

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FREIGHTCAR AMERICA, INC.,

Petitioner

v.

NATIONAL STEEL CAR LIMITED,

Patent Owner

U.S. Patent No. 8,132,515

IPR Case No. IPR2025-01048

DECLARATION OF MARK J. VIZ PH.D., P.E.

UNDER 37 C.F.R. § 1.68

I, Mark J. Viz, Ph.D., P.E, being over the age of 18 and competent to make the statements herein, hereby declare the following:

1. I am a citizen of the United States.
2. I understand that FreightCar America Inc. (“FreightCar,” or “Petitioner”) has filed a Petition for Inter Partes Review¹ (“IPR”) asserting that claims 1-44 (“the Asserted Claims”) of U.S. Patent No. 8,132,515 (“the ’515 Patent”) are invalid. I also understand that the owner of the ’515 Patent, National Steel Car Limited (“National Steel Car,” or “Patent Owner”) denies that the Asserted Claims are invalid and asserts that said claims are valid and enforceable.
3. I have been retained by counsel Ice Miller, LLP to provide my opinion on technical matters concerning the validity of the Asserted Claims of the ’515 Patent. My employer, Exponent, Inc. (“Exponent”), is being compensated for my time at my normal consulting rate in calendar year 2025 of \$690 USD per hour. My compensation is not tied to the outcome of this matter.
4. Neither I nor Exponent have a business interest or other conflict of interest with respect to either FreightCar or National Steel Car.

I. Background and Qualifications

5. My *curriculum vitae* is attached hereto as Appendix A.

¹ IPR2025-01048.

A. Educational Background

6. I hold a Doctorate (Ph.D.) in Theoretical and Applied Mechanics from Cornell University, and a Bachelor of Science (B.S.) in Aeronautics and Astronautics from the Massachusetts Institute of Technology (MIT).

B. Professional Background

1. Industry Experience

7. I have extensive experience in the performance evaluation and mechanical analysis of railcar and aircraft structures. I have 25 years of experience investigating the mechanical / dynamic performance, reliability, and conformance to design specifications of railcar and railway structures, both freight and passenger. Prior to my employment at Exponent Inc., I was a Specialist Engineer (in Structural Damage Technology) at the Boeing Commercial Aircraft Company (Renton, Washington), a Senior Engineer at GATX Rail (Chicago, Illinois) and the Director of Applied Mechanics at Packer Engineering (Naperville, Illinois). While at GATX Rail I performed analysis and field support for a range of mechanical performance matters involving GATX's fleet of over 80,000 railcars; many of these analyses and field support activities involved both covered and open-top

hopper railcars. Also, during my time at GATX Rail, I had engineering responsibilities that included aspects of new railcar design and development, budget and schedule management, and leasing and marketing support. I was also heavily involved in the regulatory environment concerning the transportation of hazardous materials in rail tank cars.

8. As a Principal Engineer with Exponent for the last almost 23 years, I have been involved in well over one hundred engagements involving railcar performance, from investigations involving claims of out-of-specification or improper structural performance, hunting and aggressive wear of trucks (bogies) and truck components, derailment investigations, ride quality issues and other wheel-rail interface problems. I have performed damage assessments of light rail vehicles involved in accident / incident claims, and I have overseen repair work on behalf of insurers for other light rail systems that have been damaged and then repaired. I have testified in rail matters in deposition, trial and arbitrations, both in the US and internationally (including Canada), and my work on fugitive coal dust emissions from coal railcars has been presented to the US Surface Transportation Board in various tariff disputes between two Class I railroads and various coal shippers.

9. I have been the project lead for approximately 35 major derailment investigations over the last almost 23 years at Exponent. I was on the ground for

weeks in Lac-Mégantic, Québec in 2013 after a 70-car unit train derailed releasing over 1.5 million gallons of crude oil and causing the deaths of 47 people. I have investigated derailments that have involved the rupture of tank cars and subsequent loss of hazmat containment, as well as derailments caused by anomalous structural and/or dynamic behavior of railcars, such as truck hunting, and track bed / rail defects. In just about all of these matters, quality and performance issues of the mechanical equipment, whether the railcars, track structures, or both, have typically been central aspects of the investigations.

10. In passenger rail, I have investigated railcar performance and/or derailments for engagements including but not limited to passenger rail systems in Dallas, Texas; Portland, Oregon; San Francisco, California; Los Angeles, California; London (England); and Manila (Philippines). I have also performed railcar mechanical analyses and design specification reviews for various manufacturers of light-rail / passenger rail vehicles. In the specialty rail area, I was involved in lengthy projects involving the performance of the Las Vegas monorail and the Seattle monorail when the latter was involved in a collision in 2005.

11. I have performed static strength, fatigue, and damage tolerance analyses of railcar structures and components using commercial finite element analysis codes such as Abaqus and Ansys. These analyses have involved many varieties of railcars, including open-top hoppers (including steel and aluminum

coal cars), covered hoppers, pressure differential cars, tank cars, mill gondolas, and various passenger cars, including those with CEM (crash energy management) provisions. Many of these analyses have included the incorporation of field data and measurements into the various models to capture the mechanical response of the railcars in their “as-is” rather than “as-designed” condition.

12. I have been involved in a number of engagements that have involved the performance of rail castings, axles, and bearings. These have included projects involving casting quality of truck bolsters and ride quality issues involving the dynamic response of trucks (bogies) and related components. These projects have also typically involved the development and implementation of non-destructive examination procedures for both on-car and off-car examination, cyclic fatigue testing, mechanical and metallurgical testing, engineering evaluation of test results with respect to mechanical performance, and development of engineering plans to manage fleet components over the projected remaining useful service life. For some of these engagements, I have presented findings on behalf of clients to the Association of American Railroads (AAR).

