

## Concept Design of Major Roads and Infrastructure in the Center of Doha City: Phase 4 project

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### ABSTRACT

Doha, the Capital City of Qatar. A cosmopolitan, diverse and ever-growing international hub in the Arabian Gulf. It's recent and continuous rapid expansion necessitates the careful planning of its roads infrastructure. This challenging task is been managed by the Ministry of Transport & Communications (MOTC). The Ministry's Land Transport Sector has developed the Concept Design of Roads & Infrastructure for Phase 4 Project which includes Design of Haloul Road" as Package 26 and Design of C-Ring Road, D-Ring Road, Al Muntaza Street, Al Mansura Street, Najma Street, Rawdat Al Khail Street, Al Khalidiya Street and Airport Street as Package 27. Following a detailed study, the Land Transport Planning Department (LTPD) developed a solution that provides optimum mobility, safety, accessibility and efficiency of traffic movement in and around the project area by assessing and designing public realm improvements which will provide additional traffic capacity to accommodate the city's future growth, as well as improve the urban environment through a series of landscaping enhancements.

**Keywords:** Land transport; Highway design; Public realm; Safety; Traffic

### 1 INTRODUCTION

Several main and vital roads within Doha Metropolitan Area are currently experiencing delay and operating close to or beyond their capacity during peak hours due to congestion and traffic volume increase now and years to come. The shortage in existing road parking and the discontinuity of footways, unsafe pedestrian crossings and cycle paths, and poor urban environment are also contributing to the current problem.

The purpose of the project is to assess and design a major public realm improvement that works within the city of Doha, which will provide additional traffic capacity to accommodate the city's future transport growth and improve the urban environment through a series of landscaping improvements. These objectives can be achieved by improving the subjects shown in the following figure (1):

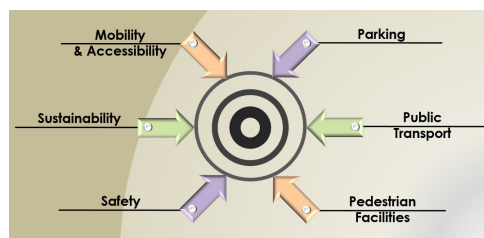


Figure 1: Phase 4 Project Objectives

The Ministry of Transport & Communications (MOTC), Land Transport Planning Department (LTPD)'s method of planning and design of roads is a global, comprehensive approach that considers several dimensions, such as serving road users from motorists, pedestrians and cyclists and ensuring sustainable road network, emphasizing urban design and parking improvements, optimizing use of public transport, protecting the environment, and upgrading infrastructure. One of the many concept design projects managed by Land Transport Planning Department (LTPD), Ministry of Transport and Communications (MOTC), is: "Phase 4 project – Concept Design of Major Roads and Infrastructure in the Center of Doha City" which consists of two packages as shown on Figure (2):

- Package 26 – Design of Haloul Road.
- Package 27 – Design of Major Roads in the Center of Doha City.

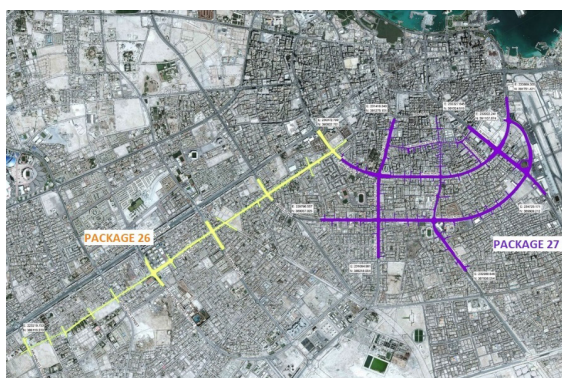


Figure 2: Phase 4 Project (Package 26 and Package 27)

## 2 PROJECT DESCRIPTION

Phase 4 project consists of two packages:

- Package 26 – Design of Haloul Road corridor between Ain Khaled Street in the southwest and C-Ring Road in the northwest, parallel to the Salwa Road Expressway. The total length of the proposed improvement is approximately 8.60kms and the proposed junction improvements at 14 locations (3 major junctions & 11 minor junctions)
- Package 27 – Design of Roads in the Center of Doha including the C and D Ring Roads, Al Mansoura, Al Muntaza, Najma, Al Khalidiya and Al Matar Streets. The Total length of the proposed improvement is approximately 20.45kms and the Junction improvements at 18 key junction locations (7 major junctions & 11 minor junctions).

