

Development of a Data Repository and Web Interface for Air Quality Studies in Border Areas – Project Summary and User Guide

Project performed by

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This research was performed by the Center for International Intelligent Transportation Research, a part of the Texas Transportation Institute. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein.

EXECUTIVE SUMMARY

The Texas Transportation Institute (TTI) and the Center for International Intelligent Transportation Research (CIITR) have conducted numerous studies over the past decade relating to transportation and air quality, both near the border and elsewhere in the state. Topics of these studies include emissions testing of vehicles, emissions inventories, truck idling, industry surveys, border crossings, and air quality policy analysis. Until recently, the data contained in project reports were only available separately. There was no centralized, consolidated location to view and access all of the information collected, as well as additional information from those interested in air quality issues in Texas, and in U.S.-Mexico border regions. As part of the CIITR research program for Fiscal Year (FY) 2009, a centralized data repository was created to house all data and information. The FY 2010 project involved making further modifications and enhancements to the website.

The website created is a user-friendly interface consisting of the following components:

- A section on Border Air Quality Resources that includes documents related to air quality research in U.S.-Mexico border regions, as well as tabulated emissions rates and emissions quantification guidance for the El Paso region.
- Sections containing research reports and publications, presentations, and pictures of projects and emissions testing related to TTI's and CIITR's air quality research initiatives. A section on other useful resources is also included.
- Sections on emissions testing and modeling data, and on sustainability-related resources.

If properly maintained and utilized, this new information system can help place TTI/CIITR in a lead position in terms of control of and access to the latest air quality research data. It will increase the efficiency of the research process and enable easy, quick emissions estimation for a variety of situations.

INTRODUCTION

BACKGROUND

Air quality is a growing concern in Texas, especially along the U.S.-Mexico border. Currently, El Paso is in non-attainment of the national air quality standards for particulate matter, and is in maintenance (previously in non-attainment) for carbon monoxide. Transportation-related mobile source emissions play a large role in contributing to these pollution factors, and thus offer a great potential for reduction as well.

Texas Transportation Institute (TTI) and the Center for International Intelligent Transportation Research (CIITR) have conducted numerous studies over the past decade relating to transportation and air quality, both near the border and elsewhere in the state. Topics of these studies include emissions testing of vehicles, emissions inventories, truck idling, industry surveys, border crossings, and air quality policy analysis. Until recently, the data contained in project reports were only available separately. There was no centralized, consolidated location to view and access all of the information collected. As part of the CIITR research program for Fiscal Year (FY) 2009, a centralized data repository was created to house all data and information. The FY 2010 project involved making further modifications and enhancements to the website.

OBJECTIVES

The main objectives of this project were to develop a web-based information system for all existing and ongoing research in air quality and vehicle emissions, focusing on border regions. This included developing a database of emissions data and a repository that allows access to useful air quality information such as reports and presentations, and linking items together with an easy to use website.

The potential benefits of this website include:

- enabling stakeholders to use these data for emissions inventories and emissions reduction estimation,
- aiding stakeholders in creating transportation strategies that maximize air quality benefits,
- allowing research institutes to assess further research needs based on contents of the database, and
- placing TTI in a lead position in terms of access to and control over air quality data.

APPROACH

Researchers gathered and sorted through several past research reports, data files, presentations, and other materials that may have relevance to this data repository. Based on a review of available material, as well as an understanding of the kind of data and information that were important to be showcased on this website, the following components were identified to be included on the web repository:

- Border air quality resources, including:
 - Documents
 - Regional emissions data for the El Paso border area
- Data file repository resources, including:
 - Reports and Publications
 - Pictures
 - Other Resources
 - Presentations
 - Emissions Testing and Modeling Data
- Sustainability Resources

A map of how these components relate to each other is shown in Figure 1. Each component is explained in detail in the next section of this report.