13. I am currently a Principal Engineer in the Mechanical Engineering group at Exponent, Inc., with my office being in Chicago, Illinois.

14. I am a Licensed Professional Engineer in the State of Illinois, license no. 062.062247.

15. Additional details about my career history and relevant qualifications are provided in the current version of my *curriculum vitae*, attached as Appendix A.

2. Academic Experience

16. Both my Bachelor of Science degree from MIT as well as my Doctorate from Cornell University involved successful completion of extensive coursework in areas directly involving and/or otherwise related to engineering design from a mechanics and materials perspective. During both my undergraduate and graduate terms, I was also regularly involved in a number of “hands-on” projects that involved various aspects of metal working and structural fabrication techniques. I received additional instruction in these various “hands-on” techniques during my time at Boeing and during extensive time spent in repair facilities owned and operated by GATX Rail in Indiana, Texas, Georgia, and various locations in Canada.

17. Additional details about my experience in academia are provided in the attached current version of my *curriculum vitae*. See Appendix A.

3. Publications

18. My publication list is provided in the attached current version of my *curriculum vitae*. See Appendix A.

4. Expert Evidence History

19. A listing of cases in which I have testified within the last eight years is found following my *curriculum vitae*. See Appendix B.

C. Scope of Assignment

20. I have been retained to provide my opinions on technical matters concerning the validity of claims 1-44 of the '515 Patent (“the Challenged Claims”), a copy of which is submitted with the Petition for Inter Partes Review (“IPR”) for IPR2025-01048 as Exhibit 1001.

21. While I expect to submit a future report presenting analysis as to whether certain published prior art references identified in IPR2025-01048 disclose the subject matter recited in the claims of the '515 Patent specified above, this current declaration will address a more limited scope of analysis. Specifically, for

this declaration I have been asked to review the declaration² of Petitioner's technical expert, Dr. Mehdi Ahmadian, and assess whether the prior art references presented by Dr. Ahmadian were cumulative to prior art which were identified or submitted to the Examiner during prosecution of the '515 Patent.

² "Declaration of Mehdi Ahmadian in Support of Petition for Inter Partes Review of U.S. Patent No. 8,132,515," herein "the Ahmadian Declaration."

II. INFORMATION CONSIDERED

22. My opinions are based on my 28 years of professional industry experience in mechanical engineering, the numerous and various investigations that I have detailed above, and other matters on which I have given expert testimony. In forming my opinions, I have considered the materials referenced below, which are submitted as exhibits accompanying the IPR.

- A. The Certified File History of U.S. Patent No. 8,132,515
(Exhibit 1002 to IPR2025-01048)
- B. The Declaration of Mehdi Ahmadian in Support of Petition
for Inter Partes Review of U.S. Patent No. 8,132,515 (Exhibit
1003 to IPR2025-01048)
- C. 1946 Car Builders' Cyclopedias Excerpt (Exhibit 1004 to
IPR2025-01048)
- D. Lancashire & Yorkshire Wagons, Vol. II, by Noel Coates
("Coates") (Exhibit 1007 to IPR2025-01048)
- E. 1912 Car Builders' Dictionary Excerpt (Exhibit 1010 to
IPR2025-01048)
- F. 1922 Car Builders' Cyclopedias of American Practice Excerpt
(Exhibit 1011 to IPR2025-01048)

- G. Private-Owner Wagons in Colour, For the Modeller and Historian, by David Ratcliffe (“Ratcliffe 2”) (Exhibit 1018 to IPR2025-01048)
- H. Wagons of the Final Years of the British Railways, By David Larkin Excerpt (“Larkin 1”) (Exhibit 1019 to IPR2025-01047)
- I. Working Wagons, by David Larkin Excerpt, (“Larkin 2”) (Exhibit 1020 to IPR2025-01048)
- J. Wagon Recognition, by Martin Buck and Mark Rawlinson (“Buck”) (Exhibit 1021 to IPR2025-01048)
- K. Private Owner Wagons, by Andrew Marshall (“Marshall”) (Exhibit 1024 to IPR2025-01048)
- L. U.S. Patent No. 8,132,515 (Exhibit 1001 to IPR2025-01048)

23. Additional information may become available which would further support or modify the conclusions that I have reached to date. Accordingly, I reserve the right to modify or expand my opinions or the bases thereof upon consideration of any further discovery, testimony, or other evidence, including any issues raised by any expert or witness of the Petitioner, or based upon interpretations of any claim term different than those proposed in this declaration.

III. LEGAL PRINCIPLES

24. In expressing my opinions and considering the subject matter of the claims of the '515 Patent, I am relying on certain legal principles that have been explained to me by counsel for Patent Owner. Accordingly, I have considered and applied the following standards in providing my analysis herein.

25. I understand that certain people involved with the prosecution of a patent application owe a duty of candor and good faith to the patent office and have a duty to disclose information material to patentability to the patent office.

26. Information is material to patentability when it is not cumulative to information already of record or being made of record in the application. Material information must either (1) establish a *prima facie* case of obviousness, either by itself or in combination with other information, or (2) refute, or be inconsistent with, a position the applicant takes in: (i) opposing an argument of unpatentability relied on by the Office, or (ii) asserting an argument of patentability.

27. I understand that prior art may be cited to the patent office in an information disclosure statement (“IDS”). I also understand that patent examiners also have the ability to require submission of information that may be reasonably necessary to properly examine or treat a matter in a pending or abandoned application, but not necessarily “material to patentability.”

28. I understand that 35 U.S.C. § 325(d) provides that “[i]n determining whether to institute or order a proceeding . . . the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office.” I understand that the Board has held that this applies to Inter Partes Review proceedings.

