U.S. Department of Transportation
Federal Highway Administration
Federal Transit Administration

User Training

Transit Economic Requirements Model

Overview

Federal Transit Administration

TERM Lite

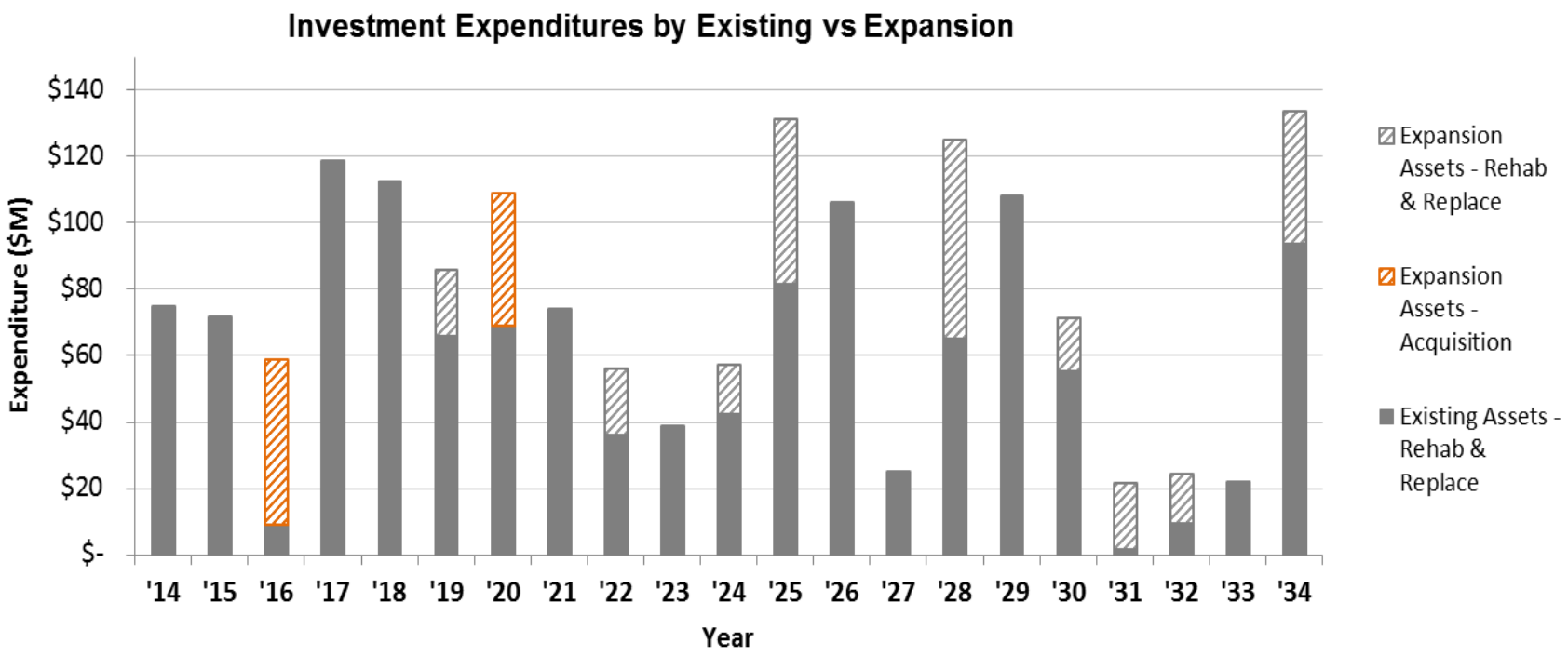
TRANSIT ECONOMIC REQUIREMENTS MODEL

Updated April 2013

This document is confidential and is intended solely for the use and information of the client to whom it is addressed.

What is TERM?

- FTA's Capital Needs Analysis Tool
  - Used to assess the current physical condition and future investment needs of the nation's transit assets / operators



What is TERM?

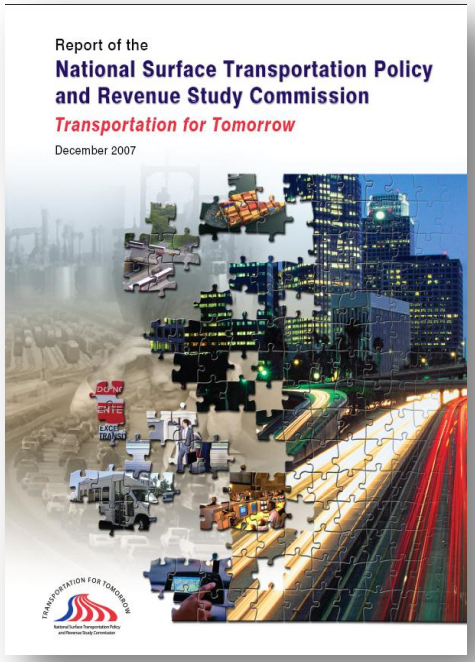
- Transit Economic Requirements Model
- National level analysis of:
  - State of Good Repair backlog
  - Asset conditions
  - 20-year projection of reinvestment needs
  - Impact of variations in funding
- Approximately $5 million in development since 1995

What is TERM?

- Determines level of investment required to:
  - Maintain condition/performance
  - Improve condition/performance
- Assesses impact of constrained investment on future conditions / performance
- Cost effectiveness of proposed investments (benefit–cost analyses)
- Results reported in the transit sections of the "Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance" (C&P)

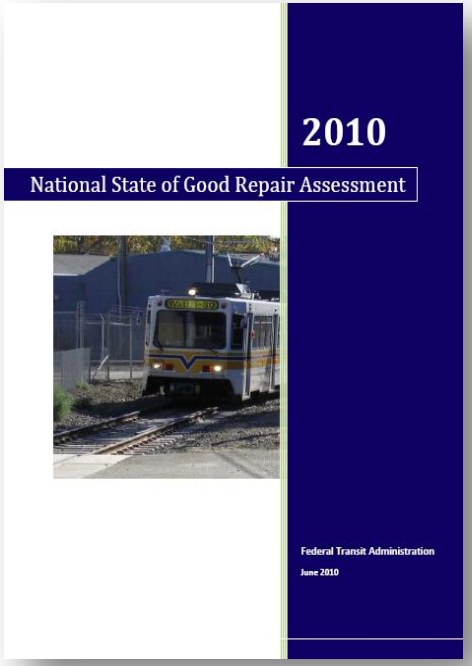
In Addition to the C&P Report, TERM is Used to Develop Related Reports

The ***National Surface Transportation Commission*** examined the condition and future needs of the nation's surface

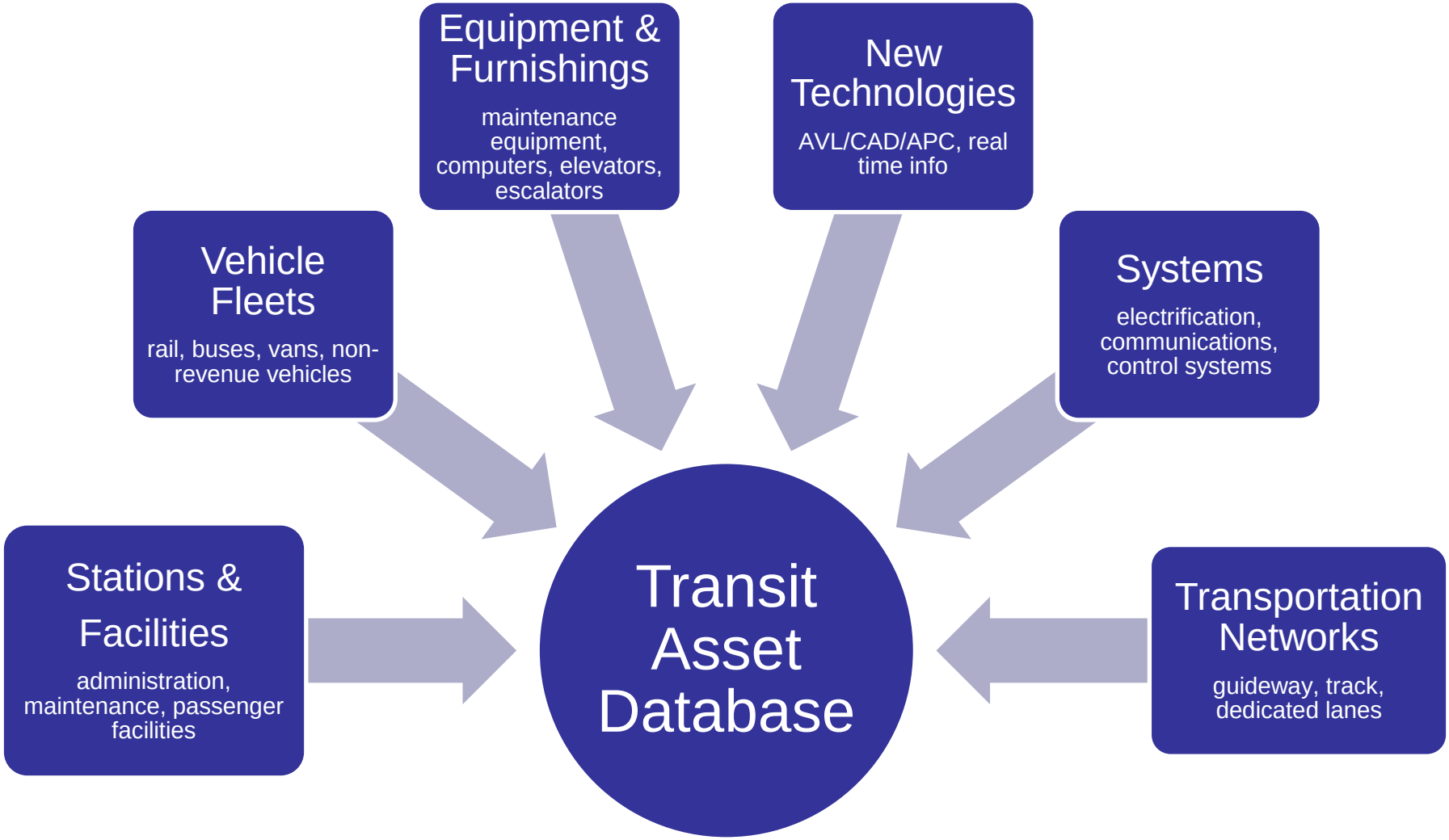


The ***Rail Modernization Study*** assessed the investment backlog and capital reinvestment needs of the nine largest rail operators

