Software User's Guide:
URBEMIS2007 for Windows

Version 9.2
Emissions Estimation for
Land Use Development Projects

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- Bay Area Air Pollution Control District;
- Feather River Air Quality Management District;
- Imperial County Air Pollution Control District;
- Mendocino County Air Pollution Control District;
- Monterey Bay Unified Air Pollution Control District;
- Placer County Air Quality Management District;
- Sacramento Metropolitan Air Quality Management District;
- San Joaquin Valley Air Pollution Control District;
- San Luis Obispo County Air Pollution Control District;
- Santa Barbara Air Pollution Control District;
- South Coast Air Quality Management District; and
- Yolo-Solano Air Quality Management District.

The primary URBEMIS2007 (Version 9.2) improvements include:

- Incorporation of EMFAC2007 emission rates for on-road mobile sources;
- Incorporation of OFFROAD2007 emission rates for off-road mobile sources;
- Upgrading URBEMIS to the .net programming environment;
- Making URBEMIS easier to use for the novice user while enhancing capabilities for power users;
- Enhancing the construction module that provides for additional phasing options; and
- Improving the reporting options, including exporting results to Excel and PDF file formats.

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INTRODUCTION

URBEMIS2007 for Windows Version 9.2, like its predecessors, is designed to estimate air emissions from land use development projects.

The flowchart shown on the following page (Figure 1) provides a conceptual overview of URBEMIS2007. Once the URBEMIS2007 program has been initiated, the user must first either select an existing project or start a new one. For new projects, the air district in which the project is located must be selected. Then, the user typically goes to the land uses module to enter land use information relevant to his project. Once land use information has been entered, the user must select the relevant construction, area, and operational assumptions that apply to the project. Mitigation measures can also be selected as applicable. Once all information has been selected for a project, the user clicks the Recalc button to obtain the emission estimates. After reviewing the results, the user can either save the project or go back and edit the land use or construction/area/operational module assumptions for the project.

Differences from Previous Versions

Several versions of URBEMIS have been released by the California Air Resources Board (ARB) since the early 1980s: Urbemis1, Urbemis2, Urbemis3, and Urbemis5, URBEMIS7G for DOS, URBEMIS7G for Windows, URBEMIS2001 version 6.2.2, URBEMIS2002 version 7.4, URBEMIS2002 version 7.5, URBEMIS2002 version 8.7, and URBEMIS2007 Version 9.2. (Urbemis4 was not released for use by the public.) Previous versions of URBEMIS allowed the user to estimate motor vehicle emissions associated with vehicle trips generated by land use development projects. Generally, each new release of URBEMIS has been associated with ARB's update of its motor vehicle emission factors.

URBEMIS7G represented the successor to URBEMIS5. URBEMIS7G differed from URBEMIS5 in several ways. First, URBEMIS7G was an updated version of URBEMIS5 because it included EMFAC7G, ARB's California motor vehicle emission factors model.

Another difference is that, for the first time, URBEMIS7G provided users with the ability to estimate construction and area source emissions. In addition, URBEMIS7G gave the user the ability to select mitigation measures for construction, area source, and motor vehicle emissions, another option not available in previous versions. And, URBEMIS7G provided estimates of the emissions benefits of those mitigation measures.

URBEMIS7G also included a series of enhanced land use selection screens. The enhancements included additional land uses, updated trip generation rates, trip generation rates for certain land uses based on equations included in the ITE Trip Generation Manual Version 6.0 (Institute of Transportation Engineers 1996), and the option of specifying whether the project is located is an urban versus a rural environment.

Previous versions of URBEMIS did not allow for estimation of reentrained road dust. URBEMIS7G estimated road dust emissions for both paved and unpaved roads.

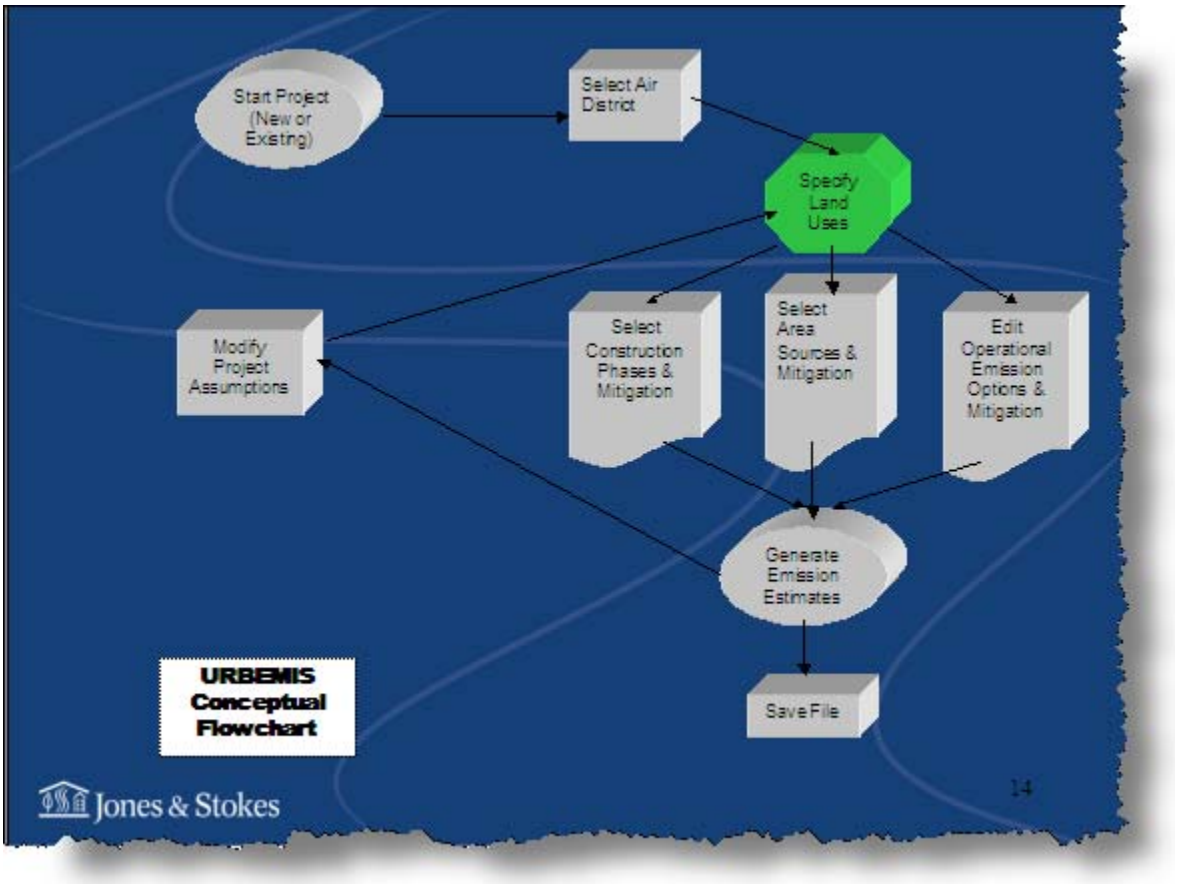

Figure 1. URBEMIS Conceptual Flowchart

URBEMIS7G also allowed the user to select a new "double-counting" option. This option was designed to minimize double counting of internal vehicle trips between residential and nonresidential land uses. Finally, URBEMIS7G allowed users to select a new "pass-by trips" option. With this option selected, URBEMIS7G could be used to estimate vehicle trip emissions based on the percentage of primary trips, diverted linked trips, and pass-by trips assumed for specific land use types.

URBEMIS7G was superceded by URBEMIS7G for Windows. The primary advantage of this enhancement is that it allowed the user to estimate emissions from within the Windows operating system environment. Several other minor improvements were made to fix previously identified bugs. URBEMIS2001 was released in early 2002, following by URBEMIS2002 in March 2003. URBEMIS2001 incorporated EMFAC2001 emissions factors, while URBEMIS2002 version 7.5 incorporated EMFAC2002 emissions factors and ITE Trip Generation, 7th edition emission factors. Additionally, EMFAC2002 included several additional land uses, contained a major enhancement to the construction emissions and mitigation measures module, and included a screening analysis option. URBEMIS2002 Version 8.7 included enhancements to the area source emission factors, and to the area source and operational mitigation measures. URBEMIS2007 version 9.2 includes updates that include adding EMFAC2007 input files, OFFROAD2007 input files, PM2.5 and CO2 emissions, enhanced construction phasing, and improved reporting capabilities.

Getting Started

Operating System Requirements

URBEMIS2007 is written in C++ within the Microsoft .net programming environment. Infragistrics controls have also been incorporated into URBEMIS. The program can be used within either the Microsoft XP or the Vista Operating Systems.

Disk Limits

URBEMIS2007 requires substantial amounts of hard disk space, primarily to store EMFAC2007 database files. Consequently, the program has been set up so that you can download only the EMFAC2007 files and associated air district default files needed.

Installation

URBEMIS2007 can be downloaded and installed by going to the following web site location: http://www.urbemis.com/software/download.html

Once you have navigated to this URBEMIS web site, follow the directions listed there to install URBEMIS directly onto your computer. You are given the option of either installing the .msi file directly from the web site or copying the .msi file to your computer, then using it to install URBEMIS. The later procedure is the recommended approach.

The installation routine provides an icon on the desktop that can be clicked to start URBEMIS. The URBEMIS icon is found in Figure 2 below.

Figure 2. URBEMIS2007 Desktop Icon

Starting URBEMIS2007

Once URBEMIS2007 has been successfully installed, it can be started by selecting the URBEMIS2007 icon from the desktop or by clicking on the Windows Start button, selecting Programs from the list, then selecting URBEMIS2007 from the list of programs. Figure 3 below consists of a portion of the Windows Desktop with the URBEMIS2007 icon. Double clicking on that icon starts the URBEMIS2007 program.

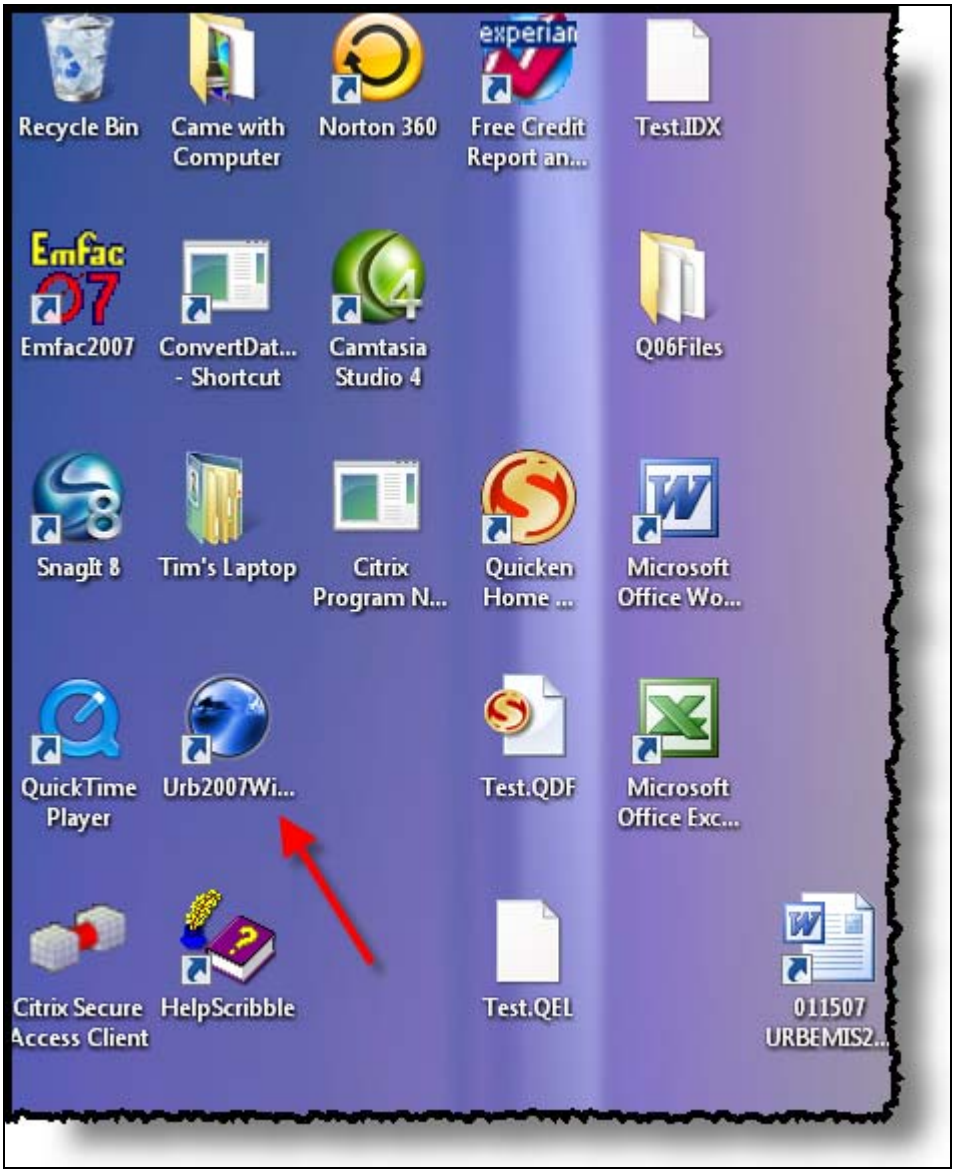

Figure 3. URBEMIS2007 Icon on Windows Desktop

One problem that frequently arises when starting URBEMIS2007 is that the program does not fit entirely within the computer screen. The optimal screen settings for running URBEMIS2002 are 1024 x 768 pixels, with the small fonts advanced setting option. These are Windows settings that can be changed by selecting the Start/Settings/Control Panel/Display from within the Windows operating system.

Quick Start

Once URBEMIS2007 has been started, you are first taken to STEP 1 – Open a New or Existing Project. Once you have started a new project, you can quickly obtain project results using the following steps. First, enter each of the land uses associated with your project (STEP 2). Then make sure that the construction phasing is correct (STEP 3). Then, check that the operational start year is correct (STEP 5). Finally, click on the dirty cloud icon at the top of the center bar. This will give you a quick estimate of your project's emissions. At this point, you may want to go back and refine your project's data by editing information in STEPS 3, 4, and 5. Before doing so, however, save your project (STEP 7). Then modify the project assumptions as necessary.

Where Else to Get Help

There are several options available to obtain help with URBEMIS. They include:

- Hitting the F1 key within any part of URBEMIS, which provides context sensitive help,
- Clicking on the Click for Instructions buttons found within each step of URBEMIS,
- Going to User Help forums located at www.urbemis.com/phpbb/index.php, and
- Consulting this URBEMIS2007 Users Manual.

Using URBEMIS2007

Appearance

When URBEMIS2007 is started, an introductory screen is presented (see Figure 4). The left side of the screen shows seven steps that can be completed for typical URBEMIS runs. Not all of these screens need to be completed to generate emission estimates, though they do provide the novice user with a roadmap for conducting URBEMIS runs. All users must complete Step 1. Open a New or Existing Project, before they can proceed. If a new project is selected, then the user should then go to Step 2. Enter Land Use Data specific to the project in question. Once land use data has been entered, the user can go directly to Step 6. View and Print Output, though its generally recommended that the user go to Steps 3, 4, and 5 to make sure that project specific information is accurately depicted.

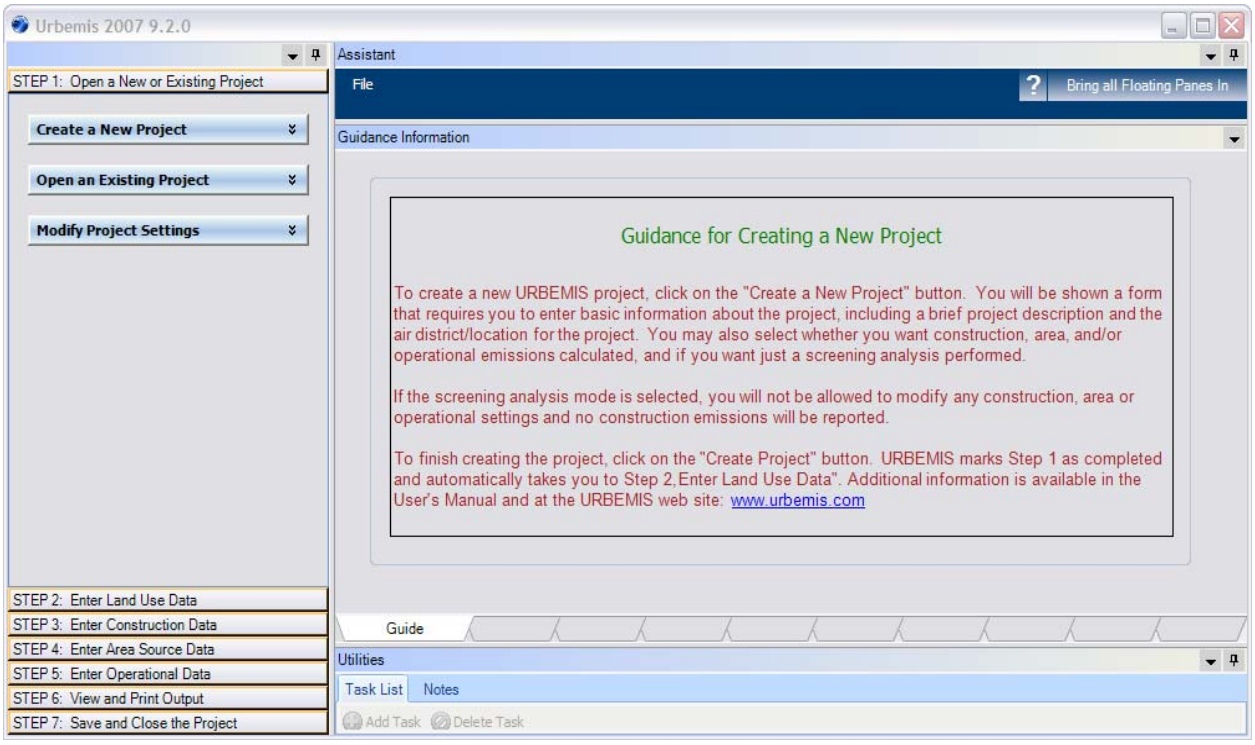

Figure 4. Introductory URBEMIS2007 Windows Screen

Step 1: Open A New or Existing Project

Figure 5 shows expanded and contracted views of the Step 1 menu. The three options within Step 1 include 1) Start a new project, 2) Open an Existing Project, 3) Modify Project Settings. As Figure 5 illustrates, each of these three Step 1 options can be expanded by clicking on the arrows at the right of each option.

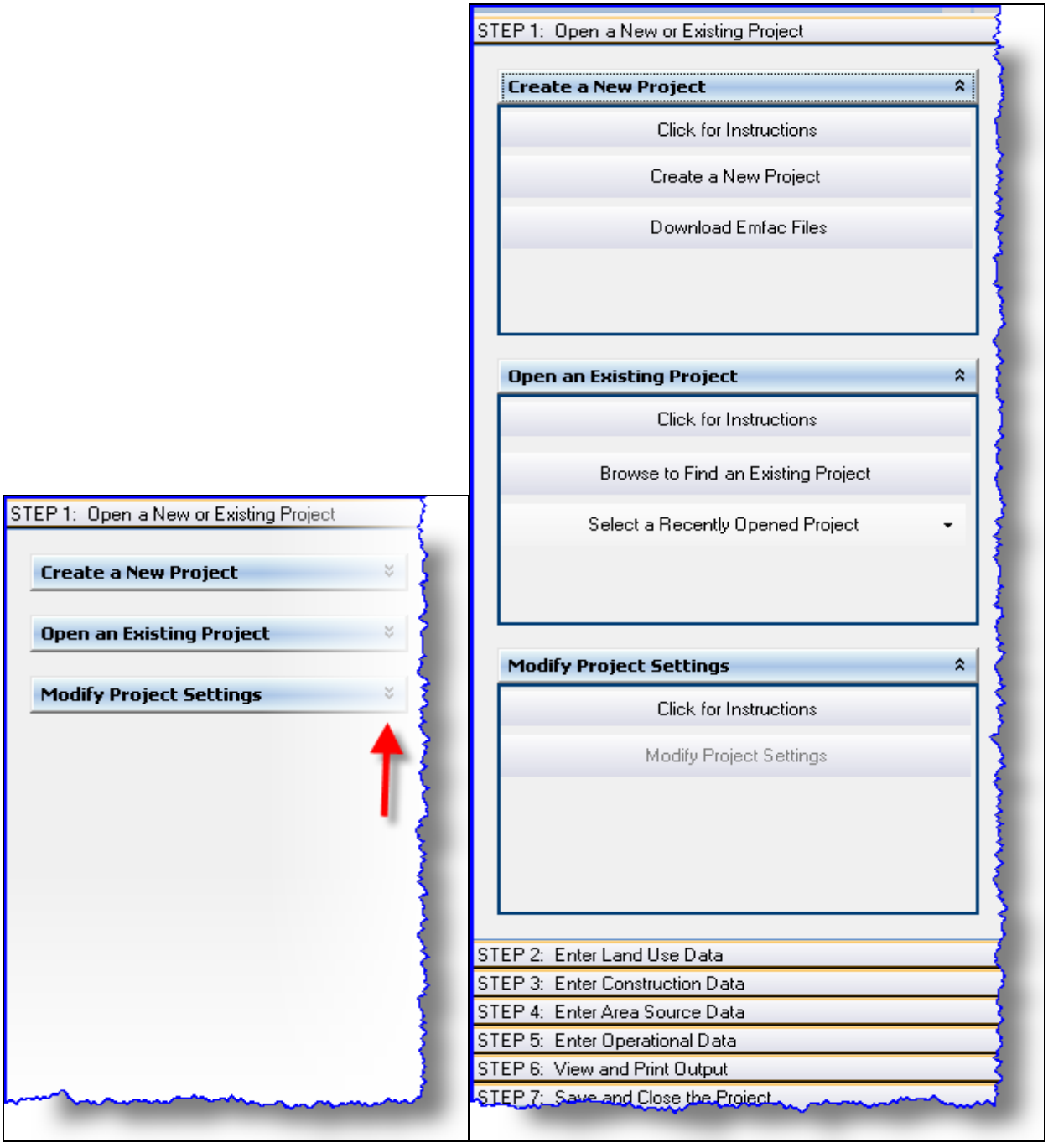

Figure 5. Step 1: Expanded and Contracted Screens

For example, clicking on Create a New Project expands this menu to include three suboptions: a) Click for Instructions, b) Create a New Project, or c) Download EMFAC files. If you attempt to Start a New Project in a location for which you have not downloaded the EMFAC files, then you will need to first download the EMFAC and air district and associated county default files.

Creating a New Project

Figure 6 shows the screen URBEMIS shows when the Create a New Project button is selected. In this example, the user wants to create a new project located in the Mountain Counties Air Basin. Since the Mountain Counties Air Basin is not shown in the list, that county's EMFAC files need to be downloaded first. To do this, you would need to cancel out of the Start a New Project screen and click on the Download EMFAC Files button within the Start a New Project button.

