

**REQUEST FOR PROPOSALS**

**FEASIBILITY STUDY FOR THE**

**PUEBLA ITS TECHNOLOGIES PROJECT IN MEXICO**

**Submission Deadline: 4:00 P.M.**

**LOCAL TIME (PUEBLA, MEXICO)**

**AUGUST 15, 2013**

**Submission Place: Victor Mata Temoltzin  
Subsecretario de Planeación y Desarrollo  
Secretaría de Transportes del Estado de Puebla  
Avenida Rosendo Márquez 1501  
Col. La Paz  
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Mexico  
Phone: + 52 (222) 229-0600**

**SEALED PROPOSALS SHALL BE CLEARLY MARKED AND RECEIVED PRIOR TO THE TIME AND DATE SPECIFIED ABOVE. PROPOSALS RECEIVED AFTER SAID TIME AND DATE WILL NOT BE ACCEPTED OR CONSIDERED.**

## REQUEST FOR PROPOSALS

|  |    |
|--|----|
| SECTION 1: INTRODUCTION .....  | 4  |
| 1.1 BACKGROUND SUMMARY.....  | 4  |
| 1.2 OBJECTIVE .....  | 5  |
| 1.3 PROPOSALS TO BE SUBMITTED .....                                  | 5  |
| 1.4 CONTRACT FUNDED BY USTDA.....                                    | 5  |
| SECTION 2: INSTRUCTIONS TO OFFERORS .....                            | 6  |
| 2.1 PROJECT TITLE.....   | 6  |
| 2.2 DEFINITIONS.....   | 6  |
| 2.3 DEFINITIONAL MISSION REPORT .....                                | 6  |
| 2.4 EXAMINATION OF DOCUMENTS .....                                   | 6  |
| 2.5 PROJECT FUNDING SOURCE.....                                      | 6  |
| 2.6 RESPONSIBILITY FOR COSTS .....                                   | 7  |
| 2.7 TAXES.....   | 7  |
| 2.8 CONFIDENTIALITY.....   | 7  |
| 2.9 ECONOMY OF PROPOSALS.....  | 7  |
| 2.10 OFFEROR CERTIFICATIONS .....                                    | 7  |
| 2.11 CONDITIONS REQUIRED FOR PARTICIPATION .....                     | 7  |
| 2.12 LANGUAGE OF PROPOSAL.....                                       | 8  |
| 2.13 PROPOSAL SUBMISSION REQUIREMENTS .....                          | 8  |
| 2.14 PACKAGING .....   | 8  |
| 2.15 OFFEROR’S AUTHORIZED NEGOTIATOR .....                           | 9  |
| 2.16 AUTHORIZED SIGNATURE .....                                      | 9  |
| 2.17 EFFECTIVE PERIOD OF PROPOSAL .....                              | 9  |
| 2.18 EXCEPTIONS .....  | 9  |
| 2.19 OFFEROR QUALIFICATIONS .....                                    | 9  |
| 2.20 RIGHT TO REJECT PROPOSALS .....                                 | 9  |
| 2.21 PRIME CONTRACTOR RESPONSIBILITY .....                           | 9  |
| 2.22 AWARD .....   | 10 |
| 2.23 COMPLETE SERVICES.....  | 10 |
| 2.24 INVOICING AND PAYMENT .....                                     | 10 |
| SECTION 3: PROPOSAL FORMAT AND CONTENT .....                         | 11 |
| 3.1 EXECUTIVE SUMMARY .....  | 11 |
| 3.2 U.S. FIRM INFORMATION.....                                       | 11 |
| 3.3 ORGANIZATIONAL STRUCTURE, MANAGEMENT, AND KEY<br>PERSONNEL ..... | 12 |
| 3.4 TECHNICAL APPROACH AND WORK PLAN .....                           | 12 |
| 3.5 EXPERIENCE AND QUALIFICATIONS .....                              | 12 |
| SECTION 4: AWARD CRITERIA .....                                      | 14 |

|         |   |
|---------|---|
| ANNEX 1 | FEDBIZOPPS ANNOUNCEMENT                                     |
| ANNEX 2 | PORTIONS OF BACKGROUND DEFINITIONAL MISSION REPORT          |
| ANNEX 3 | USTDA NATIONALITY REQUIREMENTS                              |
| ANNEX 4 | USTDA GRANT AGREEMENT, INCLUDING MANDATORY CONTRACT CLAUSES |
| ANNEX 5 | TERMS OF REFERENCE (FROM USTDA GRANT AGREEMENT)             |
| ANNEX 6 | U.S. FIRM INFORMATION FORM                                  |

## **SECTION 1: INTRODUCTION**

The U.S. Trade and Development Agency (“USTDA”) has provided a grant in the amount of US\$455,000 to the State of Puebla’s Secretariat of Transportation (Secretaría de Transportes) (the “Grantee”) of Mexico (the “Host Country”) in accordance with a grant agreement dated March 28, 2013 (the “Grant Agreement”) to fund a feasibility study (“Feasibility Study”) for the Puebla ITS Technologies Project (the “Project”). This Feasibility Study will allow the State of Puebla’s Secretariat of Transportation to assess the deployment and integration of intelligent transportation system (“ITS”) technologies as part of Puebla’s new bus rapid transit (“BRT”) system. The Grant Agreement is attached at Annex 4 for reference. The Grantee is soliciting technical proposals from qualified U.S. firms to provide expert consulting services to perform the Feasibility Study.

### **1.1 BACKGROUND SUMMARY**

The City of Puebla is the capital of the State of Puebla in central Mexico, and serves as the state’s financial, industrial, economic, and cultural hub. With a population of 2.6 million, the Puebla metropolitan area is the fourth most populous in Mexico and is among the country’s fastest-growing cities. Currently, nearly three out of every four people in Puebla rely on public transportation to get around the city, and Puebla’s demand for public transportation is expected to increase at an even higher rate than its population growth.

The development of a more efficient public transportation system that can accommodate greater passenger volume has been identified as a key developmental priority by the Government of the State of Puebla. In its 2011-2017 Development Plan, the State Government of Puebla emphasizes that investment in transportation infrastructure is strategically important and fundamental for the state’s economic development.

The Grantee has outlined a detailed strategy for improving its public transportation system through its Urban Mobility Plan, which identifies the development of key transportation corridors throughout the metropolitan area and outlines the implementation of BRT on six of these key corridors. The development of the BRT corridors is expected to provide significant benefits to Puebla’s population in terms of improved convenience and safety, shorter travel times, and reduced environmental impacts. The Grantee is developing the BRT corridors under a public-private partnership model.

The Grantee recognizes that ITS solutions are critical to operational safety and efficiency and is committed to their deployment on the BRT corridors. With the application of ITS technologies, public transportation in Puebla will become more efficient through improved monitoring and control. Centralized fleet control technologies will help manage the entire BRT system more effectively and on-board technologies will result in safer and more dependable operations. In addition, passengers will benefit from the display of system information at stations and transfer terminals.

The Feasibility Study will allow the Grantee to analyze various ITS technologies needed to adequately and efficiently operate Puebla's BRT system, as well as to develop a set of recommendations, standards, and specifications for the most appropriate ITS technologies to operate and manage key aspects of Puebla's BRT system, including control centers, traffic signals, and fare collection systems.

Portions of a background Definitional Mission report are provided for reference in Annex 2.

## **1.2 OBJECTIVE**

The objective of the Puebla ITS Technologies Feasibility Study is to assess the deployment and integration of ITS technologies into the BRT system being developed in the State of Puebla in Mexico.

The Terms of Reference ("TOR") for this Feasibility Study are attached as Annex 5.

## **1.3 PROPOSALS TO BE SUBMITTED**

Technical proposals are solicited from interested and qualified U.S. firms. The administrative and technical requirements as detailed throughout the Request for Proposals ("RFP") will apply. Specific proposal format and content requirements are detailed in Section 3.

The amount for the contract has been established by a USTDA grant of US\$455,000. **The USTDA grant of US\$455,000 is a fixed amount. Accordingly, COST will not be a factor in the evaluation and therefore, cost proposals should not be submitted.** Upon detailed evaluation of technical proposals, the Grantee shall select one firm for contract negotiations.

## **1.4 CONTRACT FUNDED BY USTDA**

In accordance with the terms and conditions of the Grant Agreement, USTDA has provided a grant in the amount of US\$455,000 to the Grantee. The funding provided under the Grant Agreement shall be used to fund the costs of the contract between the Grantee and the U.S. firm selected by the Grantee to perform the TOR. The contract must include certain USTDA Mandatory Contract Clauses relating to nationality, taxes, payment, reporting, and other matters. The USTDA nationality requirements and the USTDA Mandatory Contract Clauses are attached at Annexes 3 and 4, respectively, for reference.

## **SECTION 2: INSTRUCTIONS TO OFFERORS**

### **2.1 PROJECT TITLE**

The Project is called the “Puebla ITS Technologies Project.”

### **2.2 DEFINITIONS**

Please note the following definitions of terms as used in this RFP.

The term "Request for Proposals" means this solicitation of a formal technical proposal, including qualifications statement.

The term "Offeror" means the U.S. firm, including any and all subcontractors, which responds to the RFP and submits a formal proposal and which may or may not be successful in being awarded this procurement.

### **2.3 DEFINITIONAL MISSION REPORT**

USTDA sponsored a Definitional Mission to address technical, financial, sociopolitical, environmental and other aspects of the proposed Project. Portions of the report are attached at Annex 2 for background information only. Please note that the TOR referenced in the report are included in this RFP as Annex 5.

### **2.4 EXAMINATION OF DOCUMENTS**

Offerors should carefully examine this RFP. It will be assumed that Offerors have done such inspection and that through examinations, inquiries, and investigation they have become familiarized with local conditions and the nature of problems to be solved during the execution of the Feasibility Study.

Offerors shall address all items as specified in this RFP. Failure to adhere to this format may disqualify an Offeror from further consideration.

Submission of a proposal shall constitute evidence that the Offeror has made all the above mentioned examinations and investigations, and is free of any uncertainty with respect to conditions which would affect the execution and completion of the Feasibility Study.

### **2.5 PROJECT FUNDING SOURCE**

The Feasibility Study will be funded under a grant from USTDA. The total amount of the grant is not to exceed US\$455,000.

## **2.6 RESPONSIBILITY FOR COSTS**

Offeror shall be fully responsible for all costs incurred in the development and submission of the proposal. Neither USTDA nor the Grantee assumes any obligation as a result of the issuance of this RFP, the preparation or submission of a proposal by an Offeror, the evaluation of proposals, final selection, or negotiation of a contract.

## **2.7 TAXES**

Offerors should submit proposals that note that in accordance with the USTDA Mandatory Contract Clauses, USTDA grant funds shall not be used to pay any taxes, tariffs, duties, fees, or other levies imposed under laws in effect in the Host Country.

## **2.8 CONFIDENTIALITY**

The Grantee will preserve the confidentiality of any business proprietary or confidential information submitted by the Offeror, which is clearly designated as such by the Offeror, to the extent permitted by the laws of the Host Country.

## **2.9 ECONOMY OF PROPOSALS**

Proposal documents should be prepared simply and economically, providing a comprehensive yet concise description of the Offeror's capabilities to satisfy the requirements of the RFP. Emphasis should be placed on completeness and clarity of content.

## **2.10 OFFEROR CERTIFICATIONS**

The Offeror shall certify (a) that its proposal is genuine and is not made in the interest of, or on behalf of, any undisclosed person, firm, or corporation, and is not submitted in conformity with, and agreement of, any undisclosed group, association, organization, or corporation; (b) that it has not directly or indirectly induced or solicited any other Offeror to put in a false proposal; (c) that it has not solicited or induced any other person, firm, or corporation to refrain from submitting a proposal; and (d) that it has not sought by collusion to obtain for itself any advantage over any other Offeror or over the Grantee or USTDA or any employee thereof.

## **2.11 CONDITIONS REQUIRED FOR PARTICIPATION**

Only U.S. firms are eligible to participate in this tender. However, U.S. firms may utilize subcontractors from the Host Country for up to 20 percent of the amount of the USTDA grant for specific services from the TOR identified in the subcontract. USTDA's nationality requirements, including definitions, are detailed in Annex 3.

## **2.12 LANGUAGE OF PROPOSAL**

All proposal documents shall be prepared and submitted in English and Spanish.

## **2.13 PROPOSAL SUBMISSION REQUIREMENTS**

The Cover Letter in the proposal must be addressed to:

**Victor Mata Temoltzin**  
**Subsecretario de Planeación y Desarrollo**  
**Secretaría de Transportes del Estado de Puebla**  
**Avenida Rosendo Márquez 1501**  
**Col. La Paz**  
**Puebla, Puebla**  
**Mexico**  
**Phone: + 52 (222) 229-0600**

**An original in English, an original in Spanish, one (1) copy in English, and three (3) copies in Spanish of your proposal must be received at the above address no later than 4:00 P.M. (local time in Puebla, Mexico) on August 15, 2013.**

Proposals may be either sent by mail, overnight courier, or hand-delivered. Whether the proposal is sent by mail, courier or hand-delivered, the Offeror shall be responsible for actual delivery of the proposal to the above address before the deadline. Any proposal received after the deadline will be returned unopened. The Grantee will promptly notify any Offeror if its proposal was received late.

Upon timely receipt, all proposals become the property of the Grantee.

## **2.14 PACKAGING**

Each original and each copy of the proposal must be sealed to ensure confidentiality of the information. The proposals should be individually wrapped and sealed, and labeled for content, including the name of the project and designation of "original" or "copy number x." The original in English, the original in Spanish, one (1) copy in English, and three (3) copies in Spanish should be collectively wrapped and sealed, and clearly labeled, including the contact name and the name of the project.

Neither USTDA nor the Grantee will be responsible for premature opening of proposals not properly wrapped, sealed, and labeled.

## **2.15 OFFEROR'S AUTHORIZED NEGOTIATOR**

The Offeror must provide the name, title, address, telephone number, e-mail address, and fax number of the Offeror's authorized negotiator. The person cited shall be empowered to make binding commitments for the Offeror and its subcontractors, if any.

## **2.16 AUTHORIZED SIGNATURE**

The proposal must contain the signature of a duly authorized officer or agent of the Offeror empowered with the right to bind the Offeror.

## **2.17 EFFECTIVE PERIOD OF PROPOSAL**

The proposal shall be binding upon the Offeror for ninety (90) days after the proposal due date, and the Offeror may withdraw or modify this proposal at any time prior to the due date upon written request, signed in the same manner and by the same person who signed the original proposal.

## **2.18 EXCEPTIONS**

All Offerors agree by their response to this RFP announcement to abide by the procedures set forth herein. No exceptions shall be permitted.

## **2.19 OFFEROR QUALIFICATIONS**

As provided in Section 3, Offerors shall submit evidence that they have relevant past experience and have previously delivered advisory, feasibility study, technical assistance, and/or other services similar to those required in the TOR, as applicable.

## **2.20 RIGHT TO REJECT PROPOSALS**

The Grantee reserves the right to reject any and all proposals.

## **2.21 PRIME CONTRACTOR RESPONSIBILITY**

Offerors have the option of subcontracting parts of the services they propose. The Offeror's proposal must include a description of any anticipated subcontracting arrangements, including the name, address, and qualifications of any subcontractors. USTDA nationality provisions apply to the use of subcontractors and are set forth in detail in Annex 3. The successful Offeror shall cause appropriate provisions of its contract, including all of the applicable USTDA Mandatory Contract Clauses, to be inserted in any subcontract funded or partially funded by USTDA grant funds.

## **2.22 AWARD**

The Grantee shall make an award resulting from this RFP to the best qualified Offeror, on the basis of the evaluation factors set forth herein. The Grantee reserves the right to reject any and all proposals received.

## **2.23 COMPLETE SERVICES**

The successful Offeror shall be required to (a) provide local transportation, office space, and secretarial support required to perform the TOR if such support is not provided by the Grantee; (b) provide and perform all necessary labor, supervision, and services; and (c) in accordance with best technical and business practice, and in accordance with the requirements, stipulations, provisions, and conditions of this RFP and the resultant contract, execute and complete the TOR to the satisfaction of the Grantee and USTDA.

## **2.24 INVOICING AND PAYMENT**

Deliverables under the contract shall be delivered on a schedule to be agreed upon in a contract with the Grantee. The Contractor may submit invoices to the designated Grantee Project Director in accordance with a schedule to be negotiated and included in the contract. After the Grantee's approval of each invoice, the Grantee will forward the invoice to USTDA. If all of the requirements of USTDA's Mandatory Contract Clauses are met, USTDA shall make its respective disbursement of the grant funds directly to the U.S. firm in the United States. All payments by USTDA under the Grant Agreement will be made in U.S. currency. Detailed provisions with respect to invoicing and disbursement of grant funds are set forth in the USTDA Mandatory Contract Clauses attached in Annex 4.

### **SECTION 3: PROPOSAL FORMAT AND CONTENT**

To expedite proposal review and evaluation, and to assure that each proposal receives the same orderly review, all proposals must follow the format described in this section.

Proposal sections and pages shall be appropriately numbered and the proposal shall include a Table of Contents. Offerors are encouraged to submit concise and clear responses to the RFP. Proposals shall contain all elements of information requested without exception. Instructions regarding the required scope and content are given in this section. The Grantee reserves the right to include any part of the selected proposal in the final contract.

The proposal shall consist of a technical proposal only. A cost proposal is NOT required because the amount for the contract has been established by a USTDA grant of US\$455,000, which is a fixed amount.

Offerors shall submit one (1) original in English, one (1) original in Spanish, one (1) copy in English, and three (3) copies in Spanish of the proposal. Proposals received by fax cannot be accepted.

Each proposal must include the following:

- Transmittal Letter,
- Cover/Title Page,
- Table of Contents,
- Executive Summary,
- Firm Background Information,
- Completed U.S. Firm Information Form,
- Organizational Structure, Management Plan, and Key Personnel,
- Technical Approach and Work Plan, and
- Experience and Qualifications.

Detailed requirements and directions for the preparation of the proposal are presented below.

#### **3.1 EXECUTIVE SUMMARY**

An Executive Summary should be prepared describing the major elements of the proposal, including any conclusions, assumptions, and general recommendations the Offeror desires to make. Offerors are requested to make every effort to limit the length of the Executive Summary to no more than five (5) pages.

#### **3.2 U.S. FIRM INFORMATION**

A U.S. Firm Information Form in .pdf fillable format is attached at the end of this RFP in Annex 6. The Offeror must complete the U.S. Firm Information Form and include the completed U.S. Firm Information Form with its proposal.

### **3.3 ORGANIZATIONAL STRUCTURE, MANAGEMENT, AND KEY PERSONNEL**

Describe the Offeror's proposed project organizational structure. Discuss how the project will be managed including the principal and key staff assignments for this Feasibility Study. Identify the Project Manager who will be the individual responsible for this project. The Project Manager shall have the responsibility and authority to act on behalf of the Offeror in all matters related to the Feasibility Study.

Provide a listing of personnel (including subcontractors) to be engaged in the project, including both U.S. and local subcontractors, with the following information for key staff: position in the project; pertinent experience, curriculum vitae; other relevant information. If subcontractors are to be used, the Offeror shall describe the organizational relationship, if any, between the Offeror and the subcontractor.

A manpower schedule and the level of effort for the project period, by activities and tasks, as detailed under the Technical Approach and Work Plan shall be submitted. A statement confirming the availability of the proposed Project Manager and key staff over the duration of the project must be included in the proposal.

### **3.4 TECHNICAL APPROACH AND WORK PLAN**

Describe in detail the proposed Technical Approach and Work Plan (the "Work Plan"). Discuss the Offeror's methodology for completing the project requirements. Include a brief narrative of the Offeror's methodology for completing the tasks within each activity series. Begin with the information gathering phase and continue through delivery and approval of all required reports.

Prepare a detailed schedule of performance that describes all activities and tasks within the Work Plan, including periodic reporting or review points, incremental delivery dates, and other project milestones.

Based on the Work Plan, and previous project experience, describe any support that the Offeror will require from the Grantee. Detail the amount of staff time required by the Grantee or other participating agencies and any work space or facilities needed to complete the Feasibility Study.

### **3.5 EXPERIENCE AND QUALIFICATIONS**

Provide a discussion of the Offeror's experience and qualifications that are relevant to the objectives and TOR for the Feasibility Study. If a subcontractor(s) is being used, similar information must be provided for the prime and each subcontractor firm proposed for the project. The Offeror shall provide information with respect to relevant experience and qualifications of key staff proposed. The Offeror shall include letters of commitment from the individuals proposed confirming their availability for contract performance.

As many as possible but not more than six (6) relevant and verifiable project references must be provided for each of the Offeror and any subcontractor, including the following information:

- Project name,
- Name and address of client (indicate if joint venture),
- Client contact person (name / position / current phone and fax numbers),
- Period of Contract,
- Description of services provided,
- Dollar amount of Contract, and
- Status and comments.

Offerors are strongly encouraged to include in their experience summary primarily those projects that are similar to the Feasibility Study as described in this RFP.

## **SECTION 4: AWARD CRITERIA**

Individual proposals will be initially evaluated by a Procurement Selection Committee of representatives from the Grantee. The Committee will then conduct a final evaluation and completion of ranking of qualified Offerors. The Grantee will notify USTDA of the best qualified Offeror, and upon receipt of USTDA's no-objection letter, the Grantee shall promptly notify all Offerors of the award and negotiate a contract with the best qualified Offeror. If a satisfactory contract cannot be negotiated with the best qualified Offeror, negotiations will be formally terminated. Negotiations may then be undertaken with the second-most qualified Offeror, and so forth.

The selection of the Contractor will be based on the following criteria and their corresponding assigned weights:

1. Technical Experience (40 points):

- Offeror's experience in all areas of ITS system applications and information technology systems to support ITS applications for BRT systems, including ITS basic infrastructure and communications systems, BRT operations, fleet management systems, BRT system safety and security, and development of ITS system programs, including experience in the design, installation, operation, and maintenance of modern ITS systems and equipment for BRT systems. Offeror's experience in the areas of computer-aided dispatch (CAD) systems, automatic vehicle location (AVL) systems, advanced communication systems (ACS) for BRT, safety and security systems (BRT), integrated fare collection systems, passenger information systems, automatic passenger counter systems, radio communication systems, fleet management and maintenance systems, transit signal priority (TSP) systems, traffic control systems, on-board technologies such as on-board passenger displays, automatic voice annunciation systems (AVAS), on-board video monitoring (OVM), silent alarms, mobile data computers (MDCs), built-in mobile data terminals (MDTs), GPS systems, command and control centers, and other related ITS technologies for BRT applications. Offeror's understanding of concepts and practices in developing recommendations for the application of ITS systems and equipment for BRT corridor management.
- Offeror's experience in studying, defining, reviewing, and recommending ITS implementation plans for BRT systems (including all necessary ITS systems and equipment), as well as experience in supervising and guiding the implementation of ITS systems for BRT systems in metropolitan areas. Offeror's knowledge in the application and use of ITS technical standards, regulations, and specifications, with specific knowledge and experience in the utilization of NTCIP.
- Offeror's experience in the areas of ITS system integration and ITS equipment interoperability issues for BRT systems, as well as experience in the implementation of ITS control centers and communications systems for BRT systems. Offeror's experience in the analysis, planning, design, installation, and integration of computerized ITS systems for BRT systems and in the application of other IT systems that can support ITS applications to improve BRT operational efficiency, security, and safety.

2. Technical Approach and Work Plan (30 points): Adequacy, soundness, and thoroughness of the Offeror's proposed Technical Approach and Work Plan.
3. Financial Experience (20 points):
  - Offeror's experience in conducting economic and financial analyses for the application and implementation of modern ITS systems, ITS equipment, and related IT equipment for BRT systems. Offeror's experience in the development of capital investment plans for ITS modernization or rehabilitation projects, including experience in project financing for ITS technology modernization for BRT systems.
  - Offeror's experience in identifying eligible public, private, or multilateral financial resources for the acquisition and implementation of ITS systems, ITS equipment, and related IT equipment to support BRT operations, security, and safety.
  - Offeror's experience in working with public and private BRT system operators to identify ITS technologies for improved operations and maintenance.
4. International and Regional Experience (10 points): Offeror's familiarity and experience with ITS projects in Latin America generally and Mexico specifically. Offeror's experience and ability to work in the Spanish language.

Proposals that do not include all requested information may be considered non-responsive.

Price will not be a factor in Contractor selection.

**A N N E X 1**

**FEDBIZOPPS ANNOUNCEMENT**

Victor Mata Temoltzin  
Subsecretario de Planeación y Desarrollo  
Secretaría de Transportes del Estado de Puebla  
Avenida Rosendo Márquez 1501  
Col. La Paz  
Puebla, Puebla  
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Phone: + 52 (222) 229-0600

#### B – Mexico: Puebla ITS Technologies Feasibility Study

POC: Jennifer Van Renterghem, USTDA, 1000 Wilson Boulevard, Suite 1600,  
Arlington, VA 22209-3901, Tel: (703) 875-4357, Fax: (703) 875-4009. Mexico: Puebla  
ITS Technologies Feasibility Study.

The Grantee (the State of Puebla's Secretariat of Transportation) invites submission of qualifications and proposal data (collectively referred to as the "Proposal") from interested U.S. firms that are qualified on the basis of experience and capability to develop a Feasibility Study for the Puebla ITS Technologies Project in Mexico.

With a population of 2.6 million, the Puebla metropolitan area is the fourth most populous in Mexico and is among the country's fastest-growing cities. Currently, nearly three out of every four people in Puebla rely on public transportation to get around the city, and Puebla's demand for public transportation is expected to increase at an even higher rate than its population growth. The Grantee has outlined a detailed strategy for improving its public transportation system, which identifies the development of key transportation corridors throughout the metropolitan area and outlines the implementation of bus rapid transit ("BRT") on six of these key corridors. The development of the BRT corridors is expected to provide significant benefits to Puebla's population in terms of improved convenience and safety, shorter travel times, and reduced environmental impacts. The Grantee recognizes that intelligent transportation system ("ITS") solutions are critical to operational safety and efficiency and is committed to their deployment on the BRT corridors.

The objective of this Feasibility Study is to assess the deployment and integration of ITS technologies into the BRT system being developed in the State of Puebla in Mexico. The Feasibility Study will allow the Grantee to analyze various ITS technologies needed to adequately and efficiently operate Puebla's BRT system, as well as to develop a set of recommendations, standards, and specifications for the most appropriate ITS technologies to operate and manage key aspects of Puebla's BRT system.

The U.S. firm selected will be paid in U.S. dollars from a \$455,000 grant to the Grantee from the U.S. Trade and Development Agency ("USTDA").

A detailed Request for Proposals ("RFP"), which includes requirements for the Proposal, the Terms of Reference, and portions of a background Definitional Mission report are

available from USTDA, at 1000 Wilson Boulevard, Suite 1600, Arlington, VA 22209-3901. To request the RFP in PDF format, please go to:

<https://www.ustda.gov/businessopps/rfpform.asp>.

Requests for a mailed hardcopy version of the RFP may also be faxed to the IRC, USTDA at 703-875-4009. In the fax, please include your firm's name, contact person, address, and telephone number. Some firms have found that RFP materials sent by U.S. mail do not reach them in time for preparation of an adequate response. Firms that want USTDA to use an overnight delivery service should include the name of the delivery service and your firm's account number in the request for the RFP. Firms that want to send a courier to USTDA to retrieve the RFP should allow one hour after faxing the request to USTDA before scheduling a pick-up. Please note that no telephone requests for the RFP will be honored. Please check your internal fax verification receipt. Because of the large number of RFP requests, USTDA cannot respond to requests for fax verification. Requests for RFPs received before 4:00 PM will be mailed the same day. Requests received after 4:00 PM will be mailed the following day. Please check with your courier and/or mail room before calling USTDA.

Only U.S. firms and individuals may bid on this USTDA-financed activity. Interested firms, their subcontractors and employees of all participants must qualify under USTDA's nationality requirements as of the due date for submission of qualifications and proposals and, if selected to carry out the USTDA-financed activity, must continue to meet such requirements throughout the duration of the USTDA-financed activity. All goods and services to be provided by the selected firm shall have their nationality, source, and origin in the U.S. or host country. The U.S. firm may use subcontractors from the host country for up to 20 percent of the USTDA grant amount. Details of USTDA's nationality requirements and mandatory contract clauses are also included in the RFP.

Interested U.S. firms should submit their Proposal in English and Spanish directly to the Grantee by **4:00 PM (local time in Puebla, Mexico) on August 15, 2013** at the above address. Evaluation criteria for the Proposal are included in the RFP. Price will not be a factor in contractor selection, and therefore, cost proposals should NOT be submitted. The Grantee reserves the right to reject any and/or all Proposals. The Grantee also reserves the right to contract with the selected firm for subsequent work related to the project. The Grantee is not bound to pay for any costs associated with the preparation and submission of Proposals.

**A N N E X 2**

**PORTIONS OF BACKGROUND DEFINITIONAL MISSION REPORT**

# FINAL REPORT MEXICO: ITS MODERNIZATION PROJECTS DEFINITIONAL MISSION





Table of Contents

A. EXECUTIVE SUMMARY ..... 1
B. PROJECT DESCRIPTION..... 4
1.0 Surface Transportation Overview – Mexico ..... 4
2.0 Assessment of ITS Activities in Mexico ..... 5
C. PROJECT SPONSOR CAPABILITY AND COMMITMENT ..... 34
1.0 STP Capabilities and Commitment to Puebla’s BRT system ..... 34
D. IMPLEMENTATION FINANCING..... 40
1.0 Financial Review..... 40
2.0 STP Financial Assessment ..... 46
3.0 Financial Institutions..... 47
4.0 Estimated Capital Cost for Project Implementation ..... 49
E. U.S. EXPORT POTENTIAL ..... 50
1.0 U.S. Export Potential Assessment ..... 50
2.0 Intelligent Transportation Systems Applications ..... 51
3.0 U.S. Export Potential ..... 53
4.0 List of Potential U.S. Suppliers ..... 58
F. FOREIGN COMPETITION..... 59
1.0 Foreign Competition Key Elements..... 59
2.0 Market Entry Issues..... 61
3.0 Summary of Foreign Competition Assessment..... 61
G. DEVELOPMENTAL IMPACT ..... 62
1.0 Primary Development Impact..... 62
2.0 Alternatives..... 67
H. IMPACT ON THE ENVIRONMENT ..... 68
I. IMPACT ON U.S. LABOR ..... 70
J. QUALIFICATIONS ..... 70
K. JUSTIFICATION ..... 73
L. TERMS OF REFERENCE ..... 75



|     |  |    |
|-----|--|----|
| 1.0 | Project Background.....                                | 75 |
| 2.0 | Terms of Reference (TOR).....                          | 77 |
| M.  | FEASIBILITY STUDY BUDGET.....                          | 85 |
| 1.0 | Puebla’s Bus Rapid Transit ITS Feasibility Study ..... | 85 |
| N.  | RECOMMENDATIONS.....                                   | 94 |
| O.  | CONTACTS.....  | 98 |



## A. EXECUTIVE SUMMARY

In September 2012, the U.S. Trade and Development Agency (USTDA) funded a Definitional Mission (DM) with the purpose to support and improve its decision-making process relative to the funding of feasibility studies and technical assistance in the area of Intelligent Transportation Systems (ITS) in Mexico. USTDA received a proposal from Puebla's Secretaría de Transportes (Puebla's Secretariat of Transportation-STP) for financial assistance in connection with the development of a feasibility study in the area of Intelligent Transportation Systems for Puebla's new Bus Rapid Transit (BRT) system. Additionally, USTDA funded an ITS Reverse Trade Mission (RTM) in March of 2012 that brought a Mexican delegation to the U.S. for the review of ITS technologies. USTDA contracted HEP Transportation Consulting (HEP Consulting) for the conduct of the Mexico ITS Definitional Mission. Based on the review of the transportation sector and ITS activities in Mexico, along with information received during discussions and meetings held with various Mexican transportation officials, HEP Consulting identified one priority project that meets USTDA's criteria for grant funding.

The City of Puebla is the most important urban center in the State of Puebla and it serves as the capital for the state. The majority of the population in the State of Puebla resides within the Puebla Metropolitan Area (PMA). Puebla represents the financial, industrial, economic, and cultural nucleus for the State of Puebla and the city represents the employment center for the States of Puebla and Tlaxcala. The PMA is considered the fourth largest and most populous region in Mexico with a population of 2.6 million people. The PMA generates a massive demand for urban transportation with approximately 3.5 million trips a day.

In 2011, the Government of the State of Puebla (GSP) commissioned the preparation of the State of Puebla Development Plan (Plan de Desarrollo del Estado de Puebla 2011-2017) with the purpose to analyze the economic conditions and development scenarios within the state and to devise a plan that would serve as a guide for the GSP in promoting the development of the state for future years. One of the important areas presented in the plan is the development of the urban centers within the PMA, which seeks to identify the best alternatives for guiding the growth of the urban population. The State Development Plan sites a number of strategies that should be put in place to accomplish the plan's objectives and one of the key instruments is the development of an integrated public transportation system for Puebla. As a result, Puebla's Urban Mobility Plan (Plan Urbano de Movilidad) was prepared with the purpose to define the policies, strategies, and recommendations in transportation that would achieve the goals and objectives of the State Development Plan.

The Secretaría de Transportes of the State of Puebla (STP) was responsible for the development of the Puebla's Mobility Plan and the plan was designed to contribute to the promotion of organized transportation, serving as a tool to structure and manage urban growth in the most efficient and organized fashion. The Puebla Mobility Plan identified a hierarchy of transportation corridors that service the region as the primary focus of transforming the



transportation sector in the PMA. These corridors connect the urban centers of the PMA and form the fundamental basis for interconnecting the population to the various service centers in the region. Puebla's Mobility Plan recommended the establishment of an integrated structure for public transportation to operate efficiently through the use Bus Rapid Transit (BRT) corridors.

As such, the Red Urbana de Transportes Articulados (RUTA) de Puebla was developed by the STP as the program to implement Puebla's Bus Rapid Transit System. Puebla's BRT system will be built using the center two lanes of existing road corridors and will include numerous stations and transfer centers. The integrated BRT system for Puebla envisions the creation of major transfer centers denominated CETRANS (Centros de Transferencia) and terminals at each end of each corridor. These transfer centers along with the stations will play a key role in allowing for the interconnection among the corridors and will contribute to the distribution of passengers within the entire public transportation system. Puebla's BRT system includes the implementation of six BRT corridors over time. The first three BRT corridors to be implemented include the Corredor Blvd. Atlixco – Diagonal Defensores known as the Chachapa Corridor, Corredor 11 Norte-Sur, and Corredor 16 de Septiembre. The first BRT corridor (Chachapa) is under construction and expected to start operations in early 2013, with the second (11 Norte-Sur) and third (16 de Septiembre) BRT corridors expected to start construction in 2013 and 2014 respectively. Articulated autobuses will replace the current fleet on each BRT corridor and smaller buses will be used to service the feeder routes connecting with the main BRT trunk lines. The main purpose of Puebla's BRT system is to improve and modernize the public transportation system in Puebla.

