Assignment Title: Final Design and Tender Document Preparation for the Greater Beirut Public Transport Project-Northern Corridor

Reference No.: NA

The Lebanese Republic (hereinafter called “Borrower”) has negotiated for financing in the amount of 295 million US Dollars, expected to be from the International Bank for Reconstruction and Development (IBRD) (the “Bank”) in the form of a “loan” (hereinafter called “loan”) toward the cost of the Greater Beirut Public Transport Project (GBPTP)-Northern Corridor. The Council for Development and Reconstruction (CDR), an implementing agency of the Client, intends to apply a portion of the proceeds of this loan to eligible payments under the contract for which this Request for Expressions of Interest is issued. Eligible payments will be made by the the Bank. Payments by the Bank will be made only at the request of the Lebanese Republic and upon approval by the Bank, and will be subject, in all respects, to the terms and conditions of the loan agreement.

The project covers the alignment on the highway from Beirut to Tabarja as shown in the attached Terms of Reference.

The objective of the assignment is the provision of consultancy services to provide design consultancy services relating to the Greater Beirut Public Transport Project for carrying out such duties and responsibilities as are described in the Terms of Reference of the design consultancy services. The objective will be to ensure that the works are carried out to a high standard of workmanship and materials, as scheduled and within budget, in accordance with the specifications and drawings of the Contract, to acceptable environmental standards and in accordance with the Employer’s requirements.

The CDR now invites eligible consulting firms (“Consultants”) to indicate their interest in providing the Services. Interested Consultants should provide information demonstrating that they have the required qualifications and relevant experience to perform the Services. The short listing criteria are: (Consultants brochures, description of similar assignments, experience in similar conditions, availability of appropriate skills among staff and so forth). More details on the Supervision Services are provided in the attached Terms of Reference.

Consultants may associate with other firms in the form of a joint venture or a sub Consultancy to enhance their qualifications. In case of a Joint Venture, the partners should be equally experienced for such assignment.
Council for Development & Reconstruction

Shortlisted Consultants will be invited to submit their proposals, upon which a Consultant will be selected in accordance with the (QCBS) method set out in the “Procurement Regulations for IFP Borrowers”, July 2016- Revision of November 2017.

Further information can be obtained at the address below during office hours (9:00 AM to 2:00 PM).

The Deadline for receiving EOIs is to be on Friday March 8th, 2019 at 12:00 PM Beirut local time.

Expressions of Interest must be delivered to the address below by hand or carrier. Consultants have to submit one original EOI and two copies.

Address:
Council of Development and Reconstruction (CDR)
Tenders Department
City: Beirut
P.O Box: 11 - 3170
Beirut - Lebanon
Telephone: (+961-01-980096)
Facsimile number: (+961-01-981255)
TERMS OF REFERENCE – TOR

Final Design and Tender Document Preparation

For

Northern Greater Beirut area Public Transport Project

Draft version

December- 2018
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1 INTRODUCTION

Beirut is facing severe traffic congestion. Car dependency is very high with an almost inexistent transit system. Car dependency brings other big issue that is space for parking. Drivers use any available space for parking, including highway shoulders, sidewalks and double lane parking. Enforcement is in general very weak but there are some exceptions: BCD area and the main arterials in Beirut.

Taxis, vans and buses provide transit services to the population. There are no established routes. Anyone who wants to operate can ask for a vehicle plate and start running wherever he wishes. This procedure is under the responsibility of Traffic Management Organization (Ministry of Interior). After registration, the owner of the red plate should present an application to DGLMT (Ministry of Public Works & Transport) in order to receive final approval. This is for all legal operators. Naturally, on higher demand routes, there is some organization by the operators and they have their own rules to solve conflicts.

To face congestion, authorities are considering investing in transit.

![Figure 1: BRT Alignment](image)

The work includes:

- Data Collection
- Preliminary Design
- Traffic Management Plan
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- Final Design
- Tender documents for Construction
2 BACKGROUND

Several studies were made to improve public transportation, evaluating bus and rail alternatives.

<table>
<thead>
<tr>
<th>Year</th>
<th>Study</th>
<th>Responsible</th>
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<tbody>
<tr>
<td>1995</td>
<td>Greater Beirut Transportation Plan</td>
<td>Council of Development and Reconstruction (CDR)</td>
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<tr>
<td>2002</td>
<td>Beirut Suburban Mass Transit Feasibility Study</td>
<td>USAID / IBI</td>
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<td>2010</td>
<td>Beirut-Jounieh Transport Feasibility Study</td>
<td>Council of Development and Reconstruction (CDR) / Egis</td>
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<td>2012</td>
<td>Public Bus Transport Network for Greater Beirut and its Associated Facilities</td>
<td>Ministry of Public Works &amp; Transport (DGLMT)</td>
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<td>2015</td>
<td>Tabarja – Beirut BRT Pre-feasibility Study</td>
<td>The World Bank</td>
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<tr>
<td>2017</td>
<td>Tabarja – Beirut BRT Feasibility Study</td>
<td>Council of Development and Reconstruction (CDR)</td>
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<td>2017</td>
<td>PPP Options Study</td>
<td>The World Bank/ Rebel Group</td>
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<tr>
<td>2018</td>
<td>Road Capacity Increase in Jounieh Area</td>
<td>Council of Development and Reconstruction (CDR)</td>
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<tr>
<td>2019</td>
<td>Beirut BRT Functional Design</td>
<td>Council of Development and Reconstruction (CDR)</td>
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<td></td>
<td>(to be developed in parallel with the Infrastructure Final Design)</td>
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The BRT project is part of the Beirut Urban Transportation development initiative. The decision was to give priority to the north side where congestion is higher and the need to shift to transit is more urgent. The decision is to develop the design of a BRT dedicated infrastructure System for the Northern Corridor of the Greater Beirut, going from Beirut to Tabarja. The operation will have an extension to Jbeil with some services going up to Tripoli.

