



# California Emissions Estimator Model®

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**Version 2013.2**

Prepared for:  
**California Air Pollution Control Officers Association (CAPCOA)**

Prepared by:  
**ENVIRON International Corporation and the California Air Districts**

Date:  
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## Copyright

California Emission Estimator Model (CalEEMod)<sup>®</sup>

Version 2013.2

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Developed by ENVIRON International Corporation in collaboration with the California air districts

## Contents

	<b>Page</b>
<b>Acknowledgements</b>	<b>i</b>
<b>Copyright</b>	<b>iii</b>
<b>1 Introduction</b>	<b>2</b>
1.1 Purpose of Model	2
<b>2 Program Installation</b>	<b>4</b>
2.1 Operating System Requirements	4
2.2 Installation Procedures	4
2.3 Starting CalEEMod	6
<b>3 Using CalEEMod</b>	<b>6</b>
3.1 Home	9
3.2 Defining a Project	9
3.3 Altering Default Data	9
3.4 Mitigation	10
3.5 Reporting	10
<b>4 Detailed Program Screens</b>	<b>10</b>
4.1 Project Characteristics	10
4.2 Land Use	14
4.3 Construction	24
4.3.1 Construction Phase	24
4.3.2 Off-Road Equipment	25
4.3.3 Dust from Material Movement	26
4.3.4 Demolition	26
4.3.5 Trip and VMT	26
4.3.6 On-Road Fugitive Dust	27
4.3.7 Architectural Coatings	27
4.4 Mobile	27
4.4.1 Vehicle Trips	28
4.4.2 Vehicle Emissions	29
4.4.3 Road Dust	30
4.5 Area	30
4.5.1 Hearths and Woodstoves	31
4.5.2 Consumer Products	32
4.5.3 Area Architectural Coating	32
4.5.4 Landscape Equipment	32
4.6 Energy Use	33
4.7 Water and Wastewater Use	34

4.8	Solid Waste	36
4.9	Off -Road Equipment	35
4.10	Vegetation	38
4.10.1	Sequestration	38
4.11	Mitigation	38
4.11.1	Construction Mitigation	39
4.11.2	Traffic Mitigation	40
4.11.3	Area Mitigation	42
4.11.4	Energy Mitigation	42
4.11.5	Water Mitigation	43
4.11.6	Solid Waste Mitigation	43
4.12	Reporting	44

#### List of Appendices

Appendix A:	Calculation Details
Appendix B:	Glossary
Appendix C:	Acronym List
Appendix D:	Default Data Tables
Appendix E:	Technical Source Documentation
Appendix F:	Climate Zone Lookup



# 1 Introduction

CalEEMod® is meant to give the user an introduction on how to use the program as well as document the detailed calculations and default assumptions made in associated appendices. The purpose of CalEEMod is to provide a uniform platform for government agencies, land use planners, and environmental professionals to estimate potential emissions associated with both construction and operational use of land use projects. It is intended that these emission estimates are suitable for use in California Environmental Quality Act (CEQA) compliant documents for air quality and climate change impacts. In addition individual districts may develop additional uses to show compliance with local agency rules.

CalEEMod utilizes widely accepted models for emission estimates combined with appropriate default data that can be used if site-specific information is not available. These models and default estimates use sources such as the United States Environmental Protection Agency (USEPA) AP-42 emission factors, California Air Resources Board (ARB) vehicle emission models, studies commissioned by California agencies such as the California Energy Commission (CEC) and CalRecycle. In addition, local air districts were given the opportunity to provide default values and existing regulation methodologies to use in their specific regions. If no information was provided by local air districts, appropriate state-wide values were utilized if regional differences could not otherwise be defined. Since new information and regulations are always changing, local agencies should be consulted to determine any recommended values to use that may differ from the defaults currently used in CalEEMod. Keep in mind the assumptions and limitations of the default data in CalEEMod. A large majority of the default data associated with locations and land use is based on surveys of existing land uses. Caution should be taken if the project deviates significantly from the types and features included in the survey that forms the substantial evidence supporting the default data. In these situations site specific data that is supported by substantial evidence should be used if available.

The model provides a number of opportunities for the user to change the defaults in the model, however, users are recommended to provide justification for changing the defaults (e.g., [Air Quality Guidelines](#)). Further, the user is reminded that CalEEMod is an emissions model and not an enforcement mechanism, thus, the user should ensure correct data is inputted, including the choice and percent reduction of mitigation most applicable to the land use project being evaluated.

## 1.1 Purpose of Model

CalEEMod provides a simple platform to calculate both construction emissions and operational emissions from a land use project. It calculates both the daily max and annual average for criteria pollutants as well as total or annual greenhouse gas (GHG) emissions which can be used in support of analyses in CEQA documents such as Environmental Impact Reports (EIRs) and Negative Declarations. In addition, default values for water and energy use are quantified which may be useful for other sections in an EIR or represent opportunities to incorporate the

rigorous site-specific information from the other EIR sections. Specifically the model aids the user in the following calculations:

- ◁ Short term construction emissions associated with demolition, site preparation, grading, building, coating, and paving from the following sources
  - ┆ Off-road construction equipment
  - ┆ On-road mobile equipment associated with workers, vendors, and hauling
  - ┆ Fugitive dust associated with grading, demolition, truck loading, and roads (Fugitive dust from wind blown sources such as storage piles are not quantified in CalEEMod which is consistent with approaches taken in other comprehensive models.)
  - ┆ Volatile emissions of reactive organic gasses (ROG) from architectural coating (*including painting on parking lots*) and paving.
- ◁ Operational emissions associated with the fully built out land use development
  - ┆ On-road mobile vehicle traffic generated by the land uses
  - ┆ Fugitive dust associated with roads
  - ┆ Volatile emissions of ROG from architectural coating
  - ┆ Emissions from off-road equipment (e.g., forklifts, cranes) used during operation
  - ┆ Off-road emissions from landscaping equipment
  - ┆ Volatile emissions of ROG from consumer products and cleaning supplies
  - ┆ Wood stoves and hearth usage
  - ┆ Natural gas usage in the buildings
  - ┆ Electricity usage in the buildings (GHG only)
  - ┆ Electricity usage from lighting in parking lots and lighting, ventilation and elevators in parking structures
  - ┆ Water usage by the land uses (GHG only)
  - ┆ Solid waste disposal by the land uses (GHG only)
- ◁ One-time vegetation sequestration changes
  - ┆ Permanent vegetation land use changes
  - ┆ New tree plantings
- ◁ Mitigation impacts to both short-term construction and operational emissions
- ◁ Several of the mitigation measures described ã } Á Ô œ Ú Ô U œ q • Á Û ~ æ } c ã ~ ^ ã } \* Á Õ ! ^ Mitigation Measures<sup>1</sup> have been incorporated into CalEEMod.

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<sup>1</sup> Available at : <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>





## 2 Program Installation

The program is distributed and maintained by the California Air Pollution Control Officers Association<sup>2</sup>. The most recent version can be downloaded from [www.caleemod.com](http://www.caleemod.com).

### 2.1 Operating System Requirements

CalEEMod was programmed by ENVIRON using Microsoft SQL Compact Edition in conjunction with a Visual Basic Graphical User Interface (GUI). CalEEMod requires the following system requirements:

- ◁ Microsoft Windows XP, Vista, or 7 Operating System
- ◁ Microsoft .Net Framework 4 or higher
- ◁ 90 Mb hard drive space available

### 2.2 Installation Procedures

#### To install

1. Be sure to uninstall any previous versions of CalEEMod before installing a new version as some file names will be the same potentially confusing the computer. To uninstall for most computers, under Settings, Control Panel. Programs and Features, highlight CalEEMod .msi and .exe files and click the uninstall button.
2. Ensure you have the required Microsoft .Net framework 4 or higher installed on your machine. If not install this first. It is available free from Microsoft at <http://www.microsoft.com/net/download.aspx>
3. Download the installation files (setup.exe and CalEEMod\_2013.2.msi).
4. Click the setup.exe file that you downloaded. This should walk you through the rest of the installation.
5. The default directory for CalEEMod is C:\CalEEMod\. The user may select alternative locations for installation<sup>3</sup>. The user will also be prompted to select to install CalEEMod for everyone who uses the computer or just the current user.
6. Click the link below to install SQL Server Compact 3.5 SP2
7. Click the link below to install SQL Server Compact 3.5 SP2

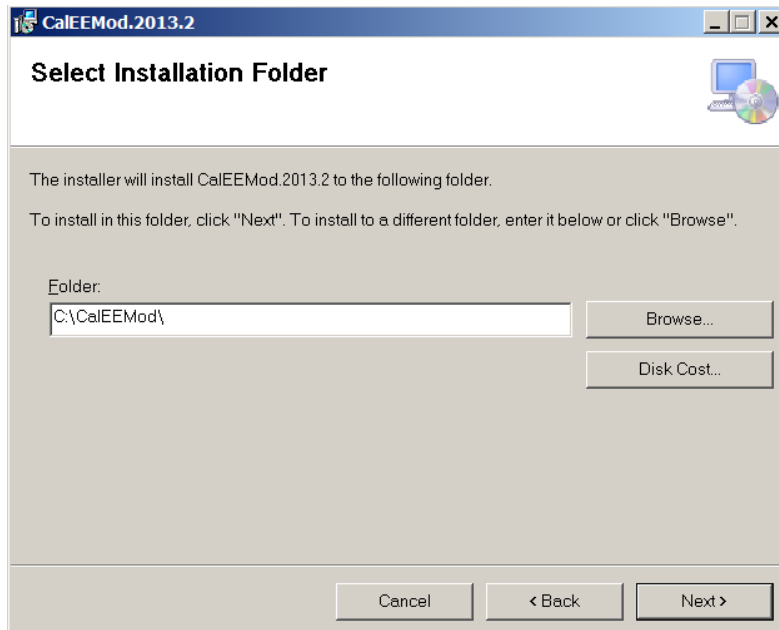
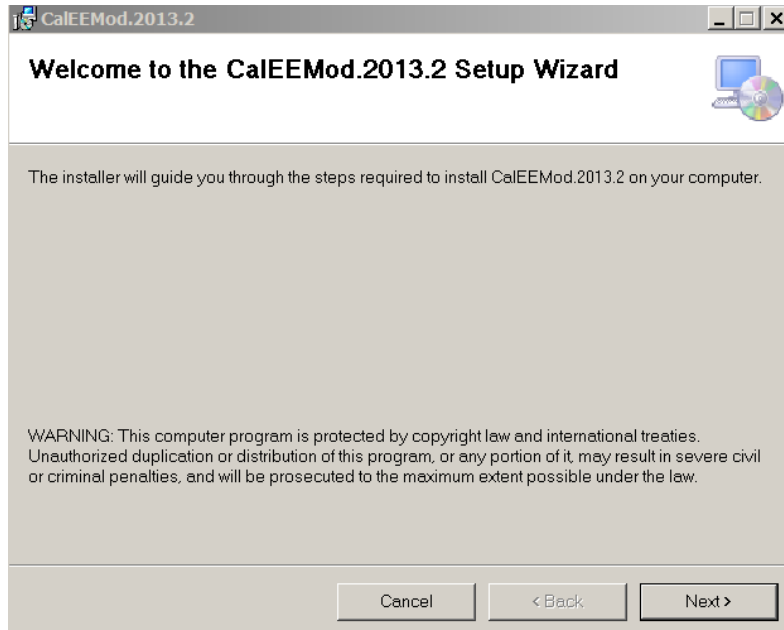
<http://www.microsoft.com/downloads/details.aspx?familyid=E497988A-C93A-404C-B161-3A0B323DCE24&displaylang=en>

<sup>2</sup> CalEEMod© 2012 All Rights Reserved by California Air Pollution Control Officers Association.

<sup>3</sup> If you use windows Vista or 7, please be aware of file privileges which may not allow access rights to some folders during program operations such as C:\Program Files\

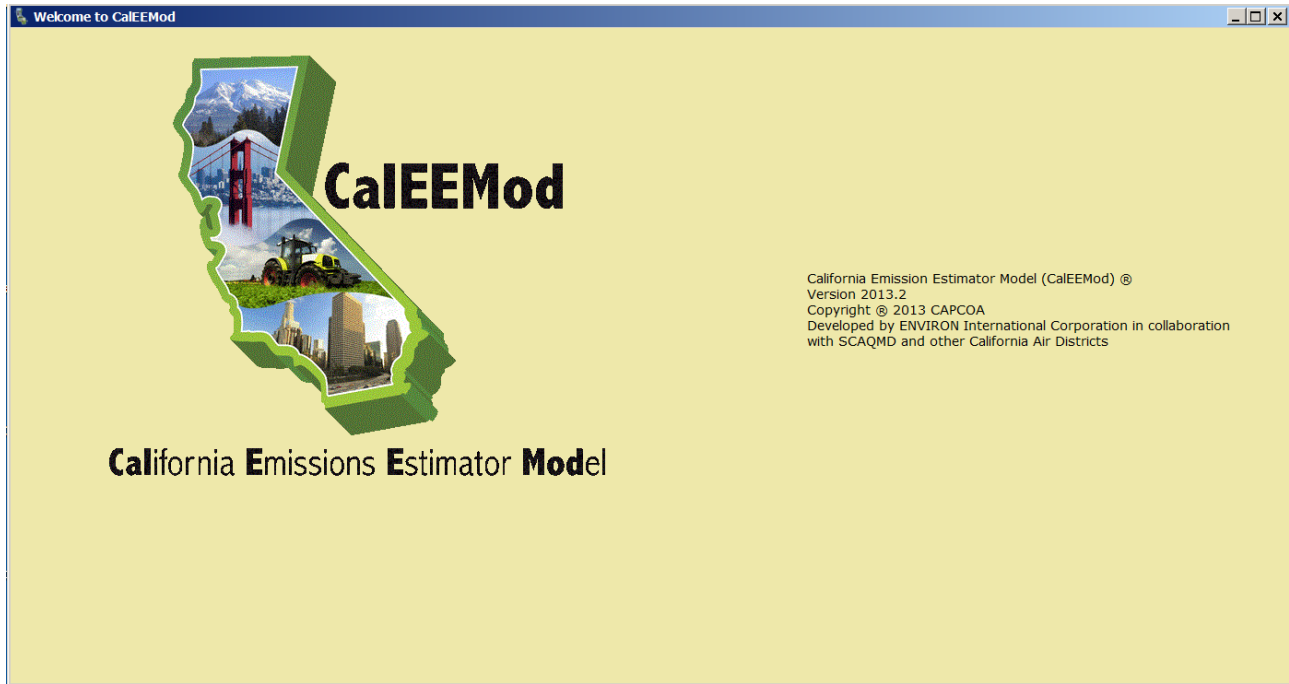
Once this file is downloaded, unzip the file anywhere on your computer and run the installation file (setup.exe). Ó ^ Á • ~ ; ^ Á c [ Á ~ [ | | [ , Á c @ ^ Á ã } • c ! ~ & c ã [ } • locate the appropriate .msi file. For 32-bit computers, one needs SSCERuntime\_x86-ENU.msi and on a 64-bit computer, install both the 32-bit and the 64-bit version of the SQL Server Compact 3.5 SP2 MSI files. Existing SQL Server Compact 3.5 applications may fail if only the 32-bit version of the MSI file is installed on the 64-bit computer.

