design of buildings submitted with the transportation study. Some consultation with other parties such as local transport providers may be required. Monitoring will be required to ensure that post-occupation trip generation is consistent with the transportation study estimates, as explained in **Section 3.8**.

D.4 Scope and Contents

The form and content of the site travel plan shall be consistent with the following:

1. The findings/outcomes of the transportation study.
2. The type and size of development.
3. The mix of land uses.
4. The location of the site in relation to surrounding services and facilities.
5. The accessibility of the site by public transport and active travel networks.
6. Existing travel patterns.
7. Existing highway capacity and safety considerations.

The main contents of a site travel plan shall be as listed in **Table D-1** and detailed in the subsections that follow.

Table D-1: Site Travel Plan Contents

Reference	Site Travel Plan Item
1	Site Information.
2	Objectives.
3	Travel Surveys.
4	Targets and Triggers.
5	Proposed Actions (Hard measures/Soft measures) and Implementation Program.
6	Site Travel Plan Coordinator.
7	Details of monitoring arrangements and roles and responsibilities of all parties relative to the site travel plan.
8	Remedies and enforcement procedures.

D.5 Site Information

a. Site address and a site location map at 1:2500 scale.
b. MOT reference number for the relevant transportation study.
c. Name and contact information of Consultant who prepared the site travel plan.
d. Description of the proposed development when fully operational.
e. Travel activities and people affected by the site travel plan. (For manufacturing, warehousing, and retail developments, the site travel plan shall cover the movements of delivery and service vehicles as well as staff and visitor movements. For education, retail, leisure, and sports developments, the site travel plan shall cover the travel needs of the students/shoppers/customers as well as staff).
f. Stakeholders to be consulted in preparing or executing the site travel plan.

D.6 Travel Surveys

a. Details of the travel surveys proposed to be used to identify baseline mode share and market potential for public transport and active travel modes, and details of the follow-up surveys proposed to be used to monitor progress over the life of the site travel plan (For new developments, travel surveys shall be conducted after the site becomes operational. For existing developments, baseline travel surveys shall be conducted prior to opening of each new phase or new building for which MOT approval is sought).
b. Baseline inventory of travel facilities (on-site/off-site).
c. Initial results of discussions with stakeholder organizations.
d. Issues identified through comparison of travel survey results and the conditions assumed/proposed in the transportation study, particularly where issues imply the need to revise the targets.

D.7 Targets and Triggers

Site travel plan targets should be challenging but realistic. They shall therefore be baselined against existing patterns of travel behavior, local geography, transport infrastructure, public transport provision, and the availability of parking on and near the site.

Initial targets may need to be based on the analysis used to support the transportation study. Initial targets should be reviewed prior to conducting the baseline travel surveys. However, when the end user of a development is known (for example a corporate headquarters building or an extension of an existing facility) surveys of existing users may be used to develop suitable targets.

Examples of suitable targets:

- Racks for 100 bicycles to be installed one month prior to opening.
- Parking provided on site shall not exceed 100 spaces.
- Dedicated site bus service to be provided with a minimum peak period service frequency of 5 vehicles per direction per hour.
- Number of vehicles entering the site shall not exceed 500 vehicles per hour.
- Average car occupancy of at least 1.8 persons per vehicle shall be achieved (averaged across all weekdays).
- Site visitor private car mode share shall not exceed 15 percent.

D.8 Proposed Actions

The core of the site travel plan will be a set of proposed actions for achieving the targets, together with a timetable for achieving them and a monitoring program for measuring their success. Actions may include a combination of both hard measures and soft measures.

D.8.1 Hard Measures

These include physical off-site and on-site infrastructure works needed to provide safe and convenient sustainable transport links. Typical hard measures include:

a. Footpaths or bicycle paths connecting to existing or planned external networks or to nearby public transport access points/interchanges.
b. Dedicated bus services.
c. Diverted bus services.
d. Employer/school transport services.
e. Intersection improvements.
f. New or enhanced roadway infrastructure.
g. New or enhanced public transport infrastructure.
h. Vertical/horizontal speed control devices.
i. The provision of safe crossing points for bicyclists and pedestrians.
j. The provision of reduced speed zones, safety treatments, parking restrictions, etc.

The site travel plan shall include specific proposals for preventing employee/student parking in spaces provided for visitors/customers. The site travel plan shall include specific proposals for addressing displacement of site-related parking onto surrounding streets. A site travel plan for concert, conference, and sports facilities shall include specific proposals to encourage shared travel to major events.