In addition, the BRT corridor will penetrate into the center of Beirut using two penetrators: 1) from the north via Charles Helou Blvd to Ain-el-Mreiseh area, 2) from the south via Pierre Gemayel Blvd to Ain-el Tineh area.

Also additional lanes should be proposed and designed in order to connect the BRT with more routes in Beirut area as Verdun / Rachidine, Bchara el Khoury road and Dbeibo Corridor.

The location of stations, terminals, bus depots, park and ride and other facilities will be developed in the Functional Design. The functional design gives all the dimensions and basic design layouts of all facilities as well the operational design, bus specification, ITS requirements...
and fleet estimation. All the outcomes of the functional design are subject to validation and modification where necessary.

The Consultant will have access to previous studies to guide his analysis and use developed information. There were different concepts used in the studies. The Consultant will evaluate the concepts for BRT planning, design and operation and propose a consistent concept for BRT implementation.

2.1 The Selected Corridor

The design considers the alignment on the highway from Beirut to Tabarja. The BRT dedicated infrastructure itinerary is:

i. Highway A1 with a starting point from the north of Tabarja interchange to Charles Helou Terminal, with the following stretches:
   a. From Tabarja to Casino Bridge, (Bus mixed with traffic)
   b. From Casino Bridge to Maameltein bridge (Bus at grade in a dedicated lane)
   c. From Maameltein Bridge to Nahr el Kalb (Bus on dedicated viaduct)
   d. From Nahr El Kalb to Charles Helou Terminal (Bus at grade in a dedicated)

ii. An outer Penetrator route considering the following itinerary:
   a. Charles Helou, Mir Majid Arsalan, Waffic Sino, Ain Meiresseh,
   b. Ain el Tineh, Museum, Adlieh, Jisr El Watti, Youssef El Hayek, Sin el Fil, Mirna Chalouhi returning to the Highway A1 at Nahr El Mott area.

The design will validate and detail the preliminary and functional design, although the Consultant can propose changes due to possible restrictions.

The BRT from Maameltein Bridge to Nahr El Kalb will be elevated with a preliminary design to start early 2019. The Consultant has only to revise and check for details for a better operation of the BRT.

3 OBJECTIVES

The main objectives of the project are:

i. To validate, modify and elaborate the BRT and the viaduct preliminary design in coordination with the operational and functional design.

ii. To elaborate the final design inclusive of all infrastructure components to allow complete operation of the BRT system and Feeder lines including but not limited to station platforms, passengers amenities, pedestrian access, geometrics, structural, bus stops, intersections, Park and ride, etc... with all the construction details.
4 SCOPE OF WORK

4.1 Data Collection and Basic Information

4.1.1 Functional Design

The functional design ensures that all system components are connected and set. It is the physical version of the conceptual design. The Consultant will use the functional design as basis for the study. The Consultant will verify with the client all the components need for the proper operation of the BRT & feeder lines and recommend for inclusion in the preliminary and final design. Any missing components will be without additional cost.

4.1.2 Inventory of Interferences

The Consultant will make an inventory of all interferences that may need to be relocated due to the construction of the BRT. Such inventory shall comprise of the following:

- An initial study of all available information relating to the Project area shall be carried out. This shall include existing dry and wet utilities, recent improvements carried out on the roads and all previous studies that can be made available including studies of planned works for future implementation. Sources of information shall include the Client, other governmental authorities and all information available from previous studies.
- A detailed engineering reconnaissance of the Project area shall be carried out to identify and evaluate site constraints, develop options for these constraints and identify appropriate alternatives for further detailed study and design.

The Consultant shall undertake detailed field observations of the Project area. These observations shall include:

- Visual evaluation of the existing conditions
- Visual evaluation of the nature of sub-grade
- Overland flows
- Capacities of existing drainage structures
- Improvements required on the drainage system
- Identify flood courses and its characteristics
- Visual evaluation of the condition of existing roadway structures
- General characteristics of horizontal and vertical alignment of existing road (e.g. location of stretches with poor visibility).

The Consultant shall also identify geometric improvements required on the horizontal and vertical geometry of the existing alignment. He shall also identify and evaluate existing expropriation decrees and available ROW as they may relate to the project sub-components (i.e.
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Stations, Platforms, Pedestrian access, etc…) and define its adequacy / modification as required and prepare any new expropriation decrees if required.

A topographic survey of the project shall be carried out for the production of necessary mapping. This shall include:

- Establishment of a control network of inter-visible reference markers (traverse). Each marker shall be precisely surveyed, levelled and tied to the national grid and datum.
- Cross-Sections, at 25 meter interval, along the road corridor covering edge of public domain. In the locations of transfer stations, platforms and pedestrian access, the cross-sections shall cover up to 50 meters either side from the edge of BRT corridor alignment. The survey shall cover the BRT corridor alignment, existing structures and topographic features including buildings and property lines.
- In all locations where re-alignment, drainage crossings or geometry improvements are anticipated, the survey shall be extended to pick up the necessary additional details.

