



BAY AREA AIR QUALITY
MANAGEMENT DISTRICT

California Environmental Quality Act
Air Quality Guidelines
Appendix D:
Using CalEEMod for
Bay Area Projects

These guidelines are nonbinding recommendations, intended to assist lead agencies with navigating the CEQA process. They may be updated as needed in the future, and any updates will likewise be nonbinding and advisory.

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LIST OF ABBREVIATIONS

Air District	Bay Area Air Quality Management District
CalEEMod	California Emissions Estimator Model
CAPCOA	California Air Pollution Control Officers Association
CAPCOA Handbook	<i>Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers</i>
CARB	California Air Resources Board
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CPUC	California Public Utilities Commission
CSTDM	California Statewide Travel Demand Model
EDFZ	Electricity Demand Forecast Zone
EF	emissions factor
EMFAC	California Air Resources Board EMISSIONS FACTOR model
g/L	grams per liter
g/m ²	grams per meter-squared
GHG	greenhouse gas
Guidelines	<i>CEQA Air Quality Guidelines</i>
GWP	global warming potential
IPCC	Intergovernmental Panel on Climate Change
MPO	metropolitan planning organization
PM _{2.5}	particulate matter with a diameter less than or equal to 2.5 microns
PM ₁₀	particulate matter with a diameter less than or equal to 10 microns

ROG	reactive organic gases
RTPA	Regional Transportation Planning Agency
TAZ	Traffic Analysis Zone
VMT	vehicle miles traveled
VOC	volatile organic compound

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1 INTRODUCTION

This appendix was designed by the Bay Area Air Quality Management District (Air District) to assist California Environmental Quality Act (CEQA) practitioners in using the California Emissions Estimator Model (CalEEMod) for projects located in the Bay Area.

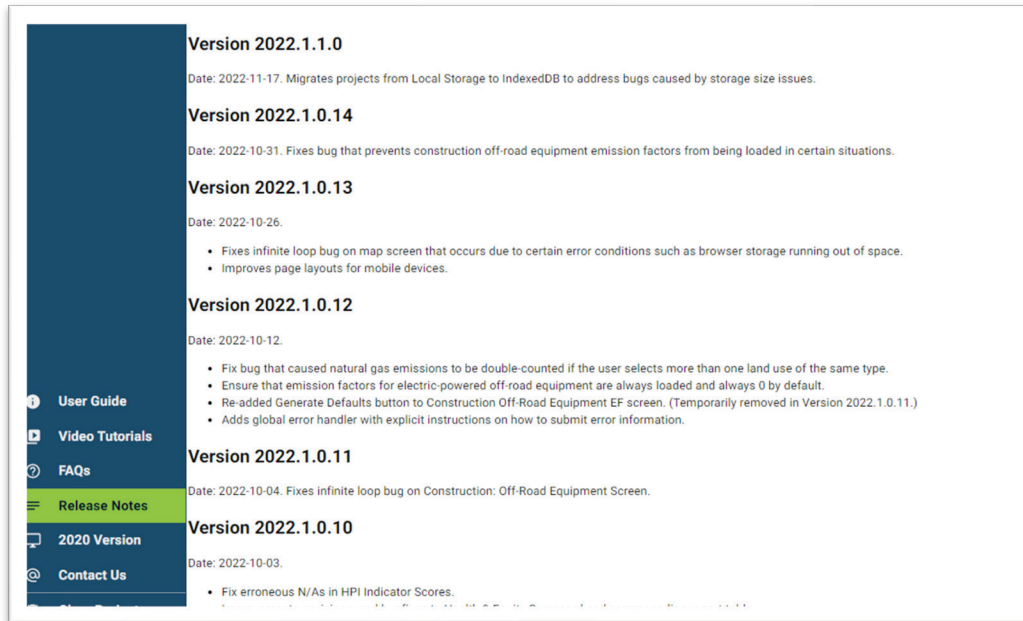
For proposed land use development projects, the Air District recommends using the latest version of CalEEMod to quantify construction emissions. CalEEMod is a statewide land use emissions model developed by the California Air Pollution Control Officers Association (CAPCOA) in collaboration with California air districts to quantify potential criteria air pollutant and greenhouse gas (GHG) emissions associated with construction and operations related to land use projects.

This appendix provides recommendations for the most recent version of CalEEMod Version 2022.1, which is web-based and available online at <https://www.caleemod.com/>. The preferred browsers for maximum functionality are Google Chrome and Microsoft Edge.

Note that the guidance and screenshots contained in this guide are based on Version 2022.1.1.0, which was released on November 17, 2022, to reflect updates to the modeling code. Although the model will continue to be updated over time based on user feedback, the guidance and screenshots in this appendix should remain mostly relevant barring substantial updates to the model interface, parameters, or methodologies.

Figure 1 shows the *Release Notes* dialog relevant at the time of this guidance formulation. As with all updates to the model, the model website, along with the *Release Notes* dialog, should be reviewed periodically to stay up to date with the model and associated data.

Figure 1 Release Notes Dialog Box



Note: Screenshot taken on November 21, 2022.

This appendix is not a user guide but does provide recommended selections specific to the Bay Area. For general model information, including the CalEEMod User Guide, technical documentation, and user tips, visit the CalEEMod website at <http://www.caleemod.com/user-guide>.

CalEEMod includes 138 emissions reduction measures, 99 climate risk reduction measures, and 50 health and equity measures. Most of these measures are based on quantification methods, assumptions, and defaults from CAPCOA's *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers* (CAPCOA Handbook), which was adopted by CAPCOA in December 2021.

The CAPCOA Handbook, which is available at <https://www.caleemod.com/handbook/index.html>, is referenced throughout this appendix because it and the update to CalEEMod were performed in tandem and in concert.

CalEEMod provides default values for estimating construction and operational emissions from Bay Area-specific projects. Although users may apply the default values, the Air District strongly recommends that default values be modified whenever project-specific information is available to obtain more accurate emissions quantification. When site-specific information is unavailable, the Air District recommends that the most conservative estimates be used for the type of construction equipment and number of pieces of equipment to be used, the hours of operation, and the distance to the nearest sensitive receptors.

When changing any default parameters, users must include notes and references in the *Justification for Changes* box, which will facilitate reviews by lead agencies and other stakeholders. Note that the model will not allow users to advance if there is no justification in the *Justification for Changes* box for changes made to defaults. The sections below discuss specific fields where inputs are required and/or where adjustments are recommended.

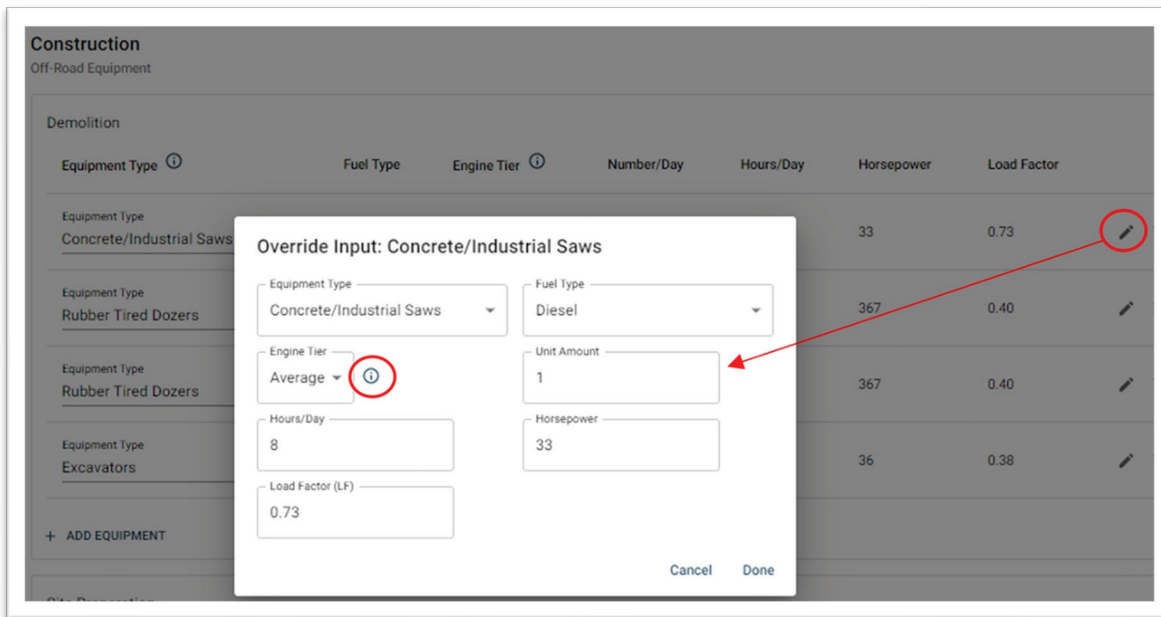
Some features and icons in CalEEMod appear on many of the screens. These icons are summarized in **Figure 2**.

Figure 2 Icons Used throughout CalEEMod**Edit icon****Trash icon****Information icon****Notepad icon**

The four major icons are as follows:

1. **Edit icon:** The user can select the edit icon to edit information in various modules. Clicking this icon will engage a new pop-up window in which the user can enter or edit information. The edit icon is in the form of a pencil. Figure 3 shows an example dialog box that appears after the edit icon is clicked.
2. **Trash icon:** The trash icon allows users to delete values, such as pieces of equipment, construction phases, and material volume quantities.
3. **Information icon:** The information icon appears as an "i" on many of the screens. The user can hover over the "i" icon, which provides the user additional content and instructions for certain variables and metrics in the model. **Figure 3** shows the "i" icon circled in red.
4. **Notepad icon:** In the Measures module (discussed in Section 7 of this appendix), the notepad icon appears next to measure titles. Clicking this icon links the user to that measure's factsheet or to the relevant description from the CAPCOA Handbook. The measure factsheet or description will open in a new tab in the user's web browser. The notepad icon looks like a document.

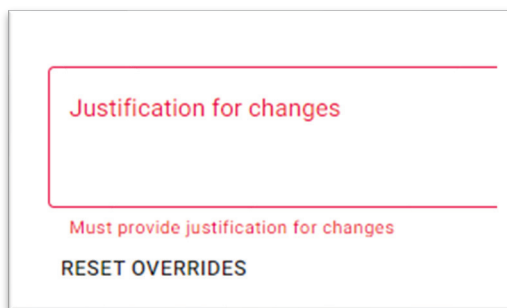
Figure 3 Override Input Dialog Box and Information Icon



When an edit is made in a module, the user can click the *Reset Overrides* text to reset a user change back to the model defaults. The *Reset Overrides* text appears only after a default has been changed. Note that clicking *Reset Overrides* resets *all* values in a module back to defaults.

Figure 4 shows the *Justification for Changes* box, along with the *Reset Overrides* option that appears when defaults are edited by the user. The box and associated text remain red until text is entered.

Figure 4 Justification for Changes Box

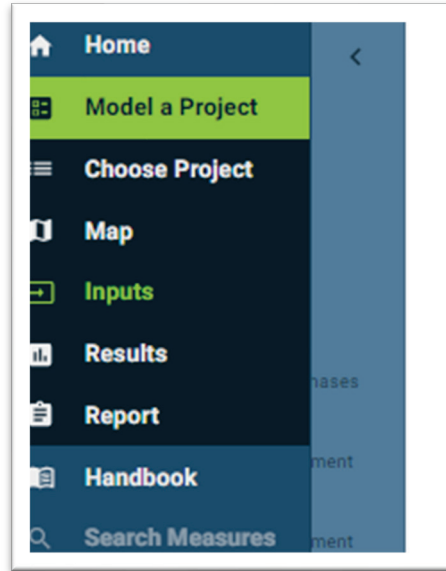


2 CHARACTERISTICS AND LAND USE MODULES

Because CalEEMod includes default parameters, the model can begin calculating emissions from a project after the first two screens, Project Detail and Land Use (found in the Characteristics and Land Use modules), are completed. Listed below are recommendations for specific input fields in the Project Detail and Land Use screens.

