Version 2.0

User Guide

RUTGERS
Edward J. Bloustein School
of Planning and Public Policy

GASCAP was developed by the Alan M. Voorhees Transportation Center at Rutgers University under contract to the New Jersey Department of Transportation (NJDOT). This software is freely available to use for all purposes associated with estimating greenhouse gas emissions for transportation capital projects. Any modifications or updates made to GASCAP must also be for public use and the product and any modifications to. GASCAP may not be sold for commercial use.

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Contents

Introduction

GASCAP is a Microsoft Excel based spreadsheet tool designed for the New Jersey Department of Transportation to estimate greenhouse gas emissions associated with transportation capital projects. The current version includes sections to calculate emissions for the following:

Section 1: Materials - Estimates direct and upstream emissions for materials used in construction projects based on item codes from NJ DOT project bid sheets.

Section 2: Non-Road Equipment - Estimates direct and upstream emissions for non-road equipment used during construction activities.

Section 3: Recyclables - Estimates a credit against estimated emissions based on the use of various recycled materials in construction projects.

Section 4: Lifecycle Maintenance - Estimates direct and upstream emissions based on expected materials and equipment that will be used in maintaining the completed product over its lifespan.

Section 5a: Staging - Estimates direct and upstream emissions for on-road vehicles and temporary lighting used during construction of a project.

Section 5b: Traffic Disruption - Estimates direct and upstream emissions resulting from changes in vehicle miles of travel and vehicle efficiency due to work zones, lane closures, and detours.

Section 6: Lighting - Estimates direct emissions from the operation of permanent lighting fixtures over the lifespan of a project.

Section 7: Rail - Estimates direct and upstream emissions for various inputs that are specific to rail construction projects.

Section 8: Induced Travel - Estimates changes in mobile source emissions caused by changes in road capacity

Maintenance Department Module - Estimates emissions from routine, minor maintenance activities.

Section 9: Updating GASCAP - Procedures for updating background data on energy, vehicles, and materials used by GASCAP when estimating emissions.

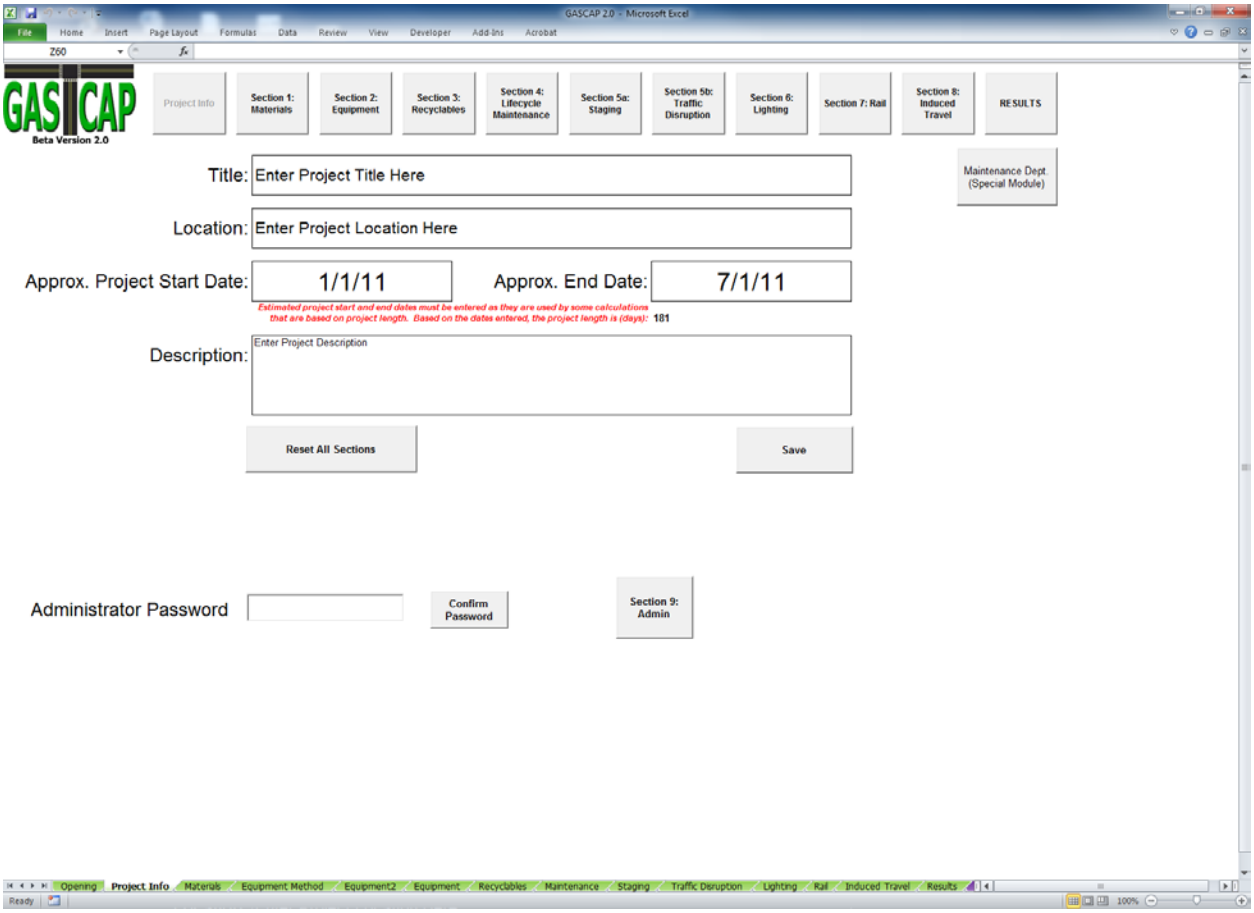
Enabling Macros

Most of the functionality of GASCAP is contained within macros, which are scripts that automate calculations and other program functionality. By default, macros are usually disabled in Excel. After opening the spreadsheet, a prompt will ask if the user wishes to enable macros or will present a security warning that some content is disabled. This prompt should be followed to enable macros. Macros must be enabled to load and run GASCAP.

Project Info

The first worksheet displayed after enabling macros is the Project Info page. Basic information about the project (title, location, start and end dates, and description) should be entered here. The Reset button can also be used to reset the entire workbook and remove all items added in all sections. The project title displayed on other sheets is linked to the one entered on this page.

It is ***critical to program functionality*** that estimated project start and end dates are entered, even if they are very rough estimates. The dates are used to calculate project length (displayed on the Project Info page for reference) which is used in several emission calculation functions.

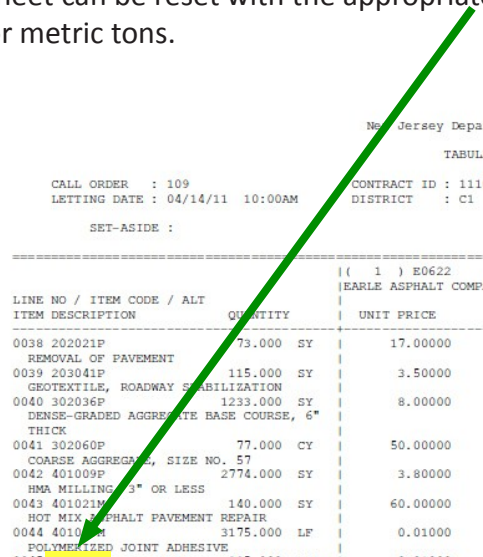


Section 1: Materials

Material inputs to GASCAP are based on NJ DOT bid sheet item codes. The first step in entering a material is to input the 7-digit item code from the bid sheet. After inputting the item code, clicking 'Go' will display the appropriate unit of measurement for the item and pre-populate default variables for that item.

If you do not know an item's 7-digit code, you can click "Find Codes" to look up codes by item name. Then click "Ok" to send the code to Input Item Code box and click "Go."

The second step is to input the quantity of the item, which is located next to the item code on the bid sheet. Additionally, in step 3, default variables related to asphalt and concrete are displayed. These variables can be changed if desired. Variables that do not apply to the item selected will be greyed out. Clicking the Add Material button creates a new line item on the spreadsheet with emissions factors (in grams) for that item, and updates the total emissions for all materials. Individual line items can be removed by their respective buttons, or the entire sheet can be reset with the appropriate button. Total emissions can be viewed in grams or metric tons.



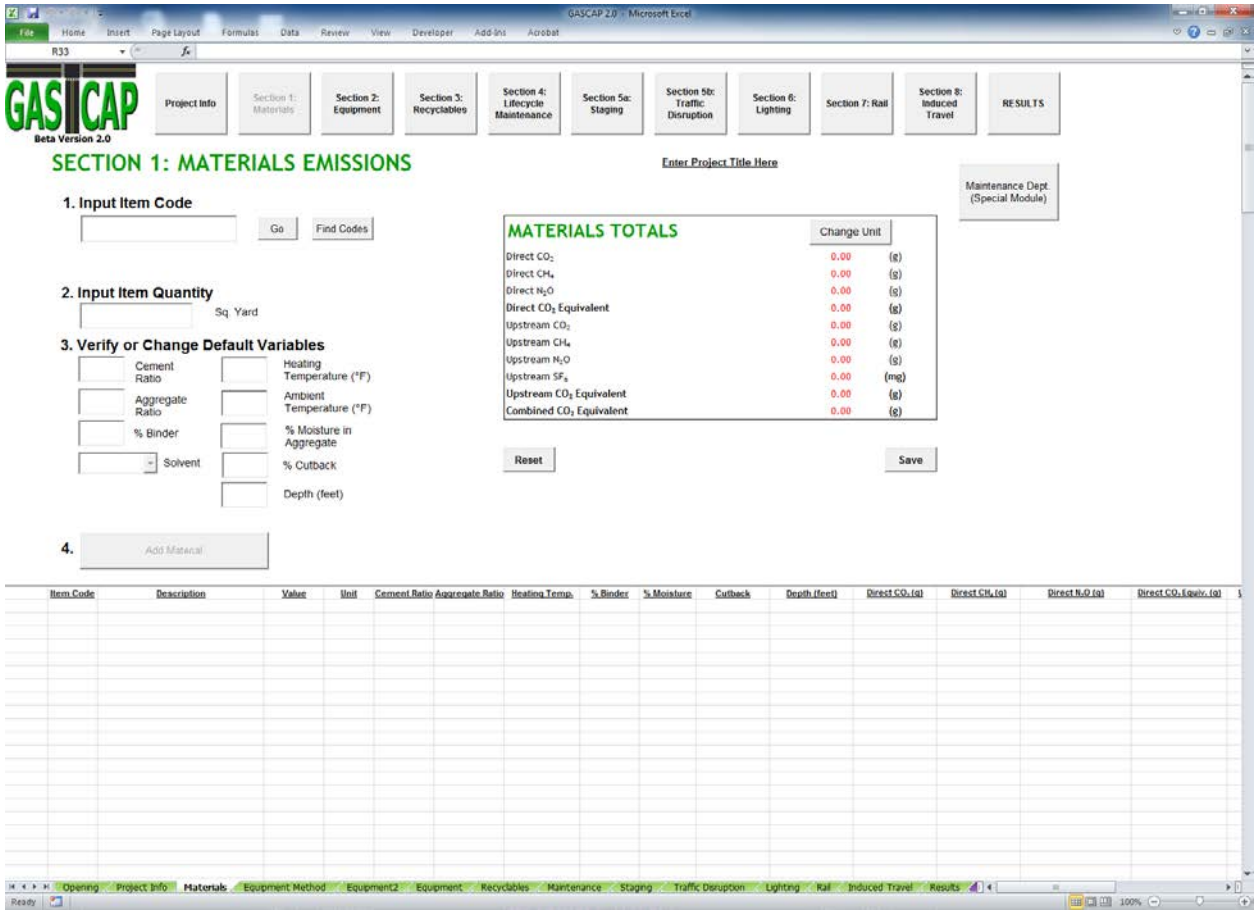
New Jersey Department of Transportation — DATE : 04/19/11 — PAGE : 109 -3

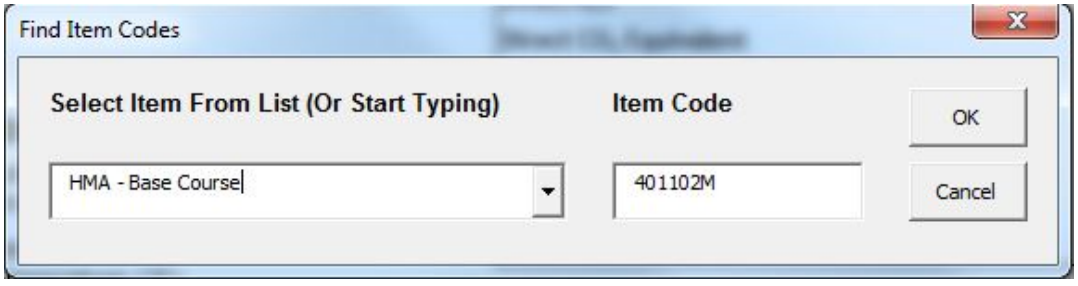
TABULATION OF BIDS

CALL ORDER : 109 — CONTRACT ID : 11109 — COUNTIES : MERCER
LETTING DATE : 04/14/11 10:00AM — DISTRICT : C1

SET-ASIDE :