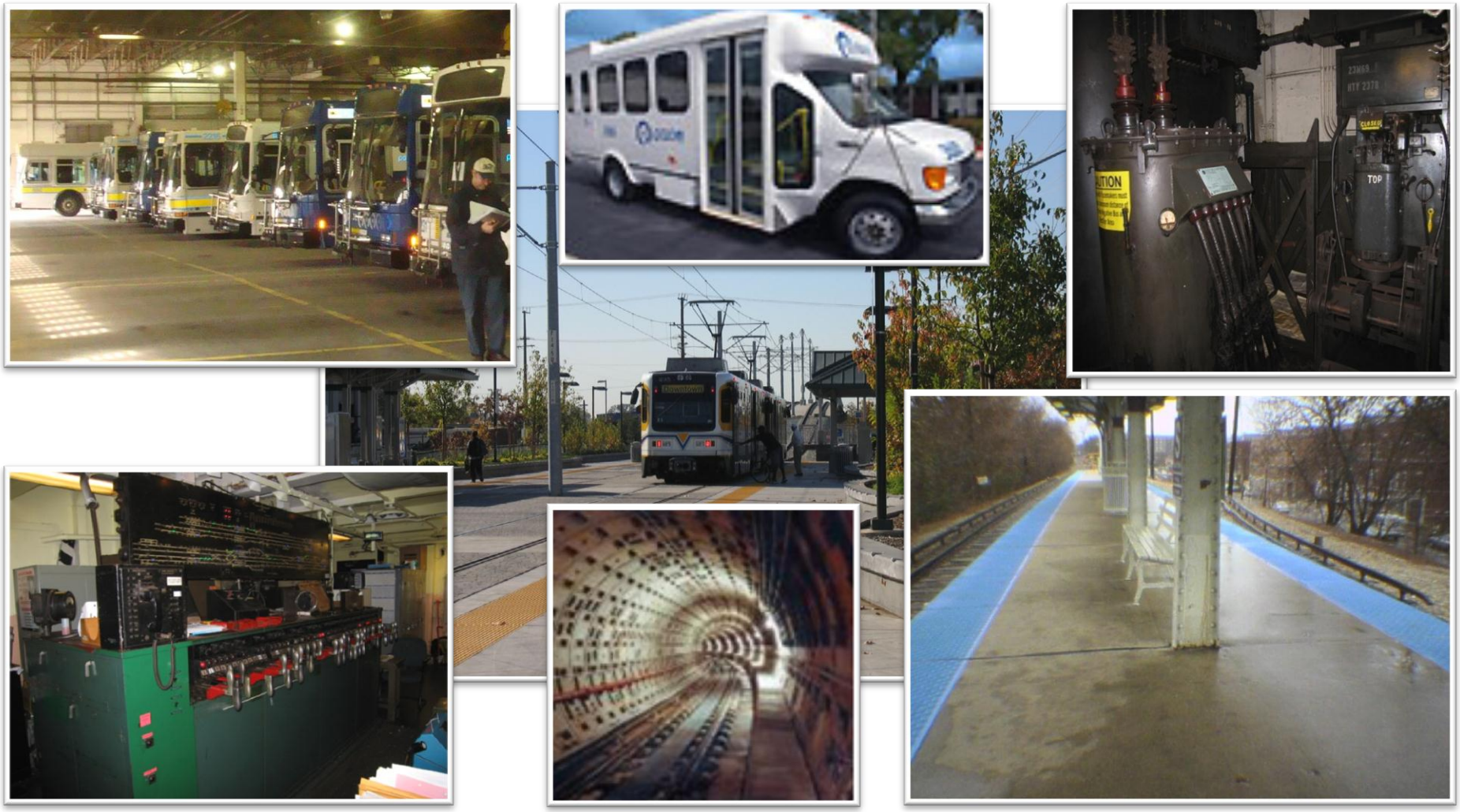
The ***National State of Good Repair*** assessed the investment backlog and capital reinvestment needs of the transit industry



Capital Needs Assessments Include all Asset Types



Data on the Condition of Some Asset Types have been Obtained Through Inspections



The Transit Economic Requirements Model (TERM) was developed to answer the question, “Where will we be in 20 years?”

The answer depends on three primary factors. The following questions are open ended but are eventually translated into relational tables that allow TERM to simulate a 20-year scenario.

What does your inventory look like today?

How much can you spend in each year?

What is most important for you? Safety? Reliability? Something else?

Do we know our inventory?

Knowing your inventory is the first step to being able to analyze the true cost ownership.

- What types of assets do we have?
- How many assets do we have of each kind and how big are they?
- What is the age of each asset? And is the condition appropriate for its age?
- How often must an asset be rehabilitated and at what cost?
- What is the cost to replace one unit of each asset type?
- What assets can never be replaced?
- Do we have redundant or non-essential inventory?

How much can we spend?

The future condition of your portfolio depends on a complex combination of capital replacement programs, operations, maintenance & sustainment practices, worker training, investments in tools, and strategic planning. All of these require funding. Future funding is rarely known but typical scenarios include the following:

- Continue to spend some historical flat amount each year.
- Increased flat funding each year
- Increased short-term funding to reduce deferred maintenance followed by a historical flat amount.
- Unlimited funding
- No funding

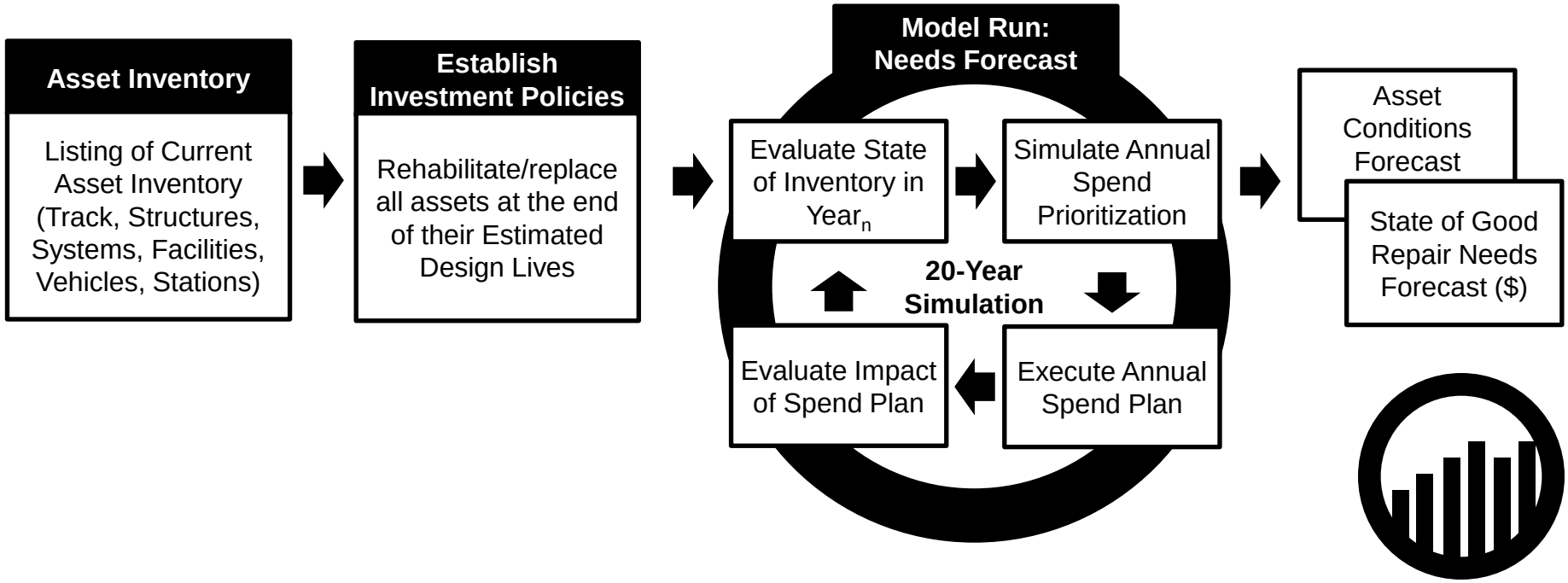
What are our priorities?

