SDMPO Project Prioritization Scoring Technical Memorandum

October 2021

Executive Summary

In support of the development of future regional project selection for the Sherman-Denison Metropolitan Planning Organization (SDMPO), Alliance Transportation Group (ATG) has conducted an analysis to facilitate scoring and prioritization of potential on-system roadway projects in Grayson County, Texas. This technical memorandum provides the SDMPO with an overview of the methodology, analysis, and results of the scoring process.

These results are intended to act as a resource in the development of future project review and selection by providing guidance in accordance with the Texas Department of Transportation (TxDOT) Decision Lens scoring criteria, the Federal FAST Act requirements, and local priorities identified by the SDMPO Transportation Advisory Committee (TAC).

The objectives of this process are listed below and were developed as part of a process to inform project development and the project prioritization process for the Sherman-Denison MPO. These objectives include:

- Identify projects that account for and properly describe regional benefits;
- Define and execute the steps necessary to ensure that SDMPO projects compete for statewide funding opportunities; and
- Ensure that project descriptions and inputs are consistent with state/federal priorities and performance measures.

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Introduction

The data-driven process for evaluating projects is intended to identify and support SDMPO to create competitive funding opportunities for SDMPO projects. ATG helped TxDOT develop and implement the process for leveraging data to inform decision making for project selection through the Performance Metrics - Data Integration System (PM-DIS). PM-DIS is primarily intended for use in preprocessing projects for Decision Lens, being the main process used for scoring projects for TxDOT's Unified Transportation Program (UTP). This process has been used in the development of the UTP since 2019.

Analysis

The PM-DIS gathers and processes data for the prioritization of projects for a funding approach based on a data-driven process. At times, when MPOs submit projects to TxDOT, the results of the TxDOT Decision Lens scoring process may come as a surprise, either positive or negative, as local scoring process outcomes may not reflect scoring in the Decision Lens as anticipated. To assist the SDMPO in the development of projects that will score well in the TxDOT Decision Lens, and successfully receive funding in a competitive funding arena, ATG used the data from PM-DIS to forecast potential project scores on all TxDOT on system roadways within the SDMPO planning area.

Potential project sponsors – the Paris TxDOT District, SDMPO, or local jurisdictions – are able to identify the specific location of potential projects, gain an understanding of the underlying performance data for the location and then forecast the performance of the transportation system with and without the project location. This forecast forms the basis of the project scoring. Not only does PM-DIS enable TxDOT to use a data-driven, predictive, performance-based process in prioritizing projects, it provides more transparency in how project selection is done and allows the project sponsors to pre-test projects before submitting them for consideration.

PM-DIS Project Forecasting

One of the major advancements made by PM-DIS is the way it pulls together all of the data needed for the project evaluation into a single system for analysis, using five major TxDOT databases. These databases cover roadway characteristics, traffic volumes, truck movements, crash history and pavement condition, bridge condition, and project history. PM-DIS generates values for performance metrics in six areas: safety, preservation, economics, congestion, environment, and connectivity. These metrics are combined using a well-documented system of weighting the criteria and individual metrics to produce scores for the location with and without the project.

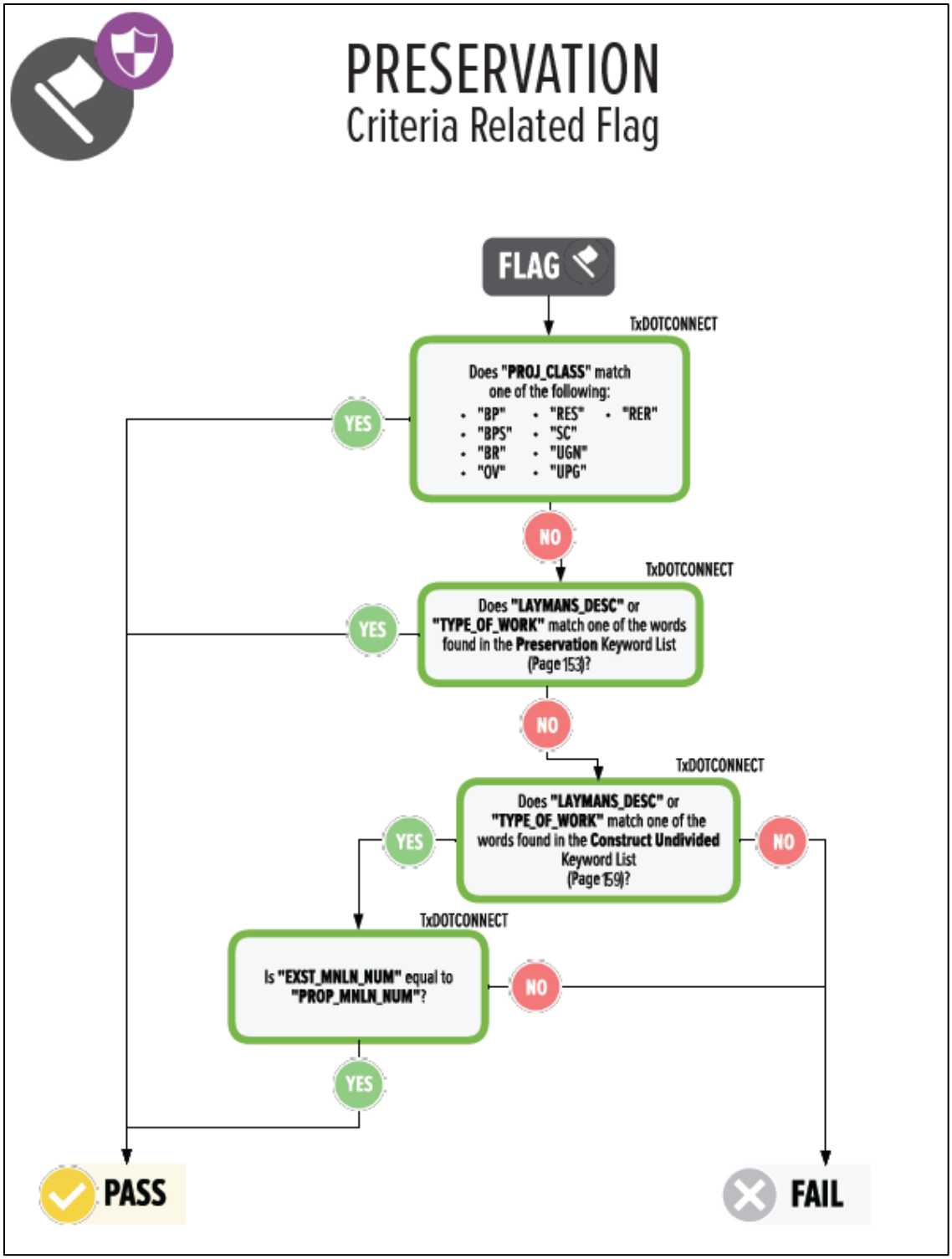
For example, the safety performance metric is made up of four sub-criteria. The criteria each make up 25% of the total safety score. The sub-criteria include crash count, crash rate, societal cost savings, and safety importance. **Figure 1** below shows the scoring chart for the safety performance measure.

Figure 1: Safety Performance Measure Criteria

CRITERIA	CRITERION %	SUB-CRITERIA		% OF TOTAL
SAFETY	31.42%	Crash Count 25%	Estimated Impact on Fatal and Serious Injury Crashes 50%	3.928%
			Estimated Impact on Total Crashes 50%	3.928%
		Crash Rate 25%	Estimated Impact on Fatal and Serious Injury Crash Rate 50%	3.928%
			Estimated Impact on Total Crash Rate 50%	3.928%
		Societal Cost Savings 25%		7.855%
		Safety Importance 25%	Safety Project Classification Y/N 50%	3.928%
			Evacuation Route Y/N 50%	3.928%

Figure 2 on the following page.

Figure 2: Preservation Criteria Related Flagging Process



Baseline Pre-Processing Methodology

As previously mentioned, the process of completing a baseline project prioritization score was developed using the PM-DIS. The following bullets detail the settings and steps used to calibrate the projects for the PM-DIS template and integrate it with the TxDOT scoring process.

1. ATG resolved a selection of all state-maintained roadways within the MPO area, with beginning and ending mile points matching the area limits.
2. Each major control-section corridor with its mile point limits was entered as a "project" in the PM-DIS spreadsheet template with a uniform description, numeric effects, etc.
    - Description: "UPGRADE TO STANDARDS, WIDEN FROM X TO Y LANES, REPLACE STRUCTURES AND APPROACHES, RESURFACE PAVEMENT, ECONOMIC".
    - Project Classification: "WF"
    - Letting Date: 1/2025
    - Existing Mainlanes: actual
    - Proposed Mainlanes: actual + 2
    - Trunk System: pulled from historical projects from TxDOTCONNECT for the control-section
    - National Highway System: pulled from historical projects from TxDOTCONNECT for the control-section
    - Toll: pulled from historical projects from TxDOTCONNECT for the control-section
    - Energy Sector: pulled from historical projects from TxDOTCONNECT for the control-section
3. The template was uploaded to PM-DIS as a portfolio.
4. Results of the PM-DIS statewide performance metrics model were exported.
5. ATG then developed a spreadsheet to apply the Decision Lens scoring strategy to the raw PM-DIS predictive performance metrics results, using the TPP statewide weighting.
6. To illustrate the outputs of the PM-DIS, ATG created an online dashboard (see results section below) to view detailed maps and charts of results for each evaluation area.

SDMPO Portfolio

The portfolio created from step #3 in the above methodology process can be used as a template for updating future project scoring. As priorities and challenge areas continue to change, the MPO will have the option to adjust the project location and descriptions in the template to prepare for submitting into Decision Lense at anytime. The excel template is provided along with this methodology.

Funding

Potential State Funding Sources

The State of Texas maintains categorized funding programs that for the most part coincide with Federal funding programs. Traditionally this funding is used to match federal sources and to fund the operations of the state Department of Transportation. The primary funding source for the Texas state program comes from motor fuels taxes allocations, motor vehicle registration fees, severance taxes allocations, and many other revenue sources and fees, including voter approved constitutional amendments Proposition 1 and Proposition 7, which redirect funding from the general fund to be spent on transportation projects. Categories 1-9 of the Texas UTP are federal and state programmatic funding categories, while categories 10, 11, and 12 are strategic and discretionary funding categories.

TxDOT's 2022 UTP [1] provides the following definitions and criteria for each funding category.

Category 1: Preventative Maintenance and Rehabilitation

Category 1 deals with preventative maintenance and rehabilitation of the existing highway system, which includes pavement, signs, traffic signalization, and other assets that can be considered part of the highway infrastructure. Preventative maintenance works to preserve, rather than improve the structural integrity of current pavements and structures. Rehabilitation focuses on repairing (which can also be considered modernizing) existing main lanes, structures, frontage roads, and other infrastructure assets.

Projects are selected by districts using a performance-based prioritization process that assesses district-wide maintenance and rehabilitation needs. The Texas Transportation Commission allocates funds through a formula allocation program.

Category 2: Metropolitan and Urban Area Corridor Projects

Category 2 addresses mobility and added capacity projects on urban corridors to mitigate traffic congestion, as well as increasing traffic safety and improving roadway maintenance or rehabilitation. Projects must be located on the state highway system. Roadway widening (both freeway and non-freeway), interchange improvements, and roadway operational improvements are common within Category 2.

Projects are selected by MPOs in consultation with TxDOT using a performance-based prioritization process that assesses mobility needs within the MPO boundaries. Project funds must be authorized by the Texas Transportation Commission by formula.

Category 3: Non-Traditionally Funded Transportation Projects

Transportation-related projects that qualify for funding from sources not traditionally part of the state highway fund, including state bond financing under programs such as Proposition 12 (General Obligation Bonds), Texas Mobility Fund, pass-through toll financing, unique federal funding, regional toll revenue, and local participation funding. New-location roadways, roadway widening, and interchange improvements are common project types that receive Category 3 funds. Projects are determined by legislation, Texas Transportation Commission-approved Minute Order, or local government commitments.

[1] 2022 Unified Transportation Program (txdot.gov)

Category 4: Statewide Connectivity Corridor Projects

Corridors are selected by the Texas Transportation Commission based on engineering analyses of three corridor types: mobility, connectivity, and strategic corridors. Funds are allocated by the Commission to TxDOT districts. Districts select projects along approved corridors in consultation with MPO's, the Transportation Planning and Programming Division (TPP), and TxDOT Administration using a performance-based evaluation.

Category 5: Congestion Mitigation and Air Quality Improvement (CMAQ)

Congestion mitigation and air quality improvement projects address attainment of a national ambient air quality standard in non-attainment areas of the state, which does not include Grayson County. Projects that relate to maintaining the non-attainment status may also be eligible for CMAQ funds.

Category 6: Structures Replacement & Rehabilitation (Bridge)

Category 6 projects address replacement and rehabilitation of deficient existing bridges located on public highways, roads, and streets in the state; construction of grade separations at existing highway and railroad grade crossings; and rehabilitation of deficient railroad underpasses on the state highway system.

Projects are selected by the Bridge Division (BRG) based on a listing of eligible bridges prioritized first by deficiency categorization (structurally deficient followed by functionally obsolete) and then by sufficiency ratings. Railroad grade separation projects are selected based on a cost-benefit index rating. Projects in the Bridge Management and Improvement Program (BMIP) are selected statewide based on identified bridge maintenance and improvement needs to aid in ensuring the management and safety of the state's bridge assets. The Texas Transportation Commission allocates funds through the Statewide Allocation Program.

Category 7: Metropolitan Mobility & Rehabilitation

Projects within Category 7 address transportation needs within the boundaries of designated metropolitan planning areas for metropolitan planning organizations located in a transportation management area (areas with populations of 200,000 or more).

Projects are selected by MPOs operating in transportation management areas, in consultation with TxDOT. The MPOs use a performance-based prioritization process that assesses mobility needs within the MPO boundaries.

Category 8: Safety

Category 8 contains safety-related projects both on and off the state highway system including the federal Highway Safety Improvement Program, Safety Bond Program, Systemic Widening Program, Federal Railway Set-Aside, and Road to Zero (RTZ). Projects are selected statewide by federally mandated safety indices and a prioritized listing. Projects selected in each program are evaluated by relevant safety or railroad factors and indexes. The Texas Transportation Commission allocates funds through the Statewide Allocation Program.

Category 9: Transportation Alternatives Set-Aside Program

Projects in Category 9 include transportation-related activities as described in the Transportation Alternatives (TA) Set-Aside Program, such as on- and off-road pedestrian and bicycle facilities, and infrastructure projects for improving access to public transportation. For urbanized areas with populations over 200,000, the MPO selects TA projects through a competitive process in consultation with TxDOT.

Funds allocated to small urban areas and non-urban areas (i.e., areas with populations below 200,000) are administered by TxDOT through a competitive process to be managed by the Public Transportation Division through a competitive process. The Texas Transportation Commission selects projects for funding under a TxDOT administered call for projects. Statewide TA Flex projects are also selected by the Commission. All projects are selected using a performance-based prioritization process that assesses local transportation needs, including bicycle and pedestrian access.

Category 10: Supplemental Transportation Programs

Category 9 covers transportation-related projects that do not qualify for funding in other categories, including landscape and aesthetic improvement, erosion control and environmental mitigation, construction and rehabilitation of roadways within or adjacent to state parks, fish hatcheries, and similar facilities, replacement of railroad crossing surfaces, maintenance of railroad signals, construction or replacement of curb ramps for accessibility to pedestrians with disabilities, and miscellaneous federal programs.

Supplemental Transportation Projects

The Texas Parks and Wildlife Department (TPWD) selects State Park Roads projects in coordination with districts. The TxDOT Rail Division in coordination with districts selects Railroad Grade Crossing Re-planking and Railroad Signal Maintenance projects. Landscape Incentive Awards are distributed to 10 locations based on the results of the Keep Texas Beautiful Awards Program and managed by the TxDOT Design Division.

Green Ribbon allocations are based on one-half percent of the estimated letting capacity for the TxDOT districts that contain air quality non-attainment or near non-attainment counties and managed by the TxDOT Design Division. Curb Ramp Program projects are selected based on conditions of curb ramps or the location of intersections without ramps and are managed by the Design Division.

Category 11: District Discretionary

Category 11 projects are eligible for federal or state funding and selected at the district engineer's discretion. Additionally, Category 11 addresses transportation needs that may impact the Energy Sector and Border Infrastructure (Rider 11(b)). Projects are selected by districts. The Texas Transportation Commission allocates funds through a formula allocation program.

A minimum $2.5 million allocation goes to each district per legislative mandate. The Commission may supplement the funds allocated to individual districts on a case-by-case basis to cover project cost overruns, as well as energy sector initiatives. Rider 11 (b) is also selected by the Commission dependent on the number of land border ports of entry, incoming commercial freight traffic, incoming personal motor vehicles and buses, and the weight of incoming cargo by commercial trucks.

Category 12: Strategic Priority

Projects with specific importance to the state, including those that generally improve congestion and connectivity, energy sector access, and border and port connectivity, promote economic opportunity, increase efficiency on military deployment routes or retain military assets in response to the federal military base realignment and closure reports, and maintain the ability to respond to both manmade and natural emergencies. The Texas Transportation Commission selects projects statewide using a performance-based prioritization process.

TxDOT District Planning Targets

Grayson County is in the Paris TxDOT District. A number of key projects in Grayson County are outlined in the 2022 UTP, which include the following projects in the short-term stage (next four or so years):

- US 75: widen from the Collin County Line to FM 902, four to six lanes
- US 75: widen from US 82 to North Loy Lake Road, four to six lanes

In the outlying years of the UTP (in the next five or more years) the following project is listed:

- US 75: widen from FM 902 to FM 1417 and SH 91 to US 82, four to six lanes

The District planning targets, as expressed in the 2022 UTP cover planning for these and other projects, as well as an allowance for the development of other efforts in coordination with the MPOs in the District's planning area. Coordinating with the Paris TxDOT District on these planning targets and possible estimated amounts within Grayson County will be crucial in helping SDMPO and their planning partners develop fiscally feasible projects.

In **Figure 3** on the following page, illustrates the most common project types that are funded for each UTP category. These project elements by funding category can be a useful reference in the development of project scope descriptions from the segments identified in the PM-DIS baseline scoring described in this memo.

Figure 3: Common Project Types in the UTP Funding Categories

These tables list the most common project types funded through each category in the 2022 UTP, as well as the statewide strategic goals that each project type addresses. All 12 UTP funding categories address all three strategic goals to varying degrees.

	% OF PROGRAMMED FUNDS	STRATEGIC GOALS: PROMOTE SAFETY	PRESERVE OUR ASSETS	OPTIMIZE PERFORMANCE
CATEGORY 1: PREVENTIVE MAINTENANCE AND REHAB				
Road surface treatment	43%		✪	☆
Road rehab and restoration	41%		✪	☆
Rural passing lanes (Super 2)	5%	☆		✪
Traffic signals, lighting, signs	3%	✪		☆
All other project types	8%			
CATEGORY 2: METROPOLITAN AND URBAN CORRIDORS				
Widening (freeway or non-freeway)	74%	☆	☆	✪
Freeway interchanges	16%	☆		✪
Roadway operational improvements	5%	☆		✪
All other project types	5%			
CATEGORY 4: CONNECTIVITY CORRIDORS				
Widening (freeway or non-freeway)	67%	☆	☆	✪
Freeway interchanges	8%	☆		✪
New-location rural highway	9%			✪
Roadway operational improvements	9%	☆		✪
All other project types	7%			
CATEGORY 5: CONGESTION MITIGATION AND AIR QUALITY				
Intersection improvements	38%	☆		✪
Freeway interchanges	26%	☆	☆	✪
Bike and pedestrian infrastructure	16%	✪		☆
Traffic mgmt. technology and signals	11%	☆		✪
Public transit, commute alternatives	8%			✪
All other project types	1%			

	% OF PROGRAMMED FUNDS	STRATEGIC GOALS: PROMOTE SAFETY	PRESERVE OUR ASSETS	OPTIMIZE PERFORMANCE
CATEGORY 6: STRUCTURES (BRIDGE)				
Bridge replacement	84%	☆	✪	
Bridge rehab or widening	8%	☆	✪	☆
Bridge maintenance	5%		✪	
All other project types	3%			
CATEGORY 7: METROPOLITAN MOBILITY AND REHAB				
Widening (freeway or non-freeway)	57%	☆	☆	✪
New-location urban roadway	14%			✪
Roadway operational improvements	7%	☆		✪
Traffic studies, transit programs, etc.	7%			✪
Freeway interchanges	7%	☆		✪
All other project types	8%			
CATEGORY 8: SAFETY				
Medians and safety barriers	29%	✪		
Intersections and rail crossings	27%	✪		☆
Turn lanes, passing lanes, shoulders	26%	✪		☆
Traffic signals, lighting, signs	9%	✪		☆
Rumble strips	4%	✪		
All other project types	5%			
CATEGORY 9: TRANSPORTATION ALTERNATIVES				
Bike and pedestrian infrastructure	77%	✪		☆
Border crossing facilities	16%			✪
Public transit	4%			✪
All other project types	3%			

	% OF PROGRAMMED FUNDS	STRATEGIC GOALS: PROMOTE SAFETY	PRESERVE OUR ASSETS	OPTIMIZE PERFORMANCE
CATEGORY 10: SUPPLEMENTAL TRANSPORTATION PROGRAMS				
Coastal ferry facilities	32%		☆	✪
Border region infrastructure	26%			✪
Culverts and storm drainage	16%	☆	✪	
State park roads and parking lots	16%		✪	
Sidewalks and curb ramps	4%	✪		
All other project types	15%			
CATEGORY 11: DISTRICT DISCRETIONARY				
Road rehab and restoration	33%		✪	☆
Rural passing lanes (Super 2)	18%	☆		✪
Roadway operational improvements	16%	☆		✪
Widening (freeway or non-freeway)	14%	☆	☆	✪
Road surface treatment	6%		✪	☆
All other project types	13%			
CATEGORY 12: STRATEGIC PRIORITY				
Widening (freeway or non-freeway)	84%	☆	☆	✪
Freeway interchanges	10%	☆		✪
New-location highway	4%			✪
All other project types	2%			

✪ = Primary goal addressed
☆ = Secondary goal addressed

SOURCE: TXDOT 2022 UNIFIED TRANSPORTATION PLAN

Potential Local Funding Sources

It is typically the responsibility of the local government jurisdictions to cover any costs not covered by federal and state programs. Local funding can come from a variety of sources including property taxes, sales taxes, user fees, special assessments, and impact fees. Match requirements make local funds critical to maintain eligibility for several federal and state funding sources, which is typically around 20% of total project costs for federal funding sources.

Property Taxes

Property taxation has historically been the primary source of funding for local governments in the United States. Property taxes account for more than 80% of all local tax revenues. Property is not subject to federal government taxation but is taxed at a high rate within the state of Texas given the lack of state and local-option income taxes.

General Sales Taxes

The general sales and use tax is also an important funding source for local governments. The most commonly known form of the general sales tax is the retail sales tax. The retail sales tax is imposed on a wide range of commodities, and the rate is usually a uniform percentage of the selling price.

User Fees

User fees are fees collected from those who use a service or facility. The fees are collected to pay for the cost of a facility, finance the cost of operations, and/or generate revenue for other uses. User fees are commonly charged for public parks, water and sewer services, transit systems, and solid waste facilities. The theory behind the user fee is that those who directly benefit from these public services pay for the costs.

Special Assessments

Special assessment is a method of generating funds for public improvements, whereby the cost of a public improvement is collected from those who directly benefit from the improvement. In many instances, new streets are financed by special assessment. The owners of property located adjacent to the new streets are assessed a portion of the cost of the new streets based on the amount of frontage they own along the new streets.

Impact Fees

Development impact fees have been generally well received in other states and municipalities in the United States. New developments create increased traffic volumes on the streets around them, and development impact fees are a way of attempting to place a portion of the burden of funding improvements on developers who are creating or adding to the need for improvements. An example of this type of local funding source would be the $2,500 impact fee recently enacted by the city of Sherman.

Bond Issues

Property tax and sales tax funds can be used on a pay-as-you-go basis, or the revenues from these taxes can be used to repay general obligation or revenue bonds. These bonds are issued by local governments upon approval of the voting public.

Estimating Costs

Federal regulations define "total project cost" for the purpose of estimating fiscal constraint to include:

- Planning elements (e.g. environmental studies and functional studies);
- Engineering costs (e.g. preliminary engineering and design);
- Preconstruction activities (e.g. ROW acquisition);
- Construction activities; and
- Contingencies.

The following assumptions could be used to help guide the development of cost estimates for any future proposed projects in Grayson County, as well as the maintenance and operation of the existing transportation system.

1. Because federal regulations do not require that the cost of maintenance and operations activities be computed for individual projects, the funding needed for maintenance and operation of the transportation infrastructure was estimated on a system-wide level.
2. Whenever a detailed engineering estimate for a particular project is not available, generalized planning-level cost figures can be used to assess the cost of each of the project's elements. These generalized cost figures can come from cost estimates derived from the sketch tool on the TxDOT planning map. [2]
3. In the absence of detailed, local inflation information for construction related activities, an inflation rate of 4.0% for Texas portions of projects can generally be used for project cost estimation based on TxDOT guidance.
4. Project costs should, where applicable, be estimated to include construction costs as well as right-of-way acquisition and engineering costs in consultation with project sponsors.

Both typical improvement costs and local knowledge of other project costs should be used to develop cost estimates for projects considered for the MTP or for submission to TxDOT for consideration. In keeping with federal regulations, cost estimates should be computed in average YOE dollars, using the inflation factors outlined above in accordance with FHWA and TxDOT guidance. The process of summarizing the funding for both mobility and preservation programs in contrast to the total costs of projects can also help show fiscal constraint not only for the development and construction of the planned projects, but for the sustained maintenance and operations of these projects as well.

As the economic impacts of the shutdown associated with COVID-19 become better understood, it's possible the financial revenue projections may need to be adjusted downward. Maintaining a cushion between expenditures and revenues pending further insight into current economic trends can help provide a conservative outlook that will allows the SDMPO to be confident that the projects developed through this process will be financially constrained even if the economy is slow to recover from the current economic uncertainties.

[2] Statewide Planning Map (txdot.gov)

Results

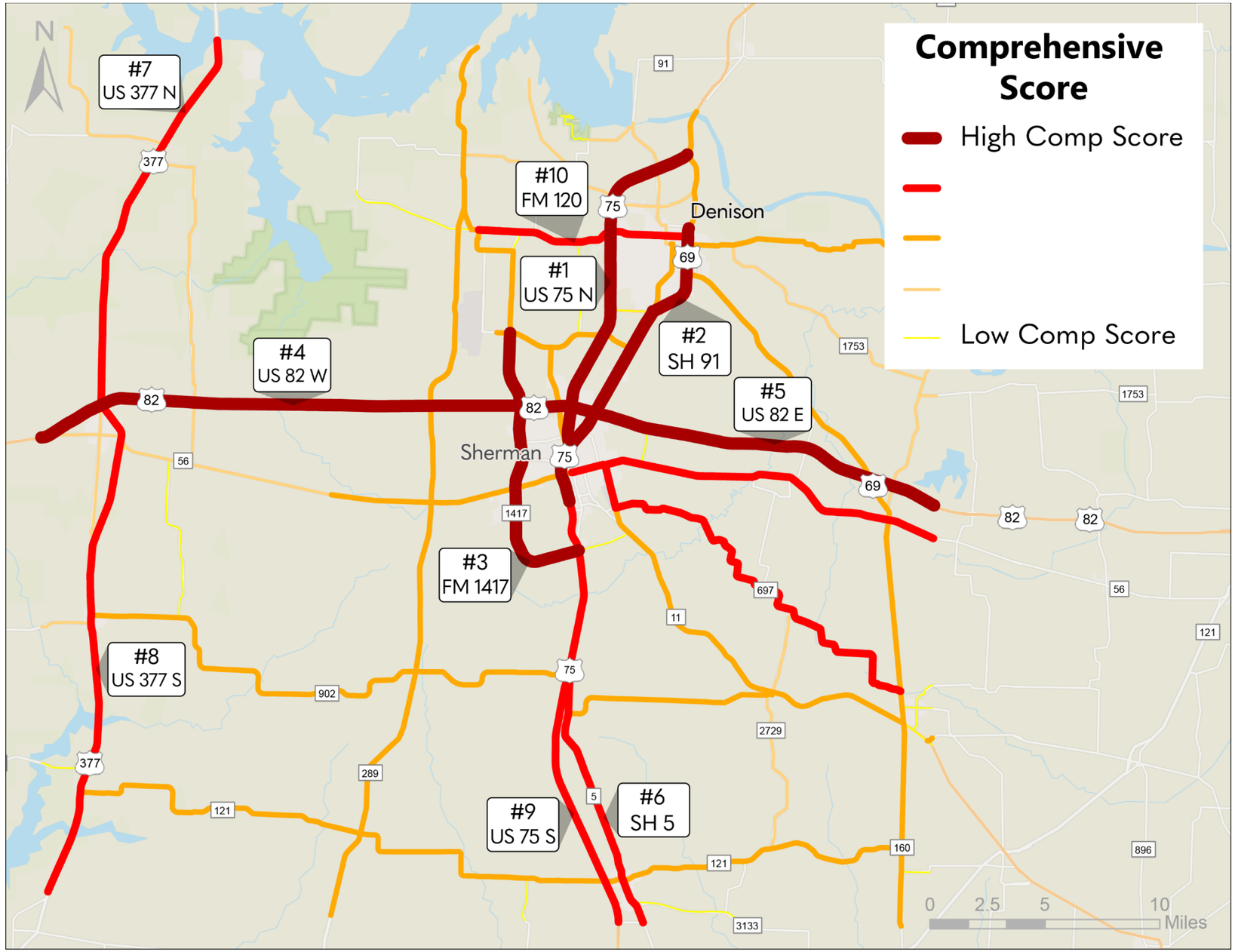
PM-DIS results are shown for each evaluation area, safety, preservation, congestion, connectivity, economic, and a final comprehensive score. For an interactive and more detailed experience with PM-DIS results, please visit the online dashboard created by ATG, located here: SDMPO Project Prioritization Tool with PMDIS.

The comprehensive scores as produced through this process are also represented in **Figure 4** and **Table 1** on the following pages, where they show the top ten overall scores.

In addition to the comprehensive score, **Table 1** also shows whether the project was within the top 10 of the five evaluation areas, by marking "Yes" in the respective column. For every project that had a top ten score in any of the five evaluation areas, the table also indicates the 2021 TxDOT UTP funding categories for which each top ten project may potentially qualify. **Table 2** through **Table 6** show Safety, Preservation, Congestion, Connectivity, and Economic scores respectively.

As mentioned in the funding section, coordinating with TxDOT on planning target dollar amounts by category, and developing projects that utilize key elements that score favorably for each funding category, SDMPO will be able to not only develop projects that score more competitively, but also have a greater potential to impact regional mobility.

Figure 4: Top Ten Comprehensive PM-DIS Scores



Comprehensive Scores

Table 1: Comprehensive Corridor Scores

ID #	Control Section	Corridor	From (milepost)	To (milepost)	Comprehensive Score	PM-DIS Evaluation Area Top 10 Scores					Potential 2021 TxDOT UTP Funding Opportunities												Possible Funding Categories
						Safety	Preservation	Congestion	Connectivity	Economic	1 - Preventative Maintenance and Rehabilitation	2 - Metropolitan and Urban Area Corridor Projects	3 - Non-Traditionally Funded Transportation Projects	4 - Statewide Connectivity Corridor Projects	5 - Congestion Mitigation and Air Quality Improvement (CMAQ)	6 - Structures Replacement & Rehabilitation (Bridge)	7 - Metropolitan Mobility & Rehabilitation	8 - Safety	9 - Transportation Alternatives Set-Aside Program	10 - Supplemental Transportation Programs	11 - District Discretionary	12 - Strategic Priority	
1	0047-18	US 75	12.245	12.411	0.42	Yes	Yes	Yes	Yes	Yes	✓	✓		✓				✓					4
2	0047-02	SH 91	11.985	12.497	0.36	Yes	Yes	Yes	Yes	Yes	✓	✓						✓					3
3	2455-01	FM 1417	6.393	6.545	0.31	Yes		Yes				✓						✓					2
4	0045-18	US 82	402.969	402.97	0.29	Yes	Yes	Yes	Yes	Yes	✓	✓		✓				✓					4
5	0045-19	US 82	421.866	421.867	0.28	Yes	Yes	Yes	Yes	Yes	✓	✓		✓				✓					4
6	0047-03	SH 5	0.104	0.105	0.27	Yes	Yes	Yes	Yes	Yes	✓	✓						✓					3
7	0081-10	US 377	10.751	11.643	0.24		Yes		Yes		✓	✓		✓									3
8	0081-07	US 377	29.398	29.403	0.23			Yes	Yes			✓		✓									2
9	0047-13	US 75	30.16	30.352	0.22			Yes	Yes	Yes		✓		✓									2
10	0728-01	FM 120	12.947	12.971	0.19			Yes		Yes		✓											1
11	0045-04	SH 56	32.479	32.942	0.18				Yes	Yes		✓											1
12	0202-09	FM 697	3.442	3.452	0.18		Yes		Yes		✓	✓											2
13	0091-01	SH 289	32.904	32.905	0.15		Yes				✓	✓											2
14	2192-01	SH 11	8.775	8.822	0.15				Yes			✓											1
15	0510-02	FM 902	41.713	41.766	0.15				Yes			✓											1
16	0410-01	US 69	12.739	13.002	0.14				Yes			✓		✓									2
17	0047-01	US 69	0.151	0.152	0.13				Yes	Yes		✓		✓									2
18	0202-08	SH 289	3.112	3.56	0.13	Yes						✓						✓					2
19	0045-03	SH 56	14.259	14.338	0.12																		
20	0729-01	FM 121	20.106	20.127	0.12		Yes				✓	✓											2
21	0728-02	FM 120	14.162	14.286	0.11																		
22	0410-02	US 69		0.278	0.11			Yes				✓		✓									2
23	0047-12	SH 91	7.624	7.642	0.11	Yes						✓						✓					2
24	0510-01	FM 902	19.547	20.102	0.11		Yes				✓	✓											2
25	0666-01	FM 691	2.112	3.288	0.10																		
26	0729-02	FM 121	27.278	28.046	0.09																		
27	2139-01	SH 11	17.394	17.395	0.09	Yes						✓						✓					2
28	0705-01	SH 91	1.487	1.604	0.09																		

ID #	Control Section	Corridor	From (milepost)	To (milepost)	Comprehensive Score	PM-DIS Evaluation Area Top 10 Scores					Potential 2021 TxDOT UTP Funding Opportunities												Possible Funding Categories
						Safety	Preservation	Congestion	Connectivity	Economic	1 - Preventative Maintenance and Rehabilitation	2 - Metropolitan and Urban Area Corridor Projects	3 - Non-Traditionally Funded Transportation Projects	4 - Statewide Connectivity Corridor Projects	5 - Congestion Mitigation and Air Quality Improvement (CMAQ)	6 - Structures Replacement & Rehabilitation (Bridge)	7 - Metropolitan Mobility & Rehabilitation	8 - Safety	9 - Transportation Alternatives Set-Aside Program	10 - Supplemental Transportation Programs	11 - District Discretionary	12 - Strategic Priority	
29	1379-01	FM 901	4.374	4.379	0.09																		
30	0081-15	BU 377D		0.223	0.08	Yes						✓						✓					2
31	1709-01	FM 1753	9.741	10.083	0.08																		
32	2640-02	FM 406		0.688	0.08																		
33	0045-02	SH 56	1.754	1.803	0.07																		
34	0047-19	SS 503	1.464	1.538	0.07					Yes													
35	0316-02	FM 84	7.14	7.418	0.07																		
36	0316-03	FM 1753	3.858	3.922	0.07																		
37	2640-01	FM 1310	0.953	1.065	0.07																		
38	0728-03	FM 1897	4.628	4.643	0.06																		
39	0081-08	BU 377B	0.629	0.99	0.06																		
40	2459-02	FM 902	11.321	11.354	0.06																		
41	2798-02	FM 2729		0.339	0.06																		
42	0202-13	US 69	26.277	26.411	0.06																		
43	2798-03	FM 2729	3.957	4.923	0.06																		
44	2453-02	FM 1417	20.755	20.925	0.06																		
45	0729-03	FM 814	0.703	0.885	0.06																		
46	2454-01	FM 131	2.534	2.566	0.05																		
47	1379-02	FM 901	21.253	22.637	0.05																		
48	0728-04	FM 120	4.265	4.448	0.05																		
49	3236-01	FM 3133	3.811	3.969	0.05																		
50	0202-01	FM 151	1.016	1.092	0.05																		
51	3427-02	FM 3356	1.536	1.544	0.05																		
52	1855-02	FM 922	38.894	38.921	0.05																		
53	2456-01	FM 1417		0.738	0.04																		
54	0510-03	FM 898	1.697	1.711	0.04																		
55	0081-16	BU 377C	0.386	0.627	0.04																		
56	0047-16	SS 381		0.303	0.04																		
57	2641-01	PR 20A		0.6	0.04																		
58	0081-17	SS 129		0.277	0.04																		

Safety Scores

Table 2: Safety Scores Sorted by Societal Cost Savings

Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Safety					
					Total Safety Score Rank	Crash Count		Crash Rate		Societal Cost Savings
						Estimated Impact on Fatal and Incapacitating Injury Crashes	Estimated Impact on Total Crashes	Estimated Impact on Fatal and Serious Injury Crash Rate	Estimated Impact on Total Crash Rate	
0047-18	US 75	12.245	12.41	41.973%	1	100.0%	84.9%	1.9%	8.3%	100.0%
0047-02	SH 91	11.985	12.5	35.542%	2	83.7%	100.0%	0.9%	5.7%	68.8%
0045-18	US 82	402.969	403	29.096%	3	74.5%	73.5%	2.0%	10.2%	57.5%
0047-03	SH 5	0.104	0.105	27.340%	4	52.3%	52.2%	0.7%	3.4%	43.2%
2139-01	SH 11	17.394	17.4	9.253%	5	2.0%	0.2%	100.0%	41.9%	0.4%
0047-12	SH 91	7.624	7.642	10.653%	6	16.3%	22.5%	9.1%	65.2%	15.0%
0045-19	US 82	421.866	421.9	28.046%	7	39.9%	41.4%	1.2%	6.5%	34.7%
0202-08	SH 289	3.112	3.56	12.994%	8	42.6%	39.5%	1.3%	6.4%	29.3%
0081-15	BU 377D	0	0.223	8.088%	9	2.0%	0.2%	80.1%	33.5%	0.4%
2455-01	FM 1417	6.393	6.545	30.660%	10	37.5%	28.2%	3.5%	13.7%	28.1%
0666-01	FM 691	2.112	3.288	9.672%	11	27.5%	19.5%	10.4%	38.3%	14.4%
0091-01	SH 289	32.904	32.91	15.426%	12	39.3%	21.5%	2.1%	5.9%	40.5%
0728-02	FM 120	14.162	14.29	11.270%	13	26.1%	19.7%	9.3%	36.1%	16.6%
0081-10	US 377	10.751	11.64	24.237%	14	41.3%	25.0%	3.4%	10.8%	26.9%
1709-01	FM 1753	9.741	10.08	7.682%	15	0.0%	1.2%	0.0%	100.0%	0.8%
0410-01	US 69	12.739	13	14.312%	16	29.4%	22.5%	5.6%	22.0%	20.2%
0047-13	US 75	30.16	30.35	21.556%	17	29.4%	36.7%	0.8%	5.4%	24.3%
0045-03	SH 56	14.259	14.34	12.002%	18	25.6%	32.3%	2.1%	14.0%	21.0%
2192-01	SH 11	8.775	8.822	15.200%	19	24.8%	12.7%	6.9%	18.1%	28.9%
0081-07	US 377	29.398	29.4	23.172%	20	28.8%	21.7%	1.9%	7.3%	31.1%
0705-01	SH 91	1.487	1.604	8.652%	21	14.8%	17.5%	6.5%	39.8%	11.2%
0202-09	FM 697	3.442	3.452	17.824%	22	36.6%	13.5%	5.8%	11.0%	18.7%
0045-04	SH 56	32.479	32.94	18.320%	23	25.5%	25.4%	1.8%	9.3%	21.5%
0728-01	FM 120	12.947	12.97	19.103%	24	8.7%	33.2%	0.8%	16.3%	15.7%
0729-02	FM 121	27.278	28.05	9.399%	25	20.8%	14.6%	4.3%	15.8%	19.2%
2640-01	FM 1310	0.953	1.065	6.656%	26	0.0%	1.9%	0.0%	69.5%	0.3%
0410-02	US 69	0	0.278	10.816%	27	28.1%	17.5%	2.3%	7.3%	15.9%
0510-01	FM 902	19.547	20.1	10.562%	28	16.8%	11.5%	4.7%	16.8%	16.8%
0729-01	FM 121	20.106	20.13	11.889%	29	24.1%	19.3%	1.0%	4.3%	14.1%
1379-01	FM 901	4.374	4.379	8.603%	30	17.2%	10.7%	3.9%	12.6%	16.9%
2640-02	FM 406	0	0.688	7.525%	31	13.4%	5.5%	10.9%	23.3%	8.0%
0510-02	FM 902	41.713	41.77	14.699%	32	20.7%	8.2%	4.8%	9.8%	10.1%
2459-02	FM 902	11.321	11.35	5.997%	33	6.0%	3.2%	10.7%	29.8%	2.3%
0729-03	FM 814	0.703	0.885	5.507%	34	2.0%	0.2%	28.6%	12.0%	3.5%
2798-02	FM 2729	0	0.339	5.958%	35	2.0%	0.8%	13.2%	29.4%	0.6%
0316-02	FM 84	7.14	7.418	6.995%	36	10.7%	9.7%	2.8%	12.9%	7.6%
0202-13	US 69	26.277	26.41	5.915%	37	8.5%	2.5%	11.5%	17.8%	2.5%

Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Safety					
					Total Safety Score Rank	Crash Count		Crash Rate		Societal Cost Savings
						Estimated Impact on Fatal and Incapacitating Injury Crashes	Estimated Impact on Total Crashes	Estimated Impact on Fatal and Serious Injury Crash Rate	Estimated Impact on Total Crash Rate	
0728-03	FM 1897	4.628	4.643	6.310%	38	9.4%	4.3%	6.4%	15.2%	6.2%
2798-03	FM 2729	3.957	4.923	5.857%	39	6.5%	1.8%	12.1%	17.2%	1.8%
0316-03	FM 1753	3.858	3.922	6.699%	40	5.9%	6.3%	3.0%	16.8%	6.7%
0045-02	SH 56	1.754	1.803	7.147%	41	6.0%	9.0%	1.7%	13.0%	8.1%
0081-08	BU 377B	0.629	0.99	6.007%	42	3.9%	4.8%	2.4%	15.2%	4.9%
0047-19	SS 503	1.464	1.538	7.002%	43	4.6%	4.2%	2.6%	12.5%	5.5%
0728-04	FM 120	4.265	4.448	4.798%	44	3.9%	2.5%	3.8%	12.8%	4.4%
2453-02	FM 1417	20.755	20.93	5.755%	45	7.2%	5.2%	1.4%	5.3%	5.6%
1855-02	FM 922	38.894	38.92	4.531%	46	2.0%	1.1%	5.1%	14.9%	0.9%
0202-01	FM 151	1.016	1.092	4.624%	47	0.0%	0.6%	0.0%	22.4%	0.3%
2454-01	FM 131	2.534	2.566	5.172%	48	2.6%	2.0%	3.5%	13.6%	1.5%
0047-01	US 69	0.151	0.152	13.276%	49	9.8%	4.2%	1.0%	2.1%	6.0%
3427-02	FM 3356	1.536	1.544	4.543%	50	0.0%	0.7%	0.0%	21.6%	0.1%
1379-02	FM 901	21.253	22.64	4.911%	51	0.7%	1.1%	1.9%	15.8%	0.3%
2456-01	FM 1417	0	0.738	4.317%	52	0.0%	0.6%	0.0%	14.9%	0.2%
3236-01	FM 3133	3.811	3.969	4.780%	53	0.7%	1.4%	0.9%	9.1%	0.8%
0510-03	FM 898	1.697	1.711	4.288%	54	0.0%	0.6%	0.0%	10.7%	0.1%
0081-16	BU 377C	0.386	0.627	4.013%	55	0.0%	0.2%	0.0%	9.6%	0.1%
0047-16	SS 381	0	0.303	4.006%	56	0.0%	0.2%	0.0%	9.6%	0.1%
2641-01	PR 20A	0	0.6	3.730%	57	0.0%	0.0%	0.0%	0.0%	0.0%
0081-17	SS 129	0	0.277	3.544%	57	0.0%	0.0%	0.0%	0.0%	0.0%

Preservation Scores

Table 3: Preservation Scores

Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Preservation					
					Total Preservation Score Rank	Bridge Condition		Pavement Condition		
						Reduction in Structurally Deficient Deck Area	Deck Area Receiving Preventative Maintenance	Reduction in Poor Lane Miles (by Ride Score)	Lane Mile Receiving Preventive Maintenance (by Ride Score)	Lane Miles Receiving Preventive Maintenance (by Distress Score)
0047-02	SH 91	11.985	12.5	35.542%	1	23.5%	57.8%	5.1%	53.4%	50.7%
0045-19	US 82	421.866	421.9	28.046%	2	0.0%	47.6%	2.9%	100.0%	16.6%
0081-10	US 377	10.751	11.64	24.237%	3	100.0%	0.0%	39.7%	13.6%	8.4%
0729-01	FM 121	20.106	20.13	11.889%	4	0.0%	6.2%	64.1%	19.2%	69.5%
0091-01	SH 289	32.904	32.91	15.426%	5	0.0%	7.2%	26.5%	72.1%	52.9%
0047-03	SH 5	0.104	0.105	27.340%	6	2.9%	12.1%	35.1%	52.8%	50.7%
0047-18	US 75	12.245	12.41	41.973%	7	0.0%	100.0%	47.3%	0.0%	0.0%
0510-01	FM 902	19.547	20.1	10.562%	8	0.0%	1.9%	11.8%	29.4%	100.0%
0045-18	US 82	402.969	403	29.096%	9	0.0%	21.5%	42.7%	48.8%	24.7%
0202-09	FM 697	3.442	3.452	17.824%	10	0.0%	3.6%	100.0%	4.5%	13.9%
0728-01	FM 120	12.947	12.97	19.103%	11	0.0%	3.6%	21.7%	38.8%	53.3%
0081-07	US 377	29.398	29.4	23.172%	12	0.0%	25.0%	69.3%	6.8%	8.4%
0202-08	SH 289	3.112	3.56	12.994%	13	0.0%	0.2%	50.7%	4.5%	51.4%
0045-04	SH 56	32.479	32.94	18.320%	14	0.0%	5.6%	77.5%	0.0%	22.5%
0410-02	US 69	0	0.278	10.816%	15	0.0%	0.6%	11.6%	44.6%	25.4%
0045-03	SH 56	14.259	14.34	12.002%	16	0.0%	7.7%	14.6%	20.4%	38.6%
0510-02	FM 902	41.713	41.77	14.699%	17	0.0%	0.0%	33.1%	4.5%	39.2%
1379-01	FM 901	4.374	4.379	8.603%	18	2.1%	1.2%	25.3%	24.9%	19.5%
0728-02	FM 120	14.162	14.29	11.270%	19	0.0%	0.0%	33.5%	9.1%	29.3%
2455-01	FM 1417	6.393	6.545	30.660%	20	0.0%	0.0%	14.6%	29.9%	22.8%
0729-02	FM 121	27.278	28.05	9.399%	21	0.0%	7.7%	53.5%	0.0%	5.8%
0045-02	SH 56	1.754	1.803	7.147%	22	0.0%	0.4%	40.1%	4.5%	19.8%
0410-01	US 69	12.739	13	14.312%	23	0.0%	1.0%	53.1%	0.0%	0.0%
0316-03	FM 1753	3.858	3.922	6.699%	24	0.0%	0.0%	52.8%	0.0%	0.0%
2192-01	SH 11	8.775	8.822	15.200%	25	0.0%	0.7%	48.7%	0.0%	0.0%
0316-02	FM 84	7.14	7.418	6.995%	26	0.0%	0.9%	45.5%	0.0%	0.0%
2640-02	FM 406	0	0.688	7.525%	27	0.0%	2.8%	14.1%	4.2%	21.4%
0081-08	BU 377B	0.629	0.99	6.007%	28	0.0%	0.0%	24.9%	0.0%	11.2%
0047-01	US 69	0.151	0.152	13.276%	29	0.0%	6.9%	27.4%	0.0%	0.0%
0666-01	FM 691	2.112	3.288	9.672%	30	0.0%	1.1%	16.0%	4.6%	12.3%
0728-03	FM 1897	4.628	4.643	6.310%	31	0.0%	0.3%	32.4%	0.0%	0.0%
0705-01	SH 91	1.487	1.604	8.652%	32	0.0%	0.0%	18.0%	6.8%	6.2%
2798-03	FM 2729	3.957	4.923	5.857%	33	0.0%	0.0%	10.6%	9.1%	11.1%
2798-02	FM 2729	0	0.339	5.958%	34	0.0%	0.0%	17.2%	0.0%	10.8%
1379-02	FM 901	21.253	22.64	4.911%	35	0.0%	0.0%	20.4%	4.5%	2.8%
0047-12	SH 91	7.624	7.642	10.653%	36	0.0%	4.6%	20.3%	0.0%	0.7%
2454-01	FM 131	2.534	2.566	5.172%	37	0.0%	0.0%	5.1%	4.5%	15.7%

Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Preservation					
					Total Preservation Score Rank	Bridge Condition		Pavement Condition		
						Reduction in Structurally Deficient Deck Area	Deck Area Receiving Preventative Maintenance	Reduction in Poor Lane Miles (by Ride Score)	Lane Mile Receiving Preventive Maintenance (by Ride Score)	Lane Miles Receiving Preventive Maintenance (by Distress Score)
3236-01	FM 3133	3.811	3.969	4.780%	38	0.0%	1.5%	19.8%	0.0%	2.8%
0047-13	US 75	30.16	30.35	21.556%	39	0.0%	1.5%	0.0%	18.1%	0.0%
2640-01	FM 1310	0.953	1.065	6.656%	40	0.0%	0.0%	10.0%	0.0%	5.6%
2641-01	PR 20A	0	0.6	3.730%	41	0.0%	0.0%	13.7%	0.0%	0.0%
2453-02	FM 1417	20.755	20.93	5.755%	42	0.0%	3.3%	7.7%	1.1%	1.3%
0510-03	FM 898	1.697	1.711	4.288%	43	0.0%	1.0%	11.5%	0.0%	0.0%
2459-02	FM 902	11.321	11.35	5.997%	44	0.0%	0.0%	10.5%	0.0%	0.0%
0202-01	FM 151	1.016	1.092	4.624%	45	0.0%	0.0%	5.9%	0.0%	2.8%
3427-02	FM 3356	1.536	1.544	4.543%	46	0.0%	0.0%	2.9%	2.3%	2.8%
0081-16	BU 377C	0.386	0.627	4.013%	47	0.0%	0.0%	6.0%	0.0%	0.0%
0729-03	FM 814	0.703	0.885	5.507%	48	0.0%	0.0%	5.8%	0.0%	0.0%
0047-19	SS 503	1.464	1.538	7.002%	49	0.0%	2.6%	1.7%	0.0%	0.0%
0081-15	BU 377D	0	0.223	8.088%	50	0.0%	0.0%	4.2%	0.0%	0.0%
0202-13	US 69	26.277	26.41	5.915%	51	0.0%	0.0%	0.0%	1.6%	2.0%
2456-01	FM 1417	0	0.738	4.317%	52	0.0%	0.0%	0.0%	3.2%	0.0%
1709-01	FM 1753	9.741	10.08	7.682%	53	0.0%	0.0%	0.0%	0.0%	2.1%
0047-16	SS 381	0	0.303	4.006%	54	0.0%	0.0%	0.0%	0.0%	1.4%
0081-17	SS 129	0	0.277	3.544%	55	0.0%	0.0%	0.0%	0.0%	1.0%
2139-01	SH 11	17.394	17.4	9.253%	56	0.0%	0.0%	0.0%	0.0%	0.0%
0728-04	FM 120	4.265	4.448	4.798%	56	0.0%	0.0%	0.0%	0.0%	0.0%
1855-02	FM 922	38.894	38.92	4.531%	56	0.0%	0.0%	0.0%	0.0%	0.0%

Congestion Scores

Table 4: Congestion Scores

Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Congestion		
					Total Congestion Score Rank	Benefit Congestion Index - Auto	Benefit Congestion Index - Truck
2455-01	FM 1417	6.393	6.545	30.7%	1	100.0%	100.0%
0047-18	US 75	12.245	12.41	42.0%	2	38.9%	39.6%
0728-01	FM 120	12.947	12.97	19.1%	3	37.0%	37.0%
0045-19	US 82	421.866	421.9	28.0%	4	32.1%	32.7%
0047-13	US 75	30.16	30.35	21.6%	5	28.5%	28.5%
0045-18	US 82	402.969	403	29.1%	6	21.5%	21.6%
0047-03	SH 5	0.104	0.105	27.3%	7	18.4%	18.6%
0081-07	US 377	29.398	29.4	23.2%	8	25.0%	8.1%
0047-02	SH 91	11.985	12.5	35.5%	9	15.9%	16.4%
0410-02	US 69	0	0.278	10.8%	10	4.1%	4.4%
0045-03	SH 56	14.259	14.34	12.0%	11	6.2%	0.2%
0729-01	FM 121	20.106	20.13	11.9%	12	2.9%	2.9%
0081-10	US 377	10.751	11.64	24.2%	13	2.9%	2.9%
0091-01	SH 289	32.904	32.91	15.4%	14	2.3%	2.3%
0202-08	SH 289	3.112	3.56	13.0%	15	1.9%	1.9%
0047-01	US 69	0.151	0.152	13.3%	16	0.5%	1.6%
2453-02	FM 1417	20.755	20.93	5.8%	17	0.9%	0.9%
0047-12	SH 91	7.624	7.642	10.7%	18	0.6%	0.6%
0666-01	FM 691	2.112	3.288	9.7%	19	0.4%	0.4%
0045-04	SH 56	32.479	32.94	18.3%	20	0.8%	0.0%
0047-19	SS 503	1.464	1.538	7.0%	21	0.3%	0.5%
0729-02	FM 121	27.278	28.05	9.4%	22	0.2%	0.2%
0202-13	US 69	26.277	26.41	5.9%	23	0.1%	0.1%
0705-01	SH 91	1.487	1.604	8.7%	24	0.1%	0.1%
0316-02	FM 84	7.14	7.418	7.0%	25	0.1%	0.1%
0410-01	US 69	12.739	13	14.3%	26	0.1%	0.1%
2192-01	SH 11	8.775	8.822	15.2%	27	0.1%	0.1%
2640-02	FM 406	0	0.688	7.5%	28	0.0%	0.0%
0081-08	BU 377B	0.629	0.99	6.0%	29	0.0%	0.0%
0047-16	SS 381	0	0.303	4.0%	30	0.0%	0.0%
0728-02	FM 120	14.162	14.29	11.3%	31	0.0%	0.0%
0510-02	FM 902	41.713	41.77	14.7%	32	0.0%	0.0%
0045-02	SH 56	1.754	1.803	7.1%	33	0.0%	0.0%
2459-02	FM 902	11.321	11.35	6.0%	34	0.0%	0.0%
0202-09	FM 697	3.442	3.452	17.8%	35	0.0%	0.0%
0728-03	FM 1897	4.628	4.643	6.3%	36	0.0%	0.0%
0316-03	FM 1753	3.858	3.922	6.7%	37	0.0%	0.0%

Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Congestion		
					Total Congestion Score Rank	Benefit Congestion Index - Auto	Benefit Congestion Index - Truck
1855-02	FM 922	38.894	38.92	4.5%	38	0.0%	0.0%
0081-17	SS 129	0	0.277	3.5%	39	0.0%	0.0%
2454-01	FM 131	2.534	2.566	5.2%	40	0.0%	0.0%
0510-01	FM 902	19.547	20.1	10.6%	41	0.0%	0.0%
0728-04	FM 120	4.265	4.448	4.8%	42	0.0%	0.0%
3236-01	FM 3133	3.811	3.969	4.8%	43	0.0%	0.0%
2456-01	FM 1417	0	0.738	4.3%	44	0.0%	0.0%
1379-01	FM 901	4.374	4.379	8.6%	45	0.0%	0.0%
2139-01	SH 11	17.394	17.4	9.3%	46	0.0%	0.0%
0081-15	BU 377D	0	0.223	8.1%	46	0.0%	0.0%
1709-01	FM 1753	9.741	10.08	7.7%	46	0.0%	0.0%
2640-01	FM 1310	0.953	1.065	6.7%	46	0.0%	0.0%
2798-02	FM 2729	0	0.339	6.0%	46	0.0%	0.0%
2798-03	FM 2729	3.957	4.923	5.9%	46	0.0%	0.0%
0729-03	FM 814	0.703	0.885	5.5%	46	0.0%	0.0%
1379-02	FM 901	21.253	22.64	4.9%	46	0.0%	0.0%
0202-01	FM 151	1.016	1.092	4.6%	46	0.0%	0.0%
3427-02	FM 3356	1.536	1.544	4.5%	46	0.0%	0.0%
0510-03	FM 898	1.697	1.711	4.3%	46	0.0%	0.0%
0081-16	BU 377C	0.386	0.627	4.0%	46	0.0%	0.0%
2641-01	PR 20A	0	0.6	3.7%	46	0.0%	0.0%

Connectivity Scores

Table 5: Connectivity Scores

Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Connectivity			
					Total Connectivity Score Rank	Congestion/Connectivity Related Y/N	Trunk Route Y/N	Lane Miles of New Connectivity
0081-07	US 377	29.398	29.4	23.2%	1	100.0%	100.0%	100.0%
0202-09	FM 697	3.442	3.452	17.8%	2	100.0%	100.0%	97.1%
0081-10	US 377	10.751	11.64	24.2%	3	100.0%	100.0%	94.1%
0510-02	FM 902	41.713	41.77	14.7%	4	100.0%	100.0%	90.8%
0045-04	SH 56	32.479	32.94	18.3%	5	100.0%	100.0%	82.7%
2192-01	SH 11	8.775	8.822	15.2%	6	100.0%	100.0%	55.2%
0047-18	US 75	12.245	12.41	42.0%	7	100.0%	100.0%	0.0%
0047-02	SH 91	11.985	12.5	35.5%	7	100.0%	100.0%	0.0%
0045-18	US 82	402.969	403	29.1%	7	100.0%	100.0%	0.0%
0045-19	US 82	421.866	421.9	28.0%	7	100.0%	100.0%	0.0%
0047-03	SH 5	0.104	0.105	27.3%	7	100.0%	100.0%	0.0%
0047-13	US 75	30.16	30.35	21.6%	7	100.0%	100.0%	0.0%
0410-01	US 69	12.739	13	14.3%	7	100.0%	100.0%	0.0%
0047-01	US 69	0.151	0.152	13.3%	7	100.0%	100.0%	0.0%
2455-01	FM 1417	6.393	6.545	30.7%	15	100.0%	0.0%	0.0%
0728-01	FM 120	12.947	12.97	19.1%	15	100.0%	0.0%	0.0%
0091-01	SH 289	32.904	32.91	15.4%	15	100.0%	0.0%	0.0%
0202-08	SH 289	3.112	3.56	13.0%	15	100.0%	0.0%	0.0%
0045-03	SH 56	14.259	14.34	12.0%	15	100.0%	0.0%	0.0%
0729-01	FM 121	20.106	20.13	11.9%	15	100.0%	0.0%	0.0%
0728-02	FM 120	14.162	14.29	11.3%	15	100.0%	0.0%	0.0%
0410-02	US 69	0	0.278	10.8%	15	100.0%	0.0%	0.0%
0047-12	SH 91	7.624	7.642	10.7%	15	100.0%	0.0%	0.0%
0510-01	FM 902	19.547	20.1	10.6%	15	100.0%	0.0%	0.0%
0666-01	FM 691	2.112	3.288	9.7%	15	100.0%	0.0%	0.0%
0729-02	FM 121	27.278	28.05	9.4%	15	100.0%	0.0%	0.0%
2139-01	SH 11	17.394	17.4	9.3%	15	100.0%	0.0%	0.0%
0705-01	SH 91	1.487	1.604	8.7%	15	100.0%	0.0%	0.0%
1379-01	FM 901	4.374	4.379	8.6%	15	100.0%	0.0%	0.0%
0081-15	BU 377D	0	0.223	8.1%	15	100.0%	0.0%	0.0%
1709-01	FM 1753	9.741	10.08	7.7%	15	100.0%	0.0%	0.0%
2640-02	FM 406	0	0.688	7.5%	15	100.0%	0.0%	0.0%
0045-02	SH 56	1.754	1.803	7.1%	15	100.0%	0.0%	0.0%
0047-19	SS 503	1.464	1.538	7.0%	15	100.0%	0.0%	0.0%
0316-02	FM 84	7.14	7.418	7.0%	15	100.0%	0.0%	0.0%
0316-03	FM 1753	3.858	3.922	6.7%	15	100.0%	0.0%	0.0%
2640-01	FM 1310	0.953	1.065	6.7%	15	100.0%	0.0%	0.0%
0728-03	FM 1897	4.628	4.643	6.3%	15	100.0%	0.0%	0.0%
0081-08	BU 377B	0.629	0.99	6.0%	15	100.0%	0.0%	0.0%

					Connectivity			
Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Total Connectivity Score Rank	Congestion/Connectivity Related Y/N	Trunk Route Y/N	Lane Miles of New Connectivity
2459-02	FM 902	11.321	11.35	6.0%	15	100.0%	0.0%	0.0%
2798-02	FM 2729	0	0.339	6.0%	15	100.0%	0.0%	0.0%
0202-13	US 69	26.277	26.41	5.9%	15	100.0%	0.0%	0.0%
2798-03	FM 2729	3.957	4.923	5.9%	15	100.0%	0.0%	0.0%
2453-02	FM 1417	20.755	20.93	5.8%	15	100.0%	0.0%	0.0%
0729-03	FM 814	0.703	0.885	5.5%	15	100.0%	0.0%	0.0%
2454-01	FM 131	2.534	2.566	5.2%	15	100.0%	0.0%	0.0%
1379-02	FM 901	21.253	22.64	4.9%	15	100.0%	0.0%	0.0%
0728-04	FM 120	4.265	4.448	4.8%	15	100.0%	0.0%	0.0%
3236-01	FM 3133	3.811	3.969	4.8%	15	100.0%	0.0%	0.0%
0202-01	FM 151	1.016	1.092	4.6%	15	100.0%	0.0%	0.0%
3427-02	FM 3356	1.536	1.544	4.5%	15	100.0%	0.0%	0.0%
1855-02	FM 922	38.894	38.92	4.5%	15	100.0%	0.0%	0.0%
2456-01	FM 1417	0	0.738	4.3%	15	100.0%	0.0%	0.0%
0510-03	FM 898	1.697	1.711	4.3%	15	100.0%	0.0%	0.0%
0081-16	BU 377C	0.386	0.627	4.0%	15	100.0%	0.0%	0.0%
0047-16	SS 381	0	0.303	4.0%	15	100.0%	0.0%	0.0%
2641-01	PR 20A	0	0.6	3.7%	15	100.0%	0.0%	0.0%
0081-17	SS 129	0	0.277	3.5%	15	100.0%	0.0%	0.0%

Economic Scores

Table 6: Economic Scores

Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Economic					
					Total Economic Score Rank	Economic Importance			System Usage	
						National Highway System (NHS) Route Y(Interstate)/Y/N	National Highway Freight Network Y/N	Energy Sector Route Y/N	Base ADT	Base ADTT
0047-18	US 75	12.245	12.41	42.0%	1	50.0%	0.0%	0.0%	100.0%	100.0%
0047-02	SH 91	11.985	12.5	35.5%	1	50.0%	0.0%	0.0%	100.0%	100.0%
0047-03	SH 5	0.104	0.105	27.3%	3	50.0%	0.0%	0.0%	85.1%	85.1%
0047-01	US 69	0.151	0.152	13.3%	4	50.0%	0.0%	0.0%	53.5%	80.6%
0047-13	US 75	30.16	30.35	21.6%	5	50.0%	0.0%	0.0%	87.8%	43.8%
0045-18	US 82	402.969	403	29.1%	6	50.0%	0.0%	0.0%	49.5%	49.6%
0045-19	US 82	421.866	421.9	28.0%	6	50.0%	0.0%	0.0%	49.5%	49.6%
0047-19	SS 503	1.464	1.538	7.0%	8	50.0%	0.0%	0.0%	24.0%	24.2%
0728-01	FM 120	12.947	12.97	19.1%	9	50.0%	0.0%	0.0%	29.6%	14.8%
0045-04	SH 56	32.479	32.94	18.3%	10	50.0%	0.0%	0.0%	23.5%	11.7%
0081-10	US 377	10.751	11.64	24.2%	11	50.0%	0.0%	0.0%	17.2%	17.4%
0081-07	US 377	29.398	29.4	23.2%	12	50.0%	0.0%	0.0%	20.8%	10.4%
0091-01	SH 289	32.904	32.91	15.4%	13	50.0%	0.0%	0.0%	16.0%	8.0%
0410-01	US 69	12.739	13	14.3%	14	50.0%	0.0%	0.0%	11.8%	12.1%
0728-02	FM 120	14.162	14.29	11.3%	15	50.0%	0.0%	0.0%	8.6%	4.3%
0045-03	SH 56	14.259	14.34	12.0%	16	0.0%	0.0%	0.0%	30.9%	15.4%
0410-02	US 69	0	0.278	10.8%	17	0.0%	0.0%	0.0%	16.9%	25.8%
2455-01	FM 1417	6.393	6.545	30.7%	18	0.0%	0.0%	0.0%	23.3%	11.6%
0047-12	SH 91	7.624	7.642	10.7%	19	0.0%	0.0%	0.0%	15.3%	15.5%
0202-13	US 69	26.277	26.41	5.9%	20	0.0%	0.0%	0.0%	12.8%	13.0%
0729-01	FM 121	20.106	20.13	11.9%	21	0.0%	0.0%	0.0%	17.2%	8.6%
0202-08	SH 289	3.112	3.56	13.0%	22	0.0%	0.0%	0.0%	17.1%	8.5%
2453-02	FM 1417	20.755	20.93	5.8%	23	0.0%	0.0%	0.0%	15.9%	7.9%
2192-01	SH 11	8.775	8.822	15.2%	24	0.0%	0.0%	0.0%	8.7%	13.6%
0705-01	SH 91	1.487	1.604	8.7%	25	0.0%	0.0%	0.0%	9.7%	9.9%
0202-09	FM 697	3.442	3.452	17.8%	26	0.0%	0.0%	0.0%	8.7%	8.9%
0666-01	FM 691	2.112	3.288	9.7%	27	0.0%	0.0%	0.0%	11.3%	5.6%
0510-02	FM 902	41.713	41.77	14.7%	28	0.0%	0.0%	0.0%	6.1%	9.6%
0729-02	FM 121	27.278	28.05	9.4%	29	0.0%	0.0%	0.0%	9.8%	4.9%
0316-02	FM 84	7.14	7.418	7.0%	30	0.0%	0.0%	0.0%	9.7%	4.8%
0081-08	BU 377B	0.629	0.99	6.0%	31	0.0%	0.0%	0.0%	7.4%	3.7%
0045-02	SH 56	1.754	1.803	7.1%	32	0.0%	0.0%	0.0%	7.4%	3.7%
2640-02	FM 406	0	0.688	7.5%	33	0.0%	0.0%	0.0%	6.8%	3.4%
2456-01	FM 1417	0	0.738	4.3%	34	0.0%	0.0%	0.0%	6.4%	3.2%
2459-02	FM 902	11.321	11.35	6.0%	35	0.0%	0.0%	0.0%	5.9%	2.9%
1709-01	FM 1753	9.741	10.08	7.7%	36	0.0%	0.0%	0.0%	1.9%	6.9%

Control Section	Corridor	From (DFO)	To (DFO)	Comprehensive Score	Economic					
					Total Economic Score Rank	Economic Importance			System Usage	
						National Highway System (NHS) Route Y(Interstate)/Y/N	National Highway Freight Network Y/N	Energy Sector Route Y/N	Base ADT	Base ADTT
0728-03	FM 1897	4.628	4.643	6.3%	37	0.0%	0.0%	0.0%	5.6%	2.8%
0047-16	SS 381	0	0.303	4.0%	38	0.0%	0.0%	0.0%	5.5%	2.8%
3236-01	FM 3133	3.811	3.969	4.8%	39	0.0%	0.0%	0.0%	4.0%	4.2%
2139-01	SH 11	17.394	17.4	9.3%	40	0.0%	0.0%	0.0%	1.9%	5.8%
1855-02	FM 922	38.894	38.92	4.5%	41	0.0%	0.0%	0.0%	4.9%	2.4%
0728-04	FM 120	4.265	4.448	4.8%	42	0.0%	0.0%	0.0%	4.7%	2.4%
2454-01	FM 131	2.534	2.566	5.2%	43	0.0%	0.0%	0.0%	4.7%	2.3%
1379-01	FM 901	4.374	4.379	8.6%	44	0.0%	0.0%	0.0%	4.6%	2.3%
0316-03	FM 1753	3.858	3.922	6.7%	45	0.0%	0.0%	0.0%	4.5%	2.3%
0081-17	SS 129	0	0.277	3.5%	46	0.0%	0.0%	0.0%	3.9%	2.0%
0510-01	FM 902	19.547	20.1	10.6%	47	0.0%	0.0%	0.0%	3.6%	1.8%
0510-03	FM 898	1.697	1.711	4.3%	48	0.0%	0.0%	0.0%	3.1%	1.5%
0202-01	FM 151	1.016	1.092	4.6%	49	0.0%	0.0%	0.0%	2.7%	1.3%
0081-16	BU 377C	0.386	0.627	4.0%	50	0.0%	0.0%	0.0%	1.3%	2.5%
3427-02	FM 3356	1.536	1.544	4.5%	51	0.0%	0.0%	0.0%	2.0%	1.0%
2798-03	FM 2729	3.957	4.923	5.9%	52	0.0%	0.0%	0.0%	1.6%	0.8%
2640-01	FM 1310	0.953	1.065	6.7%	53	0.0%	0.0%	0.0%	1.3%	0.6%
0729-03	FM 814	0.703	0.885	5.5%	54	0.0%	0.0%	0.0%	1.0%	0.5%
1379-02	FM 901	21.253	22.64	4.9%	55	0.0%	0.0%	0.0%	0.8%	0.4%
0081-15	BU 377D	0	0.223	8.1%	56	0.0%	0.0%	0.0%	0.2%	0.9%
2798-02	FM 2729	0	0.339	6.0%	57	0.0%	0.0%	0.0%	0.6%	0.3%
2641-01	PR 20A	0	0.6	3.7%	58	0.0%	0.0%	0.0%	0.0%	0.0%

PERFORMANCE MEASURES

IN THE PERFORMANCE METRICS: DATA INTEGRATION SYSTEM (PM-DIS) SCORING PROCESS

TABLE OF CONTENTS

PROJECT SCORING CHART

CRITERIA	CRITERION %	SUB-CRITERIA		% OF TOTAL
SAFETY	31.42%	Crash Count 25%	Estimated Impact on Fatal and Serious Injury Crashes 50%	3.928%
			Estimated Impact on Total Crashes 50%	3.928%
		Crash Rate 25%	Estimated Impact on Fatal and Serious Injury Crash Rate 50%	3.928%
			Estimated Impact on Total Crash Rate 50%	3.928%
		Societal Cost Savings 25%		7.855%
		Safety Importance 25%	Safety Project Classification Y/N 50%	3.928%
			Evacuation Route Y/N 50%	3.928%
PRESERVATION	20.85%	Bridge Condition 50%	Reduction in Structurally Deficient Deck Area 50%	5.213%
			Deck Area Receiving Preventive Maintenance 50%	5.213%
		Pavement Condition 50%	Reduction in Poor Lane Miles (by Ride Score) 25%	2.606%
			Lane Mile Receiving Preventive Maintenance (by Ride Score) 25%	2.606%
			Reduction in Poor Lane Miles (by Distress Score) 25%	2.606%
			Lane Miles Receiving Preventive Maintenance (by Distress Score) 25%	2.606%
CONGESTION	19.21%	Congestion Reduction 100%	Benefit Congestion Index - Auto 50%	9.605%
			Benefit Congestion Index - Truck 50%	9.605%
CONNECTIVITY	13.49%	Enhanced Connectivity 100%	Congestion/Connectivity Related Y/N 25%	3.373%
			Trunk System Route Y/N 25%	3.373%
			Intermodal Connector Y/N 25%	3.373%
			Lane Miles of New Connectivity 25%	3.373%
ECONOMIC	9.82%	Economic Importance 50%	National Highway System (NHS) Route Y/N 33.33%	1.637%
			National Highway Freight Network (NHFN) Y/N 33.33%	1.637%
			Energy Sector Route Y/N 33.33%	1.637%
		System Usage 50%	Base ADT 50%	2.455%
			Base ADTT 50%	2.455%
ENVIRONMENT	5.21%	Environmental Related Program Y/N 50%		2.605%
		Environmental Mitigation Cost 50%		2.605%

LEGEND

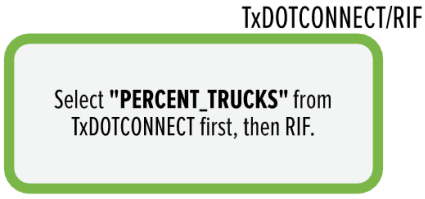
DATA

The Performance Metrics: Data Integration System (PM-DIS) uses five different data sources to populate project information. The data sources include:

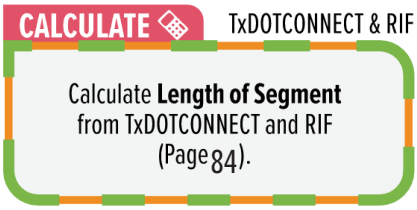
- TxDOTCONNECT
- Roadway Inventory File (RIF)
- Crash Records Information System (CRIS)
- InspectTech (Bridge Inspection Software)
- AgileAssets Pavement Analyst (Pavement Analyst)

A block can reference one or more data systems. In most instances data is referenced from TxDOTCONNECT or RIF.

Data referenced in this block is from the data source system identified in the top right hand corner, RIF.

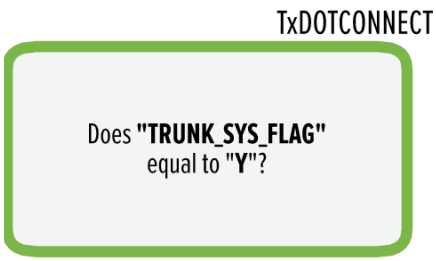


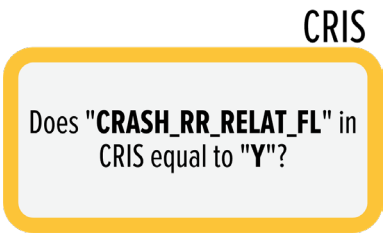
The data described in this block should be referenced from TxDOTCONNECT first, then RIF. In other words, if data is not found in TxDOTCONNECT, analogous data are then found from RIF. Also, if the targeted data is found in TxDOTCONNECT, the preprocessor no longer needs to check RIF for that data. Hence, TxDOTCONNECT is listed before RIF in the top right hand corner. Lastly, the block is highlighted in green, signifying the preferential source color.

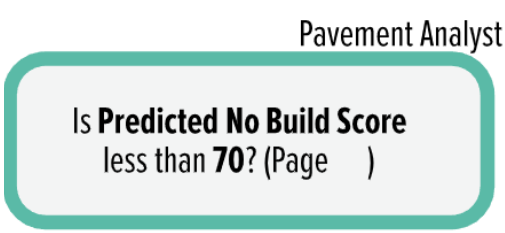


Lastly, data referenced in this block requires data points from two sources, TxDOTCONNECT and RIF. Data points are then used to calculate a value mentioned in this block.

Other data source colors include:



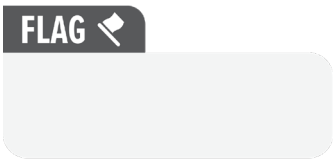




TAGS

Most blocks will have associated tags. These tags identify an action or a reference the block needs in order to proceed to the next step.

This particular block has the “Calculate” tag that signifies a mathematical related step described within the attached block.



The “Flag” tag signifies a reference to a flag. A flag is a series of checks made by the preprocessor.

SCORE BLOCKS

Score blocks signify possible outcomes from the flow charts provided. There is a check mark and X mark associated to each score block like the ones provided below. For criteria related flow charts, results of the score blocks will be normalized from 0 to 1.0 within the context of all other projects in the same portfolio.

Flag related flow charts will only have two possible outcomes because they are a series of checks. They do not have a numeric results and thus their score blocks state “PASS” or “FAIL.”

Score blocks can posses phrases that ultimately equate to a numeric value. These scores will have corresponding tables outlining their numeric value such as the table shown below. The following displays an example of possible numeric scores for the sub-criteria National Highway System Route.

SCORE VALUE	
NHS INTERSTATE	1.0
NHS NON-INTERSTATE	0.5
NOT ON NHS	0

SAFETY

CRASH COUNT

- *Estimated Impact on Fatal and Serious Injury Crashes*
- *Estimated Impact on Total Crashes*

CRASH RATE

- *Estimated Impact on Fatal and Serious Injury Crash Rate*
- *Estimated Impact on Total Crash Rate*

SOCIETAL COST SAVINGS

SAFETY IMPORTANCE

- *Safety Project Classification*
- *Hurricane Evacuation Route*

Introduction

Safety performance measures are categorized into four areas:

- **Crash Count** - Actual crash number deltas.
- **Crash Rate** - Delta for crashes per one hundred million VMT.
- **Societal Cost Savings** - The cost savings of preventing crashes.
- **Safety Importance** - Qualitative metrics regarding safety related data on the project.

The (first three) crash related metric areas are described here:

The Performance Metrics: Data Integration System (PM-DIS) preprocessor compiles historical crashes in the project area and makes predictions about similar crashes in the future. Predicted future crashes are then reduced according to the Highway Safety Manual (HSM) Crash Mitigating Factors (CMF).

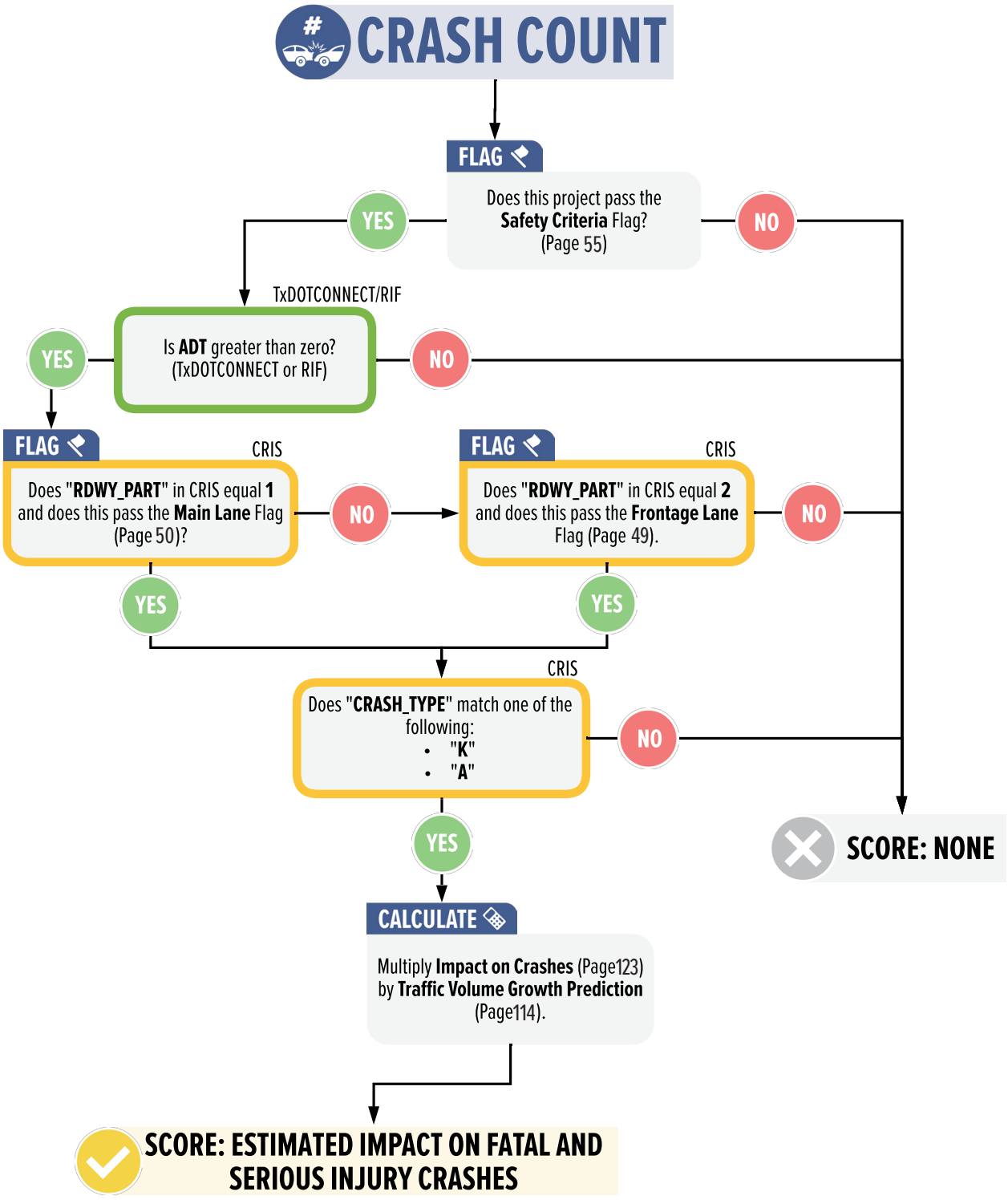
Each project's work is identified as it relates to each possible CMF, and each historical crash is also aligned with each possible CMF. Historical crashes per CMF and severity level are used as a baseline to grow into the future, and the reduction specified per CMF is multiplied by expected future crashes.

The final "Impact on..." metrics each represents the reduction (delta) in crashes that can be expected in a build scenario.

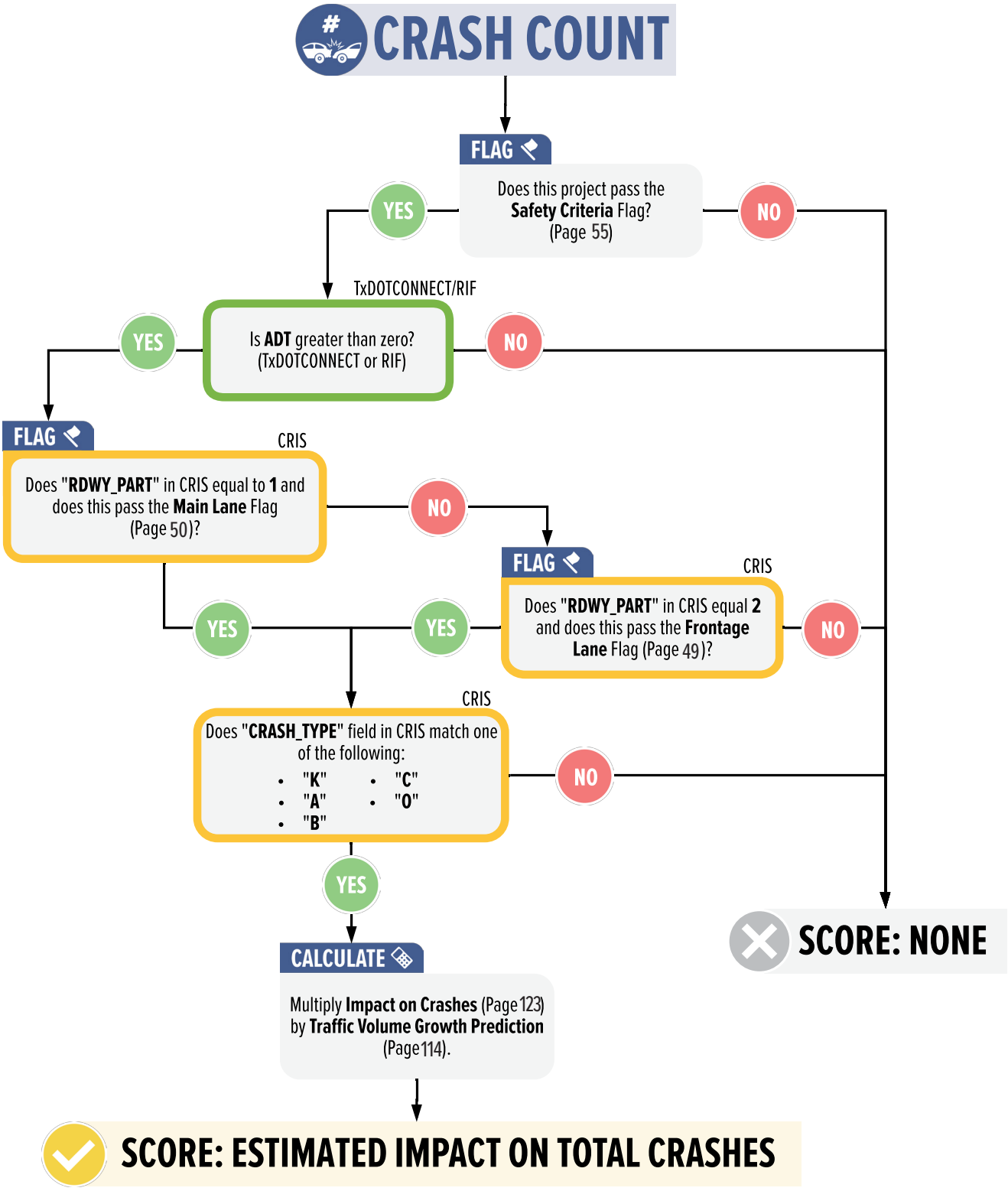
The final metrics are:

- **Crash Count**
  - **Estimated Impact on Fatal and Serious Injury Crashes** - A total number of Fatal (K) or Serious Injury (A) crashes that should be prevented in a build scenario.
  - Estimated Impact on Total Crashes - A total number of any severity of crash that should be prevented in a build scenario.
- **Crash Rate**
  - **Estimated Impact on Fatal and Serious Injury Crash Rate** - A number of Fatal (K) or Serious Inury (A) crashes that should be prevented per one hundred million vehicle miles traveled on the road segment in a build scenario.
  - **Estimated Impact on Total Crash Rate** - A number of any severity of crash that should be prevented per one hundred million vehicle miles traveled on the road segment in a build scenario.
- **Societal Cost Savings** - A sum of all crashes that should be prevented in a build scenario, multiplied by the average cost to society of that severity of each crash.
- **Safety Importance**
  - **Safety Related Program** - The project classification is one of Traffic Safety's safety codes.
  - **Hurricane Evacuation Route -** The project location is part of a hurricane evacuation route.

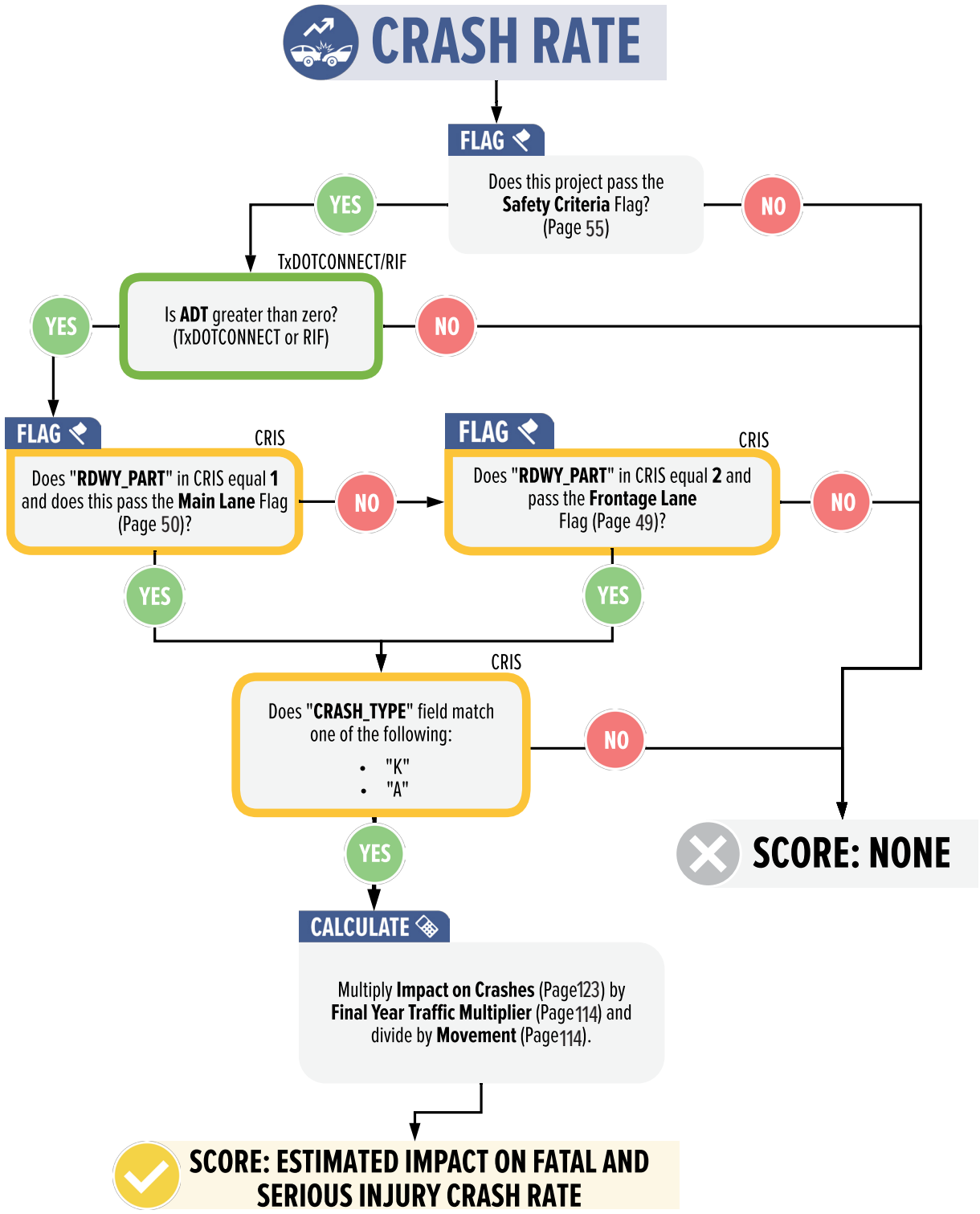
ESTIMATED IMPACT ON FATAL AND SERIOUS INJURY CRASHES



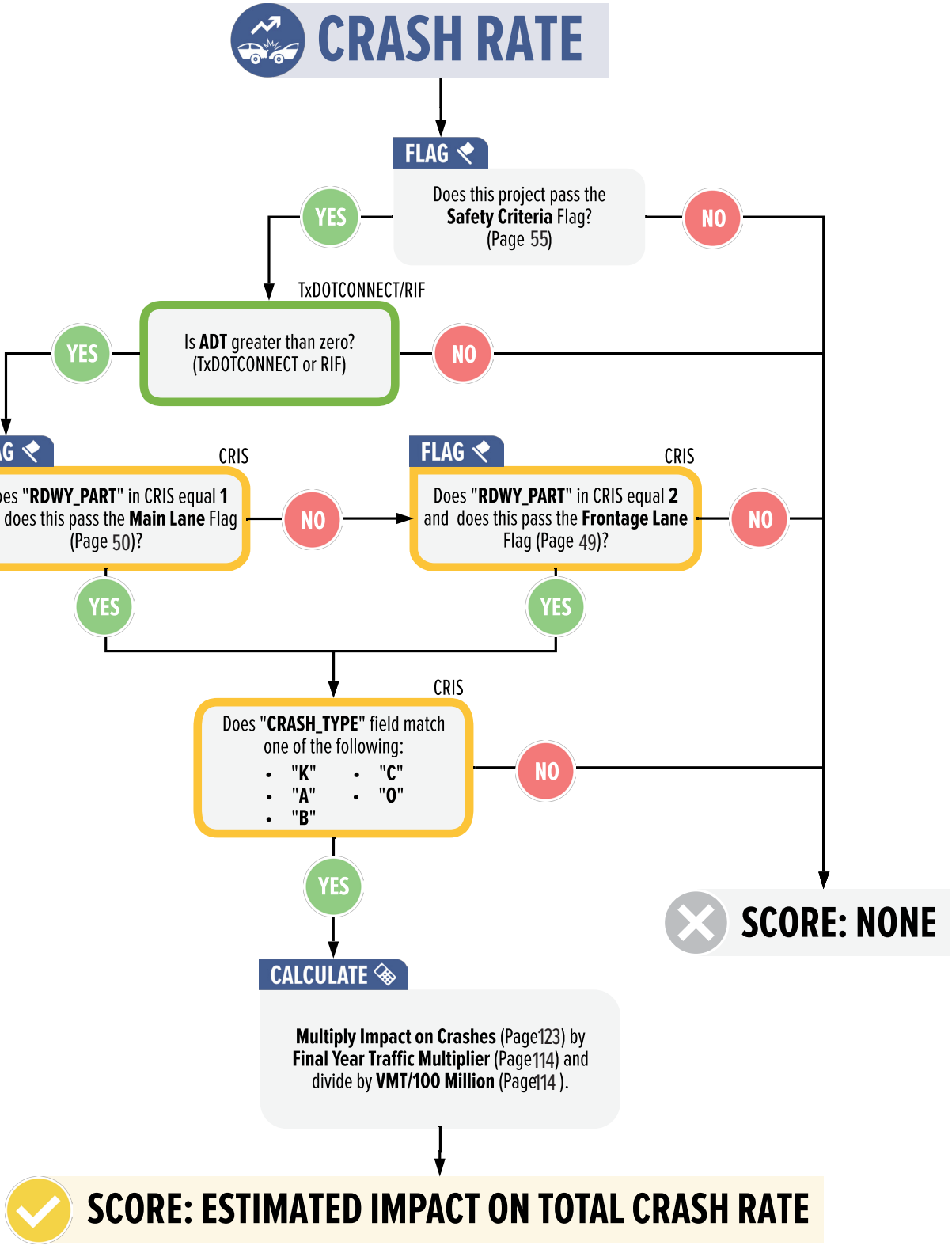
ESTIMATED IMPACT ON TOTAL CRASHES



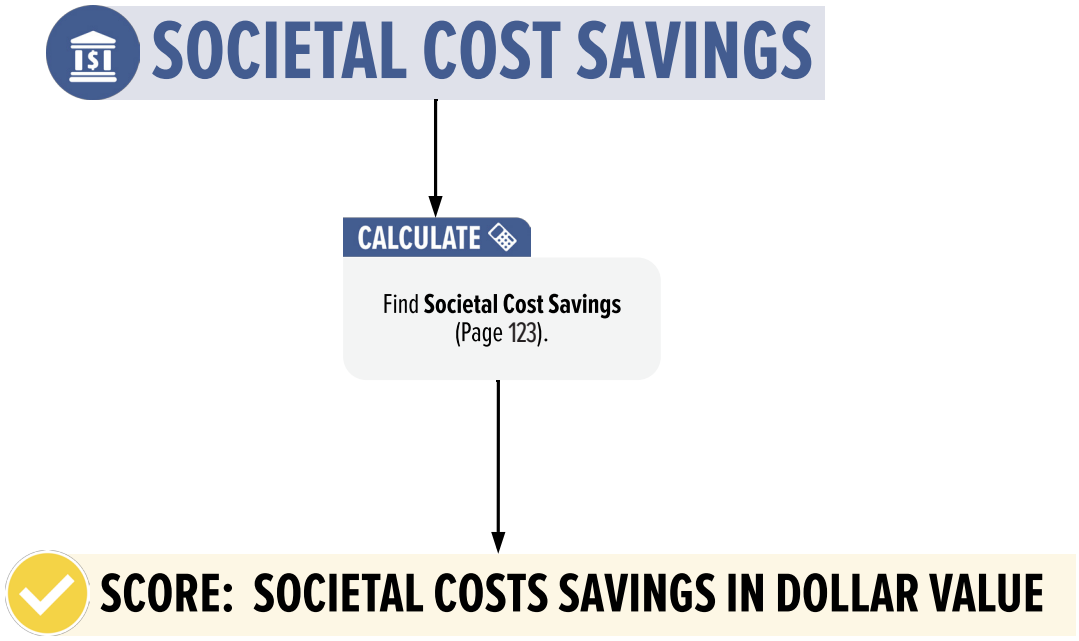
ESTIMATED IMPACT ON FATAL AND SERIOUS INJURY CRASH RATE



ESTIMATED IMPACT ON TOTAL CRASH RATE



SOCIETAL COST SAVINGS



SAFETY PROJECT CLASSIFICATION

SAFETY IMPORTANCE

SCORE VALUE	
SAFETY RELATED PROGRAM	1
NOT A SAFETY RELATED PROGRAM	0

TxDOTCONNECT

Does the "**PROJ_CLASS**" match one of the following:

- "BIK"
- "GCP"
- "HES"
- "PED"
- "RH"
- "RR"
- "SB"
- "SFT"
- "SRA"
- "TPD"
- "TS"

YES

NO

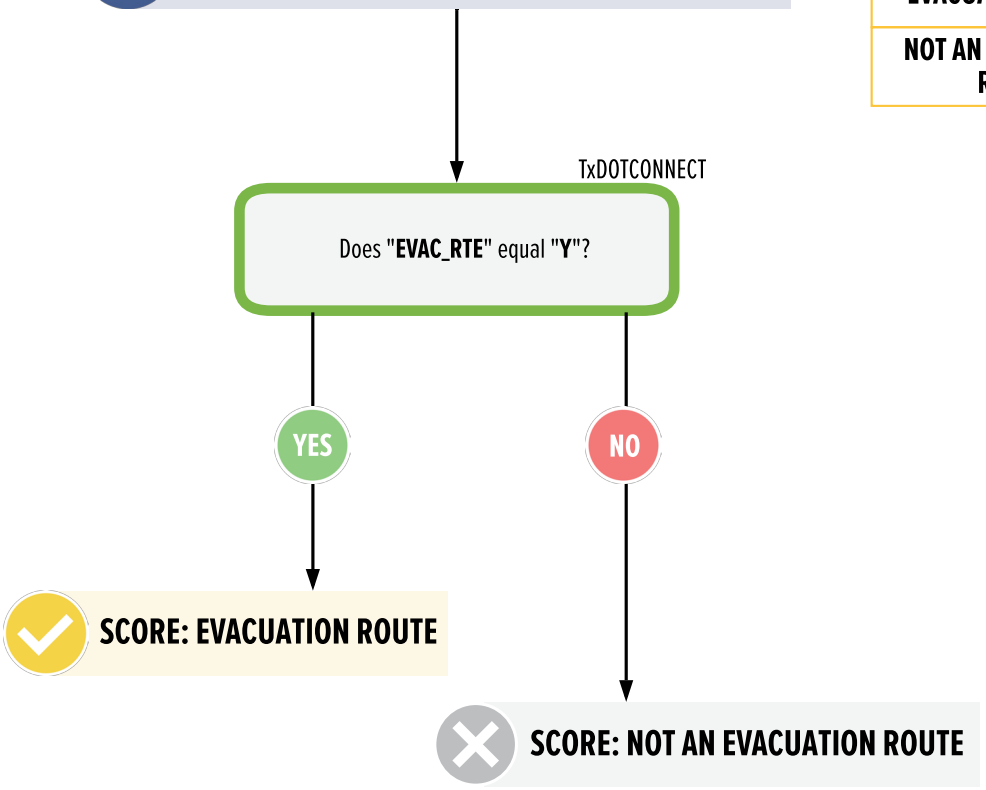
SCORE: NOT A SAFETY RELATED PROGRAM

SCORE: SAFETY RELATED PROGRAM

HURRICANE EVACUATION ROUTE

SAFETY IMPORTANCE

SCORE VALUE	
EVACUATION ROUTE	1
NOT AN EVACUATION ROUTE	0



PRESERVATION

BRIDGE CONDITION

- *Reduction in Structurally Deficient Deck Area*
- *Deck Area Receiving Preventive Maintenance*

PAVEMENT CONDITION

- *Reduction in Poor Lane Miles by Ride Score*
- *Lane Miles Receiving Preventive Maintenance by Ride Score*
- *Reduction in Poor Lane Miles by Distress Score*
- *Lane Miles Receiving Preventive Maintenance by Distress Score*

Introduction

The Performance Metrics: Data Integration System (PM-DIS) preprocessor uses historical bridge and pavement inspection data to build bridge and pavement deterioration models, used to make predictions.

If a project is identified to one of the following, it is brought through the processes in this document.

- The project both contains type of work references to bridge work and existing structures are found in the project's location.
- The project contains type of work references to pavement replacement or rehabilitation.

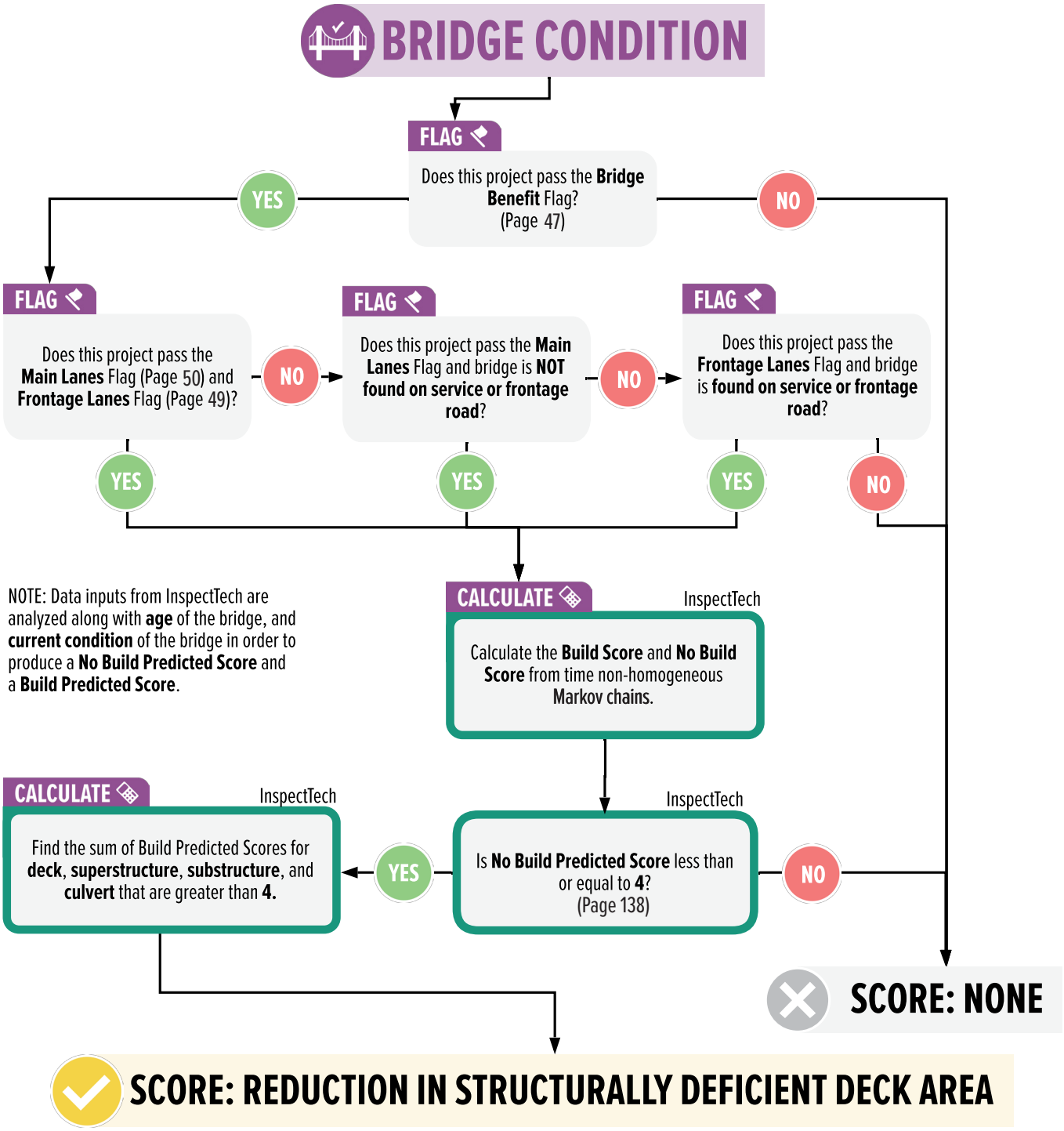
In bridge score development, the age of the bridge at the time of inspection is known. This allows a time non-homogenous deterioration model, which means deterioration is based on both the current condition and the age of the bridge.

In pavement score development, the age of the pavement at the time of inspection is not known. As a result, a time homogenous deterioration model is built, which means deterioration is based on only the current condition.

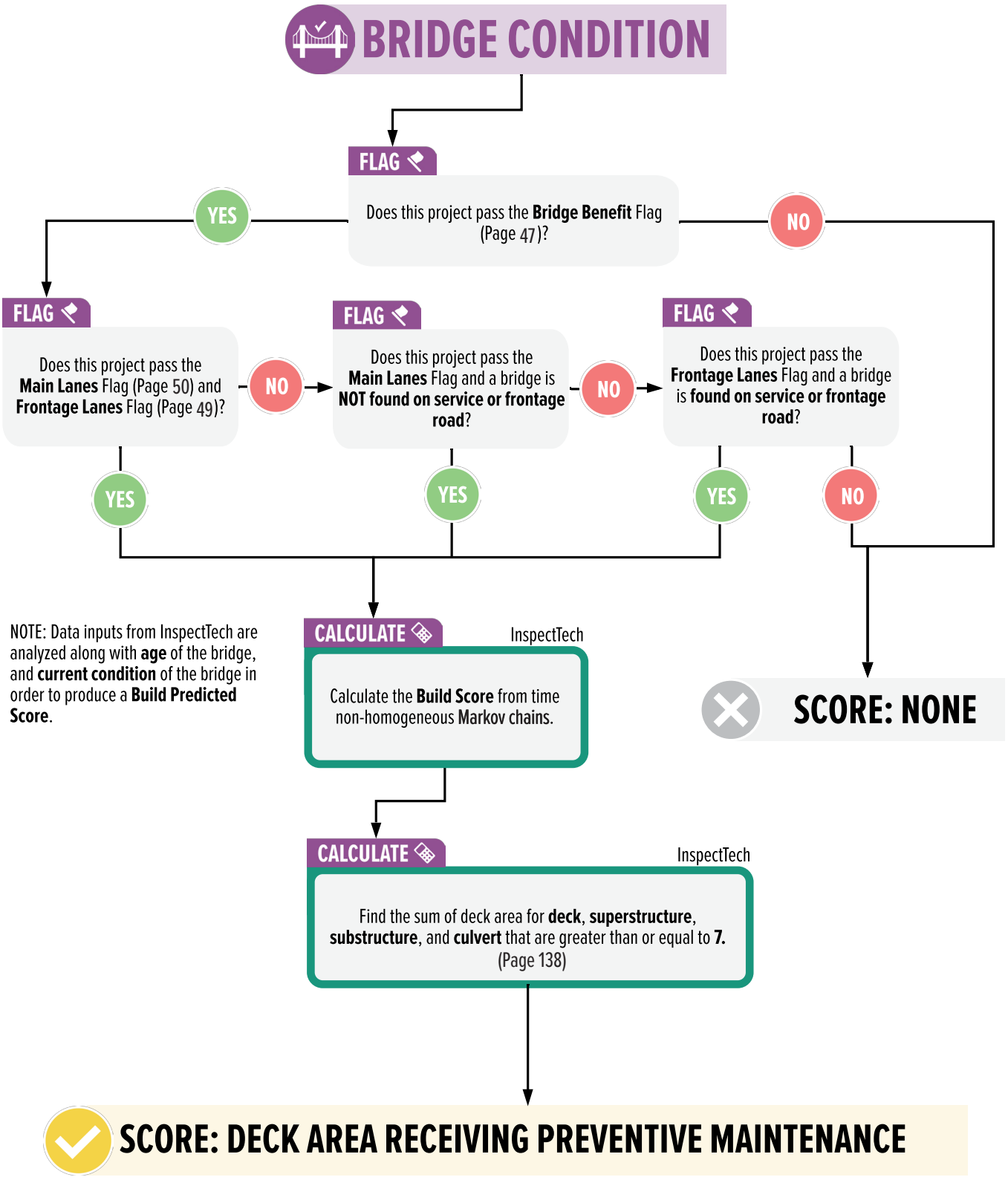
The final metrics are:

- **Bridge Condition**
  - **Reduction in Structurally Deficient Deck Area** - Total square feet of bridge deck area which would be structurally deficient at the planning horizon and will not be structurally deficient at the planning horizon in a build scenario.
  - **Deck Area Receiving Preventive Maintenance** - Total square feet of bridge deck area which would still be in good condition at the planning horizon but will be in better condition in a build scenario.
- **Pavement Condition**
  - **Reduction in Poor Lane Miles (by Ride Score)** - Total lane miles of pavement whose ride score would be poor at the time of letting but will be better than poor at the planning horizon in a build scenario.
  - **Lane Miles Receiving Preventive Maintenance (by Ride Score)** - Total lane miles of pavement whose ride score would still be good at the time of letting but will be better at the planning horizon in a build scenario.
  - **Reduction in Poor Lane Miles (by Distress Score)** - Total lane miles of pavement whose distress score would be poor at the time of letting but will be better than poor at the planning horizon in a build scenario.
  - **Lane Miles Receiving Preventive Maintenance (by Distress Score)** - Total lane miles of pavement whose distress score would still be good at the time of letting but will be better at the planning horizon in a build scenario.