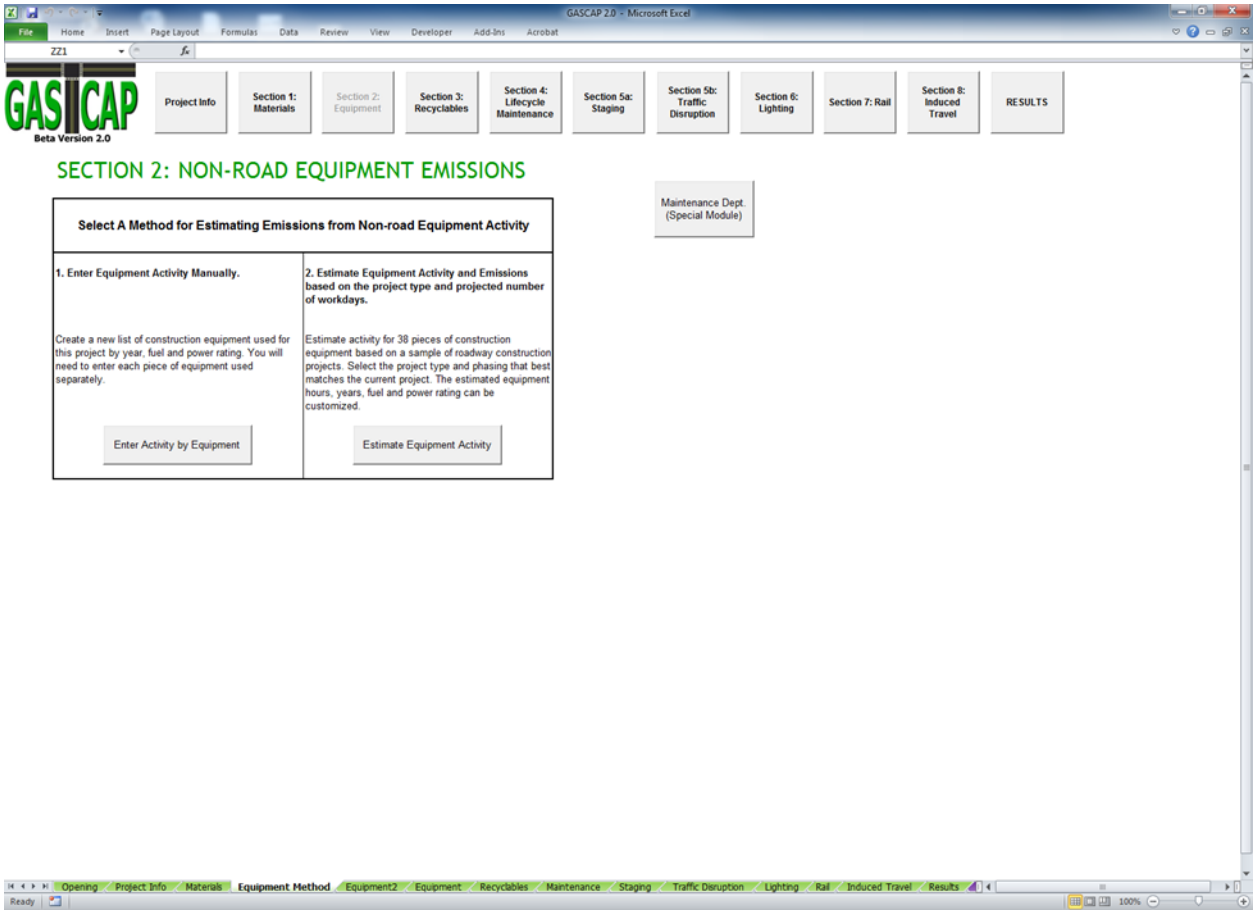
LINE NO / ITEM CODE / ALT ITEM DESCRIPTION	QUANTITY		(1) E0622 EARLE ASPHALT COMPANY UNIT PRICE	AMOUNT	(2) D2206 JOSEPH DEFINO TRUCKING CO IN UNIT PRICE	AMOUNT	(3) G7305 GREEN CONSTRUCTION INC. UNIT PRICE	AMOUNT
0038 202021P REMOVAL OF PAVEMENT	73.000	SY	17.00000	1241.00	15.00000	1095.00	30.00000	2190.00
0039 203041P GEOTEXTILE, ROADWAY STABILIZATION	115.000	SY	3.50000	402.50	5.00000	575.00	0.01000	1.15
0040 302036P DENSE-GRADED AGGREGATE BASE COURSE, 6" THICK	1233.000	SY	8.00000	9864.00	12.00000	14796.00	7.50000	9247.50
0041 302060P COARSE AGGREGATE, SIZE NO. 57	77.000	CY	50.00000	3850.00	25.00000	1925.00	0.01000	0.77
0042 401009P HMA MILLING 3" OR LESS	2774.000	SY	3.80000	10541.20	8.00000	22192.00	4.00000	11096.00
0043 401021M HOT MIX ASPHALT PAVEMENT REPAIR	140.000	SY	60.00000	8400.00	1.00000	140.00	0.01000	1.40
0044 401036M POLYMERIZED JOINT ADHESIVE	3175.000	LF	0.01000	31.75	2.00000	6350.00	0.50000	1587.50
0045 TACK COAT	225.000	GAL	0.01000	2.25	0.01000	2.25	4.00000	900.00
0046 401036M PRIME COAT	435.000	GAL	0.01000	4.35	0.01000	4.35	0.01000	4.35
0047 401063M HOT MIX ASPHALT 12.5 H 76 SURFACE COURS	990.000	T	83.00000	82170.00	100.00000	99000.00	85.00000	84150.00
0048 401099M HOT MIX ASPHALT 25 M 64 BASE COURSE	579.000	T	73.00000	42267.00	100.00000	57900.00	75.00000	43425.00
0049 401108M CORE SAMPLES, HOT MIX ASPHALT	5.000	U	60.00000	300.00	75.00000	375.00	125.00000	625.00
0050 601122P 15" REINFORCED CONCRETE PIPE	32.000	LF	50.00000	1600.00	120.00000	3840.00	85.00000	2720.00
0051 601404P SUBBASE OUTLET DRAIN	33.000	LF	32.00000	1056.00	20.00000	660.00	80.00000	2640.00
0052 602012M INLET, TYPE B	2.000	U	3500.00000	7000.00	4000.00000	8000.00	2250.00000	4500.00
0053 602099M RESET EXISTING CASTING	3.000	U	190.00000	570.00	250.00000	750.00	450.00000	1350.00
0054 602117M SET SQUARE FRAMED MANHOLE CASTING, CIRCULAR COVER	2.000	U	2500.00000	5000.00	3000.00000	6000.00	1500.00000	3000.00
0055 602153M RECONSTRUCTED INLET, TYPE B, USING NEW CASTING	1.000	U	1500.00000	1500.00	2500.00000	2500.00	1000.00000	1000.00


GASCAP 2.0 - Microsoft Excel
GASCAP
Beta Version 2.0
Project Info
Section 1: Materials
Section 2: Equipment
Section 3: Recyclables
Section 4: Lifecycle Maintenance
Section 5a: Staging
Section 5b: Traffic Disruption
Section 6: Lighting
Section 7: Rail
Section 8: Induced Travel
RESULTS
SECTION 1: MATERIALS EMISSIONS
Enter Project Title Here
Maintenance Dept. (Special Module)
1. Input Item Code
Go
Find Codes
2. Input Item Quantity
Sq. Yard
3. Verify or Change Default Variables
Cement Ratio
Aggregate Ratio
% Binder
Solvent
Heating Temperature (°F)
Ambient Temperature (°F)
% Moisture in Aggregate
% Cutback
Depth (feet)
4.
Add Material
MATERIALS TOTALS
Change Unit
Direct CO2
Direct CH4
Direct N2O
Direct CO2 Equivalent
Upstream CO2
Upstream CH4
Upstream N2O
Upstream SF6
Upstream CO2 Equivalent
Combined CO2 Equivalent
Reset
Save
Item Code
Description
Value
Unit
Cement Ratio
Aggregate Ratio
Heating Temp.
% Binder
% Moisture
Cutback
Depth (feet)
Opening
Project Info
Materials
Equipment Method
Equipment2
Equipment
Recyclables
Maintenance
Staging
Traffic Disruption
Lighting
Rail
Induced Travel
Results
Ready


Find Item Codes
Select Item From List (Or Start Typing)
Item Code
HMA - Base Course
401102M
OK
Cancel

Section 2: Equipment

Section 2 is where all non-road equipment used during construction should be entered. There are two methods for entering equipment as shown below. Click the button for the method you want to use.



Method 1: Enter Equipment Activity Manually

Choose Method 1 if you know what pieces of non-road equipment will be used in the project and how long each piece of equipment will be operating. Equipment is selected through a series of drop down boxes that must be selected in order.

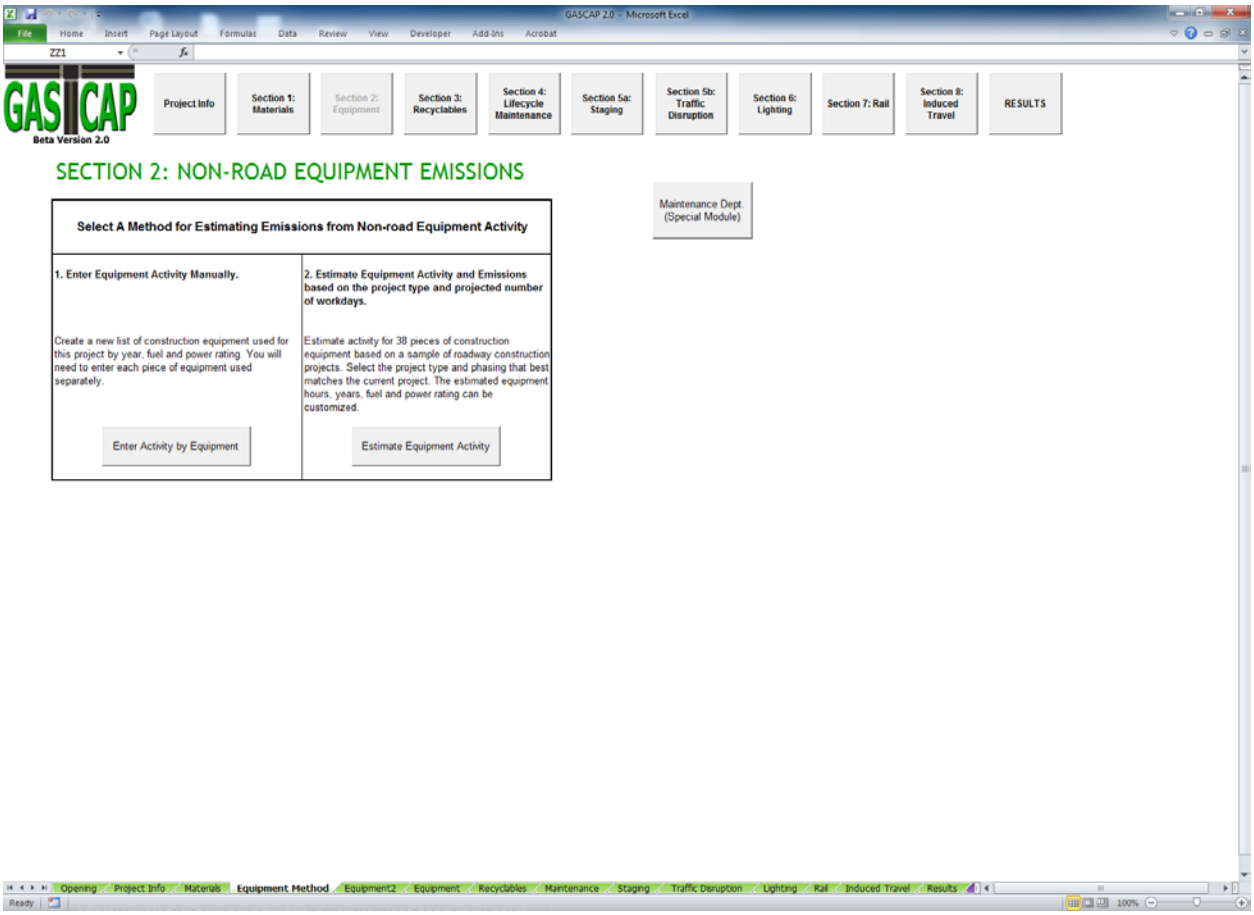
Method 2: Estimate Equipment Activity

Choose Method 2 if you do not know what pieces of equipment will be used or for what period of time. GASCAP will allow you to estimate the number of hours of equipment activity for 38 pieces of non-road equipment based on a sample of projects.

Method 1 Enter Equipment Activity Manually

Step 1: Select the year the vehicle was manufactured
Step 2: Select the type of equipment
Step 3: Select the type of fuel used
Step 4: Select the vehicle's power rating
Step 5: Enter the number of hours the vehicle will be used in total during construction
Step 6: The 'Add Equipment' button will add a line item on the spreadsheet with emissions factors (in grams) for that item, and updates the total emissions for all equipment.

Before hitting the 'Add Equipment' button, the box labeled 'Air Conditioning?' should be checked if the equipment has it. Individual line items can be removed by their respective buttons, or the entire sheet can be reset with the appropriate button. Total emissions can be viewed in grams or metric tons.



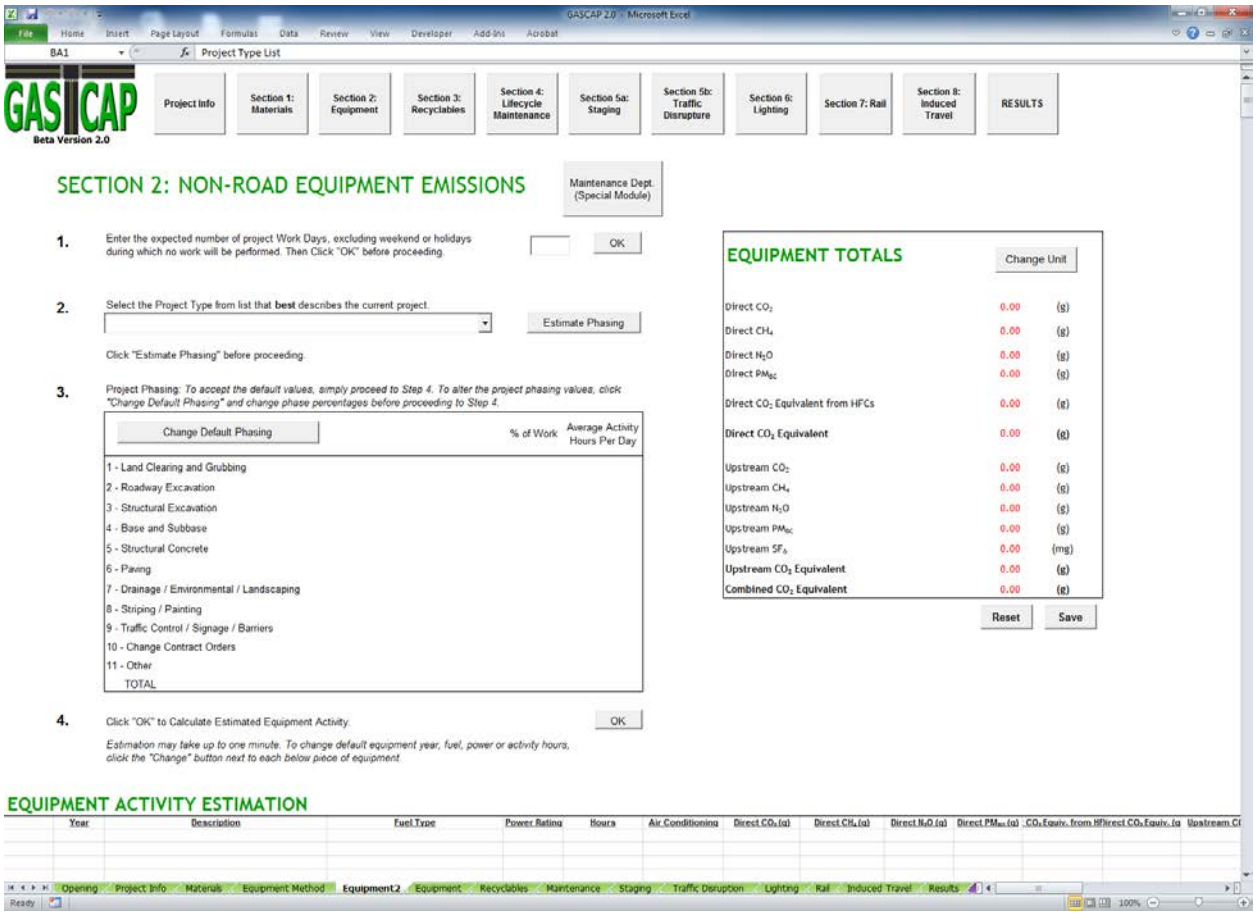
Method 2: Estimate Equipment Activity

Step 1: Enter the expected number of workdays in the textbox and click "OK." (Remember workdays do not include holidays or weekends on which no work will be performed).

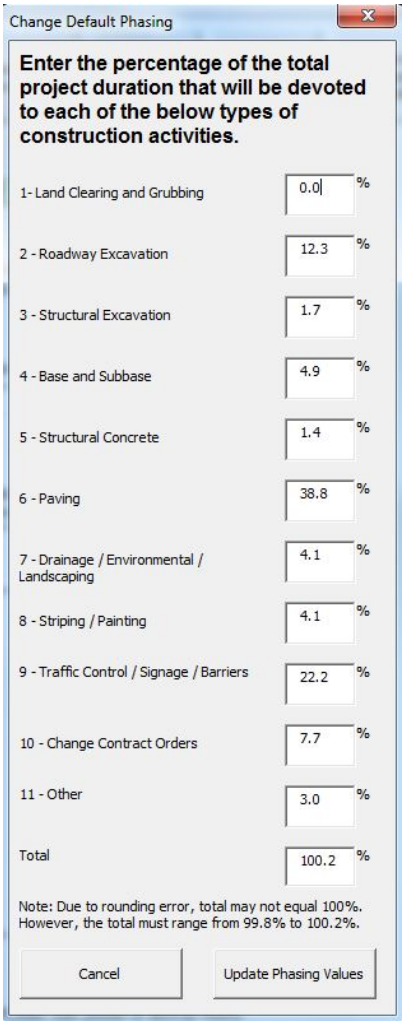
Step 2: Select one of six project types from the dropdown menu. Choose which of the following *best* describes the current project:

1. Resurface Existing Highway
2. Construct Freeway / Extra Lane
3. Pavement Rehabilitation / Widening
4. Construct / Reconstruct Bridge
5. Construct Median, Thrie Beam Barrier
6. Landscaping

Then click "Estimate Phasing."