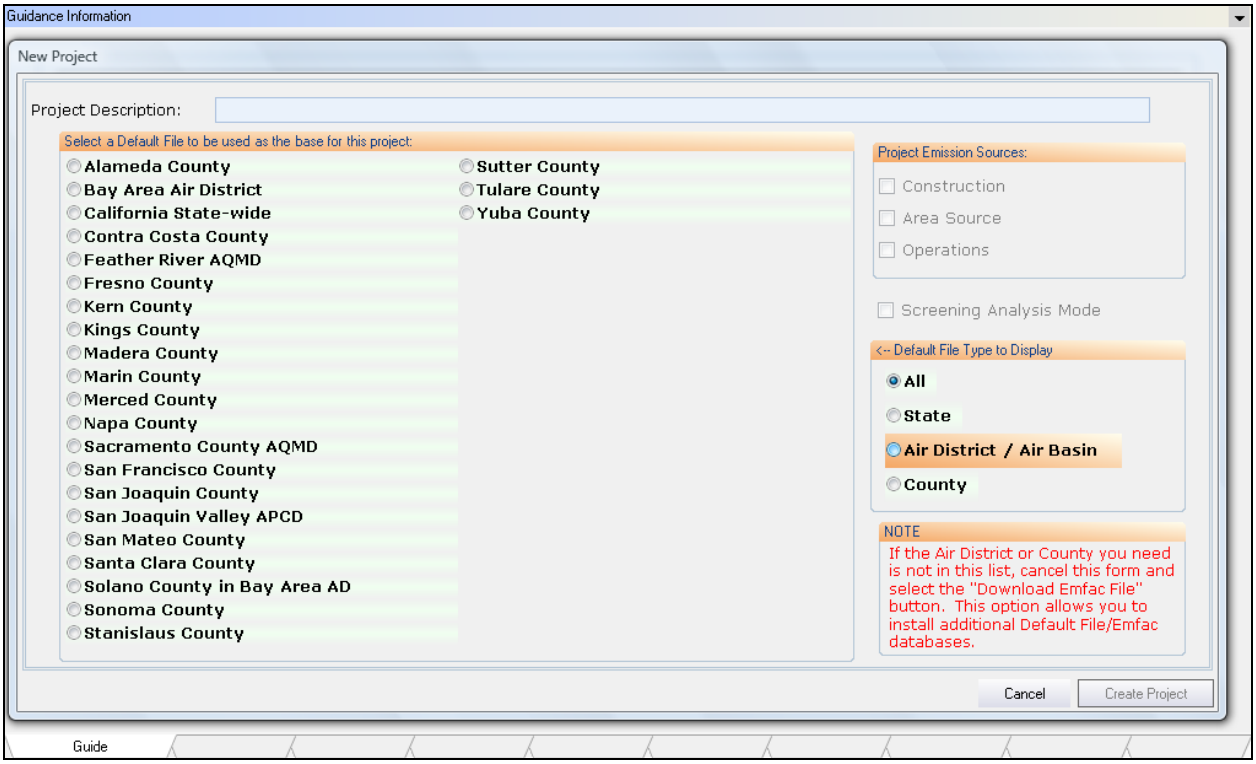

Figure 6. New Project Setup Screen

Figure 7 shows the Download EMFAC Files screen. In this example, the Mountain Counties Air Basin EMFAC database has been selected and is shown downloading. Once that database has downloaded, then you would need to Start New Project and select Mountain Counties Air Basin (see Figure 8). Also, on the Create a New Project Screen, you will need to enter a Project Description. This Project Description is not the same thing as the File Name used to store and retrieve the file on your computer. Once you have selected the project location and entered the Project Description, hit the Create Project button. URBEMIS then takes you to STEP 2.

One additional option to be aware of in the new project screen is the "screening analysis mode" checkbox located on the right side of menu. If the user turns on the "screening analysis option", they will not be able to edit the default values for construction, area sources, or operational emissions. In addition, because the construction module depends on several key assumptions that must be reviewed by the user, the screening analysis mode only generates emissions for the area and operational emission categories.

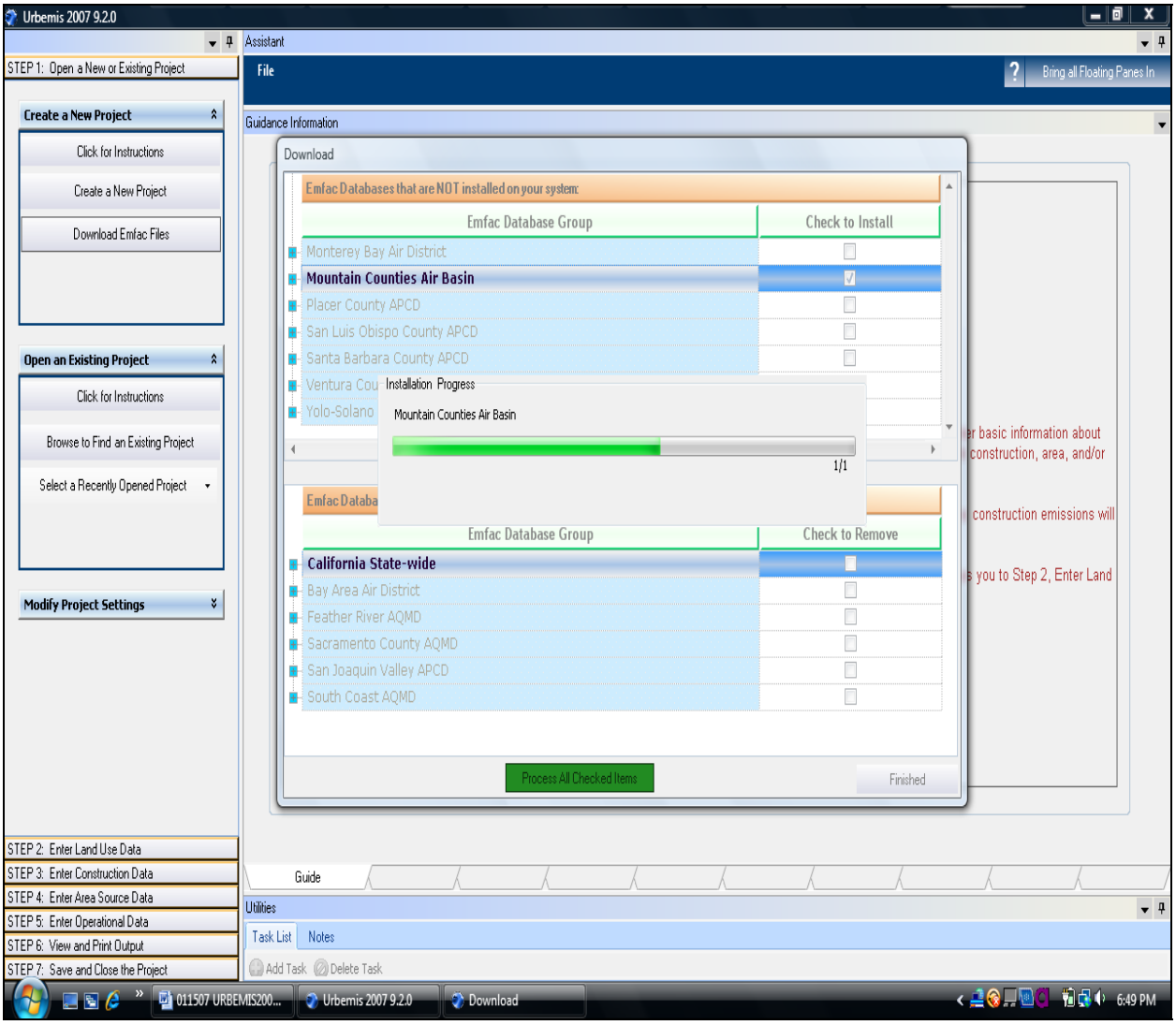

Figure 7. Download EMFAC Database Screen

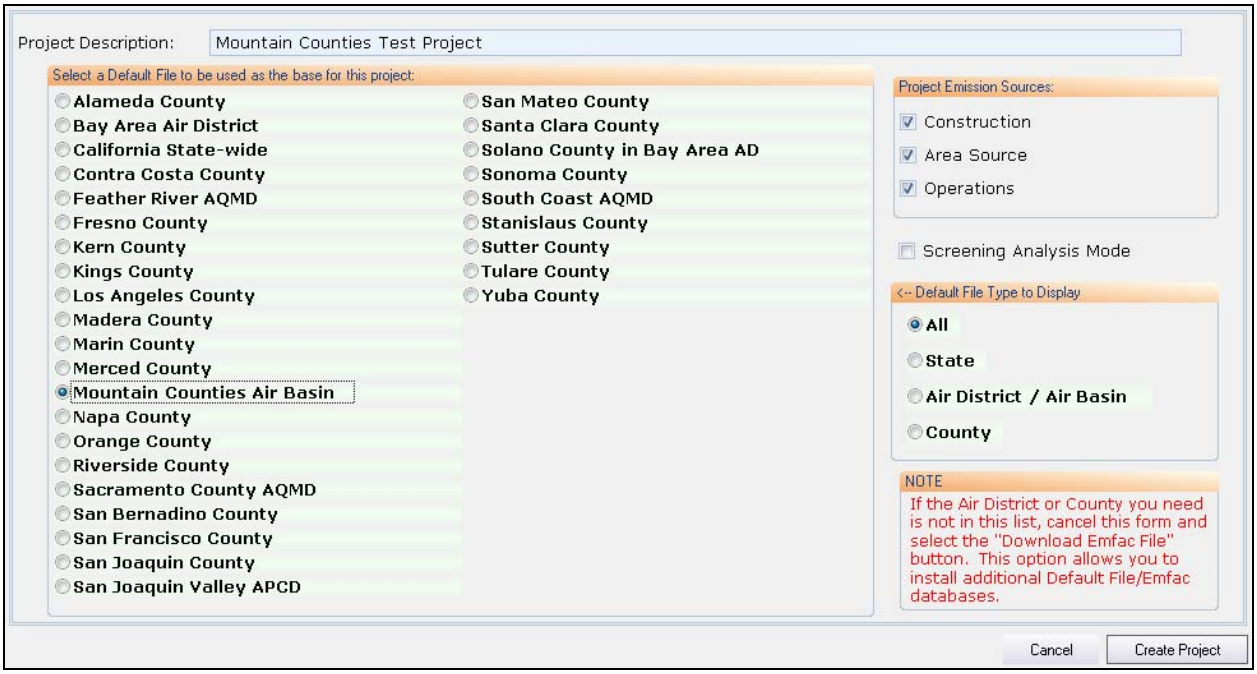

Figure 8. New Project Setup Screen

Open an Existing Project

To open an existing project, the user should click on either the a) Browse to Find an Existing Project or b) Select a Recently Opened Project bar (see Figure 5). Once you have opened a previously created project, URBEMIS takes you to STEP 2.

Another option for starting an existing or new project is to click on the word "File" shown on the project assistant bar (see Figure 9). Clicking on File reveals a drop down menu that can be used to start a new project or open an existing project

Modify Project Settings

The third option under STEP 1 involves modifying project settings. This option is available for projects that have already been created. Under this option, you can modify the project description, turn on or off the construction, area, and operational phases, and turn the screening analysis mode on or off.

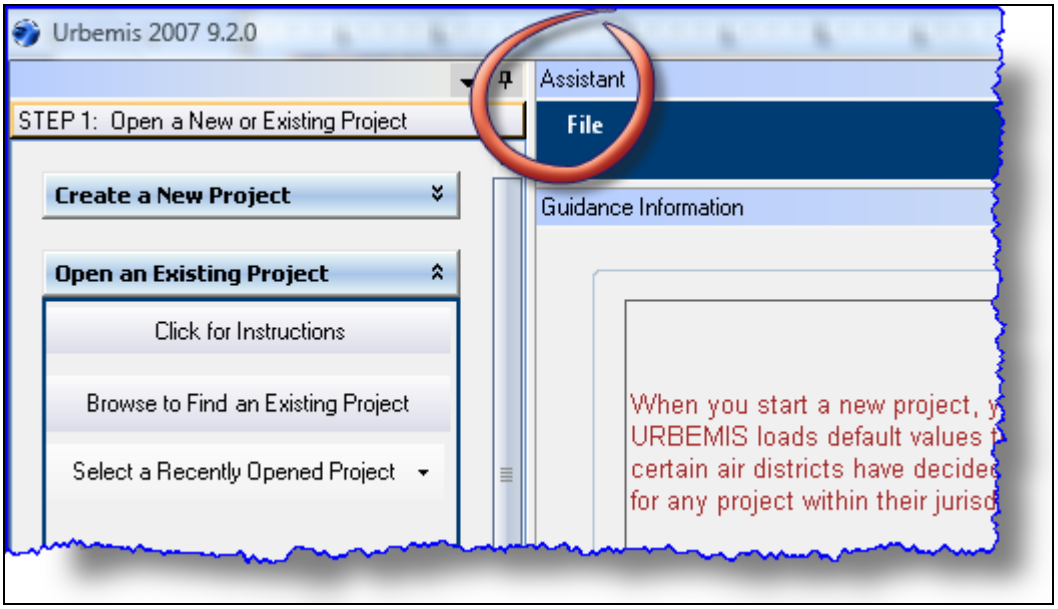

Figure 9. Select File from the Assistant Bar

Step 2 – Enter Land Use Data

Once you have opened an existing project or started a new one, URBEMIS takes you to Step 2 - Enter Land Use Data. The first land use screen displays residential land uses, which represent the first of eight possible land use screens.

- residential;
- educational;
- recreational;
- large retail;
- retail;
- commercial;

- industrial; and
- blank.

Figure 10 shows the residential land use screen with 222 single family residential uses entered. URBEMIS assumes 9.57 trips per day per residential land use. URBEMIS also assumes 3 single family residential land uses per acre. Both the trips per day and acreage values can be modified by the user.

You may access the land uses associated with either of the eight land use screens by either clicking on the appropriate tab (shown with arrow in Figure 10) or by double clicking on the appropriate land use name in the left window pane shown under Step 2.

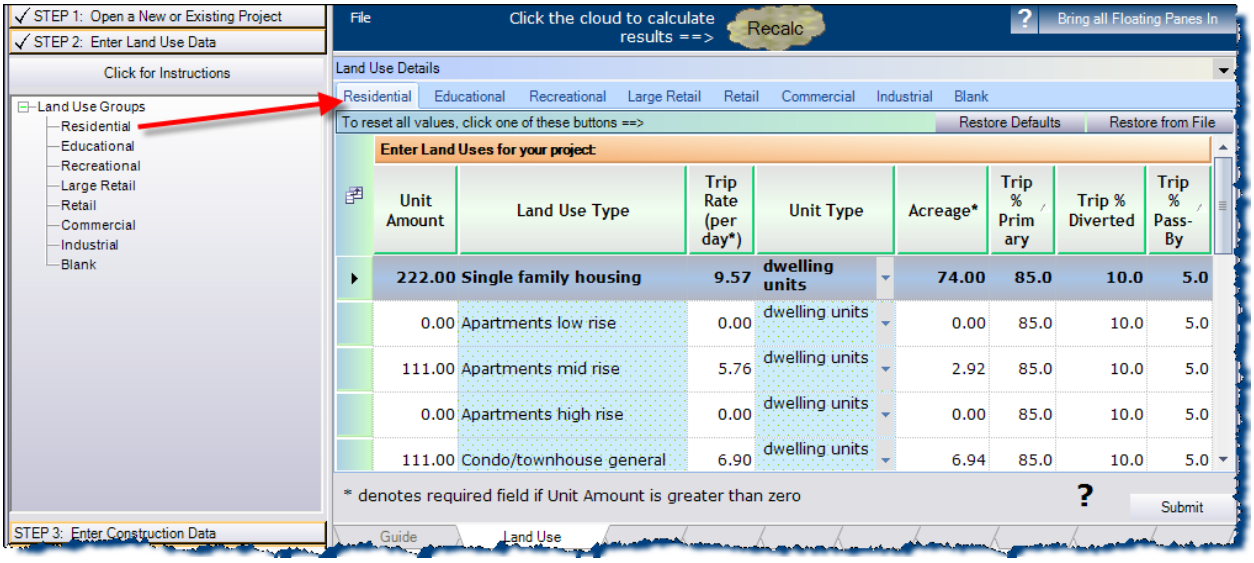

Figure 10. Land Use Screens

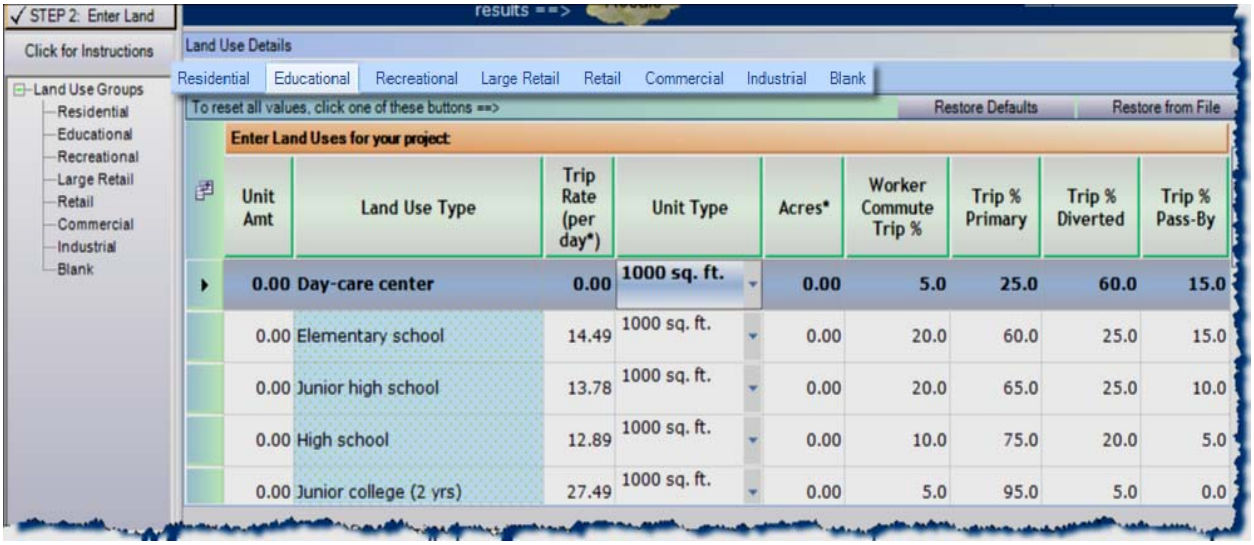

Figure 11. Land Use Tabs

In Figure 12, the educational tab has been selected and 20 has been entered as the unit amount for day-care center. The 20 represents 20,000 square feet with a daily trip generation rate of 79.26 per 1000 square feet.

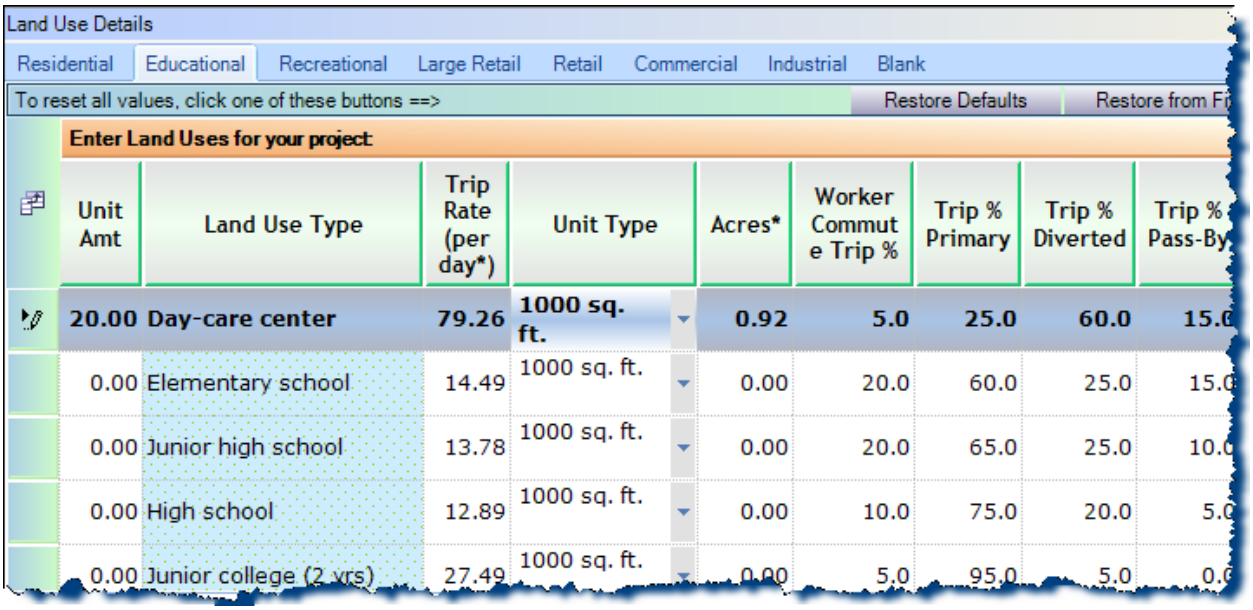

Figure 12. Educational Land Use Screen

Figure 13 shows the Blank land use tab. In this screen, the user can enter land uses that have not been entered in either of the seven previous screens. The user must enter unit amount, land use type, acres, and trip rate. Although URBEMIS will calculate acreage (as twice the building square footage), the user is urged to override this value if specific acreage data is available. Figure 14 shows an entry in the first row of the Blank Screen. A two acre dog park with 100 trips per acre has been entered.

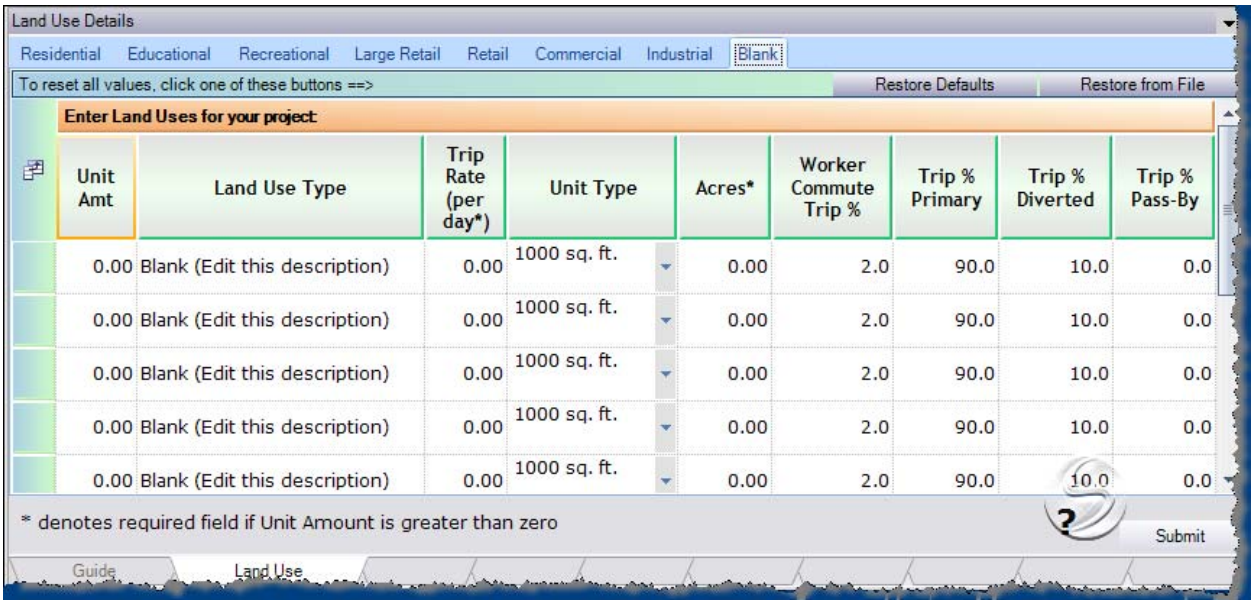

Figure 13. Blank Land Uses

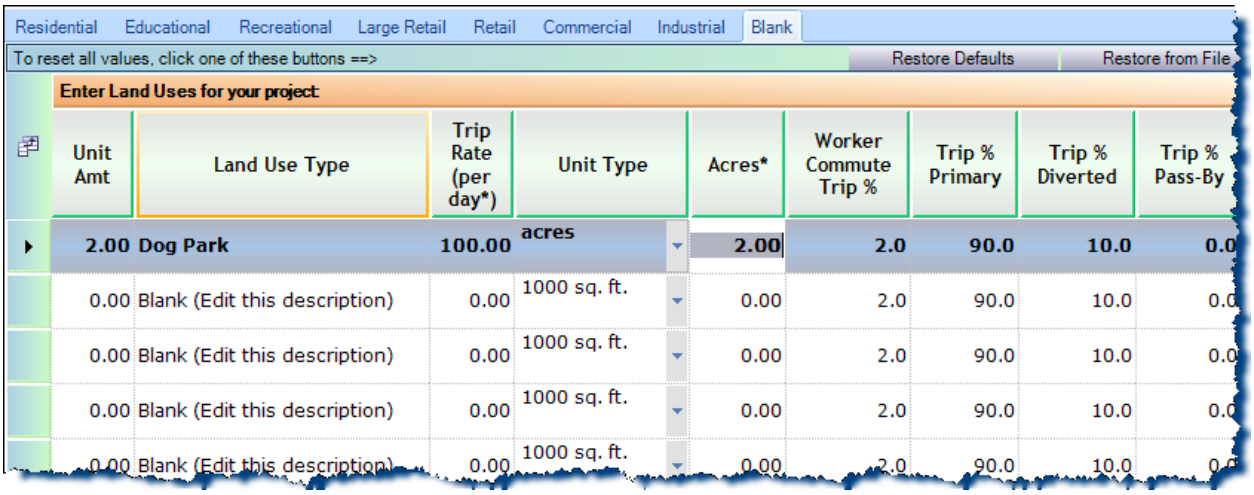

Figure 14. Sample Blank Screen Entry

Table 1 lists each of the URBEMIS2007 land uses, provides a definition of each land use, and shows the percentage of worker commute trips associated with each land use. Those percentages are called Percent Worker Commute in Table 1.