29. I understand that the Board applies a two-step test when deciding whether to deny institution of an Inter Partes Review pursuant to Section 325(d). First, the Board determines whether the Petition presents the same or substantially the same art or arguments previously presented to the Patent Office. *Id.* If so, the Board asks whether the Petition demonstrates that the Patent Office materially erred in its consideration of that same art. If reasonable minds can disagree regarding the purported treatment of the art or arguments, it cannot be said that the Patent Office erred.

30. To determine whether the same or substantially the same prior art or arguments were previously presented to the Patent Office, the Board applies a series of factors, including: (a) the similarities and material differences between the asserted art and the prior art involved during examination; (b) the cumulative nature of the asserted art and the prior art evaluated during examination; (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection; (d) the extent of the overlap

between the arguments made during examination and the manner in which
Petitioner relies on the prior art or Patent Owner distinguishes the prior art; (e)
whether Petitioner has pointed out sufficiently how the Examiner erred in its
evaluation of the asserted prior art; and (f) the extent to which additional evidence
and facts presented in the Petition warrant reconsideration of the prior art or
arguments.

IV. OPINIONS

A. Level of Skill of a Person Having Ordinary Skill in the Art

31. I was asked by counsel for National Steel Car to provide my opinions by considering the patent claims through the eyes of a “person of ordinary skill in the art” (“POSITA”) on or before the effective filing date of the claimed invention, which I have been advised is September 11, 2009.

32. In considering the characteristics of a hypothetical POSITA, I was advised to consider factors, such as the educational level and experience of people working in the field at the time of the invention, the types of problems faced in the art and the solutions found to those problems, the pace at which innovations are made in the field, and the sophistication of the technology in the field. With this in mind, I placed myself back in the time frame of the effective filing date of the claimed invention, namely, in the September 2009 time frame.

33. I understand that in the parallel District Court litigation related to the ’515 Patent,³ National Steel Car has contended that a POSITA in the field of the ’515 Patent would have at least a bachelor’s degree in a discipline related to mechanical engineering, physics, structural design, or an equivalent discipline, and

³ *National Steel Car Limited v. FreightCar America, Inc., et al.*, C.A. No. 1:24-cv-00594-JLH, D.Del.

at least two years of experience designing or analyzing railcars. I agree that this definition adequately captures the background of a POSITA at the time of the '515 Patent filing.

34. There are a number of reasons why I am able to place myself in the position of a POSITA in the September 2009 time frame. First, I have skills of at least a POSITA relevant to the technology of the '515 Patent, and therefore I have an understanding what a POSITA would have known and what a POSITA would have learned from studying prior art documents. Second, I had supervised engineers by this time of my career. Third, I was also a Teaching Assistant ("T.A.") in a Solid Mechanics class during my graduate studies at Cornell University and worked directly with students as they became skilled in the art. I also taught after-work classes to program-level staff engineers while employed at Boeing; these classes would address certain aspects of structural design involving static strength, fatigue, and damage tolerance calculations. By teaching students, I understood to various degrees what they learned at different stages, how they reviewed documents they had not yet seen, and what conclusions they drew from these various documents. Fourth, while employed at GATX Rail prior to September 2009, I performed design and analysis work / calculations involving certain structural aspects of both open-top and covered hopper railcars as well as tank cars. Accordingly, I was at least a POSITA in the September 2009 timeframe.

35. My opinions regarding the state of the art and the understanding of a POSITA provided in this Declaration are made in or before September 2009, unless expressly stated otherwise. For the ease of reading, I may use a verb in this Declaration or any deposition or testimony in its present tense, *e.g.*, “would reasonably understand,” but this should be construed to mean a POSITA on or before the effective filing date of the claimed invention, *i.e.*, September 2009, unless expressly stated otherwise.

36. In my opinion, a slight change to the time frame for the POSITA, such as to 2008 or 2010, would not alter my opinions herein.

37. I understand that FreightCar contends that a POSITA for the ’515 Patent would have had “at least a bachelor’s degree in a discipline related to mechanical engineering, physics, structural design, or an equivalent discipline, and at least two years of experience designing or analyzing railcars or similar vehicles.”⁴ While this definition is substantially similar to the definition put forward by National Steel Car, I disagree with the inclusion of “or similar vehicles” as design or analysis experience with other industrial wheeled vehicles would not necessarily be applicable to the art of the ’515 Patent. However, I am also not aware of any substantive way in which my opinions herein would be altered should FreightCar’s definition of a POSITA be adopted.

⁴ Ahmadian 048 Declaration at ¶45.

B. The Prior Art Used By Dr. Ahmadian to Assert Invalidity of the '515 Patent is Cumulative of Prior Art Considered During Prosecution

38. In his declaration, Dr. Ahmadian states that the '515 Patent claims were allowed by the Examiner because “the applicant overcame the Examiner’s rejection of original Claim 1 by arguing that the prior art had support structures—large triangular plates known as “elephant ears”—that obstructed the machinery space. The Examiner thereafter allowed 44 claims.” According to Dr. Ahmadian, each claim required either “open machinery space below the slope sheets, crosswise reinforcement beams on the slope sheets, or both.”⁵

39. Dr. Ahmadian further opines that this aspect of the '515 Patent was not a novel feature and that such a configuration of “slope-sheet support beams and open machinery spaces” were present in the prior art.⁶ In support of Petitioner’s argument that the claims of the '515 Patent would have been obvious in view of certain prior art references, Dr. Ahmadian opines that the aspects of the '515 Patent invention identified above (i.e., “crosswise reinforcement beams on the slope sheets” and “open machinery space below the slope sheets”) were disclosed by the prior art references including the 1946 Car Builders’ Cyclopedia (“the 1946 Cyclopedia”) and several photographed hopper cars.

⁵ Ahmadian 048 Declaration at ¶26.

⁶ Ahmadian 048 Declaration at ¶27.