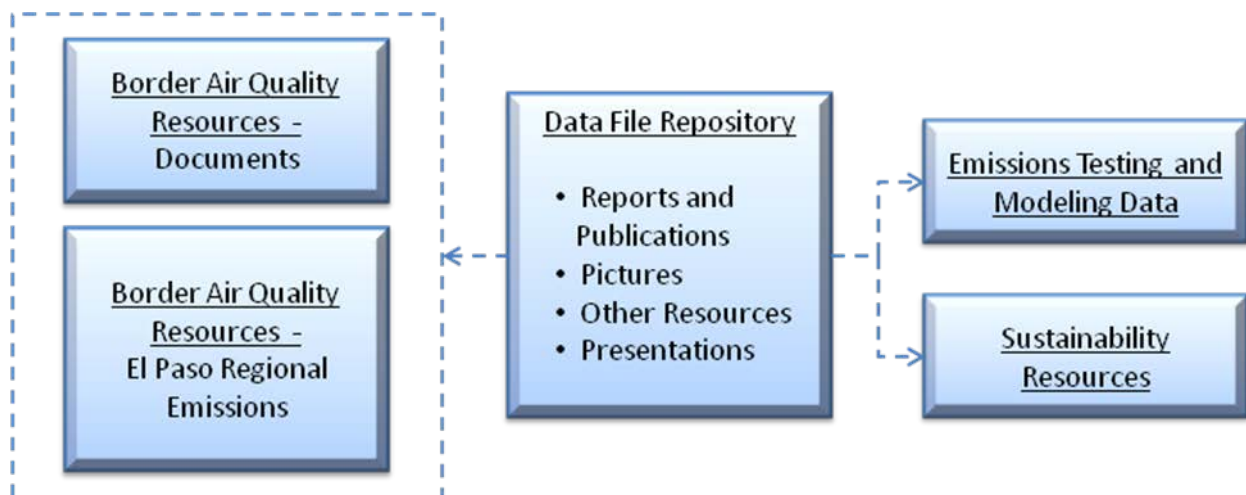


Figure 1. Map of Website Components

WEB-BASED INTERFACE

IMPLEMENTATION OF WEBSITE CONCEPT

Once a concept of what the website should look like was developed by the team in TTI College Station, the El Paso TTI team began work on programming the actual web interface. The homepage of the website is shown in Figure 2 and is found at the URL <http://ttiairquality.tamu.edu>. TTI employees can use their TTI network usernames and passwords to log in and access restricted site material, such as the emissions testing and modeling data. A majority of the site content, however, is publicly accessible.

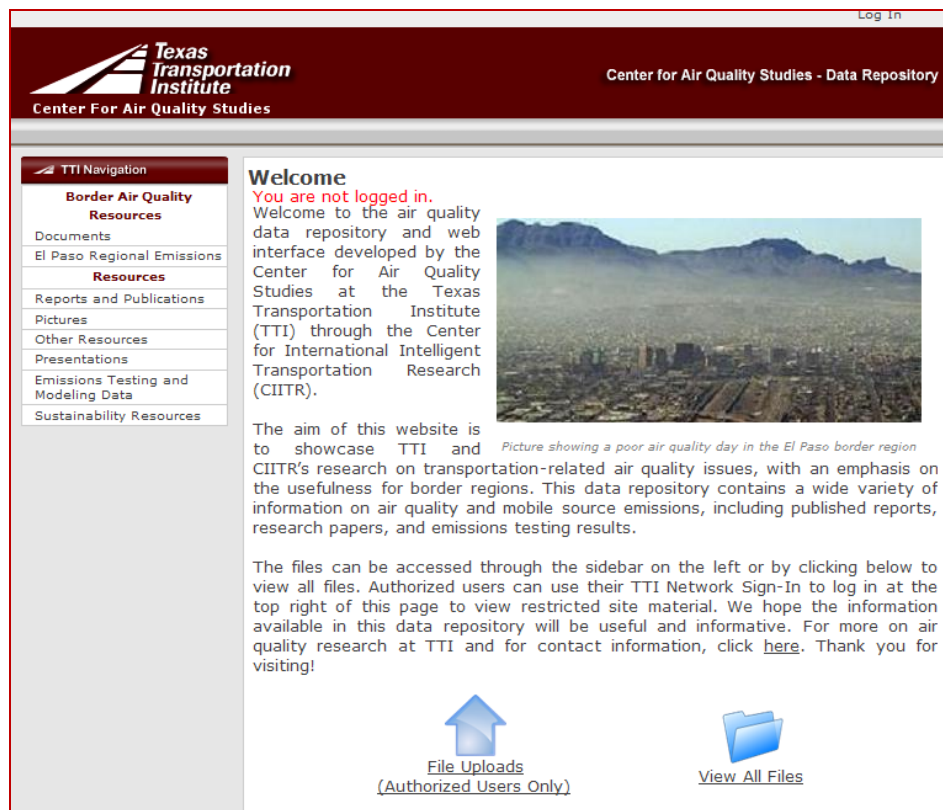


Figure 2. Homepage

Clicking on the various options on the sidebar enables the user to navigate different sections of the site. The file upload button allows authorized users to upload and edit content on the website after logging in. The other button, marked “view all files” will display all files contained in the web repository.

