Internal Audit Report

Vehicle Miles Traveled

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2023

SOUTH CAROLINA OFFICE OF THE STATE AUDITOR

1. Executive Summary

Objective

Our objective is to provide assurance that internal controls are adequately designed and operating effectively to manage risks that may hinder the achievement of Management's objectives for the Vehicle Miles Traveled calculation process.

Background

Road Data Services collects, analyzes and reports information pertaining to the areas of road inventory/road assets, traffic counts, and pavement management. A key output of the information gathered is the State's Vehicle Miles Traveled (VMT) figure. VMT reflects the movement of vehicles on roadways and is calculated by totaling all miles driven by all the cars and trucks on all the roadways in a geographic area in a given time. The VMT calculation is uniform among all states within the United States and is mandated by the Federal Highway Administration (FHWA).

Road Data Services collects data annually to report the State's VMT in accordance with FHWA's Traffic Monitoring Guide and schedule. Each state's VMT and fatality rates are publicly posted on FHWA's website where South Carolina has one of the highest rural fatality rates in the country. Road Data Services does not have involvement with the fatality rates which are calculated based on the VMT it calculates. Traffic Engineering has involvement with crash data that is reported. However, the final South Carolina fatality numbers are tabulated and reported directly by South Carolina Department of Public Safety (SCDPS).

Conclusion

During the planning stage of the engagement, Traffic Engineering, along with input from Road Data staff, discovered road classification discrepancies between SCDOT's and SCDPS data. SCDPS submits fatality information into National Highway Traffic Safety Administration (NHTSA). FHWA combines these fatalities with the submitted vehicle miles traveled to generate the fatality rates. With the information discovered, Traffic Engineering worked with SCDPS staff and has developed a plan to correct the reporting issues going forward.

Based on our facilitation of Management's assessment of risk, information gathered during the planning stage of the engagement, and in conjunction with the information discovered by SCDOT staff, we believe the risks associated with this process beyond those risks mentioned in the paragraph above are limited. Management has asserted based on its facilitation of risk that the controls in place are adequate to mitigate risk within the Agency's appetite. Therefore, we did not test the design adequacy or the operating effectiveness of controls as originally planned during this engagement and we do not offer an opinion on the design adequacy or operating effectiveness of controls.

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2. Forward

Authorization

The South Carolina Office of the State Auditor established the Internal Audit Services division (IAS) pursuant to SC Code Section 57-1-360 as revised by Act 275 of the 2016 legislative session. IAS is an independent, objective assurance and consulting function designed to add value and improve the operations of the South Carolina Department of Transportation (SCDOT). IAS helps SCDOT to achieve its objectives by bringing a systematic, disciplined approach to evaluating the effectiveness of risk management, internal control, and governance processes and by advising on best practices.

Statement of Independence

To ensure independence, IAS reports administratively and functionally to the State Auditor while working collaboratively with SCDOT leadership in developing an audit plan that appropriately aligns with SCDOT's mission and business objectives and reflects business risks and other priorities.

Report Distribution

This report is intended for the information and use of the SCDOT Commission, SCDOT leadership, the Chairman of the Senate Transportation Committee, the Chairman of the Senate Finance Committee, the Chairman of the House of Representatives Education and Public Works Committee, and the Chairman of the House of Representatives Ways and Means Committee. However, this report is a matter of public record and its distribution is not limited.

Acknowledgment

We wish to thank members of management and staff in the Road Data Services for their cooperation in assessing risks and Traffic Engineering for developing actions to correct SCDOT's fatality rate external reporting.

Performed By

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Reviewer

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3. Internal Auditor's Report

September 15, 2023

Ms. Christy A. Hall, Secretary of Transportation
and
Members of the Commission
South Carolina Department of Transportation
Columbia, South Carolina

We have completed risk and control assessment of the South Carolina Department of Transportation's (SCDOT's) Vehicle Miles Traveled statistical figure. The objective of this assessment was to contribute to the improvement of risk management by evaluating SCDOT's exposure to risks and the controls designed by Management to manage those risks. Our engagement included the following:

- Facilitation of Management's assessment of risks associated with the Vehicles Miles Traveled statistical figure process.

We planned and performed the engagement with due professional care in order to obtain sufficient, appropriate evidence to provide a reasonable basis for our conclusions. The observations, recommendation, and management's action plan presented in our report are those of management.