CalEEMod has five main components, as shown in the left-hand sidebar navigation panel of the tool: Home, Map, Inputs, Results, and Report. In addition, it has two components for initiating a project (either starting a new or loading an existing project), along with a link to the CAPCOA Handbook and a measure search tool, which allows users to search, filter, and explore the mitigation measures included in CalEEMod and in the CAPCOA Handbook. Figure 5 shows a screenshot of the model navigation panel.

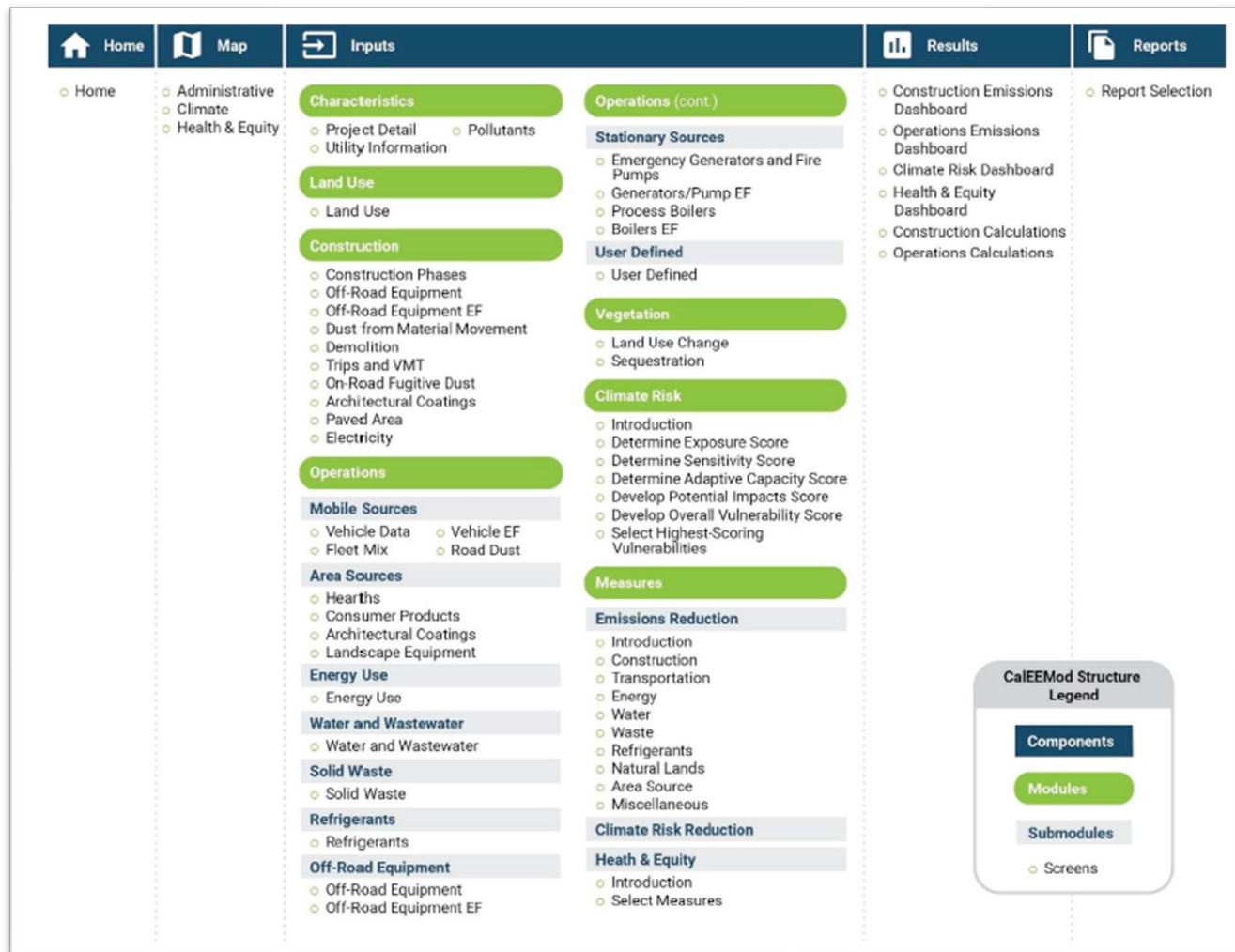
Figure 5 Model Navigation Panel



The Inputs component is the largest component in CalEEMod, requiring the user to input various required project data, review and/or adjust model defaults to estimate project-related emissions, and implement mitigation measures. Within the Inputs component, the various screens are grouped together under the following modules: Characteristics, Land Use, Construction, Operations, Vegetation, Climate Risk, and Measures.

The specific pages (or submodules) under each module are shown in **Figure 6**. An overview of key user considerations for each of these modules and submodules is provided below.

Figure 6 Structure of CalEEMod



Source: Figure 1 on page 4 of the April 2022 CalEEMod User Guide (<https://www.caleemod.com/user-guide>).

2.1 OVERVIEW AND STARTING A PROJECT

When CalEEMod is initiated, the user will begin entering the project information in the Home component. The user may start a new project or work on a previously saved model run. The model runs typically are saved in the cache of the internet browser. For additional redundancy, it is a best practice to periodically save the model run to reduce the possibility of data loss. The saved files have .json extensions and can be found in the user's computer. A description of how these files work is provided in Section 3.2 of the CalEEMod User Guide.

After a project is started or loaded, the first screen is the *Location Information* screen, which is used to collect location-specific model information based on the project's location. This screen opens up with a zoomed-out view of the northern California region, as shown in **Figure 7**. The user can navigate the map by clicking any place in the map to zoom, then moving the map around to find the specific project location, or by entering the project's street address or latitude/longitude coordinates. A screenshot of the *Location Information* screen after a location is selected is shown in **Figure 8**. In this example, the Mission District portion in the City of San Francisco was selected as the project location. After the location is selected, the user can navigate back to this module and click the *Change Location* button to change the location, if needed.

Figure 7 View of the Location Information Screen before a Location Is Selected

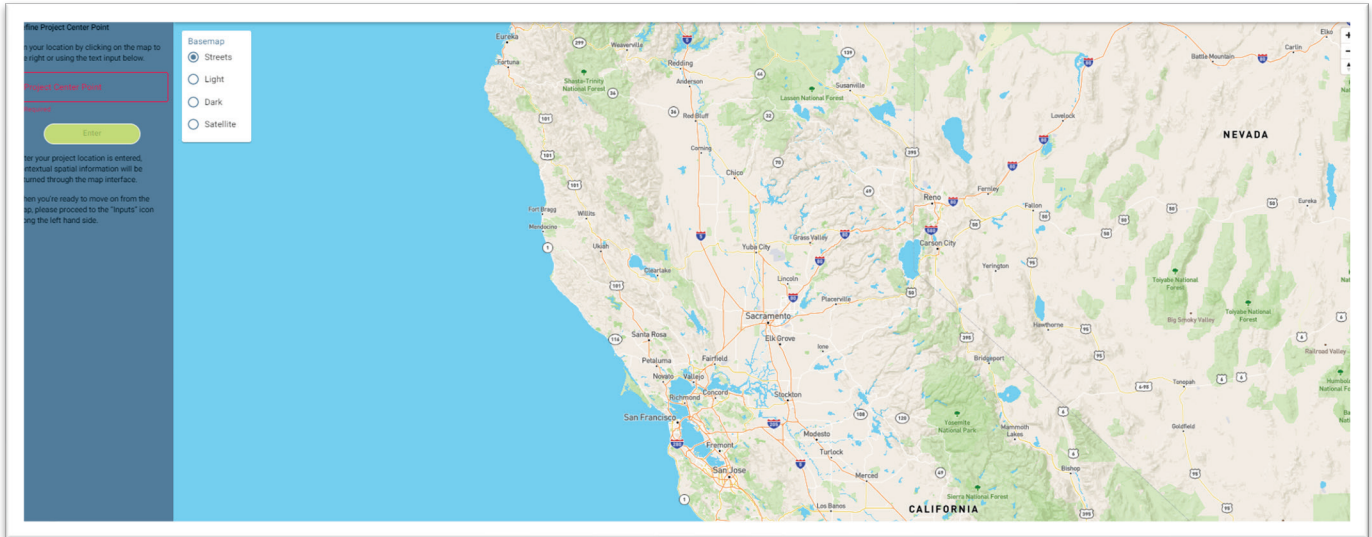
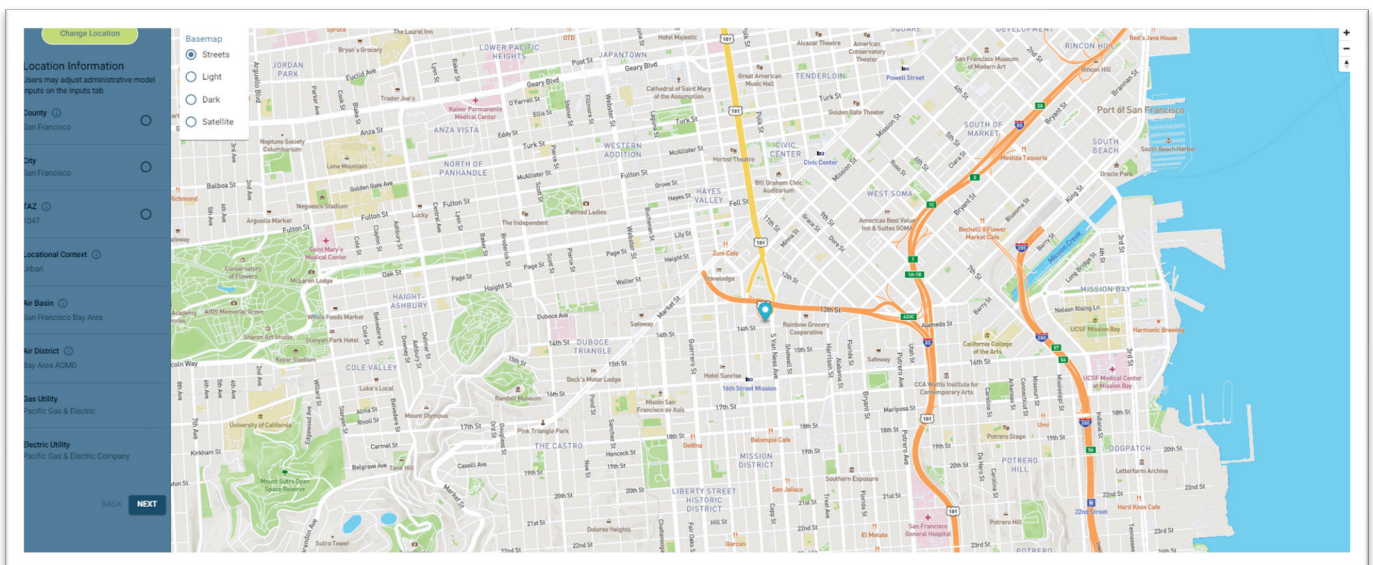


Figure 8 View of the Location Information Screen after a Location Is Selected



After the location is entered, the model populates a list of location-specific features, including:

- ▶ county of project,
- ▶ city of project,
- ▶ Traffic Analysis Zone (TAZ),
- ▶ locational context (urban, suburban, or rural),
- ▶ air basin,
- ▶ air district,
- ▶ gas utility, and
- ▶ electrical utility.

