

**UNITED STATES DISTRICT COURT  
EASTERN DISTRICT OF PENNSYLVANIA**

|                           |   |                               |
|---------------------------|---|-------------------------------|
| -----                     | X |                               |
| RAILWARE, INC.,           | : |                               |
| Plaintiff,                | : |                               |
| -against-                 | : | Case No.: 2:24-cv-02963 (JMY) |
| SOUTHEASTERN PENNSYLVANIA | : |                               |
| TRANSPORTATION AUTHORITY, | : | JURY TRIAL DEMANDED           |
| Defendant.                | : |                               |
|                           | : |                               |
| -----                     | X |                               |

**DECLARATION OF MEHDI AHMADIAN, Ph.D. IN SUPPORT  
OF RAILWARE INC.’S CLAIM CONSTRUCTION SUBMISSIONS**

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I, Mehdi Ahmadian, Ph.D., hereby declare as follows:

**I. INTRODUCTION AND OVERVIEW**

1. I have been retained in connection with the above-referenced matter on behalf of Railware, Inc. (“Railware”). I have been asked by counsel for Railware to review U.S. Patent Nos. 9,517,782 (the “’782 patent”), RE47,835 (the “’835 patent”), and RE49,115 (the “’115 patent”) (collectively, the “Asserted Patents”), as well as certain activities of Southeastern Pennsylvania Transportation Authority (“SEPTA” or “Defendant”) (collectively with Railware, the “Parties”) related to railway control and railway safety technology.

2. If asked at hearing or trial, I am prepared to testify regarding matters I discuss in this Declaration. I also reserve the right to give opinions on facts and other matters arising subsequent to this Declaration, including rebuttal to any matter raised by the Parties or their experts, either prior to or during any hearing or trial on this action. I expect to offer testimony and/or opinions to assist the Parties and the Court, including about the technology at issue in this case and/or of the Asserted Patents and/or the meanings of the claim terms to a person of ordinary skill in the art (“POSITA”). Such testimony and/or opinions could also include an explanation of the meaning of the claim terms in the context of the technology at issue in this case and/or the subject matter of the Asserted Patents, a description of the state of the technology relating to the claimed inventions prior to, at the time of, and after the filings of the applications for the Asserted Patents, a description of the qualifications of a person of ordinary skill in the art at or around the time of the filing of the applications for the Asserted Patents, and/or how a person of ordinary skill in the art would interpret and/or understand the claim terms at or around the time of the filings of the applications for the Asserted Patents.

## II. QUALIFICATIONS

3. A copy of my curriculum vitae is attached hereto as **Exhibit 1**. It includes details of my educational, professional, research, and employment credentials. I may testify with respect to my responsibilities and experiences relating to the information listed in **Exhibit 1**. A more condensed summary, which focuses on my experience with railroad safety technology, appears below.

4. I am currently employed as J. Bernard Jones Chair of Mechanical Engineering at Virginia Polytechnic Institute and State University (“Virginia Tech”). I also hold the position of Director of the Center for Vehicle Systems and Safety (CVeSS), and the Railway Technologies Laboratory (RTL) at Virginia Tech, and am the founding director of CVeSS, RTL, Virginia Institute for Performance Engineering and Research (VIPER), and the Advanced Vehicle Dynamics Laboratory (AVDL).

5. To summarize my qualifications, I hold four degrees, three of which are in the field of Mechanical Engineering. I obtained my Doctor of Philosophy degree in Mechanical Engineering from the State University of New York at Buffalo in 1984. I obtained my Master of Business Administration (MBA) degree from Pennsylvania State University – Behrend College in 1994. I obtained my Master of Science (MS) degree in Mechanical Engineering from the State University of New York at Buffalo in 1982. I obtained my Bachelor of Science (BS) degree in Mechanical Engineering from the State University of New York at Buffalo in 1980. I worked at General Electric Transportation Systems from 1993-1995 before joining Virginia Tech as an assistant professor in 1995. Since joining Virginia Tech, a substantial portion of my research has been directed to the railroad industry and railroad systems. This research is evident in the hundreds of publications, books, book chapters, and presentations listed in my CV.

6. I have over 25 years of experience as an independent consultant on matters related to product liability and patent litigation cases involving a broad spectrum of passenger cars, commercial vehicles, and railway systems. I have also assisted clients on issues related to vehicle dynamics and handling, electromechanical systems, braking, rollover stability, and active safety systems. I have broad technical experience related to advanced vehicular systems for railway systems and heavy vehicles, including railway control and railway safety systems.

7. I have received several professional awards throughout my career, including most recently being awarded the 2024 Society of Automotive Engineers (SAE) Medal of Honor (the highest recognition of lifetime achievement bestowed on one SAE member per year) and the 2023 Virginia Tech Alumni Award for Research Excellence (regarded as the most prestigious Virginia Tech award for significant life-long research) for my research contributions.

8. I am an inventor on at least the following currently-issued patents:

- Kinetic Energy-Harvesting Device for Powering and Charging Railway and Other Applications, U.S. Patent 12,088,180, September 10, 2024.
- Dual-action rotary dynamic load stabilization pneumatic valve system, U.S. Patent 9,975,392, May 22, 2018.
- A Compact Lightweight Double-piston Magnetorheological (MR) Damper with large adjustable dynamics force, Chinese Patent # ZL 201110420869.8, December 25, 2013.
- A Compact Lightweight Double-piston Magnetorheological (MR) Damper, Chinese Patent # ZL 201110418073.9, January 9, 2014.
- Doppler Sensor for the Derivation of Torsional Slip, Friction, and Related Parameters, U.S. Patent 8,294,883, October 23, 2012.
- Doppler Sensor for the Derivation of Torsional Slip, Friction and Related Parameters, U.S. Patent 7,705,972, April 27, 2010.
- No Jerk Semiactive Suspension System, U.S. Patent 6,115,658, September 5, 2000.
- No Jerk Semi-active Skyhook Control Methods and Apparatus, Canadian Patent Application, No. 09/225,147, December 17, 1999.

- Self-Steering Locomotive Truck, U.S. Patent 6,006,674, December 28, 1999.
- Self-Steering Locomotive Truck, U.S. Patent 5,746,135, May 5, 1998.
- Self-Steering Locomotive Truck, U.S. Patent 5,613,444, March 25, 1997.
- Electromagnetically Operated Pneumatic Valve Assembly for an Electrical Contactor Actuator, U.S. Patent 5,409,036, April 25, 1995.

9. I am the author of numerous publications related to advanced vehicular systems for railway and heavy vehicles, as further detailed in my CV.

10. I am being compensated at a rate of \$500 per hour for my time in this case. The compensation received from this case is not contingent upon my opinions or performance, the outcome of the case, or any issues involved in or related to the case.

### **III. SCOPE OF OPINIONS**

11. In rendering my opinions, I have reviewed and considered materials listed in **Exhibit 2** attached to this Declaration, in whole or in part, in addition to the materials expressly referenced herein. This materials list may be supplemented should any additional materials be produced, provided or identified in this matter.