The STP has presented a proposal to USTDA for the implementation of Intelligent Transportation Systems (ITS) as part of Puebla's BRT system. The STP seeks financial assistance (in the form of a grant) from USTDA for the conduct of a feasibility study to review Puebla's BRT system's plans, specifications, standards, cost estimates, and other project related factors associated with the deployment of ITS technologies for the purpose to improve safety, security, and operational efficiency of the BRT system. The feasibility study will analyze the viability for the deployment of ITS technologies in the area of Advanced Public Transportation Systems (APTS) and the development of recommendations including an implementation plan for Puebla's BRT system.

The STP is expected to utilize the recommendations from the feasibility study for its decision-making process in the selection of ITS systems' specifications, standards, and other factors for the deployment of ITS technologies associated with Puebla's BRT system. It is expected that the feasibility study will be conducted over a period of six months and conclude with the development of a practical ITS implementation plan, including recommendations for the various types of ITS technologies, the necessary systems and equipment standards and specifications, implementation procedures, cost estimates, and financing plan. The feasibility study will identify short and medium-term milestones for the acquisition and implementation of ITS technologies to be implemented as part of Puebla's BRT system.



The feasibility study will evaluate the BRT system in Puebla as well as the identification of new ITS technologies that are likely to improve the BRT's operational efficiency, safety, and security. Some of the technologies that will be evaluated include (but not limited to), Computer Aided Dispatch Systems (CAD), Automatic Vehicle Location (AVL) Systems, Advanced Communication Systems (ACS) for BRT, Safety and Security systems (BRT), Integrated Fare Collection Systems, Passenger Information Systems, Automatic Passenger Counter Systems, Radio Communication Systems, Fleet Management and Maintenance Systems, Transit Signal Priority (TSP) Systems, Traffic Control Systems, on-board technologies such as on-board passenger displays, Automatic Voice Annunciation Systems (AVAS), on-board Video Monitoring (OVM), silent alarms, Mobile Data Computers (MDCs), built-in Mobile Data, Terminals (MDTs), Global Positioning Systems (GPS), Command and Control Centers for BRT operations and other ITS technologies related to BRT systems.

USTDA's participation in financing Puebla's Bus Rapid Transit ITS Feasibility Study is expected to add significant value to the overall public transportation sector modernization program that has been undertaken by the STP in Puebla, as well as provide technical direction to STP and the private concessionaries in the selection of the most suitable ITS technologies to be implemented as part of the new BRT system. Based on the assessments conducted, HEP Consulting determines that funding Puebla's Bus Rapid Transit ITS Feasibility Study is justified as the proposed activities meet USTDA grant funding requirements.

A review of the information obtained as part of the DM indicates that the implementation of the various ITS technologies in Puebla are economically, financially, and technically feasible. Export potential of U.S. goods and services is considered to be moderate given the type of state-of-the-art ITS systems and equipment that are likely to be required by Puebla's BRT system. The U.S. export potential for Puebla's BRT system project has been estimated to be U.S. \$ 18 million. Additionally, U.S. companies definitely have the expertise required to provide the services and technologies likely to be required by STP and the private concessionaires to fully implement Puebla's BRT system project.

The assessment conducted as part of the DM determines that the project sponsor (STP) has the required administrative and financial capabilities to undertake and direct the implementation of modern ITS systems for Puebla's BRT system, as demonstrated by the project sponsors' prior commitment in pursuing the modernization of the public transportation sector in Puebla. The STP's track record in promoting a better transportation system for the State of Puebla is outstanding in terms of the agency's ability to coordinate, plan, and finance Puebla's BRT system project. The financial assessment conducted for the project sponsor revealed that the STP and the Government of the State of Puebla (GSP) have been operating in good financial standings since the new administration of Governor Rafael Moreno Valle took office in 2010. Furthermore, Banobras through its Fondo Nacional de Infraestructura (National Fund for Infrastructure-FONADIN) is supporting the financing of Puebla's BRT system project.

In summary, the findings indicate that after the consideration of all elements and factors collectively reviewed under the DM, the requirements for grant funding are met for a viable



USTDA activity in Puebla, Mexico and such, it is recommended that USTDA consider funding Puebla's Bus Rapid Transit ITS Feasibility Study in the amount of U.S. \$455,000 and select Puebla's Secretaría de Transportes as the Grantee for the project.

## **B. PROJECT DESCRIPTION**

### **1.0 Surface Transportation Overview – Mexico**

Vehicular traffic has continued to increase in many of Mexico's largest metropolitan areas over the last decade and the trend is expected to continue with additional demand for surface transportation infrastructure and services in the country. The impact of surface transportation in Mexico's state and municipal economies has grown substantially and has continued to spur demand for additional services and infrastructure. However, building roadway and highway infrastructure is very costly and due to the recent economic downturn, state and local governments have not been able to keep pace with the need to construct additional capacity by building infrastructure. One of the most pressing issues in metropolitan areas in Mexico has been urban mobility by public transportation systems. As such, state and municipal governments are investing in developing more efficient public transportation systems with the use of Bus Rapid Transit Systems (BRT). The BRT public transportation model seems to be the preferred alternative for some states and for the Government of the Federal District (GDF) to deal with massive demand for public transportation service in the large metropolitan areas in Mexico. Mexican cities and states have resorted to the use of public-private-partnership (PPP) for the construction and operation of BRT systems, where private concessions allow the private sector to invest in the acquisition of high capacity vehicles and the operation of these vehicles on government supported BRT infrastructure.

Some state and municipal governments in Mexico are taking important steps to improve public transportation in their respective geographical areas while trying to address the increased demand for transportation operations and services. As BRT systems are being considered and implemented in Mexico (States of Mexico and Puebla, the GDF), governments are considering the utilization of ITS systems, more specifically Advance Public Transportation Systems (APTS) systems to improve safety, security, and efficiency of the public transportation systems. BRT systems are so unique in their form of operation and this method of transportation is known to operate at the highest levels of efficiency and safety when APTS systems have been integrated into the overall BRT operational plan.

The key player in supporting the development of metropolitan BRT systems in Mexico is Banobras and its Fondo Nacional de Infraestructura-FONADIN through the Programa de Transporte Masivo (Mass Transportation Program). The Inter-American Development Bank (IADB) and the World Bank have assisted Mexico in certain BRT projects as well however, their role has been secondary in comparison to Banobras and the FONADIN.

## Mexico – ITS Modernization Projects Definitional Mission



The Secretaría de Transportes (State Secretariat of Transportation) from the States of Mexico and Puebla are currently planning the implementation of BRT projects in their respective jurisdictions, aimed at continuing to improve and modernize their public transportation services and infrastructures. These government entities are becoming aware of the benefits that ITS technologies can provide to their BRT systems and as such, ITS technologies are being sought as part of the development of BRT projects.

USTDA is interested in assisting the public and private transportation stakeholders in Mexico in further developing their transportation sector with financial grants for the development of feasibility studies and/or technical assistance covering the area of Intelligent Transportation Systems. As such, HEP Consulting was contracted by USTDA and conducted an assessment of the viability of potential ITS activities in Mexico, with the objective to support or improve USTDA's decision-making relative to funding ITS related projects in that country. This report outlines the results from the technical, financial, and economic evaluations undertaken by HEP Consulting for the assessment of ITS activities in Mexico. The focus of the DM included government agencies and private sector entities that sent their representatives to the U.S. (March 2012) as part of the USTDA funded ITS Reverse Trade Mission, as well as other entities such as the Secretaría de Comunicaciones y Transporte (SCT), The Secretaría de Desarrollo Económico and Secretaría de Transportes del Estado de Tlaxcala, Metrobus, and Sistemas de Transportes Eléctricos,



## 2.6 Secretaría de Transportes del Estado de Puebla (STP)

The City of Puebla is the most important urban center for the State of Puebla and it serves as the capital for the state. The majority of the population in the State of Puebla resides within the Puebla Metropolitan Area (PMA). Puebla represents the financial, industrial, and economic nucleus for the State of Puebla as the PMA represents a significant employment generator for the State of Puebla and the State of Tlaxcala. The State of Puebla is considered one of the most important industrial and technological regions in Mexico.

The PMA consist of nine large urban and suburban sectors that include Amozoc de Mota, San Juan Cuautlancingo, Sanctórum, San Lorenzo Almecatla, San Andrés Cholula, San Bernardino Tlaxcalancingo, Cholula de Rivadavia, Santiago Momoxpan and Villa Vicente Guerrero (Tlaxcala), that due to its geographic location within the PMA play an important role in the development of Puebla as a metropolitan area.

The Puebla Metropolitan Area is considered the fourth largest and most populous region in Mexico with a population of 2.6 million people. The PMA has continued to experience population growth throughout the last 40 years and future projections indicate an even greater growth rate for Puebla.

### **Puebla's Public Transportation System**

The Puebla Metropolitan Area generates a massive demand for urban transportation with approximately 3.5 million trips a day. The number of trips and large trip length place an enormous pressure to the urban transportation network in Puebla. This growth in mobility needs demands for more roads and more efficient public transportation systems that can accommodate larger amounts of people throughout the PMA. Public transportation services in Puebla are provided by individual bus owner/operators (man-bus concept) and by several bus companies (owning anywhere from 1 to 10 buses). The transportation services provided by the various bus owners are neither physically, nor operationally or financially integrated, a fact that severely reduces their efficiency.

The various bus routes in Puebla are operated by the bus companies and individual bus owners that receive concessions from the STP to provide public transportation on specific routes throughout the PMA. This creates a lack of a sustainable business environment for public transportation in the PMA. The traditional business structure of bus services in the PMA has led to highly inefficient operations, resulting in a costly, unsafe and environmentally unsustainable public transportation system. There are a number of key issues that define the problematic nature of public transportation in Puebla and these issues can be summarized as follows:

- Lack of an organizational model that would facilitate efficient public transportation operation in the metropolitan area;
- Dispersed operations that hinder the effective control of bus services and contribute to traffic congestion;



- Inefficient use of obsolete vehicles;
- Deficiencies in bus inspection and maintenance;
- Lack of professional management among bus operators;
- Lack of coordination between transport operations within the PMA;
- A non- integrated fare system which penalizes transfers and thus discourages inter-modal movements;

The public transportation system in Puebla delivers poor quality of service, particularly to the poor. The outcome of Puebla's transportation is characterized by substantial negative impacts on its users as follows:

- *High travel cost and congestion-* Time lost in traffic affects quality of life and results in sizable negative impacts on the urban economy, lessening the city's output, reducing the size of the effective labor markets, and imposing the need for higher inventories;
- *Accidents-* Car accidents are one of the leading causes of death in the PMA;
- *Urban degradation-* a more congested and polluted Puebla is forcing its citizens to live in a city with poor transportation, lower quality of life, all of which reduces the State of Puebla's competitiveness.

Additionally, the current state of the public transportation system makes air pollution in the PMA a serious health and environmental concern. There are over two million inhabitants living in Puebla, and most of them are exposed to high levels of ozone and particulate matter. The PMA constitutes the fourth largest area-source of airborne pollutants in Mexico. Current projections indicate that the population in Puebla will continue to grow in the short term, while demand for transportation is expected to increase at even higher rates. If the current public transportation system remains in place, this will result in higher level of traffic congestion, unsafe public transportation for the citizens, inefficient public transportation system, poor regulatory system for bus transportation, lower air quality and pollution, all of which leads to a degradation in the quality of life for the citizens of the State of Puebla. These factors are considered significant and require of substantial efforts at the policy and regulatory levels from the Government of the State of Puebla in order to address one of the most important issues facing the PMA today and in the future.

### **2.6.1 State Development Plan (2011-2017)**

The Government of the State of Puebla (GSP) commissioned the preparation of the State of Puebla Development Plan (Plan de Desarrollo del Estado de Puebla 2011-2017) with the purpose to analyze the economic conditions and development scenarios within the State of Puebla and to devise a plan that would serve as a guide for the GSP in promoting the development of the state for the future. One of the important areas of the plan concentrates in the development of the urban centers within the PMA which seeks to identify the best alternatives for guiding the growth of the urban population for the future (with intervals of short, medium, and long-term periods). According to recent population growth tendencies that the area has experienced, the GSP is interested in how to serve the urban centers with public and health services as well as employment and economic development for the PMA. The State



Development Plan sites a number of strategies that should be put in place to accomplish the plan's objectives and one of the key instruments is the development of an integrated public transportation system for the PMA. As a result, a new urban mobility plan was prepared for the State of Puebla with the purpose to define the policies, strategies, and recommendations that would achieve the goals and objectives of the State Development Plan.

### **2.6.2 Urban Mobility Plan for the State of Puebla**

Puebla's Urban Mobility Plan was commissioned by the GSP through the STP and was designed to contribute to the promotion of organized development of the PMA and the plan would serve as a tool to structure and manage the growth in the most efficient and organized fashion. The Puebla Mobility Plan identified a hierarchy of transportation corridors that service the region as the primary focus of transforming the transportation sector in the PMA. These corridors connect the urban centers of the PMA and form the fundamental basis for interconnecting the population to the various service centers in the region. As such, the primary objectives identified in the Puebla Mobility Plan include the following:

- Establish an integrated structure of interconnection systems and modes of transportation to operate efficiently through the use of corridors and service areas;
- Establish a network of corridors in accordance with the development policies outlined by the Puebla Development Plan;
- Capitalize on existing transportation services and infrastructure and modernize the public transportation system to promote interconnection among the urban centers and foster economic development

#### **a. Integrated Transportation System**

According to the results obtained from the origin-destination studies of the Puebla Mobility Plan, there were 3,561,312 daily trips (combination of all modes) within the PMA, of which 1,658,278 trips are made by public transportation. The Puebla Mobility Plan defined a structure for transforming the current state of the public transportation system in the PMA, consisting of six primary trunk corridors and eight complementary corridors throughout the PMA based on the supply and demand analysis conducted. Out of the six primary trunk corridors identified to satisfy the mobility demand in the PMA, three corridors were selected for short-term implementation based on results from the mobility plan that considered social, economic, and environmental impacts. The other three corridors are considered as long-term solutions for the future.

#### **b. Primary Trunk Corridors**

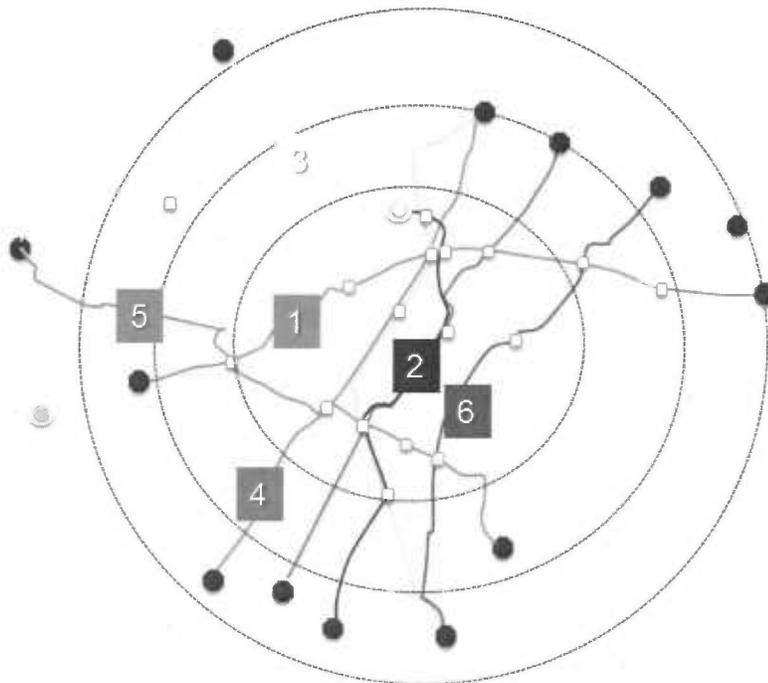
The primary trunk corridors identified by the Puebla Mobility Plan are the following:

- Diagonal Defensores De La República - Blvd. Atlixco;
- Boulevard 11 Norte-Sur;
- Av. 16 de Septiembre - Blvd. 5 De Mayo;
- Av. 14 Oriente - 10 Oriente - Blvd. Hermanos Serdán;
- Camino Real A Cholula;



- 24 Sur – Norte.

**Figure 1. Trunk Line Corridors for an Integrated Public Transportation System in Puebla.**



**Source: Puebla's Urban Mobility Plan**

In addition to the primary corridors, there are eight secondary corridors designated as complementary corridors that will interconnect with the primary trunk corridors to complete the network of public transportation corridors in Puebla. The eight complementary corridors are:

- Blvd. Valsequillo;
- Calz. Ignacio Zaragoza;
- Av. Forjadores;
- Recta Cholula;
- Resurrección;
- Carmen Serdán;
- Héroe De Nacozari;
- Prol. Vía Corta.

The total demand for the primary corridors amounts to 1,125,984 daily trips while the secondary corridors present a demand of 497,260 daily trips for a total public transportation demand of



1,623,244 daily trips. The integrated transportation program as planned under the Puebla Mobility Plan is expected to satisfy 77% of the total public transportation demand for Puebla.

The integrated transportation program for Puebla envisions the creation of major transfer centers denominated CETRANS (Centros de Transferencia) and terminals at each end of the corridors. These transfer centers along with the terminals play a key role in allowing for the interconnection among the corridors and will contribute to the distribution of passengers within the entire transportation system. Some corridors will operate with major transfer centers while other corridors will have feeder terminals. In addition, there are corridors that have been designated for construction and operation as short-term projects while others are planned as long-term activities.

**Figure 2. BRT Transfer Centers and Main Terminals - Proposed Locations**



**Source: Puebla Mobility Plan**

The studies realized as part of the Puebla Mobility Plan indicate that there are nearly 285 different routes that operate using the primary and secondary corridors and some 210 routes are being proposed to be restructured as part of a Bus Rapid Transit (BRT) corridor project which represent some 73% of the routes to be changed and substantial reduction of vehicles operating in the corridors. As of 2011, there were nearly 6,000 vehicles registered for public transportation use in Puebla. The reorganization of the public transportation system in Puebla with the use of the BRT concept will reduce the number of units operating in the corridors to approximately 3,500 vehicles once the public transportation program is complete.



### **2.6.3 Environmental Impacts of the Current Public Transportation System**

Puebla is fourth largest city in Mexico and is afflicted day by day more by pollution that causes health and economic damages. Authorities in the State of Puebla have been working on actions to improve air quality and in spite of some progress achieved, pollution continues to become another serious problem in the PMA and further efforts are required. In order to address this problem, the GSP has planned to develop a system of exclusive bus corridors for the public transportation system in the PMA. The purpose of the new public transportation system will be to both reduce pollution and improve the quality of public transportation in the PMA region. The Puebla Mobility Plan defines the actions required by the GSP to improve the public transportation system in Puebla and it provides the objectives of several trunk line corridor projects that must be implemented in order for these improvements to contribute to the promotion of low contaminating modes of transportation along strategic corridors. These corridors would complement the existing roadway infrastructure in Puebla and would increase transportation efficiency and safety throughout the PMA.

### **2.6.4 State of Puebla Government Strategy**

Given the strong links between transportation, urban development, economic development, air quality, and quality of life, the GSP is promoting the integration of the corresponding sector policies including transportation to address quality of life issues affecting the State of Puebla. Under the current administration of Governor Rafael Moreno Valle, the State of Puebla has outlined its strategy in two documents known as the State of Puebla Development Plan 2011-2017 (Plan de Desarrollo de Puebla 2011-2017) and Puebla's Urban Mobility Plan. The long-term strategy of the GSP is outlined in these plans and includes several strategies to shift modal split from private cars towards public transportation, such as:

- Improve bus-based public transportation to make safer, more efficient, and convenient for users;
- Public transportation through the implementation of high-capacity bus corridors;
- Increase bus transportation efficiency through fleet renewal;
- Enhance public transportation service by introducing new rolling stock; and
- Improve traffic management strategies through better traffic management by providing for the use of new technologies for public transportation.

Without strong government intervention, the public transportation service in Puebla will continue to degrade to the point that it will induce growth in the use of private automobile that will subsequently generate more commuting trips by private cars, deepening congestion, as well as the environmental and urban negative impacts. The GSP's project strategy for the modernization of public transportation in Puebla was developed by inter-disciplinary groups coordinated through the STP, which included working with private bus owners that service the main corridors, the state legislature for the reform of transportation policies, and the Municipality of Puebla. Through this effort, the GSP developed the RUTA program (Red Urbana de Transportes Articulados (Urban Network of Articulated Buses) which is a Bus Rapid Transit System program for the Puebla Metropolitan Area.



**2.6.5 Puebla’s BRT System**

Puebla’s BRT system is based on the successful experience of BRT systems in Bogota, Colombia, Curitiba, Brazil, Mexico City and others around the world. The infrastructure for Puebla’s BRT system will be designed to meet the demand for daily trips of each corridor. Puebla’s BRT system will be built using the center two lanes and will include numerous stations distributed along the corridors at approximately 400 to 500 meters apart. Some left turn movements along the corridors and in the BRT area will be prohibited and traffic signals along the corridor are expected to provide priority for the bus.

Diesel-fuelled articulated autobuses will replace the current fleet on each BRT corridor and smaller buses will be used to service the feeder routes into and out of the main trunk lines. The average operating speeds along the corridors are expected to be improved for public transportation and general traffic, which is expected to translate into significant improvements to travel times along the corridors. The average trip time from one extreme of the corridor to the other is expected to be reduced in some instances by as much as half and waiting periods for a bus at a terminal and stations are expected to be between 6 minutes and 7 minutes, significantly reducing bus waiting periods on the corridors.

The Puebla Mobility Plan calls for the implementation of BRT systems on six major corridors within the PMA. The first three corridors designated to receive the BRT service are the Corredor Blvd. Atlixco – Diagonal Defensores known as the Chachapa Corridor, Corredor 11 Norte - Sur, and Corredor 16 de Septiembre. The main purpose of Puebla’s BRT system is to improve and modernize the public transportation system. The first corridor (Chachapa) is expected start operations in 2013. The following table presents the first three selected BRT corridors to be implemented in Puebla in the short term.

**Table No. 1  
BRT Corridor Information**

| CORRIDOR | CORRIDOR NAME                                | ROADWAYS INCLUDED  | KM    |
|----------|--|--|-------|
| 1        | Corridor Blvd. Atlixco – Diagonal Defensores | Carretera Federal Puebla – Atlixco, Blvd. Atlixco, Blvd. Aarón Merino Fernández, Blvd. Norte, Av. 10 Poniente, Diagonal Defensores de la República | 18.50 |
| 2        | Corridor 11 Norte - Sur                      | Calle 11 Norte, Calle 11 Sur   | 31.35 |
| 3        | Corridor 16 de Septiembre                    | Blvd. Norte, Blvd. Héroes del 5 de Mayo, Av. 16 de Septiembre  | 21.35 |

Corridor 1 represents the shortest of the three selected corridors with a demand of 107,000 trips per day. In terms of the number of public transportation vehicles currently servicing the corridors, Corridor 3 (16 de Septiembre) has the fewest number of units, followed by Corridor 1 Diagonal – Blvd. Atlixco which has 1,526 units currently operating in the corridor.



**Table No. 2**  
**Operational Conditions for the Proposed BRT Corridors**

| Corridor | Name                                | Length (km) | Potential Demand | Initial Demand Expected | No. Routes on the Corridor | No. of Routes for BRT | No. of Units Operating Currently |
|----------|-------------------------------------|-------------|------------------|-------------------------|----------------------------|-----------------------|----------------------------------|
| 1        | Diagonal – Blvd. Atlixco (Chachapa) | 18.5        | 245,796          | 107,758                 | 71                         | 34                    | 1526                             |
| 2        | 11 Norte –Sur                       | 31.35       | 261,682          | 100,604                 | 196                        | 63                    | 4918                             |
| 3        | 16 de Septiembre                    | 21.35       | 246,250          | 89,553                  | 161                        | 41                    | 1041                             |

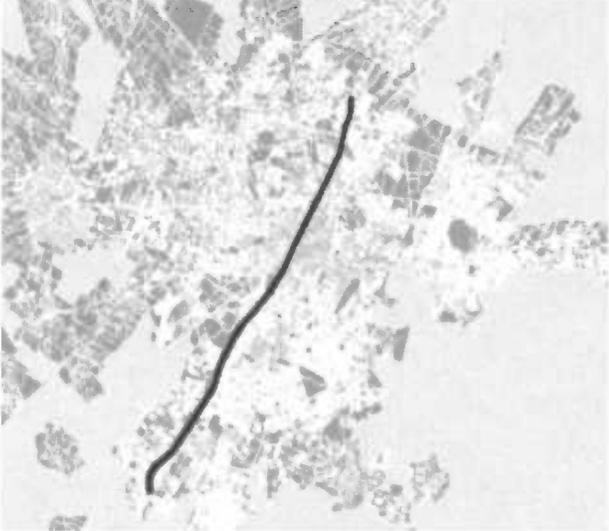
**Tabla No.3**  
**Social Indicators per Corridor**

| Corridor | Name                     | Length (Km) | People Benefited | Income \$0-\$2500 | Income \$2500-\$5000 | Income \$5000-\$8000 | Income \$8000-\$10000 | Income more than \$10000 |
|----------|--------------------------|-------------|------------------|-------------------|----------------------|----------------------|-----------------------|--------------------------|
| 1        | Diagonal – Blvd. Atlixco | 18.5        | 562,041          | 18%               | 53%                  | 22%                  | 5%                    | 2%                       |
| 2        | 11 Norte -Sur            | 31.35       | 461,615          | 19%               | 51%                  | 23%                  | 5%                    | 1%                       |
| 3        | 16 de Septiembre         | 21.35       | 529,936          | 17%               | 51%                  | 24%                  | 6%                    | 2%                       |

Table No.3 above presents information regarding each corridor and the associated population that is to benefit from the use of Puebla’s BRT system, as well as income information for those that will be serviced by the corridors. The three primary corridors were evaluated in terms of the advantages and disadvantages that each corridor offers. The table below summarizes this information for each corridor.



**Table No. 4**  
**Advantages and Disadvantages of Each BRT Corridor**

| CORRIDOR  | ADVANTAGES   | DISADVANTAGES   |
|---|--|---|
| <p><b>Corridor 1:</b><br/>                     Diagonal Defensores de la República – Blvd. Atlixco</p> <p>Demand 107,758 trips per day</p>  <p>Length 18.5 km</p> | <p><b>Demand:</b><br/>                     The corridor will satisfy the public transportation demand that is being generated by the growth in the PMA.</p> <p><b>Urban Conditions:</b><br/>                     The corridor will reduce number of routes and kilometers by public transportation vehicles.</p> <p><b>Infrastructure:</b><br/>                     Exclusive bus corridor.</p> <p><b>Proposal:</b><br/>                     The corridor proposes to reduce the number of routes compared to existing conditions.</p> | <p><b>Infrastructure:</b><br/>                     As part of the exclusive bus corridor there is a section in the corridor where the bus and private cars share the road.</p> <p><b>Traffic:</b><br/>                     There are many signalized intersections along the corridor that are not controlled with transit signal priority systems.</p> <p><b>Proposal:</b><br/>                     The negotiations process between the STP and the bus owners is very complicated.</p> |
| <p><b>Corridor 2:</b><br/>                     11 Norte-Sur</p> <p>Demand 100,604 trips per day</p>  <p>Longitud 31.35 km</p>                                    | <p><b>Demand:</b><br/>                     The corridor will satisfy the public transportation demand that is being generated by the growth in the PMA</p> <p><b>Urban Conditions:</b><br/>                     The corridor will reduce number of routes and kilometers by public transportation vehicles.</p> <p><b>Infrastructure:</b><br/>                     The infrastructure in the corridor is very good as 50% of it is ready for the introduction of BRT system.</p>   | <p><b>Demand:</b><br/>                     High demand with complicated negotiation process.</p> <p><b>Negotiation Process:</b><br/>                     Complicated negotiations given the fact that there are 193 routes with 5000 vehicles.</p> <p><b>Traffic:</b><br/>                     There are many signalized intersection along the corridor that do not provide priority for the buses.</p>  |



**Table No. 4**  
Advantages and Disadvantages of Each BRT Corridor

| CORRIDOR  | ADVANTAGES  | DISADVANTAGES  |
|---|---|--|
| <p data-bbox="383 436 496 457"><b>Corridor 3:</b></p> <p data-bbox="302 495 578 548">16 de Septiembre<br/>Demand 89,553 trips per day</p>  <p data-bbox="358 1100 521 1125">Length 21.35 km</p> | <p data-bbox="846 604 1049 632"><b>Infrastructure:</b></p> <p data-bbox="773 636 1122 726">The infrastructure is in very good condition to develop the corridor.</p> <p data-bbox="886 758 1008 785"><b>Demand:</b></p> <p data-bbox="773 789 1122 936">The demand is expected to increase once the corridor is integrated with Av. Zaragoza and Prolongación towards Central de Abastos.</p> | <p data-bbox="1252 558 1373 585"><b>Demand:</b></p> <p data-bbox="1146 590 1471 642">High demand concentration points.</p> <p data-bbox="1170 674 1446 701"><b>Negotiation Process:</b></p> <p data-bbox="1130 705 1487 831">The negotiation will include 202 bus routes which makes it for a very complicated negotiation process.</p> <p data-bbox="1260 863 1357 890"><b>Traffic:</b></p> <p data-bbox="1130 894 1487 1010">There are many signalized intersection along the corridor that do not provide priority for the buses.</p> |

**a. Diagonal Defensores de la Republica – Blvd. Atlixco Corridor (Chachapa)**

The first corridor in Puebla to be operated under a BRT system is an 18.5 km long which runs east and west through the City of Puebla. The corridor starts southwest of the City of Puebla at the intersection of federal road Atlixco with the Anillo Periférico in front of Cementera Apasco and ends northeast of the City of Puebla parallel to the rail lines and Calle San Lorenzo. There are 36 stations proposed for this corridor located in the areas of highest demand.

This corridor is known as the Chachapa Corridor and it services the most densely populated areas south of Puebla. Today the majority of the City of Puebla’s population must travel north to Puebla and beyond the Puebla center city in order to reach places of employment. There are approximately 107,000 daily passengers utilizing the current public transportation system in Puebla. The Chachapa Corridor comprises one of the most important public transportation service areas in Puebla, which daily attracts thousands of persons working in the area.

During the last three decades, the population in the PMA has continued to increase and so has the use of private vehicles and buses for transportation. However, the required roadway infrastructure improvements and transportation policies have not been developed to satisfy the high demand for public transportation and congestion mitigation. The lack of transportation



investment and transportation policies combined with the lack of enforcement of traffic laws and irregular occupation of public space, have contributed to roadway congestion and urban degradation. The proposed Chachapa Corridor is expected to significantly improve corridor transportation for public and private vehicles.

Figure 3 - Chachapa Corridor Segments



The Chachapa Corridor was selected as the pilot project to test the proposed BRT corridor system that will be implemented along the 18.5 km. A new terminal will be built at the northeastern section of the City of Puebla to operate as a transfer station (CETRAN) for commuters from poor and middle-income areas, while the southern end of the corridor will service the most densely populated areas in Southern Puebla.

This corridor will improve transportation conditions for the thousands of commuters that work in the commercial and service areas along the Diagonal Defensores de la Republica – Blvd. Atlixco roads as well as for the thousands that are employed around





the PMA. Expected benefits from the implementation of a BRT system along the Chachapa Corridor include the following:

- Shorter trips and reduced delays;
- Safer, cleaner, and more comfortable public transportation;
- Improved traffic flow resulting from the prohibition of left turns, and improved traffic signal timings;
- Reduced traffic due to the increased service quality that will attract passengers from other transportation modes;
- Reduction in contaminating emissions; and
- Better urban environment.

The design of the corridor took into account several alternatives in order to reduce impacts on:

- Congestion during construction;
- Resettlement and other economic impacts;
- Environmental; and
- Functional, such as creating problems on nearby roads.

As a result, it was determined that construction of the corridor along the center of the road was the best possible solution, although some impacts are still expected in some of the project surroundings. Under the current authorized route concessions, drivers do not work under any contracts and in most cases their working relation is based on family or friendship ties. Furthermore, current bus drivers do not earn a regular income, nor do they have social security or benefits. These drivers usually work 12 hours a day under stressful conditions without overtime pay, thus contributing to an insecure transportation system. The various bus owners/operators of the Chachapa Corridor came together with the assistance of the STP and formed a company (including most of the current operators) that subsequently obtained the sole concession to operate the BRT system along the Chachapa Corridor.



Puebla's new BRT system is expected to improve overall labor conditions for drivers. However, some in the small group of drivers without vehicles who do not qualify to work as part of the new BRT system are likely to lose their jobs.



### **Concessionaire's Responsibilities**

The RUTA public transportation program was created in 2011 by the GSP to serve as the entity under the STP in charge of providing public transportation service along BRT corridors in Puebla. The new Concessionaire is comprised of most of the existing bus owners and operating companies servicing the Chachapa Corridor today. The new Concessionaire (Articulados de Puebla) will operate under a new operational scheme to be paid by every kilometer of service. Full-capacity articulated low emission buses will replace the current obsolete and unsafe fleet in Puebla. Bus selection was accomplished after the STP invited the major BRT bus suppliers to present their proposals for the buses that would operate along the Chachapa Corridor. Companies like, Mercedes Benz, Volvo, Navistar, MasterRoad, and Dina attended the call for presentations and submitted technical proposals. The Concessionaire was responsible for the acquisition of the buses and as such, members from Articulados de Puebla visited the various manufacturing bus plants to evaluate the various products. In the end, Articulados de Puebla selected Mexican bus manufacturer DINA as the sole source for the BRT buses for Puebla.

The Concessionaire will be responsible for the operation of the buses along the Chachapa Corridor, in accordance with quality performance indicators. The Concessionaire will be responsible for the maintenance of vehicles and maintenance shops. The Concessionaire and the STP have hired a managing company (Angelcom) for the collection of revenues, distribution of earnings, monitor bus operations along the corridor, and establishment of control mechanisms for BRT traffic management. The Concessionaire is responsible for acquiring and implementing Intelligent Transportation Systems (ITS) in the bus, while Angelcom is responsible for the implementation of ticketing and fare collection systems and the communications and monitoring of buses through the corridor.

The drivers needed to operate the BRT buses will be selected from among the best drivers that currently operate the buses servicing the Chachapa Corridor today. The selection criteria will include experience in operating BRT vehicles, IQ level, and service attitude.