For each land use type, you are given the option of entering the project size or unit amount. For all land uses, URBEMIS2007 automatically calculates the acreage associated with that land use type and the trip rate based on the unit amount. The user can and should modify the acreage for a project if it differs from the default values used by URBEMIS. For residential projects, changing the project acreage will, however, also change the trip rate using the procedure described in Appendix D of this manual. For non-residential land uses, URBEMIS estimates acreage by assuming that acreage equals twice the building square footage. For residential land uses, URBEMIS assumes the following acreage:

- single family residential – 3 units per acre;
- low rise apartments and condos/townhouse units – 16 units per acre;
- mid rise apartments – 38 units per acre;
- high rise apartments – 62 units per acre;
- high rise condos – 64 units per acre;
- mobile home parks – 6 units per acre;
- congregate care (assisted living) – 16 units per acre.

The equation or value used to estimate trip generation is shown in Table 2. You can override the trip rate by typing in a different rate. For certain land uses, you also can select a different unit type by clicking on the "Unit Type" arrow.

For all non-residential land uses, you also have the option of modifying the default "% Worker Commute" value. This value represents the percentage of worker commute trips attracted to that land use as a percentage of all trips generated by that land use.

Table 1. Land Use Definitions and Percent Worker Commute

	Land Use Definition	Percent Worker Commute
First Land Use Screen: Residential		
Single Family Housing	Detached homes on individual lots	N/A
Apartments, Low Rise	Buildings with one to three floors	N/A
Apartments, Medium Rise	Buildings with four to ten floors	
Apartments, High Rise	Buildings with more than ten floors	N/A
Condo/Townhouse General	Condos and townhomes in buildings with one or two levels.	N/A
Condo/Townhouse High Rise	Condos and townhomes in buildings with 3 or more levels.	N/A
Mobile Home Park	Trailers sited and installed on permanent foundations.	N/A
Retirement Community	Self-contained villages restricted to adults or senior citizens	N/A
Congregate Care (Assisted Living) Facility	One or more multiunit buildings designed for elderly living and may contain dining rooms, medical, and recreational facilities.	N/A
Second Land Use Screen: Educational		
Day-Care Center	Facilities that care for pre-school children, normally during daytime hours. May also include after-school care for older children.	5
Elementary School	Generally includes Kindergarten through either 6th or 8th grades.	20
Junior High School	Includes 7th, 8th, and often 9th grades.	20
High School	Includes 10th, 11th, and 12th grades and oftentimes 9th grade.	10
Junior College (2 years)	Most have facilities separate from other land uses and exclusive access points and parking facilities.	5
University/College (4 years)	Four year and graduate educational institutions.	5
Library	Public or private facility, which houses books, and includes reading rooms and possibly meeting rooms.	5
Place of Worship	Building(s) providing public worship services.	3
Blank (Edit all 5 columns)	Blank commercial land use that can be entered by the URBEMIS2007 user.	2
Third Land Use Screen: Recreational		
City Park	Owned and operated by a city, these facilities can vary widely as to location, type, and number of facilities. May including boating, swimming, ball fields, camp sites, and picnic facilities.	
Racquet Club	Privately owned facilities with tennis, racquetball, and/or handball courts, exercise rooms, and/or swimming pools and/or weight rooms	5
Racquet/Health Club	Privately owned facilities with tennis, racquetball, and/or handball courts.	5
Quality Restaurant	Typically with customer turnover rates of at least one hour.	8
High Turnover (sit-down Restaurant)	Typically with high customer turnover rates of less than one hour.	5
Fast Food Restaurant with Drive Through	Includes fast food restaurants with drive through windows, such as McDonald's, Burger King, and Taco Bell.	5
Fast Food Restaurant without Drive Through	Includes fast food restaurants without drive through windows, such as McDonald's, Burger King, and Taco Bell.	5
Hotel	Place of lodging providing sleeping accommodations, restaurants, and meeting or convention facilities.	5
Motel	Place of lodging providing accommodations and often, a restaurant.	5
Fourth Land Use Screen: Large Retail		
Free-Standing Discount Store	Free-standing store with off-street parking, can be part of neighborhood shopping centers.	2
Free-Standing Discount Superstore	Same as free-standing discount store but also include full service grocery department under the same roof.	2
Discount Club	Discount/warehouse store whose shoppers pay a membership fee to take advantage of discounted prices.	2

	Land Use Definition	Percent Worker Commute
Regional Shopping Center	Integrated group of commercial establishments that are planned, developed, owned, and managed as a unit.	2
Electronics Superstore	Free-standing warehouse type facilities specializing in the sale of home and vehicle electronic merchandise, as well as TVs, compact disc and cassette tape players, cameras, radios, videos, and general electronic accessories.	2
Home Improvement Superstore	Free-standing warehouse type facilities specializing in lumber, tools, paint, lighting, wallpaper and paneling, kitchen and bathroom fixtures, lawn equipment, and garden plants and accessories.	2
Fifth Land Use Screen: Retail		
Strip Mall	Neighborhood store complexes with a variety of retail outlets.	2
Hardware/Paint Store	Stores selling general hardware items and/or paints and supplies.	2
Supermarket	Free-standing stores selling a complete assortment of food, food preparation and wrapping materials, and household cleaning and servicing items. May also contain money machines, photo centers, pharmacies, and video rental areas.	2
Convenience market (24 hour)	These markets sell convenience foods, newspapers, etc. and do not have gasoline pumps. (Trip generation rates with gas pumps is approximately 12% higher than without.	2
Convenience market with gas pumps	These markets sell convenience foods, newspapers, etc. and do have gasoline pumps.	2
Gasoline/Service Station	Excludes gasoline stations with convenience stores or car washes.	2
Sixth Land Use Screen: Commercial		
Bank (with drive-through)	Banks with one or more drive-up windows.	2
General Office Building	Houses multiple tenants in a location where affairs of businesses, commercial or industrial organizations or professional persons or firms are conducted.	35
Office Park	Contain general office buildings and related support services, arranged in a park- or campus-like setting.	48
Government Office Building	Individual building containing the entire function or simply one agency of a city, county, state, or federal government.	10
Government (Civic Center)	Group of government buildings connected with pedestrian walkways	10
Pharmacy/Drugstore with Drive Through	Retail facilities selling prescription and non-prescription drugs. Also typically sell cosmetics, toiletries, medications, stationary, personal care products, limited food products, and general merchandise. These facilities include a drive-through window.	2
Pharmacy/Drugstore without Drive Through	Retail facilities selling prescription and non-prescription drugs. Also typically sell cosmetics, toiletries, medications, stationary, personal care products, limited food products, and general merchandise. These facilities do not contain a drive-through window.	2
Medical Office Building	Includes both medical and dental office buildings that provide diagnoses and outpatient care. Generally operated by one or more private physicians or dentists.	7
Hospital	Any institution where medical or surgical care is give to non-ambulatory and ambulatory patients and overnight accommodations are provided.	25
Seventh Land Use Screen: Industrial		
Warehouse	Buildings devoted to the storage of materials, also include office and maintenance areas.	2
General Light Industry	Typical light industrial activities include: print plants, material testing labs, and assemblers of data processing equipment. They employ fewer than 500 persons and tend to be free-standing.	50
General Heavy Industry	Could also be categorized as manufacturing facilities. However, heavy industrial uses are limited to the production of large items.	90
Industrial Park	Contain a number of industrial or related facilities and are characterized by a mix of manufacturing, service, and warehouse facilities. May contain highly diversified facilities, a number of small businesses, or one or two dominant industries.	41.5
Manufacturing	Sites where the primary activity is the conversion of raw materials or parts into finished products. May also included associated office, warehouse, research, and other functions.	48

Percent worker commute represents the percentage of total trips that are work-related commute trips.

Table 2. URBEMIS2007 Trip Generation Rates

Land Use	Trip Generation Rate	Units *	Source
Single Family Housing	9.57	Dwelling Unit	ITE (210)
Apartment, Low Rise	6.9	Dwelling Unit	ITE (221)
Apartment, Mid Rise	5.76	Dwelling Unit	ITE (223)
Apartment, High Rise	5.29	Dwelling Unit	ITE (222)
Condominium/Townhouse, General	6.9	Dwelling Unit	ITE (230)
Condominium/Townhouse, High Rise	5.26	Dwelling Unit	ITE (232)
Mobil Home Park	4.99	Dwelling Unit	ITE (240)
Retirement Community	3.71	Dwelling Unit	ITE (251)
Congregate Care (Assisted Living) Facility	2.02	Dwelling Unit	ITE (253)
Day-Care Center	79.3	1000 sq. ft.	ITE (565)
Elementary School	14.49	1000 sq. ft.	ITE (520)
Elementary School	1.29	Student	ITE (520)
Junior High School	13.78	1000 sq. ft.	ITE (522)
Junior High School	1.62	Student	ITE (522)
High School	12.89	1000 sq. ft.	ITE (530)
High School	1.71	Student	ITE (530)
Junior College (2 Years)	27.49	1000 sq. ft	ITE (540)
Junior College (2 Years)	1.2	Student	ITE (540)
University/College (4 Years)	2.38	Student	ITE (550)
Library	54	1000 sq. ft.	ITE (590)
Place of Worship	9.21	1000 sq. ft.	ITE (560)
City Park	1.59	Acre	ITE (411)
Racquet Club	14.03	1000 sq. ft.	ITE (491)
Racquetball/Health Club	32.93	1000 sq. ft.	ITE (492)
Quality Restaurant	89.95	1000 sq. ft.	ITE (931)
High-Turnover (Sit-Down) Restaurant	127.15	1000 sq. ft.	ITE (932)
Fast-Food Restaurant w/o Drive-Through Window	716	1000 sq. ft.	ITE (933)
Fast-Food Restaurant with Drive-Through Window	496.12	1000 sq. ft.	ITE (934)
Hotel	8.17	Rooms	ITE (310)
Motel	5.63	Rooms	ITE (320)
Free-Standing Discount Store	56.02	1000 sq. ft.	ITE (815)
Free-Standing Discount Superstore	49.21	1000 sq. ft.	ITE (813)
Discount Club	41.8	1000 sq. ft.	ITE (861)
Regional Shopping Center	42.94	1000 sq. ft.	ITE (820)
Electronics Superstore	45.04	1000 sq. ft.	ITE(863)
Home Improvement Superstore	29.8	1000 sq. ft.	ITE(862)
Strip Mall	42.94	1000 sq. ft.	ITE (820)
Hardware/Paint Store	51.29	1000 sq. ft	ITE(816)
Supermarket	102.24	1000 sq. ft.	ITE(850)
Convenience Market (24 hr.)	737.99	1000 sq. ft.	ITE (851)

Land Use	Trip Generation Rate	Units *	Source
Convenience Market with Gasoline Pumps	845.6	1000 sq. ft.	ITE (853)
Gasoline /Service Station	162.78	Fueling Positions	ITE (945)
Bank (with Drive-Through)	246.49	1000 sq. ft.	ITE (912)
General Office Building	3.32	1000 sq. ft.	ITE (710)
Office Park	11.42	1000 sq. ft.	ITE (750)
Government Office Building	68.93	1000 sq. ft.	ITE (730)
Government (Civic Center)	27.92	1000 sq. ft.	ITE (733)
Pharmacy/Drugstore without Drive Through	88.16	1000 sq. ft	ITE(880)
Pharmacy/Drugstore with Drive Through	90.06	1000 sq. ft	ITE(881)
Medical/Dental Office Building	36.13	1000 sq. ft.	ITE (720)
Hospital	17.57	1000 sq. ft.	ITE (610)
Hospital	11.81	Beds	ITE (610)
Warehouse	4.96	1000 sq. ft.	ITE(150)
General Light Industry	6.97	1000 sq. ft.	ITE (110)
General Light Industry	51.8	Acre	ITE (110)
General Light Industry	3.02	Employee	ITE (110)
General Heavy Industry	1.5	1000 sq. ft.	ITE (120)
General Heavy Industry	6.75	Acre	ITE (120)
Industrial Park	6.96	1000 sq. ft.	ITE (130)
Industrial Park	63.11	Acre	ITE (130)
Industrial Park	3.34	Employee	ITE (130)
Manufacturing	3.82	1000 sq. ft.	ITE (140)

Notes:

sq. ft. = Square Feet

All trip generation rates from ITE Trip Generation Rate Manual, 7th Edition.

* "Dwelling unit" is a residential housing unit (including 'single room occupancy' units and 'granny flats'). "Square feet" refers to the total floor area (on all levels) of buildings, but does not include parking structures even if they are within a building (also known as 'gross leasable area'). "Acres" refers to the gross surface of the entire site, including any structures, streets, sidewalks, parking, and landscaping (but not including building or parking lot floor areas above the first level).

Pass-by Trips

URBEMIS2007 allows users to select a pass-by trip option, which results in lower operational emissions. The pass-by trip option splits trips into percentages of primary, pass-by, and diverted-linked trips. Primary trips are trips made for the specific purpose of visiting the designated land use. The stop at that trip generator is the primary reason for the trip. Pass-by trips are trips made as intermediate stops on the way from an origin to a primary trip destination. Pass-by trips are attracted from traffic passing the site on an adjacent street that contains direct access to the generator. Diverted-linked trips are trips attracted from the traffic volume on roadways in the vicinity of the generator but which require a diversion from that roadway to another roadway to gain access to the site.

When the pass-by option is turned off, URBEMIS assumes all trips are primary trips. When pass-by is turned on, lower emissions result because a percentage of trips associated with each land use is assumed to be pass-by and diverted linked trips (see Table 3). Pass-by and diverted-linked trips have a lower trip distance than primary trips. URBEMIS assumes that pass-by trips result in virtually no

extra travel, with an assumed trip length of 0.1 miles. Diverted-linked trip lengths are assumed to equal 25% of the primary trip length.

As shown in Table 3, the "fast-food restaurant without drive-through window" land use consists of 50% primary trips, 40% diverted linked trips, and 10% pass-by trips. Assuming a trip length of 10 miles, emissions calculated using the pass-by trip option would be calculated by assuming that 50% of the trips would be 10 miles, 40% of the trips would be 2.5 miles, and 10% of the trips would be 0.1 miles.

Table 3. URBEMIS Land Uses Sorted by Category with Trip Percentages

Land Use	Land Use Category	Primary Trip (%)	Diverted Linked Trip (%)	Pass-By Trip (%)	Source
Single-Family Housing	Residential	85	10	5	Sandag 1996
Apartment, Low Rise	Residential	85	10	5	Sandag 1996
Apartment, High Rise	Residential	85	10	5	Sandag 1996
Condominium/Townhouse, General	Residential	85	10	5	Sandag 1996
Condominium/Townhouse, High Rise	Residential	85	10	5	Sandag 1996
Mobile Home Park	Residential	85	10	5	Sandag 1996
Retirement Community	Residential	85	10	5	Sandag 1996
Residential Planned Unit Development (PUD)	Residential	85	10	5	Sandag 1996
Congregate Care (Assisted Living) Facility	Residential	85	10	5	Sandag 1996
Day-Care Center	Educational	25	60	15	Sandag 1996
Elementary School	Educational	60	25	15	Sandag 1996
High School	Educational	75	20	5	Sandag 1996
Junior High School	Educational	65	25	10	Sandag 1996
Junior College (2 Years)	Educational	95	5	0	Sandag 1996
University/College (4 Years)	Educational	90	10	0	Sandag 1996
Library	Educational	45	45	10	Sandag 1996
Church	Educational	65	25	10	Sandag, 1996
City Park	Recreational	70	25	5	Sandag 1996
Racquet Club	Recreational	50	40	10	Sandag 1996
Racquetball/Health Club	Recreational	50	40	10	Sandag 1996
Quality Restaurant	Recreational	50	40	10	Sandag 1996
High-Turnover (Sit-Down) Restaurant	Recreational	30	40	30	ITE 1997
Fast-Food Restaurant without Drive-Through Window	Recreational	50	40	10	Sandag 1996
Fast-Food Restaurant with Drive-Through Window	Recreational	30	30	40	ITE 1997
Hotel	Recreational	60	35	5	Sandag 1996
Motel	Recreational	60	35	5	Sandag 1996
Free-Standing Discount Store	Large Retail	45	45	10	Sandag 1996
Free-Standing Discount Superstore	Large Retail	55	40	5	ITE 1997

Land Use	Land Use Category	Primary Trip (%)	Diverted Linked Trip (%)	Pass-By Trip (%)	Source
Discount Club	Large Retail	55	40	5	Sandag 1996
Regional Shopping Center	Large Retail	55	35	10	Sandag 1996
Electronics Superstore	Large Retail	45	40	15	Sandag 1996
Home Improvement Superstore	Large Retail	45	40	15	Sandag 1996
Strip Mall	Retail	45	40	15	Sandag 1996
Hardware/Paint Store	Retail	45	40	15	Sandag 1996
Supermarket	Retail	45	40	15	Sandag 1996
Convenience Market (24 hr.)	Retail	25	30	45	ITE 1997
Convenience Market (w/gas pumps)	Retail	25	30	45	ITE 1997
Gasoline/Service Station	Retail	20	40	40	ITE 1997
Bank (with Drive-Through)	Commercial	35	45	20	Sandag 1996
General Office Building	Commercial	75	20	5	Sandag 1996
Office Park	Commercial	80	15	5	Sandag 1996
Government Office Building	Commercial	50	35	15	Sandag 1996
Government (Civic Center)	Commercial	50	35	15	Sandag 1996
Pharmacy/Drugstore with Drive Through	Commercial	45	40	15	Sandag 1996
Pharmacy/Drugstore without Drive Through	Commercial	45	40	15	Sandag 1996
Medical Office Building	Commercial	60	30	10	Sandag 1996
Hospital	Commercial	75	25	0	Sandag 1996
Warehouse	Industrial	90	5	5	Sandag 1996
General Light Industry	Industrial	80	20	0	Sandag 1996
General Heavy Industry	Industrial	90	5	5	Sandag 1996
Industrial Park	Industrial	80	20	0	Sandag 1996
Manufacturing	Industrial	90	5	5	Sandag 1996

STEP 3: Enter Construction Data

The construction emissions portion of URBEMIS2007 has been substantially modified from previous versions. STEP 3 - Enter Construction Data represents the most complicated step within URBEMIS. This is primarily because construction phasing varies considerably from project to project.

The STEP 3: Enter Construction Data screen allows you to estimate area-source emissions for up to seven different types of construction phases. The emission factors and equations used by URBEMIS2007 to estimate construction emissions are described in detail in Appendix A.

When you enter URBEMIS, you can click on STEP 3 without either opening a project or entering land use data. If you then go to STEP 3, you will see the screen shown in the left half of Figure 15. That screen shows the seven construction phases allowed by URBEMIS. If you have opened an existing project, or started a new project, and have entered one or more land uses, you will see the right half of Figure 15 when you go to STEP 3. The only exception to this is for projects within the South Coast Air District, where all seven phases are assumed as part of the construction phase setup.

This list of generic phases and schedules should only be used if specific construction information is unavailable for the project in question.

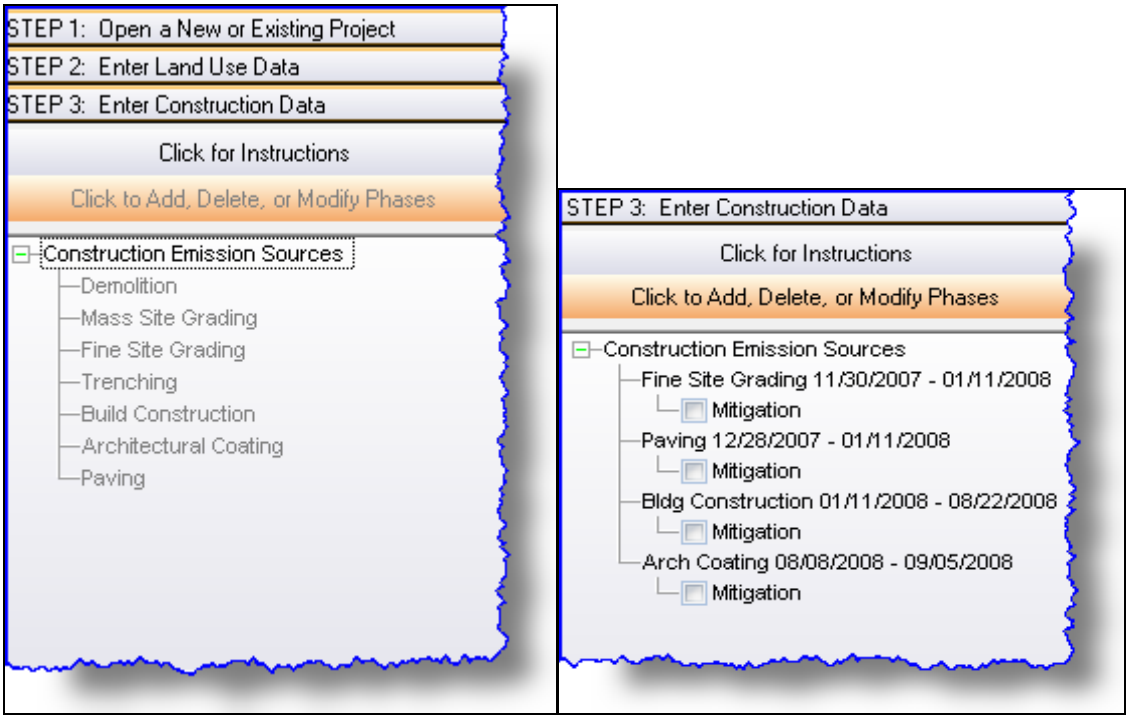

Figure 15. Construction Start Screens

Setting Up Construction Phases

The phases and schedules included in the generic construction phasing are as follows:

- Fine Site Grading,
- Asphalt,
- Building Construction, and
- Architectural Coatings.

These phases can be deleted or their phasing can be altered by clicking on the button: Click to Add, Delete, or Modify Phases (orange button just below the STEP3. Enter Construction Data button).