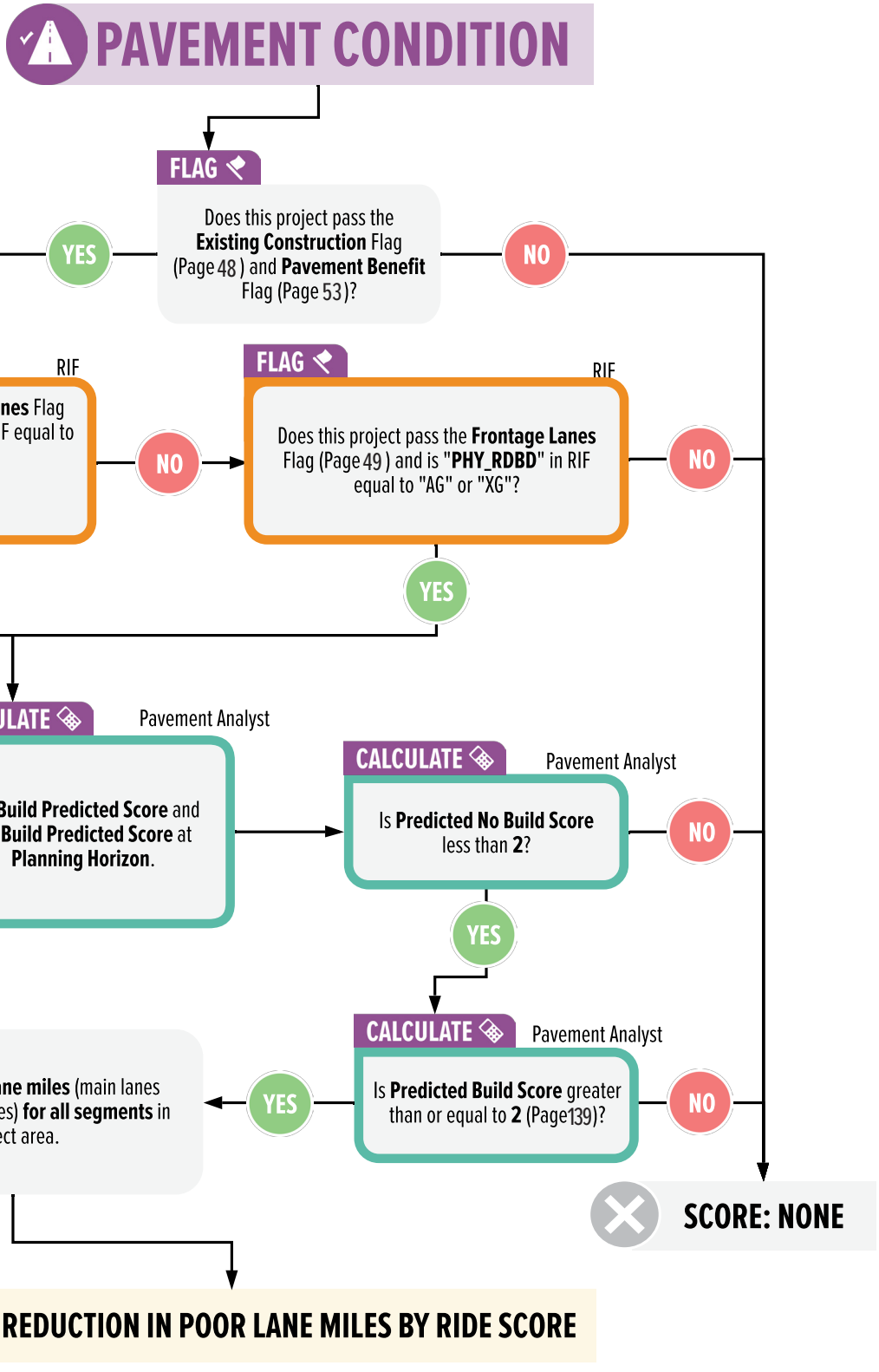
REDUCTION IN STRUCTURALLY DEFICIENT DECK AREA



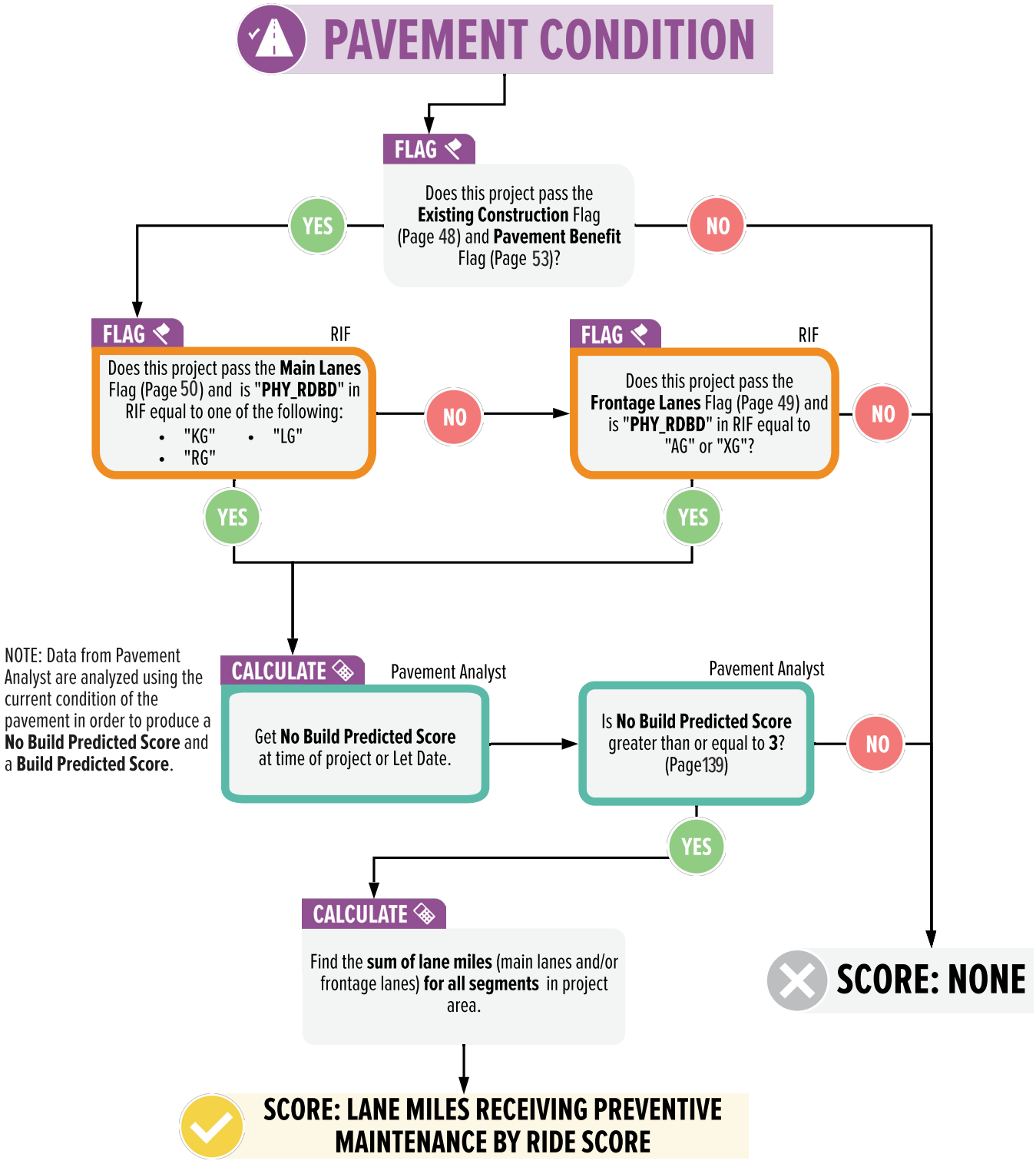
DECK AREA RECEIVING PREVENTIVE MAINTENANCE



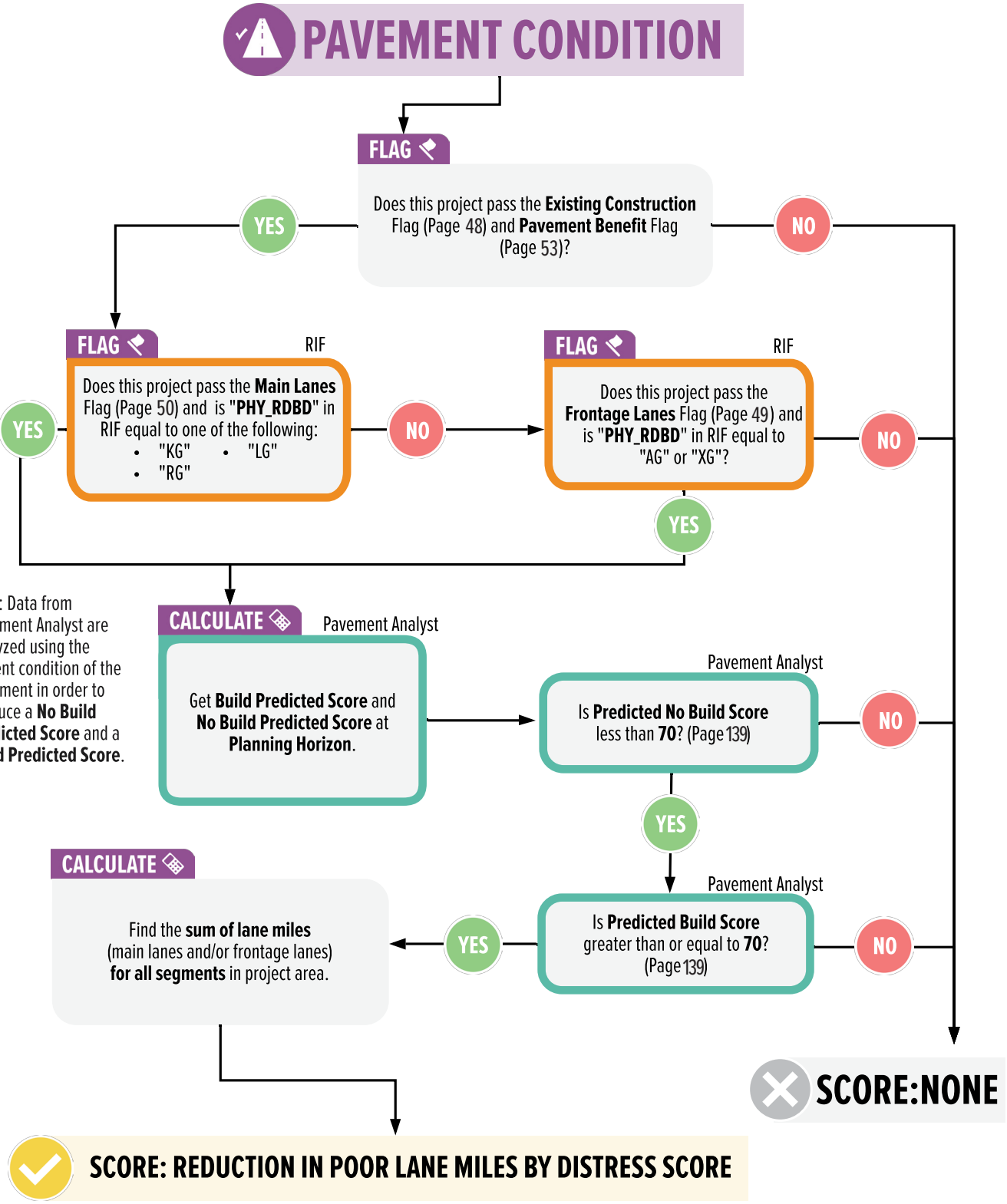
REDUCTION IN POOR LANE MILES BY RIDE SCORE



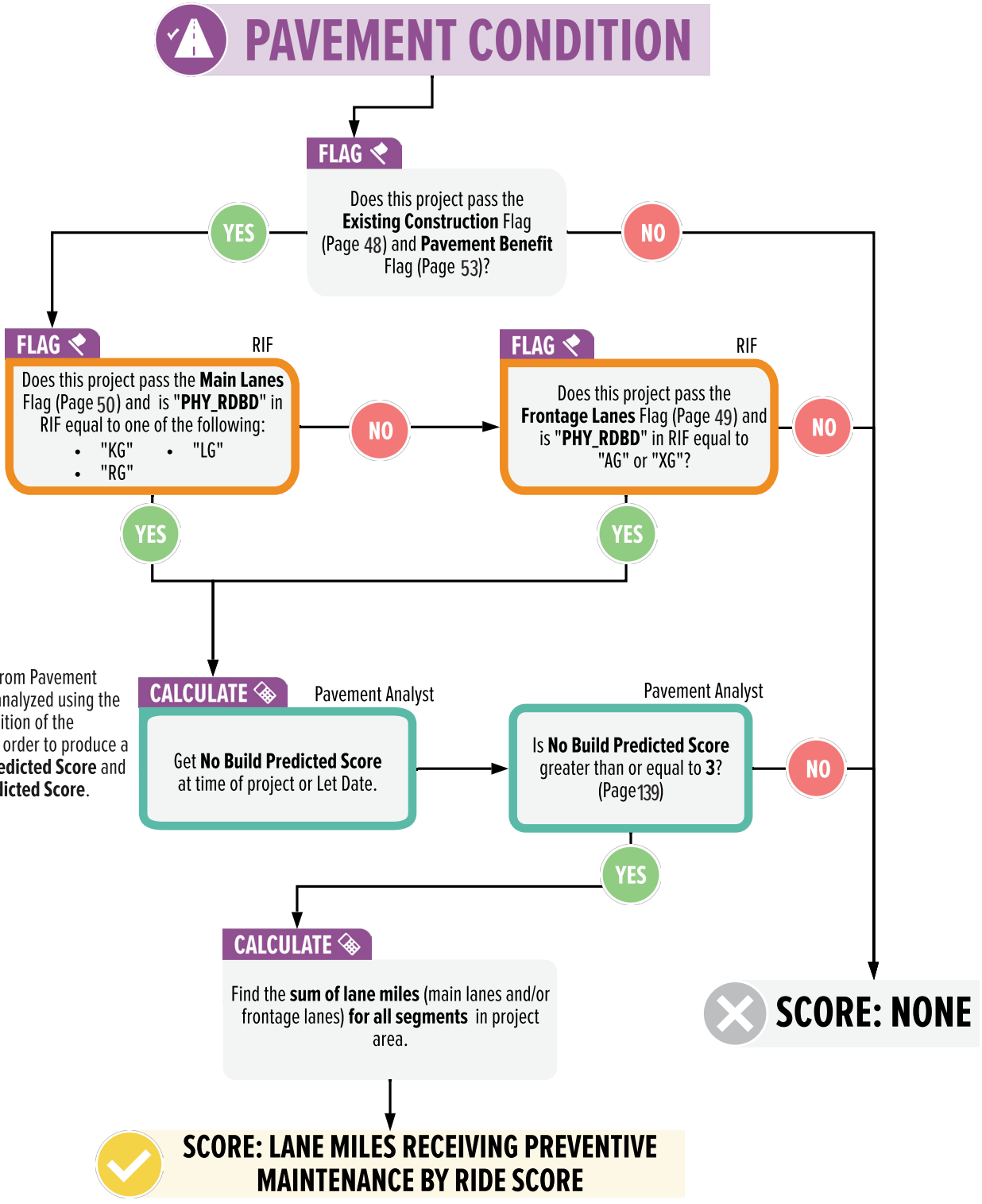
LANE MILES RECEIVING PREVENTIVE MAINTENANCE BY RIDE SCORE



REDUCTION IN POOR LANE MILES BY DISTRESS SCORE



LANE MILES RECEIVING PREVENTIVE MAINTENANCE BY DISTRESS SCORE



CONGESTION

CONGESTION REDUCTION

- *Benefit Congestion Index for Automobiles (BCI-Auto)*
- *Benefit Congestion Index for Trucks (BCI-Truck)*

Introduction

The Performance Metrics: Data Integration System (PM-DIS) preprocessor calculates a number of data points in order to predict a project's impact on roadway congestion.

TxDOTCONNECT data is parsed to determine project work types which are then added to the roadway's capacity when calculating delay.

RIF data is parsed and processed with TxDOTCONNECT data to determine volume and capacity values, lane counts, roadbed types, etc..

A detailed set of rules determines what lane counts and roadway cross-section should be used.

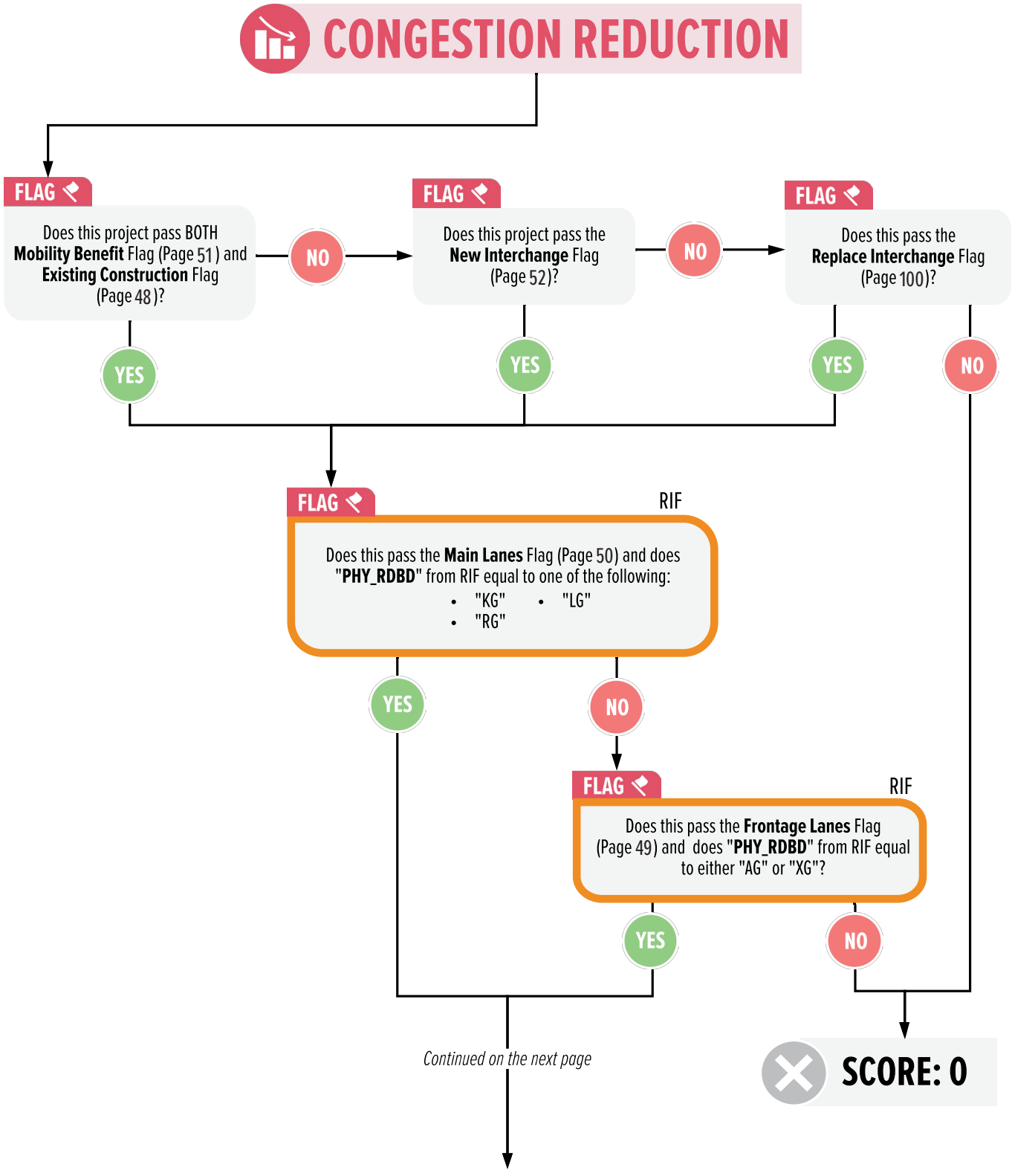
Both systems' data are used to predict a build and no-build scenario both at project opening and 20 years later. The overlapping sections of RIF and the TxDOTCONNECT project data are parsed individually, with the results being added into a total in the end.

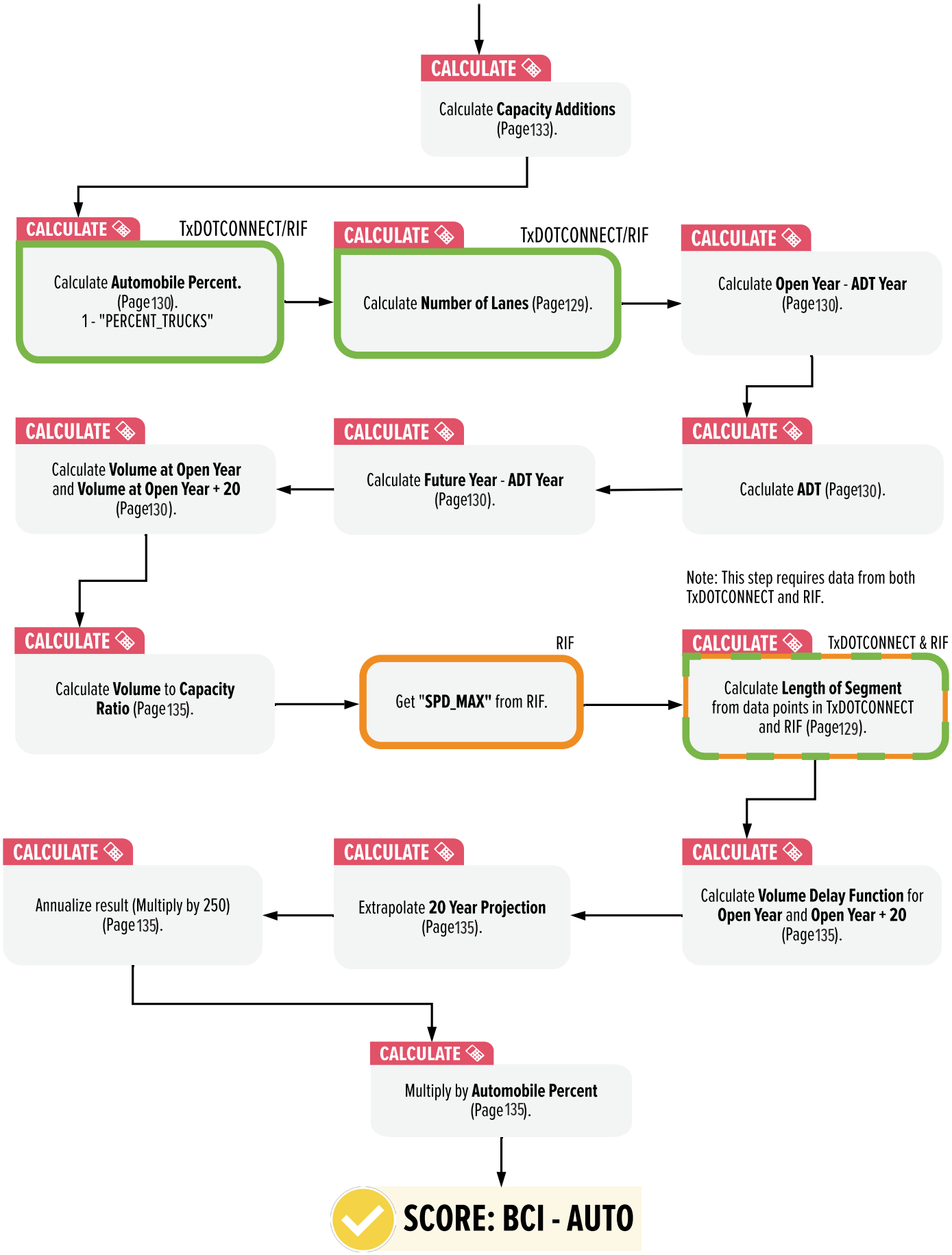
This produces two distinct sets of metrics:

- **Benefit Congestion Index (Auto)** - A total number of hours of delay savings for all auto users on the roadway over a period of 20 years.
- **Benefit Congestion Index (Truck)** - A total number of hours of delay savings for all freight users on the roadway over a period of 20 years.

BCI-AUTO

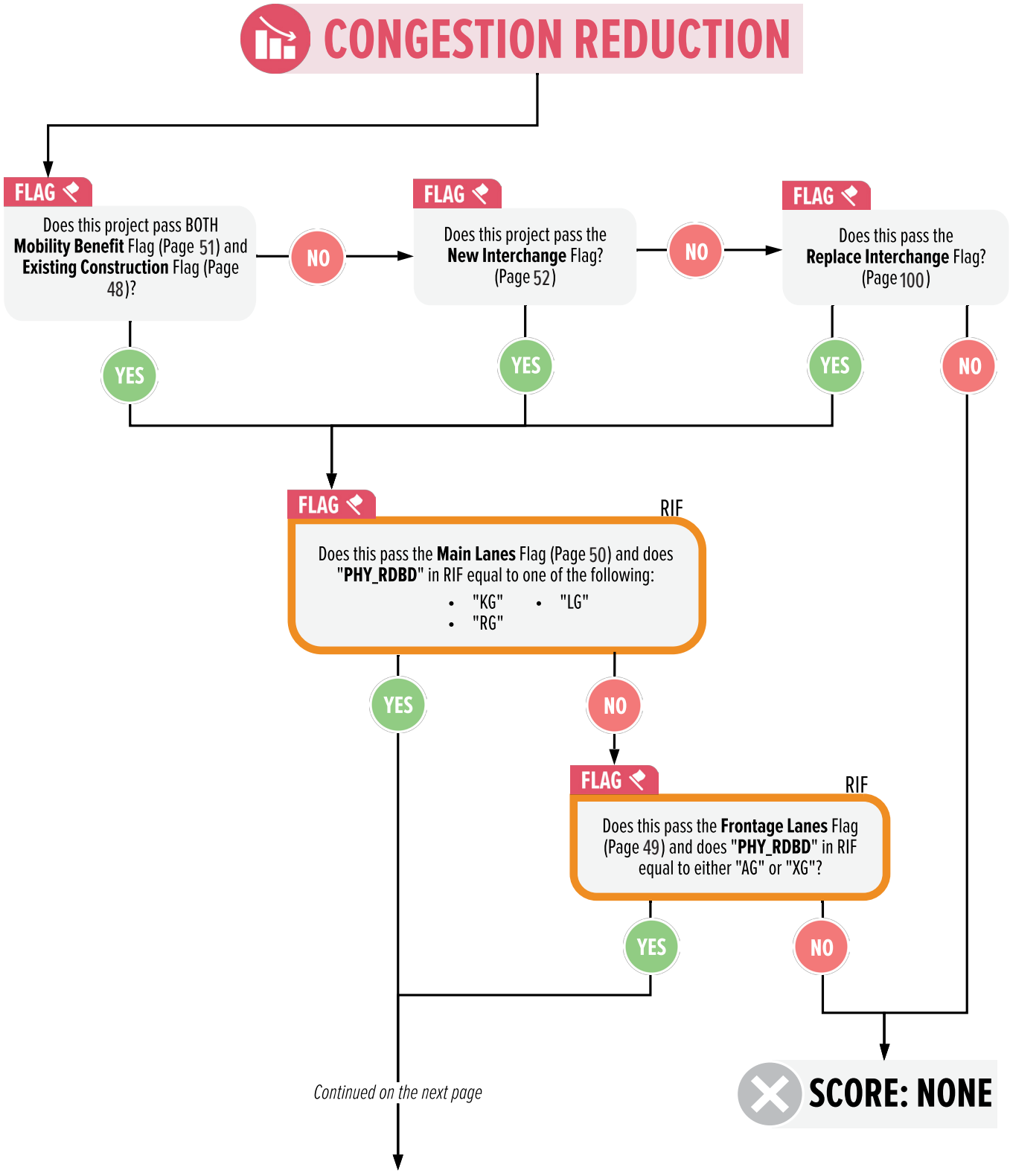
CONGESTION REDUCTION

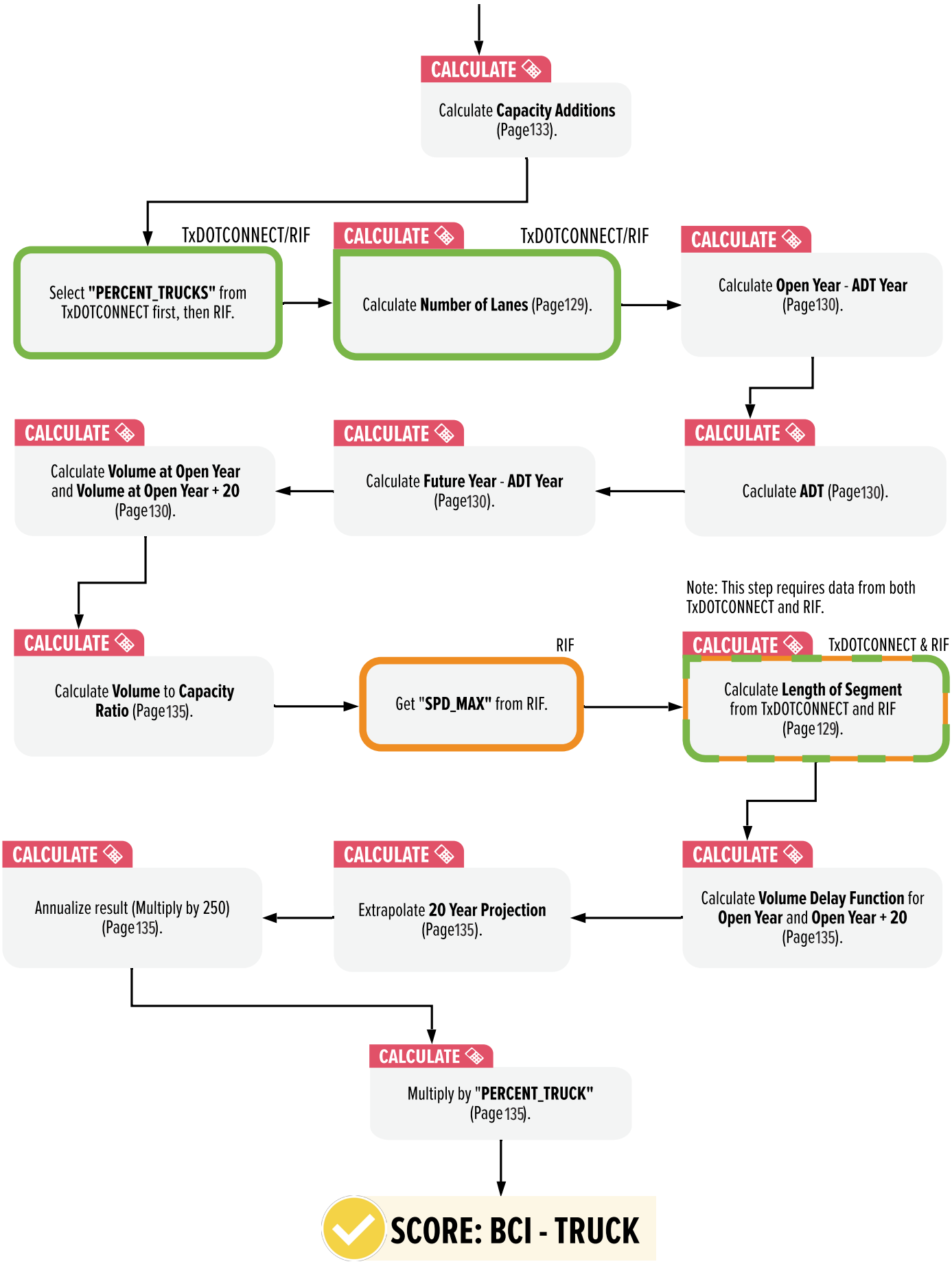



CALCULATE
Calculate Capacity Additions (Page133).
CALCULATE
TxDOTCONNECT/RIF
Calculate Automobile Percent. (Page130). 1 - "PERCENT_TRUCKS"
CALCULATE
TxDOTCONNECT/RIF
Calculate Number of Lanes (Page129).
CALCULATE
Calculate Open Year - ADT Year (Page130).
CALCULATE
Caclulate ADT (Page130).
CALCULATE
Calculate Future Year - ADT Year (Page130).
CALCULATE
Calculate Volume at Open Year and Volume at Open Year + 20 (Page130).
Note: This step requires data from both TxDOTCONNECT and RIF.
CALCULATE
TxDOTCONNECT & RIF
Calculate Length of Segment from data points in TxDOTCONNECT and RIF (Page129).
RIF
Get "SPD_MAX" from RIF.
CALCULATE
Calculate Volume to Capacity Ratio (Page135).
CALCULATE
Calculate Volume Delay Function for Open Year and Open Year + 20 (Page135).
CALCULATE
Extrapolate 20 Year Projection (Page135).
CALCULATE
Annualize result (Multiply by 250) (Page135).
CALCULATE
Multiply by Automobile Percent (Page135).
SCORE: BCI - AUTO

BCI-TRUCK

CONGESTION REDUCTION



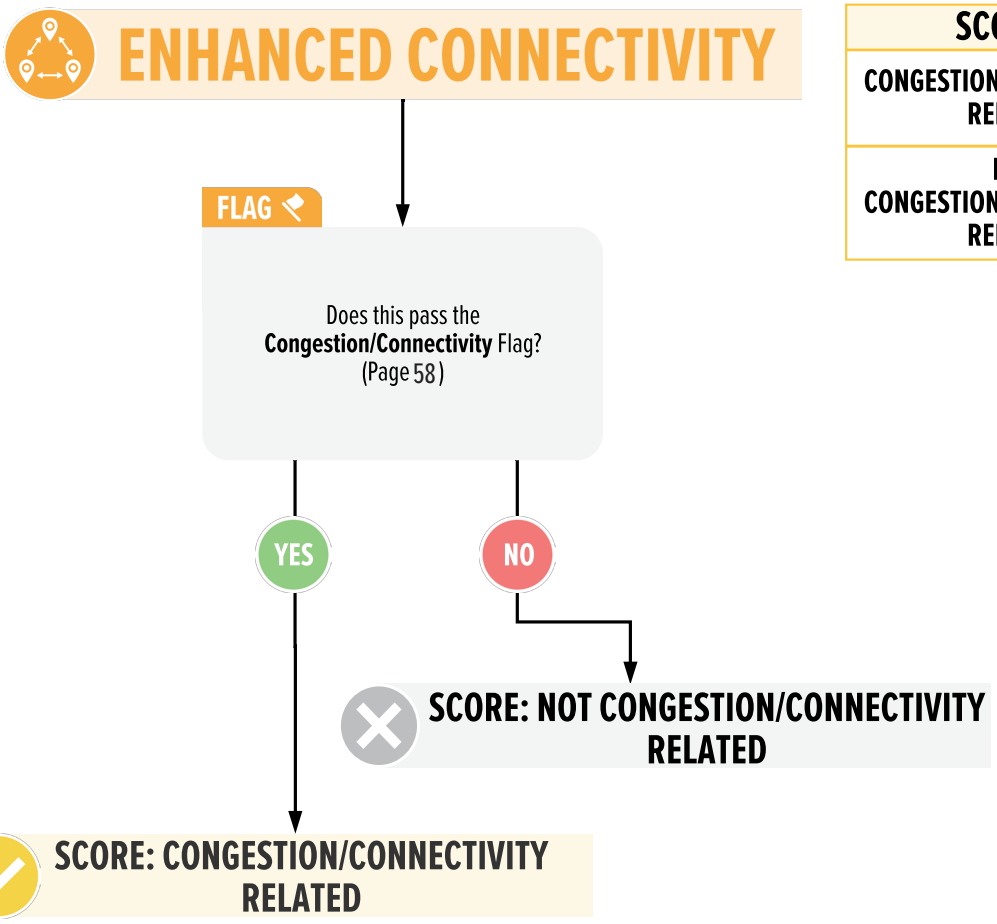

CALCULATE
Calculate Capacity Additions (Page133).
TxDOTCONNECT/RIF
Select "PERCENT_TRUCKS" from TxDOTCONNECT first, then RIF.
CALCULATE
TxDOTCONNECT/RIF
Calculate Number of Lanes (Page129).
CALCULATE
Calculate Open Year - ADT Year (Page130).
CALCULATE
Caclulate ADT (Page130).
CALCULATE
Calculate Future Year - ADT Year (Page130).
CALCULATE
Calculate Volume at Open Year and Volume at Open Year + 20 (Page130).
CALCULATE
Calculate Volume to Capacity Ratio (Page135).
RIF
Get "SPD_MAX" from RIF.
Note: This step requires data from both TxDOTCONNECT and RIF.
CALCULATE
TxDOTCONNECT & RIF
Calculate Length of Segment from TxDOTCONNECT and RIF (Page129).
CALCULATE
Calculate Volume Delay Function for Open Year and Open Year + 20 (Page135).
CALCULATE
Extrapolate 20 Year Projection (Page135).
CALCULATE
Annualize result (Multiply by 250) (Page135).
CALCULATE
Multiply by "PERCENT_TRUCK" (Page135).
SCORE: BCI - TRUCK

CONNECTIVITY

ENHANCED CONNECTIVITY

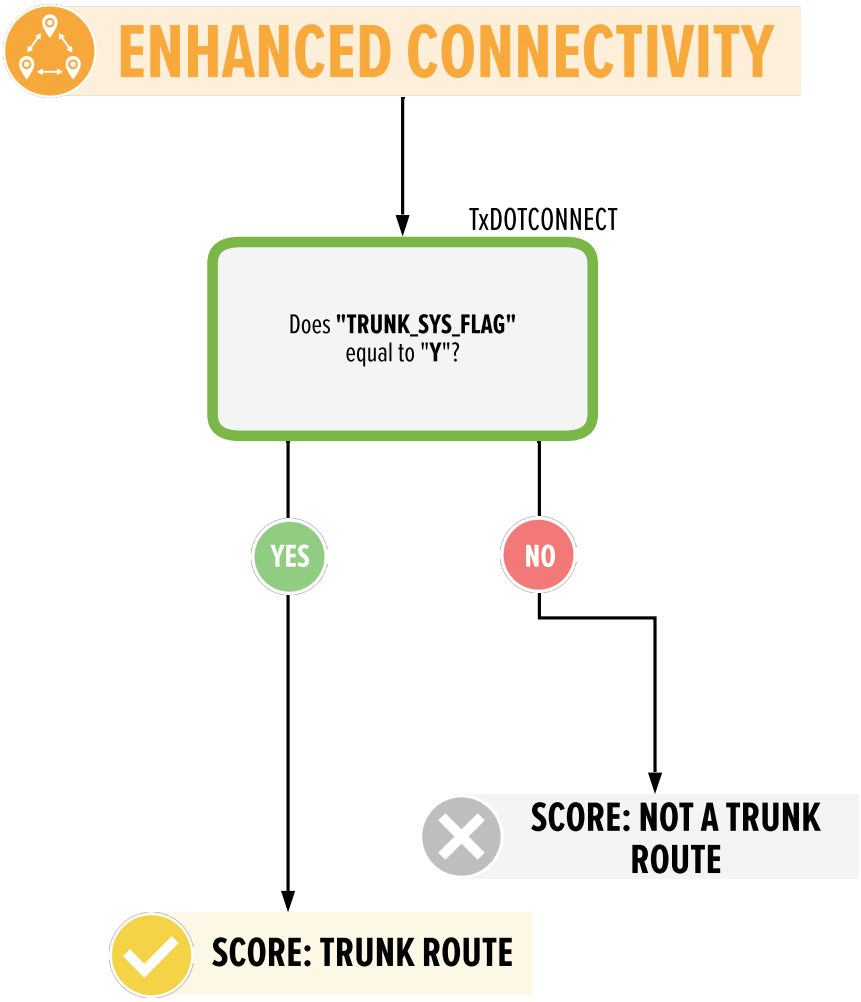
- *Congestion/Connectivity Related*
- *Trunk System Route*
- *Intermodal Connector*
- *Lane Miles of New Connectivity*

CONGESTION/CONNECTIVITY RELATED



SCORE VALUE	
CONGESTION/CONNECTIVITY RELATED	1
NOT CONGESTION/CONNECTIVITY RELATED	0

TRUNK SYSTEM ROUTE

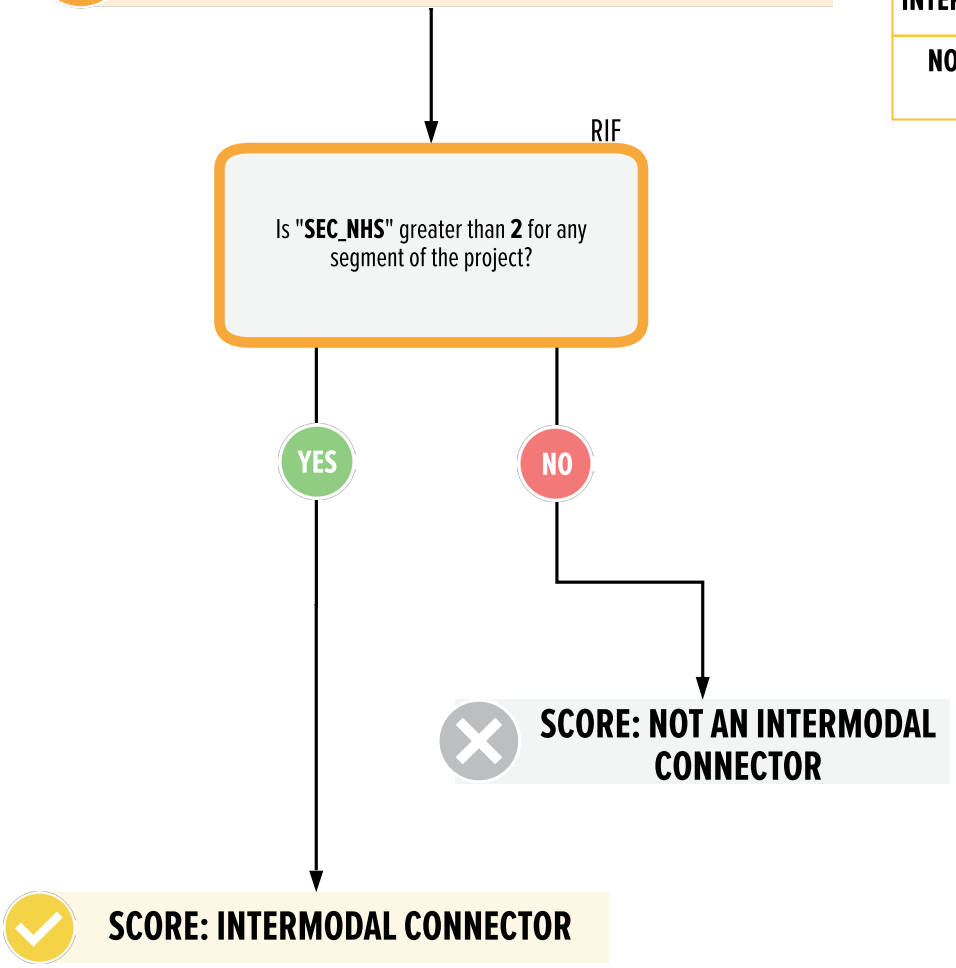


SCORE VALUE	
TRUNK ROUTE	1
NOT A TRUNK ROUTE	0

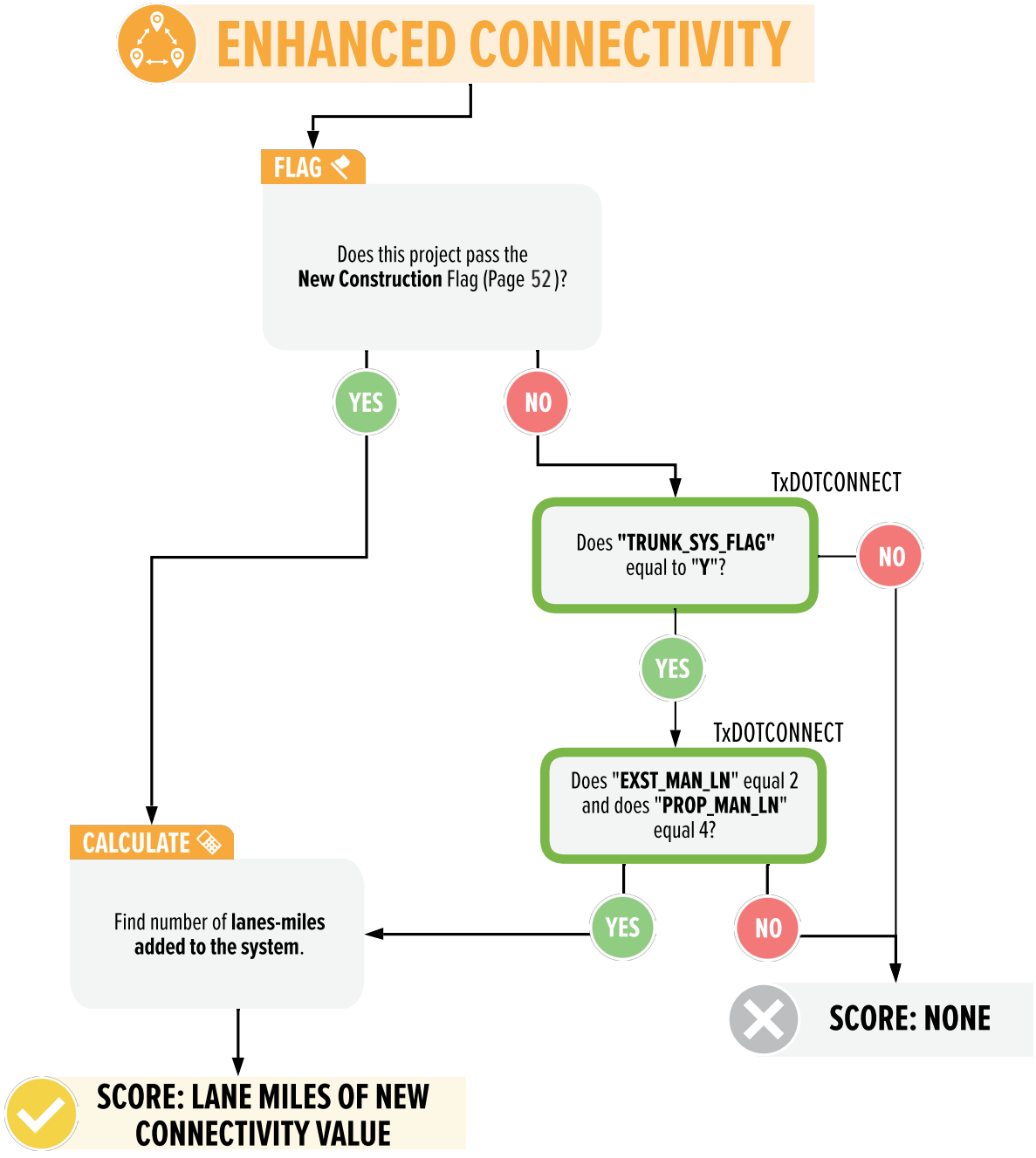
INTERMODAL CONNECTOR

ENHANCED CONNECTIVITY

SCORE VALUE	
INTERMODAL CONNECTOR	1
NOT AN INTERMODAL CONNECTOR	0



LANE MILES OF NEW CONNECTIVITY



ECONOMIC

ECONOMIC IMPORTANCE

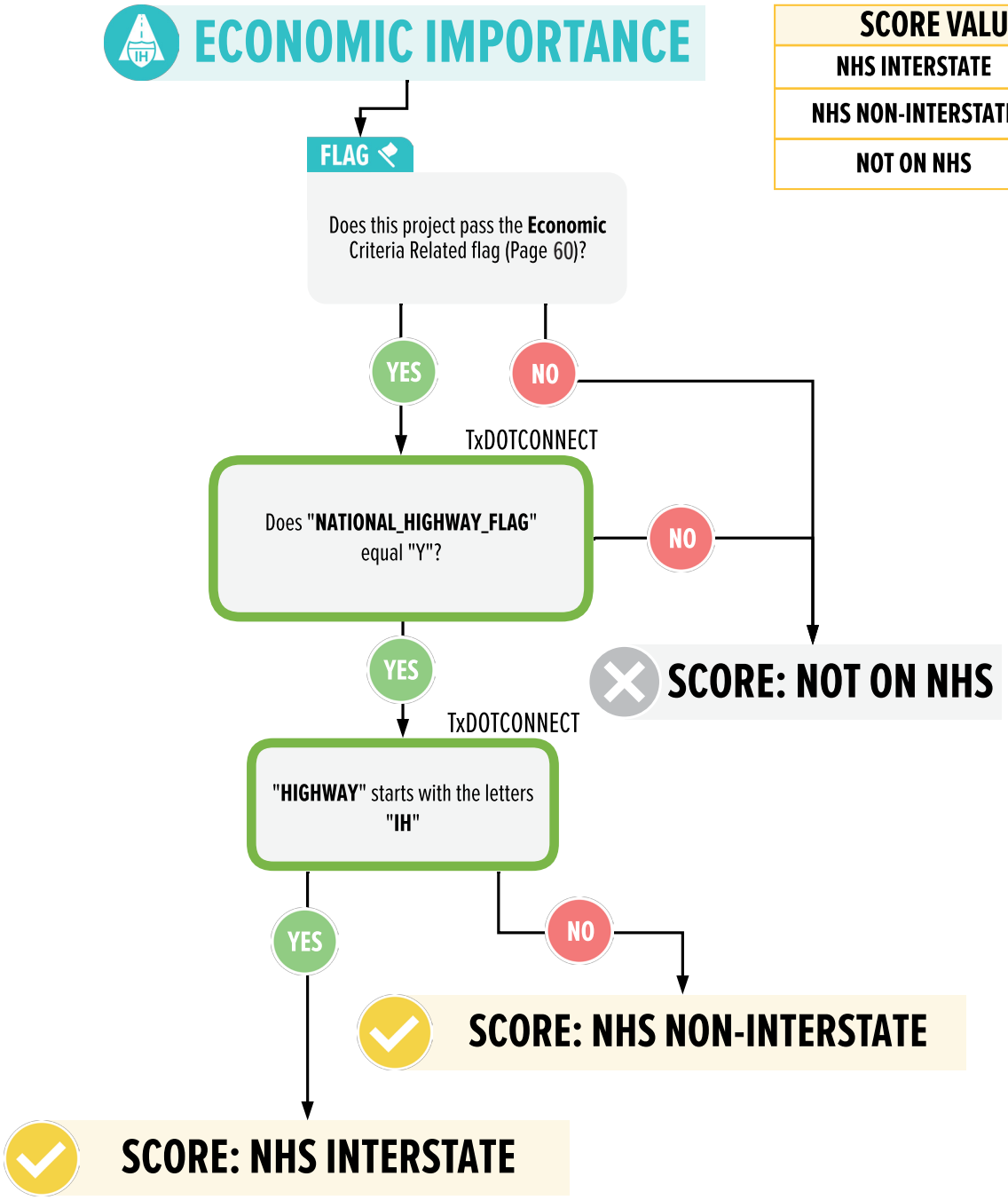
- *National Highway System (NHS) Route*
- *National Highway Freight Network (NHFN)*
- *Energy Sector Route*

SYSTEM USAGE

- *Base Average Daily Traffic (ADT)*
- *Base Average Daily Truck Traffic (ADTT)*

NATIONAL HIGHWAY SYSTEM ROUTE

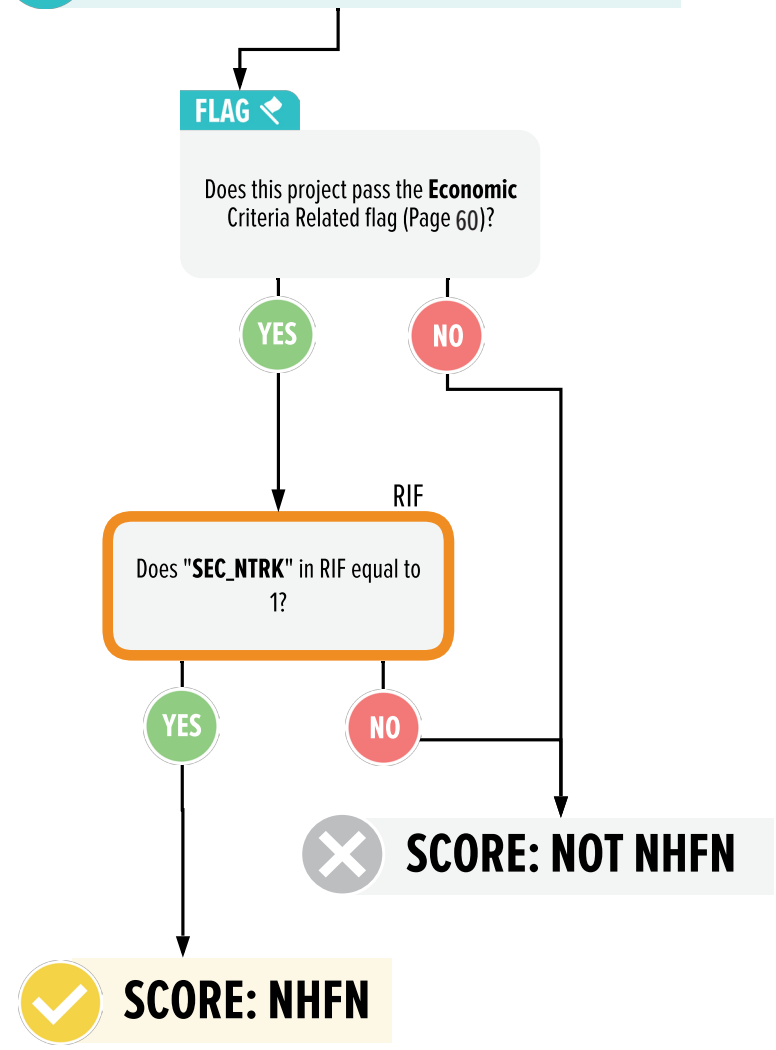
SCORE VALUE	
NHS INTERSTATE	1
NHS NON-INTERSTATE	0.5
NOT ON NHS	0



NATIONAL HIGHWAY FREIGHT NETWORK

ECONOMIC IMPORTANCE

SCORE VALUE	
NHFN	1
NOT NHFN	0



ENERGY SECTOR ROUTE

ECONOMIC IMPORTANCE

SCORE VALUE	
ENERGY SECTOR ROUTE	1
NOT AN ENERGY SECTOR ROUTE	0

FLAG

Does this project pass the **Economic** Criteria Related flag (Page 60)?

YES

NO

TxDOTCONNECT

Is **"ENERGY"** equal to "Y"?

