

findings of fact (correcting a portion of a finding of fact to clarify that Thompson appeared before the Board's Law Enforcement Committee, not the full Board; clarifying that it is the Board's practice to issue a \$1,000 civil penalty for commissions of negligence in the practice of engineering, not for all violations of any kind), which it identified in the record. The Board also provided a limited number of additional facts (identified), additional technical analysis and explanation to further clarify the engineering subjects and calculations at issue (identified), and made otherwise minor additions or changes to the Proposed Order's reasoning (also identified and, when appropriate, explained).

The Board hereby issues the following Final Order:

ISSUES

1. Whether Licensee committed negligence in the practice of engineering (termed "violated the standard of care" by the Administrative Law Judge) in his preparation of engineering calculations, including his failure to show a basic understanding of the fundamental engineering principles of equilibrium and statics¹, and in his failure to accept feedback from other engineers, violating the prohibition against negligence, found in authority of the Board to discipline under ORS 672.200(2).
2. Whether, if Licensee committed negligence in the practice of engineering, he should be assessed a civil penalty in the amount of \$500, pursuant to ORS 672.325.

EVIDENTIARY RULINGS

Exhibits A1 through A11, offered by the Board, and Exhibits R1 through R14 and R16 through R18,² offered by Thompson, were admitted into evidence without objection.

FINDINGS OF FACT

1. Thompson is a civil engineer who has been licensed in Oregon since 1964. He began working in the construction industry at age 17, in a family business, and ultimately provided oversight on commercial and residential projects until approximately 2000. After 2000, he has focused primarily on engineering. Thompson has used computers in his practice for many years, starting with machines using the Fortran software. (Test. of Thompson).
2. On September 19, 2014, Thompson submitted plans for a new roof structure to the City of Portland's Bureau of Development Services (BDS). The home, owned by Thompson's son, was built in 1924 and is located in Portland. Thompson's client took the plans to BDS for approval. (Ex. A2; Test. of Thompson).
3. When BDS engineer Eric Thomas reviewed the plans, he identified what he considered to be flaws or errors in the plans. Thomas identified overstressing of the rafters in

¹ Any engineer can make a mistake in his or her calculations. It is the nature of Thompson's errors that is at issue here.

² There is no Exhibit R15.

Thompson's plan, which he identified as a tied-rafter system, and asked Thompson to address and resolve those problems. (Test. of Thompson, Kumar).

4. Thompson brought revised plans to BDS on September 26, 2014, and met with BDS Structural Engineer Shelly Duquette³. Duquette reached the same conclusion Thomas did, confirmed the flaws in Thompson's plans, and offered some suggestions to rectify the equilibrium problem. Thompson also presented the revised calculations to Thomas, but Thomas told him he would only approve the plans if Thompson added a large ridge beam or doubled the rafters in the structure. (Test. of Kumar).

5. Thompson came to BDS Senior Structural Engineer Amit Kumar⁴ to complain about his interactions with Thomas and Duquette, and to explain why he believed they were wrong. Kumar investigated and reached the same conclusions about Thompson's calculations as had Thomas and Duquette. Wanting to convince Thompson that his calculations were incorrect, Kumar asked Thomas to prepare a computer model to demonstrate to Thompson why his plan would not work. The model agreed with the BDS critiques of the errors in Thompson's plan, (Ex. A6, A19), but Thompson concluded the model, and not his plan, was incorrect. (Test. of Kumar).

6. When Thompson expressed his disagreement with the BDS model, Kumar asked the other BDS engineers to review the calculations, and also asked an engineer in the private sector to review the calculations. All agreed that Thompson's calculations contained equilibrium errors. (Ex. A10; Test. of Kumar).

7. Following his multiple conversations with Thompson, Kumar finally concluded that Thompson was making, and continuing to make, a "fundamental engineering error." Kumar filed a complaint with the Board that stated in part:

The city has tried to reason with Mr. Thompson to let him know that his analysis of the "truss" is incorrect as it does not satisfy equilibrium and the basic principals [sic] of statics. Mr. Thompson refuses to acknowledge that his analysis is incorrect, * * * Satisfying statics and equilibrium is the most basic principles [sic] of engineering which is taught very early on in engineering schools. If this principle is not understood even after being made aware of the error could lead to design of buildings that pose a danger and a threat to life safety. (Ex. A1 at 2).