WEBSITE DOCUMENTS

Documents in the repository are stored in the following categories: Reports and Publications, Pictures, Presentations, and Other Resources. The first category contains reports, papers, and publications written by TTI staff. The Pictures category is a collection of pictures

used for various research projects, presented in PowerPoint® format. The Other Resources category includes a collection of documents from external sources. The Presentations category collects presentations by TTI staff.

Upload of Website Documents

In order to upload a file to the repository, an authorized user can log in and click on the File Uploads button on the homepage, which will direct the user to a data upload page shown in Figure 3. Depending on the type of document being uploaded, specific data fields will need to be filled in. The possible data fields for each document type are shown in Table 1.

Figure 3. Upload Page

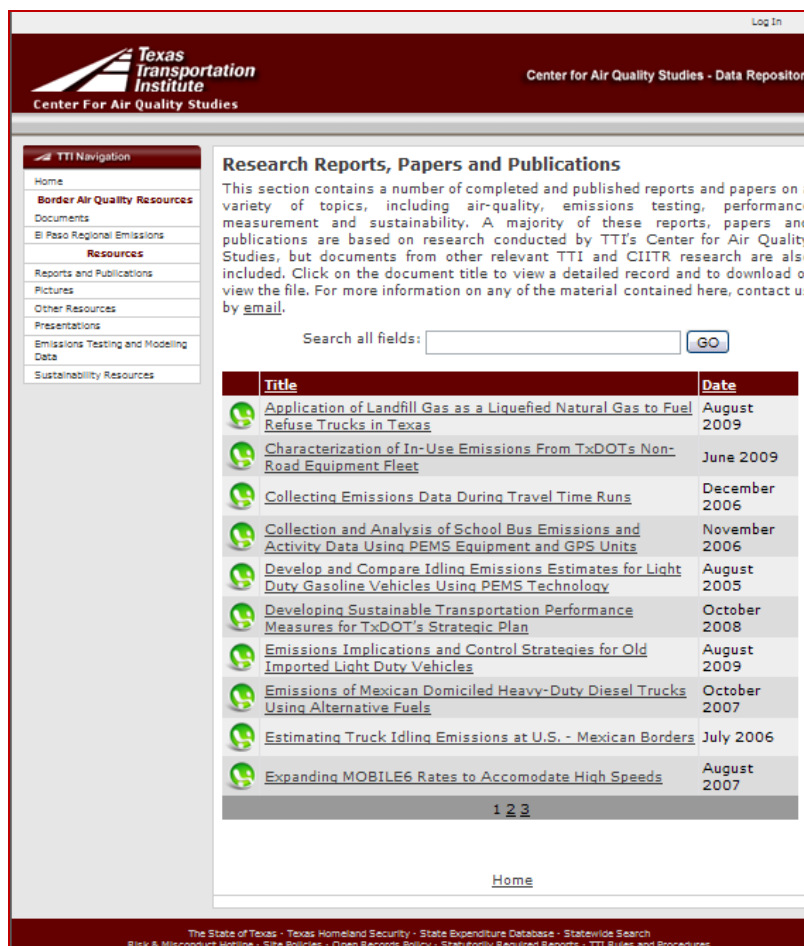
Table 1. Data Fields for Each Document Category

Category	List of Fields
Reports and Publications	Date, Description, File Name, Keywords, Project Number, Report Number, Title, Project Sponsor
Pictures	Date, Description, File Name, Keywords, Title
Other Resources	Date, Description, File Name, Keywords, Title, URL
Presentations	Date, Description, File Name, Keywords, Title, Organization

Browsing Files - Keywords and Special Categories

All files of a certain type (reports and publications, pictures, other resources, or presentations) can be viewed and browsed by clicking on the respective options from the sidebar. An example of a document display page is shown in Figure 4. The search feature at the top of the page will search for the words typed in the search box fields for the file category that is currently on display. As seen in Figure 4, ten files are displayed per page, and additional file listings can be viewed by clicking on the page numbers at the bottom of the screen. Clicking on the hyperlinked file name will display a more detailed record, and provide the option to download the document, as shown in Figure 5. Scrolling over a document title with the cursor will also display a short description of the document.

