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# Standard Guide for Forensic Engineering Expert Reports<sup>1</sup>

This standard is issued under the fixed designation E3176; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This document provides guidance on the purpose, content, and limitations of forensic engineering expert reports, and it discusses report representation in electronic form.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

**E2713 Guide to Forensic Engineering**

2.2 *Other Standards:*

**ISO 32000-2:2017 Document Management – Portable Document Format – Part 2: PDF 2.0**<sup>3</sup>

## 3. Terminology

3.1 *Definitions:*

3.1.1 *expert, n*—an individual with specialized knowledge, skills, and abilities acquired through appropriate education, training, and experience. **E2713**

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *author, n*—the individual(s) asserting responsibility for a report, along with an organizational unit (position or title, company affiliation, government agency, etc.).

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee E58 on Forensic Engineering and is the direct responsibility of Subcommittee E58.01 on General Practice.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

3.2.1.1 *Discussion*—A report may incorporate contributions from multiple individuals. Usually one individual should be named as being responsible for the report as a whole. If the report is submitted into legal proceedings, that individual will likely become the initial focus of deposition or court testimony. Joint authorship may be asserted.

3.2.2 *incident, n*—generic term for a problematic occurrence or condition which is the subject of investigation and reporting.

3.2.2.1 *Discussion*—Typical incidents include vehicle crashes, structural failures, chemical spills, electrical or plumbing failures, uncontrolled fires, roofing defects, cosmetic features, natural disasters, and various human actions. An incident which underlies a forensic engineering report is not necessarily sudden and disastrous. It may be a statistical deviation over time such as a manufacturing process, the acknowledgement of a latent phenomenon such as an explosive mixture, a design option, an alleged civil tort or criminal act, a human error or administrative violation, or a sequence or collection of such occurrences.

3.2.3 *report, n*—a formal written document which communicates the result of an investigation.

3.2.3.1 *Discussion*—A report may be qualified, such as *draft, preliminary, final, or supplementary*. Updated versions of a report will modify, supplement, or supersede previous versions.

## 4. Summary of Guide

4.1 Forensic engineering reports are typically composed of elements such as: introduction, background, description of an incident, questions to be resolved, materials examined, inspections conducted, testing or experiments performed, data obtained, assertions offered, findings, alternative explanations, and conclusions or opinions, along with the scientific or technical rationale for the foregoing. The scope of the report should lie within the expertise of the author and be relevant to the incident under investigation. The scope should be agreed upon with the client or customer. The report may be subject to legal requirements peculiar to a jurisdiction, beyond the extent of this guide.

4.2 *Forensic engineering* reports have characteristics and constraints that differ from reports prepared in forensic *science* and other disciplines. A forensic engineering report commonly communicates findings and conclusions from an investigation

of a unique incident (as broadly defined above). In contrast, forensic science reports typically deal with rigorously prescribed and accepted procedures. Forensic engineering reports may exhibit more tutorial material and technical detail than forensic science reports. A given forensic engineering report may address only a subset of an overall investigation. Certain reports may go beyond conclusions and opinions to incorporate recommendations of a knowledgeable expert describing correction of deficiencies contributing to the incident, or discussing repair of damage.

4.3 Forensic engineering uses the knowledge, education, training, experience, and skill of the practitioner to interpret and apply existing science in evaluating the incident.

4.4 As with other ‘scientific or technical reports’, courts of law may treat forensic engineering reports as ‘expert opinions’ which may or may not be deemed admissible in a given legal proceeding. A forensic engineering report should be accurate and logical. Findings and conclusions must be based on valid evidence and acceptable references.

## 5. Significance and Use

5.1 This guide may be useful to forensic engineers, courts, jurists, attorneys, insurance adjusters, and clients of forensic engineers. Although this guide is directed to the practice of forensic engineering, its description of the elements of investigative reports may be useful to practitioners in other disciplines that embrace scientific laws and theories.

5.2 This guide is based on Guide E2713, which discusses elements of the practice of forensic engineering and provides suggested readings which may be of interest to those creating (or reading) forensic engineering reports.

5.3 *This guide is informational and not mandatory.* Not all items necessarily apply to all forensic engineering reports. Practitioners should adopt the requirements stated herein as appropriate to their individual situations.