12. At the present time, I expect to testify as to Railware's claim construction submissions regarding the Asserted Patents. I expect to offer testimony and/or opinions to assist the Parties and the Court, including about the technology at issue in this case and/or of the Asserted Patents and/or the meanings of the claim terms to a person of ordinary skill in the art. Such testimony and/or opinions could also include an explanation of the meaning of the claim terms in the context of the technology at issue in this case and/or the subject matter of the Asserted Patents, a description of the state of the technology relating to the claimed inventions prior to, at the time of, and after the filings of the applications for the Asserted Patents, a description of the qualifications of a person of ordinary skill in the art at or around the time of

the filing of the applications for the Asserted Patents, and/or how a person of ordinary skill in the art would interpret and/or understand the claim terms at or around the time of the filings of the applications for the Asserted Patents. I also expect to testify as to the state of the relevant art relating to railway control, railway safety technology, the state of the technology relating to the claimed inventions prior to, at the time of, and after the applications for the Asserted Patents were filed. I understand that if the Defendant is permitted by the Court to contest the validity of the Asserted Patents at this stage of the case, I may also testify regarding those issues.

13. The opinions stated in this Declaration are based on information currently available to me. I reserve the right to continue my investigation and study, which may include review of documents, declarations, expert reports, or other information that may yet to be produced, provided, or identified, as well as any testimony from depositions or hearings that may occur in this case. Therefore, I reserve the right to supplement my opinions in response to any additional information that becomes available to me, any matters raised by the Parties, and/or other opinions provided by the Parties' expert(s).

#### **IV. BACKGROUND INFORMATION ON RAILWAY CONTROL AND RAILWAY SAFETY SYSTEMS**

14. Many modern railroads control the movement of trains through a railway network using a centralized system known as centralized traffic control (CTC). CTC systems are used for monitoring, tracking, and operating trains traversing tracks throughout a railway network. CTCs are controlled by dispatchers. CTC systems typically include control consoles, which may take a variety of forms and have a variety of back-end and front-end components, that display various pieces of information, such as track conditions, train traffic, and scheduling. Through the control console, the dispatcher can view and control the movement of trains throughout the railway

network. Movement of trains within a sector of track is typically governed by interlocking signals, which are controlled by the dispatcher via a control console. Shown below is an example of a control center where dispatchers control train traffic using a CTC system<sup>1</sup>:



15. When railway tracks require maintenance, railway field workers must physically enter the track area to perform the necessary maintenance, as shown below<sup>2</sup>:

<sup>1</sup> Pratima Bhattacharyya, Reporter's Notebook: Taking a look at SEPTA control, DAILY PENNSYLVANIAN (Oct. 5, 2010), [https://www.thedp.com/article/2010/10/reporters\\_notebook\\_taking\\_a\\_look\\_at\\_septa\\_control](https://www.thedp.com/article/2010/10/reporters_notebook_taking_a_look_at_septa_control).

<sup>2</sup> <https://x.com/SEPTAPHILLY/status/1250759355416432640/photo/1>.



16. Entering an active track area poses grave risks to the railway field workers, who are defenseless against train traffic. Over time, various safety systems were developed, such as alarm systems that alerted railway workers to incoming train traffic, ideally allowing them time to vacate the track area before the train approached. These systems proved inadequate in protecting railway field workers.

17. As one example, using the CTC system, the dispatcher could remotely control the tracks used by trains. *See* '782 patent at 1:48-62. This remote control enabled the remote dispatcher to “block” sections of track and to temporarily reroute trains away from blocked track sections that were being worked on by railway field workers. *Id.* at 5:50-54. But these systems suffered from certain drawbacks. *Id.* at 2:27-37. Specifically, the blocking of track sections was controlled entirely by the remote dispatcher. *Id.* at 1:46-47. Human error could and did lead to blocks being removed prematurely, errantly, or mistakenly by the dispatcher, such as either because the dispatcher falsely believed that the work was complete, or because the dispatcher

intended to remove a different block and mistakenly removed a block on a track section where railway field workers were still working. *See id.* at 2:27-37.

18. Other examples of inadequate safety precautions include NORAC's Operating Rules, including the "Form D" control system. NORAC's Operating Rules have existed since the mid-1980's and "Form D" has been an integral part of NORAC's Operating Rules since at least the early 1990's. A "Form D" contains "written authorization(s), restriction(s), or instruction(s) issued by the Dispatcher to specified individuals." NORAC Operating Rules, 6th ed., 6 (Jan. 1, 1997). These instructions can include a "Form D Line 4," which is used when "removing a track from service." *Id.* at 48. The Operating Rules require the dispatcher to determine that "controlled signals leading to the affected track are in Stop position" prior to issuing a "Form D Line 4." *Id.* Similarly, prior to releasing a "Form D," the dispatcher ostensibly must take certain actions, including "contact the addressee(s) and state his intent to cancel the Form D . . . , state the Form D number and, date, the cancellation time and date, and his initials, [and] ensure that all cancellation information is repeated [by the addressee] correctly." *Id.* at 66. Despite these protections, human errors and accidents continued to occur, resulting in railway worker injuries and fatalities and other damages, such as those recognized in the Federal Railroad Administration's (FRA) Final Rule and in the Asserted Patents. Such errors included mistakes such as where "the train dispatchers did not maintain the required blocking devices." Federal Railroad Administration, *Railroad Workplace Safety; Roadway Worker Protection Miscellaneous Revisions (RRR)* at 75-76 (May 26, 2016).

## V. THE ASSERTED PATENTS

### A. U.S. Patent No. 9,517,782

19. I have reviewed the '782 patent entitled "Tools for Railway Traffic Control" and the related prosecution and *inter partes* review ("IPR") history. I understand the '782 patent was duly and legally issued on December 13, 2016. I understand that the '782 patent is entitled to a priority date of at least October 21, 2013.

20. The '782 patent generally relates to methods, tools and systems provided to control traffic over a railway track section when a railway worker is working on or near the track section. *See, e.g.*, '782 patent, Abstract.

21. The '782 patent is directed "to railway traffic control, and more specifically, a system, apparatus, and method for railway traffic control to address concerns for safety of railway workers working on or near railroad tracks." '782 patent at 1:14-17. The '782 patent describes prior safety features present in railway systems and notes that despite these preexisting safety features, numerous "roadway worker accidents" resulted in the death of workers "while attending to tasks . . . on or near track." *Id.* at 2:27-37.

22. According to the '782 patent, in a standard railway system, "[i]nterlocking signals govern movement within a sector controlled by an interlock." *Id.* at 1:27-28. "[A] track may be divided into sections," and an "interlocking signal" is exhibited at the entrance to each track section. *Id.* at 1:28-32. "[T]he interlocking signal displays a color system which instructs the conductor of the train, or the train operating by automated response, how to move through the upcoming section of track." *Id.* at 1:32-35.

23. The '782 patent further explains that a centralized traffic control (CTC) system may be used "to place a block on one or more specified track sections to permit a railway field

worker to enter the track sections while blocking railway traffic.” *Id.* at 2:47-57. “[O]nce a block is placed, no train can traverse the blocked section of rail,” and “maintenance workers and railway personnel can travel, inspect and work on the rails without the danger of oncoming train traffic.” *Id.* at 5:43-44, 5:48-50; *see also id.* at 5:44-48 (stating that an interlock can “output a STOP signal, therefore, stopping any train traffic within the rails controlled by that interlock”), 5:50-54 (stating that “[t]rains that are scheduled to traverse said blocked tracks either come to a complete stop, electronically or mechanically, before passing the interlock or are rerouted using tracks that are not in a blocked state”). When “the block is removed,” the result is that train “traffic to that section of rail is then allowed.” *Id.* at 7:19-20. Thus, an errant, mistaken, or premature removal or release of the block could endanger a railway field worker still present in the specified track section. *Id.* at 2:27-37.