Step 3: The phasing describes what portion of the project work (in hours) is allocated to each phase – or general category of activity. To accept the default phasing, simply go to Step 4. To alter the default phasing, click the "Change Default Phasing" button to bring up the below menu. Enter new values for the percent of time devoted to each phase. To account for rounding errors, the total may range from 99.8% to 100.2%.



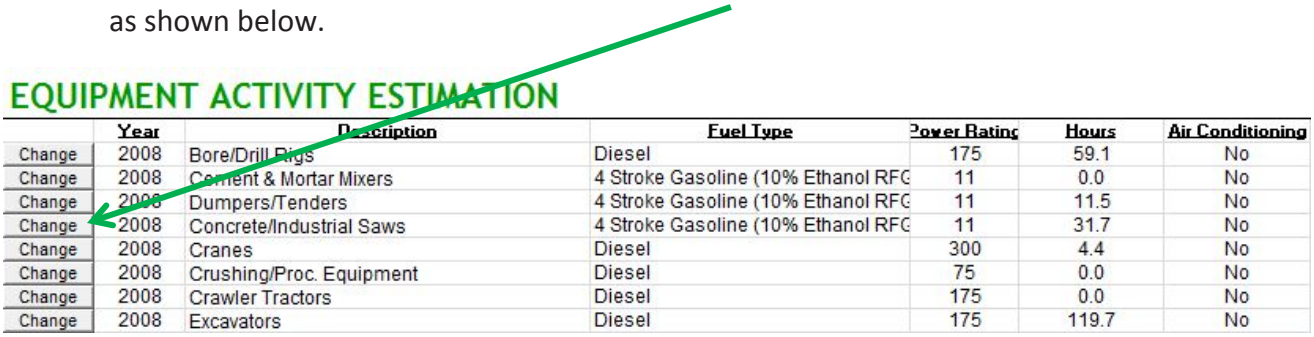
Click the "Update Phasing Values" button to update the value.

Different mixes of equipment are used in each phase, so accurate phasing helps GASCAP to more closely approximate the specific project.

"Change Contract Orders" is an allowance for extra construction time due to changes in the contract. "Other" accounts for time that is spent performing uncategorized activities.

Step 4: Click the "OK" Button on the main screen to populate a default list of equipment activity and emissions.

Step 5: If you need to change the default hours of activity, model year, fuel type, or power of equipment, click the "Change" button next to the piece of equipment you would like to alter, as shown below.



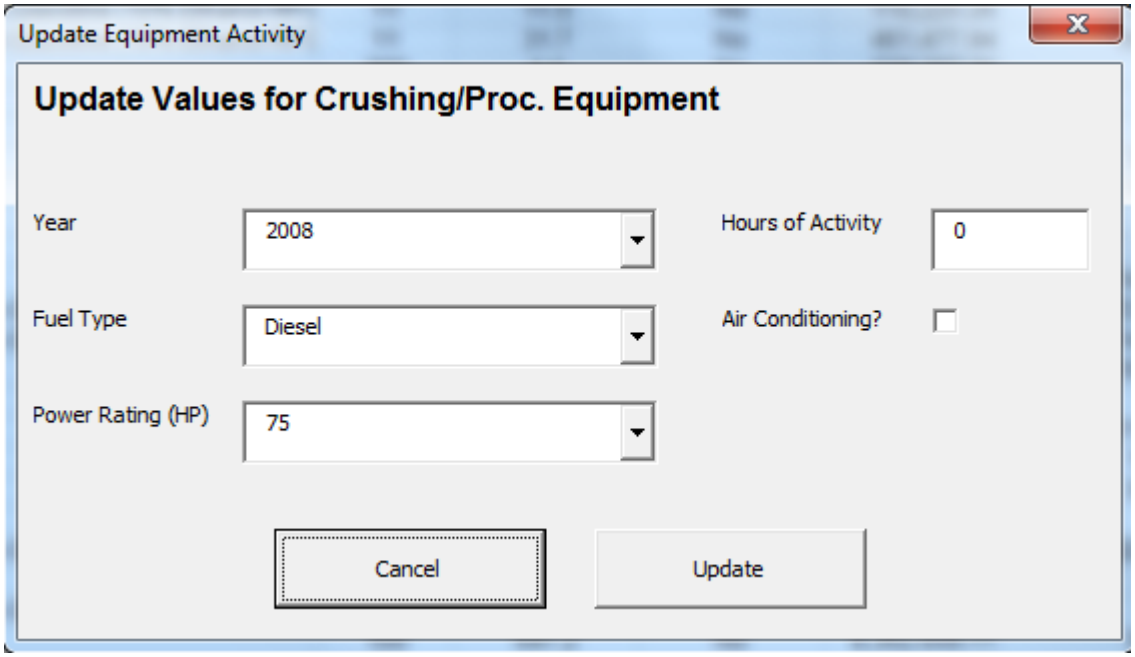
EQUIPMENT ACTIVITY ESTIMATION

	Year	Description	Fuel Type	Power Rating	Hours	Air Conditioning
Change	2008	Bore/Drill Rigs	Diesel	175	59.1	No
Change	2008	Cement & Mortar Mixers	4 Stroke Gasoline (10% Ethanol RFG	11	0.0	No
Change	2008	Dumpers/Tenders	4 Stroke Gasoline (10% Ethanol RFG	11	11.5	No
Change	2008	Concrete/Industrial Saws	4 Stroke Gasoline (10% Ethanol RFG	11	31.7	No
Change	2008	Cranes	Diesel	300	4.4	No
Change	2008	Crushing/Proc. Equipment	Diesel	75	0.0	No
Change	2008	Crawler Tractors	Diesel	175	0.0	No
Change	2008	Excavators	Diesel	175	119.7	No

The "Change" button will bring up a menu for selecting the equipment model year, fuel type and horsepower (which you must change in that order). Check the Air Conditioning box if the specific equipment model uses air conditioning.

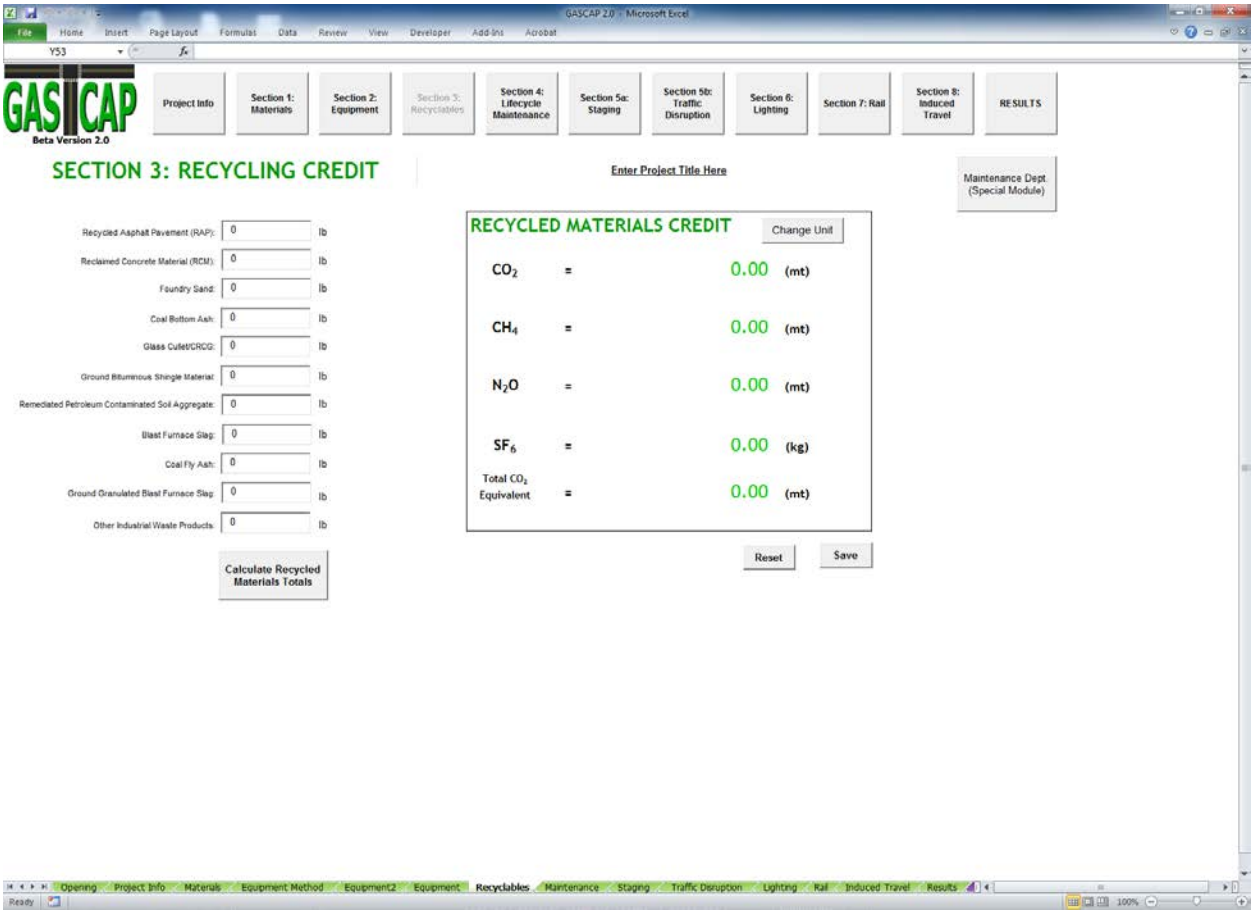
To change the Hours of Activity, simply overwrite the previous value. There is no way to remove equipment from the list. If the equipment *will not be used at all*, specify 0 as the Hours of Activity.

Then click "Update."



Section 3: Recyclables

The Recyclables worksheet displays a list of recycled materials that will give a credit against emissions if used in the project. The amount of each material used in pounds should be entered in the respective cell. Pressing the 'Calculate Recycled Materials Credit' button will update the Recycled Materials Credit totals to reflect the amount of the credit. Pressing Reset returns all values to zero. Total emissions can be viewed in grams or metric tons.



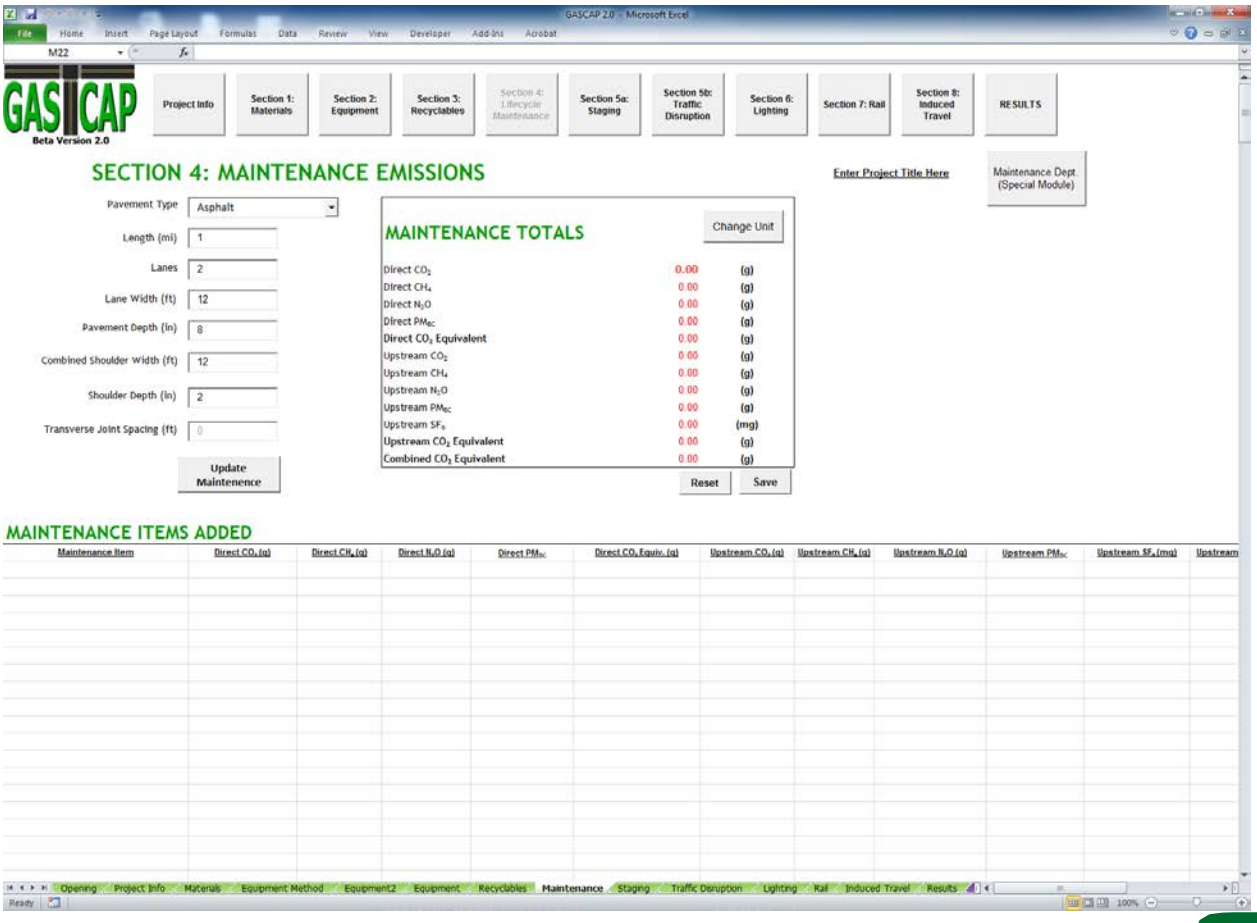
Section 4: Lifecycle Maintenance

The Lifecycle Maintenance section is designed to estimate direct and upstream emissions based on expected materials and equipment that will be used in maintaining the completed product over its lifespan. *Bridge lifecycle maintenance is not estimated in the current version.*

Each field in the steps below is populated with default values that may be changed.

Step 1: Select the Pavement Type from the dropdown (Asphalt, Concrete, or Asphalt Overlay Concrete)
Step 2: Enter the Length of the project in miles.
Step 3: Enter the number of Lanes
Step 4: Enter the Pavement Depth (in inches) of the main roadway
Step 5: Enter the Combined Width (in feet) of both shoulders of the roadway
Step 5: Enter the Pavement Depth for the shoulders of the roadway
Step 6: Enter the distance (feet) for Transverse Joint Spacing
(Step 6 does not apply when the Pavement Type is Asphalt).

Click “Update Maintenance.”



	Asphalt Pavement	Concrete Pavement	Asphalt Overlay Concrete Pavement
Total Lifecycle	50 Years	50 Years	30 Years
5 years	Clean and seal 100% of longitudinal joints Crack seal 500 ft. per lane mile (PA) Micro surface all lanes and shoulders	Crack seal 500 ft. per lane mile (PA)	
10 years	Clean and seal 100% of longitudinal joints Crack seal 500 ft. per lane mile (PA) Micro surface all lanes and shoulders	Clean and seal 100% of longitudinal joints Clean and seal 100% of transverse joints Crack seal 500 ft. per lane mile (PA)	Concrete patch 2 - 10% of pavement area Crack seal 500 ft. per lane mile (PA) Bituminous overlay to 4 in. depth
20 years	Mill wearing course to 2 in. depth Bituminous inlay to 2 in. depth micro surface shoulders	Concrete patch 2 - 10% of pavement area Diamond grind 100% of total area Clean and seal 100% of longitudinal joints Clean and seal 100% of transverse joints	Concrete patch 2 - 10% of pavement area Mill wearing course to 2 in. depth Bituminous inlay to 2 in. depth
30 years	Clean and seal 100% of longitudinal joints Crack seal 500 ft. per lane mile (PA) Micro surface all lanes and shoulders	Concrete patch 2 - 10% of pavement area Diamond grind 100% of total area Clean and seal 100% of longitudinal joints Clean and seal 100% of transverse joints	
40 years	Full depth patch 5% of pavement area Mill wearing course to 4 in. depth Bituminous inlay to 4 in. depth micro surface shoulders	Concrete patch 2 - 10% of pavement area Crack seal 500 ft. per lane mile (PA) Bituminous overlay to 4 in. depth	
50 years	Clean and seal 100% of longitudinal joints Crack seal 500 ft. per lane mile (PA) Micro surface all lanes and shoulders	Concrete patch 2 - 10% of pavement area Mill wearing course to 2 in. depth Bituminous inlay to 2 in. depth	

Section 5a: Staging

Transportation

The Staging worksheet allows emissions to be estimated for activities involved in staging the construction site. The first box, Transportation, is similar in function to the Equipment worksheet, except with on-road vehicles.