#### **b. 11 Norte-Sur and 16 de Septiembre BRT Corridors**

The second and third BRT corridors to be implemented in Puebla include the 11 Norte-Sur and 16 de Septiembre corridors. The main objective for the implementation of these two corridors is two provide a solution to the mobility problem for public transportation users within the north and south areas of the PMA. The main objectives are:

- Provision of a structured public transportation system for the north-south routes of the City of Puebla in a manner to supplement the Chachapa BRT corridor;
- Satisfy the demand for trips within the north-south corridors by using the 11 Norte-Sur and 16 de Septiembre Boulevards that connect with the Chachapa corridor in the north area of the PMA;
- Restructure all the routes that currently operate along the north-south corridors with the purpose to satisfy the demand for trips and to optimize the benefits for the 11 Norte-Sur and 16 de Septiembre corridors;



- Provide inter-connection of services and continue to expand and promote an integrated public transportation system in Puebla;
- Prioritize the public transportation system for users in the PMA by offering an accessible and high quality service;
- Construct the required infrastructure to prioritize the use of public transportation buses on segregated bus lanes supplemented by stations and terminals with the purpose to minimize operational costs and travel time for users;
- Promote the organization of bus owners as concessionaires to provide for the operation of the BRT buses;
- Promote a public sector participation in the investment of infrastructure and equipment needed for the BRT system;
- Promote the use of clean energy technologies and modern BRT technologies for the safe and efficient operation of the BRT and improvement to the environment;
- Maintain the interconnection characteristics among the principal corridors within the PMA to benefit the areas of highest population density.

### **Characteristics of the 11 Norte-Sur and 16 de Septiembre Corridors**

The 11 Norte- Sur Corridor will have exclusive bus lanes of approximately 3.5 meters wide throughout its length in addition to a bike lane in each direction. The stations and transfer centers will have low level platforms in order to match aesthetics of the historic urban center in Puebla. The 11 Norte- Sur Corridor will have 32 regular stations, 2 stations for inter-connections and 2 transfer centers in the area of Central de Abasto and another one south of Periférico Ecológico. The bus fleet will consist of articulated buses with low platforms and capacity of 160 passengers. Additionally, buses with capacities 40 to 100 passengers will also be utilized for the feeder routes.

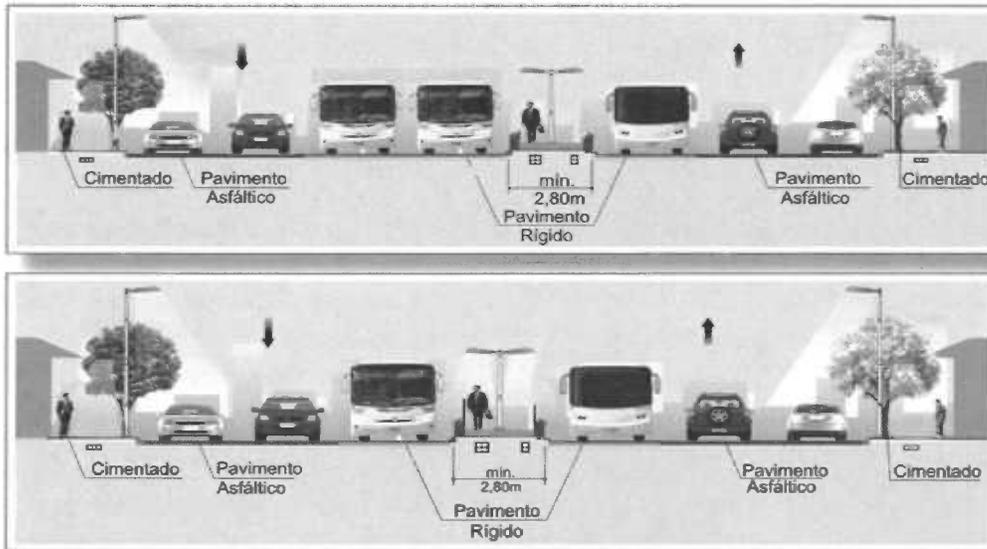
The 16 de Septiembre Corridor has most of the infrastructure in place for the BRT system except that the resurfacing of the road will be required. The corridor will have 48 stations along the corridor and 1 main terminal on the 16 de Septiembre Boulevard south of the Periférico Ecológico. The bus fleet will consist of 111 buses with capacity of 100 passengers for the main corridor and additional buses for the feeder routes. Both the 11 Norte-Sur and 16 de Septiembre corridors will require the implementation of command and control centers for BRT operations, ITS, and integrated prepay electronic and fare collection system, and bus fleet maintenance centers.

### **Project Execution for 11 Norte-Sur and 16 de Septiembre**

The execution of the project is contemplated to take place in two phases given the fact that it is very important to guarantee the continued vehicular traffic flow along the north/south bus routes in Puebla. The first phase will consist of the implementation of the 11 Norte-Sur Corridor including the construction of bus maintenance shops, three bus storage facilities, two transfer centers, and bike lanes. Construction of this corridor is expected to start in 2013 with completion in the second quarter of 2014. The second phase of the project will include the implementation of the BRT corridor for the 16 de Septiembre, expected to start construction in second quarter of 2014 with completion expected in 2015.



Figure 4. - Typical BRT Corridor Cross Section for Puebla's BRT System



Source: Puebla Mobility Plan

### 2.6.6 Puebla's BRT System Development Objectives

The Puebla BRT project will contribute to an improved public transportation system in Puebla which is expected to enhance quality of life for the millions of citizens in the PMA. The Puebla BRT system will contribute to reductions in local airborne pollutants and greenhouse gas emissions generated by the transportation sector in the PMA. This will be sought through the development of the first three BRT transportation corridors in Puebla. Another project objective will be to implement new and improve traffic management measures to better organize public transportation in the PMA while improving general vehicular traffic and minimizing current levels of traffic congestion. The project is also intended to develop and demonstrate the use of new buses with improved emission rates, as well as regulatory and institutional changes in the public transportation sector.

While the implementation of the first BRT corridor does not clearly identify the ITS technologies that will be necessary for Puebla's BRT system, this first BRT initiative will be used as a pilot project for the STP to determine the needs for ITS solutions, tools, measurements, and procedures that may be applied, on a larger scale, to the rest of Puebla's BRT system. The development of an ITS implementation plan for the entire BRT system is expected to guide the acquisition and deployment of ITS technologies for the Puebla BRT system. Thus, the initial BRT project is expected to demonstrate that a high-quality bus corridor approach is a viable alternative for promoting improved public transportation in Puebla and along with the development of an ITS implementation plan, the BRT system is expected to operate at optimum levels. In this context, the first BRT project along with the development of an ITS implementation



plan will provide a valuable blueprint for other corridors in Puebla which could bring about a much higher overall positive impact.

Additionally, the implementation of BRT corridors along the 11 Norte-Sur and 16 de Septiembre Corridors is expected to provide significant benefits to the population in terms of improved public transportation system, safety, reduced travel time, improve convenience, and reduced environmental impacts. The second and third BRT projects in Puebla will support a safer, cleaner, more efficient and modernized transportation system, strengthening the operating institutions by offering higher quality transportation services and promoting sustainability by replacing old inefficient vehicles with modern bus technologies that would lead to a reduction of local pollutants. The introduction of ITS systems in the public transportation systems for the 11 Norte-Sur and 16 de Septiembre Corridors will benefit all transportation operations in the corridors and in particular, the low income strata of the population who are the predominant users of public transportation in the PMA. The BRT system is expected to make environmentally proactive choices in the modernization of the transportation sector in Puebla by the utilization of buses that produce significantly less emission than those currently operating along the major corridors and improved operational efficiency by the use of ITS technologies.

The following are the main technical components of the BRT corridors to be implemented:

- Exclusive bus lane in the center of the avenue for exclusive use by public transportation;
- Elevated stations for access to articulated buses;
- Level access to the system's stations and terminals;
- Obstacle-free waiting areas to enable fluid movement of passengers;
- Turnstiles to control entrance to the station by means of a prepayment system;
- Access ramps for persons with different types of handicaps;
- Modular design of stations to ensure uniformity of the Corridor's image.

### **a. Operation**

In order to optimize the transportation service along the BRT corridors, the operating fleet and the corridors' infrastructure will be adjusted to trip demand. For this purpose and based on the current and projected demand for the BRT corridors, a special operational concept will be developed for the corridors in Puebla. The operational concept for the BRT system in Puebla will be primarily based on the application of a coordinated, centralized control system, with a fixed itinerary, to allow transportation to be provided comprehensively throughout the hours of service. The existing routes and features of the current public transportation systems along the three main priority corridors will be modified, especially through the redefinition of existing routes with main trunk lines and feeder routes. The new BRT system will include the replacement of the current fleet of passenger vehicles with a number of higher-capacity buses (articulated buses) and the regulation of boarding and departing the bus at exclusive points provided with the necessary infrastructure for this purpose (each of these points will have a station or terminal).



Puebla's BRT system will consist of a main trunk line (the BRT corridor) that utilizes articulated buses that remain in the designated corridor from start to end of the corridor. The main corridors will receive passengers from the different feeder routes that are serviced with smaller buses.

**b. Service Schedules**

For the main trunk lines and feeder routes, detailed service programs will be developed for different hours of the day, days of the week, peak and non-peak periods, as well as contingency plans. The schedule of service will have to be monitored by a central control system and by on-board APTS equipment on the buses to ensure BRT system reliability and dependability for the ridership and the operators.

**c. Buses**

The characteristics of the bus fleet that will operate along the corridors will ensure compliance with the operational, environmental, and safety objectives proposed for each corridor. Likewise, there should be an adequate number of vehicles to properly meet current demand for each corridor. In this context, it has been determined that operators will utilize state-of-the-art, articulated buses, with diesel-fueled electronic motors, high capacity, and low pollutant emissions for the corridors. The idea is for buses to be equipped with on-board APTS systems that can establish communications with other components of the BRT system such as central bus fleet management, traffic control, transit signal priority systems, station and terminal passenger information systems, and others.

**d. Fare Collection System**

As part of the technological improvements proposed by the BRT system in Puebla, a new fare collection system technology will be implemented which provides electronic tickets including a certain number of prepaid trips. These tickets can be replenished. Validation equipment at the entrance of each station will detect each electronic ticket and will deduct the corresponding fare. This will consist of a prepayment system that will considerably streamline the boarding and departing of passengers on public transportation vehicles. Drivers will no longer have to handle fares which will allow them to concentrate primarily on ensuring that their units comply with an operating plan. In summary, the prepayment system will play a key role in optimizing BRT operations. For the first BRT project, technical specifications for the fare collection systems and on-board technologies were never developed, thus leaving it up to the operator (Articulados de Puebla) and managing company (Angelcom) to select the technology of their choice. The STP intends to make the fare collection operation a seamless process when all the BRT corridors are implemented, meaning that the ticketing and fare collection systems operation should be standardized for all BRT corridors. The development of these standards and system specifications is something that has not been developed by STP.

**e. Measures to Ensure Un-Interrupted Flow on the Corridors**

Another important condition for optimizing bus service along the BRT corridor is to avoid as much as possible its interruption by normal traffic on the road. In this particular case, to ensure smooth bus service, driving characteristics along each corridor and the corridors' areas of influence will be modified. These changes will include the elimination of left turns at selected



intersections and there will be the need to install Transit Signal Priority (TSP) systems along the corridors. TSP is a form of ITS that provides for the communication between the bus and the traffic signal system to provide special traffic signal intervals that gives priority to the BRT bus along the corridor. The first BRT corridor in Puebla envisioned the use of TSP operation, however there were no studies conducted to determine what is actually required for the implementation of the TSP system.

As the first BRT project is nearing completion, members of the STP and Articulados de Puebla realized that TSP could not be implemented at part of the project due to the need for upgrades to the current traffic signal system that is operated by the City of Puebla. As such, the plan now is for the driver of the bus to communicate (through radio or cellular phone) with the operators of the City of Puebla's traffic signal system and request changes to specific traffic signals as needed. This is a very difficult, to say the least, yet inefficient and ineffective manner to operate the BRT system and members from the STP realized the need to conduct a thorough study to identify the needs for a modern TSP system and other ITS components that could be implemented for all BRT corridors in Puebla. Representatives from Banobras indicated the same concern with the lack of studies, strategies, and plans for the implementation of ITS systems for Puebla's BRT system and indicated that funds would be made available to acquire ITS technologies that would prove to enhance operational efficiencies of the BRT system in Puebla.

**f. Left Turns**

The three planned BRT corridors are considered major transportation arteries for the PMA and the corridors have numerous intersecting streets that cross these corridors with vehicles and pedestrian traffic. Because of the location of the BRT corridor in the center of the roads, the currently allowed left turn movements along the main trunk lines will be eliminated at specific locations in order to improve speed conditions on the corridor. This will be done on a case by case basis taking into account the following issues:

- Minimization of trip times/distances along the BRT corridor;
- Continuity will be given to right turns, following their natural direction;
- Road sections will be selected according to their capacity, ensuring their suitability for channeling the volumes of vehicles that will be detoured;
- Vehicular traffic will preferably be channeled prior to the intersection.

**g. Traffic Signs**

Drivers of private vehicles will be guided by clear signs to allow them to anticipate the route they should take in order to make left turns. For this purpose, static traffic signs will be installed along the BRT corridors and in the corridor's area of influence. The need for the use of Variable Message Signs (VMS) may also arise as these types of signs provide better service in communicating corridor conditions to drivers.



**h. Traffic Signals**

The operation of the corridor will require significant changes in the traffic signal system to control vehicular traffic and pedestrians, provided that priority is given to public transportation. The current traffic signal system is operated and maintained by the City of Puebla and the system was provided Semex of Mexico. The current traffic signal system does not have the capability to provide TSP operations. If TSP operations are required by the BRT corridors, substantial upgrades or replacement of the existing system may be required. Additionally, a study of the communications infrastructure for the BRT corridors will be needed in order to establish the framework for the implementation of ITS systems such as TSP and other technologies. Banobras' Fondo Nacional de Infraestructura has identified funding to upgrade or replace the signal system in Puebla for those signals along the BRT corridors.

**2.6.7 Concerns from Puebla's Secretaría de Transportes**

Members from the STP have expressed concern over the issue of ITS systems that are required to adequately operate the new BRT system. The concern arises from the fact that during the negotiation process between the STP, the Concessionaire, and the managing company, the STP did not impose a set of standards or specifications related to ITS components that would be utilized as part of the operation of the first BRT corridor. As such, the concessionaire and the managing company have full discretion in the selection of ITS systems to be implemented as part of the first BRT system. Members from the STP have indicated that they do not possess the expertise to evaluate the ITS technologies that the concessionaire and managing company are planning to implement.

Additionally, STP indicates that during the development of the RUTA BRT program, the appropriate ITS studies should have been conducted in order to develop the framework from which the STP would administer the deployment of ITS systems for the entire RUTA BRT program. Now the STP understands the significance of utilizing ITS technologies for the benefit of operating the BRT corridors and as such, the STP seeks assistance from USTDA for the conduct of a study that would analyze the various ITS technologies that are needed to adequately and efficiently operate Puebla's BRT system, evaluate the ITS systems that the concessionaire and managing company are implementing as part of the first BRT corridor project, and ultimately present a set of recommendations and specifications for the most appropriate ITS equipment and systems for Puebla's BRT system.

At the same time, as the STP moves forward with the design and implementation of the second and third BRT corridors (11 Norte-Sur and 16 de Septiembre), members from the STP believe it is imperative that the necessary studies be conducted now, in order to identify the most appropriate ITS technologies that will be required for these two new corridors. The STP staff wants to avoid following the same steps missed with the development of the first BRT corridor, where the necessary advance planning did not take place in terms of studying and identifying the best ITS solutions for implementation. Furthermore, the STP intends for the feasibility study to include recommendations for possible actions that may be necessary to retrofit the ITS systems that may have been implemented by the concessionaire and managing company in the



Chachapa Corridor. The intent is to make sure that in the end, all of the BRT corridors are integrated from an operational and ITS perspective, including fare collection systems, on-board (bus) ITS systems, and traffic control and management systems.

### **2.6.8 Development of ITS Plan for Puebla's BRT System**

A specific, precise, and efficient operating plan for the magnitude and sophistication of the BRT corridors will be highly complex and difficult to implement without the application of suitable Intelligent Transportation Systems in Puebla. Strict control of each of the system's buses will be needed to ensure that actual and planned operations are well coordinated, monitored, and executed. With the application of ITS technologies in the area of Advanced Public Transportation Systems (APTS), the public transportation service in Puebla will become more efficient, better monitored and controlled, passengers would benefit from the dissemination of BRT information at stations and transfer terminals, buses can flow without interruptions along the corridors with TSP, centralized fleet control technologies would help manage the entire BRT systems more effectively, on-board technologies can result in safer and more dependable operations, and much more.

The monitoring and communications component of the BRT systems is extremely important to the overall operation and success of the BRT project in Puebla. Monitoring, generally with satellite technologies, will allow the BRT system to pinpoint with considerable precision the location of each unit in the system. This will allow it to compare the placement of vehicles with those it should have, in accordance with pre-defined plans. The communications system will make it possible to transmit information to articulated vehicles, indicating to drivers whether they are behind or ahead of schedule. In case of a contingency, the communications system will make it possible to inform each unit what it should do and to dispatch replacement units.

The implementation of APTS technologies throughout the BRT system in Puebla affects positively the efficiency of operation by providing valuable information to improve operating plans and better adjust them to demand, with the ability to respond quickly, on a daily basis, to possible changes. The APTS technologies will also contribute to producing more reliable, comfortable, and regular service for the thousands of riders in the PMA. For these reasons it is extremely important that a comprehensive ITS feasibility study be conducted to analyze not only those ITS technologies that will be implemented by the private sector as part of the Chachapa Corridor, but also to evaluate and recommend the ITS technologies for an integrated BRT system that includes all BRT corridors in Puebla.

The STP wishes to embark on a planning process to expedite the review and implementation of state-of-the-art technologies that can facilitate the monitoring and control of Puebla's BRT system. The evaluation and implementation of ITS technologies for Puebla's BRT system is high on the STP priorities mostly because STP staff understands the need for the use of the technologies, but also because the agency knows that the ITS study is something that should have been anticipated prior to the construction of the first BRT project. Since the first BRT project is almost ready for operation, there is a high level of urgency to review those ITS



technologies that will be needed for the rest of Puebla's BRT system in order to create an integrated BRT system, that with the appropriate ITS applications, seeks to improve traffic flow while increasing traffic safety.

The STP intends to develop preliminary plans, specifications, and cost estimates for the deployment of ITS systems throughout its BRT system. Given the fact that the first BRT corridor is almost complete, budgetary procedures makes it complicated for the STP to allocate funding to conduct the ITS feasibility study. Similarly, since all the studies are nearly completed for the second and third corridors and due to the fact that these projects are actually under final approval process by Banobras, this makes it complicated for STP allocate funding for the ITS study.

Consequently, the STP has presented a proposal to USTDA for the implementation of ITS technologies in connection with Puebla's BRT system. The STP seeks financial assistance (in the form of a grant) from USTDA for the conduct of a Feasibility Study (FS) to review and develop ITS solutions for the public transportation system, specifications, standards, cost estimates, and other project related factors associated with Puebla's BRT system, with the purpose to analyze the viability of ITS implementation activities in Puebla and develop recommendations including an ITS implementation plan for the project.

The feasibility study's technical analysis would result in the development of recommendations and specifications for the implementation of ITS systems for Puebla's BRT system, which would be based on the financial viability analysis of the proposed project. The ITS feasibility study would identify the most likely sources of financing for the implementation of ITS technologies in Puebla (including but not limited to the private sector, STP, City of Puebla, and Banobras) and other financial institutions.

As a result of the feasibility study, the STP is expected to utilize the recommendations from the feasibility study for its decision-making process in the selection of ITS systems specifications, standards, and other factors for the implementation of ITS systems in Puebla.

Some of the technologies that will be evaluated include (but not limited to) Computer Aided Dispatch Systems (CAD), Automatic Vehicle Location (AVL) Systems, Advanced Communication Systems (ACS) for BRT, Safety and Security systems (BRT), Integrated Fare Collection Systems, Passenger Information Systems, Automatic Passenger Counter Systems, Radio Communication Systems, Fleet Management and Maintenance Systems, Transit Signal Priority (TSP) Systems, Traffic Control Systems, on-board technologies such as on-board passenger displays, Automatic Voice Annunciation Systems (AVAS), on-board Video Monitoring (OVM), silent alarms, Mobile Data Computers (MDCs), built-in Mobile Data, Terminals (MDTs), Global Positioning Systems (GPS), Command and Control Centers for BRT operations and other ITS technologies related to BRT systems.

The final product of Puebla's Bus Rapid Transit ITS Feasibility Study will be the development of a practical ITS implementation plan for Puebla's BRT system. The purpose of the



implementation plan is not to develop a general ITS concept architecture, but rather to formulate the specific documentation outlining the various ITS systems and solutions to be implemented, ITS systems specifications, ITS system standards to be used, including a step by step practical approach that defines the actions needed to be taken by STP and the private sector to effectively and efficiently implement the recommended ITS technologies for Puebla's BRT system.

## **C. PROJECT SPONSOR CAPABILITY AND COMMITMENT**

This section of the report describes the project sponsor capability and commitment to support and implement Puebla's BRT system including the acquisition and deployment of ITS technologies.

### **1.0 STP Capabilities and Commitment to Puebla's BRT system**

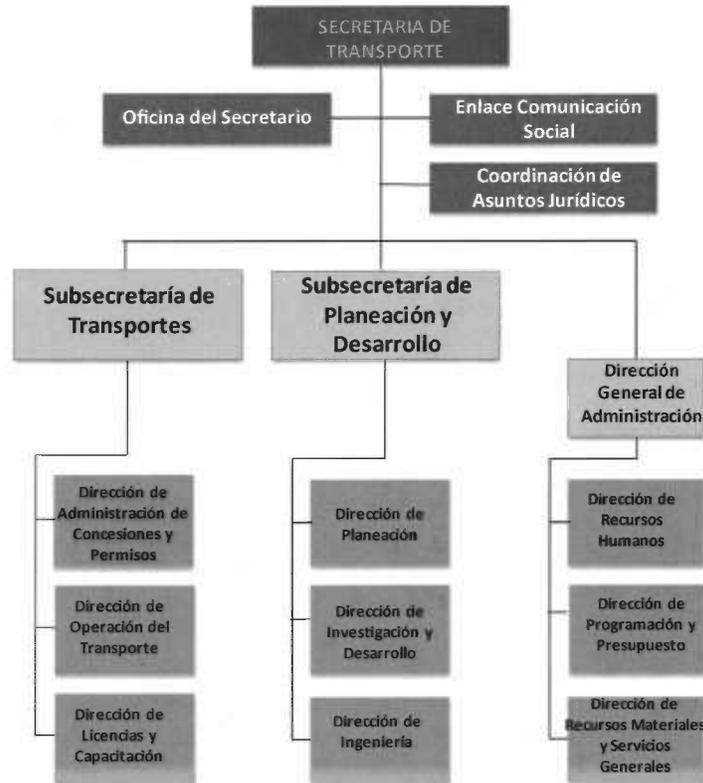
The STP's organizational objectives are to improve the safe and efficient movement of people and goods through the provision of adequate transportation infrastructure and systems, to develop and sustain transportation safety programs, to support economic development and other public service initiatives, to work and advise the GSP on technical issues affecting state transportation issues, and to implement government policies in the transportation sector.

The project sponsor for Puebla's Bus Rapid Transit ITS Feasibility Study is the Secretaría de Transporte (STP). The STP is responsible for regulating of public transportation, commercial transportation, and general transportation in the State of Puebla. The STP is the main entity responsible for conducting all transportation planning for the State of Puebla, proposing transportation policy and programs to the Governor, development of plans, studies, and projects directly related to transportation according to federal and state law, the preparation of annual budgets for transportation investment, the promotion, regulation, and supervision of the construction, reconstruction, maintenance, and modernization of transportation infrastructure within the State of Puebla.

In addition to the agency's state responsibilities, the STP will be responsible for the operation and supervision of Puebla's BRT system under the necessary agreements with the Municipality of Puebla. Figure 5 describes the STP organizational structure:



Figure 5. - Secretaría de Transporte (STP) Organizational Structure



Despite repeated efforts from previous state administrations to organize the public transportation system in Puebla, there were many barriers to the modernization of the transportation system in the PMA that were never surmounted in the past. Today, with the new administration of Governor Rafael Moreno Valle, the STP introduced a unique process whereby the government worked side by side with the bus operators/owners of specific routes in the Municipality of Puebla to convince them that a public private partnership (PPP) model for the implementation of a BRT system would be most beneficial to the citizens of Puebla, as well as for the operators. The share participation of government and private sector resources used in the PPP model provided the mechanism to bring the first BRT project to construction in 2011. The leadership from state government officials along with the private sector's desire to invest in a safe and efficient public transportation system, were the tools that enabled the initiation of the Puebla's BRT system.

The initiative taken by the GSP and STP to engage the bus operators into the discussion of reforming the public transportation system in Puebla was key to introducing the new RUTA BRT program for Puebla and confirms the STP's commitment to improving public transportation. The



STP with its framework of policies and tools helped convert a very difficult local issue into an innovative state and local opportunity within a national context of improving public transportation in Mexico. The STP worked diligently to present Puebla's BRT system to the Mexican Federal Government as part of a national problem seeking to enhance the mobilization of people in large metropolitan areas in Mexico. The well executed planning process, collaboration between public and private entities, and establishment of the PPP initiative, contributed to the project receiving major attention from the highest levels of the federal government and the Mexican development bank Banobras.

The dialogue and institutional building activities conducted by the STP during the preparation process were essential to overcome the significant barriers to the establishment of Puebla's BRT system. Initially there was a lack of a sustainable business environment for public transportation in Puebla when the new state administration took office in 2010. The STP took the necessary steps to transform the current public transportation system model and addressed the significant number of issues through the support of a new transportation corridor program, which pioneered the adoption of organizational measures and incentives in Puebla to promote and enhance the public transportation system.

One of the key elements of the reform instituted by STP is the new regulatory framework under which the public transportation services will be provided. The Chachapa Corridor is the first BRT corridor to operate in Puebla and its implementation will enable the GSP to invest additional financial resources to build additional BRT corridors to complement the foundations set through the RUTA BRT program. The first BRT project will have a demonstration effect to consolidate the reforms necessary to undertake the development and execution of other BRT corridors in the PMA. The new BRT framework developed by the STP creates a market structure in which predatory competition is eliminated by regulating bus service provision through the new bus operating company.

Additionally, the new BRT framework will also eliminate the oversupply of buses and will generate operational savings that, along with a fare structure reflecting actual cost, will create a sustainable business model for bus transportation service provision in the PMA. Moreover, the savings will allow operators to invest in a technological upgrade, from small polluting buses driving unnecessary distances, to high-capacity low emission buses, driving significantly fewer kilometers.

The corridors consists of trunk-feeder corridors with segregated bus lanes, operating under a new regulatory framework that creates a sustainable business models for private operators, enabling them to provide a high-quality of service. The trunk-feeder system reduces the number of bus-kilometers because small buses are only used to transport passengers to and from trunk stations and high-capacity buses transport passengers long distances among trunk stations, resulting in buses running with high occupancy levels, reducing operational cost and travel times. A potential downside of this type of system is that passengers might be induced to take two buses (the feeder and the trunk), forcing them to paying double fare, unless fares are flat



and integrated. The STP recognized this potential problem and to address this issue, the STP has proposed a system for Puebla that will have a flat integrated fare.

Another goal of the state government is to significantly improve environmental conditions in the PMA. The STP recognizes the large contribution that the current public transportation system represents to the problem of air quality and greenhouse gas emissions in the PMA. This issue is expected to be addressed by the STP through the intended modal shift. It is expected that fewer buses, driving fewer kilometers along with fewer pollutant emissions per kilometer, will result in lower congestion and travel costs, better environmental performance and better urban environment. The increasing transit share will enhance these benefits by further reducing congestion and travel cost, emissions, and urban degradation. The idea from the STP has been to design of a modern BRT system supported by policies of scrapping of old vehicles, reforming of institutions and adoption of modern business and organizational practices and regulations to promote a safer, more efficient, and environmentally friendly solution to the existing problematic transportation situation in Puebla.

### **1.1 Improved Business Model**

The baseline business model for the public transportation sector in Puebla consists of independently owned and operated small transportation companies or individuals, managing a few vehicles without standards for performance, safety nor health and fringe benefits for the drivers. This multitude of operators creates a chaotic operational condition throughout many important corridors in Puebla. As part of the RUTA BRT program, a new business model was developed for the grouping of the small operators under a single company with business statutes, performance indicators, modern financial and safety standards and clear operational rules. The new company (Articulados de Puebla) is now the concessionaire that will operate the first BRT corridor created under the RUTA BRT program. Concession contracts were drafted and agreed with between STP and Articulados de Puebla. The operation of the corridor will function as a business under stipulated performance standards that will enable the delivery of safer and more efficient public transportation service in Puebla with lower emission rates.

### **1.2 Lack of a Regulatory Framework**

Currently, the roadways are not regulated for public transportation, nor is there confinement for public transportation allowed on the corridors which creates for chaotic traffic congestion and total disorganization of roadway uses. There are essentially no rules on the use of the bus lanes and no disincentives for the use of bus lanes by other modes of transport which leads to the complete disrespect for exclusive bus lanes in Puebla. The lack of a regulatory framework promotes these types of activities rendering significant damage to the overall operation of the main transportation corridors in Puebla. Under the new RUTA program, the transportation regulations were modified by the STP and new transportation rules are being issued to create the specific travel lanes as exclusive lanes for public transportation. The efficient allocation of public space within the roadways rights-of-way will permit the improvement in mobility that is central to the design of the RUTA BRT Program. All of this has been completed by the state government and speaks to the commitment that the STP places on the development and success of Puebla's BRT system.



### **1.3 Lack of Incentives for Scrapping of Old Buses**

With the current situation in Puebla, old and dilapidated buses continue to operate throughout the corridors. However, through dialogue initiated by STP with the bus operators, the idea of eliminating old buses from the first BRT corridor route was discussed and agreed upon to ensure that strict scrapping rules for old rolling equipment would be in effect by the time the BRT project initiates its activities. The idea of scrapping old buses from the main corridors in Puebla had failed numerous attempts before (by previous administrations) and were seen as barriers to improve public transportation in Puebla. These barriers were solved with the support of the STP working with the various bus operators along the Chachapa Corridor which has set precedent and will facilitate similar activities for the second and third BRT corridor implementations.

### **1.4 Key Policy and Institutional Reforms Supported by State of Puebla Government**

As part of project preparations, major decisions have been taken by the GSP and by the STP to improve the institutional and policy framework of public transportation in the PMA. These policy and institutional reforms include:

- Definition of a programmatic and institutional framework for the BRT corridors;
- Bus regulations in the corridors;
- Definition of business and management structures for operating the bus corridors;
- Identification of measures to promote ridership; and
- Improvements in the environmental and social framework in the transportation sector.

### **1.5 Institutional and Implementation Arrangements**

The corridor will be operated by Articulados de Puebla and managed by Angelcom, an independent, professionally run, private agency organized for this purpose. Articulados de Puebla will work in coordination with Angelcom on bus route operational issues to insure the highest level of operational efficiency in the BRT system. The STP oversees the entire BRT system in Puebla and will be coordinating directly by Articulados de Puebla and Angelcom on performance standards set for the project. However, the STP lacks the necessary ITS technologies to adequately administer the RUTA BRT program and has requested financial assistance from USTDA for the conduct of a feasibility study to guide the acquisition and implementation of ITS technologies in Puebla.

### **1.6 Progress to Date in Puebla's BRT System Preparation**

Puebla's BRT system originated from the development of Puebla's State Development Plan for 2011-2017 and from recommendations that resulted from the development of the Puebla's Urban Mobility Plan completed in 2010. Since then, a significant amount of work has been done on the part of the Government of the State of Puebla and in particular the STP, in support of the formulation of the project, the negotiations with bus owners/operators, transportation policy and institutional reforms, and ultimately financing of the infrastructure for the project. The funded project has supported the design of the institutional and regulatory framework for sustainable



use of the BRT corridors Puebla. The FONADIN has assisted the State of Puebla in financing the BRT infrastructure for the first BRT corridor and stands ready to finance similar activities for the second and third BRT corridors.

The Mayor of the Municipality of Puebla endorsed the new BRT system and the findings of the studies and authorized that further steps be undertaken for their implementation of BRT corridors throughout the municipality. The GSP confirmed the allocation of the budgetary resources for the development of the first BRT transportation corridor in early 2011 and has demonstrated its commitment to fund the next two BRT corridors as evident by the financing that the GSP has authorized to complete the pre-feasibility, environmental studies, and financial and economic assessments for the subsequent BRT corridor projects.

The construction of the Chachapa Corridor was initiated in 2011 and the project is expected to be completed and operational in early 2013. The 11 Norte-Sur and 16 de Septiembre BRT corridors are nearing completion of the final studies including viability assessment, environmental analysis, implementation financing package, and final authorization. The 11 Norte-Sur and 16 de Septiembre Corridor projects have received a federal registration number from the Mexican Ministry of Finance which is the official authorization from the federal government to allow Banobras's FONADIN to fund its corresponding portion of Puebla's BRT system. These next BRT corridors including 11 Norte-Sur and 16 de Septiembre, are expected to start construction in 2013 and 2014 respectively.

The STP wishes to be assisted by USTDA in the project activity for the evaluation and implementation of ITS technologies in the area of APTS for the BRT corridors in Puebla. A USTDA funded activity could transfer the important ITS lessons learned in other U.S. cities including ITS project structure, stakeholder involvement, ITS standardization, communications protocols, and equipment specifications that may be required for the overall deployment of ITS systems in Puebla.

### **1.7 Institutional Arrangements Made by the STP**

Concerning Puebla's BRT system preparation process, the STP modified its transportation policies and regulations to authorize the selection of companies that would become the operators of the BRT system. In the case of the first BRT corridor, Articulados de Puebla will become the only operator of buses. Articulados de Puebla has been organized as a private agency consisting of a conglomerate of current bus owners that provide service to the Chachapa Corridor and the company was created with the sole dedication for the operation, maintenance, and planning of the first BRT corridor program in Puebla. The STP considered similar BRT success projects including the Transmilenio system in Bogota, Colombia, Curitiba, Brazil, Mexico City and others as the entity developed its institutional and transportation policy reforms. After careful review of the alternative models for BRT operation, the STP selected a model BRT system that consists of five fundamental components:

- One entity in charge of the administration, planning, and verification (Secretaría de Transportes);



- One corridor operating company (Articulados de Puebla);
- Adequate building of infrastructure for the BRT projects;
- A standard ticketing and fare collection system; and
- A private managing company for the collection of revenues and distribution (Angelcom).