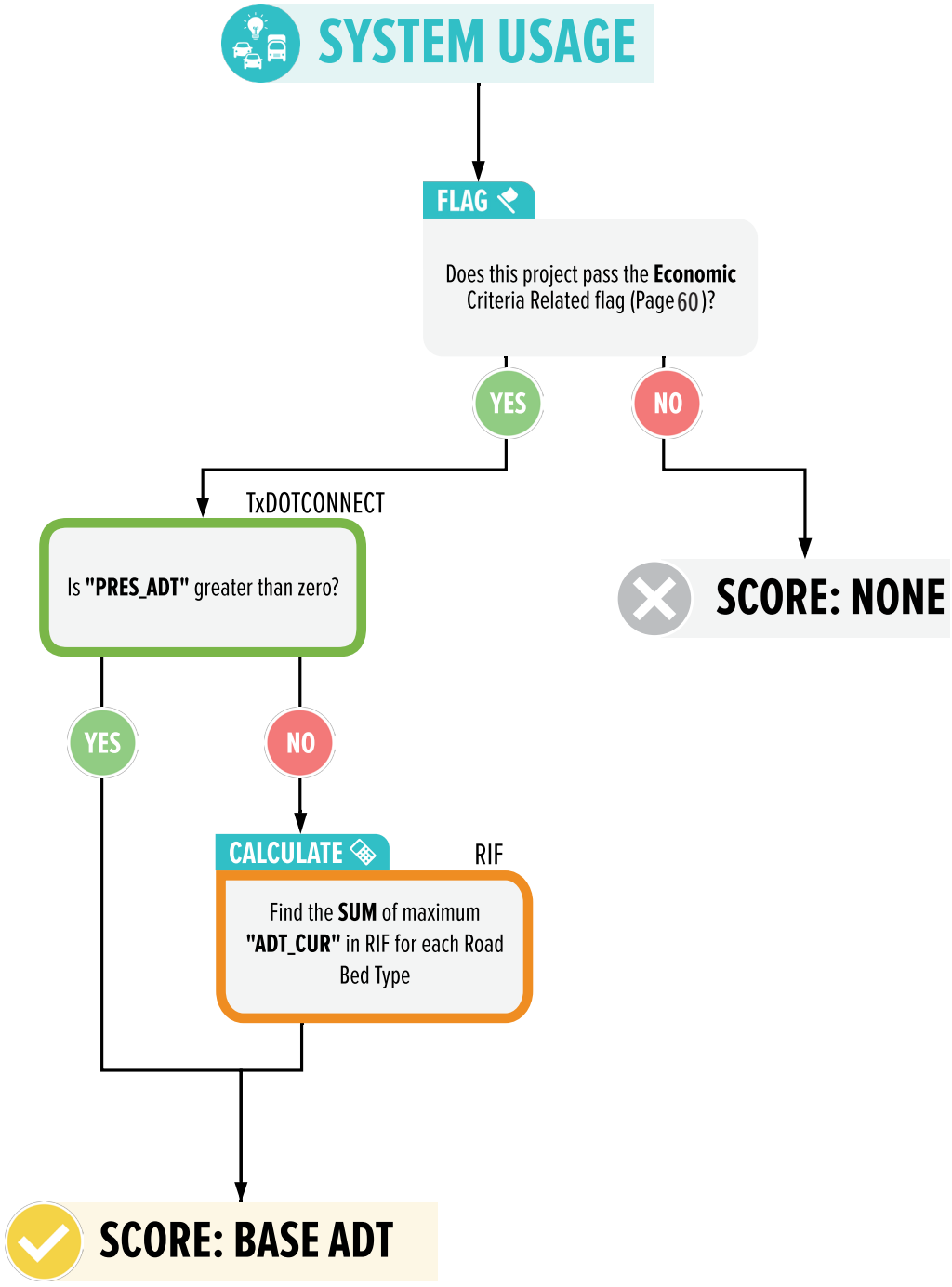
YES

NO

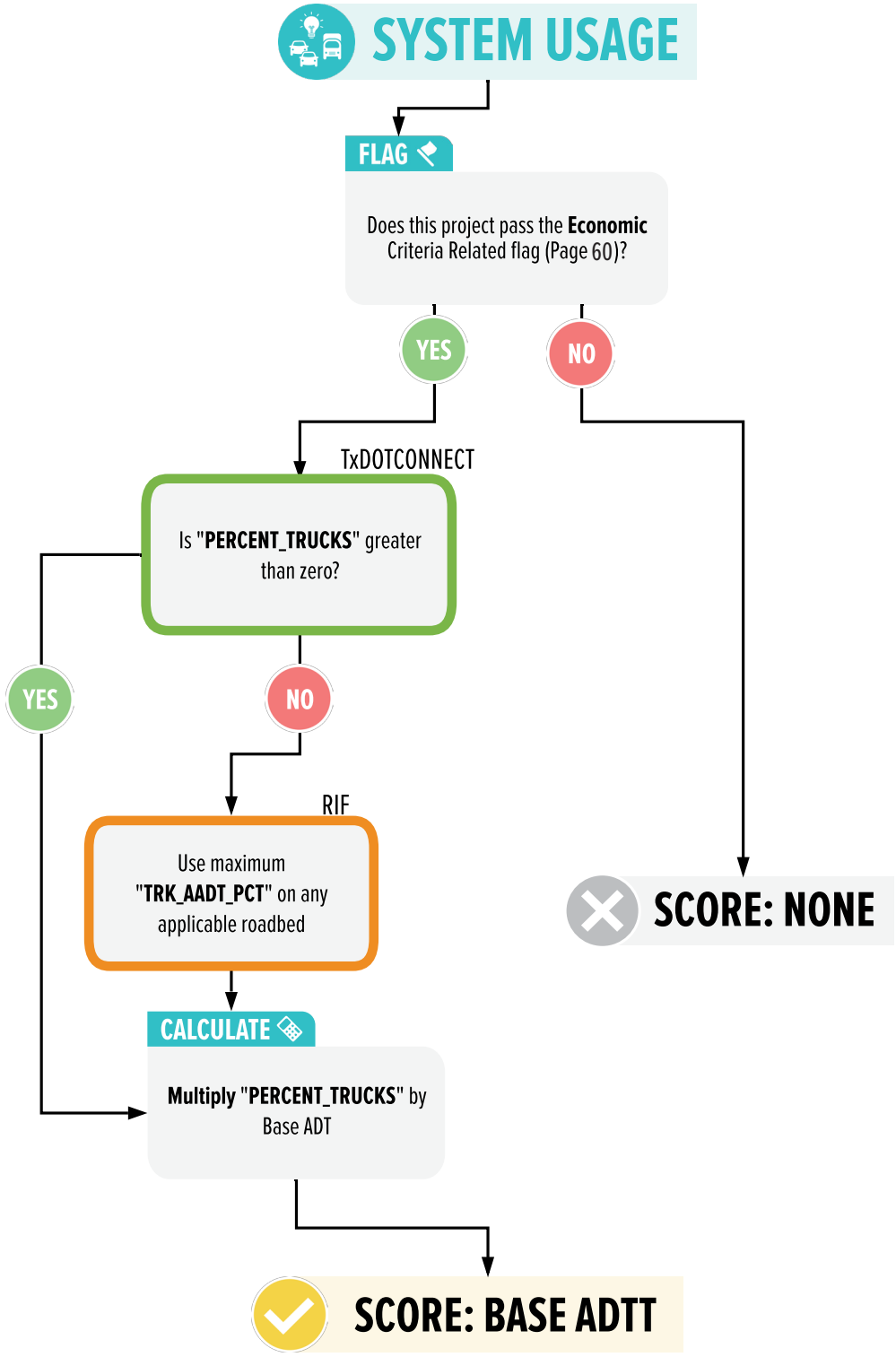
SCORE: NOT AN ENERGY SECTOR ROUTE

SCORE: ENERGY SECTOR ROUTE

BASE AVERAGE DAILY TRAFFIC



BASE AVERAGE DAILY TRUCK TRAFFIC

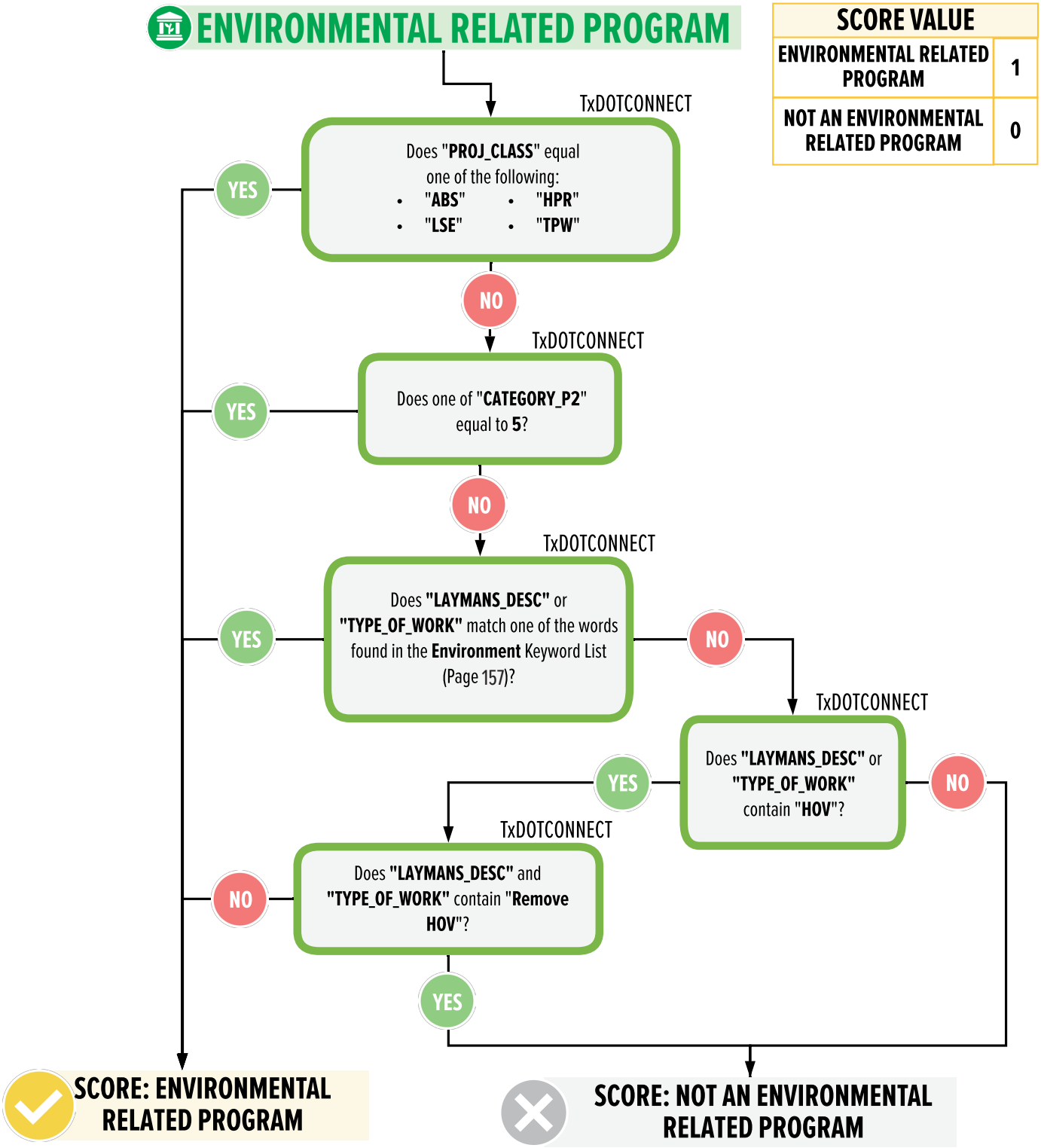


ENVIRONMENT

ENVIRONMENTAL RELATED PROGRAM

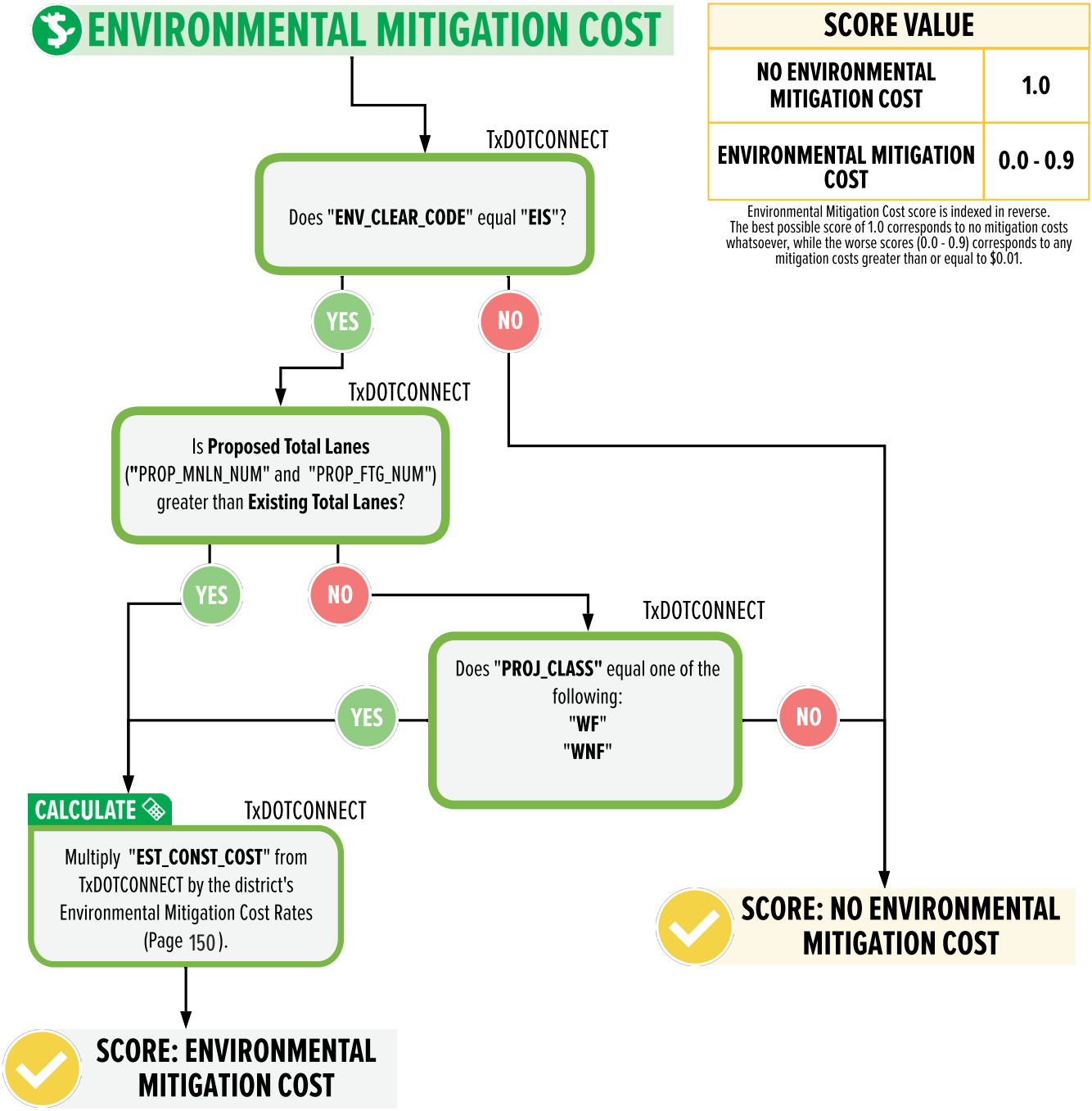
ENVIRONMENTAL MITIGATION COST

ENVIRONMENTAL RELATED PROGRAM



SCORE VALUE	
ENVIRONMENTAL RELATED PROGRAM	1
NOT AN ENVIRONMENTAL RELATED PROGRAM	0

ENVIRONMENTAL MITIGATION COST



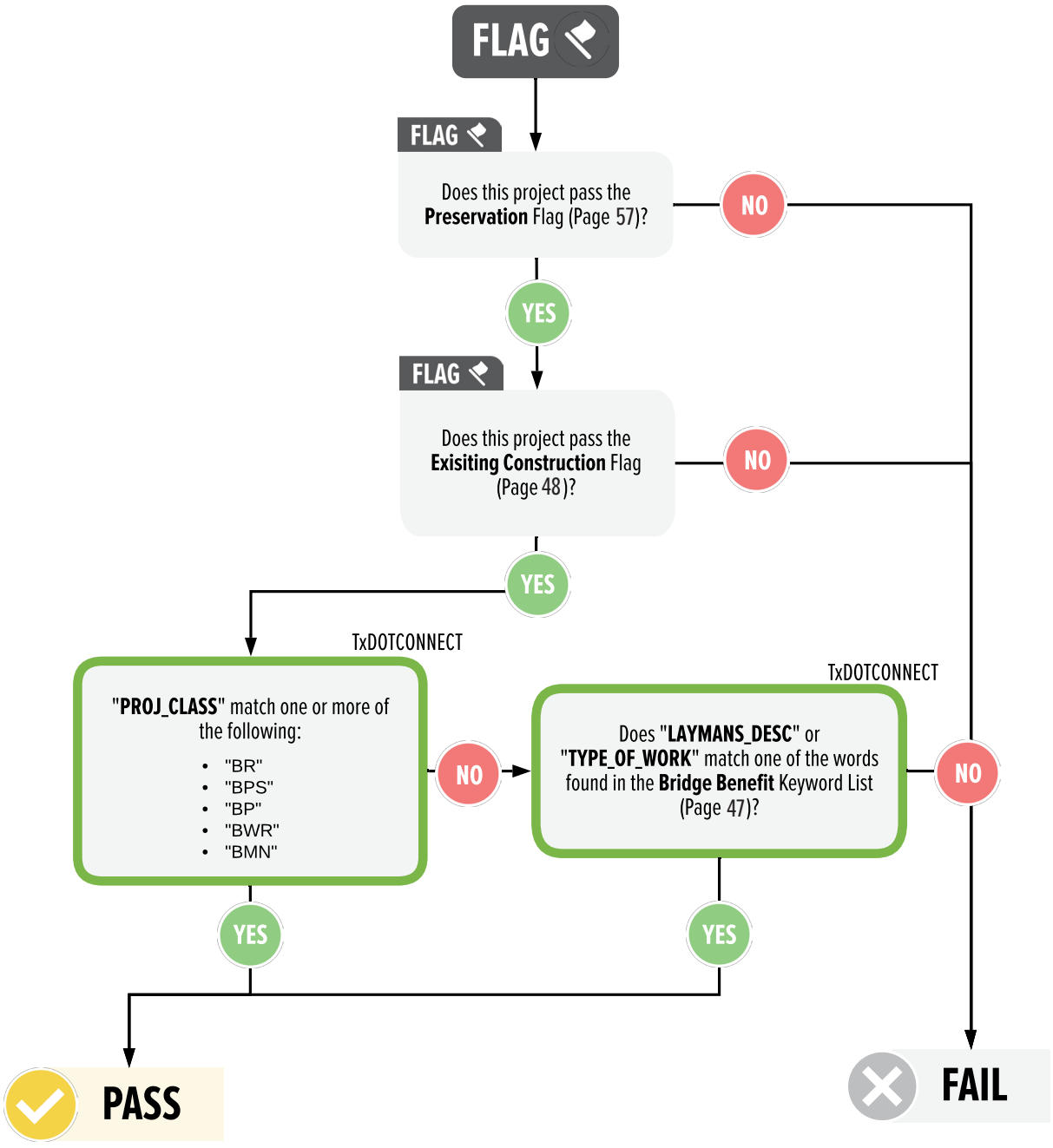
SCORE VALUE	
NO ENVIRONMENTAL MITIGATION COST	1.0
ENVIRONMENTAL MITIGATION COST	0.0 - 0.9

Environmental Mitigation Cost score is indexed in reverse. The best possible score of 1.0 corresponds to no mitigation costs whatsoever, while the worse scores (0.0 - 0.9) corresponds to any mitigation costs greater than or equal to $0.01.

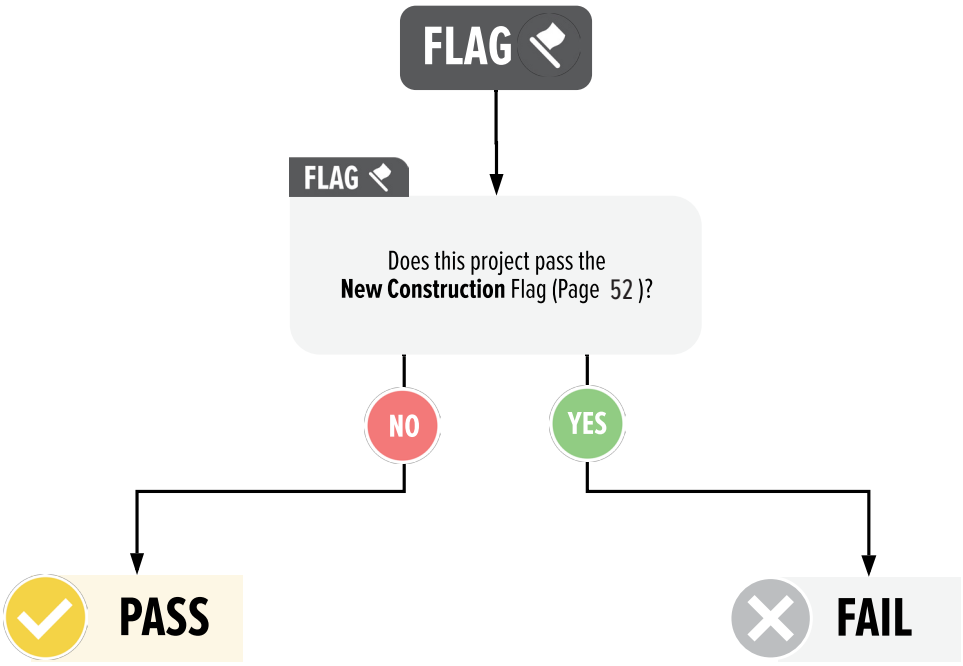
PROJECT PROCESSING FLAGS

- *Bridge Benefit*
- *Existing Construction*
- *Frontage Lanes*
- *Main Lanes*
- *Mobility Benefit*
- *New Construction*
- *Pavement Benefit*

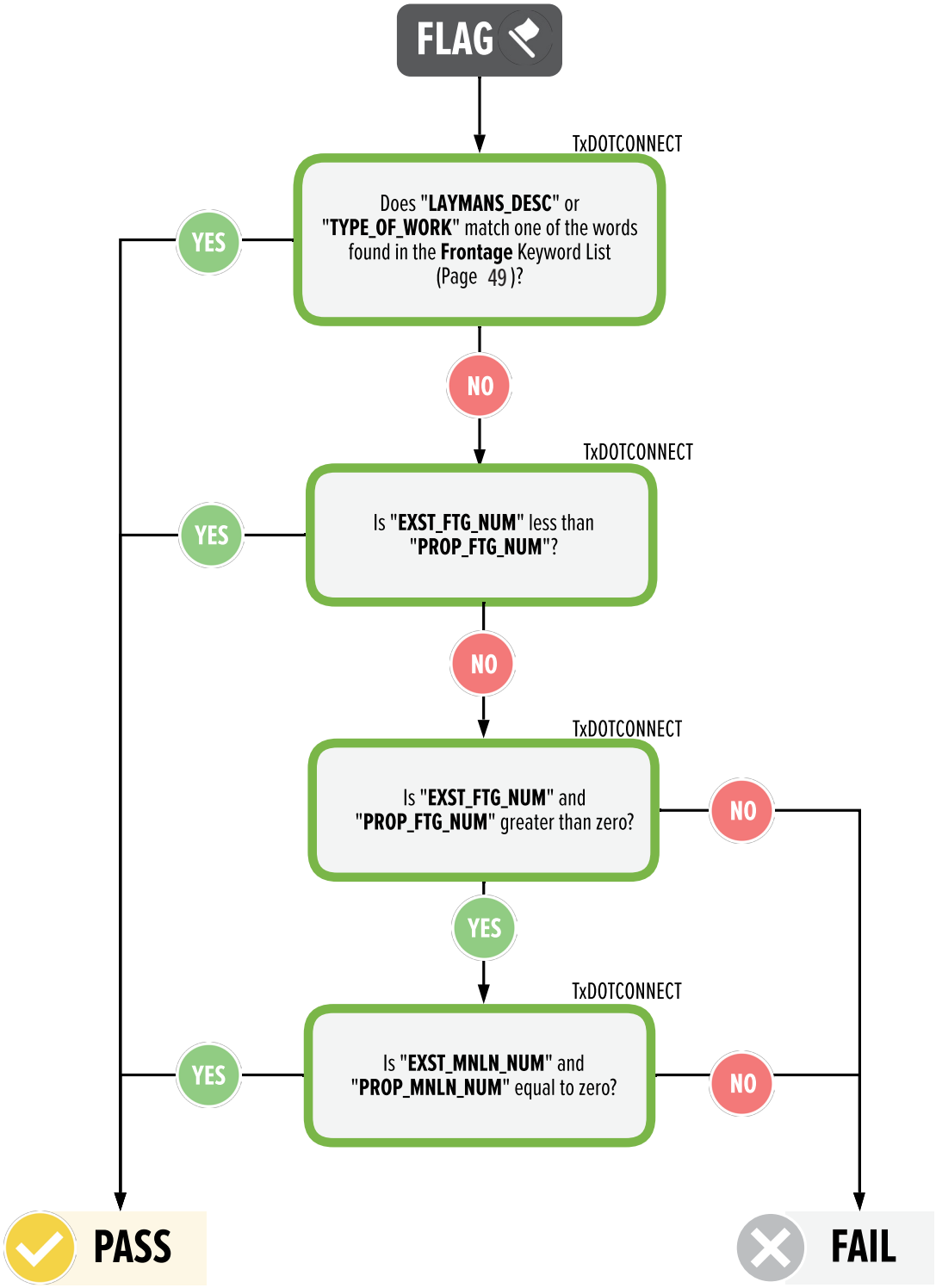
BRIDGE BENEFIT
Project Processing Flag



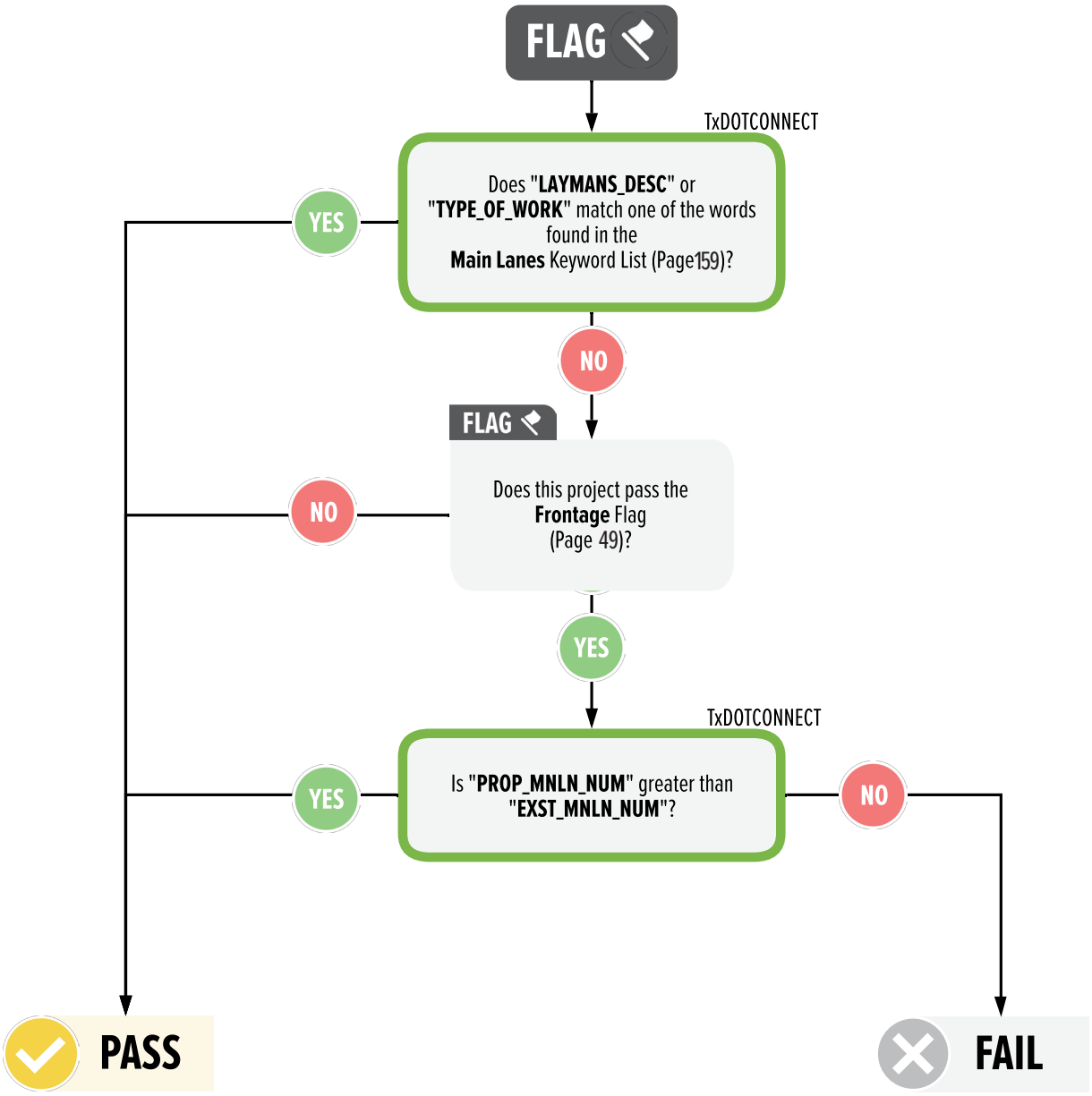
EXISTING CONSTRUCTION
Project Processing Flag



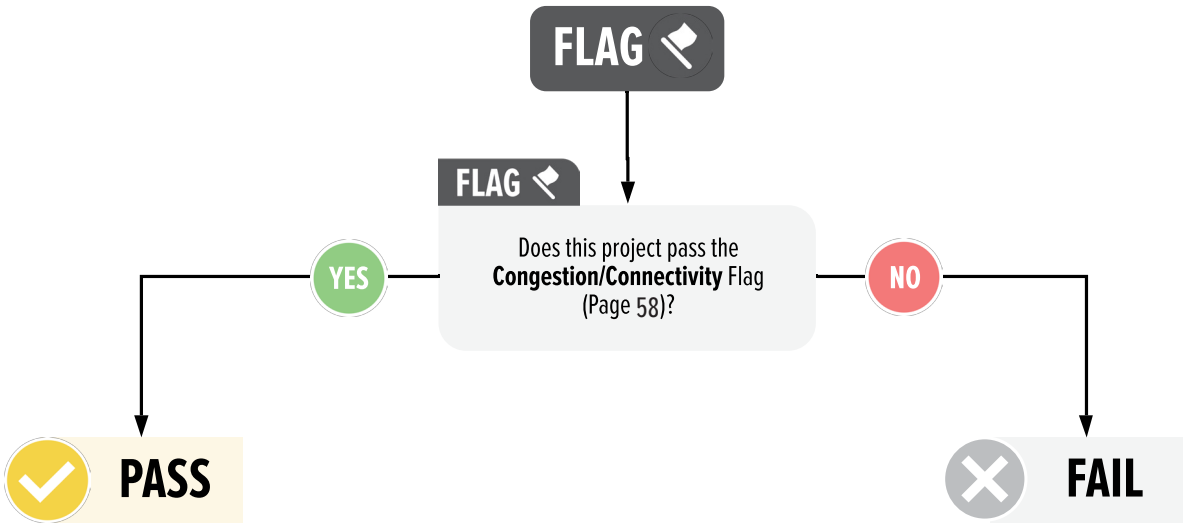
FRONTAGE LANES
Project Processing Flag



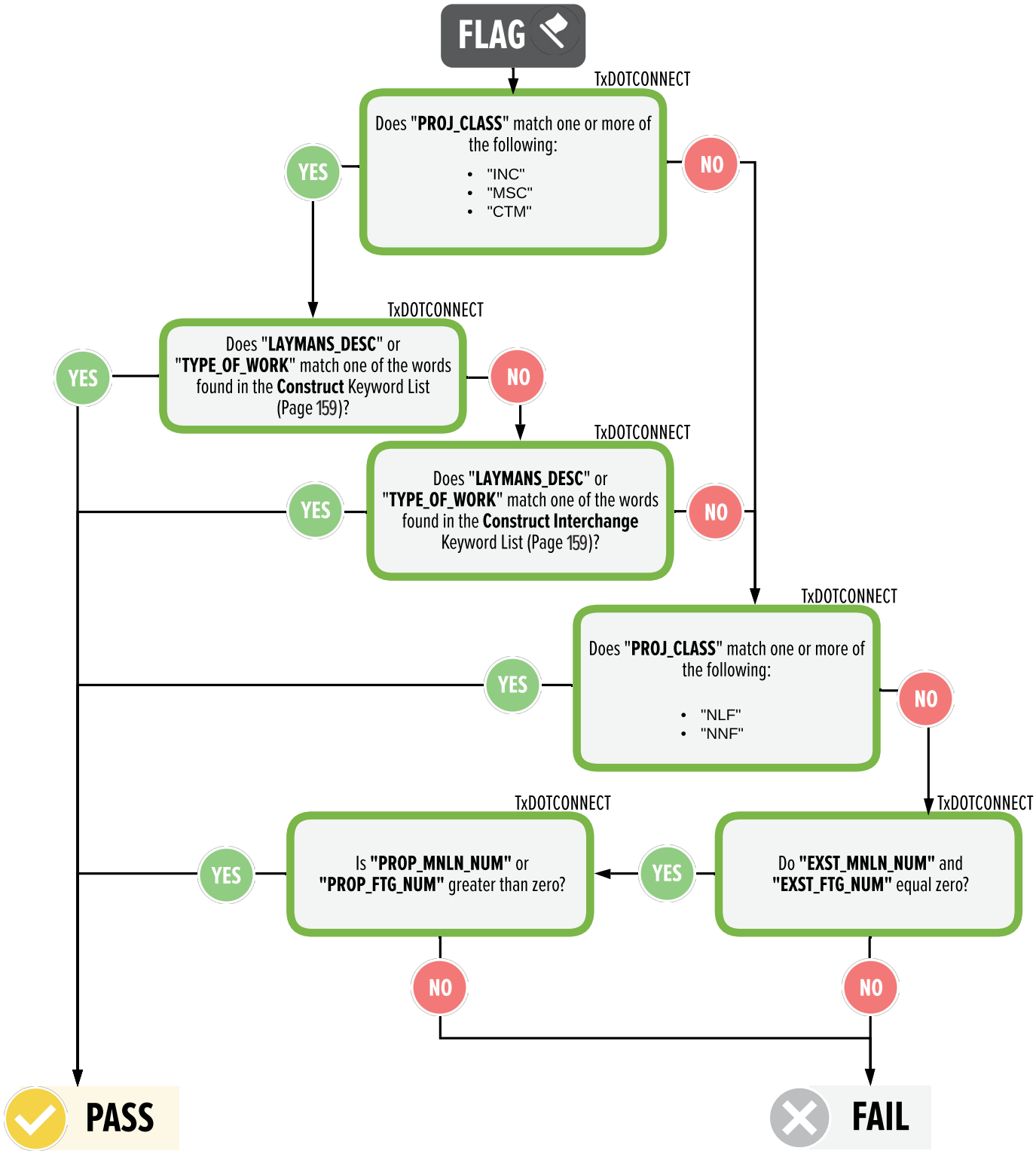
MAIN LANES
Project Processing Flag



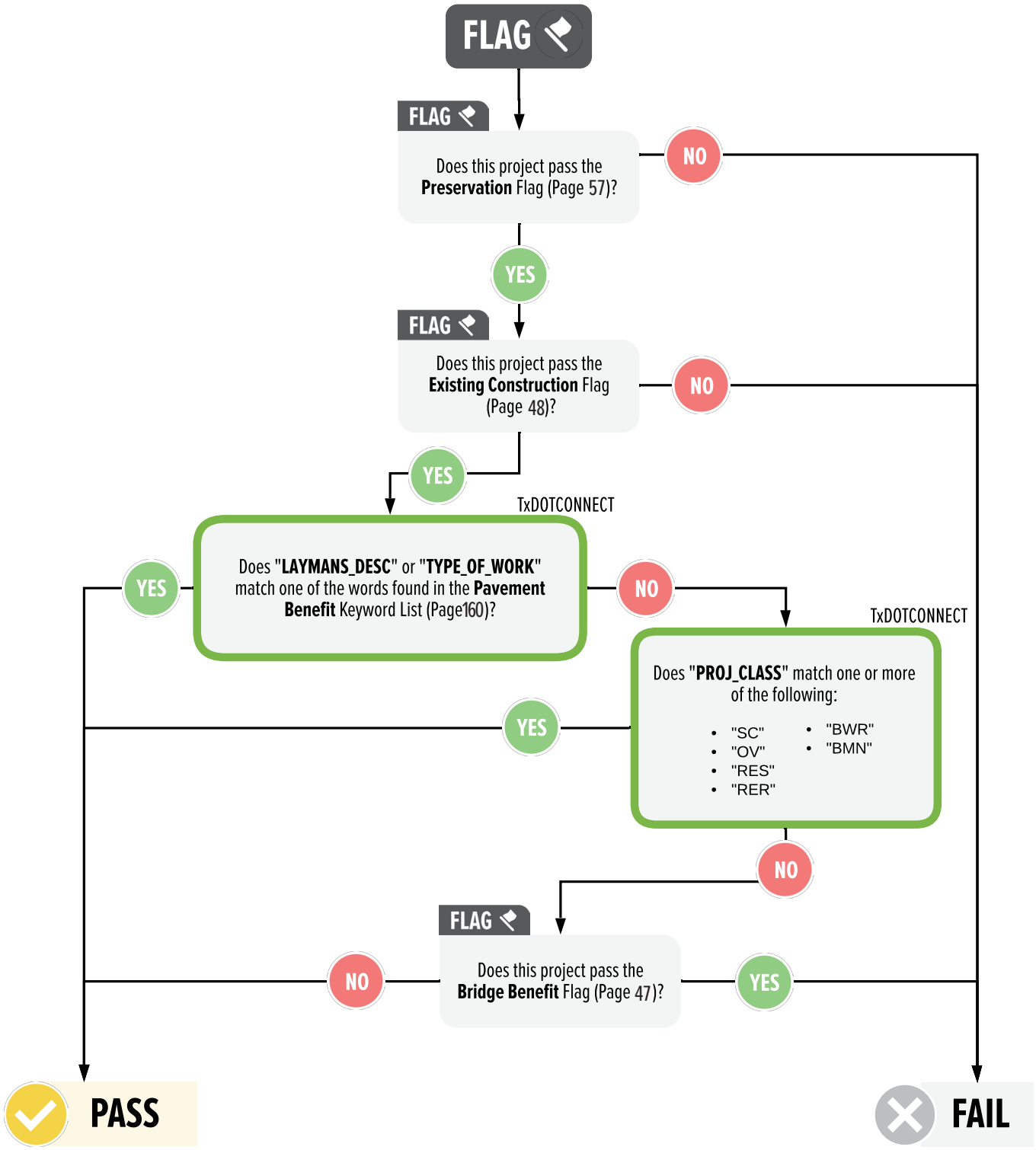
MOBILITY BENEFIT
Project Processing Flag



NEW CONSTRUCTION
Project Processing Flag



PAVEMENT
Project Processing Flag

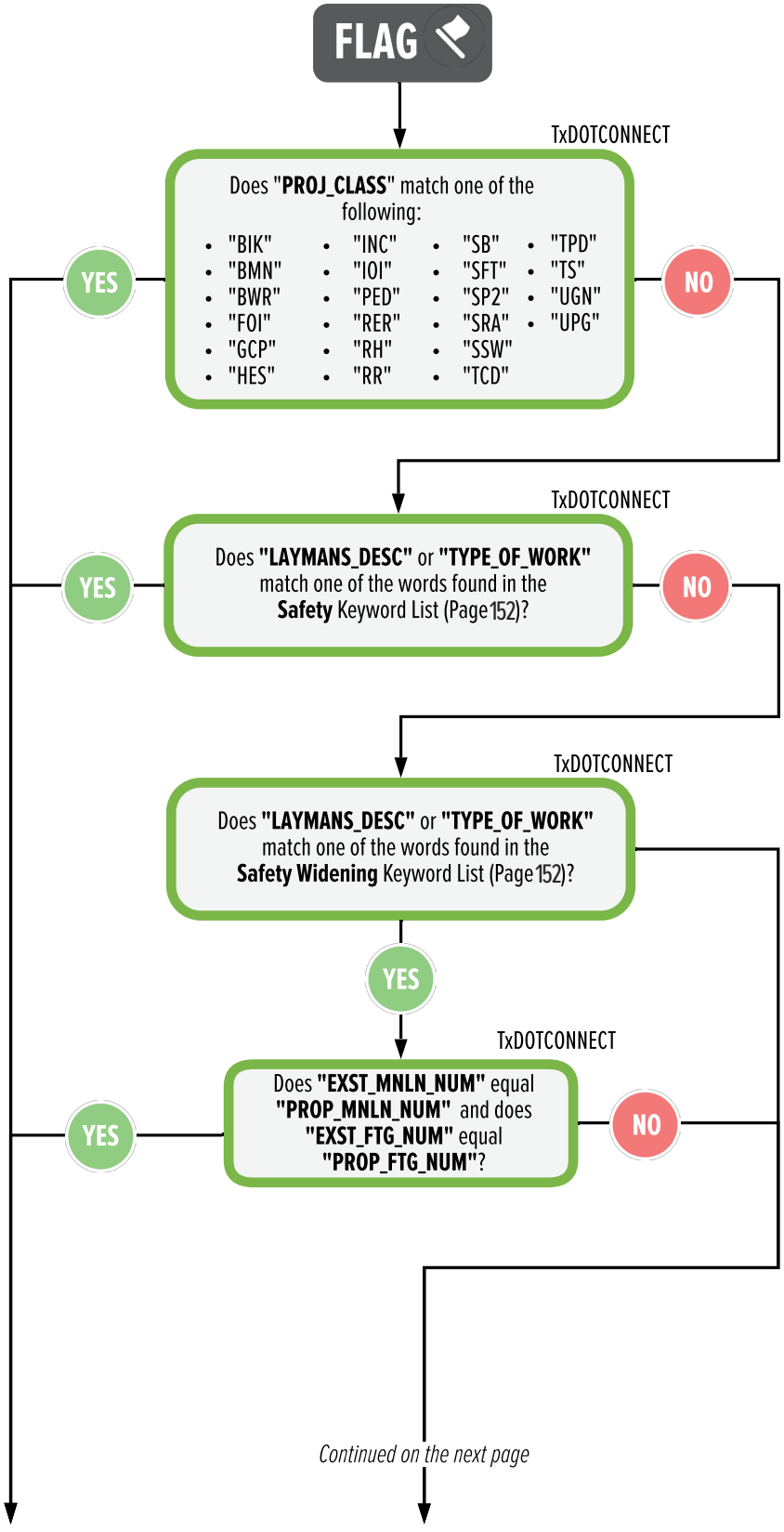


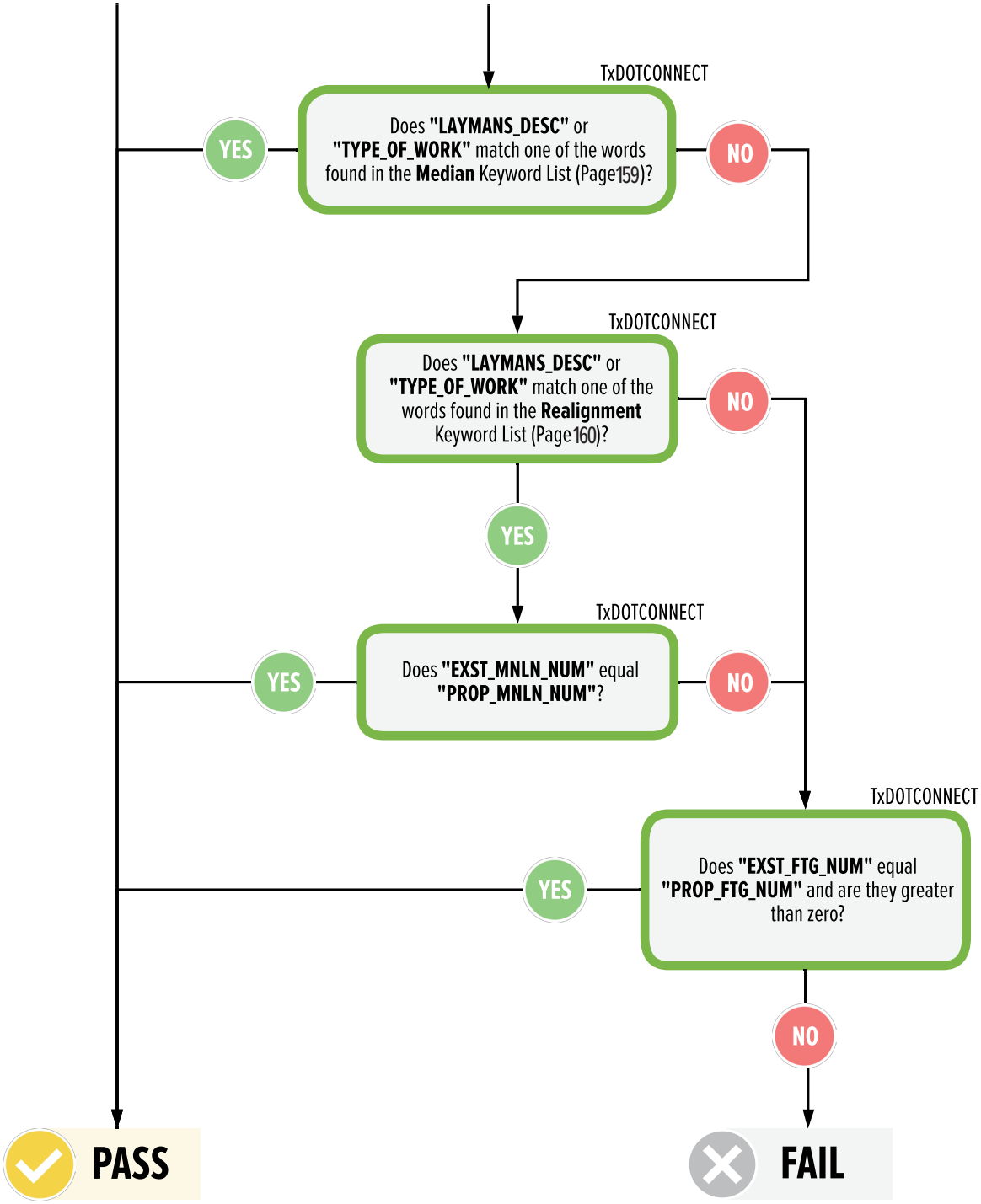
CRITERION RELATED FLAGS

- *Safety*
- *Preservation*
- *Congestion/Connectivity*

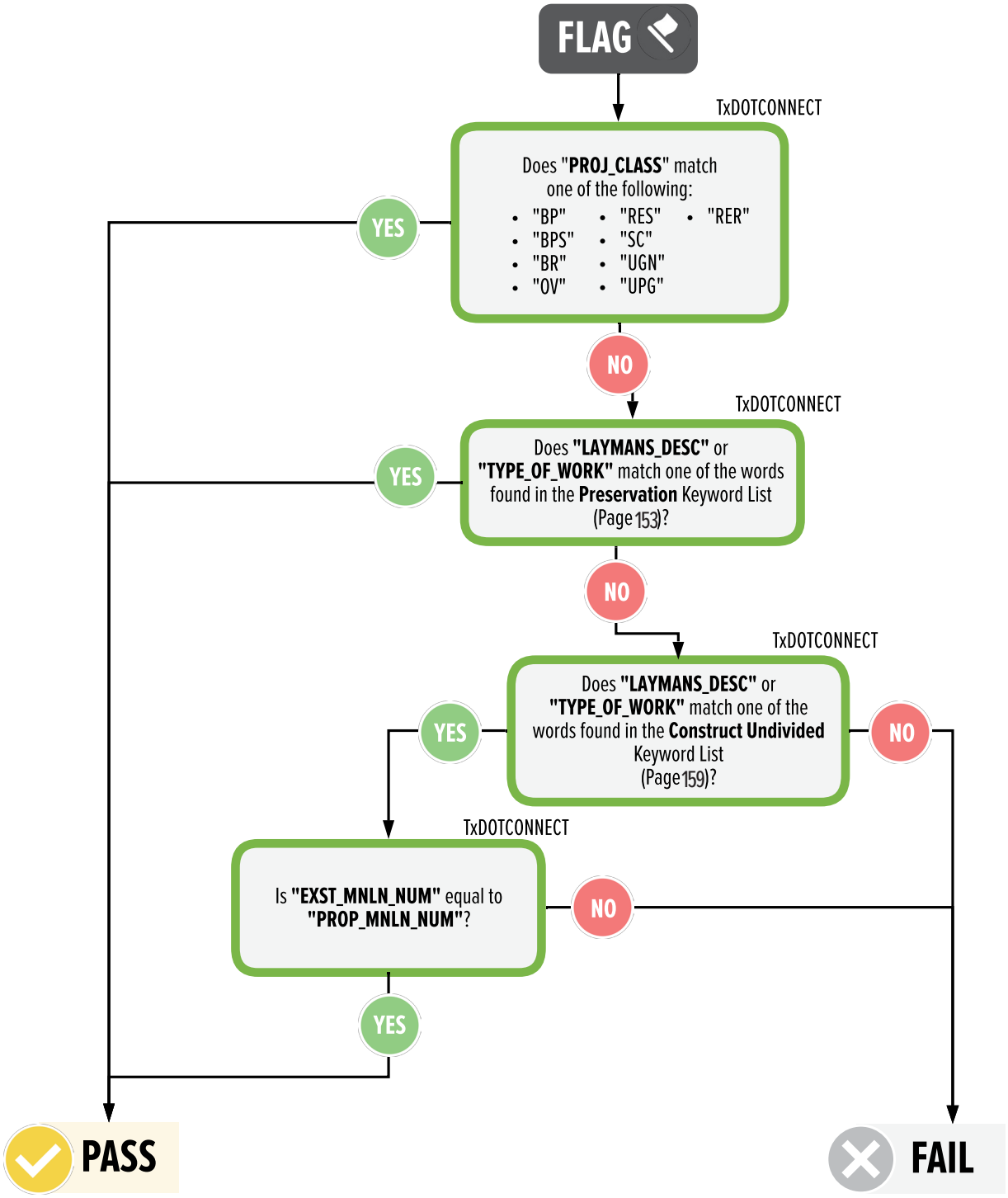
  Note: Congestion and Connectivity flags are combined.
- *Economic*

SAFETY
Criteria Related Flag



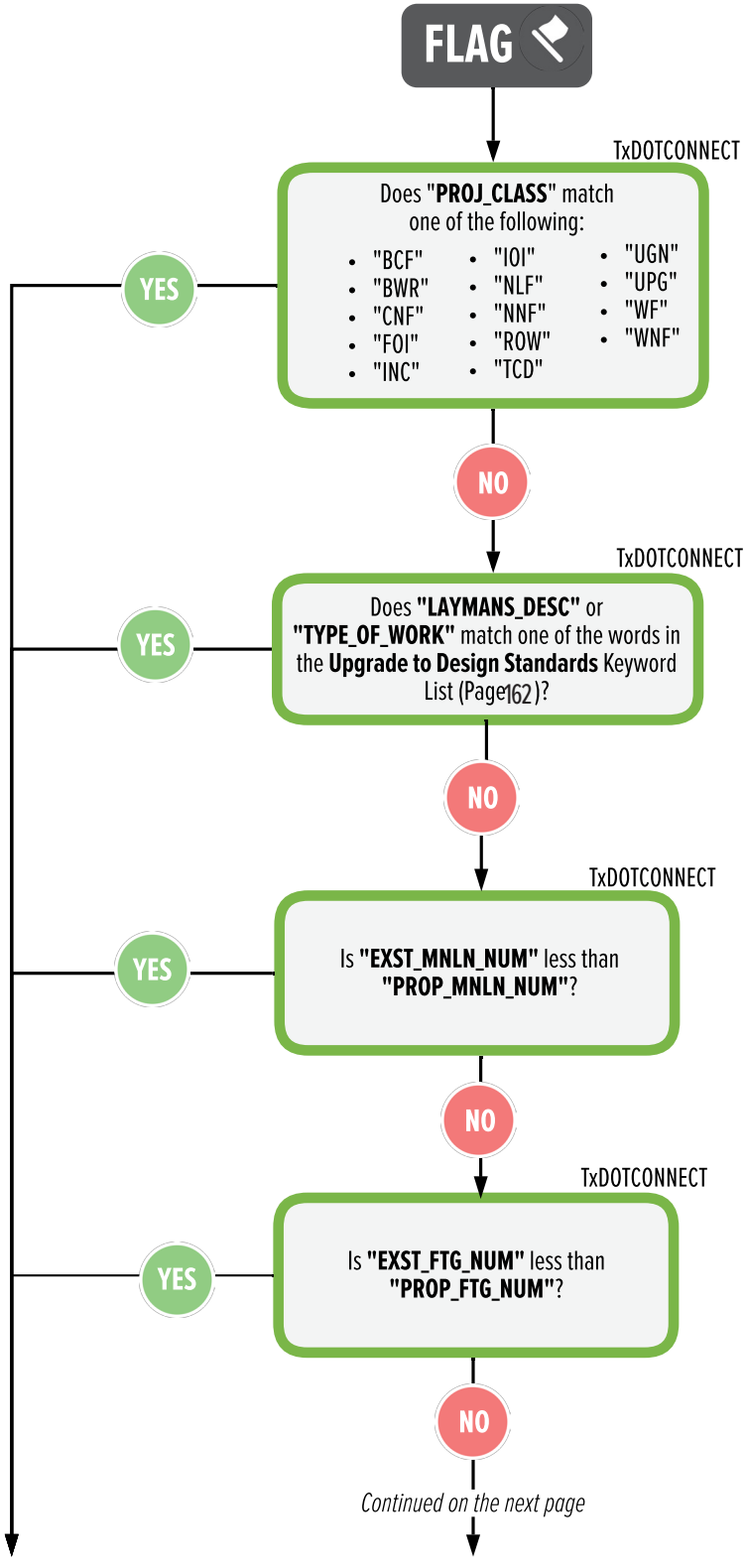

TxDOTCONNECT
Does "LAYMANS_DESC" or "TYPE_OF_WORK" match one of the words found in the Median Keyword List (Page159)?
YES
NO
TxDOTCONNECT
Does "LAYMANS_DESC" or "TYPE_OF_WORK" match one of the words found in the Realignment Keyword List (Page160)?
NO
YES
TxDOTCONNECT
Does "EXST_MNLN_NUM" equal "PROP_MNLN_NUM"?
YES
NO
TxDOTCONNECT
Does "EXST_FTG_NUM" equal "PROP_FTG_NUM" and are they greater than zero?
YES
NO
PASS
FAIL