8. If you have any further trouble installing CalEEMod, make sure you have appropriate user privileges and the system requirements.



### 2.3 Starting CalEEMod

The installation will create a short cut icon on the desktop as well as add CalEEMod to the Programs available from the Start Button. Select CalEEMod from the program files or double click on the CalEEMod short cut. This will open CalEEMod.



## 3 Using CalEEMod

CalEEMod is designed as a linear series of screens with an individual purpose such as project characteristics, construction schedule and equipment, operational activity, mitigation measures, etc. The user is expected to input basic information about the project such as location, land use type (e.g., residential, commercial, retail, etc.) and its size. The functionality of the model is to populate later screens with pre-determined defaults based on basic project and location information provided by the user. However, if more accurate information is known, the user has the ability to override the defaults provided.

The figure on page 7 identifies some key features of CalEEMod which are described below.

1. **File Menu:** This menu contains options for creating and saving projects. It includes features such as New Project, Open Project, Save Project, and Save As Project. The File menu also includes options for printing and exiting the program. All other menus will allow navigation between screens in any order.
2. **Screen Name:** Identifies the name of the current screen.

3. **Default Button:** This button allows the restoration of program defaults if the user has changed any values on the screen. User entered values will be highlighted yellow to clearly indicate that they have been changed from the defaults. The user will be prompted if they would like to restore default for the current or last cell or the whole page. %Q { ] [ ; c Á Ô Ù X + Á , ã | | Á æ | | [ , Á æ Á ~ • ^ ; Á c [ Á | [ æ ã Á ã } Á a % Õ æ } & ^ | + Á & æ } & ^ | • Á c @ ^ Á ] ; ^ ç ã [ ~ • Á æ & c ã [ } È

4. **Remarks:** This section at the bottom of each screen allows the user to enter comments regarding any user defined values entered on this screen. This is meant to assist reviewers of the program in determining justification for values selected.

5. **Next Button:** This button when clicked will take the user to the next sequential step. Š æ c ^ ; Á { [ ã ~ | ^ • Á , ã | | Á æ | • [ Á @ æ ç ^ Á æ Á % Ú ; ^ ç ã [ ~ • + Á à ~ c c previous sequential step.

6. **Data Grid:** This is a common box where values for the variables defined across the top to be filled in. The number of rows will automatically be adjusted based on the number of rows of information required to define the information. The last row is indicated with an asterisk (\*) and once information is started to be added to this row a new row will be added at the end. To delete a row select the desired row to delete, and hit the delete button on your keyboard (This is allowed unless the data grid is a fixed list such as the Pollutant selection list.). Scroll bars (both horizontal and vertical) will occur automatically if necessary.

7. **Cascade Default:** CalEEMod version 2013.2 introduces a new feature freezing the downloading of programmed defaults È Á Ô æ & @ Á ã } ] ~ c Á • & ; ^ ^ } Á ã ã • ] | æ ^ • Á a ã ^ ~ æ automatically checked to populate defaults in future screens. However, if the % & æ • & æ ã ^ Á ã ^ ~ æ ~ | c + Á à [ ç Á ã • Á ~ } & @ ^ & \ ^ ã È Á } [ Á ã ^ ~ æ ~ | c screens. Unless all the necessary input parameters required for a proper analysis are known, it is recommended the user runs the model at least onc^ Á , ã c @ Á % & æ • & æ ã ^ Á ã ^ clicked on to allow the defaults to be populated. Then, if the user would like to change project parameters (e.g., number of dwelling units, building square footage, etc) without cascading new defaults in later screens, then unchec\ Á c @ ^ Á % & æ • & æ ã ^ Á ã ^ ~ æ ~ | c + the land use screen. This feature will prove useful for those users who override the defaults with specific project information (e.g., construction schedule, construction equipment, water use, energy use, etc.) and would like to evaluate different project scenarios with the same basic project information (i.e., land use type, location). If ~ } & @ ^ & \ ã } \* Á c @ ^ Á % & æ • & æ ã ^ Á ã ^ ~ æ ~ | c + Á à [ ç È Á c @ ^ Á ~ • ^ ;

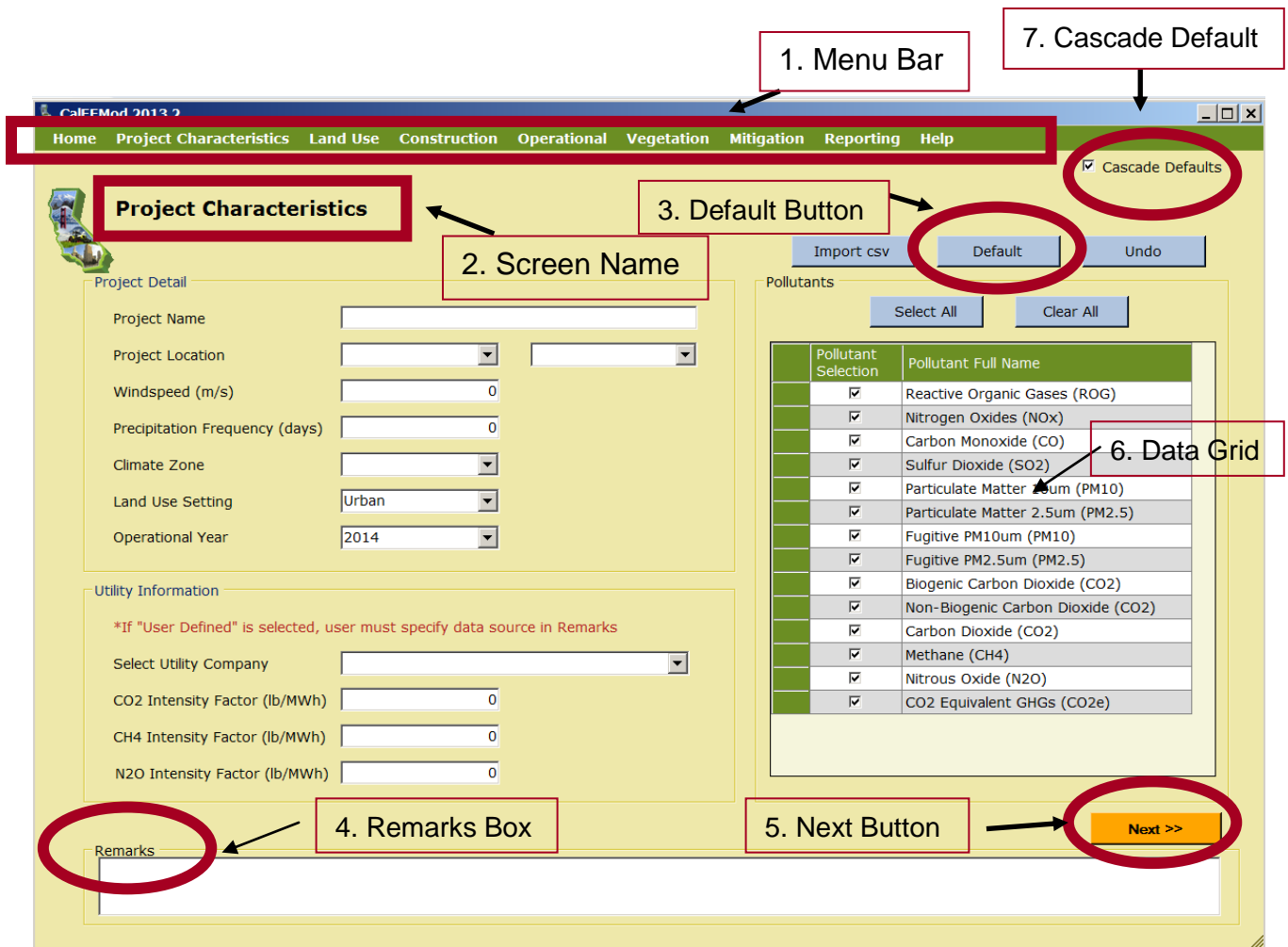
< *All subsequent screens will freeze defaults*

< *Changes to screens after land use (e.g., adding a new construction phase) will not cascade defaults relating to that change or add new tabs (e.g., trips and VMT, dust material movement) so any necessary input information will have to be added manual or impact will not be calculated*

< *If changing or adding a land use type (e.g., from single family housing to a hospital), the future screens will not reflect the new land use type so some calculations (e.g., impacts from energy and water use) will not be properly performed*

If a land use type is changed or added, the analysis.

The next sections will give you some quick details on how to get started with a project in CalEEMod. Section 4 gives more specific details about each individual screen the user can encounter in CalEEMod.



The screenshot shows the CalEEMod 2013.2 software interface. The menu bar at the top includes Home, Project Characteristics, Land Use, Construction, Operational, Vegetation, Mitigation, Reporting, and Help. The 'Project Characteristics' screen is active, showing fields for Project Name, Project Location, Windspeed, Precipitation Frequency, Climate Zone, Land Use Setting (set to Urban), and Operational Year (set to 2014). Below these are Utility Information fields for CO2, CH4, and N2O intensity factors. A 'Remarks' box is at the bottom left. On the right, a 'Pollutants' table is displayed with a 'Default' button above it. A 'Next >>' button is at the bottom right. A 'Cascade Defaults' checkbox is checked in the top right corner.

Pollutant Selection	Pollutant Full Name
<input checked="" type="checkbox"/>	Reactive Organic Gases (ROG)
<input checked="" type="checkbox"/>	Nitrogen Oxides (NOx)
<input checked="" type="checkbox"/>	Carbon Monoxide (CO)
<input checked="" type="checkbox"/>	Sulfur Dioxide (SO2)
<input checked="" type="checkbox"/>	Particulate Matter 2.5um (PM10)
<input checked="" type="checkbox"/>	Particulate Matter 2.5um (PM2.5)
<input checked="" type="checkbox"/>	Fugitive PM10um (PM10)
<input checked="" type="checkbox"/>	Fugitive PM2.5um (PM2.5)
<input checked="" type="checkbox"/>	Biogenic Carbon Dioxide (CO2)
<input checked="" type="checkbox"/>	Non-Biogenic Carbon Dioxide (CO2)
<input checked="" type="checkbox"/>	Carbon Dioxide (CO2)
<input checked="" type="checkbox"/>	Methane (CH4)
<input checked="" type="checkbox"/>	Nitrous Oxide (N2O)
<input checked="" type="checkbox"/>	CO2 Equivalent GHGs (CO2e)

### 3.1 Home

This is the part of the file menu bar that controls the file saving and opening features. The available options are:

- < New Project
- < Open Project
- < Save
- < Save As
- < Exit

The user should select Open Project if they wish to load in a project that has been previously saved. Note that this will remove any information that has been entered into the GUI unless it has been saved to a file. Save will save the currently loaded project database as a Microsoft Excel file that can be used to open this project again into CalEEMod. Save As will allow the user to change the name of the saved project file. Exit will close CalEEMod. The Microsoft Excel file can be edited following the format of the save file to quickly make edits outside of the Graphical User Interface (GUI). The user will still need to use the GUI for reporting of results. This can be most useful in making changes to construction lists. Individual tabs can be loaded in as a .csv file in various places in CalEEMod to minimize the data entry.

### 3.2 Defining a Project

In order to define a project, the user will have to enter information on both the Project Characteristics screen and land use screen. After entering information on these two screens, CalEEMod will populate all of the other information required to calculate unmitigated construction (unless there is demolition, grading, or site preparation) and operation emissions using default data. Demolition, grading, and site preparation requires additional information regarding the amount of material to be demolished and material (debris, soil, etc) transported to or from the site that is entered on the appropriate construction screens. If site specific information will not be used, the user can jump to entering mitigation measures followed by reporting. If the user has any site-specific information that will replace the default information, this should be entered on the appropriate screens and provide justification for the change in the %Ü ^ { æ section at the bottom of each screen before moving on to mitigation and reporting. This justification for the default override will be printed in the report so the user is encouraged to provide a robust reasoning to allow for seamless review of the analysis.

### 3.3 Altering Default Data

CalEEMod was designed to allow for ease in changing default assumptions. Site-specific information that is supported with substantial evidence required by CEQA, is preferred when it is available. However, it is often the case that site-specific information is not available. CalEEMod was designed to assume reasonable default assumptions supported by substantial evidence to

the degree available at the time of programming. CalEEMod is based on fully adopted methods and data. Therefore, draft methods and data are not used as defaults.

### 3.4 Mitigation

Common construction mitigation measures that impact the calculations in CalEEMod have been incorporated as options for the user to select. At this time, required mitigation measures to comply with individual fugitive dust rules have not been incorporated in unmitigated calculations due to different interpretations of CEQA guidance regarding required mitigation.

