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TASK FORCE WHITEPAPER

ON

**THE ROLE OF THE ENGINEER IN RESPONSIBLE CHARGE OF
INSPECTION AND TESTING SERVICES**

OCTOBER 28, 2010

Introduction

The Nevada State Board of Professional Engineers and Land Surveyors (Board) was established by the State Legislature in 1919 with the ultimate purpose of the Board being to safeguard life, health and property, and to promote the public welfare by providing for the licensure of qualified and competent professional engineers and professional land surveyors. The Board was created by, and now governed by, Section 625 of the Nevada Revised Statutes (NRS 625) and subsequently Section 625 of the Nevada Administrative Code (NAC 625).

The practice of the engineering and land surveying professions has become very dynamic to accommodate changes due to the continued development of science, construction techniques, technology, and changes within the market. The profession's governing regulations are not, however, always as dynamic or fluid as the profession. Therefore, the Board is often required to use its authority and discretion when applying regulations to current day issues. The majority of the Board's use of its discretion occurs during compliance related matters. When the Board has acted on reoccurring compliance matters or ones with similar characteristics, the Board is provided with case history to use in its deliberations. It is not uncommon, however, for the Board to receive a compliance issue that is altogether new to the Board. An example is the Board's compliance related matter of September 2009, where the Board was provided with a complaint relating to inspection of a multi-story building located in Las Vegas. Until September of 2009, the Board had little experience in applying NRS 625 and NAC 625 to inspection related complaints or issues.

In September of 2009, a complaint was filed with the Board alleging that the Engineer in Responsible Charge (EIRC), while providing inspection related services for concrete and structural steel for a multi-story building, was not in responsible charge. The complaint stated that rebar in the link beams was missing or positioned in such a way that the design capacity of the building was seriously compromised. The Board, pursuant to the findings and recommendations made by the Advisory Committee, found that the EIRC had violated NRS/NAC 625 on five counts. Subsequently, the Board executed a stipulated agreement whereby the engineer's license was suspended with the suspension being stayed. Additionally, the engineer was placed on probation for 2 years, required to complete Board approved college level courses in ethics and organizational management, and the engineer was required to pay administrative and investigative costs totaling \$25,900.

In March of 2010, the Board appointed a Task Force in accordance with NAC 625.646 (c). The Board's charge to the Task Force was to address the recommendation from the Advisory Committee, which was to "...revisit and possibly revise the language in NRS to specifically address special inspector and duties of Engineer Manager in responsible charge of these services." Also, the Board requested that the Task Force issue a "whitepaper" of its findings to the Board. For clarification purposes, a **white paper** (or "**whitepaper**") is often used in politics, business and technical fields as an authoritative report or guide to address issues and how to solve them. Whitepapers are typically used to educate readers and help people, in this case the Board, make decisions.

The Board's intent upon creation of the Task Force was to determine if the system was broken and what involvement should or could the Board have in amending NRS 625 or NAC 625 to provide better protection for the public. The Board appointed Task Force consisted of five members; three civil engineers employed in the private sector, one structural engineer employed by a public agency, and one civil engineering member of the Board. The Task Force first met on March 26, 2010 to review its charge, as provided by the Board, establish an approach, set goals and objectives for the whitepaper, and establish an overall schedule. The Task Force also met on May 8, 2010 and interviewed Ron Lynn, CBO of Clark County Department of Development Services and Dan Campbell, P.E. representing the Structural Engineers Association of Southern Nevada regarding the role of the engineer providing professional inspection and testing services. Additionally, the Task Force conducted several conference calls between April and October of 2010.

Initially, the Task Force deliberated over the Board's specific charge to "...revisit and possibly revise the language in NRS to specifically address special inspector and duties of Engineer Manager in responsible charge of these services." The Task Force, however, felt the special inspection issue was too narrow, and it should be broadened to include any inspection requiring a professional engineer of any discipline, as defined by NAC 625.220, to be in responsible charge.

The following whitepaper summarizes the sections of NRS 625 and NAC 625 that are applicable to an EIRC providing inspection and testing services, defines the role of an EIRC when providing testing and inspection services, differentiates the role of an EIRC as it relates to design services, compared to inspection and testing services, defines subordinates, and provides the Task Force's ensuing recommendations.

Statutes and Codes Specific to this Whitepaper

Nevada Revised Statute (NRS) 625 is applicable to professional engineers engaged in providing inspection and testing services. Several of the NRS 625 sections are particularly applicable to the discussions in this whitepaper. They include:

- NRS 625.050: "Practice of Professional Engineering" defined.
- NRS 625.080: "Responsible Charge of Work" defined.
- NRS 625.090: "Subordinate" defined.