The section titled Documents under Border Air Quality Resources will display files of all types that have been tagged with the keyword “BAQR,” which indicates that they are relevant to the category of border air quality resources. The website currently has about 15 such documents. Similarly, clicking on Sustainability Resources will display all documents tagged with a keyword of “sustainability” and having relevance to that subject area. Users can also select the View All Files option from the homepage to list all files contained in the repository.



The screenshot shows the Texas Transportation Institute website's "Center for Air Quality Studies - Data Repository" page. The page features a navigation sidebar on the left with options like "Home", "Border Air Quality Resources", "Documents", "El Paso Regional Emissions", "Resources", "Reports and Publications", "Pictures", "Other Resources", "Presentations", "Emissions Testing and Modeling Data", and "Sustainability Resources". The main content area is titled "Research Reports, Papers and Publications" and includes a search bar with a "GO" button. Below the search bar is a table listing ten research reports with columns for "Title" and "Date". The reports are listed in descending order of date, from August 2009 to July 2006. At the bottom of the table, there are page numbers "1 2 3" and a "Home" link.

Title	Date
Application of Landfill Gas as a Liquefied Natural Gas to Fuel Refuse Trucks in Texas	August 2009
Characterization of In-Use Emissions From TxDOT's Non-Road Equipment Fleet	June 2009
Collecting Emissions Data During Travel Time Runs	December 2006
Collection and Analysis of School Bus Emissions and Activity Data Using PEMS Equipment and GPS Units	November 2006
Develop and Compare Idling Emissions Estimates for Light Duty Gasoline Vehicles Using PEMS Technology	August 2005
Developing Sustainable Transportation Performance Measures for TxDOT's Strategic Plan	October 2008
Emissions Implications and Control Strategies for Old Imported Light Duty Vehicles	August 2009
Emissions of Mexican Domiciled Heavy-Duty Diesel Trucks Using Alternative Fuels	October 2007
Estimating Truck Idling Emissions at U.S. - Mexican Borders	July 2006
Expanding MOBILE6 Rates to Accommodate High Speeds	August 2007

Figure 4. Example File Listing Page

Sign Out

Texas Transportation Institute
Center For Air Quality Studies | Center for Air Quality Studies - Data Repository

TTI Navigation

- Home
- Border Air Quality Resources**
- Documents
- El Paso Regional Emissions Resources
- Reports and Publications
- Pictures
- Other Resources
- Presentations
- Emissions Testing and Modeling Data
- Sustainability Resources

Download File

Title	Collection and Analysis of School Bus Emissions and Activity Data Using PEMS Equipment and GPS Units
Document Type	research papers pubs
Report Number	402231-07
Project Number	TCEQ Contract 70880-06-07
Date	11/1/2006
Uploaded on	7/20/2009 8:04:00 AM
Filename	Collection and Analysis of School Bus Emissions and Activity Data Using PEMS Equipment and GPS Units.pdf
File Size	182.2 KB
Description	A group of representative school buses were equipped with emissions measurement systems and GPS units to collect data during actual real-world operations. Based on this, school bus drive cycles and emissions profiles were characterized.
Uploaded By	n-fluker

