Selection process #CO-T1784-P001

TERMS OF REFERENCE

CONSULTANCY SERVICES FOR GENERAL DATA GATHERING, PREPARATION AND INTEGRATION

Colombia

CO-T1784

AI models for congestion prediction and optimal traffic management in Bogotá

www.iadb.org/en/project/CO-T1784

1. Background and Justification

1.1. The Transport Division (INE/TSP) of the Inter-American Development Bank (IDB) is seeking a consultant with experience in data collection, preparation, and integration prior to the generation of Artificial Intelligence (AI) models, specifically applied to the Transport sector.

1.2. From the Transportation Division of the IDB Group, together with the Secretaría de Movilidad de Bogotá, the aim is to enhance traffic flow prediction and optimization in Bogotá by leveraging AI as a key tool, utilizing existing data resources for traffic management and transportation planning, and establishing a clear pathway for AI integration into mobility management.

1.3. Mobility in Bogotá faces significant challenges due to population growth, high levels of motorization, and rapid urbanization. The city ranks among the most congested in the world. AI can significantly enhance urban mobility in Bogotá by optimizing traffic management, improving transportation planning, informing transportation policies, and guiding optimal infrastructure placement. AI-based models for traffic prediction and management can play a crucial role in identifying and implementing targeted interventions to enhance mobility and optimize infrastructure.

1.4. Investing in AI and new technologies supports the development of sustainable and resilient infrastructure, providing benefits such as increased productivity, process automation, new services and products, optimized asset management, cost reduction, improved transparency with the public sector, more efficient decision-making, and greater user empowerment in transport services. Additionally, this initiative can significantly reduce congestion, improve air quality, and increase economic efficiency. These enhancements will lead to safer and more reliable transportation, better public health, and a higher quality of life for residents.

2. Objectives

2.1. The main objective of the consultancy is to gather, prepare and integrate the information regarding congestion and traffic generated by the Secretaría de Movilidad de Bogotá and other sources, consisting of data sets of big size of structure and unstructured data. The information will be used to train, test and validate AI based congestion models targeted to improve traffic management and transportation planning and establishing a clear pathway for AI integration into

mobility management.

3. Scope of Services

3.1. The consultancy services will include all activities related to general data gathering, review of information including process documentation and tools definition, data preparation and integration.

4. Key Activities

4.1. Gathering and Review of Information Sources. These include existing data from the Secretaría de Movilidad de Bogotá, data generated by transportation services (mass and individual), data generated by apps that transmit GPS data, available GIS information, and other sources considered relevant for the study. This activity also includes the collection of public data from scientific, governmental, and international organizations. The review will cover services requested via delivery and micro-mobility apps, as well as data collected from user information systems in mass transportation and real-time traffic and transportation monitoring systems.

4.2. Data Source Validation. The consultant must validate the relevant parameters before using the data, including: (i) defining the appropriate data storage mechanism for the Secretaría de Movilidad de Bogotá; (ii) defining the legal framework for data collection, storage, dissemination, and publication; (iii) integrating a gender and inclusion approach in data collection, preparation, and integration; (iv) the scheme and costs of information acquisition, if applicable; and (v) the metadata needed to index this information. The existing regulatory framework in the region and common practices used by governmental actors will be reviewed by the consultant.

4.3. Generation, Integration, and Standardization of Data sets. Based on the previously described activities, the data sets generated by the consultancy will be delivered and stored in the IDB's IT infrastructure and/or in the Secretaría de Movilidad de Bogotá's IT infrastructure, along with a user manual for their use and dissemination, focused on generating AI models for traffic prediction and optimization. The manual must include the criteria used for data collection validation to facilitate its use by relevant stakeholders, including gender and inclusion mainstreaming criteria, if applicable.

4.4. Guidelines for new data inclusion. The consultant will develop a procedure for implementing new data in the future, including considerations for data storage, information validation requirements, and software for processing, among others.

4.5. Training for the Secretaría de Movilidad de Bogotá and relevant stakeholders on information processing and updating.

4.6. Engagement and Close Collaboration with the Secretaría de Movilidad de Bogotá during the Execution of the Consultancy. Progress and results will be presented in coordination with the Bank and relevant stakeholders.

4.7. Joint work with other consultants and/or firms related to data collection, preparation, and integration, and the development of the AI model for congestion prediction and traffic

management optimization.

5. Expected Outcome and Deliverables

5.1. Deliverable #1: Initial consultancy report. Contains the methodology and work plan that will be followed in the consultancy execution.

5.2. Deliverable #2: Intermediate consultancy report. Includes, but not limited to the initial information gathering, data sets of raw data initial delivery, additional information requirements, and validation criteria for data sources.

5.3. Deliverable #3: Final consultancy report. Includes, but not limited to final delivery of data sets of raw and processed data, user manuals and data updating process, and reports of the developed training for relevant stakeholders.

6. Reporting Requirements

6.1. Data sets will be delivered in a compatible format among the identified data sources. They must also have an effective integration among the gathered data, and compatibility with the AI model development. The selected formats must allow data updating by the relevant stakeholders. The formats must be agreed with the Bank and the relevant stakeholders, if applicable. Data sets must be deliverable in an editable format.

6.2. Reports must be delivered in an editable and non-editable format.

7. Acceptance Criteria

7.1. The consultancy deliverables will be approved based on the following criteria: (i) compliance with the consultancy's activities and objectives; (ii) review of the deliverables in accordance with the comments provided by the IDB; and (iii) excellent use of language and presentation of the deliverables.