George L. Kennedy, III, CPA
State Auditor

4. Engagement Overview

Background

Road Data Services collects, analyzes and reports information pertaining to the areas of road inventory/road assets, traffic counts, and pavement management. A key output of the information gathered is the State's Vehicle Miles Traveled (VMT) figure. VMT reflects the movement of vehicles on roadways and is calculated by totaling all miles driven by all the cars and trucks on all the roadways in a geographic area in a given time. The VMT calculation is uniform among all states within South Carolina and is mandated by the Federal Highway Administration (FHWA).

Road Data Services collects data annually to report the State's VMT in accordance with FHWA's Traffic Monitoring Guide and schedule. Each state's VMT and fatality rates are publicly posted on FHWA's website where South Carolina has one of the highest rural fatality rates in the country. See Appendix A Original 2020 Fatality Rate Per 100 Million Annual VMT Functional System – Top 10 States filtered by Total Rural. SCDOT, however, does not externally report the State's fatality rates, as this information is tabulated and reported directly by South Carolina Department of Public Safety (SCDPS).

Management's Objective

Management's objective for Road Data Services is to collect, analyze and report information pertaining to the areas of road inventory, road assets, traffic counts and pavement management. The key objective of the Vehicle Miles Traveled process is to gather and report the annual movement of vehicles on South Carolina roadways. The objectives of VMT are:

1. Obtain traffic counts at permanent and portable traffic data stations as well as estimate traffic counts at non-coverage locations.
2. Manage road inventory to the best of SCDOT's ability to calculate the most up-to-date route segments statistics by functional class and other important characteristics.
3. Report VMT annually to FHWA through the Highway Performance Monitoring System (HPMS) and update Statewide Reports on SCDOT website.

Audit Objective and Scope

During this engagement, our initial objective was to provide assurance that internal controls were adequately designed and operating effectively to manage risks that may hinder the achievement of Management's objectives for the Vehicle Miles Traveled calculation process.

During the planning stage of the engagement, Traffic Engineering, along with input from Road Data Services, discovered road classification discrepancies between SCDOT's and SCDPS data. FHWA uses the SCDOT vehicles miles traveled calculation and SCDPS fatality information to report the South Carolina fatality rates which are publicly posted on the FHWA website. With the information discovered, Traffic Engineering worked with SCDPS staff and developed a plan to correct the reporting issues going forward.

After we facilitated management's completion of a risk and control matrix in Item 2 of Methodology below, IAS determined that the remaining risks posed to the Agency were limited. Using our professional judgment, we decided not to test controls to determine if controls are designed adequately and operating effectively.

The Vehicles Miles Traveled calculation is comprised of three processes involving multiple stakeholders as follows:

1. Traffic Data Collection
2. Quality Assurance/Quality Control
3. Road Inventory

Methodology

For the processes included in the engagement scope, we performed the following procedures:

1. We facilitated Management's completion of a process outline that documents the steps in the process and the individuals responsible for those steps.
2. We facilitated Management's completion of a risk and control matrix used to:
    a. identify risks which threaten process objectives,
    b. score the risks as to their consequence and likelihood of occurrence using the risk scoring matrix in Appendix E,
    c. determine if controls are adequately designed to manage the risks to within the Agency's risk appetite, and
    d. propose design improvements to controls when risks are not managed to within the Agency's risk appetite.
3. We evaluated Management's assessment to determine if it was reasonable and comprehensive.

5. Conclusion

Vehicle Miles Traveled statistical figure Controls

Based on our facilitation of Management's assessment of risk, information gathered during the planning stage of the engagement, and in conjunction with the information discovered by SCDOT staff, we believe the risks associated with this process beyond those risks mentioned in the paragraph above are limited. Management has asserted based on its facilitation of risk that the controls in place are adequate to mitigate risk within the Agency's appetite. Therefore, we did not test the design adequacy or the operating effectiveness of controls as originally planned during this engagement and does not offer an opinion on the design adequacy or operating effectiveness of controls.

Development of Management Action Plans

Traffic Engineering facilitated Management's development of action plans for each observation to improve control operating effectiveness with practical, cost-effective solutions. These improvements, if effectively implemented, are expected to reduce the overall risk exposure to an acceptable level (i.e. within the Agency's risk appetite).