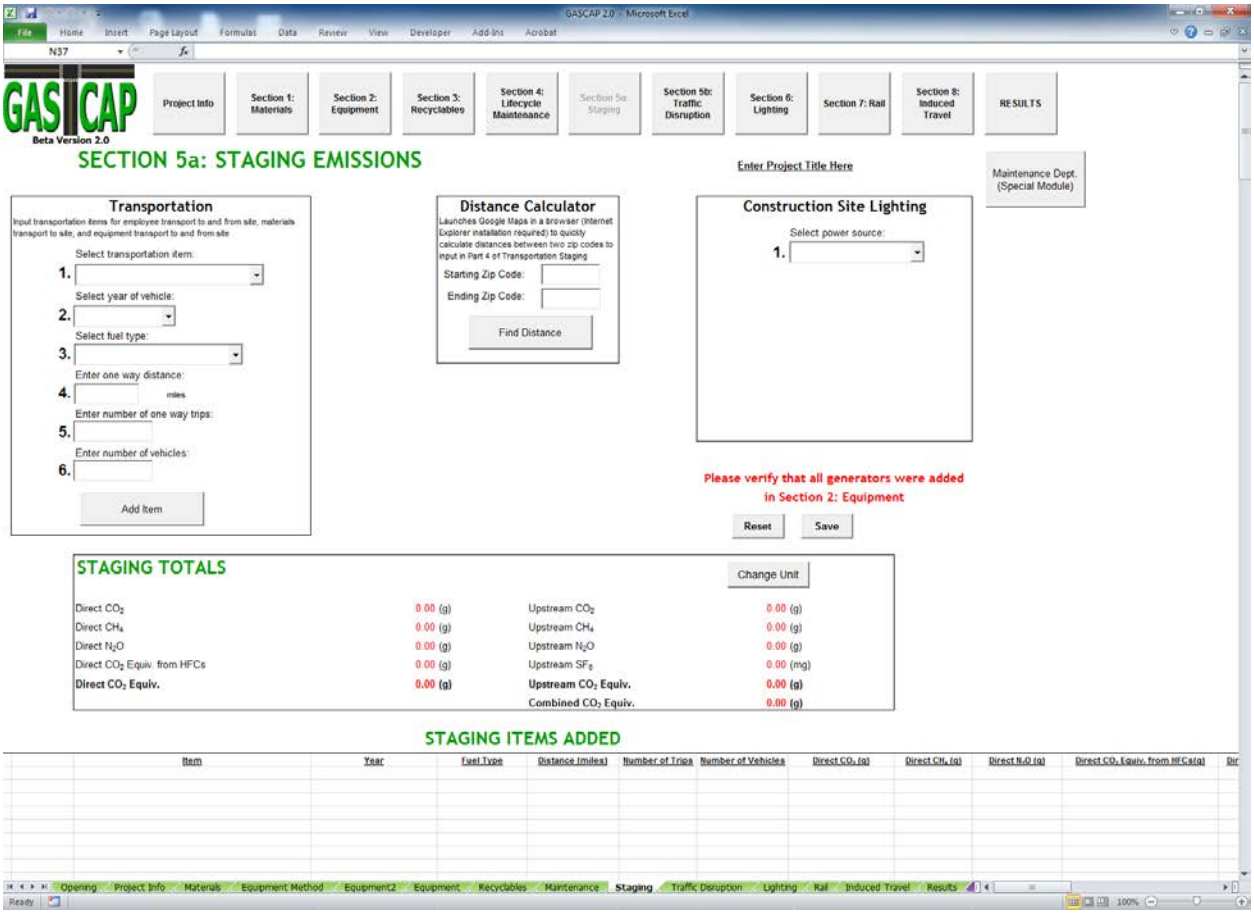
Step 1: Select the vehicle type
Step 2: Select the year the vehicle was manufactured
Step 3: Select the type of fuel used
Step 4: Enter the one way distance of a trip with that vehicle type
Step 5: Enter the number of one way trips made with that vehicle type
Step 6: Enter the number of vehicles of that type
Step 7: The 'Add Item' button will add a line item on the spreadsheet with emissions factors (in grams) for that item, and updates the total emissions for all equipment.

To assist in determining distance traveled, a quick Distance Calculator box accepts the input of a starting and ending 5-digit zip code; clicking the 'Find Distance' button will bring up the user's web browser with a Google Maps page giving the driving miles between the two zip codes.

Construction Site Lighting

The second part of calculating construction staging emissions involves estimating the use of lighting for nighttime work at the site. By default, the power is generator based. In this event, please verify that generators were added as equipment items in Section 2.

If the power is grid-based, choose that option in the drop down box. The sheet then prompts for the number of fixtures, watts per fixture, and operating hours per day. Multiple line items can be added. The operating hours box is prepopulated with an estimated figure based on the actual daylight hours expected based on the dates of the project. This default number can be changed if desired. Pressing the 'Add Lighting' button creates a new line item on the spreadsheet with emissions factors (in grams) for that item, and updates the total emissions for all materials. Pressing Reset returns all values to zero. Total emissions can be viewed in grams or metric tons.


GASCAP 2.0 - Microsoft Excel
GASCAP
Beta Version 2.0
Project Info
Section 1: Materials
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Section 4: Lifecycle Maintenance
Section 5a: Staging
Section 5b: Traffic Disruption
Section 6: Lighting
Section 7: Rail
Section 8: Induced Travel
RESULTS
SECTION 5a: STAGING EMISSIONS
Enter Project Title Here
Maintenance Dept. (Special Module)
Transportation
Input transportation items for employee transport to and from site, materials transport to site, and equipment transport to and from site
Select transportation item:
Select year of vehicle:
Select fuel type:
Enter one way distance:
miles
Enter number of one way trips:
Enter number of vehicles:
Add Item
Distance Calculator
Launches Google Maps in a browser (Internet Explorer installation required) to quickly calculate distances between two zip codes to input in Part 4 of Transportation Staging
Starting Zip Code:
Ending Zip Code:
Find Distance
Construction Site Lighting
Select power source:
Please verify that all generators were added in Section 2: Equipment
Reset
Save
STAGING TOTALS
Change Unit
Direct CO2
Direct CH4
Direct N2O
Direct CO2 Equiv. from HFCs
Direct CO2 Equiv.
Upstream CO2
Upstream CH4
Upstream N2O
Upstream SF6
Upstream CO2 Equiv.
Combined CO2 Equiv.
STAGING ITEMS ADDED
Item
Year
Fuel Type
Distance (miles)
Number of Trips
Number of Vehicles
Direct CO2 (g)
Direct CH4 (g)
Direct N2O (g)
Direct CO2 Equiv. from HFCs(g)
Opening
Project Info
Materials
Equipment Method
Equipment2
Equipment
Recyclables
Maintenance
Staging
Traffic Disruption
Lighting
Rail
Induced Travel
Results
Ready

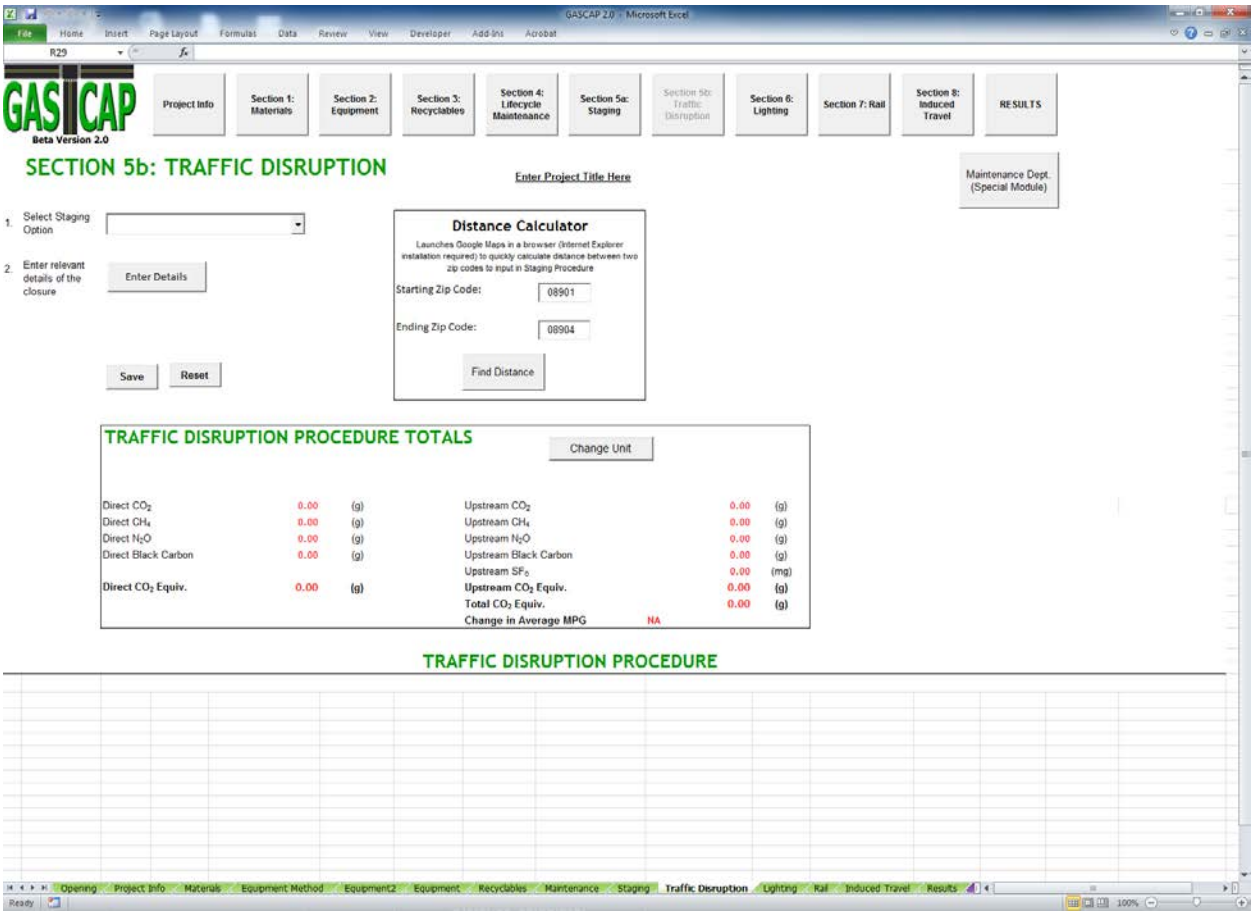
Section 5b: Traffic Disruption

Section 5b estimates the emissions from six project staging options, which result in changes in traffic patterns that occur during roadway construction and maintenance. GASCAP classifies staging procedures as one of the following work zone types:

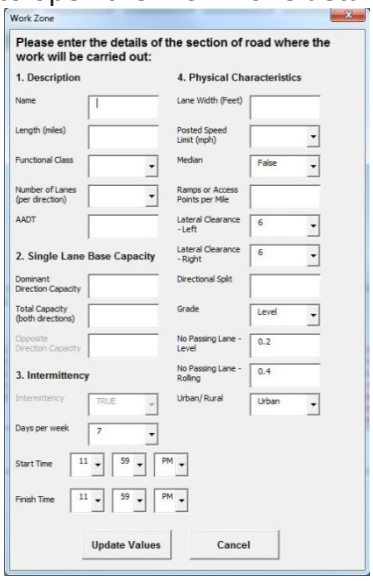
1.	Work Zone Only	*No lanes closed, with workers present during construction for the duration of the project*
2.	Lane Closure	*One or more, but fewer than all, lanes are closed for the duration of the project*
3.	Intermittent Lane Closure	*One or more, but fewer than all, lanes are closed during specific periods each day or week, but otherwise open, for the duration of the project*
4.	Full Road Closure	*Road is fully closed (all lanes) for the duration of the project, with a signed diversion route*
5.	Combination Road and Lane Closure	*Road is fully closed (all lanes) during specified periods each day or week, with a signed diversion route; otherwise one or more, but fewer than all, lanes are closed.*
6.	Intermittent Road Closure	*Road is fully closed (all lanes) during specific periods each day or week, with a signed diversion route, but otherwise open, for the duration of the project*
7.	Intermittent Work Zone	*No lanes closed, with workers present during construction during specific periods each day or week, for the duration of the project*

Traffic flow changes in GASCAP are based on calculations from the 2010 Highway Capacity Manual. Because different emissions impacts must be calculated for each staging procedure, this is the most complex module in GASCAP. Some staging procedures will require entering additional data, as noted in the procedures below.

Step 1: Select the Staging Option from the dropdown menu



Step 2: Click the Enter Details Button to open the Work Zone details window.



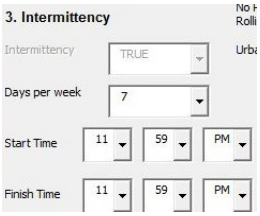
Step 3.1: Enter the following Descriptions of the roadway at the site of the Work Zone:

a. Name of the roadway
b. Length (in miles) of the segment of the roadway affected by the work zone
c. The functional class of the roadway at the work zone.
   Note: Selecting a functional class will populate default values for Physical Characteristics of the roadway. These may be changed in Step 3.4
d. The number of lanes per direction of that road segment at the work zone
e. The Annual Average Daily Traffic (AADT) for the roadway

Step 3.2: Accept Default Values for the Single Base Lane Capacity of the Work Zone, or enter:

a. The dominant direction of traffic flow at the work zone
b. The total flow at the work zone
c. The opposite direction flow at the work zone is then calculated automatically

Step 3.3: Enter the Intermittency schedule for intermittent lane/road closures:



Note: Step 3.3 applies only for intermittent work zones. During Step 1, if you selected any staging options other than 3 (Intermittent Lane Closure), 5 (Combination Road and Lane Closure), 6 (Intermittent Road Closure) or 7 (Intermittent Work Zone) this section will appear as "grayed out" and the fields will be inactive.

a. The number of days per week the lane/road closure is expected to take place
b. The start time at which the lane/road closure is expected to begin each day
c. The finish time at which the lane/road closure is expected to end each day.

Step 3.4: Enter the following Physical Characteristics of the Roadway around the site of the work zone:

a. The lane width (in US Feet)
b. The posted speed limit (in miles per hour)
c. Select TRUE if there is a median within the work zone; otherwise select FALSE
d. The number of ramps per mile within the work zone plus three miles upstream and downstream of the work zone for Freeways, or the number of access points per mile (driveways and unsignalized intersections within the work zone for other road types)
e. The lateral clearance (shoulder width) on the left and right sides of the roadway at the work zone
f. The directional split of traffic (proportion from 0.00 to 1.00 of traffic flowing in the dominant direction) at the work zone
g. The grade (either Level, Rolling, or Mountainous) of the roadway at the work zone
h. No passing Lane – Level

i. No Passing Lane – Rolling
j. Whether the work zone is in an Urban or a Rural location

Step 3.5: Click the Update Values button.