CalEEMod uses these location-specific metrics to automatically populate specific parameters, such as average wind speed, number of precipitation days, vehicle trip lengths, energy consumption, and electrical utility, that are used to estimate emissions in the model. Each of these items and their associated metrics can be overridden if project-specific information is known. Users are advised to be as precise as possible when selecting the project location. For larger development projects (such as general, master, or specific plans) and for linear projects (such as construction or modification of a bridge or overpass or new road construction or road widening), the user should identify the center point of the project site to define the project location.

When starting a project file in CalEEMod, the first two modules are the Characteristics and Land Use modules. **Table 1** presents recommendations for specific input fields in the Characteristics module, and **Table 2** presents recommendations for specific input fields in the Land Use module.

Table 1 Characteristics Module Inputs

Screen and Input Field	Recommendations
Project Detail	
Project Name	This is automatically populated based on the name entered in the <i>Start a New Project</i> page, but it can be modified if needed.
Automatic Updates to Default Values	<p>This value affects how the model will treat programmed defaults in subsequent steps. The user can choose one of the following related to automatic updates:</p> <ul style="list-style-type: none"> • <i>Always</i> (the model will override the user input if the user overrides a default with project-specific information but later changes a land use input). • <i>Never</i> (for users who wish to provide every model input with project-specific information (e.g., vehicle miles traveled, electricity consumption). The model will not populate default metrics, and the user must ensure consistency between screen inputs). • <i>Unless Overridden</i> (the model will provide default metrics, and if metrics are adjusted by the user based on project-specific information, the model will not override these inputs as the user navigates the model). <p>The <i>Always</i> and <i>Unless Overridden</i> options are likely to be the most frequently used choices. Although this is an upgrade from previous versions of CalEEMod, which often overrode user-provided inputs with defaults without user consent, users are advised to be cautious and ensure that inputs are reflective of the project.</p>
Lead Agency	Information can be entered in this field but is not necessary.
Quantify Emissions For	This allows the user to designate whether the model run is for construction or operations or both. For construction-only projects, the operations-specific modules on left-hand sidebar navigation panel will disappear. For operations-only projects, the construction-specific modules on left-hand sidebar navigation panel will disappear. Please note that the Air District does not recommend using CalEEMod to estimate operational emissions from sources permitted by the Air District.
Locational Context	This is automatically populated based on the location entered on the map. This assumption primarily affects the efficacy of certain transportation measures (mitigation measures). The user can modify this assumption using the drop-down menu, if appropriate, as long as justification is provided.
City	This is automatically populated based on the location entered on the map. The user can modify this assumption using the drop-down menu, if appropriate.
County	This is automatically populated based on the location entered on the map. The user can modify this assumption using the drop-down menu, if appropriate.

Screen and Input Field	Recommendations
	If the project is located in Solano County or Sonoma County, be sure that Solano-San Francisco or Sonoma-San Francisco, respectively, are populated to capture the portion of the county in the San Francisco Bay Area Air Basin. For larger development or linear projects that span multiple counties, the user should identify the center point of the project site to define the project location.
Air District	This is automatically populated based on the location entered on the map. The user can modify this assumption using the drop-down menu, if appropriate.
Air Basin	This is automatically populated based on the location entered on the map. The user can modify this assumption using the drop-down menu, if appropriate.
Wind Speed (meters per second)	This is automatically populated based on the location entered on the map. The model assigns the average wind speed from the nearest airport wind monitoring location. Wind speed is used to estimate fugitive dust emissions from truck loading during construction. Under certain circumstances, the user can modify the wind speed using site-specific monitoring data or data from another station if evidence is provided to justify this change. Monitoring stations and associated wind speeds are shown in CalEEMod Appendix G, Table G-1.
Precipitation Days per Year	This is automatically populated based on the location entered on the map. The model assigns the precipitation frequency (annual days greater than 0.1 inch) based on the nearest airport monitoring location. Precipitation frequency influences the intensity of emissions factors related to construction fugitive dust and from vehicles traveling on paved and unpaved roads during both construction and operation. Under certain circumstances, the user can modify the precipitation frequency using site-specific monitoring data or data from another station if evidence is provided to justify this change. Monitoring stations and precipitation days are shown in CalEEMod Appendix G, Table G-2.
CEC California Electricity Demand Forecast Zone	This is automatically populated based on the location entered on the map. The California Energy Commission has divided the state into 28 Electricity Demand Forecast Zones (EDFZs) based on climate and associated electricity consumption. The EDFZ influences default calculations for building energy consumption and the effectiveness of emissions reduction measures in the energy sector. The user can revise the default building energy consumption metrics (e.g., kilowatt-hours of electricity, therms of natural gas) if project-specific information is known.
Traffic Analysis Zone	This is automatically populated based on the location entered on the map. Traffic Analysis Zone (TAZ) locations are based on the 2015 California Statewide Travel Demand Model. The TAZ selection determines key default inputs related to construction trip lengths and operational vehicle miles traveled that are used to determine the vehicle trip purpose percentages and vehicle trip lengths. On the Vehicle Data screen in the Operations module, the user can change the trip length and trip purpose assumption to be based on Metropolitan Planning Organization or Regional Transportation Planning Agency data instead. Moreover, the user can enter vehicle miles traveled and trip data manually if these data are available from the project's traffic study.
Start of Construction	The user should select the earliest possible start date for construction.
Operational Year	The user should select the anticipated year when the project would be operational.
Utility Information	
Electric Utility	This is automatically populated based on the location entered on the map. The user can modify the utility name using the drop-down menu or add a User Defined name, if appropriate.
Gas Utility	This is automatically populated based on the location entered on the map. The user can modify the utility name using the drop-down menu or add a User Defined name, if appropriate.

Screen and Input Field	Recommendations
Operations GHG Emission Factors (electricity)	This is automatically populated based on the electrical utility assigned above. The default emissions factors are loaded in for the most recent year available at the time of programming (2019) and the forecasted future year of 2025. Note that forecasted future year rates are not available for every utility. The user can adjust these emissions factors based on project- or utility-specific information for other years (see the next item below).
Greenhouse gas pollutant intensity factors (lb/MWh)	These emissions factors (in pounds per megawatt-hour) are automatically populated based on the electrical utility and year (2019 or 2025) assigned above. Emissions factors for other years can be manually adjusted if those rates are available. In addition, although not incorporated in the model, emissions factors for each utility are provided in CalEEMod Appendix G, Table G-1, for all years through 2045.
Pollutants	
Pollutant	The user should select the pollutants to be quantified in the emissions modeling. It is recommended that users "Select All" pollutants.
Threshold	The user can choose to include daily, quarterly, and/or annual thresholds. These will appear in the report outputs but will not affect the emissions.

Table 2 Land Use Module Inputs

Input field	Recommendations
Land Use Type	The user should include all land use types that are part of the project site, including paved and landscaped areas. Select City Park for landscaped areas requiring irrigation, and zero any trips associated with landscaped areas unless the landscaped areas themselves would generate trips. There are options for nonlinear (such as office, retail, or residential uses) and linear (such as roadway) projects.
Land Use Subtype	The user should select the most applicable subtype. If User Defined is selected, the user must supply the necessary input data because no default values are associated with this option (include references in Remarks). For linear projects, the type of project (such as new road, road widening, bridge/overpass construction) will affect several construction assumptions.
Unit	The user should select the most applicable land use unit (e.g., acreage, 1,000 square feet, dwelling unit).
Size	This metric denotes the size of the land use.
Lot Acreage	Lot acreage is calculated based on the land use type and amount specified. The user should adjust as necessary for mixed-use buildings. See CalEEMod User Guide Section 4.2 for additional information.
Building Square Feet	Square footage is calculated based on the land use type and amount specified. The user should adjust as necessary for the project.
Landscape Area (square feet)	The user should include any landscape areas. The model will provide defaults for certain single-family housing. The size of landscape areas for all other land uses needs to be input manually. This metric affects outdoor water consumption.
Special Landscape Area (square feet)	This metric denotes the portion of the landscaped area dedicated to edible plants; areas irrigated with recycled water; water features using recycled water; and areas dedicated to active play, such as parks, sports fields, golf courses, and places where turf provides a playing surface.
Population	CalEEMod assigns a default population for residential land uses. The user can adjust this metric if project-specific population is known.
Description	This metric denotes any special notes that the user wants to show in the output. It is particularly useful for mixed-use projects with multiple land use types.

Input field	Recommendations
Predominant Soil/ Site Type	If a linear land use type is selected, a prompt asks the user to select the Predominant Soil/Site Type, which affects the construction phasing information in later modules. The California Geological Survey provides an online geologic map, which can help determine the appropriate option, at https://maps.conservation.ca.gov/cgs/gmc/ .

3 CONSTRUCTION MODULE

After the Characteristics and Land Use modules have been completed, the Construction module begins setting up the model to calculate the emissions associated with construction of the project. Construction has several different types of sources that contribute to emissions of pollutants, including off-road equipment use, on-road vehicle travel, fugitive dust, architectural coating, and paving off-gassing. The sections below discuss the specific input fields for the Construction module.

3.1 CONSTRUCTION PHASES SCREEN

CalEEMod includes the following construction phases: demolition, site preparation, grading, trenching, paving, building construction, and architectural coating. Based on the information entered on the screens in the Characteristics and Land Use modules, CalEEMod populates the construction phases and schedules.

For nonlinear land use types (such as office, retail, and residential uses), the construction phasing schedule (and equipment assignments, discussed below) are based on total project acreage (similar to previous versions of CalEEMod). For linear projects (such as construction or modification of a bridge or overpass or new road construction or widening roadways), the construction phasing schedule (and equipment assignments, discussed below) also are based on total project acreage. Default phases and durations are based on the total number of workdays and the predominant soil/site type, as input by the user in the Land Use screen.

Users may need to add or remove phases as appropriate. For example, a demolition phase should be included only if there is demolition of existing structures on-site, and a trenching phase should be included only if the project requires trenching, generally associated with underground utilities. It is recommended that users adjust the timing and duration of each phase based on the actual project construction schedule, including the start date, end date, and number of working days per week. The model uses specific preloaded emissions factors based on the averaged fleetwide engine year of equipment and the calendar year of the construction phase.

CalEEMod defaults to construction activity occurring 5 days per week (Monday through Friday). Users can select fewer (1–4 days per week) or more (6–7 days per week) using the dropdown box. The selected number of days per week influences the calculation of total workdays and can influence maximum daily emissions calculations (if a number of phases occur on the same day) and annual emissions calculations.

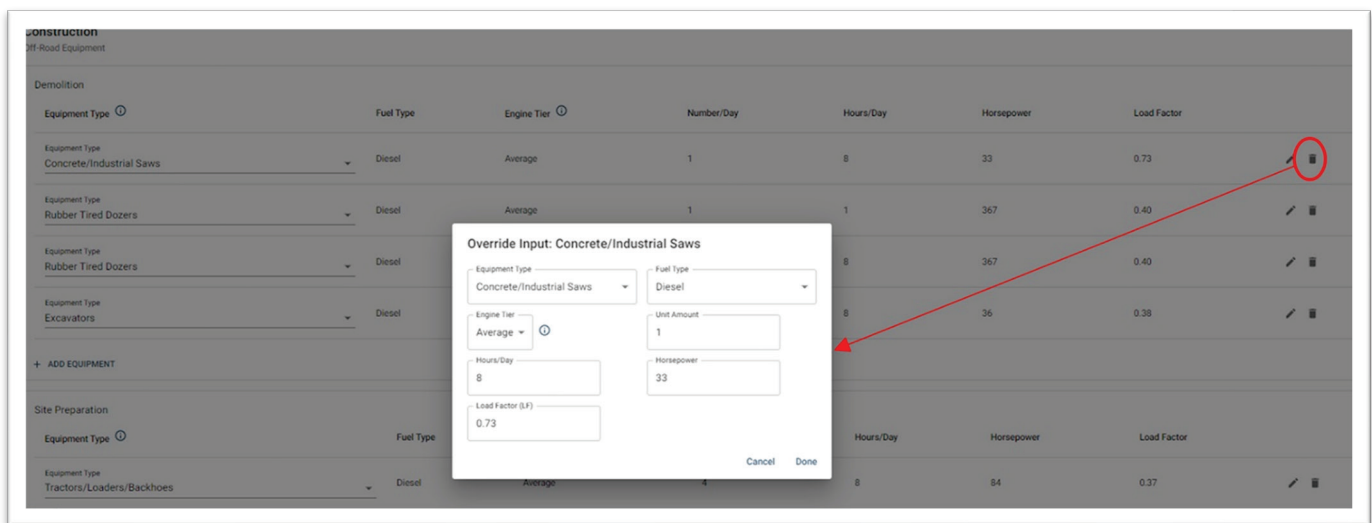
The user can toggle the Enable Auto Scheduler on (toggled to the right) if the user wants the model to automatically update phase start and end dates based on CalEEMod defaults as phases are added. If the user wants to control the construction schedule, then the user should ensure that the Enable Auto Scheduler option is toggled off (toggled to the left).