Ù ^ ç ^ ! æ | Á { ã c ã \* æ c ã [ } Á { ^ æ • ~ ! ^ • Á ~ ! [ { Á Ô Œ Ú Ô U Œ eq • Á Û ~ æ } c ã ~ have been incorporated including combinations and caps when using multiple mitigation measures. Some mitigation measures are not as amenable to simple input information or are less common in their use and therefore not included at this time. CalEEMod was designed to include typical mitigation measures that are some of the more effective measures available to development projects. If mitigation measures are not available as options in CalEEMod, the user can likely alter values in the program that will allow for adjustment of hand calculated reductions due to mitigation that may be less common. This will require separate runs of CalEEMod files in order to properly account for unmitigated and mitigated scenarios.

### 3.5 Reporting

This is the part of the program that allows the user to select predefined reports that will display the emission calculation results. The user will be able to view these on a screen and save as either a Microsoft Excel file or a pdf file.

## 4 Detailed Program Screens

### 4.1 Project Characteristics

The project characteristics screen is where the user enters key location, electricity company information and pollutants they want to analyze. The information on this screen needs to be entered before proper default information can be used in subsequent screens. Changes on this screen will result in overriding user defined data with defaults in subsequent screens where this information is used. Under the Project Detail section the user enters the Project Name which will appear in the reports. The user then selects information from drop down boxes or overrides the default values in the text boxes. Each of the information categories on this screen are described in more detail below.

#### Project Location

The user selects the region in which the project is located. The user first selects if they want to choose an Air District, Air Basin, County, or State-wide. The second drop down box will give the list of specific locations based on the first drop down box which the user selects. For counties

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that are divided between air districts, air basins or district requested subregions; the county is followed by the sub-county area which can influence some of the default values selected by modules. Consult your lead agency on their preference for location. This primarily influences on-road vehicle emissions, trip lengths, water supply and treatment electricity use, solid waste disposal rates, amount of paved roads, days of landscaping equipment use, architectural coating emissions, and hearth usage.

### **Wind Speed and Precipitation Frequency**

Selection of project location will fill in the default wind speed and precipitation frequency. The user can choose to override this information and type in a different value. The wind speed is in units of meters per second and is used in some fugitive dust calculations. Precipitation frequency is the number of days in a year that has precipitation greater than 0.01 inches in a day and is used in fugitive dust calculations.

### **Climate Zone**

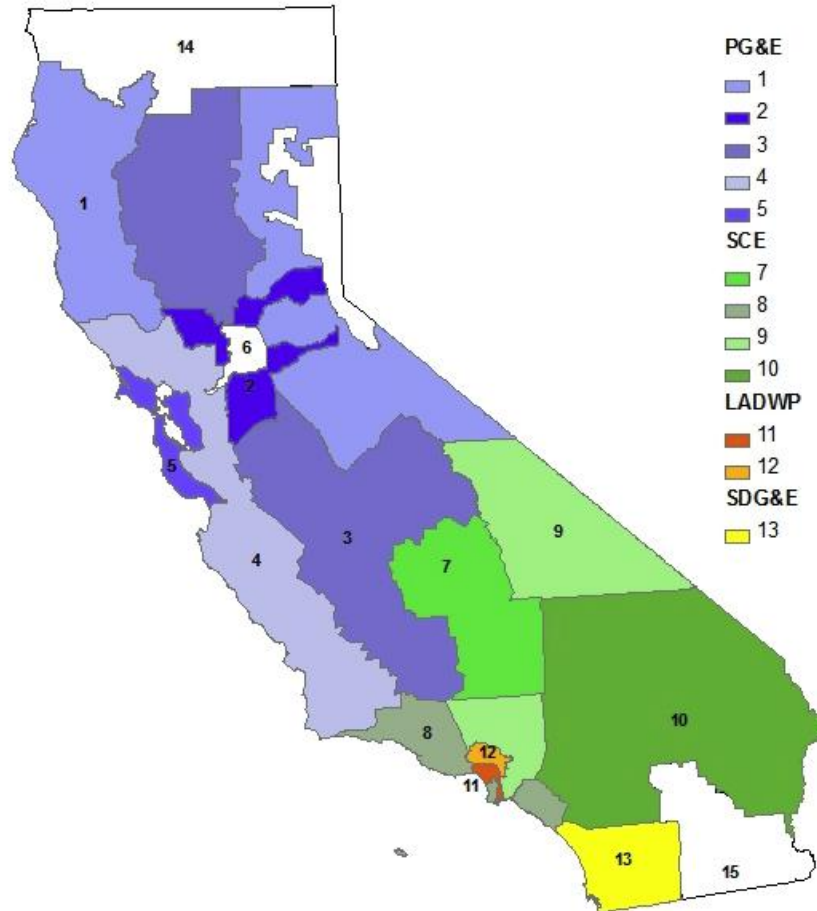
Selection of project location will restrict the climate zones available for the user to choose from based on the climate zones in the project location. The climate zones used are based on CEC forecasting climate zones (different than Title-24 building climate zones) as used in the California Commercial End Use Survey (CEUS) and Residential Appliance Saturation Survey (RASS)<sup>4</sup>. The figure below indicates these climate zones. A spreadsheet is available in Appendix F, which allows the user to look up climate zones based on city or zipcodes if a user needs further assistance in selecting the appropriate climate zone.

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<sup>4</sup> CalEEMod v. 2013.2 has been updated to incorporate the October 2010 version of RASS.



### CEC Forecast Climate Zones<sup>5,6</sup>



### Land Use Setting

This is where the user indicates if the project is located in a rural or urban setting. The user should contact their local air districts for guidance on the appropriate land use setting to select as the definition used may differ based on the definitions used to support the urban and rural trip lengths in the relevant air basin.

5 Adapted from Figure ES-2 of CEC. 2010. Residential Appliance Saturation Survey. Available online at: <http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-ES.PDF>

6 White spaces represent areas served by other electric utilities not included in survey.



### Operational Year

The user should indicate the first year the project will be fully operational that they wish to use as a basis for determining emission factors for all operational modules. CalEEMod can handle the following years: 1990, 2000, 2005, 2010-2025, 2030, 2035, and 2040. This was done to limit the file size associated with vehicle emission factors. CalEEMod is currently designed for one year that initiates the beginning of the full operation of the project. However, it is recognized that some projects could be phased so the operation of the project begins over more than one year. In that case, it is recommended the user run the model multiple times for the various input parameters for each operational year.

### Utility Information

user will need the GHG emissions associated with electricity use in various modules. The default values are protocols (CO<sub>2</sub>), and E-Grid values (CH<sub>4</sub> and N<sub>2</sub>O). The CO<sub>2</sub> intensity factor used as defaults in CalEEMod are based on the latest reporting year available for each of the different utilities. Table 1.2 in Appendix D provides the default CO<sub>2</sub> intensity factor used and reporting year from which the factor was identified for each of the utilities. As with other defaults in the model, if a new value is identified before the defaults are updated, the user has the ability to override the default and provide a new value. Some of the pollutants are a combination of other identified pollutants such as Carbon dioxide (CO<sub>2</sub>) is made up of biogenic and non-biogenic carbon dioxide. CO<sub>2</sub> Equivalent GHGs is the Global Warming Potential (GWP) weighted value of all GHGs.

### Pollutants

The list of pollutants to the right of the screen automatically has all boxes checked. Uncheck those reported. Some of the pollutants are a combination of other identified pollutants such as Carbon dioxide (CO<sub>2</sub>) is made up of biogenic and non-biogenic carbon dioxide. CO<sub>2</sub> Equivalent GHGs is the Global Warming Potential (GWP) weighted value of all GHGs.

### Remarks

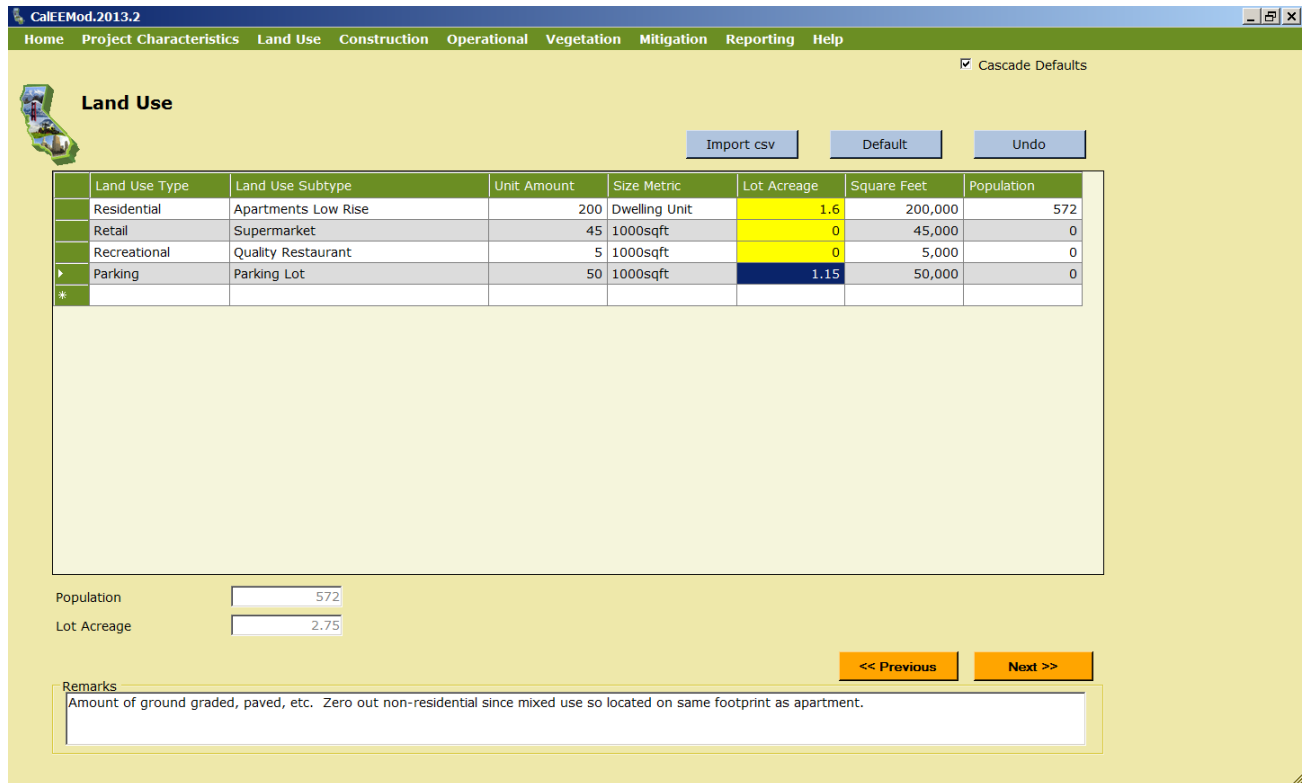
The user can enter any remarks to describe the reasonable explanation and justification of non-default values or to add additional detail regarding the basis for information used such as relevant EIR sections. These remarks are included in the report and will assist a reviewer in understanding the reasons for a change in the default value (e.g., new trip rate based on a project specific traffic study conducted by *reputable traffic engineers*)).

7 Available at: <http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm>

8 Available at: <http://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf>

## 4.2 Land Use

This screen is used to define the specific land uses that will occur at the project site. The land uses, size features and population are used throughout CalEEMod in determining default variables and calculations.



CalEEMod.2013.2

Home Project Characteristics Land Use Construction Operational Vegetation Mitigation Reporting Help

Cascade Defaults

Land Use

Import csv Default Undo

Land Use Type	Land Use Subtype	Unit Amount	Size Metric	Lot Acreage	Square Feet	Population
Residential	Apartments Low Rise	200	Dwelling Unit	1.6	200,000	572
Retail	Supermarket	45	1000sqft	0	45,000	0
Recreational	Quality Restaurant	5	1000sqft	0	5,000	0
Parking	Parking Lot	50	1000sqft	1.15	50,000	0
*						

Population:

Lot Acreage:

Remarks: Amount of ground graded, paved, etc. Zero out non-residential since mixed use so located on same footprint as apartment.

<< Previous Next >>

### Land Use Type

The user selects from the drop down list of the primary land use types: Commercial, Educational, Industrial, Residential, Retail, Recreational, and **Parking**. The 63 different land uses types were chosen for inclusion in CalEEMod because each has an established trip rate critical for mobile source calculations.

This program specifically designates parking areas as a separate land use rather than as a part of an associated non-residential land use (e.g., commercial buildings, retail facilities, etc.). Due to the nature of the available data, parking (i.e., driveway) for residential land uses have been incorporated (see discussion under Lot Acreage) so no separate parking land use needs to be identified. For a better understanding of how CalEEMod treats parking based on the footprint and lot acreage of residential and non-residential land uses, please refer to the following figure. As depicted, the lot acreage of a residential land use includes the parking and building footprint. For non-residential land uses, the lot acreage is the same as the building footprint so parking needs to be added as a separate land use.

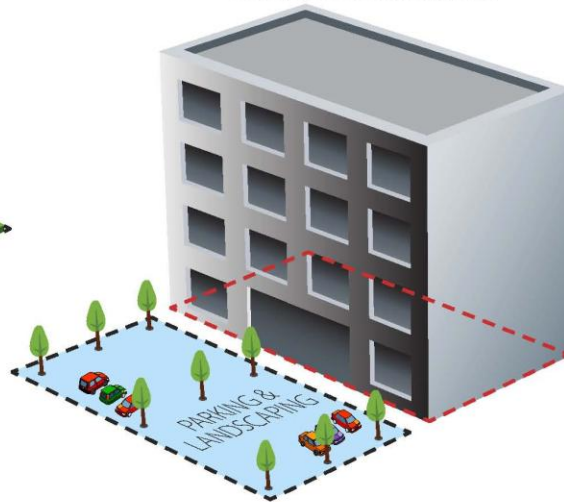
## CalEEMod Default Lot Acreage for Res and Non Res Land Uses

RESIDENTIAL  
SINGLE FAMILY DWELLING



Lot acreage & building footprint are NOT equal. Lot acreage includes grading for parking & landscaping.

NON-RESIDENTIAL  
COMMERCIAL OFFICE BUILDING



Lot acreage & building footprint are equal; add parking as separate land use and assign associated square footage and acreage.