24. The ’782 patent further explains that “all of the interlocks” within a railway system may be controlled electronically through “a centralized traffic control (CTC).” *Id.* at 1:40-44. “The CTC is controlled by a single person known as a train dispatcher.” *Id.* at 1:46-47. “Information regarding track conditions, train traffic, scheduling, etc.” is displayed to the dispatcher “on a control console,” and “[t]hrough the control console, the dispatcher has control of each interlock signal.” *Id.* at 1:48-59. Thus, the dispatcher is responsible for both blocking a specified railway section and for removing/releasing this block from the railway section. *Id.* at 1:40-47, 2:47-57, 5:44-50, 7:19-20. And, as discussed above, an errant, mistaken or premature removal/release of the block would endanger a railway field worker still present in the specified

section of track. *Id.* at 2:27–37. Shown below is an example of a control center where dispatchers control train traffic using a CTC system<sup>3</sup>:



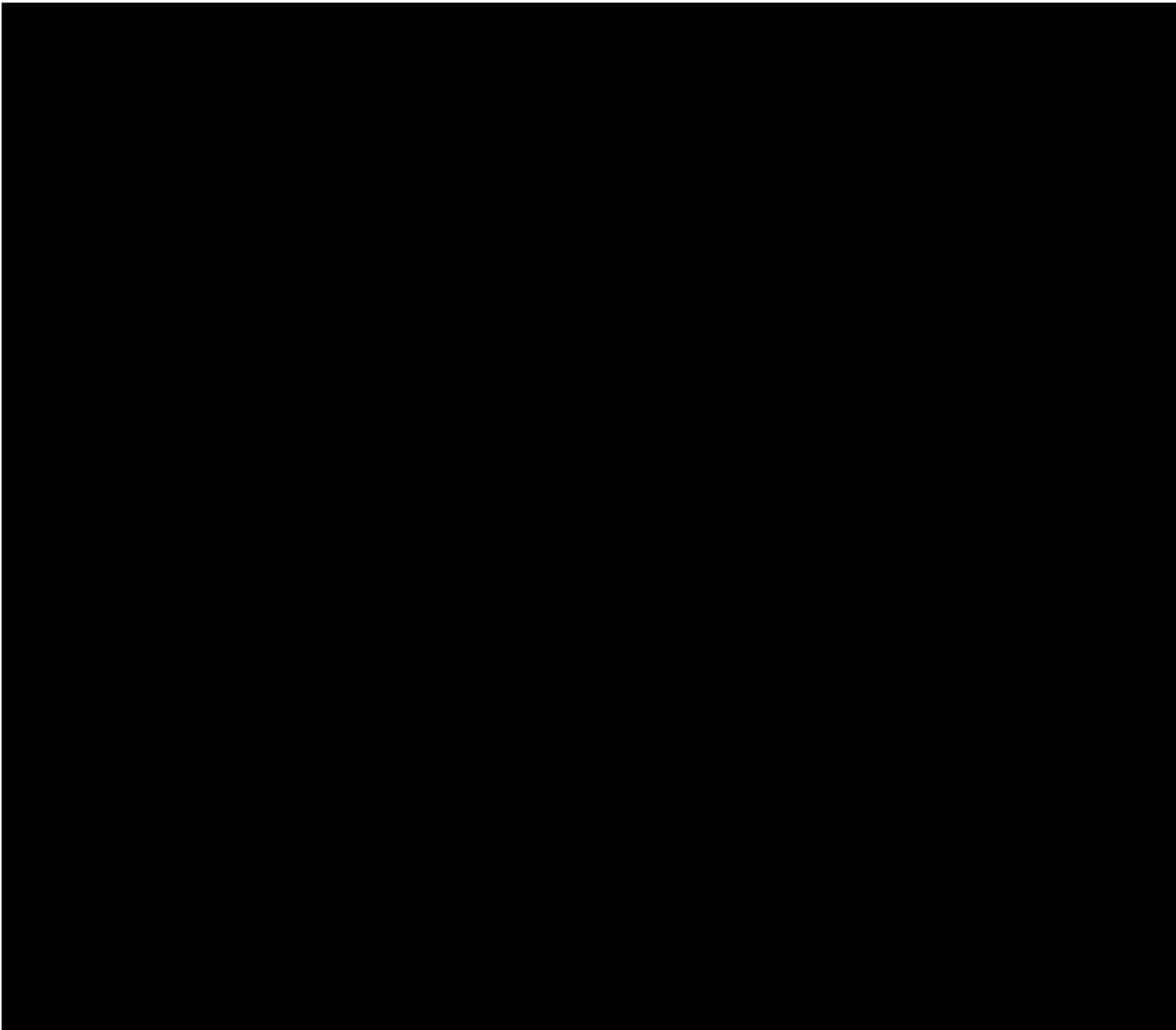
25. The '782 patent identifies as a fundamental goal of the inventions, the provision of systems, tools and methods that assure “the railway worker has more control over the traffic through the rail block in which the worker is working, and fatal on-track accidents can be reduced.” *Id.* at 11:12-14. To accomplish this goal, the '782 patent requires “generating a removal code and transmitting the removal code to the electronic contact address of the railway field worker, and permitting the block to the track sections to be removed only upon entry of the removal code in the centralized railway control system.” *Id.* at 2:47-57. Each of the claims of the

<sup>3</sup> Pratima Bhattacharyya, Reporter’s Notebook: Taking a look at SEPTA control, DAILY PENNSYLVANIAN (Oct. 5, 2010), [https://www.thedp.com/article/2010/10/reporters\\_notebook\\_taking\\_a\\_look\\_at\\_septa\\_control](https://www.thedp.com/article/2010/10/reporters_notebook_taking_a_look_at_septa_control).

Asserted Patents requires an unconventional network architecture for generating, transmitting, receiving and using a “removal code” or “release code” or “secret code” that is transmitted to the railway field worker that is working on the track, but otherwise remains “secret” from the dispatcher.