The following highlights the portions of these sections that are specific to the discussions in this whitepaper and sets forth the Task Force's interpretations of these sections.

NRS 625.050 states as follows:

1. *"The practice of professional engineering" includes, but is not limited to:*
 - (a) *Any professional service which involves the application of engineering principles and data, such as surveying, consultation, investigation, evaluation, planning and design, or responsible supervision of construction or operation in connection with any public or private utility, structure, building, machine, equipment, process, work or project, wherein the public welfare or the safeguarding of life, health or property is concerned or involved.*
 - (b) *Such other services as are necessary to the planning, progress and completion of any engineering project or to the performance of any engineering service.*

This paragraph is interpreted to mean the inspection and testing of construction falls within the practice of professional engineering. This interpretation can be derived from the language of many parts of the above section.

The statement "responsible supervision of construction" is thought to specifically refer to construction inspection and testing. Our research indicates that this language has been in NRS 625.050 since at least 1937. At that time and up through about the 1960's to 1970's, inspection and testing services were commonly referred to as responsible supervision of construction or simply supervision of construction. Over the years, this terminology has fallen out of favor, as supervision of construction now refers to activities reserved solely for the construction contractor, which are not part of the practice of professional engineering. Furthermore, engineering services provided for the owner during construction, including inspection

and testing, are not intended to relieve the construction contractor of his responsibility to independently comply with the construction contract.

NRS 625.080 states as follows:

"Responsible charge of work" means the independent control and direction, by the use of initiative, skill and independent judgment of the investigation or design of professional engineering or land-surveying work or the supervision of such work.

This definition is applicable to inspection and testing services. This whitepaper more fully explains the application of this provision in the current practices in the inspection and testing fields in the subsequent discussion.

NRS 625.090 states as follows:

"Subordinate" means any person directly supervised by a professional land surveyor or professional engineer who assists a professional land surveyor or professional engineer in the practice of land surveying or professional engineering.

This definition is applicable to inspection and testing services. Subordinates in inspection and testing services are typically inspectors and testing technicians, but may also include subordinate engineers, managers, and supervisors. Further discussion of the use of subordinates in inspection and testing is contained in subsequent sections of this whitepaper.

NAC 625 is applicable to professional engineers engaged in providing inspection and testing services. Several of the NAC 625 sections are particularly applicable to the discussions in this whitepaper. They include:

- NAC 625.210 through 625.490: Licensure requirements.
- NAC 625.530: Relations with employers and clients.
- NAC 625.610: Stamps, seals and signatures on documents.
- NAC 625.612: Reports, studies, test reports, certifications and calculations submitted to public authority: Stamps and signatures.

The following highlights the portions of these sections that are specific to the discussions in this whitepaper and sets forth the Task Force's interpretations of these sections.

NAC sections 625.210 through 625.490 present the requirements for original and on-going licensure in the various engineering disciplines. These requirements are applicable to engineers providing these services in the inspection and testing fields for all of the engineering disciplines as listed in NAC 625.220.

NAC 625.530, paragraph 5 states the professional engineer shall:

5. *Undertake only those engineering (or land surveying) assignments for which he is qualified and engage or advise his employer or client to engage specialists and*

cooperate with them whenever his employer's or client's interests are served best by such an arrangement.

In the inspection and testing field, an engineer is considered qualified when meeting the licensure requirements of NAC 625 and when working within his discipline or expertise. For example, engineers providing professional engineering services in inspection and testing on civil engineering projects should be licensed in the civil discipline, for mechanical systems in the mechanical discipline, electrical in the electrical discipline, and so on. Current practice is that professional engineers licensed in the civil discipline are qualified to be in responsible charge of the inspection and testing of structural elements, including those where licensure in the structural discipline is required for design.

With respect to the engagement of specialists, these may be subconsultants or subordinates. It is common in the inspection and testing fields for subordinates to possess expertise that the professional engineer does not possess. For example, a technician may be qualified and certified to perform welding inspection or radiographic or ultrasonic testing and be under the responsible charge of an engineer not possessing those qualifications. It remains the engineer's responsibility to supervise this individual and orchestrate expert services, whether by a subconsultant or subordinate, within the overall inspection and testing program to develop an engineering opinion regarding the compliance of work with the design documents or codes.

NAC 625.610 paragraph 6 states:

6. *For the purposes of NRS 625.565, a professional engineer has "responsible charge of the work" and may sign, stamp or seal plans, specifications, plats or reports which were not prepared by him:*
 - (a) *If he personally supervises the work on the plans, specifications, plats or reports to the degree that he is satisfied that the work is completed in a proper and professional manner; or*
 - (b) *Where plans, specifications, plats or reports are not prepared under his personal supervision, if he or persons under his personal supervision review the work as necessary for the professional engineer to determine that the work has been completed in a proper and professional manner.*

The description of responsible charge in this paragraph is representative of the inspection and testing field. Later in this whitepaper the application of responsible charge, as it often occurs in inspection and testing, will be discussed in detail.