School travel plans are similar in nature to general site travel plans but are expected to place greater emphasis on road safety in and around the school site. Specific reference should therefore be made to the *Standard Process for Reviewing and Designing a School Zone*[13].

To ensure consistency and to maximize benefits that will accrue throughout the life of a site travel plan, proposed hard measures shall take into account relevant elements of the reference materials listed in **Section 2.2**.

D.8.2 Soft Measures

Site travel plans can only be effective if they are tailored to the site in question, realistic in what they attempt to achieve, and have the commitment and support of the management and employees of the organization occupying the site.

Soft measures are essentially marketing tools aimed at obtaining stakeholder buy-in and at maximizing the anticipated benefits of the proposed hard measures. Typically, soft measures include a mix of incentives to use desirable travel modes and disincentives for the use of undesirable travel modes. Incentives may be monetary or may be non-monetary, such as access priority, free or subsidized refreshments, changing and shower facilities, etc. Disincentives may be charges for car parking, locating car parking spaces further away from building access points than bicycle parking, giving pedestrians/bicyclists the right-of-way over internal roads, etc.

D.9 Site Travel Plan Coordinator

The site travel plan shall require the appointment of a Site Travel Plan Coordinator who will actively manage the site travel plan and monitor achievement of the agreed targets and compliance with conditions of approval. The Site Travel Plan Coordinator shall communicate progress with all relevant parties. The Site Travel Plan Coordinator should have sufficient seniority to influence staff travel behavior and should report directly to senior management.

D.10 Monitoring and Review

Monitoring and review of the site travel plan will be formally managed by the Site Travel Plan Coordinator in line with the mechanisms agreed during Stage 6 of the study. The Site Travel Plan Coordinator will be required to regularly report site travel plan progress and achievements to the stakeholders identified in the site travel plan.

[13] De Roos, 2015. Standard Process for Reviewing and Designing a School Zone. Ashghal. Doha, Qatar.

The site travel plan shall clearly identify the organizational arrangements and resources that will be committed to monitor, achieve, and review the targets set out in the plan throughout its life. The site travel plan shall define the roles and responsibilities of all parties to the agreement.

Depending on the nature of a development, a site travel plan might be of limited duration, or it might run for the entire life of the development. In general, MOT will expect the developer to introduce sustainable travel support measures from occupancy of the first unit to beyond occupancy of the last.

D.11 Remedies and Enforcement

The site travel plan shall include appropriate remedies that will be enforced as outlined in the approved site travel plan. The remedies may include, but not be limited to:

a. Financial contributions toward increased public transport provision
b. The introduction of workplace parking charges
c. Restrictions on occupation of part of the development until a specified element of the site travel plan has been implemented
d. Provision of employee transport
e. Highway infrastructure improvements.

In some cases, a financial commitment to achieve the targets outlined in the site travel plan may need to be imposed and secured by a bond. The site travel plan shall clearly identify the conditions that would warrant enforcement of the identified remedies.

APPENDIX

E

Forms

Appendix E Forms

E.1 Form A: Transportation Study Application Form

(Mandatory for ATS, DTS, and LTS)

Form A: Transportation Study Application Forms (Part 1 of 3)					
		PROJECT INFORMATION (MOT TO COMPLETE)			
		Project Name:			
		Project ID:			
		Reviewer:			
		Date Submitted:			
APPLICANT TO COMPLETE				Compliant?	Document Reference
Check	Signature	**Transport Consultant Information**			
		1	Consultant Name:		
		2	Consultant Liaison Person:		
		3	Contact e-mail: Telephone: Fax:		
Check	Signature	**Developer Information**			
		4	Developer Name:		
		5	Developer Contact Person:		
		6	Contact e-mail: Telephone: Fax:		
Check	Signature	**Development Information**			
		7	Municipality: Zone: Plot Number:		
		8	Site Location Map *(please attach copy)*		
		9	Project Opening Date: **DD-MM-YYYY**		