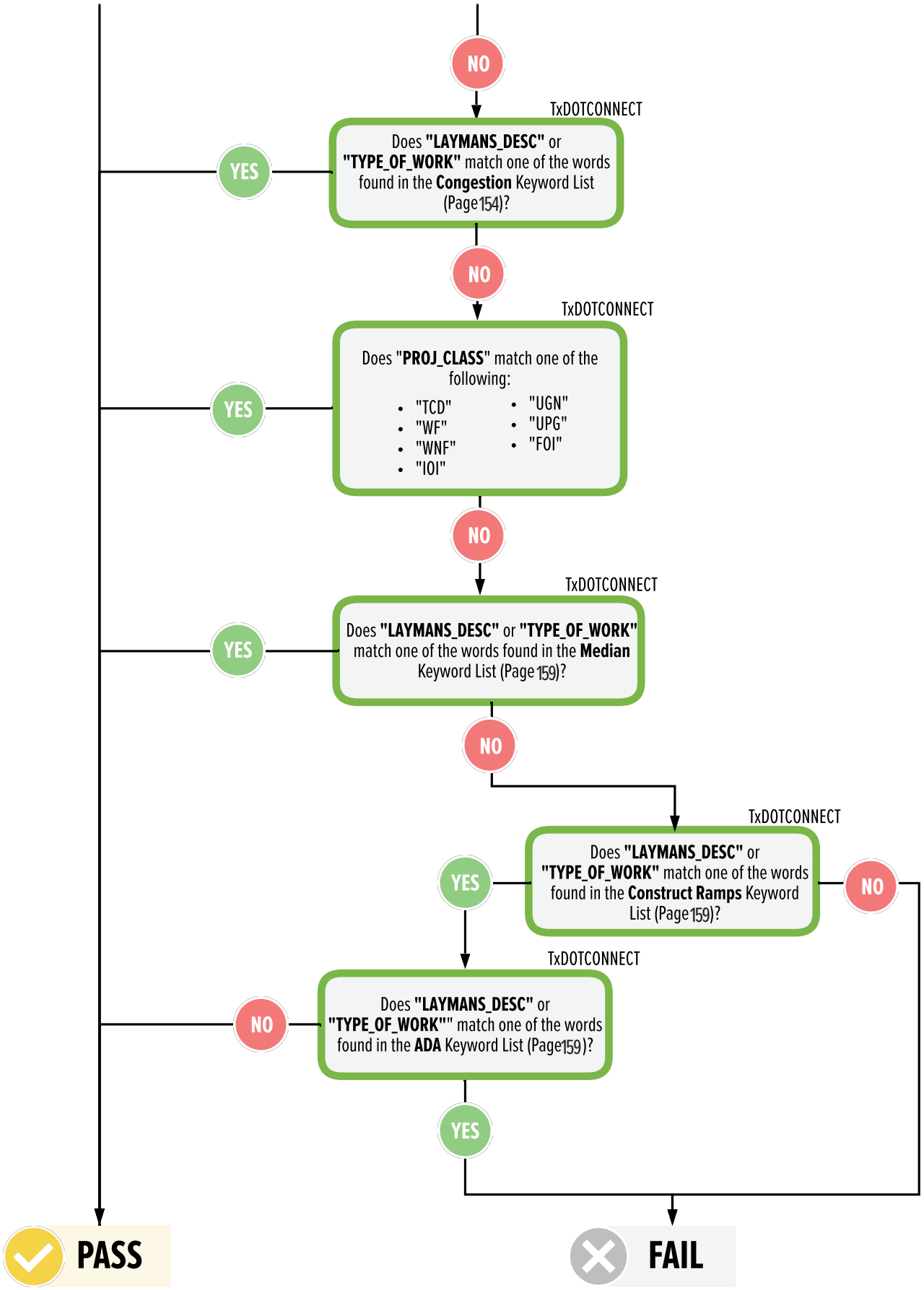
PRESERVATION
Criteria Related Flag



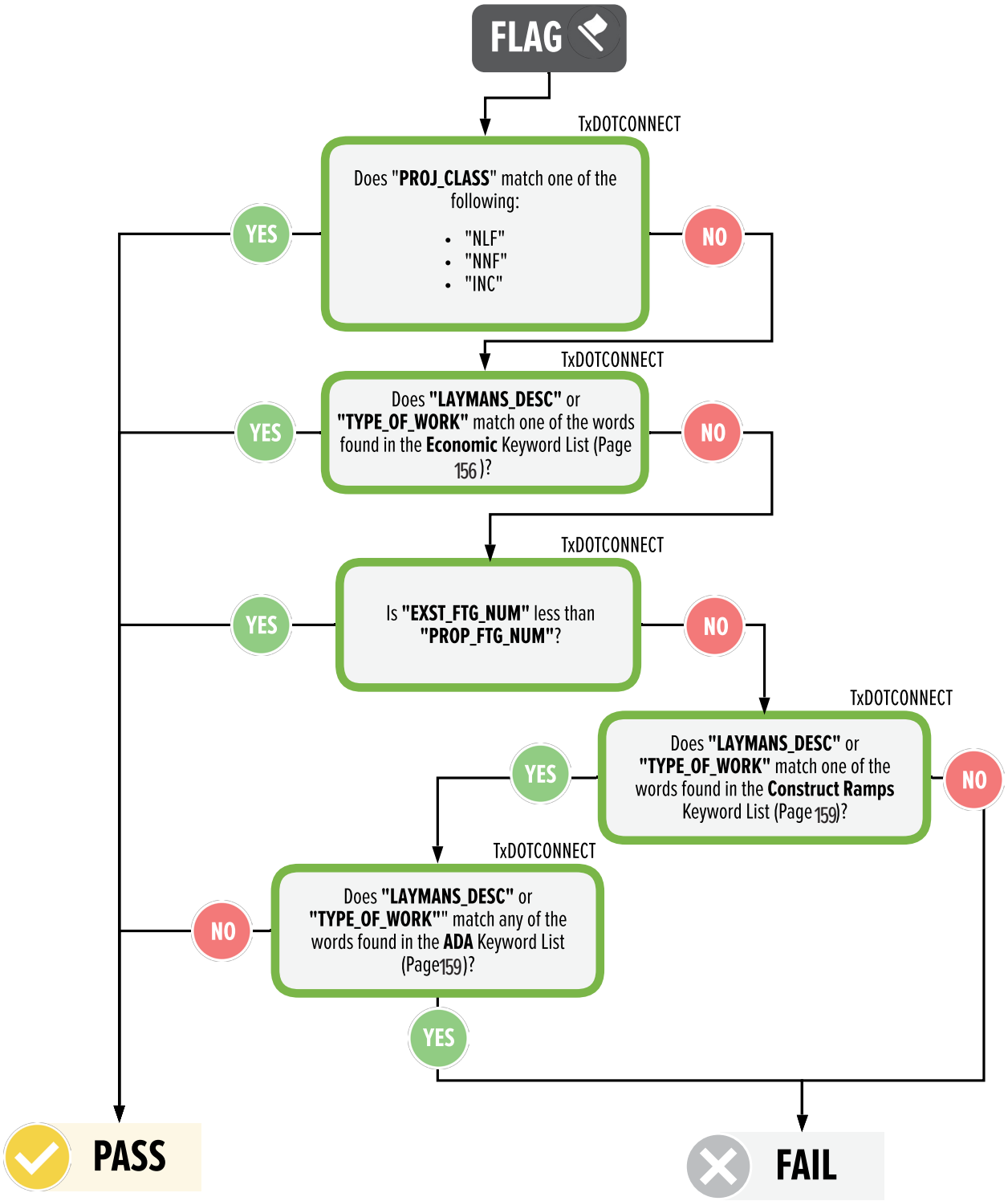
CONGESTION/CONNECTIVITY

Criteria Related Flag




NO
TxDOTCONNECT
Does "LAYMANS_DESC" or "TYPE_OF_WORK" match one of the words found in the Congestion Keyword List (Page 154)?
YES
NO
TxDOTCONNECT
Does "PROJ_CLASS" match one of the following:
"TCD"
"WF"
"WNF"
"IOI"
"UGN"
"UPG"
"FOI"
YES
NO
TxDOTCONNECT
Does "LAYMANS_DESC" or "TYPE_OF_WORK" match one of the words found in the Median Keyword List (Page 159)?
YES
NO
TxDOTCONNECT
Does "LAYMANS_DESC" or "TYPE_OF_WORK" match one of the words found in the Construct Ramps Keyword List (Page 159)?
YES
NO
TxDOTCONNECT
Does "LAYMANS_DESC" or "TYPE_OF_WORK"" match one of the words found in the ADA Keyword List (Page 159)?
NO
YES
PASS
FAIL

ECONOMIC
Criteria Related Flag



SAFETY RELATED FLAGS

- *AUX Lanes*
- *Center Left*
- *Construct Interchange*
- *Construct Shoulders*
- *Divided Roadway*
- *Frontage 1-Way*
- *Grade Separation*
- *Passing Lanes*
- *Railroad Grade Separation*
- *Reconstruct Interchange*
- *Roadway Signs*
- *Super Two*
- *Upgrade to Standards*
- *Vertical Alignment*
- *Widen Lanes*
- *Widen Shoulders*

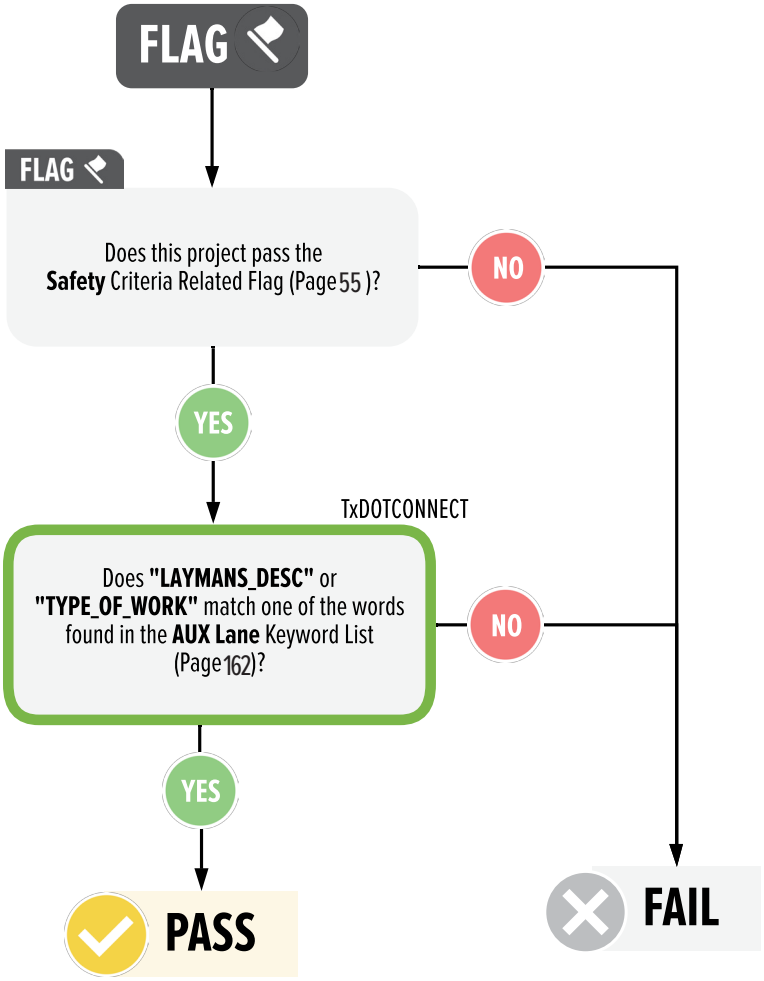
Introduction

Project data is parsed to determine its alignment with Crash Mitigating Factors (CMFs). These CMFs are associated with a percentage reduction in crashes of a certain type.

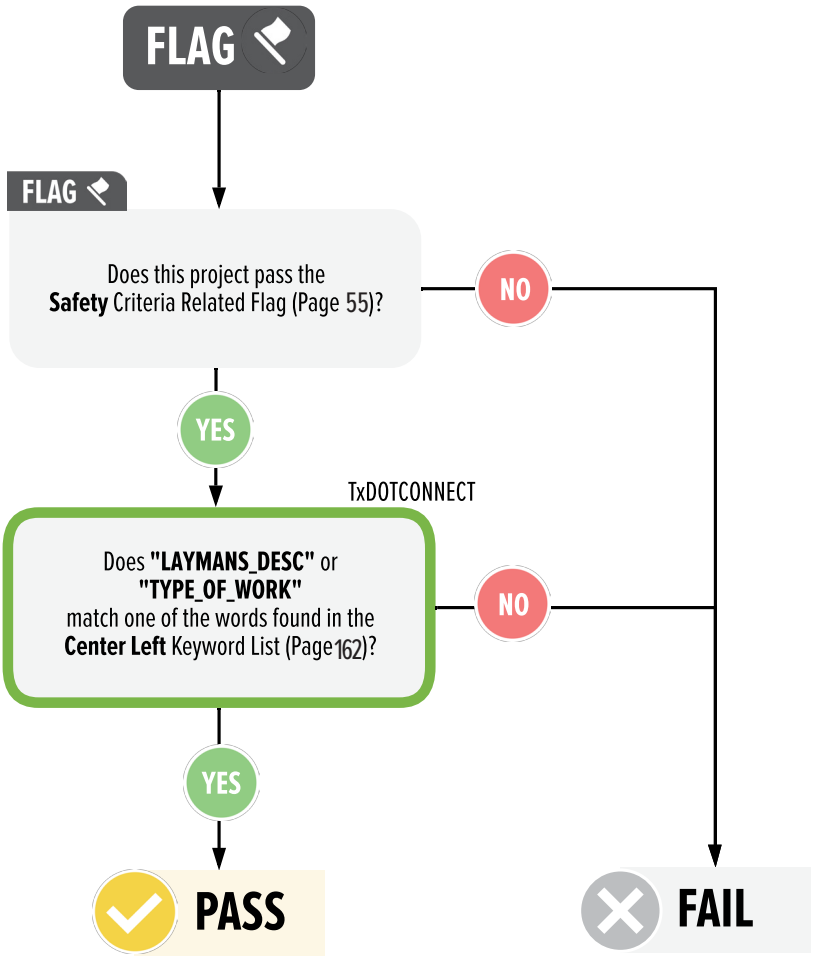
The project's associated CMF categorization is paired with all crashes matching the same categories to predict a quantity of preventable crashes in the future. Project description, type of work, lane counts, project classification, and more are parsed to determine categorization.

Crash CMF categorization is detailed in the Crash Type Flags section.

AUX LANES
Safety Related Flag

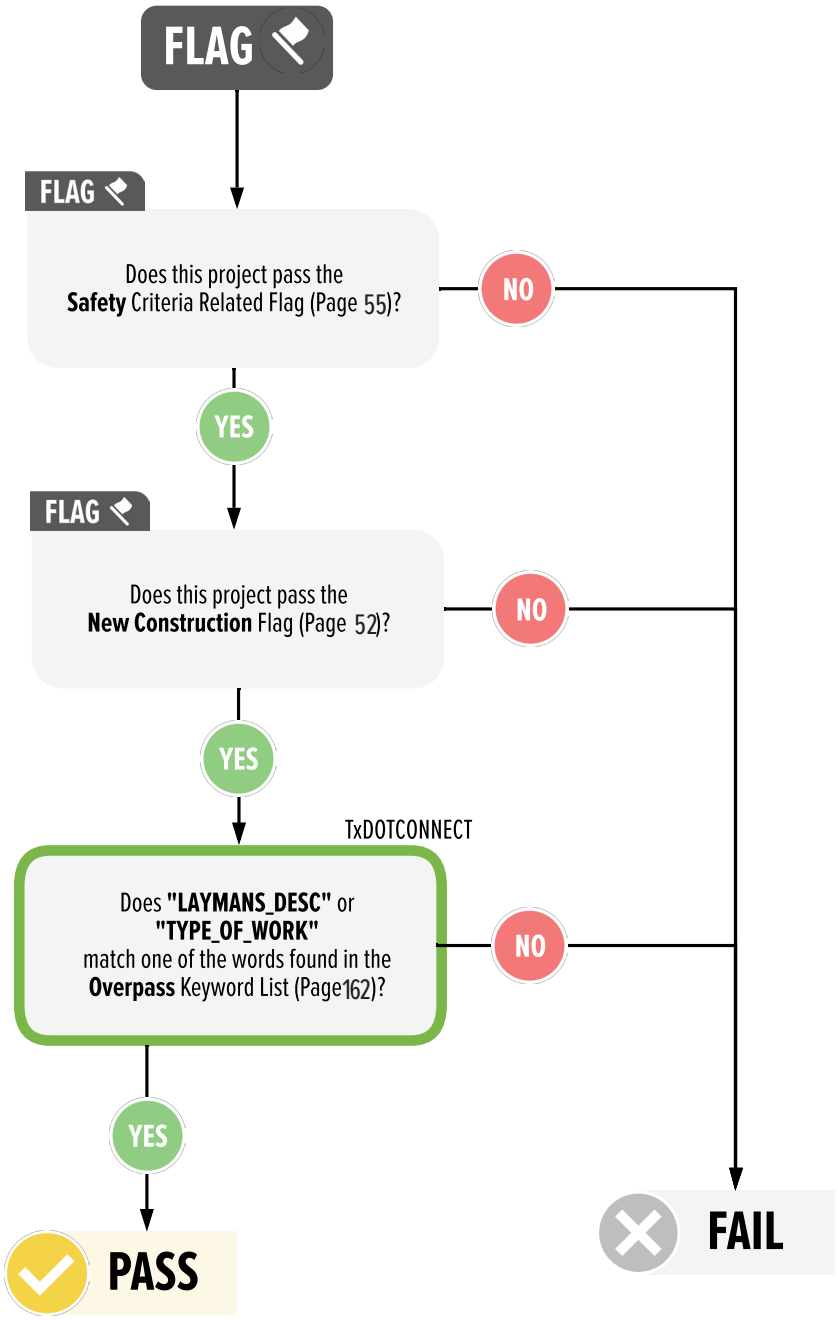


CENTER LEFT
Safety Related Flag



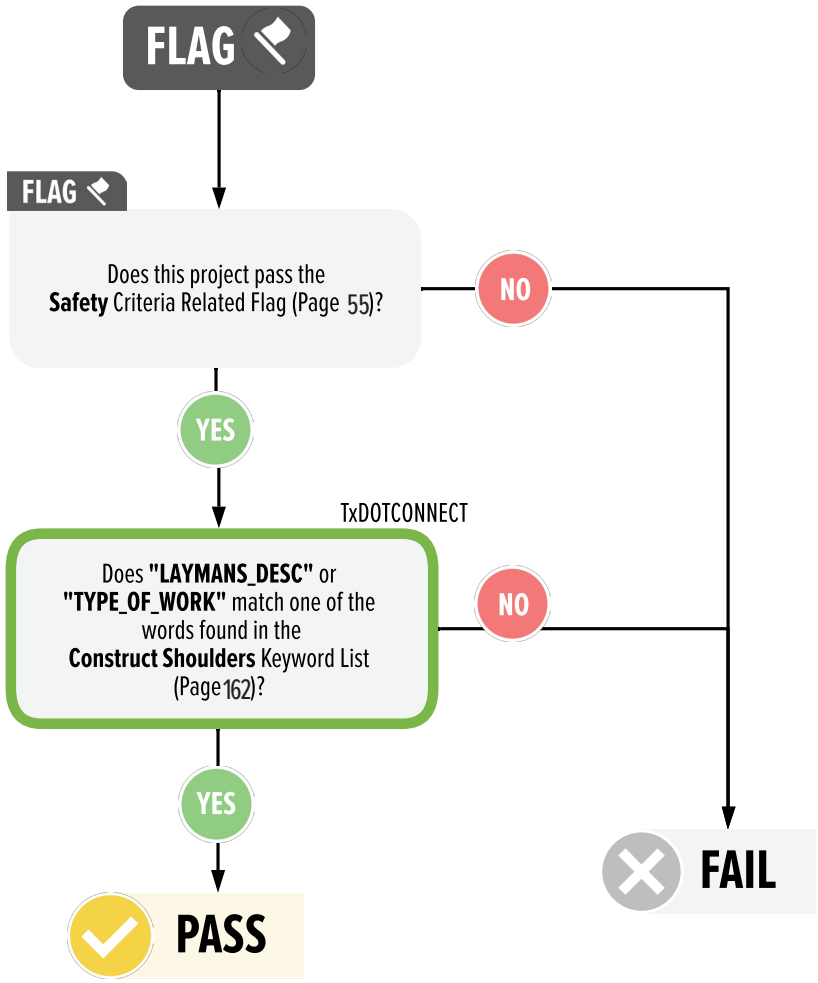
CONSTRUCT INTERCHANGE

Safety Related Flag

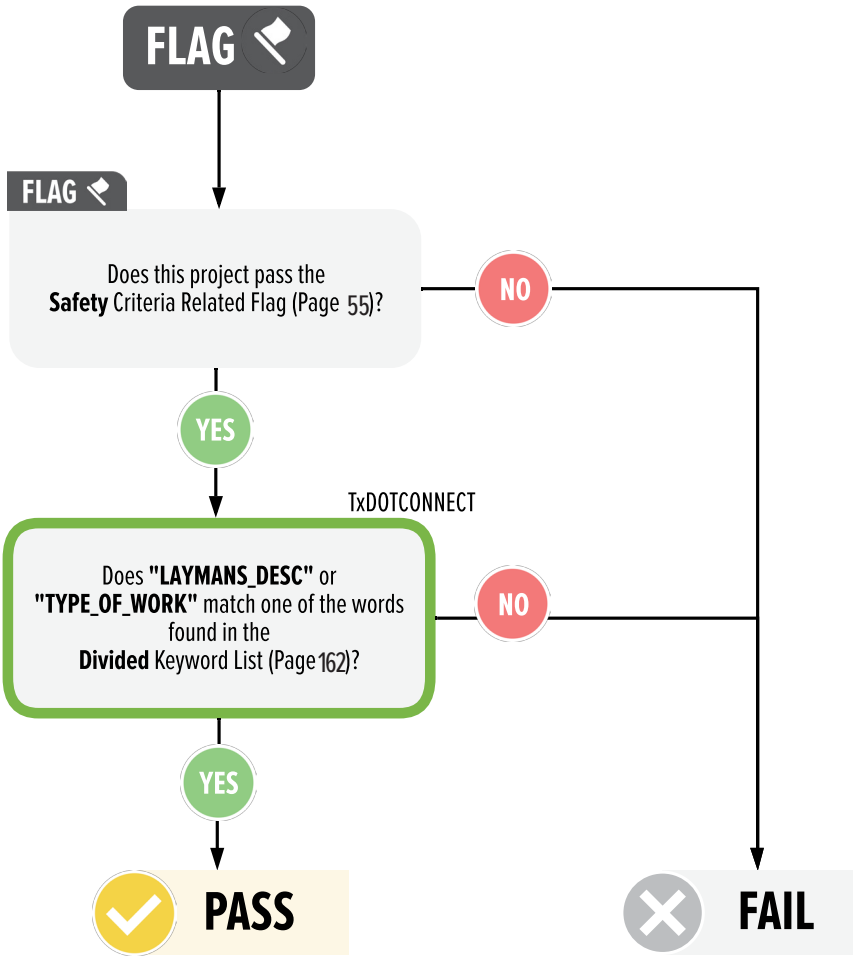


CONSTRUCT SHOULDERS

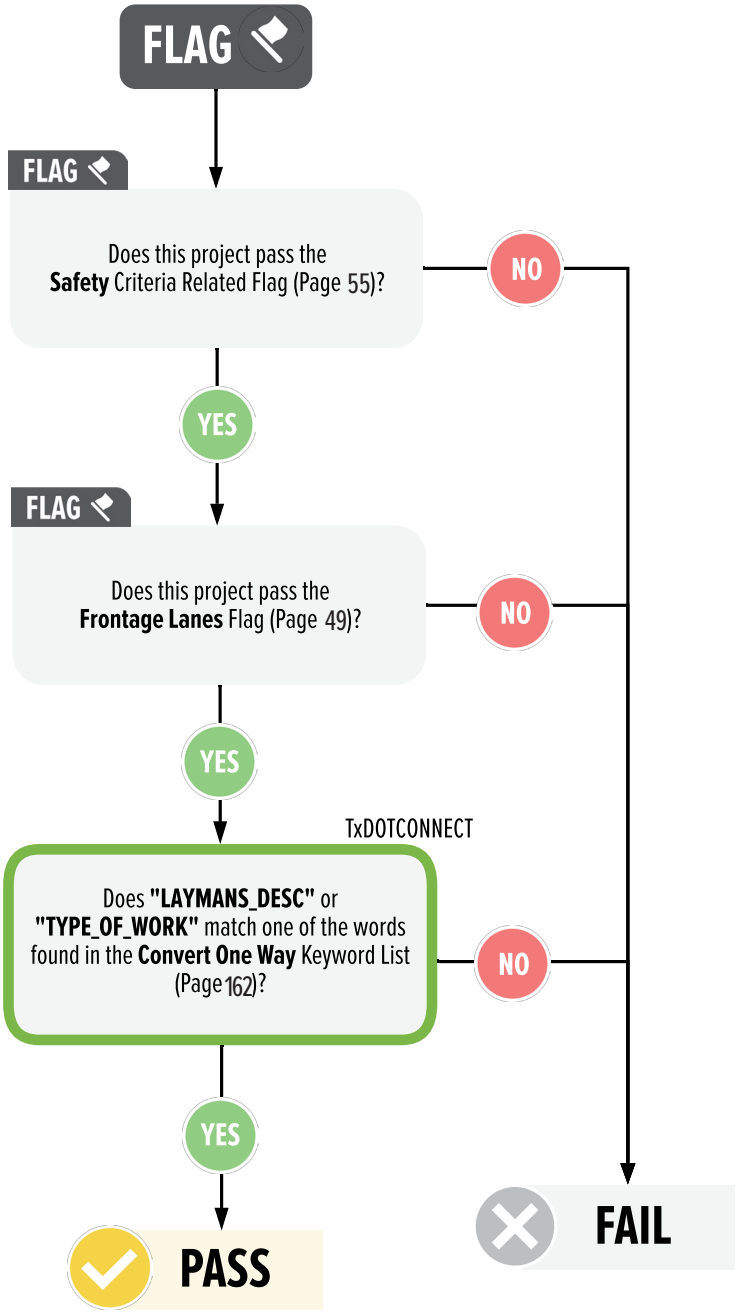
Safety Related Flag



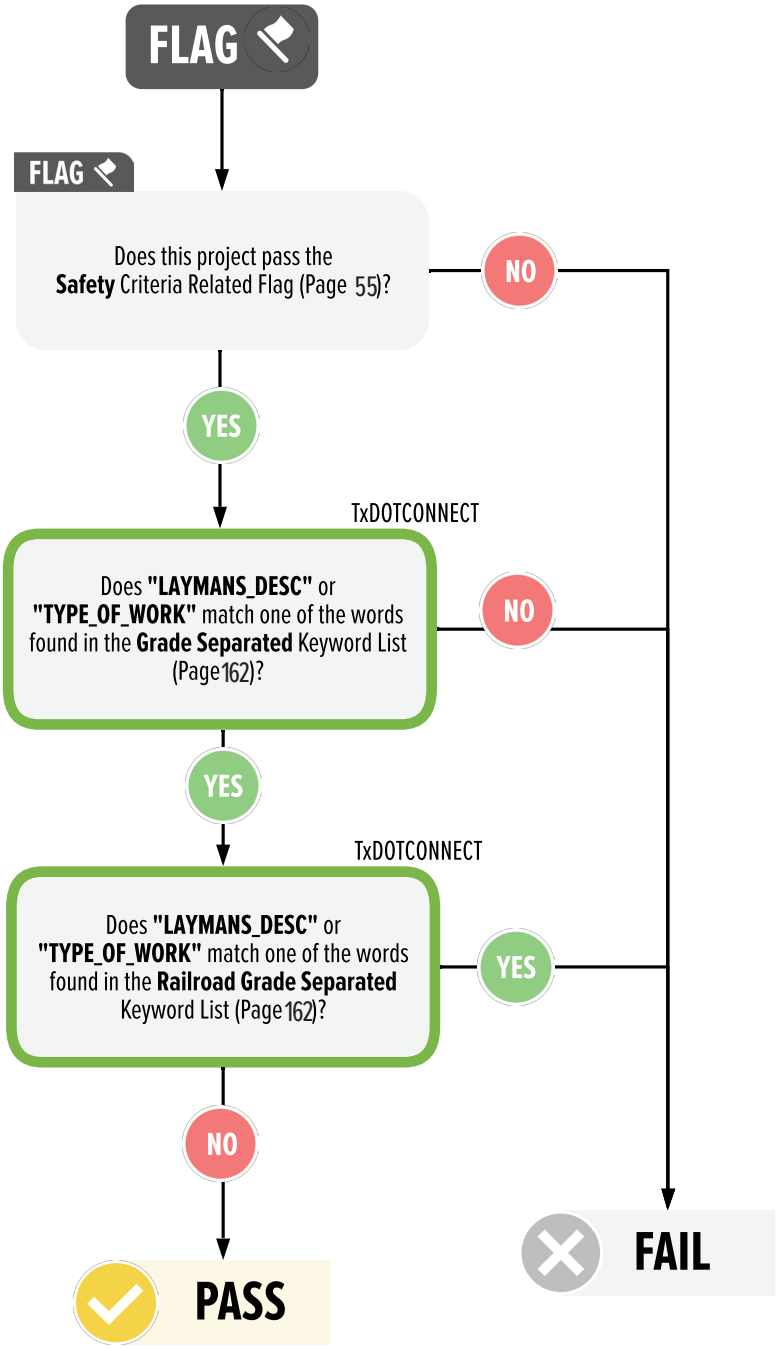
DIVIDED ROADWAY
Safety Related Flag



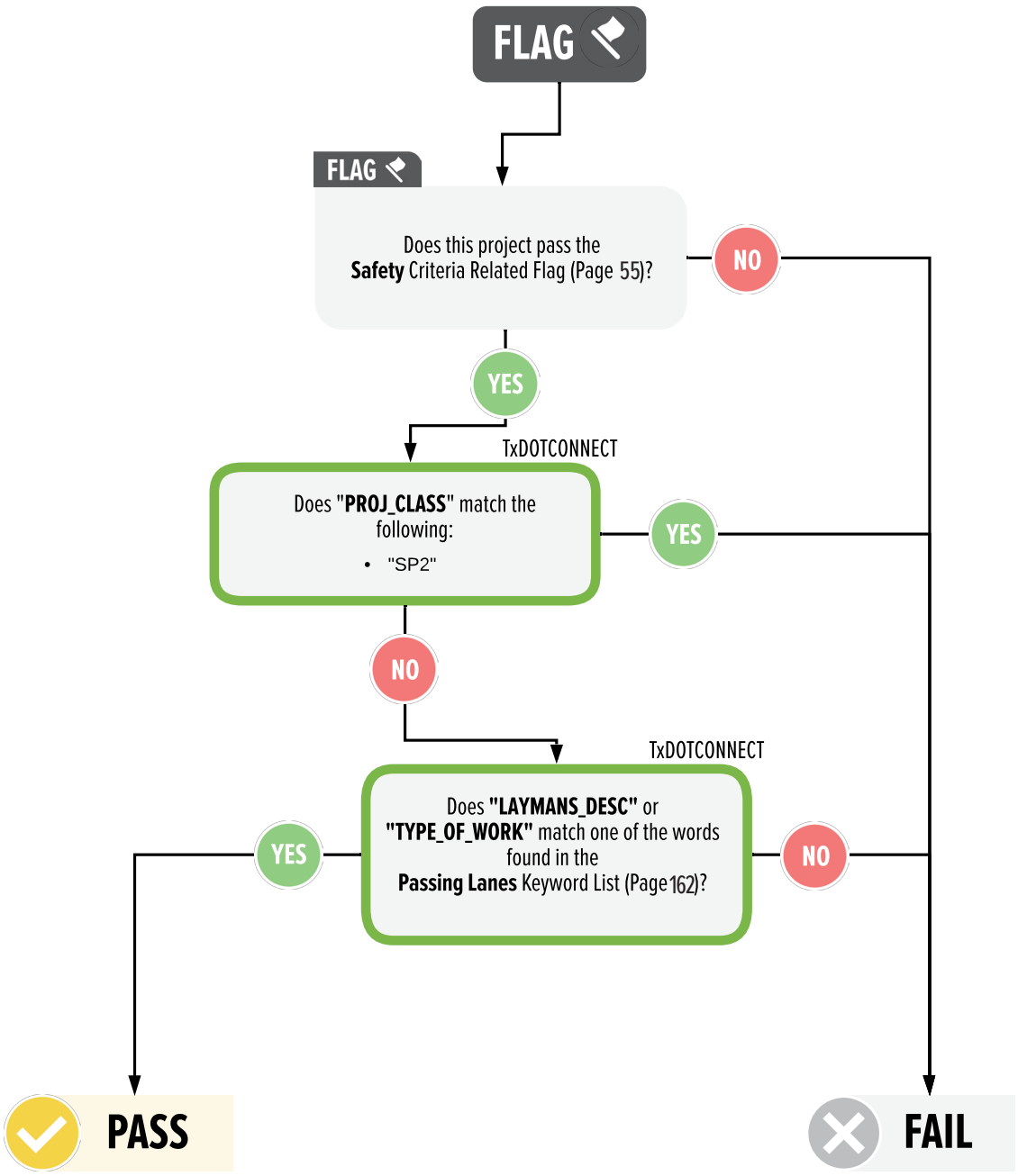
FRONTAGE 1-WAY
Safety Related Flag



GRADE SEPARATION
Safety Related Flag

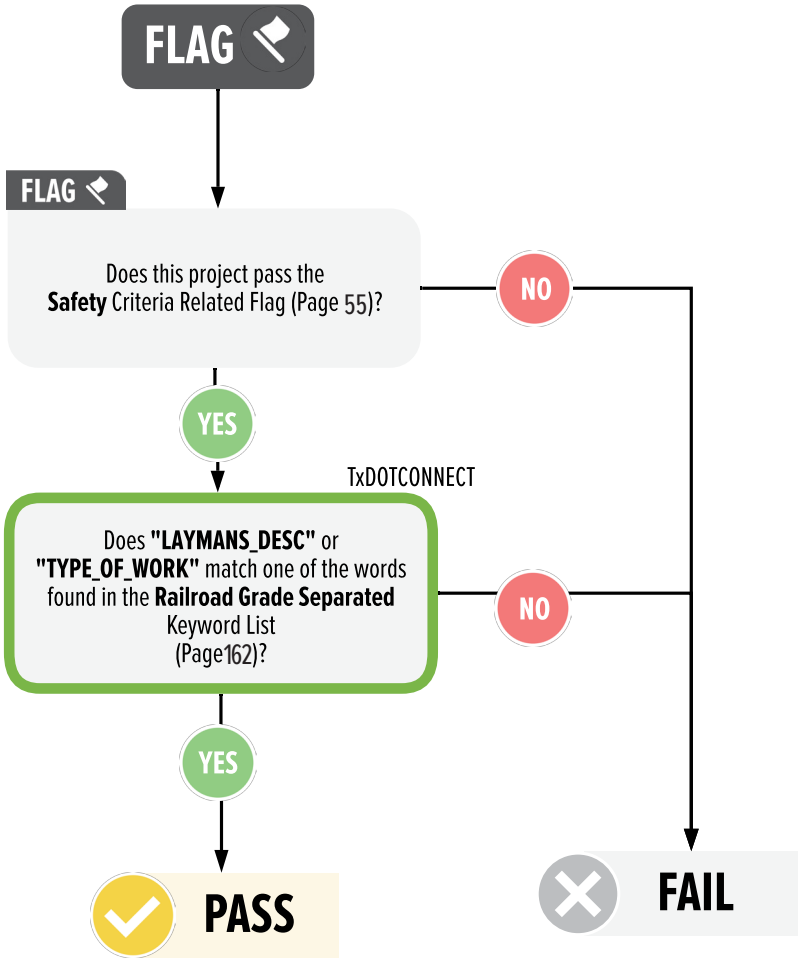


PASSING LANES
Safety Related Flag



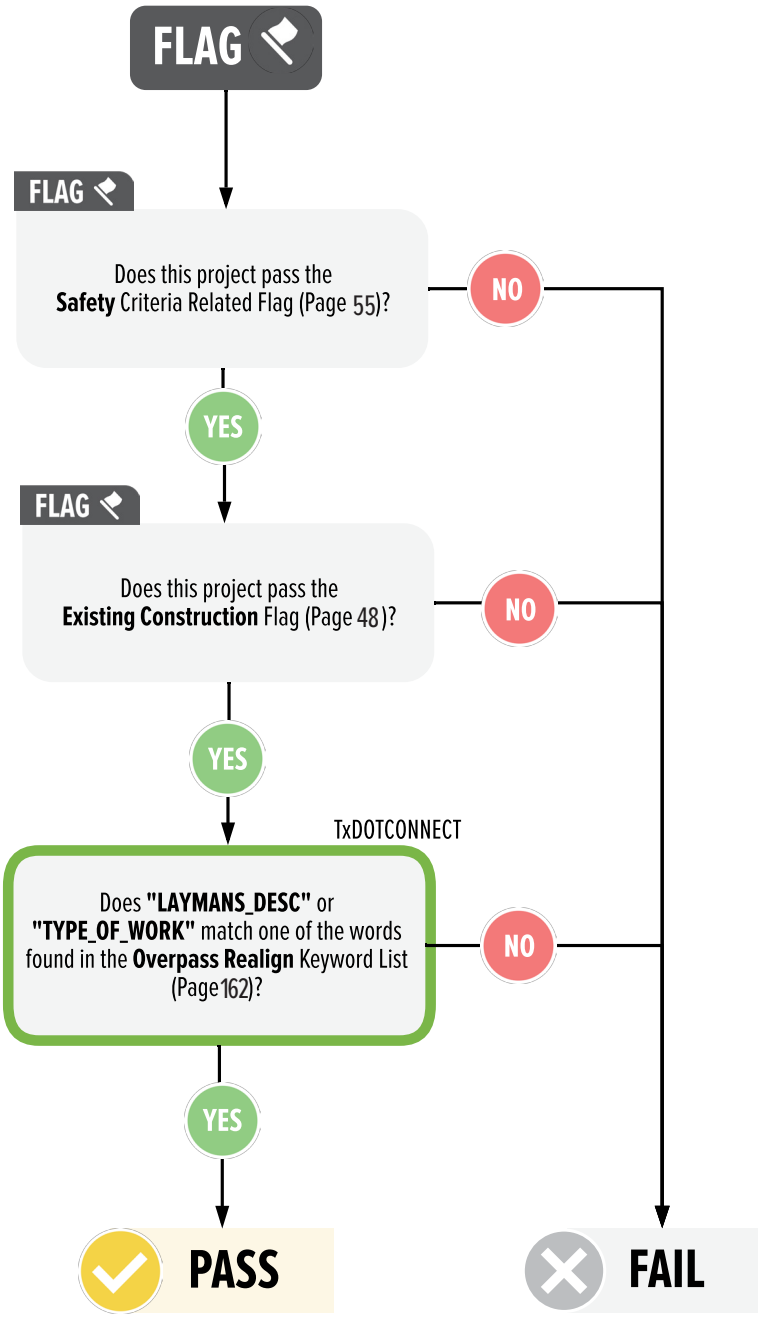
RAILROAD GRADE SEPARATION

Safety Related Flag

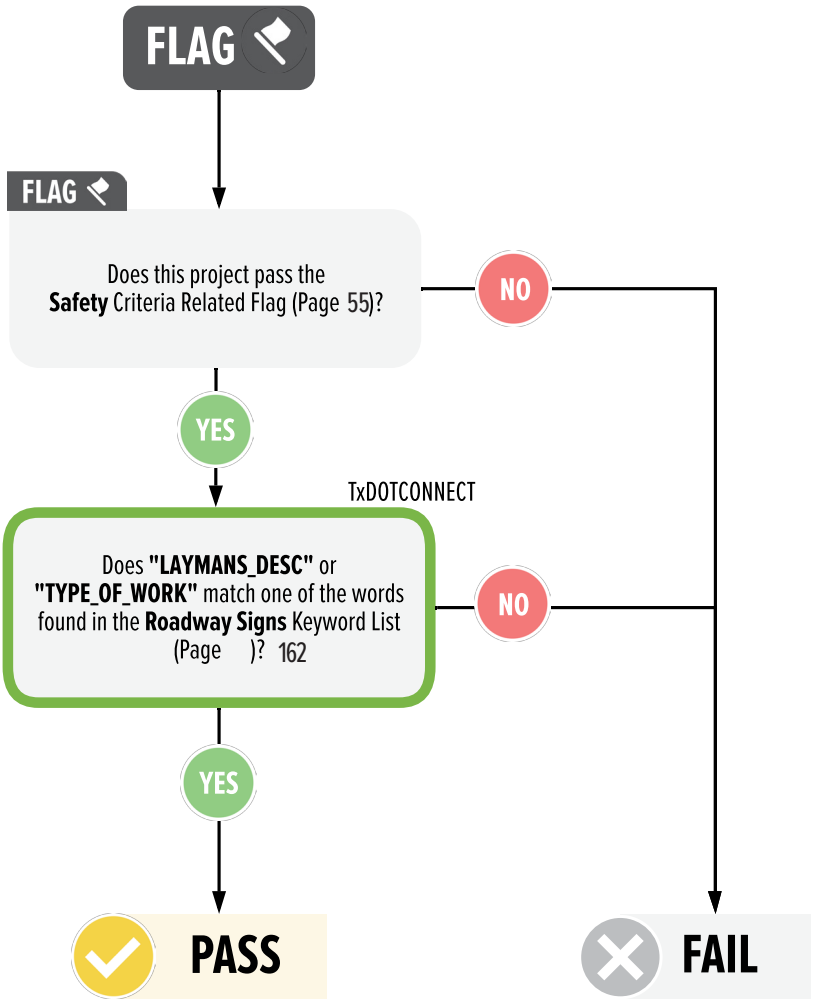


RECONSTRUCT INTERCHANGE

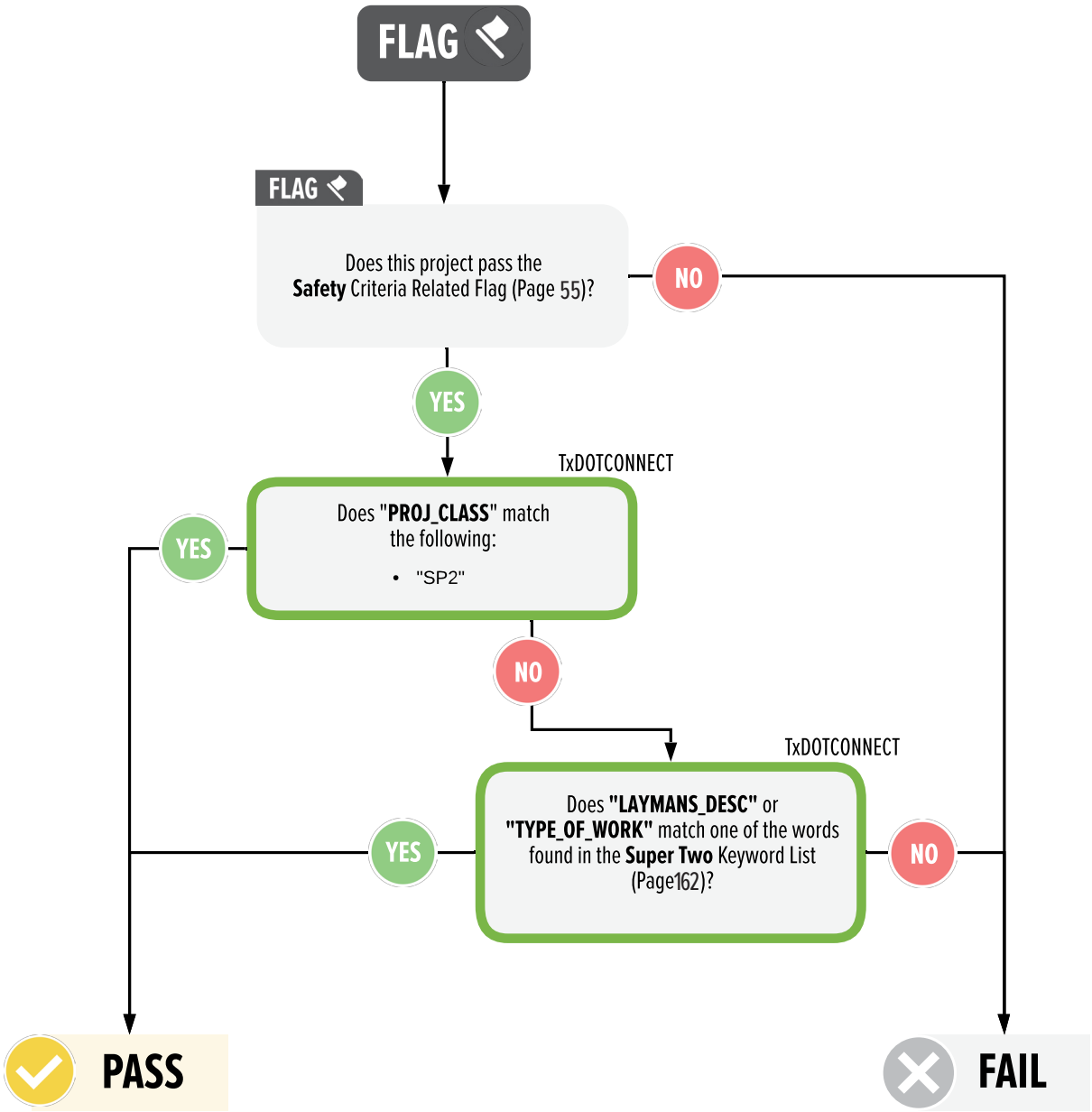
Safety Related Flag



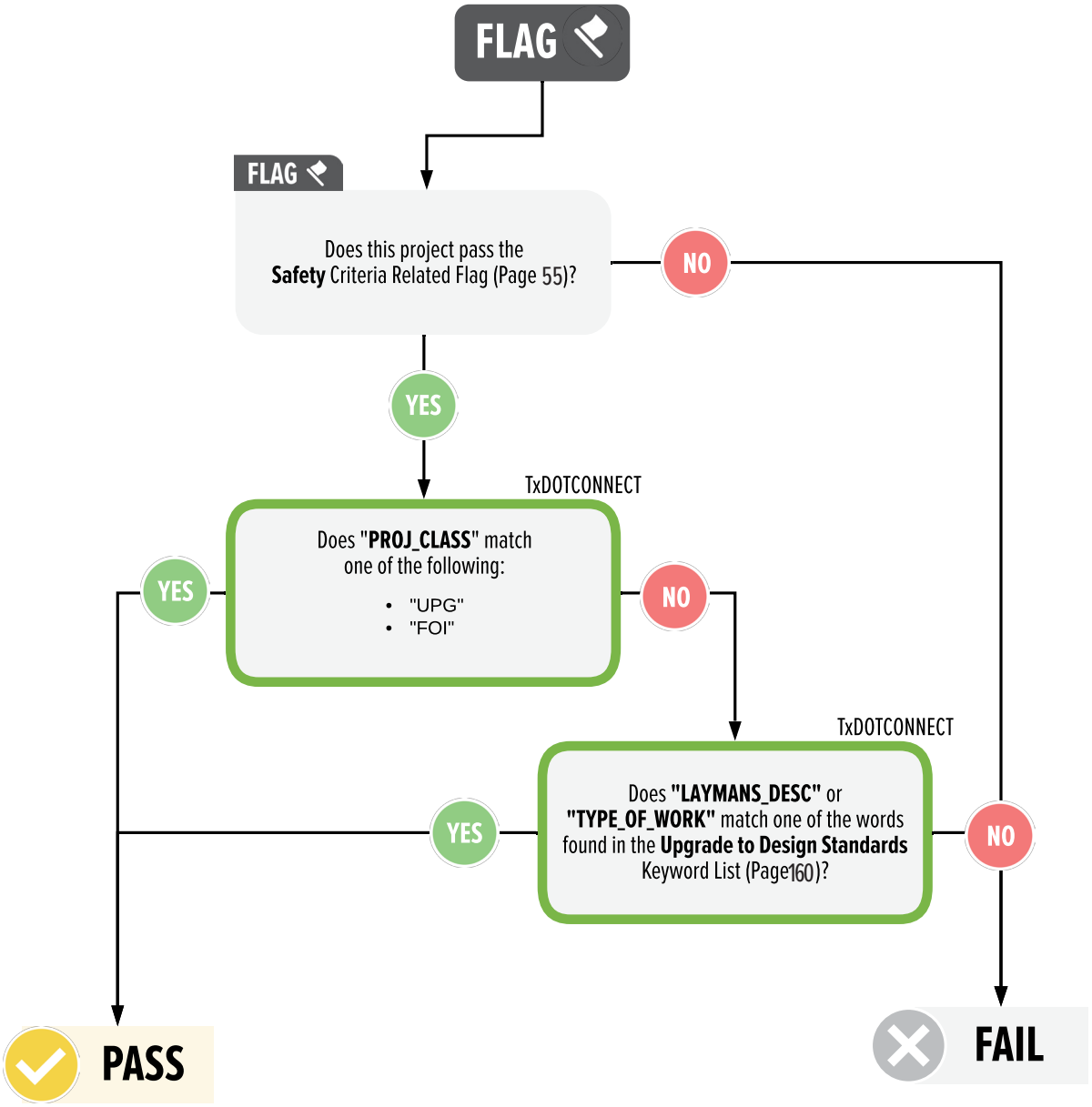
ROADWAY SIGNS
Safety Related Flag



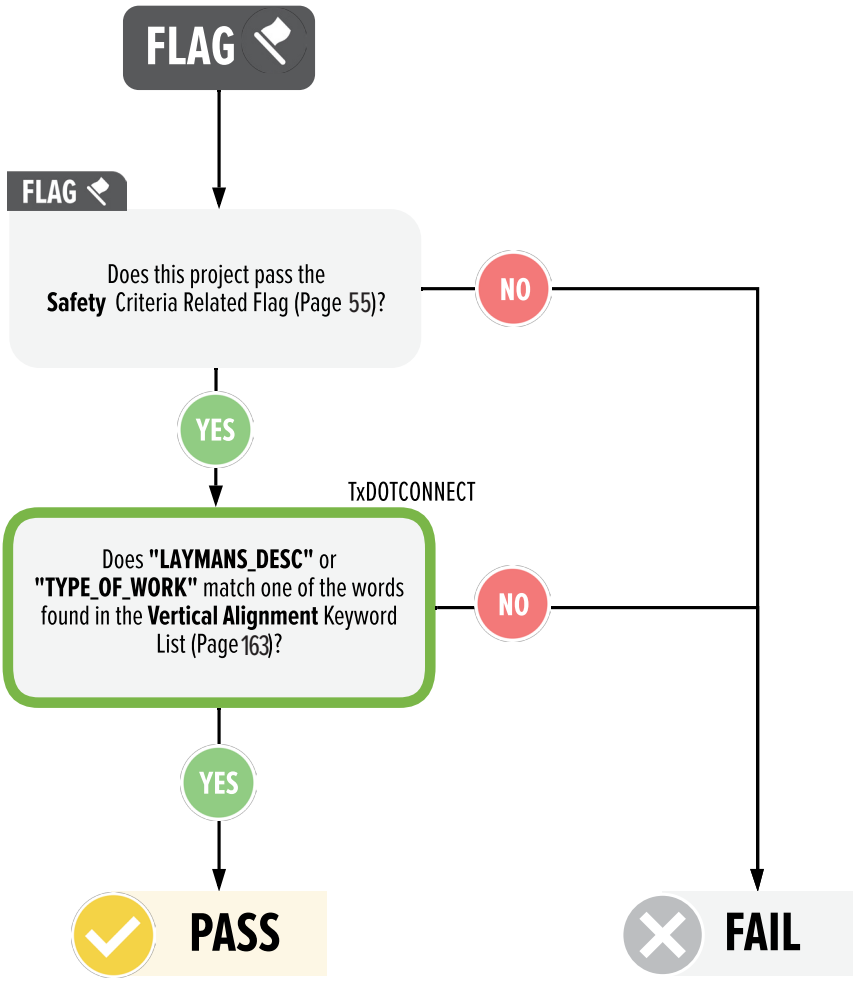
SUPER TWO
Safety Related Flag



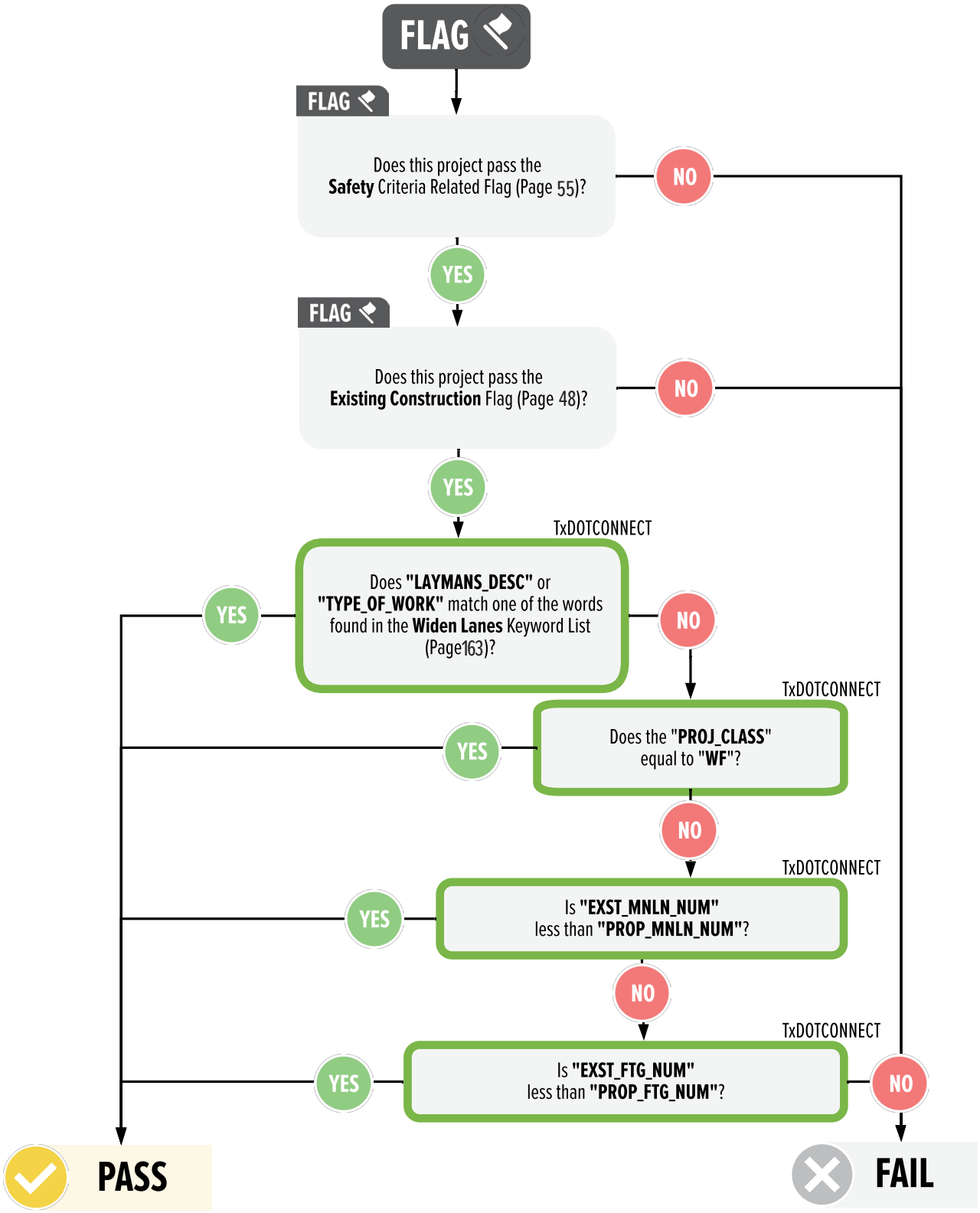
UPGRADE TO STANDARDS
Safety Related Flag



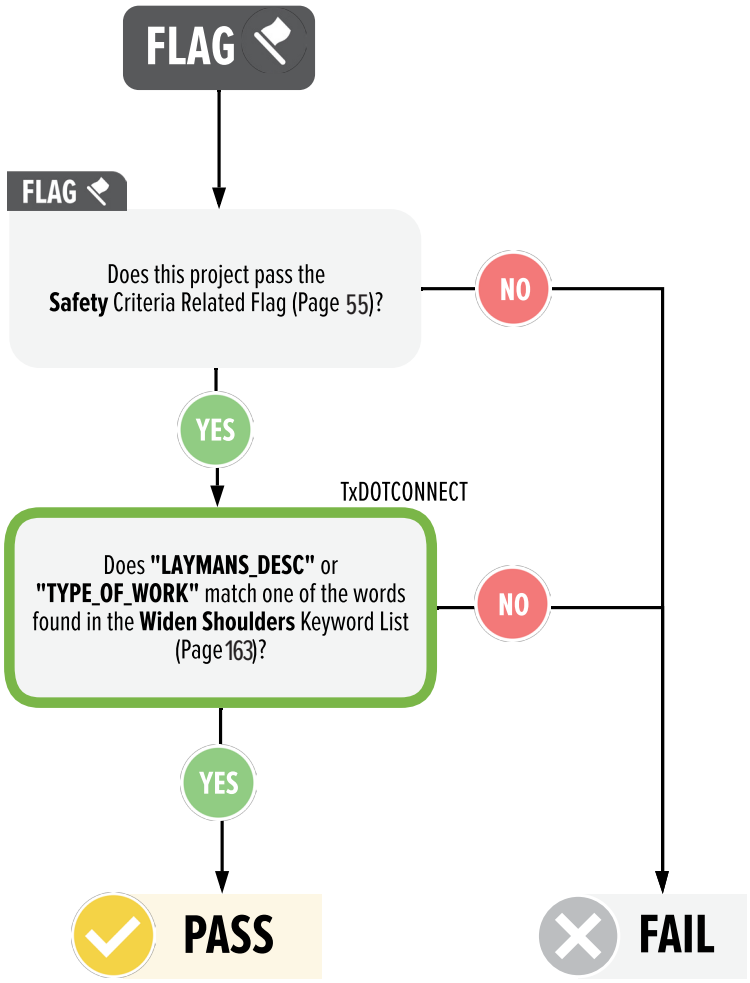
VERTICAL ALIGNMENT
Safety Related Flag



WIDEN LANES
Safety Related Flag



WIDEN SHOULDERS
Safety Related Flag



CRASH TYPE FLAGS

- *Construct Shoulders*
- *Divided*
- *Frontage*
- *Intersection*
- *Passing Lanes*
- *Railroad*
- *Roadway Signs*
- *Super 2*
- *Upgrade Center Left*
- *Vertical Alignment*
- *Widen Lanes*
- *Widen Shoulders*

Introduction

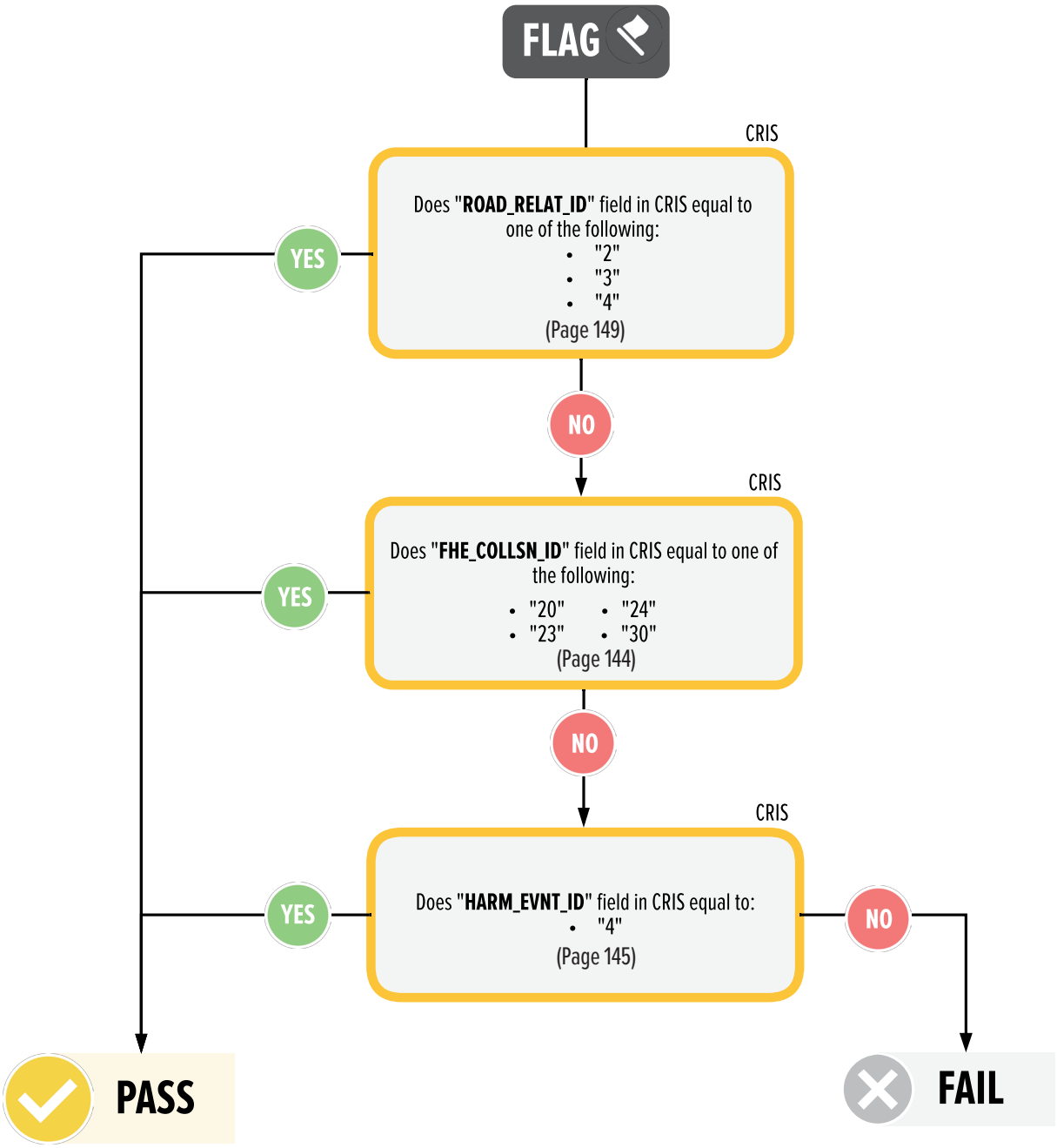
Crashes are parsed individually, and categorized by Crash Mitigating Factors (CMFs) that may affect the same type of crash in the future.