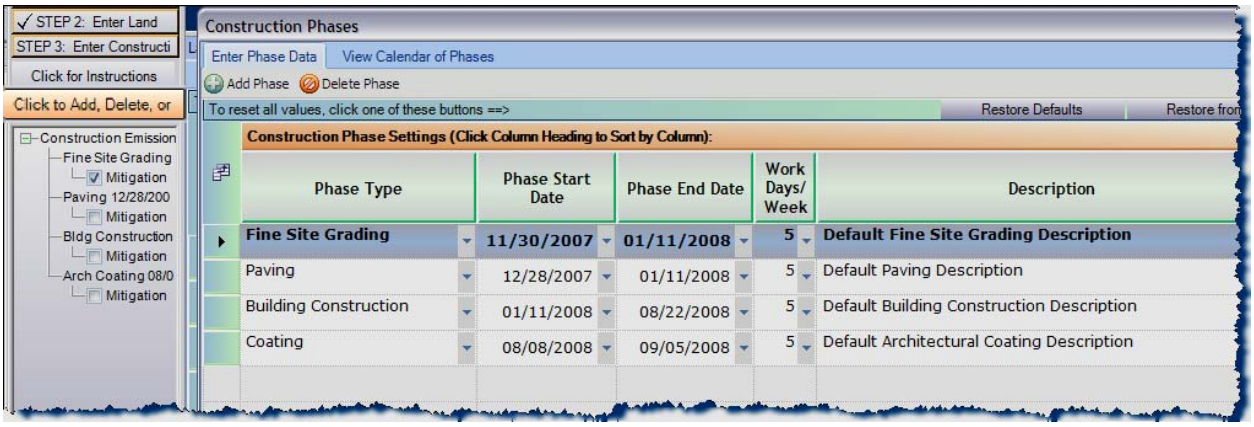

Figure 16. Adding, Deleting and Modifying Construction Phases

This will take you to a screen that allows you to add or delete phases. The seven types of phases that be included in URBEMIS are:

- Demolition,
- Mass Site Grading,
- Fine Site Grading,
- Trenching,
- Building Construction,
- Asphalt, and
- Coating (paints)

For each phase, you must identify construction phase settings that include phase type, start date, end date, work days/week, and a description. There is no limit to the number of phases that can be entered. More than one phase of any type can be entered. The only limitation is that phases of the same type must have a unique start date/end date pair. For any phase, the start and end dates must be on or after January 1, 2005 and the end date must be on or before December 31, 2040.

Phases can overlap, occur sequentially, or have time gaps between them.

As shown in Figure 16, a second tab allows you to View a Calendar of Phases. When you select that tab, you are shown a calendar (See Figure 17). This calendar shows all days that have any phase activity as bolded days. If you place your cursor over any bolded day, the number of phases occurring on that date are displayed, and if you click a day, the phases that occur on that day will be displayed in the box on the right.

Once you are satisfied that your project's construction phasing has been set up correctly, from within the Enter Phase Data tab click on the Done, Process these Changes Button. This will save your changes and display your project's phases in the left hand pane of STEP 3 (see Figure 18).

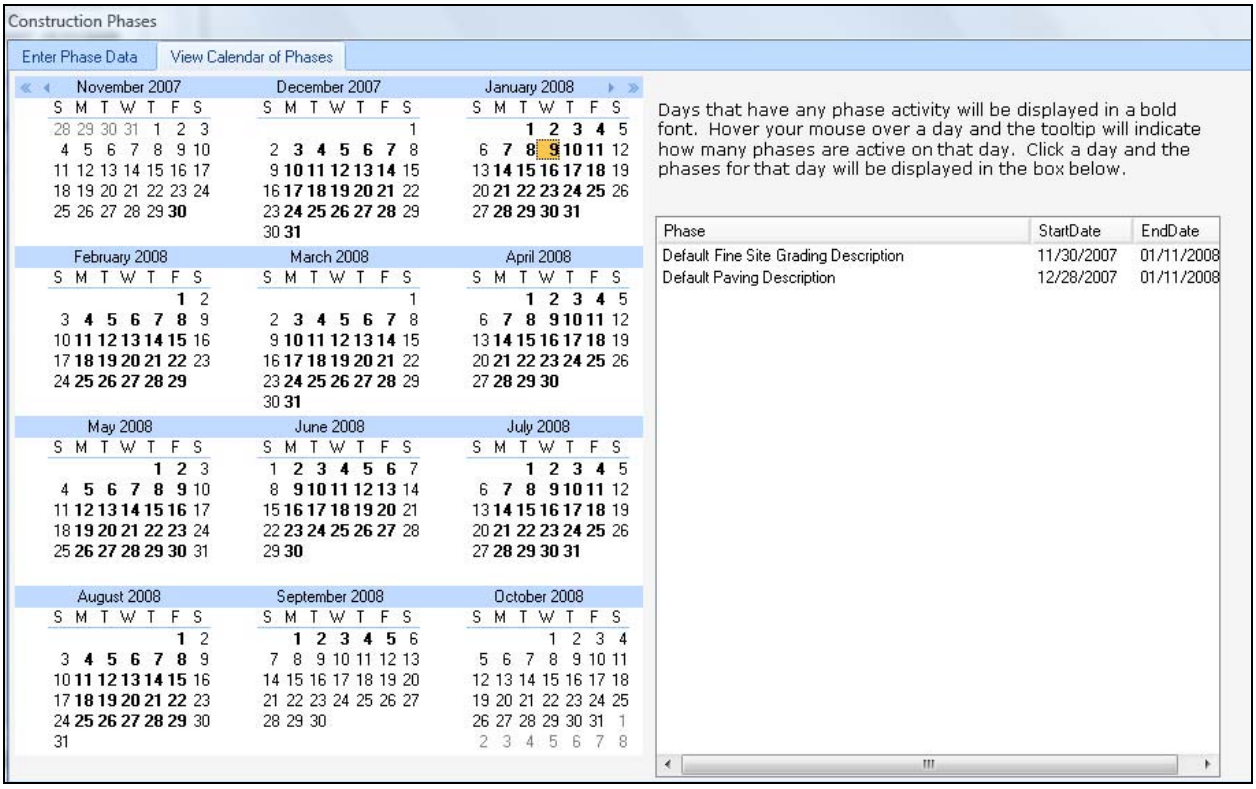

Figure 17. Construction Calendar of Phases

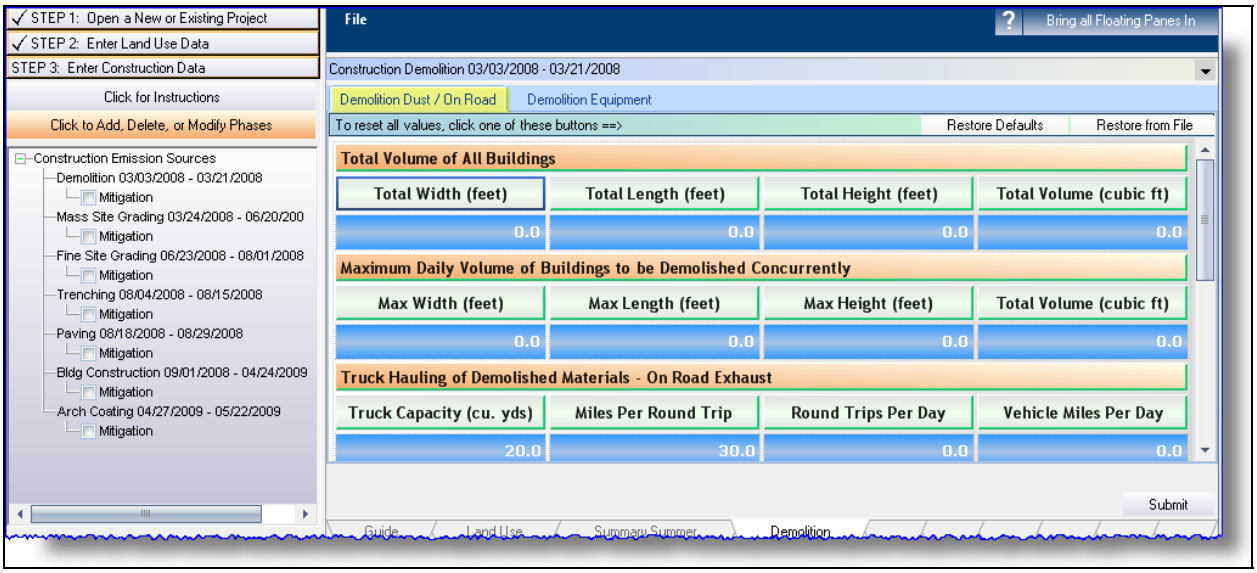

Figure 18. Seven Phase Example with Demolition Screen Showing

Demolition

Figure 18 shows the construction phasing in the left hand window pane. In this example, the demolition line has been selected, resulting in the first demolition tab being shown in the right hand pane. In this screen, the user is required to enter the volume of the building that will be demolished. URBEMIS then uses that information to estimate the amount of truck vehicle miles traveled needed to haul the demolished material away.

URBEMIS also generates estimates of the demolition equipment that would be needed to demolish the building. That estimate is based on the acreage of the demolition project. Figure 19 shows that URBEMIS estimates 3 excavators and 2 rubber tired dozers will be used in this demolition project. The user can change those values by entering different numbers in the column labeled Amt Model Uses (Click to Sort). For example, assume for your project that only 2 excavators and 2 rubber tired dozers would be used during demolition. You can enter the 2 in the third column. The user is cautioned, however, that URBEMIS will automatically override any values you enter if you change any land use values (STEP 2) unless you uncheck the box in the first column.

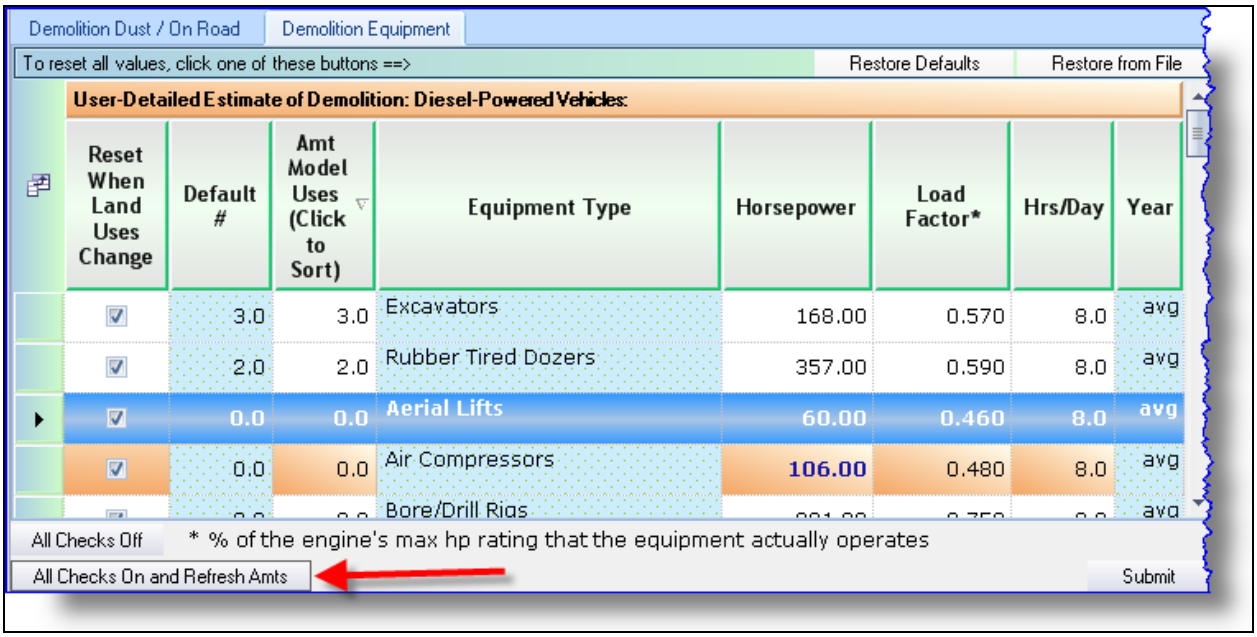

Figure 19. Demolition Equipment

Fine Site Grading

Figure 20 shows the first of the four tabs in the fine grading screen. This screen shows the acreage estimates that URBEMIS uses to estimate fugitive dust and fine site grading equipment emissions. The total acreage to be graded and maximum daily acreage disturbed estimates are shown at the bottom of the page.

URBEMIS uses the acreages entered in the residential and non-residential land use screens. For non-residential land uses, URBEMIS assumes that acreage is twice the size of the building square footage, unless the values are overridden by the user. URBEMIS also assumes that the maximum daily acreage disturbed is 25 percent of total acreage to be graded.

The user should change the maximum daily acreage disturbed value if they know that their project would have different values. The user should also be aware that if the maximum daily acreage disturbed value is changed, URBEMIS will reset that value whenever a land use is modified (STEP 2) unless the reset acreage with land use changes box has been unchecked (see arrow at bottom right of Figure 20).

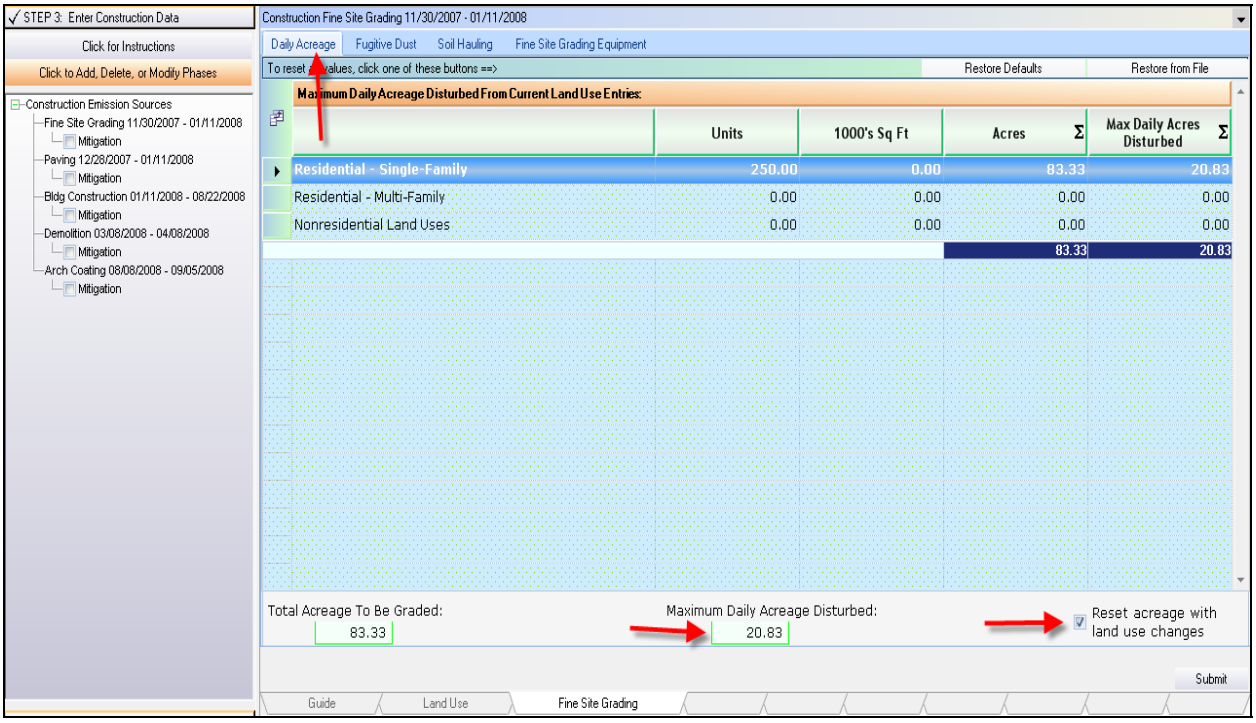

Figure 20. Construction Fine Grading

Figure 21 shows the Fine Site Grading tab. URBEMIS automatically estimates the number and type of construction equipment based on the maximum daily acreage disturbed (Daily Acreage tab). The amount of construction equipment the model uses can be overridden by the user. However, unless the box in column 1 is turned off, the amount of equipment entered by the user will change whenever the maximum daily acreage disturbed value changes. (See also Appendix H for the equipment list).

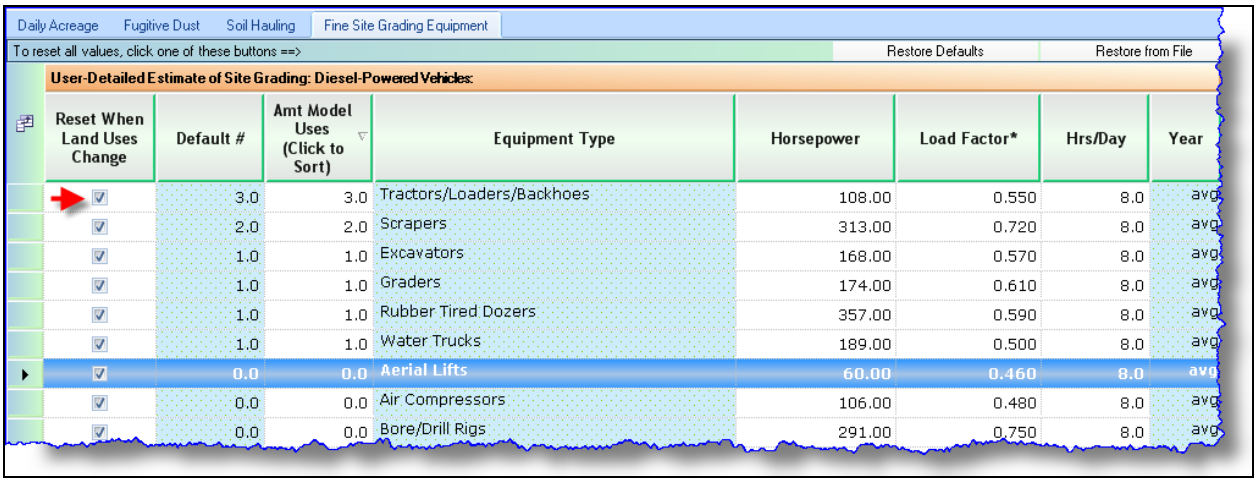

Figure 21. Fine Site Grading

Mass Site Grading

The mass site grading phase works identically to the fine site grading phase. Please refer to the fine site grading discussion above for more information.

Trenching

Trenching typically consists of digging trenches for installation of natural gas and water pipelines, and electric conduit. If trenching is selected as a phase, URBEMIS generates estimates of trenching equipment type and number based on the amount of disturbed acreage per day. URBEMIS uses 25% of the total project acreage (as entered on the land use screens) and determines the trenching equipment use based on the equipment values shown in Appendix H.

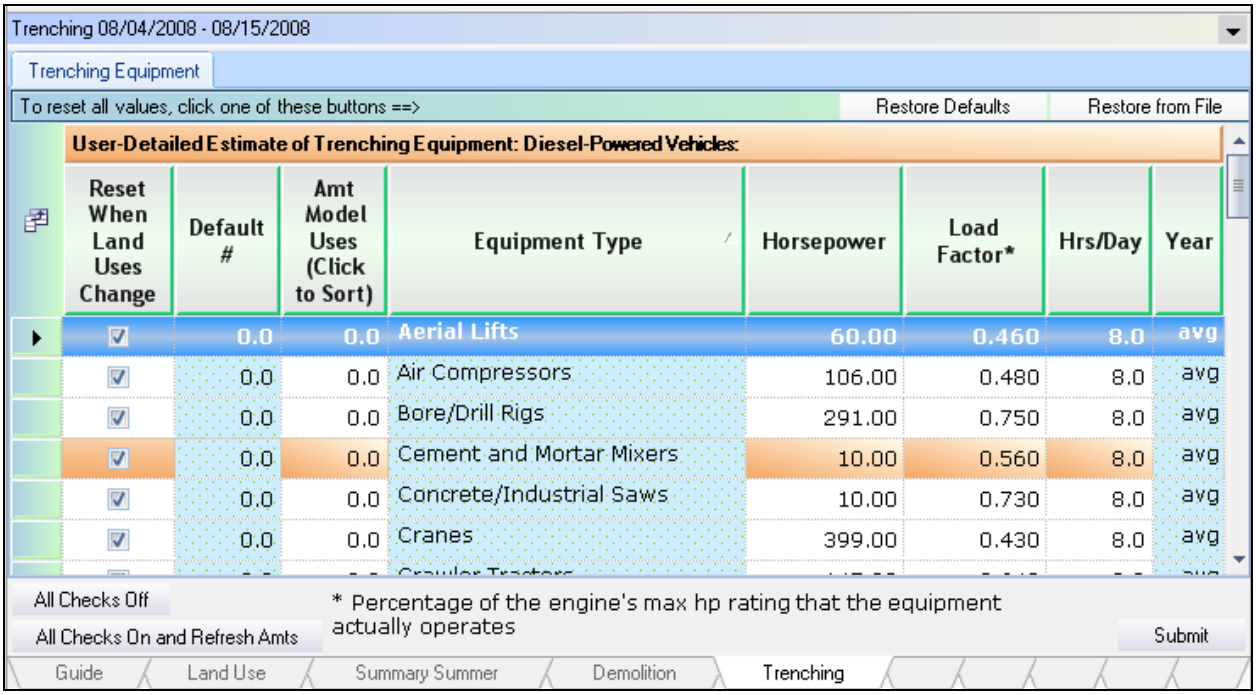

Figure 22. Trenching

Building Construction

Figure 23 shows the first tab of the building construction phase: worker trips. Two additional tabs are available, vendor trips and construction equipment. All of the values in each tab can be modified by the user. URBEMIS estimates on-road worker trips and vendor trips based on the values in these two tabs and on the land uses entered by the user.

URBEMIS uses 25% of the total project acreage (as entered on the land use screens) and determines the construction equipment use based on the equipment values shown in Appendix H.

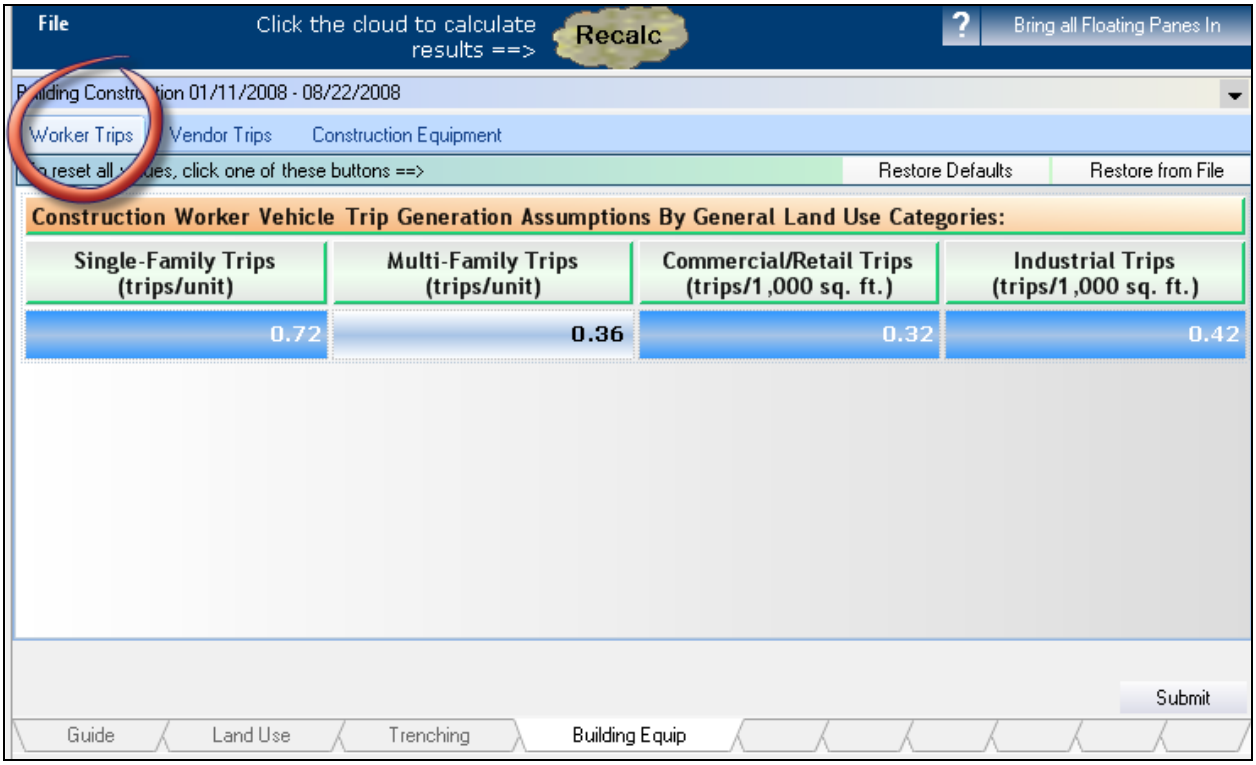

Figure 23. Building Construction

Asphalt

URBEMIS estimates asphalt emissions associated with asphalt off-gassing, asphalt off-road and on-road equipment, and worker trips. Figure 24 shows the first tab of the two asphalt paving tabs. Circled in red is URBEMIS' best estimate of the total acreage to be paved with asphalt. That value equals 25% of the total building project acreage. This value should be overridden if a more accurate, project-specific value is available. The user should understand that, to reset the default acreage, the "Reset Acreage with Land Use Changes" value box must be unchecked. Otherwise, URBEMIS will replace the user entered number with the URBEMIS generated number whenever land uses is modified.