40. I have reviewed the images of the prior art including the 1946 Cyclopedia and several photographed hopper cars that Dr. Ahmadian asserts disclose “crosswise reinforcement beams on the slope sheets” and “open machinery space below the slope sheets.” I have also reviewed figures and prior art references specifically provided to the Examiner during prosecution of the ’515 Patent.

41. It should be noted that some of the figures used by Dr. Ahmadian in his analysis, as well as figures which were in front of the Examiner during prosecution of the ’515 Patent, are somewhat degraded in clarity; additionally, it is not entirely clear that these figures conform with modern-day practices for engineering arrangement drawings. Accordingly, there is some irreducible ambiguity in the interpretation of these figures and the identification of structures therein. However, to the extent that the structures identified in figures used by Dr. Ahmadian are accurate, it is my opinion that the images of those structures are substantively the same as images showing the same structures within prior art specifically brought to the attention of the Examiner during prosecution.

1. The 1946 Cyclopedia

42. In his declaration, Dr. Ahmadian presents drawings of the “NSC Ore Car” from the 1946 Cyclopedia (which he opines “discloses the claimed machinery

space bounded by (a) the first end of the slope sheet, (b) the shear plate, (c) the end post, and (d) the corner posts” of the ’515 Patent.⁷ Shown below in Figure 1 is an annotated figure from the 1946 Cyclopedia presented by Dr. Ahmadian (with Dr. Ahmadian’s annotations) as compared to an annotated version of a drawing disclosed during prosecution to the Examiner of the “Enterprise Car” from the 1943 Car Builders’ Cyclopedia (the “1943 Cyclopedia”).

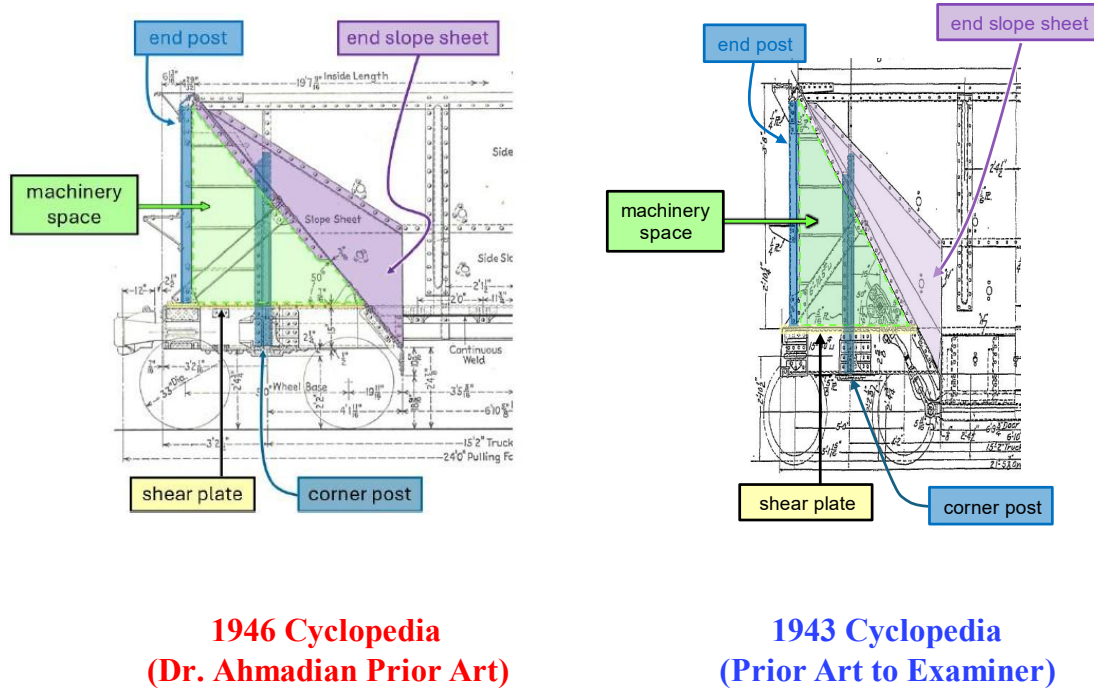


Figure 1: Comparison of drawings of the NSC Ore Car from the 1946 Cyclopedia⁸ used by Dr. Ahmadian to drawings of the Enterprise Car from the 1943 Cyclopedia (brought to the Examiner’s attention).⁹ The 1946 Cyclopedia drawing was annotated by Dr. Ahmadian. The 1943 Cyclopedia drawing was annotated by Exponent using the same terminology for the same structures as used by Dr. Ahmadian.

⁷ Ahmadian 048 Declaration at ¶78.

⁸ Ahmadian 048 Declaration at p. 55, citing Ex. 1004 at p. 294.

⁹ Ex. 1002 at p. 241.

43. To the extent that Dr. Ahmadian is accurate in his identification of elements in the NSC Ore Car from the 1946 Cyclopedia, the drawings of the Enterprise Car from the 1943 Cyclopedia disclose the same structures.

44. The drawings of NSC Ore car from the 1946 Cyclopedia presented by Dr. Ahmadian were the same or substantially the same as the drawings of the Enterprise Car in the 1943 Cyclopedia brought to the attention of the Examiner during the prosecution of the '515 Patent, yet the Examiner still found that the claims of the '515 Patent were novel and nonobvious in view of the prior art. Dr. Ahmadian does not identify any specific remarks made by the Examiner during prosecution that would suggest the Examiner did not understand the drawings of the Enterprise Car.

45. Additionally, Dr. Ahmadian opines that the drawings of the NSC Ore Car found within the 1946 Cyclopedia disclose “two-part side-wall stiffeners with web continuity” claimed in the '515 Patent.¹⁰ Shown below in Figure 2 is the drawing of the NSC Car presented and annotated by Dr. Ahmadian alongside the Enterprise Car and “Pressed Steel Car” from the 1943 Cyclopedia.¹¹

¹⁰ Ahmadian 048 Declaration at ¶54.

