CAMBRIDGE SYSTEMATICS

Think Forward

ITTS FEAT Tool

Final Training

presented to

ITTS Member States

presented by

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Agenda

- FEAT Overview
- “On-model” projects tool
  - `MO SHIFT example
- Operational projects tool
- Rail model revisions
- Discussion and next steps

Training Outcomes

- Discuss key features of FEAT tools
- Demonstrate uses of tools
- Summarize uses of tools
- Address any outstanding questions and concerns about tools

Key Features of FEAT

- Flexible
- Transparent
- Efficient
- Comprehensive

FEAT Overview

- Built on CS' TIERS system
- Consists of three tools
  - Capacity investment or "on-model"
  - Operations and safety (OPS) tool
  - Rail diversion tool
- Automates and standardizes benefit cost analysis and prepares inputs for economic impacts
- Facilitates project and program analysis and grant applications

On-Model Tool Overview

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On-Model Tool

- Evaluates changes in roadway capacity for which travel demand model is used to assess travel impacts
- Can evaluate expansion or reduction in capacity
- Compatible with SHIFT or state/regional travel demand model

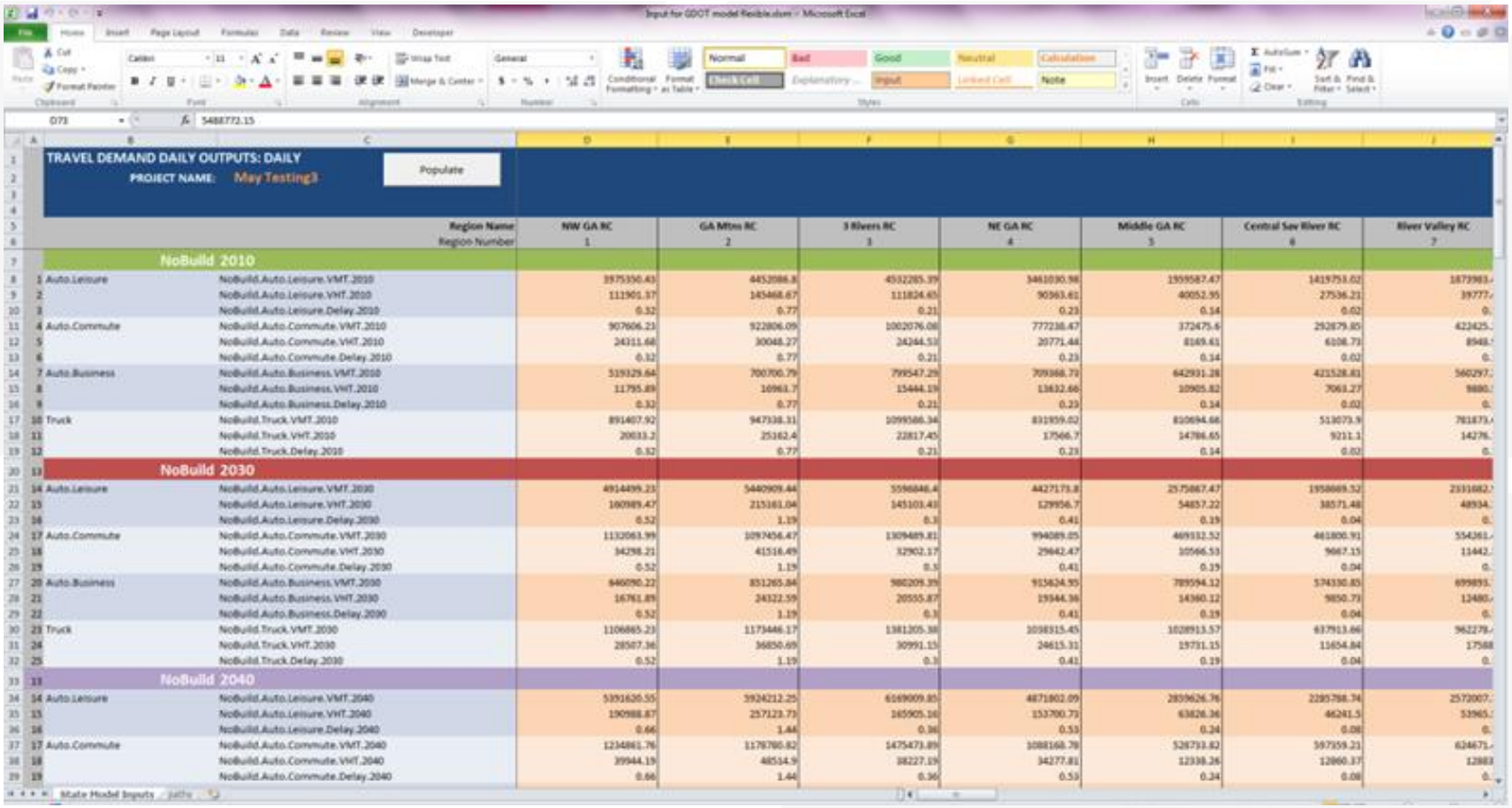
Impacts Evaluated

- FEAT Tool
  - Travel time – auto and truck
  - Logistics cost impacts
  - Vehicle operating costs – fuel and non-fuel
  - Emissions – with and without CO2
  - Safety- with and without fatalities
  - Costs – capital and O&M
  - Input for economic modeling – REMI and IMPLAN
- Economic model
  - Jobs, income and economic output impacts

Requirements for Using the Tool

- Windows 7 or newer
- Excel 2010 or newer
- Access to REMI or Implan (for economic analysis only)
- ArcGis Version 10.0 or newer (for GIS analysis for REMI users only)
- Excel input spreadsheet populated with the travel demand model output