3.2 OFF-ROAD EQUIPMENT SCREEN

The Off-Road Equipment screen includes default construction equipment for each phase based on project acreage. The model loads equipment types, fuel type, engine tier, number of units, and number of hours per day for each phase of construction based on the project information loaded in previous fields (such as land use acreage) in the model and information (horsepower, load factor, emissions factors) from the California Air Resources Board's (CARB's) OFFROAD model. If project-specific information, such as equipment types, the number of pieces, the specific pieces of equipment, and whether pieces are nondiesel, is known, then the Air District recommends that the user edit this information using the pencil icon, which engages an *Override Input* dialog box. If the equipment type is not available in CalEEMod, users should calculate the emissions off-model using information from the manufacturer specifications and anticipated use.

Figure 9 shows the equipment inputs that the user can override using the pencil (editing) icon. The equipment inputs can be overridden for each piece of equipment if equipment-specific information (such as specific engine tier, or specific horsepower, and whether the number of pieces or hours of use per day need to be changed) is known.

Figure 9 Editing Construction Off-Road Equipment



3.3 OFF-ROAD EQUIPMENT EF SCREEN

The Off-Road Equipment EF (for "emissions factor") screen summarizes the emissions factors for the off-road pieces that were loaded on the previous screen. These emissions factors are pulled from an OFFROAD database based on the construction years, equipment types, engine tier (default or tier), fuel type (e.g., diesel), and horsepower range. If equipment-specific emissions factor information is known, then the Air District recommends that the user edit this information using the pencil (edit) icon on this screen.

3.4 DUST FROM MATERIAL MOVEMENT SCREEN

The Dust from Material Movement screen calculates the fugitive dust emissions associated with site preparation and grading during construction. This screen calculates fugitive dust from dozers moving dirt, from graders or scrapers leveling land, and from dirt being loaded onto or unloaded from haul trucks. Users should enter the anticipated volume of material imported and exported, as well as the total acreage graded for the project. Various metrics, such as mean vehicle speed (7.1 mph), bulldozing material moisture content (7.9 percent), truck loading material moisture content (12 percent), and material silt content (6.9 percent) are preloaded defaults. Although not common practice, the user may adjust these details if site-specific information is known, provided justification is included.

The Water Exposed Area toggle allows the user to account for dust control as part of the project design, part of regulatory compliance, or part of best management practices as recommended by the Air District (see Section 5.2.2 of Chapter 5, "Project-Level Air Quality Impacts"). The user can select watering twice daily (61-percent reduction) or three times daily (74-percent reduction) or can select Other and load in another reduction percentage. If Other is selected, justification needs to be provided.

Figure 10 shows the layout of this screen, with the Water Exposed Area toggle and Frequency drop-down box highlighted. Appendix A of the CalEEMod User Guide includes a detailed discussion of the methods, variables, and assumptions related to fugitive dust calculations.

The Air District recommends the implementation of Basic Best Management Practices for Construction-Related Fugitive Dust Emissions for all projects, regardless of whether construction-related fugitive dust emissions would exceed applicable thresholds of significance.

There are two Basic Best Management Practices for Construction-Related Fugitive Dust Emissions that can be quantified within CalEEMod: B-1 states that all exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered twice per day, and B-4 states that all vehicle speeds on unpaved roads shall be limited to 15 mph.

Basic Best Management Practices for Construction-Related Fugitive Dust Emissions Measure B-1 (watering) is implemented on the Dust from Material Movement screen. Because this measure (watering) is applied in the Construction module instead of in the Measures module (discussed below), emissions reductions associated with watering will be included in the unmitigated emissions results. Consistent with Air District guidance, if a project's construction emissions would exceed the applicable thresholds of significance, then implementation of additional best management practices is required.

As noted, users are required to implement watering twice daily in the unmitigated analysis. If additional watering (e.g., watering three times daily) or other mitigation (e.g., use of dust suppressants) is required to reduce particulate matter with a diameter less than or equal to 10 microns (PM₁₀) or particulate matter with a diameter less than or equal to 2.5 microns (PM_{2.5}) impacts related to fugitive dust, users should implement additional reductions in the Measures module.

Basic Best Management Practices for Construction-Related Fugitive Dust Emissions Measure B-4 (speeds on unpaved roads) is reflected on the On-Road Fugitive Dust screen, discussed later in Section 3.7.

Figure 10 Dust from Material Movement Screen

Construction
Dust from Material Movement

Water Exposed Area **F**

Frequency: 2

PM10 (% Reduction): 61

PM2.5 (% Reduction): 61

Phase Name	Phase Type	Total Material Imported	Total Material Exported	Size Metric	Material Import/Export Phased?	Mean Vehicle Speed (mph)	Total Acres Graded	Material Moisture Content (%) Bulldozing	Material Moisture Content (%) Truck Loading	Material Silt Content (%)
Site Preparation	Site Preparation	0	1000	Cubic Yards	<input type="checkbox"/>	7.1	15	7.9	12	6.9
Grading	Grading	0	0	Cubic Yards	<input type="checkbox"/>	7.1	27.5	7.9	12	6.9
Dozing	Grading	0	0	Cubic Yards	<input type="checkbox"/>	7.1	1,375	7.9	12	6.9
Linear, Grubbing & Land Clearing	Linear, Grubbing & Land Clearing	Material Imported Recommended	Material Exported Recommended	Size Metric	<input type="checkbox"/>	7.1	0	7.9	12	6.9
Linear, Grading & Excavation	Linear, Grading & Excavation	Material Imported Recommended	Material Exported Recommended	Size Metric	<input type="checkbox"/>	7.1	0	7.9	12	6.9
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	Material Imported Recommended	Material Exported Recommended	Size Metric	<input type="checkbox"/>	7.1	0	7.9	12	6.9

Add Phase

3.5 DEMOLITION SCREEN

The Demolition screen allows users to enter the amount of demolished material expected at the project site that would generate dust emissions during mechanical and explosive demolition, site removal of debris, and on-site truck traffic on paved and unpaved roads. Users should enter the debris tonnage or building square footage to allow the model to correctly calculate fugitive dust emissions and truck trips generated from demolition.

The Water Demolished Area toggle allows the user to account for dust control as part of the project design, part of regulatory compliance, or part of best management practices recommended by the Air District. The user can select watering twice daily (36-percent reduction) or select Other and load in another reduction percentage. If Other is selected, justification needs to be provided.

For projects involving demolition of structures containing asbestos, the project sponsor must obtain a permit from the Air District and properly remove asbestos material following the requirements under Air District Regulation 11-2: Asbestos Demolition, Renovation, and Manufacturing.

3.6 TRIPS AND VMT SCREEN

The Trips and VMT (for “vehicle miles traveled”) screen allows users to enter the number and length of on-road vehicle trips for workers, vendors, and haulers for each construction phase. Hauling trips assume that a truck can hold 20 short tons (16 cubic yards) of material per load, and the default haul trip length is 20 miles per one-way trip. Users can override defaults to modify the number of trips, haul trip length (if a specific destination is known), and vehicle fleet to match the anticipated construction trip data for the project.

Vendor (material delivery) trips are preloaded only for building construction phases. For all other phases (e.g., grading, paving), vendor trips are zero by default but can be manually input.

3.7 ON-ROAD FUGITIVE DUST SCREEN

The On-Road Fugitive Dust screen allows users to define the variables that will be used to determine the fugitive dust emissions from on-road vehicles driving over paved and unpaved roads during construction. CalEEMod automatically populates the data fields based on the construction phase. The calculations use emissions factors from the U.S. Environmental Protection Agency's AP-42 for paved and unpaved roads.^{1,2} The defaults for road dust (e.g., material silt content, material moisture content, and mean vehicle speed) are statewide averages, but users can override the defaults if data specific to the project are known. In CalEEMod, all roads in the Bay Area are assumed to be paved, so the model does not calculate emissions from unpaved road travel. The user must enter site-specific assumptions if a project includes on-site truck trips or unpaved road travel.

The amount of fugitive dust emissions depends on the quantity of silt present on the roadway, called silt loading. Freeways have low silt loading because high volumes of traffic prevent the buildup of silt on the roadway, whereas local streets, which are used by fewer vehicles, have a much higher silt loading factor. The CalEEMod default silt loading factor (grams per meter squared [g/m^2]) for paved roads is $0.1 \text{ g}/\text{m}^2$ based on Section 13.2.1 of AP-42, which corresponds to vehicle travel on roads with at least 5,000 vehicle per day under *normal* conditions.

For the construction analysis, users should modify this variable in CalEEMod to use a silt loading factor of $0.5 \text{ g}/\text{m}^2$ for all roadways, which corresponds to vehicle travel on roads with at least 5,000 vehicle per day under *worst-case* conditions (defined in AP-42 as representative of conditions such as post-winter-storm or areas with substantial mud/dirt carryout consistent with typical construction activities).

This approach is designed to ensure adequate health protection to local residents nearest the project site, who would be affected from on-road vehicle emissions as workers, vendors, and haulers travel to and from the construction site. Weighted silt loading factors can be used in cases where construction vehicles travel exclusively on nonlocal roads, such as freeways or arterials.

Note that the guidance for silt loading is different for operations. See Section 4.1.4 for that discussion.

Regarding Basic Best Management Practices for Construction-Related Fugitive Dust Emissions, B-4 (limiting unpaved travel speed to 15 mph) is implemented on the On-Road Fugitive Dust screen. The default unpaved road travel speed in CalEEMod is 40 mph. The user adjusts this speed to 15 mph on this screen, as shown in **Figure 11**. Because this measure is being applied in the Construction module instead of in the Measures module (discussed below), emissions reductions associated with limiting unpaved travel speed will be included in the unmitigated emissions results. Consistent with Air District guidance, if a project's construction emissions would exceed the applicable thresholds of significance, then implementation of Enhanced Best Management Practices for Construction-Related Fugitive Dust Emissions is required. As with all adjustments to defaults, the user must provide a justification for the travel speed change before proceeding to the next page. The user should cite Air District Best Management Practices for Construction-Related Fugitive Dust Emissions as the reason for the change. Also, as noted above, all roads in the Bay Area are assumed to be paved; thus, by default, CalEEMod will not estimate any unpaved road dust emissions unless the user

¹ Section 13.2.1, "Paved Roads." Available: https://www.epa.gov/sites/default/files/2020-10/documents/13.2.1_paved_roads.pdf.