We will follow up with Management on the implementation of the proposed actions on an ongoing basis and provide SCDOT leadership with periodic reports on the status of management action plans and whether those actions are effectively and timely implemented to reduce risk exposure to an acceptable level.

Traffic Engineering Management Observation

Management Observation 5.1

Urban/Rural Designations and Fatality Rate Reporting

Source: Traffic Engineering obtained the Fatality Rate Per 100 Million Annual VMT – 2020 Functional Class System from the FHWA's website and inquired with SCDPS regarding their process when submitting South Carolina's information into the Fatality Analysis Reporting System (FARS).

Division: Traffic Engineering

Process Affected: (See process descriptions in Appendix D)
Process 4 Traffic Engineering Fatality Rates

NOTE: Management provided information on their assessment of the following information. We relied on management's assertions and did not test the accuracy and completeness of the information.

Procedure: Using the data used to create the Fatality Rate Per 100 Million Annual VMT – 2020 Functional Class System, Traffic Engineering reviewed the SCDPS data observing items such as urban/rural designations and attempted to recreate South Carolina reported fatality rates and found the following:

Observations:

1. Reviewing the 961 fatal crashes submitted by SCDPS to generate the 2020 data shown on the FHWA's website, Traffic Engineering found the following discrepancies between SCDPS and SCDOT data:
   - 42% of SCDPS urban and rural designations and functional class matched SCDOT's systems
   - 35% of SCDPS data had correct urban and rural designations but incorrect functional class
   - 14% of SCDPS data had correct functional class but incorrect urban and rural designations
   - 9% of SCDPS data didn't match either the urban or rural designations or the functional class as SCDOT data

   The above data discrepancies contribute to the variances in the figures reported in Appendix B SCDOT Recalculated Fatality Rate and the Posted Fatality Rate.

2. Traffic Engineering found that SCDOT's Safety Management System (SMS), noted in Process 4 of Appendix D, changed the route type, route number and other classifications of what the law enforcement officer submitted on 15 of the 961 crashes (2%). Furthermore, when SCDOT attempted to map the Roadway Information System (RIS) and Google Earth locations using coordinates provided by SCDPS in the monthly fatality file, the crash location resulted in locations outside the state (This file does not include functional class and is different than the quarterly crash data sent by SCDPS which has for the most part, correct coordinates).

3. In the attempt to replicate SCDPS process of reporting South Carolina's fatality rates, SCDOT sampled just over 100 crashes and about 4% of the (RIS) data did not agree with the data in Roadway Information Management System (RIMS). Roughly, another 4% of crashes SCDOT found were very close to a change in functional class.

The data discrepancies discussed in observations #2 and #3 contribute to a small variance in the rows entitled SCDOT Fatality Rate and the Posted Fatality Rate reported in Appendix B.

Conclusion:

After Traffic Engineering discovered the discrepancies between SCDOT and SCPDS data sets, SCDOT inquired how SCDPS Fatality Analysis Reporting System (FARS) analysts were using SCDOT's RIS system to assign the functional class. Using the information obtained from the SCDPS FARS analysts, Traffic Engineering reviewed approximately 100 crash locations and could not recreate the functional class information as submitted by SCDPS. See Appendix B on page 11 for the chart for the recalculated 2020 fatality rates based on Traffic Engineering division.

Recommendation:

To correct the urban and rural designations, functional class, and other related information, we recommend that Traffic Engineering coordinate with SCDPS to accurately report South Carolina's fatality rates per category to FHWA, ensuring that South Carolina's fatality information is correctly portrayed when compared to other states.

Management Action Plan (MAP) 5.1

Every quarter, Traffic Engineering will send the statewide crash data to SCDPS to include the functional class information that SCDOT's SMS assigns each crash using RIMS data. This effort will temporarily resolve the data discrepancies until SCDPS' Report Beam software replacement is operational. The new software will incorporate SCDOT's Geographic Information System (GIS) street data with SCDOT's functional class information. The product, managed by SCDPS is still in development and is expected to go live July 1, 2024.