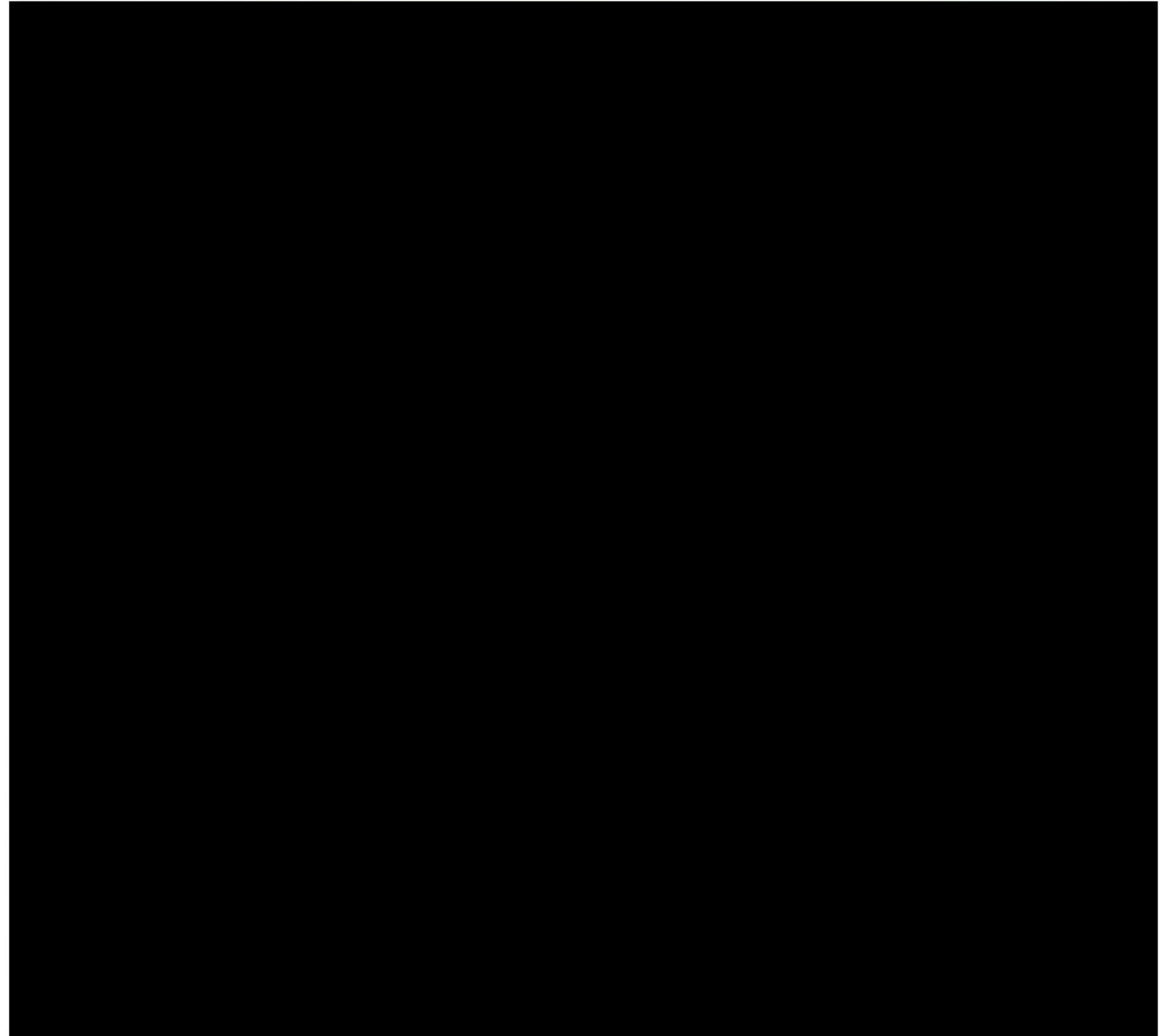
26. The '782 patent describes the inventions in further detail, explaining that, first, the dispatcher places a block on a specified rail section by inputting corresponding information into the control console via a user interface. *Id.* at 7:39-47. The image above shows an example of dispatchers at work controlling trains, including placing blocks.

27. As one example, the image below shows an example from Railware’s Dispatch X system of a user interface through which the dispatcher can place a block:



RAILWARE\_(SEPTA)\_0034115.

28. As another example, the image below shows an example from SEPTA's system of a user interface through which the dispatcher can place a block.

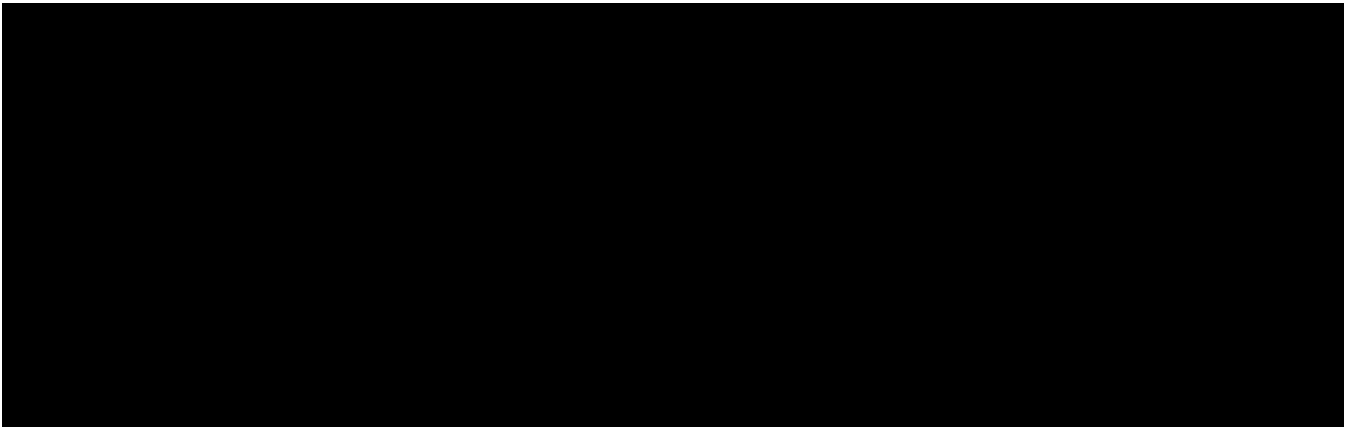


SEPTA\_0004445.

29. “Once the block is put into place,” the railway traffic control terminal generates a removal or release code, saves this code to an internal storage, and “sends the code to the maintenance worker designated for track work.” *Id.* at 7:50-55; *see also id.* at 7:1-3 (stating “the railway traffic control apparatus . . . may then generate a release code and save it to an internal storage”).

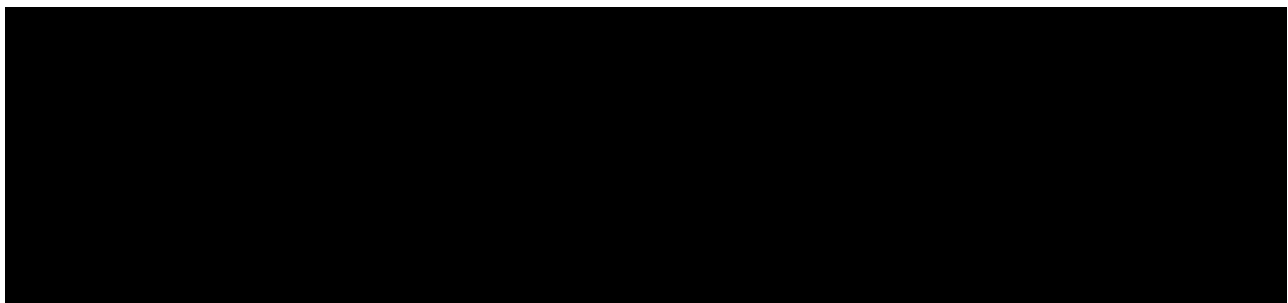
30. Information corresponding to the now-blocked railway section is displayed to the dispatcher on the user interface, but this displayed information does not include the computer-generated removal or release code. *See, e.g., id.*, Fig. 6; *see also id.* at 5:58-64, 7:4-10, 7:59-61, 10:23-36.

31. Below is an example from Railware's Dispatch X of the dispatcher user interface showing the active blocks, but not showing any release codes.



RAILWARE\_(SEPTA)\_0034128.

32. As another example, this aspect is illustrated in SEPTA's implementation of the blocking dialog box below, which shows the active blocks, but not showing any release codes:



SEPTA\_0004445.

33. The '782 patent states that "where there are multiple maintenance workers assigned to a certain track section, there may be provided one release code to one, multiple or all

of maintenance workers assigned.” *Id.* at 8:32-35; *see also id.* at 8:35-39 (stating that the “train traffic controller may input that the release code be specified to one maintenance worker, preferably a supervisor or foreman, to multiple maintenance workers or to all of the maintenance workers assigned to work on a given track section”), 8:39-45 (stating “where there are multiple workers assigned for a certain track section, there may be provided multiple unique release codes which would then all be required to be input into the train traffic control terminal . . . by the train traffic controller in order to be able to remove blocks on certain track sections”).