² Section 13.2.2, "Unpaved Roads." Available: https://www.epa.gov/sites/default/files/2020-10/documents/13.2.2_unpaved_roads.pdf.

specifies otherwise. If there are no unpaved roads for the project in question, then the mean travel speed does not need to be revised, because the change would have no bearing on the emissions calculations.

Figure 11 On-Road Fugitive Dust Screen

Phase Name	Percent (%) of Travel on Paved Roads				Roadway Characteristics			Vehicle Characteristics	
	% Pave Worker	% Pave Vendor	% Pave Hauling	% Pave Onsite Truck	Road Silt Loading (g/m ²)	Material Silt Content (%)	Material Moisture Content (%)	Average Vehicle Weight (tons)	Mean Vehicle Speed (mph)
Demolition	100	100	100	0	0.1	8.5	0.5	2.400000953674316	15
Site Preparation	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Grading	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Building Construction	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Paving	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Architectural Coating	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Dozing	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Linear, Grubbing & Land Clearing	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Linear, Grading & Excavation	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Linear, Drainage, Utilities, & Sub-Grade	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Linear, Paving	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40

Justification for changes:
BAAQMD Basic BMP - 15 mph unpaved travel speed

3.8 ARCHITECTURAL COATINGS SCREEN

The Architectural Coatings screen is intended to calculate reactive organic gases (ROG) (or volatile organic compounds [VOC]) emissions associated with painting the interior and exterior of residential and nonresidential buildings, as well as calculate emissions from parking lot painting or striping. Users can modify the Air District’s default for residential and nonresidential interior and exterior coatings using project information if more stringent coatings would be used. In accordance with Air District’s Regulation 8-3: Architectural Coatings,³ residential and nonresidential interior coatings are preloaded into CalEEMod at 100 grams per liter (g/L), whereas exterior coatings are set at 150 g/L. Likewise, the architectural coating limit for parking areas is also set at 100 g/L in CalEEMod.

3.9 PAVED AREA SCREEN

The Paved Area screen is intended to calculate ROG (or VOC) off-gassing emissions associated with asphalt paving. Paved acreage is calculated automatically based on the land use inputs, but it can be manually adjusted by the user. The emissions area is estimated by multiplying the paved area of each parking stall with the capacity of the parking lot or the number of parking stalls. Parking areas can be either asphalt (which emits ROG or VOC emissions during application) or concrete (which does not emit ROG or VOC emissions during application). The CalEEMod default is 100-percent asphalt for all Linear and Parking land use subtypes (except for the *Non-Asphalted Surfaces* land use option) and 0 percent for all

³ Regulation 8-3 is available at the following link: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-8-rule-3-architectural-coatings>.

other land use types. The user can specify the percentage of paving that is asphalt, although it is not recommended that users revise the default emissions factors of 2.62 pounds per acre.

3.10 ELECTRICITY SCREEN

The Electricity screen calculates electricity emissions for the construction phase. The utility and emissions factors are preloaded based on the utility confirmed in the Characteristics module. The user can input the estimated electricity consumption (in kilowatt-hours) for each year of construction.

4 OPERATIONS MODULE

The Operations module calculates emissions from mobile sources, area sources, energy use, waste and wastewater, solid waste, off-road equipment, and stationary sources. CalEEMod should not be used to estimate emissions from stationary sources that require an Air District permit to operate, such as gas stations, standby and prime generators, boilers, and fire pumps. Instead, users should estimate emissions from these sources following the methodology outlined in the Air District's Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>. The sections below discuss the specific input fields for the Operations module where an Air District permit is not required.

4.1 MOBILE SOURCES SUBMODULE

4.1.1 Vehicle Data Screen

The Vehicle Data screen includes several data fields related to vehicles trips and VMT. Daily trip rates affect the calculation of starting exhaust and evaporative emissions. VMT is used in the calculation of running exhaust, brake wear, tire wear, and fugitive dust from paved and unpaved roads.

The user can define the project vehicle trip and VMT data using model defaults or using project-specific trip and VMT inputs from a traffic study,

Weekday, Saturday, and Sunday vehicle trip rates are automatically generated based on the corresponding land uses in the Institute of Transportation Engineers Trip Generation Manual (10th Edition). It is highly recommended that users adjust the trip rates if a traffic study was completed for the project.

Default trip lengths are based on TAZ-specific data from the California Statewide Travel Demand Model (CSTDM) when the user entered the project location, but they can be changed to refer to Metropolitan Planning Organization/Regional Transportation Planning Agency (MPO/RTPA) data instead. In addition, if a project-specific traffic study was completed that estimates VMT on a per-trip basis, that information should be used instead of the default data. This information can be input by clicking the *Enter VMT and Trips Manually Instead* option, which initiates a new page. **Figure 12** shows the layout of the Vehicle Data screen with the default CSTDM data populated. The circled area in the top-right corner shows the toggle option between CSTDM trip lengths (default) and the MPO/RTPA trip lengths. The circled area on the left is where the user can select to enter VMT and trips manually instead of using default data. If this is clicked,

a separate page opens on which the user can enter project-specific trip and VMT data. This page, as it appears when it first opens up (with all values blank), is shown in **Figure 13**.

When entering VMT and trips manually, the user can choose to enter *daily* trips and VMT estimates then click Calculate Annual Trips from Daily, enter *annual* trips and VMT then click Calculate Daily Trips from Annual, or enter both daily and annual data if those data are available from the traffic study.

Figure 12 Vehicle Data Screen with Defaults Loaded

The screenshot shows the 'Vehicle Data' screen with two tables. The first table, 'Rates and Lengths', lists trip rates and lengths for 'Strip Mall' and 'Apartments Low Rise'. The second table, 'Purpose and Percentages', lists the percentage of trips for various purposes like 'Primary Trip', 'Divert Trip', and 'Pass By Trip'.

Land Use Sub Type	Size	Weekday Trip Rate (size/day)	Saturday Trip Rate (size/day)	Sunday Trip Rate (size/day)	Res H-W Trip Length (miles)	Res H-S Trip Length (miles)	Res H-O Trip Length (miles)	Non Res H-W Trip Length (miles)	Non Res W-O Trip Length (miles)	Non Res O-O Trip Length (miles)
Strip Mall	1000sqft	44.3199996948242	42.0400009155273	20.4300003051757	0	0	0	12.21133377	6.911913208	3.194303522
Apartments Low Rise	Dwelling Unit	7.32000017166137	8.14000034332275	6.28000020980835	13.01236635	2.482680903	2.727759598	0	0	0

Land Use Sub Type	Size	Weekday Primary Trip (%)	Weekday Divert Trip (%)	Weekday Pass By Trip (%)	Saturday Primary Trip (%)	Saturday Divert Trip (%)	Saturday Pass By Trip (%)	Sunday Primary Trip (%)	Sunday Divert Trip (%)	Sunday Pass By Trip (%)	Res H-W Trip (%)	Res H-S Trip (%)	Res H-O T (%)
Strip Mall	1000sqft	100	0	0	100	0	0	100	0	0	0	0	0
Apartments Low Rise	Dwelling Unit	100	0	0	100	0	0	100	0	0	25.758764699	22.8781167	51.36311

Figure 13 Vehicle Data Popup for Entering VMT and Trips Manually

The screenshot shows a popup form with input fields for 'Trips per weekday', 'Trips per Saturday', 'Trips per Sunday', 'VMT per weekday', 'VMT per Saturday', 'VMT per Sunday', 'Annual Trips', and 'Annual VMT'. There are also buttons for 'Calculate Daily Trips from Annual' and 'Calculate Annual Trips from Daily'.

4.1.2 Fleet Mix Screen

The default fleet mix draws on CARB’s Emission FACtor (EMFAC) Model 2021 based on the project location and operational year information provided. Users should adjust the fleet mix based on the anticipated fleet

mix if it is provided in the project's traffic study. The user must ensure that the latest version of EMFAC is being used and updated accordingly because new versions of EMFAC become available from CARB.

CARB provides both a web-based and a stand-alone (downloadable) software tool for EMFAC. The emissions factors are the same in each, but the downloadable software (which is installed on the user's PC) provides more customization options. For most project-level analyses, the web tool will provide the necessary data.

The web tool is available at <https://arb.ca.gov/emfac/emissions-inventory>.

The entire EMFAC package, which includes background, tutorials, and related resources, is available at <https://arb.ca.gov/emfac/>.

4.1.3 Vehicle EF Screen

The Vehicle EF screen draws on EMFAC 2021 based on the project location and operational year information provided. Users should adjust the emissions factors manually if a more recent version of EMFAC becomes available or if project-specific fleet information is available.

4.1.4 Road Dust Screen

The Road Dust screen allows users to define the variables that will be used to determine the fugitive dust emissions from on-road vehicles driving over paved and unpaved roads during operations. The formulas and variables here are similar to the those used on the On-Road Fugitive Dust screen in the Construction module, discussed in Section 3.7, above. On paved roads, the amount of fugitive dust emissions depends on the quantity of silt present on the roadway, called silt loading. The CalEEMod default silt loading factor (g/m^2) for paved roads is $0.1 \text{ g}/\text{m}^2$, which corresponds to vehicle travel on roads with at least 5,000 vehicle per day under normal conditions. Unlike for construction, users do not need to modify the silt loading assumption of $0.1 \text{ g}/\text{m}^2$, because the "normal conditions" assumption is applicable to long-term operations in roadways in the Bay Area.

In CalEEMod, all roads in the Bay Area are assumed to be paved under operations unless the user specifies that portions of roads traveled by project-related vehicles are unpaved. By default, the model assumes 100 percent of roads in the Bay Area are paved unless the user specifies otherwise. The average vehicle weight assumption (2.4 tons for the Bay Area), which factors into paved road calculations, should not be revised, per AP-42 guidance.

Other default factors, including material silt content (4.3 percent), material moisture content (0.5 percent), and mean vehicle speed (40 mph) variables used to estimate emissions from unpaved road travel, can be modified to incorporate project-specific information when available. Specifically, vehicle speed can be revised if the project design and approval require different travel speeds. Adjustments to the travel speed will also result in changes to unmitigated unpaved road dust emissions. Note that unpaved and paved road percentages when summed should equal 100 percent. **Figure 14** shows the variables specific to calculations for paved road dust (on the left) and unpaved road dust (on the right).

Figure 14 Paved and Unpaved Road Dust Variables in Road Dust Screen

The screenshot shows the 'Road Dust' screen in the CalEEMod software. On the left is a navigation menu with categories: Characteristics, Land Use, Construction, Operations, Mobile Sources, and Vehicle Data. The main area is titled 'Operations' and 'Road Dust'. A toggle switch is set to 'Off' for 'CARB Unmitigated Unpaved Road Statewide Emission Inventory Method: Use CARB's 2.0 (lbs PM10/VMT) and 0.2 (lbs PM2.5/VMT)'. Below this are two main sections: 'Roadway Characteristics' and 'Vehicle Characteristics'. The 'Roadway Characteristics' section includes three input fields: '% Paved' (100), 'Road Silt Loading (g/m³)' (0.1), and 'Average Vehicle Weight (tons)' (2.4). The 'Vehicle Characteristics' section includes three input fields: 'Material Silt Content (%)' (4.3), 'Material Moisture Content (%)' (0.5), and 'Mean Vehicle Speed (mph)' (40). Red boxes enclose the 'Roadway Characteristics' and 'Vehicle Characteristics' sections. Red arrows point from these boxes to two labels at the bottom: 'Paved Road Dust variables' (pointing to the Roadway Characteristics box) and 'Unpaved Road Dust variables' (pointing to the Vehicle Characteristics box).