The user can also select the Paving Equipment tab. URBEMIS will generate estimates of paving equipment based on total acreage to be paved. As with off-road construction equipment shown in other phases such as fine site grading, URBEMIS generates estimates of construction equipment that can be overridden by the user.

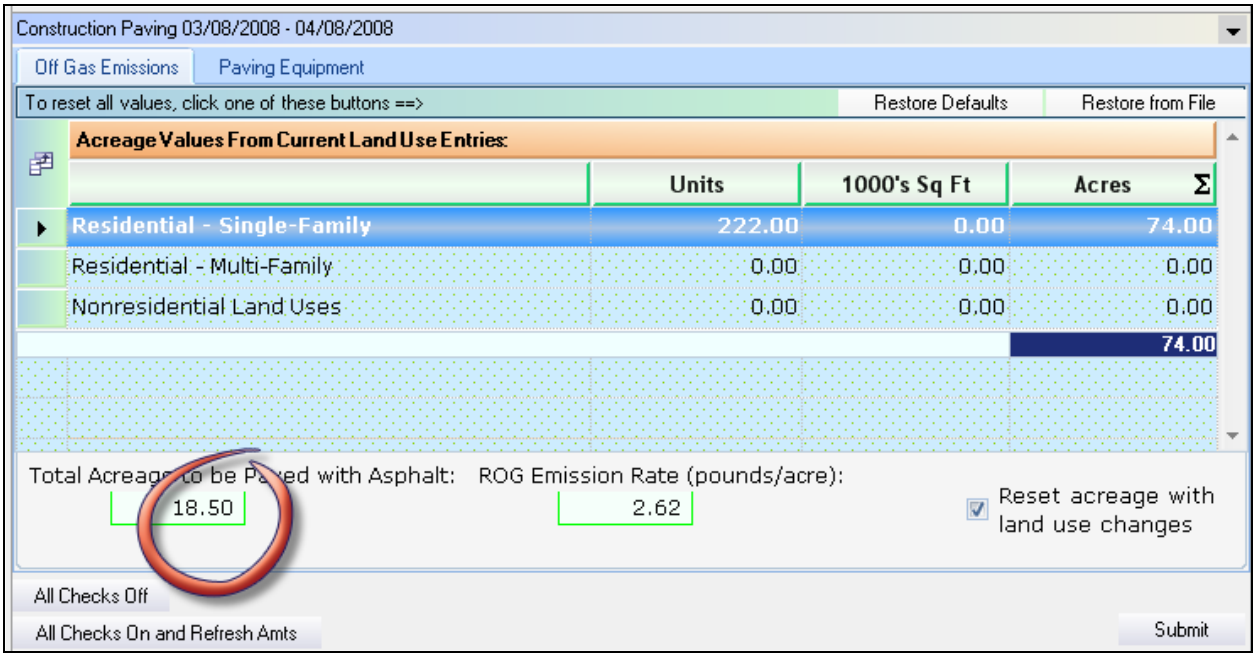

Figure 24. Asphalt Paving

Architectural Coating

When the user selects architectural coatings, the VOC content for each of four coating types are displayed. The VOC content is based on architectural coatings rules that have been developed by each air district. Consequently, they cannot be modified by the user.

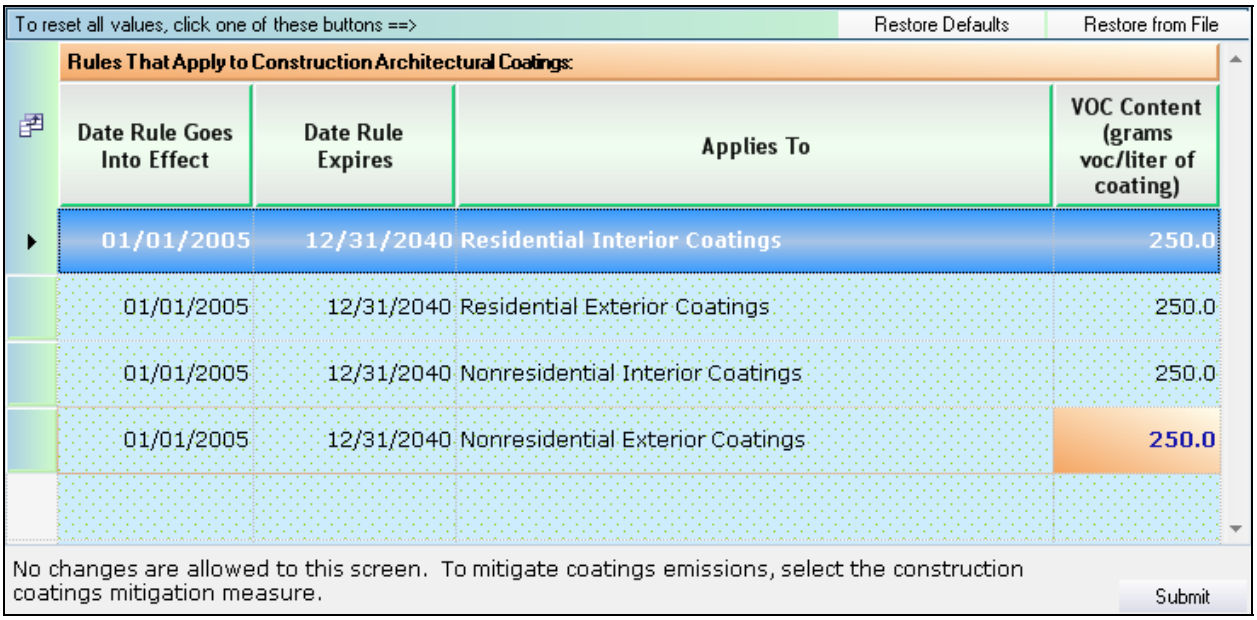

Figure 25. Architectural Coatings

Construction Mitigation Measures

Construction mitigation measures include measures to reduce fugitive dust and off-road construction emissions. URBEMIS2007 allows the user to identify specific mitigation measures for individual

classes of construction equipment. Figure 26 shows the mitigation measures that can be selected for fine site grading. In this example, the excavator line has been checked to show the types of mitigation measures allowed for excavators. The options include use of aqueous diesel fuel, diesel particulate filters, and diesel oxidation catalysts. The user needs to turn on each mitigation measure that applies. In addition, several of the mitigation measures have drop down boxes (arrow on far right in Figure 26) that allows the user to select the stringency of each mitigation measure.

Construction Equipment Exhaust

The mitigation measure shown in Figure 26 works in the same way for all construction phases that have off-road construction equipment, which includes six of the seven phase types (does not include architectural coatings). However, the mitigation measures must be selected separately for each phase.

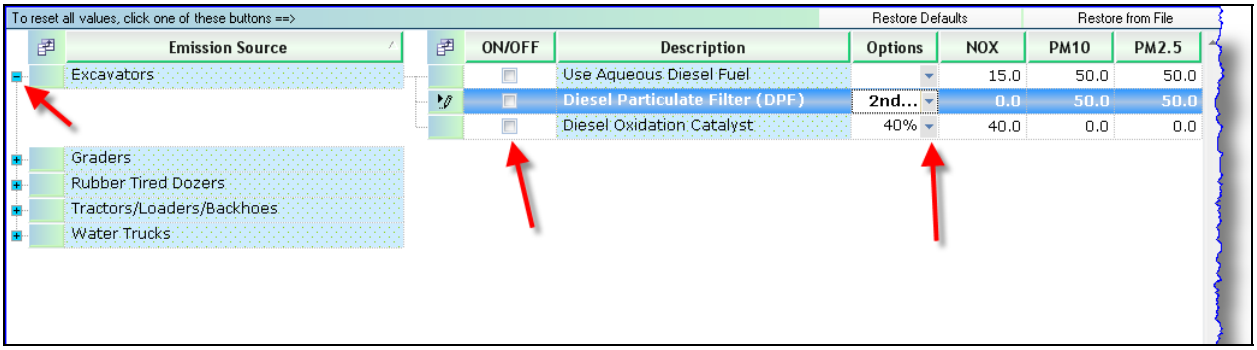

Figure 26. Construction Equipment Exhaust Mitigation Measures

Fugitive Dust Mitigation

Both fine and mass site grading also include methods to mitigated fugitive dust generated by travel on unpaved roads and by soil disturbance from off-road equipment operating on a construction site. To specify mitigation, the user needs to enter a check in on/off column for each mitigation measure that applies (see Figure 27). By clicking on the Unpaved Roads Mitigation tab, the user can also select those mitigation measures that apply.

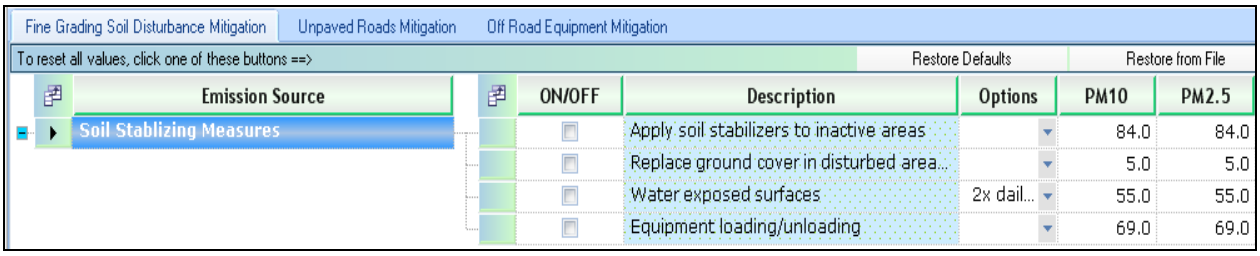

Figure 27. Soil Disturbance Mitigation

Figure 28 shows the architectural mitigation measures screen. The user simply turns on one or more of the four percentage reductions that apply. The user can also edit the ROG percent reduction.

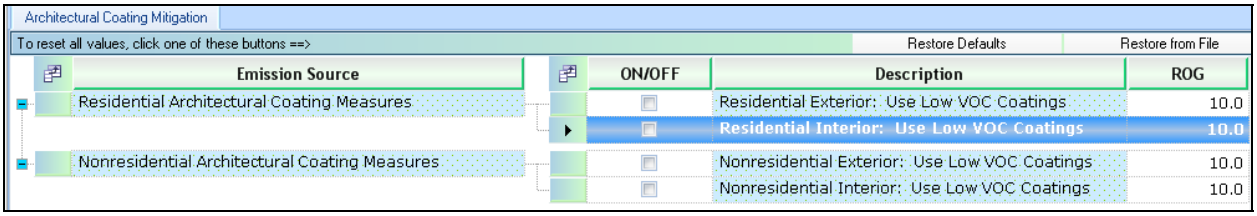

Figure 28. Architectural Coatings Mitigation

STEP 4 – Enter Area Source Data

The "Area-Source Emission" screen allows you to estimate area-source emissions for up to five categories of emission sources. Figure 29 lists those five categories in the left hand column. Three of these five categories are fuel combustion related: natural gas, hearths, and landscape maintenance. Two categories, consumer products and architectural coatings, consist of evaporative emissions. The emission factors and equations used by URBEMIS2007 to estimate area-source emissions are described in detail in Appendix B.

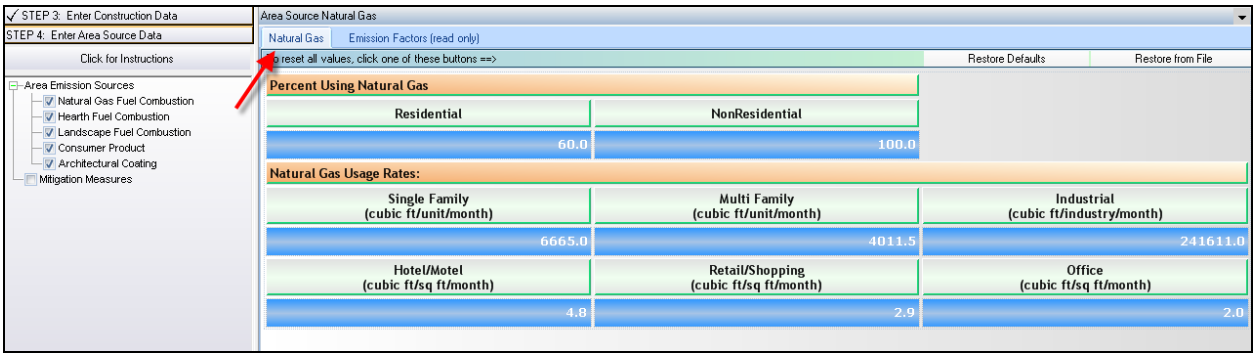

Figure 29. STEP 4 – Area Source Screen with Natural Gas Combustion Selected

Natural Gas Combustion

Figure 29 shows STEP 4 after the Natural Gas Fuel Combustion line has been selected in the left column. By double-clicking on the Natural Gas Fuel Combustion line, the screen on the right is presented. It shows the default values associated with this category. None of these values need be changed unless project specific information is available.

Hearth Fuel Combustion

Clicking on the second item in the left column, Hearth Fuel Combustion, results in the screen shown in Figure 30. URBEMIS shows the percentages of wood stoves, wood fireplaces, natural gas fireplaces associated with the project (assuming the project includes residential units). For projects that include no residential units, the Hearth Fuel Combustion category generates no emissions. The user can opt to change the percentages of the hearth categories, though they must total to 100 percent. (The user should also be aware that the hearth percentages screen looks slightly different for projects in the San Joaquin Valley. This is because the percentages are specified by the San Joaquin Valley Air Pollution Control District's wood fuel combustion rule.)

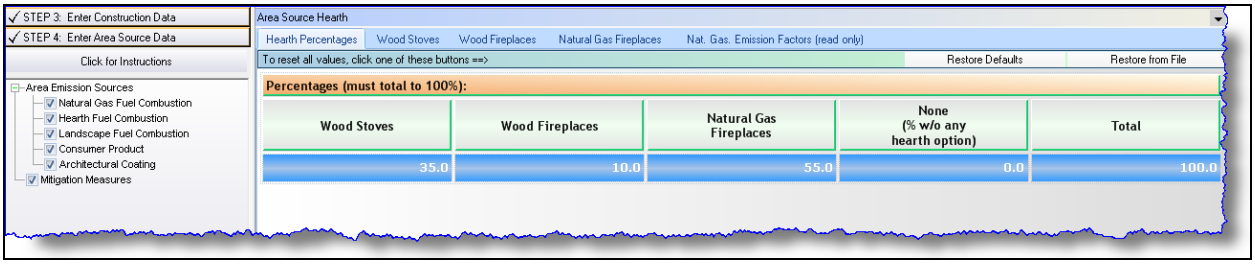

Figure 30. Area Source Hearth Fuel Combustion Screen

Wood Stoves

The Hearth Fuel Combustion category also includes additional tabs for wood stoves, wood fireplaces, natural gas fireplaces, and natural gas emission factors. Figure 31 shows the wood stoves tab. The screen shows emission factors (pounds of pollutant per ton fuel burned) by stove type, the percentage of each stove type assumed by URBEMIS, and, at the bottom of the screen, the amount of wood burned per stove each year, the number of days each stove is used, and pounds of wood per cord. All of these values except the emission factors can be modified by the user.

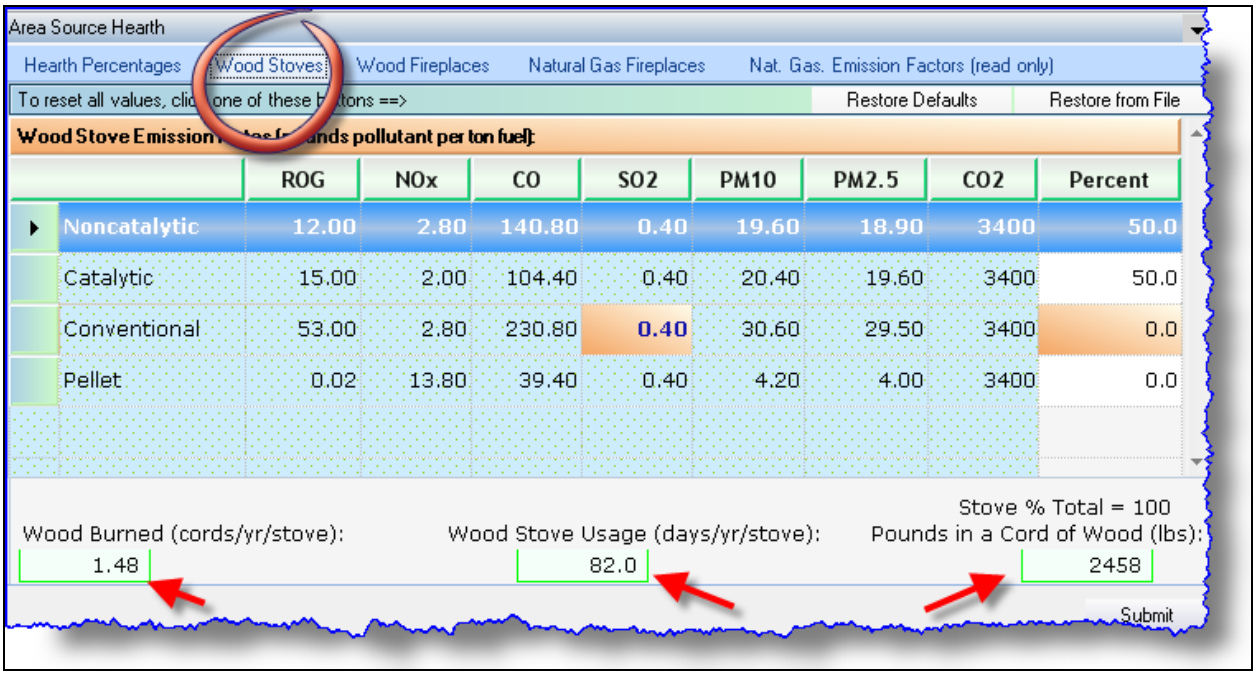

Figure 31. Wood Stoves Screen

Fireplaces

Figure 32 shows the wood fireplaces tab. It is similar to the wood stoves tab in that all of the values except the emission rates can be modified by the user. The user is cautioned about revising any of these values, however, because they represent defaults set by the individual air districts.

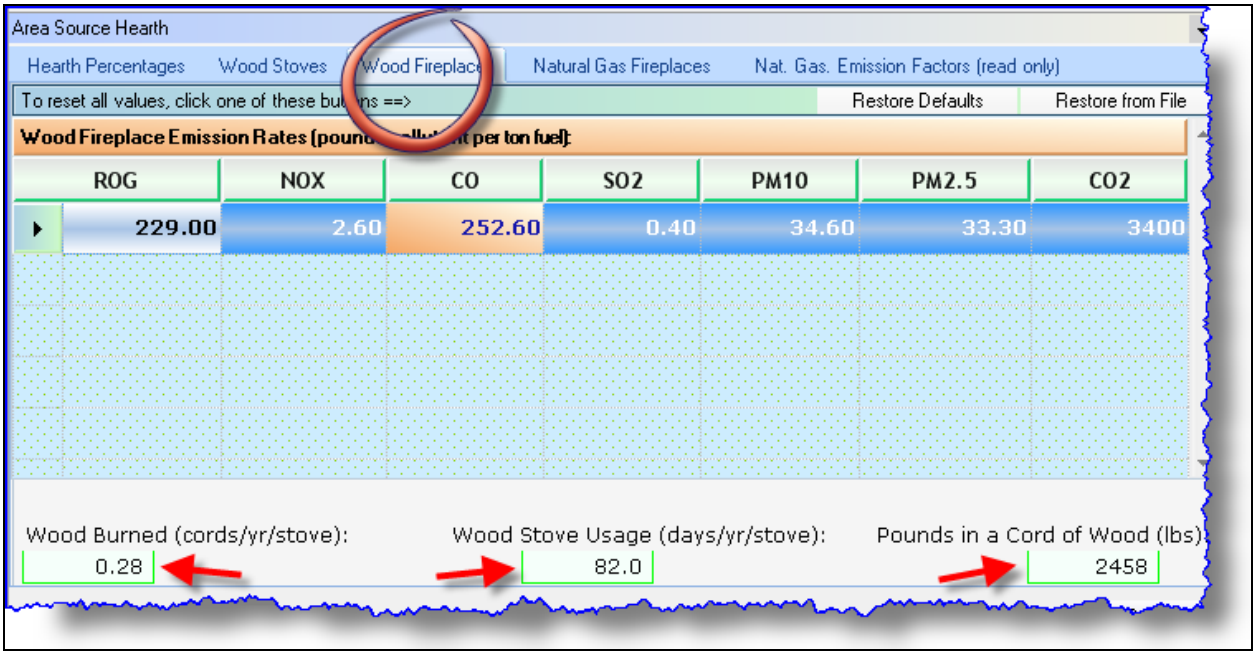

Figure 32. Wood Fireplace Screen

Natural Gas Fireplaces

Figure 33 shows the natural gas fireplace tab. This screen shows the default fireplace use information for single family and multi family fireplaces. These values can be modified by the user. The natural gas fireplace emission factors, which are in the fourth tab, cannot be modified by the user.

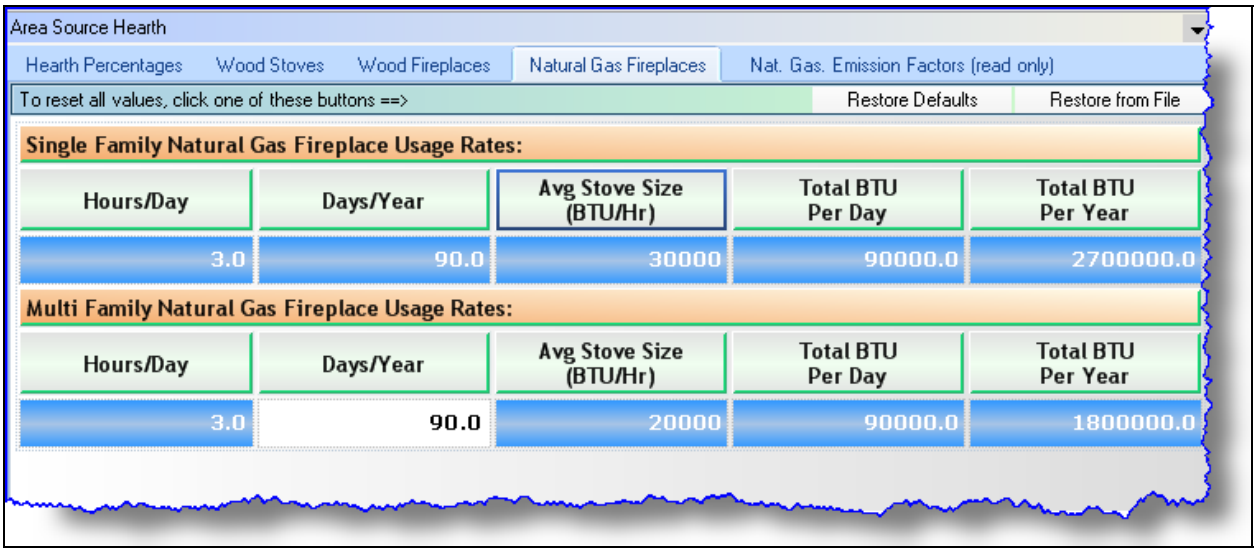

Figure 33. Natural Gas Fireplaces

Landscape Equipment Fuel Combustion

Figure 34 shows the screen when landscape equipment fuel combustion has been selected. Only one screen is available, which shows data for the length of the summer period and the year being analyzed. Landscape emissions can only be calculated for the summer period. Both of these values can be modified by the user. The year being analyzed should be consistent with the project's operational year.