8. Other Requirements

8.1. The consultant must comply the following criteria:

Citizenship: You are a citizen of one of our 48 member countries.

Consanguinity: You do not have relatives (up to the fourth degree of consanguinity and second degree of affinity, including your spouse) who work in the IDB Group.

Education: Bachelor's degree or engineering in areas related to data science, computer science, big data or similar fields.

Experience: 5 years of relevant experience in technology projects using Big Data. Experience working with public agencies in LAC countries and experience in data management focused on AI model development is preferred.

Languages: Fluent in Spanish. Practical knowledge of English is preferred.

9. Schedule of Payments

9.1. The payments will be made as follows:

Payment Schedule	
Deliverable	**%**
1. Deliverable #1	30 %
2. Deliverable #2	40 %
3. Deliverable #3	30 %
TOTAL	100%

Selection process #CO-T1784-P002

TERMS OF REFERENCE

CONSULTANCY SERVICES FOR DATA GATHERING IN SMALL DATA SETS, PREPARATION AND INTEGRATION

Colombia

CO-T1784

AI models for congestion prediction and optimal traffic management in Bogotá

www.iadb.org/en/project/CO-T1784

1. Background and Justification

1.1. The Transport Division (INE/TSP) of the Inter-American Development Bank (IDB) is seeking a consultant with experience in data collection, preparation, and integration prior to the generation of Artificial Intelligence (AI) models, specifically applied to the Transport sector.

1.2. From the Transportation Division of the IDB Group, together with the Secretaría de Movilidad de Bogotá, the aim is to enhance traffic flow prediction and optimization in Bogotá by leveraging AI as a key tool, utilizing existing data resources for traffic management and transportation planning, and establishing a clear pathway for AI integration into mobility management.

1.3. Mobility in Bogotá faces significant challenges due to population growth, high levels of motorization, and rapid urbanization. The city ranks among the most congested in the world. AI can significantly enhance urban mobility in Bogotá by optimizing traffic management, improving transportation planning, informing transportation policies, and guiding optimal infrastructure placement. AI-based models for traffic prediction and management can play a crucial role in identifying and implementing targeted interventions to enhance mobility and optimize infrastructure.

1.4. Investing in AI and new technologies supports the development of sustainable and resilient infrastructure, providing benefits such as increased productivity, process automation, new services and products, optimized asset management, cost reduction, improved transparency with the public sector, more efficient decision-making, and greater user empowerment in transport services. Additionally, this initiative can significantly reduce congestion, improve air quality, and increase economic efficiency. These enhancements will lead to safer and more reliable transportation, better public health, and a higher quality of life for residents.

2. Objectives

2.1. The main objective of the consultancy is to gather, prepare and integrate the information regarding congestion and traffic generated by the Secretaría de Movilidad de Bogotá and other sources, consisting of small size data sets of structure and unstructured data. The information will be used to complement Big Data gathered for this initiative, in the training, testing and validation of AI based congestion models targeted to improve traffic management and

transportation planning and establishing a clear pathway for AI integration into mobility management.

3. Scope of Services

3.1. The consultancy services will include all activities related to data gathering, review of information including process documentation and tools definition, data preparation and integration.

4. Key Activities

4.1. Gathering and Review of Information Sources. These include existing data from the Secretaría de Movilidad de Bogotá, data generated by transportation services (mass and individual), demographic and geographic data from public and private data sets, available GIS information, and other sources considered relevant for the study. This activity also includes the collection of public data from scientific, governmental, and international organization publications, as well as interviews and meetings with key players in the public, private, and academic sectors to identify additional data and define best practices for data collection focused on traffic management. The review will cover information from other sectors that may be relevant to analyze congestion.

4.2. Data Source Validation. The consultant must validate the relevant parameters before using the data, including: (i) defining the appropriate data storage mechanism for the Secretaría de Movilidad de Bogotá; (ii) defining the legal framework for data collection, storage, dissemination, and publication; (iii) integrating a gender and inclusion approach in data collection, preparation, and integration; (iv) the scheme and costs of information acquisition, if applicable; and (v) the metadata needed to index the gathered information. The existing regulatory framework in the region and common practices used by governmental actors will be reviewed by the consultant.

4.3. Generation, Integration, and Standardization of Data sets. Based on the previously described activities, the data sets generated by the consultancy will be delivered and stored in the IDB's infrastructure and/or in the Secretaría de Movilidad de Bogotá's IT infrastructure, along with a user manual for their use and dissemination. The manual must include the criteria used for data collection validation to facilitate its use by relevant stakeholders, including gender and inclusion mainstreaming criteria, if applicable.

4.4. Guidelines for new data inclusion. The consultant will develop a procedure for implementing new data in the future, including considerations for data storage, information validation requirements, and software for processing, among others.

4.5. Training for the Secretaría de Movilidad de Bogotá and relevant stakeholders on information processing and updating.

4.6. Engagement and Close Collaboration with the Secretaría de Movilidad de Bogotá during the Execution of the Consultancy. Progress and results will be presented in coordination with the Bank and relevant stakeholders.

4.7. Joint work with other consultants and/or firms related to data collection, preparation, and integration, and the development of the AI model for congestion prediction and traffic

management optimization.