Roadway Characteristics			Vehicle Characteristics		
% Paved	Road Silt Loading (g/m³)	Average Vehicle Weight (tons)	Material Silt Content (%)	Material Moisture Content (%)	Mean Vehicle Speed (mph)
100	0.1	2.4	4.3	0.5	40

4.2 AREA SOURCES SUBMODULE

4.2.1 Hearths Screen

The Hearths screen allows users to modify the types and amount of fuel burned in fireplaces and wood stoves. The default number of hearths and stoves reflects Air District Regulation 6-3: Wood-Burning Devices.⁴ The defaults for residential projects in the Bay Area are as follows: 20 percent of single-family and 51 percent of multifamily dwelling units include natural gas fireplaces, 80 percent of single-family and 49 percent of multifamily dwelling do not include any fireplaces, and no wood-burning fireplaces or wood stoves are assumed. In addition, no hearths are assumed for nonresidential uses, but the user can input fireplace and wood stove data if they are available for the project.

4.2.2 Consumer Products Screen

The Consumer Products screen allows users to modify emissions factors for consumer products that emit ROG. Some consumer products include solvents used in nonindustrial applications, such as cleaning supplies and kitchen aerosols, as well as pesticides and fertilizers.

4.2.3 Architectural Coatings Screen

The Architectural Coatings screen is intended to calculate ROG/VOC emissions associated with periodic painting of residential and nonresidential building interiors and exteriors, as well as calculate emissions from parking lot painting or striping. Users can modify the Air District's default for residential and nonresidential interior and exterior coatings using project information if more stringent coatings would be used. In accordance with the Air District's Regulation 8-3,⁵ the default for residential and nonresidential interior coatings is set at 100 g/L, the default for residential and nonresidential exterior coatings is set at 150 g/L, and the default for parking areas is set at 100 g/L.

4.2.4 Landscape Equipment Screen

The Landscape Equipment screen allows users to enter the number of snow days and summer days to allow the model to calculate the number of days landscaping equipment would be used at the project site. Users can generate defaults that estimate landscaping-related emissions based on the number of summer and snow days combined with the project-specific land use. The model defaults to zero for snow days and 180 for summer days for projects in the Bay Area. In addition, instead of using the number of snow and summer days, the user can choose to manually enter specific landscaping equipment and associated information (e.g., fuel type, number of days per year) if this information is known (such as for a golf course or city park).

⁴ Regulation 6-3 is available at the following link: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-6-rule-3-woodburning-devices>.

⁵ Regulation 8-3 is available at the following link: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-8-rule-3-architectural-coatings>.

4.3 ENERGY USE SUBMODULE

The Energy Use screen in the Energy Use submodule allows users to modify the energy intensity for electricity and natural gas. CalEEMod generates default electricity and natural gas consumption based on the Electricity Demand Forecast Zone (EDFZ) input on the Project Detail screen and on the land use subtypes and building square footage inputs in the Land Use module. CalEEMod energy defaults are based on the results of multiple sources, including the California Energy Commission's (CEC's) Commercial Forecast database and CEC's 2019 Residential Appliance Saturation Survey. Some land uses, such as golf courses, parks, and recreational pools, have no default energy consumption values. The user can modify the estimated energy consumption if this project-specific information is known.

4.4 WATER AND WASTEWATER SUBMODULE

The Water and Wastewater screen in the Water and Wastewater submodule estimates the emissions associated with supplying water and treating wastewater. Users can modify the amount of water in gallons used indoors and outdoors for each land use subtype.

4.5 SOLID WASTE SUBMODULE

The Solid Waste screen in the Solid Waste submodule estimates the emissions associated with disposal of solid waste. Users can modify the solid waste generation rate and associated landfill gas capture rates.

4.6 REFRIGERANTS SUBMODULE

Refrigerants are substances used in equipment for air conditioning and refrigeration. CalEEMod quantifies refrigerant GHG emissions from leaks during regular operation and routine servicing over the equipment lifetime. The user can modify the key variables, such as equipment charge size, operation and service leak rate, and equipment lifetime, if this information is known.

4.7 OFF-ROAD EQUIPMENT SUBMODULE

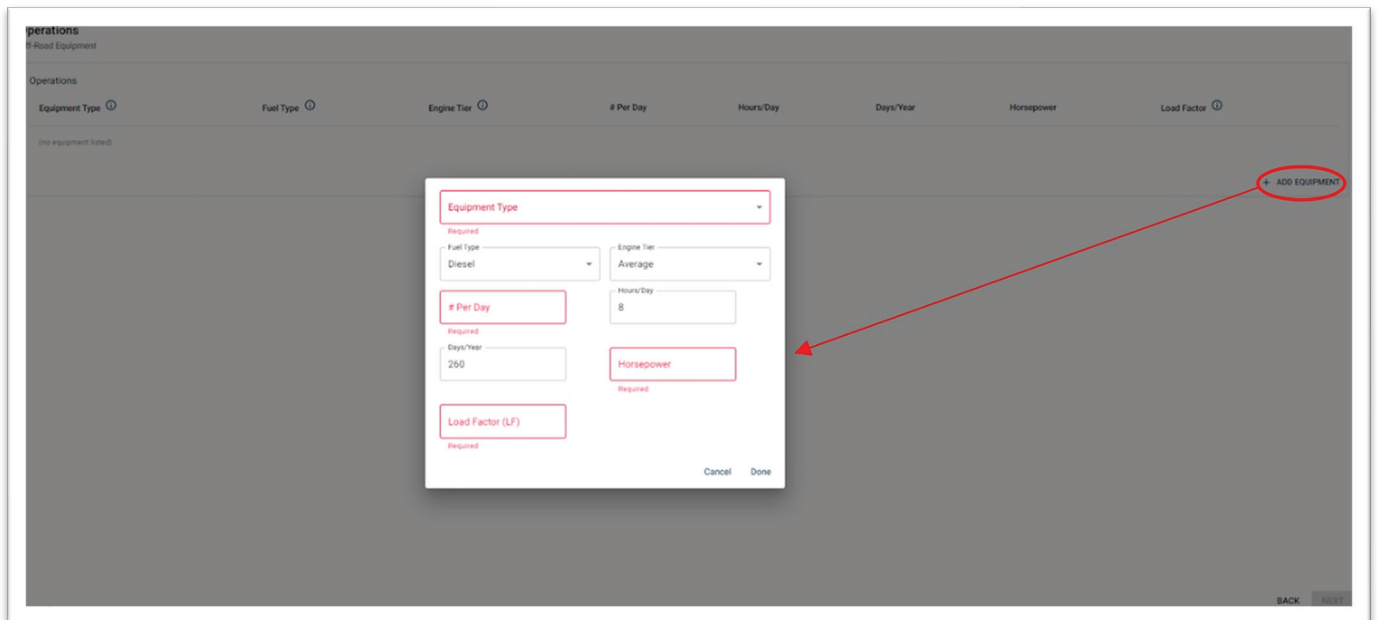
4.7.1 Off-Road Equipment Screen

The Off-Road Equipment screen in the Off-Road Equipment submodule allows users to select off-road equipment that may be used as part of the operations at the site. The user can select from the list of off-road equipment listed in the Construction module (see Section 3.2) and then modify key variables, such as fuel type, engine tier, daily and annual use, horsepower, and load factor, to reflect specific equipment conditions at the site.

To add operational off-road equipment, the user can select the + Add Equipment text on the right side of this screen, which initiates a pop-up box. The pop-up box opens with minimal data populated, as shown in **Figure 15**. The user is required to input certain data, including equipment type, number of pieces of equipment used per day, horsepower, and load factor, and the user can modify data that are automatically populated, including fuel type, engine tier, hours per day, and days per year. The user can input these data based on the equipment specifications, if they are known, or input the data based on the CalEEMod default

data used in the Construction module (Section 3.2). The CalEEMod default data are available in Appendix G of the model.⁶ Appendix G is an Excel workbook that includes defaults for every input in the model.

Figure 15 Adding Operational Off-Road Equipment



4.7.2 Off-Road Equipment EF Screen

The Off-Road Equipment EF screen summarizes the emissions factors for the off-road equipment added or selected on the Off-Road Equipment screen. These emissions factors come from OFFROAD2021 and are based on the operational year, equipment types, engine tier (default or specific tier), fuel type (e.g., diesel), and horsepower range. If equipment-specific emissions factor information is known, the Air District recommends that the user enter this information using the pencil (edit) icon on this screen.

4.8 STATIONARY SOURCES SUBMODULE

4.8.1 Emergency Generators and Fire Pumps Screen

The Emergency Generators and Fire Pumps screen allows users to input any emergency generators or fire pumps that would be included in the project. Users should check the Air District's rules and regulations regarding obtaining an authority to construct/permit to operate for any stationary sources associated with the project. CalEEMod should not be used to estimate emissions from standby and prime generators and fire pumps that require an Air District permit to operate. Instead, users should estimate emissions from these sources following the methodology outlined in the Air District's Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>. To estimate emissions for backup generators, the Air District recommends that users combine the emissions from operations or

⁶ Appendix G of the CalEEMod User Guide, which summarizes model defaults and emission factors used in CalEEMod, is available at https://www.caleemod.com/documents/user-guide/08_Appendix%20G.xlsx.

emergency use (nontesting and nonmaintenance) with the allowable testing and maintenance hours. In this instance, the user can include an additional 100 hours per year for each generator for nontesting and nonmaintenance purposes. Alternatively, the user can substantiate use of site-specific nontesting and nonmaintenance hours for backup generator operation. The user can also obtain information on backup generator use from the California Public Utilities Commission (CPUC) Emergency Load Reduction Program and CPUC information on temporary emergency generation use. Additional information can be referenced from Chapter 5, Section 5.2.4, "Impact Analysis."

4.8.2 Generators + Pumps EF Screen

The Generators + Pumps EF screen summarizes the emissions factors for the emergency generators or fire pumps that were loaded on the previous screen. These emissions factors are pulled from an OFFROAD database based on the operational year, equipment types, engine tier (default or tier), fuel type (e.g., diesel), and horsepower range. If equipment-specific emissions factor information is known, then the Air District recommends that the user edit this information using the pencil (edit) icon on this screen. The user should ensure that the emissions factors selected for all generators and fire pumps are consistent with the values recommended in the Air District's Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>.

4.8.3 Process Boilers Screen

The Process Boilers screen allows users to input any process boilers that would be included in the project. Users should check the Air District's rules and regulations regarding obtaining an authority to construct/permit to operate for any stationary sources associated with the project. CalEEMod should not be used to estimate emissions from boilers that require an Air District permit to operate. Users should review and follow the methodology presented in the Air District Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>.

4.8.4 Boilers EF Screen

The Boilers EF screen summarizes the emissions factors for the process boilers that were loaded on the previous screen. These emissions factors are pulled from a database based on the process boiler fuel type and heat rating. If equipment-specific emissions factor information is known, then the Air District recommends that the user edit this information using the pencil (edit) icon on this screen. The user should ensure that the emissions factors selected for boilers are consistent with the values recommended in the Air District's Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>.

4.9 USER DEFINED SUBMODULE

The User Defined screen in the User Defined submodule allows users to input other operational sources of emissions that do not fit into the previous categories. The user must provide all input information specific to the source, including equipment type; fuel type; and actual emissions estimates, in pounds per day (for both criteria pollutants and GHGs), tons per year (for criteria pollutants), and metric tons per year (for GHGs).

Because CalEEMod does not provide information documenting the methodology used to estimate the emissions, the Air District recommends that the user perform a separate off-model emissions calculation for any sources not included in CalEEMod. Supporting references and justification should also be provided.

5 VEGETATION MODULE

The Vegetation module allows users to estimate the one-time change in carbon sequestration capacity attributable to a project as a result of land use change (e.g., conversion from grassland to urban) or as a result of the removal or planting of trees.