For the parking land use, two primary options are available: parking lots or parking structure (e.g., garages). There are four types of parking structures for the user to choose . enclosed, enclosed with an elevator, unenclosed, or unenclosed with an elevator. The reason for the specific description is to properly calculate energy impacts from ventilation and elevator operation. Parking as a separate land use made the estimate of default acreage and paving area easier.

For those land uses not listed (e.g., roads, underground parking, pipelines, etc.) each land use type has a %W• ^ | Á Ö land use subtype. Associated with it that the user can select if the other land use subtypes do not describe or reflect the project being analyzed. It is critical to understand that there is no default data (including size metric) associated with the %W• ^ | Á Ö ^ ~ ã land uses. And all information that is based on these land uses will need to be entered by the user otherwise no emissions will be calculated. Also, whatever size metric (e.g., per acre, per 1000 square foot, etc.) the user chooses ~ [ ; Á c @ ^ Á %W• ^ | Á Ö ^ ~ ã } ^ á + Á | æ } á applied to all subsequent default values (e.g., gallons of water used *per acre* or *per 1000 square foot* D Á æ • • [ & ã æ c ^ á Á , ã c @ Á c @ æ c Á %W• ^ | Á Ö ^ ~ ã } ^ á + Á | æ } á Á ~ • ^ È Á a land use that most closely fits the proposed project and allow the model to populate with pre-

determined defaults. Then, go back through the model and modify the defaults with any known specific project information.

### Land Use Subtype

Tabbing over to the next column in a row, the user selects from a drop down list of available land use subtypes based on the primary land use type selected. The user also has the option to select a land use subtype, however, as discussed above, no default data will be available and the user will have to enter in subsequent screens the appropriate values. Land use subtypes are based primarily on the ITE land use definitions used for (mobile source) trip generation rate information. In some cases similar generalized land uses or surrogate data was mapped to some land use subtypes in order to generate the default data needed for various modules.

**Table 1: Land Use Sub Type Descriptions**

Land UseSubType	Description <sup>1</sup>	ITE Number
<b>RESIDENTIAL</b>		
Apartments High Rise	High-rise apartments are units located in rental buildings that have more than 10 levels and most likely have one or more elevators.	222
Apartments Low Rise	Low-rise apartments are units located in rental buildings that have 1-2 levels.	221
Apartments Mid Rise	Mid-rise apartments in rental buildings that have between 3 and 10 levels.	223
Condo/Townhouse	These are ownership units that have at least one other owned unit within the same building structure.	230
Condo/Townhouse High Rise	These are ownership units that have three or more levels.	232
Congregate Care (Assisted Living)	These facilities are independent living developments that provide centralized amenities such as dining, housekeeping, transportation and organized social/recreational activities. Limited medical services may or may not be provided.	253
Mobile Home Park	Mobile home parks consist of manufactured homes that are sited and installed on permanent foundations and typically have community facilities such as recreation rooms, swimming pools and laundry facilities.	240
Retirement Community	These communities provide multiple elements of senior adult living. Housing options may include various combinations of senior adult housing, congregate care, assisted living, and skilled nursing care aimed at allowing the residents to live in one community as their medical needs change.	255
Single Family Housing	All single-family detached homes on individual lots typical of a suburban subdivision	210

**Table 1: Land Use Sub Type Descriptions**

Land UseSubType	Description <sup>1</sup>	ITE Number
<b>EDUCATIONAL</b>		
Day-Care Center	A day care center is a facility where care for pre-school age children is provided, normally during the daytime hours. Day care facilities generally include classrooms, offices, eating areas and playgrounds.	565
Elementary School	Elementary schools typically serve students attending kindergarten through the fifth or sixth grade. They are usually centrally located in residential communities in order to facilitate student access and have no student drivers.	520
High School	High schools serve students who have completed middle or junior high school.	530
Junior College (2Yr)	This land use includes two-year junior, community, or technical colleges.	540
Junior High School	Junior High schools serve students who have completed elementary school and have not yet entered high school.	522
Library	A library is a facility that consists of shelved books; reading rooms or areas; and sometimes meeting rooms.	590
Place Of Worship	A church is a building in which public worship services are held. A church houses an assembly hall or sanctuary; it may also house meeting rooms, classrooms and occasionally dining catering or party facilities.	560
University/College (4Yr)	This land use includes four-year universities or colleges that may or may not offer graduate programs.	550
<b>RECREATIONAL</b>		
Arena	Arenas are large indoor structures in which spectator events are held. These events vary from professional ice hockey and basketball to non-sporting events such as concerts, shows, or religious services. Arenas generally have large parking facilities, except when located in or around the downtown of a large city.	460
City Park	City parks are owned and operated by a city.	411
Fast Food Restaurant W/O Drive Thru	This land use includes fast-food restaurants without drive-through windows. Patrons generally order at a cash register and pay before they eat.	933
Fast Food Restaurant With Drive Thru	This category includes fast-food restaurants with drive-through windows.	934
Golf Course	Golf courses include 9, 18, 27 and 36 hole courses. Some sites may also have driving ranges and clubhouses with a pro shop, restaurant, lounge and banquet facilities.	430
Health Club	These are privately-owned facilities that primarily focus on individual fitness or training. Typically they provide exercise classes; weightlifting, fitness and gymnastics equipment; spas; locker rooms; and small restaurants or snack bars.	492

**Table 1: Land Use Sub Type Descriptions**

Land UseSubType	Description <sup>1</sup>	ITE Number
High Turnover (Sit Down Restaurant)	This land use consists of sit-down, full-service eating establishments with turnover rates of approximately one hour or less. This type of restaurant is usually moderately priced and frequently belongs to a restaurant chain.	932
Hotel	Hotels are places of lodging that provide sleeping accommodations and supporting facilities such as restaurants; cocktail lounges; meeting and banquet rooms or convention facilities; limited recreational facilities and other retail and service shops.	310
Motel	Motels are places of lodging that provide sleeping accommodations and often a restaurant. Motels generally offer free on-site parking and provide little or no meeting space and few supporting facilities.	320
Movie Theater (No Matinee)	Movie theaters consist of audience seating, single or multiple screens and auditoriums, a lobby and a refreshment stand. Movie theaters without matinees show movies on weekday evenings and weekends only; there are no weekday daytime showings.	443
Quality Restaurant	This land use consists of high quality, full-service eating establishments with typical turnover rates of at least one hour or longer. Quality restaurants generally do not serve breakfast, some do not serve lunch; all serve dinner. This type of restaurant usually requires reservations and is generally not part of a chain. Patrons commonly wait to be seated, are served by a waiter, order from menus and pay for meals after they eat.	931
Racquet Club	These are privately-owned facilities that primarily cater to racquet sports.	491
Recreational Swimming Pool	This is a typical recreational swimming pool that may be associated with community centers, parks, swim clubs, etc.	
<b>PARKING</b>		
Enclosed Parking Structure	This is an enclosed parking structure that may be above or below ground. It is not covered in asphalt. This land use will require lighting and ventilation, and will be more than one floor with no elevator.	
Enclosed Parking with Elevator	This is an enclosed parking structure that may be above or below ground. It is not covered in asphalt. This land use will require lighting and ventilation, and will be more than one floor with an elevator.	
Other Asphalt Surfaces	This is an asphalt area not used as a parking lot (e.g., long driveway, basketball court, etc.)	
Other Non-Asphalt Surfaces	This is a non-asphalt area (e.g., equipment foundation, loading dock area, etc.).	
Parking Lot	This is a typical single surface parking lot typically covered with asphalt. This land use will require lighting.	
Unenclosed Parking Structure	This is an unenclosed parking structure that may be above or below ground. It is not covered in asphalt. This land use will require lighting but not ventilation. It will be more than one floor with no elevator.	
Unenclosed Parking with Elevator	This is a unenclosed parking structure that may be above or below ground. It is not covered in asphalt. This land use will require lighting but not ventilation. It will be more than one floor with an elevator.	



**Table 1: Land Use Sub Type Descriptions**

Land UseSubType	Description <sup>1</sup>	ITE Number
<b>RETAIL</b>		
Automobile Care Center	An automobile care center houses numerous businesses that provide automobile-related services, such as repair and servicing; stereo installation; and seat cover upholstery.	942
Convenience Market (24 Hour)	These markets sell convenience foods, newspapers, magazines and often beer and wine. They do not have gasoline pumps.	851
Convenience Market With Gas Pumps	These markets sell gasoline, convenience foods, newspapers, magazines and often beer and wine. This includes convenience markets with gasoline pumps where the primary business is the selling of convenience items, not the fueling of motor vehicles.	853
Discount Club	A discount club is a discount store or warehouse where shoppers pay a membership fee in order to take advantage of discounted prices on a wide variety of items such as food, clothing, tires and appliances. Many items are sold in large quantities or in bulk.	857
Electronic Superstore	These are free-standing facilities that specialize in the sale of electronic merchandise.	863
Free-Standing Discount Store	Discount stores offer centralized cashiering and sell products that are advertised at discount prices. These stores offer a variety of customer services and maintain long store hours seven days a week.	815
Free-Standing Discount Superstore	The discount superstore is similar to the free-standing discount stores with the addition that they also contain a full-service grocery department under the same roof that shares entrances and exits with the discount store area.	813
Gasoline/Service Station	This land use includes gasoline/service stations where the primary business is the fueling of motor vehicles. They may also have ancillary facilities for servicing and repairing motor vehicles.	944
Hardware/Paint Store	These stores sell hardware and paint supplies and are generally free-standing buildings.	816
Home Improvement Superstore	These are free-standing facilities that specialize in the sale of home improvement merchandise.	862
Regional Shopping Center	A shopping center is an integrated group of commercial establishments that is planned, developed, owned and managed as a unit. A shopping center's composition is related to its market area in terms of size, location and type of store.	820
Strip Mall	Small strip shopping centers contain a variety of retail shops and specialize in quality apparel, hard goods and services such as real estate offices, dance studios, florists and small restaurants.	814



**Table 1: Land Use Sub Type Descriptions**

Land UseSubType	Description <sup>1</sup>	ITE Number
Supermarket	Supermarkets are free-standing retail stores selling a complete assortment of food: food preparation and wrapping materials; and household, cleaning items. Supermarkets may also contain the following products and services: ATMs, automobile supplies, bakeries, books and magazines, dry cleaning, floral arrangements, greeting cards, limited-service banks, photo centers, pharmacies and video rental areas.	850
<b>COMMERCIAL</b>		
Bank (With Drive-Through)	Drive-in banks provide banking facilities for motorists who conduct financial transactions from their vehicles; many also serve patrons who walk into the building.	912
General Office Building	A general office building houses multiple tenants where affairs of businesses commercial or industrial organizations or professional persons or firms are conducted. If information is known about individual buildings, it is suggested that this land use be used instead of the more generic office park.	710
Government (Civic Center)	A group of government buildings that are interconnected by pedestrian walkways.	733
Government Office Building	This is an individual building containing either the entire function or simply one agency of a city, county, state, federal, or other governmental unit.	730
Hospital	A hospital is any institution where medical or surgical care and overnight accommodations are provided to non-ambulatory and ambulatory patients. However, it does not refer to medical clinics or nursing homes.	610
Medical Office Building	This is a facility that provides diagnoses and outpatient care on a routine basis but is unable to provide prolonged in-house medical and surgical care. One or more private physicians or dentists generally operate this type of facility.	720
Office Park	Office parks are usually suburban subdivisions or planned unit developments containing general office buildings and support services, such as banks, restaurants and service stations, arranged in a park-or campus-like atmosphere. This should be used if details on individual buildings are not available.	750
Pharmacy/Drugstore W/O Drive Thru	These are retail facilities that primarily sell prescription and non-prescription drugs. These facilities may also sell cosmetics, toiletries, medications, stationery, personal care products, limited food products and general merchandise. The drug stores in this category do not contain drive-through windows.	880

**Table 1: Land Use Sub Type Descriptions**

Land UseSubType	Description <sup>1</sup>	ITE Number
Pharmacy/Drugstore With Drive Thru	These are retail facilities that primarily sell prescription and non-prescription drugs. These facilities may also sell cosmetics, toiletries, medications, stationery, personal care products, limited food products and general merchandise. The drug stores in this category contain drive-through windows.	881
Research & Development	R&D centers are facilities devoted almost exclusively to R&D activities. The range of specific types of businesses contained in this land use category varies significantly. R&D centers may contain offices and light fabrication areas.	760
<b>INDUSTRIAL</b>		
General Heavy Industry	Heavy industrial facilities usually have a high number of employees per industrial plant and are generally limited to the manufacturing of large items.	120
General Light Industry	Light industrial facilities are free-standing facilities devoted to a single use. The facilities have an emphasis on activities other than manufacturing and typically have minimal office space. Typical light industrial activities include printing, material testing and assembly of data processing equipment.	110
Industrial Park	Industrial parks contain a number of industrial or related facilities. They are characterized by a mix of manufacturing, service and warehouse facilities with a wide variation in the proportion of each type of use from one location to another. Many industrial parks contain highly diversified facilities.	130
Manufacturing	Manufacturing facilities are areas where the primary activity is the conversion of raw materials or parts into finished products. It generally also has office, warehouse, R&D functions at the site.	140
Refrigerated Warehouse-No Rail	This is a warehouse that has refrigeration but no rail spur.	150
Refrigerated Warehouse-Rail	This is a warehouse that has refrigeration and a rail spur.	150
Unrefrigerated Warehouse-No Rail	This is a warehouse that does not have refrigeration and no rail spur.	150
Unrefrigerated Warehouse-Rail	This is a warehouse that does not have refrigeration but has a rail spur.	150

1. Based on land use descriptions in ITE Trip Generation 8th Edition. In September 2012, ITE published the 9<sup>th</sup> edition that updated some of the trip rates from the 8<sup>th</sup> edition. The updates are not yet incorporated into CalEEMod. However, the user has the ability to override the trip rate default but is expected to justify the change  $\tilde{a}$  } Á c @ ^ Á % á c t i o n a t t h e b o t t o m o f t h e O p e r a t i o n a l - M o b i l e s c r e e n .

### Unit Amount

Tabbing over to the next column, the user enters the appropriate size of the land use in terms of the size metric selected. This will be used to calculate the rest of the columns in this datagrid.