Form A: Transportation Study Application Forms (Part 2 of 3)					
APPLICANT TO COMPLETE				Compliant?	Document Reference
		10	Has an Application for this Site been Submitted before? **Yes/No** *(delete as applicable)*		
		11	Has the Development been Approved by MME? **Yes/No** *(delete as applicable)* If **Yes**, please provide MME reference:		
		12	Relevant Municipal Spatial Development Plan(s):		
		13	Relevant Zoning Regulations:		
		14	Development Schedule *(please attach copy using QTGPRM Land Use Classes)*		
		15	Initial Peak Hour Traffic Estimate *(please attach copy using QTGPRM Land Use Classes)*		
		16	Site Layout Plan *(please attach copy)*		
Check	Signature	**Parking Demand and Supply**			
		17	Initial Parking Demand Estimate/Provision *(please attach using QTGPRM Land Use Classes)*		
		18	Parking Lot(s) Plan *(please attach copy cross-referenced to demand estimates)*		

Please submit to MOT 3 hard copies and 1 soft copy of each document

SIGNATURES			
Project Role	Date	Name	Signature
Consultant Liaison			
Consultant PM			
MOT Liaison Engineer			

E.2 Form B: Project Methodology Report Submission Form

(Mandatory for ATS, DTS)

Form B: Project Methodology Report Submission Form (Part 1 of 2)					
	PROJECT INFORMATION (MOT TO COMPLETE)				
	Project Name:				
	Project ID:				
	Study Type:	ATS o DTS o			
	Reviewer:				
	Date Submitted:				
APPLICANT TO COMPLETE				Compliant?	Document Reference
Check	Signature	**Development Information** *(figures/tabulations/explanatory text)*			
		1	Location of Proposed Project		
		2	Name(s) of Owner(s)/Contact Details		
		3	Planned Project Start and Completion Dates		
		4	Development Schedule *(table referencing QTGPRM)*		
		5	Site Plan/Layout		
		6	Initial Peak Hour Traffic Estimate		
		7	Initial Parking Demand Estimate/Provision		
Check	Signature	**Known Issues/Problems** *(figures/tabulations/explanatory text)*			
		8	Descriptions/Maps/Implications		
Check	Signature	**Modeling Approach** *(figures/tabulations/explanatory text)*			
		9	Assessment Years Opening Year: Horizon Year(s):		
		10	Study Area *(map and description)*		
		11	Cordon Boundary *(where applicable)*		
		12	Modeling Approach/Analyses for Existing Situation		
		13	Modeling Approach/Analyses for Assessment Years		

Form B: Project Methodology Report Submission Form (Part 2 of 2)					
APPLICANT TO COMPLETE				Compliant?	Document Reference
Check	Signature	**Data Collection** *(figures/tabulations/explanatory text)*			
		14	Third Party Data to be Reviewed		
		15	Planned Surveys *(location maps, types, timetable, etc.)*		
Check	Signature	**Key Assumptions** *(tabulations/explanatory text)*			
		16	Reported and Explained *(e.g., % Heavy Vehicles/Internal Capture Rate/Pass-By Trips/Mode Share)*		
Check	Signature	**Appendices**			
		17	Building Permit Application and Relevant Responses		
		18	Prior Approvals and Supporting Documents		
Please submit to MOT 3 hard copies and 1 soft copy of each document					
SIGNATURES					
Project Role		Date	Name		Signature
Consultant Liaison					
Consultant PM					
MOT Liaison Engineer					

E.3 Form C: Data Collection Report Submission Form

(Mandatory for ATS, DTS)

Form C: Data Collection Report Submission Form					
	PROJECT INFORMATION (MOT TO COMPLETE)				
	Project Name:				
	Project ID:				
	Study Type:	ATS o DTS o			
	Reviewer:				
	Date Submitted:				
APPLICANT TO COMPLETE				Compliant?	Document Reference
Check	Signature	**Third Party Data** *(figures/tabulations/explanatory text)*			
		1	Key Findings, Sources, and Proposed Uses		
Check	Signature	**Project Surveys** *(figures/tabulations/explanatory text)*			
		2	Plan(s) with Survey Date(s) and Survey Type		
		3	Site Conditions, General Observations, etc.		
		4	Correction Factors Applied *(e.g., seasonal variation)*		
		5	Data Quality Checks and Findings		
		6	Survey Data Summaries with Key Statistics		
		7	Interpretation of Results and Benchmarking		
Check	Signature	**Design Traffic Hours/Design Flows for Project** *(figures/tabulations/explanatory text)*			
		8	Reported and Explained		
Please submit to MOT 3 hard copies and 1 soft copy of any document					
SIGNATURES					
Role		Date	Name	Signature	
Consultant Liaison					
Consultant PM					
MOT Liaison Engineer					