NAC 625.612 states as follows:

Each report, study, test result, certification or calculation which is submitted to a public authority must be stamped, signed and dated by the licensee who had responsible charge of that report study, test result, certification or calculation.

This is representative of the current practice in the inspection and testing field.

Engineer In Responsible Charge of Inspection and Testing Services

Engineering design and inspection and testing related to those designs both require engineering knowledge, expertise, and experience, but the roles of the EIRC in design services and the EIRC in inspection and testing services differ in some respects. These differences relate primarily to the relationship between the EIRC and subordinates to which the EIRC delegates work.

For design services, when the EIRC delegates work to a subordinate, the EIRC can directly review the engineering calculations, plans, specifications, and reports prior to submittal to the client. This oversight goes beyond supervising the subordinate and is a direct review of the engineering work product.

For inspection and testing services, the work delegated to a subordinate is often performed independently by the subordinate at a site remote to the EIRC. Although the EIRC can review paperwork prepared by the subordinate documenting the inspection and testing work, the EIRC typically neither physically observes the subordinate performing the inspection and testing work nor does the EIRC often inspect or test the construction work and compare the results with inspections and tests by the subordinate. This makes personnel management and supervision a much larger component of responsible charge than it is for design services.

This "indirect" supervision is complicated by the fact that subordinates may possess skills and expertise specific to the inspection or testing task that the EIRC does not possess, such as the welding inspection or radiographic or ultrasonic testing previously mentioned. Additionally, sub-consultants, with specialized expertise, may also be used by the EIRC to formulate an opinion regarding the compliance or non-compliance of the overall work being inspected or tested. These differences make defining responsible charge for inspection and testing services difficult and the topic of this whitepaper.

As it relates to the EIRC, there are three basic organizational approaches to providing inspection and testing services:

1. The EIRC performs the inspections and tests.
2. The EIRC is the immediate and direct supervisor of a subordinate who performs the inspections and tests.
3. The EIRC manages and supervises an organizational chain of command that may include other subordinate managers and supervisors who then supervise the subordinates who perform the inspections and tests.

Although these organizational approaches vary in complexity, they share commonalities that are necessary for the engineer to be in responsible charge. That commonality is that the individual, be he the EIRC or a subordinate performing an inspection or test, should be competent for the assigned task and have the physical

and human resources necessary to properly execute his assignment. To be in responsible charge, the EIRC must have the ability to control the inspection and testing effort so the EIRC has reasonable confidence the inspection and testing work is being performed by competent subordinates with the necessary resources.

If the EIRC meets the NRS 625 and NAC 625 qualification criteria, it is straightforward that organizational approaches 1 and 2 achieve the responsible charge requirements. In addition to the NRS 625 and NAC 625 requirements, the EIRC may also have to meet the requirements of other governing authorities, such as building departments, transportation departments, federal agencies, airport authorities, and even project specifications. It is typically considered to be the responsibility of the EIRC to assure these requirements are achieved or to execute corrective actions if they are not.

Determining if responsible charge has been achieved under organizational approach 3 is more difficult. The testing and inspection industry has a number of guide standards that have been established that provide guidance for the organizational components that are necessary to have an agency, public or private, where the engineers in responsible charge can develop a reasonable degree of confidence that services under their responsible charge are being competently provided.

Many jurisdictions and project specifications require compliance and even third party accreditation in these standards. Many agencies providing inspection and testing services have adopted these standards as their management practices with the objective to comply with these standards paragraph by paragraph.

Regardless of whether an agency is accredited or how formally it has executed these standards, these standards represent management and supervisory practices that should be components of an organizational approach to provide the engineer with responsible charge. An engineer actively engaged in providing inspection and testing services within the general boundaries of the standards listed below will be in responsible charge of those services.

For reference, some of these standards include:

- American Society of Testing and Materials, ASTM, E 329, *Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction*
- International Accreditation Service of the International Code Council AC291, *Accreditation Criteria for International Building Code Special Inspection Agencies*
- American Association of State Highway and Transportation Officials R 18, *Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories*
- International Standards Organization, ISO, 17020, *General Criteria for the Operation of Various Types of Bodies Performing Inspection*

- ISO 17025, *General Requirements for the Competence of Testing and Calibration Laboratories*
- ASTM C 1077, *Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation*
- ASTM D 3666, *Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials*
- ASTM D 3740, *Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction*
- ASTM C 1093, *Practice of Accreditation of Testing Agencies for Masonry*

Although each of these standards may differ in some of their details and have been developed by different agencies, the organizational and operational components are nearly identical, and almost all specifically require an engineer to be in responsible charge and incorporate registered professionals into their standards.