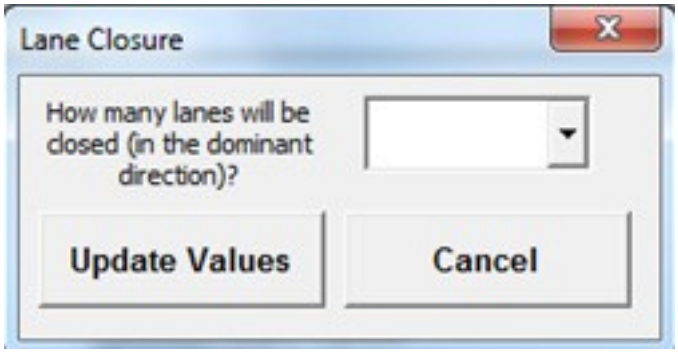
Step 4: Accept the default values or enter custom values for the proportion (from 0.000 to 1.000) of vehicles using the roadway that are:
a. Passenger Cars
b. Trucks or Buses
c. Recreational Vehicles (RVs)

Note: Entered values must add up to 1.000

Click "Update Values."

If staging procedure 1 (Work Zone Only) is selected, this is all of the information that is required.

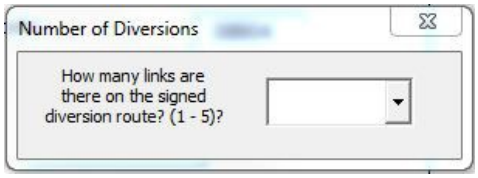
If staging procedure 2 (Lane Closure), 3 (Intermittent Lane Closure) is selected, you will be prompted to enter the number of lanes affected by closures in the following dialogue:



Step 5.1: Enter the number of lanes to be closed in the dominant direction. The maximum number of lanes that can be closed is one less than the total number of lanes in the work zone. If all of the lanes are to be closed, this would be classified as a Road Closure.

If staging procedure 4 (Full Road Closure) or 6 (Intermittent Road Closure) is selected, you will be prompted to enter further information for establishing a detour.

Step 6.1: Enter the number of links (1 – 5) for the signed diversion route resulting from any road closures.

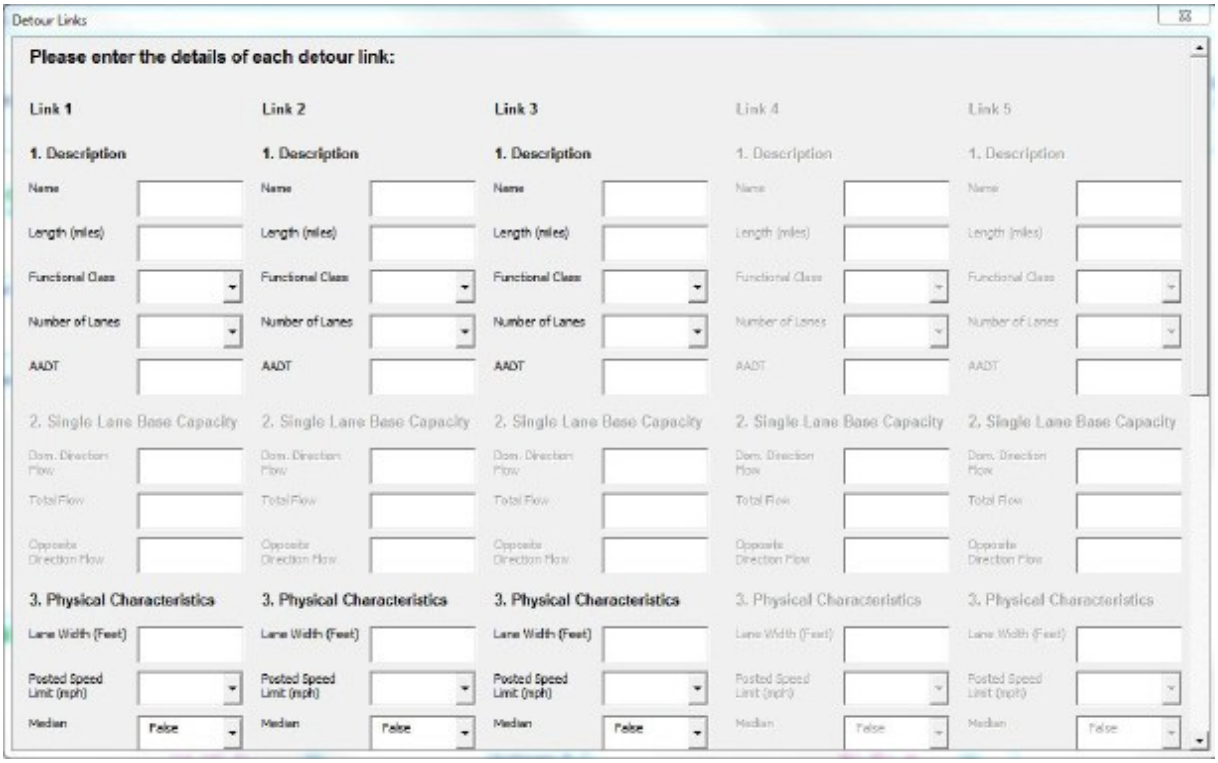


Step 6.2: Enter the following details for each diversion route link into the dialogue box shown below:

a. Enter the Description, Single Lane Base Capacity, and Physical Characteristics for each link in the detour, as in Step 3

b. Accept, for each detour link, the default values or enter custom values for the proportion (from 0.000 to 1.000) of vehicles using the roadway that are:
   1) Passenger Cars
   2) Trucks or Buses
   3) Recreational Vehicles (RVs)

   Note: Entered values must add up to 1.000



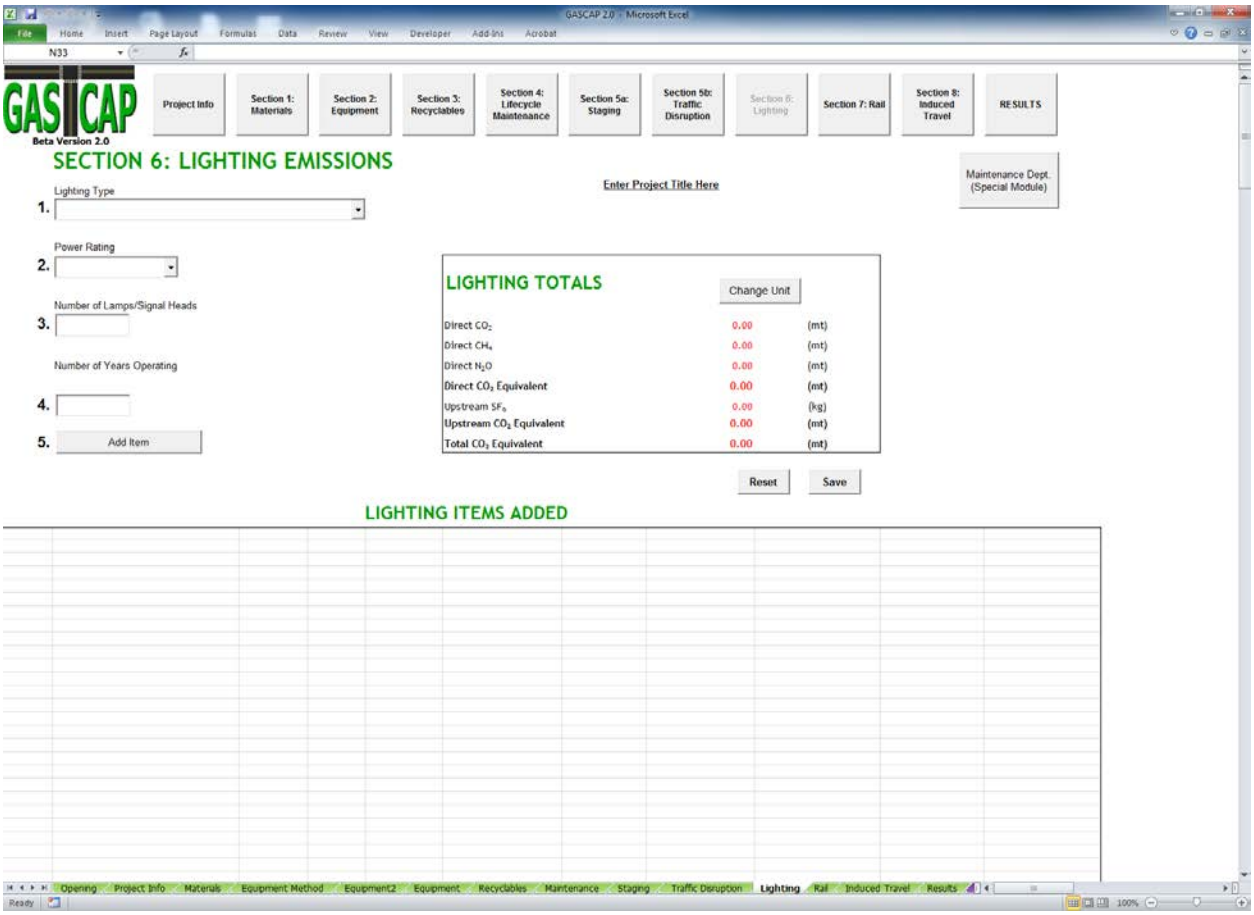
If staging procedure 5 (Combination Road and Lane Closure) is selected, you will be prompted to enter information about BOTH a road closure with detour and a lane closure. Refer to Steps 5.1 - 6.2.

Section 6: Lighting

The Lighting worksheet estimates direct emissions from traffic lights and street lights that are installed as part of the project over their operating lifespan.

Step 1: Select the lighting type
Step 2: Select the power rating for the light if necessary
Step 3: Enter the number of lamps or signal heads
Step 4: Enter the anticipated number of operating years

Pressing the 'Add Item' button creates a new line item on the spreadsheet with emissions factors (in grams) for that item, and updates the total emissions for all materials. Pressing Reset returns all values to zero. Total emissions can be viewed in grams or metric tons.



Section 7: Rail

Section 7 estimates emissions from the construction of railway projects.

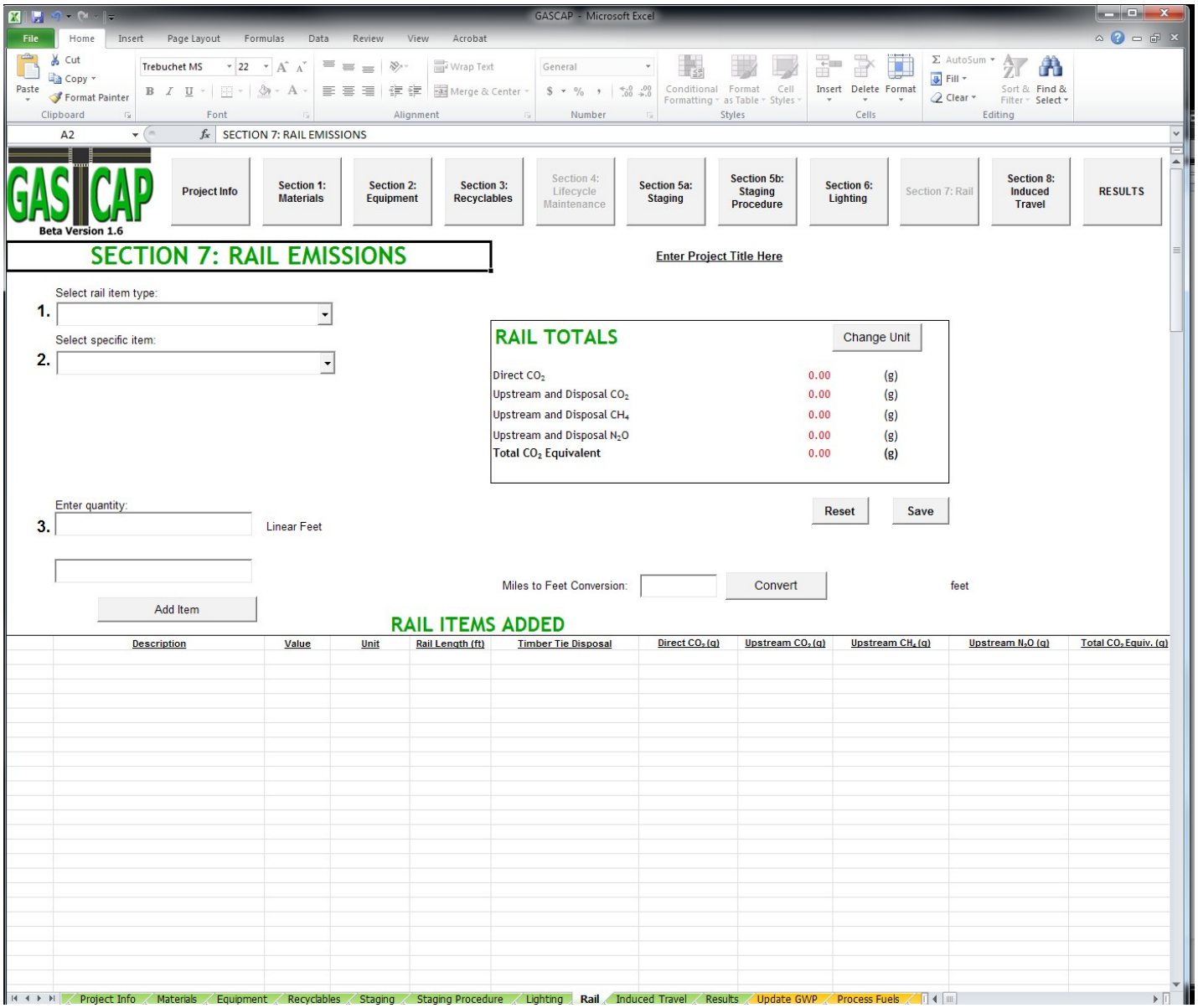
Step 1: Select the category of rail item to be added.
Step 2: Select the specific item within that category.

Step 2 will determine the remaining steps, dependent on the variables involved with the selected item. Variables for specific items include:

Joint Bars: When selecting joint bars, the user will be prompted for rail length in order to determine how many joint bars are required. Rail length options are 39 feet, 80 feet, or continuous. If continuous is selected, the user will be prompted to enter the continuous rail length.

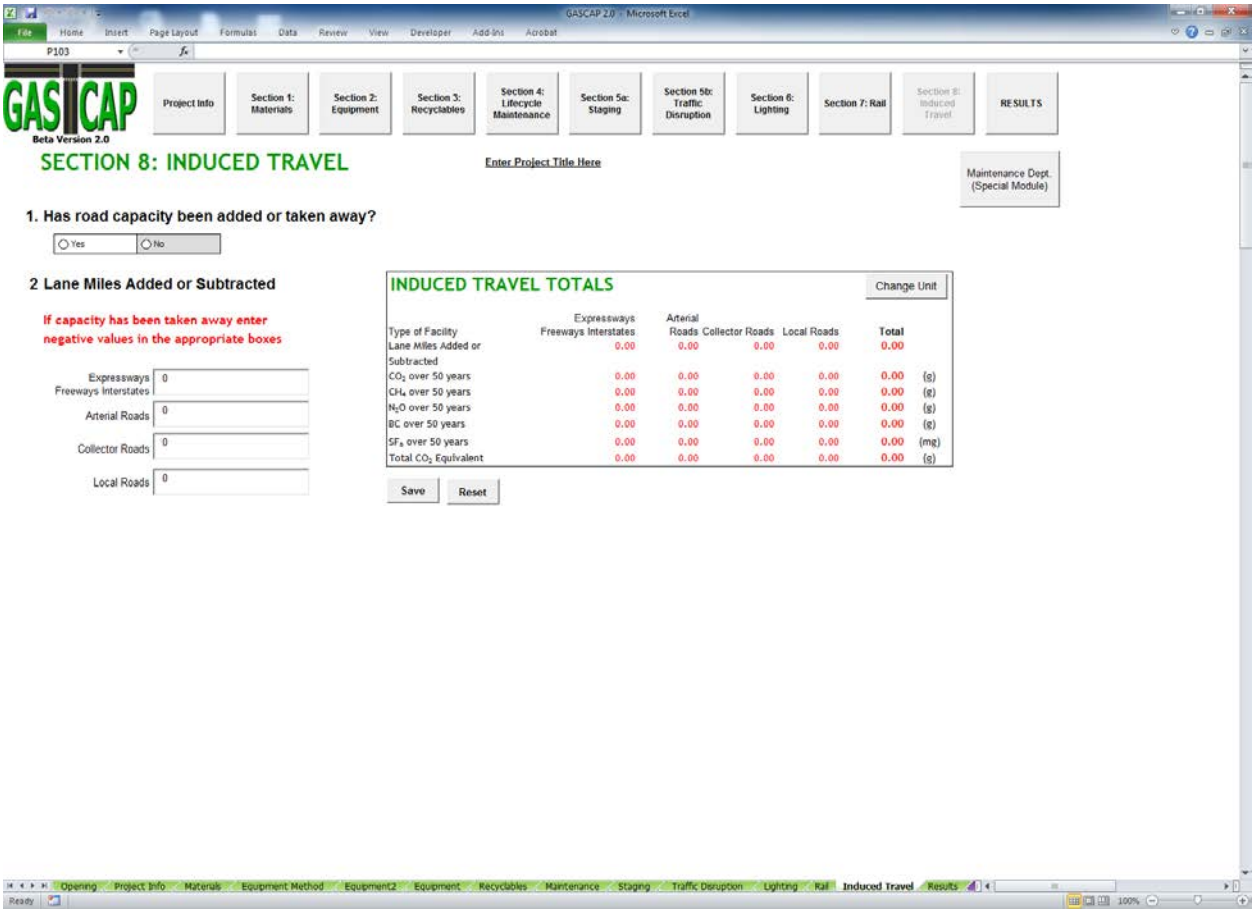
Timber Ties: For timber ties, the user is prompted to choose a timber disposal method. The disposal method will result in a credit against emissions due to either the burning of the timber as fuel or the storing of it in a landfill (carbon sequestration).