5. Expected Outcome and Deliverables

5.1. Deliverable #1: Initial consultancy report. Contains the methodology and work plan that will be followed in the consultancy execution.

5.2. Deliverable #2*:* Intermediate consultancy report. Includes, but not limited to the initial information gathering, data sets initial delivery, additional information requirements, and validation criteria for data sources.

5.3. Deliverable #3: Final consultancy report. Includes, but not limited to final delivery of data sets, user manuals and data updating process, and reports of the developed training for relevant stakeholders.

6. Reporting Requirements

6.1. Data sets will be delivered in compatible formats among the identified data sources. They must also have an effective integration among the gathered data, and compatibility with the AI model development. The selected formats must allow data updating by the relevant stakeholders. The format must be agreed with the Bank and the relevant stakeholders, if applicable. Data sets must be deliverable in an editable format.

6.2. Reports must be delivered in an editable and non-editable format.

7. Acceptance Criteria

7.1. The consultancy deliverables will be approved based on the following criteria: (i) compliance with the consultancy's activities and objectives; (ii) review of the deliverables in accordance with the comments provided by the IDB; and (iii) excellent use of language and presentation of the deliverables.

8. Other Requirements

8.1. The consultant must comply the following criteria:

Citizenship: You are a citizen of one of our 48 member countries.

Consanguinity: You do not have relatives (up to the fourth degree of consanguinity and second degree of affinity, including your spouse) who work in the IDB Group.

Education: Bachelor's degree or engineering in areas related to data science, computer science, or similar fields.

Experience: 5 years of relevant experience in technology projects applied to transportation or related areas. Experience working with public agencies in LAC countries and experience in data management focused on traffic management.

Languages: Fluent in Spanish. Practical knowledge of English is preferred.

9. Schedule of Payments

9.1. The payments will be made as follows:

Payment Schedule	
Deliverable	**%**
1. Deliverable #1	30 %
2. Deliverable #2	40 %
3. Deliverable #3	30 %
TOTAL	100%

Selection process #CO-T1784-P003

TERMS OF REFERENCE

CONSULTANCY SERVICES FOR THE DESIGN, DEVELOPMENT, TESTING, AND EVALUATION OF DEEP LEARNING MODELS USING AI FOR CONGESTION PREDICTION AND TRAFFIC MANAGEMENT OPTIMIZATION

Colombia

CO-T1784

AI models for congestion prediction and optimal traffic management in Bogotá

www.iadb.org/en/project/CO-T1784

1. Background and Justification

1.1 From the Transportation Division of the IDB Group, together with the Secretaría de Movilidad de Bogotá, the aim is to enhance traffic flow prediction and optimization in Bogotá by leveraging artificial intelligence (AI) as a key tool, utilizing existing data resources for traffic management and transportation planning, and establishing a clear pathway for AI integration into mobility management.

1.2 Mobility in Bogotá faces significant challenges due to population growth, high levels of motorization, and rapid urbanization. The city ranks among the most congested in the world. AI can significantly enhance urban mobility in Bogotá by optimizing traffic management, improving transportation planning, informing transportation policies, and guiding optimal infrastructure placement. AI-based models for traffic prediction and management can play a crucial role in identifying and implementing targeted interventions to enhance mobility and optimize infrastructure.

1.3 Investing in AI and new technologies supports the development of sustainable and resilient infrastructure, providing benefits such as increased productivity, process automation, new services and products, optimized asset management, cost reduction, improved transparency with the public sector, more efficient decision-making, and greater user empowerment in transport services. Additionally, this initiative can significantly reduce congestion, improve air quality, and increase economic efficiency. These enhancements will lead to safer and more reliable transportation, better public health, and a higher quality of life for residents.

2. Objectives

2.1 As a result of this contract, it is expected to accomplish the development of an AI-based model for traffic prediction and management and congestion measurement in Bogotá, to improve congestion analysis and optimize infrastructure deployment. Building upon existing and newly developed AI models, the project seeks to create a robust system to improve traffic flow and congestion levels as well as reduce travel times and noise and air pollution.

3. Scope of Services

3.1 The services will include all activities related to the design, development, testing, and evaluation of an AI-based model for congestion prediction and traffic management in Bogotá.

4. Key Activities

4.1 The consultant will be part of a team that will be responsible for developing the activities listed below.

4.2 Develop a workplan for INE/TSP for the development of deep learning models using AI for traffic prediction and management and congestion measurement, based on data collected by the Secretaría de Movilidad de Bogotá and the IDB, along with tools like video analytics and information from platforms such as Waze and GPS tracking. The model should be developed based on the models previously developed by the IADB and algorithms available at the IADB, as well as new models but should be replicable for use in other countries.

4.3 Develop a software library designed for the use of the models based on open-source algorithms. This library will enable users to efficiently implement and interact with the models, providing the necessary tools and documentation for integration.

4.4 Prepare a written report containing the methodology, data and results of the analysis.

4.5 Attend periodic virtual meetings with the team in HQ and COFs and accompany and represent the IDB in executive and operational meetings with clients on a weekly basis.

4.6 Produce presentations, documentation, and manuals of the developed model in order to facilitate understanding and its application in country.

5. Expected Outcome and Deliverables

5.1 Workplan for model development.

5.2 Library designed for model implementation

5.3 Documentation of script, algorithms and models, methodology, data, and results of analysis.

5.4 Monthly progress reports referencing client requests and advances.

5.5 Documentation of presentations and operation manual of the digital tool/model.

6. Reporting Requirements

6.1 The reports, presentations and deliverables in general that are delivered within the framework of this consultancy will be made with the templates provided by the IDB. In any case, they will always incorporate the IDB logos both on the cover page and on the rest of the sheets/slides.

