Section 5.11

FORENSIC INVESTIGATIONS

5.11.1 PURPOSE

This procedure establishes a process for engineering investigation of failed or distressed components of the transportation infrastructure. The procedure will guide consistent, uniform, and thorough investigations when a problem is indicated. This procedure will also provide guidance for investigations that seek to identify root causes of successful infrastructure performance in order to build on and repeat success.

5.11.2 AUTHORITY

Code Of Federal Regulations (CFR), Federal-Aid Policy Guide (FAPG), Subchapter G - Engineering and Traffic Operations, Part 637 - Construction Inspection and Approval, Subpart B - Quality Assurance Procedures for Construction
Sections 334.044(2), 334.044(10)(a), 334.048 and 334.24(2) Florida Statutes

5.11.3 SCOPE

Primary Offices affected by this procedure include the State Materials Office (SMO), the State Construction Office (SCO), District Construction Offices (DCO), District Materials & Research Offices (DMRO) and Resident Construction Offices (RCO) / Operations Centers (OC).

5.11.4 FORENSIC INVESTIGATIONS

Forensic investigation is a careful inquiry and report of causes of distress and failure of engineered processes, materials, and transportation infrastructure components. The investigation purposes may vary from providing expedient recommendations to fix a specific item, determine the root cause of consistent failures and provide a recommendation for processes improvement, or to assign responsibility and develop strategies for legal cases. A forensic investigation may also be instigated to determine what worked and why on successful endeavors. Each forensic investigation involves a unique set of circumstances. The nature and intensity of the forensic investigation should

be modified based on the unique circumstances and the potential use of the recommendations. The investigator must carefully assess the depth of investigative study needed and identify time and other constraints that may impact the investigation. Plan the investigation carefully to fully assess all aspects of the unique situation. The general guidance in this procedure is to help the investigator recognize possible resources available to assist with a thorough and precise study. Not all the resources may be needed for every study and the investigator should determine the resource balance needed to successfully complete the investigation. A complete forensic investigation should include:

(A) Problem Identification
(B) Determination of significance of the problem
(C) Identification of the causes.
(D) Identification of what changes need to be made to prevent recurrence.

Similar steps should apply to forensic investigations targeted to evaluate infrastructure successes. The identification of steps needed to reinforce and repeat he success on under similar conditions.

5.11.4.1 Safety

Areas of failed infrastructure can be dangerous places. The investigator should take precautions to ensure the safety of the investigator, the investigative team, fellow workers, and the public.

5.11.4.2 Investigative team

An investigative team of subject area experts may be needed to thoroughly evaluate and provide resolution of the problem. Materials and Research area experts, geotechnical experts, design engineers, maintenance engineers, construction engineers, State Materials Office area experts, structural engineers, drainage engineers, traffic engineers, and so forth are potential sources of assistance to provide insight and resolve specific problems. The investigative team may be headed by the specific area expert that is most familiar with the type and nature of the problem. The materials area experts may assist forensic teams headed by other area experts by providing recommendations for investigative sampling plans, laboratory evaluation programs, FDOT, American Society for Testing and Materials (ASTM), American Association of State Highway and Transportation Officials(AASHTO), American Concrete Institute (ACI), American Welding Society (AWS), and other resources of standards of practice.

5.11.4.3 Initial Site Visit and Reconnaissance

The investigator should visit the site and perform an initial reconnaissance as soon as practical following the notification of need for the forensic investigation. The situation may require the investigator to immediately visit the site to avoid alteration or destruction of evidence that may be helpful to identify the physical conditions present as potential contributing factors. A camera, note taking equipment, plans if available, and appropriate measuring equipment may be useful during the initial visit. Interviews with witnesses and interested parties should be conducted to assess the situation. A list of all personnel present at the time the failure occurred or became known should be gathered for follow up interviews. The investigator should maintain objectivity and avoid rushing to initial conclusions based solely on the opinions formed by others during the initial site visit. The opinions of others should be gathered as part of the initial site visit and incorporated when appropriate as part of the detailed study. Any initial samples should be carefully documented, photographed, and labeled to ease identification.