E.4 Form D: Modeling Report Submission Form

(Mandatory for ATS, DTS)

Form D: Modeling Report Submission Form					
	PROJECT INFORMATION (MOT TO COMPLETE)				
	Project Name:				
	Project ID:				
	Study Type:	ATS o DTS o			
	Reviewer:				
	Date Submitted:				
APPLICANT TO COMPLETE				Compliant?	Document Reference
Check	Signature	**Introduction** *(figures/tabulations/explanatory text)*			
		1	Model(s) Used and for Which Tasks		
		2	Study Area		
		3	Assessment Years/Scenarios		
		4	Vehicle Types and Peak Periods/Hours Modeled		
Check	Signature	**Base Year Modeling** *(where applicable - figures/tabulations/explanatory text)*			
		5	Base Year Networks *(screenshots, tabulations, text)*		
		6	Calibration/Validation Data and How Used		
		7	Updates to QSTM *(where applicable)*		
		8	Calibration/Validation Results *(plots, tabulations, etc.)*		
Check	Signature	**Future Year Modeling** *(figures/tabulations/explanatory text)*			
		9	Future Year Networks *(screenshots, tabulations, text)*		
		10	Future Year Demand *(project and non-project)*		
		11	Model Reasonableness Checks *(where applicable)*		
		12	Input/Output Summaries for All Scenarios		
Please submit to MOT 3 hard copies and 1 soft copy of each document					
SIGNATURES					
Role		Date	Name	Signature	
Consultant Liaison					
Consultant PM					
MOT Liaison Engineer					

E.5 Form E: Transportation Study Report Submission Form

(Mandatory for ATS, DTS, and LTS)

Form E: Transportation Study Report Submission Form (Part 1 of 2)					
		PROJECT INFORMATION (MOT TO COMPLETE)			
		Project Name:			
		Project ID:			
		Study Type:	ATS o DTS o LTS o		
		Reviewer:			
		Date Submitted:			
APPLICANT TO COMPLETE				Compliant?	Document Reference
Check	Signature	**Introduction** (figures/tabulations/explanatory text)			
		1	Location Map of Proposed Project		
		2	Name(s) of Owner(s)/Contact Details		
		3	Planned Project Start/Completion and Phasing		
		4	Development Schedule *(referencing QTGPRM)*		
		5	Site Plan/Layout		
		6	Executive Summary of Methodology Report		
Check	Signature	**Study Area** *(figures/explanatory text)*			
		7	Study Area/Cordon Boundary *(where applicable)*		
Check	Signature	**Existing Conditions** *(figures/tabulations/explanatory text)*			
		8	Existing Land Uses		
		9	Existing Roadways/Intersections		
		10	Current Public Transport Provision		
		11	Current Provision for Pedestrians		
		12	Current Provision for Cyclists		
		13	Peak Hour Traffic/LOS/Delays, etc.		
Check	Signature	**Project Traffic** *(figures/tabulations/explanatory text)*			
		14	Expected Project Traffic *(Design Hour)*		
		15	Project Traffic Distribution/Assignment		

Form E: Transportation Study Report Submission Form (Part 2 of 2)					
APPLICANT TO COMPLETE				Compliant?	Document Reference
Check	Signature	**Future Background Traffic** *(figures, tabulations, text)*			
		16	Expected Non-Project Traffic *(with derivation)*		
Check	Signature	**Impact Analysis** *(figures, tabulations, text)*			
		17	Summary Findings for all Assessment Scenarios		
		18	Site Circulation *(key findings)*		
		19	Parking Analysis *(key findings)*		
Check	Signature	**Appendices**			
		21	Concept Design Drawings		
		22	Site Circulation and Access Plan		
		23	Model Outputs/Calculation Sheets		

Please submit to MOT 3 hard copies and 1 soft copy of each document

SIGNATURES			
Role	Date	Name	Signature
Consultant Liaison			
Consultant PM			
MOT Liaison Engineer			

E.6 Form F: Site Travel Plan Submission Form

(Mandatory for ATS)