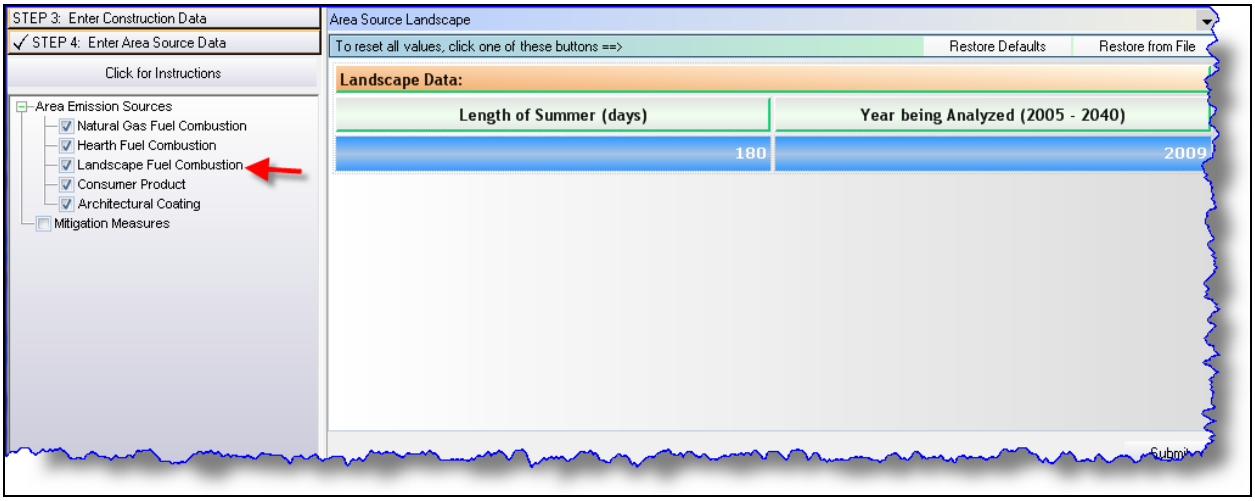

Figure 34. Landscape Fuel Combustion

Consumer Products

Figure 35 shows the consumer product screen. This screen includes the pounds of ROG emitted per person per day and the number of persons per residential unit. Consumer product emissions are only generated for residential land uses.

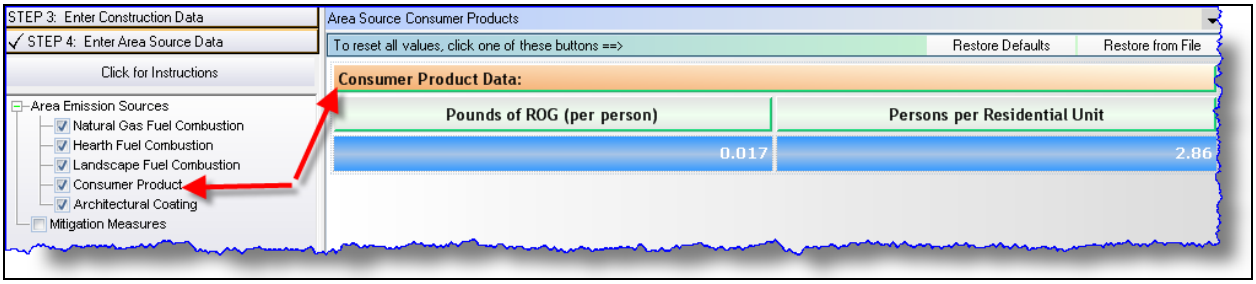

Figure 35. Consumer Products

Architectural Coatings

The last emission category for Step 4. Area Sources is architectural coatings. Architectural coatings is similar to architectural coatings included in construction (Phase 3), except that here a percentage of the buildings are assumed to be repainted each year. As a default, URBEMIS assumes 10% of residential and non-residential building surface area is repainted each year. These percentages can be modified by the user. The coatings rules upon which emission estimates are based, cannot be modified.

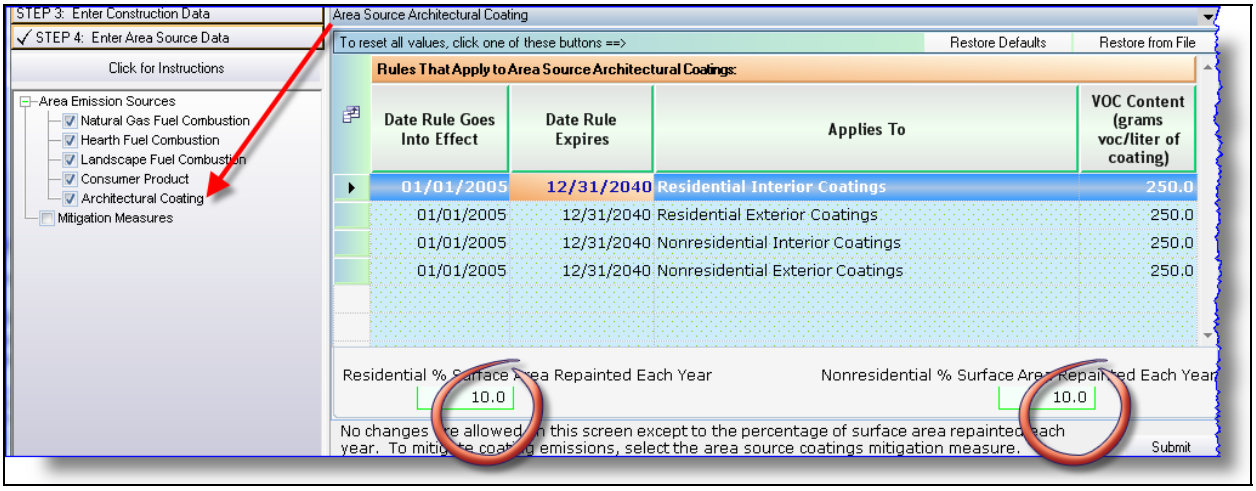

Figure 36. Architectural Coatings

Area-Source Mitigation Measures

From the "Area Source" main menu, you may select area-source mitigation measures by clicking the "Mitigation Measures" checkbox in the left pane list. This action forces URBEMIS2007 to display the area source mitigation measures in the right pane. The user can select one of three tabs in the right hand pane: Energy Efficiency, Landscape, or Architectural Coating. (A fourth tab for hearths is available for projects located within the San Joaquin Valley Air Basin.)

Energy Efficiency Mitigation

Figure 37 shows the Energy Efficiency tab. Users can turn on residential, commercial, and/or industrial energy efficiency mitigation and modify the % increase in efficiency.

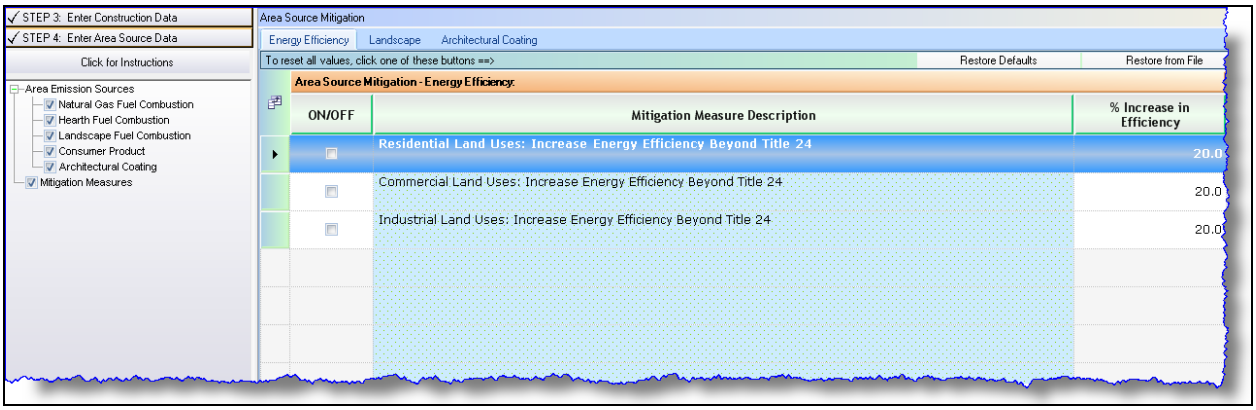

Figure 37. Energy Efficiency Mitigation Measures

Landscape Maintenance Equipment Mitigation

The second tab (see Figure 38) consists of landscape maintenance mitigation measures. Users can turn on the residential and/or commercial/industrial mitigation measures and alter the percentage of applicable equipment.

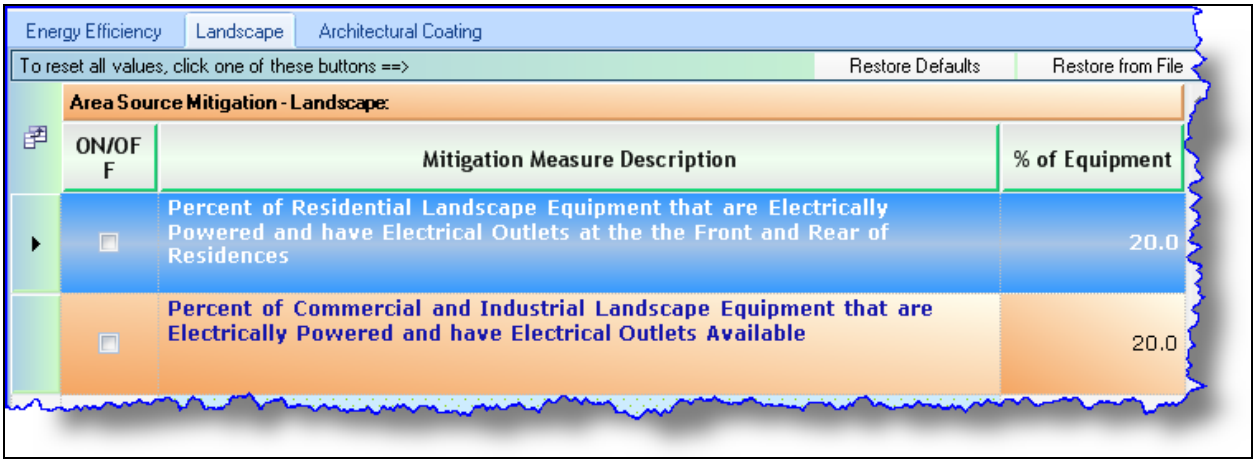

Figure 38. Landscape Mitigation Measures

Architectural Coatings Mitigation

Figure 39 shows the architectural coating mitigation tab. The user can select a % reduction of VOC for one or more of four coating types. The user can also modify the percentage reduction.

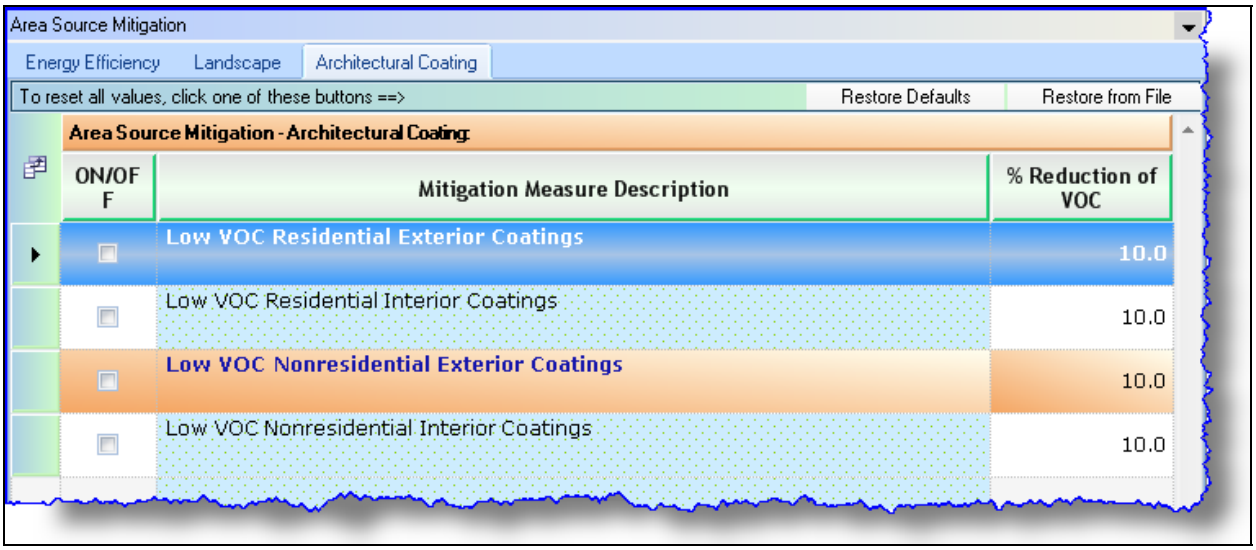

Figure 39. Architectural Coating

STEP 5 – Enter Operational Data

Step 5 involves entering operational data so as to generate estimates of on-road vehicle emissions. Figure 40 shows Step 5 in the left hand pane. Under Step 5, seven lines are listed under Operational Emission Sources, ignoring Mitigation Measures. Clicking on the first of those seven lines, Year & Vehicle Fleet, results in the screen shown on the right in Figure 40.

The user should be sure that the project start year is correct (see arrow in Figure 40). Changing the project start year also changes the fleet mix. URBEMIS uses the fleet mix information included in the EMFAC2007 files to generate the fleet mix estimates. For example, if the user changes the project start year to 2020 (and the project is in Los Angeles County), then URBEMIS goes to the 2020 Los Angeles County EMFAC file to obtain the average fleet mix for that location and year. For certain project types, the user may want to use a fleet mix that differs from the average vehicle fleet mix. For

example, a project may consist of an industrial land use with 80 percent heavy-heavy duty truck trips. In that situation, the user should click on the check mark to the right of the year. That check box reads "Keep Current Fleet Mix When Changing Years". If that check box is turned on, then URBEMIS will not update the fleet mix hat a user has entered if the user opts to change the year.

For each vehicle type, there are three fuel/technology classes: non-catalyst (gasoline), catalyst (gasoline), and diesel. Within the right pane, you can modify any of the fleet percentages or fuel/technology classes. The total fleet percentage must total to 100. Also, for each vehicle type, the three fuel/technology classes must subtotal to 100 percent.

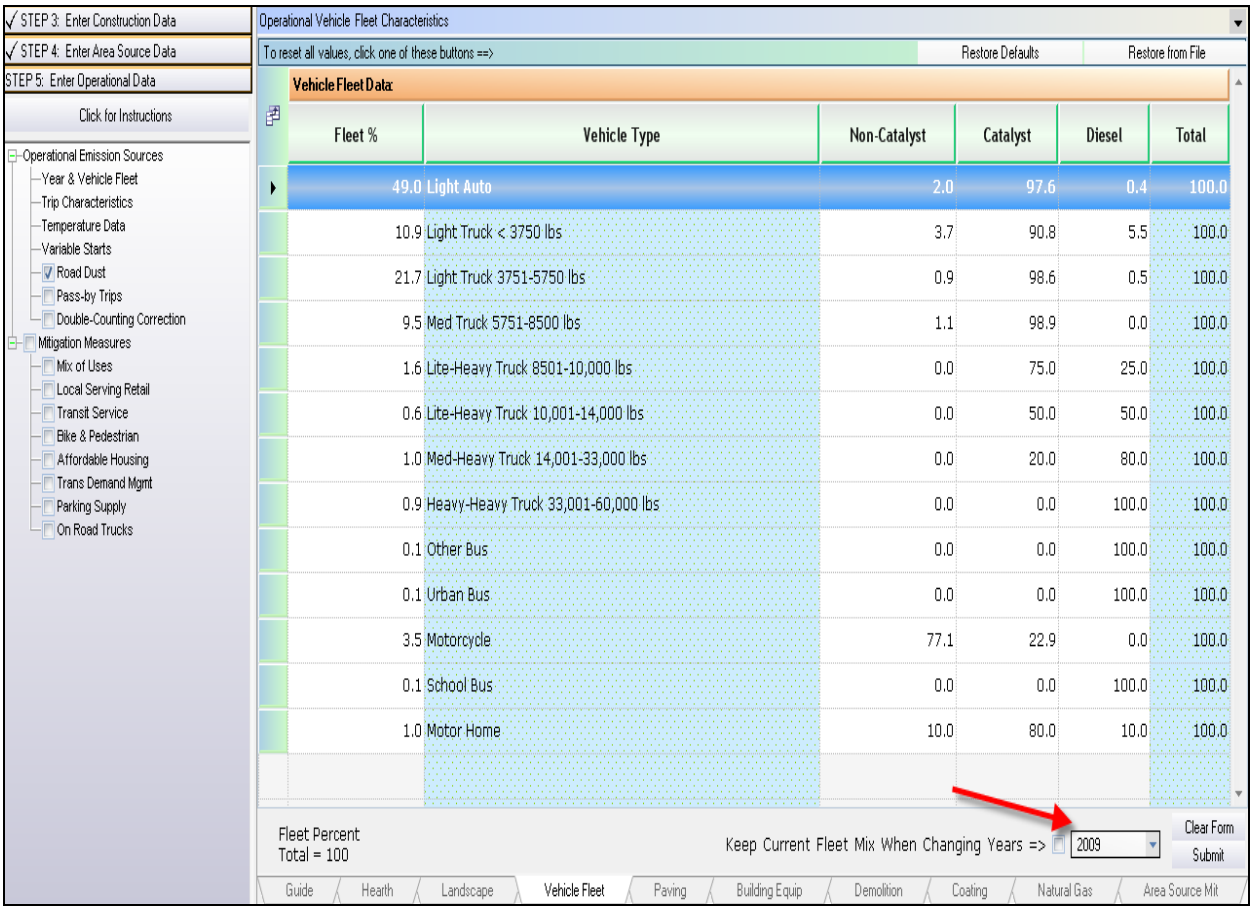

Figure 40. Operational Emissions Entry Screen

Trip Characteristics

The "Trip Characteristics" screen can be modified by clicking on the "Trip Characteristics Settings" node in the left pane. This action displays the trip characteristics in the right pane. Several pieces of information are contained in the "Trip Characteristics" screen: average trip speeds, trip percentages, and trip lengths for six different trip types (home-based work trips, home-based shopping trips, home-based other trips, work trips, commercial-based non-work trips, and commercial-based customer trips) (see Figure 41). The trip characteristics screen also includes an urban/rural project checkbox in the lower left hand corner. URBEMIS uses the urban trip lengths if the urban project check box is turned on, rural trip lengths if the rural project box is checked.

Note that the "Trip Characteristics" screen allows you to enter the trip percentages for home-based trips, which must total 100 percent. However, this same screen does not permit you to enter trip

percentages for commercial-based trips. Instead, commercial-based percentages are calculated separately by URBEMIS2007 for each nonresidential land use selected in the "Land Use" screens.

The "% Worker Commute" information from the land use screens corresponds to the commercial-based commute work trip value. The commercial-based commute trip percentage is then used to estimate commercial-based non commute work trip and customer based trip percentages for each land use. If the commercial-based commute trip value exceeds 50 percent, then the commercial-based non commute trip percentage equals 100 percent minus the commute trip percentage, multiplied by 50 percent. If the commercial-based commute trip value is less than 50 percent, then the commercial-based non commute trip percentage equals one half of the commercial-based commute trip value. Finally, for each land use, customer based trips are assumed to equal the 100 percent minus the total of the commercial commute and non commute percentages.

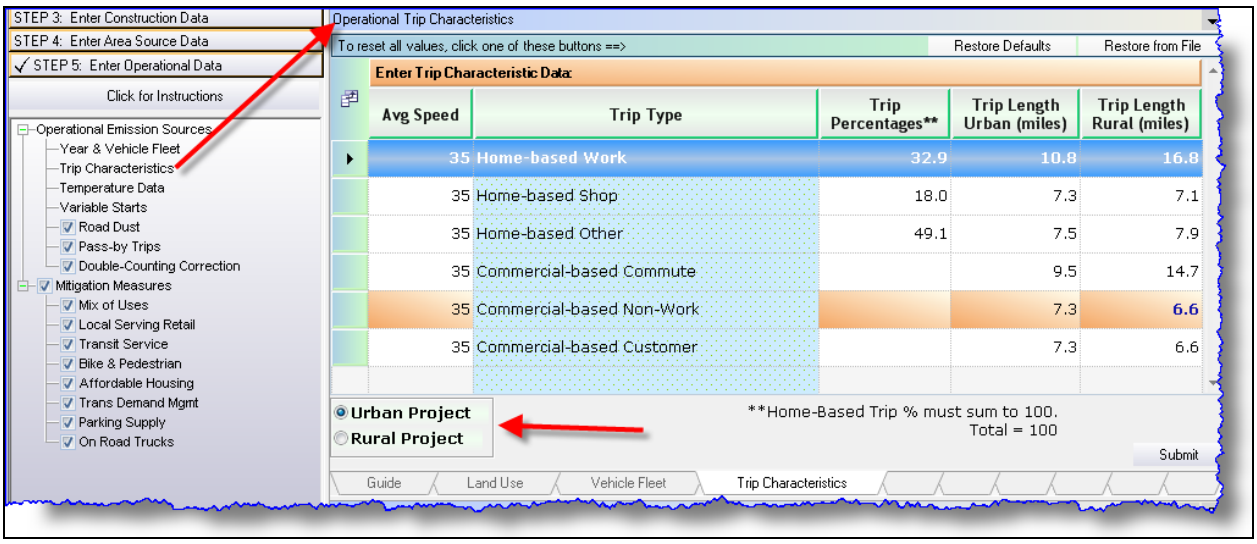

Figure 41. Trip Characteristics

Temperature Data

By clicking on the temperature data in the left pane, temperature options are presented in the right pane. You have the option of modifying both winter and summer ambient temperatures, which are used to estimate winter and summer emission estimates and which correspond to the summer versus winter gasoline specifications used in California outside of the South Coast Air Basin (greater Los Angeles).

Variable Starts

You may modify the "Variable Starts" information by clicking on the "Variable Starts" settings button shown in the left pane. This action causes URBEMIS2007 to display variable starts information in the right pane. That screen includes information on "Variable Start Percentages by Trip Type and Time since Engine Stopped". EMFAC2007 requires the vehicle engine shut-off percentages for 18 time increments, ranging from 5 minutes to 720 minutes. The information provided in this screen by trip type represents statewide averages of pre-start cool-down profiles from an ARB analysis of the 1991 California Department of Transportation household travel survey. These percentages should not be modified unless better information is available.

Road Dust

You may turn the Road Dust option on or off by clicking the check box in the left pane. This action will also display in the right pane information on "Entrained Road Dust Emissions". You have the option to modify the distribution of travel between paved and unpaved roads. You also have the option to modify the paved road or unpaved road defaults by clicking on the accompanying tabs.

If you click on the "Change Paved Road Defaults..." tab, you are taken to the "Paved Road Dust Emissions" screen. From within that screen, you may modify the default emission factors and percentage of travel for each of four road types.

You may also click on the "Change Unpaved Road Defaults" tab, where URBEMIS2007 will display the "Unpaved Road Dust Emissions" screen. From this screen, you can select either the U.S. EPA methodology for calculating emissions or you can use the California Air Resources Board's emission factor. If you select the U.S. EPA methodology, you are allowed to modify one or more of the five variables used to estimate unpaved road dust emissions.

Pass-by Trips

You may select the "Pass-By Trips" button from the left pane list. When you select "Pass-By Trips", no optional information is presented in the right pane. Selecting the "Pass-By Trips" button allows URBEMIS2007 to calculate emissions from vehicle trips that are generally lower than estimates without the pass-by trip option. The pass-by trip algorithm is described in Appendix C.

Double Counting

Another option available to URBEMIS2007 users is to adjust for double-counting.. The double-counting adjustment is designed to reduce double counting of internal trips between residential and nonresidential land uses. Consequently, selecting this option is available only when you have selected both residential and nonresidential land uses. You must click the check box in the left pane where URBEMIS2007 displays the "Double Counting Correction".

Then you are shown the number of residential and nonresidential trips that would be generated based on the land uses selected (see example in Figure 42). You are given the option of entering the number of internal trips between residential and nonresidential land uses. The value entered represents the number of internal trips that will not be included in the emissions estimate. This value can often be obtained from a traffic report prepared for the project.