For all items that are dependent on length of track, the user will be prompted to enter the number of parallel tracks. As most items require an input in feet, there is a simple calculator on the page that can be used to convert miles into feet. Pressing Reset returns all values to zero. Total emissions can be viewed in grams or metric tons.


GASCAP - Microsoft Excel
SECTION 7: RAIL EMISSIONS
Project Info
Section 1: Materials
Section 2: Equipment
Section 3: Recyclables
Section 4: Lifecycle Maintenance
Section 5a: Staging
Section 5b: Staging Procedure
Section 6: Lighting
Section 7: Rail
Section 8: Induced Travel
RESULTS
Beta Version 1.6
SECTION 7: RAIL EMISSIONS
Enter Project Title Here
Select rail item type:
1.
Select specific item:
2.
RAIL TOTALS
Change Unit
Direct CO2 0.00 (g)
Upstream and Disposal CO2 0.00 (g)
Upstream and Disposal CH4 0.00 (g)
Upstream and Disposal N2O 0.00 (g)
Total CO2 Equivalent 0.00 (g)
Reset
Save
Enter quantity:
3.
Linear Feet
Miles to Feet Conversion:
Convert
feet
Add Item
RAIL ITEMS ADDED
Description
Value
Unit
Rail Length (ft)
Timber Tie Disposal
Direct CO2 (g)
Upstream CO2 (g)
Upstream CH4 (g)
Upstream N2O (g)
Total CO2 Equiv. (g)
Project Info
Materials
Equipment
Recyclables
Staging
Staging Procedure
Lighting
Rail
Induced Travel
Results
Update GWP
Process Fuels

Section 8: Induced Travel

Section 8 of GASCAP estimates the additional impact of mobile emissions from induced travel —the increase (or decrease) in travel activity that occurs in response to adding (or removing) capacity from a roadway, assuming that the project life is 50 years.

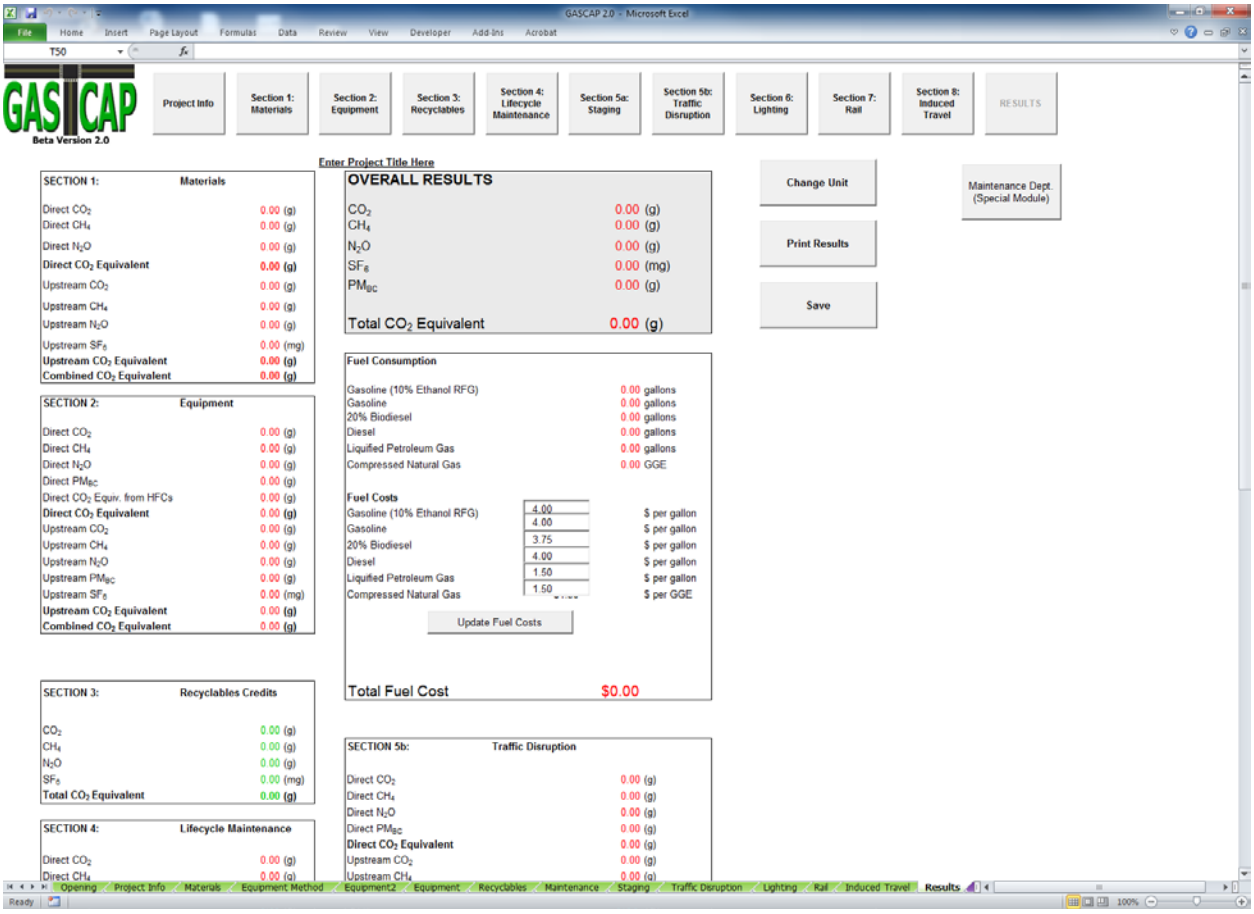


Step 1: Select "Yes" if the project has either added or reduced road capacity; otherwise select "No."

Step 2: Enter the additional capacity in lane-miles for each class of road (Expressways/Freeways/Interstates, Arterial Roads, Collector Roads, Local Roads) that will result from the project. If capacity has been reduced, enter the change as negative lane-miles.

Results

The Results worksheet displays the cumulative results from all sections of GASCAP. In addition to results from each individual section, the worksheet contains emission estimation totals for the entire project, and an estimated fuel consumption box based on the Equipment and Staging sections. Current fuel prices can be entered and the total cost updated by pressing the 'Update Fuel Costs' button. The 'Print Results' button will print all results in a two page format.



Maintenance Department Module

GASCAP's Maintenance module addresses planned rehabilitations of NJDOT facilities, but not routine maintenance, such as pothole filling and crack sealing. To address this gap, GASCAP includes a special module for estimating direct and upstream emissions from equipment fuels and materials from routine maintenance activities to enable a more complete life-cycle analysis with respect to capital projects. The results from this data gathering module are treated as separate section from other GASCAP modules.

Maintenance Equipment

Step 1: Click the "Equipment" radio button to begin adding equipment.

Step 2: Enter (in the following order) the type; quantity of pieces; model year; fuel; time spent idling; miles travelled; horse power rating; and air conditioning for each equipment item you would like to add. Not all fields are applicable to every equipment item, and may appear grey.

Step 3: Click "Update Maintenance" to add equipment. The item will appear in list the bottom of the spreadsheet (once for running emission and once for idling emissions). Click the "Remove" button to the right of the item to remove it from the equipment list.

Maintenance Materials

Step 1: Click the "Materials" radio button to begin adding materials.

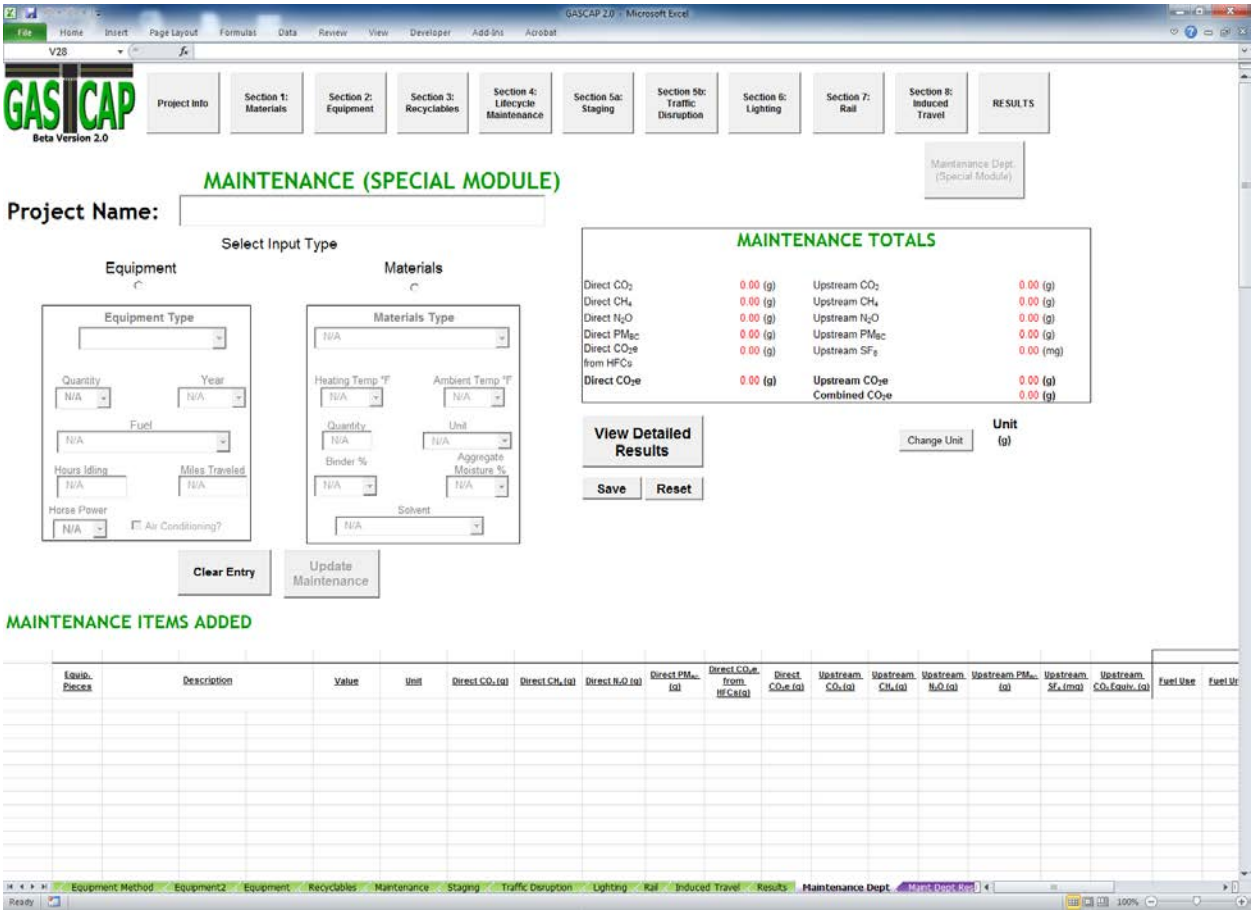
Step 2: Enter (in the following order) the type; heating temperature; outdoor ambient temperature; quantity; percentage of binder; percentage of aggregate moisture; and solvent type for each material item you would like to add. Not all fields are applicable to every material and may appear grey.

Step 3: Click "Update Maintenance" to add materials. The item will appear in list the bottom of the spreadsheet. Click the "Remove" button to the right of the item to remove it from the materials list.

Viewing and Saving Detailed Results

A summary of the maintenance emissions appears on main worksheet. You can also view emissions separately for materials; generators; idling vehicles; and running vehicles. To see separate results, click "View Detailed Results" to navigate to the results page.

Clicking "Save" on the data entry sheet opens a dialogue to save the results in a new workbook. The first sheet will contain the list of equipment and materials. The second sheet will contain detailed results from the module. *Once the results are saved, the module will automatically reset.*


GASCAP 2.0 - Microsoft Excel
GASCAP
Beta Version 2.0
Project Info
Section 1: Materials
Section 2: Equipment
Section 3: Recyclables
Section 4: Lifecycle Maintenance
Section 5a: Staging
Section 5b: Traffic Disruption
Section 6: Lighting
Section 7: Rail
Section 8: Induced Travel
RESULTS
Maintenance Dept. (Special Module)
MAINTENANCE (SPECIAL MODULE)
Project Name:
Select Input Type
Equipment
Materials
Equipment Type
Quantity
Year
Fuel
Hours Idling
Miles Traveled
Horse Power
Air Conditioning?
Materials Type
Heating Temp °F
Ambient Temp °F
Quantity
Unit
Binder %
Aggregate Moisture %
Solvent
Clear Entry
Update Maintenance
MAINTENANCE TOTALS
Direct CO2
Direct CH4
Direct N2O
Direct PM8C
Direct CO2e from HFCs
Direct CO2e
Upstream CO2
Upstream CH4
Upstream N2O
Upstream PM8C
Upstream SF6
Upstream CO2e
Combined CO2e
View Detailed Results
Change Unit
Unit
(g)
Save
Reset
MAINTENANCE ITEMS ADDED
Equip. Pieces
Description
Value
Unit
Direct CO2 (g)
Direct CH4 (g)
Direct N2O (g)
Direct PM8C (g)
Direct CO2e from HFCs (g)
Direct CO2e (g)
Upstream CO2 (g)
Upstream CH4 (g)
Upstream N2O (g)
Upstream PM8C (g)
Upstream SF6 (mg)
Upstream CO2 Equiv. (g)
Fuel Use
Equipment Method
Equipment2
Equipment
Recyclables
Maintenance
Staging
Traffic Disruption
Lighting
Rail
Induced Travel
Results
Maintenance Dept.
Maint Dept Reg
Ready

CURRENT MAINTENANCE RESULTS

Materials

Direct CO_2	0.00 (g)	Upstream CO_2	0.00 (g)
Direct CH_4	0.00 (g)	Upstream CH_4	0.00 (g)
Direct N_2O	0.00 (g)	Upstream N_2O	0.00 (g)
Direct PM_{bc}	0.00 (g)	Upstream PM_{bc}	0.00 (g)
Direct CO_2 Equiv. from HFCs	0.00 (g)	Upstream SF_6	0.00 (mg)
Direct CO_2 Equiv.	0.00 **(g)**	**Upstream CO_2 Equi**	0.00 **(g)**
		Combined CO_2 Equ	0.00 **(g)**

Change Unit — Unit (g)