A summary of the requirements of these standards is as follows:

- Defined Organizational Structure:
 - Organization Chart defining positions and responsibilities and showing the supervisory and authority relationships between the various positions.
 - Typically includes:
 - Operational and technical management.
 - Quality manager.
 - Engineer in responsible charge.
 - Project managers.
 - Field and laboratory supervisors.
 - Field and laboratory inspectors and technicians.
 - Administrative positions.
 - Position/Job Descriptions for each position in the organizational chart:
 - Minimum Qualifications:
 - Education.
 - Experience.
 - Registration and Certification.
 - Supervision exercised and received.
 - Description of the duties, responsibilities, and authority.
- Personnel Competency Verification:
 - Methods used to verify competency of individuals to perform assigned tasks both initially and on-going.
 - Positions with authority to verify competency of other inspectors or technicians.
 - Record keeping system to document competency verification.
- Personnel Training:
 - Methods of training.
 - Record keeping documenting training.

- Personnel Supervision:
 - Assignment of Personnel:
 - Systems to assure individuals assigned specific tasks meet the Job Description Minimum Qualifications, have been adequately trained, and have had their competency verified.
 - Systems to assure personnel meet the minimum qualification requirements of governing authorities.
 - Systems that assure personnel meet the minimum qualifications established by project specifications.
 - EIRC authority with respect to assignment of personnel should be clear and provide the engineer with responsible charge.
 - Systems of supervision where subordinate managers, supervisors, and engineers provide operational and technical supervision of third tier subordinates, including inspectors and technicians:
 - EIRC authority with respect to these subordinate supervisors should be clear and provide the engineer with responsible charge.
 - EIRC authority should include control of the assignment of subordinate managers and supervisors and knowledge that those subordinate managers and supervisors meet the Assignment of Personnel requirements for their positions.
 - Systems typically include lines of communication and reporting through the chain of supervisory and management control.
 - Decision trees: It should be clear the authority of each position to make various types of decisions and specifically which decisions must have EIRC involvement and approval or may only be made by the EIRC and decisions requiring engineering registration.
 - Systems should include active involvement of the EIRC, such as periodic site visits, report review, progress meetings, etc.
- Physical Resources:
 - Equipment: Use of task proper, currently calibrated equipment.
 - Reference materials: Current plans, specifications, and standards.
 - Forms and records: Standard forms and report records should meet the EIRC's requirements for the project.
 - Record keeping system: Systems should be in place meeting the EIRC's requirements for field and laboratory reports and include a system of routing and review by supervisors, managers, and the EIRC.
- Diagnostic and Preventative Procedures and Corrective Actions:
 - Systems to identify performance issues, such as third party assessments, reference sample testing, internal audits, etc.
 - Systems to deal with technical complaints from any source.
 - Methods of analyzing and correcting deficiencies and complaints.
- Subcontracting:
 - Methods of subcontracting to subconsultants that assure subconsultants meet standards acceptable to the EIRC.

- Assuring that subconsultant work is clearly identified as performed by the subconsultant, including sealing for the subconsultant's EIRC when appropriate.

Again, some organizations may have very detailed programs that include Quality System Manuals and third party verification and accreditation, where other organizations may achieve the above objectives less formally. The key criteria either way, is that management and supervisory systems are in place giving the EIRC a reasonable degree of confidence that the individuals performing the tasks to which they are assigned are competent. The EIRC should have knowledge the systems are in place and operating and should be knowledgeable and engaged in those systems. The EIRC should have the authority to remove subordinates, including subordinate managers, supervisors, inspectors, and technicians who the EIRC believes are not competent for the specific project or task assignment.

Recommendations

NRS 625 and NAC 625, presently in place and as written, sufficiently define the role of the EIRC for inspection and testing services. It is important to recognize the differences in the role of the EIRC that may exist between design services and inspection and testing services.

It would be beneficial to revise NRS 625.050 paragraph 1 (a) to make it consistent with current terminology. The following is a suggestion for such a revision:

Delete the words "responsible supervision of construction or operation" and replace them with: "observation, inspection, and testing of construction for the purpose of providing the client with a greater degree of confidence that construction complies with the project documents."

Closing

The Subcommittee appreciates to opportunity to provide the Board with our industry perspective of the role of the engineer in responsible charge of inspection and testing services. Please do not hesitate to contact any of the Subcommittee members with any questions.

Respectfully submitted,



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