MAP Owner:	Traffic Safety Engineer
Division:	Traffic Engineering
Scheduled Date:	July 1, 2024

Appendix A – Original 2020 Fatality Rate Per 100 Million Annual VMT Functional System – Top 10 States filtered by Total Rural

	State	Rural - Interstate	Rural - Other Freeways and Expressways	Rural - Other Principal Arterial	Rural - Minor Arterial	Rural - Major Collector	Rural Minor Collector	Rural - Local	Total - Rural
1	South Carolina	1.11	2.72	6.09	8.31	0.35	1.83	1.89	3.21
2	Delaware		0.67	1.75	2.61	4.27	3.06	1.39	2.33
3	Oregon	0.36		2.81	2.77	3.69	2.09	4.79	2.30
4	Montana	1.47		2.20	2.34	4.10	1.82	2.81	2.26
5	Georgia	0.73		2.03	2.90	3.27	3.45	2.63	2.23
6	North Carolina	0.65	0.89	1.80	2.68	3.20	3.61	2.51	2.22
7	Mississippi	1.23		2.32	3.54	3.48	16.34	0.20	2.21
8	California	0.88	1.01	2.73	3.35	2.41	5.96	2.76	2.12
9	Florida	1.10	0.91	2.85	2.27	1.87	2.81	3.17	2.10
10	Texas	0.94	0.64	2.06	2.65	3.01	3.02	2.84	2.10

Note: The omitted figures in the chart above were not provided in the 2020 Fatality Rate Per 100 Million VMT Functional System posted on the FHWA's website.

Appendix B - SCDOT Recalculated 2020 Fatality Rate Per 100 Million Annual VMT
Functional System

Source	Rural - Interstate	Rural - Other Freeways & Expressways	Rural - Principal Arterial	Rural - Minor Arterial	Rural - Major Collector	Rural - Minor Collector	Rural - Local	Total Rural
2020 SMS	73	2	86	150	209	16	67	603
2020 FARS	83	8	260	352	17	5	56	781
VMT	7,445,225,324	293,495,697	4,258,007,583	4,221,805,322	4,832,020,243	272,935,739	3,000,668,622	24,324,158,532
% of Rural Crashes	12.10%	0.30%	14.30%	24.90%	34.70%	2.70%	11.10%	100.00%
SCDOT Fatality Rate	0.98	0.68	2.02	3.55	4.33	5.86	2.23	2.48
FARS Fatality Rate (From SCDPS)	1.11	2.73	6.11	8.34	0.35	1.83	1.87	3.21
Posted Fatality Rate	**1.11**	**2.72**	**6.09**	**8.31**	**0.35**	**1.83**	**1.89**	**3.21**

Vehicle Miles Traveled

Appendix C – 2020 Fatality Rate Per 100 Million Annual VMT Functional System – Top 10 States filtered by Total Rural with Traffic Engineering Recalculation

	State	Rural - Interstate	Rural - Other Freeways and Expressways	Rural - Other Principal Arterial	Rural - Minor Arterial	Rural - Major Collector	Rural Minor Collector	Rural - Local	Total - Rural
1	South Carolina	0.98	0.68	2.02	3.55	4.33	5.86	2.23	2.48
2	Delaware		0.67	1.75	2.61	4.27	3.06	1.39	2.33
3	Oregon	0.36		2.81	2.77	3.69	2.09	4.79	2.30
4	Montana	1.47		2.20	2.34	4.10	1.82	2.81	2.26
5	Georgia	0.73		2.03	2.90	3.27	3.45	2.63	2.23
6	North Carolina	0.65	0.89	1.80	2.68	3.20	3.61	2.51	2.22
7	Mississippi	1.23		2.32	3.54	3.48	16.34	0.20	2.21
8	California	0.88	1.01	2.73	3.35	2.41	5.96	2.76	2.12
9	Florida	1.10	0.91	2.85	2.27	1.87	2.81	3.17	2.10
10	Texas	0.94	0.64	2.06	2.65	3.01	3.02	2.84	2.10

Note: The omitted figures in the chart above were not provided in the 2020 Fatality Rate Per 100 Million VMT Functional System posted on the FHWA's website.