¹¹ Ex. 1002 at pp. 237-244.

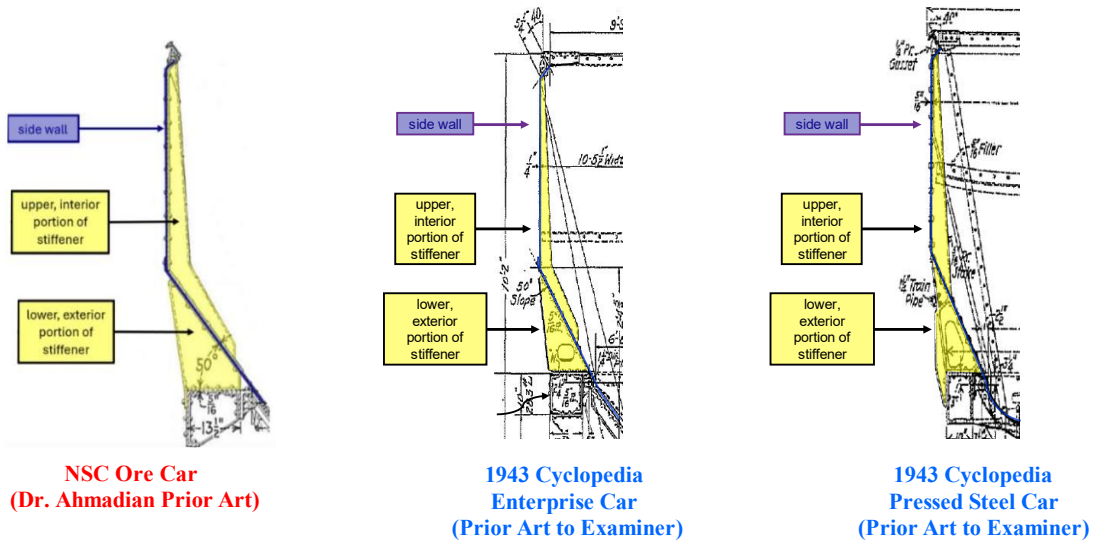


Figure 2: Comparison of the side wall stiffeners shown in the NSC Ore Car (used by Dr. Ahmadian, left)¹² to drawings of the Enterprise and Pressed Steel Cars from the 1943 Cyclopedia¹³ (brought to the Examiner’s attention, middle and right). The NSC Ore Car was annotated by Dr. Ahmadian. The Enterprise Car and Pressed Steel Car were annotated by Exponent using the same terminology for the same structures as used by Dr. Ahmadian.

46. To the extent that Dr. Ahmadian is accurate in his identification of elements in the figures he uses shown in Figure 2, the same structures can be seen in figures brought to the attention of the Examiner during prosecution.

47. By examining the information presented to the Examiner during prosecution of the '515 Patent, it can be seen that this figure was substantively the same as the figures specifically brought to the Examiner’s attention, yet the Examiner still found that the claims of the '515 Patent were novel and nonobvious in view of the prior art. Dr. Ahmadian does not identify any specific remarks made

¹² Ahmadian 048 Declaration at p. 27.
¹³ Ex. 1002 at pp. 237-244.

by the Examiner during prosecution that would suggest the Examiner did not understand the drawings of the Enterprise Car or Pressed Steel Car.

2. Photographed Hopper Cars

48. Dr. Ahmadian also presents photographed hopper cars and opines that the hopper cars disclose the open machinery space and reinforced beams claimed by the '515 Patent. Photographs¹⁴ presented by Dr. Ahmadian are shown below in Figure 3, beside prior art and non-patent literature reviewed previously by the Examiner¹⁵.

49. To the extent that Dr. Ahmadian is accurate in his identification of elements in the photographs he uses shown in Figure 3, the same structures can be seen in photographs brought to the attention of the Examiner during prosecution.

50. As can be seen in Figure 3, the photographs relied upon by Dr. Ahmadian were the same or substantially the same as the photographs brought to the attention of the Examiner during the prosecution of the '515 Patent, yet the Examiner still found that claims of the '515 Patent were novel and nonobvious in view of the prior art. Dr. Ahmadian does not identify any specific remarks made

¹⁴ Ahmadian 048 Declaration at pp. 16-21, citing Ex. 1007, Ex. 1010, Ex. 1011, Ex. 1019, Ex. 1020, Ex. 1018, Ex. 1021, Ex. 1024.

¹⁵ Ex. 1002 at pp. 223, 233, 244.

by the Examiner during prosecution that would suggest the Examiner did not understand the photographs of the railcars from the prior art.



Figure 3: Comparison of photographs used and annotated by Dr. Ahmadian (top, red border) to photographs brought to the Examiner’s attention (bottom, blue border). Exponent has annotated the photographs presented to the Examiner using the same terminology for the same structures as used by Dr. Ahmadian. (*Annotation label for Marcroft Hopper Car has been cropped by Exponent for formatting.)

51. Therefore, as shown above, much of the prior art (and specific features of said prior art) used by Dr. Ahmadian is cumulative to features of the prior art specifically called out to the Examiner during prosecution. As stated above, Dr. Ahmadian provides no analysis (such as specific comments from the Examiner) which demonstrate that the Examiner misunderstood what they were looking at.

52. Dr. Ahmadian opines: “In my view, the ’515 Patent would not have been granted if the Examiner had been aware that slope-sheet support beams and open machinery spaces were old in 2009.”¹⁶ Dr. Ahmadian does not provide adequate support for this opinion.