34. The dispatcher “may not remove” the block on the specified track section “without the input of the release code.” *Id.* at 7:55-59; *see also id.* at 11:1-5 (“Once a block has been placed, the interlock remains in a blocked s[t]ate, until the maintenance worker supplies the release code” to the dispatcher). Thus, “[s]o long as the block is in place, [the] maintenance worker can perform on-track work, without interference of oncoming train traffic.” *Id.* at 11:5-7.

35. “After the maintenance worker finishes the assigned work and is clear of the train tracks, he/she may then supply the interlock control system with the release code, and the interlock control system in turn can release the interlock over the block.” *Id.* at 7:7-11.

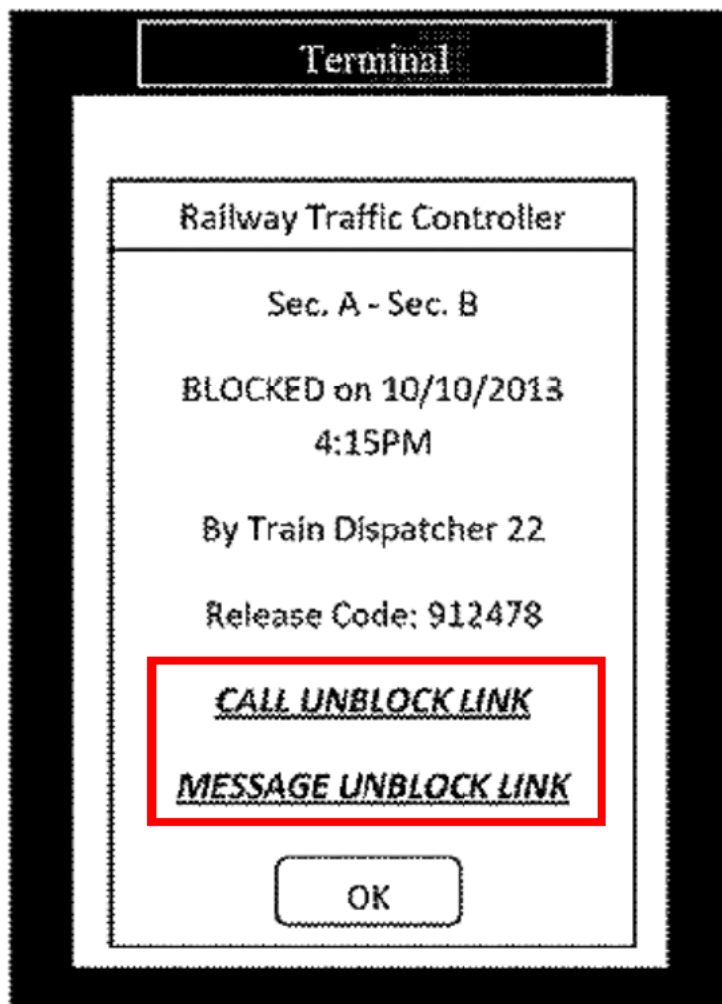
36. The ’782 patent discloses a number of different embodiments that describe how the maintenance or railway field worker can return the removal or release code to the dispatcher/railway control apparatus. Specifically, the ’782 patent provides that the “block removal user interface may be provided in any of various ways.” *Id.* at 3:11-12.

37. In some exemplar embodiments, the maintenance or railway field worker can interact directly with their own remote user terminal to lift a block. For example, in some embodiments, the railway field worker may be able to directly release the block through a block

removal user interface “provided within a mobile application or webpage through which the railway field worker can enter the removal code manually or orally.” *Id.* at 12-16.

38. Similarly, in some exemplar embodiments, the removal code may be “embedded in a link in a message transmitted by email or messaging to the electronic contact address of the railway field worker, and the railway field worker can simply cause the removal code to be entered by activating the link in the message received by the railway field worker.” *Id.* at 3:16-23.

39. Such an exemplar embodiment is shown, for example, in Figure 10 of the ’782 patent, which shows “an example of a user interface display that may be provided on the field worker side or triggering block removal.” (*Id.* at 4:20-22):

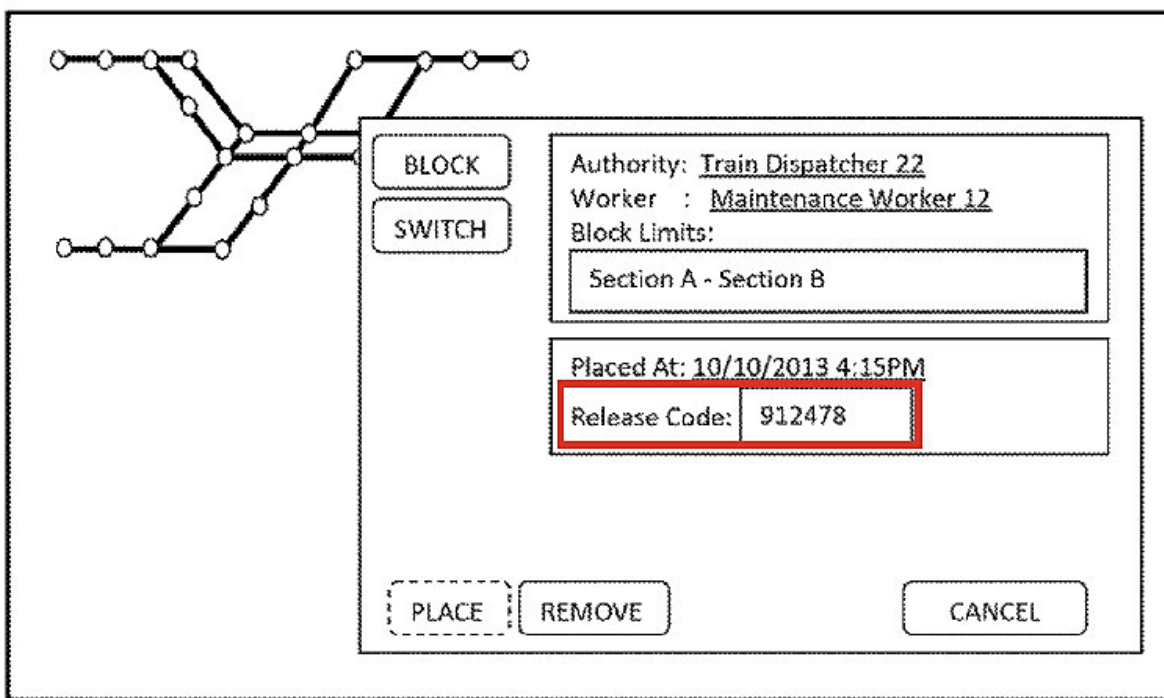
**FIGURE 10**

40. In other exemplar embodiments, “the block removal user interface may be provided on the same user terminal on which the block placing part is disclosed.” *Id.* at 3:23-25.