Form F: Site Travel Plan Submission Form (Part 1 of 1)					
	PROJECT INFORMATION (MOT TO COMPLETE)				
	Project Name:				
	Project ID:				
	Study Type:	ATS o			
	Reviewer:				
	Date Submitted:				
APPLICANT TO COMPLETE				Compliant?	Document Reference
Check	Signature	**Site Travel Plan Contents**			
		1	Site Information		
		2	Plan Goals and Objectives		
		3	Travel Surveys		
		4	Proposed Actions		
		5	Targets and Triggers		
		6	Site Travel Plan Coordinator		
		7	Monitoring Arrangements		
		8	Remedies and Enforcement		
Please submit to MOT 3 hard copies and 1 soft copy of any document					
SIGNATURES					
Role		Date	Name		Signature
Consultant Liaison					
Consultant PM					
MOT Liaison Engineer					

E.7 Form G: Annual Monitoring Review Submission Form

(Mandatory for ATS)

Form G: Annual Report Submission Form (Part 1 of 1)					
	PROJECT INFORMATION (MOT TO COMPLETE)				
	Project Name:				
	Project ID:				
	Study Type:	ATS o			
	Reviewer:				
	Date Submitted:				
APPLICANT TO COMPLETE				Compliant?	Document Reference
Check	Signature	**Monitoring Period** *(in years)*			
		1			
Check	Signature	**Start Year** *in the following format YYYY*			
		2			
Check	Signature	**Current Year** *in the following format YYYY*			
		3			
Check	Signature	**Contents**			
		4	Summary of Outcomes from Previous Review *(where applicable)*		
		5	Performance Measures for Current Year		
		6	Comparison with Previous Year(s)		
		7	Required Actions Completed		
Check	Signature	**Date of Next Review** *in the following format YYYY*			
		8			
Please submit to MOT 3 hard copies and 1 soft copy of any document					

SIGNATURES			
Role	Date	Name	Signature
Consultant Liaison			
Consultant PM			
MOT Liaison Engineer			