8. Thompson ultimately changed his plans to include a tied rafter, in order to obtain approval to finish his son's house. He still, as of the time of hearing, believes that BDS engineers were incorrect and that his calculations (for a second design that he called a "three pinned arch") were correct and would have worked on the building. (Test. of Thompson).

³ Ms. Duquette holds licensure as a Professional Engineer, like Thompson, but she also holds the more advanced licensure, Structural Engineer.

⁴ Mr. Kumar, like Ms. Duquette, holds licensure as a Professional Engineer and the more advanced licensure – Structural Engineer.

9. Sean St. Clair is a professor of civil engineering at Oregon Technical Institute (OIT). He has a Ph.D. in Civil Engineering from Georgia Tech⁵. (Test. of St. Clair).

10. Licensee appeared before the Board's Law Enforcement Committee⁶ to explain and defend his calculations in this case. Professor St. Clair was present at the meeting as an observer and, listening to Licensee's comments, concluded that there were mistakes in his calculations. Professor St. Clair attempted to explain what he had observed, but Licensee would not listen and "talked over" him. (Test. of St. Clair).

11. The Board assigned an expert reviewer to the case, a Professional Engineer and Structural Engineer from a private firm unaffiliated with the Board, who also came to the same conclusions as BDS staff.⁷ (Ex. A 10).

12. The Board later asked Professor St. Clair to critique Thompson's calculations, without giving him the other calculations or critiques made by BDS staff. Professor St. Clair independently concluded that Thompson's initial calculations failed to satisfy equilibrium, based on Sir Isaac Newton's Third Law of Motion, that for every action there is an equal and opposite reaction. The need for equilibrium in structural engineering is to prevent unintended and destructive motion in a structure that is intended to be stationary. He concluded that, if the roof system was built according to Thompson's calculations, there could be damage to the structure. (Test. of St. Clair).

13. Professor St. Clair found errors of "moment" (the product of force times distance) in Thompson's initial calculations. These errors would stress the rafter system by approximately 340 percent of its design capacity, an approximation the professor later learned was very similar to the computer model's estimate of 350 percent. (Test. of St. Clair).

14. When reviewing Thompson's second set of calculations for the tied rafter system⁸, Professor St. Clair found mathematical errors (for example, using a figure of 162 lbs. when the correct amount was 1056 lbs.). Thompson's second set of calculations again failed to satisfy equilibrium. (Ex. A11; Test. of St. Clair).

15. When reviewing Thompson's second design, the "three-pinned arch," Professor St. Clair again found serious mathematical errors and serious errors of basic equilibrium.⁹

16. Professor St. Clair and Mr. Kumar both agreed that understanding and correctly applying the principles of equilibrium and statics to engineering designs is the standard of care for every professional engineer, in every community. (Test. of St. Clair and Kumar). Professor

⁵ Professor St. Clair also holds licensure as a Professional Engineer.

⁶ Thompson appeared before the Board's Law Enforcement Committee, not before the full Board.

⁷ The Board has added this finding of fact.

⁸ Thompson provided calculations for the tied-rafter system, and for the three-pin arch system. However, he provided more than one set of calculations for the tied-rafter system.

⁹ The Board has added this finding of fact.

St. Clair further confirmed that being able to recognize and correct errors in your design when they are pointed out to you by the reviewing entity and multiple practitioners in your field is the standard of care for every professional engineer, in every community. (Test. of St. Clair).¹⁰

16. On June 21, 2017, the Board issued its Notice of Intent to Assess Civil Penalty to Licensee. Typically, if the Board assesses a penalty for negligence¹¹ it is for \$1,000. However, because Licensee had never been disciplined previously, in over 50 years of practice as a Professional Engineer, the Board concluded that a \$500 civil penalty was appropriate. (Test. of Sobotka).