On-Model Tool Input Sheet



TRAVEL DEMAND DAILY OUTPUTS: DAILY

PROJECT NAME: May Testing3

Populate

			Region Name	NW GA RC	GA Mtns RC	3 Rivers RC	NE GA RC	Middle GA RC	Central Sav River RC	River Valley RC
			Region Number	1	2	3	4	5	6	7
		NoBuild 2010								
1	Auto.Leisure	NoBuild.Auto.Leisure.VMT.2010		3975350.43	4452086.8	4532285.39	3461030.98	1959587.47	1419753.02	1873983.4
2		NoBuild.Auto.Leisure.VHT.2010		111901.37	145468.67	111824.65	90363.61	40052.95	27536.21	39777.4
3		NoBuild.Auto.Leisure.Delay.2010		0.32	0.77	0.21	0.23	0.14	0.02	0.
4	Auto.Commute	NoBuild.Auto.Commute.VMT.2010		907606.23	922806.09	1002076.08	777238.47	372475.6	292879.85	423425.
5		NoBuild.Auto.Commute.VHT.2010		24311.68	30048.27	24244.51	20771.44	8169.61	6108.73	8948.
6		NoBuild.Auto.Commute.Delay.2010		0.32	0.77	0.21	0.23	0.14	0.02	0.
7	Auto.Business	NoBuild.Auto.Business.VMT.2010		519329.64	700700.79	798547.29	709368.73	642931.28	421528.81	560297.
8		NoBuild.Auto.Business.VHT.2010		11795.89	16963.7	15444.19	13832.66	10905.82	7063.27	9880.
9		NoBuild.Auto.Business.Delay.2010		0.32	0.77	0.21	0.23	0.14	0.02	0.
10	Truck	NoBuild.Truck.VMT.2010		891407.92	947338.31	1099586.34	831959.02	810694.66	513073.9	761873.4
11		NoBuild.Truck.VHT.2010		20033.2	25162.4	22817.45	17566.7	14786.65	9211.1	14276.
12		NoBuild.Truck.Delay.2010		0.32	0.77	0.21	0.23	0.14	0.02	0.
13		NoBuild 2030								
14	Auto.Leisure	NoBuild.Auto.Leisure.VMT.2030		4914499.23	5440909.44	5596846.4	4427173.8	2575867.47	1958869.52	2331682.
15		NoBuild.Auto.Leisure.VHT.2030		160989.47	215161.04	145103.43	129956.7	54857.22	38571.48	48934.
16		NoBuild.Auto.Leisure.Delay.2030		0.52	1.19	0.3	0.41	0.19	0.04	0.
17	Auto.Commute	NoBuild.Auto.Commute.VMT.2030		1132063.99	1097456.47	1309489.81	994089.05	469332.52	461800.91	554261.
18		NoBuild.Auto.Commute.VHT.2030		34298.21	41516.49	32902.17	29642.47	10566.53	9667.15	11442.
19		NoBuild.Auto.Commute.Delay.2030		0.52	1.19	0.3	0.41	0.19	0.04	0.
20	Auto.Business	NoBuild.Auto.Business.VMT.2030		846090.22	851265.84	980209.39	913624.95	789594.12	574330.85	699893.
21		NoBuild.Auto.Business.VHT.2030		16761.89	24322.59	20555.87	19344.36	14360.12	9850.73	12480.
22		NoBuild.Auto.Business.Delay.2030		0.52	1.19	0.3	0.41	0.19	0.04	0.
23	Truck	NoBuild.Truck.VMT.2030		1106865.23	1173446.17	1381205.38	1038915.45	1028913.57	637913.66	962279.
24		NoBuild.Truck.VHT.2030		28507.36	36850.69	30991.15	24615.31	19731.15	11654.84	17588
25		NoBuild.Truck.Delay.2030		0.52	1.19	0.3	0.41	0.19	0.04	0.
26		NoBuild 2040								
27	Auto.Leisure	NoBuild.Auto.Leisure.VMT.2040		5391620.55	5924212.25	6169009.85	4871802.09	2859626.76	2285788.74	2572007.
28		NoBuild.Auto.Leisure.VHT.2040		190988.87	257123.73	165905.16	153700.73	63826.36	46241.5	53965.
29		NoBuild.Auto.Leisure.Delay.2040		0.66	1.44	0.36	0.53	0.24	0.08	0.
30	Auto.Commute	NoBuild.Auto.Commute.VMT.2040		1234861.76	1178780.82	1475473.89	1088168.78	528793.82	597359.21	624671.
31		NoBuild.Auto.Commute.VHT.2040		39944.19	48514.9	38227.19	34277.81	12338.26	12860.37	12883
32		NoBuild.Auto.Commute.Delay.2040		0.66	1.44	0.36	0.53	0.24	0.08	0.

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Using the Tool

- Parameters Tab (Step 1)
  - Name project and set file paths
  - Define travel cost factors, study period and key assumptions
- Travel demand model input tab (Step 2a or 2b)
- Analysis tabs allow for checking of intermediate calculation (Steps 3a-3d)
- REMI/Implan input (Steps 4-6a) and output tabs (Step 6b)
- GIS tabs (REMI model users only)
- Results tab (BCA and Summary)

On-Model Tool demo

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MO SHIFT

- Shutting down lanes on I-70
- Results in no BCA because benefits are negative and there is no cost to enter
- Also reduce number of years in analysis
  - Had to run the SHIFT model as if lanes shut down entire period
  - FEAT model uses the analysis years to restrict to number of years of projected lane closures