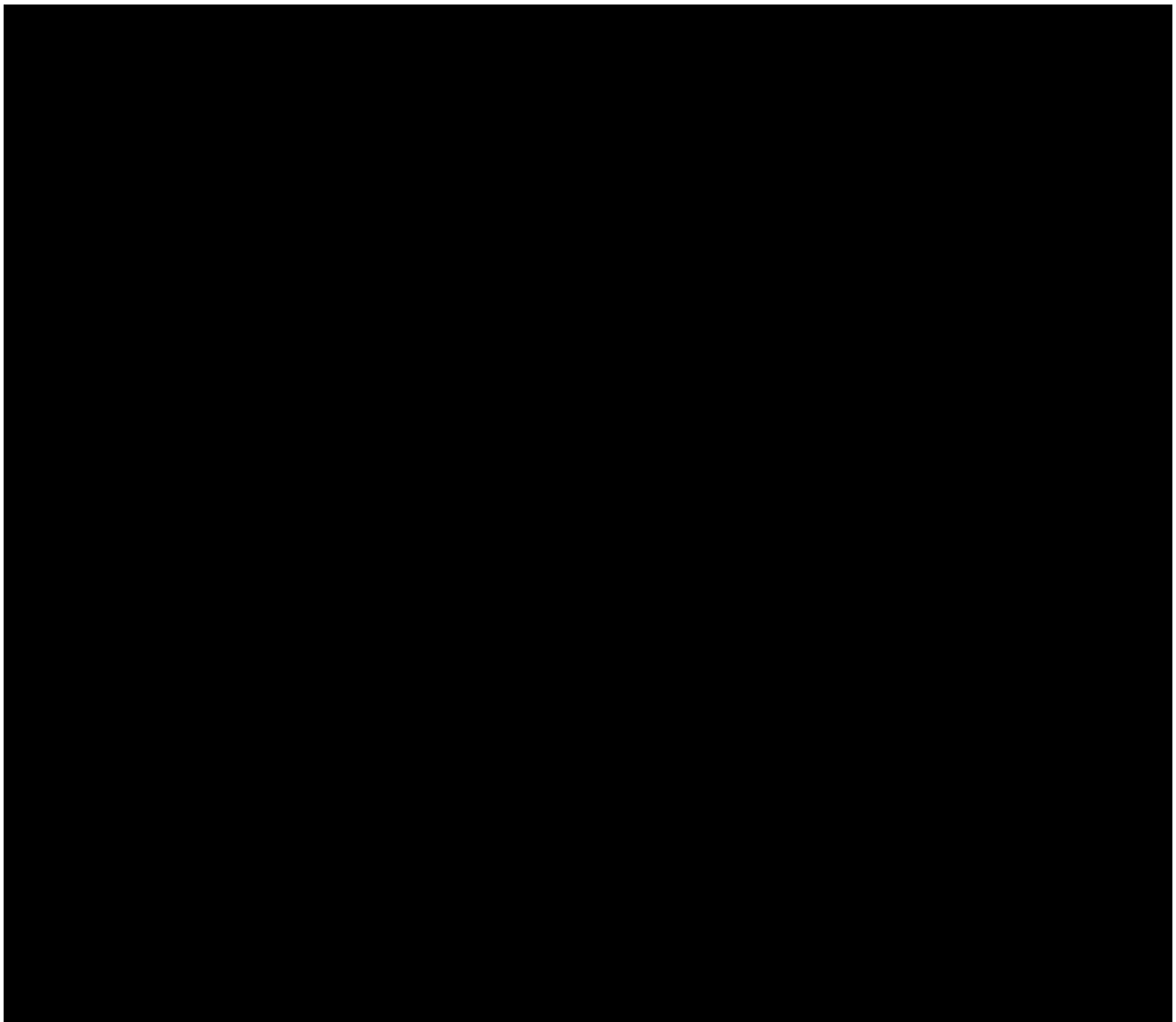
41. Again, the ’782 patent discloses a number of different embodiments in this configuration. For example, “a voice or speech interface part may be disposed on the system-side to process a voice message (such as received via a telephone call from the railway field worker), extract the removal code from the Voice message, and enter the block removal code.” *Id.* at 3:25-29.

42. As another example, the '782 patent makes clear that the maintenance or railway field worker may simply call the dispatcher and provide the removal or release code to the dispatcher, who then enters the code into the dispatcher's terminal to remove the block. For example, "FIG. 8 shows the user interface of the railway traffic control terminal 105 as the railway traffic controller inputs the release code to remove the block on certain track sections. (*Id.* at 8:21-24).

**FIGURE 8**

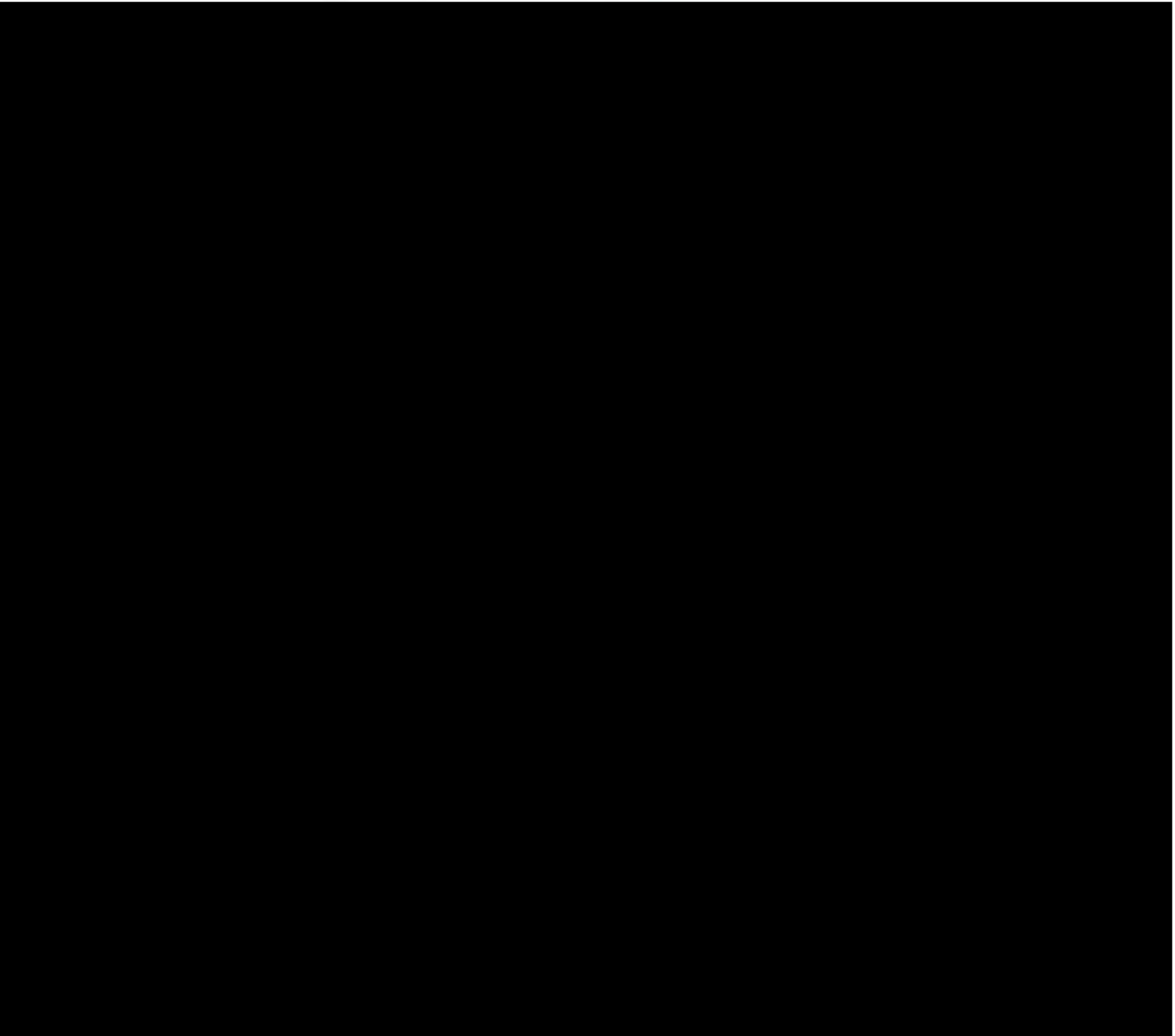


43. Consistent with this disclosure, as another example, below is an image of a user interface used to input a release code and release a block from Railware's Dispatch X system:



RAILWARE\_(SEPTA)\_0006659.