4.2 Preliminary Design

4.2.1 Standards and Guidelines

All activities related to field studies, design and documentation will be conducted in compliance with the latest local guidelines / circulars and relevant publications. For aspects not covered by local standards, international standards, such as American or English standards, will be applied.

4.2.2 Road Geometric Design

The road geometric design will be drawn on the cartographic database developed for the project and its topographical additions, adapting it to existing projects, and also considering the necessary changes in the vicinity of the selected path in order to make it compatible with the existing road network. The horizontal geometric design will be calculated analytically, and all characteristic elements (grid coordinates, width, super elevation, the main axes staking, etc.), curve elements (radius, central angle, tangent, development, transition curve) and coordinates of PI’s location axes will be presented in proper tables. Sheets on a 1: 1,000 scale will be presented.

The vertical geometric design indicates the terrain profile and paving gradient, showing ramps with their length, extensions, stakes and concordance points for vertical curves. The profiles will be displayed with the following scale: horizontal 1: 1,000 and vertical: 1:100.

The design will focus on access to properties by analyzing the level of access for pedestrian and vehicles. Cross-sections characterizing all design elements must be submitted (at each section, before, at and after stations).

The design of road junctions has a significant effect on the capacity and safety of the operation. Each junction shall be studied by its own taking into account all types of traffic such as
weaving/turning/through and the space available, to identify and develop the optimum solution (i.e. at grade intersection and required channelization). Irrespective of the solution adopted, the junction shall be carefully laid out with appropriate number of lanes, turning lanes, sight distances, road widths and turning radii. Warrants for traffic signals and other control options should also be investigated.

The survey data shall be used as a base for this geometric study which shall take into account traffic safety, construction economy, expropriation requirements, utility diversions / relocation and road drainage requirements. The Consultant shall prepare a preliminary geometric design of each junction on 1/500 scale.

4.2.3  Drainage Design and Complementary Works

Comprehensive inventory of transverse and longitudinal drainage systems shall be made during the detailed reconnaissance. The relationship between damage observed in the pavement and drainage deficiencies shall be analyzed and recommendations formulated for rehabilitation works or reconstruction.

This will consist of the design and detailing of collectors and other devices that allow the capture and conduction of waters poured over the project area and which could damage the platform conditions and the system operation. The Consultant will consider the use existing drainage systems when it entails the increase in flow generated by the implementation of the BRT. The Contractor will be responsible for obtaining proper authorization for using the rainwater drainage system.

4.2.4  Pavement Design

The Consultant shall propose the structural design of new pavements to be performed, including the restoration of existing pavement.

Flexible or rigid pavement solutions should be considered, if the technical-economic feasibility is checked.

In all cases, the need of compliance with functional, structural and security standards shall be considered, as well as the principle of economy.

The choice of the type of pavement must result from the analysis of alternatives considering the use of semi-rigid or flexible, and rigid (Portland cement concrete) pavements. It is necessary to consider their initial investment cost, maintenance cost, second routine annual level of PSI recovery (Present serviceability Index), and reinforcements for a certain period, in order to maintain IRI (International Roughness Index) below 4m/km.

Pavement for internal circulation inside terminals and bus depot (circulation and parking) will be in rigid concrete or polymerized HMA depending on the technical-economic results.
4.2.5 Bridges and underpasses

The Consultant shall establish the localization of bridges, underpasses and pedestrian walkways. The design will take into consideration the status of existing infrastructure while developing the BRT. The solutions chosen after inspection will be detailed according to the basic design phase.

In addition, during the basic design phase, the Consultant shall review the BRT viaduct preliminary design, recommend any design or station layouts or other pertinent functional elements and details in order to be developed in detail in the final design.

4.2.6 Signalization

The design refers to the horizontal road signs, vertical signs, Variable Message Panels (VMP) and traffic lights (operated remotely commanded by the CCO). These projects will aim at the safety of users and orientation of vehicular and pedestrian traffic, as well as prioritizing BRT flows.

4.2.7 Utilities relocation

This study will identify existing public utilities in the project area and propose solutions for their relocation when they can potentially interfere with the implementation of the corridor. Registration, location and importance of possible interferences constitute necessary information for estimating the cost of their removal or deflection, so that the design does not have to be modified later due to unexpectedly found utilities.

The Consultant will coordinate with public agencies and services the most viable alternatives for relocating their equipment, as well as the measures to be taken. The solutions will allow cost estimate for relocation.

The project will consist of:

- A descriptive report of interferences, and a descriptive and schematic presentation of solutions and estimated costs;
- A cadastral map in scale 1: 2,000, indicating all interferences;
- A calculation of quantities.

4.2.8 Landscape design

The Consultant will present a landscape design for the public space and surrounding areas of roads, stations and terminals, indicating opportunities for Transit Oriented Development.

4.2.9 Park & Ride facilities design

The Consultant shall make detailed design of all park&ride facilities identified by the functional design with the parking spaces, circulation, entrance and exit gates, administration, fare collection areas and traffic management on the surrounding streets, bearing in mind recommendations from previous studies which were conducted regarding this BRT project. The
Consultant will also design all the paths to reach BRT stations from the Park & Ride sites. Parking areas should not be more than 100 m away from the station.