### Size Metric

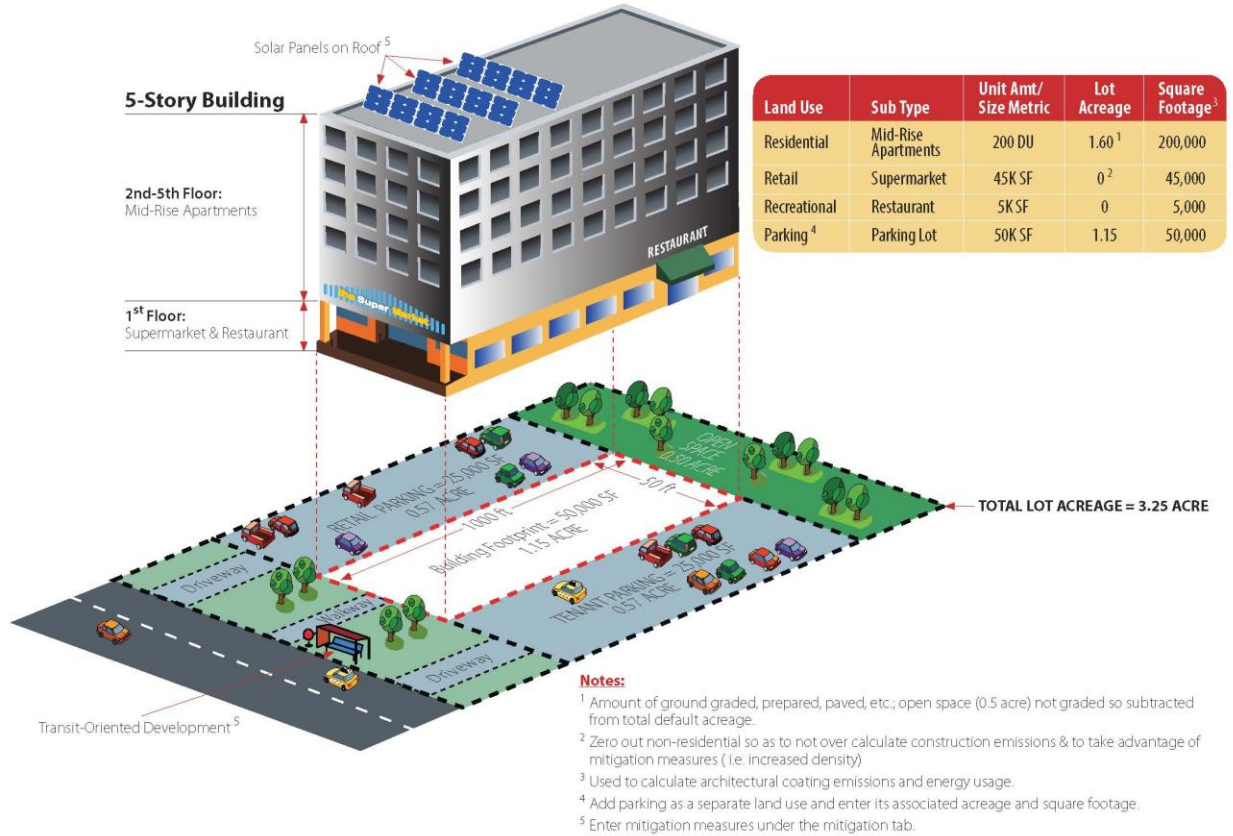
Tabbing over to the next column in the land use identification row, the user can select another size metric unit if it is available for that land use subtype. For example, a school land use allows the user to define its size by the number of students, building square footage, or number of employees. Please note that the square footage, which is used for calculating such impacts as architectural coatings and energy use, relates to the total building square footage and not the building footprint or lot acreage (which is used for housing density as well as grading and site preparation calculations).

### Lot Acreage (datagrid)

The user should override the default value if known. For multi-use, multistory building, the square footage should be preserved for each individual land use and the acreage assigned to the residential portion or split between non-residential land uses if there is no residential. The figure below provides an example of a mixed use project and how to apply the appropriate square footage and acreage for an accurate calculation of air quality impacts.

Acreage is used to estimate housing density as needed for calculations (see Table 2) and total acreage for the project is used in assigning construction default data (e.g., grading, site preparation, etc.). Based on ITE data, CalEEMod is able to estimate the acres per dwelling unit (DU) for residential land use. For example, 10 apartments in a low rise will need a 0.625 acre lot (10 DU divided by 16 acres/DU). According to the Residential Appliance Saturation Survey (RASS), low rise apartments are 1000 square foot per DU (see Table 2.1) so the building footprint is 0.23 acres (10 DU x 1000 sq ft/DU divided by 43,560 sq ft per acre). Thus, the lot space beyond the residential footprint accounts for driveway and landscaping.

## Example of Mixed Use Project in CalEEMod



**Table 2: Default Housing Density**

Land Use Sub Type	Density (Dwelling Units/Acre)
Single Family Housing	3
Apartments low rise	16
Apartments mid rise	38
Apartments high rise	62
Condo/townhouse	16
Condo/townhouse high rise	64
Mobile Home Park	8
Retirement Community	5
Congregate care (Assisted Living)	16

1. Based on the density assumed in ITE Trip Generation 8th Edition

### Square Footage

The user should override the default value if known. This is the total building square footage.

### Population (datagrid)

This is the population estimated for the land use identified. The user should override the default value if known.

### Population and Lot Acreage (text box)

This is the total population and acreage of all land uses entered in the data grid. This is for informational purposes [ ~ Á ç æ | ~ ^ • Á c @æc Á , ã | | Á à ^ Á ~ • ^ à Á à ^ Á c @ ^ Á ] ; [ \* user.

## 4.3 Construction

The construction screen introduces the first of a tabbed structure subscreens. There are seven subscreens for construction with each one listed in the grey area under the screen name. To jump to different subscreens: the user can use the next and previous buttons, click on the grey tab name, or use the menu bar. Default information is based on a survey of construction sites grouped by construction phase and lot acreage performed by SCAQMD which can be found in Appendix E. The default construction equipment list and phase length are most appropriate for the size and types surveyed while the survey has been extrapolated to indicate default values, more detailed site specific equipment and phases are highly suggested in these cases for the most accurate results.

### 4.3.1 Construction Phase

This is the screen where the user enters the type of each construction phase and the date range of these phases. The date of the construction phase is critical in determining the correct emission factor for the off-road equipment • ã } & ^ Á Ô Æ Ü Ó q • Á ~ æ & c [ ; Defául & @æ } \* ^ Á ^ æ & phases are based on the total lot acreage of the project. Depending on the project being modeled, not all phases will be necessary (e.g., not all projects require demolition). In addition multiple phases of similar types may be used for large projects with build out in stages. If the project has demolition, grading, and site preparation phases, additional project specific data will need to be entered on Demolition subscreen and Dust from Material Movement subscreen.

#### Phase Name

The user should enter a unique name for the phase in the text box.

#### Phase Type

The user selects from the drop down list the type of construction phase: Site preparation, demolition, grading, building construction, paving, and architectural coating. This influences the types of calculations and default assumptions for on-road vehicle trips and fugitive emissions that occur in subsequent construction subscreens. The definitions of the default data phases are as follows:

- ◁ Demolition involves tearing down of buildings or structures.
- ◁ Site Preparation involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.
- ◁ Grading involves the cut and fill of land to ensure the proper base and slope for the construction foundation.
- ◁ Building Construction involves the construction of structures and buildings.
- ◁ Architectural Coating involves the application of coatings to both the interior and exterior of buildings or structures and includes parking lot striping as well as painting of the walls of parking structures.
- ◁ Paving involves the laying of concrete or asphalt such as in parking lots or roads.

### Start Date and End Date

The user can enter with the aid of a calendar, the start and end dates. The default start date is 1/1/2014 starting with demolition with subsequent phases starting the next day after the phase. Changes to these cells will alter the total days estimated for the phase.

### Days per Week

The user can select from a drop down box the number of days per week (5, 6, or 7) the project will operate. Five days per week is assumed to be Monday through Friday, and six days per week is Monday through Saturday.

### Total Days

The total number of days in the construction phase is indicated. If the end date or the days per week are changed, clicking in this cell will recalculate the number of days. If the total number of days for a phase is changed, then once leaving this cell, the program will adjust the end date based on the start date for that phase.

## 4.3.2 Off-Road Equipment

This subscreen shows the off-road equipment usage for each phase. Since equipment lists can be lengthy, the user must go through a different subscreen for each phase. This is done by selecting the appropriate phase name from the drop down list or the Previous or Next buttons located next to the phase name. The emission calculations associated with this screen are from off-road equipment engine use based on the equipment list and phase length. The fugitive emissions from off-road equipment performing work are associated with additional information in other construction screens.

The user enters in the datagrid each piece of equipment in the phase in a new row. The user enters the unit amount and hours per day of equipment usage. Horsepower and load factors are loaded with the default average values of the mode tier according to population based on OFFROAD2011, but the user can override these values. Since CalEEMod is restricted in the



years of OFFROAD emission factors, CalEEMod will use the lower end year if a construction year is in between a year of OFFROAD values in the database. For example if a construction phase is in 2027, CalEEMod will use OFFROAD emission factors from 2025.

For site specific construction equipment lists including equipment not specifically listed can be added under the Other Equipment categories or Off-Highway Trucks listed in CalEEMod matching the closest in horsepower to the missing equipment for each phase the construction equipment is operating. For inclusion of water trucks and cement trucks specifically can be considered in two ways although both of those trucks were part of the SMAQMD vendor trip survey during construction. The first is to use the Off-Highway Trucks category in this screen. The second is to add these as additional vendor trips in the Trips and VMT screen.

### 4.3.3 Dust from Material Movement

This subscreen is used to enter the information necessary to calculate the fugitive dust emissions associated with grading phases. Three distinct fugitive dust calculations are performed as described in Appendix A: dust from dozers moving dirt around, dust from graders or scrapers leveling the land, and loading or unloading the dirt into haul trucks. These methods are described in the report prepared for the USEPA by Midwest Research Institute, Gap Filling PM<sub>10</sub> Emission Factors for Selected Open Area Dust Sources. The user needs to enter the amount of material imported and exported to the site in order for CalEEMod to estimate hauling trips correctly from material transport. There is an option to select either ton of debris or cubic yards. The user also selects if the import and export of material are phased. If they are phased a truck comes in with material and leaves with another load of material to export. Non-phased trips have one-way of the haul trip performed with an empty truck. Phasing material import and export reduces the number of haul trips. The number of acres that are displayed represent the total acres traversed by grading equipment assuming a blade width of 12 feet. In order to properly grade a piece of land multiple passes with equipment may be required. The acres is based on the equipment list and days in grading or site preparation phase according to the anticipated maximum number of acres a given piece of equipment can pass over in an 8-hour workday. See Appendix A for the equipment specific grading rates.

### 4.3.4 Demolition

This subscreen is used to enter the amount of material that is demolished if demolition phases are selected. The user can enter either the ton of material or the building square footage. Fugitive dust emissions from the demolition are then calculated. Demolition fugitive dust emissions are based on the methodology described in the report prepared for the USEPA by Midwest Research Institute, Gap Filling PM<sub>10</sub> Emission Factors for Selected Open Area Dust Sources.

### 4.3.5 Trip and VMT

This subscreen is used to provide the number and length of on-road vehicle trips for workers, vendors, and hauling. It also allows the user to select different weightings of vehicle fleet mixes and is either the EMFAC mix for the region, or an mix of the vehicle classes listed. HHDT, MHDT is a 50/50 percent mix of heavy-heavy duty trucks and medium-heavy duty trucks. LDA, LDT1,



LDT2 is 50/25/25 percent mix of light duty autos, light duty truck class 1 and light duty truck class 2. Since CalEEMod is restricted in the years of EMFAC emission factors, CalEEMod will use the lower end year if a construction year is in between a year of EMFAC values in the database. For example if a construction phase is in 2027, CalEEMod will use EMFAC emission factors from 2025.

The number of workers is 1.25 times the number of pieces of equipment for all phases except building construction and architectural coating. Building construction estimates the number of workers based on the types of land use and their size based on an analysis of a study conducted by SMAQMD. This study and its analysis are included in Appendix E. The number of workers for architectural coating is based on 20% of the building construction workers.

The number of vendor trips for building construction phase is based on a study performed by SMAQMD based on land use types and their size. As noted earlier, the SMAQMD trip survey during construction counted cement and water trucks as vendor trips. These values were phase is being eliminated and there are known water (and/or cement) trucks, it is recommended to consider those vendor trips under another phase or accounted for as OFFROAD equipment. Hauling trips are based on the assumption that a truck can handle 20 tons (or 16 cubic yards) of material per load. Assuming one load of material, CalEEMod considers a haul truck importing material will have a return trip with an empty truck (2 trips). Similarly, the haul truck to take material away will have an arrival trip in an empty truck (2 trips). Thus, each trip to import and export material is considered as two separate round trips (4 trips). Then, a haul truck trip to import material will be the same haul truck to export material (2 trips).

### 4.3.6 On-Road Fugitive Dust

This subscreen defines the variables that will be used to determine the fugitive dust emissions from construction on-road vehicles over paved and unpaved roads. The emission calculations are based on US EPA February 2011 paved road and November 2006 unpaved roads emission factors. The variables in this datagrid are the same as those defined in the appropriate AP-42 sections.

### 4.3.7 Architectural Coatings

This subscreen allows the user to override any of the default interior and exterior surface area estimated for residential and non-residential buildings. In addition, each of these surface types has a different emission factor indicating the VOC content of the paint in grams per liter. See Appendix A for the method of estimating surface areas to be coated from building square footage.