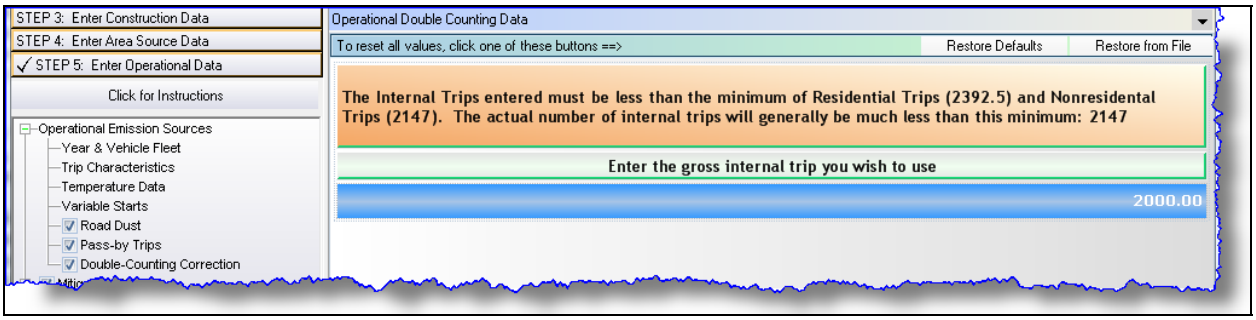

Figure 42. Double Counting Correction

Operational Mitigation Measures

Operational mitigation relies on a variety of smart growth measures that reduce the number of vehicle trips. From within STEP 5, you have the option of turning on operational mitigation measures by selecting one or more of eight optional "Mitigation Measures" options in the left pane (see Figure 43):

- Mix of uses
- Local serving retail
- Transit use
- Bike and pedestrian
- Affordable housing
- Transportation demand management
- Parking supply; and
- On-Road Trucks

Each of these is briefly described below. A much more detailed description is included in Appendix D.

Mix of Uses Mitigation

Figure 43 shows the Mix of Uses screen when the Mix of Uses line has been selected in the left hand pane. The following procedure is used to adjust trip generation rates as a function of the mix of land uses for any particular project.

Trip reduction = (1- (ABS (1.5 * h e) / (1.5 * h + e)) 0.25) / 0.25 * 0.03

Where: h = study area households (or housing units)
e = study area employment.

This formula assumes an "ideal" housing balance of 1.5 jobs per household and a baseline diversity of 0.25. The maximum possible reduction using this formula is 9%. Negative reductions of up to 3% can result when the housing to jobs ratio falls to levels less than the baseline diversity of 0.25. This reduction takes into account overall jobs-population balance.

The number of households or housing units and employment should be based on the area located within a 1/2 mile radius of the project's center.

In the example shown in Figure 43, the user has entered 500 residential uses located within ½ of the proposed project (which includes the 250 units from the project) and a study area employment of 750.

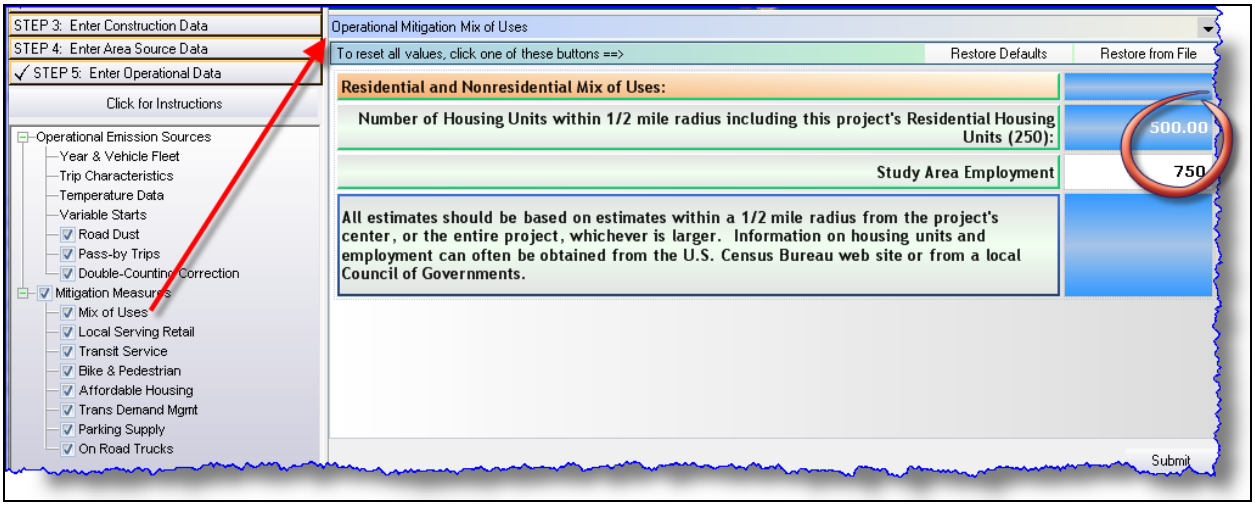

Figure 43. Mix of Uses Mitigation

Operational Local Serving Retail Mitigation

The presence of local serving retail can be expected to bring further trip reduction benefits, and an additional reduction of 2% is assumed. This is towards the lower end of the values presented in the research, in order to avoid double counting with the diversity indicator.

Operational Transit Mitigation

The Transit Service Index emphasizes frequency but with greater weighting given to rail services. Greater weight is also given to dedicated shuttles, in recognition of the fact that these are likely to be more closely targeted to the needs of the development. Information on transit availability and frequency can be obtained from transit agency maps and schedules.

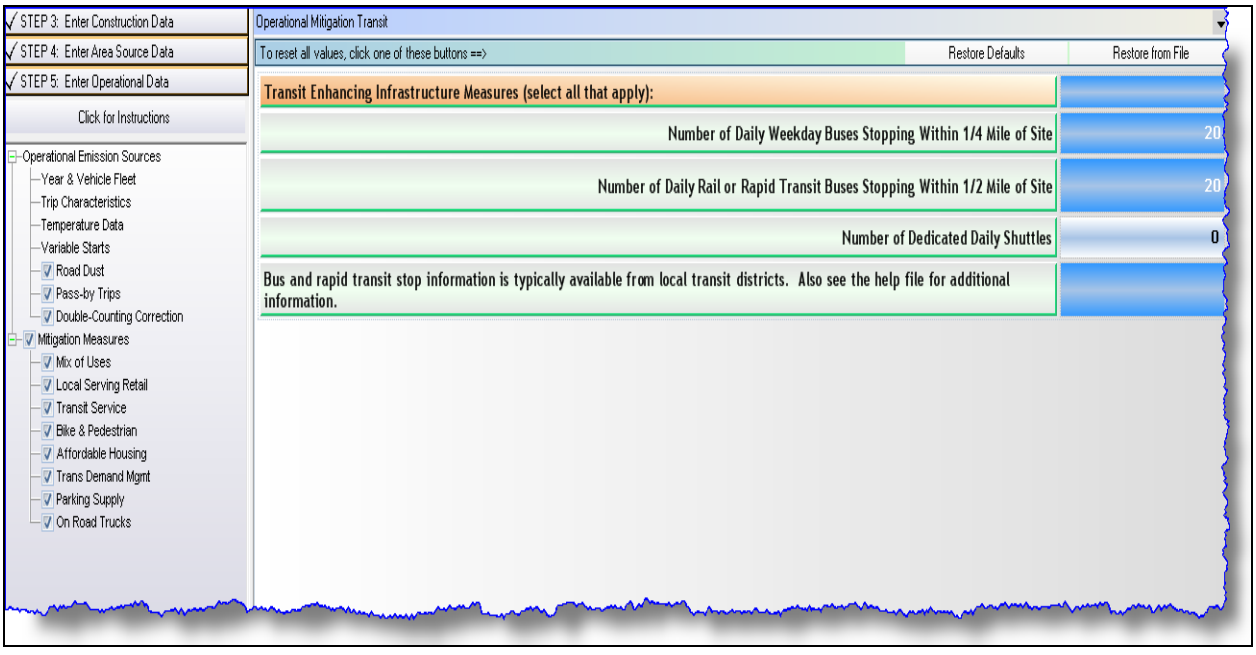

Figure 44. Transit Mitigation

The Transit Service Index is determined as follows:

- Number of average daily weekday buses stopping within 1/4 mile of the site; plus
- Twice the number of daily rail or bus rapid transit trips stopping within 1/2 mile of the site; plus
- Twice the number of dedicated daily shuttle trips;
- Divided by 900, the point at which the maximum benefits are assumed. (This equates to a BART station on a single line, plus four bus lines at 15-minute headways.)

Developments that are larger than 0.5 miles across in any direction must be broken into smaller units for purposes of determining the transit service index. The average of all units would then be used.

The figure shown below provides some examples of how service frequencies translate into Transit Service Index scores (note these are additive, if a location has more than one component).

Example Transit Service Index Scores

Transit Service	Score	Assumptions
BART (single line)	0.33	150 trips per day (15-20 minute headways in each direction from 4 AM-12 AM)
15-minute bus	0.17	4 buses per hour
30-minute bus	0.06	2 buses per hour
Amtrak San Joaquin	0.03	6 trips per day in each direction
Dedicated commute shuttle	0.02	5 trips per commute period (single direction)

As well as existing service, planned and funded transit service should be included in the calculation. Purely demand responsive service should not be included. A maximum trip reduction of 15% is assumed.

To account for non-motorized access to transit, half the reduction is dependent on the pedestrian/bicycle friendliness score. This ensures that places with good pedestrian and bicycle access to transit are rewarded.

Trip reduction = t * 0.075+ t * ped/bike score * 0.075

Where: t = transit service index

Operational Bike and Pedestrian Mitigation

Figure 45 shows the bike and pedestrian mitigation screen. The user must enter information on the project's number of intersections per square mile, the percent of streets with sidewalks on one or both sides, and the percent of arterials/collectors with bike lanes.

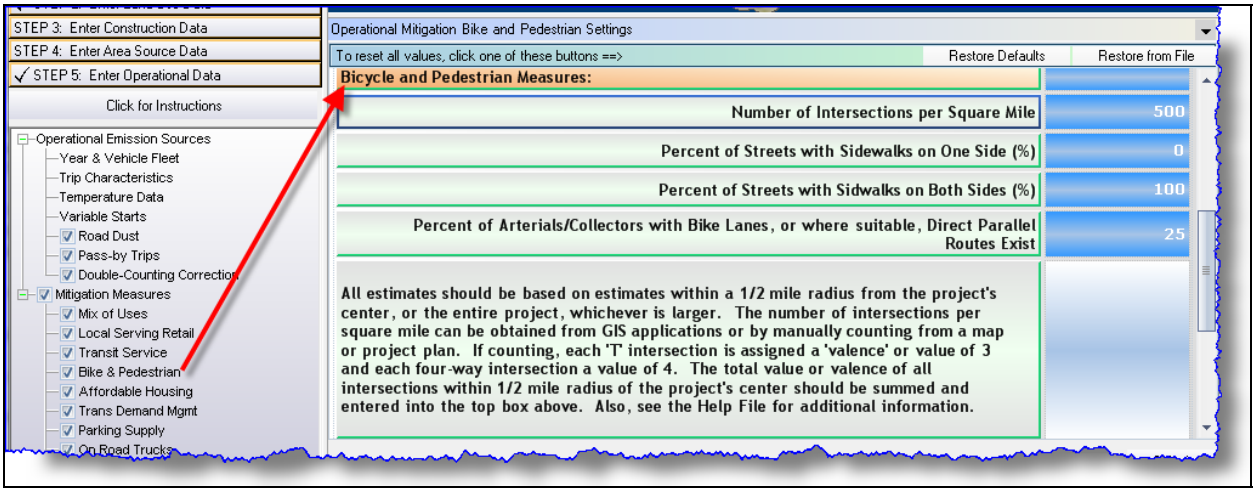

Figure 45. Bike and Pedestrian Mitigation

The pedestrian/bicycle factor is calculated as follows:

Ped/bike factor = (network density + sidewalk completeness + bike lane completeness) / 3

Where: Network density = intersections [sum of valences] per square mile / 1300 (or 1.0, whichever is less)

Note: In most GIS applications, intersections are counted based on the number of line segment terminations, or each "valence." Intersections have a valence of 3 or higher. A valence of 3 is a "T" intersection, 4 is a four-way intersection. Therefore, if intersections are counted manually on a map or project plan, care needs to be taken to distinguish between 3-, 4- and 5-way intersections, and factor them up accordingly. The 1,300 value roughly equates to a dense grid with four-way intersections every 300 feet. Intersections with dedicated routes for pedestrians and/or bicyclists should be included in this calculation.

Sidewalk completeness = % streets with sidewalks on both sides + 0.5 * % streets with sidewalk on one side

Bike lane completeness = % arterials and collectors with bicycle lanes, or where suitable, direct parallel routes exist

A maximum reduction of 9% is assumed. The trip reduction is calculated as:

Trip reduction = 9% * ped/bike factor

No reduction is allowed if the entire area within a half-mile walk of the project center consists of a single use. (Note that this applies to a half-mile walk, rather than straight-line distance, to account for barriers such as freeways.) However, the ped/bike factor can still be used to calculate pedestrian access to transit, as part of the transit mitigation measure.

Information on the number of intersections can be obtained from street plans or maps. Information on sidewalk completeness and bike lane completeness can be obtained from site observations or from

aerials such as those obtainable from http://terrraserver.microsoft.com or from Google's Google Earth software.

Operational Affordable Housing Mitigation

It is difficult if not impossible to account for the exact incomes of residents in URBEMIS, most obviously because the occupants are not known at the pre-development stage. However, the percentage of deed-restricted below-market-rate (BMR) housing does offer a way to incorporate this effect.

URBEMIS assumes a 4% reduction in vehicle trips for each deed-restricted BMR unit. Thus, the total reduction is as follows:

Trip reduction = % units that are BMR * 0.04

A development with 20% BMR units would thus gain a 0.8% reduction. A development with 100% BMR units would gain a 4% reduction.

Operational Transportation Demand Management

Figure 46 shows the first of three transit demand management screens: parking and transit passes. Figures 47 and 48 show the remaining two screens, telecommuting, and other transportation demand measures.

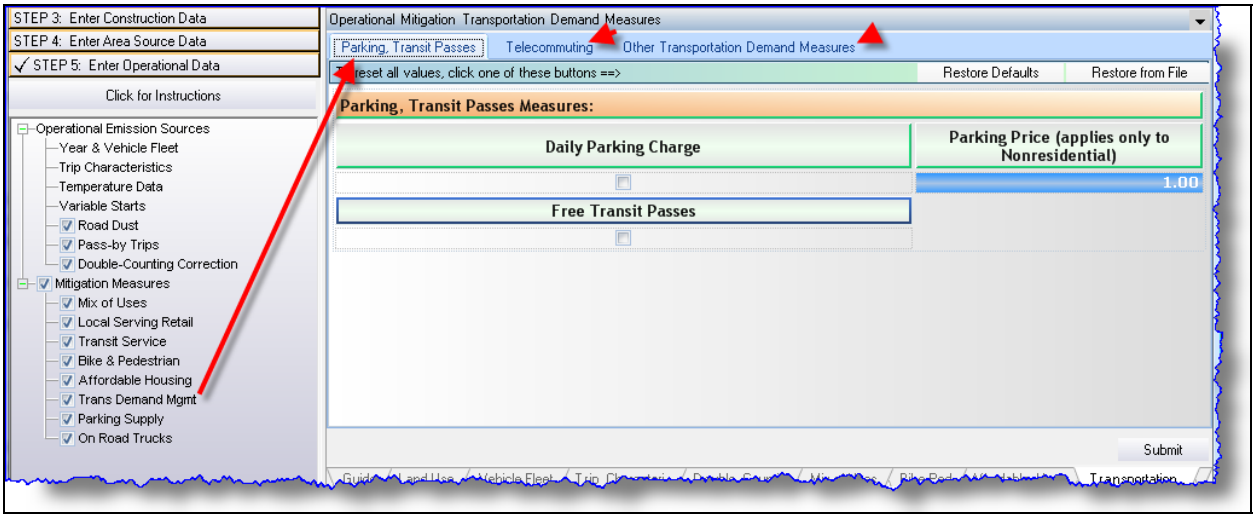

Figure 46. Transportation Demand Management

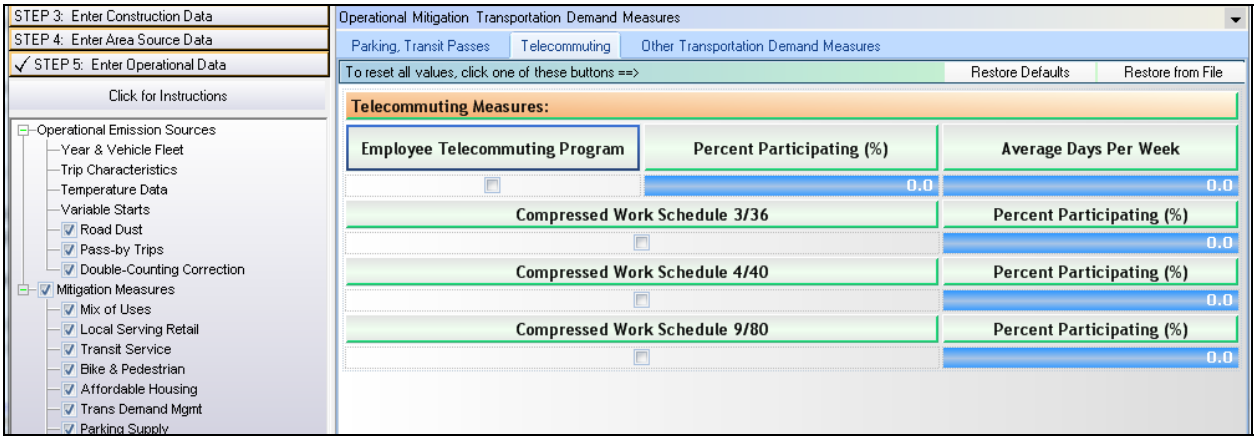

Figure 47. Transportation Demand Management – Telecommuting

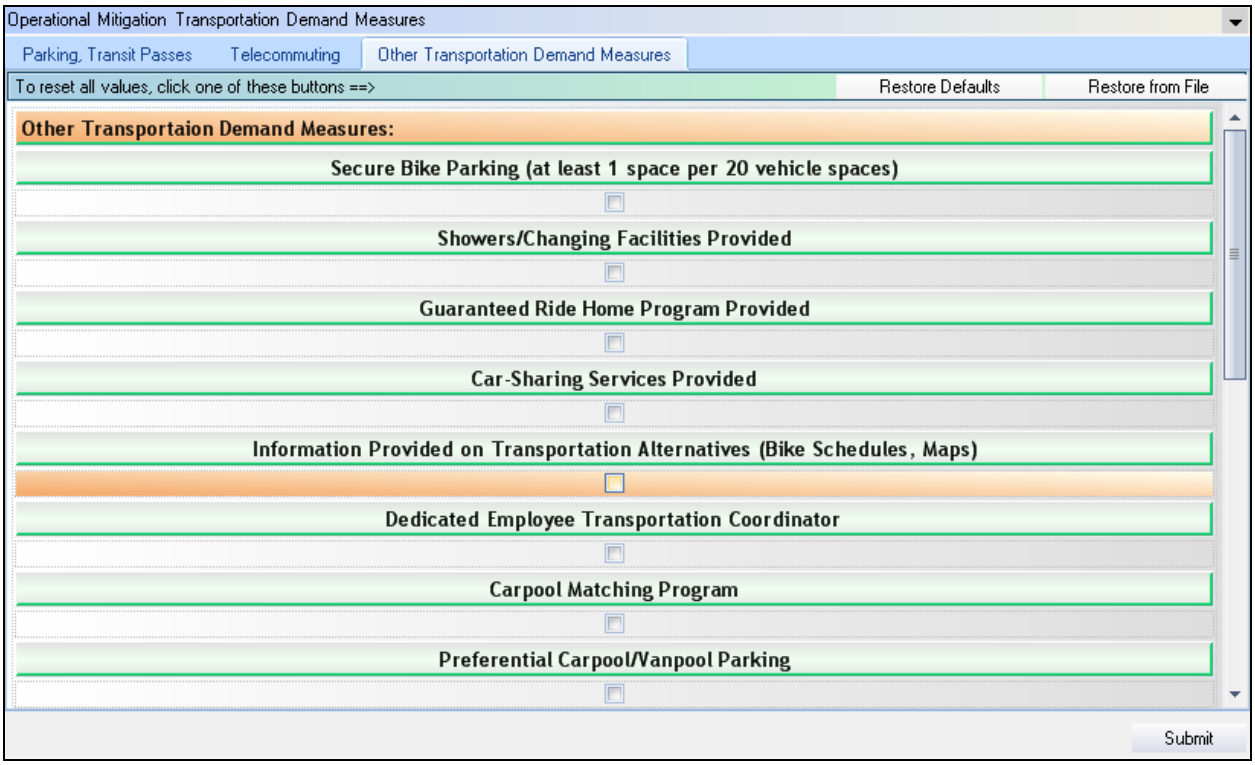

Figure 48. Transportation Demand Management – Other Transportation Demand Measures

Daily Parking Charge

URBEMIS assumes a maximum trip reduction of 25% for projects that commit to introducing parking pricing. The maximum reduction applies to prices of $6 per day or greater (in 2004 dollars).

The trip reduction will therefore be as follows:

Trip reduction = daily parking charge / 6 * 0.25

If the parking charge is more than $6, the 25% reduction is taken. If parking charges do not apply to all trips to a site (e.g. customers are exempt), the reduction is pro-rated by the percentage of trips that

the charges apply to. If little or no on-site parking is provided, the parking charges are applied to those of surrounding public facilities.

Free Transit Passes

Some California transit agencies, most notably VTA in Santa Clara County, have EcoPass or similar programs, whereby employers or property managers bulk-purchase transit passes for (free) distribution to their employees or tenants. Eco Pass programs have been shown to increase transit ridership by 50-79% and reduce vehicle trips by 19%. (Note that many of these new riders were making new trips, or ones previously made by walking or cycling.)

We therefore recommend that any project committing to providing free transit passes would receive an additional credit equivalent to 25% of the reduction granted for transit service. Thus, the credit is more valuable in places that have good transit service. This reduction only applies to the portion of trips generated by those granted the free transit passes (e.g. residents and/or employees, but excluding shoppers and other visitors).

Telecommuting

As with the reductions for other mitigation measures, there must be an enforceable commitment (e.g. development agreement) for telecommuting programs, which cover both the take-up rate (employees actually telecommuting or using compressed work schedules) as well as the provision of the option.

The percentage reduction is not additive (in contrast to most other trip reduction measures). For example, if 20% of employees telecommute, and other trip reduction measures are estimated to reduce vehicle trips from 1,000 to 800 per day, the 20% reduction is applied to the 800 trips, not the original 1,000.

Other TDMs

Other TDM program elements that do not include financial incentives tend to have a smaller impact on travel behavior. Trip and associated emission reductions for other TDMs selected within URBEMIS are based on the number of the following elements incorporated into the program.

- Secure bicycle parking (at least one space per 20 vehicle parking spaces)
- Showers/changing facilities
- Guaranteed Ride Home
- Car-sharing services
- Information on transportation alternatives, such as bus schedules and bike maps
- Dedicated employee transportation coordinator
- Carpool matching programs
- Preferential carpool/vanpool parking

The impact of a TDM program also depends on the travel alternatives available. A program will have more impact if the site is served by frequent transit, for example (although note that a TDM program can do much to promote carpooling even in other locations). For this reason, part of the TDM credit is used to adjust the credits granted for transit service and pedestrian/bicycle friendliness (see table below).

Recommended TDM Program Reductions

Level	Number of Elements	Trip Reduction
Major	At least 5 elements	2%, plus 10% of the credit for transit and pedestrian/bike friendliness
Minor	At least 3 elements	1%, plus 5% of the credit of transit and pedestrian/bike friendliness
No program	Less than 3	None

Operational Parking Supply Mitigation

The parking supply mitigation measure uses the Institute of Transportation Engineers Parking Generation, 3rd Edition handbook as the baseline. It applies only to non-residential land uses. The trip reduction is calculated as follows:

Trip reduction = 1- (Actual parking provision / (ITE Parking Generation rate * # units)

Since ITE parking generation rates use the same land use codes as the trip generation rates, URBEMIS calculates the ITE estimated values of parking demand. The user is only required to enter the actual parking provision for each land use.