Any one crash may be matched to multiple CMFs at once, leading to a greater chance of future crashes being prevented.

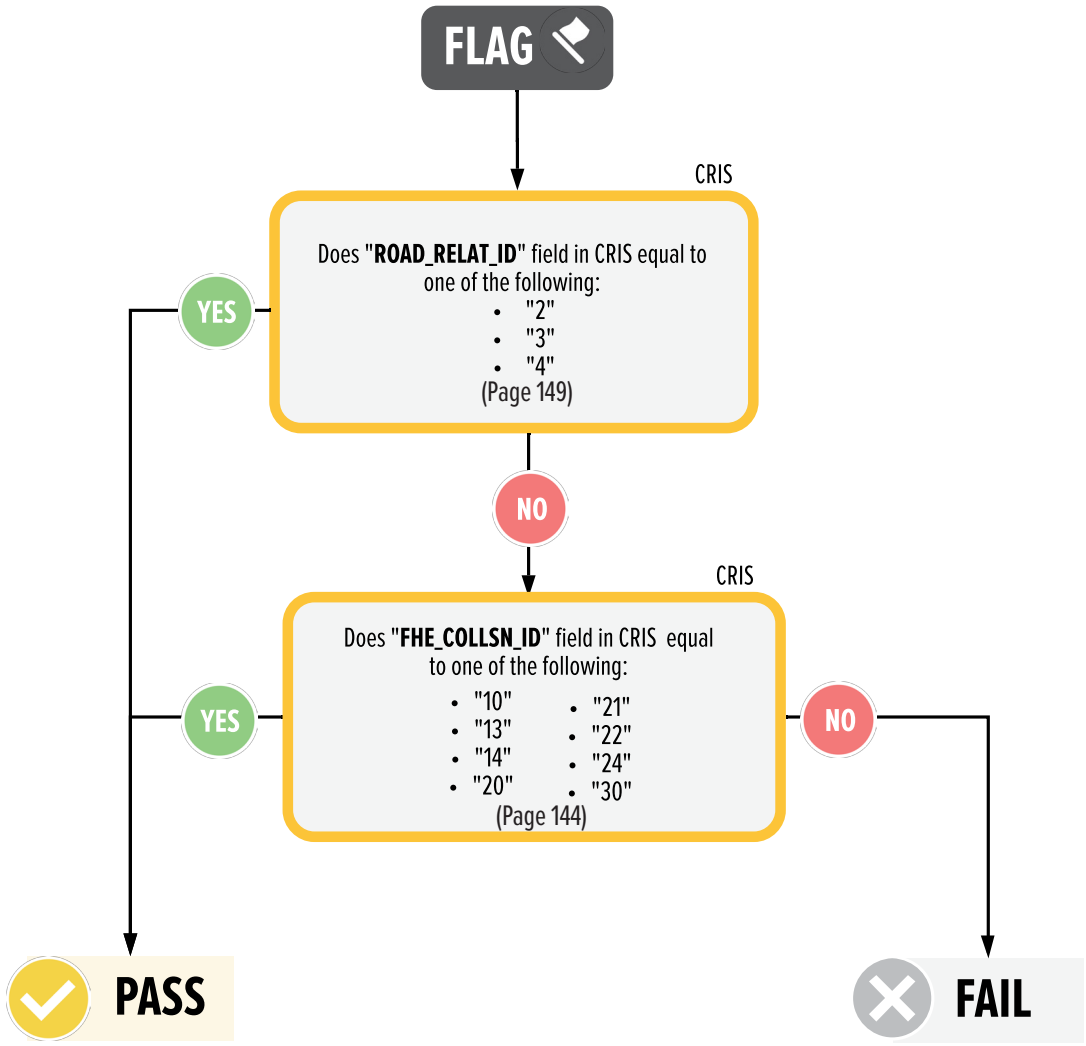
The data on each crash is read to determine where on or off the roadway it occurred; what the conditions were that led to the crash; what the weather or lighting conditions were; what other vehicles, people, or objects were struck; and more. Combinations of this data are used to align the crash with any applicable CMF.

Once all crashes are categorized, the project that may affect them must also be parsed to determine whether it provides the CMFs in question. This process is detailed in the Safety Related Flags section.

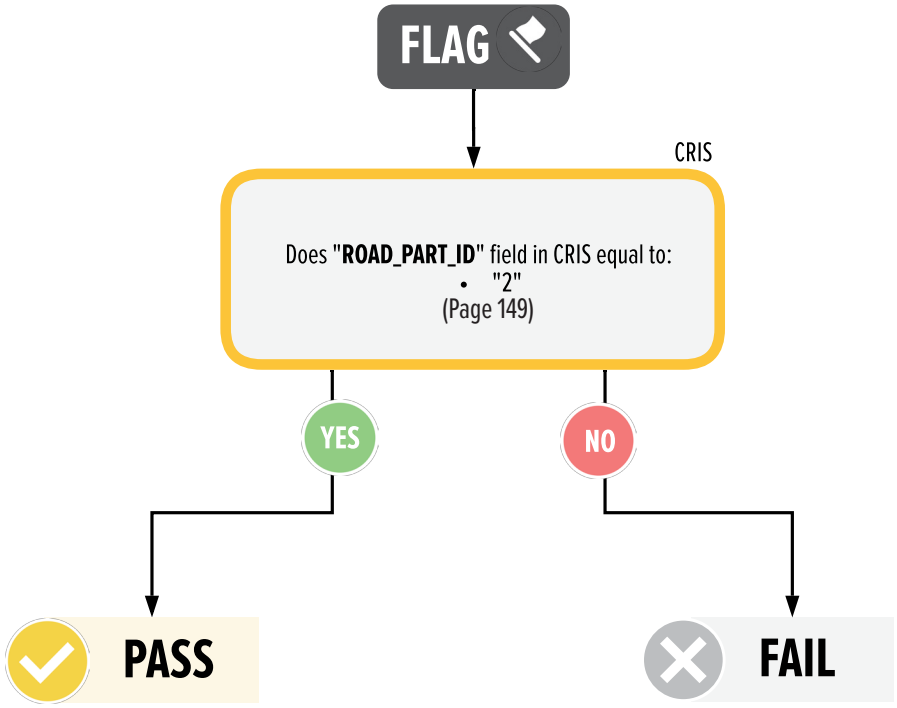
CONSTRUCT SHOULDERS
Crash Type Flag



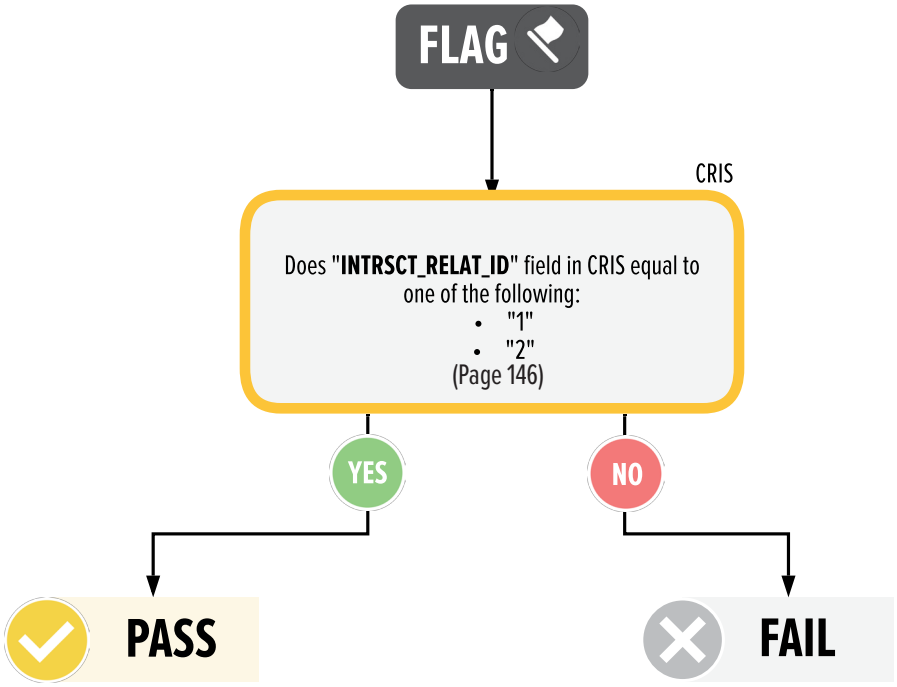
DIVIDED
Crash Type Flag



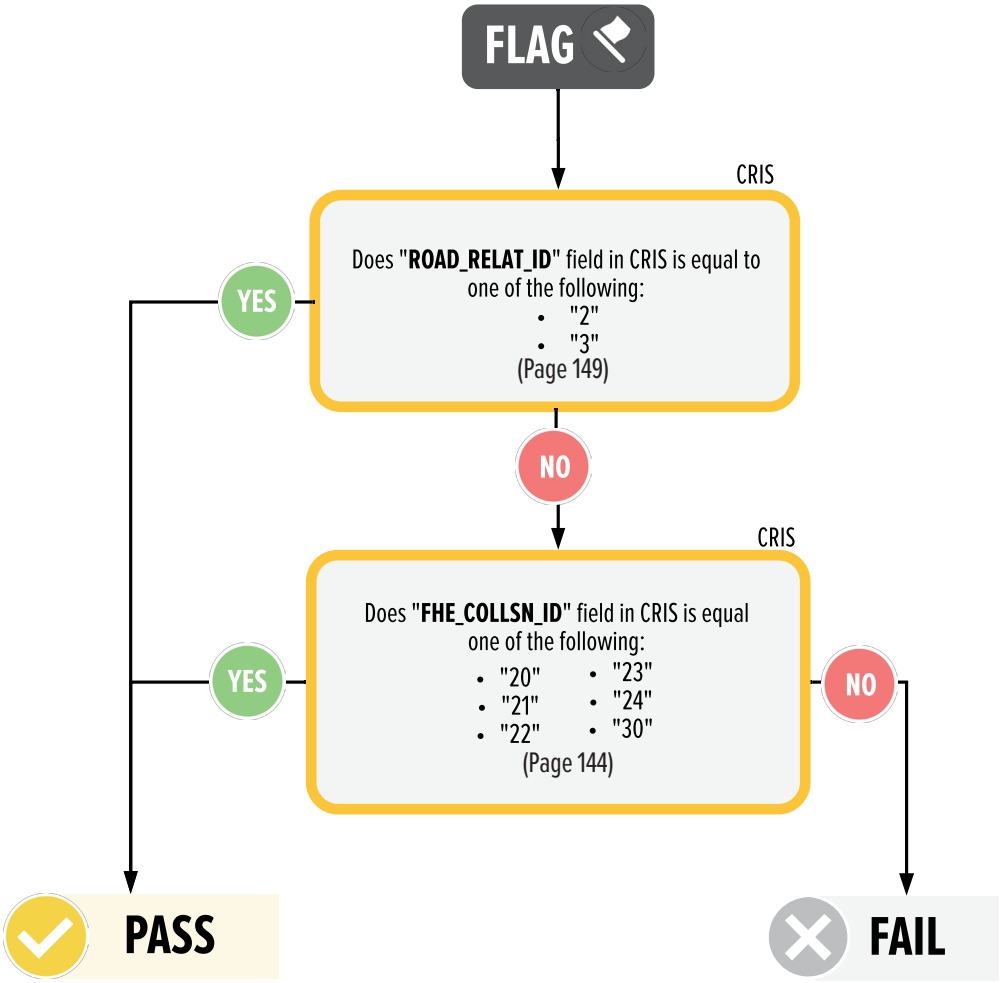
FRONTAGE
Crash Type Flag



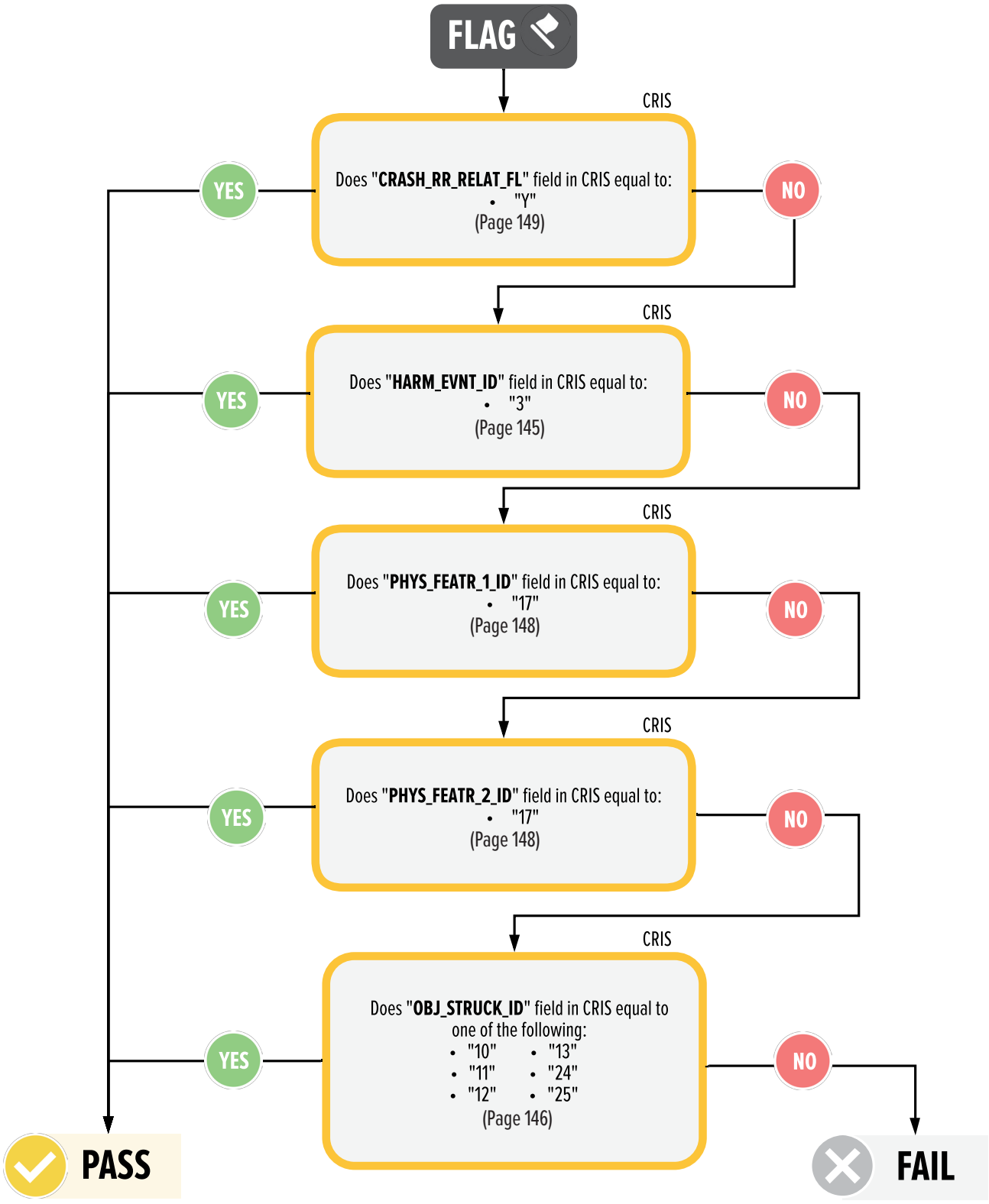
INTERSECTION
Crash Type Flag



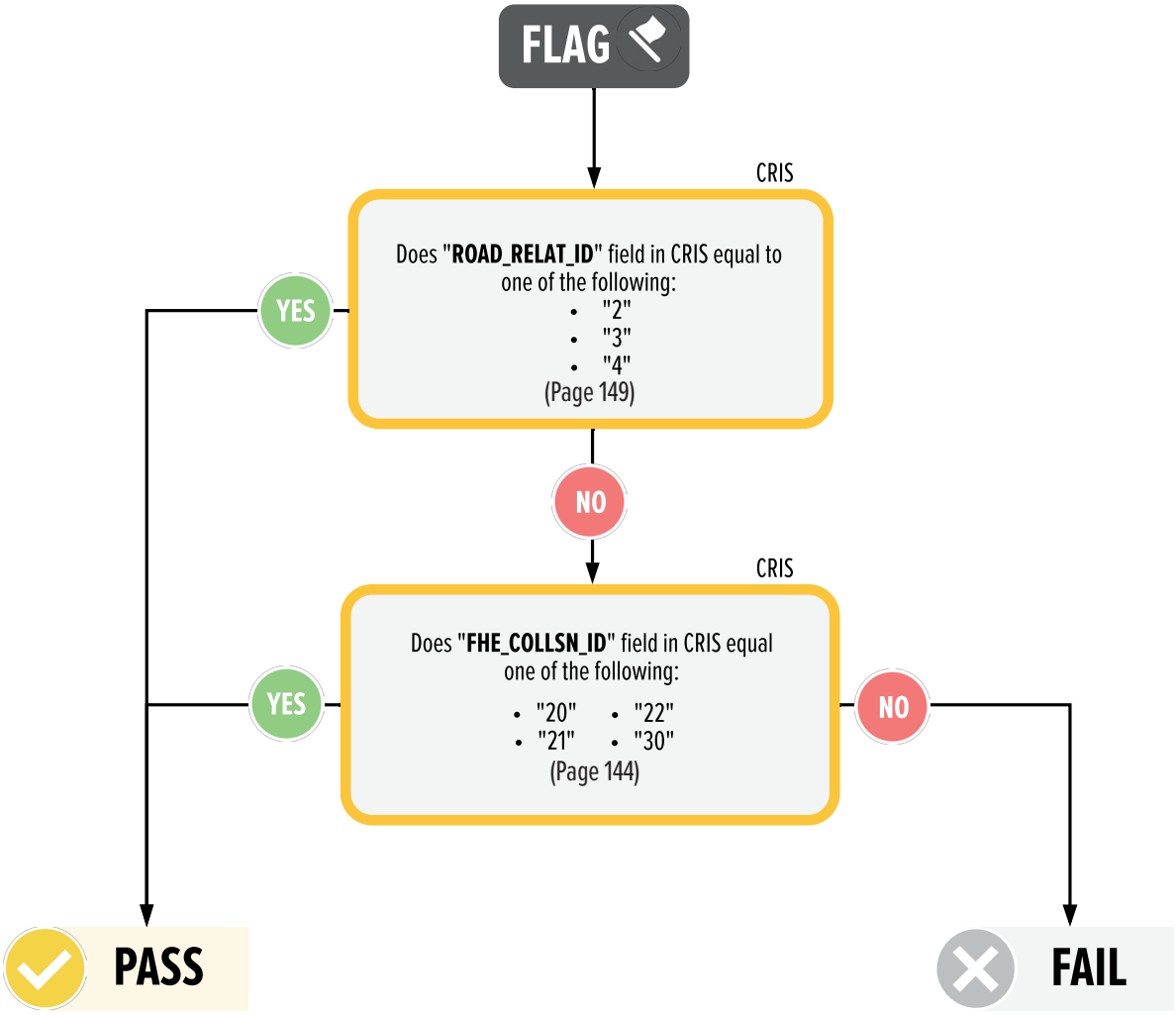
PASSING LANES
Crash Type Flag



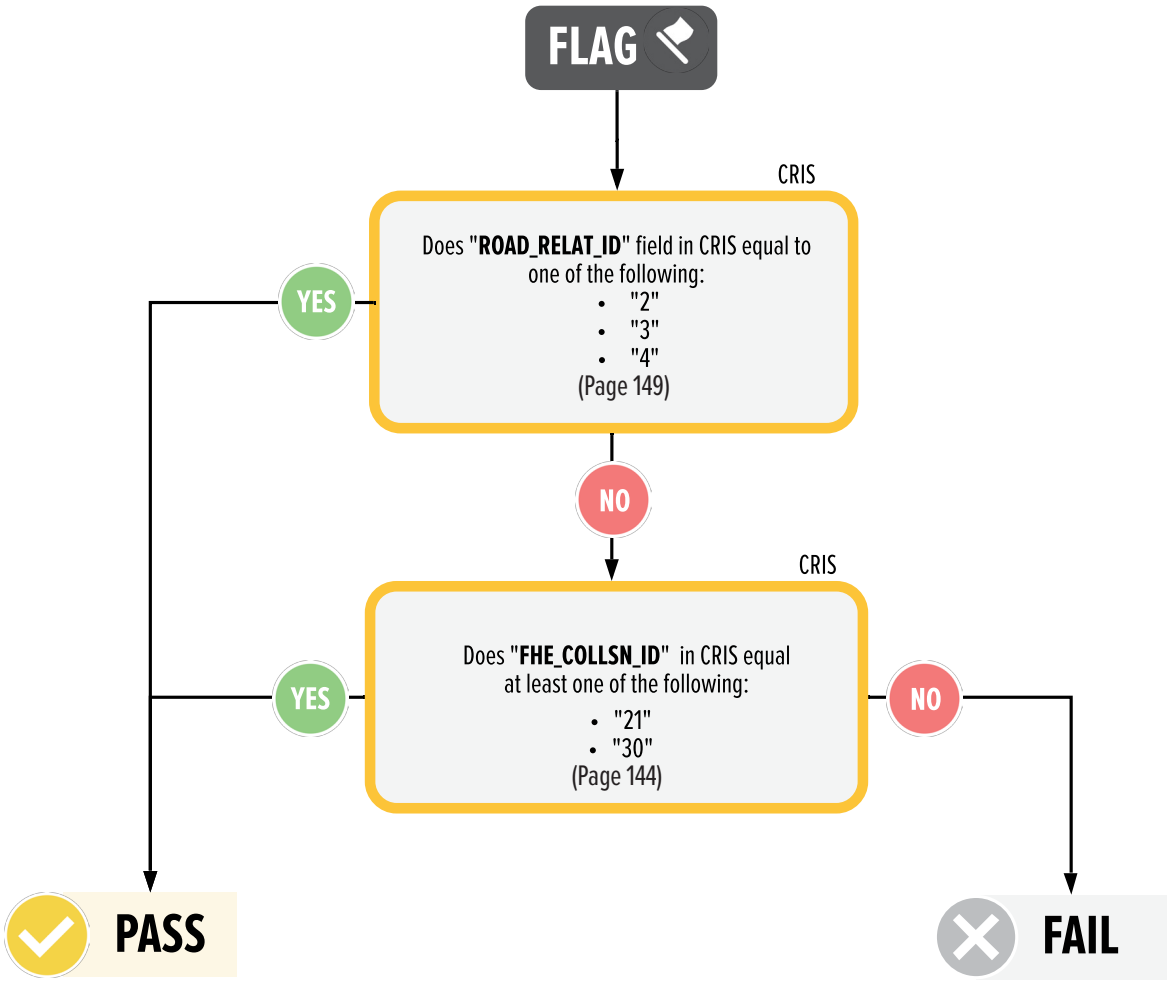
RAILROAD
Crash Type Flag



ROADWAY SIGNS
Crash Type Flag



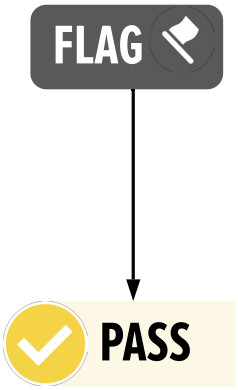
SUPER 2
Crash Type Flag



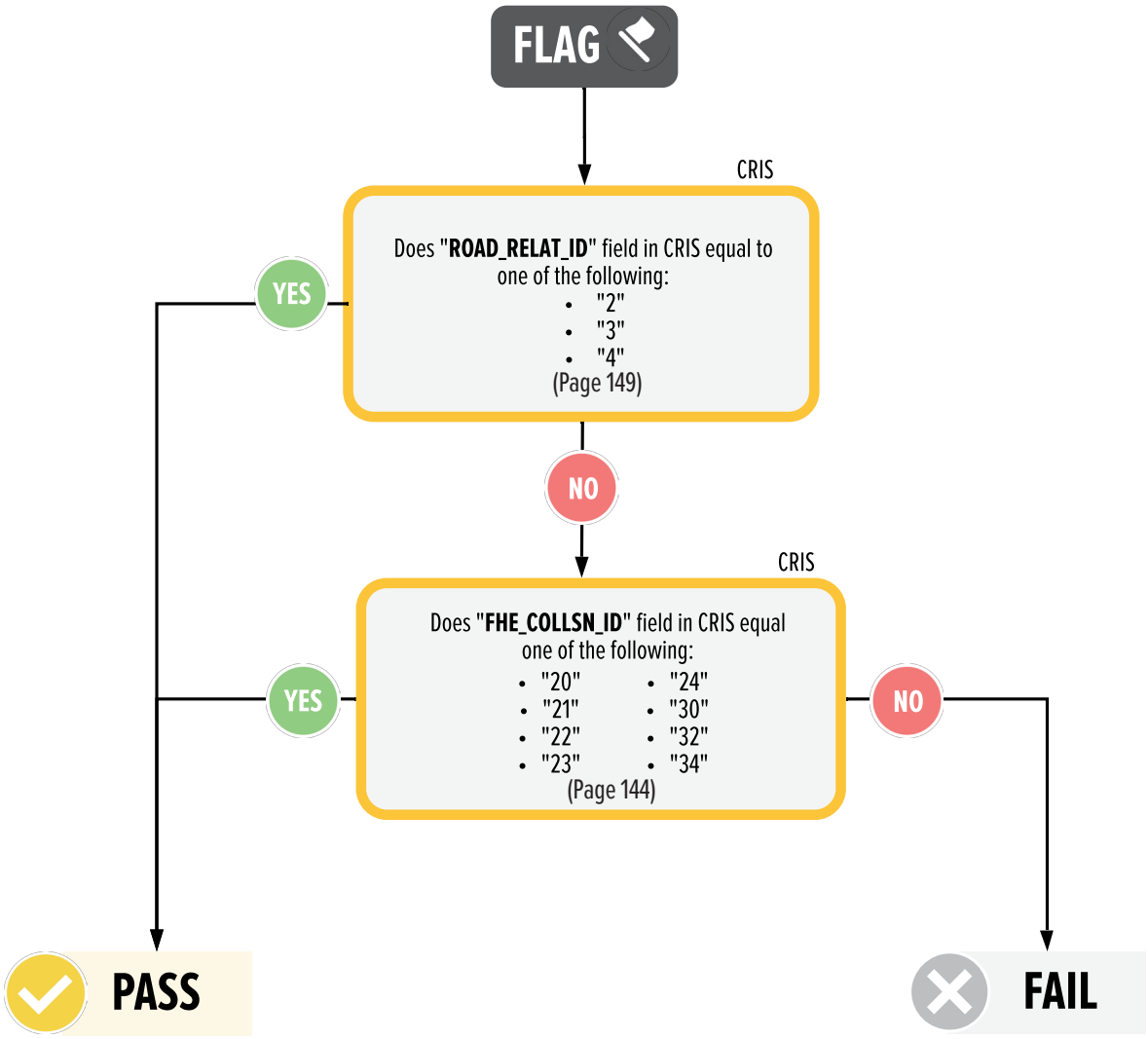
UPGRADE CENTER LEFT

Crash Type Flag

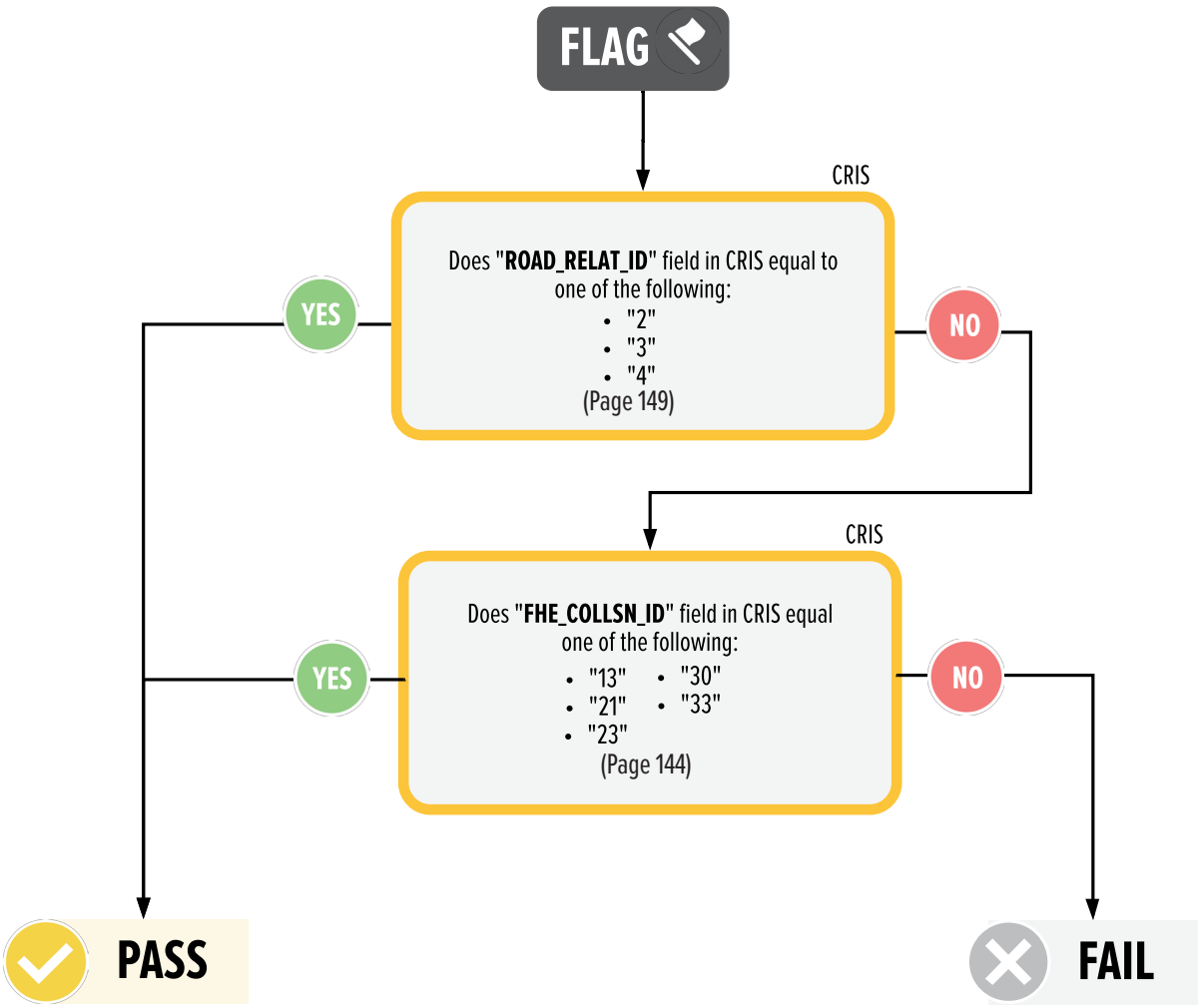
Note: All roads will recieve a score of "PASS" because all crashes are mitigated when there are upgrades to center left lanes.



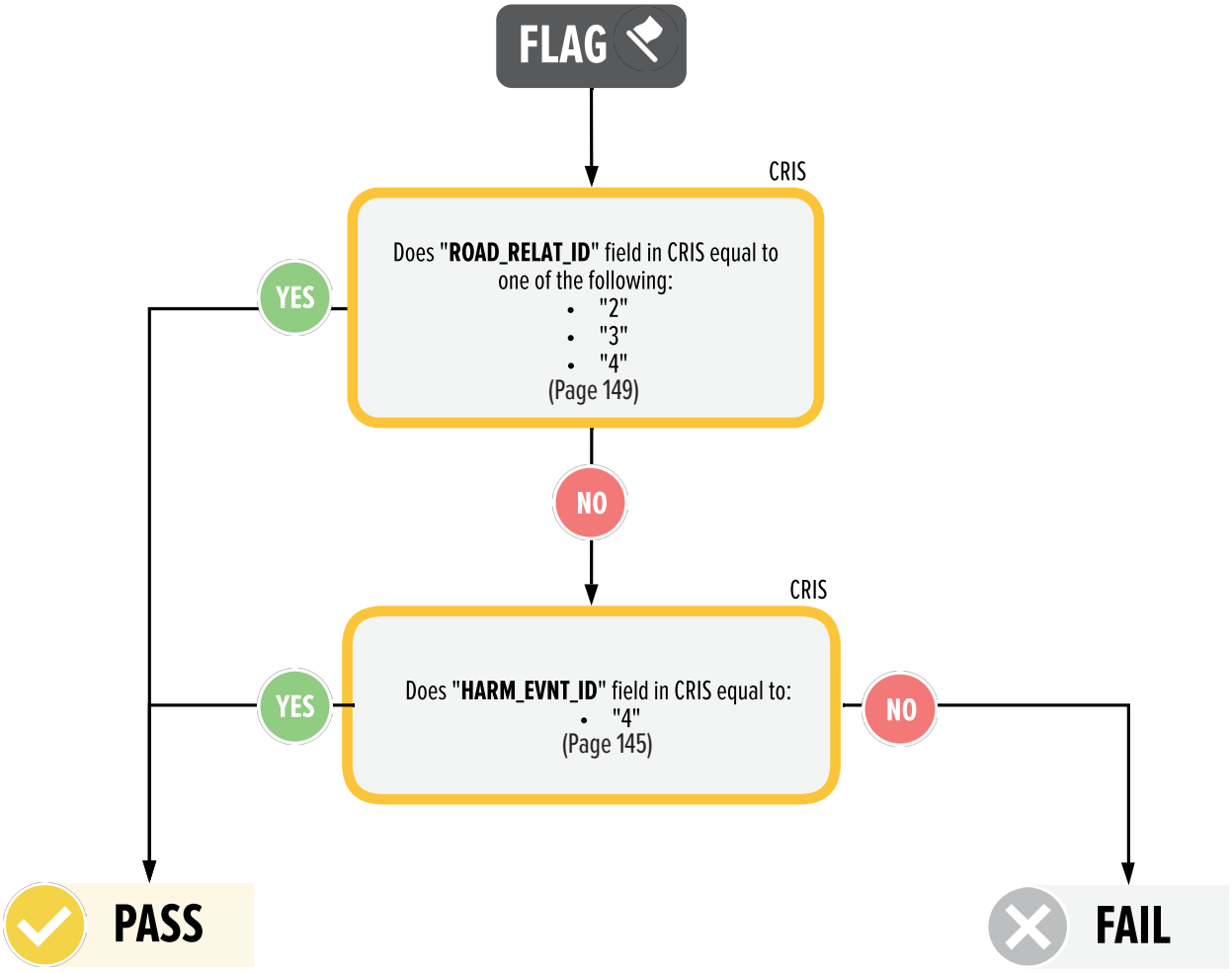
VERTICAL ALIGNMENT
Crash Type Flag



WIDEN LANES
Crash Type Flag



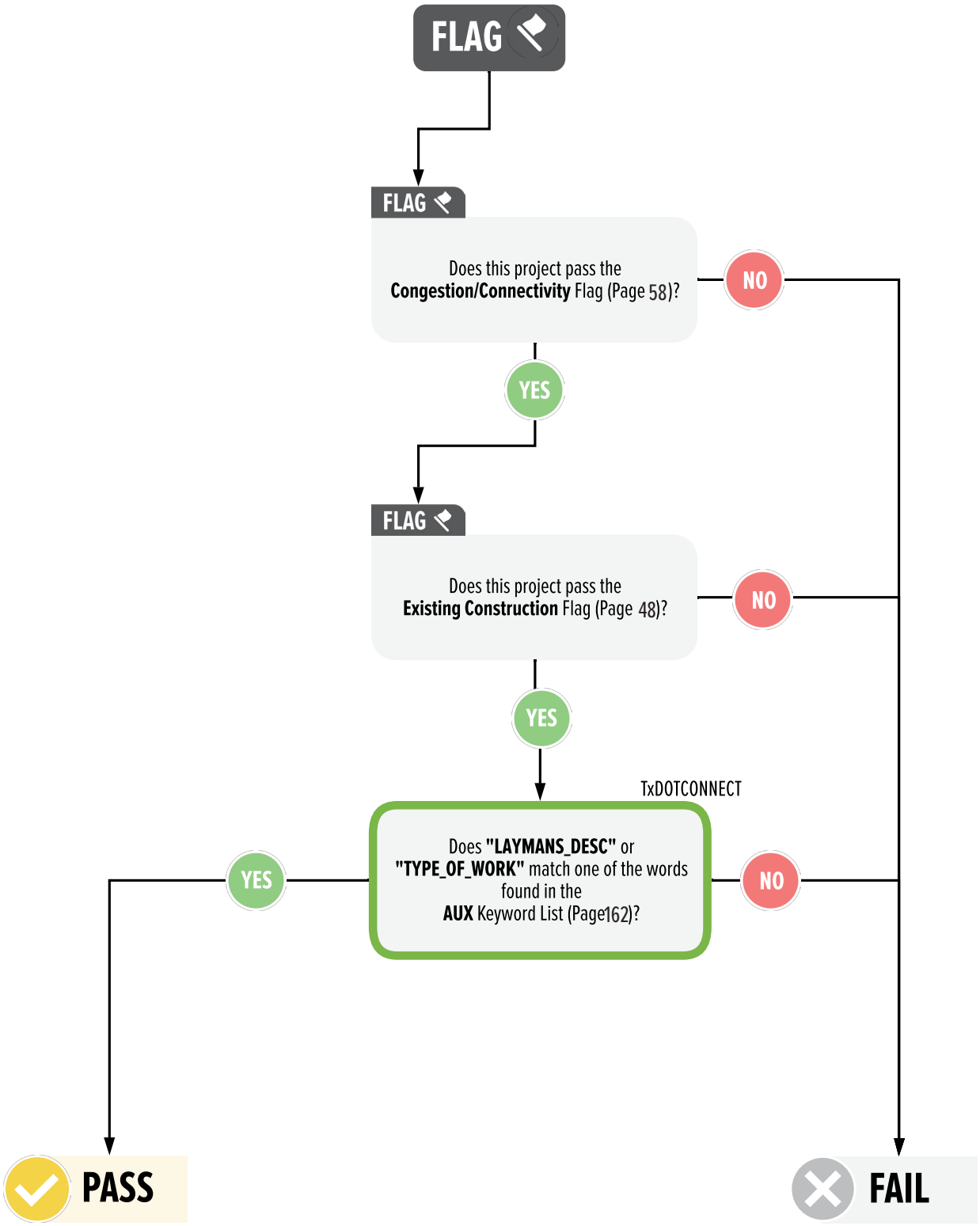
WIDEN SHOULDERS
Crash Type Flag



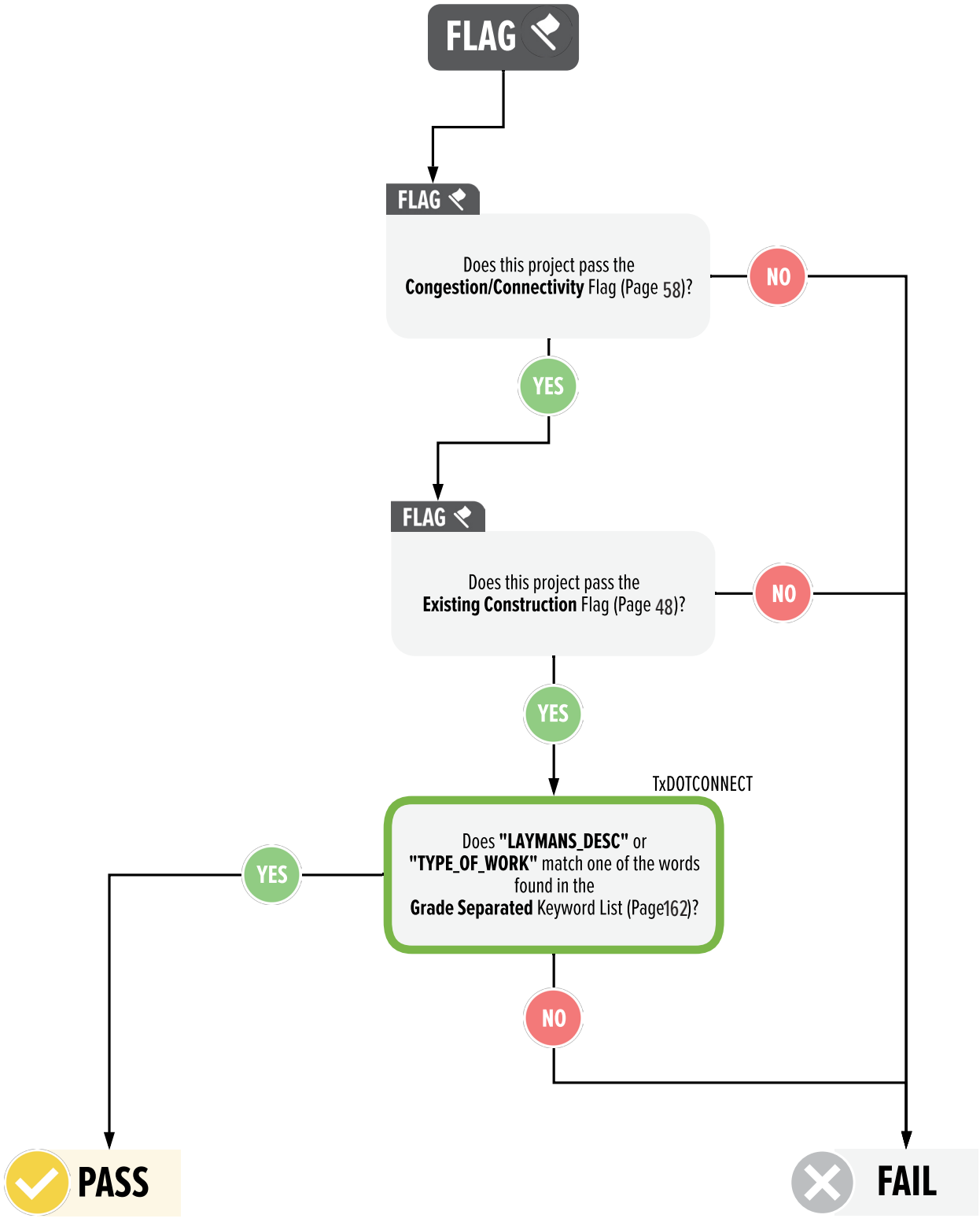
CONGESTION RELATED FLAGS

- *Add AUX Lanes*
- *Grade Separation*
- *Intersection Improvements*
- *ITS*
- *New Interchange*
- *Ramp Reconfiguration*
- *Replace Interchange*