6.2 They will be delivered in a format that guarantees a better and more elegant viewing, although always accompanied by the editable version of them in tools for free or extended use.

6.3 All deliverables shall be produced in formal language and shall be accompanied by glossaries of terms in case uncommon concepts or acronyms are used. The deliverables will always be conveniently foliated and will incorporate an index.

6.4 Progress reports will be delivered at the end of the month to the team supervisor.

6.5 All deliverables will be in Spanish.

6.6 The firm/consultant must deliver to the Bank, at the end of the consultancy, a repository containing the source code, documentation, and reports (in editable and non-editable format) of all the work completed during the consultancy period. Additionally, each time a product is delivered, the consulting firm must present a report detailing the work completed, as well as the work and recommendations proposed for the following product, so that the Bank's stakeholders can provide approval or indicate any required changes. The developed code will be the intellectual property of the Bank.

7. Acceptance Criteria

7.1 The reports described shall be submitted, in electronic version, in Spanish, for approval by the IDB.

7.2 The consultancy's products will be approved according to the following criteria: (i) compliance with the consultancy's activities and objectives; (ii) review of the products in accordance with the comments provided by the IDB; and (iii) excellent use of language and presentation of the products.

8. Other Requirements

8.1 **Education:** Master's or PhD Degree in areas related to Data Science, Computer Science or a related field in an accredited university.

8.2 **Experience:** 5 years of relevant experience in technology projects applied to transportation or related areas. Experience working with public agencies in LAC countries is preferred.

8.3 **Languages:** Proficient in Spanish or English.

8.4 Core and technical requirements:

- Programming knowledge of Python.
- Strong understanding of Software Development.
- Experience with Machine Learning and Deep Learning, Data Storage, Data Analysis, and Management infrastructure on which to run analytics tools as well as a place to store and query data.
- Knowledge of how to use cloud services from major providers (AWS or Azure).

9. Schedule of Payments

9.1 Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts.

9.2 The payment schedule is detailed below:

Payment Schedule	
Deliverable	**%**
Workplan	20%
Software library	35%
Supporting documentation: methodology, scripts, data, results, analysis	35%
Supporting documentation: presentation and manuals	10%
TOTAL	100%

Selection process #CO-T1784-P004

TERMS OF REFERENCE

CONSULTANCY SERVICES FOR THE DESIGN, DEVELOPMENT, TESTING, AND EVALUATION OF MACHINE LEARNING AI-BASED AND STATISTICAL MODELS FOR CONGESTION PREDICTION AND TRAFFIC MANAGEMENT OPTIMIZATION

Colombia

CO-T1784

AI models for congestion prediction and optimal traffic management in Bogotá

www.iadb.org/en/project/CO-T1784

1. Background and Justification

1.1 From the Transportation Division of the IDB Group, together with the Secretaría de Movilidad de Bogotá, the aim is to enhance traffic flow prediction and optimization in Bogotá by leveraging artificial intelligence (AI) as a key tool, utilizing existing data resources for traffic management and transportation planning, and establishing a clear pathway for AI integration into mobility management.

1.2 Mobility in Bogotá faces significant challenges due to population growth, high levels of motorization, and rapid urbanization. The city ranks among the most congested in the world. AI can significantly enhance urban mobility in Bogotá by optimizing traffic management, improving transportation planning, informing transportation policies, and guiding optimal infrastructure placement. AI-based models for traffic prediction and management can play a crucial role in identifying and implementing targeted interventions to enhance mobility and optimize infrastructure.

1.3 Investing in AI and new technologies supports the development of sustainable and resilient infrastructure, providing benefits such as increased productivity, process automation, new services and products, optimized asset management, cost reduction, improved transparency with the public sector, more efficient decision-making, and greater user empowerment in transport services. Additionally, this initiative can significantly reduce congestion, improve air quality, and increase economic efficiency. These enhancements will lead to safer and more reliable transportation, better public health, and a higher quality of life for residents.

2. Objectives

2.1 As a result of this contract, it is expected to accomplish the development of an AI-based model for traffic prediction and management and congestion measurement in Bogotá, to improve congestion analysis and optimize infrastructure deployment. Building upon existing and newly developed AI models, the project seeks to create a robust system to improve traffic flow and congestion levels as well as reduce travel times and noise and air pollution.

3. Scope of Services

3.1 The services will include all activities related to the design, development, testing, and evaluation of machine learning AI-based and statistical models for congestion prediction and traffic management in Bogotá.

4. Key Activities

4.1 The consultant will be part of a team that will be responsible for developing the activities listed below.

4.2 Develop a workplan for INE/TSP for the development of models using AI and statistics for traffic management and congestion measurement, based on data collected by the Secretaría de Movilidad de Bogotá and the IDB. The models should be replicable for use in other countries.

4.3 Develop a software library designed for the use of the models based on open-source algorithms and models. This library will enable users to efficiently implement and interact with the model, providing the necessary tools and documentation for integration.

4.4 Prepare a written report containing the methodology, data and results of the analysis.

4.5 Attend periodic virtual meetings with the team in HQ and COFs and accompany and represent the IDB in executive and operational meetings with clients on a weekly basis.