With this type of BRT arrangement, the public organism (STP) is responsible for the regulation of the BRT system, programming, verification, and correction of the operation and infrastructure, while the private concessionaire (Articulados de Puebla) will be charged with operating and maintaining the bus fleet. The infrastructure of the exclusive bus lanes, including the repair and maintenance of the terminals and stations will be the responsibility of the STP. Angelcom will provide revenue collection services for the first BRT system, distribution of payment measures (electronic tickets), and distribution of revenues according to contractual agreements between STP and Articulados de Puebla. Angelcom will charge 10.6% of all collected revenues against the BRT operation. In addition, Angelcom will be responsible for the acquisition of equipment for detecting and controlling access to the stations and will implement traffic control and monitoring mechanisms for the first BRT system in Puebla.

### **D. IMPLEMENTATION FINANCING**

#### **1.0 Financial Review**

This section of the report describes the process that was followed during the financial evaluation of potential ITS projects in Mexico, the financing methods expected to be utilized for the implementation of the Puebla BRT system and related ITS implementations, a report on the financial assessment performed for STP, a summary of the discussions held with those financial institutions that were contacted during the DM assessment process, and an estimate for Puebla's BRT system implementation for the second and third BRT corridors.

The financial review as part of the DM consisted of the following steps:

- Identification of ITS technology modernization projects and objectives;
- Evaluation of assumptions for future traffic conditions and forecast;
- Identification and screening of reasonable ITS projects and alternatives;
- Review of the implementation periods for selected ITS projects;
- Identification, quantification, and evaluation of potential ITS projects;
- Measurement of impact on the public transportation system with modern technologies;
- Evaluation of cost estimates for the acquisition and implementation of ITS systems; and
- Evaluation of financial resources most likely to be utilized for funding the proposed ITS systems.

The implementation of ITS technologies for Puebla's BRT system were evaluated on the basis of the objectives that the project sponsor is attempting to meet, in addition to evaluating other critical factors that included the following:



- Reduction of delay associated with the BRT corridors and congestion;
- Improve efficiency, security, and safety for public transportation operations;
- Increase primary corridor capacity and efficiency;
- Supplement public transportation system with ITS technologies;
- Improve transportation efficiency and safety on existing infrastructure;
- Potential mitigation of environmental impacts for public transportation projects;
- Improvement of public transportation user comfort and convenience;
- Potential for lower operating costs and lower fuel consumption for public transportation;
- Standardization of revenue collections for the public transportation system.

As part of the planning and project preparation process for Puebla's BRT system, the STP conducted a financial analysis for each of the three BRT corridors. The financial analysis was a requirement of Mexico's Ministry of Finance and Banobras in order to receive proper authorization and issuance of the federal project registration number. Mexico's Ministry of Finance imposes strict requirements of all applicants seeking federal funding for infrastructure projects to be funded through the FONADIN. In conversations with representatives from Banobras, HEP Consulting confirmed that the financial analysis for Puebla's BRT system provided satisfactory results and that the STP has obtained the required federal project registration number which allows Banobras to allocate and disburse federal funding for the BRT system in Puebla.

The high-capacity (BRT) transportation project will be the result of a PPP, in which the public sector will be responsible for the investment to construct the required infrastructure (exclusive bus lanes, stations, terminals, roadways, bike lanes), while the private sector will be responsible for the investment of the bus fleet, the managing company will be responsible for the ticket selling and validating system, the fare collection and revenue collection system and for the monitoring the BRT system. The GSP's initial expenditure in providing the BRT infrastructure is considered a sunk cost, while the fare is expected to cover the capital and operational costs incurred by the private operators in running the system, as well as the operational costs of the managing agency that collects all revenues and monitors the system operations. The allocation of the fare revenue is distributed among the partnership responsible for the service provision and the STP, according to a set of specific rules and contractual arrangements.

The financial analysis performed as part of Puebla's BRT system presents the main conclusions as follows:

- The new BRT systems are expected to generate a moderate operational surplus. This is due to the corridor's high level of demand and elevated passenger turn over;
- The fare revenues are expected to defray a significant share of the capital cost and carries out a relevant social implementation cost (compensation to former corridor operators);
- A share of the fare box to be allocated to STP would be distributed to cover administration costs;



The projected cash flow for Puebla's BRT system is expected to generate a positive net income. The financial revenues for each BRT corridor are expected to compensate the financial expenditures, as the fare level has been designed to account for the coverage of expenditures. The financial plan for Puebla's BRT system comprises the participation of several public and private entities. First the GSP is financially responsible for the completion of all studies and planning efforts and for the construction of infrastructure on the BRT corridors, with the consent and support from the Municipality of Puebla and for the administration of Puebla's BRT system.

The second key player in the financial plan is the federal program PROTRAM (Programa de Apoyo Federal al Transporte Masivo) supported by the FONADIN that is contributing funds to supplement the GSP funding for the construction of infrastructure of the BRT corridors and technology improvements. The last component of the financial plan is assigned to the private sector (Articulados de Puebla) for the acquisition of the bus fleet and operation of the buses on the Chachapa corridor. A similar arrangement is expected to be implemented for the second and third BRT corridors where new BRT bus operators will form companies for the operations of 11 Norte-Sur and 16 de Septiembre corridors.

The main components of the financial plan include infrastructure, administration, fleet acquisition and operation, BRT system management, and technology applications. The technology application component include all possible applications related specifically to the BRT project which includes supplements to the infrastructure such as at stations, transfer centers, ticketing and fare collection systems, fleet management and control systems, and all other ITS technologies that would be applicable to the improvement of Puebla's BRT system. The private sector is responsible for the ITS technologies that are associated to the vehicles such as on-board equipment and communication systems, as well as for the maintenance of such systems and the entire fleet. The STP wishes to implement ITS technologies in an integrated manner that would allow the agency to supervise the entire BRT operation overseeing operations by the bus operator as well as by the managing company. For this, STP staff has expressed their desire to evaluate ITS technologies that will allow the agency to perform these monitoring and supervision functions.

### **1.1 Expected BRT Revenues and Disbursements**

Puebla's BRT system revenues will depend primarily on the collection of fare revenues. A flat integrated fare has been established for the first BRT and various fare values are now being evaluated for the second and third BRT corridors. Some passengers (students and the elderly) will pay a preferred lower fare. Daily demand estimated for the Chachapa Corridor is about 107,000 passengers for a typical week day, and about half that figure for weekends and holidays.

The expected demand is represented by current users of the three BRT corridors and therefore no major demand risks are expected as demand is already captured. For the same reason there is not a ramp-up period considered for the initial start-up in operations for the BRT corridors and natural demand growth is expected over time. Likewise, annual kilometers traveled and the



annual operational costs are not expected to change significantly for the initial operational period. The design of the PPP assumes that the fare should be defined as to cover the private expenditures (including a reasonable return on capital) and the government control tasks, excluding the government initial sunk costs for building of infrastructure.

The Trunk line bus operators will be rewarded based on a predefined rate per kilometer, times the number of kilometers traveled every month. Ticketing selling and revenue collection will be rewarded as a percentage of the total passenger fare that will be collected by a managing company. This percentage will be 10.6 percent of the total passenger fare revenues collected for the Chachapa Corridor and somewhere in the general neighborhood of 6 to 7.5 percent for the second and third corridors. Moreover, the managing company will have the rights to commercially exploit of the publicity spaces of the BRT system (in buses, stations, and transfer centers) which is expected to bring additional revenues. The BRT system coordination and regulation will be the responsibility of the SCT under the RUTA program. The RUTA program is expected to receive somewhere in the range of 4 to 6 % of the total revenues.

#### **Contingency Fund**

Given the normal uncertainties associated with the implementation of a BRT system carrying out a new model, the STP has considered it of strategic importance to establish a contingency fund to cover any misalignment between the system revenues and the system expenses.

#### **Sensibility Analysis**

In order to establish the financial risk associated with changes in the demand, the fare, and the value of the U.S. dollar, a sensibility analysis was developed. Additional scenarios were developed with reductions of various percentages (5%, 10%, 15%) in the demand or in the fare. A series of estimations were also performed for U.S. dollar value variations. The results from the sensibility analysis indicate that the BRT project will yield positive financial results (for the three corridors) after the initiation period when capital expenditures are paid and the RUTA program is expected to yield revenues to cover the investments made by the private sector and still provide profit to the SCT for the administration and regulation of the BRT program.

#### **Compliance with Federal Bank (Banobras) Policies**

Puebla's BRT system project has been reviewed and approved by Mexico's federal Government which gave the project the "green light" to receive federal funding from Banobras' FONADIN. Puebla's BRT system project complies with all applicable Banobras policies and FONADIN funding requirements. As such, Puebla's BRT system has received financing for the construction of infrastructure of the first BRT corridor and is expected to receive substantial amount of funding for the completion of the second and third BRT corridors.

### **1.2 Economic Analysis for 11 Norte-Sur and 16 de Septiembre Corridors**

The economic analysis for the BRT corridor project was based on the estimation of the cost for the infrastructure of the corridor, as well as for the buses and other equipment, and the associated maintenance cost. In addition, the cost considered for scrapping the old buses, the annual replacement cost of the current fleet without the project, the residual value of corridors



and buses at the end of the crediting period were also taken into consideration as the economic analysis was conducted. On the benefit side, the analysis considered the time savings for the users of the new public transportation system and of the other vehicles, the reduction of the accident rate, the environmental benefits, as well as the cost savings in operational and maintenance cost.

The cost for the investment in the infrastructure of the corridor will be provided by the executing agency which is the STP. These costs include the investment in the infrastructure, the residual value of the corridor at the end of the evaluation period, and the maintenance cost of the corridor over the implementation period. The capital cost for the acquisition of new vehicles will be provided by the BRT operator. In addition, the current vehicle replacement is taken into account on a yearly basis as the base case for buses. The residual value of the new buses is accounted for in the economic analysis at the end of the analysis period. The current bus fleet is going to be scrapped incurring an additional cost to the project and this was also considered in the economic analysis.

The STP has conducted an economic analysis for the 11 Norte-Sur and 16 de Septiembre BRT corridors and has presented the results to the FONADIN. The total initial investment for the three BRT corridors has been set at approximately U.S. \$204 million. Based on this amount, the Internal Rate of Return (IRR) calculated for the project is 15.49%. Additionally, the evaluations conducted for the Immediate Rate of Return of the second and third BRT corridors project indicates that the start of operations for the 11 Norte-Sur corridor would be in the year 2014. The economic indicators for both corridors (11 Norte-Sur and 16 de Septiembre) demonstrates positive results that have led the FONADIN to consider funding the project in the near future.

The risks associated with the implementation of the second and third BRT corridors were also evaluated to include technical, legal, environmental, social, financial, and economic risks to determine the potential impact that these would have in the completion of the second and third BRT corridors. The risk evaluation concluded that there is no risk associated with demand given the fact that existing routes that operate along the main trunk lines and feeder routes will not change initially and in fact, there is the potential that demand will increase over time.

The risk analysis considered the fact that the concessionaries or bus owners may not reach an agreement to form the required association to operate the BRT buses and to invest in the acquisition of the required equipment. The situation experienced with the implementation of the first BRT corridor suggests that it is likely that the current bus owners operating the routes along 11 Norte-Sur and 16 de Septiembre corridors will come to an agreement that will lead to the creation of companies for the operation of the buses on the corridors. Additionally, the STP has contacted Mexico's Centro de Transporte Sustentable (Mexico's Center for Sustainable Transportation) and the Instituto de Políticas para el Transporte y Desarrollo (Institute of Policy for Transportation and Development) to guide the bus owners in the formation of their companies that will ultimately operate the buses on the corridors.



The other risk considered is the potential increase of the U.S. dollar and what consequences this may have on the project as the fleet equipment and other technologies have components that originate from outside Mexico. However, this risk has been considered in the sensibility analysis that was conducted as part of the financial plans and the results indicate that the amounts set for financing the project should cover any reasonable fluctuations of the U.S. dollar to allow the project to continue as planned.

The 11 Norte-Sur and 16 de Septiembre BRT corridors are expected to generate social benefits that include savings in vehicular operational cost, travel time saving for users of the main trunk lines and feeder routes, as well as for users of private vehicles that travel along the BRT corridors. In relationship to the current situation, the second and third BRT corridors are expected to generate vehicular cost savings of U.S.\$19.8 million and savings in travel time of an average of 4.1 minutes for the users.

The implementation of the second and third BRT corridors has the following benefits:

- Time savings for the vehicles, taxis, and other vehicles,
- Time savings for the users of the new public transportation system on the corridor,
- Operating and maintenance cost savings,
- Environmental benefits include reduction of pollutants.

The estimation of the time savings is based on the “build” scenario travel time from vehicles on the corridors in minutes per kilometer measured against the baseline (current) travel time on the same two corridors (min/km), and the daily kilometers traveled by the vehicles on the corridor. The quantification of the time savings for the passengers per vehicle, estimated a conservative number of passengers (1.5 passengers per vehicle), and the minimum salary per day. The time savings for the passengers currently using the buses and those who will use the new BRT corridor buses, take into account the total demand, the changes in demand according to weekdays and weekends, and the different distances traveled by the bus passengers on the two corridors.

The current operation and maintenance cost were obtained by the current public bus operators and have been prorated for the private bus operator. The pollutants generated along the corridors were taken into account in the estimation of the emission reduction due to the implementation of the BRT corridors. The quantifiable benefits include the burning of less fuel by replacing old inefficient technology with modern efficient technology, and by improving the traffic flow of vehicles along the corridors. The estimates indicate that less fuel will be consumed because of an expected modal shift from vehicles to the articulated buses, the use of more efficient buses, less congestion on the corridor, and less delay and stops. These benefits are partly offset by burning more fuel by delaying an improved corridor’s cross flow vehicular traffic, and by lengthening the travel time and distance for vehicles that used to turn left across the corridor and are not longer allowed.



### **1.3 Fiscal Impact**

The GSP has allocated budgetary resources of the order of U.S. \$50 million to finance the infrastructure for the first BRT corridor in Puebla and has also indicated that it will budget and spend in exceed U.S. \$80 million for the implementation of the second and third BRT corridors. Agreements have been reached with the operators for use of the infrastructure and reorganization of small private bus owners into a single, operating company for the first BRT corridor and similar agreements are expected for the implementation of the second and third corridors. After inviting several banks to propose on financing opportunities for the acquisition of the BRT buses (BBVA, Bancomer, Banco del Bajío, Banca Mifel, and Banorte), Articulados de Puebla decided to finance the purchase of 119 new buses directly with Mexican bus manufacturer DINA.

The Puebla BRT system feasibility study results demonstrate that the bus corridor approach is a viable option to promote safe and efficient mobility for the PMA. If the viability of the first three BRT corridors concept can be proven, the project will serve as a blueprint for other corridors in the PMA with a much higher impact. The State of Puebla envisions a BRT corridor program of six corridors. The preparation studies for the second and third corridors have already been developed and the results indicate that the projects are viable and are awaiting funding approvals from the FONADIN.

The financial participation of USTDA in Puebla's BRT system total cost could represent a significant value added to the overall project as ITS technologies should be an integral component of the operational features of the BRT corridors and it is an area that has not received the deserved attention by the project stakeholders. The STP has recognized this shortfall in ITS technology planning and wishes to undertake a comprehensive review of how ITS technologies can improve the BRT corridor performance, security, and safety, identify what are the most suitable ITS technologies for the BRT corridors, and the development of an ITS implementation plan for all BRT corridors in Puebla.

The project is considered to have a low to medium risk level primarily due to the novelty and pioneering character of both the reforms made to date and the new institutional changes that will govern the operation of public transportation systems in Puebla. The STP understands that the success of Puebla's BRT system will bring in substantial rewards to the State of Puebla, as it would then be in a position to replicate the experience to the entire PMA. The community's acceptance of the new type of public transportation is expected to be high given the surveys conducted prior to and during the project preparation period. HEP Consulting randomly interviewed several citizens in the streets of Puebla and most shared a positive attitude towards the new public transportation system.

## **2.0 STP Financial Assessment**

The financial assessment conducted for the STP indicates that this government agency operates as a self-sustaining institution that has good financial standing that would allow STP to enter into additional construction agreements with the private sector for the construction of



additional BRT corridor infrastructure and the operation of additional BRT systems. The financial sustainability of the STP and GSP was confirmed by both Mexico's Ministry of Finance and Banobras as requirements to receive federal funding for Puebla's BRT system.

### 3.0 Financial Institutions

HEP Consulting made contact with financial institutions in the United States and in Mexico with the purpose to determine the most likely source of financing Puebla's BRT system, as well as to determine if these institutions had any on-going financing activities in the transportation sector in Mexico.

#### 3.1 Banobras

Banobras is the Mexican development bank responsible for promoting and financing infrastructure projects and public services mainly through sub-national government lending and project finance. Banobras also promotes private participation in the development of infrastructure in Mexico. By encouraging the efficient use of private sector capital, the bank contributes to the development of strategic projects that the country needs. The Fondo Nacional de Infraestructura FONADIN is administered under Banobras. The FONADIN supports the development of infrastructure in Mexico by providing financing in the areas of studies, credit guarantee, and direct capital for infrastructure projects in the country. FONADIN supports transportation, environmental, public services, tourism, and other projects throughout Mexico. In the transportation sector, FONADIN supports projects in the areas of airports, rail, ports, and urban transportation. Urban transportation projects supported by FONADIN include light rail systems, Mexico city's metro system, and BRT projects throughout Mexico.

The first corridor of Puebla's BRT system is being supported financially by FONADIN. These funds will not have to be repaid by the STP as the project is considered a national transportation development initiative. The second and third BRT corridors for Puebla will also be financed in part by FONADIN. HEP Consulting discussed the Puebla BRT project with Mr. Francisco Quiñones Partida, Director de la Subdivisión de Estudios, Investigación y Evaluación Tecnológica de Banobras to determine the status of Puebla's BRT system project. Mr. Quiñones confirmed that Banobras and its FONADIN are financing a portion of the first BRT infrastructure project in Puebla. Mr. Quiñones further indicated that the STP has received the federal registration number for the second and third BRT corridors from the Unidad de Inversiones de Hacienda, under Mexico's Ministerio de Hacienda y Crédito Público (Mexico Ministry of Finance) which gives Banobras the "green light" to financially support the next phase of BRT corridors in Puebla.

Mr. Quiñones indicated that the Puebla BRT system is considered a national transportation initiative and as such, has the full support from Banobras for financing the project infrastructure and related technologies. HEP Consulting discussed with Mr. Quiñones the potential USTDA assistance to conduct an ITS feasibility study for Puebla's BRT system project. Mr. Quiñones confirmed that the one thing that was missing from Puebla's BRT system project was a strong consideration for the application of ITS technologies. Mr. Quiñones could not agree more with



the fact that an evaluation and identification of ITS technologies for Puebla's BRT system was imperative for the success of the BRT corridors.

Mr. Quiñones further indicated that currently there is funding available under the FONADIN for ITS technologies such as the implementation of TSP and possible upgrade of the traffic signal system in Puebla to specifically address the BRT corridors. It is expected that as the second and third BRT corridors are finally approved for funding, that FONADIN will include funding allocation for the implementation of ITS technologies for these corridors. Mr. Quiñones indicated that the completion of an ITS feasibility study will be of great importance for the STP and Banobras in helping these entities identify the most appropriate ITS technologies that will benefit the BRT system in Puebla. A completed ITS feasibility study would provide the STP and Banobras with the information required to allocate the necessary financial resources to fund the implementation of ITS systems for the BRT corridors in Puebla. Based on the conversations that HEP Consulting conducted with Mr. Quiñones, it is determined that Banobras is fully committed to funding Puebla's BRT system project, including the future implementation of ITS systems if necessary.

### **3.2 World Bank**

The bank is heavily involved in Mexico and has been a major supporter of transportation infrastructure activities in that country. The World Bank is currently financing and supporting the Mexican government under various programs. Contact was made with Mr. Georges B. Darido, Transport Specialist with the Bank's Latin America and Caribbean Region Transport Unit, to inquire about the bank's participation in any transportation activity that would involve ITS systems. Mr. Darido indicated that at this time the Bank does not have any current active lending instruments in the area of public transportation in Puebla. The bank has not been asked to financially participate in Puebla's BRT system project, although bank representatives often visit with staff of the STP to offer advice on specific topics such as environmental assessment and planning for the BRT corridors.

### **3.3 The Inter-American Development Bank – IADB**

The Inter-American Development Bank has been active in Mexico for many years assisting the Mexican governments of all levels in the development of social, environmental, technological and infrastructure sectors. Contact was made with Mr. Carlos Mojica from the IADB concerning potential transportation projects being funded by the IADB where ITS technologies were part of the project. Additionally, inquiries were made regarding Puebla's BRT system project. IADB representatives indicated that the bank is not financing any transportation projects where ITS technology is an integral part of the activity. Furthermore, the bank has not received a request for financing any portions of Puebla's BRT system project as Banobras is heavily subsidizing that project.



### **3.4 International Finance Corporation - (IFC)**

HEP Consulting held meetings with Mr. Alejandro Morales and Ms. Nayve Martínez Rubio, to inquire about the IFC's involvement in the surface transportation sector in Mexico and to determine if any activity included ITS as a project component. Ms. Martínez Rubio and Mr. Morales indicated that the IFC in Mexico is working in the development of PPP's and the corporation is providing all the services necessary for the development of projects including pre-feasibility and feasibility studies, environmental studies, economic, financial, and technical viability studies, and technical assistance to the private sector in Mexico on projects that directly affect the public sector. The IFC does not currently have a transportation project where ITS systems are contemplated to be used. The IFC has not been involved in supporting the private sector in Puebla's BRT system project as the bus operator decided to finance the acquisition of the buses directly with the bus manufacturer (DINA).

### **3.5 Export-Import Bank of the U.S.**

Contact was made with Ms. Kate Bishop, Business Development Officer for the Ex-Im Bank to inquire about the bank's activities in the transportation sector in Mexico. Ms. Bishop indicated that the bank does not specifically collect data on intelligent transportation systems applications. However, Ms. Bishop indicated that the bank has financed nearly \$600 million in the transportation sector in Mexico in 2012. The bank will be interested in learning more about potential opportunities to support the private sector in exporting ITS technologies to Mexico.

### **4.0 Estimated Capital Cost for Project Implementation**

This section of the report presents the estimated capital cost for the implementation of the second and third BRT corridor projects in Puebla. The first corridor is already under construction and expected to start operations in early 2013. The next BRT corridor project will be conducted in two phases. The first phase will include the construction and implementation of the 11 Norte-Sur corridor followed by the second phase which includes the implementation of the 16 de Septiembre corridor.



**Table No. 5**  
**Puebla's BRT System Capital Cost**  
**11 Norte - Sur Corridor (Phase I)**  
**16 de Septiembre Corridor (Phase II)**  
**(U.S. \$ Million)**

|            |   | <b>Total<br/>Investment<br/>U.S. \$</b> | <b>Phase I<br/>11 Norte-Sur<br/>U.S. \$</b> | <b>Phase II<br/>16 de Sep.<br/>U.S. \$</b> |
|------------|---|---|---|--|
| <b>1.0</b> | <b>Exclusive Bus Lane and other BRT Infrastructure</b>  | 57.86                                   | 53.80                                       | 4.06                                       |
| <b>2.0</b> | <b>Other Infrastructure, Facilities, and Systems</b><br>(Stations, terminals, bus storage facilities, traffic signal system, signage, bike lanes, pedestrian bridges, vehicle maintenance shop, and command and control center) | 40.8                                    | 32.08                                       | 8.72                                       |
| <b>3.0</b> | <b>Other Investment</b><br>(Land acquisition, studies and design, licensing and approvals, project management and supervision)  | 30.50                                   | 23.34                                       | 7.16                                       |
| <b>4.0</b> | <b>BRT Systems and other Technologies</b><br>(Maintenance equipment, fare collection systems, station/terminal equipment, and other)  | 14.74                                   | 3.55  | 11.19                                      |
| <b>5.0</b> | <b>Bus Fleet</b>  |   |   |  |
|            | ➤ 78 Articulated Buses (11 Norte-Sur/160 passenger)   | 36.08                                   | 36.08                                       | N/A  |
|            | ➤ 111 Buses (16 de Sep./100 passenger)  | 14.10                                   | N/A   | 14.10                                      |
|            | ➤ 268 Auxiliary Buses (40 & 100 passenger)  | 26.65                                   | 18.24                                       | 8.41                                       |
|            | <b>Total Capital Cost</b>   | <b>220.73</b>                           | <b>167.09</b>                               | <b>53.64</b>                               |
|            | IVA Tax (Impuesto Valor Agregado)   | 33.09                                   | 26.45                                       | 6.64                                       |
|            | <b>TOTAL</b>  | <b>253.82</b>                           | <b>193.54</b>                               | <b>60.28</b>                               |

## **E. U.S. EXPORT POTENTIAL**

### **1.0 U.S. Export Potential Assessment**

This section of the report summarizes the findings that resulted from the U.S. export potential assessment conducted as part of the DM. The U.S. export potential was developed from discussions held with the various Mexican transportation officials, from site inspections conducted at transportation facilities in Mexico, and from the review of documentation as part of the DM research. The U.S. export potential assessment was conducted based on the potential acquisition and implementation of a wide range of ITS technologies for Puebla's BRT system and more specifically technologies that fall under the ITS category of Advanced Public Transportation Systems (APTS).

Intelligent Transportation Systems have assisted public transportation agencies increase safety, operational efficiency, and quality of service and ITS may have their highest and best



applications in Bus Rapid Transit systems. ITS include a variety of advanced technologies to collect, process, and the dissemination of real-time data from the bus and roadway sensors. BRT operational data can be transmitted via a dedicated communications network and computing intelligence is used to transform the data into useful information for the operating agency, driver, and ultimately the customer. Different applications of technologies combine to form different types of ITS systems which in the public transportation arena is known as APTS.

APTS technologies provide many performance improvements and benefits to BRT systems. The remote monitoring of transit vehicle location and status and passenger activity also improves passenger and facility safety and security. APTS systems are also used to assist operators in maintaining vehicle fleets and alert mechanics to impending mechanical problems as well as routine maintenance needs. APTS applications are fundamental to generating many of the BRT's benefits. However, integration of individual ITS applications into the overall BRT system is essential. The combination of ITS applications must ultimately work together systematically to provide the high quality service which defines BRT.

Puebla's BRT system project was evaluated in terms of those ITS technologies that may present opportunities for improving operational efficiencies, safety, and security for the new BRT corridors in Puebla.

## **2.0 Intelligent Transportation Systems Applications**

This section of the report outlines the individual ITS technologies that should be considered by the STP for potential implementation as part of Puebla's BRT system, as well as the potential integration of various ITS systems for the BRT corridors.

### **2.1 Bus Prioritization Systems**

These technologies include methods to provide preference or priority to BRT services. The intent is not only to reduce the overall traffic signal delays (thus greater operating speed and shortened travel time) of in-service transit vehicles, but also to achieve greater schedule and headway adherence and consistency (thus enhanced reliability and shorter waiting times). Signal timing and phasing as well as Transit Signal Priority (TSP) help BRT vehicles minimize delay caused by having to stop for traffic at signalized intersections.

TSP technologies can be used to extend or advance green times or allow left turn swaps to allow buses that are behind schedule to get back on schedule, improving schedule adherence, reliability, and speed. TSP requires traffic signal controllers, special software and other TSP capable equipment on the transit vehicle and at the intersection for identifying the transit vehicle and generating low priority request when appropriate. TSP modifies the normal signal operation process to better accommodate transit vehicles. The objectives of TSP include reduced travel time, improved schedule adherence, improved transit efficiency, contribution to enhanced transit information, and increased road network efficiency.



The Puebla BRT system anticipates the use of TSP, however the necessary studies were not conducted to define the process and technologies that are required for TSP. As such, the first BRT corridor in Puebla will not operate with TSP and is expected to significantly reduce operational capacity of the BRT system. The STP and Banobras are very interested in the implementation of TSP and Banobras through its FONADIN has allocated funding for TSP. However, studies are needed to develop an implementation plan and identification of the TSP technologies to be utilized in conjunction with the BRT system.

## **2.2 Operations Management Technology**

These technologies include automation methods that enhance management of BRT fleets. Use of Automated Scheduling Dispatch System and Automatic Vehicle Location Systems assists BRT management to best utilize the BRT vehicles. All Operations Management functions improve operating efficiencies, supporting a reliable service and reduced travel times. Automated Scheduling Dispatch System use real-time vehicle data (location, schedule adherence, passenger counters) to manage all BRT vehicles in the system and insure proper level of service for passengers. This requires a communication system and vehicle tracking components integrated with special software package.

Automated Vehicle Location (AVL) systems provide transit operations personnel with the current location of BRT vehicles on the network. Transit location information is used for improved traveler advisory services, schedule adherence and archived to support future planning efforts. This requires a communications system integrated with vehicle tracking components. The most typical installations are based on the Global Positioning System (GPS) to identify vehicle location.

## **2.3 Passenger Information Systems**

Passenger Information technologies can improve passenger satisfaction, help to reduced wait times, and thus increase ridership. Passenger Information systems can also be a source of revenue through the sale of advertising time and space on information screens. These services rely on a communications system that is able to track individual vehicles, transmit vehicle location data to a central processing center and disseminating processed vehicle data to the transit customer. For BRT systems, information about the vehicle schedule can be provided to the transit customer at the station / stop and / or on the vehicle. Providing schedule information to travelers via mobile devices (e.g., PDA, cell phone) and supporting trip itinerary planning typically require implementation across the entire transit network.

## **2.4 Safety and Security Technologies**

The use of silent alarms and on-board and in-station monitoring systems can increase the security of the BRT operation. Silent alarms can be installed on the BRT vehicle and can be activated by the BRT vehicle driver. Messages such as "Call 911" can be displayed on the exterior sign board for others to see or messages can be sent back to the operations center to indicate an emergency or problem. CCTV cameras are often installed on board the buses to provide for increased security on the vehicle and data can be sent back to an operations center for monitoring purposes.



## **2.5 Advanced Communications System (ACS)**

Key to support ITS technologies is the Advanced Communication System which creates a backbone on which the rest of the ITS applications operate. Utilization of the latest in voice and data communication allows for the operation of other ITS technologies. An ACS is the foundation for many of the ITS technologies. The storage of data that is collected from vehicle sensors (passenger counters, vehicle maintenance systems, etc.) is important for BRT operators for future planning purposes or analysis. ITS technologies require the utilization of a robust communication system, either via wire line or wireless, to transmit both voice and data and create an integrated system. Therefore, it is imperative that BRT sites have an Advanced Communication System (ACS) designed to meet the needs of the ITS technologies they plan to deploy and any future technology utilization to have an integrated BRT systems. BRT operations with signal priority, operator lane assist, reduced headways between vehicles, and real time information may need both more frequent updates and more types of data than normal operations.

## **3.0 U.S. Export Potential**

Based on the results from the U.S. export potential assessment, HEP Consulting determines that there are opportunities for U.S. firms to market ITS technologies in Puebla. The U.S. export assessment results indicate that the most likely sources of U.S. exports to Puebla would be in the procurement and installation of modern ITS systems associated with Puebla's BRT system.

### **3.1 Estimate of Potential Procurement**

The information obtained as part of the DM indicates that the types of ITS technologies necessary for the Puebla's BRT system must be imported into Mexico. Puebla's BRT system project would cover a broad range of ITS systems that have been developed and used for some years in the United States. While the number of U.S. companies involved in the manufacturing of APTS technologies is limited, there are some U.S. companies that definitely have the expertise to provide the services and technologies required by Puebla's BRT system project. In reviewing the potential need for equipment, materials, software and ITS services and systems, it is determined that a number of U.S. companies could adequately supply the required services and equipment for Puebla's BRT system. The technology that is most likely to be required for Puebla's BRT system, is currently being utilized widely throughout the United States, and it is therefore readily available for export to Puebla, Mexico.

An estimate of potential procurements of U.S. goods and services has been developed and the following table presents a breakdown by category of goods and services likely to be imported by the STP and BRT operators in Puebla. The U.S. export potential was estimated based on ITS equipment and systems that will be required for the implementation of the second and third BRT corridors given the fact that the first BRT corridor is scheduled to start operations in early 2013. However, there are certain ITS systems that will not be implemented as part of the first BRT corridor and those systems (such as TSP, traveler information systems, safety and security



systems, others) were taken into consideration as potential ITS applications that could be introduced for the entire BRT system.