ADD AUX LANES
Congestion Related Flag

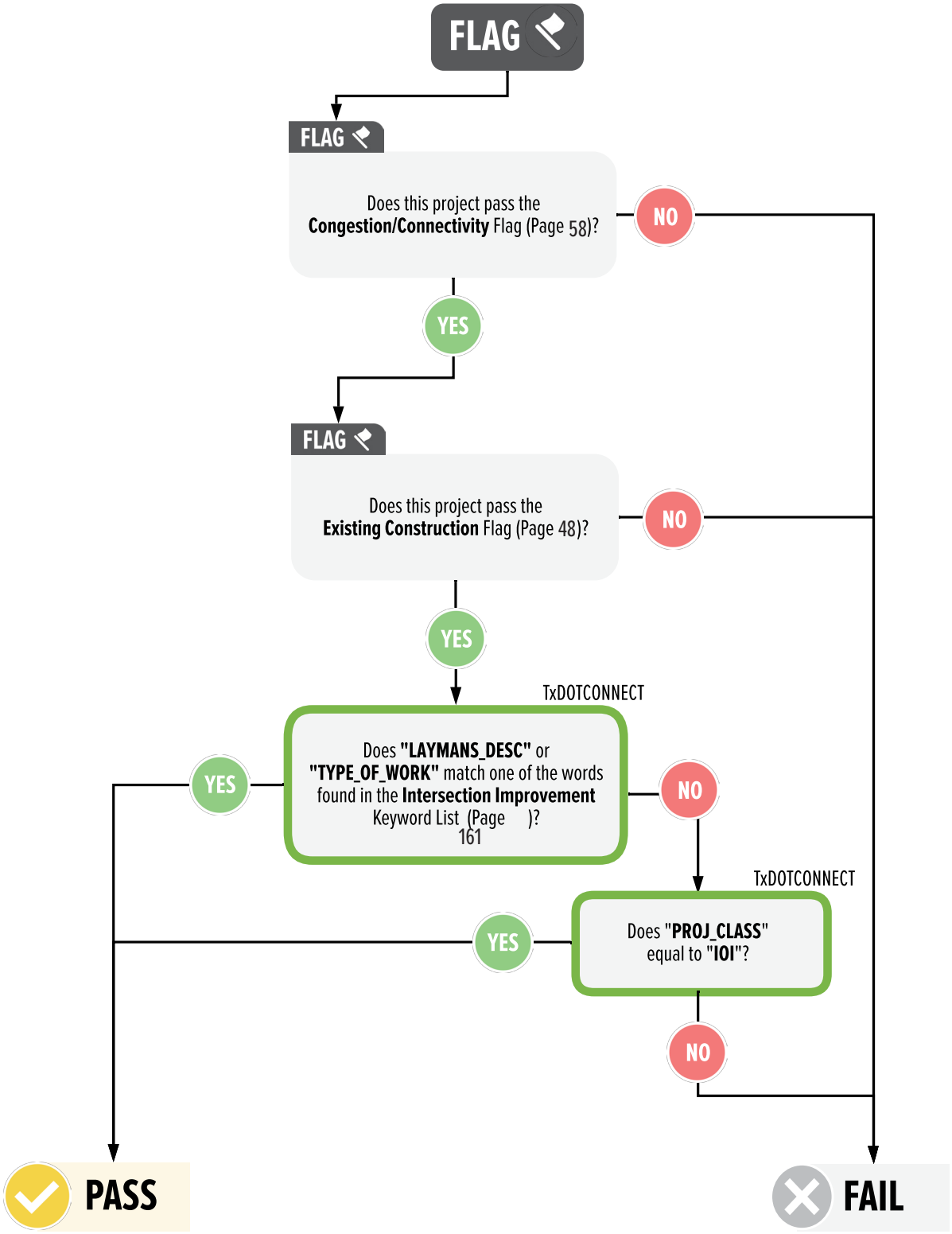


GRADE SEPARATION
Congestion Related Flag

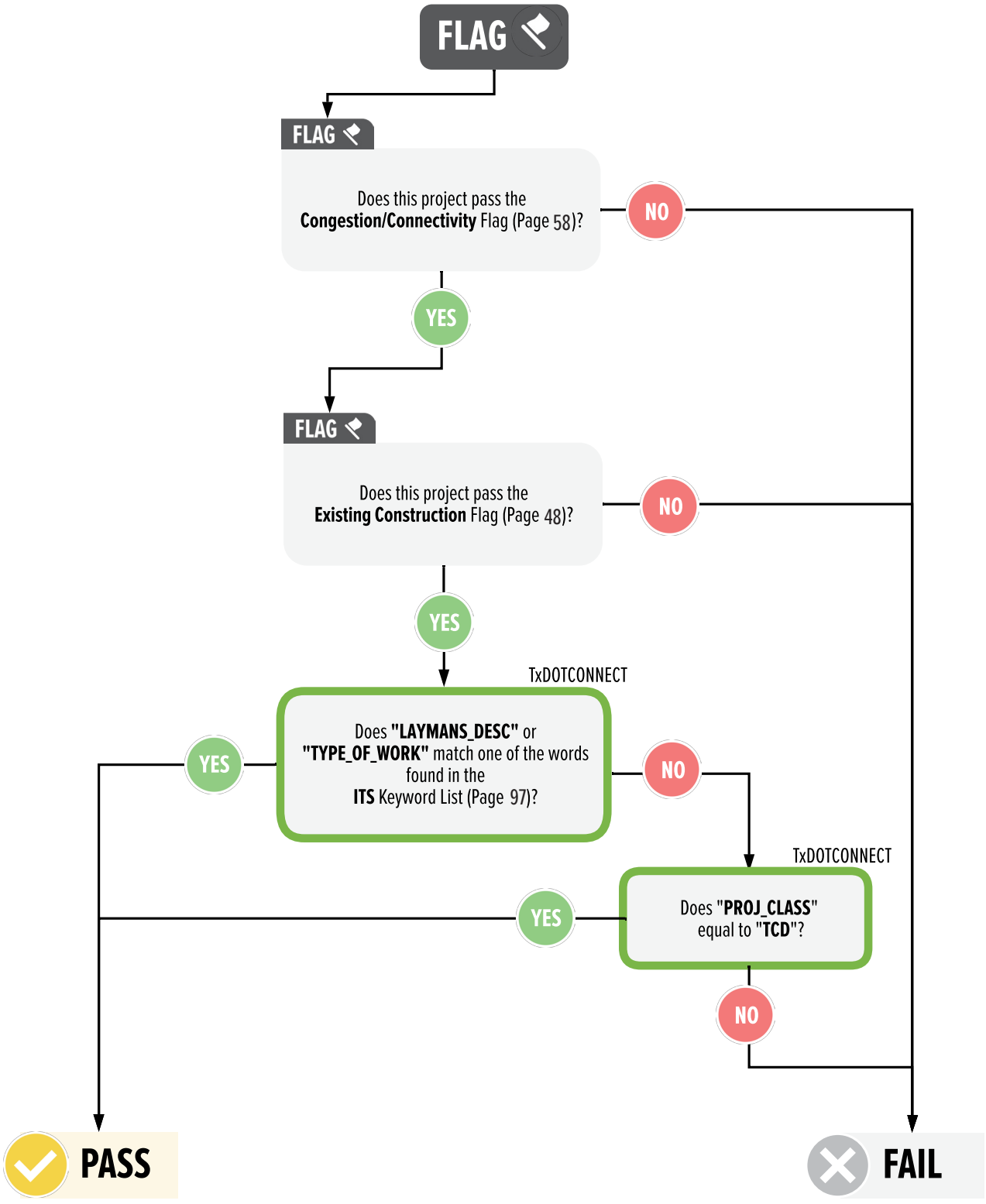


INTERSECTION IMPROVEMENTS

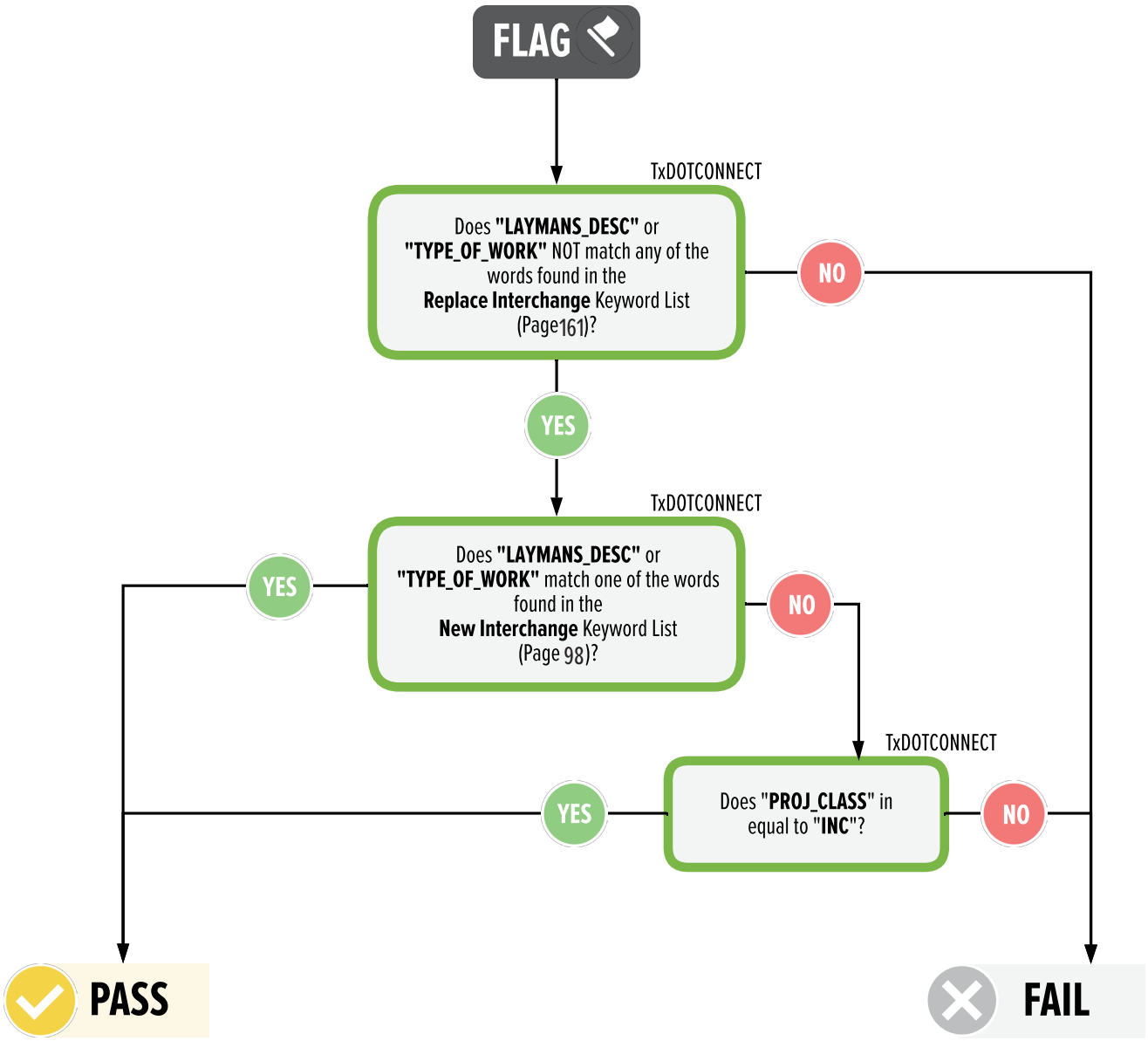
Congestion Related Flag



ITS
Congestion Related Flag

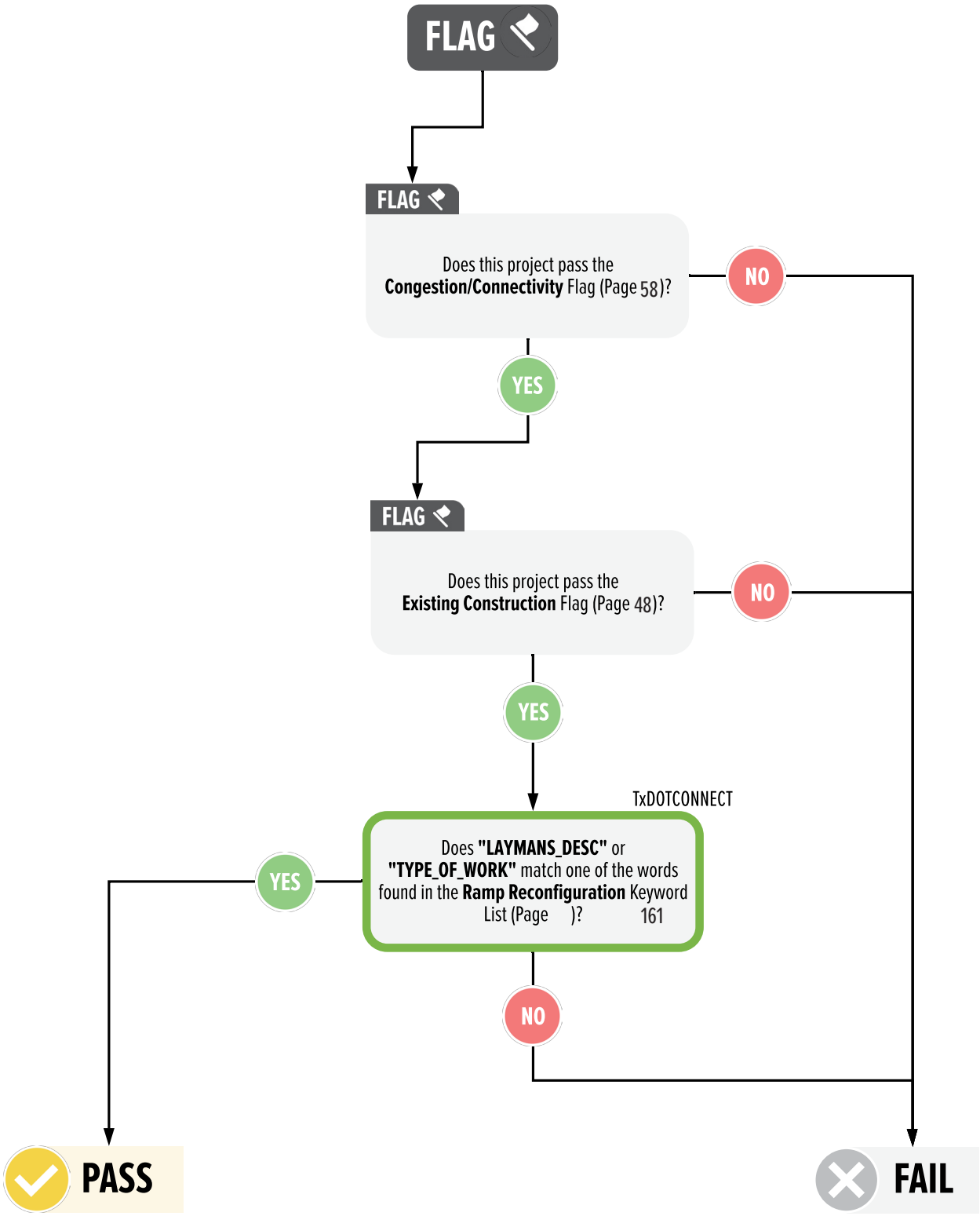


NEW INTERCHANGE
Congestion Related Flag



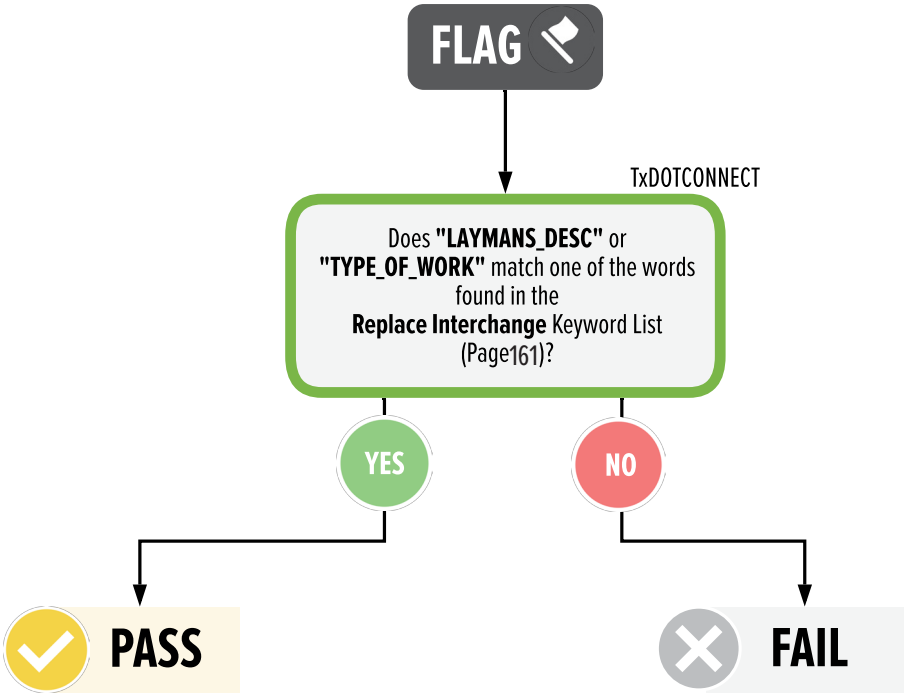
RAMP RECONFIGURATION

Congestion Related Flag



REPLACE INTERCHANGE

Congestion Related Flag



EQUATIONS

SAFETY RELATED

CONGESTION REDUCTION

Crash Reduction Equations

Introduction

The Performance Metrics: Data Integration System (PM-DIS) preprocessor compiles historical crashes in the project area and makes predictions about similar crashes in the future. Predicted future crashes are then reduced according to the Highway Safety Manual (HSM) Crash Mitigating Factors (CMF).

Each project's work is identified as it relates to each possible CMF, and each historical crash is also aligned with each possible CMF. Historical crashes per CMF and severity level are used as a baseline to grow into the future, and the reduction specified per CMF is multiplied by expected future crashes.

The final "Impact on..." metrics each represents the reduction (delta) in crashes that can be expected in a build scenario.

The final metrics are:

- **Crash Count**
  - **Estimated Impact on Fatal and Serious Injury Crashes** - A total number of Fatal (K) or Serious Injury (A) crashes that should be prevented in a build scenario.
  - **Estimated Impact on Total Crashes** - A total number of any severity of crash that should be prevented in a build scenario.
- **Crash Rate**
  - **Estimated Impact on Fatal and Serious Injury Crash Rate** - A number of Fatal (K) or Serious Injury (A) crashes that should be prevented per one hundred million vehicle miles traveled on the road segment in a build scenario.
  - **Estimated Impact on Total Crash Rate** - A number of any severity of crash that should be prevented per one hundred million vehicle miles traveled on the road segment in a build scenario.
- **Societal Cost Savings** - A sum of all crashes that should be prevented in a build scenario, multiplied by the average cost to society of that severity of each crash.

Crash Reduction Equations

Notation Used in This Document

Data field in a system

$$\text{System.field\_name}$$

"Switch" array of cases. Only one result is possible.

$$\begin{cases} \text{result 1} & \text{condition 1} \\ \text{result 2} & \text{condition 2} \\ \text{result 3} & \text{else} \end{cases}$$

Logical AND condition

$$\text{condition 1} \wedge \text{condition 2}$$

Summation: n is set size, i is the index within the set. All items in the set are processed.

$$\sum_{i=0}^{n} f(x_i)$$

Item is found in set of items

$$\text{item} \in \{\text{set}\}$$

Item is not found in set of items

$$\text{item} \notin \{\text{set}\}$$

Floor of expression

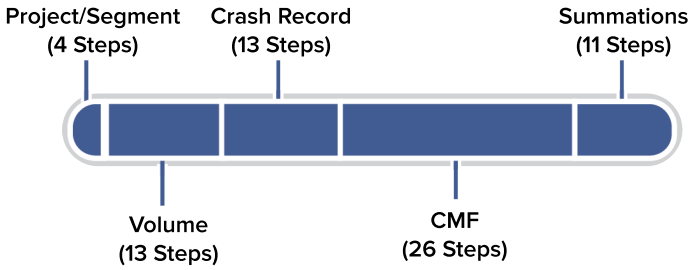
$$\lfloor 2.6 \rfloor = 2$$

Modulo (remainder of a division)

$$3 \bmod 2 = 1$$

Related Steps in This Document

There are five sections with multiple steps within them to find the performance measures Estimated Impact on Fatal and Serious Injury Crashes, Estimated Impact on Total Crashes, Estimated Impact on Fatal and Serious Injury Crash Rate, Estimated Impact on Total Crash Rate, and Societal Cost Savings. Each step builds upon one another. This loading bar illustrates this progression.



Crash Reduction Equations

Definitions

Systems

TxDOTCONNECT TxDOTCONNECT is the Texas Department of Transportation's automated information system used for planning, programming, and developing projects. TxDOTCONNECT is an essential part of preparing construction projects for contract letting. Project information such as work descriptions, funding requirements, and dates for proposed activities can be found in TxDOTCONNECT.

DCIS Design and Construction Information System. This was the original project repository, based on which PM-DIS project data and field names were developed. The DCIS data dictionary/user manual were used for data field descriptions, which may be updated at a later date if a TxDOTCONNECT data dictionary is produced..

RIF Roadway Information File. An export from TxDOT's main network data system which includes roadway location, routing, attributes, and usage.

CRIS Crash Records Information System. The Texas crash records repository, storing all available data regarding all state reported crashes. This data is publicly accessible but can be difficult to use without proper tools in place.

Portfolio Settings

current_year_crash The "current year" when considering crash growth rate calculations.

planning_horizon Number of years from current to which predictions are made. Current prediction tables can only support up to 10 years.

Data Fields

TxDOTCONNECT

beg_mile_point Project beginning mile point on the control-section. Used for length calculations in relation to RIF segment overlap with the project area.

DCIS manual description: This two-digit field with three decimal places corresponds to the beginning limits of this project as it relates to the control section. When the user inputs the reference marker information, this field is automatically populated with mile point information from the Texas Reference Marker System maintained by TPP(D) based on a batch job submitted at the time of input.

end_mile_point Project ending mile point on the control-section. Used for length calculations in relation to RIF segment overlap with the project area.

DCIS manual description: This two-digit field with three decimal places corresponds to the ending limits of this project as it relates to the control section. When the user inputs the reference marker information, this field is automatically populated with mile point information from the Texas Reference Marker System maintained by TPP(D) based on a batch job submitted at the time of input.

dist_let_date District estimated letting date. Stored as four digits in YYMM format, with leading zeroes removed. Used to create dist_fy, which is project opening year in volume calculations.

DCIS manual description: This four-digit field shows the district's estimated letting date for this project as it was approved in the latest STIP. This field is updated by the 'DIST LET DATE' field on the project identification screen.

pres_adt Present ADT at the project location. Used for volume calculations including growth rates. Takes precedence over RIF volume.

DCIS manual description: This six-digit field represents the present average daily traffic (ADT) using the facility. For a new location project, the ADT represents the expected ADT if the facility were open today.

pres_adt_year Present ADT collection year at the project location. Used for volume calculations including growth rates. Takes precedence over RIF volume collection year.

This field did not exist in DCIS, but it is a 4-digit year.

proj_adt Projected ADT at the project location. Used for volume calculations including growth rates. Takes precedence over RIF volume.

DCIS manual description: This six-digit field represents the projected future estimate of the average daily traffic (ADT) using the facility.

proj_adt_year Number of years into the future ADT was projected. Used for volume calculations including growth rates. Takes precedence over RIF volume.

DCIS manual description: This two-digit field represents the future time increment in years for which projected traffic (PROJ-ADT) is provided.

Crash Reduction Equations

Definitions

Data Fields

TxDOTCONNECT description/other based flags

Each flag is the result of a key word/phrase search within the TxDOTCONNECT Description and Type of Work fields. For detailed key word search information and more exhaustive listings, please see in PM-DIS documentation key word reference.

main Project work affects mainlanes. Used to include or exclude RIF segments on a mainlane roadbed and intelligently divide traffic counts by roadbed.

Key words: "MAIN LANES"

frontage Project work affects frontage/service lanes. Used to include or exclude RIF segments on a frontage/service lane roadbed and intelligently divide traffic counts by roadbed.

Key words: "FRONTAGE", "FR R"

new_construction Project work is a new location, not an existing roadway.

grade_separated Project work will separate the roadway from existing intersections.

Key words: "GRADE SEPARATION"

construct_interchange Project work will construct a new interchange.

Key words: "OVERPASS", "INTERCHANGE", "RAMPS"

reconstruct_interchange Project work will reconstruct an existing interchange to be match current standards.

Key words: "OVERPASS", "INTERCHANGE", "RAMPS", "REALIGNMENT"

aux_lane Project work includes auxiliary lanes.

Key words: "AUX"

railroad_grade_separated Project work separates the roadway from railroad crossings.

Key words: "RAILROAD GRADE SEPARATION"

frontage_one_way Project work converts two-way frontage roads to one-way.

Key words: "CONVERT TO ONE-WAY"

widen_shoulders Project work widens roadway shoulders to be more safe.

Key words: "WIDEN SHOULDERS"

construct_shoulders Project work widens roadway to provide shoulders.

Key words: "CONSTRUCT SHOULDERS"

upgrade_standards Project work will upgrade the existing roadway to current design standards.

Key words: "UPGRADE TO STANDARDS"

center_left Project work will install center-left turn lanes.

Key words: "CENTER-LEFT", "TWO-WAY LEFT TURN", "TWLTL"

Crash Reduction Equations

Definitions

Data Fields

TxDOTCONNECT description/other based flags

widen_lanes Project work will widen existing lanes to be more safe.

Key words: "WIDEN"

vertical_alignment Project work will change road alignment to improve sight distance.

Key words: "VERTICAL"

super_two Project work will install super-two passing lanes.

Key words: "SUPER-TWO"

divided Project work will convert undivided roadway to divided roadway.

Key words: "DIVIDED"

passing_lanes Project work will install passing lanes.

Key words: "PASSING"

roadway_signs Project work will install safety related roadway signs.

Key words: "SIGNS"

RIF

adt_cur Current ADT for the RIF segment/roadbed. "R" and "L" roadbeds include traffic in both directions. Used for volume calculations including growth rates. TxDOTCONNECT volume takes precedence over this value.

adt_year Year of ADT data collection. Used for volume calculations including growth rates. TxDOTCONNECT volume takes precedence over this value.

adt_desgn Projected ADT for the RIF segment/roadbed. "R" and "L" roadbeds include traffic in both directions. Used for volume calculations including growth rates. TxDOTCONNECT volume takes precedence over this value.

desgn_yr Year of projected ADT. Used for volume calculations including growth rates. TxDOTCONNECT volume takes precedence over this value.

trk_aadt_pct Percent of ADT that is freight trucks. Used to split performance metrics into truck and auto traffic. TxDOTCONNECT truck percent takes precedence over this value.

Data Fields

Crash Reduction Equations

Definitions

CRIS

first_year Not a data field, but a selection of the earliest year in which a crash is recorded in the database.

final_year Not a data field, but a selection of the latest year in which a crash is recorded in the database.

intrsct_relat_id Intersection Related - Specifies whether a crash occurred at an intersection, not at an intersection, or if the presence of an intersection contributed to the crash.

INTRSCT_RELAT_ID	INTRSCT_RELAT_DESC
1	INTERSECTION
2	INTERSECTION RELATED
3	DRIVEWAY ACCESS
4	NON INTERSECTION
5	NOT REPORTED
93	UNDETERMINED - FAIL BR
94	REPORTED INVALID

rr_relat_fl Railroad Crash Identifier - Indicates whether the crash involved a train or railroad crossing.

YES_NO_CHOICE_ID	YES_NO_CHOICE_SHORT_DESC
-2	-2
-1	-1
1	Y
2	N
3	NR
4	NC
93	UD
94	RI
99	UNK

Crash Reduction Equations

Definitions

Data Fields

CRIS

harm_evnt_id First Harmful Event - First Injury or damage producing event

HARM_EVNT_ID	HARM_EVNT_DESC
1	PEDESTRIAN
2	MOTOR VEHICLE IN TRANSPORT
3	RR TRAIN
4	PARKED CAR
5	PEDALCYCLIST
6	ANIMAL
7	FIXED OBJECT
8	OTHER OBJECT
9	OTHER NON COLLISION
10	OVERTURNED
11	NOT REPORTED
93	UNDETERMINED - FAIL BR
94	REPORTED INVALID

Definitions

Data Fields

CRIS

phys_featr_1_id, phys_featr_2_id Physical Features - Physical Features fields 1 and 2 describe roadway features which were a factor in the crash

PHYS_FEATR_ID	PHYS_FEATR_DESC
-2	INVALID
-1	NO DATA
1	PRIVATE DRIVE OR ROAD
11	ALLEY
12	PARKING AREA WITHIN RIGHT OF WAY
14	OPENING IN MEDIAN
15	CROSSOVER FROM ONE FRONTAGE ROAD TO OTHER
16	AT DETOUR
17	RR GRADE CROSSING
20	ONE OR MORE TRAFFIC LANES CLOSED
21	NOT APPLICABLE
22	NOT REPORTED
32	ENTRANCE TO OR EXIT FROM PRIVATE PROPERTY OR DRIVEWAY
33	IN A PARKING LOT
93	UNDETERMINED - FAIL BR
94	REPORTED INVALID
98	OTHER
99	UNKNOWN

Crash Reduction Equations

Definitions

Data Fields

CRIS

obj_struck_id Object Struck - Object Struck is an obstruction in, on, or around a road that a motor vehicle involved in a crash has made contact with.

OBJ_STRUCK_ID	OBJ_STRUCK_DESC
1	OVERTURNED
2	HIT HOLE IN ROAD
3	JACK-KNIFED
4	PERSON FELL OR JUMPED FROM VEHICLE
9	HIT TRAIN ON TRACKS PARALLEL TO ROAD - NO CROSSING
10	HIT TRAIN MOVING FORWARD
11	HIT TRAIN BACKING
12	HIT TRAIN STANDING STILL
13	HIT TRAIN-ACTION UNKNOWN
20	HIT HIGHWAY SIGN
21	HIT CURB
22	HIT CULVERT-HEADWALL
23	HIT GUARDRAIL
24	HIT RAILROAD SIGNAL POLE OR POST
25	HIT RAILROAD CROSSING GATES
26	HIT TRAFFIC SIGNAL POLE OR POST
27	HIT OVERHEAD SIGNAL LIGHT, WIRES, SIGNS, ETC
28	HIT WORK ZONE BARRICADE, CONES, SIGNS OR MATERIAL
29	HIT LUMINAIRE POLE
30	HIT UTILITY POLE
31	HIT MAILBOX
32	HIT TREE, SHRUB, LANDSCAPING
33	HIT FENCE
34	HIT HOUSE, BLDG. OR BLDG. FIXTURE
35	HIT COMMERCIAL SIGN
36	HIT OTHER FIXED OBJECT
37	HIT BUS STOP STRUCTURE (BENCH)

OBJ_STRUCK_ID	OBJ_STRUCK_DESC
38	HIT WORK ZONE MACHINERY OR STOCKPILED MATERIALS
39	HIT MEDIAN BARRIER
40	HIT END OF BRIDGE (ABUTMENT OR RAIL END)
41	HIT SIDE OF BRIDGE (BRIDGE RAIL)
42	HIT PIER OR SUPPORT AT UNDERPASS, TUNNEL OR OVERHEAD SIGN BRIDGE
43	HIT TOP OF UNDERPASS OR TUNNEL
44	HIT BRIDGE CROSSING GATE
45	HIT ATTENUATION DEVICE
49	HIT BY FALLEN/BLOWING ROCKS FROM A TRUCK
50	HIT FALLEN TREES OR DEBRIS ON ROAD
51	HIT OBJECT FROM ANOTHER VEHICLE IN ROAD
52	HIT PREVIOUSLY WRECKED VEHICLE
53	HIT TOLL BOOTH
54	HIT OTHER MACHINERY
56	HIT CONCRETE TRAFFIC BARRIER
57	HIT DELINEATOR OR MARKER POST
58	HIT RETAINING WALL
59	HIT HOV LANE GATE
60	HIT GUARD POST
61	FIRE HYDRANT
62	DITCH
63	EMBANKMENT
64	NOT APPLICABLE
65	NOT REPORTED
93	UNDETERMINED - FAIL BR
94	REPORTED INVALID
98	OTHER

Crash Reduction Equations

Definitions

Data Fields

CRIS

road_relat_id Roadway Relation - Roadway Relation refers to where the First Harmful Event (point of impact) occurred in relation to the roadway.

ROAD_RELAT_ID	ROAD_RELAT_DESC
1	ON ROADWAY
2	OFF ROADWAY
3	SHOULDER
4	MEDIAN
5	NOT APPLICABLE
6	NOT REPORTED
93	UNDETERMINED - FAIL BR
94	REPORTED INVALID

rpt_road_part_id Roadway Part (road on which crash occurred)

ROAD_PART_ID	ROAD_PART_DESC
1	MAIN/PROPER LANE
2	SERVICE/FRONTAGE ROAD
3	ENTRANCE/ON RAMP
4	EXIT/OFF RAMP
5	CONNECTOR/FLYOVER
7	OTHER (EXPLAIN IN NARRATIVE)
10	NOT REPORTED
93	UNDETERMINED - FAIL BR
94	REPORTED INVALID

Crash Reduction Equations

Definitions

Data Fields

CRIS

fhe_collsn_id Manner of Collision - The manner in which the vehicle(s) were moving prior to the first harmful event.

COLLSN_ID	COLLSN_DESC
1	OMV VEHICLE GOING STRAIGHT
2	OMV VEHICLE TURNING RIGHT
3	OMV VEHICLE TURNING LEFT
4	OMV VEHICLE BACKING
5	OMV OTHER
10	ANGLE - BOTH GOING STRAIGHT
11	ANGLE - ONE STRAIGHT-ONE BACKING
12	ANGLE - ONE STRAIGHT-ONE STOPPED
13	ANGLE - ONE STRAIGHT-ONE RIGHT TURN
14	ANGLE - ONE STRAIGHT-ONE LEFT TURN
15	ANGLE - BOTH RIGHT TURN
16	ANGLE - ONE RIGHT TURN-ONE LEFT TURN
17	ANGLE - ONE RIGHT TURN-ONE STOPPED
18	ANGLE - BOTH LEFT TURN
19	ANGLE - ONE LEFT TURN-ONE STOPPED
20	SD BOTH GOING STRAIGHT-REAR END
21	SD BOTH GOING STRAIGHT-SIDESWIPE
22	SD ONE STRAIGHT-ONE STOPPED
23	SD ONE STRAIGHT-ONE RIGHT TURN
24	SD ONE STRAIGHT-ONE LEFT TURN
25	SD BOTH RIGHT TURN
26	SD ONE RIGHT TURN-ONE LEFT TURN
27	SD ONE RIGHT TURN-ONE STOPPED
28	SD BOTH LEFT TURN

COLLSN_ID	COLLSN_DESC
29	SD ONE LEFT TURN-ONE STOPPED
30	OD BOTH GOING STRAIGHT
31	OD ONE STRAIGHT-ONE BACKING
32	OD ONE STRAIGHT-ONE STOPPED
33	OD ONE STRAIGHT-ONE RIGHT TURN
34	OD ONE STRAIGHT-ONE LEFT TURN
35	OD ONE BACKING-ONE STOPPED
36	OD ONE RIGHT TURN-ONE LEFT TURN
37	OD ONE RIGHT TURN-ONE STOPPED
38	OD BOTH LEFT TURNS
39	OD ONE LEFT TURN-ONE STOPPED
40	O ONE STRAIGHT-ONE ENTER OR LEAVE PARKING SPACE
41	O ONE RIGHT TURN-ONE ENTER OR LEAVE PARKING SPACE
42	O ONE LEFT TURN-ONE ENTER OR LEAVE PARKING SPACE
43	O ONE ENTER OR LEAVE PARKING SPACE-ONE STOPPED
44	O BOTH ENTERING OR LEAVING A PARKING SPACE
45	O BOTH BACKING
46	OTHER
48	NOT REPORTED
93	UNDETERMINED - FAIL BR
94	REPORTED INVALID

System/Record

Crash Reduction Equations

System Variables

D = TxDOTCONNECT project record

C_i = Each CRIS record, processed individually. Predictions will be summed.

R_i = Each RIF record, processed individually. Results will be summed.

Project/Segment Details

4 Steps

$$let\_fy = \begin{cases} 1900 & \text{if D.dist\_let\_date mod } 100 \geq 80 \\ 2000 & \text{else} \end{cases} + \lfloor \frac{\text{D.dist\_let\_date}}{100} \rfloor + \begin{cases} 1 & \text{if D.dist\_let\_date mod } 10 > 8 \\ 0 & \text{else} \end{cases}$$

$$project\_bmp = \min\left(\text{D.beg\_mile\_point},\ \text{D.end\_mile\_point}\right)$$

$$project\_emp = \max\left(\text{D.beg\_mile\_point},\ \text{D.end\_mile\_point}\right)$$

$$project\_length = project\_emp - project\_bmp$$

Crash Reduction Equations

Volume

13 Steps

$$aadt\_open\_year = \begin{cases} let\_fy & \text{if D.pres\_adt} \notin \{\text{null}, 0\} \\ \text{R}_i\text{.adt\_year} & \text{else} \end{cases}$$

$$aadt = \begin{cases} \text{D.pres\_adt} & \text{if D.pres\_adt} \notin \{\text{null}, 0\} \\ \text{R}_i\text{.adt\_cur} & \text{else} \end{cases}$$

$$aadt\_annual\_growth_D = \left[\left(\frac{\text{D.proj\_adt}}{\text{D.pres\_adt}} \right) \left(\frac{1}{\text{D.pres\_adt\_year} - \text{D.proj\_adt\_year}} \right) \right] - 1$$

$$aadt\_annual\_growth_R = \left[\left(\frac{\text{R}_i\text{.adt\_desgn}}{\text{R}_i\text{.adt\_cur}} \right) \left(\frac{1}{\text{R}_i\text{.desgn\_yr} - \text{R}_i\text{.adt\_year}} \right) \right] - 1$$

$$aadt\_annual\_growth = \begin{cases} aadt\_annual\_growth_D & \text{if } aadt\_annual\_growth_D \leq 0.02 \\ aadt\_annual\_growth_R & \text{if } aadt\_annual\_growth_R \leq 0.02 \\ 0.02 & \text{else} \end{cases}$$

$$plan\_horizon\_year = \text{current\_year\_crash} + \text{plan\_horizon}$$

$$plan\_horizon\_years = plan\_horizon\_year - \left(\text{C}_{\text{last\_year}} - 1 \right)$$

$$open\_year\_years = \begin{cases} \text{D}_{\text{let\_fy}} - 1 & \text{if D}_{\text{let\_fy}} \leq plan\_horizon\_year \\ plan\_horizon\_year - 1 & \text{else} \end{cases}$$

$$plan\_horizon\_multiplier = \begin{cases} plan\_horizon\_years & \text{if } aadt\_annual\_growth = 0 \\ \dfrac{\left(1 + aadt\_annual\_growth\right)^{(plan\_horizon\_years+1)} - 1}{aadt\_annual\_growth} - 1 & \text{else} \end{cases}$$

Crash Reduction Equations

Volume (cont'd)

13 Steps

$$open\_year\_difference = \begin{cases} open\_year\_years & \text{if } aadt\_annual\_growth = 0 \\ \left[\dfrac{\left(1 + aadt\_annual\_growth\right)^{(open\_year\_years+1)}}{aadt\_annual\_growth} - 1 \right] & \text{else} \end{cases}$$

$$after\_open\_year\_multiplier = plan\_horizon\_multiplier - open\_year\_difference$$

$$final\_year\_multiplier = \left(1 + aadt\_annual\_growth\right)^{plan\_horizon\_years}$$

$$hundred\_million\_vmt = 365 \times future\_aadt \times final\_year\_multiplier \times project\_length$$

Crash Reduction Equations

Crash Record Details

13 Steps

$$intersection_i = \begin{cases} \text{true} & \text{if } C_i.\text{intrsct\_relat\_id} \in \{1, 2\} \\ \text{false} & \text{else} \end{cases}$$

$$railroad_i = \begin{cases} \text{true} & \text{if } C_i.\text{rr\_relat\_fl} = \text{"Y"} \\ \text{true} & \text{if } C_i.\text{harm\_evnt\_id} = 3 \\ \text{true} & \text{if } C_i.\text{phys\_featr\_1\_id} = 17 \\ \text{true} & \text{if } C_i.\text{phys\_featr\_2\_id} = 17 \\ \text{true} & \text{if } C_i.\text{obj\_struck\_id} \in \{10, 11, 12, 13, 24, 25\} \\ \text{false} & \text{else} \end{cases}$$

$$frontage_i = \begin{cases} \text{true} & \text{if } C_i.\text{rpt\_road\_part\_id} = 2 \\ \text{false} & \text{else} \end{cases}$$

$$widen\_shoulders_i = \begin{cases} \text{true} & \text{if } C_i.\text{road\_relat\_id} \in \{2, 3, 4\} \\ \text{true} & \text{if } C_i.\text{harm\_evnt\_id} = 4 \\ \text{false} & \text{else} \end{cases}$$

$$construct\_shoulders_i = \begin{cases} \text{true} & \text{if } C_i.\text{road\_relat\_id} \in \{2, 3, 4\} \\ \text{true} & \text{if } C_i.\text{fhe\_collsn\_id} \in \{20, 23, 24, 30\} \\ \text{true} & \text{if } C_i.\text{harm\_evnt\_id} = 4 \\ \text{false} & \text{else} \end{cases}$$

$$widen\_lanes_i = \begin{cases} \text{true} & \text{if } C_i.\text{road\_relat\_id} \in \{2, 3, 4\} \\ \text{true} & \text{if } C_i.\text{fhe\_collsn\_id} \in \{13, 21, 23, 30, 33\} \\ \text{false} & \text{else} \end{cases}$$

Crash Reduction Equations

Crash Record Details (cont'd)

$$vertical\_alignment_i = \begin{cases} \text{true} & \text{if } C_i.\text{road\_relat\_id} \in \{2, 3, 4\} \\ \text{true} & \text{if } C_i.\text{fhe\_collsn\_id} \in \{20, 21, 22, 23, 24, 30, 32, 34\} \\ \text{false} & \text{else} \end{cases}$$

$$super\_two_i = \begin{cases} \text{true} & \text{if } C_i.\text{road\_relat\_id} \in \{2, 3, 4\} \\ \text{true} & \text{if } C_i.\text{fhe\_collsn\_id} \in \{21, 30\} \\ \text{false} & \text{else} \end{cases}$$

$$divided_i = \begin{cases} \text{true} & \text{if } C_i.\text{road\_relat\_id} \in \{2, 3, 4\} \\ \text{true} & \text{if } C_i.\text{fhe\_collsn\_id} \in \{10, 13, 14, 20, 21, 22, 24, 30\} \\ \text{false} & \text{else} \end{cases}$$

$$passing\_lanes_i = \begin{cases} \text{true} & \text{if } C_i.\text{road\_relat\_id} \in \{2, 3\} \\ \text{true} & \text{if } C_i.\text{fhe\_collsn\_id} \in \{20, 21, 22, 23, 24, 30\} \\ \text{false} & \text{else} \end{cases}$$

$$roadway\_signs_i = \begin{cases} \text{true} & \text{if } C_i.\text{road\_relat\_id} \in \{2, 3, 4\} \\ \text{true} & \text{if } C_i.\text{fhe\_collsn\_id} \in \{20, 21, 22, 30\} \\ \text{false} & \text{else} \end{cases}$$

Crash Reduction Equations

Crash Record Details (cont'd)

13 Steps

$$crash\_type_i = \begin{cases} \text{"K"} & \text{if } C_i.\text{crash\_fatal\_fl} = \text{"Y"} \\ \text{"A"} & \text{if } C_i.\text{incap\_injry\_cnt} > 0 \\ \text{"B"} & \text{if } C_i.\text{nonincap\_injry\_cnt} > 0 \\ \text{"C"} & \text{if } C_i.\text{poss\_injry\_cnt} > 0 \\ \text{"O"} & \text{if } C_i.\text{non\_injry\_cnt} > 0 \\ \text{"O"} & \text{if } C_i.\text{unkn\_injry\_cnt} > 0 \end{cases}$$

$$crash\_cost_i = \begin{cases} 11,000,000.00 & \text{if } crash\_type = \text{"K"} \\ 1,400,000.00 & \text{if } crash\_type = \text{"A"} \\ 480,000.00 & \text{if } crash\_type = \text{"B"} \\ 270,000.00 & \text{if } crash\_type = \text{"C"} \\ 46,000.00 & \text{if } crash\_type = \text{"O"} \\ 0.00 & \text{else} \end{cases}$$

Crash Reduction Equations

CMF Multipliers

26 Steps

$$cmf\_multiplier\_intersection = 1.000 - \begin{cases} 0.200 & \text{if } D_{grade\_separated} = \text{true} \\ 0.350 & \text{if } D_{construct\_interchange} = \text{true} \\ 0.693 & \text{if } D_{reconstruct\_interchange} = \text{true} \\ 0.770 & \text{if } crash\_type \in \{\text{"K", "A", "B", "C"}\} \wedge D_{aux\_lane} = \text{true} \\ 0.800 & \text{if } crash\_type = \text{"O"} \wedge D_{aux\_lane} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

$$cmf\_multiplier\_railroad = 1.000 - \begin{cases} 0.000 & \text{if } D_{railroad\_grade\_separated} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

$$cmf\_multiplier\_frontage = 1.000 - \begin{cases} 0.750 & \text{if } D_{frontage\_one\_way} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

$$cmf\_multiplier\_widen\_shoulders = 1.000 - \begin{cases} 0.600 & \text{if } D_{widen\_shoulders} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

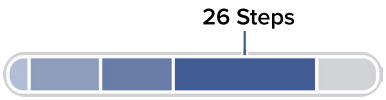
$$cmf\_multiplier\_construct\_shoulders = 1.000 - \begin{cases} 0.600 & \text{if } D_{construct\_shoulders} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

$$cmf\_multiplier\_upgrade\_standards = 1.000 - \begin{cases} 0.850 & \text{if } D_{upgrade\_standards} = \text{true} \\ 0.739 & \text{if } D_{center\_left} = \text{true} \wedge crash\_type \in \{\text{"K", "A", "B", "C"}\} \\ 0.797 & \text{if } D_{center\_left} = \text{true} \wedge crash\_type = \text{"O"} \\ 1.000 & \text{else} \end{cases}$$

$$cmf\_multiplier\_widen\_lanes = 1.000 - \begin{cases} 0.700 & \text{if } D_{widen\_lanes} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

Crash Reduction Equations

CMF Multipliers (cont'd)



$$cmf\_multiplier\_vertical\_alignment = 1.000 - \begin{cases} 0.500 & \text{if } D_{vertical\_alignment} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

$$cmf\_multiplier\_super\_two = 1.000 - \begin{cases} 0.750 & \text{if } D_{super\_two} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

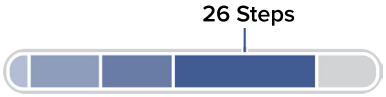
$$cmf\_multiplier\_divided = 1.000 - \begin{cases} 0.550 & \text{if } D_{divided} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

$$cmf\_multiplier\_passing\_lanes = 1.000 - \begin{cases} 0.750 & \text{if } D_{passing\_lanes} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

$$cmf\_multiplier\_roadway\_signs = 1.000 - \begin{cases} 0.800 & \text{if } D_{roadway\_signs} = \text{true} \\ 1.000 & \text{else} \end{cases}$$

Crash Reduction Equations

CMF Multipliers (cont'd)



$$cmf\_mult\_intersection\_applied_i = \begin{cases} cmf\_multiplier\_intersection & \text{if } intersection_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$cmf\_mult\_railroad\_applied_i = \begin{cases} cmf\_multiplier\_railroad & \text{if } railroad_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$cmf\_mult\_frontage\_applied_i = \begin{cases} cmf\_multiplier\_frontage & \text{if } frontage_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$cmf\_mult\_widen\_shoulders\_applied_i = \begin{cases} cmf\_multiplier\_widen\_shoulders & \text{if } widen\_shoulders_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$cmf\_mult\_construct\_shoulders\_applied_i = \begin{cases} cmf\_multiplier\_construct\_shoulders & \text{if } construct\_shoulders_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$cmf\_mult\_upgrade\_standards\_applied_i = \begin{cases} cmf\_multiplier\_upgrade\_standards & \text{if } upgrade\_standards_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

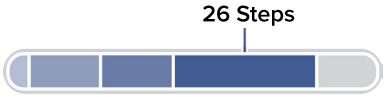
$$cmf\_mult\_widen\_lanes\_applied_i = \begin{cases} cmf\_multiplier\_widen\_lanes & \text{if } widen\_lanes_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$cmf\_mult\_vertical\_alignment\_applied_i = \begin{cases} cmf\_multiplier\_vertical\_alignment & \text{if } vertical\_alignment_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$cmf\_mult\_super\_two\_applied_i = \begin{cases} cmf\_multiplier\_super\_two & \text{if } super\_two_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

Crash Reduction Equations

CMF Multipliers (cont'd)



$$cmf\_mult\_divided\_applied_i = \begin{cases} cmf\_multiplier\_divided & \text{if } divided_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$cmf\_mult\_passing\_lanes\_applied_i = \begin{cases} cmf\_multiplier\_passing\_lanes & \text{if } passing\_lanes_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$cmf\_mult\_roadway\_signs\_applied_i = \begin{cases} cmf\_multiplier\_roadway\_signs & \text{if } roadway\_signs_i = \text{true} \\ 0.000 & \text{else} \end{cases}$$

$$\begin{aligned} cmf\_multiplier\_sum_i = \\ & cmf\_mult\_intersection\_applied_i \\ & + cmf\_mult\_railroad\_applied_i \\ & + cmf\_mult\_frontage\_applied_i \\ & + cmf\_mult\_widen\_shoulders\_applied_i \\ & + cmf\_mult\_construct\_shoulders\_applied_i \\ & + cmf\_mult\_upgrade\_standards\_applied_i \\ & + cmf\_mult\_widen\_lanes\_applied_i \\ & + cmf\_mult\_vertical\_alignment\_applied_i \\ & + cmf\_mult\_super\_two\_applied_i \\ & + cmf\_mult\_divided\_applied_i \\ & + cmf\_mult\_passing\_lanes\_applied_i \\ & + cmf\_mult\_roadway\_signs\_applied_i \end{aligned}$$

$$cmf\_multiplier_i = \min\left(cmf\_multiplier\_sum_i,\ 1.0\right)$$

Crash Reduction Equations

Final Summations

11 Steps

$$total\_crash\_years = C_{final\_year} - C_{first\_year}$$

$$cmf\_annual\_sum\_total_y = \sum_{i=0}^{n} cmf\_multiplier_i$$

$$cmf\_annual\_sum\_k\_a_y = \sum_{i=0}^{n} \begin{cases} cmf\_multiplier_i & \text{if } crash\_type_i \in \{\text{"K", "A"}\} \\ 0 & \text{else} \end{cases}$$

$$annual\_cost\_savings_y = \sum_{i=0}^{n} \left(cmf\_multiplier_i \times crash\_cost_i\right)$$

where n = quantity of CRIS records in the year y

$$average\_annual\_crashes\_total = \frac{1}{total\_crash\_years} \times \sum_{y=0}^{total\_crash\_years} cmf\_annual\_sum_y$$

$$average\_annual\_crashes\_k\_a = \frac{1}{total\_crash\_years} \times \sum_{y=0}^{total\_crash\_years} cmf\_annual\_sum\_k\_a_y$$

Final Performance Metrics

$$estimated\_impact\_total\_crashes = average\_annual\_crashes\_total \times after\_open\_year\_multiplier$$

$$estimated\_impact\_fatal\_injury\_crashes = average\_annual\_crashes\_k\_a \times after\_open\_year\_multiplier$$

$$estimated\_impact\_total\_crash\_rate = \frac{average\_annual\_crashes\_total \times final\_year\_multiplier}{hundred\_million\_vmt}$$

$$estimated\_impact\_fatal\_injury\_crash\_rate = \frac{average\_annual\_crashes\_k\_a \times final\_year\_multiplier}{hundred\_million\_vmt}$$

$$societal\_cost\_savings = annual\_cost\_savings_y \times final\_year\_multiplier$$

Congestion Reduction Equations

Introduction

The Performance Metrics: Data Integration System (PM-DIS) preprocessor calculates a number of data points in order to predict a project's impact on roadway congestion.

TxDOTCONNECT data is parsed to determine project work types which are then added to the roadway's capacity when calculating delay.

RIF data is parsed and processed with TxDOTCONNECT data to determine volume and capacity values, lane counts, roadbed types, etc..

A detailed set of rules determines what lane counts and roadway cross-section should be used.

Both systems' data are used to predict a build and no-build scenario both at project opening and 20 years later. The overlapping sections of RIF and the TxDOTCONNECT project data are parsed individually, with the results being added into a total in the end.

This produces two distinct sets of metrics:

- **Benefit Congestion Index (Auto)** - A total number of hours of delay savings for all auto users on the roadway over a period of 20 years.
- **Benefit Congestion Index (Truck)** - A total number of hours of delay savings for all freight users on the roadway over a period of 20 years.

Congestion Reduction Equations

Notation Used in This Document

Data field in a system

$$\text{System.field\_name}$$

"Switch" array of cases. Only one result is possible.

$$\begin{cases} \text{result 1} & \text{condition 1} \\ \text{result 2} & \text{condition 2} \\ \text{result 3} & \text{else} \end{cases}$$

Logical AND condition

$$\text{condition 1} \wedge \text{condition 2}$$

Summation: n is set size, i is the index within the set. All items in the set are processed.

$$\sum_{i=0}^{n} f(x_i)$$

Item is found in set of items

$$\text{item} \in \{\text{set}\}$$

Item is not found in set of items

$$\text{item} \notin \{\text{set}\}$$

Floor of expression

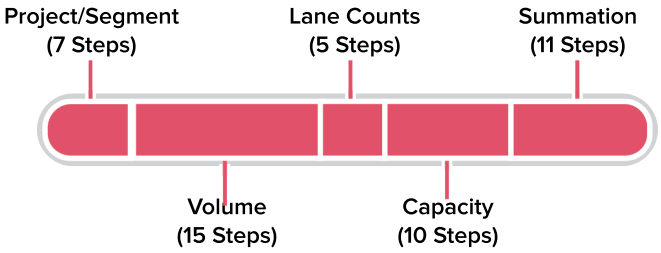
$$\lfloor 2.6 \rfloor = 2$$

Modulo (remainder of a division)

$$3 \bmod 2 = 1$$

Related Steps in This Document

There are five sections with multiple steps within them to find Benefit Congestion Index and Normalized Congestion Index. Each step builds upon one another. This loading bar illustrates this progression.



Congestion Reduction Equations

Definitions

Systems

TxDOTCONNECT TxDOTCONNECT is the Texas Department of Transportation's automated information system used for planning, programming, and developing projects. TxDOTCONNECT is an essential part of preparing construction projects for contract letting. Project information such as work descriptions, funding requirements, and dates for proposed activities can be found in TxDOTCONNECT.

DCIS Design and Construction Information System. This was the original project repository, based on which PM-DIS project data and field names were developed. The DCIS data dictionary/user manual were used for data field descriptions, which may be updated at a later date if a TxDOTCONNECT data dictionary is produced..

RIF Roadway Information File. An export from TxDOT's main network data system which includes roadway location, routing, attributes, and usage.

Data Fields

TxDOTCONNECT

beg_mile_point Project beginning mile point on the control-section. Used for length calculations in relation to RIF segment overlap with the project area.

DCIS manual description: This two-digit field with three decimal places corresponds to the beginning limits of this project as it relates to the control section. When the user inputs the reference marker information, this field is automatically populated with mile point information from the Texas Reference Marker System maintained by TPP(D) based on a batch job submitted at the time of input.

end_mile_point Project ending mile point on the control-section. Used for length calculations in relation to RIF segment overlap with the project area.

DCIS manual description: This two-digit field with three decimal places corresponds to the ending limits of this project as it relates to the control section. When the user inputs the reference marker information, this field is automatically populated with mile point information from the Texas Reference Marker System maintained by TPP(D) based on a batch job submitted at the time of input.

dist_let_date District estimated letting date. Stored as four digits in YYMM format, with leading zeroes removed. Used to create dist_fy, which is project opening year in volume calculations.

DCIS manual description: This four-digit field shows the district's estimated letting date for this project as it was approved in the latest STIP. This field is updated by the 'DIST LET DATE' field on the project identification screen.

exst_mnln_num Existing predominate number of facility mainlanes at the project location. Used for capacity calculations. Takes precedence over RIF lane count.

DCIS manual description: This two-digit field represents the number of through travel lanes in both directions for the existing facility.

prop_mnln_num Proposed predominate number of facility mainlanes at the project location. Used for build capacity calculations.

DCIS manual description: Proposed predominate number of facility mainlanes at the project location. Used for build capacity calculations.

exst_ftg_num Existing predominate number of facility frontage/service lanes at the project location. Used for capacity calculations. Takes precedence over RIF lane count.

DCIS manual description: This two-digit field represents the number of through travel lanes on the frontage roads for both two-way and one-way operations on the existing facility of this project.

prop_ftg_num Proposed predominate number of facility frontage/service lanes at the project location. Used for capacity calculations.

DCIS manual description: This two-digit field represents the number of through travel lanes on the frontage roads for both two-way and one-way operations on the proposed facility for this project.

pres_adt Present ADT at the project location. Used for volume calculations including growth rates. Takes precedence over RIF volume.

DCIS manual description: This six-digit field represents the present average daily traffic (ADT) using the facility. For a new location project, the ADT represents the expected ADT if the facility were open today.

pres_adt_year Present ADT collection year at the project location. Used for volume calculations including growth rates. Takes precedence over RIF volume collection year.

This field did not exist in DCIS, but it is a 4-digit year.

Congestion Reduction Equations

Definitions

Data Fields

TxDOTCONNECT

proj_adt Projected ADT at the project location. Used for volume calculations including growth rates. Takes precedence over RIF volume.

DCIS manual description: This six-digit field represents the projected future estimate of the average daily traffic (ADT) using the facility.

proj_adt_year Number of years into the future ADT was projected. Used for volume calculations including growth rates. Takes precedence over RIF volume.

DCIS manual description: This two-digit field represents the future time increment in years for which projected traffic (PROJ-ADT) is provided.

percent_trucks Percent of ADT that is freight trucks. Used to split performance metrics into truck and auto traffic. Takes precedence over RIF truck percent.

DCIS manual description: This two-digit field with one decimal place indicates the percent of the average daily traffic (ADT) that are trucks.

TxDOTCONNECT description-based flags

Each flag is the result of a key word/phrase search within the TxDOTCONNECT Description and Type of Work fields. For detailed key word search information and more exhaustive listings, please see in PM-DIS documentation key word reference.

main Project work affects mainlanes. Used to include or exclude RIF segments on a mainlane roadbed and intelligently divide traffic counts by roadbed.

Key words: "MAIN LANES"

frontage Project work affects frontage/service lanes. Used to include or exclude RIF segments on a frontage/service lane roadbed and intelligently divide traffic counts by roadbed.

Key words: "FRONTAGE", "FR R"

add_aux_lanes Project adds auxiliary lanes, adding 12,500 vehicles per day.

Key words: "AUX"

grade_separation Project separates the project roadway from other intersecting roads, adding 12,500 vehicles per day.

Key words: "CONSTRUCT GRADE SEPARATION"

ramp_reconfiguration Project will reconfigure existing ramps, adding 12,500 vehicles per day.