44. As another example, below is an image of a user interface used to input a release code and release a block from SEPTA's system:



SEPTA\_0004454.

45. Further, the '782 patent provides that “in a case where there are multiple workers assigned for a certain track section, there may be provided multiple unique release codes which would then all be required to be input into the train traffic control terminal 105 *by the train traffic controller* in order to be able to remove blocks on certain track sections.” '782 patent at 8:40-45 (emphasis added). Further, the '782 patent makes clear that “[t]he user interface 101D is configured preferably for the ease of use for the railway traffic controller. As shown by way of

examples in FIGS. 6-9 and 11, the user interface 101D displays information and tools needed to enable/disable blocks on rail sections.” *Id.* at 6:4-8. This description demonstrates that the user interface 101D, which is the dispatcher’s user interface, can control the removal of blocks, such as the ways discussed above, including with respect to Figure 8 above.

46. In each of the above exemplar embodiments where the dispatcher is involved in the removal of the block, it is not until the railway field worker seeks to remove the block that the dispatcher receives the code for the first time. As explained in the specification:

*Once* the secret code is received, the secret code may be input to the designated field (S1308) . . . [T]he railway traffic control terminal 105 checks that all information input into all fields is correct and that all fields are filled in. *After* this check is performed by the railway traffic control terminal 105, the remove button is enabled on the form (01312) and the railway traffic controller may remove the block on the corresponding track section.

*Id.* at 10:23-36 (emphasis added). By using words like “once” and “after,” the specification makes clear that, in embodiments where the dispatcher is involved in the removal of the block, the dispatcher cannot remove the block until the dispatcher receives the code from the railway field worker.

47. In sum, the ’782 patent makes clear that the dispatcher does not have ready access to the removal or release code to lift the block until that code is provided by a maintenance or railway field worker. Further, the removal or release code can be returned to the railway control apparatus in any number of ways, including automatically by the railway field worker or manually by returning the code to the dispatcher, who then inputs the removal or release code into the dispatcher’s terminal to release the block.

48. The ’782 patent also describes instances where the removal or release code may be obtained by the dispatcher from the internal storage of the railway traffic control apparatus

rather than from the maintenance or railway field worker. *Id.* at 10:6-22. Indeed, the '782 patent explains that a block placed on a section of track may be removed by the dispatcher if an eligible maintenance or railway field worker transmits the removal or release code to the railway traffic control center, but that “[i]f there is no maintenance worker available to transmit the random secret code, the code can be retrieved from the train traffic control terminal . . . by the train traffic controller.” *Id.* at 10:6-22. A POSITA would understand that by using the words “retrieved from the railway control apparatus,” the otherwise “secret” nature of the “release code” creates a hurdle for the dispatcher to obtain the code and such a mechanism for retrieving the code is employed only in certain limited circumstances. By forcing the “release code” to be “retrieved from the train traffic control apparatus” (as opposed to simply displaying the “release code” in full view of the dispatcher, like in the prior art), the '782 patent makes clear that the claimed “release code” is not “readily” available to the dispatcher. Thus, the operation of the system, even in the absence of an available maintenance or railway field worker, is consistent with the '782 patent’s description of tools, systems and methods, as noted above, that assures “the railway worker has more control over the traffic through the rail block in which the worker is working, and fatal on-track accidents can be reduced.” *Id.* at 11:12-14.

49. Consistent with the above, the '782 patent provides methods, tools, and systems to mitigate the potential for errant, mistaken, or premature release of blocks by restructuring the methods, tools, and systems used to protect railway workers by putting the power to lift a block with the removal or release code in the hands of the railway field worker operating under the block’s protection, and not the dispatcher. *See generally*, the '782 patent.

50. The inventions described and claimed in the '782 patent (and the other Asserted Patents) are consistent with my understanding of Railware’s own Dispatch X system and the

tragic industry events that gave rise to the inventions described and claimed in the Asserted Patents.

51. Specifically, I understand that in 2013, a Metro-North passenger train struck and killed several track workers in West Haven, Connecticut. I further understand that Metro-North asked Railware's President, Ross Pirtle (and the inventor on the Asserted Patents), to determine and assess the cause of this accident. I understand Mr. Pirtle did so and determined that the accident was caused when two separate blocks were shown in close proximity on the dispatcher's user interface, and the dispatcher talked to one of the railway foremen and was told that the workers were clear of the railroad track and that the dispatcher could remove the block protection from that track. However, through his investigation, I understand that Mr. Pirtle determined that the dispatcher mistakenly removed the wrong block protection on another railroad track that appeared in close proximity to the block protection that should have been removed (the block that was removed was for a different railway foreman who had workers still working on the track). Through his investigation, I understand that Mr. Pirtle realized that the dispatcher, then believing the track to be clear, routed a train on the track where the workers were still working, which resulted in the train striking the workers on the track and tragically killing them.

52. I further understand that, in order to prevent this from happening in the future, Mr. Pirtle then developed his inventions that are described and claimed in the Asserted Patents and that are implemented in Railware's train control software (Dispatch X) and would ultimately become a commercial embodiment of the Asserted Patents called EEPS (Enhanced Employee Protection System). I discuss further below aspects of Railware's commercial embodiment, EEPS, as it relates to the issues herein. I further understand that Railware filed its first patent

application within months of the tragic incidents above and Mr. Pirtle's resulting investigation and development of the inventions described and claimed in the Asserted Patents.

**B. U.S. Patent No. RE47,835**

53. I have reviewed the '835 patent entitled "Tools for Railway Traffic Control" and the related prosecution and IPR history. I understand the '835 patent was duly and legally issued on February 4, 2020 as a reissuance of U.S. Patent No. 9,403,545 (the "'545 patent"), which was duly and legally issued on August 2, 2016. I have reviewed the '545 patent and the related prosecution history. I understand that the '835 patent is entitled to a priority date of at least October 21, 2013.

54. As with the '782 patent, the '835 patent generally relates to methods, tools and systems provided to control traffic over a railway track section when a railway worker is working on or near the track section. *See, e.g.*, '835 patent, Abstract. These methods, tools, and systems mitigate the potential for errant, mistaken or premature release of blocks by restructuring the methods, tools, and systems used to protect railway workers by putting the power to lift a block with the removal or release code in the hands of the railway field worker operating under the block's protection, and not the dispatcher. *See generally*, the '835 patent.

55. The '835 patent differs from the '782 patent in some terminology. For example, the '835 patent was amended to consistently use the terms "terminal" and "user terminal" to refer to the maintenance or railway field worker's terminal. In the '782 patent, the terms "terminal" and "user terminal" were used in both the claims and the specification to refer to either the railway field worker's terminal or the dispatcher's terminal depending on the context in which it was used. As discussed further below, a POSITA would readily understand, however, the context and how the terms are being used.

**C. U.S. Patent No. RE49,115**

56. I have reviewed the '115 patent entitled “Tools for Railway Traffic Control” and the related prosecution and IPR history. I understand the '115 patent was duly and legally issued on June 28, 2022 as a reissuance of U.S. Patent No. 9,403,545, which was duly and legally issued on August 2, 2016. As previously stated, I have reviewed the '545 patent and the related prosecution history. I understand that the '115 patent is entitled to a priority date of at least October 21, 2013.