DOWNLOAD NOW

Figure 5. Detailed File View and Download

Editing and Deleting Records

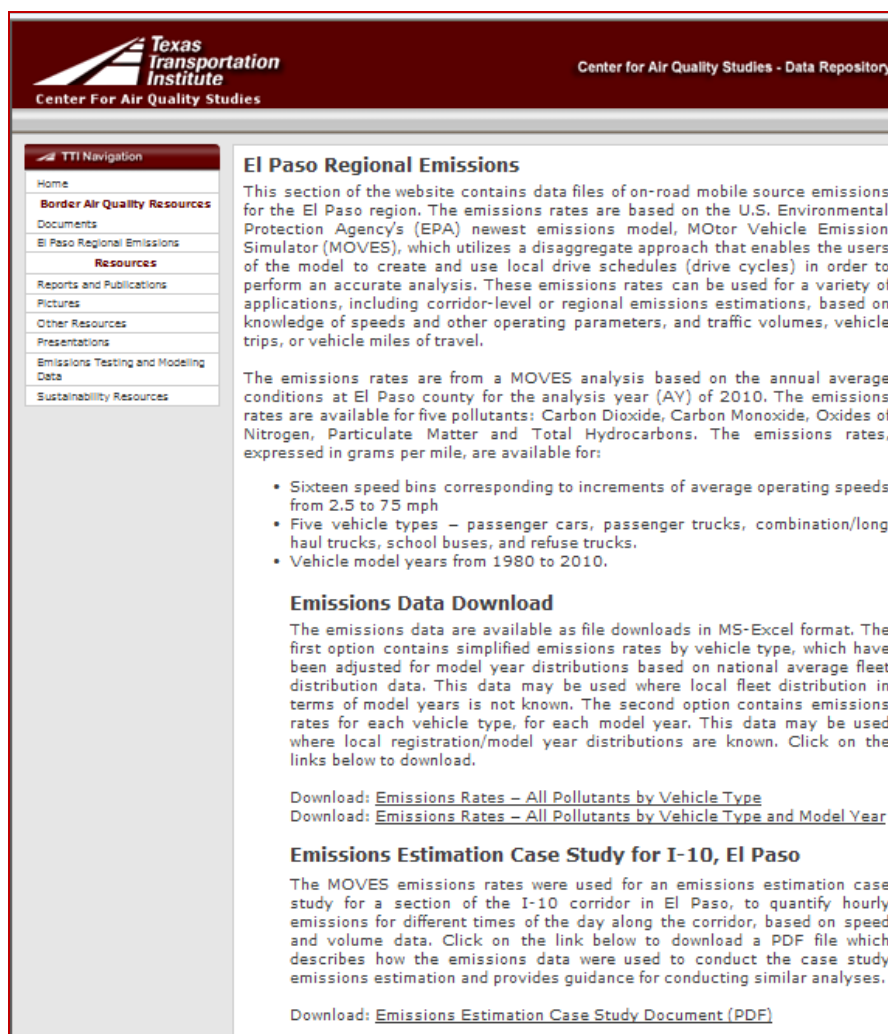
When authorized users log in to the website, they will be able to select additional edit/delete options as shown in Figure 6 (the pencil symbol is for editing, and the X is for deletion). Editing a record opens up that file's upload page, and the user is allowed to change any of the fields; however, the original uploaded file cannot be replaced. If a file needs to be replaced, users will need to delete the original record and upload a new one.

	<u>Title</u>	<u>Date</u>	
	Application of Landfill Gas as a Liquefied Natural Gas to Fuel Refuse Trucks in Texas	August 2009	 
	Characterization of In-Use Emissions From TxDOTs Non-Road Equipment Fleet	June 2009	 
	Collecting Emissions Data During Travel Time Runs	December 2006	 

Figure 6. Edit and Delete Options

EL PASO REGIONAL EMISSIONS

This section of the website contains data files of on-road mobile source emissions for the El Paso region, as well as guidance for the practical application of the emissions rates for case study emissions estimations. The emissions rates are based on the U.S. Environmental Protection Agency's (EPA's) newest emissions model, MOTO Vehicle Emission Simulator (MOVES), which utilizes a disaggregate approach that enables the users of the model to create and use local drive schedules (drive cycles) in order to perform an accurate analysis. These emissions rates can be used for a variety of applications, including corridor-level or regional emissions estimations, based on knowledge of speeds and other operating parameters, traffic volumes, vehicle trips, or vehicle miles of travel. Figure 7 shows the layout of this section of the website, from which emissions data can be downloaded in the form of Excel® documents. There is an emissions estimation case study for the I-10 corridor in El Paso (in the form of a PDF file), as shown in Figure 8, containing guidance on using the emissions rates and the case study results.



The screenshot displays the website interface for the Texas Transportation Institute's Center for Air Quality Studies. The header includes the institute's logo and the text "Center for Air Quality Studies - Data Repository". A navigation menu on the left lists various resources, with "El Paso Regional Emissions" highlighted. The main content area is titled "El Paso Regional Emissions" and contains a detailed description of the data, a list of available parameters, and links for downloading emissions data and a case study document.

El Paso Regional Emissions

This section of the website contains data files of on-road mobile source emissions for the El Paso region. The emissions rates are based on the U.S. Environmental Protection Agency's (EPA) newest emissions model, MOTO Vehicle Emission Simulator (MOVES), which utilizes a disaggregate approach that enables the users of the model to create and use local drive schedules (drive cycles) in order to perform an accurate analysis. These emissions rates can be used for a variety of applications, including corridor-level or regional emissions estimations, based on knowledge of speeds and other operating parameters, and traffic volumes, vehicle trips, or vehicle miles of travel.