4.6 Produce presentations, documentation, and manuals of the developed model in order to facilitate understanding and its application in country.

5. Expected Outcome and Deliverables

5.1 Workplan for model development.

5.2 Library designed for model implementation

5.3 Documentation of script, algorithms and models, methodology, data, and results of analysis.

5.4 Monthly progress reports referencing client requests and advances.

5.5 Documentation of presentations and operation manual of the digital tool/model.

6. Reporting Requirements

6.1 The reports, presentations and deliverables in general that are delivered within the framework of this consultancy will be made with the templates provided by the IDB. In any case, they will always incorporate the IDB logos both on the cover page and on the rest of the sheets/slides.

6.2 They will be delivered in a format that guarantees a better and more elegant viewing, although always accompanied by the editable version of them in tools for free or extended use.

6.3 All deliverables shall be produced in formal language and shall be accompanied by glossaries of terms in case uncommon concepts or acronyms are used. The deliverables will always be conveniently foliated and will incorporate an index.

6.4 Progress reports will be delivered at the end of the month to the team supervisor.

6.5 All deliverables will be in Spanish.

6.6 The firm/consultant must deliver to the Bank, at the end of the consultancy, a repository containing the source code, documentation, and reports (in editable and non-editable format) of all the work

completed during the consultancy period. Additionally, each time a product is delivered, the consulting firm must present a report detailing the work completed, as well as the work and recommendations proposed for the following product, so that the Bank's stakeholders can provide approval or indicate any required changes. The developed code will be the intellectual property of the Bank.

7. Acceptance Criteria

7.1 The reports described shall be submitted, in electronic version, in Spanish, for approval by the IDB.

7.2 The consultancy's products will be approved according to the following criteria: (i) compliance with the consultancy's activities and objectives; (ii) review of the products in accordance with the comments provided by the IDB; and (iii) excellent use of language and presentation of the products.

8. Other Requirements

8.1 **Education:** Master's or PhD Degree in areas related to Data Science, Computer Science or a related field in an accredited university.

8.2 **Experience:** 5 years of relevant experience in technology projects applied to transportation or related areas. Experience working with public agencies in LAC countries is preferred.

8.3 **Languages:** Proficient in Spanish or English.

8.4 Core and technical requirements:

- Programming knowledge of Python.
- Strong understanding of Software Development.
- Experience with Machine Learning and Deep Learning, Data Storage, Data Analysis, and Management infrastructure on which to run analytics tools as well as a place to store and query data.
- Knowledge of how to use cloud services from major providers (AWS or Azure).

9. Schedule of Payments

9.1 Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts.

9.2 The payment schedule is detailed below:

Payment Schedule	
Deliverable	**%**
Workplan	20%
Software library	35%
Supporting documentation: methodology, scripts, data, results, analysis	35%
Supporting documentation: presentation and manuals	10%
TOTAL	100%

Selection process #CO-T1784-P005

TERMS OF REFERENCE

CONSULTANCY SERVICES FOR THE MANAGEMENT OF AN AI-BASED MODEL FOR CONGESTION PREDICTION AND TRAFFIC MANAGEMENT OPTIMIZATION

Colombia

CO-T1784

AI models for congestion prediction and optimal traffic management in Bogotá

www.iadb.org/en/project/CO-T1784

1. Background and Justification

1.1. The Transport Division (INE/TSP) of the Inter-American Development Bank (IDB) is seeking a consultant with experience in project management, specifically applied to the Transport sector, to provide management, support, accompaniment, integration and supervision to the development of an AI-based model for congestion prediction and traffic management optimization.

1.2. From the Transportation Division of the IDB Group, together with the Secretaría de Movilidad de Bogotá, the aim is to enhance traffic flow prediction and optimization in Bogotá by leveraging artificial intelligence (AI) as a key tool, utilizing existing data resources for traffic management and transportation planning, and establishing a clear pathway for AI integration into mobility management.

1.3. Mobility in Bogotá faces significant challenges due to population growth, high levels of motorization, and rapid urbanization. The city ranks among the most congested in the world. AI can significantly enhance urban mobility in Bogotá by optimizing traffic management, improving transportation planning, informing transportation policies, and guiding optimal infrastructure placement. AI-based models for traffic prediction and management can play a crucial role in identifying and implementing targeted interventions to enhance mobility and optimize infrastructure.

1.4. Investing in AI and new technologies supports the development of sustainable and resilient infrastructure, providing benefits such as increased productivity, process automation, new services and products, optimized asset management, cost reduction, improved transparency with the public sector, more efficient decision-making, and greater user empowerment in transport services. Additionally, this initiative can significantly reduce congestion, improve air quality, and increase economic efficiency. These enhancements will lead to safer and more reliable transportation, better public health, and a higher quality of life for residents.

2. Objectives

2.1. The objective of this contract is to guarantee adequate management of the activities and professionals required for the development of an AI-based model for traffic prediction and management and congestion measurement in Bogotá, to improve congestion analysis and optimize infrastructure deployment. Building upon existing and newly developed AI models, the project seeks to create a robust system to improve traffic flow and congestion levels as well as reduce travel times and noise and air pollution.

3. Scope of Services

3.1. The services will include all activities related to management, support, accompaniment, integration and supervision of an AI-based model for congestion prediction and traffic management in Bogotá.