OPS Tool Overview

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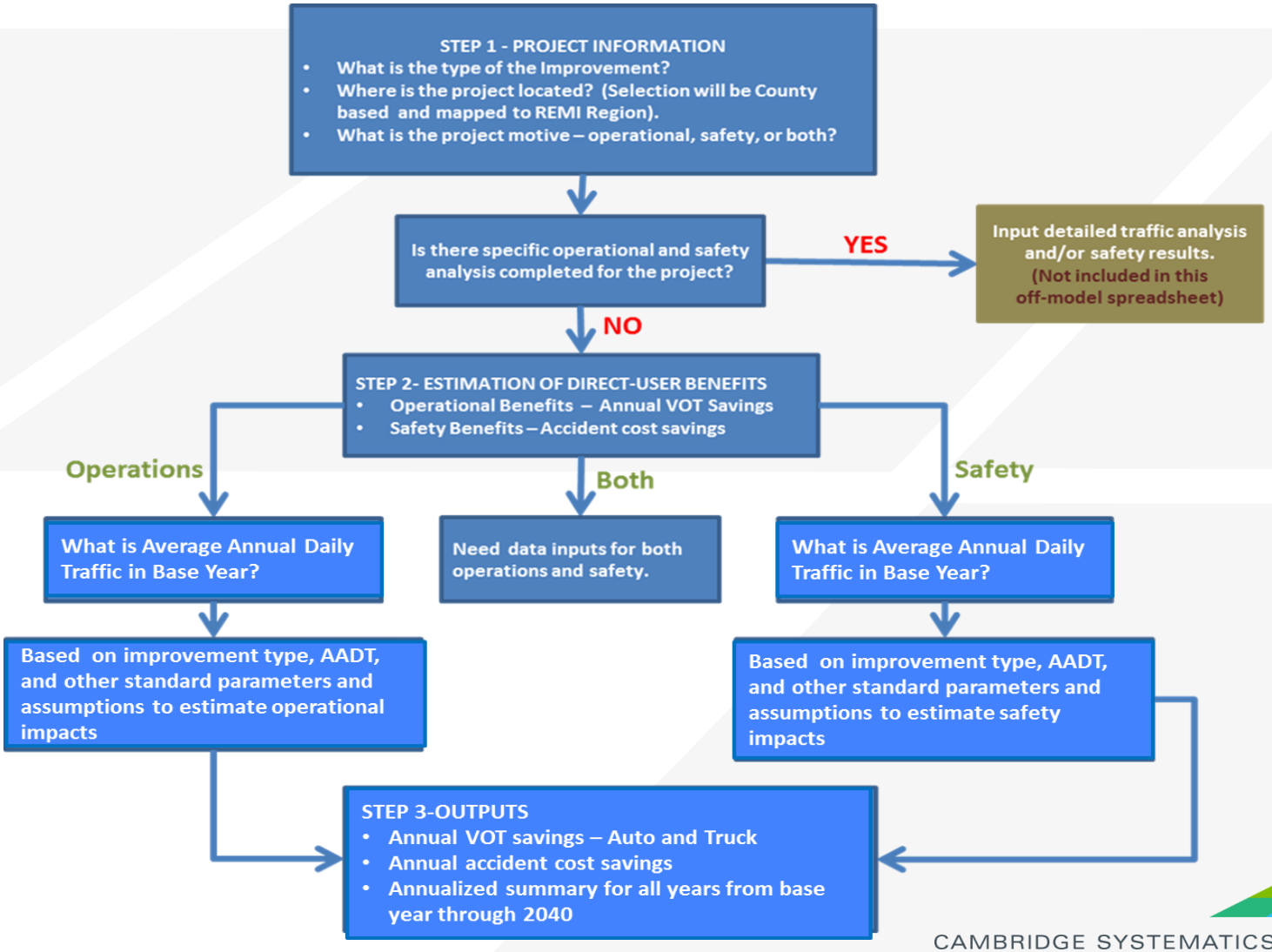
OPS Tool Basics

- Operational and safety projects
- Planning level analysis using user provided data on:
  - AADT
  - Motivation –Operational/safety
  - Location - County
- Estimates travel time savings and safety impacts only
- Conducts BCA and produces inputs for economic modeling

Operational/Safety Projects

- Increasing Length of Turn Bay
- Increasing the Turn Radius
- Striping Changes
- Signal Timing/Phasing Changes
- Adding Turn Lanes
- Adding a Through Lane
- Adding a Traffic Signal
- Adding a Roundabout
- Innovative Intersection (Continuous Flow Interchange, etc.)