5.1 LAND USE CHANGE SCREEN

The Land Use Change screen estimates the change in carbon dioxide attributable to a change in vegetation resulting from the project. Estimates can be provided for soil carbon accumulation and for aboveground and belowground biomass carbon accumulation. The user can enter the vegetation land use type, the vegetation soil type, the initial and final acreage of the vegetation land use type, and the annual carbon dioxide accumulation per acre. This screen provides a link to ensure that the correct soil type is selected for the project site.

5.2 SEQUESTRATION SCREEN

The Sequestration screen estimates changes in GHGs, criteria pollutants, and energy from tree planting and removal. Users can enter the project lifetime (in years), the tree types and number of trees, and the carbon sequestration rate. This screen provides a link to the i-Tree Planting Calculator, which can be used to determine the changes in GHGs, criteria pollutants, and energy from tree planting and removal. The user must manually input the output data from the i-Tree tool onto this screen. The tool is available at <https://planting.itreetools.org/>. In the i-Tree tool, the user selects the location, tree species, and number of trees being affected. As shown in **Figure 16**, on the Report page, the user should click the Export icon and make a PDF file of the page. The PDF file is to be included in the administrative record for the project.

Figure 16 Exporting Data from the i-Tree Tool

Planting Report

NOTE: Printing is recommended as the "landscape" orientation or at a reduced scale.

Project Report - i-Tree Planting Calculator

Location: San Francisco, California 94114
 Electricity Emissions Factor: 252.40 kilograms CO2 equivalent/MWh
 Fuel Emissions Factor: 52.00 kilograms CO2 equivalent/MMBtu
 Lifetime: 40 years
 Tree Mortality: 10%

All amounts in the tables are for the full lifetime of the project.

Units
 English (pounds & tons; kWh & MMBtu; gallons) Metric (kilograms & metric tons; kWh & MMBtu; cubic meters)

Copy Export CO₂ Energy Eco Air Pollution Search:

Location		CO ₂ Benefits			
Group Identifier	Tree Group Characteristics	CO ₂ Avoided (pounds)	CO ₂ Avoided (\$)	CO ₂ Sequestered (pounds)	CO ₂ Sequestered (\$)
1	<ul style="list-style-type: none"> (100.0) Acacia, Black (Acacia melanoxylon) at 1.0 inch DBH. Planted 0-19 feet and north (0°) of buildings that were built post-1980 with heating and cooling. Trees are in excellent condition and planted in full sun. 	453,701.9	\$10,551.71	378,500.6	\$8,802.76

Sequestration and biomass are gross values that exclude losses to mortality.
 Application v2.2.0, powered by engine v0.9.0 (APIv2) and database v12.0.36.

6 CLIMATE RISK MODULE

The Climate Risk module provides a high-level assessment of the elements contributing to a project's climate vulnerabilities, including exposure, sensitivity, and existing adaptive capacity to projected climate hazards. The various metrics are based on the project's location, selected in the initial stages of the model run (see Section 2.1). The Air District is not providing guidance on this module at this time.

7 MEASURES MODULE

The Measures module allows users to select emissions reduction measures that the project would implement to reduce emissions from construction or operations. CEQA requires that all feasible mitigation measures be adopted to lessen or avoid significant impacts. When imposing the mitigation, the lead agency must ensure that a connection exists between the adopted mitigation and the significant impact and ensure that the mitigation is not part of the original project design. All mitigation measures must be feasible and fully enforceable, and all feasible mitigation must be imposed by the lead agency.

Users must follow the guidance below when developing the mitigation measures:

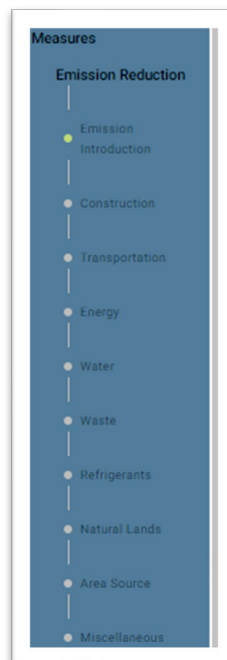
- ▶ Do not defer mitigation measure to a later time. It is important to identify the timing of implementation of each mitigation measure. If the mitigation is time dependent and cannot be in place as specified in the analysis, then either the user should propose a more reliable mitigation measure or the impact may be significant and unavoidable.

- ▶ Ensure that the mitigation measures are fully enforceable through legally binding instruments and are independently measurable. The mitigation should be site appropriate, accurate, and sufficiently detailed to be effective at the time it is applied at the project site. Avoid mitigation measures that are intended solely to provide information or educate the project sponsor, employees, workers, and the public.
- ▶ Ensure that the mitigation measures are consistent with all applicable constitutional requirements and are above and beyond existing laws, regulations, and requirements. If a federal, state, or local law already addresses the impact, compliance with the law should be discussed in the analysis but should not be identified as a mitigation measure.
- ▶ Ensure that the mitigation measures address only significant environmental impacts identified in the analysis and not preexisting environmental conditions.
- ▶ Ensure that the mitigation allows for some flexibility, where appropriate, related to changes in site conditions, and identify contingencies that include implementation of mitigation measures other than those adopted in the analysis that are just as effective as the adopted measures in avoiding the significant impact.

Embedded in CalEEMod are emissions reduction measures grouped into nine sectors corresponding to the primary emission sources or processes. These measures are verified, and most are quantified in CalEEMod.

Figure 17 shows the pages available in the left-hand navigation panel in the Measures module. To navigate, users must click on the sector title in the left-hand navigation panel to view available reduction measures. Except for some Area Source measures, all the measures come directly from the CAPCOA Handbook.

Figure 17 Navigation Panel Options in the Measures Module



There is a link to the CAPCOA Handbook in the navigation panel on the left side of the screen. In addition, in each page in the Measures module, the notepad icon to the right of a measure title links to the measure factsheet or description in the CAPCOA Handbook. When the user clicks on the icon, the measure factsheet or description opens in a new tab in the user's web browser. The icon is shown in **Figure 2**.

An example of how listed measures and the related notepad icons appear is shown in **Figure 18**, with the notepad icon circled in red.

Figure 18 Construction Measures Screen



The sectors used in the Measures module match the emissions sectors above (e.g., construction, transportation, energy). Some measures are categorized as “Quantified,” and some are “Qualitative or Supporting Measures.” The discussion below is a general overview of the Measures module. Users should refer to the CAPCOA Handbook for a more thorough discussion of the various measures.

After a measure is selected, the user may be prompted for additional information to enable quantification. Where available, default values are shown in the input boxes. Emissions reductions achieved by several measures may be quantified by equally applying the reduction efficacy to all land use subtypes in the project run or through targeted application to specific land use subtypes.

Quantified Reductions

The discussion below addresses the Air District measures that are quantifiable in CalEEMod. Approximately 80 of the measures in CalEEMod are quantifiable. Of these, only two of the Air District’s Basic Best Management Practices for Construction-Related Fugitive Dust Emissions are quantifiable in CalEEMod. Others, such as the quantification of wind screens, should be performed outside of CalEEMod.

Nonquantified Reductions

Most of the Air District’s Best Management Practices for Construction-Related Fugitive Dust Emissions (Basic and Enhanced) are not quantifiable in CalEEMod. These specific measures, such as requiring truck cargo to be covered, limiting trackout, and limiting activities on windy days, are not quantifiable because these metrics required specific information that is typically not available for most projects. Although they are not quantifiable, these measures should be included in the project design because they do achieve reductions in the real world.

An overview of the Air District’s Basic Best Management Practices for Construction-Related Fugitive Dust Emissions and Enhanced Best Management Practices to Control Construction-Related Fugitive Dust Construction Mitigation Measures and how they can or cannot be implemented in CalEEMod is provided in Attachment 1.

7.1 EMISSIONS REDUCTION SUBMODULE

7.1.1 Construction Screen

The Construction screen calculates emissions reductions based on the selected mitigation measures for the project. CalEEMod includes 14 quantified construction measures. Measures C-1-A through C-8 reduce combustion emissions, whereas Measures C-9 through C-12 reduce fugitive dust. Measure C-13 (Low-VOC Paints for Construction) reduces VOC emissions from architectural coatings. Note that some measures (e.g., watering exposed surfaces, using cleaner-fuel equipment), may require the selection of additional details. In some instances these additional details will not be selectable if these measures are included in the unmitigated scenario in the previous modules.

7.1.2 Transportation Screen

The Transportation screen allows users to select from 27 quantified transportation measures aimed primarily at reducing VMT and encouraging mode shifts from single-occupancy vehicles to shared (e.g., transit) or active modes of transportation (e.g., bicycle). If a traffic study was completed for the project and used to modify the trip generation rates and/or VMT estimates, then the traffic study may have already accounted for some potential reductions affecting VMT and mode shifts. This may be the case for projects for which VMT was estimated using a regional model that accounts for shared or active modes of transport in the specific area (e.g., in walkable area near a major transit station). Emissions reduction measures included in the traffic study should not be considered mitigation measures, because they are incorporated into the project. If reductions are not already accounted for in the traffic study, the Transportation screen provides options to adjust land use, site enhancement, and commute patterns and calculate reductions based on the corresponding measures described in the CAPCOA Handbook.

7.1.3 Energy Screen

The Energy screen allows users to estimate the emissions reductions from 14 quantified energy measures aimed at improving building energy efficiency, increasing renewable energy generation, and electrifying building end uses. CalEEMod includes a series of rules embedded in its logic, but many emissions reduction metrics can be manually adjusted by the user if project-specific information, such as the specific emissions factor for an alternate energy supplier, is available.

7.1.4 Water Screen

The Water screen allows users to estimate the emissions reductions from seven quantified measures aimed at water conservation. Similar to other sources, CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with water savings, but many emissions reduction metrics can be manually adjusted by the user if project-specific information is available. Users should ensure that their projects comply with local water conservation efforts and regulations.

7.1.5 Waste Screen

The Waste screen allows users to estimate the emissions reductions from one quantified solid waste measure in order to reduce the amount of waste sent to the landfill. CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with waste reductions, but the reduction metrics can be manually adjusted by the user if project-specific information is available.

7.1.6 Refrigerants Screen

The Refrigerants screen allows users to estimate the emissions reductions from six quantified measures in order to decrease the charge size and/or leak rate of equipment or replace the baseline refrigerant with a lower global warming potential (GWP)⁷ refrigerant. CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with refrigerants, but some reduction metrics can be manually adjusted by the user if project-specific information is available.

7.1.7 Natural Lands Screen

The Natural Lands screen allows users to estimate the emissions reductions from two quantified natural lands measures in order to create new vegetated open space and plant trees. Green space overall has been proven to improve people's physical and mental health by encouraging an active lifestyle and access to exercise opportunities. CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with vegetation and tree planting, but some reduction metrics can be manually adjusted by the user if project-specific information is available.

7.1.8 Area Source Screen

The Area Source screen allows users to select measures that reduce emissions from areawide sources. CalEEMod includes four quantified area source measures, including use of low-VOC cleaning supplies, use of low-VOC paints, and use of zero-emission landscaping equipment. CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with area sources, but some reduction metrics can be manually adjusted by the user if project-specific information is available.

7.1.9 Miscellaneous Screen

The Miscellaneous screen allows users to select from measures that reduce emissions from overall project activities. CalEEMod includes three quantified miscellaneous options:

- ▶ Establish a Carbon Sequestration Project.
- ▶ Establish Off-Site Mitigation.
- ▶ Implement an Innovative Strategy for GHG Mitigation.

⁷ Each GHG has a GWP value that reflects the climate forcing of a kilogram of emissions relative to the same mass of carbon dioxide. This number is calculated by the Intergovernmental Panel on Climate Change (IPCC), based on the intensity of infrared absorption by each GHG and how long emissions remain in the atmosphere. GWP values are calculated using a set time horizon. All GWP values used for GHG inventory purposes are considered over a 100-year timeframe. CalEEMod uses GWP values from IPCC's (2007) Fourth Assessment Report.