**Table No. 6  
U.S. Export Potential - Puebla Bus Rapid Transit ITS Systems**

| No.        | Intelligent Transportation Systems and Professional Services                  | Cost/U.S. Dollar |
|------------|---|------------------|
| <b>1.0</b> | <b>Central Systems Hardware For Command And Control Center</b>                |                  |
| 1.1        | Workstations, Servers, Racks  | \$10,000.00      |
| 1.2        | Communications Hardware   | \$75,000.00      |
| 1.3        | Video Display Equipment   | \$400,000.00     |
| 1.4        | Network Video Recorder  | \$2,000.00       |
| 1.5        | Data Storage Hardware   | \$5,000.00       |
| 1.6        | Dispatch Center Hardware  | \$150,000.00     |
| <b>2.0</b> | <b>Central System Software For Command And Control Center</b>                 |                  |
| 2.1        | Computer Aided Dispatch/Automatic Vehicle Location (CAD/AVL) Central Software | \$100,000.00     |
| 2.2        | Automatic Voice Annunciation (AVA) Software                                   | \$30,000.00      |
| 2.3        | Automatic Passenger Counters (APC) Management Software                        | \$30,000.00      |
| 2.4        | Traveler Information Software   | \$30,000.00      |
| 2.5        | Fare Collection Manager Central Software                                      | \$125,000.00     |
| 2.6        | Closed Circuit Television (CCTV) Camera Management Software                   | \$25,000.00      |
| 2.7        | Network Management System   | \$30,000.00      |
| <b>3.0</b> | <b>Automatic Fare Collection System</b>                                       |                  |
| 3.1        | Ticket Vending Machines   | \$1,800,000.00   |
| 3.2        | Ticket Validation Machines  | \$1,450,000.00   |
| 3.3        | Fare Box Units (On The Bus)   | \$1,500,000.00   |



|             |   |                        |
|-------------|---|------------------------|
| <b>4.0</b>  | <b>Traveler Information Systems</b>                                 |                        |
| 4.1         | Variable Message Signs (VMS) Systems                                | \$1,300,000.00         |
| 4.2         | Public Address System (PA)  | \$400,000.00           |
| <b>5.0</b>  | <b>On-Board Technologies</b>  |                        |
| 5.1         | Mobile Data Computers (MDCs)  | \$500,000.00           |
| 5.2         | GPS Units (On-Board)  | \$1,000,000.00         |
| 5.3         | Automatic Passenger Counters (APC)                                  | \$370,000.00           |
| 5.4         | On-Board Automatic Voice Annunciation Unit (AVA)                    | \$230,000.00           |
| 5.5         | On-Board Passenger Displays   | \$320,000.00           |
| 5.6         | On-Board Cameras, Silent Alarm, Other (Security Package)            | \$750,000.00           |
| <b>6.0</b>  | <b>Safety and Security Systems</b>                                  |                        |
| 6.1         | CCTV Camera Units (Stations and Transfer Centers)                   | \$250,000.00           |
| 6.2         | CCTV Camera Units (Corridors)                                       | \$250,000.00           |
| 6.3         | Emergency Call Boxes (Stations and Transfer Centers)                | \$100,000.00           |
| <b>7.0</b>  | <b>Communications System</b>  |                        |
| 7.1         | Fiber Optic Communications (Fiber, Receiver, Transmitter Equipment) | \$450,000.00           |
| 7.2         | Radio Data Communication Systems (Fleet - Hardware)                 | \$2,200,000.00         |
| <b>8.0</b>  | <b>Transit Signal Priority (TSP) System</b>                         |                        |
| 8.1         | TSP Software  | \$50,000.00            |
| 8.2         | Controller/Hardware   | \$1,400,000.00         |
| 8.3         | Other Roadside Equipment (Detectors)                                | \$200,000.00           |
| 8.4         | Vehicle Equipment (Emitters, Software)                              | \$270,000.00           |
| <b>9.0</b>  | <b>Fleet Management Systems</b>                                     |                        |
| 9.1         | Fleet Management Systems Hardware                                   | \$400,000.00           |
| 9.2         | Fleet Management Software (Operations)                              | \$200,000.00           |
| 9.3         | Fleet Management Software (Maintenance)                             | \$200,000.00           |
| <b>10.0</b> | <b>ITS Design, Engineering, and Integration Services</b>            |                        |
| 10.1        | ITS System Design and Engineering                                   | \$1,100,000.00         |
| 10.2        | ITS Integration Services  | \$1,100,100.00         |
| 10.3        | Optimization of Traffic Signals for TSP                             | \$500,000.00           |
|             | <b>Grand Total</b>  | <b>\$18,002,100.00</b> |



Based on the U.S. export assessment conducted for Puebla's BRT system project, it is expected that the U.S. export potential for ITS systems, equipment, and services could reach U.S. \$18 million.

Puebla's BRT system will require a series of ITS technologies to allow the entire BRT system to operate at ultimate performance levels, including accurate and reliable systems required for revenue collection. It is estimated that the U.S. export potential could include the area of central systems hardware comprised of workstations, servers, racks, communications hardware, video display equipment, network video recorder, and data storage hardware.

Central systems software for the operation of command and control centers would include Computer-Aided Dispatch/Automatic Vehicle Location (CAD/AVL) Central Software, AVA (Automatic Voice Annunciation) Software, APC (Automatic Passenger Counters) Management Software, Traveler Information Software, Fare Management Central Software, CCTV (Closed Circuit Television) Camera Management Software, Emergency Call Box (ECB) Central Software, and Network Management System. These central systems software could be integrated with other ITS systems for the BRT operations and as such, it is expected that professional services for ITS integration design and services will be required.

U.S. export potential could also include the area of Automatic Fare Collection systems which would be comprised of Ticket Vending Machines (TVMs) and Ticket Validators located at every station and transfer terminal for the BRT system. In order to serve passenger demand and provide redundancy at most stations, at least two TVMs may be installed and two validators could be installed at the stations. Electronic payment fare boxes will also be required for the integrated electronic payment system throughout Puebla's BRT system. This will further represent opportunities for U.S. firms to export their fare collection technologies to Mexico. The fare collection system for the BRT in Puebla would be managed through the Fare Management Central Software (part of the Central Systems), which can monitor equipment status data and manage relevant information.

Traveler Information Systems (TIS) also represent good U.S. export potential as all the BRT stations and transfer centers will require this technology. The ITS system would include Variable Message Signs (VMS) and Public Address (PA) systems installed on each station platform. These VMS and PA systems could be coordinated and controlled from a control center. The central Traveler Information Software (part of the Central Systems) would be interfaced with the CAD/AVL Central Software to provide real-time bus arrival prediction information to the VMS and PA systems at the stations and transfer centers in Puebla.

While on-board technologies are the responsibility of the BRT bus operator, the STP is extremely interested in making sure that these technologies are utilized in connection with other ITS technologies to provide for the most efficient and safe operation of Puebla's BRT system. As such, the STP seeks to develop ITS system specifications that could be used in the



implementation of on-board technologies in connection with the rest of the technologies to be implemented through the BRT system.

Puebla's BRT system presents significant opportunities for U.S. firms to export their products to Mexico in working with the BRT private operators as on-board technologies will be required for the buses. On-board technologies would include Mobile Data Computers (MDCs), with built-in Mobile Data Terminals (MDTs), and GPS receivers, that could be installed on all buses. This presents U.S. export potential for equipment such as Automatic Passenger Counters (APC). The APC Management Software can be integrated with the CAD/AVL Central Software (both part of the Central Systems). On-board Automatic Voice Annunciation (AVA) controller and interior Variable Message Sign (VMS) are also systems that could be exported to Mexico. Other on-board technologies, such as onboard passenger displays, Automatic Voice Annunciation Systems (AVAS), On-board Video Monitoring (OVM), and silent alarms would most likely be required by Puebla's BRT system.

Safety and Security Systems will be required as part of Puebla's BRT system and certain equipment and systems have been included in the U.S. export potential list which include CCTV cameras to monitor the station platforms, the Ticket Vending Machines, and provide some coverage of station plazas and pedestrian pathways. CCTV cameras can also be placed at strategic operational locations along the various BRT corridors in between stations to improve situational awareness for the dispatchers at the control center. The video from these cameras could be transmitted to a control center for viewing and recording. Emergency Call Boxes (ECBs) were also considered as part of U.S. export potential as these applications are provided in BRT stations to provide for security and communications for the users.

The STP has indicated that a fiber optic communications network will be required for Puebla's BRT system. The fiber optic communications system will initially support the communications between stations for ticketing services, ticket validation operations, phone communications, and other data transfer operations. The deployment of ITS systems will require a sound communications infrastructure in order to integrate the various ITS components and for the transmittal and receipt of data between the field equipment and a command and control center.

The fiber optic communications system along the BRT corridor should provide a secure, high speed and reliable platform for transmission of voice, data and video to support monitoring and management of the bus operations and security functions at stations and transfer stations. This communications system is expected to include a dedicated fiber optic backbone installed along the length of the BRT corridors connecting to stations, intersections, and stand-alone cameras.

The fleet and vehicle voice communications could be handled by a radio communications system that will be deployed as the BRT corridors are implemented. However, fleet and vehicle data communications will have to be evaluated to determine the most suitable method of providing this service to support the exchange of information between transit vehicles and other BRT facilities, including the command and control center.



#### 4.0 List of Potential U.S. Suppliers

HEP Consulting first contacted all of the U.S. companies that participated in the 2012 Mexico ITS RTM Business Briefing as well as other U.S. companies that participated in discussions with the RTM Mexican delegation. Additionally, HEP Consulting contacted the American Public Transportation Association (APTA), The Intelligent Transportation Systems of America (ITS America), and the International Road Federation (IRF) to inform their representatives of the Puebla BRT system project and the potential needs for ITS technologies for BRT applications, as well as to inquire about U.S. companies that (within each organization's membership) may be interested in exporting their ITS products to Mexico. Representatives from APTA, ITS America, and IRF provided input on potential services and company information for U.S. firms that would be potential suppliers of APTS technologies for Puebla's BRT system. The number of U.S. firms manufacturing and installing APTS systems in the U.S. is somewhat limited given that ITS for public transportation applications is considered a specialty industry.

HEP Consulting made contact with U.S. suppliers of APTS products with the purpose to appraise the companies' interest in the upcoming activities associated with the Puebla's ITS BRT system. The responses received from U.S. suppliers were positive, with the majority of those U.S. companies expressing interest in the possibility of exporting their ITS products to Puebla. Some of the main questions raised by some U.S. suppliers were related to project funding, the type of ITS product specifications to be used, and whether or not the STP would be implementing their ITS systems under a specific operative standard.

The following is a list of companies that responded to HEP Consulting's inquiries about Puebla's BRT system project and those that provided a positive response toward the opportunity to supply equipment in Puebla.

- Clever Devices
- Control Technologies
- GFI Genfare
- EMTRAC Systems
- Los Alamos Tech. Assoc
- Luminator Tech. Group
- NexBus
- Peek Traffic
- REI
- Transcore

There is one U.S. company in particular (Clever Devices) that has been investing in business visits to Mexico to meet with various state and local transportation agencies to promote ITS technologies for public transportation systems. Clever Devices representatives have also met with bus manufacturer DINA about the on-board technologies for BRT systems. Clever Devices is one of the U.S. companies that is extremely interested in the Puebla BRT project as it represents good opportunities for short and long-term business.



In summarizing this section of the report, there is clear indication of interest by U.S. suppliers for the potential of exporting U.S. goods to Mexico in connection with Puebla's BRT system.

## **F. FOREIGN COMPETITION**

### **1.0 Foreign Competition Key Elements**

An assessment of foreign competition was conducted for Puebla's BRT system project and supply of ITS technologies in Mexico. The foreign competition assessment was performed based on information obtained from various meetings and interviews held in Mexico, from the review of documentation pertaining to STP activities, and from communications with transportation Mexican officials and representatives from the U.S. industry. The DM findings indicate that there are seven key elements associated with the foreign competition component related to the procurement of ITS technologies as follows:

- STP's procurement methods and tendencies;
- BRT Bus Operator - Equipment selection and acquisition;
- BRT Managing Companies - Equipment selection and acquisition;
- European companies' strong presence in Mexico;
- ITS Equipment pricing;
- Risk factors;
- Market entry issues.

Public sector procurement in the State of Puebla is governed by the procurement laws of the State of Puebla. The STP as a state agency has to adhere to the State of Puebla's procurement laws which require an open tender for most government acquisitions, as well as the selection of the lowest responsible bid or tender price. International tenders are required when public agencies determine that there is not effective competition for procurement unless foreign companies are invited to participate in tenders. When the first BRT corridor was being developed, the STP invited bus manufacturers from Mexico as well as from other countries around the world to present proposals for the use of the BRT buses. Likewise, the STP invited companies from Mexico and other countries to present qualifications for the management of the first BRT corridor in Puebla. The STP has demonstrated their desire to maintain an open structure when it comes to tenders as this brings competition and improves pricing for the acquisition of goods.

Given the fact that ITS technologies have to be imported into Puebla, the STP has indicated that international tenders will be issued for the acquisition and implementation of ITS systems that will be acquired by the GSP and the goal is also to set ITS technical specifications for those technologies that are the responsibility of the private sector.

The STP intends to implement ITS systems by way of international tenders where local and international contractors will compete for turn-key projects which include the design, acquisition,



and installation of ITS systems. STP staff will depend on the recommendations from the Puebla ITS Bus Rapid Transit Feasibility Study (including ITS system specifications) for the implementation of the various ITS technologies.

Another important factor in the evaluation of foreign competition is the fact that currently the BRT bus operator (Articulados de Puebla) is responsible for the procurement of ITS technologies that reside on the bus. For the first BRT corridor project, the STP did not issue a set of ITS specifications to either the BRT bus operator or the BRT managing company, leaving the acquisition of ITS systems at the discretion of the private sector. Obviously, the private sector will look for the lowest product pricing most likely disregarding product quality, life-cycle cost, and maintenance issues. If the same situation was encountered as part of the ITS implementation for the second and third BRT corridors, this could represent a risk for the STP and USTDA. However, the STP has learned its lesson from the first BRT corridor and now intends to develop and enforce new ITS specifications for all ITS systems associated with Puebla's BRT system and thus the need to develop the Puebla's Bus Rapid Transit ITS Feasibility Study. With new ITS standards and specifications, the STP intends to require the private operators and managers to acquire ITS systems that meet minimum standards and technical specifications.

It is important to note that while ITS technologies and services have been well developed and implemented in the United States, other countries in Europe and Asia have also been successful in developing their own ITS technologies. The competitive nature of the implementation of ITS technologies in Puebla would be considered high. Traditionally, Latin American countries have selected, for the most part, European technologies when it comes to the transportation sector. There is clear evidence of European companies in Mexico that are seeking to implement their transportation technologies in that country. European companies will continue to pursue ITS projects in the Mexican market, unless the U.S. companies become more aggressively involved in Mexico.

Pricing is also another factor that plays a role in foreign competition because U.S. technology (due to its high quality and reliability) tends to be more costly. When it comes to APTS systems, usually U.S. standards and specifications are more stringent and require higher levels of quality control and more reliable/accurate systems that often lead to a higher price. HEP Consulting discussed this issue with STP staff who indicated that life-cycle-cost and reliability are important for Puebla's BRT system because the initial investment is intended to procure systems with a high degree of durability and low maintenance. Additionally, STP staff indicated their willingness to consider the use of a comprehensive ITS set of norms and standards such as the National Transportation Communications for ITS Protocol (NTCIP) if applicable.

Risks factors also tend to somewhat scare U.S. firms away from markets like Mexico due to specific tender requirements, procurement laws, methods of payments, repayment periods, different and inconsistent legal requirements, procurement policies, government and private industry corruption, lack of transparency on government contracts, local bureaucracy, and high crime activities. Fortunately, the GSP and STP have good credibility and excellent track records



when it comes to government accountability and this should be attractive to U.S. firms that may be trying to export their products into Mexico.

Other factors to consider would be the fact that the U.S. and Mexico have a trade agreement in place that can facilitate certain trade activities, as well as the close proximity of the U.S. to Mexico as border partners as compared to European countries.

The factors identified as part of the foreign competition assessment clearly illustrate and confirm that foreign competition is considered high for U.S. companies attempting to export their products into Puebla. However, the conduct of the Puebla's Bus Rapid Transit ITS Feasibility Study could represent a deciding factor that may open the door for potential U.S. exports and may prove to assist U.S. companies in expanding their product line and services into Mexico.

## **2.0 Market Entry Issues**

Competition in the Mexican market for ITS systems and equipment is sensitive to price while quality has not been as important for government institutions. While price is a decisive buying factor for government tenders in Mexico, U.S. made products, which generally carry a higher price tag, are also recognized for their quality and therefore have a potential for finding market acceptance in Mexico. This is especially true in the information technology sector where computer systems and software packages require operating systems by companies like Oracle and Microsoft as the standard. The STP is willing to consider the adoption of U.S. standards for ITS implementation (such as NTCIP) and this issue would be thoroughly reviewed and presented as part of the Puebla ITS Bus Rapid Transit Feasibility Study.

It is determined that for U.S. companies to become successful in penetrating the Mexican ITS market they must do so with the aid of local representation or through licensing agreements with the private sector. The knowledge of local regulatory and business framework in Mexico is best left for the local companies that have experience and can assist U.S. companies in entering the market. Personal contact is considered a necessity when doing business in Mexico, with both the private and public sectors and when dealing with government sponsored tenders. Having a local agent is a must due to complicated bureaucratic regulations and procedures. Several of the U.S. companies contacted for potential interest in Puebla's BRT system project indicated their desire to work with local firms if business opportunities would arise.

## **3.0 Summary of Foreign Competition Assessment**

The DM findings determine that the foreign competition component is considered high in Mexico, presenting significant challenges to U.S. suppliers of ITS systems. However, with the development of the Puebla ITS Bus Rapid Transit Feasibility Study, STP officials can be exposed to U.S. technologies and standards and begin building a business relationship with U.S. suppliers that could eventually allow U.S. firms to export ITS systems to Mexico. Furthermore, the development of Puebla's Bus Rapid Transit ITS Feasibility Study would allow



a U.S. firm to assist the STP in identifying the most suitable and appropriate ITS technologies for implementation in Puebla.

## **G. DEVELOPMENTAL IMPACT**

This section of the report includes an assessment of the developmental impact associated with the implementation of Intelligent Transportation Systems in connection with Puebla's ITS Bus Rapid Transit Project. The developmental impact section is divided into two sections to cover the aspects of the primary developmental benefits as well as the alternatives considered by the STP relative to public transportation systems for Puebla.

### **1.0 Primary Development Impact**

The increasing demand for travel by roadway and public transit in Puebla has caused the transportation system in the city to reach the limits of its existing capacity. ITS systems include a wide collection of applications that are provided by APTS technologies to advance public transportation systems and its operations. The diverse array of ITS applications available can address a variety of transportation problems and needs. Some applications provide more cost-effective benefits than others, and as technology evolves, the available choices change. ITS systems have been deployed with significant success on BRT systems throughout the world. The ITS systems category that mostly applies to BRT operations is known as Advanced Public Transportation Systems, which is a combination of ITS technologies that are used in the various areas of public transportation systems.

The BRT corridor project in Puebla provides an intrinsic benefit in terms of several improvements to the users and to the population around the corridors. In addition, Puebla's BRT system will support a bicycle integration program that consists of facilities for bicycle riders to use the rapid bus transit system of a few selected corridors. This will be done through the design and construction of bicycle parking and storage facilities and the adoption of traffic measures to increase safety for non motorized transport in the area of some of the corridors. The Puebla BRT system will also allow for the provision of better accessibility to the handicapped and other public transportation users and better working conditions for bus drivers (reduced working hours, stable salaries, etc).

Additionally, access to the corridor will promote non motorized transport, making it more viable, low cost and accessible. The project would benefit the entire population of the PMA by improving its welfare, through measurable gains in the environmental and air quality and the provision of a better transportation system. The emissions reductions and improvement of air quality will result in health and economic improvements that will benefit especially the poorest and the most vulnerable population (children and elderly people). The new BRT fare policy is expected to reduce household expenditures for transportation in the longer term. The residents and businesses along the corridors will benefit from increased property value because of better



accessibility and improved mobility options including a more attractive public transportation system with an improved image and convenience.

The significant reduction of vehicular congestion will benefit all corridor users. The low income areas are expected to benefit from better access and facilitation of low cost alternatives which raises the level of self esteem and development potential. The increase in enforcement and control of bus route concessions will reduce unfair competition from informal operators, creating a healthier and safer operating environment.

ITS technologies have been proven to help transit agencies increase safety and operational efficiencies. Remote monitoring of transit vehicle status and passenger activity helps to provide additional safety and security to passengers. ITS technologies also assist operations in maintaining vehicle fleets. Vehicle self-diagnostics can alert mechanics of impending mechanical problems as well as routine maintenance needs. AVL that utilizes Automated Scheduling and Dispatch Service (ASDS) can improve scheduling activities and schedule adherence. All of these technologies have demonstrated that they are capable of reducing travel time both, by improving the operation of the vehicle and the overall operation of the transportation network.

BRT is designed to overcome weaknesses of traditional service and sources of delay. Individual ITS technologies provide the basic features key to many of BRT's benefits. Combinations of ITS technologies can work together to provide synergies to increase improvements in service. Separately, all of these ITS technologies would provide no unique benefit to BRT systems. Collectively they help to define BRT. What makes BRT unique is that it requires a combination, or set, of technologies to help meet system requirements.

### **1.1 ITS Applications and Key Performance Indicators**

As part of the Puebla BRT system project, the SCT will develop key performance indicators to measure the effectiveness of the BRT systems. These performance indicators can be directly improved with the utilization of ITS systems. The key performance indicators will be measured as reduced emission of local and global pollutants from the transportation system along the BRT corridors. The use of ITS systems in the BRT project will increase operational efficiency of bus operation which directly and positively impacts emissions. Improved operation of the bus transportation system in the corridors can be achieved with the implementation of ITS systems which will be measured by reduced average travel times.

Improved bus energy efficiency is expected to be measured as a key performance indicator. The application of ITS systems to the BRT system is expected to reduce energy consumption. Additionally, improved bus productivity will be assessed in terms of serving more passengers with lesser number of units and increased modal share for large buses. The utilization of ITS systems can make bus transportation more efficient which leads to the public transportation agency or operators to use the least number of buses to satisfy passenger demand. Finally, the public's acceptance of the BRT project will be measured through the conduct of customer service surveys during various periods of operation of the BRT project.



## **1.2 How will ITS help Achieve Key Performance Indicators?**

The use of ITS technologies are expected to significantly improve the overall performance of Puebla's BRT system. This section provides information as to how ITS technologies will help the SCT and the private sector meet key performance indicators.

### **a. Improvement in Operating Conditions for Buses**

Confined, segregated bus lanes together with the use of ITS technologies such as TSP and others will allow buses on the BRT corridors to operate more efficiently and without interference from other traffic reducing travel time and idle periods for the bus, both of which will result in lower fuel consumption and lower emissions.

### **b. Improvement in Bus Technology and Capacity**

The use of on-board technologies will significantly increase operational efficiency for the buses and the BRT system as a whole, will provide for a higher level of operational safety for BRT operations and improve the operational capacity of the public transportation system in Puebla. Additionally, the use of passenger information systems will support the BRT efficiencies and will provide users of the system with real-time information.

### **c. Introduction of Integrated Fare Technology**

Fare prepayment will streamline the boarding process and reduce travel time and bus-idle times, thus improving operations for the BRT systems and reducing fuel consumption and local emissions. An efficient and effective fare collection system implemented under the overall ITS implementation will provide for higher accountability of revenues, a higher level of record keeping for auditing purposes and distribution of revenues, and a safer method of operation for bus drivers that no longer have to be involved in the exchange of cash for fare payment.

### **d. Use of Centralized Bus Fleet Control**

The use of centralized bus fleet control systems will allow for a coordinated scheduling of bus services that dynamically adjusts bus frequency with demand to result in fewer buses scheduled in off-peak hours. Currently all the buses in the corridors operate continually all-day even though the passenger demand drops outside peak-hours. This increases operational efficiency for the entire BRT system, minimizes maintenance costs, decreases expenses, and reduces bus fuel consumption and local emissions.

### **e. Traffic Improvements for the Other Vehicles on the Route**

The use of ITS technologies on the BRT system will have a positive impact on general traffic using the corridors. This can be achieved by virtue of improving the safety and operational efficiency of the public transportation system in Puebla with the use of ITS technologies that can result in reduced travel time for other (non-bus) vehicles. The elimination of multi-lane interference from buses competing for passengers, together with the traffic flow improvement programs such as bus-priority signal systems (TSP) are expected to bring about improve traffic condition for non-bus users as well.



The introduction of ITS technologies in Puebla's BRT system will provide for a more efficient public transportation system and in turn will improve delay, traffic congestion, and travel time for the corridors which makes the entire BRT more efficient. This allows for the provision of a gradual alternative to the building of additional corridors in Puebla. This will result in a better use of public space through the active promotion of increasing transit share. The use of ITS systems will enhance the corridors' benefits by further reducing congestion and travel cost, emissions, urban degradation, and improvement of quality of life.

### **1.3 Infrastructure**

The transportation sector is key to the State of Puebla's economic growth and the state's integration with the rest of the country. The implementation of ITS technologies for Puebla's BRT system is expected to support and improve the Bus Rapid Transit infrastructure that will be built in Puebla, as well as the general transportation infrastructure in the PMA (streets, arterials, pedestrian walkways, bus stations, transfer terminals, etc. ) and further increasing the efficiency of those transportation facilities.

Vehicle travel continues to grow in Puebla as the population increases, particularly in the urbanized areas. Construction of new roadway capacity to accommodate the growth and travel has not kept up with traffic demand in Puebla. Vehicle miles traveled have increased in Puebla in the last five years while road expansion to meet this demand has lag behind. Likewise public transportation demand has surged in recent years while the public transportation system in Puebla continues to operate with inefficient, unsafe, and obsolete units. This increasing demand for transportation is causing the public transportation system in Puebla to reach the limits of its existing capacity.

The goal of the Puebla BRT project is to improve the overall public transportation infrastructure by constructing exclusive bus lanes along priority corridors in Puebla, construction of stations and transfer centers along the BRT corridors, construction and implementation of bus storage and maintenance facilities, and construction and maintenance of command and control centers. The BRT infrastructure can be significantly improved by the utilization of ITS systems to make the BRT infrastructure more efficient and safe for its users.

USTDA's participation in Puebla's BRT system project would support the development of the BRT infrastructure that could lead to the implementation of a series of ITS systems for better system efficiency and safety. The construction of BRT infrastructure is expected to be completed by early 2013 for the first BRT corridor, and by 2014 and 2015 respectively for the second and third BRT corridors.

### **1.4 Technology Transfer and Productivity Enhancement**

Technology transfer opportunities could be created by implementing ITS systems for the Puebla BRT project given that new intelligent transportation systems are comprised of sophisticated technologies. Currently the type of ITS technologies needed for the proposed BRT project in Puebla would necessitate importing these technologies into Mexico. The level of technology transfer is therefore considered high for the application of ITS systems in Puebla.



Productivity enhancements can be mentioned as another factor related to other improvements such as reduced roadway delay, improved travel time, reduced corridor congestion, and others that are expected to be realized as the BRT system is completed. Time lost in traffic affects quality of life and results in sizable negative impacts on the urban economy, lessening the city's output, reducing the size of the effective labor markets, and imposing the need for higher inventories.

With the new BRT system in Puebla, more people will have access to quality public transportation, more convenient transportation to and from work, less time to get to work and home, less hours spent in the transportation system will lead to improved productivity. The implementation of ITS technologies in Puebla can reduce operating cost and allow productivity to increase in some cases. Some ITS applications may save time in completing business or regulatory processes, enabling business to increase their economic efficiency and therefore increasing productivity, as well as promoting a more efficient movement of people and goods through the Puebla's transportation system. Operational efficiencies and cost savings may be possible with ITS implementations, thus helping public and private entities make the most productive use of their resources. Key performance indicators listed above will be monitored and some of these are also expected to improve productivity in Puebla.

Productivity enhancements are expected occur immediately after the first BRT corridors becomes fully operational and additional productivity enhancements are anticipated as the second and third BRT corridors are completed. In the end when all three BRT corridors are in full operation, productivity levels are anticipated to increase given the cumulative benefits that the entire BRT system will provide for the citizens of Puebla.

### **1.5 Human Capacity Building**

The construction of the BRT system in Puebla along with the implementation of new state-of-the-art ITS technologies would support existing transportation infrastructure that in turn is expected to completely restructure and reorganize the public transportation system in Puebla. Due to this restructuring, the number of routes will be reduced significantly thus requiring less transportation units and drivers. As of 2011, there were nearly 6,000 vehicles registered for public transportation use in Puebla. The reorganization of the public transportation system in Puebla with the use of the BRT concept will reduce the number of units operating in the corridors to approximately 3,500 vehicles once the public transportation program is complete.

For the first BRT corridor, the number of routes are expected to be reduced in half, while for the second and third BRT corridors, the number of routes will be reduced by more than 60%. While Puebla's new BRT system project is expected to hire as many existing drivers as possible, the need for bus drivers will be reduced significantly. Under the current authorized route concessions, drivers do not work under any contracts and in most cases their working relation is based on family or friendship ties. Furthermore, current bus drivers do not earn a regular income, nor do they have social security or benefits. These drivers usually work 12 hours a day



under stressful conditions without overtime pay, thus contributing to an insecure transportation system. Puebla's BRT system is expected to improve working conditions and benefits for bus drivers and the new BRT program will train bus operators under a new reformed public transportation system where bus operators are compensated based on kilometers traveled as opposed to the current system where individual bus owners compete for passengers throughout the system making it a very inefficient service.

The majority of new jobs will be created in the construction of the BRT infrastructure. The number of jobs related to the construction of the BRT infrastructure is expected to be reduced as the first BRT corridor is completed in early 2013, but more jobs are expected to be created later in the same year as construction of the second BRT corridor begins. It is likely that there will be an overlap during the period of construction of the second BRT corridor and the start of construction for the third BRT corridor and this period could represent the highest level of employment for the construction aspect of the project. The number of jobs for bus drivers will be reduced from the initial conversion of the current public transportation system to the creation of the new BRT project, as the BRT system requires less number of buses to operate the corridors. This will likely displaced a number of drivers that currently operate buses along the corridors, however, the private sector responsible for the operation of the buses agreed to hire and maintain as many employees as possible.

## **2.0 Alternatives**

As part of the Puebla BRT system project, a series of alternatives to the BRT concept were evaluated. The first consisted in reviewing the alternative for the implementation of modal shift versus investing in additional roadways. The traditional solution has often been to expand the supply of road lanes in linear response to growth in transportation demand. However, the Puebla BRT project utilizes the concept of public transportation priority corridors as a tool to improve the efficiency of existing infrastructure as opposed to the continuation of the current trends for construction of travel lanes for automobile use. Additionally, one of the benefits of the use of ITS technologies is exactly to improve the efficiency and safety of current transportation facilities which usually leads to significant cost savings in building expensive infrastructure.

The implementation of "light" bus corridors was considered as an option (corridors with minimal additional infrastructure and where buses share lanes with other vehicles). This option was not deem the preferred alternative because of its potentially weak impact on improving traffic congestion, as well as difficulties in enforcing the dedicated character of the exclusive bus lanes. This approach, where applied, has not resulted in significant improvements in modal shift nor on vehicular congestion reduction. The same can be said for the implementation of temporary corridors that open depending on a fixed timetable during the day. Puebla had experimented with this concept in the past with no success.

Another alternative reviewed consisted in the potential implementation of passenger rail systems along the main corridors in Puebla. This alternative was deemed not viable due to the fact that the cost per kilometer is substantially more than other alternatives such as BRT.



Additionally, the ridership demand presented along the corridors in Puebla is somewhat lower than what would be required to financially support any type of passenger rail transportation system. The analysis for Puebla's BRT system therefore supports public transportation with the concept of utilizing the existing roadway infrastructure and an adequate fleet of modern buses to service the BRT corridors through the PMA.

Following the selection of the BRT concept as recommended by Puebla's Urban Mobility Plan, another alternative considered was a programmatic approach for the development of an entire set of corridors, on a metropolitan scale. This was reviewed as part the Puebla's Urban Mobility Plan and this idea was not pursued as the authorities considered being more important to start with one or two BRT corridors at a time. This would have the catalytic effect of initiating the BRT program in stages and learning from the operation of the Chachapa, 11 Norte-Sur and 16 de Septiembre corridors first, before embarking on a full implementation of the RUTA program. This approach also would have required additional budgetary resources that were not available by the GSP at the time.

#### **H. IMPACT ON THE ENVIRONMENT**

The environment can be negatively impacted by several factors, and one of them implicates air pollution generated by vehicular emissions. Air pollution is normally associated with pollution generated from the exhaust system of vehicles, buses, trucks, and other modes of transportation that generate pollutants. Air quality in the PMA is becoming a major concern for the GSP, as many vehicles, especially public transportation buses operate with the utilization of diesel fuel causing air contamination. On the other hand, traffic congestion also contributes negatively to air quality in Puebla. Each time buses have to slow down or come to a complete stop due to congestion, idling occurs which translates into higher emission levels. In an area as large as Puebla, with a great number of vehicles and recurring traffic congestion, the level of vehicle-hour delay is significant and therefore, a negative impact on the environment.

One of the great benefits that ITS technologies offer is the improvement of the efficiency of transportation facilities. ITS technologies have shown positive impacts on the environment as contamination levels decrease with improved and efficient traffic flows. Decreases in contamination levels and energy consumption have been identified as measure of effectiveness for ITS applications for public transportation systems.

With the utilization of ITS, congestion is often reduced, accidents are reduced, mobility improves, delays are reduced and safety is improved. All could be improvements to the environment since it makes transportation more efficient and safe.

The environmental impacts of Puebla's BRT system have been analyzed for each of the BRT corridors. The following presents a summary of the various categories of environmental impacts associated with the different phases of the BRT project:



- **Preparation Phase** - activities prior to construction, including excavation, expropriation, protection, and preparation of the area have been completed for the Chachapa Corridor, and preliminary assessments completed for the 11 Norte-Sur and 16 de Septiembre corridors to insure minimal impacts to the environment as construction starts.
- **Construction Phase** - including activities to prepare the terrain, the removal of vegetation, earthwork, transportation, final disposal, improvement of pavement, and activities to build the actual infrastructure, such as stations, terminals, pedestrian facilities, barriers for corridor, and others are almost complete for the Chachapa Corridor. Similar preparations will be made during the construction phase for the 11 Norte-Sur and 16 de Septiembre corridors.
- **Operational Phase**- The impacts evaluated are related to activities that result from the project, including impacts on traffic (change of routes, improved public transportation, changes method of transportation) and maintenance (operation of stations and transfer centers, and traffic management systems). Most of the environmental impacts associated with Puebla's BRT system are generated during the construction phase of the project. The infrastructure investments will take place within the existing right-of-way of the corridors (for the most part) and will make use of existing roadway infrastructure. Investments will focus on strengthening the pavement, bus corridor segregation, construction of stations/terminals, access facilities, improvement of sidewalks, and rearrangements of traffic signs and signals. The main impacts expected from the construction phase of the BRT projects include increased levels of air, soil, water and noise pollution, solid waste, limitations on traffic circulation, interruptions in public transportation services, damage to existing green areas, increase energy and fuel use and others. However, the environmental benefits predicted by the environmental assessment include a rationalization of the "collective" transportation system in Puebla, a decrease in travel time and the reduction of air and noise pollution.
- **Impacts on Cultural Heritage** – The old and historic center of Puebla has been designated as historic patrimony for the world. As such, historic sites are off-limits for any type of infrastructure improvements in Puebla. The environmental assessment does not expect that the construction or operation of the BRT corridors will have any negative impact on cultural heritage or historic buildings.

Other Benefits expected from the implementation of Puebla's BRT system include the following:

- Reductions in local airborne emissions that would yield to health and economic benefits through improvements in air quality in the area of the corridors;
- Contribution that targets lower greenhouse gases emissions;
- Reductions in congestion, improved traffic flow for all vehicles reducing emissions per Veh-Km, and improvements in efficiency of the public transportation system including transportation service improvements;
- Efficiency in energy use and reduced travel times; and
- Improved road safety along the corridors.



Additionally, there will be a bus scrapping program in place for the BRT corridors to ensure that the old buses are taken out of service on specific corridors prior to the operation of the new BRT fleet. The permit for the new large capacity buses to operate on the BRT corridors will be provided against a corresponding scrapping certificate. Puebla's BRT system project will therefore result in a net reduction of old and inefficient buses on the BRT corridors.