Every asset in your inventory contributes to meet your organization's goals and mission objectives. If they don't, you should probably decommission them. When funds are constrained, budget planners must consider where to spend the available money first. Criteria that is most often considered for a transit planner include the following:

- Safety & Security
- Reliability
- Operations & Maintenance Impact
- Customer Experience
- Asset Condition

TERM Simulates how you Invest in your Assets

Once the current inventory, spending constraints, prioritization criteria, and a few other economic assumptions are provided, TERM simulates up to 30 years of aging, wear & tear, rehabilitation, maintenance, and replacement for a collection of assets.



TERM is an MS Access-based tool designed for use by a novice

The analyst controls the simulation by using the following modules:

- **Inventory Publisher**: Transferring inventory data from MS Excel to TERM
- **Prioritization Settings**: Assign priority weights to each of five criteria and score each asset type on those five criteria
- **Expenditure Constraints**: Specify the maximum annual funding available to the simulator
- **Backlog Target Seek**: Optimize funding to achieve a specific reduction in backlog
- **Inventory Management:** Add, delete, or modify the inventory details
- **Expansion Analysis:** Review the impact of adding new capacity on annual expenditure needs and long-term backlog growth/decline
- **Life Cycle Cost**: Edit assumptions regarding number and cost of interval rehabilitations, unit replacement cost, and useful life by asset type
- **Inflation Module**: Specify how costs should be escalated over time and how results are displayed

Inventory Publisher

TERM-Lite is developed in MS Access. Users that are comfortable using Access may choose to become familiar with the tables and manage the data directly in the model.

However, FTA has developed an MS Excel-based Inventory Publisher which helps format data to conform to TERM's business rules.

Publish Inventory

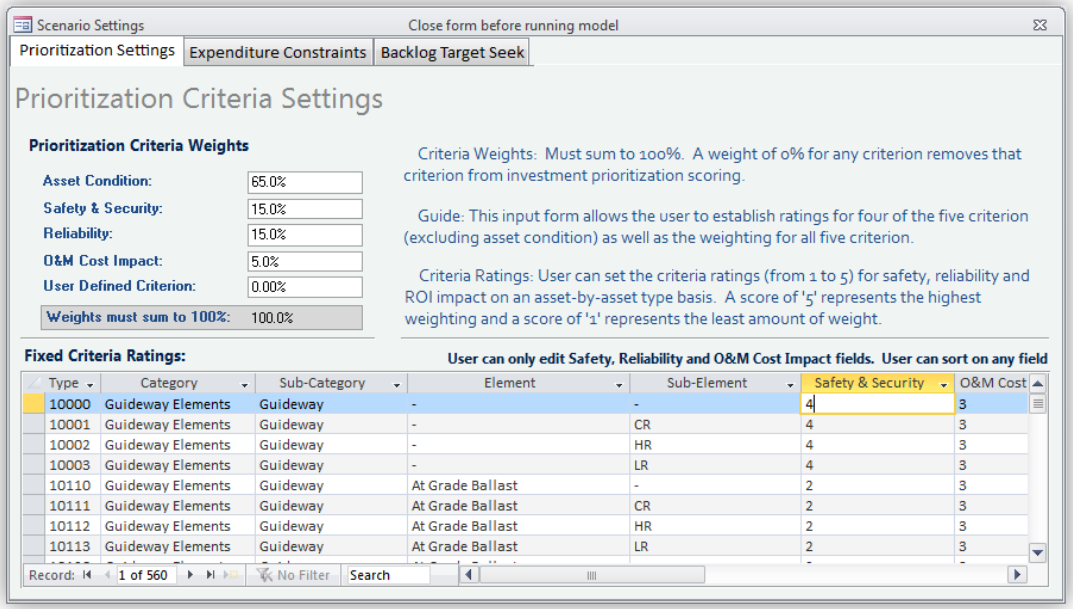
TERM-Lite Inventory Publisher
for the Transit Economic Requirements Model

Delete Records with no Description
Currently, there are 500 records
Delete Selected Records | *+10 record(s)* | Add | Show/Hide Optional Fields

Record	★ (mandatory) Mode	★ Description	★ Asset Classification	★ Quantity	Unit	Expan-sion?	★ Year Built	★ Replacement Cost Unit Cost ($)	Acquisition Cost ($)	Repl. Cost ($)	Soft Cost	★ Cost Year	Base Year 2014 Repl. Cost ($)	Useful Life	★ Priority	Additional Notes	Data Information Year	Source
1	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	50.48	LF	No	2011	116.15		5,863.25		2011	6,487.46	40 Yrs	Normal	WEST VALLEY LIGHT RAIL TI		
2	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	220.92	LF	No	2011	116.15		25,659.86		2011	28,391.61	40 Yrs	Normal	Mid Jordan Horizontal Align		
3	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	100.	LF	No	1999	116.15		11,615.00		1999	20,700.26	40 Yrs	Normal	L53 RR As-Builts DM/M C03		
4	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	281.32	LF	No	2012	116.15		32,675.32		2012	34,955.09	40 Yrs	Normal	Provo to Salt Lake Horizonta		
5	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	100.19	LF	No	1999	116.15		11,637.07		1999	20,739.59	40 Yrs	Normal	L53 RR As-Builts DM/M C02		
6	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	99.64	LF	No	1999	116.15		11,573.19		1999	20,625.74	40 Yrs	Normal	L53 RR As-Builts DM/M C02		
7	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	238.2	LF	No	2008	116.15		27,666.93		2008	33,871.36	40 Yrs	Normal	Parsons Weber County to Sa		
8	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	300.	LF	No	2000	120.00		36,000.00		2000	62,795.30	0 Yrs	Normal			
9	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	198.31	LF	No	2008	116.15		23,033.71		2008	28,199.12	40 Yrs	Normal	Parsons Weber County to Sa		
10	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	125.	LF	No	2008	116.15		14,518.75		2008	17,774.64	40 Yrs	Normal	Parsons Weber County to Sa		
11	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	112.43	LF	No	2012	116.15		13,058.74		2012	13,969.86	40 Yrs	Normal	Provo to Salt Lake Horizonta		
12	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	200.	LF	No	1999	116.15		23,230.00		1999	41,400.53	40 Yrs	Normal	L53 RR As-Builts DM/M C02		
13	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	1.	EA	No	2008	25,000.00		25,000.00		2008	30,606.36	32 Yrs	Normal	Parsons Weber County to Sa		
14	LR - Light Rail	Guideway Elements - Ballasted,	11201 - Guideway Elements, Track	4,786.21	LF	No	2011	116.15		555,918.29		2011	615,101.53	40 Yrs	Normal	Mid Jordan Horizontal Align		
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		200,297		2008	[illegible]	20 Yrs	[illegible]	[illegible]		

Prioritization Settings

TERM-Lite simulates the long-term impact of *constrained* funding scenarios using a robust prioritization algorithm. The model considered five dimensions of priority: Asset Condition, Safety & Security, Reliability, O&M Cost Impact, and one User Defined criteria. The User is in control of how each asset type scores against other asset types. The User also determines how each criteria is weighted against other criteria.



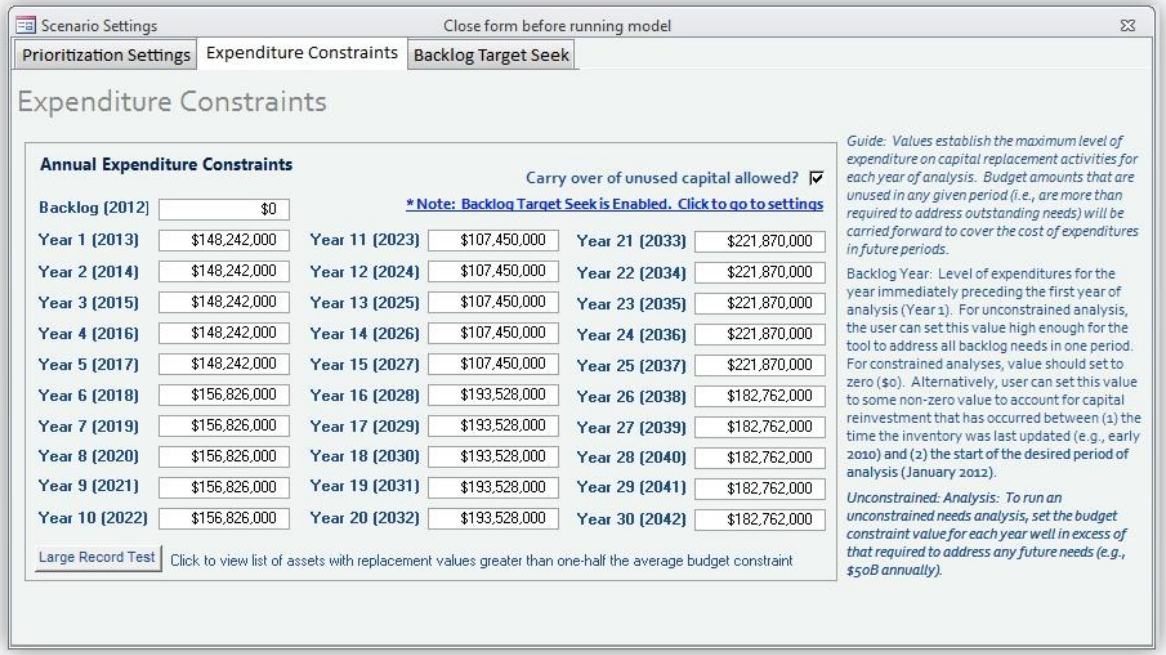
Type	Category	Sub-Category	Element	Sub-Element	Safety & Security	O&M Cost
10000	Guideway Elements	Guideway	-	-	4	3
10001	Guideway Elements	Guideway	-	CR	4	3
10002	Guideway Elements	Guideway	-	HR	4	3
10003	Guideway Elements	Guideway	-	LR	4	3
10110	Guideway Elements	Guideway	At Grade Ballast	-	2	3
10111	Guideway Elements	Guideway	At Grade Ballast	CR	2	3
10112	Guideway Elements	Guideway	At Grade Ballast	HR	2	3
10113	Guideway Elements	Guideway	At Grade Ballast	LR	2	3

Expenditure Constraints

The User controls the amount of funding that is available for each of the years of analysis.