The emissions rates are from a MOVES analysis based on the annual average conditions at El Paso county for the analysis year (AY) of 2010. The emissions rates are available for five pollutants: Carbon Dioxide, Carbon Monoxide, Oxides of Nitrogen, Particulate Matter and Total Hydrocarbons. The emissions rates, expressed in grams per mile, are available for:

- Sixteen speed bins corresponding to increments of average operating speeds from 2.5 to 75 mph
- Five vehicle types – passenger cars, passenger trucks, combination/long haul trucks, school buses, and refuse trucks.
- Vehicle model years from 1980 to 2010.

Emissions Data Download

The emissions data are available as file downloads in MS-Excel format. The first option contains simplified emissions rates by vehicle type, which have been adjusted for model year distributions based on national average fleet distribution data. This data may be used where local fleet distribution in terms of model years is not known. The second option contains emissions rates for each vehicle type, for each model year. This data may be used where local registration/model year distributions are known. Click on the links below to download.

Download: [Emissions Rates – All Pollutants by Vehicle Type](#)
Download: [Emissions Rates – All Pollutants by Vehicle Type and Model Year](#)

Emissions Estimation Case Study for I-10, El Paso

The MOVES emissions rates were used for an emissions estimation case study for a section of the I-10 corridor in El Paso, to quantify hourly emissions for different times of the day along the corridor, based on speed and volume data. Click on the link below to download a PDF file which describes how the emissions data were used to conduct the case study emissions estimation and provides guidance for conducting similar analyses.

Download: [Emissions Estimation Case Study Document \(PDF\)](#)

Figure 7. Layout of Regional Emissions Section

This paper describes the process of estimating hourly emissions for specific sections on I-10 in El Paso, TX, based on the MOVES emissions rate available on this website. The emissions of various pollutants are estimated on three sections of I-10 shown in the map below. Each section is approximately 7 miles in length, and the average speed and volume on these sections for two vehicle categories (LDV – light duty vehicles/ HDT– heavy duty trucks) are shown in the table alongside, for different times of day.



	Section	Length (miles)	Time	Vehicle Type	Eastbound		Westbound	
					Avg. Speed	Volume	Avg. Speed	Volume
1	Resler (N. Mesa to Porfirio Diaz)	7	7 - 9 a.m.	LDV	21	5306	65	4453
				HDT	21	238	64	288
			11 - 1 p.m.	LDV	66	4558	64	4929
				HDT	65	445	62	426
			3 - 5 p.m.	LDV	64	5636	63	8058
				HDT	63	368	61	408
2	Spaghetti Bowl (Porfirio Diaz to Airway)	7	7 - 9 a.m.	LDV	64	8308	59	11493
				HDT	62	432	58	386
			11 - 1 p.m.	LDV	48	8871	64	8119
				HDT	47	606	63	636
			3 - 5 p.m.	LDV	33	9503	61	8904
				HDT	33	604	60	450

Figure 8. View of the I-10 Case Study and Guidance Document

EMISSIONS TESTING AND MODELING DATA

This section is designed to store and display emissions data from finished reports and studies that utilized either field measurement of emissions or modeled/simulated emissions results. Data can be viewed by selecting Emissions Testing and Modeling Data from the sidebar. The page shown in Figure 9 then appears. Users can select the type of data they wish to see and choose to make detailed comparisons of records. This section of the site is only accessible to users with a TTI login.