No defaults are available for these measures, so the user must input the amount of pollutant reduced per year based on project evaluations. Two qualitative or supporting measures are also available:

- ▶ Require Environmentally Responsible Purchasing.
- ▶ Fund Incentives for Green Technologies.

7.2 CLIMATE RISK REDUCTION SUBMODULE

The Climate Risk Reduction screen on the Climate Risk Reduction submodule presents the available climate risk reduction measures for user selection and analysis. Measures that address these priority hazards are shown first in the list of available measures on this screen. The icons for priority hazards are also shown in a larger font. The Air District is not providing guidance on this topic at this time.

7.3 HEALTH AND EQUITY SUBMODULE

The Health and Equity screen in the Health and Equity submodule includes two screens with 50 available health and equity measures that seek to promote health and equity; progress toward racial equity; and inclusion of and solidarity with marginalized, underrepresented, and vulnerable communities. The Air District is not providing guidance on this topic at this time.

8 RESULTS COMPONENT

The Results component includes various options to view emissions summaries. The page loads the Construction Emissions Dashboard first. An Operational Emissions Dashboard is also available. This page allows the user to see the emissions estimates, compare unmitigated to mitigated emissions, and spotlight a key pollutant without having to export or download results. The user can select Construction Calculations or Operations Calculations to see a summary of emissions estimate inputs by source (equipment, material movement, truck travel) and by season (summer, winter, and annually). The Results component is used primarily to view results and to verify that results look accurate.

9 REPORTS COMPONENT

The Reports component includes various options for downloading reports: Summary Report, Quarterly Report, Detailed Report, and Custom Report. The most common report will be the Detailed Report. The user can select to download a report as a PDF, a CSV, or an Excel file. The reports provide a summary of all emission calculations included in the model run at the maximum daily, average daily, and annual time scale. The PDF option is ideal for technical appendices to CEQA documents and technical reports because the file is formatted and includes all emissions sources. However, CEQA practitioners may also want to download the Excel version, which will assist in postprocessing results for the CEQA documentation or for subsequent analysis (such as for a health risk assessment).

The Air District recommends downloading a PDF version of the Detailed Report and including it as part of the administrative record. These options are shown in **Figure 19**.

Because the Air District’s metric for the daily criteria air pollutant emissions threshold is *average* pounds per day, the user should compare the *average* pounds per day summaries in the CalEEMod output to the Air District’s criteria air pollutant thresholds of significance (see Chapter 3 of the Guidelines).

Figure 19 Report Output Screen

The screenshot shows the '1.1. Basic Project Information' section of the CalEEMod report output. On the left, there is a sidebar with two main sections: '1. Select Report' and '2. Select Format'. Under '1. Select Report', there are buttons for 'Summary Report', 'Quarterly Report', 'Detailed Report' (highlighted in red), and 'Custom Report'. Under '2. Select Format', there are buttons for 'Download PDF' (highlighted in red), 'Download CSV', and 'Download Excel'. The main content area displays a table with the following data:

Data Field	Value
Project Name	Test - Mission District Mixed Use
Lead Agency	-
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	3.90
Precipitation (days)	41.8
Location	37.7688015440435, -122.41840395123413

10 RESOURCES

Bay Area Air Quality Management District. Regulation 8-3: Architectural Coatings. Available: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-8-rule-3-architectural-coatings>.

Bay Area Air Quality Management District. Regulation 6-3: Wood-Burning Devices. Available: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-6-rule-3-woodburning-devices>.

———. 2018 (June). Staff Report – Particulate Matter. New Regulation 6, Rule 6: Prohibition of Trackout. Available: https://www.baaqmd.gov/~/_media/dotgov/files/rules/archive-2018-regulation-6/bundled-documents/20180801_91_fsr_0606-pdf.pdf?la=e.

California Air Pollution Control Officers Association. Appendix G of the CalEEMod User Guide. Available: https://www.caleemod.com/documents/user-guide/08_Appendix%20G.xlsx.

Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report.

U.S. Environmental Protection Agency. AP-42. Section 13.2.1, “Paved Roads.” Available: https://www.epa.gov/sites/default/files/2020-10/documents/13.2.1_paved_roads.pdf.

U.S. Environmental Protection Agency. AP-42. Section 13.2.2, “Unpaved Roads.” Available: https://www.epa.gov/sites/default/files/2020-10/documents/13.2.2_unpaved_roads.pdf.

ATTACHMENT A FUGITIVE DUST GUIDANCE

This attachment provides an overview of the Air District's Basic Best Management Practices for Construction-Related Fugitive Dust Emissions and Enhanced Best Management Practices to Control Construction-Related Fugitive Dust Construction Mitigation Measures and how they can or cannot be implemented in CalEEMod.

Table DA-1 presents the best management practices that are implementable in CalEEMod, and Sections D-A1 and D-A2 discuss additional adjustments and calculations for two best management practices: unpaved road travel speeds and wind screens.

Table DA-1 Air District Best Management Practices for Construction-Related Fugitive Dust Emissions

Measure ID/Source	Measure Description	Implementable in CalEEMod?	Fugitive PM Reduction	Applicable Sector	Notes
Basic Measures					
B-1+	All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.	Yes. The user should specify twice-per-day watering as a best management practice on the Dust from Material Movement screen in the Construction module. Results will populate in the unmitigated emissions summary.	61%	Earthmoving, including site grading and bulldozing	All users are required to implement twice-per-day watering in the unmitigated analysis. If additional watering or other mitigation is required to reduce dust impacts, the user should implement additional reductions in the Measures module.
B-2+	All haul trucks transporting soil, sand, or other loose material off-site shall be covered.	No	—	—	—
B-3+	All visible mud or dirt trackout onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.	No	—	—	—
B-4+	All vehicle speeds on unpaved roads shall be limited to 15 mph.	Yes. The user should specify a 15-mph mean vehicle speed as a best management practice on the On-Road Fugitive Dust screen in the Construction module. Results will populate in the unmitigated emissions summary.	See Table DA-2, below.	Unpaved road dust travel. This strategy is applicable only if the percentage of paved on-site truck travel is greater than 0.	The default unpaved road travel speed in CalEEMod is 40 mph. The user can adjust the speed on the Dust from Material Movement screen in the Construction module to implement the measure as part of the unmitigated analysis. If additional speed or other mitigation is required, the user should implement additional reductions in the Measures module.

Measure ID/Source	Measure Description	Implementable in CalEEMod?	Fugitive PM Reduction	Applicable Sector	Notes
B-5 ⁺	All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.	No	—	—	—
B-6 [†]	All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph.	No	—	—	—
B-7 [^]	All trucks and equipment, including their tires, shall be washed off prior to leaving the site.	No	—	—	—
B-8 [†]	Unpaved roads providing access to sites located 100 feet or further from a paved road shall be treated with a 6- to 12-inch layer of compacted layer of wood chips, mulch, or gravel.	No	—	—	—
B-9 ⁺	Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's General Air Pollution Complaints number shall also be visible to ensure compliance with applicable regulations.	No	—	—	—

Measure ID/Source	Measure Description	Implementable in CalEEMod?	Fugitive PM Reduction	Applicable Sector	Notes
Enhanced Measures					
E-1 [^]	Limit the simultaneous occurrence of excavation, grading, and other ground-disturbing construction activities.	No	—	—	—
E-2 [^]	Install wind breaks (e.g., trees, fences) on the windward side(s) of actively disturbed areas of construction and storage piles. Wind breaks shall be a minimum of three-sided installed fencing the predominant wind direction, have at maximum 50-percent air porosity, and be at least equal in height to storage pile heights.	No	See Section D-A2, "Wind Screens," below.	—	—
E-3 [†]	Plant vegetative ground cover (e.g., fast-germinating native grass seed) in disturbed areas as soon as possible and watered appropriately until vegetation is established.	No	—	—	—
E-4 [†]	Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with a slope greater than 1 percent.	No	—	—	—
E-5 [^]	Minimize the amount of excavated material or waste materials stored at the site.	No	—	—	—
E-6 [^]	Hydroseed or apply nontoxic soil stabilizers to construction areas, including previously graded areas, that are inactive for at least 10 calendar days.	No	—	—	—

[^] 2017 Air District CEQA Guidelines, Basic Construction Mitigation Measures

[†] 2017 Air District CEQA Guidelines, Enhanced Construction Mitigation Measures

[^] Adapted from San Francisco Dust Control Ordinance, SEC. 1242 (c)

D-A1 UNPAVED ROAD TRAVEL SPEED

CalEEMod assumes a linear relationship between particulate matter (PM) emissions and unpaved road vehicle speed. The CalEEMod default travel speed is 40 mph. As discussed in Section 3.7, the Air District’s Basic Best Management Practices for Construction-Related Fugitive Dust Emissions require users to adjust the travel speed to 15 mph on the On-Road Fugitive Dust screen (see **Figure 11**). If the project would include unpaved road travel, the change in vehicle speed will be reflected in the unmitigated analysis. If the project would exceed applicable thresholds of significance after implementing Basic and Enhanced Best Management Practices for Construction-Related Fugitive Dust Emissions, additional mitigation may be required.

In the Measures module in CalEEMod, the user can input the PM reduction from limiting vehicle speeds. The user is not asked to input the vehicle speed so that the model would perform the calculation. Instead, the user must input the reduction (**Figure DA-1**). This reduction is relative to the unmitigated analysis. If the unmitigated analysis assumed a 15-mph travel speed, then reductions from slower speeds (e.g., 10 mph, 5 mph) should be relative to the 15-mph travel speed. If the unmitigated analysis assumed a CalEEMod default 40-mph travel speed, then reductions from slower speeds (e.g., 35 mph and below) should be relative to the 40-mph travel speed.

Figure DA-1 Input for Limiting Vehicle Speeds in the Measures Module

The screenshot shows a software interface for entering measures. A measure titled 'C-11 Limit Vehicle Speeds on Unpaved Roads' is selected. Below the title, there are two input fields: 'PM10 (% Reduction)' and 'PM2.5 (% Reduction)'. Both fields have the number '33' entered. Red circles highlight the measure title and the two input fields.

Reductions to assume for lower unpaved road are summarized in Table DA-2. As noted above, there are two reduction options. The user needs to ensure that the most appropriate reduction is applied depending on what speed was assumed in the unmitigated analysis.

Table DA-2 Unpaved Road Dust Reductions by Vehicle Speeds in the Measures Module

Speed (in mph)	Reduction % from Basic Mitigation Measure Requirement of 15 mph
10	33%
5	67%

D-A2 WIND SCREENS

Use of a wind screen can reduce the effective wind velocity by 50 percent. If the wind speed at a given location is 10 mph, then the effective wind speed behind a wind screen is likely to be 5 mph.

Fugitive dust from wind erosion occurs when wind speeds reach or exceed what is known as the “friction threshold velocity,” which is the wind speed required to initiate the first windblown fugitive dust particle. Although CalEEMod does not quantify emissions from inactive storage piles (only for active piles associated

with truck loading), the approximate effect of a wind screen can be estimated using the 50-percent-reduction assumption and the truck loading formula from CalEEMod, which includes wind speed as a key variable.

The formula, taken from AP-42, is as follows:

$$EF_D = k \times (0.0032) \times \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where k is the particle size multiplier (constant), M is the material moisture content (assumed to be 12 percent for truck loading and piles), and U is the mean wind speed. Based on this formula, a 50-percent reduction in wind speed (U) would reduce the fugitive PM₁₀ and PM_{2.5} emissions factor from truck loading by 59 percent. This reduction applies regardless of the baseline wind speed.