The User can specify whether unspent funds are carried over to future year or returned to the funding authority based on that agency's unique circumstances.

A built-in 'Large Record Test' will help the User evaluate of the inventory is structured optimally for TERM-Lite analysis.



Scenario Settings — Close form before running model

Prioritization Settings | Expenditure Constraints | Backlog Target Seek

Expenditure Constraints

Annual Expenditure Constraints

Carry over of unused capital allowed? ☑

*Note: Backlog Target Seek is Enabled. Click to go to settings

Backlog (2012)	$0				
Year 1 (2013)	$148,242,000	Year 11 (2023)	$107,450,000	Year 21 (2033)	$221,870,000
Year 2 (2014)	$148,242,000	Year 12 (2024)	$107,450,000	Year 22 (2034)	$221,870,000
Year 3 (2015)	$148,242,000	Year 13 (2025)	$107,450,000	Year 23 (2035)	$221,870,000
Year 4 (2016)	$148,242,000	Year 14 (2026)	$107,450,000	Year 24 (2036)	$221,870,000
Year 5 (2017)	$148,242,000	Year 15 (2027)	$107,450,000	Year 25 (2037)	$221,870,000
Year 6 (2018)	$156,826,000	Year 16 (2028)	$193,528,000	Year 26 (2038)	$182,762,000
Year 7 (2019)	$156,826,000	Year 17 (2029)	$193,528,000	Year 27 (2039)	$182,762,000
Year 8 (2020)	$156,826,000	Year 18 (2030)	$193,528,000	Year 28 (2040)	$182,762,000
Year 9 (2021)	$156,826,000	Year 19 (2031)	$193,528,000	Year 29 (2041)	$182,762,000
Year 10 (2022)	$156,826,000	Year 20 (2032)	$193,528,000	Year 30 (2042)	$182,762,000

Large Record Test — Click to view list of assets with replacement values greater than one-half the average budget constraint

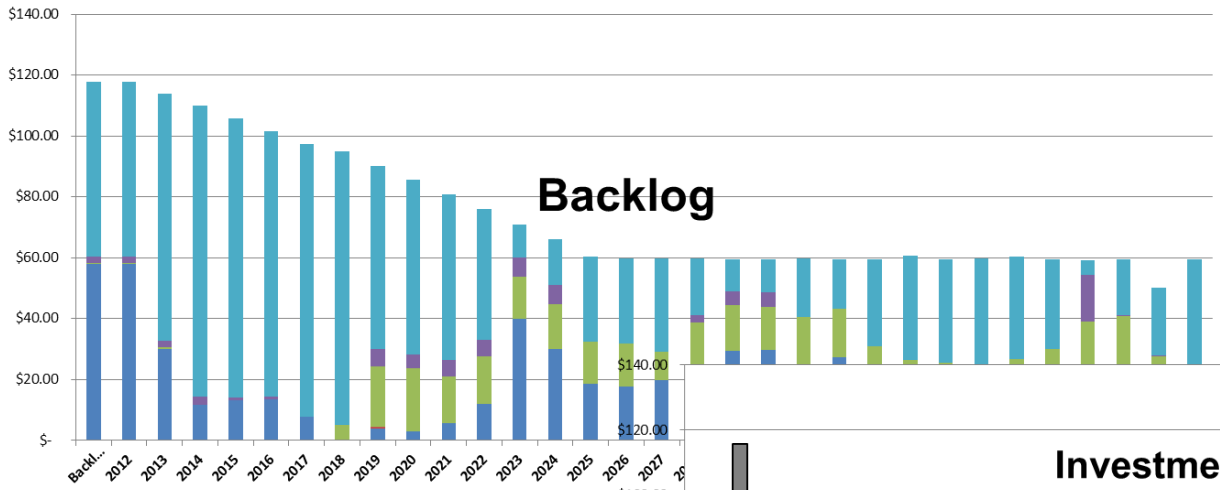
Guide: Values establish the maximum level of expenditure on capital replacement activities for each year of analysis. Budget amounts that are unused in any given period (i.e., are more than required to address outstanding needs) will be carried forward to cover the cost of expenditures in future periods.

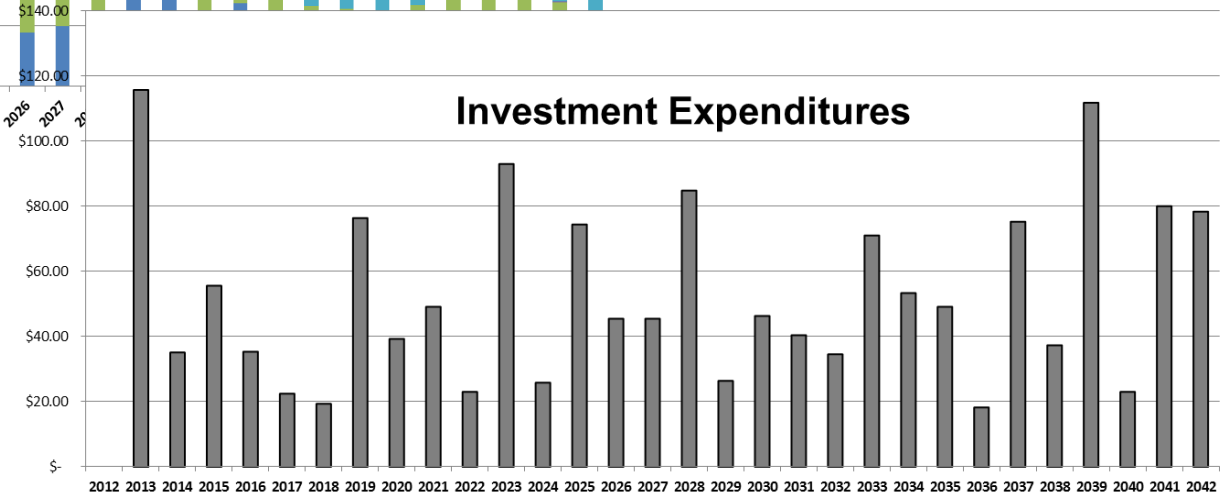
Backlog Year: Level of expenditures for the year immediately preceding the first year of analysis (Year 1). For unconstrained analysis, the user can set this value high enough for the tool to address all backlog needs in one period. For constrained analyses, value should set to zero ($0). Alternatively, user can set this value to some non-zero value to account for capital reinvestment that has occurred between (1) the time the inventory was last updated (e.g., early 2010) and (2) the start of the desired period of analysis (January 2012).

Unconstrained: Analysis: To run an unconstrained needs analysis, set the budget constraint value for each year well in excess of that required to address any future needs (e.g., $50B annually).

Backlog Target Seek

In contract to using the Expenditure Constraints module, the User can also specify a performance outcome by reducing existing backlog to a specific level within a desired period of time. TERM-Lite calculates the annual funding required to achieve this objective.