OPS Tool Overview



Project Impact Assumptions

Project Type	Operational		Safety	
	Impact Level	Time Reduction	Impact Level	Time Reduction
Increase Length of Turn Bay	Minor	5%	Minor	5%
Increase the Turn Radius	Minor	5%	Minor	5%
Striping Changes	Minor	5%	Minor	5%
Signal Timing/Phasing Changes	Minor	5%	Minor	5%
Adding Turn Lanes	Moderate	10%	Minor	5%
Adding a Through Lane	Moderate	10%	Moderate	10%
Add a Traffic Signal	Moderate	10%	Moderate	10%
Add a Roundabout	Moderate	10%	Moderate	10%
Bridge Replacement	Moderate	10%	Minor	5%
Interchange Reconstruction	Moderate	10%	Moderate	10%
Innovative Intersection (Continuous Flow Interchange, etc.,)	Major	20%	Major	20%
Grade Separation	Major	20%	Major	50%

Estimating Value of Time Savings

- No Build Level-of-Service (LOS) (F is default)
- Delay per Vehicle (sec) (55 seconds is default)
- The Planning Analysis Hour Factor (K Factor)- ratio of the traffic volume in the study hour to the AADT (10% is default)
- Number of congested hours/day (4 hours is default)

VOT Assumptions in Tool

Delay Assumptions

LOS	Range of Delay per Vehicle	Default Delay/vehicle assumption
A	<10	0
B	10-20	10
C	20-35	20
D	35-55	35
F	55-80	55

Default values in tool

Parameter	Default Value
No-Build Level-of-Service	F
Delay per Vehicle (Sec)	55
K-Factor	10%
Number of congested hours/day	4

Using the Ops Tool

- Instructions and Flow Chart Tabs- Overview of tool
- Tool Engine Tab – User input tab
- Annualized Savings by Region Tab - Review
- Auto and Truck Inputs Tabs – Format savings by REMI region
- REMI/Implan Inputs Tab – Create REMI input file
- REMI/Implan Results Tab- Review REMI output
- GIS Tabs – Create tables for ArcGIS for REMI users

Ops Tool Demo

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I-10 Diamondhead Interchange in MS

COMPARATIVE DELAY SUMMARY -- DESIGN YEAR (2040)									
Design Year (2040)	Average Peak Hour Delay								
	(second per vehicle)							(hours per vehicle)	
	EB Ramps		WB Ramps		W. Aloha				
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Weighted Avg Peak Delay	Weighted Avg Peak Delay	Delay Savings vs. Alt A
Alternative A (No Build - TSM)	25.3	257.1	187.5	261.1	57.2	54.9	150.3	0.0417	
Alternative B (Signals w/ Full Bridge Reconstruction)	21.9	27.1	4.7	13.4	33.4	29.6	21.7	0.0060	0.0357
Alternative C (DDI w/ Full Bridge Reconstruction)	3.3	5.0	4.4	8.4	31.7	29.3	15.2	0.0042	0.0375
Alternative D (Roundabouts w/ Full Bridge Reconstruction)	5.7	11.6	10.1	8.7	14.9	15.3	11.6	0.0032	0.0385

- Alt B – Lane widening – delay reduction 85%
- Alt C – Cont flow interchange – delay reduction 89%,
- Alt D – Roundabout – delay reduction 92%,

Summary of Benefits from Engineering Study

Engineering Report

SCENARIO	OPENING YEAR (2020) BENEFIT	DESIGN YEAR (2040) BENEFIT	PRESENT VALUE OF YEARLY BENEFITS (2020 - 2040)
B vs. A	$7,000	$4,700,000	**$25,200,000**
C vs. A	$66,900	$4,900,000	**$26,900,000**
D vs. A	**$152,700**	**$5,100,000**	**$28,200,000**