Additionally, in order to obtain approval for federal funding the Ministerio de Hacienda y Crédito Público, as well as the FONADIN, these government entities have policies in place that requires the conduct of a very comprehensive Environmental Impact Assessment for each BRT corridor project. The policy was triggered due to the potential environmental impacts of the BRT project in Puebla. As such, numerous environmental assessments were completed during project preparation process (for the Chachapa corridor and assessments continue for the second and third corridors) to ensure proper handling of potential impacts and to ensure that potential environmental benefits are capitalized upon.

#### **I. IMPACT ON U.S. LABOR**

Components of ITS systems that would be required for the implementation of ITS systems in Puebla are being manufactured in the United States by U.S. companies. Other services such as ITS engineering, ITS system design and integration services could be performed by U.S. firms. The scale of the ITS system implementation in Puebla is not sufficiently large to justify a U.S. company relocating manufacturing services to Mexico for the production of ITS technologies or even spare parts. It is anticipated that if U.S. firms are awarded contracts for the supply of ITS technologies in connection with Puebla's BRT system, that the design and manufacturing of the equipment will take place in the U.S. As such, U.S. labor should not be negatively impacted by the proposed implementation of ITS technologies in Puebla.

#### **J. QUALIFICATIONS**

This section of the report describes the U.S. Contractor qualifications for the conduct of Puebla's Bus Rapid Transit ITS Feasibility Study project.

The focus of the feasibility study is to analyze, identify, prioritize and recommend modern ITS systems, equipment, and related information technologies for the purpose of improving operations, safety, and security for Puebla's BRT system. The U.S. Contractor selected for the work will be responsible for the identification and recommendations of ITS technologies that would be beneficial to the STP in promoting a safer and more efficient public transportation system in Puebla. As such, the U.S. Contractor selected for Puebla's Bus Rapid Transit ITS Feasibility Study shall have the required personnel with ample experience in the various technology applications of ITS systems and equipment (in particular APTS technologies), as well as experience in the application, design, implementation, operations, and maintenance of ITS systems that are used in conjunction with Bus Rapid Transit systems.

In summary, it is extremely important that the consulting personnel assigned to this project have a good understanding of all aspects of ITS systems for BRT operations, as well as a strong technical background in public transportation.

## **K. JUSTIFICATION**

This section of the report outlines the justification for Puebla's ITS Bus Rapid Transit Project Feasibility Study.

Based on the overall DM assessment, it is determined that the STP has identified the need to implement state-of-the-art ITS technologies with the purpose to improve operational efficiency, security, and safety for Puebla's BRT system. The STP is investing and plans to continue to invest in the modernization of Puebla's public transportation systems with the intent to continue to promote and improve transportation and economic development for the city and the State of Puebla. The STP wishes to strengthen the agency's capabilities to administer Puebla's new BRT system by acquiring and implementing ITS technologies to support public transportation operations, increase security and safety, and support economic development in Puebla.

While the first BRT corridor is expected to start operations in early 2013, it is evident that the STP plans to continue its movement towards full development a BRT infrastructure with additional BRT corridors already planned in the City of Puebla, including the implementation of ITS technologies to support operational efficiency for the new BRT system. Even with the economic downturn of recent years, the GSP and the STP have managed to generate substantial revenues for the State of Puebla that has allowed the government to invest in the construction of the first BRT corridor in Puebla and will allow the STP to continue to invest in additional BRT corridors and advanced transportation technologies.

In addition, the STP intends to continue to address public transportation operational capacity and efficient flow in Puebla and the agency expects to receive financial assistance from the GSA and the federal government (Banobras) for additional BRT corridor implementation. The STP intends to utilize modern ITS technologies to better integrate the operational, security, and safety functions of its new BRT system and to increase coordination and collaboration among



the BRT operator (Articulados de Puebla), the managing company (Anglecom), and the various transportation system users (motorists, public transportation users, pedestrians, private/public car users, etc). The STP's objective is to introduce the use of the latest ITS systems and equipment to support the operational, management, maintenance, commercial activities, security, safety, and administrative functions for the new RUTA BRT program, with the purpose to provide transportation users with the most efficient and convenient public transportation services in Puebla.

The STP is considered to be a leader government agency in the State of Puebla, as the agency has proposed a significant capital improvement program for the state that has resulted in the construction of the first BRT corridor in the City of Puebla. The transformation of the public transportation system and the approval of transportation reforms in Puebla were challenges that previous state administrations have failed to accomplish over the years.

With the continued population growth expected in future years in the State of Puebla, the GSP is committed to completing the plans for the implementation of six BRT corridors to improve public transportation in Puebla, along with the required ITS technologies that would support the BRT system. As such, the STP has requested financial assistance from USTDA for the conduct of an ITS feasibility study in connection with Puebla's Bus Rapid Transit System.

The development of state-of-the-art ITS technologies is an area that U.S. firms have developed and implemented successfully for many years in numerous U.S. cities and as such, U.S. firms are extremely proficient and capable of engaging in the conduct of feasibility studies, design, and ultimately the supply and implementation of ITS technologies for Puebla's BRT system.

STP staff has indicated that the agency lacks the knowledge and experience to identify the best technologies to be implemented for Puebla's BRT system and as such, the STP is seeking assistance from USTDA for the technical expertise needed to evaluate and develop the ITS implementation plan for Puebla's BRT system.

The GSP has committed funding for the construction and implementation of the first BRT corridor in Puebla which is under construction. The GSP has also committed the financing for the construction and implementation of the second and third BRT corridors in Puebla where the Mexican Federal Government, through the FONADIN will finance portions of the BRT corridor infrastructure and related technologies.

It is reasonably expected that the STP could begin an active pursuit for international assistance to advance the implementation of ITS technologies for Puebla's BRT system (if USTDA does not provide the requested assistance) as this activity represents one of STP's priority projects for the immediate future. Given the strong presence of European companies in Mexico, it may not be long before other non-U.S. firms propose to assist the STP in completing the ITS implementation plan for Puebla's BRT system. This could potentially result in a European firm defining the ITS implementation plan, as well as system and equipment specifications for Puebla's BRT system. The assessment of foreign competition for the DM indicates that the



competitive level for U.S. firms would be high, especially from European countries. However, if USTDA funds the ITS feasibility study, this would guarantee that a U.S. firm would be the one performing the work that could eventually lead to the procurement and installation of U.S. equipment and systems and help U.S. suppliers to compete in the Mexican ITS market.

Rather than waiting for this to happen, USTDA has an opportunity to fund the ITS feasibility study for the STP that could allow a U.S. firm to take the first steps in defining the best uses of modern ITS technologies for Puebla's BRT system.

The development of the ITS feasibility study represents a good opportunity for USTDA to assist the STP and GSP in their need to implement advanced technologies for legitimate and practical purposes that support local, state, and national economic development goals. USTDA's participation in the ITS feasibility study (for STP) could add significant value to the overall modernization of the public transportation systems in Puebla, as a high qualified U.S. firm would most likely be in a position to assist the STP in the development of a sound ITS implementation plan for Puebla's Bus Rapid Transit System.

Based on the assessment conducted as part of the DM, it is determined that funding Puebla's ITS Bus Rapid Transit Project Feasibility Study by USTDA is justified and meets USTDA grant funding requirements.

## **L. TERMS OF REFERENCE**

This section of the report presents the Terms of Reference (TOR) proposed for Puebla's ITS Bus Rapid Transit Project Feasibility Study.

### **1.0 Project Background**

The City of Puebla is the most important urban center in the State of Puebla and it serves as the capital for the state. The majority of the population in the State of Puebla resides within the Puebla Metropolitan Area (PMA). Puebla represents the financial, industrial, economic, and cultural nucleus for the State of Puebla and the City represents the employment center for the States of Puebla and Tlaxcala. The PMA is considered the fourth largest and most populous region in Mexico with a population of 2.6 million people. The PMA generates a massive demand for urban transportation with approximately 3.5 million trips a day. The number of trips and large trip length place an enormous pressure on the urban transportation system in Puebla. This growth in mobility demands more roads and more efficient public transportation systems to accommodate larger amounts of people mobilizing throughout the PMA.

In 2011 The Government of the State of Puebla (GSP) commissioned the preparation of the State of Puebla Development Plan (Plan de Desarrollo del Estado de Puebla 2011-2017) with the purpose to analyze the economic conditions and development scenarios within the state and



to devise a plan that would serve as a guide for the GSP in promoting the development of the state for future years. One of the important areas of the plan is in the development of the urban centers within the PMA which seeks to identify the best alternatives for guiding the growth of the urban population. The State Development Plan sites a number of strategies that should be put in place to accomplish the plan's objectives and one of the key instruments is the development of an integrated public transportation system for Puebla. As a result, Puebla's Urban Mobility Plan (Plan Urbano de Movilidad) was prepared with the purpose to define the policies, strategies, and recommendations in transportation that would achieve the goals and objectives of the State Development Plan.

The Secretaria de Transportes of the State of Puebla – STP (Puebla's Secretariat of Transportation) was responsible for the development of the Puebla's Mobility Plan and the plan was designed to contribute to the promotion of organized transportation, serving as a tool to structure and manage urban growth in the most efficient and organized fashion. The Puebla Mobility Plan identified a hierarchy of transportation corridors that service the region as the primary focus of transforming the transportation sector in the PMA. These corridors connect the urban centers of the PMA and form the fundamental basis for interconnecting the population to the various service centers in the region. Puebla's Mobility Plan recommended the establishment of an integrated structure for public transportation to operate efficiently through the use Bus Rapid Transit (BRT) corridors.

As such, the Red Urbana de Transportes Articulados (RUTA) de Puebla was developed by the STP as the program to implement Puebla's Bus Rapid Transit System. Puebla's BRT system will be built using the center two lanes of existing road corridors and will include numerous stations and transfer centers. The integrated BRT system for Puebla envisions the creation of major transfer centers denominated CETRANS (Centros de Transferencia) and terminals at each end of each corridor. These transfer centers along with the stations will play a key role in allowing for the interconnection among the corridors and will contribute to the distribution of passengers within the entire public transportation system.

Puebla's BRT system includes the implementation of six BRT corridors over time. The first three BRT corridors to be implemented include the Corredor Blvd. Atlixco – Diagonal Defensores known as the Chachapa Corridor, Corredor 11 Norte-Sur, and Corredor 16 de Septiembre. The first BRT corridor (Chachapa) is under construction and expected to start operations in early 2013, with the second (11 Norte-Sur) and third (16 de Septiembre) BRT corridors expected to start construction in 2013 and 2014 respectively. Articulated autobuses will replace the current fleet on each BRT corridor and smaller buses will be used to service the feeder routes connecting with the main BRT trunk lines. The main purpose of Puebla's BRT system is to improve and modernize the public transportation system in Puebla.

The STP has presented a proposal to the U.S. Trade and Development Agency (USTDA) for the implementation of Intelligent Transportation Systems (ITS) as part of Puebla's BRT system. The STP seeks financial assistance (in the form of a grant) from USTDA for the conduct of a feasibility study to review Puebla's BRT system's plans, specifications, standards, cost



estimates, and other project related factors associated with the deployment of ITS technologies for the purpose to improve safety, security, and operational efficiency of the BRT system. The feasibility study will analyze the viability for the deployment of ITS technologies in the area of Advanced Public Transportation Systems (APTS) and the development of recommendations including an implementation plan for Puebla's BRT system.

The STP is expected to utilize the recommendations from the feasibility study for its decision-making process in the selection of ITS systems' specifications, standards, and other factors for the deployment of ITS technologies associated with Puebla's BRT system. It is expected that the feasibility study will be conducted over a period of six months and conclude with the development of a practical ITS implementation plan, including recommendations for the various types of ITS technologies, the necessary systems and equipment standards and specifications, implementation procedures, cost estimates, and financing plan. The feasibility study will identify short and medium-term milestones for the acquisition and implementation of ITS technologies to be implemented as part of Puebla's BRT system.

The U.S. Contractor shall evaluate the current and planned BRT system in Puebla as well as the identification of new ITS technologies that are likely to improve the BRT's operational efficiencies, safety, and security. Some of the technologies that shall be evaluated include (but not limited to), Computer Aided Dispatch Systems (CAD), Automatic Vehicle Location (AVL) systems, Advanced Communication Systems (ACS) for BRT, Safety and Security systems (BRT), Integrated Fare Collection Systems, Passenger Information Systems, Automatic Passenger Counter Systems, Radio Communication Systems, Fleet Management and Maintenance Systems, Traffic Signal Priority (TSP) Systems, Traffic Control Systems, on-board technologies such as on-board passenger displays, Automatic Voice Annunciation Systems (AVAS), on-board Video Monitoring (OVM), silent alarms, Mobile Data Computers (MDCs), built-in Mobile Data Terminals (MDTs), Global Positioning Systems (GPS), Command and Control Centers for BRT operations, and other ITS technologies related to BRT systems.

### **1.2.6 Feasibility Study Schedule**

The feasibility study is expected to take six months to be completed. The table below outlines the proposed schedule for the feasibility study.



**Table No. 10  
Feasibility Study Schedule**

| Task No. | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 |
|----------|---------|---------|---------|---------|---------|---------|
| Task 1   | →       |         |         |         |         |         |
| Task 2   |         | →       |         |         |         |         |
| Task 3   |         |         |         | →       |         |         |
| Task 4   |         |         |         | →       |         |         |
| Task 5   |         |         |         |         | →       |         |
| Task 6   |         | →       |         |         |         |         |
| Task 7   |         |         |         |         | →       |         |
| Task 8   |         |         |         |         | →       |         |
| Task 9   |         |         |         |         |         | →       |

**N. RECOMMENDATIONS**

This section of the report outlines the Definitional Mission recommendations as it pertains to Puebla’s Bus Rapid Transit ITS Feasibility Study.

The results from the DM assessment indicate that STP staff has great interest in further developing and improving the operational efficiency, safety, and security of Puebla’s BRT system by investing in the implementation of ITS technologies. In particular, the GSP and STP have invested substantially in the construction and implementation of Puebla’s first BRT system with expenditures in the order of U.S. \$ 50 million and further financial commitments have been made for the construction and implementation of the second and third BRT corridors.

The GSP and STP have increased financial projections for the period of 2013 to 2014 with the objective to complete the construction of additional BRT infrastructure and implementation of BRT corridors in Puebla. Furthermore, the FONADIN under the administration of Banobras will fund in excess of U.S. \$ 65 million for the completion of the second and third BRT corridors in Puebla. The DM concludes that Puebla’s BRT system project definitely has the political and financial support from the state and federal governments, as well as the political support from the Municipality of Puebla. This strong political and financial support from all levels of



government demonstrates the commitment from the GSP and STP to complete the BRT project as planned.

The GSA and STP faced critical issues at the beginning of the process in order to overcome persistent and long-standing barriers that in the past had prevented other state administrations from modernizing the public transportation system in the Puebla. The STP worked diligently with bus owners and assisted in the visualization and design of a modern BRT system supported by policies for scrapping of old vehicles, enacting institutional reforms, and the adoption of modern business and organizational practices and regulations to govern public transportation in Puebla.

The STP has been engaged and responsible for the development of the BRT project from the conceptual phase to the construction phase (Chachapa corridor operation expected in early 2013). The institutional building, analytical process, and approaches taken by the STP in connection with preparing the RUTA BRT program provided the leverage needed to overcome many barriers to successfully launch the project in 2011. By elevating Puebla's BRT system as a state and national priority, a more enabling framework was realized by the STP and the momentum was achieved to successfully overcome barriers.

STP staff wants to ensure that its overall business strategy for the full development of the RUTA BRT program is aligned with the trends of modern technology developments to support the BRT system's growth, quality of service, and ultimately improving the quality of life for the citizens of Puebla. STP staff has indicated that the agency lacks the expertise to undertake a study to identify and prioritize the application of ITS technologies for Puebla's BRT system.

The STP wants to continue to strengthen the agency's growth strategy towards marketing and delivering a comprehensive public transportation system that includes a range of intelligent transportation system solutions and services for Puebla's BRT system. Additionally, the STP wants to focus on the need to expand public transportation services beyond the current "single bus owner" environment to include an integrated public transportation system that utilizes an integrated form of electronic payment system, safety and security systems, traffic control and management systems, on-board technologies, and much more.

The STP has not only demonstrated its commitment to improve public transportation services in Puebla, but the agency wishes to place emphasis in creating an adequate framework for monitoring and administering Puebla's BRT system by implementing ITS technologies to support the various functions of the BRT system, as well as increased accountability. The STP's ability to implement innovative transportation solutions has been well demonstrated by the transformation of the public transportation system in Puebla, the creation of transportation reforms that had never been done before, and by working with the private sector under a PPP scheme to promote public and private investment in the new BRT program.

The SCT seeks financial assistance from USTDA to develop an ITS technology plan to provide the strategic view and direction for the implementation of ITS technologies in conjunction with Puebla's BRT system. The ITS implementation plan will provide strategies and procedures in



order for ITS technologies to be structured and implemented to accommodate the different types of Advanced Public Transportation Systems (APTS) within Puebla's BRT system.

The DM findings indicate that the SCT has the required capability and commitment to undertake the development of the BRT corridors and the agency has demonstrated the commitment to support and strengthen the public transportation sector in Puebla, as evidenced by their development of Puebla's BRT system and the formation of a PPP structure with bus operators in Puebla.

The financial review of the GSA and SCT indicates that the government is in good financial standings and fully capable of supporting its operations and maintenance responsibilities for the development of Puebla's BRT system, and allowing the GSA to invest further in additional BRT corridors that will require the use of ITS technologies to improve the operational efficiency, safety, and security of the new public transportation system in Puebla. It is evident that the GSA and STP have plans to continue its movement towards the implementation of an integrated BRT system in Puebla, as well as intentions to deploy ITS technologies for the operation of the new BRT corridors. The STP is in need of a feasibility study in order to identify and prioritize the implementation and modernization of ITS equipment and systems.

USTDA should consider funding Puebla's Bus Rapid Transit ITS Feasibility Study because the proposed ITS activities meet USTDA grant funding criteria as confirmed by the Definitional Mission findings. A review of the information obtained as part of the Definitional Mission indicates that the implementation of ITS technologies for Puebla's BRT system is economically, financially, and technically feasible. Export potential of U.S. goods and services is considered to be moderate given the type of modern ITS technologies that are likely to be required by Puebla's BRT system. U.S. export potential for ITS technologies has been estimated at U.S. \$ 18 million.

If the proposed feasibility study recommendations prove to be successful in the implementation of U.S. technologies (ITS), the STP could expand the use of U.S. manufactured ITS systems to other BRT corridors planned for the future (after 2015) and long term, this could translate into additional business opportunities for U.S. firms, thus potentially increasing U.S. exports.

The feasibility study could assist the STP and the private operators in identifying a plan that not only identifies the most immediate and short-term needs for ITS technologies, but also for those medium and long-term ITS technologies that will be required in the future. This could also increase the medium and long-term potential for U.S. exports.

U.S. companies definitely have the expertise required to provide the services and technologies likely to be required by the STP and Puebla's BRT system. The ITS technologies most likely required by Puebla's BRT system are currently being utilized widely in the U.S., and are therefore readily available for export to Mexico. The United States is an industry leader in ITS technology development with a significant number of applications in public transportation systems in the U.S. Furthermore, since the substantial increase in public transportation usage



traffic over the last 15 years, the ITS industry in the United States has experienced significant growth and technological advancement that has led to the development and application of the most sophisticated technologies for BRT systems.

Several of the U.S. companies contacted during the conduct of the DM demonstrated interest in exporting their products to Mexico. There is sufficient interest on the part of U.S. suppliers to sale their products in Mexico, as these U.S. companies recognize the potential of the ITS market in that country.

Puebla's BRT system is expected to become a profitable operation for the public and private sectors and the STP expects that a substantial portion of RUTA's program revenues will be invested back into the public transportation system, some in the area of ITS systems which could support the acquisition of ITS technologies.

The overall assessment of the foreign competition component for the proposed implementation of ITS technologies in Puebla indicates that U.S. companies could expect significant foreign competition, primarily from European companies. However, U.S. technologies (ITS) in general are known to be of the highest quality and the highest level of reliability.

USTDA could play a key role in promoting U.S. business activities in the transportation sector in Puebla by financing Puebla's Bus Rapid Transit ITS Feasibility Study, which could open the door for U.S. companies to export their products to Mexico. One of the key issues mentioned by STP staff was the need to identify the best ITS technologies for BRT application with high quality products and life-cycle costs as important factors for the decision-making process to purchase and implement ITS systems. STP staff understands that revenues and customer satisfaction factors depend heavily on the use of the most reliable and accurate technologies and as such, the STP wishes to focus its attention on the implementation of high quality products.

USTDA's funding of the feasibility study could represent significant value added to the RUTA BRT program as an ITS technology study has never been conducted in Puebla and the recommendations for the study should provide the means required by the STP to guide the ITS deployment for Puebla's new public transportation system.

The implementation of ITS technologies for Puebla's BRT system could support the current and future BRT corridor infrastructure that would likely enhance operational efficiency, improve the movement of people within the Puebla Metropolitan Area, and promote economic development in the region. Additionally, the State of Puebla and the Municipality of Puebla intend to continue to promote the city as a major tourist destination in Mexico. The completion of the BRT system with the most advanced ITS technologies in place could assist the governments in Puebla with their plans to strengthen the City's tourism industry and increase international/regional commercial trade to further promote economic development.



Furthermore, the implementation of ITS equipment and systems would represent good technology transfer opportunities for Puebla as these will be the first time that ITS technologies for BRT systems will be implemented in that city. The proposed implementation of ITS systems is likely to result in productivity improvements as time spent by public transportation users could improve in the form of reduced delay, more efficient processing at bus stations and transfer centers, reduced idle time for general vehicular traffic, lower transportation cost as a result of efficiency, and better accessibility for workers to reach their place of employment. Additionally, the proposed implementation of ITS technologies in Puebla is not expected to have a negative impact on the environment nor on U.S. labor.

In summary, the findings indicate that after the consideration of all elements and factors collectively reviewed under the DM, the requirements for grant funding are met for a viable USTDA activity in Puebla, Mexico and such, it is recommended that USTDA consider funding Puebla's Bus Rapid Transit ITS Feasibility Study in the amount of U.S. \$455,000 and select the STP as the Grantee for the project.

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**A N N E X 3**

**USTDA NATIONALITY REQUIREMENTS**



**U.S. TRADE AND DEVELOPMENT AGENCY  
Arlington, VA 22209-2131**

**NATIONALITY, SOURCE, AND ORIGIN REQUIREMENTS**

The purpose of USTDA's nationality, source, and origin requirements is to assure the maximum practicable participation of American contractors, technology, equipment and materials in the prefeasibility, feasibility, and implementation stages of a project.

**USTDA STANDARD RULE (GRANT AGREEMENT STANDARD LANGUAGE):**

Except as USTDA may otherwise agree, each of the following provisions shall apply to the delivery of goods and services funded by USTDA under this Grant Agreement: (a) for professional services, the Contractor must be either a U.S. firm or U.S. individual; (b) the Contractor may use U.S. subcontractors without limitation, but the use of subcontractors from host country may not exceed twenty percent (20%) of the USTDA Grant amount and may only be used for specific services from the Terms of Reference identified in the subcontract; (c) employees of U.S. Contractor or U.S. subcontractor firms responsible for professional services shall be U.S. citizens or non-U.S. citizens lawfully admitted for permanent residence in the U.S.; (d) goods purchased for implementation of the Study and associated delivery services (e.g., international transportation and insurance) must have their nationality, source and origin in the United States; and (e) goods and services incidental to Study support (e.g., local lodging, food, and transportation) in host country are not subject to the above restrictions. USTDA will make available further details concerning these standards of eligibility upon request.

**NATIONALITY:**

1) Rule

Except as USTDA may otherwise agree, the Contractor for USTDA funded activities must be either a U.S. firm or a U.S. individual. Prime contractors may utilize U.S.

subcontractors without limitation, but the use of host country subcontractors is limited to 20% of the USTDA grant amount.

## 2) Application

Accordingly, only a U.S. firm or U.S. individual may submit proposals on USTDA funded activities. Although those proposals may include subcontracting arrangements with host country firms or individuals for up to 20% of the USTDA grant amount, they may not include subcontracts with third country entities. U.S. firms submitting proposals must ensure that the professional services funded by the USTDA grant, to the extent not subcontracted to host country entities, are supplied by employees of the firm or employees of U.S. subcontractor firms who are U.S. individuals.

Interested U.S. firms and consultants who submit proposals must meet USTDA nationality requirements as of the due date for the submission of proposals and, if selected, must continue to meet such requirements throughout the duration of the USTDA-financed activity. These nationality provisions apply to whatever portion of the Terms of Reference is funded with the USTDA grant.

## 3) Definitions

A "U.S. individual" is (a) a U.S. citizen, or (b) a non-U.S. citizen lawfully admitted for permanent residence in the U.S. (a green card holder).

A "U.S. firm" is a privately owned firm which is incorporated in the U.S., with its principal place of business in the U.S., and which is either (a) more than 50% owned by U.S. individuals, or (b) has been incorporated in the U.S. for more than three (3) years prior to the issuance date of the request for proposals; has performed similar services in the U.S. for that three (3) year period; employs U.S. citizens in more than half of its permanent full-time positions in the U.S.; and has the existing capability in the U.S. to perform the work in question.

A partnership, organized in the U.S. with its principal place of business in the U.S., may also qualify as a "U.S. firm" as would a joint venture organized or incorporated in the United States consisting entirely of U.S. firms and/or U.S. individuals.

A nonprofit organization, such as an educational institution, foundation, or association may also qualify as a "U.S. firm" if it is incorporated in the United States and managed by a governing body, a majority of whose members are U.S. individuals.

## **SOURCE AND ORIGIN:**

### 1) Rule

In addition to the nationality requirement stated above, any goods (e.g., equipment and materials) and services related to their shipment (e.g., international transportation and insurance) funded under the USTDA Grant Agreement must have their source and origin in the United States, unless USTDA otherwise agrees. However, necessary purchases of goods and project support services which are unavailable from a U.S. source (e.g., local food, housing and transportation) are eligible without specific USTDA approval.

### 2) Application

Accordingly, the prime contractor must be able to demonstrate that all goods and services purchased in the host country to carry out the Terms of Reference for a USTDA Grant Agreement that were not of U.S. source and origin were unavailable in the United States.

### 3) Definitions

“Source” means the country from which shipment is made.

"Origin" means the place of production, through manufacturing, assembly or otherwise.

*Questions regarding these nationality, source and origin requirements may be addressed to the USTDA Office of General Counsel.*

**A N N E X 4**

**USTDA GRANT AGREEMENT,  
INCLUDING MANDATORY CONTRACT CLAUSES**



## GRANT AGREEMENT

This Grant Agreement is entered into between the Government of the United States of America, acting through the U.S. Trade and Development Agency ("USTDA"), and the Government of the State of Puebla, acting through the Secretariat of Transportation ("Grantee"). USTDA agrees to provide the Grantee under the terms of this Grant Agreement US\$455,000 ("USTDA Grant") to fund the cost of goods and services required for a feasibility study ("Study") on the proposed Puebla ITS Technologies project ("Project") in Mexico ("Host Country").

### 1. USTDA Funding

The funding to be provided under this Grant Agreement shall be used to fund the costs of a contract between the Grantee and the U.S. firm selected by the Grantee ("Contractor") under which the Contractor will perform the Study ("Contract"). Payment to the Contractor will be made directly by USTDA on behalf of the Grantee with the USTDA Grant funds provided under this Grant Agreement.

### 2. Terms of Reference

The Terms of Reference for the Study ("Terms of Reference") are attached as Annex I and are hereby made a part of this Grant Agreement. The Study will examine the technical, financial, environmental, and other critical aspects of the proposed Project. The Terms of Reference for the Study shall also be included in the Contract.

### 3. Standards of Conduct

USTDA and the Grantee recognize the existence of standards of conduct for public officials and commercial entities in their respective countries. Therefore, USTDA, the Grantee, and the Contractor shall not directly or indirectly provide, offer, or promise to provide money or anything of value to any public official in violation of any United States or Host Country laws relating to corruption or bribery.

### 4. Grantee Responsibilities

The Grantee shall undertake its best efforts to provide reasonable support for the Contractor, such as local transportation, office space, and secretarial support.

### 5. Contract Matters and USTDA's Rights as Financier

#### (A) Grantee Competitive Selection Procedures

Selection of the U.S. Contractor shall be carried out by the Grantee according to its established procedures for the competitive selection of contractors with advance notice of the procurement published online through *Federal Business Opportunities* ([www.fbo.gov](http://www.fbo.gov)). Upon

request, the Grantee will submit these contracting procedures and related documents to USTDA for information and/or approval.

**(B) USTDA's Right to Approve Contractor Selection**

The Grantee shall notify USTDA at the address of record set forth in Article 16 below upon selection of the Contractor to perform the Study. USTDA then shall notify the Grantee whether or not USTDA approves the Grantee's Contractor selection. Upon USTDA approval of the Grantee's Contractor selection, the Grantee shall notify in writing the U.S. firms that submitted unsuccessful proposals to perform the Study that they were not selected. The Grantee and the Contractor then shall enter into a contract for performance of the Study.

**(C) USTDA's Right to Approve Contract Between Grantee and Contractor**

**(1) Contract**

The Grantee and the Contractor shall enter into a contract for performance of the Study. The Grantee (or the Contractor on the Grantee's behalf) shall transmit to USTDA, at the address set forth in Article 16 below, a photocopy of an English language version of the signed contract or a final negotiated draft version of the contract. USTDA then shall notify the Grantee and the Contractor whether or not USTDA approves the contract.

**(2) Amendments and Assignments**

The Grantee or the Contractor may submit any proposed amendment to the contract, including any proposed amendment to any annex thereto, or any proposed assignment of the contract, to USTDA at the address set forth in Article 16 below. USTDA then shall notify the Grantee and the Contractor whether or not USTDA approves the proposed amendment or assignment.

**(D) USTDA Not a Party to the Contract**

It is understood by the parties that USTDA has reserved certain rights such as, but not limited to, the right to approve the terms of the contract and any amendments thereto, including assignments, the selection of all contractors, the Terms of Reference, the Final Report, and any and all documents related to any contract funded under the Grant Agreement. The parties hereto further understand and agree that USTDA, in reserving any or all of the foregoing approval rights, has acted solely as a financing entity to assure the proper use of United States Government funds, and that any decision by USTDA to exercise or refrain from exercising these approval rights shall be made as a financier in the course of funding the Study and shall not be construed as making USTDA a party to the contract. The parties hereto understand and agree that USTDA may, from time to time, exercise the foregoing approval rights, or discuss matters related to these rights and the Project with the parties to the contract or any subcontract, jointly or separately, without thereby incurring any responsibility or liability to such parties. Any approval or failure to approve by USTDA shall not bar the Grantee or USTDA from asserting any right they might have against the

Contractor, or relieve the Contractor of any liability which the Contractor might otherwise have to the Grantee or USTDA.

**(E) Grant Agreement Controlling**

Regardless of USTDA approval, the rights and obligations of any party to the contract or any subcontract thereunder must be consistent with this Grant Agreement. In the event of any inconsistency between the Grant Agreement and the contract or any subcontract funded by the Grant Agreement, the Grant Agreement shall control.

**6. Disbursement Procedures**

**(A) USTDA Approval of Contract Required**

USTDA will make disbursements of Grant funds directly to the Contractor only after USTDA approves the Grantee's contract with the Contractor.

**(B) Contractor Invoice Requirements**

The Grantee should request disbursement of funds by USTDA to the Contractor for performance of the Study by submitting invoices in accordance with the procedures set forth in the USTDA Mandatory Clauses in Annex II.

**7. Effective Date**

The effective date of this Grant Agreement ("Effective Date") shall be the date of signature by both parties or, if the parties sign on different dates, the date of the last signature. In the event that only one signature is dated, such date shall constitute the Effective Date.

**8. Study Schedule**

**(A) Study Completion Date**

The completion date for the Study, which is December 31, 2013, is the date by which the parties estimate that the Study will have been completed.

**(B) Time Limitation on Disbursement of USTDA Grant Funds**

Except as USTDA may otherwise agree, (i) no USTDA funds may be disbursed under this Grant Agreement for goods and services which are provided prior to the Effective Date of the Grant Agreement; and (ii) no USTDA funds may be disbursed more than four (4) years after the Effective Date of the Grant Agreement.

## **9. USTDA Mandatory Contract Clauses**

All contracts funded under this Grant Agreement shall include the USTDA Mandatory Contract Clauses set forth in Annex II to this Grant Agreement. All subcontracts funded or partially funded with USTDA Grant funds shall include the USTDA Mandatory Contract Clauses, except for clauses B(1), G, H, I, and J.

## **10. Use of U.S. Carriers**

### **(A) Air**

Transportation by air of persons or property funded under this Grant Agreement shall be on U.S. flag carriers in accordance with the Fly America Act, 49 U.S.C. 40118, to the extent service by such carriers is available, as provided under applicable U.S. Government regulations.

### **(B) Marine**

Transportation by sea of property funded under this Grant Agreement shall be on U.S. carriers in accordance with U.S. cargo preference law.

## **11. Nationality, Source, and Origin**

Except as USTDA may otherwise agree, the following provisions shall govern the delivery of goods and professional services funded by USTDA under this Grant Agreement:

- (a) the Contractor must be a U.S. firm;
- (b) the Contractor may use U.S. subcontractors without limitation;
- (c) employees of U.S. Contractor or U.S. subcontractor firms shall be U.S. citizens or non-U.S. citizens lawfully admitted for permanent residence in the United States, except as provided pursuant to subpart (d) below;
- (d) up to twenty percent (20%) of the USTDA Grant amount may be used to pay for services performed by (i) Host Country subcontractors, and/or (ii) Host Country nationals who are employees of the Contractor;
- (e) a Host Country subcontractor may only be used for specific services from the Terms of Reference identified in the subcontract;
- (f) subcontractors from countries other than the United States or Host Country may not be used;
- (g) goods purchased for performance of the Study and associated delivery services (e.g., international transportation and insurance) must have their nationality, source, and origin in the United States; and

(h) goods and services incidental to Study support (e.g., local lodging, food, and transportation) in Host Country are not subject to the above restrictions.

USTDA will make available further details concerning these provisions upon request.

## **12. Taxes**

USTDA funds provided under this Grant Agreement shall not be used to pay any taxes, tariffs, duties, fees, or other levies imposed under laws in effect in Host Country, except for taxes of a de minimis nature imposed on local lodging, food, transportation, or airport arrivals or departures. Neither the Grantee nor the Contractor will seek reimbursement from USTDA for taxes, tariffs, duties, fees, or other levies, except for taxes of a de minimis nature referenced above.