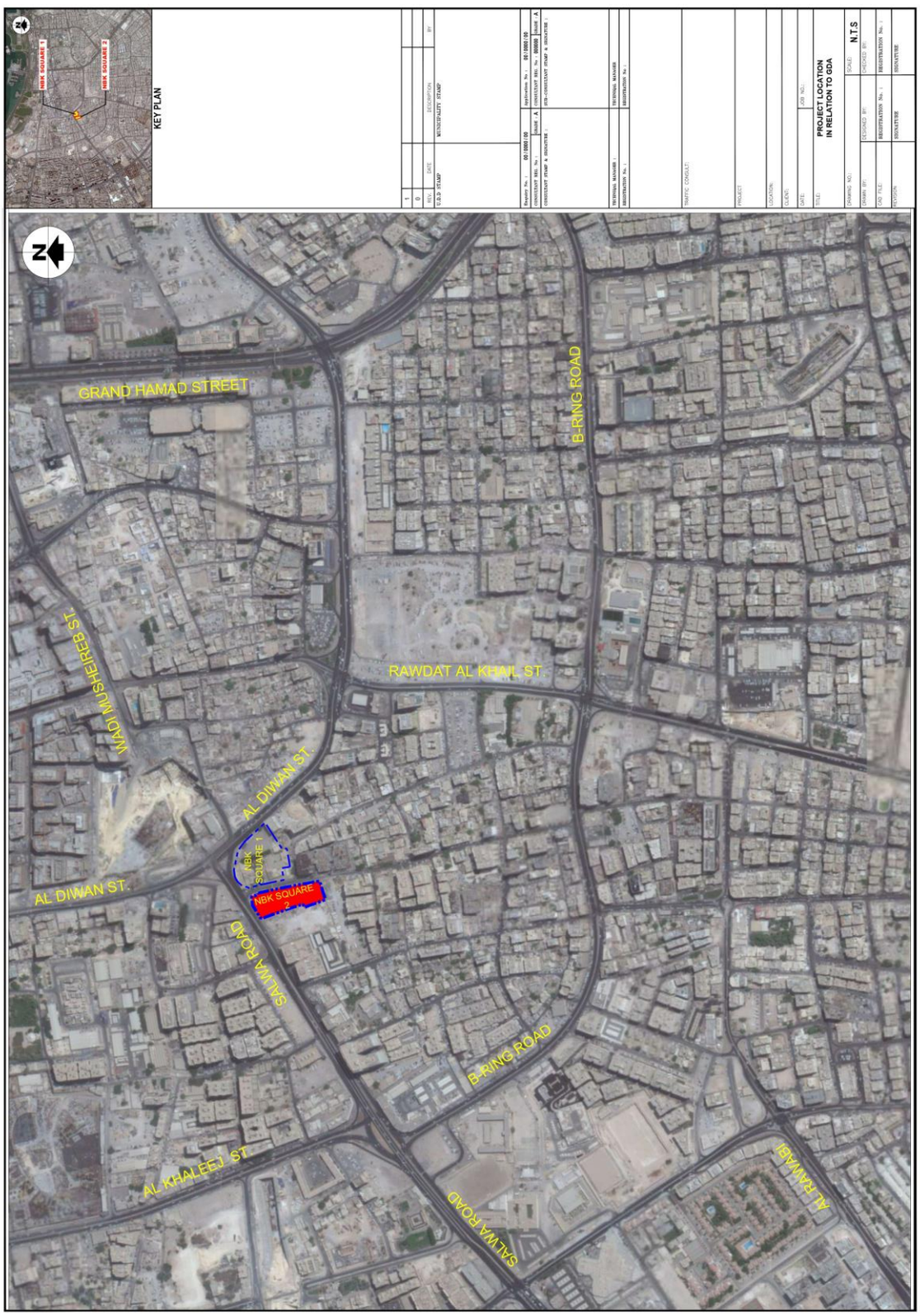
APPENDIX

F

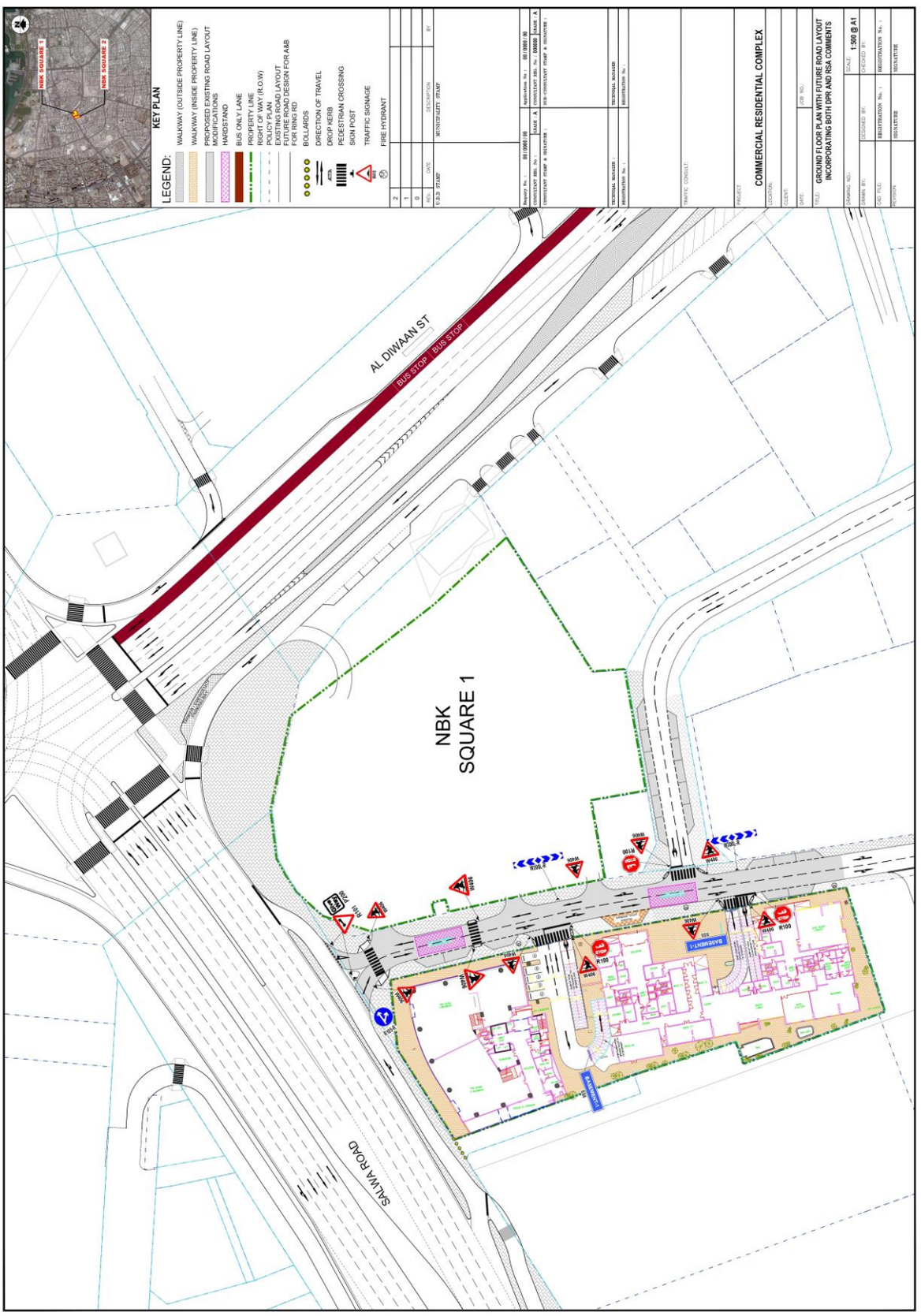
Example Drawings

Appendix F Example Drawings