4. Key Activities

4.1. Project coordination: Manage and coordinate activities among the professionals and firms hired by the IDB for the project development, government agencies (Secretaría de Movilidad de Bogotá, among others), private sector, and any other relevant stakeholder involved in the project.
4.2. Deliverable management: Integrate stakeholders' work, ensuring that the project deliverables, including reports, documentation, models and presentations, are delivered to the bank on time and within quality standards.
4.3. Schedule management: Define and agree a homogeneous schedule among stakeholders. Ensure timely execution of all tasks.
4.4. Risk identification, assessment and management regarding the project's completion.
4.5. Communication: The consultant will oversee the communication between the stakeholders and the IDB. The consultant will prepare and deliver regular updates to the IDB and, if needed, to stakeholders.

5. Expected Outcome and Deliverables

5.1. Planning report: Includes an agreed detailed schedule for the project completion, methodology and work plan.
5.2. Initial consultancy report: Includes a detailed description of the project's development, current work plan, identified risks and mitigation measures.
5.3. Intermediate consultancy report: Includes a detailed description of the project's development, current work plan, identified risks and mitigation measures.
5.4. Final consultancy report: Includes the integration of all project deliverables, final presentation, lessons learned and conclusions.

6. Reporting Requirements

6.1. The reports, presentations and deliverables in general that are delivered within the framework of this consultancy will be made with the templates provided by the IDB. In any case, they will always incorporate the IDB logos both on the cover page and on the rest of the sheets/slides.

6.2. They will be delivered in a format that guarantees a better and more elegant viewing, although always accompanied by the editable version of them in tools for free or extended use.

6.3. All deliverables shall be produced in formal language and shall be accompanied by glossaries of terms in case uncommon concepts or acronyms are used. The deliverables will always be conveniently foliated and will incorporate an index.

6.4. All deliverables will be in Spanish.

6.5. All relevant updates will be timely reported in a shared MS Projects with the Bank's team and the relevant stakeholders.

7. Acceptance Criteria

7.1. The reports described shall be submitted, in electronic version, in Spanish, for approval by the IDB.

7.2. The consultancy's products will be approved according to the following criteria: (i) compliance with the consultancy's activities and objectives; (ii) review of the products in accordance with the comments provided by the IDB; and (iii) excellent use of language and presentation of the products.

8. Other Requirements

8.1. Education: Bachelor's or master's degree in areas related to Data Science, Computer Science or a related field in an accredited university. PMP or PRINCE2 certification is preferred.

8.2. Experience: 5 years of relevant experience in technology projects applied to transportation or related areas. Experience working with public agencies in LAC countries is preferred.

8.3. Languages: Proficient in Spanish or English.

8.4. Core and technical requirements: Strong understanding of Software Development Management.

9. Schedule of Payments

9.1. Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts.

Payment Schedule	
Deliverable	**%**
1. Planning report	20%
2. Initial consultancy report	35%
3. Intermediate consultancy report	35%
4. Final consultancy report	10%
TOTAL	100%

Selection process #CO-T1784-P006

TERMS OF REFERENCE

CONSULTANCY SERVICES FOR THE DESIGN AND ADAPTATION OF PUBLIC POLICIES FOR DATA AND TRAFFIC MANAGEMENT BASED ON AN AI CONGESTION MODEL FOR "SECRETARIA DE MOVILIDAD DE BOGOTÁ", INCLUDING MAINSTREAMING OF GENDER PERSPECTIVE

Colombia

CO-T1784

AI models for congestion prediction and optimal traffic management in Bogotá

www.iadb.org/en/project/CO-T1784

1. Background and Justification

1.1. From the Transportation Division of the IDB Group, together with the Secretaría de Movilidad de Bogotá, the aim is to enhance traffic flow prediction and optimization in Bogotá by leveraging artificial intelligence (AI) as a key tool, utilizing existing data resources for traffic management and transportation planning, and establishing a clear pathway for AI integration into mobility management.

1.2. Mobility in Bogotá faces significant challenges due to population growth, high levels of motorization, and rapid urbanization. The city ranks among the most congested in the world. AI can significantly enhance urban mobility in Bogotá by optimizing traffic management, improving transportation planning, informing transportation policies, and guiding optimal infrastructure placement. AI-based models for traffic prediction and management can play a crucial role in identifying and implementing targeted interventions to enhance mobility and optimize infrastructure.

1.3. Investing in AI and new technologies supports the development of sustainable and resilient infrastructure, providing benefits such as increased productivity, process automation, new services and products, optimized asset management, cost reduction, improved transparency with the public sector, more efficient decision-making, and greater user empowerment in transport services. Additionally, this initiative can significantly reduce congestion, improve air quality, and increase economic efficiency. These enhancements will lead to safer and more reliable transportation, better public health, and a higher quality of life for residents.

2. Objectives

2.1. The objective of this contract is to design and implement congestion mitigation measures in critical areas of Bogotá, prioritizing low-cost, high-impact interventions based on the results generated by an artificial intelligence (AI) traffic prediction model. The professional is expected to propose immediate operational actions, such as on-site personnel response or modifications to traffic signal plans. Additionally, they should propose medium-term measures, including the optimization of signage, intersection reconfiguration, and potential demand management

strategies for the study area. The measures should take into account gender considerations and the inclusion of persons with disabilities, prioritizing interventions that benefit women and persons with disabilities.