## 4.4 Operational Mobile

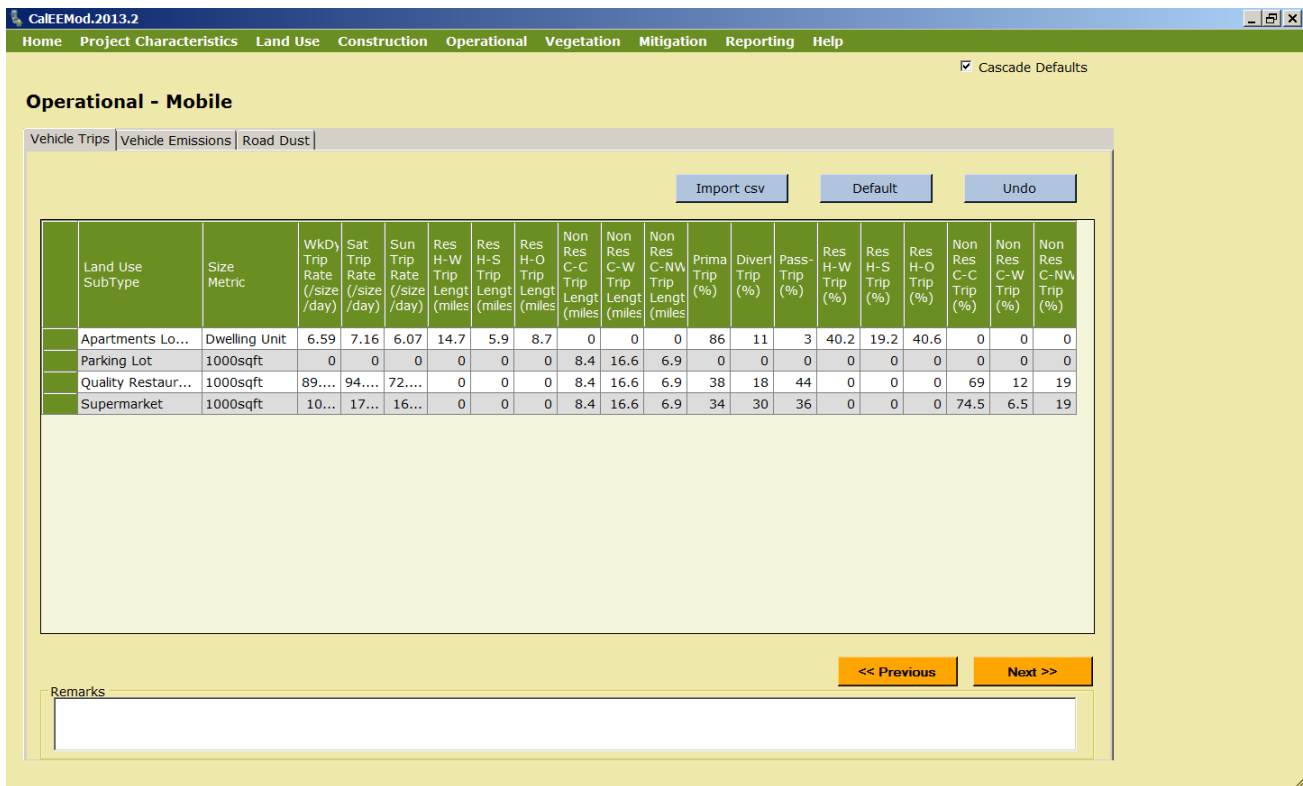
The operational mobile screen is made up of 3 subscreens: Vehicle Trips, Vehicle Emissions, and Road Dust. These screens are used in defining the information necessary to calculate the emissions associated with operational on-road vehicles.



### 4.4.1 Vehicle Trips

Vehicle Trips are defined for each land use subtype in the project. The user can edit any of this information by entering a new value in the appropriate cell. Trip rates are in terms of the size metric (square footage or dwelling unit) defined on the land use screen and are listed for weekday, Saturday and Sunday if available. Trip lengths are for primary trips. Trip purposes are primary, diverted, or pass-by trips. Diverted trips are assumed to take a slightly different path than a primary trip and are assumed to be 25% of the primary trip lengths. Pass-by trips are assumed to be 0.1 miles in length and are a result of no diversion from the primary route. Residential trip types are defined as home-work (H-W), home-shop (H-S), and home-other (H-O). Non-residential trip types are defined as commercial-customer (C-C), commercial-work (C-W), and commercial-nonwork (C-NW) such as delivery trips. See Appendix A for the equations and methodology used to calculate motor vehicle emissions from the operation of a project.

For the residential and non-residential category. For warehouses, SCAQMD evaluated the primary data from ITE along with other recent studies regarding warehouses and concluded that it was more appropriate to break out the warehouses based on access to a rail spur and refrigeration. In addition, they concluded that it was more appropriate to use the maximum values from the studies. A detail memorandum describing the justification for these values is contained in Appendix E.



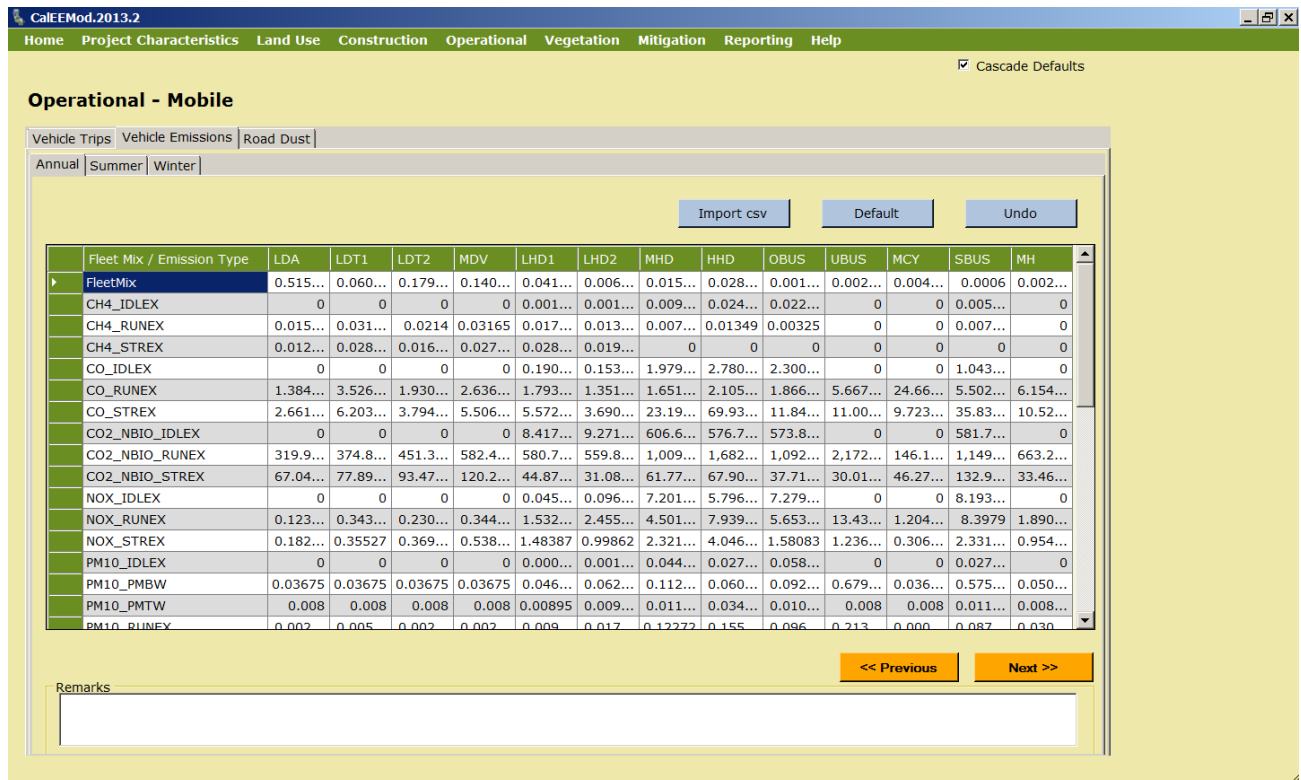
The screenshot shows the 'Operational - Mobile' screen in the CalEEMod 2013.2 application. The 'Vehicle Trips' tab is selected, showing a table with columns for Land Use SubType, Size Metric, and trip rates/lengths for various days and purposes. The table includes rows for 'Apartments Lo...', 'Parking Lot', 'Quality Restaur...', and 'Supermarket'. Navigation buttons like 'Import csv', 'Default', 'Undo', '<< Previous', and 'Next >>' are visible.

Land Use SubType	Size Metric	Wkd Trip Rate (/size /day)	Sat Trip Rate (/size /day)	Sun Trip Rate (/size /day)	Res H-W Trip Length (miles)	Res H-S Trip Length (miles)	Res H-O Trip Length (miles)	Non Res C-C Trip Length (miles)	Non Res C-W Trip Length (miles)	Non Res C-NW Trip Length (miles)	Primary Trip (%)	Divert Trip (%)	Pass-Trip (%)	Res H-W Trip (%)	Res H-S Trip (%)	Res H-O Trip (%)	Non Res C-C Trip (%)	Non Res C-W Trip (%)	Non Res C-NW Trip (%)
Apartments Lo...	Dwelling Unit	6.59	7.16	6.07	14.7	5.9	8.7	0	0	0	86	11	3	40.2	19.2	40.6	0	0	0
Parking Lot	1000sqft	0	0	0	0	0	0	8.4	16.6	6.9	0	0	0	0	0	0	0	0	0
Quality Restaur...	1000sqft	89....	94....	72....	0	0	0	8.4	16.6	6.9	38	18	44	0	0	0	69	12	19
Supermarket	1000sqft	10...	17...	16...	0	0	0	8.4	16.6	6.9	34	30	36	0	0	0	74.5	6.5	19

### 4.4.2 Vehicle Emissions

This subscreen is a large datagrid containing the detailed vehicle emission factors and fleet mix based on EMFAC2011. See Appendix A for information on how these emission factors were developed based on burden mode EMFAC runs including effects from Pavley (Clean Car Standards) and Low Carbon Fuel Standards. Pavley and Low Carbon Fuel Standards are applicable for future years and do not impact EMFAC values prior to these regulations implementations (i.e, 1990, 2000, 2005, etc). It is anticipated that most users will not edit data in this subscreen. There is a separate tab for annual, summer, and winter emission values. If the user wants to alter the breakdown of fuel types (catalytic, non-catalytic, other) within a vehicle class, they will have to provide their own data as this will likely be an infrequent change due to CEQA enforceability requirements. For details on how EMFAC data was processed see Appendix A.

This screen along with the previous screen (Vehicle Trips) will calculate the emissions associated with on-road motor vehicle use. It does not include the fugitive dust emissions from travel over roads as these are associated with the next screen (Road Dust).



The screenshot shows the 'Operational - Mobile' screen in the CalEEMod.2013.2 application. The interface includes a menu bar (Home, Project Characteristics, Land Use, Construction, Operational, Vegetation, Mitigation, Reporting, Help) and a toolbar with 'Import csv', 'Default', and 'Undo' buttons. The main area displays a datagrid with columns for 'Fleet Mix / Emission Type' and various emission factors (LDA, LDT1, LDT2, MDV, LHD1, LHD2, MHD, HHD, OBUS, UBUS, MCY, SBUS, MH). The 'FleetMix' row is highlighted. Below the datagrid are 'Previous' and 'Next' navigation buttons and a 'Remarks' text area.

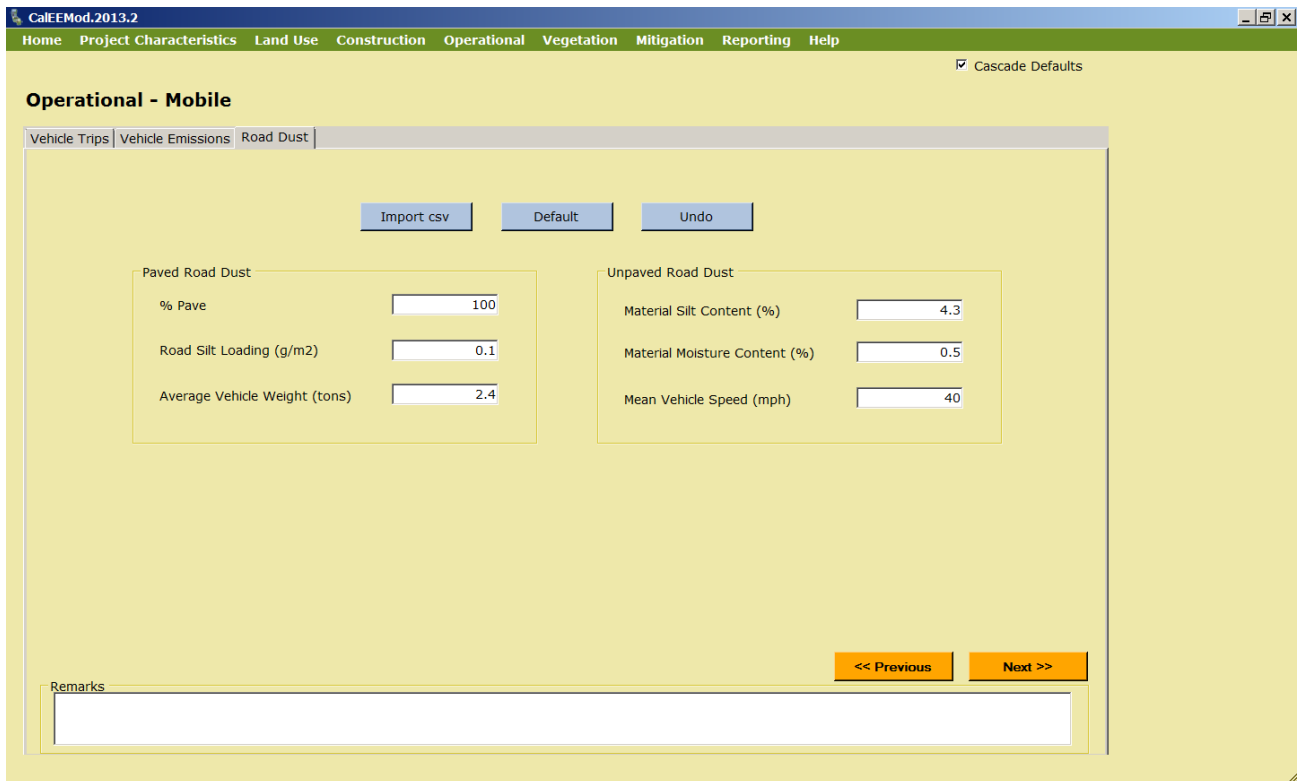
Fleet Mix / Emission Type	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
FleetMix	0.515...	0.060...	0.179...	0.140...	0.041...	0.006...	0.015...	0.028...	0.001...	0.002...	0.004...	0.0006	0.002...
CH4_IDLEX	0	0	0	0	0.001...	0.001...	0.009...	0.024...	0.022...	0	0	0.005...	0
CH4_RUNEX	0.015...	0.031...	0.0214	0.03165	0.017...	0.013...	0.007...	0.01349	0.00325	0	0	0.007...	0
CH4_STREX	0.012...	0.028...	0.016...	0.027...	0.028...	0.019...	0	0	0	0	0	0	0
CO_IDLEX	0	0	0	0	0.190...	0.153...	1.979...	2.780...	2.300...	0	0	1.043...	0
CO_RUNEX	1.384...	3.526...	1.930...	2.636...	1.793...	1.351...	1.651...	2.105...	1.866...	5.667...	24.66...	5.502...	6.154...
CO_STREX	2.661...	6.203...	3.794...	5.506...	5.572...	3.690...	23.19...	69.93...	11.84...	11.00...	9.723...	35.83...	10.52...
CO2_NBIO_IDLEX	0	0	0	0	8.417...	9.271...	606.6...	576.7...	573.8...	0	0	581.7...	0
CO2_NBIO_RUNEX	319.9...	374.8...	451.3...	582.4...	580.7...	559.8...	1,009...	1,682...	1,092...	2,172...	146.1...	1,149...	663.2...
CO2_NBIO_STREX	67.04...	77.89...	93.47...	120.2...	44.87...	31.08...	61.77...	67.90...	37.71...	30.01...	46.27...	132.9...	33.46...
NOX_IDLEX	0	0	0	0	0.045...	0.096...	7.201...	5.796...	7.279...	0	0	8.193...	0
NOX_RUNEX	0.123...	0.343...	0.230...	0.344...	1.532...	2.455...	4.501...	7.939...	5.653...	13.43...	1.204...	8.3979	1.890...
NOX_STREX	0.182...	0.35527	0.369...	0.538...	1.48387	0.99862	2.321...	4.046...	1.58083	1.236...	0.306...	2.331...	0.954...
PM10_IDLEX	0	0	0	0	0.000...	0.001...	0.044...	0.027...	0.058...	0	0	0.027...	0
PM10_PMBW	0.03675	0.03675	0.03675	0.03675	0.046...	0.062...	0.112...	0.060...	0.092...	0.679...	0.036...	0.575...	0.050...
PM10_PMTW	0.008	0.008	0.008	0.008	0.00895	0.009...	0.011...	0.034...	0.010...	0.008	0.008	0.011...	0.008...
PM10_RUNEX	0.002	0.005	0.002	0.002	0.009	0.017	0.12372	0.155	0.096	0.213	0.000	0.087	0.030