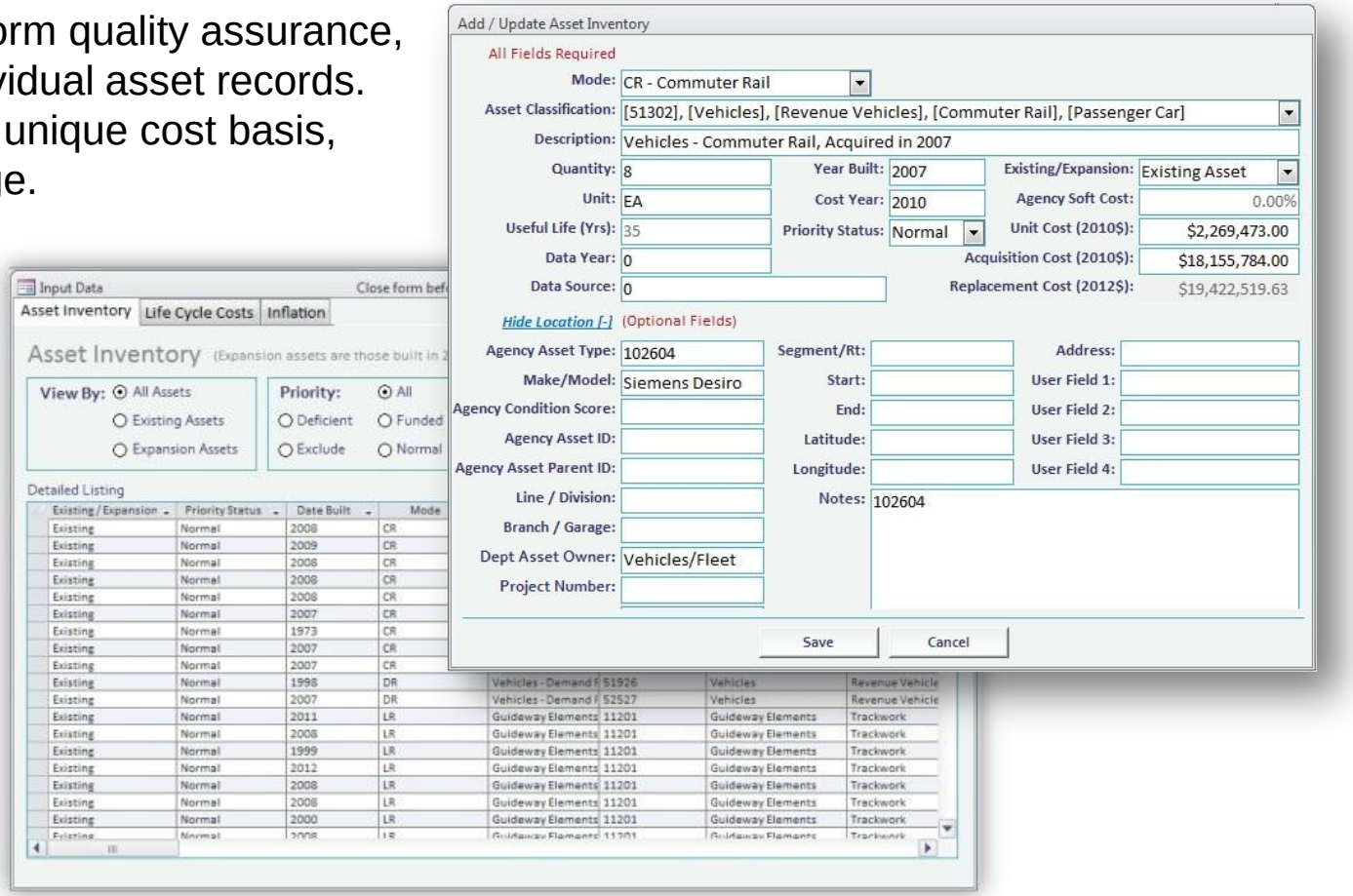


Inventory Management

The User can review, perform quality assurance, edit, delete, or modify individual asset records. Each record can include a unique cost basis, quantity, useful life, and age.

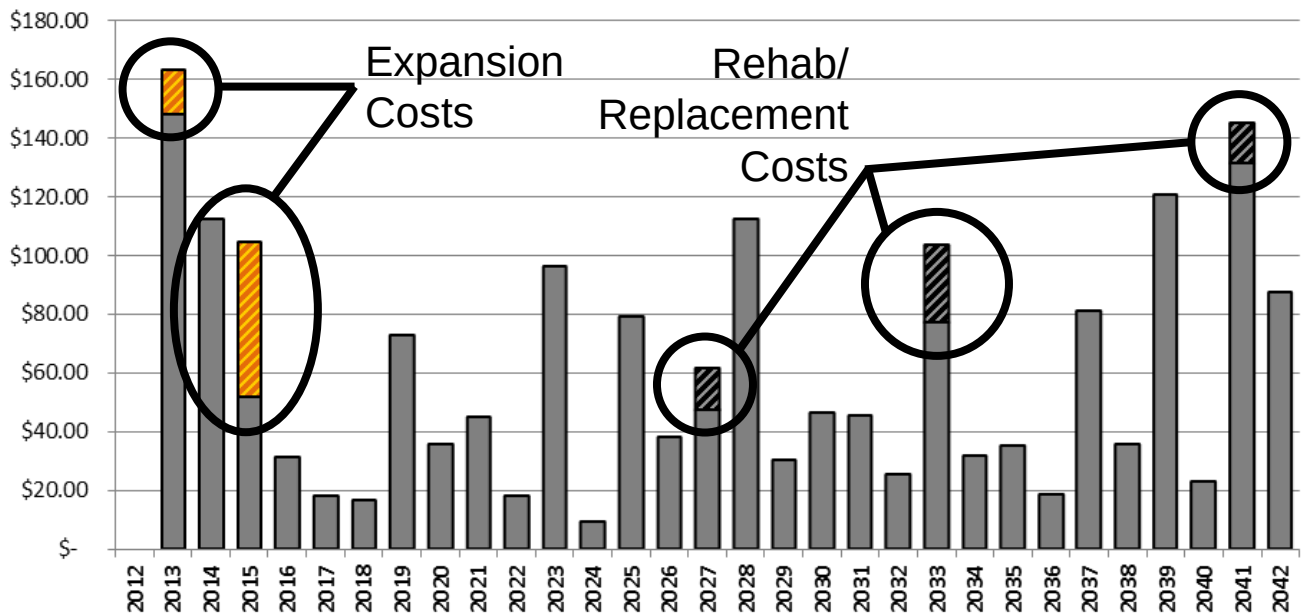
Each asset can be tagged as one be of four levels of “overriding” priority (Funded, Deficient, Normal, or Exclude).

In addition, twenty (20) fields are available to track metadata that is important to the agency.



Expansion Analysis

The User can choose to include planned or prospective capital improvements in the analysis. This “what-if” scenario analysis allows a thorough review of the impacts of such improvements on spending needs and, when funding is constrained, on overall portfolio performance (as measured by average age, and condition).

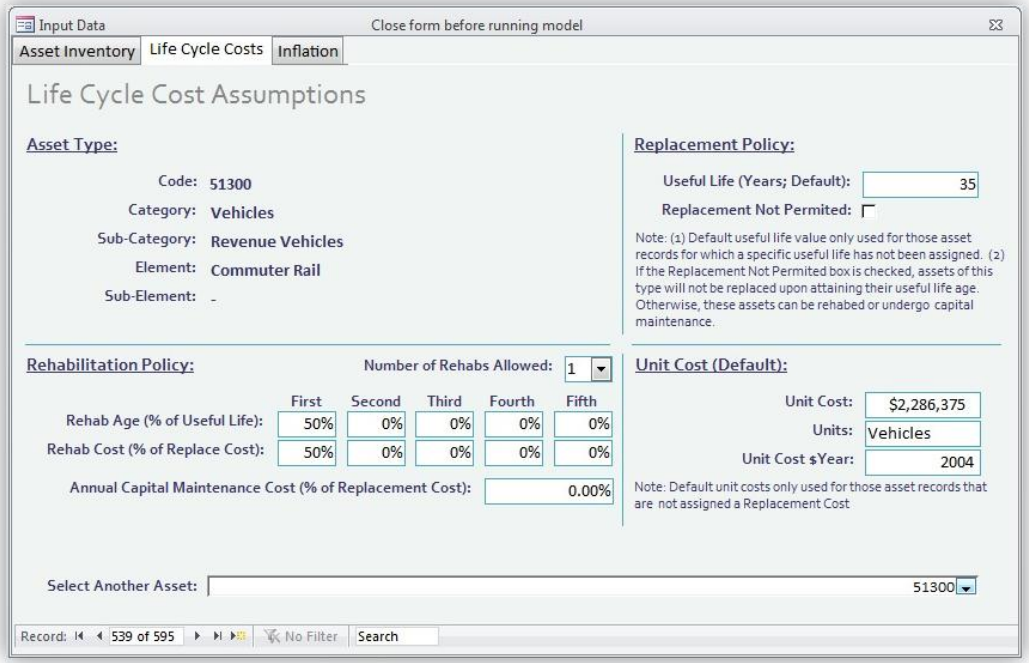


Life Cycle Cost and Inflation

Users can customize the rehab and replacement cost assumptions for each asset type. This customization can include up to five (5) intermediate rehabs stated as a percentage of the replacement cost.

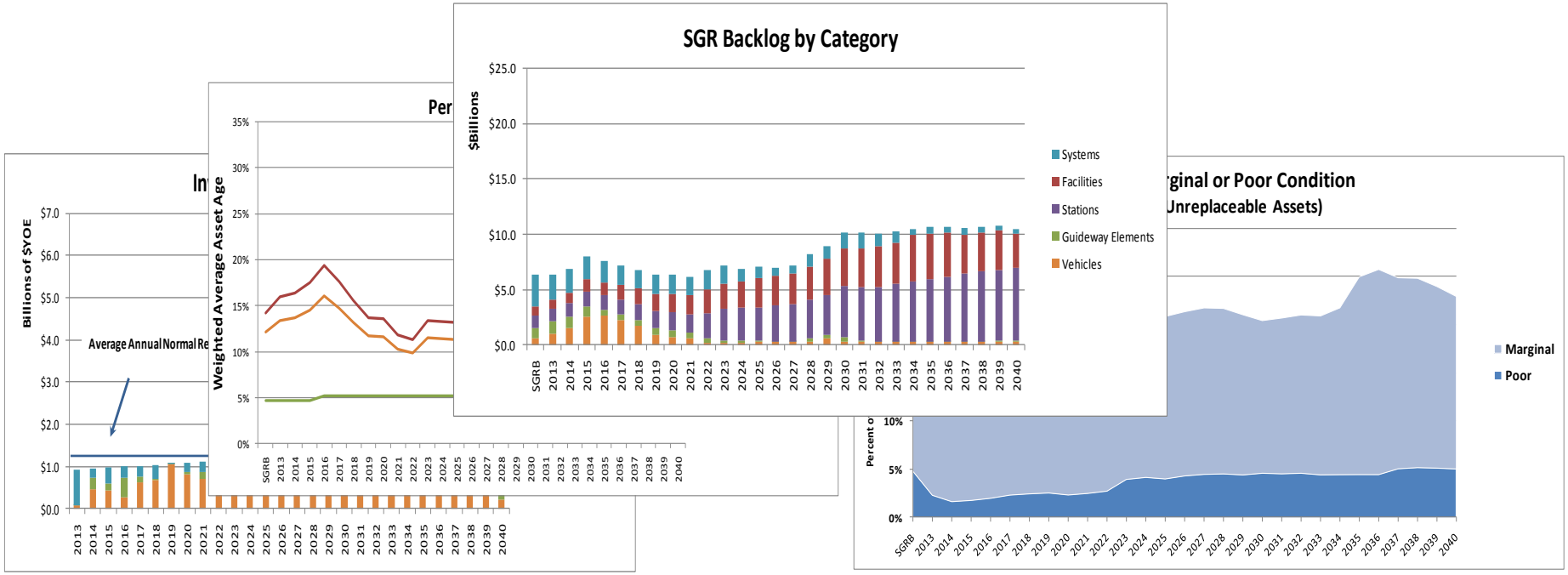
Assets that are typically maintained for an indefinite period (tunnels or historic assets), an annual capital cost can be defined to allow for regular investments in rehab.