4.2.10 Preparation of expropriation files

The Consultant shall review all existing expropriation decrees and will make an inventory of areas (properties) to expropriate and surrounding properties after calculating all needs of expropriation.

4.2.11 Stations, Bus Stops, Depots and Terminals

These structures should be architecturally simple, lightweight, functional and practical to meet user’s needs for fast transfer between modes, with minimal time spent based on practicality and economy criteria. Projected buildings should fit in with the surrounding environment.

The project should include architectural solutions to secure the mobility of people with special needs, based on the principles of "Universal Design".

The stations should be standardized as appropriate and architecturally designed to meet the BRT conceptual model. Therefore, the following items should be considered:

- Width and length of boarding/alighting platforms;
- The number and positioning of entrance and exit electronic turnstiles;
- The width of pedestrian bridges:
- The location and dimensions of ramps, stairs and escalators;
- The pursuit of standardization should not prevail over the specific space requirements of each station, depending on their demand defined in the studies.
- Parking lots will be designed to integrate users who want to access the system by individual motor vehicles.

The design of the terminals and stations will include:

- The complete architecture of the building (body of buildings / pedestrian bridges and crossings), with the design of all rooms and areas necessary for its operation.
- Additional projects necessary to perfect operation of the projected installations;
- The project’s precision level will allow a quantification and budgeting of needs to allow bidding for the work.

The design of Bus Stops shall include:

- Review of current designs for various types of bus stations as prepared by the Directorate of land and maritime Transport
- Make necessary recommendations/modification
- Insure that all electronic public information system is properly integrated.

Based on the functional design, the Consultant shall present a design for the basic station module with all its elements. Furthermore, the Consultant shall present all the indicators for terminal design and the layout design of the bus depots with all related facilities.
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4.2.11.1 Architectural Design

The design will cover the definition and development of architectural solution for buildings, upon approval of the Steering Committee.

The minimum area for terminal buildings shall include:

- Security: hall and administration;
- Administration: hall, management office, secretary, bathroom, coffee area.
- Operational Control Center (CCO),
- Information office, storage for cleaning supplies and locker facilities;
- Services: lost and found, male and female bathroom and shopping area;
- "Intelligent Transportation System (ITS)" management office;
- Parking areas for parking and ride;
- Desks, counters, box office and turnstiles
- Security facilities at the entrance and exit of buses;
- ITS equipment, displays, turnstiles, automatic doors, telecommunications infrastructure, CCTV, etc.
- Energy generator for energy supply shortage

Besides this, the design shall include:

- Structural design
- Hydraulic
- Wet Utilities
- Electrical design lighting, telephony and sound: the lighting design should cover the terminal’s interior, stations, and their access, parking and surroundings
- Air conditioning and ventilation;
- Fire prevention;
- Communications
- User information and visual communication

4.2.12 Bus Depot Design

The bus depot design will consider in the basic design:

- Entrance area for vehicle checking and dispatching
- Bus cleaning and washing (with washing machines)
- Bus fueling
- Facilities for preventive and corrective maintenances
- Spare parts storage
- Parking
- Buildings for administration, training, control center, restrooms for employees, coffee shop for employees.
The bus depots design will take into account the recycling and reuse of effluents and safe disposal of lubricants and other material with hazardous impact on environment. In addition, the design will present measures against noise and bad image impact on the neighborhood.

The design will include:

- Structural design
- Hydraulic
- Wet Utilities design
- Electrical lighting design, telephony and sound: the lighting design should cover the terminals’ interior, stations and their access, parking and surroundings
- Energy generator for energy supply shortage
- Communications
- Air conditioning and ventilation;
- Fire prevention;

4.2.13 Fare Collection System

Fare collection is the manner in which passengers pay their fares, either on board of the bus, at the station, or in advance.

Based on the functional design, the fare collection design will include:

i. Hardware specification and quantities
ii. Software specification
iii. Facilities (fare boots, selling points, etc.)
iv. Communications
v. Turnstiles quantification and specification
vi. Clearing
vii. Valuables transportation
viii. Security (CCTV and officers)
ix. Human resources (quantity and profile)
x. Training program

4.2.14 Operations Control and ITS

The functional design needs and the operational design should be closely interrelated. Infrastructure should serve all operational needs, and operational design should consider space restrictions in its infrastructure implementation.
The operations control will include:

i. Hardware specification and quantity for buses, bus depots, terminals and main office
ii. Software specification for fleet control and user information
iii. Communications, installation of optical fiber cables, etc.
iv. CCTV system on stations and terminals
v. CCTV cameras on crossings and lane invasion points
vi. Human resources (quantity and profile)
vii. Training program
viii. Real Time Passenger Information System (RTPIS) on bus stops, stations and terminals.
ix. Global Positioning System (GPS) in each bus for a real time information

4.2.15 Traffic Enforcement System

Automated enforcement provides a means of enforcing BRT-related regulations (particularly regulations prohibiting standing in bus stops and bus lanes, and driving in bus lanes) without requiring an ongoing presence by enforcement personnel.

Enforcement cameras can also be used to enforce prohibitions against entering and/or crossing busways. Under such a system, cameras capture still pictures or videos of violations and automatically create an enforcement action against the violator.

Cameras can be mounted at traffic lights, on buses, at the roadside, or in marked or unmarked enforcement vehicles parked to observe the bus lane or stop.