### 4.4.3 Road Dust

Methods for calculating fugitive emissions from paved and unpaved roads. The defaults for the road dust (e.g., material silt content, material moisture content, ) are statewide averages, but the user has the ability to override the defaults if data specific to the project is known. Local jurisdictions can also provide guidance to users as to what default properly reflects known regional road dust parameters.

For the San Luis Obispo region, users are recommended to provide the following road dust parameters overriding the statewide defaults:

- J È H Á ~ [ ; Á % T æ c ^ ; ã (instead of 4.3 statewide default) Á Ç ã D + Á
- € È F Á ~ [ ; Á % T æ c ^ ; ã æ | (instead of 0.5 statewide default) } c Á Ç ã D + Á
- H G È I Á ~ [ ; Á % T ^ æ } Á X ^ (instead of 40 statewide default) @ D + Á

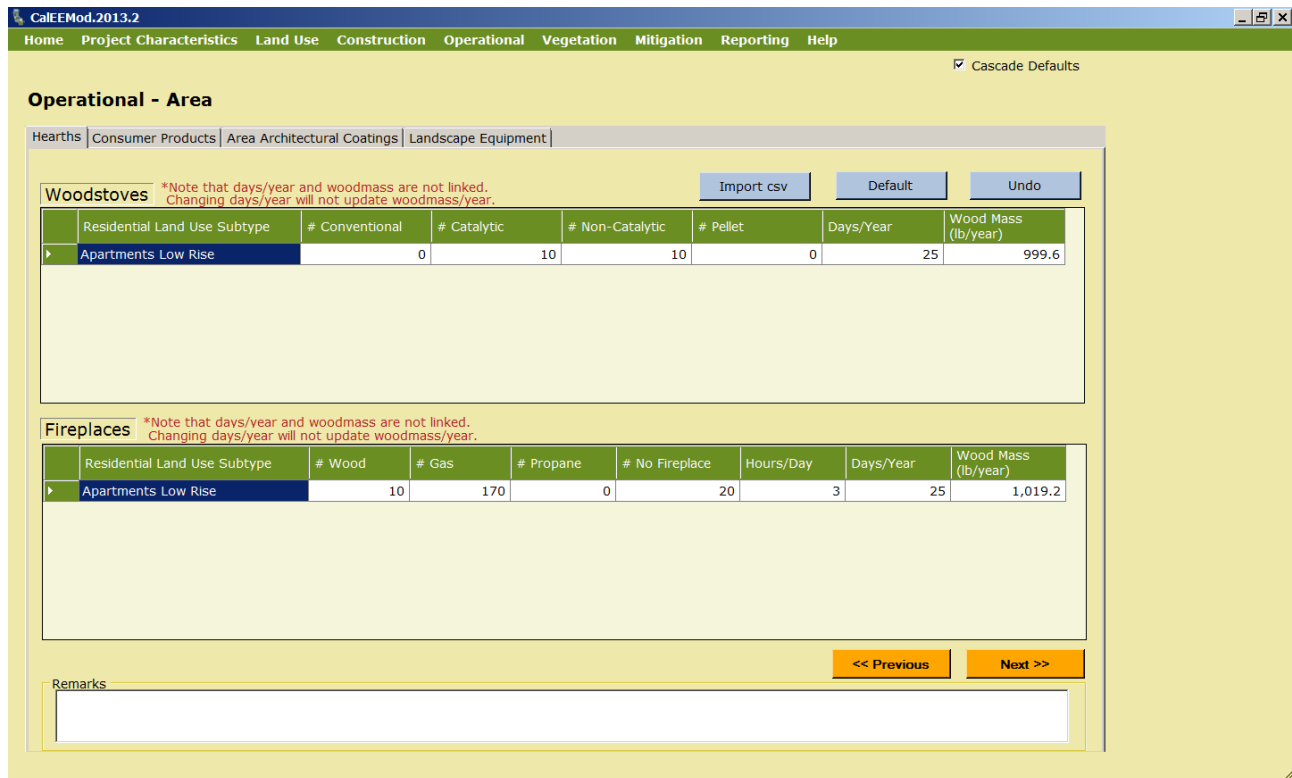


### 4.5 Area

The area source screen consists of four subscreens: Hearths, Consumer Products, Area Architectural Coatings, and Landscaping Equipment. Natural gas emission variables from all uses except hearths are included in the energy use screen.

### 4.5.1 Hearths and Woodstoves

This subscreen allows the user to enter the number of woodstoves and hearths of various types as well as the usage of these devices. Woodstoves are separate from fireplaces since a home may have both and these devices may have different use patterns. The number of devices that is entered for each device type represents the total number of devices installed in the dwelling units for a particular land use. See Appendix A for emissions calculation methodology and details of variables that the user can not override. Some of these emissions may be classified as biogenic and are therefore reported as CO<sub>2</sub>-Biogenic. For most locations a default percent of hearths and stoves was provided by districts and is multiplied through. The number was chosen for CalEEMod instead of a percentage to allow for incorporation of various districts rules regarding hearths and woodstoves in new residences without having specialized screens. Commercial land uses by default do not have any hearths or woodstoves in CalEEMod. These are included for those cases where they may occur such as in restaurants or hotels.



The San Joaquin Valley jurisdiction has a regulatory limit on the number of hearths depending upon the type and number of residential development. The regulatory limit is generated by CalEEMod but all the input parameters (e.g., unit density, etc.) are necessary to determine the value. Thus, the regulatory limit is calculated based on impacts from the number of hearths inputted on the Area source screen. Therefore, if the user wants to calculate emissions from regulatory limit, the report needs to be run to determine the regulatory limit and the user needs to go back to the Area source screen to

input that value and re-run the report. If the user chooses to calculate emissions from a different number of hearths (e.g, a number of hearths less than the regulatory limit), then that number needs to be inputted on the Area source screen to properly calculate emissions. Again, t@^ Á | ^ ] [ | c Á , ã | | Á ] : [ ç ã á ^ Á c @^ Á | ^ \* ~ | æ c [ | ^ Á | ã { ã c Á ~ } á ^ ! ç æ | ~ ^ Á ~ } á ^ ! Á c ã | , Á X æ | ~ ^ +

### 4.5.2 Consumer Products

Consumer products are various solvents used in non-industrial applications which emit VOCs during their product use. These typically include cleaning supplies, kitchen aerosols, cosmetics and toiletries. SCAQMD has developed an emission factor based on the total of all building square footage for both residential and non-residential buildings. Details of how this emission factor was developed can be found in Appendix E. The user can change this emission factor if they have more relevant data.

### 4.5.3 Area Architectural Coating

This subscreen has text boxes for the reapplication rate and paint VOC content for each building surface type. The reapplication rate is the frequency at which surfaces get repainted every year. A default of 10% is used which means that 10% of the surface area is repainted each year so all surfaces are completely repainted once every 10 years. Daily emissions divide the annual rate by 365 days per year. This is based on assumptions used by SCAQMD in their district rules regarding architectural coatings. Some districts provided details on their coating regulations that phase in over time which have been incorporated to the extent feasible given the general classifications of paint (interior or exterior for residential and non-residential). As not all districts submitted their architectural coating regulations, consult your local agency for any suggested values that may be lower than the state regulations.

If changing the operational architectural coating VOC content (e.g., lower VOC content limit), the User is advised to change the architectural coating VOC content under the Area Mitigation screen where the operational coating VOC content defaults will not change unless prompted. If not, the model assumes the value on the mitigation screen is the %New Value+(as listed in report). In the case of applying a lower VOC content limit on the operational architectural coating screen, the unchanged mitigation value (%New Value+) will be higher. However, unless the box is checked on the Area Mitigation screen next to the coating type, the model will not calculate a mitigated emissions value.

### 4.5.4 Landscape Equipment

This subscreen has two text boxes to show the number of snow days or summer days. In addition, the defaults consider a realistic number of days which the landscaping equipment would be operated. For example, landscaping at commercial facilities typically do not take place during a weekend or during the summer at educational facilities that are not open. The number of days are applied to the appropriate landscape equipment types available in OFFROAD2011 using the average horsepower and load factors of the population mode. The

derivation of emission factors used for each equipment type from OFFROAD2011 is described in Appendix A.

## 4.6 Energy Use

The energy use screen is used to gather the information necessary to estimate the emissions associated with building electricity and natural gas usage (non-hearth). The electricity energy use is in kilowatt hours per size metric for each land use subtype and natural gas use is in kiloBritish Thermal Units (kBTU) per size metric for each land use subtype. The California Energy Code contains energy conservation standards applicable to all residential and non-residential buildings throughout California, including schools. The electricity use is split into three areas: Title-24, non-Title 24, and lighting. The Title 24 of the California Code of Regulations, known as the California Building Standards  $\hat{O} [ \grave{a} ^ \acute{A} \grave{C} [ ; \acute{A} \grave{U} \acute{s} \acute{a} \acute{r} \acute{e} \acute{d} \acute{e} ] + D$  as the major building envelope systems covered by Part 6 (California Energy Code) of Title 24 such as space heating, space cooling, water heating, and ventilation. Lighting was separated out since it can be both part and not part of Title-24. Since lighting is not considered as part of the building envelope energy budget, CalEEMod does not consider lighting to have any further association with Title 24 references in the program. Non-Title 24 is everything else such as appliances and electronics. Natural gas is just distinguished as Title 24 or Non-Title 24. The default values are based on the CEC sponsored California Commercial End Use Survey (CEUS) and Residential Appliance Saturation Survey (RASS) studies<sup>9</sup>. For climate zones not included in these surveys a data from the closest climate zone was used as a surrogate. Since these studies are based on older buildings, adjustments have been made to account for changes to Title 24 building codes as described in Appendix A. A user should select the use historical box if they only want an adjustment to the 2005 standards which were in effect when ARB developed its Scoping Plan 2020 No Action Taken predictions. After selecting the historical button, the user must also click the default button to load the historical default values.