TERM-Lite analysis can be run using any desired assumed inflation rate.



TERM provides analysis charts and reports that describe the outcome of each scenario

Reports help the analyst visualize the resulting condition and service performance of the asset inventory based on the input settings. Comparing multiple scenarios side by side help build a business case to support "right funding" of the portfolio



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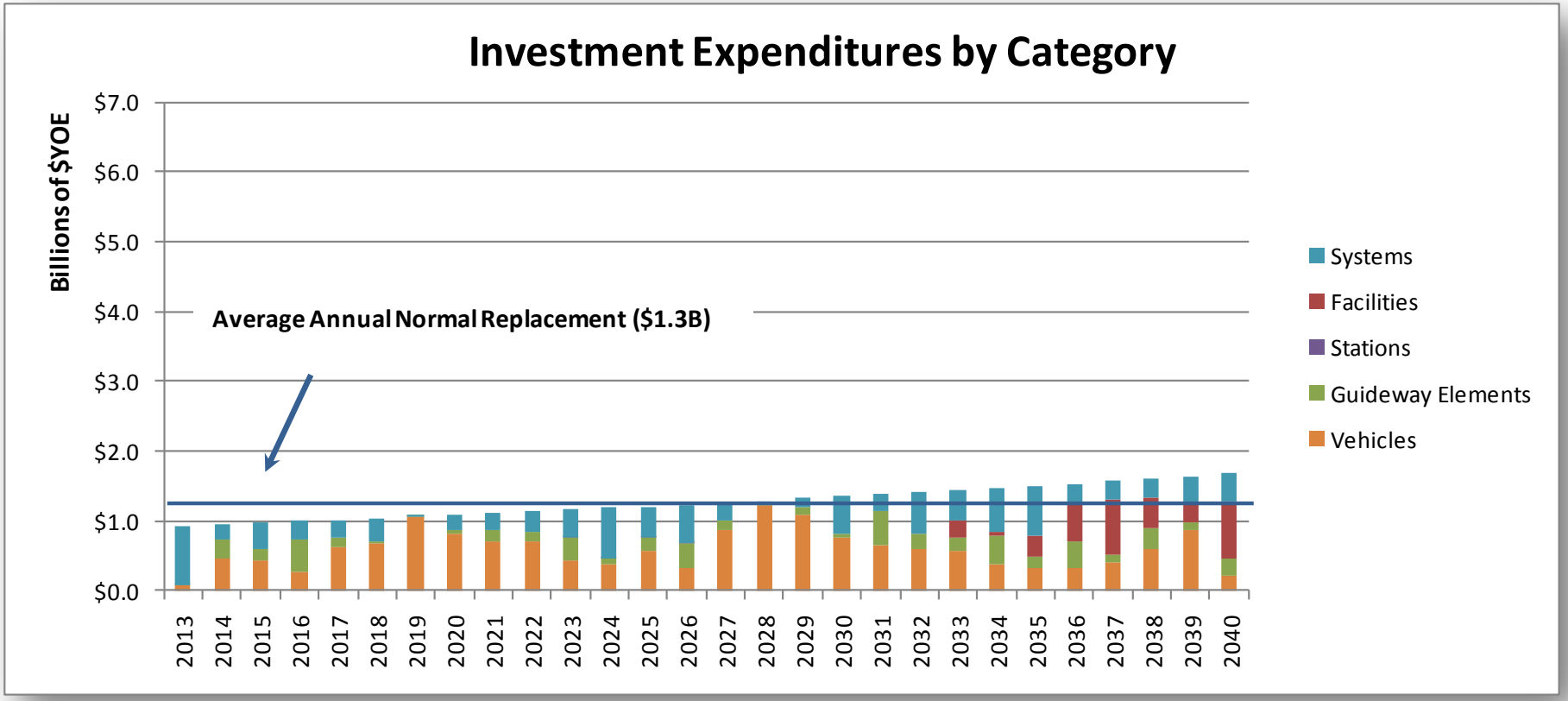

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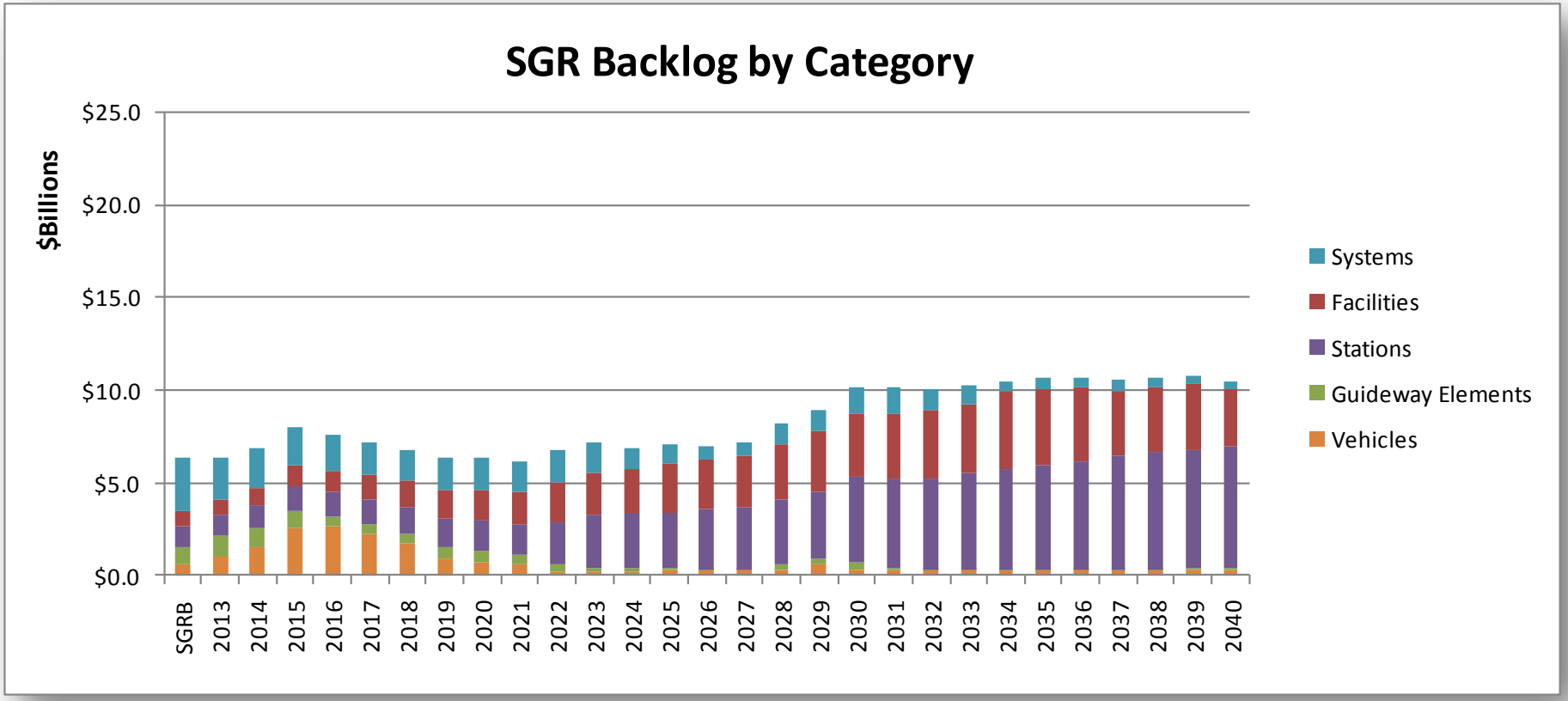