The Parking Generation handbook covers most common land uses. For some land uses, however, no parking generation rates are available: in these cases, this particular mitigation measure may not be used. Those land uses without parking generation rates include:

- City Park
- Gas/Service Station

To avoid double counting with other trip reduction measures, the impacts of parking supply are assessed in conjunction with all other non-residential trip reduction measures as follows:

The total of all other non-residential trip reduction measures is used if this is greater than or equal to the trip reduction from parking supply measures. For example, if parking supply is reduced 10% from ITE levels, and transit, mixed use and pedestrian/bicycle trip reductions amount to 20%, the 20% figure is used.

If the total of all other non-residential trip reduction measures (r1) is less than the trip reduction from parking supply measures (r2), the total trip reduction is as follows:

r1 + 0.5 * (r2 - r1)

In effect, the parking supply reduction is only used if it is greater than the impact from other trip reduction measures, and the difference is discounted by 50%. For example, if parking supply is reduced 25% from ITE levels, and transit, mixed use and pedestrian/bicycle credits amount to 15%, the total reduction would be:

15 + 0.5 * (25-15) = 20%.

This reduction should only be granted if measures to control overspill are in place, such as Residential Permit Parking programs, time limits or meters.

Operational On-Road Truck Mitigation

For project applicants wishing to provide on-road mitigation for diesel trucks, the applicant has two choices.

The first choice requires that the user enter an estimate of the pounds per day and tons per year emission reductions associated with the project. This information will typically be provided as a result of consultation with the applicable air district. The district-approved emission reductions should be entered into the operational mitigation: on-road trucks screen.

The second choice requires that the user select a mitigation measure by diesel truck (or bus) fleet type category. This mitigation measure will only be applied to truck trips associated with non-residential land uses and only to the non-commute portion of those trips. Each mitigation measure has a specific emission reduction percentage applied to it. The user also has the option of entering their own mitigation and the associated emission reduction by pollutant class (ROG, NOx, CO, SO2, and PM10). The percentage reductions are only applied to the percentage of diesel vehicles within each truck class.

STEP 6 – View and Print Output

As mentioned earlier, to view and print output in Step 6, you do not need to proceed through each proceeding step. Instead, once you have entered one or more land uses, the Recalc button appears at the top of the screen (see Figure 49). This button, in the form of a dirty cloud, should be clicked to generate emission estimates. Once the Recalc button has been pressed, URBEMIS generates emission estimates that appear as part of Step 6 (see Figures 50 and 51).

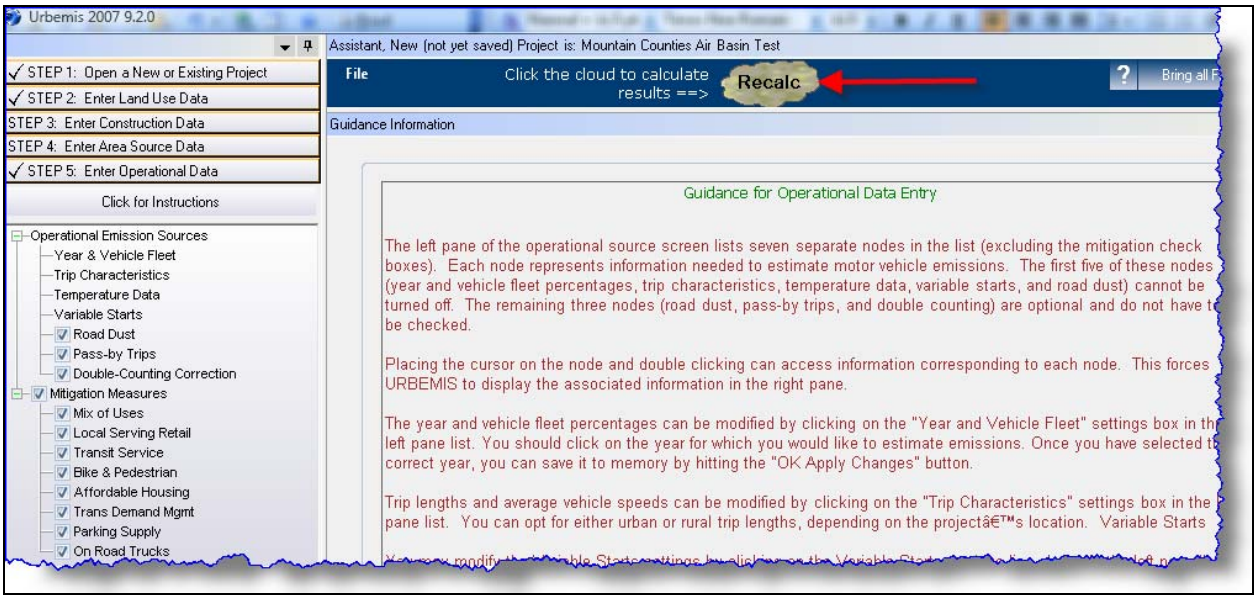

Figure 49. Recalc Button

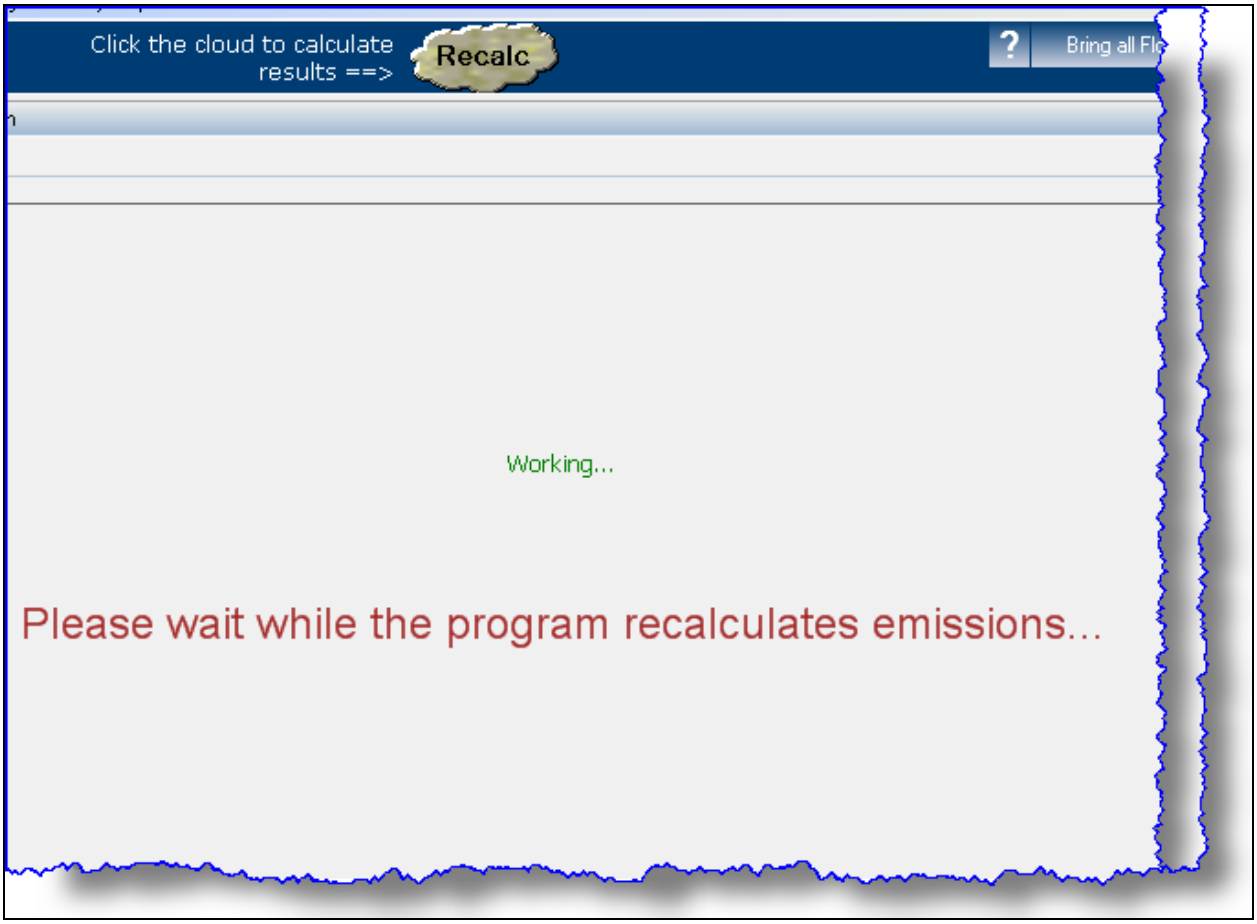

Figure 50. URBEMIS Recalculating After Recalc Pressed

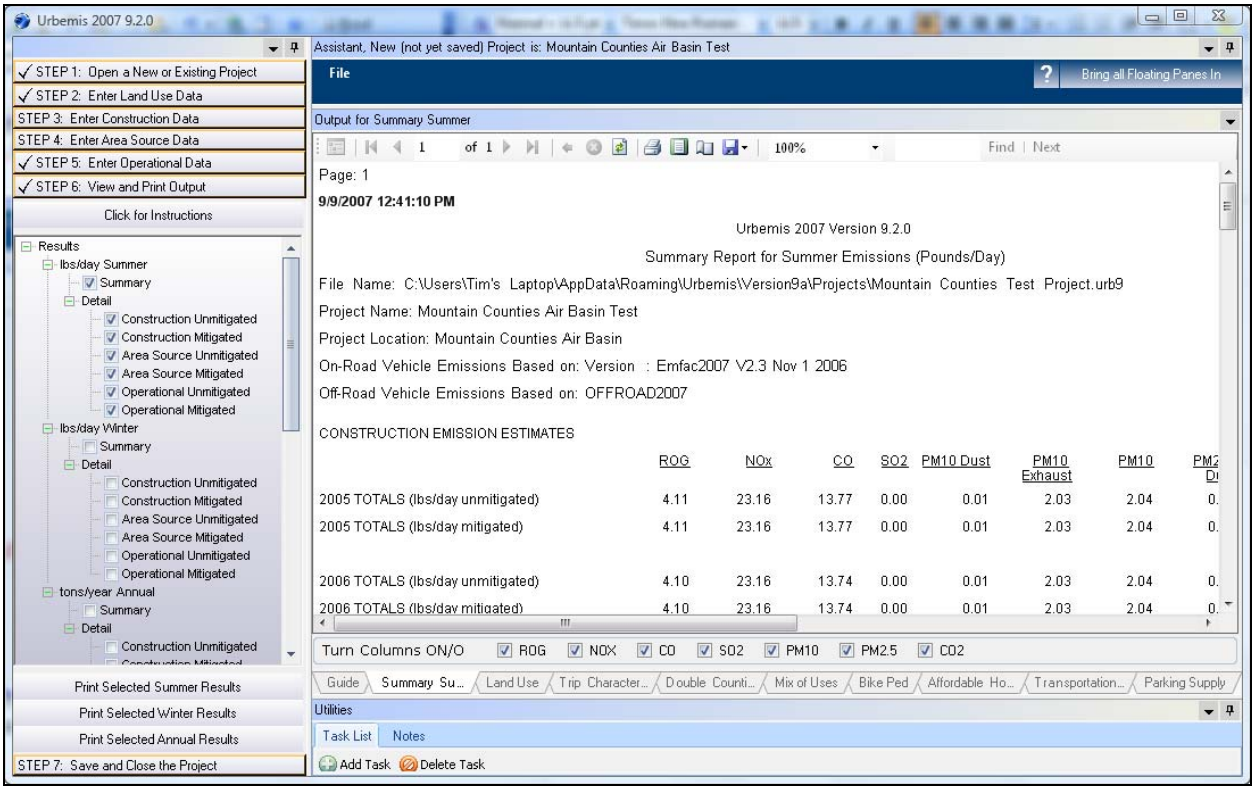

Figure 51. URBEMIS Recalc Results

As Figure 51 shows, when the Recalc button has been pressed, URBEMIS generates emission estimates and automatically shows the Summer summary results in the right hand pane. Double-clicking on any of the print results lines in the left hand pane forces URBEMIS to calculate emissions for that option. For example, if you click on the Construction Unmitigated line under lbs/day Winter, URBEMIS displays winter construction emissions in the right hand pane.

Figure 52 shows winter construction emissions. In this example, all pollutants except ROG, NO, and CO2 have been turned off. Pollutant can be turned off by unchecking them, as shown in the bottom of Figure 52 in the highlighted area. Also, the first time slice has been expanded by clicking the plus sign to the left of time slice. In addition, the asphalt phase in that time slice has been expanded to show the individual components of asphalt emissions (see red arrows in highlighted area). Time slices are described in detail in Appendix A.

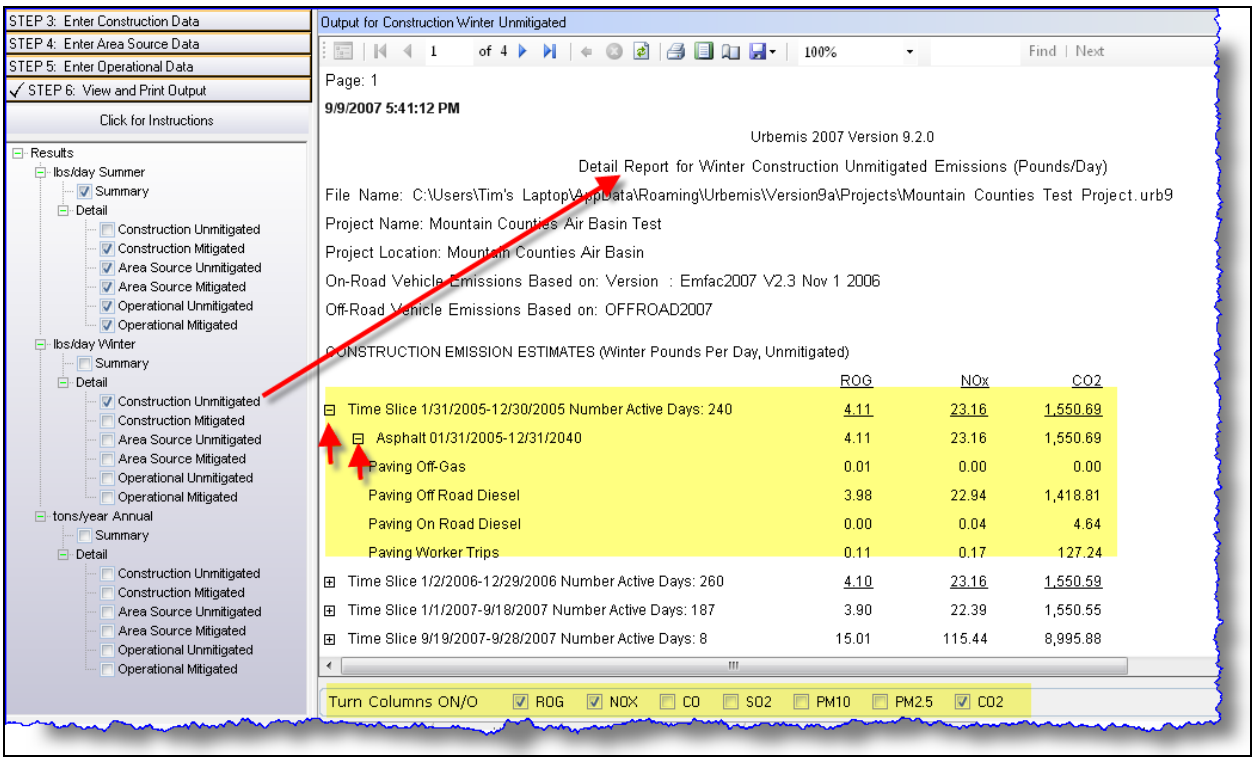

Figure 52. Winter Construction Emissions Results

URBEMIS also allows the user to send one or more of the items checked in the left hand pane to a single report that will be shown in the right hand pane. Three separate reports can be run: summer, winter, and annual. Figure 53 shows printing of the selected summer results. All of the summer emission categories have been checked (highlighted area). Then the Print Selected Summer Results button was clicked, which generated the report in the right hand pane.

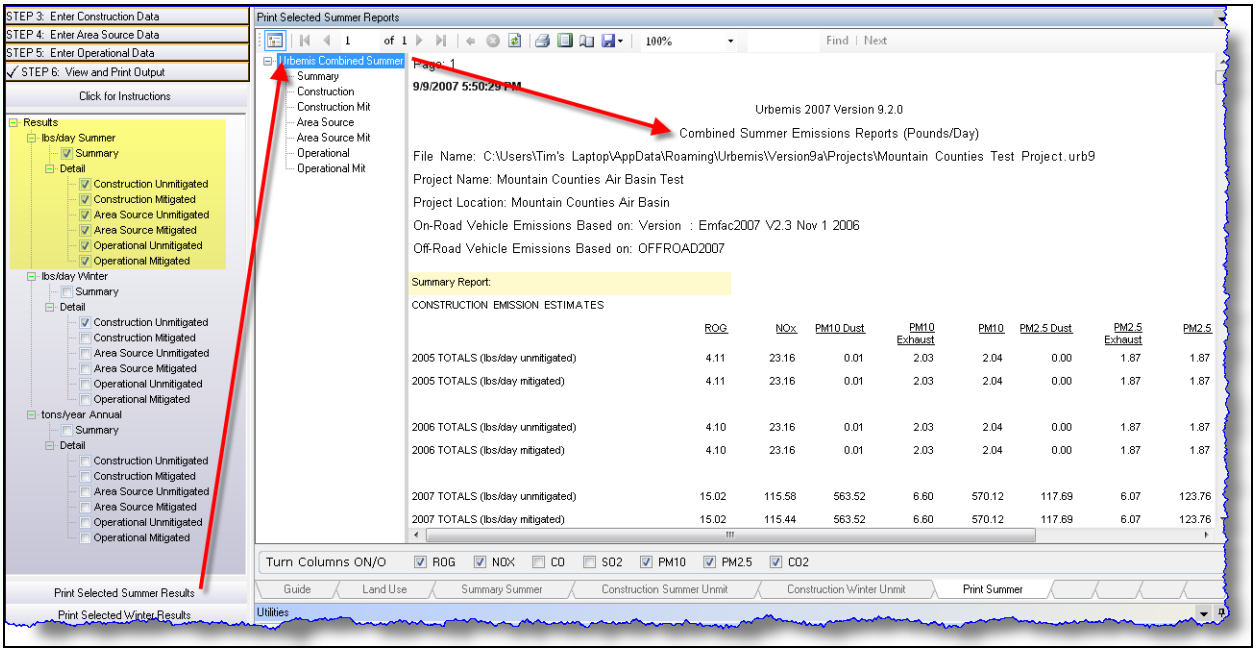

Figure 53. Combined Summer Emission Results

Printing Reports

Once a report has been generated and is displayed in the right hand pane, it can be sent to a printer, to an Excel file, or to a PDF file. Figure 54 illustrates how to print a report. First, click on the printer icon, shown circled. This will pop up the print window, which allows you to select a printer destination. Please note that you cannot print to a text file with URBEMIS2007. Once you have selected your printer destination and printer preferences (such as two sided printing), you must hit the apply button, then the print button.

Excel or PDF Reports

Although URBEMIS2007 does not allow a report to be sent to a text file, you can send it to either a PDF or Excel file by selecting the blue diskette icon, denoted with a arrow in the top line of Figure 54.

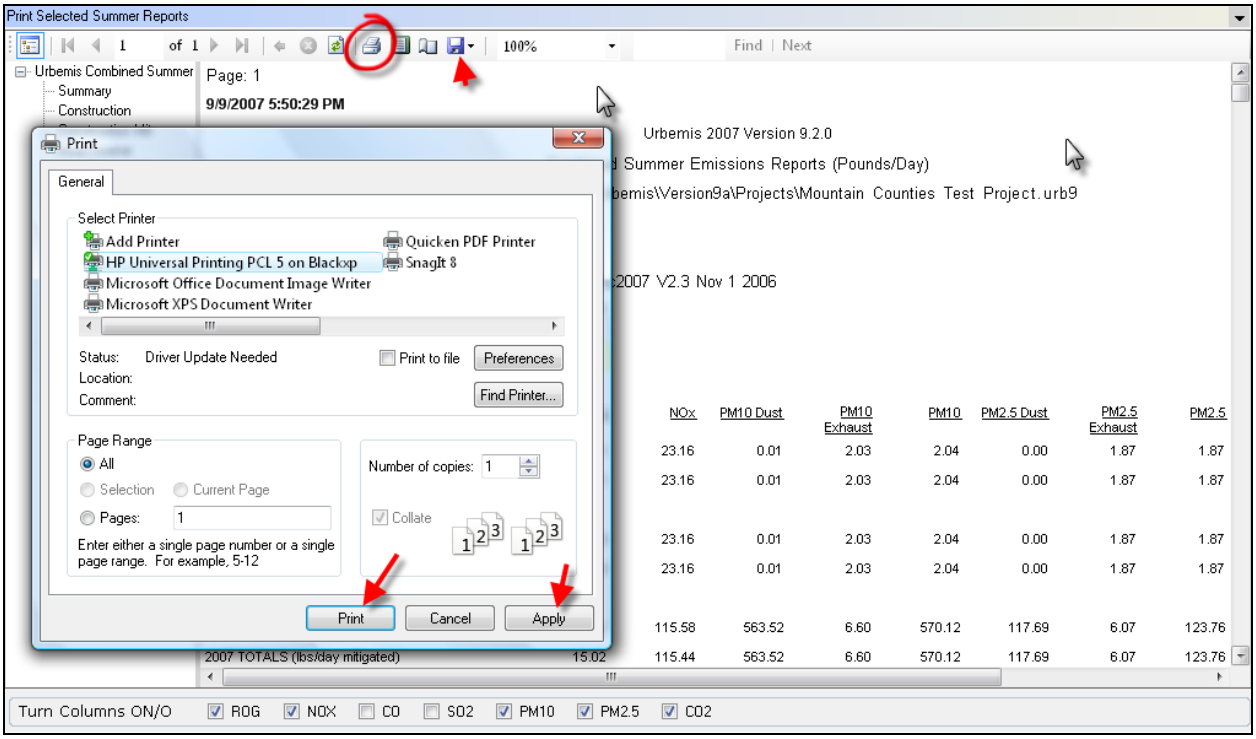

Figure 54. Printing a Report

STEP 7 – Save and Close the Project

Saving and/or closing a project is straightforward in URBEMIS2007. Clicking on Step 7 – Save and Close the Project results in the screen shown in Figure 55. A project can be saved with the current name, as a different project (with different name), or URBEMIS can be closed and exited. If you opt to close the project and you have turned on the "Save on Closing, Without a Prompt", then URBEMIS will save the current project with the current project name. Also, if you opt to just "X" out of the program by hitting the x in the top right hand corner of the program, the project will automatically be saved with the current project name.

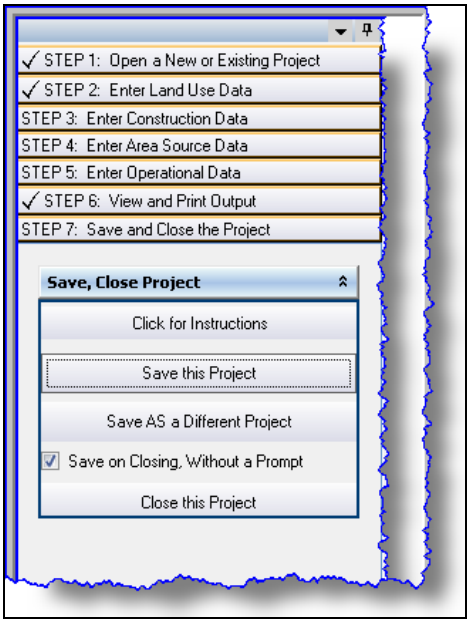

Figure 55. Saving and Closing a Project

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