FEAT Tool

Scenario	PV OF BENEFITS (2020 - 2040)
B	$25,850,990
C	$26,967,353
D	$27,804,626

Rail Diversion Model

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Rail Tool Summary

- Estimates impacts arising from truck to rail diversion
- Based on CS work for AAR, Transportation Energy Futures and NCHRP
- Three types projects
  - New intermodal yard
  - Track upgrade to 286,000 pounds
  - Double-tracking a mainline

Benefits Estimated in Tool

- Freight rate savings
- Congestion cost savings
- Highway emission benefits
- Highway safety benefits
- Road maintenance cost savings

Truck to Rail Diversion

$$ADP_{g,t}^{r,sa} = AFV_{g,t}^{sa} \times \left(MS_g^{r,na} - MS_g^{r,sa}\right)$$

Where:

- $ADP_{g,t}^{r,sa}$ = the annual potential rail diversion in the study area in ton-miles, for good g in year t
- $AFV_{g,t}^{sa}$ = the annual freight volume in ton-miles of good g in the study area in year t
- $MS_g^{r,na}$ = the rail mode share (percentage) nationally for good g
- $MS_g^{r,sa}$ = the rail mode share (percentage) in the study area for good g
- g = subscript indicating the type of good or commodity
- t = subscript indicating the specific intermittent year over the analysis period

User can select diversion based on percentage of freight or number of trucks

Shipping Cost Impacts

$$\Delta ASHC_{g,t} = (SR^{r} - SR^{tr}) \times ADP_{g,t}^{r,sa}$$

Where:

- $\Delta ASHC_{g,t}$ = the change in annual shipping costs for good g in the study area in year t
- SR^{r} = average shipping rates per ton-mile for rail
- SR^{tr} = average shipping rates per ton-mile for truck
- $ADP_{g,t}^{r,sa}$ = the annual potential rail diversion in the study area in ton-miles, for good g in year t
- g = subscript indicating the type of good or commodity
- t = subscript indicating the specific intermittent year over the analysis period

Congestion Cost Impacts

$$\Delta ACC_t = CC^{tr} \times \left(DP_g^{r,sa} \times \frac{AFV_{g,t}^{sa}}{LF_g^{tr}} \right)$$

Where:

- ΔACC_t = the change in annual congestion cost in year t
- CC^{tr} = the cost of congestion per truck mile
- $AFV_{g,t}^{sa}$ = the annual freight volume in ton-miles of good g in the study area in year t
- $LF_{g,}^{tr}$ = the average truckload in tons for good g
- $DP_g^{r,sa}$ = the potential rail diversion percentage in the study area for good g

State of Repair Impacts

$$\Delta AHMC_t = HMC^{tr} \times \left(DP_g^{r,sa} \times \frac{AFV_{g,t}^{sa}}{LF_g^{tr}} \right)$$

Where:

- $\Delta AHMC_t$ = the change in annual highway maintenance cost in year t
- $HMCC^{tr}$ = the highway maintenance cost per truck mile
- $AFV_{g,t}^{sa}$ = the annual freight volume in ton-miles of good g in the study area in year t
- $LF_{g,}^{tr}$ = the average truckload in tons for good g
- $DP_g^{r,sa}$ = the potential rail diversion percentage in the study area for good g

Other Benefits

- Emissions and safety estimated using same methodology from On-model tool
- Based on reduction in truck VMTs