53. For example, Dr. Ahmadian shows prior art which (he asserts) discloses the isolated limitations relating to open machinery spaces and slope-sheet support beams; however, he does not provide a complete analysis of the remaining limitations of the Challenged Claims reciting these features, nor of claims which do not include these features. This absence of this analysis is especially notable given that ’515 Patent recites over 40 claims, some of which have over 10-15 limitations. In other words, Dr. Ahmadian cannot opine that the entire ’515 Patent would have been disallowed based on his limited analysis of specific limitations,

¹⁶ Ahmadian 048 Declaration at ¶29.

whereas the Examiner would have presumably based any decision on allowability on the entire set of limitations and claims.

54. I reserve the right to supplement or modify this declaration should additional information or materials be provided to me.

Executed in Chicago, Illinois on August 18, 2025.

A handwritten signature in black ink, appearing to read "Mark J. Viz", with a long horizontal line extending to the right from the end of the signature.

Mark J. Viz, Ph.D., P.E.



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Engineering & Scientific Consulting

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Professional Profile

Dr. Viz specializes in performance evaluation and mechanical analysis of railcar and aircraft structures. He also specializes in risk, reliability, and mechanical integrity assessments of a variety of process plant equipment such as pressure vessels and tanks, and certain types of transportation vessels including railcar tanks, intermodal vehicles, and over-the-road tank trailers.

Dr. Viz also has experience in component life reliability assessments, “repair or replace” risk decisions, and statistical analysis of in-service component performance. Other areas of Dr. Viz’s specific academic expertise include nonlinear finite element analysis, metal and composite material testing, fatigue and fracture mechanics, and statistical data reduction methods. He has investigated and/or consulted in matters involving railcar derailments, tank car ruptures, releases of hazardous materials in transportation, coal mining haulage accidents, rotor failures, bus rollovers, pressure vessel explosions, and other industrial accidents.

Given his expertise in engineering mechanics, Dr. Viz also performs engineering evaluations and analyses involving the mechanical performance of a variety of machines and products. Some of these devices include elements of cranes and lifting devices (e.g., wire rope failures, hydraulic and valve failures), elements of elevators, a variety of industrial machines (e.g., printing equipment, CNC machine tools, pumps, compressors), certain aspects of machine guarding and lock-out/tag-out procedures, and specialized evaluations of consumer products. Dr. Viz’s involvement in these types of cases typically involves the synthesis and execution of a variety of engineering mechanics calculations and analyses.

Prior to joining Exponent, Dr. Viz was a Product Development Engineer at the GATX Rail Corporation. His responsibilities included new rail car design and development, budget and schedule management, and sales and marketing support. Dr. Viz was also heavily involved in the regulatory environment concerning the transportation of hazardous materials in rail tank cars. Dr. Viz also served as a Specialist Engineer in the Structural Damage Technology group at the Boeing Company. He was responsible for the durability and damage tolerance analysis and testing of a wide variety of aircraft structures from wing and fuselage sections to individual fasteners. He has also taught probability, statistics, and mechanics of materials at the college level.

Academic Credentials & Professional Honors

Ph.D., Theoretical and Applied Mechanics, Cornell University, 1996

B.S., Aeronautics and Astronautics, Massachusetts Institute of Technology (MIT), 1990

Licenses and Certifications

Professional Engineer, Illinois, #62062247

Mining Safety and Health Administration (MSHA) Part 46 and Part 48 trained

Respirator and SCBA fit-tested and trained

Prior Experience

Director of Applied Mechanics, Packer Engineering, 2001-2003

Product Development Engineer, GATX Rail, 1999-2001

Specialist Engineer - Structural Damage Tolerance, Boeing, 1997-1999

Professional Affiliations

American Society of Mechanical Engineers—ASME (member)

American Institute of Aeronautics and Astronautics—AIAA (member)

Society for Risk Analysis—SRA (member)

Publications

Viz MJ. Failure analysis in the design cycle. Presented as a guest lecture for CIV-ENG 395-0 Engineering Forensics course, Evanston, IL, April 16, 2008.

Viz MJ, Momsen RH. Reliability and risk management of railcar truck castings in high mileage, high gross rail load service: A case study. Presented at the Annual Meeting of the Society for Risk Analysis, Baltimore, MD, December 5, 2006.

Morrison III DR, Ogle RA, Viz MJ, Carpenter AR, Su YS. Investigating chemical process accidents: Examples of good practices. Process Safety Progress 2006; 25:71-77, March.

Ogle RA, Morrison III DR, Viz MJ. Emergency response to a non-collision HAZMAT release from a railcar. Process Safety Progress 2005; 24:81-85, June.

Morrison III DR, Ogle RA, Viz MJ, Carpenter AR, Su YS. Investigating chemical process accidents: Examples of good practices. Presented at the Process Plant Safety Symposium, 2005 Spring National Meeting, American Institute of Chemical Engineers, Atlanta, GA, April 11-13, 2005.

Zehnder AT, Viz MJ. Fracture mechanics of thin plates and shells under combined membrane, bending, and twisting loads. Applied Mechanics Reviews 2005; 58:37-48, January.

Ogle RA, Viz MJ, Morrison III DR, Carpenter AR. Bulk transportation of hazardous materials by rail: Lessons learned from non-collision accidents. Presented at the 2004 Annual Symposium, Mary Kay O'Connor Process Safety Center, Texas A&M University, College Station, TX, October 2004.

Ogle RA, Morrison III DR, Viz MJ. Emergency response to a non-collision HAZMAT release from a railcar. Presented at the 19th Annual CCPS International Conference, Emergency Planning: Preparedness, Prevention and Response, American Institute of Chemical Engineers, Orlando, FL, June 2004.

Ogle RA, Viz MJ, Carpenter AR. Lessons learned from HAZMAT accident investigations. Presented at the

17th Annual AAR/BOE Hazardous Materials Seminar, Association of American Railroads/Bureau of Explosives, Houston, TX, May 2004.

Zehnder AT, Potdar YK, Viz MJ. Fatigue fracture in plates in tension and out-of-plane shear. *Fatigue and Fracture of Engineering Materials and Structures* 2000; 23:403-415.