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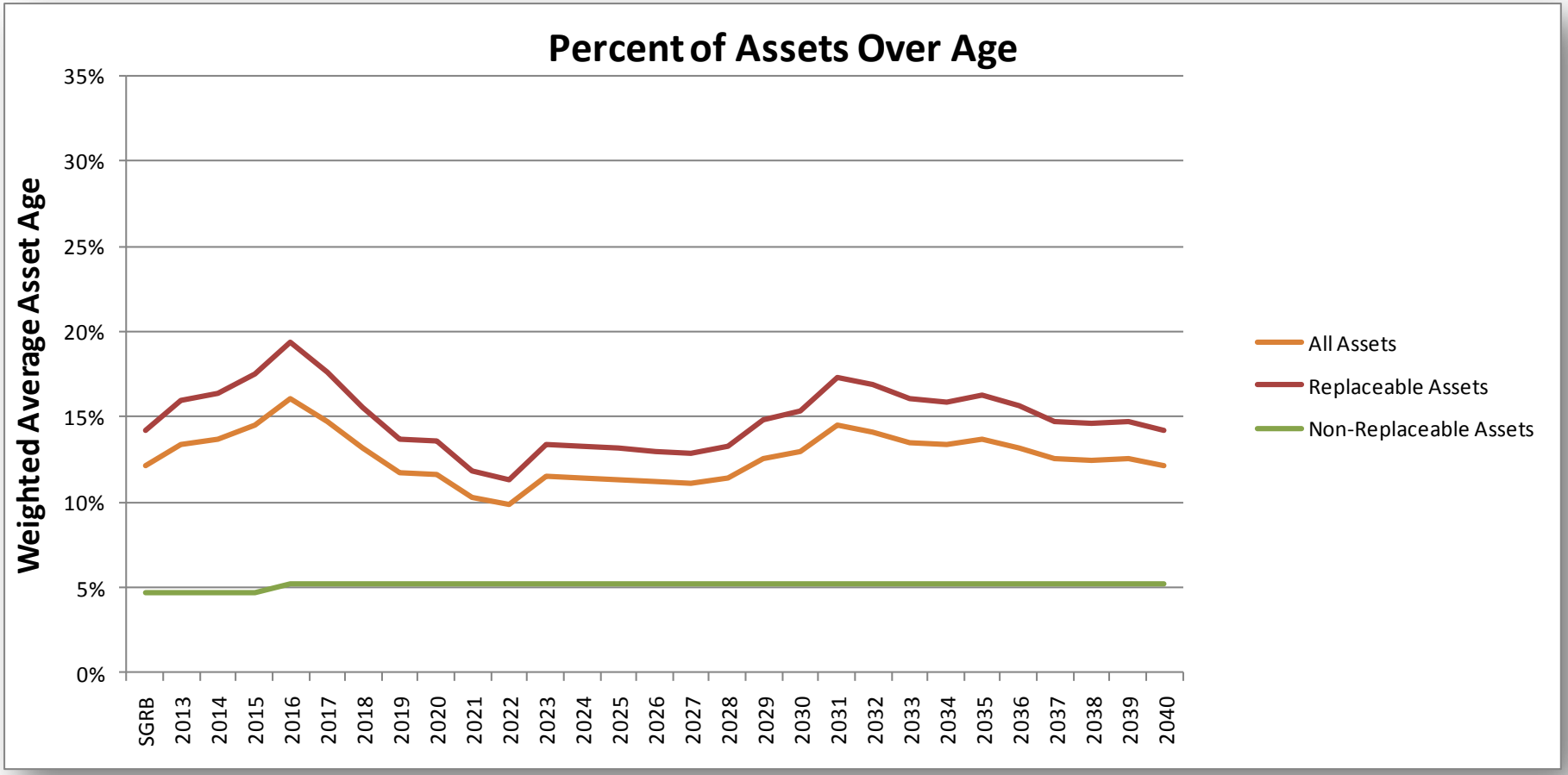

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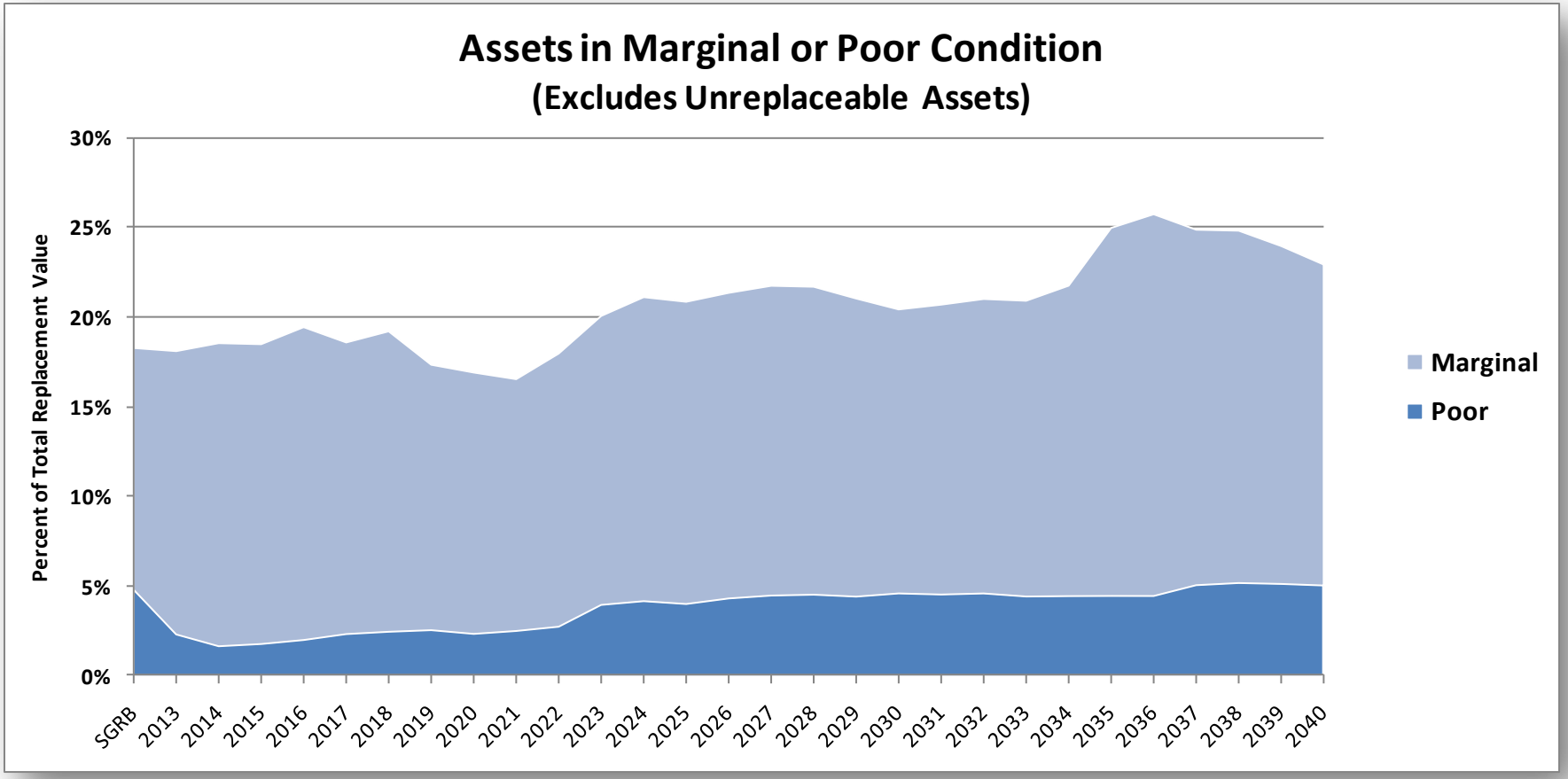

Questions?

Rick Laver
CH2M Hill
703-946-5065
richard.laver@ch2m.com

Dan Schriever
Booz Allen Hamilton
703-677-8424
schriever_dan@bah.com

Appendix A - Useful Constrained Expenditure Scenarios

Scenario	Purpose / Value	How to Define
Maintain Current Spending	• What is the impact on the SGR backlog and prioritization of continuing to reinvest at the current (historical) rate?	• Enter $0 for year 0 • For years 1 to 20 enter avg. level of Service Board reinvestment for past 5 to 10 years • Can adjust for inflation
Maintain Backlog	• What level of investment will maintain the current size of the backlog (either in dollar terms or as a percent of all asset holdings)?	• User must enter test values for years 1 to 20 (enter same value for each year) and run the model multiple times until value of backlog in year 20 = value in year 0.
SGR in 20 Years	• What level of annual reinvestment is required to eliminate the SGR backlog in 20 years?	• User must enter test values for years 1 to 20 (e.g., enter same value for each year) and run the model multiple times until value of SGR backlog = $0 in year 20.
Un-constrained	• What would avg. annual reinvestment be if there was no backlog? • Investment must be higher than this to reduce the backlog	• Enter a very high level of investment (e.g., $500B) for years 0 (backlog year) through year 20
“Planned” or “Budgeted”	• Enter year by year funding amounts that are both (1) financially sustainable and (2) correspond with timing of known major reinvestment needs • Output will show impact of plan on future SGR backlog and help prioritize needs	

Appendix B - How to Define a Scenario

Scenario Control (Location)	Description & Use	Example Uses
Expenditure Constraints (Scenario Settings Form)	• User controls level of expenditures for projection years 0 through 30 • Used to assess impact of varying rates of reinvestment on conditions, prioritization and the SGR backlog	• Sample scenarios include: – Unconstrained needs – Maintain current spending – Level of funding to attain SGR
Prioritization Settings (Scenario Settings Form)	• While typically held fixed, user can change investment scoring to assess impact on priority rankings, composition of reinvestment activities, and SGR backlog	• User can alter: – Criteria weights (simple adjustment) – Fixed criteria scoring (detailed change)
Inflation (Input Data Form)	• Sets assumed rate of inflation for analysis period from year 0 to 30 – same rate applied across all years • "Sensitivity" factor allows user to simultaneously adjust all projection costs up or down by the same set amount (default value is 100%)	• User can select: – Current year dollars – in Start Year dollars as input on Main Menu – Year of Expenditure – based on user entered rate

Appendix B - How to Define a Scenario

Scenario Control (Location)	Description & Use	Example Uses
Asset Useful Life (Asset Inventory Update Tab: Input Data Form)	• User can alter the useful life values of individual assets • Extending asset useful lives will lower long-term needs as assets require less frequent replacement	• e.g., change the useful life of “twelve year) buses to 14 years

Override (Asset Inventory Update Tab: Input Data Form)	• Assign one of four levels of priority
	  • Funded (highest priority)
	  • Deficient
	  • Normal
	  • Exclude (from analysis)
		• These settings only emphasize certain assets of another. However, each scenario is still subject to the maximum annual funding available.