## 6. Report Purpose

6.1 The purpose of a forensic engineering report is to elucidate and inform parties and decision-makers, and to facilitate resolution of issues that are, or may become, in litigation or legal proceeding. Forensic engineering is based in part on observation, analysis, and application of scientific principles, laws, and theories. Forensic engineering reports may also address design opinions, human factors, regulatory issues, facts pertinent to adjudication, and other considerations.

6.2 Forensic engineering reports are typically used for these purposes: (1) to define and address alleged defects or malfunctions, (2) to provide information relevant to the damages compensation part of insurance claims, (3) to impart technical information for use by administrative officials and courts of law, or (4) to submit recommendations for use by clients of forensic engineers.

6.3 Forensic engineering reports are a form of technical communication. The word forensic derives from forum, meaning a council or place of discussion. Forensic engineering

reports are likely to be subjected to technical critique, adverse interpretation, and cross-examination in the legal forum.

6.4 **Appendix X1** discusses issues surrounding representation of forensic engineering reports in electronic form.

## 7. Report Content

7.1 Candidates for sections of a report are given below. In short reports, the text may flow without division into sections. Long reports may warrant section headings such as suggested here, and may also require subheadings to maintain continuity.

### 7.2 Identification:

7.2.1 At the beginning of the report, list the relevant identifying information by means of a cover sheet, a corporate letterhead, plain text, or a combination thereof. Identification and reference information may include: (1) author; (2) client or other entity who commissioned the report; (3) incident short title (for example, fire loss, crane malfunction, water damage, illicit transaction, electric shock, code violation, etc.); (4) date of incident; (5) geographic location (including street address and earth coordinates if appropriate); (6) affected parties (insured, plaintiff, claimant, defendant, etc.); (7) claim number or case number if assigned; (8) case caption and court docket number if filed; and (9) author’s file reference and report date.

### 7.3 Introduction:

7.3.1 An introductory section may be provided to relate the purpose or intent of the investigation, or to state the issue(s) being addressed, or to ask the question(s) to be resolved by the investigation.

7.3.2 The introduction may also define one’s assignment or the scope of work, along with expressing confidentiality restrictions or similar disclaimers if necessary.

7.3.3 For lengthy reports, an Introduction and Summary section, or an Executive Summary, may include a brief of the conclusions or opinions.

7.3.4 An early overview may be useful for long or complex reports, in order to provide context for the analysis that follows. A reader may appreciate learning in the Introduction that, “This report concludes that the cause of the incident was a defect in the cruise control while operating in the low-speed radar-following mode.” or a similarly terse extract.

### 7.4 Qualifications:

7.4.1 It may be opportune to condense the qualifications of the author. For instance, state relevant licensure or certification to differentiate the author’s expertise from that of lay witnesses.

7.4.2 If pertinent to the report, give the level of experience both in general (for example, forensic engineering) and specific to the subject of the report (for example, electrical incidents). Identify positions held, papers published, or testimony given.

7.4.3 The qualifications stated in the body of the report might be just enough to represent that the author is qualified to expound on the subject. When a lengthy CV (*curriculum vitae*) is necessary, move it to an appendix or enclosure. Reference to the author’s available CV may suffice, such as one posted on an Internet site. However, when the report is submitted in litigation, the author’s entire qualifications will be subject to exacting inquiry in the deposition or at trial.

### 7.5 *Description of the Incident:*

7.5.1 Describe what transpired or what is alleged. This section may be titled “Facts Relied Upon” or similar phrases of the author’s choice.

7.5.2 Narrate the chronology of the incident if appropriate. The incident may have been satisfactorily described elsewhere and need not be repeated in, for example, a rebuttal report. Be prudent in using specialized words such as medical or legal terms.

7.5.3 Be precise. For example, distinguish between overheating (temperature increase) and fire (flaming combustion), between insured and claimant, between electric shock (sensation or injury) and electrocution (death by electricity), between damage (loss) and damages (legal reimbursement), and among distress (as with a finish), deformation, and collapse.

7.5.4 Avoid inflammatory phrases or subjective descriptions (for example, *painful* fracture) or imply an estimate of damage (for example, *huge* inventory). Do not confound the factual description with prejudicial phrases (for example, eight *long* hours; 15 *full* gallons; in a *single* day; *each and every* item).