Viz MJ. Fatigue fracture of 2024-T3 aluminum plates under in-plane symmetric and out-of-plane anti-symmetric mixed-mode deformations. Ph.D. Dissertation, Cornell University, 1996.

Potyondy DO, Viz MJ, Zehnder AT, Rankin CC, Riks E. Computation of membrane and bending stress intensity factors for thin cracked plates. *International Journal of Fracture* 1995; 72:21-38.

Viz MJ, Zehnder AT, Bamford JD. Fatigue fracture of thin plates under tensile and transverse shear stresses. *Fracture Mechanics, 26th Volume. ASTM STP 1256*, Reuter WG, Underwood JH, and Newman JC (eds), American Society for Testing and Materials, pp. 631-651, 1995.

Viz MJ, Zehnder AT. Fatigue crack growth in 2024-T3 aluminum under tensile and transverse shear stresses. *Proceedings, FAA/NASA International Symposium on Advanced Structural Integrity Methods for Airframe Durability and Damage Tolerance. NASA CP-3271*, pp. 891-910, 1992

Viz MJ, Zehnder AT, Ingraffea AR. Fatigue fracture in thin plates subjected to tensile and shearing loads: Crack tip fields, j integral and preliminary experimental results. *Proceedings, 7th International Congress on Experimental Mechanics, Society of Experimental Mechanics*; 1992: 44-50.

Project Experience

Directed, managed, and performed numerous rail tank car failure cause and origin investigations, most involving the release of hazardous materials. Projects typically involve extensive field investigations, including confined space entry of tank cars, mechanical and metallurgical analysis, mechanical integrity assessments, non-destructive examination, and sample collection.

Managed and performed numerous rail tank car loading and unloading incident investigations, often involving worker injuries or fatalities.

Investigated the unintentional uncoupling of mining service cars in a Virginia underground coal mine. The uncoupling resulted in a runaway car situation that led to the fatalities of two miners. Project work included incident modeling and reconstruction, performance calculations, and inspections.

Actively directing a lengthy study involving the investigation of railroad track ballast fouling and coal dust mitigation evaluations for coal transport out of the Powder River Basin in Wyoming. Project work includes measurement of fugitive dust emissions, static and dynamic (over-the-road) monitoring of dust loss from railcars, cost analysis for proposed mitigation techniques, and analysis of health and safety issues.

Managed and performed projects for multiple clients involving the mechanical integrity assessment and fitness-for-service evaluations of railcar truck castings (bolsters and side frames). These projects have typically involved the development and implementation of non-destructive examination procedures for both on-car and off-car examination, cyclic fatigue testing, mechanical and metallurgical testing, engineering evaluation of test results with respect to mechanical performance, and development of engineering plans to manage fleet components over the projected remaining useful service life. Have presented findings to the Association of American Railroads (AAR) for multiple clients.

Performed risk, reliability, and mechanical integrity assessments for a variety of process plant equipment including piping and tanks. Select assignments have involved flash train tanks at a bauxite to alumina processing plant, piping and vessels at a district cooling ammonia refrigeration plant, liquid carbon dioxide

storage tanks, baghouse equipment at cement kilns, and a variety of other equipment subject to OSHA PSM (process safety management) and EPA RMP (risk management plan) regulations.

Directed, managed, and performed numerous incidents involving the release of hazardous materials from transportation vessels, including rail tank cars, intermodal containers, and over-the-road tank trailers. Projects typically have involved extensive field investigations, including confined space entry of tank cars, mechanical and metallurgical analysis, mechanical integrity assessments, non-destructive examination, and sample collection.

Performed design evaluation and risk assessment of a manufacturer's new product offering that provides GPS location and condition monitoring of railcars while in-transit. System includes remote sensing, GPS and satellite uplink equipment, all packaged in a field-hardened package. Project work included FMEA (failure modes and effects analysis), reliability modeling, and predictions for warranty structuring and material compatibility analyses.

Performed mechanical performance and stress analysis calculations for a fleet of coal railcars that exhibited top chord and side sheet buckling failures. The project involved performing detailed field inspections of the damaged railcars, finite element analysis (FEA) of the cars, and a determination of the in-service loads that were needed to produce the exhibited damage.

Managed and performed a collision damage assessment and engineering repair oversight for a major accident involving a monorail train in the Pacific northwest. Project work included responsibility for oversight of repair plans, mechanical contractor selection and qualification review, quality assurance oversight, schedule analysis, and general technical consulting. Project involved extensive field work and multiple presentations to technical staff and insurance adjusters.

Performed numerous mechanical performance analyses/evaluations for a variety of machines and products including:

- Manufacturing machinery (printing and binding equipment, forming and cutting machines, product conveying equipment, certain types of CNC machine tools)
- Elements of machine guarding and lock-out/tag-out procedures (drum foamers, printing and binding equipment, packaging equipment)
- Elements of crane and lifting devices (e.g., scissor lifts), including wire rope failures, hydraulic cylinder failures, holding valve failures, and stability issues
- Elements of consumer product performance including structural performance and mechanical response.