Life Cycle Costs (Input Data Form)	• User can alter number, timing and cost of rehabs • Also controls cost of annual capital maintenance	• User can assess impact on needs of increasing/reducing number and/or cost of rehabs (note: will not impact condition measures)
Useful Life Factor (Main Menu)	• When set to values other than 100%, assets will be kept in service longer or shorter than their expected useful lives • This single factor allies to all assets	• Note: Useful life values are not altered (hence, if factor is set to 110%, assets will be kept in service until 110% of their expected useful life but will be overage one they exceed 100% of useful life)

Appendix C – Reports

Report	Type	Content
Asset Inventory Record Ages	• Input Data	• Analysis of the age of the tools' asset records
Asset Inventory Replacement Value	• Inventory	• Total replacement value of all • Grouped by mode and asset category
Asset Types	• Input Data	• Asset types recognized by the database • Data tab provides detail on asset life-cycle cost assumptions
Average Annual Expenditures Forecast	• Needs forecast	• Average annual level of dollar investment needs over 20-years of model run (based on scenario inputs)
Condition Distribution Forecast	• Condition	• Forecast of percent of assets in excellent, good, fair, marginal and poor condition
Expenditures Forecast	• Needs forecast	• Forecast of prioritized annual investment needs (based on scenario inputs)

Appendix C – Reports

Report	Type	Content
Over Age Asset Forecast	• Condition	• Forecast of percent of assets that exceed their useful life (based on scenario inputs)
Priority Scores: Backlog Investments by Asset Record (Detail)	• Prioritization scores	• Record level prioritization scores for investments to reduce current backlog (year 0)
Priority Scores: Backlog Investments by Asset Type by Location	• Prioritization scores	• Prioritization scores for investments to reduce current backlog (year 0) grouped by asset type and location
Priority Scores: Backlog Investment by Asset Type (Base 100)	• Prioritization scores	• Prioritization scores for investments to reduce current backlog (year 0) grouped only by asset type
Priority Scores: Summary Scores By Asset Type for Next 10 Years	• Prioritization scores	• Prioritization scores grouped only by asset type for projection years 0 to 20
SGR Backlog Forecast	• Backlog	• Projection of SGR backlog for years 0 through 20 (based on scenario inputs)

Appendix D – Field Definitions

Field Name	Description	Required Field?	Notes	Data Type	Text Field Size
Asset ID	Unique Asset ID	No	Optional asset identifier number	Integer	
Agency ID Code	Agency ID Code	Yes	Use "9999" for default value	Text	25
Transit System	Agency Name	Recommended		Text	50
Mode Code	NTD mode code	Yes	Two (2) letter FTA transit mode codes: CR, HR, LR, MB, DR, BRT, VP	Text	25
Description	Agency specified asset type name	No	Asset Description	Text	50
Asset Type Code	TERM Asset Type Code (5 digit code)	Yes	Must be selected from asset type codes populated in tbl05AssetTypes (5 digit code)	Integer	
Category	TERM Asset Category	Yes		Text	50
Sub-Category	TERM Asset Sub-category	Yes		Text	50
Element	TERM Asset Element	Yes		Text	50
Sub-Element	TERM Asset Sub-element	Yes		Text	50
Quantity	Unit quantity	Yes	Can be entered as decimal value	Double	
Units	Type of units (e.g., each, sq feet, miles, spaces)	Recommended		Text	25

Appendix D – Field Definitions

Field Name	Description	Required Field?	Notes	Data Type	Text Field Size
Date Built	Year asset was built / entered service life	Yes	Enter four digit value for year "XXXX"	Integer	
Rehabed	Has asset been rehabbed: False or True	Yes	Indicate yes if asset has undergone significant rehab investments	True/False	
CostYr	Dollar year replacement costs are denominated in	Yes	e.g., $2012; Enter four digit value for cost year "XXXX"	Integer	
Agency_SoftCost	Assumed soft-cost factor	Yes	Will be added to rehab and replacement cost calculations	Percent	
Unit Replacement Cost	Unit replacement cost denominated in "CostYr" dollars	Yes	Enter full value, including cents if needed (e.g., $X,XXX.XX)	Double	
Current Dollars Total Cost	Total replacement cost denominated in "CostYr" dollars	No	Tool will auto-populate this field when model is run based on unit cost and unit quantity	Double	
Total Replacement Cost	Total replacement cost denominated in model start year dollars	No	Tool will auto-populate this field when model is run based on unit cost and unit quantity	Double	

Appendix D – Field Definitions

Field Name	Description	Required Field?	Notes	Data Type	Text Field Size
PriorityStatus	Assigns assets to one of four levels of priority stauts: Funded, Deficient, Normal, Exclude	Recommended	Default value is "Normal": Funded and Deficient forces highly prioritized asset replacement (or highest priority for replacement). Assets with Exclude selected will not be included in needs analysis.	True/False	
Condition Rating	Observed, actual condition rating for asset	No	Informational only / will be used in future	Double	
Data Date	Date the asset record was last updated	Recommended		Integer	
Data Source	Source of asset data	Recommended		Text	50
Agency_UsefulLife	Expected useful life of asset in years (e.g., “50”)	Highly Recommended	Tool will utilize default useful life value from asset types table if not populated	Integer	
Notes	Additional details on asset (type, history, special considerations)	No		Text	255

Appendix D – Field Definitions

Field Name	Description	Required Field?	Notes	Data Type	Text Field Size
DelayReplaceAge	Allows user to specify an asset replacement age in years that differs from Useful life (e.g., “55”)	No	Useful for forced scheduling of asset replacement (e.g., based on planned procurement)	Integer	
Existing_Expansion	Enter “Existing” for assets currently in service / “Expansion” for (non-replacement) assets to be acquired in a future year	No	Date built values for expansion assets occur in the future	Text	50
Start_Year	Start year for model run (temporary field that will be removed) entered as “XXXX”	Yes	Please enter expected start year of analysis (this field to be eliminated) entered as “XXXX”	Integer	
Agency_Asset_Type	Optional: User defined asset type	No		Text	50
Make_Model	Optional: Asset make/model	No		Text	50
Agency_Asset_ID	Optional: User defined asset ID #	No		Text	50

Appendix D – Field Definitions

Field Name	Description	Required Field?	Notes	Data Type	Text Field Size
Agency_Asset_Parent_ID	Optional: User defined parent asset ID #	No	Used to group related agency asset IDs to a parent number. Example would be to group individual agency asset IDs for components of a maintenance facility (roof, HVAC, etc.) to a common parent ID. Recommended to populate with asset ID if there is no parent ID (to support grouping at Parent ID level)	Text	50
Line_Division	Optional: Rail line or bus division	No		Text	50
Branch_Garage	Optional: Rail branch or bus garage	No		Text	50
Segment_Route	Optional: Rail segment or bus route	No		Text	50
Start	Optional: Mile post marker start	No		Text	50
End	Optional: Mile post marker end	No		Text	50

Appendix D – Field Definitions

Field Name	Description	Required Field?	Notes	Data Type	Text Field Size
Latitude	Optional: Asset location latitude	No		Text	50
Longitude	Optional: Asset location longitude	No		Text	50
Address	Optional: Asset street address	No		Text	255
UserField1	Optional: User defined field (open to user to determine field contents)	No		Text	100
UserField2	Optional: User defined field (open to user to determine field contents)	No		Text	100
UserField3	Optional: User defined field (open to user to determine field contents)	No		Text	100
UserField4	Optional: User defined field (open to user to determine field contents)	No		Text	100
Dept_Asset_Owner	Optional: Identifies which agency department is responsible for the asset	No		Text	50

Appendix D – Field Definitions

Field Name	Description	Required Field?	Notes	Data Type	Text Field Size
Agency_Project_Number	Optional: Identifies project number asset would be grouped with for reinvestment	No	E.g., various segments of trackwork might be grouped together into a single project	Text	30
Agency_Project_Category	Optional: Identifies type or name assets with same Agency_Project_Number would be grouped with for reinvestment	No	E.g., various types of trackwork might be grouped together into a single project type	Text	150
Agency_project_Desc	Optional: Provides project or asset specific description for assets grouped with same Agency_Project_Number	No		Text	100