Appendix D - Process Descriptions

Process 1 Traffic Data Collection

South Carolina roadways are broken up into four categories: interstates, primaries/major roads, farm to market and neighborhood streets. On an annual basis Road Data Services collects traffic coverage counts on South Carolina roadways which include, but are not limited to, interstates and primaries/majors roads. Coverage counts are collected using permanent stations such as continuous count station (CCS) or weigh-in-motion (WIM). In the absence of permanent sites, portable count stations are utilized. Traffic data is collected by SCDOT staff and consultants. The generated Annual Average Daily Traffic (AADTs) collected from the count sites are automatically calculated in the Traffic Data Management and Analysis System (TDMA). At the end of a given year, calculations are performed which create the portable and permanent Factored Annual Average Daily Traffic (FAADT) values.

Any count station without a current year count, will have an estimated value applied to it which will result in a calculated FAADT. This value is the finalized information that is published to FHWA. Estimations include factors based on large metropolitan planning organizations (MPO) counties, other MPO counties, and non-MPO counties by volume factor group. SCDOT staff review estimation changes generated by the system. Non-coverage locations, which primarily include farm to market and neighborhood streets, are calculated using a software mathematical model.

Process 2 Quality Assurance/Quality Control

After all traffic counts have been collected, the data is reviewed. For any out of range values that are identified within the TDMA, SCDOT staff will exclude or estimate count data prior to being finalized. There are segregation of duties present in the system ensuring all changes are reviewed by someone other than the individual who made the change. The system is designed with numerous edit validations to prohibit the majority of erroneous data.

Process 3 Road Inventory

The Road Inventory unit is responsible for the collection, analysis, and reporting of information pertaining to all public roadway data in the State. These attributes are recorded, maintained and reported from within the Inventory Manager (IM) application. The Road Inventory staff analyzes and processes any changes in roadway (attribute) data as a result of information extracted from construction and resurfacing projects, commission actions, and other systems requests-for-change. One such attribute is the roadway section length which make up a portion of the Vehicle Miles Traveled (VMT) Calculation *(VMT = <FAADT> * <Section Length> (miles)*). This section length is calculated as *the Ending Milepoint minus the Beginning Milepoint of a route segment*.

Various QA/QC reports are generated and manual checking of data is conducted on a monthly, semi-annual, and annual basis. Users will verify mileages by route categories, counties, pavement types, MPOs and many other breakouts from month to month and year to year. These reports totals must match what the Road Inventory staff had calculated prior to data entry into the software. If the reports mileage totals balance to what the analyst expects, then the team will close out the work flow for a given month/year. If the totals do not match then the analyst must perform a detailed investigation as to the origin of the conflict of data. The unit may not close out a given month/year until a resolution is applied.