Additional Education & Training

Completion of Highway-Rail Grade Crossing Safety course offered through the University of Wisconsin - Madison, 12-13 November 2019

Completion of Aircraft Accident Investigation Orientation for Aviation Professionals course offered by the NTSB, 27-28 October 2021

Completion of Accident Investigation Orientation for Rail Professionals course offered by the NTSB, 8-10 November 2021

Completion of Ethics for Engineers course offered by ASME, 5 January 2022

Mark J. Viz, Ph.D., P.E. – Testimony List (eight years prior to 18 August 2025)

DEPOSITIONS

1. George Holloway and Georgia Holloway v. Harbor Freight Tools USA, Inc., United States District Court for the Western District of Missouri, Southwestern Division, No. 3:15-CV-05047-DPR, 28 March 2017.
2. Milton Banks, Jr. v. Hiab USA, Inc. and Deep South Equipment Co., United States District Court for the Middle District of Louisiana, No. 3:15-CV-00263, 6 April 2017.
3. George Holloway and Georgia Holloway v. Harbor Freight Tools USA, Inc., United States District Court for the Western District of Missouri, Southwestern Division, No. 3:15-CV-05047-DPR, 8 May 2017, (second deposition for this matter).
4. Colette Carpenter, individually and as Administrator of the Estate of Clayton O. Carpenter, deceased; Jon Ternstrom, an individual; Maria Ternstrom, an individual; Cameron Witzler, an individual; and Michelle Witzler, an individual v. Sikorsky Aircraft Corporation, a Delaware corporation; Sikorsky Support Services, Inc. dba Sikorsky Aerospace Maintenance, a Delaware Corporation, United States District Court, District of Connecticut, No. 3:15-CV-01582-JBA, 20 December 2017.
5. Matthew Mosley v. Johnny Scoggins; Pureenergy Operating Services, LLC; StoneAge, Inc.; Jetstream of Houston, LLP; Federal Signal Corp., State Court of Fulton County, State of Georgia, No. 15EV003510, 25 January 2018.
6. Ruben Lopez and Carmen Lopez, Husband and Wife, v. DMP Corporation, Alphatronics Engineering, Alphatek of Texas, Inc., Illinois Crane, Inc., and All-Brite Anodizing Co., Circuit Court of Cook County, Illinois, County Department, Law Division, No. 14 L 7532, 8 February 2018.
7. Timothy Juve Jr., by and through his legal guardian, Timothy Juve, Sr., v. Premier Tech Technologies, Ltd., f/k/a Premier Tech Ltd., d/b/a Premier Tech, Premier Tech Chronos, Premier Tech, Inc., and Premier Tech Horticulture, v. Pine Products, Inc., United States District Court, District of Minnesota, Court File No. 0:17-CV-04545 (DWF/LIB), 12 July 2019.
8. Martin McCallion v. Michael Nemlich, Circuit Court of Cook County, Illinois, County Department, Law Division, No. 2017 L 001387, 16 July 2019.
9. Emma Schmidt and Hallie Meyer v. Conagra Foods, Inc., United States District Court, District of Connecticut, No. 3:14-CV-01816 (SRU), 26 July 2019.

10. Southern California Regional Rail Authority v. Hyundai Rotem Company, Raul V. Bravo + Associates, Inc., and DOES 1 through 10, United States District Court, Central District of California, No. 16-cv-08042-JAK (JEMx), 28 August 2019.
11. Korean Air Lines Co., Ltd. (Claimant) v. Greenpoint Technologies, Inc. and Aviation Technical Services (Respondents), International Centre for Dispute Resolution, No. 01-19-0001-7823, 15 December 2020.
12. GATX Corporation v. Georgia Power Co., United States District Court, Northern District of Georgia, Atlanta Division, No. 1:19-CV-04790-AT, 24 June 2021.
13. Metrolink Train Accident Cases, Case No. 4889, Superior Court of the State of California, County of Los Angeles, Central District, 17 May 2022.
14. Jennifer Barr, as Personal Representative of the Estate of Matthew Barr, Deceased, v. Walter Matisiak, James Blase, Progress Rail Locomotive, Inc., Progress Rail Services Corporation, Progress Rail Welding Corporation, Progress Rail Equipment Leasing Corporation, and Caterpillar, Inc., Circuit Court of Cook County, Illinois, County Department, Law Division, No. 2021 L 007441, 14 March 2024.
15. Kyle Phillips v. Pioneer Pipe, Inc. and Constellium Rolled Products Ravenswood, LLC, Circuit Court of Jackson County, West Virginia, Case No. 23-C-39, 11 July 2024 (first).
16. Kyle Phillips v. Pioneer Pipe, Inc. and Constellium Rolled Products Ravenswood, LLC, Circuit Court of Jackson County, West Virginia, Case No. 23-C-39, 30 August 2024 (second).
17. Dalton Merritt v. BASF Corporation and GATX Corporation, United States District Court, Southern District of Ohio, Cincinnati Division, Case No. 1:21-cv-00067-DRC, 4 April 2025.
18. Rodney Romans and Regina Romans v. SWVA, Inc. d/b/a Steel of West Virginia, Inc., United States District Court, Southern District of West Virginia, Huntington Division, Case No. 3:24-cv-00301-RCC, 25 July 2025.

TRIAL/ ARBITRATION

1. Martin McCallion v. Michael Nemlich, Circuit Court of Cook County, Illinois, County Department, Law Division, No. 2017 L 001387, *jury trial*, 29 July 2019.
2. Airbus SAS (France), Airbus Operations GmbH (Germany), Airbus Operations SL (Spain), Airbus Operations SAS (France), Airbus Operations Limited (United Kingdom), Airbus Defence and Space GmbH (Germany) (Claimants) v. Howmet Aerospace Inc. (USA), Howmet Europe SARL (Switzerland), Arconic Manufacturing (GB) Limited (United Kingdom) (Respondents) AND Airbus Defence and Space GmbH (Germany) (Claimant)

v. Howmet Aerospace Inc. (USA) and Arconic Manufacturing (GB) Limited (United Kingdom) (Respondents), International Court of Arbitration, International Chamber of Commerce, ICC Case Nos. 23279/FS and 23281/FS, respectively, *three-member panel*, London, 26 October – 13 November 2020.

3. Korean Air Lines Co., Ltd. (Claimant) v. Greenpoint Technologies, Inc. and Aviation Technical Services (Respondents), International Centre for Dispute Resolution, No. 01-19-0001-7823, *three-member panel*, virtual hearing, 21 January 2021.