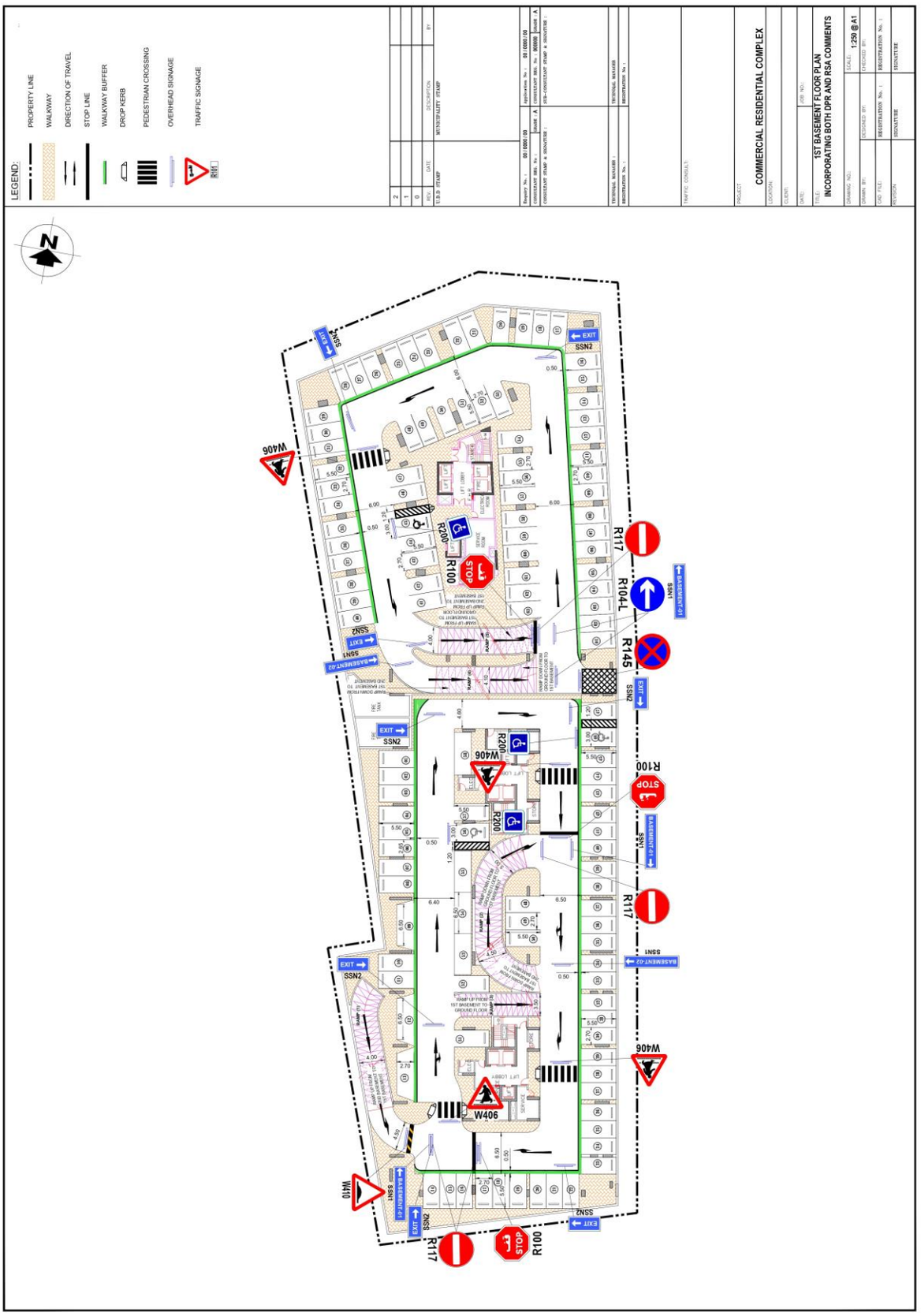
F.1 Example Site Location Map



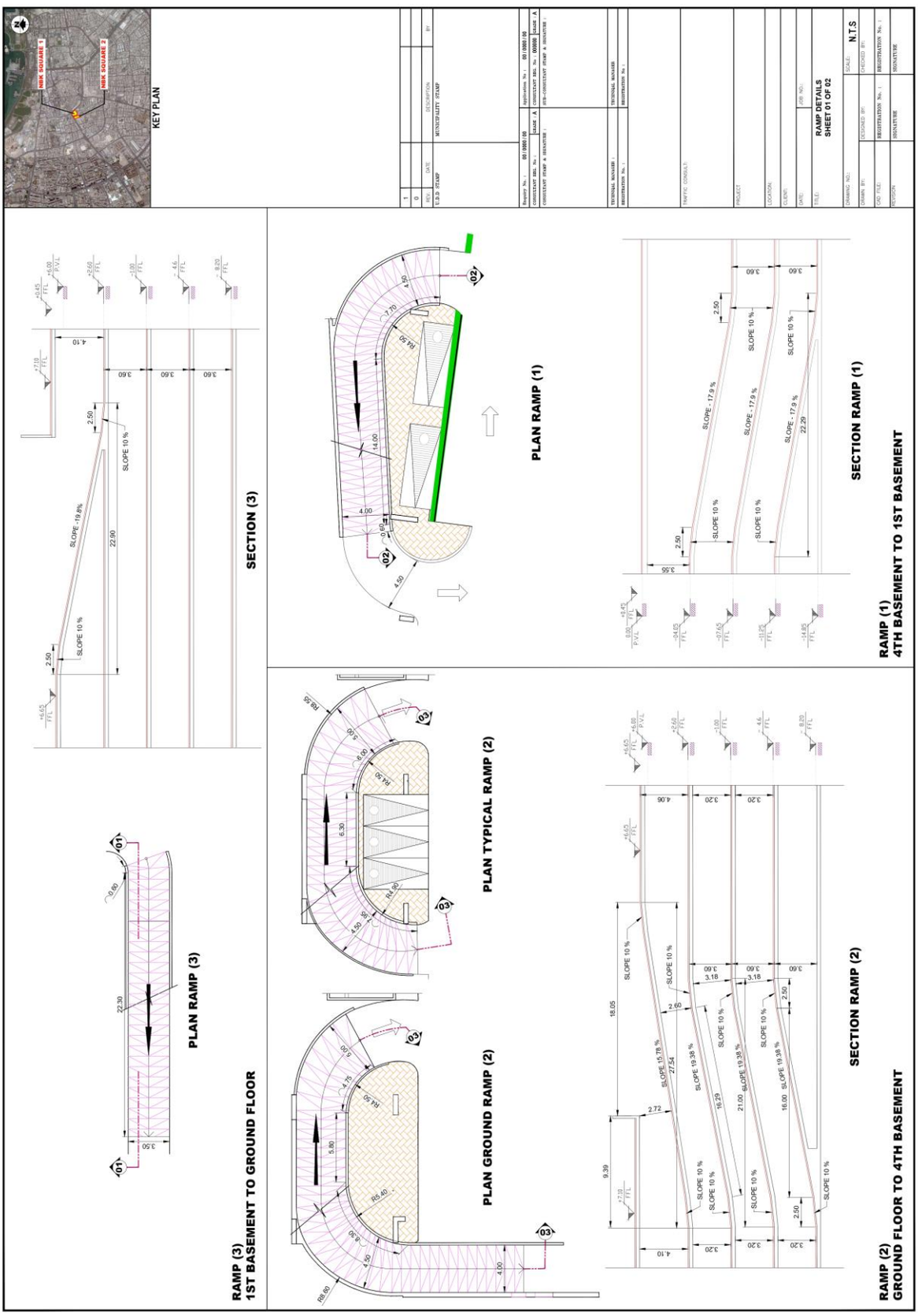
F.2 Example Access and Circulation Plan



F.3 Example Parking Layout Plan



F.4 Example Cross Section Layout



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