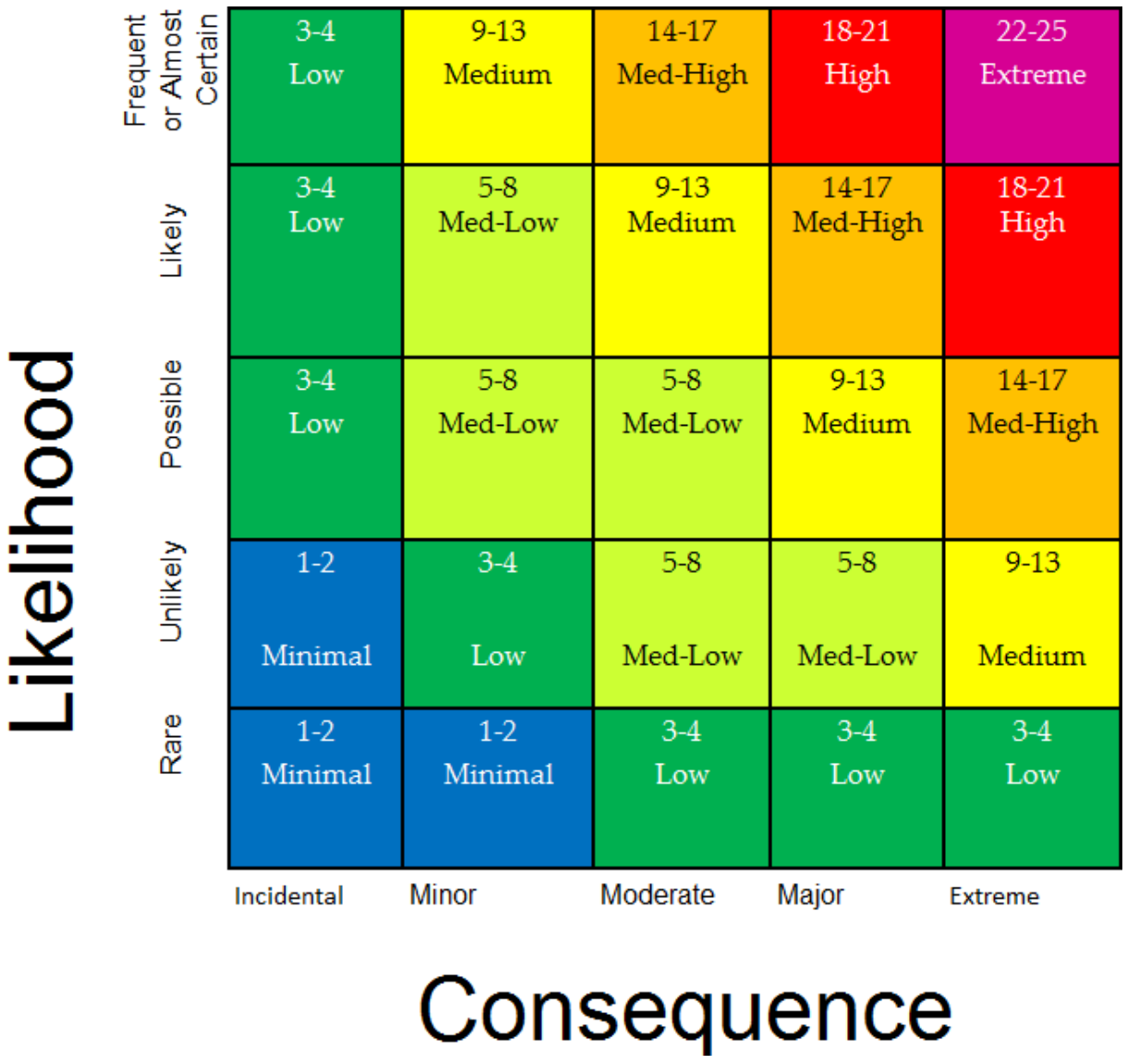
Process 4 Traffic Engineering Coordination with SCDPS

SCDPS' Fatality Analysis Reporting System (FARS) manager manually enters different fields of information for every roadway fatality in the state, including the urban and rural designation. SCDPS later keys the information into an online portal for submission into the National Highway Traffic Safety Administration's (NHSTA) database. The published fatality rate combines these submitted fatalities with the VMT submitted to FHWA.

Prior to 2019, SCDOT would review and send corrections to the urban and rural designation back to SCDPS. In 2019 SCDOT introduced the Roadway Inventory System (RIS) website, and provided SCDPS access to obtain functional class information directly. In March of 2022 SCDOT's Safety Management System went live, which is an internal standalone software for importing and managing crash data from SCDPS onto SCDOT's road network. This software uses a complex locating method, taking in the coordinates and route information recorded by the officer to locate crashes onto the SCDOT network. Since September 2022, every quarter, SCDOT has been sending the statewide crash data back to SCDPS to include the functional class that the Safety Management System assigns each crash (using RIMS data).

Appendix E - Risk Scoring Matrix

Risk significance is rated on a scale of 1 (lowest) to 25 (highest) and is the product of the risk consequence score (1 to 5) multiplied by the risk likelihood score (1 to 5). The following matrix provides a color scale corresponding to risk significance scores.



Appendix F - Risk Appetite

Risk appetite is defined as the amount of risk the Agency is willing to accept in the pursuit of its objectives. Management's goal is to manage risks to within the appetite where mitigation is cost- beneficial and practical. Management has set the Agency's risk appetite by risk type using scoring methodology consistent with the Risk Scoring Matrix shown in Appendix E. Risk appetites by risk type are as follows:

RISK TYPE	EXAMPLES	RISK APPETITE SCORE 1 = Minimal Risk 25 = Extreme Risk (See Scoring Matrix in Appendix E)
Safety	Employee and Public Well-Being	2
Ethical	Fraud, Abuse, Mismanagement, Conflict of Interest	2
Financial	Funding, Liquidity, Credit, Reporting	4
Strategic	Resources not Aligned, Unclear Objectives	4
Reputational	Unintentional Unwanted Headlines	4
Operational	Delays, Cost Overruns, Waste, Inefficiency	6
Regulatory	Non-Compliance	6
Legal	Lawsuits	10