7.5.5 Avoid confirmation bias, the unintentional favoring of information that confirms the author’s previously existing beliefs or opinions.

### 7.6 *Materials Reviewed:*

7.6.1 List every discovery document, witness statement, reference document, manual, report, Internet address, standard, or other material reviewed that is relevant to preparation of the report. Note that the author may not have been aware of every possibly relevant document.

7.6.2 Redact material that may reveal protected information (see 8.2). If appropriate, state that the preparation of the report included review of proprietary or protected information.

7.6.3 If the list of materials is extensive, cite or refer to an appendix of reviewed materials as needed. Discovery materials that were received but not reviewed might be listed separately. Group like materials together (for example, deposition transcripts, manufacturers manuals, evidence examinations, photographs) including dates and places where applicable.

7.6.4 Subsequent reference to the various materials might have a shortened name (for example, *Smith deposition page 12*, or *Jones report paragraph 3.4*, or *second site examination*).

### 7.7 *Observations Made:*

7.7.1 Characterize relevant observations. Convey if and how the author contributed to the investigation.

7.7.2 Identify and clarify drawings, maps, photographs, or other materials which depict the incident. Refer to an appendix of relevant materials as needed. Document the significant measurements. Be sure all observations trace back to materials reviewed or conditions observed and documented.

7.7.3 It may not be necessary to describe in the report those measurements that might have been made for completeness of examination (for example, physical dimensions) but which have no bearing on the results or conclusions.

7.7.4 Sometimes a change of tense assists the reader in discerning what the expert did or did not observe or conduct, distinct from the incident itself. Past tense may be used for author’s activities (for example, I *examined* the evidence on 2017 January 13). Then past perfect (pluperfect) tense can

indicate prior activities (for example, The body *had been moved* before I took control). As a further example, “striations *were visible* indicating stress direction” (past tense) refers to the examination, while, “the pedestal *had crumbled* from overload” (past perfect tense) refers to the underlying incident.

### 7.8 *Experiments Performed:*

7.8.1 Detail relevant experiments and their results.

7.8.2 Document an experiment, in-field test, or laboratory test to the extent that another similarly skilled expert could reproduce it. Identify standard methods where they exist.

7.8.3 Make the distinction between observations or tests referring to the subject or evidence (the actual incident), and observations or tests referring to an exemplar or comparable (a representative, equivalent, or model).

### 7.9 *Analysis:*

7.9.1 Based on the materials examined, observations made, and experiments performed, provide a technical explanation of the incident. If this section refers to a specific process or procedure, it may be titled “Methodology.”

7.9.2 Identify contributing factors to the extent that they are appropriate. Give the rationale for supporting or refuting any given supposition, theory, or contention. Supply statistical data or results from computer modeling, with associated error types and rates, if applicable.

7.9.3 Distinguish between non-compliance with a code, standard, or ordinance, and the (physical) cause of an incident. An administrative deviation may be relevant to report, in the context of the failure mode or the effect of the non-compliant condition. If a defect is both a deviation from code and the cause of a physical event, state it as such.

### 7.10 *Findings:*

7.10.1 Describe discoveries, comparisons, determinations, considerations, or judgments.

7.10.2 If findings are based on physical evidence such as burn patterns, stretch marks, crush zone, surface texture, or other features, explain the significance of that evidence. Clarify certain engineering terms that may be misinterpreted by practitioners in other fields, such as: (1) *risk* (severity and likelihood of a hazard) which the insurance industry uses as a generic term for describing property or items insured, and (2) *volatility* (propensity to vaporize) which the finance industry uses to express price variation.

7.10.3 The two report sections titled Analysis and Findings may be combined into one section.

### 7.11 *Alternative Interpretations:*

7.11.1 The report may identify alternative or contrary explanations for the incident, stating the rationale for their acceptance or dismissal.

7.11.2 A matrix of ‘causation’ vs. ‘damage’ may be useful to compare alternative possibilities. Explain why the analysis permits a supposition, theory, or contention to be adopted or discarded.

7.11.3 Where a critical review of an interpretation by others is required, maintain professional ethics; criticize respectfully.