Return to Data Entry

Generators

Direct CO_2	0.00 (g)	Upstream CO_2	0.00 (g)
Direct CH_4	0.00 (g)	Upstream CH_4	0.00 (g)
Direct N_2O	0.00 (g)	Upstream N_2O	0.00 (g)
Direct PM_{bc}	0.00 (g)	Upstream PM_{bc}	0.00 (g)
Direct CO_2 Equiv. from HFCs	0.00 (g)	Upstream SF_6	0.00 (mg)
Direct CO_2 Equiv.	0.00 **(g)**	**Upstream CO_2 Equi**	0.00 **(g)**
		Combined CO_2 Equ	0.00 **(g)**

Change Unit — Unit (g)

Return to Data Entry

Vehicle Idling Emissions

Direct CO_2	0.00 (g)	Upstream CO_2	0.00 (g)
Direct CH_4	0.00 (g)	Upstream CH_4	0.00 (g)
Direct N_2O	0.00 (g)	Upstream N_2O	0.00 (g)
Direct PM_{bc}	0.00 (g)	Upstream PM_{bc}	0.00 (g)
Direct CO_2 Equiv. from HFCs	0.00 (g)	Upstream SF_6	0.00 (mg)
Direct CO_2 Equiv.	0.00 **(g)**	**Upstream CO_2 Equi**	0.00 **(g)**
		Combined CO_2 Equ	0.00 **(g)**

Change Unit — Unit (g)

Return to Data Entry

Vehicle Running Emissions

Direct CO_2	0.00 (g)	Upstream CO_2	0.00 (g)
Direct CH_4	0.00 (g)	Upstream CH_4	0.00 (g)
Direct N_2O	0.00 (g)	Upstream N_2O	0.00 (g)
Direct PM_{bc}	0.00 (g)	Upstream PM_{bc}	0.00 (g)
Direct CO_2 Equiv. from HFCs	0.00 (g)	Upstream SF_6	0.00 (mg)
Direct CO_2 Equiv.	0.00 **(g)**	**Upstream CO_2 Equi**	0.00 **(g)**
		Combined CO_2 Equ	0.00 **(g)**

Change Unit — Unit (g)

Return to Data Entry

Total Emissions

Direct CO2	0.00 (g)	Upstream CO2	0.00 (g)
Direct CH4	0.00 (g)	Upstream CH4	0.00 (g)
Direct N2O	0.00 (g)	Upstream N2O	0.00 (g)
Direct PMBC	0.00 (g)	Upstream PMBC	0.00 (g)
Direct CO2 Equiv. from HFCs	0.00 (g)	Upstream SF6	0.00 (mg)
Direct CO2 Equiv.	0.00 **(g)**	**Upstream CO2 Equi**	0.00 **(g)**
		Combined CO2 Equ	0.00 **(g)**

Change Unit — Unit (g)

Section 9: Updating GASCAP

Periodically, it may be necessary to update GASCAP with new data with emissions factors, new vehicles, etc. There are several, password-protected modules which allow administrators to easily update the software.

There are 9 modules for updating data in GASCAP:

- Section 9a: Update Global Warming Potential Values
- Section 9b: Process Fuels
- Section 9c: Electricity Production
- Section 9d: Steel
- Section 9e: Other Materials
- Section 9f: Equipment Year
- Section 9g: Staging
- Section 9h: Induced Travel

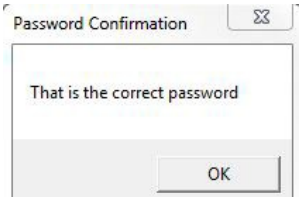
Before updating Sections 9b - 9e, it is necessary to extract new emissions factors from the latest version of Argonne National Laboratory's GREET model. For detailed instructions for obtaining these factors, see the Technical Memorandum **Updating GASCAP with Revised Greet Vehicle and Fuel Cycle Values.**

Other Sections may require extracting data from other models, such as NONROAD or MOVES. This will be noted in the instructions for updating these sections.

Accessing the Update Modules

To access GASCAP's updating modules, type the administrator password into the box on the Project Info tab.

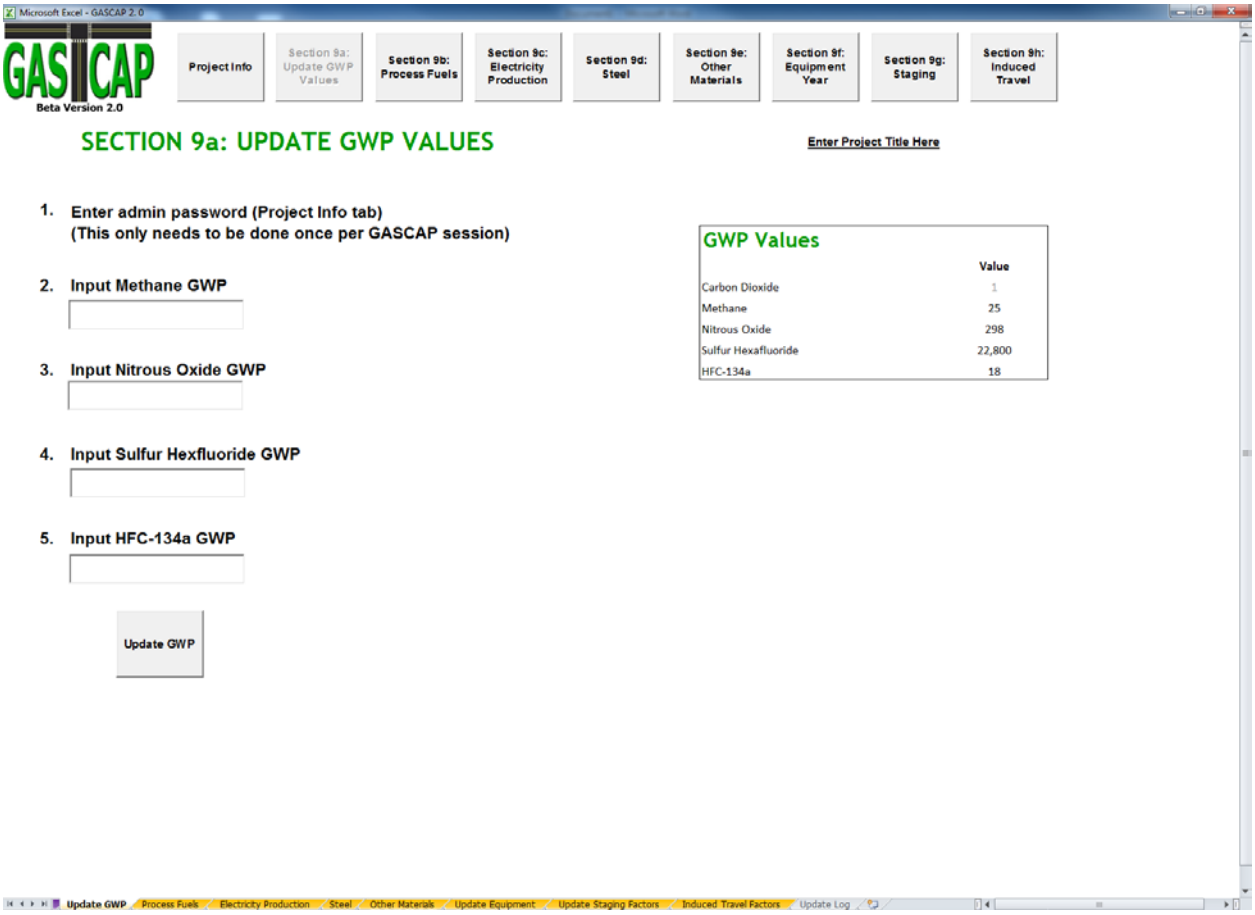
Click Confirm Password. If the password is correct, the confirmation window to the right will appear.



Click OK. Then click the Section 9: Admin button.

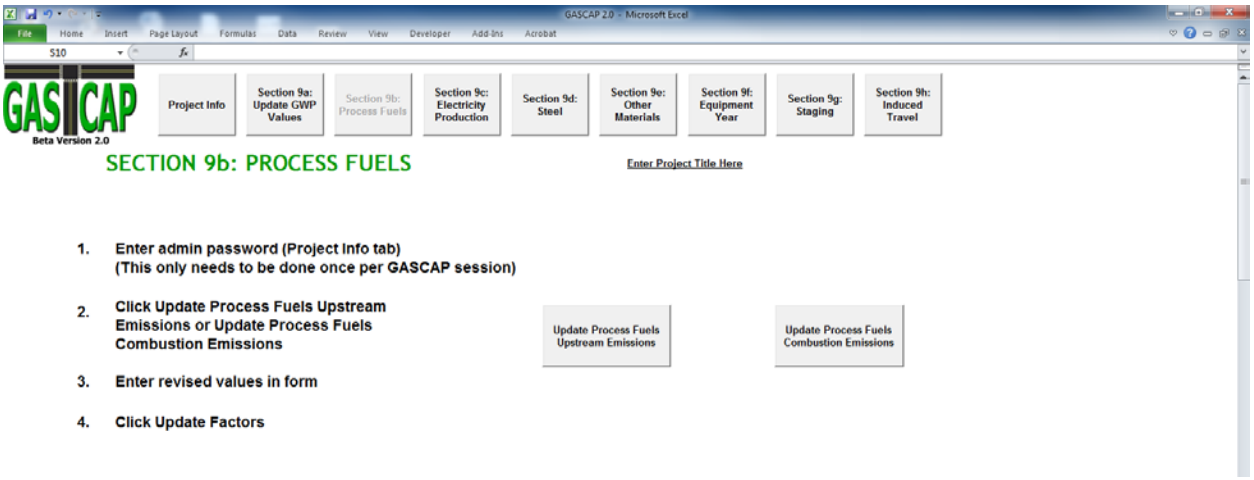
Section 9a: Global Warming Potential Values

Click the “Section 9a: Update GWP Values” button at the top of the screen to navigate to the correct worksheet. To update GWP values, replace the existing values for Methane, Nitrous Oxide, Hexafluoride, and HFC-134a. Then click the “Update GWP” button at the bottom.

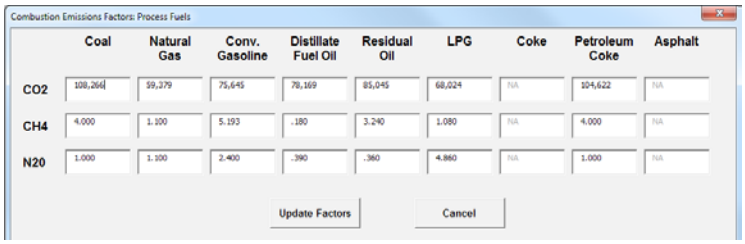


Section 9b: Process Fuels Emissions Factors

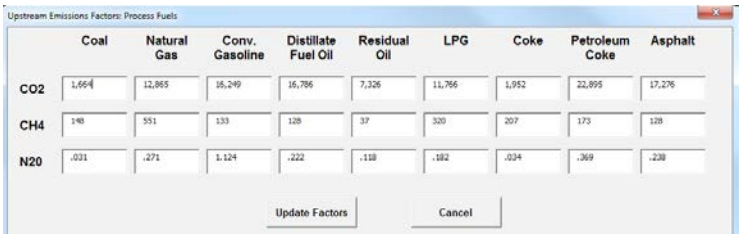
GASCAP allows you to update upstream emissions and combustion emissions for process fuels. Click the "Section 9b: Process Fuels" button to navigate to the correct updating worksheet, shown below.



To update the upstream emissions, click the "Update Process Fuels Upstream Emissions" button. Enter new values for each greenhouse gas and process fuel in the dialogue box shown below. Click Update Factors.

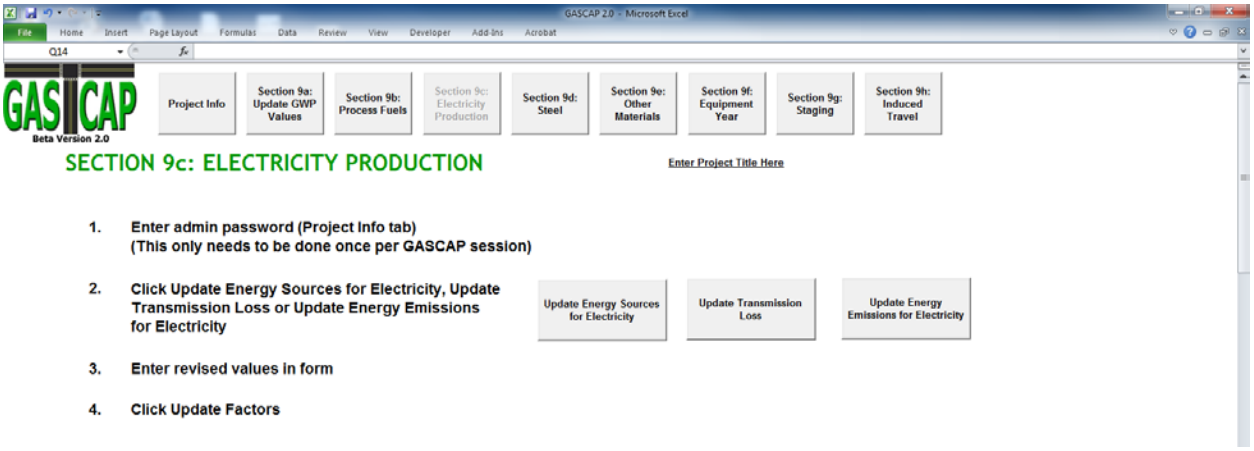


To update the combustion emissions, click the "Update Process Fuels Upstream Emissions Button." Enter new values for each greenhouse gas and process fuel in the dialogue box shown below. Click Update Factors.

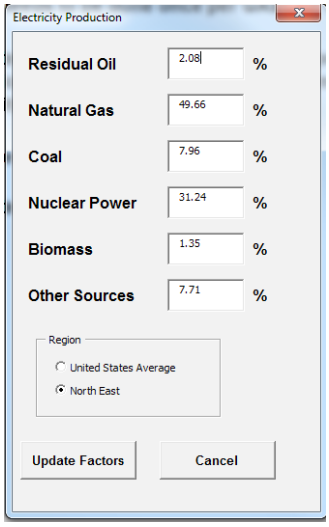


Section 9c: Electricity Production Emissions Factors

Click the "Section 9c: Electricity Production" button to navigate to the correct worksheet, shown below.

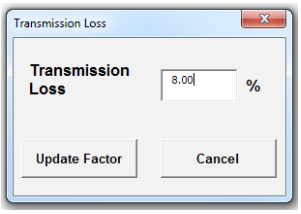


First click the "Update Energy Sources for Electricity" button to update the mix of fuels used to generate electricity. The dialogue below will appear.

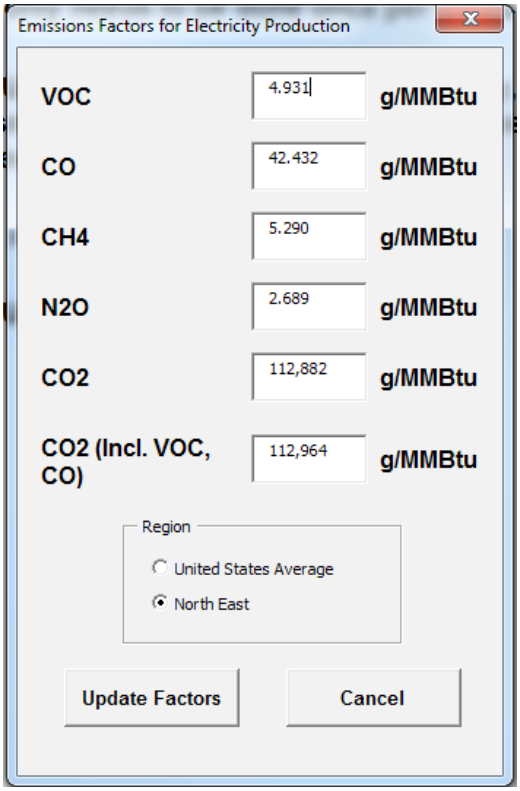


Select your region to load default data, either the United States Average or for Northeast. Enter the new values and click Update Factors.