Key words: "RAMP REVERSAL", "RECONFIGURE RAMPS", "REVERSE RAMPS", "REMOVE RAMPS"

new_interchange Project will build a new interchange where none exists, adding 12,500 vehicles per day.

Key words: "INTERCHANGE" + NOT:"REPLACE INTERCHANGE"

replace_interchange Project will replace an existing interchange with a more effective structure, adding 12,500 vehicles per day.

Key words: "REPLACE INTERCHANGE"

intersection_improvements Project implements intersection improvements, adding 2,500 vehicles per day.

Key words: "RECONFIGURE INTERSECTION", "INTERSECTION IMPROVEMENTS", "IMPROVE INTERSECTION"

ITS Project implements intelligent transportation systems, reducing overall travel time by 5%.

Key words: "ITS EQUIPMENT", "CONSTRUCT ITS"

Congestion Reduction Equations

Definitions

Data Fields

RIF

bmp Segment beginning mile point on the control section. Used for length calculations in relation to RIF segment overlap with the project area.

emp Segment ending mile point on the control section. Used for length calculations in relation to RIF segment overlap with the project area.

fun_sys_expanded Roadway functional classification and rural/urban area type. Used to determine hourly lane capacity.

phy_rdbd Physical roadbed. Used to split traffic count and lane numbers into relevant quantities. Possible values:
"K": undivided roadway mainlanes
"R": divided roadway mainlanes of the side on which traffic travels in the direction of increasing reference marker numbers.
"L": divided roadway mainlanes of the side on which traffic travels in the direction of decreasing reference marker numbers.
"A": frontage/service lanes of the side on which traffic travels in the direction of increasing reference marker numbers.
"X": frontage/service lanes of the side on which traffic travels in the direction of decreasing reference marker numbers.

num_lanes Number of lanes in the segment/roadbed. Used for capacity calculations. TxDOTCONNECT lane counts take precedence over this value.

spd_max Roadway speed limit. Used in travel time calculations.

adt_cur Current ADT for the RIF segment/roadbed. "R" and "L" roadbeds include traffic in both directions. Used for volume calculations including growth rates. TxDOTCONNECT volume takes precedence over this value.

adt_year Year of ADT data collection. Used for volume calculations including growth rates. TxDOTCONNECT collection year takes precedence over this value.

adt_desgn Projected ADT for the RIF segment/roadbed. "R" and "L" roadbeds include traffic in both directions. Used for volume calculations including growth rates. TxDOTCONNECT volume takes precedence over this value.

desgn_yr Year of projected ADT. Used for volume calculations including growth rates. TxDOTCONNECT future year takes precedence over this value.

trk_aadt_pct Percent of ADT that is freight trucks. Used to split performance metrics into truck and auto traffic. TxDOTCONNECT truck percent takes precedence over this value.

System Variables

System/Record

D = DCIS project record

R_i = Each RIF record, processed individually. Results will be summed.

Congestion Reduction Equations

Project/Segment Details

7 Steps

$$let\_fy = \begin{cases} 1900 & \text{if D.dist\_let\_date mod } 100 \geq 80 \\ 2000 & \text{else} \end{cases} + \lfloor \frac{\text{D.dist\_let\_date}}{100} \rfloor + \begin{cases} 1 & \text{if D.dist\_let\_date mod } 10 > 8 \\ 0 & \text{else} \end{cases}$$

$$project\_bmp = \min\left(\text{D.beg\_mile\_point},\ \text{D.end\_mile\_point}\right)$$

$$project\_emp = \max\left(\text{D.beg\_mile\_point},\ \text{D.end\_mile\_point}\right)$$

$$project\_length = project\_emp - project\_bmp$$

$$seg\_bmp = \min\left(\text{R}_\text{i}\text{.bmp},\ \text{R}_\text{i}\text{.emp}\right)$$

$$seg\_emp = \max\left(\text{R}_\text{i}\text{.bmp},\ \text{R}_\text{i}\text{.emp}\right)$$

$$seg\_length = \min\left(\text{R}_\text{i}\text{.emp},\ project\_emp\right) - \max\left(\text{R}_\text{i}\text{.bmp},\ project\_bmp\right)$$

Congestion Reduction Equations

Volume

15 Steps

$$congestion\_horizon = 20$$

Traffic growth predictions are set 20 years into the future, and accumulated total hours are within that window.

$$aadt\_open\_year = \begin{cases} let\_fy & \text{if D.pres\_adt} \notin \{\text{null}, 0\} \\ \text{R}_\text{i}\text{.adt\_year} & \text{else} \end{cases}$$

$$aadt\_annual\_growth_D = \left[\left(\frac{\text{D.proj\_adt}}{\text{D.pres\_adt}} \right) \left(\frac{1}{\text{D.pres\_adt\_year} - \text{D.proj\_adt\_year}} \right) \right] - 1$$

$$aadt\_annual\_growth_R = \left[\left(\frac{\text{R}_\text{i}\text{.adt\_desgn}}{\text{R}_\text{i}\text{.adt\_cur}} \right) \left(\frac{1}{\text{R}_\text{i}\text{.desgn\_yr} - \text{R}_\text{i}\text{.adt\_year}} \right) \right] - 1$$

$$aadt\_annual\_growth = \begin{cases} aadt\_annual\_growth_D & \text{if } aadt\_annual\_growth_D \leq 0.02 \\ aadt\_annual\_growth_R & \text{if } aadt\_annual\_growth_R \leq 0.02 \\ 0.02 & \text{else} \end{cases}$$

$$aadt\_undivided_D = \begin{cases} \text{D.pres\_adt} \times 0.9 & \text{if D.frontage} = \text{true} \\ \text{D.pres\_adt} & \text{else} \end{cases}$$

$$aadt\_mnln_D = \begin{cases} \text{D.pres\_adt} \times 0.45 & \text{if D.frontage} = \text{true} \\ \text{D.pres\_adt} \times 0.5 & \text{else} \end{cases}$$

$$aadt\_ftg_D = \begin{cases} \text{D.pres\_adt} \times 0.05 & \text{if D.main} = \text{true} \\ \text{D.pres\_adt} \times 0.5 & \text{else} \end{cases}$$

Congestion Reduction Equations

Volume (cont'd)

15 Steps

$$aadt_D = \begin{cases} aadt\_mnln_D & \text{if } R_i.\text{phy\_rdbd} \in \{\text{"R", "L"}\} \\ aadt\_ftg_D & \text{if } R_i.\text{phy\_rdbd} \in \{\text{"A", "X"}\} \\ aadt\_undivided_D & \text{if } R_i.\text{phy\_rdbd} = \text{"K"} \\ 0 & \text{else} \end{cases}$$

$$aadt_R = \begin{cases} \frac{R_i.\text{adt\_cur}}{2} & \text{if } R_i.\text{phy\_rdbd} \in \{\text{"R", "L"}\} \\ R_i.\text{adt\_cur} & \text{else} \end{cases}$$

$$aadt\_cur = \begin{cases} aadt_D & \text{if D.pres\_adt} \notin \{\text{null}, 0\} \\ aadt_R & \text{else} \end{cases}$$

$$V_{open} = aadt\_cur \times \left(1 + aadt\_annual\_growth\right)^{\left(let\_fy - aadt\_open\_year\right)}$$

This builds traffic exponentially by the number of years between traffic collection year and letting. Were this negative, the growth would be inversed correctly.

$$V_{future} = aadt\_cur \times \left(1 + aadt\_annual\_growth\right)^{\left(let\_fy - aadt\_open\_year + congestion\_horizon\right)}$$

Similar to the above calculation, traffic is built exponentially up to 20 years after letting.

$$truck\_pct = \frac{\begin{cases} \text{D.percent\_trucks} & \text{if D.percent\_trucks} \notin \{\text{null}, 0\} \\ R_i.\text{trk\_aadt\_pct} & \text{else} \end{cases}}{100}$$

$$auto\_pct = 1 - truck\_pct$$

Congestion Reduction Equations

Lane Counts

5 Steps

$$num\_lanes_D = \begin{cases} \frac{\text{D.exst\_mnln\_num}}{2} & \text{if } R_i\text{.phy\_rdbd} \in \{\text{"R", "L"}\} \wedge \text{D.exst\_mnln\_num} \notin \{\text{null}, 0\} \\ \text{D.exst\_mnln\_num} & \text{if } R_i\text{.phy\_rdbd} = \text{"K"} \wedge \text{D.exst\_mnln\_num} \notin \{\text{null}, 0\} \\ \frac{\text{D.exst\_ftg\_num}}{2} & \text{if } R_i\text{.phy\_rdbd} \in \{\text{"A", "X"}\} \wedge \text{D.exst\_ftg\_num} \notin \{\text{null}, 0\} \\ R_i\text{.num\_lanes} & \text{else} \end{cases}$$

$$num\_lanes = \begin{cases} num\_lanes_D & \text{if D.pres\_adt} \notin \{\text{null}, 0\} \\ R_i\text{.num\_lanes} & \text{else} \end{cases}$$

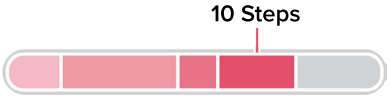
$$future\_lanes = \begin{cases} \text{D.prop\_mnln\_num} & \text{if D.prop\_mnln\_num} \notin \{\text{null}, 0\} \\ num\_lanes & \text{else} \end{cases}$$

$$mnln\_addition = \begin{cases} 0 & \text{if } R_i\text{.phy\_rdbd} \in \{\text{"A", "X"}\} \\ \frac{\text{D.prop\_mnln\_num} - \text{D.exst\_mnln\_num}}{\begin{cases} 1 & \text{if } R_i\text{.phy\_rdbd} = \text{"K"} \\ 2 & \text{else} \end{cases}} & \text{else} \end{cases}$$

$$ftg\_addition = \begin{cases} \frac{\text{D.prop\_ftg\_num} - \text{D.exst\_ftg\_num}}{2} & \text{if } R_i\text{.phy\_rdbd} \in \{\text{"A", "X"}\} \\ 0 & \text{else} \end{cases}$$

Congestion Reduction Equations

Capacity



$$daily\_hours = 10$$

The annualized average day is 10 hours at peak capacity. This is to account for significantly higher traffic during busy times and lower traffic during slow times.

$hourly\_lane\_capacity =$

R_i.fun_sys_expanded	Definition	Capacity
1	Rural Interstate	1,890
2	Rural Other Freeway and Expressway	1,890
3	Rural Other Principal Arterial	870
6	Rural Minor Arterial	780
7	Rural Major Collector	650
8	Rural Minor Collector	650
9	Rural Local	390
11	Interstate (Urban)	2,000
12	Urban Other Freeway and Expressway	2,000
14	Urban Other Principal Arterial	870
16	Urban Minor Arterial	780
17	Urban Major Collector	650
18	Urban Minor Collector	650
19	Urban Local	390

Source: RHiNo data dictionary

$$daily\_lane\_capacity = hourly\_lane\_capacity \times daily\_hours$$

$$added\_lane\_capacity = mnln\_addition \times daily\_lane\_capacity + ftg\_addition \times 6{,}250$$

Frontage/service road lanes have an average hourly capacity of 625 vehicles.

Congestion Reduction Equations

Capacity (cont'd)

10 Steps

$$added\_special\_capacity = \begin{cases} 12{,}500 & \text{if D.add\_aux\_lanes} = \text{true} \\ 12{,}500 & \text{if D.ramp\_reconfiguration} = \text{true} \\ 12{,}500 & \text{if D.grade\_separation} = \text{true} \\ 12{,}500 & \text{if D.replace\_interchange} = \text{true} \\ 12{,}500 & \text{if D.new\_interchange} = \text{true} \\ 0 & \text{else} \end{cases}$$

$$added\_int\_imp\_capacity = \begin{cases} 2{,}500 & \text{if D.intersection\_improvements} = \text{true} \\ 0 & \text{else} \end{cases}$$

$$added\_capacity = added\_lane\_capacity + added\_special\_capacity + added\_int\_imp\_capacity$$

$$C_{nobuild} = daily\_lane\_capacity \times num\_lanes$$

$$C_{build} = C_{nobuild} + added\_capacity$$

C = Capacity

$$delay\_pct\_mult = \begin{cases} 0.95 & \text{if D.ITS} = \text{true} \\ 1 & \text{else} \end{cases}$$

5% direct reduction in travel time due to ITS improvements

Congestion Reduction Equations

Volume Delay Function and Final Summation

11 Steps

$$ffl = \mathrm{R_i}.\mathrm{spd\_max}$$

Free-flow speed in the BPR volume delay function is here assumed to be the posted speed limit.

$$\alpha = 0.25$$

Alpha is the environment dependent multiple used in the BPR volume delay function. A standard BPR formula has proscribed Alpha values depending on functional classification and other factors, but this is intended to describe only one trip. 0.25 was arrived upon as the value which best illustrates an average travel time result when considered for a full day.

$$\beta = 5.6788$$

Beta is the environment dependent exponent used in the BPR volume delay function. A standard BPR formula has proscribed Beta values depending on functional classification and other factors, but this is intended to describe only one trip. 5.6788 was arrived upon as the value which best illustrates an average travel time curve result when considered for a full day.

$$VDF\left(V, C\right) = \frac{seg\_length}{ffl} \times \left(1 + \alpha \times \min\left(\frac{V}{C}, 1.5\right)^{\beta}\right)$$

$$VDF\_difference_{open} = \left(VDF\left(V_{open}, C_{nobuild}\right) - VDF\left(V_{open}, C_{build}\right) \times delay\_pct\_mult\right) \times V_{open}$$

$$VDF\_difference_{future} = \left(VDF\left(V_{future}, C_{nobuild}\right) - VDF\left(V_{future}, C_{build}\right) \times delay\_pct\_mult\right) \times V_{future}$$

$$annual\_days = 250$$

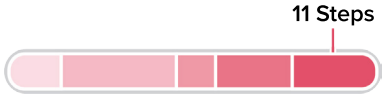
Due to seasonal demand changes, 250 days is a standard "annualization factor" which should represent the actual average full year's traffic on a facility.

$$BCI = \frac{VDF\_difference_{open} + VDF\_difference_{future}}{2} \times congestion\_horizon \times annual\_days$$

$$BCI_i = \begin{cases} BCI & \text{if D.main} = \text{true} \wedge \mathrm{R_i}.\mathrm{phy\_rdbd} \in \{\text{"K", "R", "L"}\} \\ BCI & \text{if D.frontage} = \text{true} \wedge \mathrm{R_i}.\mathrm{phy\_rdbd} \in \{\text{"A", "X"}\} \\ 0 & \text{else} \end{cases}$$

Congestion Reduction Equations

Volume Delay Function and Final Summation cont'd



Final Performance Metrics

$$BCI_{auto} = auto\_pct \times \sum_{i=0}^{n} BCI_i$$

$$BCI_{truck} = truck\_pct \times \sum_{i=0}^{n} BCI_i$$

where n = quantity of RHiNo records

TABLES

BRIDGE SCORES

PMIS RELATED DOCUMENTATION

Ride Score
Distress Score

CRIS DATA RELATED TABLES

FHE_COLLSN_ID
HARM_EVNT_ID
INTRSCT_RELAT_ID
OBJ_STRUCK_ID
PHYS_FEATR_ID
ROAD_PART_ID
ROAD_RELAT_ID
YES_NO_CHOICE_ID

ENVIRONMENTAL MITIGATION COST RATES

BRIDGE SCORES

BRIDGE SCORE VALUES	
Code	Description
N	NOT APPLICABLE
9	EXCELLENT CONDITION
8	VERY GOOD CONDITION — no problems noted.
7	GOOD CONDITION — some minor problems.
6	SATISFACTORY CONDITION — structural elements show some minor deterioration.
5	FAIR CONDITION — all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
4	POOR CONDITION — advanced section loss, deterioration, spalling or scour.
3	SERIOUS CONDITION — loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	CRITICAL CONDITION — advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1	“IMMINENT” FAILURE CONDITION — major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.
0	FAILED CONDITION — out-of-service beyond corrective action.

PMIS RELATED DOCUMENTATION

The following information is from PMIS Data Dictionary Report on tables depicting Ratings and Score Summary/PMIS_CONDITION_SUMMARY. The follow includes tables for Ride Score and Distress Score only. For more information, please refer to the official documentation.

Ride Score

Ride Score describes the overall ride quality of the data collection section. Ride Score is defined for each of the PMIS broad pavement types:

ACRONYM	DEFINITION
ACP	Asphaltic Concrete Pavement
CRCP	Continuously Reinforces Concrete Pavement
JCP	Jointed Concrete Pavement

Valid values:

0.1 (roughest) to 5.0 (smoothest)

RIDE-SCORE is the length-weighted average of the raw SI (serviceability index) values measured in the data collection section.

$$RIDE\text{-}SCORE = \frac{\Sigma\,(DISTANCE\text{-}TRAVELED\text{-}MEAS * RIDE\text{-}SERVICE\text{-}INDEX\text{-}QTY)}{\Sigma\,(DISTANCE\text{-}TRAVELED\text{-}MEAS)}$$

DISTANCE-TRAVELED-MEAS is usually, but not always, 0.1 miles for each SI measurement, so the length-weighted average is needed to give an accurate description of the data collection section's ride quality.

Distress Score

Distress Score describes the overall amount of surface distress (such as cracking, patching, rutting, etc.) on the data collection section.

Distress-score is defined for each of the PMIS broad pavement types:

ACRONYM	DEFINITION
ACP	Asphaltic Concrete Pavement
CRCP	Continuously Reinforces Concrete Pavement
JCP	Jointed Concrete Pavement

Distress score is a product calculated from utility values for each distress evaluated on a pavement type. The utility value represents the value of service provided by the damaged pavement from 0.0000 (worst) to 1.0000 (best). This allows different pavement types to be compared.

Valid Values:

1 (most distress) - 100 (lease distress)

Distress score values which calculate less than 1 (for example 0.4500) are rounded up to 1 in the database.

0 indicates a numm distress code.

The utility equation is the same for each distress where L (L-sub-I) is substituted by a normalized distress value described for each distress.

$$U = 1.0 - AE^{-((P/L)^B)}$$

U = Utility value
A = Alpha - a horizontal asymptote factor that controls the maximum amount of utility that can be lost
B = Beta - a slope factor that controls how steeply utility is lost in the middle of the curce
E = Base of natural logarithms (e = approximately 2.71828...)
P = Rho - a prolongation factor that controls 'how long' the utility curce will 'last' above a certain value
L = (L-Sub-I) - normalized distress, described for each. Measured pavement condition based on visual distresses alone.

Prior to FY 2004:

Asphalt Concrete Pavements (ACP):

U-ACP-RUTTING-DEEP	= UTILITY FACTOR FOR DEEP RUTTING
U-ACP-RUTTING-SHALLOW	= UTILITY FACTOR FOR SHALLOW RUTTING
U-ACP-PATCHING	= UTILITY FACTOR FOR PATCHING
U-ACP-FAILURE	= UTILITY FACTOR FOR FAILURES
U-ACP-BLOCK-CRACKING	= UTILITY FACTOR FOR BLOCK CRACKING
U-ACP-ALLIGATOR-CRACKING	= UTILITY FACTOR FOR ALLIGATOR-CRACKING
U-ACP-LONGITUDINAL-CRACKING	= UTILITY FACTOR FOR LONGITUDINAL-CRACKING
U-ACP-TRANSVERSE-CRACKING	= UTILITY FACTOR FOR TRANSVERSE CRACKING

L-Sub-I value to be substituted for L in Utility Equation:

L-ACP-RUTTING-DEEP	= ACP-RUTTING-DEEP-PCT
L-ACP-RUTTING-SHALLOW	= ACP-RUTTING-SHALLOW-PCT
L-ACP-PATCHING	= ACP-RUTTING-PATCHING
L-ACP-FAILURE	$= \frac{ACP\text{-}FAILURE\text{-}QTY}{SECT\text{-}LNGTH\text{-}RDBD\text{-}OLD\text{-}MEAS}$
L-ACP-BLOCK-CRACKING	= ACP-BLOCK-CRACKING-PCT
L-ACP-ALLIGATOR-CRACKING	= ACP-ALLIGATOR-CRACKING-PCT
L-ACP-LONGITUDIAL-CRACKING	= ACP-LONGITUDIAL-CRACKING-PCT
L-ACP-TRANSVERSE-CRACKING	= ACP-TRANSVERSE-CRACKING-QTY

IF L = 0 SET U-ACP-RUTTING-DEEP = 1.0
U-ACP-RUTTING-SHALLOW = 1.0
U-ACP-PATCHING = 1.0
U-ACP-FAILURE = 1.0
U-ACP-BLOCK-CRACKING = 1.0
U-ACP-ALLIGATOR-CRACKING = 1.0
U-ACP-LONGITUDINAL-CRACKING = 1.0
U-ACP-TRANSVERSE-CRACKING = 1.0

Distress-Score Equation For ACP Pavements:

DISTRESS-SCORE = 100 * (U-ACP-RUTTING-DEEP)
DISTRESS-SCORE = 100 * (U-ACP-RUTTING-SHALLOW)
DISTRESS-SCORE = 100 * (U-ACP-PATCHING)
DISTRESS-SCORE = 100 * (U-ACP-FAILURE)
DISTRESS-SCORE = 100 * (U-ACP-BLOCK-CRACKING)
DISTRESS-SCORE = 100 * (U-ACP-ALLIGATOR-CRACKING)
DISTRESS-SCORE = 100 * (U-ACP-LONGITUDINAL-CRACKING)
DISTRESS-SCORE = 100 * (U-ACP-TRANSVERSE-CRACKING)

Continuously Reinforced Concrete Pavements (CRCP):

U-CRCP-SPALLED-CRACKS = UTILITY FACTOR FOR SPALLED CRACKS
U-CRCP-PUNCHOUT = UTILITY FACTOR FOR PUNCHOUTS
U-CRCP-ACP-PATCHES = UTILITY FACTOR FOR ASPHALT PATCHES
U-CRCP-PCC-PATCHES = UTILITY FACTOR FOR CONCRETE PATCHES

L-Sub-I values to be substituted for L in Utility Equation:

$$\text{L-CRCP-SPALLED-CRACKS} = \frac{\textit{CRCP-SPALLED-CRACKS-QTY}}{\textit{SECT-LNGTH-RDBD-OLD-MEAS}}$$

$$\text{L-CRCP-PUNCHOUT} = \frac{\textit{CRCP-PUNCHOUT-QTY}}{\textit{SECT-LNGTH-RDBD-OLD-MEAS}}$$

$$\text{L-CRCP-ACP-PATCHES} = \frac{\textit{CRCP-ACP-PATCHES-QTY}}{\textit{SECT-LNGTH-RDBD-OLD-MEAS}}$$

$$\text{L-CRCP-PCC-PATCHES} = \frac{\textit{CRCP-PCC-PATCHES-QTY}}{\textit{SECT-LNGTH-RDBD-OLD-MEAS}}$$

IF L = 0 SET U-CRCP-SPALLED-CRACKS = 1.0
U-CRCP-PUNCHOUT = 1.0
U-CRCP-ACP-PATCHES = 1.0
U-CRCP-PCC-PATCHES = 1.0

IF L <= 0 SET U-CRCP-SPALLED-CRACKS = 0.0001
U-CRCP-PUNCHOUT = 0.0001
U-CRCP-ACP-PATCHES = 0.0001
U-CRCP-PCC-PATCHES = 0.0001

Distress-score equation for CRCP pavements:

DISTRESS-SCORE = 100 * (U-CRCP-SPALLED-CRACKS)
DISTRESS-SCORE = 100 * (U-CRCP-PUNCHOUT)
DISTRESS-SCORE = 100 * (U-CRCP-ACP-PATCHES)
DISTRESS-SCORE = 100 * (U-CRCP-PCC-PATCHES)

Jointed Concrete Pavements (JCP):

U-JCP-FAILED-JOINTS = UTILITY FACTOR FOR FAILED JOINTS
U-JCP-FAILURES = UTILITY FACTOR FOR FAILURES
U-JCP-SHATTERED-SLABS = UTILITY FACTOR FOR SHATTERED SLABS
U-JCP-LONGITUDINAL-CRACKS = UTILITY FACTOR FOR LONGITUDINAL CRACKS
U-JCP-PCC-PATCHES = UTILITY FACTOR FOR CONCRETE PATCHES

L-Sub-I values to be substituted for L in Utility Equation:

L-JCP-FAILED-JOINTS $= \frac{JCP\text{-}FAILED\text{-}JNTS\text{-}CRACKS\text{-}QTY}{\left(\frac{5280\ FT * SECT\text{-}LNGTH\text{-}RDBD\text{-}OLD\text{-}MEAS}{JCP\text{–}APPARENT\text{–}JNT\text{–}SPACE\text{–}MEAS}\right)}$

L-JCP-FAILURES $= \frac{JCP\text{-}SHATTERED\text{-}SLABS\text{-}QTY}{\left(\frac{5280\ FT * SECT\text{-}LNGTH\text{-}RDBD\text{-}OLD\text{-}MEAS}{JCP\text{–}APPARENT\text{–}JNT\text{–}SPACE\text{–}MEAS}\right)}$

L-JCP-SHATTERED-SLABS $= \frac{JCP\text{-}SHATTERED\text{-}SLABS\text{-}QTY}{\left(\frac{5280\ FT * \{SECT\text{-}LNGTH\text{-}RDBD\text{-}OLD\text{-}MEAS\}}{JCP\text{–}APPARENT\text{–}JNT\text{–}SPACE\text{–}MEAS}\right)}$

L-JCP-LONGITUDINAL-CRACKS $= \frac{JCP\text{-}LONGITUDINAL\text{-}CRACKS\text{-}QTY}{\left(\frac{5280\ FT * SECT\text{-}LNGTH\text{-}RDBD\text{-}OLD\text{-}MEAS}{JCP\text{–}APPARENT\text{–}JNT\text{–}SPACE\text{–}MEAS}\right)}$

L-JCP-PCC-PATCHES $= \frac{JCP\text{-}PCC\text{-}PATCHES\text{-}QTY}{\left(\frac{5280\ FT * SECT\text{-}LNGTH\text{-}RDBD\text{-}OLD\text{-}MEAS}{JCP\text{–}APPARENT\text{–}JNT\text{–}SPACE\text{–}MEAS}\right)}$

IF L = 0 SET U-JCP-FAILED-JOINTS = 1.0
U-JCP-FAILURES = 1.0
U-JCP-SHATTERED-SLABS = 1.0
U-JCP-LONGITUDINAL-CRACKS = 1.0
U-JCP-JCP-PCC-PATCHES = 1.0

IF L <= 0 SET U-JCP-FAILED-JOINTS = 0.0001
U-JCP-FAILURES = 0.0001
U-JCP-SHATTERED-SLABS = 0.0001
U-JCP-LONGITUDINAL=CRACKS = 0.0001
U-JCP-PCC-PATCHES = 0.0001

Distress-Score Equation For JCP Pavements:

DISTRESS-SCORE = 100 * (U-JCP-FAILED-JOINTS)
DISTRESS-SCORE = 100 * (U-JCP-FAILURES)
DISTRESS-SCORE = 100 * (U-JCP-SHATTERED-SLABS)
DISTRESS-SCORE = 100 * (U-JCP-LONGITUDINAL-CRACKS)
DISTRESS-SCORE = 100 * (U-JCP-PCC-PATCHES)

FY 2004 to Present:

Asphalt Concrete Pavements (ACP):

NOTE: Distress types may be visual (rated) or automated (measured).

U-ACP-RUTTING-DEEP = UTILITY FACTOR FOR DEEP RUTTING
U-ACP-RUTTING-SHALLOW = UTILITY FACTOR FOR SHALLOW RUTTING
U-ACP-RUTTING-SEVERE = UTILITY FACTOR FOR SEVERE RUTTING
U-ACP-RUTTING-FAILURE = UTILITY FACTOR FOR FAILURE RUTTING
U-ACP-POTHOLES = UTILITY FACTOR FOR POTHOLES
U-ACP-BLOCK-CRACKING = UTILITY FACTOR FOR BLOCK CRACKING
U-ACP-ALLIGATOR-CRACKONG = UTILITY FACTOR FOR ALLIGATOR-CRACKING
U-ACP-LONGITUDINAL-CRACKING = UTILITY FACTOR FOR LONGITUDINAL-CRACKING
U-ACP-TRANSVERSE-CRACKING = UTILITY FACTOR FOR TRANSVERSE CRACKING

L-Sub-I value to be substituted for L in Utility Equation:

L-ACP-RUTTING-DEEP = ACP-RUTTING-DEEP-PCT
L-ACP-RUTTING-SHALLOW= ACP-RUTTING-SHALLOW-PCT
L-ACP-RUTTING-SEVERE = ACP-RUTTING-SEVERE-PCT
L-ACP-RUTTING-FAILURE = ACP-RUTTING-FAILURE-PCT

$$\text{L-ACP-POTHOLES} = \frac{ACP\text{-}POTHOLES\text{-}QTY}{SECT\text{-}LNGTH\text{-}RDBD\text{-}OLD\text{-}MEAS}$$

L-ACP-BLOCK-CRACKING = ACP-BLOCK-CRACKING-PCT
L-ACP-ALLIGATOR-CRACKING = ACP-ALLIGATOR-CRACKING-PCT
L-ACP-LONGITUDIAL-CRACKING = ACP-LONGITUDIAL-CRACKING-PCT
L-ACP-TRANSVERSE-CRACKING = ACP-TRANSVERSE-CRACKING-QTY

IF L = 0 SET U-ACP-RUTTING-DEEP = 1.0
U-ACP-RUTTING-SHALLOW = 1.0
U-ACP-RUTTING-SEVERE = 1.0
U-ACP-RUTTING-FAILURE = 1.0
U-ACP-POTHOLES = 1.0
U-ACP-BLOCK-CRACKING = 1.0
U-ACP-ALLIGATOR-CRACKING = 1.0
U-ACP-LONGITUDINAL-CRACKING = 1.0
U-ACP-TRANSVERSE=CRACKING = 1.0

IF U <= 0 SET U-ACP-RUTTING-DEEP = 0.0001
U-ACP-RUTTING-SHALLOW = 0.0001
U-ACP-RUTTING-SEVERE = 0.0001
U-ACP-RUTTING-FAILURE = 0.0001
U-ACP-POTHOLES = 0.0001
U-ACP-BLOCK-CRACKING = 0.0001
U-ACP-ALLIGATOR-CRACKING = 0.0001
U-ACP-LONGITUDINAL-CRACKING = 0.0001
U-ACP-TRANSVERSE=CRACKING = 0.0001

CRIS DATA RELATED TABLES

FHE_COLLSN_ID

Manner of Collision - The manner in which the vehicle(s) were moving prior to the first harmful event.

COLLSN_ID	COLLSN_DESC	EFF_BEG_DATE	EFF_END_DATE
1	OMV VEHICLE GOING STRAIGHT	2003-01-01	9999-12-31
2	OMV VEHICLE TURNING RIGHT	2003-01-01	9999-12-31
3	OMV VEHICLE TURNING LEFT	2003-01-01	9999-12-31
4	OMV VEHICLE BACKING	2003-01-01	9999-12-31
5	OMV OTHER	2003-01-01	9999-12-31
10	ANGLE - BOTH GOING STRAIGHT	1990-01-01	9999-12-31
11	ANGLE - ONE STRAIGHT-ONE BACKING	2003-01-01	9999-12-31
12	ANGLE - ONE STRAIGHT-ONE STOPPED	2003-01-01	9999-12-31
13	ANGLE - ONE STRAIGHT-ONE RIGHT TURN	2003-01-01	9999-12-31
14	ANGLE - ONE STRAIGHT-ONE LEFT TURN	2003-01-01	9999-12-31
15	ANGLE - BOTH RIGHT TURN	1990-01-01	9999-12-31
16	ANGLE - ONE RIGHT TURN-ONE LEFT TURN	2003-01-01	9999-12-31
17	ANGLE - ONE RIGHT TURN-ONE STOPPED	2003-01-01	9999-12-31
18	ANGLE - BOTH LEFT TURN	1990-01-01	9999-12-31
19	ANGLE - ONE LEFT TURN-ONE STOPPED	2003-01-01	9999-12-31
20	SD BOTH GOING STRAIGHT-REAR END	2003-01-01	9999-12-31
21	SD BOTH GOING STRAIGHT-SIDESWIPE	2003-01-01	9999-12-31
22	SD ONE STRAIGHT-ONE STOPPED	2003-01-01	9999-12-31
23	SD ONE STRAIGHT-ONE RIGHT TURN	2003-01-01	9999-12-31
24	SD ONE STRAIGHT-ONE LEFT TURN	2003-01-01	9999-12-31
25	SD BOTH RIGHT TURN	2003-01-01	9999-12-31
26	SD ONE RIGHT TURN-ONE LEFT TURN	2003-01-01	9999-12-31
27	SD ONE RIGHT TURN-ONE STOPPED	2003-01-01	9999-12-31
28	SD BOTH LEFT TURN	2003-01-01	9999-12-31
29	SD ONE LEFT TURN-ONE STOPPED	2003-01-01	9999-12-31
30	OD BOTH GOING STRAIGHT	2003-01-01	9999-12-31
31	OD ONE STRAIGHT-ONE BACKING	2003-01-01	9999-12-31
32	OD ONE STRAIGHT-ONE STOPPED	2003-01-01	9999-12-31
33	OD ONE STRAIGHT-ONE RIGHT TURN	2003-01-01	9999-12-31
34	OD ONE STRAIGHT-ONE LEFT TURN	2003-01-01	9999-12-31
35	OD ONE BACKING-ONE STOPPED	2003-01-01	9999-12-31

36	OD ONE RIGHT TURN-ONE LEFT TURN	2003-01-01	9999-12-31
37	OD ONE RIGHT TURN-ONE STOPPED	2003-01-01	9999-12-31
38	OD BOTH LEFT TURNS	2003-01-01	9999-12-31
39	OD ONE LEFT TURN-ONE STOPPED	2003-01-01	9999-12-31
40	O ONE STRAIGHT-ONE ENTER OR LEAVE PARKING SPACE	2003-01-01	9999-12-31
41	O ONE RIGHT TURN-ONE ENTER OR LEAVE PARKING SPACE	2003-01-01	9999-12-31
42	O ONE LEFT TURN-ONE ENTER OR LEAVE PARKING SPACE	2003-01-01	9999-12-31
43	O ONE ENTER OR LEAVE PARKING SPACE-ONE STOPPED	2003-01-01	9999-12-31
44	O BOTH ENTERING OR LEAVING A PARK-ING SPACE	2003-01-01	9999-12-31
45	O BOTH BACKING	2003-01-01	9999-12-31
46	OTHER	2010-01-01	9999-12-31
48	NOT REPORTED	2002-01-01	9999-12-31
93	UNDETERMINED - FAIL BR	2010-01-01	9999-12-31
94	REPORTED INVALID	2010-01-01	9999-12-31

HARM_EVNT_ID

First Harmful Event - First Injury or damage producing event.

HARM_EVNT_ID	HARM_EVNT_DESC	EFF_BEG_DATE	EFF_END_DATE
1	PEDESTRIAN	1990-01-01	9999-12-31
2	MOTOR VEHICLE IN TRANSPORT	1990-01-01	9999-12-31
3	RR TRAIN	1990-01-01	9999-12-31
4	PARKED CAR	1990-01-01	9999-12-31
5	PEDALCYCLIST	1990-01-01	9999-12-31
6	ANIMAL	1990-01-01	9999-12-31
7	FIXED OBJECT	1990-01-01	9999-12-31
8	OTHER OBJECT	1990-01-01	9999-12-31
9	OTHER NON COLLISION	2010-01-01	9999-12-31
10	OVERTURNED	2010-01-01	9999-12-31
11	NOT REPORTED	2010-01-01	9999-12-31
93	UNDETERMINED - FAIL BR	2010-01-01	9999-12-31
94	REPORTED INVALID	2010-01-01	9999-12-31

INTRSCT_RELAT_ID

Intersection Related - Specifies whether a crash occurred at an intersection, not at an intersection, or if the presence of an intersection contributed to the crash.

INTRSCT_RELAT_ID	INTRSCT_RELAT_DESC	EFF_BEG_DATE	EFF_END_DATE
1	INTERSECTION	1990-01-01	9999-12-31
2	INTERSECTION RELATED	1990-01-01	9999-12-31
3	DRIVEWAY ACCESS	1990-01-01	9999-12-31
4	NON INTERSECTION	1990-01-01	9999-12-31
5	NOT REPORTED	2010-01-01	9999-12-31
93	UNDETERMINED - FAIL BR	2010-01-01	9999-12-31
94	REPORTED INVALID	2010-01-01	9999-12-31

OBJ_STRUCK_ID

Object Struck - Object Struck is an obstruction in, on, or around a road that a motor vehicle involved in a crash has made contact with.

OBJ_STRUCK_ID	OBJ_STRUCK_DESC	EFF_BEG_DATE	EFF_END_ DATE
1	OVERTURNED	1990-01-01	9999-12-31
2	HIT HOLE IN ROAD	1990-01-01	9999-12-31
3	JACK-KNIFED	1990-01-01	9999-12-31
4	PERSON FELL OR JUMPED FROM VEHICLE	1990-01-01	9999-12-31
9	HIT TRAIN ON TRACKS PARALLEL TO ROAD - NO CROSSING	1990-01-01	9999-12-31
10	HIT TRAIN MOVING FORWARD	1990-01-01	9999-12-31
11	HIT TRAIN BACKING	1990-01-01	9999-12-31
12	HIT TRAIN STANDING STILL	1990-01-01	9999-12-31
13	HIT TRAIN-ACTION UNKNOWN	1990-01-01	9999-12-31
20	HIT HIGHWAY SIGN	1990-01-01	9999-12-31
21	HIT CURB	1990-01-01	9999-12-31
22	HIT CULVERT-HEADWALL	1990-01-01	9999-12-31
23	HIT GUARDRAIL	1990-01-01	9999-12-31
24	HIT RAILROAD SIGNAL POLE OR POST	1990-01-01	9999-12-31
25	HIT RAILROAD CROSSING GATES	1990-01-01	9999-12-31
26	HIT TRAFFIC SIGNAL POLE OR POST	1990-01-01	9999-12-31
27	HIT OVERHEAD SIGNAL LIGHT, WIRES, SIGNS, ETC	1990-01-01	9999-12-31
28	HIT WORK ZONE BARRICADE, CONES, SIGNS OR MATERIAL	1990-01-01	9999-12-31
29	HIT LUMINAIRE POLE	1990-01-01	9999-12-31

30	HIT UTILITY POLE	1990-01-01	9999-12-31
31	HIT MAILBOX	1990-01-01	9999-12-31
32	HIT TREE, SHRUB, LANDSCAPING	1990-01-01	9999-12-31
33	HIT FENCE	1990-01-01	9999-12-31
34	HIT HOUSE, BLDG. OR BLDG. FIXTURE	1990-01-01	9999-12-31
35	HIT COMMERCIAL SIGN	1990-01-01	9999-12-31
36	HIT OTHER FIXED OBJECT	1990-01-01	9999-12-31
37	HIT BUS STOP STRUCTURE (BENCH)	1990-01-01	9999-12-31
38	HIT WORK ZONE MACHINERY OR STOCK-PILED MATERIALS	1990-01-01	9999-12-31
39	HIT MEDIAN BARRIER	1990-01-01	9999-12-31
40	HIT END OF BRIDGE (ABUTMENT OR RAIL END)	1990-01-01	9999-12-31
41	HIT SIDE OF BRIDGE (BRIDGE RAIL)	1990-01-01	9999-12-31
42	HIT PIER OR SUPPORT AT UNDERPASS, TUN-NEL OR OVERHEAD SIGN BRIDGE	1990-01-01	9999-12-31
43	HIT TOP OF UNDERPASS OR TUNNEL	1990-01-01	9999-12-31
44	HIT BRIDGE CROSSING GATE	1990-01-01	9999-12-31
45	HIT ATTENUATION DEVICE	1990-01-01	9999-12-31
49	HIT BY FALLEN/BLOWING ROCKS FROM A TRUCK	1990-01-01	9999-12-31
50	HIT FALLEN TREES OR DEBRIS ON ROAD	1990-01-01	9999-12-31
51	HIT OBJECT FROM ANOTHER VEHICLE IN ROAD	1990-01-01	9999-12-31
52	HIT PREVIOUSLY WRECKED VEHICLE	1990-01-01	9999-12-31
53	HIT TOLL BOOTH	1990-01-01	9999-12-31
54	HIT OTHER MACHINERY	1990-01-01	9999-12-31
56	HIT CONCRETE TRAFFIC BARRIER	1990-01-01	9999-12-31
57	HIT DELINEATOR OR MARKER POST	1990-01-01	9999-12-31
58	HIT RETAINING WALL	1990-01-01	9999-12-31
59	HIT HOV LANE GATE	1990-01-01	9999-12-31
60	HIT GUARD POST	1990-01-01	9999-12-31
61	FIRE HYDRANT	1990-01-01	9999-12-31
62	DITCH	1990-01-01	9999-12-31
63	EMBANKMENT	1990-01-01	9999-12-31
64	NOT APPLICABLE	2010-01-01	9999-12-31
65	NOT REPORTED	2002-01-01	9999-12-31
93	UNDETERMINED - FAIL BR	2010-01-01	9999-12-31
94	REPORTED INVALID	2010-01-01	9999-12-31
98	OTHER	2010-01-01	9999-12-31

PHYS_FEATR_ID

Physical Features - Physical Features fields 1 and 2 describe roadway features which were a factor in the crash.

PHYS_FEATR_ID	PHYS_FEATR_DESC	EFF_BEG_DATE	EFF_END_DATE
-2	INVALID		
-1	NO DATA		
1	PRIVATE DRIVE OR ROAD	2010-01-01	9999-12-31
11	ALLEY	2010-01-01	9999-12-31
12	PARKING AREA WITHIN RIGHT OF WAY	2010-01-01	9999-12-31
14	OPENING IN MEDIAN	2010-01-01	9999-12-31
15	CROSSOVER FROM ONE FRONTAGE ROAD TO OTHER	2010-01-01	9999-12-31
16	AT DETOUR	2010-01-01	9999-12-31
17	RR GRADE CROSSING	2010-01-01	9999-12-31
20	ONE OR MORE TRAFFIC LANES CLOSED	2010-01-01	9999-12-31
21	NOT APPLICABLE	2010-01-01	9999-12-31
22	NOT REPORTED	2002-01-01	9999-12-31
32	ENTRANCE TO OR EXIT FROM PRIVATE PROPERTY OR DRIVEWAY	2010-01-01	9999-12-31
33	IN A PARKING LOT	2010-01-01	9999-12-31
93	UNDETERMINED - FAIL BR	2010-01-01	9999-12-31
94	REPORTED INVALID	2010-01-01	9999-12-31
98	OTHER	2010-01-01	9999-12-31
99	UNKNOWN	2010-01-01	9999-12-31

ROAD_PART_ID

Roadway Part - The part of the roadway on which the vehicle(s) was traveling prior to the crash.

ROAD_PART_ID	ROAD_PART_DESC	EFF_BEG_DATE	EFF_END_DATE
1	MAIN/PROPER LANE	2010-01-01	9999-12-31
2	SERVICE/FRONTAGE ROAD	2010-01-01	9999-12-31
3	ENTRANCE/ON RAMP	2010-01-01	9999-12-31
4	EXIT/OFF RAMP	2010-01-01	9999-12-31
5	CONNECTOR/FLYOVER	2010-01-01	9999-12-31
7	OTHER (EXPLAIN IN NARRATIVE)	2010-01-01	9999-12-31
10	NOT REPORTED	2010-01-01	9999-12-31
93	UNDETERMINED - FAIL BR	2010-01-01	9999-12-31
94	REPORTED INVALID	2010-01-01	9999-12-31

ROAD_RELAT_ID

Roadway Relation - Roadway Relation refers to where the First Harmful Event (point of impact) occurred in relation to the roadway.

ROAD_RELAT_ID	ROAD_RELAT_DESC	EFF_BEG_DATE	EFF_END_DATE
1	ON ROADWAY	1990-01-01	9999-12-31
2	OFF ROADWAY	2003-01-01	9999-12-31
3	SHOULDER	2003-01-01	9999-12-31
4	MEDIAN	2003-01-01	9999-12-31
5	NOT APPLICABLE	2010-01-01	9999-12-31
6	NOT REPORTED	2002-01-01	9999-12-31
93	UNDETERMINED - FAIL BR	2010-01-01	9999-12-31
94	REPORTED INVALID	2010-01-01	9999-12-31

CRASH_RR_RELAT_FL

Railroad Crash Identifier - Indicates whether the crash involved a train or railroad crossing.

YES_NO_ CHOICE_ID	YES_NO_ CHOICE_ SHORT_DESC	YES_NO_CHOICE_DESC	EFF_BEG_DATE	EFF_END_DATE
-2	-2	INVALID		
-1	-1	NO DATA		
1	Y	YES	1999-01-01	9999-12-31
2	N	NO	1999-01-01	9999-12-31
3	NR	NOT REPORTED	1999-01-01	9999-12-31
4	NC	NOT COLLECTED	1999-01-01	9999-12-31
93	UD	UNDETERMINED - FAIL BR	2010-01-01	9999-12-31
94	RI	REPORTED INVALID	2010-01-01	9999-12-31
99	UNK	UNKNOWN	1999-01-01	9999-12-31

ENVIRONMENTAL MITIGATION COST RATES PER DISTRICT

District Name	Rate
Abilene	0.0045%
Amarillo	0.0045%
Atlanta	0.0079%
Austin	0.0114%
Beaumont	0.0045%
Brownwood	0.0045%
Bryan	0.2120%
Childress	0.0045%
Corpus Christi	0.0050%
Dallas	0.0242%
El Paso	0.0186%
Fort Worth	0.0045%
Houston	0.3881%
Laredo	0.0045%
Lubbock	0.0045%
Lufkin	0.0632%
Odessa	0.0045%
Paris	0.0045%
Pharr	0.0214%
San Angelo	0.0045%
San Antonio	0.0045%
Tyler	0.2278%
Waco	0.0096%
Wichita Falls	0.0045%
Yoakum	0.0084%

CRITERION RELATED CATEGORY LISTS

The following sections include lists of various categories pertaining to each criterion. The preprocessor compares each categorical word or phrase to the project description in order to calculate criteria values and scores.

SAFETY

PRESERVATION

CONGESTION

CONNECTIVITY

ECONOMIC

ENVIRONMENTAL

SAFETY CATEGORY LIST

- Acceleration
- Approach Railing
- AUX
- Beacon
- Chevron
- Concrete Barrier
- Construct Ada Ramps
- Construct Frontage Overpass
- Construct Guardfence
- Construct Guardrail
- Construct Interchange
- Construct Its
- Construct Managed Lanes
- Construct Overpass
- Crosswalk
- Deceleration
- Divided
- Dragnet
- Edgeline
- Emergency
- Expressway
- Flashing
- Friction
- Hazard
- HSIP
- Illumination
- Interchange Improvements
- ITS Equipment
- LED
- One Way
- Passing
- Pavement Marking
- Pedestrian
- Railing
- Ramp Improvement
- Relief
- Replace Guardfence
- Replace Guardrail
- Rest
- Rumble Strips
- Safety
- Shared Use
- Shoulder
- Sidewalk
- Sight Distance
- Signal Improvements
- Strips
- Super Two
- Texturized
- Tie Back
- To Freeway
- Upgrade To Standards
- Warning Signal
- Widening Lanes
- Widening Shoulders

SAFETY WIDENING LIST

- Widening
- Widen
- Wide

PRESERVATION CATEGORY LIST

- ACP
- Approach
- Bridge
- Cam
- Coat
- Improve Interchange
- Interchange Improvements
- Maintenance
- Microsurfacing
- Mill
- Mix
- NBI
- Novachip
- Overlay
- Pavement Repairs
- Preventative
- Reconstruct
- Rehabilitate
- Repair
- Repave
- Replacement
- Restoration
- Resurfacing
- Rubber
- Sealcoat
- Slope
- Surfacing
- Treatment
- Upgrade To Standards

CONGESTION CATEGORY LIST

- Acquisition
- AUX
- Construct Frontage Overpass
- Construct Interchange
- Construct Its
- Construct Managed Lanes
- Construct Overpass
- Construct Passing Lanes
- Construct Ramps
- Construct Turn Lanes
- Frontage Overpass
- Frontage Underpass
- Future Transportation Corridor
- Improve Intersection
- Intersection Bypass
- Intersection Improvements
- Its Equipment
- New Location
- One Way
- Operational Improvements
- Property Disposition
- Ramp Relocation
- Ramp Reversal
- Reconfigure Intersection
- Reconfigure Ramps
- Relocate Ramps
- Remove HOV
- Remove Ramps
- Reverse Ramps
- Row Acquisition
- Super Two
- T Ramp
- Turnaround
- Upgrade To Standards
- Widen From # To #
- Widen Frontage

CONNECTIVITY CATEGORY LIST

- Acquisition
- Construct Grade Separation
- Construct Interchange
- Construct Overpass
- Construct Ramps
- Continuous Frontage
- Frontage Overpass
- Frontage Underpass
- Future Transportation Corridor
- Intersection Bypass
- New Location
- One Way
- Property
- Property Disposition
- Ramp Reversal
- Ramps Relocation
- Reconfigure Ramps
- Relocate Ramps
- Reverse Ramps
- Row Acquisition
- T Ramp
- Turnaround
- Widen From # To #
- Widen Frontage

ECONOMIC CATEGORY LIST

- Construct Interchange
- Construct Overpass
- Construct Ramps
- Continuous Frontage
- Economic
- Ramp Relocation
- Ramp Reversal
- Realign Ramps
- Relocate Ramps
- Reverse Ramps
- Shared Use

ENVIRONMENT CATEGORY LIST

- CMAQ
- Construct Detention
- Drainage
- Environment
- Erosion
- Irrigation
- Landscaping
- Ozone
- Pollution
- Soil

WORD LISTS

The following word lists include only one spelling variation of associated words. The preprocessor acknowledges these terms as well as the vast variations of spelling of each word and phrase. These key words and their spelling variations are compared against project descriptions to define criteria related scoring.

For a more concise list of keywords and phrases refer to each individual word list provided along with this document.

PROJECT PROCESSING WORD LIST

ADA
Bridge Benefit
Construct
Construct Ramp
Construct Undivided
Frontage
HOV
Interchange
Main
Median
NCEC New Interchange
NCEC Construct Interchange
New Construct
Pavement Benefit
Realign
Remove
Remove HOV
Replace
Road Suffix
Upgrade Standards?

CONGESTION INDEX RELATED WORD LIST

Add AUX Lanes
Grade Separation
Intersection Improvement
ITS
New Interchange
Ramp Reconfiguration

SAFETY RELATED WORD LIST

AUX Lane
Center Left
Construct Shoulders
Convert One Way
Divided
Grade Separated
Overpass
Overpass Realign
Passing Lane
Railroad Grade Separated
Roadway Signs
Super Two
Upgrade to Design Standards
Vertical Alignment
Safety-Widening
Widen Lane
Widen Shoulder

PROJECT PROCESSING WORD LIST

ADA:
ADA, Compliant, Sidewalk

Bridge Benefit:
Bridge, Structure, Overpass

Construct:
Build, Add, Construct, Create, Extend, Install

Construct Ramps:
Build Ramps, Add Ramps, Construct Ramps, Create Ramps, Extend Ramps, Install Ramps

Construct Undivided:
Build Undivided, Add Undivided, Construct Undivided, Create Undivided, Extend Undivided, Install Undivided

Frontage:
Frontage, FR R

HOV:
HOV

Interchange:
Interchange, I/C, Overpass, Underpass

Main:
Main, Main Lanes

Median:
Median

NCEC New Interchange:
Build, Add, Construct, Create, Extend, Install

NCEC Construct Interchange:
Construct

New Construct:
New Build, New Add, New Construct, New Create, New Extend, New Install

Pavement Benefit:
Pavement, Repave, Repavement, Resurface, Overlay, CR, A, J, CP

Realign:
Realign

Remove HOV:
Remove HOV, Deconstruct HOV, Convert HOV, Uninstall HOV, Destroy HOV, Obliterate HOV, Delete HOV, Dismantle HOV, Eliminate HOV

Remove:
Remove, Convert, Deconstruct, Uninstall, Destroy

Replace:
Rebuild, Re-add, Reconstruct, Recreate, Reextend, Reinstall, Replace, Reconfigure, Realign

Road Suffix:
Road, Drive, Street, Route, IH, SH, Loop, RR, RM, SL, Boulevard, Circle, Place, Sky Speed, Express, Park, Highway, Lane, Avenue, Trail, Cove, Court, Bend

Upgrade Standards:
Upgrade Standard

CONGESTION INDEX RELATED WORD LIST

Add AUX Lanes:
AUX

Grade Separation:
Add Grade Separation, Build Grade Separation, Construct Grade Separation, Create Grade Separation, Extend Grade Separation, Install Grade Separation

Intersection Improvement:
Reconfigure Intersection, Intersection Improvement, Improve Intersection

ITS:
ITS Equipment, Build ITS, Add ITS, Construct ITS, Create ITS, Extend ITS, Install ITS

New Interchange:
Interchange, I/C, Overpass, Underpass

Ramp Reconfiguration:
Ramps Reversal, Ramps Reconfigure, Ramps Remove

Replace Interchange:
Re-add I/C, Re-add Interchange, Re-add Overpass, Re-add Underpass, Realign I/C, Realign Interchange, Realign Overpass, Realign Underpass, Rebuild I/C, Rebuild Interchange, Rebuild Overpass, Rebuild Underpass, Reconfigure I/C, Reconfigure Interchange, Reconfigure Overpass, Reconfigure Underpass, Reconstruct I/C, Reconstruct Interchange, Reconstruct Overpass, Reconstruct Underpass, Recreate I/C, Recreate Interchange, Recreate Overpass, Recreate Underpass, Reinstall I/C, Reinstall Interchange, Reinstall Overpass, Reinstall Underpass, Replace I/C, Replace Interchange, Replace Overpass, Replace Underpass, Re-extend I/C, Re-extend Interchange, Re-extend Overpass, Re-extend Underpass.

SAFETY RELATED WORD LIST

AUX Lane:
AUX

Center Left:
Center Left, TWLTL, Two-Way Left-Turn

Convert One Way:
Convert One Way, Convert 1-Way

Construct Shoulders:
Add Shoulder, Build Shoulder, Construct Shoulder, Create Shoulder, Extend Shoulder, Install Shoulder

Divided:
Divided

Grade Separated:
Grade Separated

Overpass:
Overpass, Interchange, Ramps

Overpass Realign:
Overpass, Interchange, Ramps, Realignment

Passing Lanes:
Passing

Railroad Grade Separated:
Railroad Grade Separated

Roadway Signs:
Signs

Super Two:
Super 2, Super Two

Upgrade to Design Standards:
Upgrade Standard

Vertical Alignment:

Vertical

Widen Lanes:

Widen, Widen Lanes

Widen Shoulders:

Widen Shoulders