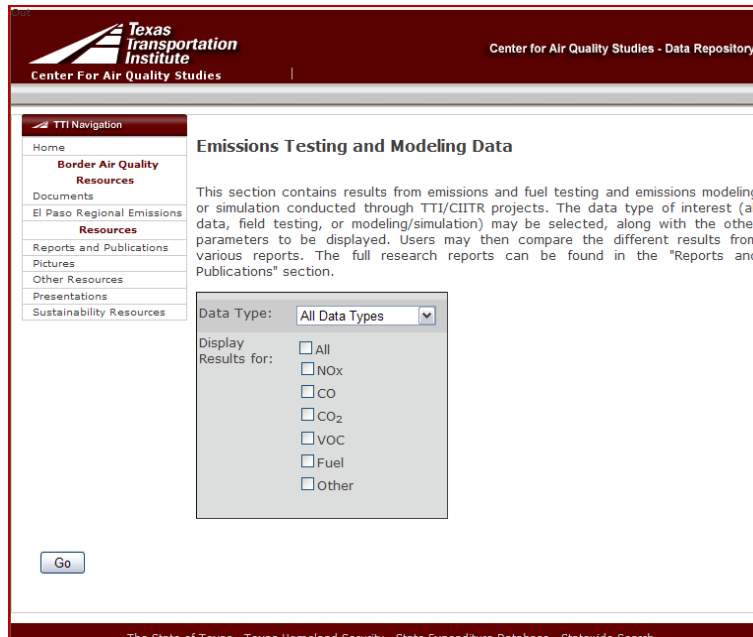


Figure 9. Emissions Testing and Modeling Data

Uploading Emissions Testing and Modeling Data

A data upload program was specifically created to upload, edit and delete emissions data. This program, once installed, can be opened to a data upload module shown in Figure 10. Table 2 shows all data fields and explains what should be entered in each one. No data fields are mandatory—users should simply input as much information as is available.

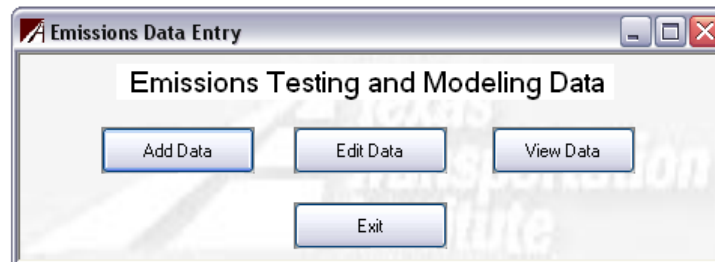


Figure 10. Data Upload Program

Table 2. Warehouse Data Fields

	Field	Description
Module 1	Date	Date of publishing
	Title	Title of study/report
	Reference Number	Project or report number
	Data Type	Field measurement or modeling/simulation
Module 2	Instrument Type	PEMS, CATI, etc
	Instrument Details	Further details of instrument: brand, model number, etc.
	Test Vehicle Type	On-road or non-Road
	Vehicle Class	Classification: HDDV, LDGV, etc
	Description	General description of vehicle
	Make and Model	Toyota T100, Chevy Impala, etc
	Model Year	Year
	Odometer Miles	Number of miles
	Service Hours	Hours in operation
Rated Fuel Economy	Mpg	
Module 2b	Engine Make	Manufacturer
	Engine Model	Name of engine
	Engine Model Year	Year
	Engine Size	Liters
	Cylinders	Number
	Emissions reduction technology applied?	Yes or no
Applied Technology	Description of the applied technology	
Module 2c	Test Location	City, area, etc.
	Temperature	Degrees F
	Relative Humidity	Percentage
	Wind Speed	Mph
	Wind Direction	NW, SE, etc.
Module 2d	Test Mode	Idle, cycle, etc.
	Test Duration	Time in seconds
	Vehicle Load	Weight or description of load
	Additional Description	Additional description of test
	Average Speed	Mph
Module 3	Simulation/Modeling Tool	Program used: TRANSIMS, MOBILE6, etc.
	Analysis Level	Aggregate or disaggregate
	Analysis Period	Time
	Network or Corridor Information	Description of test bed
	Average Speed	Mph
	Vehicle Class	Type of vehicles
	Additional Description	Any other relevant information
Module 4	General Comments	Comments on results or additional space for another variable
	NOX	Oxides of nitrogen
	CO	Carbon monoxide
	CO2	Carbon dioxide
	VOC	Volatile organic compounds
	HC	Hydrocarbon emissions
	PM	Particulate matter
	Other Emissions	Other emissions not previously mentioned
	Fuel Consumption	Amount of fuel used during test
Units	Units of emissions: kg, g/hr, etc.	

CONCLUDING REMARKS

This project involved the design and development of a user-friendly data repository and interface, and the population of the repository with useful documents, data, and resources. Further enhancements were made to the website as an iterative process, and the website is now suitable for public access.

The updating of data on the website can be carried out using available resources such as the file upload application and the data upload module. Thus, maintaining current and relevant data on the site is fairly easy and convenient. If properly maintained and utilized, this new information system can help place TTI/CIITR in a lead position in terms of control of and access to the latest air quality research data. It will increase the efficiency of the research process, and enable easy, quick emissions estimation for a variety of situations. Future partnerships with other institutions could further improve this resource.