4.2.16 Pre-emption on Traffic Lights

Pre-emption traffic lights use various techniques to improve service and reduce delay for buses at intersections (or junctions) controlled by traffic signals. Pre-emption on traffic lights requires specialized hardware: the detection system typically involves a transmitter on the transit vehicle and one or more receivers (detectors), and the signal controller.

Selective Vehicle Detectors (SVD) shall be provided at all signalized intersections along the BRT path. SVD allows buses to be progressed through traffic signals by prioritising their passage to improve speed and reliability for passengers.

4.3 Traffic Management Plan

The Consultant will elaborate a traffic management plan to manage traffic flows during construction in order to minimize congestion due to civil works. The traffic management plan shall include:
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- Proposed strategy for construction;
- Inventory of roads to support traffic diversion;
- Signalization and circulation plan according to the construction phases.

4.4 Final Design

After the preliminary design, the Consultant will elaborate the Final Construction and Implementations Design.

The Consultant shall prepare the detailed design for the various project components at the construction drawing level of details. The format for the design and drawings should conform to the client’s requirements in order to facilitate tendering of appropriate construction package. This will include, but not be limited to, the following:

1. Functional and technical specifications of all infrastructure components and materials
2. Civil works for road components, including road sections interchanges, sidewalks, drainage, landscaping and other features
3. Pedestrian facilities and how it links with the existing network;
4. Cyclists facilities where appropriate;
5. BRT Stations
6. Terminals and bus depots
7. Park and ride facilities
8. Terminals and interchanges
9. Any other system component necessary for the successful implementation of the Project.

4.4.1 Geometric studies

Following the completion of stage I, the Consultant shall embark on carrying out the alignments and cross sections design, together with the junctions design for the selected alternative.

4.4.1.1 Road Design

Existing cross section, widening and alignment improvements based upon previous studies shall be checked against the new mapping.

Design criteria to be used for the different sections of this road project should be presented to and approved by the Client prior to commencement of the design. The design criteria would include: roadway classification, number of lanes, posted and design speed, maximum and
minimum grades, vertical curves minimum K, lane width, median width, shoulder, right-of-way, and minimum passing and stopping sight distance.

Horizontal and vertical alignments of the existing roads shall be studied and any modifications or improvements shall be presented and discussed with the Client on drawings at 1/1000 horizontal and 1/100 vertical scales, prior to incorporation into the overall design of the road project. The survey data shall be used as a base for this geometric study which shall take into account traffic safety, construction economy, expropriation requirements, utility diversions / relocation and road drainage requirements.

The earthwork limits (cut and fill sections), drainage structures and road safety installations shall be presented on the same plan and profile drawings.

Miscellaneous details shall also be prepared including typical road cross-sections, pavement details, side slopes treatment, superelevation application, safety barriers, road marking and signs details and channelization details.

Road designs shall be carried out using computer facilities with a combination of the most up-to-date highway engineering software.

The geometric design of the project road shall be according to the American Association of State Highway and Transportation Official’s Standards “AASHTO” unless otherwise agreed with the Client.

The Consultant shall prepare a plan showing the sequence of construction based on the project road and traffic constraints.

4.4.1.2 Junction Design

The design of road junctions has a significant effect on the capacity and safety of the road. Each junction shall be studied by its own taking into account turning traffic and through traffic and the space available, to identify and develop the optimum solution (i.e. at grade intersection, interchanges and required channelization). Irrespective of the solution adopted, the junction shall be carefully laid out with appropriate number of lanes, turning lanes, sight distances, road widths and turning radii. Warrants for traffic signals and other control options should also be investigated.

The Consultant shall prepare a detailed geometric design of each junction on 1/500 scale.
4.4.1.3 Pavement Design

The Consultant shall develop the design for strengthening / reconstruction /new construction of the pavement where needed (i.e. BRT lanes, depot parking, park & Ride facilities, etc....). The design should consider the various methods for pavement strengthening and reconstruction such as “AASHTO”, Asphalt Institute and the Analytical Mechanistic (stress – strain analysis) approaches. The verification of the pavement design in different methods should be directed towards achieving an optimum design of pavement for the various types of pavement deterioration. A rationalisation of the pavement cross-section shall be made in order to minimize the number of pavement structural designs.

A pavement design report shall be prepared in two parts:

Part 1: The geotechnical study findings, including deflection surveys, pavement surface condition surveys, trial pits and asphalt coring locations and tests together with their analysis.

Part 2: The proposed pavement section and the pavement strengthening methodology, and including:

Traffic volumes and forecasts, axle loads, standard axle equivalence factor per truck type and cumulative equivalent standard axles for a 20 years analysis period.

Pavement design and analysis of each road section.

Justification of the type of pavement section.

Description of each typical pavement design and procedures of application.

4.4.1.4 Structural Design

The Consultant shall prepare structures drawings for buildings, bridges, culverts, retaining walls and concrete ditches and barriers. This shall include general arrangement, dimensions, elevations, type of finish, reinforcement details, wing walls, apron and head walls details, foundation details, construction and expansion joints, protection and all other details required for the construction of these structures.

4.4.1.5 Drainage Design

The Consultant shall evaluate the existing drainage structures and study the requirements of replacing / adding drainage facilities based on the catchment areas which shall be calculated using the available 1/20,000 and 1/50,000 maps.
Council for Development & Reconstruction

The drainage structures shall be shown on the plan, profile drawings, and shall be supported by the necessary standard details.