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9 CEC. October 2010. Residential Appliance Saturation Survey. Available online at:

<http://www.energy.ca.gov/appliances/rass>

CEC. 2006. Commercial End-Use Survey. Available online at: <http://www.energy.ca.gov/ceus/>

CalEEMod.2013.2

Home Project Characteristics Land Use Construction Operational Vegetation Mitigation Reporting Help

Cascade Defaults

### Operational - Energy Use

Using Historical Data

Import csv Default Undo

Land Use Subtype	Title-24 Electricity Energy Intensity (KWhr/size/yr)	Nontitle-24 Electricity Energy Intensity (KWhr/size/yr)	Lighting Energy Intensity (KWhr/size/yr)	Title-24 Natural Gas Energy Intensity (KBTU/size/yr)	Nontitle-24 Natural Gas Energy Intensity (KBTU/size/yr)
▶ Apartments Low Rise	636.58	2,630.88	810.36	11,224.2	2,498
Parking Lot	0	0	0.88	0	0
Quality Restaurant	15.13	28.48	8.79	81.74	195.77
Supermarket	7.42	22.82	9.1	13.31	6.61

Remarks

<< Previous Next >>

## 4.7 Water and Wastewater Use

This module only estimates the land uses contribution of GHG emissions associated with supplying and treating the water and wastewater. This screen is used to enter the amount of water in gallons used indoors and outdoors for each land use subtype<sup>10</sup>. The indoor water is also used to estimate the amount of wastewater. The electricity intensity for various phases of providing water is broken out. Depending on the specific water supply used or treatment method used these numbers can vary over a wide range. Supplying water is bringing the water from its primary source such as the ground, river, or snowpack to the treatment plant. Distributing the water is bringing the water from the treatment plant to the end users. The electricity intensities are multiplied by the utility intensity factors for the GHGs and are classified as indirect emissions. The default

2006 Refining • Á ~ ! [ { Á c @ ^ Á

Estimates of Water-Related Energy Use in California using the average values for Northern and

10 Gleick, P.H.; Haasz, D.; Henges-Jeck, C.; Srinivasan, V.; Cushing, K.K.; Mann, A. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California. Published by the Pacific Institute for Studies in Development, Environment, and Security. Full report available online at: [http://www.pacinst.org/reports/urban\\_usage/waste\\_not\\_want\\_not\\_full\\_report.pdf](http://www.pacinst.org/reports/urban_usage/waste_not_want_not_full_report.pdf). Appendices available online at: [http://www.pacinst.org/reports/urban\\_usage/appendices.htm](http://www.pacinst.org/reports/urban_usage/appendices.htm)

Dziegielewski, B.; Kiefer, J.C.; Optiz, E.M.; Porter, G.A.; Lantz, G.L.; DeOreo, W.B.; Mayer, P.W.; Nelson, J.O. 2000. Commercial and Institutional End Uses of Water. Published by the American Water Works Association Research Foundation.

Northern California Golf Association. Improving California Golf Course Water Efficiency. <http://www.owue.water.ca.gov/docs/2004Apps/2004-079.pdf>



Southern California<sup>11</sup>. The location will automatically select the appropriate values if using these defaults. Since the electricity can vary greatly based on locations, the user should override these values if they have more specific information regarding their specific water supply and treatment.

Wastewater may also have direct emissions of GHGs. These depend on the type of wastewater treatment system (e.g., septic, aerobic or lagoons) used and therefore the wastewater treatment type percentages are variables. In addition, the model calculates impacts if the solids are digested either through an anaerobic digester or with co-generation from combustion of digester gas. Each type has associated GHG emission factors. Some of these may be classified as biogenic. Not all of the biogenic emissions are accounted for since there are not adequate emissions factors at this time. Refer to Appendix A on how to properly change the defaults, if necessary, and the methodology used to calculate impacts from wastewater treatment.

CalEEMod.2013.2

Home Project Characteristics Land Use Construction Operational Vegetation Mitigation Reporting Help

Cascade Defaults

**Operational - Water and Wastewater**

Import csv Default Undo

Land Use Subtype	Size Metric	Indoor Water Use (gals/year)	Outdoor Water Use (gals/year)	Electricity Intensity Factor To Supply (kWhr/Mgal)	Electricity Intensity Factor To Treat (kWhr/Mgal)	Electricity Intensity Factor To Distribute (kWhr/Mgal)	Electricity Intensity Factor For Wastewater Treatment (kWhr/Mgal)	Septic Tank (%)	Aerobic (%)	Facultative Lagoons (%)	Anaerobic Digester with Combustion of Digester Gas (%)	Anaerobic Digestion with Cogeneration from Combustion of Digester Gas (%)
▶ Apartments Low Rise	Dwelling Unit	13,030...	8,215,...	9,727	111	1,272	1,911	10.33	87.46	2.21	100	0
Parking Lot	1000sqft	0	0	9,727	111	1,272	1,911	10.33	87.46	2.21	100	0
Quality Restaurant	1000sqft	1,517,...	96,872...	9,727	111	1,272	1,911	10.33	87.46	2.21	100	0
Supermarket	1000sqft	5,547,...	171,55...	9,727	111	1,272	1,911	10.33	87.46	2.21	100	0

Remarks

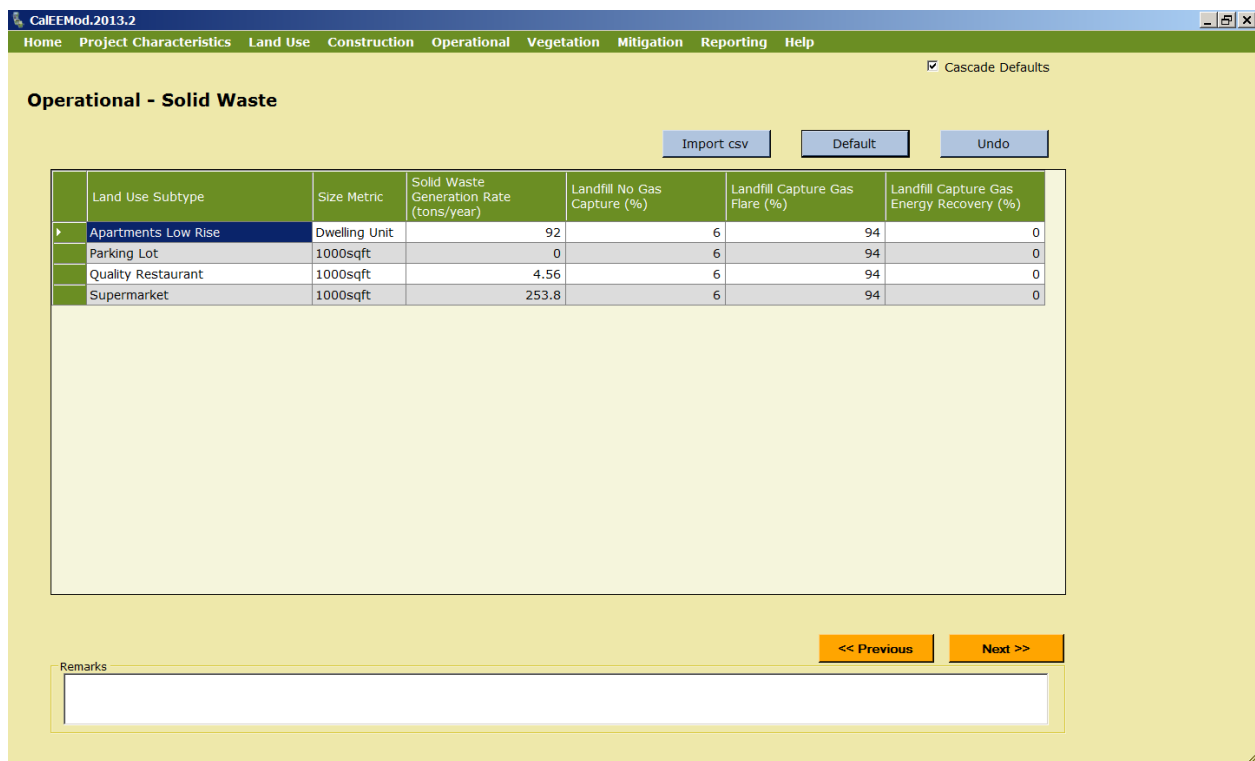
<< Previous Next >>

<sup>11</sup> CEC-500-2006-118.



## 4.8 Solid Waste

The solid waste module determines the GHG emissions associated with disposal of solid waste into landfills. In order to estimate the eventual contribution of GHG emissions from solid waste for the waste disposed by a land use annually, the total amount of carbon dioxide and methane that would be evolved over the span of many years is estimated using methods for quantifying GHG emissions from solid waste using the degradable organic content of waste<sup>12</sup>. Waste disposal rates by land use and overall composition of municipal solid waste in California was primarily based on Calrecycle data. The amount of methane emitted depends on characteristics of the landfill, and therefore the default percentage is based on the types of landfills assumed by ARB in their GHG emission inventories. Portions of these emissions are biogenic. The defaults for the gas capture (e.g., no capture, flaring, energy recovery) are statewide averages, but the user has the ability to override the defaults if the gas capture is known. Local jurisdictions can also provide guidance to users as to what default properly reflects known regional solid waste gas capture. Users in the Santa Barbara region are recommended to apply 100% landfill capture gas flare overriding the statewide default to reflect a more accurate regional solid waste activity.



CalEEMod.2013.2

Home Project Characteristics Land Use Construction Operational Vegetation Mitigation Reporting Help

Cascade Defaults

**Operational - Solid Waste**

Import csv Default Undo

Land Use Subtype	Size Metric	Solid Waste Generation Rate (tons/year)	Landfill No Gas Capture (%)	Landfill Capture Gas Flare (%)	Landfill Capture Gas Energy Recovery (%)
▶ Apartments Low Rise	Dwelling Unit	92	6	94	0
Parking Lot	1000sqft	0	6	94	0
Quality Restaurant	1000sqft	4.56	6	94	0
Supermarket	1000sqft	253.8	6	94	0

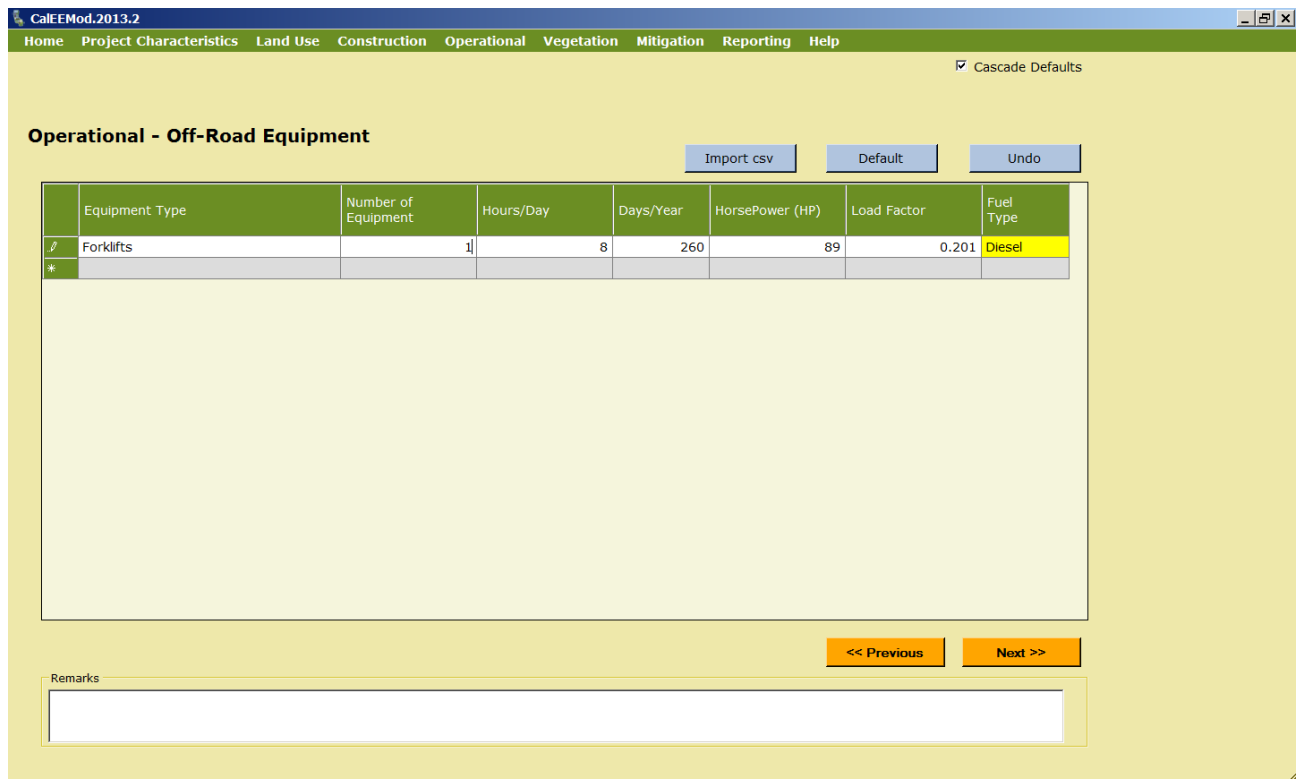
Remarks

<< Previous Next >>

12 IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 5 Waste.

## 4.9 Off-Road Equipment

A new sub-screen under Operational allows the user to identify any off-road equipment used during operational activities (e.g., forklifts, cranes, loaders, generator sets, pumps, pressure washers, etc.) at the project site. Because such equipment cannot be assumed to be needed for a particular land use project, a user needs to provide the input in order for CalEEMod to calculate the resulting emissions from equipment operation. A dropdown list of off-road equipment is provided for the user to identify each piece of equipment. The model requires the following specific information per equipment type. The user would need to provide the number of pieces for each equipment type. The model assumes an operation activity of 8 hours per day and 260 days per year, as well as the horsepower and load factor of the equipment type, but the user has the ability to override the default assumptions with project specific information. Finally, the model assumes diesel fuel, but a dropdown menu is provided to allow the user to choose bio-diesel or compressed natural gas (CNG) if known to power the equipment.



CalEEMod.2013.2

Home Project Characteristics Land Use Construction Operational Vegetation Mitigation Reporting Help

Cascade Defaults

**Operational - Off-Road Equipment**

Import csv Default Undo

	Equipment Type	Number of Equipment	Hours/Day	Days/Year	HorsePower (HP)	Load Factor	Fuel Type
?	Forklifts	1	8	260	89	0.201	Diesel
*							

<< Previous Next >>

Remarks

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## 4.10 Vegetation

The vegetation module is used to estimate the one-time change in carbon sequestration capacity of a vegetation land use type. The methods used are based on IPCC<sup>13</sup>. The user enters the vegetation land use type, the initial and final acreage of the vegetation land use type, and the annual carbon dioxide equivalent accumulation per acre if the user chooses to over ride the default value. Settlement land use acreage is not considered since it is a net zero at steady state unless trees are added.

### 4.10.1 Sequestration

This subscreen to vegetation is used to estimate the GHG emissions associated with the sequestration of net new trees added to the project site. Consistent with IPCC recommendations a 20 year active growth period is assumed. The user enters the tree type or miscellaneous if it is not known, and the total number of trees. The user can override the default carbon sequestration rate.

## 4.11 Mitigation

The mitigation module screen consists of six subscreens that the user can indicate and supply the necessary information to estimate the emissions after mitigation measures have been implemented. The mitigation measures included in CalEEMod are largely based on the recent

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13 IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4.