3. Scope of Services

3.1. The professional will work closely with the development team for the AI-based congestion prediction model and the existing platforms of the Secretaría de Movilidad de Bogotá. They will analyze the information provided by the model, conduct field visits to the identified critical areas, and propose a series of operational and structural mitigation measures. Moreover, the professional will coordinate and monitor the implementation of some of these measures in collaboration with the city's Traffic Management Center, while considering fluctuations in transportation demand and traffic congestion during specific periods of the year, such as year-end holidays, school vacations, public holidays, and the impact of alternate-day driving restrictions (pico y placa) on even and odd days of the month.

4. Key Activities

4.1. Critical Area Analysis: Identify and prioritize areas with the greatest impact on traffic congestion based on the information provided by the traffic prediction model.

4.2. Development of Mitigation Measures: Propose immediate operational actions, such as traffic regulation or adjustments to traffic signal timings, as well as light infrastructure measures and signage optimization.

4.3. Field Visits: Conduct field visits to critical points to assess congestion issues on-site and propose interventions. Evaluate the impact of the implemented measures.

4.4. Support at the Traffic Management Center: Coordinate with the engineer in charge to test and monitor proposed mitigation measures, measure response times, and assess their impact.

4.5. Field Measurement: Plan and execute field activities to measure queue lengths and travel times, comparing real data with the predictions from the traffic model to support the development team in model adjustments and calibration.

4.6. Development of a Mitigation Action Matrix: Create a matrix linking detected critical congestion points with the suggested mitigation measures.

4.7. Proposal of Key Performance Indicators (KPIs): Define and propose performance indicators to evaluate the effectiveness of the interventions and assess whether they have contributed to reducing congestion in the study area.

5. Expected Outcome and Deliverables

5.1. Critical Area Analysis Report: Document identifying the most problematic congestion points, prioritized based on their impact on passenger flow and location in the study area.

5.2. Mitigation Measure Plan: Document detailing proposed operational and light infrastructure

interventions, categorized by feasibility and cost, to be considered for implementation in future critical congestion points.

5.3. Mitigation Action Matrix: A matrix linking detected critical congestion points with the proposed actions for each, along with suggested implementation timelines.

5.4. Field Visit Report: Report summarizing observations and suggestions derived from field visits to critical points.

5.5. Key Performance Indicator (KPI) Proposal: Document listing KPIs to monitor the impact of the implemented mitigation measures.

5.6. Model Evaluation and Adjustment Report: Report with recommendations for adjusting and calibrating the traffic prediction model based on field measurements (queue lengths and travel times).

5.7. Final Results Report: Document detailing the impact of the implemented measures, including a follow-up on the defined KPIs, and recommendations for future interventions. This document may also be published by the bank to serve as an example for other cities in Latin America and the Caribbean, potentially replicating the exercise in those cities.

6. Reporting Requirements

6.1. The reports, presentations and deliverables in general that are delivered within the framework of this consultancy will be made with the templates provided by the IDB. In any case, they will always incorporate the IDB logos both on the cover page and on the rest of the sheets/slides.

6.2. They will be delivered in a format that guarantees a better and more elegant viewing, although always accompanied by the editable version of them in tools for free or extended use.

6.3. All deliverables shall be produced in formal language and shall be accompanied by glossaries of terms in case uncommon concepts or acronyms are used. The deliverables will always be conveniently foliated and will incorporate an index.

6.4. Progress reports will be delivered at the end of the month to the team supervisor.

6.5. All deliverables will be in Spanish.

6.6. The firm/consultant must deliver to the Bank, at the end of the consultancy, a repository containing the source code, documentation, and reports of all the work completed during the consultancy period. Additionally, each time a product is delivered, the consulting firm must present a report detailing the work completed, as well as the work and recommendations proposed for the following product, so that the Bank's stakeholders can provide approval or indicate any required changes. The developed code will be the intellectual property of the Bank

7. Acceptance Criteria

7.1. The reports described shall be submitted, in electronic version, in Spanish, for approval by the IDB.

7.2. The consultancy's products will be approved according to the following criteria: (i) compliance with the consultancy's activities and objectives; (ii) review of the products in accordance with the

comments provided by the IDB; and (iii) excellent use of language and presentation of the products.

8. Other Requirements

8.1. Education: Master's degree in areas related to transportation, urban mobility, or intelligent transportation systems (ITS).

8.2. Experience: 7 years of relevant experience in urban mobility projects, traffic management, traffic analysis and recommendations, transportation modeling, or traffic microsimulation. Experience in the implementation or monitoring of Intelligent Transportation Systems (ITS) or similar projects involving real-time traffic data management and analysis. Experience in projects implementing congestion mitigation measures at the operational level or through roadway infrastructure.

8.3. Languages: Spanish, with the ability to communicate in English.

8.4. Core and Technical Requirements:

-Effective communication skills: Ability to present results clearly and comprehensively to both technical and non-technical audiences, including government authorities and citizens.

-Teamwork and leadership skills: Demonstrated ability to collaborate with and lead multidisciplinary teams, including engineers, technicians, and AI model developers.

-Results-oriented: Capacity to prioritize and execute tasks efficiently, focusing on delivering concrete results that positively impact urban mobility.

-Adaptability and decision-making: Ability to make quick and efficient decisions in contingency situations related to traffic congestion, proposing innovative and effective solutions.

-Advanced knowledge in traffic management and urban mobility: Deep understanding of traffic management principles, urban transport planning, and intersection design.

-Familiarity with traffic modeling and simulation tools.