Profile of all longitudinal drainage structures shall be prepared on scale H: 1/1000, V: 1/100.

4.4.1.6 Electrical Design

The Consultant shall identify, in close co-ordination with the Client, the sections of the roads, parking, park & ride facilities, etc... that require lighting.

Once these locations are identified, the Consultant shall carry out the design related to the electrical civil works, installations and lighting.

The layout of the electrical works may be presented on the plans supported by typical details of pole foundation, cable laying, feeder pillars, etc.

4.4.1.7 Road Signing and Marking

The Consultant shall prepare a scheme regarding road signing and marking for the project.

The signing and marking shall be shown on the plans. All existing signs have to be indicated on the plans together with the required remedial works.

Typical details shall be prepared for all signs (regulatory, warning and information) and sign supports, including their sizes and types using current local standards. Similarly, details shall be prepared for road markings showing dimensions, types and pattern of road paint lines and symbols.

Signing and road safety related to the construction activity should also be identified along with the traffic circulation plans for the various construction stages.
4.4.1.8 Road Safety

The Consultant shall provide, within the study, details regarding all safety measures relating to the project. This includes, appropriate safety barriers segregating the BRT path from other vehicles along the whole path, ensuring that all measures are in place to prevent passengers from interacting with moving BRT vehicles, shall be prepared.

4.4.1.9 Landscaping

The Consultant shall prepare the landscape design for the entire project road as applicable. This shall include medians, rotaries, open public spaces adjacent to the project, barrier zones between the road and road side development, etc...

The design shall consist of fully detailed layout plans showing the location and arrangement of hard and soft landscaping, supported by typical cross-sections and details of landscaping features. The design drawings shall be accompanied by schedules and specifications for planting, establishment and maintenance of soft landscaping.

4.4.1.10 Expropriation Plans

Where required such as at junctions or other locations, the Consultant shall carry the required modification to the expropriation plans or preparing new expropriation plans. The modified/new expropriation plans shall show all necessary information required for issuing a decree of expropriation. This shall involve showing the limits of the existing right of way, the proposed expropriation limits, existing features, buildings, property limits, identification number of affected and neighboring plots and the cadastral zones.

The survey data shall be used as the base of the plan. Cadastral maps shall be collected from the concerned authorities, digitised and entered into the computer as an overlay to the base plan. Also the Consultant shall carry out a survey of all the affected structures showing in detail the inside layout of each structure (building, store, warehouse, etc.)

The Consultant shall prepare an expropriation plan (the decree) and affected structures plan showing the extent of the expropriation and the expropriation files of the affected parcels to the satisfaction of the Expropriation Section in CDR.
4.4.1.11 Utilities Relocation

Utility data collected from site surveys and from the relevant authorities shall be reviewed, and measures for the relocation and/or protection of underground and overhead lines shall be discussed and agreed in principle with each concerned authority.

Standard drawings for relocations and protection operations shall be obtained from the utility authorities along with specifications and method statement.

The Consultant shall present evidence that all relevant utility authorities were informed of the Project and that data provided by them was considered in his design. The utility crossings shall be adequate for a minimum period of 10 years.

In case these documents are not available at the utility authorities, the Consultant shall discuss and agree with the concerned utility authorities on the procedures of installing new underground utilities and relocation of existing utilities, and prepare the necessary drawings and specifications.

It is expected that the relocation of some existing underground utility lines shall not be established during the design phase, because of incompatible records or lack of surface evidence. Estimates of these “unknown” lines shall be agreed with the relevant authorities, along with national proposal for treatment, and shall be incorporated in the bill of quantities if relocation/protection is required. The precise identification of these lines and the configuration of the “known” lines shall take place during the early construction stage, using trial trenches.

The Consultant shall prepare detailed drawings for the construction of new underground utilities and the relocation of existing utilities at scale 1/500.

4.4.1.12 Maintenance and Protection of Traffic

The Consultant shall prepare maintenance and protection of traffic plans and details for all the areas, junctions and road section where construction will be carried out while traffic is present. Where possible, the Consultant shall develop initial detour schemes in order to detour traffic around the construction zone. These detour schemes will be reviewed and elaborated by the contractor at the construction stage. In all cases, the Consultant shall base the development of the maintenance and protection of traffic and detour plans on the existing traffic volumes and conditions and include in the Bill of quantities, under a separate heading, sufficient items and quantities required for the establishment of proper and safe detours.
The Consultant shall prepare a final engineering report including a description of the project roads, results of the reconnaissance study and all other studies such as geotechnical, environmental mitigation, traffic, drainage, structure, electrical, signing, landscaping, etc., together with the design criteria adopted in the design of the various road components. A clear description and details of the recommended design should also be included. The final report shall state clearly the solutions to face energy shortage.

The Consultant shall prepare all design calculation notes in a specific volume.

All quantities calculation notes of the various trades of the Project shall be compiled in a specific volume.

Fair price estimate shall be prepared and presented in a separate confidential document. In the preparation of the fair price estimate, the Consultant shall conduct a study of current unit prices of various work items from the contracts currently under construction and current market prices of materials and labor.

The Consultant shall develop the Final Design regarding the Fare Collection System following the Basic Design with possible adjustments required by the Client.