7.11.4 An expert’s opinions about alternative interpretations may not be appropriate in a report, for example in a rebuttal report.



#### 7.12 *Commentary:*

7.12.1 A Commentary section may be included to interpret specialized technical matters in layperson terms. This section may be titled “Discussion” or “Explanation.”

7.12.2 While scholarly correctness requires precision of language, the report may be read by people unfamiliar with its technical terminology. Analogies or metaphors may aid understanding, though take care to avoid oversimplification.

7.12.3 Achieve an appropriate level between formal technical explanation and informal terminology for the layperson.

#### 7.13 *Conclusions:*

7.13.1 Formulate the Conclusions as a self-contained section of the report. This section may be titled “(Professional) Opinions.” If the reasoning is complex, consider breaking it down using bullet points.

7.13.2 State the conclusions or opinions as unambiguously as possible (for example, “The fire in the Johnson warehouse was caused by electrical overheating and arcing...”) and precisely (for example, “...of the 240-volt transformer supplying branch circuit panel #5”). If a conclusion is negative, use unmistakable wording, for example, “The actions or inactions of driver Davis of Vehicle 2 did not contribute to the crash.”

7.13.3 Be definite to the extent practicable. Avoid sheer possibilities (might, could, seems, appears). However, it is acceptable in some venues to state that a given conclusion is only “more likely than not.”

7.13.4 The content of the Conclusions or Opinions section should respond to the issue(s) posed in the Introduction. A “causation statement” might be so labeled, affording a single concise sentence to contain the author’s reasoning and opinion(s).

7.13.5 This section may end with a simple conditional sentence, such as “If the manufacturing change order had been executed more promptly, the injury to Mr. Nagle would not have occurred.”

#### 7.14 *Recommendations:*

7.14.1 Give suggestions for subsequent work if applicable. An interim report may be submitted, anticipating a more comprehensive report to follow. If the report addresses one step in a sequence, it may detail the next steps or the proposed future work. Recommendations may embrace suggestions for defect correction, procedure changes, safety enhancement, or cost reduction measures, if the author is qualified to make such statements and if such content is desirable.

#### 7.15 *Signature:*

7.15.1 Final reports should be signed and dated. An actual written signature, or an electronic version thereof, should be withheld from drafts and partial versions of a report. Only the

final report should be personally (or electronically) “signed and sealed.” Some jurisdictions prescribe the format and content of the report signature block. The block may incorporate a professional seal or approved organizational insignia.

#### 7.16 *Appendix:*

7.16.1 Immediately below the signature block, or in a Table of Contents, disclose the existence of subsequent material which is to be considered part of the report, such as an appendix or enclosure. Itemize content with sufficient identification to assure that nothing is omitted in subsequent reproduction. For example, the report may list:

- Appendix 1 — Author’s CV
- Appendix 2 — Previous Testimony
- Exhibits A, B, and C (with captions)
- Photographs 01–14 (with captions)
- Audio file(s) by name
- Video file(s) by name

#### 7.17 *Reviews:*

7.17.1 A report which is being submitted by a firm or agency may bear a staff reviewer’s signature. Such an internal review may be *administrative* or *technical*, or both. Reserve the term *peer review* for the traditional process of independent technical critique by external reviewers who are not affiliated with the author.

## 8. Limitations

8.1 Practical realities, such as unavailability of key evidence or lack of witnesses, may affect the robustness of opinions formulated during an investigation. The report should nevertheless acknowledge and accommodate these limitations (directly or indirectly) in a defensible manner.

8.2 Protective orders and confidentiality agreements might restrict report content. Rather than imposing a court-ordered sealing of an entire report, extract only the material having restrictions on disclosure, into a separate file that may be independently secured. Identify it in the report, for example, “The schematic drawing is proprietary and not reproduced herein.” or “The reference manual is copyrighted work.”

8.3 Reports may be subject to court rules, national security constraints, attorney stipulations, or other reservations outside the scope of this guide. Respect those limitations rigorously.

## 9. Keywords

9.1 composition; Daubert; engineering report; expert disclosure; expert opinion; expert report; Federal Rules of Evidence; forensic engineer; forensic report; Frye; record; report; Rule 26; Rules of Civil Procedure; scientific opinion; scientific report; submittal; technical communication