-Knowledge of ITS systems and smart mobility technologies: Understanding of Intelligent Transportation Systems (ITS) and their application in congestion management.

9. Schedule of Payments

9.1. Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required.

Payment Schedule	
Deliverable	**%**
1. Critical Area Analysis Report, Field Visit Report and Key Performance Indicator (KPI) Proposal	25%
2. Mitigation Measure Plan and Mitigation Action Matrix 3. Model Evaluation and Adjustment Report	50%
4. Final Report	25%
TOTAL	100%

Selection process #CO-T1784-P007

TERMS OF REFERENCE

CONSULTANCY SERVICES FOR ACCOMPANIMENT AND SUPERVISION OF THE EXECUTION OF THE TECHNICAL COOPERATION "AI MODELS FOR CONGESTION PREDICTION AND OPTIMAL TRAFFIC MANAGEMENT IN BOGOTÁ"

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1.2. Mobility in Bogotá faces significant challenges due to population growth, high levels of motorization, and rapid urbanization. The city ranks among the most congested in the world. AI can significantly enhance urban mobility in Bogotá by optimizing traffic management, improving transportation planning, informing transportation policies, and guiding optimal infrastructure placement. AI-based models for traffic prediction and management can play a crucial role in identifying and implementing targeted interventions to enhance mobility and optimize infrastructure.

1.3. Investing in AI and new technologies supports the development of sustainable and resilient infrastructure, providing benefits such as increased productivity, process automation, new services and products, optimized asset management, cost reduction, improved transparency with the public sector, more efficient decision-making, and greater user empowerment in transport services. Additionally, this initiative can significantly reduce congestion, improve air quality, and increase economic efficiency. These enhancements will lead to safer and more reliable transportation, better public health, and a higher quality of life for residents.

2. Objectives

2.1. The objective of this contract is to accompany and supervise the technical execution of the cooperation "AI Models for Congestion Prediction and Optimal Traffic Management in Bogotá." The professional will be responsible for managing the overall project schedule, monitoring budget execution, coordinating meetings between the different stakeholders, and ensuring the consistency and quality of the reports delivered by the consultants, in accordance with the expectations of the Bank and the beneficiary entity.

3. Scope of Services

3.1. Monitor project schedule compliance and generate early alerts when risks of delay are identified.
3.2. Coordinate and manage meetings between consultants, the beneficiary entity, the Bank's teams, and other key stakeholders.
3.3. Closely track budget execution, ensuring that payments and financial processes are completed within the projected timelines.
3.4. Assist in reviewing the reports delivered by consultants, verifying their consistency with the Bank's and beneficiary entity's expectations, and ensuring that feedback is adequately addressed.
3.5. Organize and maintain all documents generated during the project.

4. Key Activities

4.1. Project Schedule Monitoring: Consolidate and harmonize the schedules proposed by each consultant into a general project schedule. Hold regular meetings with consultants to track progress and ensure deadlines are being met. Identify potential delays and propose solutions to mitigate their impact.
4.2. Meeting Coordination: Plan and manage meetings between consultants and various project stakeholders. Prepare meeting agendas and coordinate logistics. Draft minutes and follow up on agreements reached.
4.3. Budget Monitoring: Keep a detailed record of the allocated budget and payments made to consultants. Identify payment delays and manage necessary alerts to prevent project delays.
4.4. Report Review: Review reports delivered by consultants, ensuring their consistency, clarity, and alignment with project objectives. Ensure that feedback from the beneficiary entity and the Bank is addressed in the report revisions.
4.5. Document Organization: Create and maintain an organized file of all documents generated during project execution. Ensure that key documents are available to relevant project stakeholders.

5. Expected Outcome and Deliverables

5.1. General Project Schedule: A consolidated document that harmonizes the individual schedules of the consultants and reflects the overall project deadlines.
5.2. Monthly Progress Reports: A document detailing the project's progress, including compliance with deadlines, budget execution, and potential risk alerts.
5.3. Meeting Minutes: Detailed minutes from each meeting, documenting agreements and commitments made.

5.4. **Consultant Report Reviews**: Comments and suggestions on the reports delivered by the consultants, with a special focus on consistency and alignment with project objectives.

5.5. **Organized File System**: A filing system with all documents generated during the project, accessible to key stakeholders.

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8. Other Requirements

8.1. **Education**: University degree in business administration, engineering, economics, project management, or related fields. Additional training in project management will be considered a plus.

8.2. **Experience**: Minimum of 2 years of experience in project supervision and management, preferably in the public sector or in projects financed by international organizations. Previous experience in urban mobility projects, transportation systems, or technology development is desirable.

8.3. Languages: Proficiency in Spanish, English is desirable.

8.4. Core and Technical requirements:

- Project Management: Proven ability to manage complex schedules, coordinate meetings, and track project execution.
- Communication Skills: Ability to communicate effectively with multidisciplinary teams and present results to both technical and non-technical audiences.
- Results-Oriented: Focus on delivering concrete, timely results, with the ability to manage multiple tasks and meet tight deadlines.
- Organization and Monitoring: Ability to efficiently organize documentation and follow up on project activities in detail.
- Financial Knowledge: Ability to track budget execution and manage alerts in case of deviations or payment delays.

9. Schedule of Payments

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Payment Schedule	
Deliverable	**%**
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2. Mid-term progress report	25%
3. Final progress report	25%
4. Organized File System	25%
TOTAL	100%