The Consultant shall propose and develop the recommended ITS components for the project including a relative Fleet Control System with possible adjustments required by the Client.
4.4.4 Technical Specifications and Construction Methods

The Consultant will present the necessary technical specifications for the acquisition of all materials and equipment, as well as for executing all services defined in the basic design.

The existing specifications can only be considered if used in full, otherwise specifications will be presented with modifications to ensure services performance.

Electrical and electronic equipment and systems must list all technological and operational characteristics to enable cost survey.

The specifications encompass the following:

- Characterization of services, applications and construction materials;
- Civil works equipment: indication of the type of equipment to use in each service stage;
- Implementation: detailed implementation plans, including foregoing services;
- Control: setting the control parameters and their tolerances; and
- Measurement and payment: definition of measurement criteria and payment methods.

The construction methods to be used should ensure the project’s safe implementation, with minimal disruption to the surrounding population and traffic.

4.4.5 Quantitative, Costs, Budget and Implementation Schedule

All inputs involved in the project's implementation will be budgeted for the establishment of the total cost of implementing the Tabarja – Beirut BRT, feeder lines, extension to Jbeil and service to Tripoli.

The quantities of inputs will be calculated in accordance with the design and technical specifications and will be presented with all its details.

Under no circumstances, services or inputs may be presented as lump sums.

The costs of expropriation will be included in the project’s total cost.

The Consultant will present a physical and financial schedule considering local requirements and restrictions in liberating public space and roads.

The physical and financial schedule will include all items of the project to ensure the supply of vehicles, equipment and systems to guarantee the accomplishment of the final milestone.
5 DELIVERABLES

5.1 Inception Report

The Inception Report will be submitted within the first month of commencement of the Study. As a minimum, the Inception report will cover:

1. Status of the project, team mobilisation, and logistics
2. Report on the initial activities,
3. Preliminary concept review,
4. An initial review of the BRT corridor,
5. Any issues arising concerning the Terms of Reference or scope of the work,
6. Finalised timetable for the Project.

5.2 Monthly Progress Reports

The Consultant will submit Monthly Progress Reports on:

1. Work progress with respect to the tasks in the scope of work and schedule.
2. Achievements and outputs.
3. Consumption of resources.
4. Any problems, delays or issues arising, with explanation of the factors involved and the proposed means of resolving problems and restoring the schedule.
5. Planned activities for the following month.

5.3 Work Reports

5.3.1 Report 1 – Month 3

This report will provide confirmation on the BRT concept and alignment and information collected.

5.3.2 Report 2 – Month 6

This report will present all results of the preliminary design will all elements.

5.3.3 Report 3 – Month 8

The Consultant will present the Preliminary version of the Final Design for discussion and comments.

5.3.4 Report 4 – Month 10

This report will present the Final Design. This report will be presented in English.

This report will include the traffic management plan.

The Final Design drawings will be presented in printed sheets scale 1:1000, A1 format.
5.3.5 Report 5 – Month 10 – Executive Summary

The Consultant will present an executive summary report for the entire project. The project will be summarized in no more than 50 pages with all relevant information, in 20 copies in quality paper. This report will be presented in English.

General requirements for these reports include:

1. Reports will be provided in English with final report and executive summary in Arabic.
2. Reports will be presented in hard copy and in electronic format as specified by the Client.
3. Hard copy reports will be provided in A4 format, except for drawings and other documents, which will be in the appropriate size.
4. All reports will be submitted as draft versions to allow for feedback and to accommodate Client’s comments.
5. A total of five (5) hard copies of all reports will be submitted, except for draft reports where a lower number of copies may be agreed on a case-by-case basis.

5.4 Database and Digital Files

All database and digital files will be delivered in the required format on DVD media in five copies.

5.4.1 Database

The Consultant will deliver all database files with results from data collection, any data used in analysis and all simulation model files (input and output). A user manual shall accompany this database.

5.4.2 Design Drawings

All design drawings will be presented in Digital AutoCAD Files or equivalent editable system.

5.5 Bidding Documents

5.5.1 Bidding Documents for Construction

The Consultant shall develop the conditions of tender and contract in accordance with the World Bank guidelines and bidding documents for tendering the works of the Beirut - Tabarja BRT and feeder lines Infrastructure based on the final design, including road, terminals, BRT stations and feeder lines bus stops, park and ride facilities, mode transfer facilities and bus depots.

The tender documents shall comprise the following:

Volume 1 : Conditions of Contract
This document shall include:

a. Invitations to Bid
b. Instructions to Bidders
c. Forms of Bid
d. Forms of Bid Bond and Performance Bond
e. Form of Advance Payment Guarantee
f. Schedule of Day Work Rates
g. Schedule of Basic Rates
h. Form of Contract
i. General and Special Conditions of Contract
j. CDR, Safety Health and Environmental Regulations

The Conditions of Contract shall be based on CDR Standard Bidding Document. At such time, the Consultant shall coordinate with CDR in order to finalise the conditions of contract.

**Volume 2 : Specifications**

The Consultant shall prepare all specifications required. CDR will coordinate with the Consultant to provide input based on previous project packages.

**Volume 3 : Bill of Quantities**

Based on the approval of the detailed design, the Consultant shall prepare a detailed take-offs from the plans.
Deliverables of this phase shall be:

The bills of quantities with the unit prices list enumerating the various types of material used in the construction and indicating the quantity of each item.