Rail Tool Project Set-up

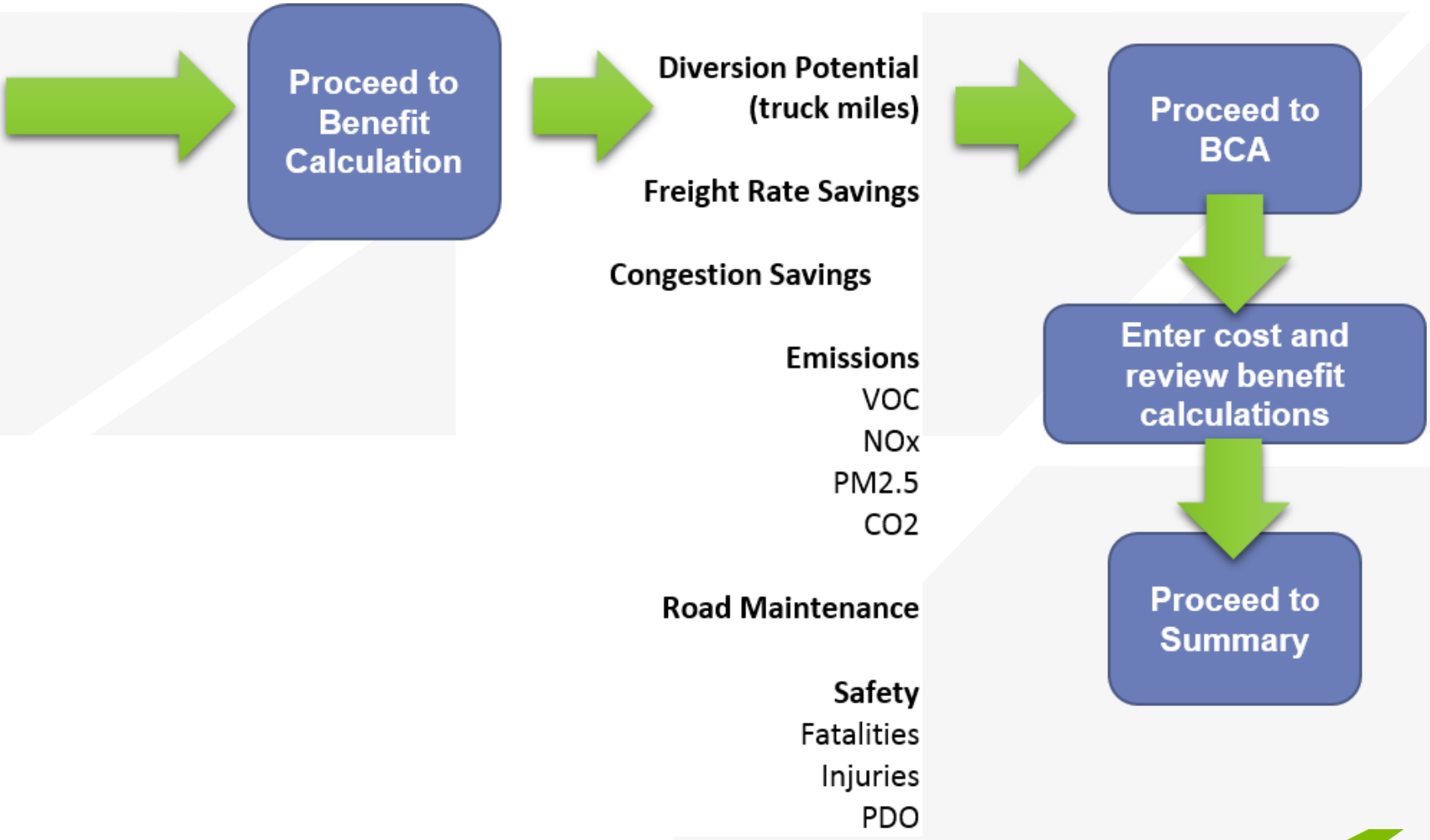
Enter project information

Project Name	
Select Project Type	
Select Potential for Truck-to-Rail Diversion	
Select Percentage or Number of Trucks	
Number of Trucks	
Model Save Path	

Enter simulation options

State	Choose State	
Discount Rate	Choose discount rate for economic impact calculations	3%
Year Parameters	Starting Analysis Year	
	End of Analysis Year	
Safety Options	Estimate Fatality Impacts (Statistical Life)	
Federal Emission Standards	Includes CO2 benefits	
Freight Annual Growth Rate	Growth Rate	2%

Rail Tool Analysis Overview



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Rail Tool Demo