CONCLUSIONS OF LAW

1. Licensee committed negligence in the practice of engineering through his preparation of engineering calculations and his failure to accept correction from other engineers.
2. Licensee should be assessed a civil penalty in the amount of \$500.

OPINION

The Board contends that Licensee should be required to pay a civil penalty for committing negligence¹² in the practice of engineering. The Board has the burden of proof. *Sobel v. Board of Pharmacy*, 130 Or App 374, 379 (1994), *rev den* 320 Or 588 (1995) (standard of proof under the Administrative Procedures Act is preponderance of evidence absent legislation adopting a different standard). Proof by a preponderance of the evidence means that the fact finder is persuaded that the facts asserted are more likely true than not. *Riley Hill General Contractor v. Tandy Corp.*, 303 Or 390 (1987). The burden of proof encompasses two burdens, the burden of production of evidence in support of an assertion, and the burden to persuade the fact-finder that the facts asserted are true. *Marvin Wood Products v. Callow*, 171 Or App 175 (2000).

At issue in this case is negligence pursuant to the terms of ORS 672.200, which states in part:

Grounds for suspension or revocation of certificate or permit or refusal to issue, restore or renew certificate or permit; grounds for reprimand. The State Board of Examiners for Engineering and Land Surveying may suspend, revoke or refuse to issue, restore or renew a certificate or permit, or may reprimand an individual enrolled as an intern or holding a certificate or permit:

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¹⁰ *The Board has added this finding of fact.*

¹¹ *The Board typically assesses civil penalties of less than \$1000 for some, lesser violations, but not for commission of professional negligence.*

¹² *Although violating the standard of care is inherent in professional negligence, the Board's Notice specifically alleged that Thompson had committed negligence, so it uses that same language here.*

(2) For gross negligence, negligence or incompetence in the practice of engineering, land surveying or photogrammetric mapping[.]

With respect to professional negligence in Oregon, “the standard of care is that of a reasonably prudent, careful and skillful practitioner of that discipline in the community or a similar community under the same or similar circumstances.” *Creasey v. Hogan*, 292 Or 154, 163, 637 P2d 114 (1981) (omitted) (malpractice claim against podiatrist); see also *Getchell v. Mansfield*, 260 Or 174, 179, 489 P2d 953 (1971) (recognizing that a professional acts negligently by failing to follow “the reasonable practice * * * in the community”).¹³

Similar to the evaluation of expert opinion in any area, the review of the evidence comes down to determining which of the experts presents an opinion that is well-reasoned and based upon complete information. *See, e.g., Somers v. SAIF*, 77 Or App 259, 263 (1986) (in a case involving medical experts, the courts will rely on the opinion that is both well-reasoned and based on complete information).

In this case, recognizing the long engineering experience¹⁴ of Licensee, as well as the experience and expertise of the engineers from BDS, the outside engineering firm used by BDS to review their work and Thompson’s, the Board’s expert reviewer, and Professor St. Clair, we agree with ALJ Barber that Professor St. Clair’s expert testimony was the most helpful in explaining the engineering principles and the problems that were identified with Licensee’s calculations.

The first question to be addressed is whether Licensee made errors in his calculations. The Board does not seek to discipline Thompson based on calculation errors alone. As Professor St. Clair and others noted, everyone makes mistakes. A mistake in a mathematical or engineering calculation does not, in and of itself, demonstrate negligence or incompetence, or violate the standard of care. On the other hand, an incorrect mathematical or engineering calculation, if not discovered and corrected, could prove dangerous to occupants of a poorly constructed dwelling. When the error is not a simple miscalculation, but demonstrates a misunderstanding or disregard of the fundamental laws of physics and engineering, the error is more serious still.¹⁵ Therefore, the question of whether Thompson made calculation errors, and what type of errors those were, is an important question that must be answered. We find Thompson did make serious calculation errors in this case, serious errors concerning equilibrium and statics.¹⁶

Mr. Kumar, the complainant in this case, explained the basis for the City’s rejection of Thompson’s plan and for the complaint to the Board:

The city has tried to reason with Mr. Thompson to let him know that his analysis

¹³ *Applicable legal standard, with citation, added by the Board.*

¹⁴ *Respectfully, Thompson established himself as very experienced, not expert. The lack of expertise he displayed in both his tied-rafter system and three-pin arch are at the heart of this case. In contrast, two of the BDS engineers, as well as the Board’s expert reviewer hold more advanced engineering licensure than Thompson, and Professor St. Clair has both a practical license, as well as a Ph.D. in Civil Engineering.*

¹⁵ *Addition by the Board.*

¹⁶ *The Board finds these errors to be serious in nature, and note so in our opinion.*

of the “truss” is incorrect as it does not satisfy equilibrium and the basic principals [sic] of statics. Mr. Thompson refuses to acknowledge that his analysis is incorrect. * * * Satisfying statics and equilibrium is the most basic principles [sic] of engineering which is taught very early on in engineering schools. If this principle is not understood even after being made aware of the error could lead to design of buildings that pose a danger and a threat to life safety.

(Ex. A1 at 2). All of the evidence in the case indicates that mistakes in equilibrium are at the heart of the calculation errors that the city and the Board criticize.

Professor St. Clair testified that lack of equilibrium was the primary issue in Thompson’s errors in calculation. Correctly satisfying equilibrium is required to address issues arising from Newton’s Third Law of Motion—that for every action there is an equal and opposite reaction. This is one of the most basic and fundamental concepts in physics. When Professor St. Clair reviewed Thompson’s initial calculations, the first thing he noted was that equilibrium (essentially the balance between the action and the reaction in Newton’s law, to prevent motion) was incorrectly calculated, placing the planned roof structure out of balance. If built in the way that Thompson planned, portions of the roof structure would be overstressed by the lack of equilibrium. Professor St. Clair estimated that the overstressing would be in the range of 340 percent, a number that roughly matched¹⁷ what the city had told Thompson, and similar to the computer model the city had prepared in an effort to convince Thompson of his errors.

Professor St. Clair reviewed Thompson’s second submission to the city, and again found mistakes in equilibrium. These mistakes included mathematical errors (at one point using 162 pounds in a calculation when the correct number was 1056 pounds), and further equilibrium errors. Additionally, Professor St. Clair noted comments such as “adjustment to equilibrium” on Thompson’s documents, and responded that one does not adjust equilibrium (“that’s not how the universe works”). Instead, the professor testified, one achieves equilibrium in the design - in other words, ensures the structure being designed remains stationary and sound -- by creating a balance between the various forces at work in that design.

As important as Thompson’s errors were, his unwillingness to reconsider his errors is more important. Professor St. Clair was present, although not in any specific capacity, when Thompson presented his argument to the Board concerning his calculations. Afterwards, the professor attempted to talk to Thompson about the errors, but Thompson would not listen to the explanation.

At hearing, the testimony of Professor St. Clair and Kumar unequivocally focused on equilibrium as the issue. However, when presenting his defense—and despite direct questioning from the ALJ—Thompson did not specifically address the equilibrium issue or show how his calculations solved the equilibrium problems in the design. Strangely, and for the first time, Thompson testified that the numbers he provided to the City (the ones containing errors) were not his own calculations but were actually a critique of Thomas’s calculations. If that is the case, Thompson never informed the City or the Board that it was a critique—and he never provided

¹⁷ 340 percent is roughly the same as the city’s estimate of “three and a half times” which, if numerated, would be 350 percent.

any rebuttal or explanation for the calculations that he would acknowledge *were* his.¹⁸

Thus, on the key engineering question in the case—the allegation that Thompson’s equilibrium analysis was flawed and needed to be corrected—Thompson presented no evidence in support of his calculations and no response to the Board’s analysis of the calculations. The preponderance of the evidence establishes that Thompson’s calculations were incorrect.