## **13. USTDA Project Evaluation**

The parties will cooperate to assure that the purposes of the Grant Agreement are accomplished. For five (5) years following receipt by USTDA of the Final Report, the Grantee agrees to respond to any reasonable inquiries from USTDA about the status of the Project. Inquiries will include, but not be limited to, whether the Final Report recommendations have been or will be used to implement the Project, anticipated Project implementation timeline, and likely source of financing. In addition, the Grantee agrees to notify USTDA any time the Grantee selects a new primary contact person for this Project during the five-year period referenced above.

## **14. Recordkeeping and Audit**

The Grantee agrees to maintain books, records, and other documents relating to the Study and this Grant Agreement adequate to demonstrate implementation of its responsibilities under this Grant Agreement, including the selection of contractors, receipt and approval of contract deliverables, and approval or disapproval of contractor invoices for payment by USTDA. Such books, records, and other documents shall be separately maintained for three (3) years after the date of the final disbursement by USTDA. The Grantee shall afford USTDA or its authorized representatives the opportunity at reasonable times to review books, records, and other documents relating to the Study and the Grant Agreement.

## **15. Representation of Parties**

For all purposes relevant to this Grant Agreement, the Government of the United States of America will be represented by the U.S. Ambassador to Host Country or USTDA and Grantee will be represented by its Secretary of Transportation. The parties hereto may, by written notice, designate additional representatives for all purposes under this Grant Agreement.

## 16. Addresses of Record for Parties

Any notice, request, document, or other communication submitted by either party to the other under the Grant Agreement shall be in writing or through an electronic medium that produces a tangible record of the transmission, such as a facsimile or e-mail message, and will be deemed duly given or sent when delivered to such party at the following:

To: Secretaría de Transportes  
Avenida Rosendo Márquez 1501  
Col. La Paz  
Puebla, Puebla  
MEXICO

Phone: +52 (222) 229-0600  
Fax: +52 (222) 229-0600 ext. 3021  
E-Mail: Victor.Mata@puebla.gob.mx

To: U.S. Trade and Development Agency  
1000 Wilson Boulevard, Suite 1600  
Arlington, Virginia 22209-3901  
USA

Phone: (703) 875-4357  
Fax: (703) 875-4009  
E-Mail: grantnotices@ustda.gov and  
LAC@ustda.gov

All such communications shall be in English, unless the parties otherwise agree in writing. In addition, the Grantee shall provide the Commercial or Economic Section of the U.S. Embassy in Host Country with a copy of each communication sent to USTDA.

Any communication relating to this Grant Agreement shall include the following fiscal data:

Appropriation No.: 11 13/14 1001  
Activity No.: 2013-51013A  
Reservation No.: 2013130  
Grant No.: GH201351130

## 17. Implementation Letters

To assist the Grantee in the implementation of the Study, USTDA may, from time to time, issue implementation letters that will provide additional information about matters covered by this Grant Agreement. USTDA may also issue implementation letters to (i) extend the estimated completion date set forth in Article 8(A) above, or (ii) change the fiscal data set forth in Article 16 above. The parties may also use jointly agreed upon implementation letters to confirm and record their mutual understanding of matters covered by this Grant Agreement.

## **18. Grant Agreement Amendments**

Either party may submit to the other party at any time a proposed amendment to the Grant Agreement. A Grant Agreement amendment shall be effective only if it has been signed by both parties.

## **19. Termination**

Either party may terminate this Grant Agreement by giving the other party written notice thereof. The termination of the Grant Agreement will end any obligations of the parties to provide financial or other resources for the Study, except for payments that may be made pursuant to Clause I of the USTDA Mandatory Contract Clauses set forth in Annex II to this Grant Agreement. This article and Articles 5, 12, 13, 14, and 21 of the Grant Agreement shall survive termination of the Grant Agreement.

## **20. Non-Waiver of Rights and Remedies**

No delay in exercising any right or remedy accruing to either party in connection with the Grant Agreement shall be construed as a waiver of such right or remedy.

## **21. U.S. Technology and Equipment**

By funding this Study, USTDA seeks to promote the project objectives of the Host Country through the use of U.S. technology, goods, and services. In recognition of this purpose, the Grantee agrees that it will allow U.S. suppliers to compete in the procurement of technology, goods and services needed for Project implementation.

## **22. Governing Law**

This Grant Agreement shall be governed by, and construed in accordance with, the applicable laws of the United States of America. In the absence of federal law, the laws of the State of New York shall apply.

## **23. Counterparts**

This Grant Agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same agreement. Counterparts may be delivered via electronic mail or other transmission method and any counterpart so delivered shall be deemed to be valid and effective for all purposes.

**[THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK]**

**IN WITNESS WHEREOF, the Government of the United States of America and the Government of the State of Puebla, each acting through its duly authorized representative, have caused this Grant Agreement to be signed in the English language in their names and delivered as of the day and year written below. In the event that this Grant Agreement is signed in more than one language, the English language version shall govern.**

**For the Government of the  
United States of America**

**For the Government of the  
State of Puebla**

By: *Georgina J. Jr*

Date: March 28, 2013

By: *[Signature]*

Date: 27.03.13.

**Annex I -- Terms of Reference**

**Annex II -- USTDA Mandatory Clauses**

## Annex I

### **Terms of Reference**

#### Objective

The objective of the feasibility study (“Study”) for the Puebla ITS Technologies Project (“Project”) is to assess the deployment and integration of intelligent transportation system (“ITS”) technologies into the bus rapid transit (“BRT”) system being developed in the State of Puebla in Mexico. The Study will allow the State of Puebla’s Secretariat of Transportation (“Grantee”) to analyze various ITS technologies needed to adequately and efficiently operate Puebla’s BRT system, as well as to develop a set of recommendations, standards, and specifications for the most appropriate ITS technologies to operate and manage key aspects of Puebla’s BRT system.

#### General Considerations for Deliverables and Documents

The U.S. firm selected by the Grantee to perform the Study (“Contractor”) shall undertake a quality control review process, including a technical and editorial review, of all deliverables and documents submitted to the Grantee to ensure readability, accuracy, and consistency. The interim deliverables specified in these Terms of Reference shall serve to keep the Grantee informed about the Contractor’s work on the Study and to ensure that the Contractor’s findings are acceptable to the Grantee before critical decisions are made on the Study. The Contractor shall submit monthly progress reports to the Grantee. The Contractor shall submit all deliverables and documents to the Grantee in English and Spanish.

#### Activities

##### Task 1            Review of Puebla’s BRT System Infrastructure and Technologies

- The Contractor shall work with the Grantee to verify the key members of the Grantee’s staff that will guide the Contractor’s work on the Study;
- The Contractor shall verify the Study’s goals, parameters, and objectives in coordination with the Grantee;
- The Contractor shall work with the Grantee to develop a timeline to be utilized as a guide in the performance of the Study, including the venue and frequency of meetings; and
- The Contractor shall travel to Puebla, Mexico to conduct the Study kick-off meeting with the Grantee. The purpose of the kick-off meeting shall be to familiarize and acquaint all those involved in the Study with the goals and responsibilities, as well as to gather and review relevant information on Puebla’s BRT system, including the State of Puebla’s Development Plan (2011-2017), Puebla’s Urban Mobility Plan, related technical studies and pre-feasibility studies, BRT design documents, BRT corridor traffic forecasts, BRT infrastructure

improvement plans, BRT technology investment plans, and BRT bus fleet investment plans.

Task 2            Technical Analysis of ITS Technologies and Applications

- The Contractor shall analyze any existing ITS systems being used in connection with Puebla's BRT system and shall provide recommendations for upgrading or replacing any existing ITS technologies and applications;
- The Contractor shall analyze existing communications systems being used in connection with Puebla's BRT system and shall provide recommendations for the necessary communications systems that will support the deployment of ITS technologies for operational, safety, and security enhancements;
- The Contractor shall analyze and provide recommendations on live data communications, such as live voice data to and from the buses, Global Positioning System ("GPS") coordinates for Automatic Vehicle Location ("AVL") operations, text messaging to and from the buses, emergency alarms, live video streaming, and the most viable method for live data transmission;
- The Contractor shall analyze and provide recommendations on deferred data communications, such as passenger count data, vehicle data, video surveillance segments, route and schedule updates, announcements, destination sign program updates, on-board advertising, and the most viable method for deferred data transmission (including wireless local area network ("WLAN"), infrared, short range radio communications, and Wi-Fi);
- The Contractor shall analyze and provide recommendations on other technologies that could be utilized as part of Puebla's BRT system, including radio frequency identification ("RFID"), inductive loops, and street-side beacons;
- The Contractor shall analyze and provide recommendations on the communications infrastructure needed along the BRT corridors to support the communication services between a command and control center and the BRT stations and transfer centers, such as a fiber optic communications network;
- The Contractor shall evaluate the integration and interdependence of ITS technologies and communications systems, particularly in relation to transit signal priority, automatic passenger counting systems, passenger information systems, fare collection systems, surveillance systems, computer-aided dispatching ("CAD") systems, AVL systems, panic button systems, fleet management systems, passenger Wi-Fi service, and other technologies;
- The Contractor shall analyze the application and integration of AVL technology to monitor the location of transit vehicles in real-time through the use of GPS devices and other location-monitoring methods for improved BRT system control, improved bus safety, improved quality of service, improved system integration, reduced need for voice communications, and follow-up analysis functionality;
- The Contractor shall analyze the implementation of transit signal priority on Puebla's BRT corridors. This analysis shall include the required technologies for traffic signal equipment, field detection equipment, communications systems, central system software, and on-board equipment;

- The Contractor shall analyze the existing traffic signal system in Puebla to determine if the current system is capable of providing transit signal priority functions along the BRT corridors or if new traffic signal equipment is required for transit signal priority;
- The Contractor shall analyze the utilization of automatic passenger counting systems that would be used on-board transit vehicles to record passenger entry and exit activities;
- The Contractor shall analyze the implementation of CAD systems to provide BRT operators with the capability of dispatching transit vehicles to meet system demands, including the transmission of messages from BRT operators to transit vehicles via mobile data terminals. This analysis shall include the evaluation of the method of communications for the operation of CAD systems and its integration requirements with other ITS systems recommended by the Study;
- The Contractor shall analyze the implementation of passenger information systems, including passenger information system central software, variable message signs for stations and transfer centers, and on-board variable message signs. This analysis shall include the integration requirements of passenger information systems with other ITS systems recommended by the Study;
- The Contractor shall analyze the implementation of a comprehensive fare collection system to include electronic pre-paid cards. This analysis shall include the review of fare collection system central software, electronic ticketing machines, electronic ticket validation machines, and communications systems to support the real-time exchange of fare collection activities. This analysis shall also include the integration requirements of fare collection systems with other ITS technologies recommended by the Study, such as passenger information systems, automatic passenger counting systems, CAD systems, fleet management and monitoring systems, and surveillance systems;
- The Contractor shall analyze the implementation of security systems both in the field (at stations, transfer centers, corridors, control centers, and other facilities), and on-board transit vehicles, including closed-circuit television (“CCTV”) systems and alarms systems. This analysis shall include the integration requirements of the security systems with other ITS technologies recommended by the Study, such as CAD, AVL, communications systems, and performance monitoring and archiving;
- The Contractor shall analyze the implementation of fleet management systems to record key performance indicators defined by BRT operators. This analysis shall include the communications systems required to transmit data from the transit vehicles to a central system, as well as the integration requirements of the fleet management systems with other ITS technologies recommended by the Study, such as automatic passenger counting systems, AVL, security systems, panic button systems, and emergency response systems;
- The Contractor shall identify other potential ITS technologies and their applications to improve BRT operational efficiency, safety, security, and the accountability and accuracy of fare collection systems;

- The Contractor shall identify the functional requirements of the recommended ITS systems, including hardware, software, communications, procedures, and standards;
- The Contractor shall identify other supplementary electronics equipment, information technology (“IT”) equipment, administrative systems, and other requirements that may be necessary for the successful implementation of the Project;
- The Contractor shall evaluate the technical capabilities of existing computer, communications, and BRT management systems with the purpose of determining if the existing systems and technologies are capable of being integrated with the recommended ITS technologies or if the existing systems should be upgraded or replaced; and
- The Contractor shall address the Project’s technical challenges, such as interoperability issues or proprietary systems, and shall provide recommendations for overcoming such challenges. The Contractor shall develop recommendations for the integration of future systems with the recommended ITS technologies.

Interim Deliverable No. 1:

The Contractor shall prepare and submit to the Grantee an interim report detailing the findings from Tasks 1-2.

Task 3            Economic and Financial Analysis

- The Contractor shall review the various financing alternatives for the acquisition and deployment of the recommended ITS technologies. The Contractor shall develop estimates of the projected annual cost savings and potential revenues that are likely to result from ITS technology deployment. The Contractor shall conduct a cost-benefit analysis of the recommended ITS technologies, which are expected to improve BRT system operations, management, revenues, safety, and security;
- The Contractor shall evaluate the actual or projected revenue streams generated from Puebla’s BRT system and shall determine the specific sources of revenue (from both the private and public sectors) that are likely to be utilized for the acquisition and deployment of the recommended ITS technologies. The Contractor shall examine the Grantee’s annual capital improvement and investment plan, and shall determine the anticipated funding sources to be used for Project implementation;
- The Contractor shall investigate funding sources for financing the acquisition and deployment of the recommended ITS technologies, such as Mexico’s Banco Nacional de Obras y Servicios Públicos (“BANOBRAS”), U.S. government financing institutions (such as the Export-Import Bank of the United States and Overseas Private Investment Corporation), multilateral development banks (such as the World Bank and Inter-American Development Bank), and private and commercial sources;
- The Contractor shall review the financing arrangements being utilized to fund Puebla’s BRT corridors under Mexico’s Fondo Nacional de Infraestructura

("FONADIN"), and shall investigate how this fund could be utilized to finance the acquisition and deployment of the recommended ITS technologies;

- The Contractor shall conduct a financial analysis of the Project, including the operation and maintenance costs, life-cycle costs, training, certifications, regulatory approvals, permits, and procurement methods associated with the recommended ITS technologies. The financial analysis shall include an identification of the cost savings that may be achieved by deploying the recommended ITS technologies, including the potential savings to the overall BRT system, public transportation users, operational savings, delay reductions, improved security and safety, and any other societal benefits;
- The Contractor shall conduct a life-cycle cost analysis of the Project. The life-cycle cost analysis shall examine the total initial capital costs to plan, design, develop, and build the Project, and shall also include a detailed analysis of the costs associated with the long-term operation of the Project, which includes maintaining the facilities, equipment, and other financed assets. Such costs include, but are not limited to, warranties, operation, maintenance, acquisition, installation, refurbishment, and disposal costs that could be encountered throughout the life of the Project;
- The Contractor shall review the Grantee's and the BRT operator's procurement methods and shall identify any issues that may impact the acquisition and deployment of the recommended ITS technologies;
- The Contractor shall develop cost estimates for the recommended ITS technologies; and
- Based on the results of the economic and financial analysis, the Contractor shall formulate an overall financial plan for the Grantee to use as a guide to carry out the acquisition and deployment of the recommended ITS technologies in a reasonable timeframe.

Interim Deliverable No. 2:

The Contractor shall prepare and submit to the Grantee an interim report detailing the findings from Task 3.

Task 4 Institutional, Legal, and Regulatory Review

- The Contractor shall review applicable local, state, and federal laws, regulations, and standards that may have an impact on the deployment of the recommended ITS technologies;
- The Contractor shall review current state and federal laws allowing for the creation of private-public partnerships ("PPPs") to provide public transportation services in Puebla, and shall determine how the current laws allow for the private and public sectors to finance Project implementation; and
- The Contractor shall address any institutional, legal, or regulatory challenges to Project implementation, and shall provide recommendations for overcoming such challenges.

#### Task 5 Preliminary Environmental Impact Assessment

- The Contractor shall conduct a preliminary review of the Project's environmental impact with reference to local requirements and those of multilateral development banks (such as the World Bank and Inter-American Development Bank). This review shall identify potential positive and negative impacts and shall discuss the extent to which negative impacts can be avoided or mitigated; and
- The Contractor shall identify any necessary environmental approvals required for Project implementation.

#### Interim Deliverable No. 3:

The Contractor shall prepare and submit to the Grantee an interim report detailing the findings from Task 4-5.

#### Task 6 Development of ITS Systems and Equipment Specifications

- The Contractor shall develop technical specifications for the recommended ITS technologies and shall develop a functional design for the overall Project implementation. When developing the technical specifications for the recommended ITS technologies, the Contractor shall take into account applicable standards, regulations, and recommendations from local state and federal agencies. The Contractor shall consider the National Transportation Communications for ITS Protocol ("NTCIP") standards, as appropriate;
- The Contractor shall develop technical specifications for other components or supplementary equipment related to the recommended ITS technologies;
- The Contractor shall identify prospective U.S. suppliers of equipment and services for the Project in accordance with Clause J of Annex II of the Grant Agreement. The Contractor shall identify the potential value of U.S. exports of equipment and services and shall prepare a searchable list of U.S. suppliers that outlines prospective U.S. sources for the procurement of goods and services related to Project implementation. The list shall include business name, point of contact, address, telephone and fax numbers, e-mail address, and a general description of products and services that may be procured;
- The Contractor shall identify any interoperability and integration issues between the recommended ITS technologies and other existing systems. If such issues are identified, the Contractor shall make recommendations for overcoming the issues; and
- For each of the recommended ITS technologies, the Contractor shall examine the technology's expected contribution to public transportation management, assess its potential effect on BRT system operations and management, explore the implementation and installation considerations that would have to be addressed, and identify the likely risks involved.

## Task 7 Development Impact Assessment

- For the benefit of those interested in the Project, the Contractor shall assess the development benefits associated with the Project and the methodology for measuring those benefits. The assessment shall include examples of the development benefits that would be expected in Mexico if the Project is implemented as outlined in the Study. The Contractor shall focus on examples from the categories listed below and shall develop a methodology for assessing these impacts over time. The Contractor shall only list benefits in the categories that are applicable to the Project. The categories to be considered are as follows:
  - *Infrastructure*: The Contractor shall provide a statement describing how the implementation of the recommended ITS technologies and applications will supplement the BRT infrastructure and the overall public transportation system in Puebla;
  - *Technology Transfer and Productivity Improvement*: The Contractor shall provide a description of the advanced ITS technologies and applications that would be utilized as part of the BRT system. This shall include any efficiency benefits that would be derived from the application of ITS technologies, such as lower transportation costs, lower operational and maintenance costs, fewer delays, lower fuel consumption, and improved operational efficiency for public transportation users;
  - *Human Capacity Building*: The Contractor shall assess the number and type of local positions that would be created to implement, operate, and maintain the Project, as well as any specialized training that would be required;
  - *Market-Oriented Reforms*: The Contractor shall provide a description of any regulations, laws, or institutional changes that may be recommended, as well as their anticipated effect;
  - *Other*: The Contractor shall describe any other development benefits derived from the Project, such as enhanced safety and security, environmental benefits (such as reduced vehicle emissions), enhanced government revenues, or societal benefits.

## Task 8 Development of an ITS Implementation Plan

- The Contractor shall formulate an implementation plan for the Project. The implementation plan shall provide step-by-step details of the actions to be taken by the Grantee, BRT operators, and other stakeholders in the acquisition and deployment of the recommended ITS technologies. The implementation plan shall also include the necessary steps and actions related to the various institutional, legal, financial, and technical requirements of the Project;
- The Contractor shall evaluate the most effective and efficient approach to ITS technology deployment. The Contractor shall specify if a phased implementation approach would be beneficial to the Grantee and other stakeholders, and shall prioritize the deployment of the recommended ITS systems and applications;

- The Contractor shall develop a timeline, schedule, and process outline for the Grantee to complete Project implementation, either as a turn-key project or in project phases;
- The Contractor shall provide a list of local companies (with all available background and contact information) that may be able to partner with U.S. firms in order to facilitate U.S. exports of the recommended ITS technologies;
- The Contractor shall identify locations where the recommended ITS technologies have been successfully implemented. The Contractor shall focus on proven ITS technologies and applications that are commercially available at the time of the Study;
- The Contractor shall prepare a set of guidelines for ITS equipment selection, taking into account operational and life-cycle cost elements, as well as equipment warranties; and
- The Contractor shall identify the overall benefits of Project implementation as it relates to operational and management improvements of the BRT system.

Interim Deliverable No. 4:

The Contractor shall prepare and submit to the Grantee an interim report detailing the findings from Tasks 6-8. The Contractor shall obtain the Grantee's approval on all interim deliverables prior to completing the Final Report in Task 9.

Task 9            Final Report

- The Contractor shall prepare and deliver to the Grantee and USTDA a substantive and comprehensive final report of all work performed under these Terms of Reference ("Final Report"). The Final Report shall be organized according to the above tasks, and shall include all deliverables and documents that have been provided to the Grantee. The Final Report shall be prepared in accordance with Clause J of Annex II of the Grant Agreement. The Final Report shall be prepared in English and Spanish.

## Annex II

### **USTDA Mandatory Contract Clauses**

#### **A. USTDA Mandatory Clauses Controlling**

The parties to this Contract acknowledge that this Contract is funded in whole or in part by the U.S. Trade and Development Agency ("USTDA") under the Grant Agreement between the Government of the United States of America acting through USTDA and the Government of the State of Puebla acting through the Secretariat of Transportation ("Client"), dated \_\_\_\_\_ ("Grant Agreement"). The Client has selected \_\_\_\_\_ ("Contractor") to perform the feasibility study ("Study") for the Puebla ITS Technologies project ("Project") in Mexico ("Host Country"). The Client and the Contractor are the parties to this Contract, and they hereinafter are referred to collectively as the "Contract Parties." Notwithstanding any other provisions of this Contract, the following USTDA Mandatory Contract Clauses shall govern. All subcontracts entered into by Contractor funded or partially funded with USTDA Grant funds shall include these USTDA Mandatory Contract Clauses, except for clauses B(1), G, H, I, and J. In addition, in the event of any inconsistency between the Grant Agreement and the Contract or any subcontract thereunder, the Grant Agreement shall be controlling.

#### **B. USTDA as Financier**

##### **(1) USTDA Approval of Contract**

This Contract, and any amendment thereto, including any amendment to any annex thereto, and any proposed assignment of this Contract, must be approved by USTDA in writing in order to be effective with respect to the expenditure of USTDA Grant funds. USTDA will not authorize the disbursement of USTDA Grant funds until the Contract conforms to modifications required by USTDA during the Contract review process and the Contract has been formally approved by USTDA. To make this review in a timely fashion, USTDA must receive from either the Client or the Contractor an English language version of a final negotiated draft Contract or a signed Contract to the attention of the General Counsel's office at USTDA's address listed in Clause N below.

##### **(2) USTDA Not a Party to the Contract**

It is understood by the Contract Parties that USTDA has reserved certain rights such as, but not limited to, the right to approve the terms of this Contract and amendments thereto, including assignments, the selection of all contractors, the Terms of Reference, the Final Report, and any and all documents related to any contract funded under the Grant Agreement. The Contract Parties hereto further understand and agree that USTDA, in reserving any or all of the foregoing approval rights, has acted solely as a financing entity to assure the proper use of United States Government funds, and

that any decision by USTDA to exercise or refrain from exercising these approval rights shall be made as a financier in the course of financing the Study and shall not be construed as making USTDA a party to the Contract. The Contract Parties hereto understand and agree that USTDA may, from time to time, exercise the foregoing approval rights, or discuss matters related to these rights and the Project with the Contract Parties or the parties to any subcontract, jointly or separately; and in consideration of USTDA's role as financier, the Contract Parties further agree that USTDA's rights may be exercised without thereby incurring any responsibility or liability, in contract, tort, or otherwise, to the Contract Parties or the parties to any subcontract. Any approval or failure to approve by USTDA shall not bar the Client or USTDA from asserting any right they might have against the Contractor, or relieve the Contractor of any liability which the Contractor might otherwise have to the Client or USTDA.

### **C. Nationality, Source, and Origin**

Except as USTDA may otherwise agree, the following provisions shall govern the delivery of goods and professional services funded by USTDA under the Grant Agreement:

- (a) the Contractor must be a U.S. firm;
- (b) the Contractor may use U.S. subcontractors without limitation;
- (c) employees of U.S. Contractor or U.S. subcontractor firms shall be U.S. citizens or non-U.S. citizens lawfully admitted for permanent residence in the United States, except as provided pursuant to subpart (d) below;
- (d) up to twenty percent (20%) of the USTDA Grant amount may be used to pay for services performed by (i) Host Country subcontractors, and/or (ii) Host Country nationals who are employees of the Contractor;
- (e) a Host Country subcontractor may only be used for specific services from the Terms of Reference identified in the subcontract;
- (f) subcontractors from countries other than the United States or Host Country may not be used;
- (g) goods purchased for performance of the Study and associated delivery services (e.g., international transportation and insurance) must have their nationality, source, and origin in the United States; and
- (h) goods and services incidental to Study support (e.g., local lodging, food, and transportation) in Host Country are not subject to the above restrictions.

USTDA will make available further details concerning these provisions upon request.

#### **D. Recordkeeping and Audit**

The Contractor and subcontractors funded under the Grant Agreement shall maintain, in accordance with generally accepted accounting procedures, books, records, and other documents, sufficient to reflect properly all transactions under or in connection with the Contract. These books, records, and other documents shall clearly identify and track the use and expenditure of USTDA funds, separately from other funding sources. Such books, records, and documents shall be maintained during the period of performance of work provided for by this Contract, and for a period of three (3) years after final disbursement by USTDA. The Contractor and subcontractors shall afford USTDA, or its authorized representatives, the opportunity at reasonable times for inspection and audit of such books, records, and other documentation.

#### **E. U.S. Carriers**

##### **(1) Air**

Transportation by air of persons or property funded under the Grant Agreement shall be on U.S. flag carriers in accordance with the Fly America Act, 49 U.S.C. 40118, to the extent service by such carriers is available, as provided under applicable U.S. Government regulations.

##### **(2) Marine**

Transportation by sea of property funded under the Grant Agreement shall be on U.S. carriers in accordance with U.S. cargo preference law.

#### **F. Workman's Compensation Insurance**

The Contractor shall provide adequate Workman's Compensation Insurance coverage for work performed under this Contract.

#### **G. Reporting Requirements**

The Contractor shall advise USTDA by letter as to the status of the Project on March 1st annually for a period of two (2) years after completion of the Study. In addition, if at any time the Contractor receives follow-on work from the Client, the Contractor shall so notify USTDA and designate the Contractor's contact point including name, telephone, fax number, and e-mail address. Since this information may be made publicly available by USTDA, any information which is confidential shall be designated as such by the Contractor and provided separately to USTDA. USTDA will maintain the confidentiality of such information in accordance with applicable law.

## **H. Disbursement Procedures**

### **(1) USTDA Approval of Contract**

Disbursement of Grant funds will be made only after USTDA approval of this Contract.

### **(2) Payment Schedule Requirements**

A payment schedule for disbursement of Grant funds to the Contractor shall be included in this Contract. Such payment schedule must conform to the following USTDA requirements: (1) up to twenty percent (20%) of the total USTDA Grant amount may be used as a mobilization payment; (2) all other payments, with the exception of the final payment, shall be based upon Contract performance milestones; and (3) the final payment may be no less than fifteen percent (15%) of the total USTDA Grant amount, payable upon approval by USTDA of a Final Report that has been (i) prepared and submitted in accordance with the requirements set forth in Clause I below, and (ii) approved in writing by the Client in the manner provided for by Clause H(3)(b)(iii) below. Invoicing procedures for all payments are described below.

### **(3) Contractor Invoice Requirements**

USTDA will make all disbursements of USTDA Grant funds directly to the Contractor. The Contractor must provide USTDA with an ACH Vendor Enrollment Form (available from USTDA) with the first invoice. The Client shall request disbursement of funds by USTDA to the Contractor for performance of the Contract by submitting the following to USTDA:

#### **(a) Contractor's Invoice**

The Contractor's invoice shall include reference to an item listed in the Contract payment schedule, the requested payment amount, and an appropriate certification by the Contractor, as follows:

##### **(i) For a mobilization payment (if any):**

"As a condition for this mobilization payment, the Contractor certifies that it will perform all work in accordance with the terms of its Contract with the Client. To the extent that the Contractor does not comply with the terms and conditions of the Contract, including the USTDA Mandatory Contract Clauses contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA."

(ii) For Contract performance milestone payments:

"The Contractor has performed the work described in this invoice in accordance with the terms of its Contract with the Client and is entitled to payment thereunder. To the extent the Contractor has not complied with the terms and conditions of the Contract, including the USTDA Mandatory Contract Clauses contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA."

(iii) For final payment:

"The Contractor has performed the work described in this invoice in accordance with the terms of its Contract with the Client and is entitled to payment thereunder. Specifically, the Contractor has submitted the Final Report to the Client, as required by the Contract, and received the Client's approval of the Final Report. To the extent the Contractor has not complied with the terms and conditions of the Contract, including the USTDA Mandatory Contract Clauses contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA."

**(b) Client's Approval of the Contractor's Invoice**

(i) The invoice for a mobilization payment must be approved in writing by the Client.

(ii) For Contract performance milestone payments, the following certification by the Client must be provided on the invoice or separately:

"The services for which disbursement is requested by the Contractor have been performed satisfactorily, in accordance with applicable Contract provisions and the terms and conditions of the USTDA Grant Agreement."

(iii) For final payment, the following certification by the Client must be provided on the invoice or separately:

"The services for which disbursement is requested by the Contractor have been performed satisfactorily, in accordance with applicable Contract provisions and the terms and conditions of the USTDA Grant Agreement. The Final Report submitted by the Contractor has been reviewed and approved by the Client."

**(c) USTDA Address for Disbursement Requests**

Requests for disbursement shall be submitted to the attention of the Finance Department at USTDA's address listed in Clause N below, or by e-mail to [invoices@ustda.gov](mailto:invoices@ustda.gov).

## **I. Termination**

### **(1) Method of Termination**

Either Contract Party may terminate this Contract upon giving written notice to the other party and USTDA. This notice shall be effective after either 30 days, or any other period set forth elsewhere in this Contract. Furthermore, this Contract shall terminate immediately upon notification of USTDA's termination of the Grant Agreement or the term of availability of any funds thereunder.

### **(2) Ramifications of Termination**

In the event that this Contract is terminated prior to completion, the Contractor will be eligible, subject to USTDA approval, for payment for the value of the work performed pursuant to the terms of this Contract. Likewise, in the event of such termination, USTDA is entitled to receive from the Contractor all USTDA Grant funds previously disbursed to the Contractor (including but not limited to mobilization payments) which exceed the value of the work performed pursuant to the terms of this Contract.

### **(3) Survivability**

Clauses B, D, G, H, I, and O of the USTDA Mandatory Contract Clauses shall survive the termination of this Contract.

## **J. USTDA Final Report**

### **(1) Definition**

"Final Report" shall mean the Final Report described in the attached Annex I Terms of Reference or, if no such "Final Report" is described therein, "Final Report" shall mean a substantive and comprehensive report of work performed in accordance with the attached Annex I Terms of Reference, including any documents delivered to the Client.

### **(2) Final Report Submission Requirements**

The Contractor shall provide the following to USTDA:

- (a)** One (1) complete hard copy of the Final Report for USTDA's records. This version shall have been approved by the Client in writing and must be in the English language. It is the responsibility of the Contractor to ensure that confidential information, if any, contained in this version be clearly marked. USTDA will maintain the confidentiality of such information in accordance with applicable law.

and

**(b)** One (1) hard copy of the Final Report suitable for public distribution ("Public Version"). The Public Version shall have been approved by the Client in writing and must be in the English language. As this version will be available for public distribution, it must not contain any confidential information. If the report in (a) above contains no confidential information, it may be used as the Public Version. In any event, the Public Version must be informative and contain sufficient Project detail to be useful to prospective equipment and service providers.

and

**(c)** Two (2) CD-ROMs, each containing a complete copy of the Public Version of the Final Report. The electronic files on the CD-ROMs shall be submitted in a commonly accessible read-only format. As these CD-ROMs will be available for public distribution, they must not contain any confidential information. It is the responsibility of the Contractor to ensure that no confidential information is contained on the CD-ROMs

The Contractor shall also provide one (1) hard copy of the Public Version of the Final Report to the Commercial or Economic Section of the U.S. Embassy in Host Country for informational purposes.

### **(3) Final Report Presentation**

All Final Reports submitted to USTDA must be paginated and include the following:

**(a)** The front cover of every Final Report shall contain the name of the Client, the name of the Contractor who prepared the report, a report title, USTDA's logo, and USTDA's address. If the complete version of the Final Report contains confidential information, the Contractor shall be responsible for labeling the front cover of that version of the Final Report with the term "Confidential Version." The Contractor shall be responsible for labeling the front cover of the Public Version of the Final Report with the term "Public Version." The front cover of every Final Report shall also contain the following disclaimer:

"This report was funded by the U.S. Trade and Development Agency (USTDA), an agency of the U.S. Government. The opinions, findings, conclusions or recommendations expressed in this document are those of the author(s) and do not necessarily represent the official position or policies of USTDA. USTDA makes no representation about, nor does it accept responsibility for, the accuracy or completeness of the information contained in this report."

(b) The inside front cover of every Final Report shall contain USTDA's logo, USTDA's address, and USTDA's mission statement. Camera-ready copy of USTDA Final Report specifications will be available from USTDA upon request.

(c) The Contractor shall affix to the front of the CD-ROM a label identifying the Host Country, USTDA Activity Number, the name of the Client, the name of the Contractor who prepared the report, a report title, and the following language:

“The Contractor certifies that this CD-ROM contains the Public Version of the Final Report and that all contents are suitable for public distribution.”

(d) The Contractor and any subcontractors that perform work pursuant to the Grant Agreement must be clearly identified in the Final Report. Business name, point of contact, address, telephone and fax numbers, and e-mail address shall be included for Contractor and each subcontractor.

(e) The Final Report, while aiming at optimum specifications and characteristics for the Project, shall identify the availability of prospective U.S. sources of supply. Business name, point of contact, address, telephone and fax numbers, and e-mail address shall be included for each commercial source.

(f) The Final Report shall be accompanied by a letter or other notation by the Client which states that the Client approves the Final Report. A certification by the Client to this effect provided on or with the invoice for final payment will meet this requirement.

(g) The Client, USTDA, and the Commercial and/or Economic Section(s) of the U.S. Embassy in Host Country shall have irrevocable, worldwide, royalty-free, non-exclusive rights to use and distribute the Final Report.

## **K. Modifications**

All changes, modifications, assignments or amendments to this Contract, including the appendices, shall be made only by written agreement by the Contract Parties hereto, subject to written USTDA approval.

## **L. Study Schedule**

### **(1) Study Completion Date**

The completion date for the Study, which is December 31, 2013, is the date by which the Contract Parties estimate that the Study will have been completed.