5.11.4.4 Investigation Plan

An investigation plan should be formed after the initial site reconnaissance. The plan may be simple or detailed depending upon the situation. The investigative plan should be formed with the intent of identifying the root cause of the failure. The following elements may be incorporated into the plan. The more complex the situation is, the more detailed the plan should be.

(A) Research - Project plans and specification documents should be reviewed. Project documentation review should include a search for warranty or value added requirements. Other sources and publications may be reviewed to build an understanding of the situation. Internet sources may be used to help identify similar situations.

(B) Samples and testing program - Samples to assess the areas of concern as well as control samples representing normally behaving areas should be identified and incorporated into the investigation plan. FDOT, ASTM, AASHTO, etc, references should be consulted to identify standard test methods available to assist with the precision of the assessment. All samples should be carefully labeled, photographed, and documented to ensure accurate application of the information generated.

(C) Monitoring Stations - It may be useful to establish field monitoring points or areas to determine the potential for additional growth of the failed area. Monitoring should include control points outside the affected zone. The purpose of monitoring points and criteria for action should be clearly established as part of the investigation plan.

(D) Flexibility - The investigator must recognize the investigative plan is formed from the information know at the initial phase of the investigation. The plan must be flexible to incorporate new information and changes in conditions as the investigation progresses.

5.11.4.5 Analysis

A theory or alternate theories of the failure mechanism should be formulated. Analysis of the failure theories should be complete and to the appropriate depth needed to convince the investigative team of the theory's merit. Additional alternate theories of failure proposed or suggested by the gathered evidence, witnesses, or other area experts should be investigated for merit and properly considered as part of the analysis.

Conclusions must be formed after the investigation and data analysis is complete. Consideration of factors and contributing causes should be weighed and assigned. The failure is often not assignable to a single contributing cause. Possible contributing factors may include but are not limited to;

(A) Design
(B) Construction
(C) Materials
(D) Processes
(E) Maintenance
(F) Environmental Demands
(G) Specifications and Standards
(H) Human Factors
(I) External Forces
(J) Training
(K) Equipment
(L) Procedures
(M) Resource allocation
(N) Etc.

The conclusions should include a determination of the root cause of the failure, responsibility for the assignable cause, and recommendations to avoid a similar failure

5.11.4.6 Report

A summary report should be provided to document the findings of the investigative team. The summary report should include details about the makeup of the investigative team, the interviewed witnesses, reference relevant research, document the investigative plan, sample photos, laboratory data, field monitoring data, theories, analysis, conclusions and recommendations. The report need only contain the information necessary to adequately document the forensic investigation. Reports may vary from e-mails or bound printed materials depending upon the nature and purpose of the investigation. The report should be provided to the person initiating the forensic investigation and copied and distributed with their permission and in accordance with public record requirements.

All samples and documentation should be retained in an easily referenced organized manner consistent with document and sample control standards.

5.11.5 ROLES AND RESPONSIBILITIES

5.11.5.1 State Materials Office (SMO)

The SMO is responsible for assigning their materials and geotechnical area experts to head statewide forensic investigations or assist in District or Project level forensic investigations The SMO coordinates with the SCO.

5.11.5.2 State Construction Office (SCO)

The SCO is responsible for assigning construction experts to head statewide forensic investigations or assist in District or Project level forensic investigations as it relates to Construction Engineering and Inspection.

5.11.5.3 District Materials & Research Offices (DMROs)

The DMROs are responsible for District and project Level forensic investigations. The DMROs coordinate with District Construction Offices

and RCOs/ OCs as needed. The DMROs provide technical assistance for materials related issues.

5.11.5.4 District Construction Offices (DCOs)

The DCOs are responsible for District and project Level forensic investigations. The DCOs coordinate with the DMROs and Resident Offices as needed to ensure that the Quality Acceptance Procedure for Construction (QAPC) programs are managed on the project level. The DCOs provide technical assistance on contract administration issues.

5.11.5.5 Resident Construction Offices (RCOs) / Operations Centers (OCs).

The RCOs/OCs are responsible to assist with project level forensic investigations They coordinate with the DCOs and DMROs as needed for materials and contract administration matters.

5.11.6 TRAINING

None needed.

5.11.7 FORMS

None needed.