Click the “Update Transmission Loss” button, opening the dialogue box below. Enter the new value for the percentage of electricity lost in transmission. Click Update Factor.

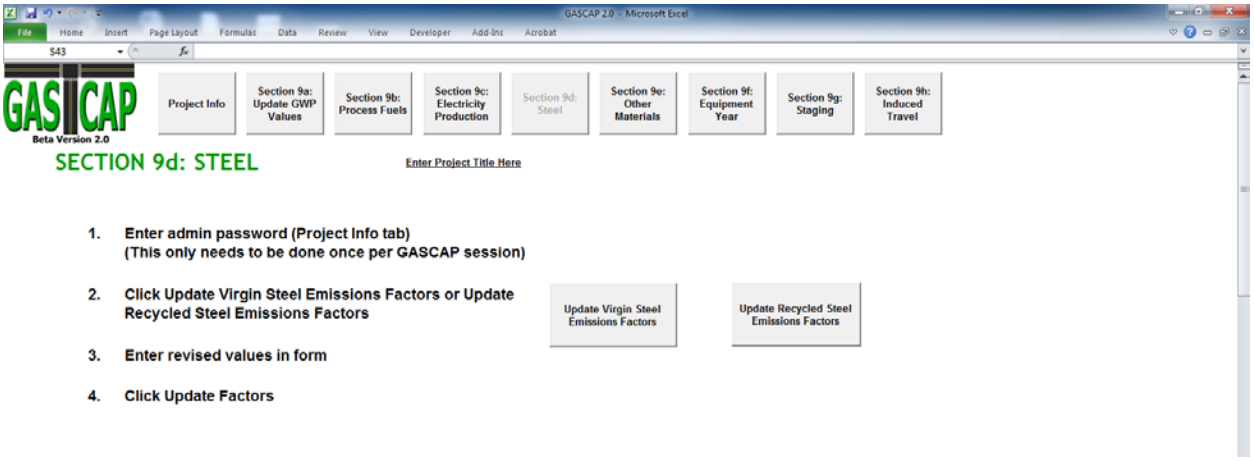


Click the “Update Energy Emissions for Electricity” button to open the updating dialogue box shown below. Select a region to load the default data for either the United States Average or the Northeast. Enter the new emissions factors in grams per million BTUs. Click Update Factors.

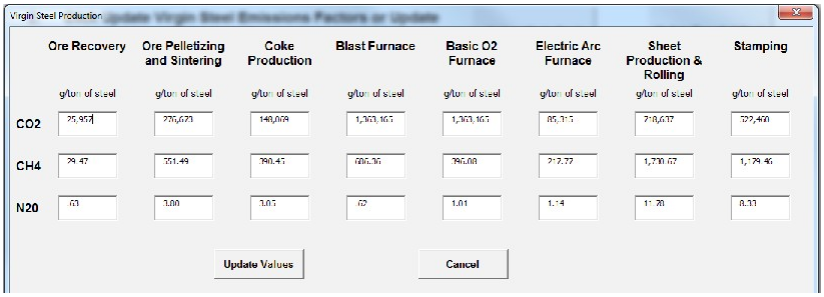


Section 9d: Emissions Factors for Steel

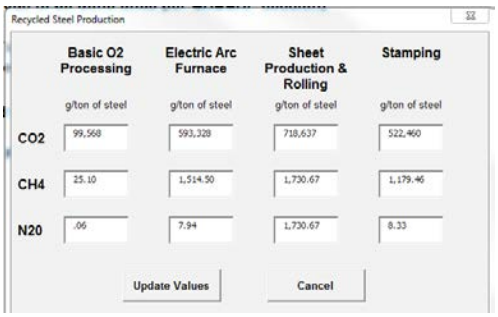
Click the "Section 9d: Steel" button to navigate to the worksheet for updating emissions factors associated with virgin and recycled steel, shown below.



To update factors for virgin steel, click the "Update Virgin Steel Emissions Factors" button. Enter the new values in the dialogue box shown below. Click "Update Values."

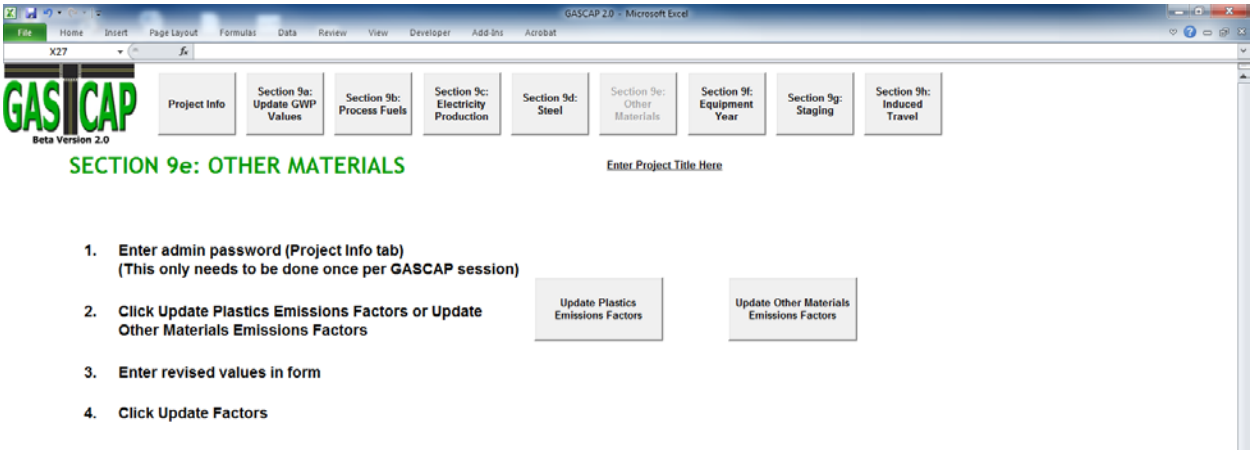


To update factors for recycled steel, click the "Update Recycled Steel Emissions Factors" button. Enter the new values in the dialogue box shown below. Click "Update Values."

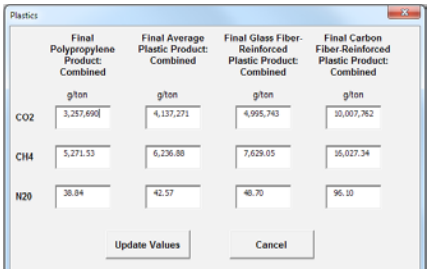


Section 9e: Emissions Factors for Other Materials

Click the Section 9e: Other Materials button to navigate to the worksheet for updating emissions factors associated with plastics or other materials, shown below.



Click the "Update Plastics Emissions Factors" button. Enter the new values for carbon dioxide, methane, and nitrous oxide emissions (in grams per ton) for each plastic product type in the dialogue box shown below. Click "Update Values."

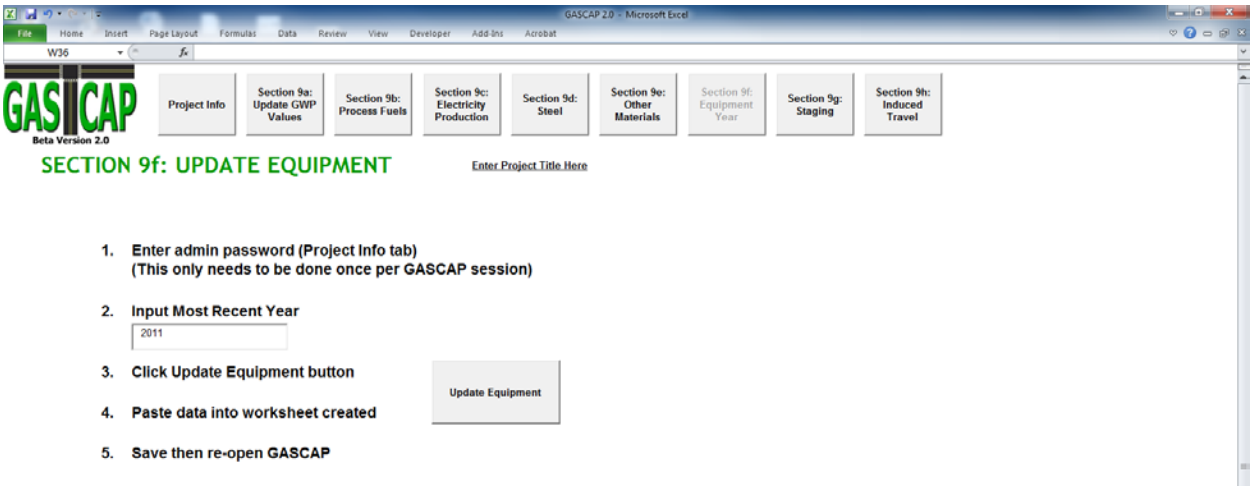


Click the "Update Other Materials Emissions Factors." Enter the new values for carbon dioxide, methane, and nitrous oxide emissions (in grams per ton) for each other material product type in the dialogue box shown below. Click "Update Values."

Section 9f: Equipment Data

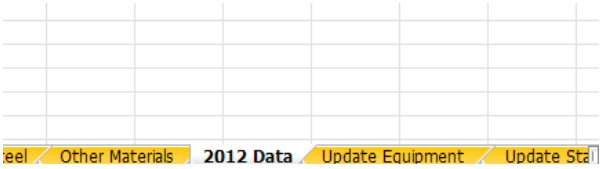
GASCAP can be updated with new models of construction equipment. Emissions factors for new equipment must be extracted from EPA's NONROAD model. VTC has prepared scripts for extracting this data using MySQL. See the Technical Memorandum "**Updating Equipment Data in GASCAP"** for step by step directions for preparing a spreadsheet with updated equipment data for new model years. Then follow the instructions below.

Click the "Section 9f: Equipment" button to navigate to the worksheet for updating equipment, shown



below.

Enter the most recent year for new equipment in the box labeled Input Most Recent Year. Click Update Equipment. This will create and open a new worksheet tab called "20xx Data," as shown below.

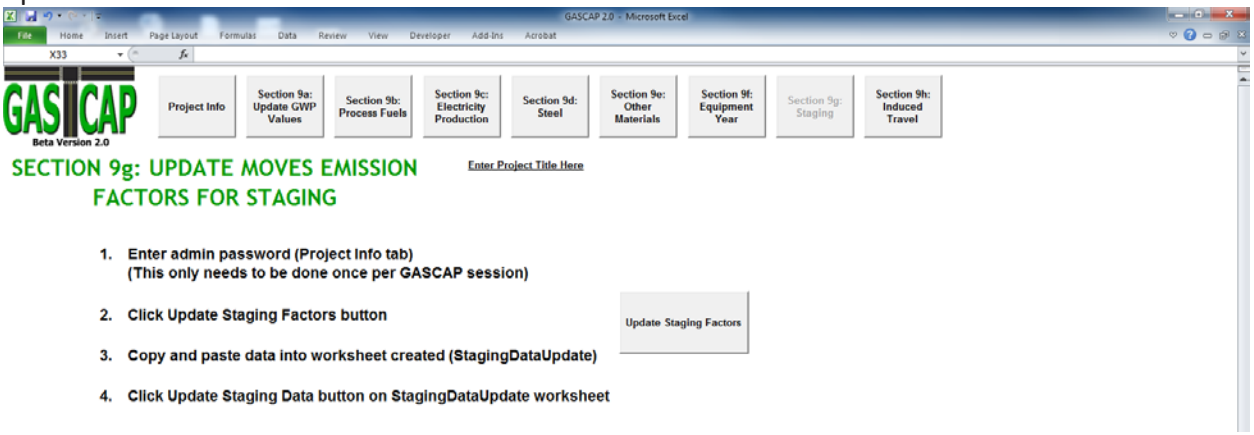


Copy and paste the data from the spreadsheet created using NONROAD into the "20xx Data" worksheet. Save and then re-open GASCAP.

You do not need to do anything else. GASCAP will then be able to estimate emissions from new construction equipment.

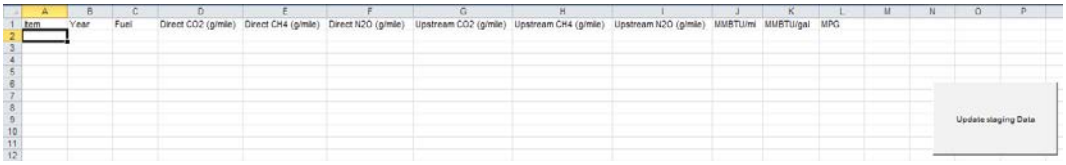
Section 9g: Staging Emissions Factors

Before updating Staging emissions factors, it is necessary to extract updated data from the latest version of EPA's MOVES software. See the Technical Memorandum "**Updating Staging Emissions Factors in GASCAP"** for detailed instructions for creating a spreadsheet with updated data.



Click the "Section 9g: Staging" button to navigate to the worksheet for updating emissions factors associated with transportation of vehicles and personnel to and from construction sites, shown below.

Click the Update Staging Factors button to create and open a new worksheet tab called "Staging Data Update," shown below.

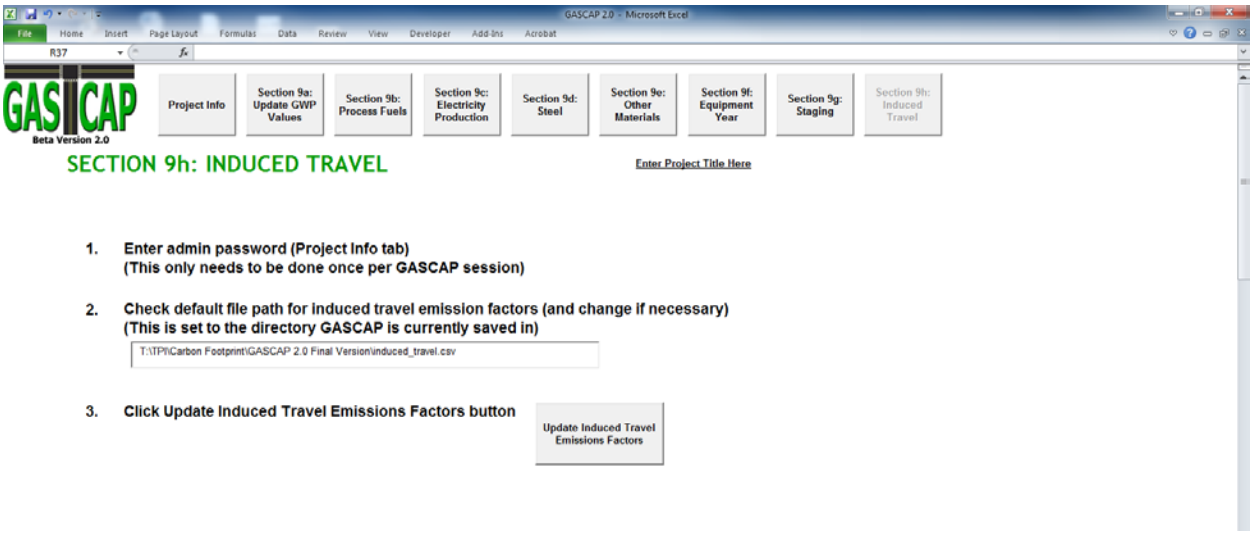


Copy and paste the updated data from the spreadsheet created with MOVES into the "Staging Data Update" worksheet. Then click the "Update Staging Data" button.

Section 9h: Induced Travel Emissions Factors

Before updating Induced Travel emissions factors, it is necessary to extract updated data from the latest version of EPA's MOVES software. See the Technical Memorandum "**Updating Induced Travel Emissions Factors in GASCAP"** for detailed instructions for creating a spreadsheet with updated data.

Click the Section 9h: Induced Travel button to navigate to the worksheet for updating emissions factors for Induced Travel, shown below.



Locate the spreadsheet created with MOVES on your computer. Copy and paste complete file path into the box provided.

Click the "Update Induced Travel Emissions Factors" button.