## **(2) Time Limitation on Disbursement of USTDA Grant Funds**

Except as USTDA may otherwise agree, (a) no USTDA funds may be disbursed under this Contract for goods and services which are provided prior to the Effective Date of the Grant Agreement; and (b) no USTDA funds may be disbursed more than four (4) years after the Effective Date of the Grant Agreement.

### **M. Business Practices**

The Contract Parties recognize the existence of standards of conduct for public officials and commercial entities in their respective countries. Therefore, the Contract Parties shall fully comply with all United States and Host Country laws relating to corruption or bribery. For example, the Contractor and its subcontractors shall fully comply with the requirements of the Foreign Corrupt Practices Act, as amended (15 U.S.C. §§ 78dd-1 et seq.). Each Contract Party agrees that it shall require that any agent or representative hired to represent it in connection with the Study will comply with this paragraph and all laws which apply to activities and obligations of that Contract Party, including, but not limited to, those laws and obligations referenced above.

### **N. USTDA Address and Fiscal Data**

Any communication with USTDA regarding this Contract shall be sent to the following address and include the fiscal data listed below:

U.S. Trade and Development Agency  
1000 Wilson Boulevard, Suite 1600  
Arlington, Virginia 22209-3901  
USA

Phone: (703) 875-4357

Fax: (703) 875-4009

#### Fiscal Data:

Appropriation No.: 11 13/14 1001

Activity No.: 2013-51013A

Reservation No.: 2013130

Grant No.: GH201351130

### **O. Taxes**

USTDA funds provided under the Grant Agreement shall not be used to pay any taxes, tariffs, duties, fees, or other levies imposed under laws in effect in Host Country, except for taxes of a de minimis nature imposed on local lodging, food, transportation, or airport arrivals or departures. Neither the Client nor the Contractor will seek reimbursement from USTDA for taxes, tariffs, duties, fees, or other levies, except for taxes of a de minimis nature referenced above.

**P. Export Licensing**

The Contractor and all subcontractors are responsible for compliance with U.S. export licensing requirements, if applicable, in the performance of the Terms of Reference.

**Q. Contact Persons**

The Client designates the following person as the contact person for matters concerning this Contract:

Name: Victor Mata Temoltzin  
Title: Under Secretary for Planning and Development  
Phone: +52 (222) 229-0600  
Fax: +52 (222) 229-0600 ext. 3021  
E-Mail: Victor.Mata@puebla.gob.mx

The Contractor designates the following person as the contact person for matters concerning this Contract:

Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Phone: \_\_\_\_\_  
Fax: \_\_\_\_\_  
E-Mail: \_\_\_\_\_

If anyone designated by a Contract Party as a contact person ceases service as a contact person at any point during the ten-year period following the date of signing of this Contract, the Contract Party that had designated that contact person shall provide USTDA and the other Contract Party with the name and contact information of a replacement contact person.

**R. Liability**

This Contract may include a clause that limits the liability of the Contract Parties, provided that such a clause does not (i) disclaim liability for special, incidental, general, or punitive damages, or (ii) limit the total amount of damages recoverable to an amount less than the total amount disbursed to the Contractor pursuant to this Contract.

**S. Arbitration**

If the Contract Parties submit any dispute arising under this Contract for arbitration, the scope of any such arbitration shall be limited to the Contract Parties' rights and/or obligations under this Contract and may not extend to any right or obligation of USTDA. The arbitrator(s) shall not arbitrate issues directly affecting the rights or obligations of USTDA.

**A N N E X 5**

**TERMS OF REFERENCE  
(FROM USTDA GRANT AGREEMENT)**

## Annex I

### **Terms of Reference**

#### Objective

The objective of the feasibility study (“Study”) for the Puebla ITS Technologies Project (“Project”) is to assess the deployment and integration of intelligent transportation system (“ITS”) technologies into the bus rapid transit (“BRT”) system being developed in the State of Puebla in Mexico. The Study will allow the State of Puebla’s Secretariat of Transportation (“Grantee”) to analyze various ITS technologies needed to adequately and efficiently operate Puebla’s BRT system, as well as to develop a set of recommendations, standards, and specifications for the most appropriate ITS technologies to operate and manage key aspects of Puebla’s BRT system.

#### General Considerations for Deliverables and Documents

The U.S. firm selected by the Grantee to perform the Study (“Contractor”) shall undertake a quality control review process, including a technical and editorial review, of all deliverables and documents submitted to the Grantee to ensure readability, accuracy, and consistency. The interim deliverables specified in these Terms of Reference shall serve to keep the Grantee informed about the Contractor’s work on the Study and to ensure that the Contractor’s findings are acceptable to the Grantee before critical decisions are made on the Study. The Contractor shall submit monthly progress reports to the Grantee. The Contractor shall submit all deliverables and documents to the Grantee in English and Spanish.

#### Activities

##### Task 1            Review of Puebla’s BRT System Infrastructure and Technologies

- The Contractor shall work with the Grantee to verify the key members of the Grantee’s staff that will guide the Contractor’s work on the Study;
- The Contractor shall verify the Study’s goals, parameters, and objectives in coordination with the Grantee;
- The Contractor shall work with the Grantee to develop a timeline to be utilized as a guide in the performance of the Study, including the venue and frequency of meetings; and
- The Contractor shall travel to Puebla, Mexico to conduct the Study kick-off meeting with the Grantee. The purpose of the kick-off meeting shall be to familiarize and acquaint all those involved in the Study with the goals and responsibilities, as well as to gather and review relevant information on Puebla’s BRT system, including the State of Puebla’s Development Plan (2011-2017), Puebla’s Urban Mobility Plan, related technical studies and pre-feasibility studies, BRT design documents, BRT corridor traffic forecasts, BRT infrastructure

improvement plans, BRT technology investment plans, and BRT bus fleet investment plans.

Task 2            Technical Analysis of ITS Technologies and Applications

- The Contractor shall analyze any existing ITS systems being used in connection with Puebla's BRT system and shall provide recommendations for upgrading or replacing any existing ITS technologies and applications;
- The Contractor shall analyze existing communications systems being used in connection with Puebla's BRT system and shall provide recommendations for the necessary communications systems that will support the deployment of ITS technologies for operational, safety, and security enhancements;
- The Contractor shall analyze and provide recommendations on live data communications, such as live voice data to and from the buses, Global Positioning System ("GPS") coordinates for Automatic Vehicle Location ("AVL") operations, text messaging to and from the buses, emergency alarms, live video streaming, and the most viable method for live data transmission;
- The Contractor shall analyze and provide recommendations on deferred data communications, such as passenger count data, vehicle data, video surveillance segments, route and schedule updates, announcements, destination sign program updates, on-board advertising, and the most viable method for deferred data transmission (including wireless local area network ("WLAN"), infrared, short range radio communications, and Wi-Fi);
- The Contractor shall analyze and provide recommendations on other technologies that could be utilized as part of Puebla's BRT system, including radio frequency identification ("RFID"), inductive loops, and street-side beacons;
- The Contractor shall analyze and provide recommendations on the communications infrastructure needed along the BRT corridors to support the communication services between a command and control center and the BRT stations and transfer centers, such as a fiber optic communications network;
- The Contractor shall evaluate the integration and interdependence of ITS technologies and communications systems, particularly in relation to transit signal priority, automatic passenger counting systems, passenger information systems, fare collection systems, surveillance systems, computer-aided dispatching ("CAD") systems, AVL systems, panic button systems, fleet management systems, passenger Wi-Fi service, and other technologies;
- The Contractor shall analyze the application and integration of AVL technology to monitor the location of transit vehicles in real-time through the use of GPS devices and other location-monitoring methods for improved BRT system control, improved bus safety, improved quality of service, improved system integration, reduced need for voice communications, and follow-up analysis functionality;
- The Contractor shall analyze the implementation of transit signal priority on Puebla's BRT corridors. This analysis shall include the required technologies for traffic signal equipment, field detection equipment, communications systems, central system software, and on-board equipment;

- The Contractor shall analyze the existing traffic signal system in Puebla to determine if the current system is capable of providing transit signal priority functions along the BRT corridors or if new traffic signal equipment is required for transit signal priority;
- The Contractor shall analyze the utilization of automatic passenger counting systems that would be used on-board transit vehicles to record passenger entry and exit activities;
- The Contractor shall analyze the implementation of CAD systems to provide BRT operators with the capability of dispatching transit vehicles to meet system demands, including the transmission of messages from BRT operators to transit vehicles via mobile data terminals. This analysis shall include the evaluation of the method of communications for the operation of CAD systems and its integration requirements with other ITS systems recommended by the Study;
- The Contractor shall analyze the implementation of passenger information systems, including passenger information system central software, variable message signs for stations and transfer centers, and on-board variable message signs. This analysis shall include the integration requirements of passenger information systems with other ITS systems recommended by the Study;
- The Contractor shall analyze the implementation of a comprehensive fare collection system to include electronic pre-paid cards. This analysis shall include the review of fare collection system central software, electronic ticketing machines, electronic ticket validation machines, and communications systems to support the real-time exchange of fare collection activities. This analysis shall also include the integration requirements of fare collection systems with other ITS technologies recommended by the Study, such as passenger information systems, automatic passenger counting systems, CAD systems, fleet management and monitoring systems, and surveillance systems;
- The Contractor shall analyze the implementation of security systems both in the field (at stations, transfer centers, corridors, control centers, and other facilities), and on-board transit vehicles, including closed-circuit television (“CCTV”) systems and alarms systems. This analysis shall include the integration requirements of the security systems with other ITS technologies recommended by the Study, such as CAD, AVL, communications systems, and performance monitoring and archiving;
- The Contractor shall analyze the implementation of fleet management systems to record key performance indicators defined by BRT operators. This analysis shall include the communications systems required to transmit data from the transit vehicles to a central system, as well as the integration requirements of the fleet management systems with other ITS technologies recommended by the Study, such as automatic passenger counting systems, AVL, security systems, panic button systems, and emergency response systems;
- The Contractor shall identify other potential ITS technologies and their applications to improve BRT operational efficiency, safety, security, and the accountability and accuracy of fare collection systems;

- The Contractor shall identify the functional requirements of the recommended ITS systems, including hardware, software, communications, procedures, and standards;
- The Contractor shall identify other supplementary electronics equipment, information technology (“IT”) equipment, administrative systems, and other requirements that may be necessary for the successful implementation of the Project;
- The Contractor shall evaluate the technical capabilities of existing computer, communications, and BRT management systems with the purpose of determining if the existing systems and technologies are capable of being integrated with the recommended ITS technologies or if the existing systems should be upgraded or replaced; and
- The Contractor shall address the Project’s technical challenges, such as interoperability issues or proprietary systems, and shall provide recommendations for overcoming such challenges. The Contractor shall develop recommendations for the integration of future systems with the recommended ITS technologies.

Interim Deliverable No. 1:

The Contractor shall prepare and submit to the Grantee an interim report detailing the findings from Tasks 1-2.

Task 3            Economic and Financial Analysis

- The Contractor shall review the various financing alternatives for the acquisition and deployment of the recommended ITS technologies. The Contractor shall develop estimates of the projected annual cost savings and potential revenues that are likely to result from ITS technology deployment. The Contractor shall conduct a cost-benefit analysis of the recommended ITS technologies, which are expected to improve BRT system operations, management, revenues, safety, and security;
- The Contractor shall evaluate the actual or projected revenue streams generated from Puebla’s BRT system and shall determine the specific sources of revenue (from both the private and public sectors) that are likely to be utilized for the acquisition and deployment of the recommended ITS technologies. The Contractor shall examine the Grantee’s annual capital improvement and investment plan, and shall determine the anticipated funding sources to be used for Project implementation;
- The Contractor shall investigate funding sources for financing the acquisition and deployment of the recommended ITS technologies, such as Mexico’s Banco Nacional de Obras y Servicios Públicos (“BANOBRAS”), U.S. government financing institutions (such as the Export-Import Bank of the United States and Overseas Private Investment Corporation), multilateral development banks (such as the World Bank and Inter-American Development Bank), and private and commercial sources;
- The Contractor shall review the financing arrangements being utilized to fund Puebla’s BRT corridors under Mexico’s Fondo Nacional de Infraestructura

("FONADIN"), and shall investigate how this fund could be utilized to finance the acquisition and deployment of the recommended ITS technologies;

- The Contractor shall conduct a financial analysis of the Project, including the operation and maintenance costs, life-cycle costs, training, certifications, regulatory approvals, permits, and procurement methods associated with the recommended ITS technologies. The financial analysis shall include an identification of the cost savings that may be achieved by deploying the recommended ITS technologies, including the potential savings to the overall BRT system, public transportation users, operational savings, delay reductions, improved security and safety, and any other societal benefits;
- The Contractor shall conduct a life-cycle cost analysis of the Project. The life-cycle cost analysis shall examine the total initial capital costs to plan, design, develop, and build the Project, and shall also include a detailed analysis of the costs associated with the long-term operation of the Project, which includes maintaining the facilities, equipment, and other financed assets. Such costs include, but are not limited to, warranties, operation, maintenance, acquisition, installation, refurbishment, and disposal costs that could be encountered throughout the life of the Project;
- The Contractor shall review the Grantee's and the BRT operator's procurement methods and shall identify any issues that may impact the acquisition and deployment of the recommended ITS technologies;
- The Contractor shall develop cost estimates for the recommended ITS technologies; and
- Based on the results of the economic and financial analysis, the Contractor shall formulate an overall financial plan for the Grantee to use as a guide to carry out the acquisition and deployment of the recommended ITS technologies in a reasonable timeframe.

Interim Deliverable No. 2:

The Contractor shall prepare and submit to the Grantee an interim report detailing the findings from Task 3.

Task 4 Institutional, Legal, and Regulatory Review

- The Contractor shall review applicable local, state, and federal laws, regulations, and standards that may have an impact on the deployment of the recommended ITS technologies;
- The Contractor shall review current state and federal laws allowing for the creation of private-public partnerships ("PPPs") to provide public transportation services in Puebla, and shall determine how the current laws allow for the private and public sectors to finance Project implementation; and
- The Contractor shall address any institutional, legal, or regulatory challenges to Project implementation, and shall provide recommendations for overcoming such challenges.

#### Task 5 Preliminary Environmental Impact Assessment

- The Contractor shall conduct a preliminary review of the Project's environmental impact with reference to local requirements and those of multilateral development banks (such as the World Bank and Inter-American Development Bank). This review shall identify potential positive and negative impacts and shall discuss the extent to which negative impacts can be avoided or mitigated; and
- The Contractor shall identify any necessary environmental approvals required for Project implementation.

#### Interim Deliverable No. 3:

The Contractor shall prepare and submit to the Grantee an interim report detailing the findings from Task 4-5.

#### Task 6 Development of ITS Systems and Equipment Specifications

- The Contractor shall develop technical specifications for the recommended ITS technologies and shall develop a functional design for the overall Project implementation. When developing the technical specifications for the recommended ITS technologies, the Contractor shall take into account applicable standards, regulations, and recommendations from local state and federal agencies. The Contractor shall consider the National Transportation Communications for ITS Protocol ("NTCIP") standards, as appropriate;
- The Contractor shall develop technical specifications for other components or supplementary equipment related to the recommended ITS technologies;
- The Contractor shall identify prospective U.S. suppliers of equipment and services for the Project in accordance with Clause J of Annex II of the Grant Agreement. The Contractor shall identify the potential value of U.S. exports of equipment and services and shall prepare a searchable list of U.S. suppliers that outlines prospective U.S. sources for the procurement of goods and services related to Project implementation. The list shall include business name, point of contact, address, telephone and fax numbers, e-mail address, and a general description of products and services that may be procured;
- The Contractor shall identify any interoperability and integration issues between the recommended ITS technologies and other existing systems. If such issues are identified, the Contractor shall make recommendations for overcoming the issues; and
- For each of the recommended ITS technologies, the Contractor shall examine the technology's expected contribution to public transportation management, assess its potential effect on BRT system operations and management, explore the implementation and installation considerations that would have to be addressed, and identify the likely risks involved.

## Task 7 Development Impact Assessment

- For the benefit of those interested in the Project, the Contractor shall assess the development benefits associated with the Project and the methodology for measuring those benefits. The assessment shall include examples of the development benefits that would be expected in Mexico if the Project is implemented as outlined in the Study. The Contractor shall focus on examples from the categories listed below and shall develop a methodology for assessing these impacts over time. The Contractor shall only list benefits in the categories that are applicable to the Project. The categories to be considered are as follows:
  - *Infrastructure*: The Contractor shall provide a statement describing how the implementation of the recommended ITS technologies and applications will supplement the BRT infrastructure and the overall public transportation system in Puebla;
  - *Technology Transfer and Productivity Improvement*: The Contractor shall provide a description of the advanced ITS technologies and applications that would be utilized as part of the BRT system. This shall include any efficiency benefits that would be derived from the application of ITS technologies, such as lower transportation costs, lower operational and maintenance costs, fewer delays, lower fuel consumption, and improved operational efficiency for public transportation users;
  - *Human Capacity Building*: The Contractor shall assess the number and type of local positions that would be created to implement, operate, and maintain the Project, as well as any specialized training that would be required;
  - *Market-Oriented Reforms*: The Contractor shall provide a description of any regulations, laws, or institutional changes that may be recommended, as well as their anticipated effect;
  - *Other*: The Contractor shall describe any other development benefits derived from the Project, such as enhanced safety and security, environmental benefits (such as reduced vehicle emissions), enhanced government revenues, or societal benefits.

## Task 8 Development of an ITS Implementation Plan

- The Contractor shall formulate an implementation plan for the Project. The implementation plan shall provide step-by-step details of the actions to be taken by the Grantee, BRT operators, and other stakeholders in the acquisition and deployment of the recommended ITS technologies. The implementation plan shall also include the necessary steps and actions related to the various institutional, legal, financial, and technical requirements of the Project;
- The Contractor shall evaluate the most effective and efficient approach to ITS technology deployment. The Contractor shall specify if a phased implementation approach would be beneficial to the Grantee and other stakeholders, and shall prioritize the deployment of the recommended ITS systems and applications;

## Task 7 Development Impact Assessment

- For the benefit of those interested in the Project, the Contractor shall assess the development benefits associated with the Project and the methodology for measuring those benefits. The assessment shall include examples of the development benefits that would be expected in Mexico if the Project is implemented as outlined in the Study. The Contractor shall focus on examples from the categories listed below and shall develop a methodology for assessing these impacts over time. The Contractor shall only list benefits in the categories that are applicable to the Project. The categories to be considered are as follows:
  - *Infrastructure*: The Contractor shall provide a statement describing how the implementation of the recommended ITS technologies and applications will supplement the BRT infrastructure and the overall public transportation system in Puebla;
  - *Technology Transfer and Productivity Improvement*: The Contractor shall provide a description of the advanced ITS technologies and applications that would be utilized as part of the BRT system. This shall include any efficiency benefits that would be derived from the application of ITS technologies, such as lower transportation costs, lower operational and maintenance costs, fewer delays, lower fuel consumption, and improved operational efficiency for public transportation users;
  - *Human Capacity Building*: The Contractor shall assess the number and type of local positions that would be created to implement, operate, and maintain the Project, as well as any specialized training that would be required;
  - *Market-Oriented Reforms*: The Contractor shall provide a description of any regulations, laws, or institutional changes that may be recommended, as well as their anticipated effect;
  - *Other*: The Contractor shall describe any other development benefits derived from the Project, such as enhanced safety and security, environmental benefits (such as reduced vehicle emissions), enhanced government revenues, or societal benefits.

## Task 8 Development of an ITS Implementation Plan

- The Contractor shall formulate an implementation plan for the Project. The implementation plan shall provide step-by-step details of the actions to be taken by the Grantee, BRT operators, and other stakeholders in the acquisition and deployment of the recommended ITS technologies. The implementation plan shall also include the necessary steps and actions related to the various institutional, legal, financial, and technical requirements of the Project;
- The Contractor shall evaluate the most effective and efficient approach to ITS technology deployment. The Contractor shall specify if a phased implementation approach would be beneficial to the Grantee and other stakeholders, and shall prioritize the deployment of the recommended ITS systems and applications;

- The Contractor shall develop a timeline, schedule, and process outline for the Grantee to complete Project implementation, either as a turn-key project or in project phases;
- The Contractor shall provide a list of local companies (with all available background and contact information) that may be able to partner with U.S. firms in order to facilitate U.S. exports of the recommended ITS technologies;
- The Contractor shall identify locations where the recommended ITS technologies have been successfully implemented. The Contractor shall focus on proven ITS technologies and applications that are commercially available at the time of the Study;
- The Contractor shall prepare a set of guidelines for ITS equipment selection, taking into account operational and life-cycle cost elements, as well as equipment warranties; and
- The Contractor shall identify the overall benefits of Project implementation as it relates to operational and management improvements of the BRT system.

Interim Deliverable No. 4:

The Contractor shall prepare and submit to the Grantee an interim report detailing the findings from Tasks 6-8. The Contractor shall obtain the Grantee's approval on all interim deliverables prior to completing the Final Report in Task 9.

Task 9            Final Report

- The Contractor shall prepare and deliver to the Grantee and USTDA a substantive and comprehensive final report of all work performed under these Terms of Reference ("Final Report"). The Final Report shall be organized according to the above tasks, and shall include all deliverables and documents that have been provided to the Grantee. The Final Report shall be prepared in accordance with Clause J of Annex II of the Grant Agreement. The Final Report shall be prepared in English and Spanish.

**A N N E X 6**

**U.S. FIRM INFORMATION FORM**



## USTDA-Funded Feasibility Study, Technical Assistance, or Training Grant

### U.S. Firm Information Form

This form is designed to enable the U.S. Trade and Development Agency ("USTDA") to obtain information about entities and individuals proposed for participation in USTDA-funded activities. Information in this form is used to conduct screening of entities and individuals to ensure compliance with legislative and executive branch prohibitions on providing support or resources to, or engaging in transactions with, certain individuals or entities with which USTDA must comply.

USTDA Activity Number *[To be completed by USTDA]*

|   |                   |                      |                 |
|---|-------------------|----------------------|-----------------|
| Activity Type <i>[To be completed by USTDA]</i> | Feasibility Study | Technical Assistance | Other (specify) |
|---|-------------------|----------------------|-----------------|

Activity Title *[To be completed by USTDA]*

Full Legal Name of U.S. Firm

Business Address (street address only)

|           |  |     |  |         |  |
|-----------|--|-----|--|---------|--|
| Telephone |  | Fax |  | Website |  |
|-----------|--|-----|--|---------|--|

Year Established (include any predecessor company(s) and year(s) established, if appropriate).  
Please attach additional pages as necessary.

Please provide a list of directors and principal officers as detailed in Attachment A. Attached? Yes

|                   |                         |
|-------------------|-------------------------|
| Type of Ownership | Publicly Traded Company |
|                   | Private Company         |
|                   | Other (please specify)  |

If Private Company or Other (if applicable), provide a list of shareholders and the percentage of their ownership. In addition, for each shareholder that owns 15% or more shares in U.S. Firm, please complete Attachment B.

|  |     |
|--|-----|
| Is the U.S. Firm a wholly-owned or partially owned subsidiary? | Yes |
|  | No  |

If so, please provide the name of the U.S. Firm's parent company(s). In addition, for any parent identified, please complete Attachment B.

|  |     |
|--|-----|
| Is the U.S. Firm proposing to subcontract some of the proposed work to another firm? | Yes |
|  | No  |

|   |                |
|---|----------------|
| If yes, U.S. Firm shall complete Attachment C for each subcontractor. Attached? | Yes            |
|   | Not applicable |

#### Project Manager

|           |            |  |
|-----------|------------|--|
| Name      | Surname    |  |
|           | Given Name |  |
| Address   |            |  |
| Telephone |            |  |
| Fax       |            |  |
| Email     |            |  |

#### Negotiation Prerequisites

|  |  |
|--|--|
| Discuss any current or anticipated commitments which may impact the ability of the U.S. Firm or its subcontractors to complete the Activity as proposed and reflect such impact within the project schedule. |  |
|--|--|

|  |  |
|--|--|
| Identify any specific information which is needed from the Grantee before commencing negotiations. |  |
|--|--|

*U.S. Firm may attach additional sheets, as necessary.*

**U.S. Firm's Representations**

U.S. Firm shall certify to the following (or provide any explanation as to why any representation cannot be made):

1. U.S. Firm is a [check one]  Corporation  LLC  Partnership  Sole Proprietor  Other:   
 duly organized, validly existing and in good standing under the laws of the State of:   
 The U.S. Firm has all the requisite corporate power and authority to conduct its business as presently conducted, to submit this proposal, and if selected, to execute and deliver a contract to the Grantee for the performance of the USTDA Activity. The U.S. Firm is not debarred, suspended, or to the best of its knowledge or belief, proposed for debarment or ineligible for the award of contracts by any federal or state governmental agency or authority.
2. The U.S. Firm has included herewith, a copy of its Articles of Incorporation (or equivalent charter or document issued by a designated authority in accordance with applicable laws that provides information and authentication regarding the legal status of an entity) and a Certificate of Good Standing (or equivalent document) issued within 1 month of the date of signature below by the State of:   
 The U.S. Firm commits to notify USTDA and the Grantee if it becomes aware of any change in its status in the state in which it is incorporated. USTDA retains the right to request an updated certificate of good standing.
3. Neither the U.S. Firm nor any of its principal officers have, within the ten-year period preceding the submission of this proposal, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a federal, state or local government contract or subcontract; violation of federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, violating federal or state criminal tax laws, or receiving stolen property.
4. Neither the U.S. Firm, nor any of its principal officers, is presently indicted for, or otherwise criminally or civilly charged with, commission of any of the offenses enumerated in paragraph 3 above.
5. There are no federal or state tax liens pending against the assets, property or business of the U.S. Firm. The U.S. Firm, has not, within the three-year period preceding the submission of this proposal, been notified of any delinquent federal or state taxes in an amount that exceeds US\$3,000 for which the liability remains unsatisfied. Taxes are considered delinquent if (a) the tax liability has been fully determined, with no pending administrative or judicial appeals; and (b) a taxpayer has failed to pay the tax liability when full payment is due and required.
6. The U.S. Firm has not commenced a voluntary case or other proceeding seeking liquidation, reorganization or other relief with respect to itself of its debts under any bankruptcy, insolvency or other similar law. The U.S. Firm has not had filed against it an involuntary petition under any bankruptcy, insolvency or similar law.
7. The U.S. Firm certifies that it complies with USTDA Nationality, Source, and Origin Requirements and shall continue to comply with such requirements throughout the duration of the USTDA-funded activity. The U.S. Firm commits to notify USTDA and the Grantee if it becomes aware of any change which might affect U.S. Firm's ability to meet the USTDA Nationality, Source, and Origin Requirements.

*The U.S. Firm shall notify USTDA if any of the representations are no longer true and correct.*

U.S. Firm certifies that the information provided in this form is true and correct. U.S. Firm understands and agrees that the U.S. Government may rely on the accuracy of this information in processing a request to participate in a USTDA-funded activity. If at any time USTDA has reason to believe that any person or entity has willfully and knowingly provided incorrect information or made false statements, USTDA may take action under applicable law. The undersigned represents and warrants that he/she has the requisite power and authority to sign on behalf of the U.S. Firm.

|              |                      |           |                      |
|--------------|----------------------|-----------|----------------------|
| Name         | <input type="text"/> | Signature | <input type="text"/> |
| Title        | <input type="text"/> |           |                      |
| Organization | <input type="text"/> | Date      | <input type="text"/> |





**ATTACHMENT B**

**USTDA-Funded Feasibility Study, Technical Assistance, or Training Grant**

**U.S. Firm Information Form – Shareholder(s) and Parent Company(s)**

If applicable, U.S. Firm provided a list of shareholders and the percentage of their ownership. This form shall be completed for each shareholder that owns 15% or more shares in U.S. Firm, as well as any parent corporation of the U.S. Firm ("Shareholder"). In addition, this form shall be completed for each shareholder identified in Attachment B that owns 15% or more shares in any Shareholder, as well as any parent identified in Attachment B.

|  |  |
|--|--|
| USTDA Activity Number [To be completed by USTDA] |  |
|--|--|

|   |  |
|---|--|
| Activity Title [To be completed by USTDA] |  |
|---|--|

|                              |  |
|------------------------------|--|
| Full Legal Name of U.S. Firm |  |
|------------------------------|--|

|                                |  |
|--------------------------------|--|
| Full Legal Name of Shareholder |  |
|--------------------------------|--|

|   |  |
|---|--|
| Business Address of Shareholder (street address only) |  |
|---|--|

|                  |  |            |  |
|------------------|--|------------|--|
| Telephone number |  | Fax Number |  |
|------------------|--|------------|--|

|   |  |
|---|--|
| Year Established (include any predecessor company(s) and year(s) established, if appropriate). Please attach additional pages as necessary. |  |
|---|--|

|  |  |
|--|--|
| Country of Shareholder's Principal Place of Business |  |
|--|--|

|  |     |
|--|-----|
| Please provide a list of directors and principal officers as detailed in Attachment A. Attached? | Yes |
|--|-----|

|                   |                         |
|-------------------|-------------------------|
| Type of Ownership | Publicly Traded Company |
|                   | Private Company         |
|                   | Other                   |

|   |  |
|---|--|
| If applicable, provide a list of shareholders and the percentage of their ownership. In addition, for each shareholder that owns 15% or more shares in Shareholder, please complete Attachment B. |  |
|---|--|

|  |     |
|--|-----|
| Is the Shareholder a wholly-owned or partially owned subsidiary? | Yes |
|  | No  |

|  |  |
|--|--|
| If so, please provide the name of the Shareholder's parent(s). In addition, for any parent identified, please complete Attachment B. |  |
|--|--|

*Shareholder may attach additional sheets, as necessary.*



**ATTACHMENT C**

**USTDA-Funded Feasibility Study, Technical Assistance, or Training Grant**

**Subcontractor Information Form**

This form is designed to enable the U.S. Trade and Development Agency ("USTDA") to obtain information about entities and individuals proposed for participation in USTDA-funded activities. Information in this form is used to conduct screening of entities and individuals to ensure compliance with legislative and executive branch prohibitions on providing support or resources to, or engaging in transactions with, certain individuals or entities with which USTDA must comply.

|   |  |
|---|--|
| USTDA Activity Number <i>[To be completed by USTDA]</i> |  |
|---|--|

|  |  |
|--|--|
| Activity Title <i>[To be completed by USTDA]</i> |  |
|--|--|

|   |  |
|---|--|
| Full Legal Name of Prime Contractor U.S. Firm ("U.S. Firm") |  |
|---|--|

|                                  |  |
|----------------------------------|--|
| Full Legal Name of Subcontractor |  |
|----------------------------------|--|

|   |  |
|---|--|
| Business Address of Subcontractor (street address only) |  |
|---|--|

|                  |  |
|------------------|--|
| Telephone Number |  |
|------------------|--|

|            |  |
|------------|--|
| Fax Number |  |
|------------|--|

|   |  |
|---|--|
| Year Established (include any predecessor company(s) and year(s) established, if appropriate). Please attach additional pages as necessary. |  |
|---|--|

**Subcontractor Point of Contact**

|      |            |  |
|------|------------|--|
| Name | Surname    |  |
|      | Given Name |  |

|         |  |
|---------|--|
| Address |  |
|---------|--|

|           |  |
|-----------|--|
| Telephone |  |
|-----------|--|

|     |  |
|-----|--|
| Fax |  |
|-----|--|

|       |  |
|-------|--|
| Email |  |
|-------|--|

**Subcontractor's Representations**

Subcontractor shall provide the following (or any explanation as to why any representation cannot be made), made as of the date of the proposal:

|  |                                      |                              |                                      |  |                                |
|--|--------------------------------------|------------------------------|--------------------------------------|--|--------------------------------|
| 1. Subcontractor is a <i>[check one]</i> | <input type="checkbox"/> Corporation | <input type="checkbox"/> LLC | <input type="checkbox"/> Partnership | <input type="checkbox"/> Sole Proprietor | <input type="checkbox"/> Other |
|--|--------------------------------------|------------------------------|--------------------------------------|--|--------------------------------|

duly organized, validly existing and in good standing under the laws of: \_\_\_\_\_ .

The subcontractor has all the requisite corporate power and authority to conduct its business as presently conducted, to participate in this proposal, and if the U.S. Firm is selected, to execute and deliver a subcontract to the U.S. Firm for the performance of the USTDA Activity and to perform the USTDA Activity. The subcontractor is not debarred, suspended, or to the best of its knowledge or belief, proposed for debarment or ineligible for the award of contracts by any federal or state governmental agency or authority.

2. Neither the subcontractor nor any of its principal officers have, within the ten-year period preceding the submission of the Offeror's proposal, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a federal, state or local government contract or subcontract; violation of federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, violating federal or state criminal tax laws, or receiving stolen property.

3. Neither the subcontractor, nor any of its principal officers, is presently indicted for, or otherwise criminally or civilly charged with, commission of any of the offenses enumerated in paragraph 2 above.

4. There are no federal or state tax liens pending against the assets, property or business of the subcontractor. The subcontractor, has not, within the three-year period preceding this RFP, been notified of any delinquent federal or state taxes in an amount that exceeds \$3,000 for which the liability remains unsatisfied. Taxes are considered delinquent if (a) the tax liability has been fully determined, with no pending administrative or judicial appeals; and (b) a taxpayer has failed to pay the tax liability when full payment is due and required.

5. The subcontractor has not commenced a voluntary case or other proceeding seeking liquidation, reorganization or other relief with respect to itself or its debts under any bankruptcy, insolvency or other similar law. The subcontractor has not had filed against it an involuntary petition under any bankruptcy, insolvency or similar law.

6. The Subcontractor certifies that it complies with the USTDA Nationality, Source, and Origin Requirements and shall continue to comply with such requirements throughout the duration of the USTDA-funded activity. The Subcontractor commits to notify USTDA, the Contractor, and the Grantee if it becomes aware of any change which might affect U.S. Firm's ability to meet the USTDA Nationality, Source, and Origin Requirements.

*The selected Subcontractor shall notify the U.S. Firm, Grantee and USTDA if any of the representations included in its proposal are no longer true and correct.*

Subcontractor certifies that the information provided in this form is true and correct. Subcontractor understands and agrees that the U.S. Government may rely on the accuracy of this information in processing a request to participate in a USTDA-funded activity. If at any time USTDA has reason to believe that any person or entity has willfully and knowingly provided incorrect information or made false statements, USTDA may take action under applicable law. The undersigned represents and warrants that he/she has the requisite power and authority to sign on behalf of the Subcontractor.

|              |  |           |  |
|--------------|--|-----------|--|
| Name         |  | Signature |  |
| Title        |  |           |  |
| Organization |  | Date      |  |