## 3 PROJECT STAGES AND DEVELOPMENT OF DESIGN

The project is undertaken in the following three stages:

### 3.1 Stage – 1: Investigations and Studies:

The following investigations and studies were carried out to form the basis for the development of design options:

### 3.1.1 Topographic Surveys.

3.1.2 Transport Studies: A comprehensive traffic assessment study was carried in order to analyze the impact on the transportation system, which considered all future developments within and around the project area. The Transport Investigation and Study included the following:

- a. Traffic Surveys
- b. Land Use Survey
- c. Strategic Modeling
- d. Traffic Impact Assessment Analysis

### 3.1.3 Ground Investigations

### 3.1.4 Hydrological and Drainage Studies

### 3.1.5 Environmental Impact Assessment

### 3.1.6 Urban Design and Landscape related survey data

### 3.1.7 Utilities Investigations and Assessment

## 3.2 Stage – 2: Development of Concept Design Options:

During the first stage of the project, several road design options were developed following the (MOTC, 2015), Qatar Highway Design Manual (QHDM, 2015). After careful assessment, the following three design options were finalized:

### 3.2.1 Options Development:

- a. Option (1) Full Traffic Demand Design: This option is to meet all the traffic demand requirements.
- b. Option (2) Constrained Design: This option considers all network constraints, including Qatar Rail, highway boundaries, buildings, Private lands, and developments.
- c. Option (3) Balanced option: This design uses the information and understanding derived from the options 1 and 2 analysis in order to arrive at a balanced option which considers traffic requirements and constraints equally.

### 3.2.2 Options Evaluations:

The three (3) best possible options were shortlisted considering key features, advantages, disadvantages, impact on services, preliminary estimated costs, accessibility to side roads and private properties, impact on the right of way etc. Further a qualitative assessment was carried out to select the preferred option as presented in the following figure (Figure 3).

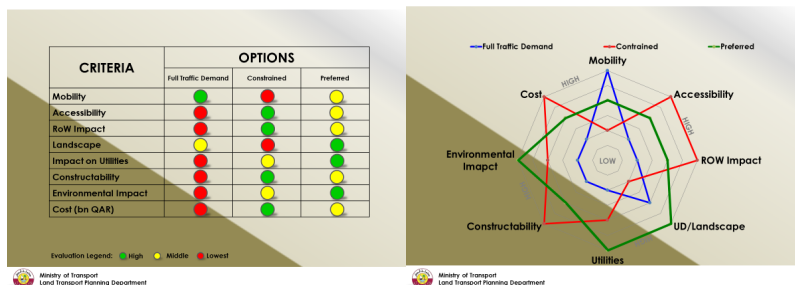


Figure 3: Qualitative Assessment of Three Options

### 3.2.3 Selection of Option:

Balanced Design (blended between constrained and full traffic demand) was recommended as preferred option to proceed to the next stage, which is the Concept Design.

### **3.3 Stage (3) Development of Concept Design for Preferred/Recommended Option:**

Based on the selected option layout, further detailed traffic assessment study and analyses were carried out. This helped to refine and validate the design using VISSIM micro-simulation modelling, weave and ramp analysis using Highway Capacity Manual (HCS) and additional Synchro junction modelling. The detailed Transport Study included VISUM modelling (QSTM, 2013), traffic circulation and connectivity, parking study, pedestrian and cyclist study (GPTS, 2011).

### **3.4 Project Design Considerations**

While developing the concept design layout and profile, the design team undertook several refinements to the design with paying more attention to minimize the land acquisition without affecting the level of service (LOS) of junctions and corridors (GPTS, 2011), avoid/minimize departures from design standards, improve accessibility, increase parking, improve traffic safety, provide pedestrian accessibility with safety, enhance landscaping, and to minimize impact to existing utilities.

### **3.5 Other Project Design Components**

In addition to the geometric layout and profile, the project included other components that are needed to cover all aspects of road concept design such as geotechnical, earthwork, surface water drainage, foul sewerage and treated effluent (TSE), road signs and markings (QTCM, 2015), road safety audit (RSA), street lighting, structure, construction phasing strategy, pavement, intelligent transport systems (ITS), traffic signal, and urban and landscape design.

## **4 CONCLUSION**

The Phase 4 project – Concept Design of Major Roads and Infrastructure in the Center of Doha City is a major part of Doha as envisioned in the year 2031 successfully planned and delivered by the Ministry of Transportation and Communications. The completed design improved performance when compared to reference case by improving road capacity and travel time 38%- 46%, improving pedestrian facilities by proposed 16no's at grade pedestrian crossing at signals and one (1) grade separated pedestrian crossing, maximizing the parking by proposing on-street parking at six (6) locations and off-street parking at two (2) locations, maximizing the landscaping, foot paths, planting areas and pedestrian shade provisions, improving accessibility and circulation in the project area, mapping and integrating the utilities impacts with appropriate solutions, improving the traffic safety and efficient traffic operations, and improving and enhancing the urban environment.

## REFERENCES

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