Volume 4 : Contract Drawings

The drawings shall comprise the following:

- Plans and profiles of the road at 1/1000 horizontal and 1/100 vertical scale. The drawings shall include all design data for the construction of the proposed road and the upgrade of the existing road such as earthwork slopes, drainage structures, retaining walls, signing and road marking, safety barriers, relocation of existing utilities and utility crossings.
- Detailed plans of junctions at 1/500 scale.
- Typical road cross-sections and pavement structures.
- Drainage details.
- Traffic Safety device details (Signals, crash barriers, etc…).
- Road marking and signing details.
- Detailed signal plans including timing, phasing, detector layouts, pole locations, etc…(where required)
- Structures details for buildings, depots, pedestrian bridges (this shall include all general arrangements, dimensions, elevations, reinforcing details, types of finishes, foundation details, joint details, and bearing type details and all other details required for the construction of these structures)
- Electrical plans and details.
- Landscape plans and details.
- Utility plans at scale 1/500.
- Maintenance and protection of traffic and detour plans
- Miscellaneous details.

6 TIME AND SCHEDULE

The completion of the Study tasks is estimated to take no more than 10 months. The Consultant will prepare a study program detailing all activities as part of the proposal. Additional activities deemed necessary to the design, along with justifications, may be proposed by the Consultant according to his own understanding of the project.
The Consultant will identify the activities to be carried out in Beirut and establish the schedule for on-site presence by all Study Team members. The Consultant will establish an office in Greater Beirut, and the team leader dedicated to this project will have to spend at least 75% of the time in the Beirut office with the required minimum staff to address the project properly.

7 EXPERTISE

7.1 Consultant

The Consultant will offer expertise in complete BRT design as defined by the ITDP Manual.

The Consultant will present at least five (5) BRT projects developed by his Company.

The Company needs to have experience in all the elements required by the Tabarja – Beirut BRT project.

The Consultant may join in a consortium of companies to provide broader experience.

7.2 Composition of the Consultant's Project Team

The minimum requirements for the Consultant’s project team are presented below. The Consultant can retain other professionals and support personnel as required to complete the study. The Consultant will include a local engineering consultancy within the Study Team.

The Consultant is expected to provide expert professionals who have suitable qualifications and extensive experience with relevance to BRT Projects. The team’s qualifications constitute a major criterion in the evaluation of the proposal. The Consultant will be required to supply the personnel named in the proposal, and to ensure that they are available to the design when needed. Substitution of team members is discouraged and can only be accepted by submission of alternative CV’s with equal or higher qualifications and reasons for substitution. Written approval from the Client will be required.

7.2.1 Team Leader

The Project Team Leader (Project Manager) shall have a minimum relevant experience of twenty (20) years with a minimum specific experience of ten (10) years as Project Director/Manager or equivalent for a major urban transport infrastructure project, involving the design of BRT. He or she must have considerable project management experience in addition to specific hands-on experience in the planning and implementation of successful one BRT systems minimum. References will be required for the Project Team Leader whom will be contacted by the Client to verify satisfactory performance by the nominee in the referenced projects. It is essential that the Project Team Leader spend a significant amount of time in Beirut through the duration of the project. Educational requirements for the Project Team Leader include a primary degree in civil engineering. Postgraduate qualification is desirable (at least Master’s Degree or equivalent) in transportation engineering or, transportation planning.

7.2.2 Traffic Engineer

Bachelor’s degree in civil engineering and post graduate degree in traffic or transportation engineering. An internationally recognised professional qualification in traffic engineering is
desirable. Minimum experience of fifteen (15) years and minimum specific experience of five (5) years in complex urban traffic engineering/traffic management/road safety.

7.2.3 Highway Engineer

Bachelor’s degree in civil engineering with professional registration. Minimum experience should be ten (10) years in road and highway design with a minimum specific experience of five (5) years as a Highway or Road Engineer on urban road Infrastructure projects.

7.2.4 Structural Engineer

Bachelor’s degree in civil engineering with professional registration. Post Graduate qualification in Structural Engineering will be an advantage. Minimum experience should be fifteen (15) years in structural design of transport infrastructure with a minimum specific experience of five (5) years as Design Engineer for major bridge and/or interchange structures in reinforced concrete.

7.2.5 Pavement Engineer

Bachelor’s degree in civil engineering with professional registration. Post Graduate qualification will be an advantage. Minimum experience should be ten (10) years, with a minimum specific experience of five (5) years in pavement design. A track record in design of flexible, rigid and concrete block pavements will be favourably considered.

7.2.6 Architect

Bachelor’s degree or professional qualification in architecture. Minimum post qualification experience should be fifteen (15) years with a minimum specific experience of five (5) years as architect responsible for similar projects. Proven experience in urban or industrial design of similar project as well as familiarity with the region will be an added advantage.

7.2.7 Transport Economist

Bachelor’s degree in transportation economics or business administration and professional certificate. Graduate studies (at least Master’s degree or equivalent) in economics or business administration. Minimum experience should be ten (10) years with a minimum specific experience of five (5) years as transport economist in infrastructure projects.

7.2.8 Urban/City planner

Bachelor’s degree or professional qualification in related field. Minimum post qualification experience should be ten (10) years with a minimum specific experience of five (5) years as in urban/city planning as well as familiarity with the region will be an added advantage.