The essence of Thompson’s defense in the case is that the Board should give more weight to his practical on-the-ground experience as a contractor and engineer than to Professor St. Clair’s, Kumar’s, Duquette’s, Thomas’s, BDS’s third party reviewer’s, and the Board’s expert reviewer’s calculations. However, Thompson’s level of experience, while certainly extensive, is no substitute for a direct response to the critique of his calculation errors or his unwillingness to accept criticism or correction from his engineering peers, the reviewing engineering body that received his design in the first place, or engineers with more expert qualifications.

Again, errors in calculations are relatively common and not a basis for discipline. However, as Professor St. Clair testified, the number of mistakes, the fundamental principles of engineering to which they were tied, and the failure to correct them does call the standard of care into question.

Thompson has been an engineer in Oregon since 1964 and, as he testified, he has also applied his engineering knowledge and experience in the construction field. Although the Board’s outside expert reviewer suggested that his intransigence here is due to his inexperience with computer models, the record does not bear that out. Thompson testified he had been using computers since the early days of computers, when he used the Fortran software in his engineering practice. We accept that statement as true.

However, his years of experience and apparent understanding of computer modeling only add to the concern raised by Thompson’s failure and refusal to address or resolve his calculation errors, which other engineers and the modeling program demonstrated. Based upon the record, including his strident assertion, “because I’m right and I know I am right!” (Testimony of Thompson), and Thompson’s demeanor at hearing as relayed by the Administrative Law Judge, we conclude that Thompson simply did not believe his calculations were incorrect and was unwilling to demonstrate why they were correct.

Thompson apparently still believes his calculations were correct, but he has not explained how or why. The preponderance of the evidence in this case shows that his calculations were incorrect and potentially a danger to the homeowner.

Part of the standard of care is to be willing to accept the correction of colleagues, to engage in colloquy even when believing that no error has been made, and to admit errors when they have been made. In this case, Thompson violated the standard of care.

¹⁸ It is unclear whether the documents and calculations were Thompson’s or whether some of them were a critique of the others’ calculations. Resolution of that issue is not necessary for a determination that Thompson failed to correct his own calculations.

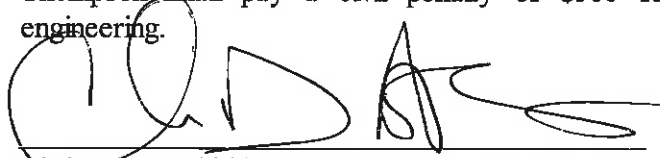
In summary, Thompson committed negligence by failing to meet the standard of care of a reasonably prudent, careful, and skillful engineer, in the design of a home, in any community. He did so by making fundamental and potentially dangerous calculation errors in the design of the roof he submitted to the City of Portland, ignoring or misunderstanding basic, foundational engineering principles. More importantly, he also did so by refusing to accept or consider responses intended to correct his errors, stubbornly repeating the errors and making new ones instead.¹⁹ This was the case even when six other professional engineers, or professional and structural engineers, agreed on his errors, and no professional engineer supported his calculations, nor could he explain them himself. None of these actions meet the standard of care of a reasonably prudent, careful and skillful engineer, in the design of a home or any other structure, in any community.

Civil Penalty

Pursuant to ORS 672.325, the Board has the authority to assess a civil penalty of up to \$1000 for any violation of its statutes or rules, and could also have chosen other sanctions under ORS 672.200, including license revocation. Consideration was already given for his long history of practice without sanction. Therefore, a \$500 civil penalty is reasonable.

ORDER

The Notice to Assess Civil Penalty is AFFIRMED. For the reasons set forth above, Thompson shall pay a civil penalty of \$500 for committing negligence in the practice of engineering.



Christopher Aldridge, RPP, Vice President
Oregon State Board of Examiners for
Engineering and Land Surveying

Date: 11/13/18

APPEAL NOTICE

You are entitled to judicial review of this order in accordance with ORS Chapter 183.482. You may request judicial review by filing a petition with the Court of Appeals in Salem, Oregon within 60 days from the date of service of this order.

¹⁹ *The errors in this case were not mere miscalculations; they were fundamental errors of engineering.*

CIVIL PENALTY

Pursuant to ORS 183.745, any civil penalties imposed are due and payable 10 days after the Final Order becomes final by operation of law or on appeal.