57. As with the patents discussed above, the '115 patent generally relates to methods, tools and systems provided to control traffic over a railway track section when a railway worker is working on or near the track section. *See, e.g.*, '115 patent, Abstract.

58. These methods, tools, and systems mitigate the potential for errant, mistaken or premature release of blocks by restructuring the methods, tools, and systems used to protect railway workers by putting the power to lift a block with the removal or release code in the hands of the railway field worker operating under the block's protection, and not the dispatcher. *See generally*, the '115 patent.

59. Like the '835 patent, the '115 patent differs from the '782 patent in some terminology. For example, the '115 patent was amended to consistently use the terms “terminal” and “user terminal” to refer to the maintenance or railway field worker's terminal. In the '782 patent, the terms “terminal” and “user terminal” were used in both the claims and the specification to refer to either the railway field worker's terminal or the dispatcher's terminal depending on the context in which it was used. As discussed further below, a POSITA would readily understand, however, the context and how the terms are being used.

## **VI. DEFINITIONS AND LEGAL UNDERSTANDINGS**

### **A. Claims Are Construed as Understood by a Person of Ordinary Skill in the Art (“POSITA”).**

60. I have been advised that patents and relevant literature must be assessed from the perspective of a hypothetical “person of ordinary skill in the art.” I understand this to be a hypothetical person of ordinary creativity, imparted with knowledge of the relevant, publicly available art, and the education and skills ordinarily associated with carrying out research in the particular field to which the patents pertain.

61. I may use the term “person of ordinary skill” or “one of ordinary skill” or “one skilled in the art” or “skilled artisan” or “artisan” as shorthand for the hypothetical person of ordinary skill in the art. I may also use the acronym POSITA.

62. I further understand that the relevant date for assessing the perspective of the hypothetical person skilled in the art for the issues I address below is in or around 2013.

63. It is my opinion that a person of ordinary skill in the art of the Asserted Patents would have (i) at least a bachelor’s degree in electrical, mechanical, industrial or related engineering, and (ii) would have had at least two (2) years of experience in railway safety, railway operations, and/or railway control systems. A higher level of education or specific skill might make up for less experience, and vice-versa.

### **B. Evidence of Claim Construction**

64. I understand that the purpose of claim construction is to ascertain the proper meaning and scope of a claim term, as understood by a POSITA. In district court litigation, I understand that patent claims are construed in light of (i) the claims themselves; (ii) the specification, including the drawings of the patent; and (iii) the prosecution history of the patent

and its family members, including the cited references. I understand that this material is typically referred to as “intrinsic” evidence.

65. I understand that the Court may consider additional evidence (“extrinsic” evidence), which is outside the items discussed above. I understand that extrinsic evidence can include expert testimony, dictionaries, treatises, prior art and the like. But it is my understanding that one should first look to the intrinsic evidence in construing claims.

66. A primary source for understanding a claim term is the plain and ordinary meaning of the claim term itself. Other claims in the patent also can be informative, even if those claims are not asserted. It is also my understanding that language in a claim should not be construed so as to render that language superfluous. Thus, I understand that when construing the claim terms each claim limitation should be given meaning. I also understand that the file history of a related patent can be useful in construing claim terms.

67. I understand that claims are read in light of the specification as understood by a POSITA. Where the meaning of a particular claim term is not plain and ordinary, one should look to the specification and other intrinsic evidence for assistance in understanding that term. However, it is my understanding that limitations from the specification should not be imported or read into the claims. In other words, a limitation from a preferred embodiment should not be read into a claim if that limitation is not present in the claim itself.

68. I also understand that claim terms are to be given the full scope of their plain and ordinary meaning, as understood by a POSITA, absent clear and unmistakable disavowal or disclaimer of claim scope. I understand that no disavowal or disclaimer of claim scope will be found unless the patentee uses language that is clear and unmistakable to make such disavowal or disclaimer.

69. I also understand that the same terms appearing in different claims are not presumed to have the same meaning if it is clear from the claims, specification, and prosecution history that the terms have different meanings at different portions of the claims.

70. The prosecution history of a patent provides the record of the examination of a patent application before the U.S. Patent and Trademark Office (PTO) with reference to the prior art cited during the examination.

71. I also understand that where a dependent claim adds a particular limitation, there is a presumption that that same limitation is not present in the independent claim. I understand this is referred to as claim differentiation.

72. I understand that the preamble to a claim will function as a limit on the scope of the claim where it recites essential structure or steps, or if it is necessary to give life, meaning, and vitality to the claim.

73. I understand that in the process that leads to issuance of a U.S. patent, the future patentee or their representatives may make amendments to the pending claims. These amendments are conventionally indicated by underlining (to indicate additions) and strike-through (to indicate deletions). Further, I understand that the record of a patent's prosecution (the "file history" or "prosecution history") is relevant to understanding a patent and its claims.

74. I further understand that a patent may be "reissued" with certain changes to the specification and/or claims of the patent. I understand that such changes are conventionally indicated by italics (to show additions) and square brackets (to indicate deletions).

### **C. Indefiniteness**

75. I understand that indefiniteness is not an issue that should be considered by the Court as part of the claim construction process. I also understand that SEPTA failed to timely

provide its positions on indefiniteness under the Court's Scheduling Order. However, should the Court allow SEPTA to raise indefiniteness issues as part of this process, I understand that the following standards apply.

76. I have been informed that a patent claim must particularly point out and distinctly claim the subject matter which the patentee regards as his/her invention. I also understand that, in the face of an allegation of indefiniteness, general principles of claim construction apply. I also understand that a claim term is sufficiently definite if, when read in light of the specification, claims and the prosecution history, it informs, with reasonable certainty, a POSITA about the scope of the invention.

77. I understand that patents are presumed valid. Thus, any fact(s) critical to a holding on indefiniteness must be proved by the challenger by clear and convincing evidence. I further understand that definiteness requires neither absolute nor mathematical precision. I also understand that claim language employing terms of degree has long been found definite where it provides reasonable certainty to a POSITA when read in the context of the invention, specification, claims and prosecution history. Although a claim term must inform a POSITA with reasonable certainty, I understand absolute precision is not required.

## **VII. OPINIONS REGARDING CLAIM CONSTRUCTION**

78. Based on my review of the materials prepared by both Parties in support of their respective claim construction positions, it is my view that the issues related to construction fall, generally, into four categories: (1) claim construction issues common across all of the Asserted Patents, (2) claim construction issues common to the '835 patent and '115 patent, (3) claim construction issues specific to the '782 patent, and (4) claim construction issues specific to the

'835 patent. My Declaration and analysis will consider the claim construction issues presented in accordance with these categories.

**A. Claim Construction Issues Common Across All of the Asserted Patents**

79. Both Parties have raised a number of claim terms that appear, in some form or another, across all three of the Asserted Patents. For Railware, I understand that it is seeking construction of various claim terms that include the word “code,” specifically (i) “release code,” (ii) “removal code,” (iii) “secret code,” and (iv) “secret release code.” For SEPTA, I understand that it is seeking construction of various terms that include the word “apparatus,” specifically (i) “railway control apparatus” and (ii) “railway traffic control apparatus.” I address each of these groups of claims terms together.

**1. “release code,” “removal code,” “secret code,” and “secret release code” [’782 patent claims 5-8; ’835 patent claims 1, 3, 5-6, 10, 12, 14-15, 19, 20, 23, 24, 26, 30, 33-34, 36, 40, 41; ’115 patent claims 20-36; proposed by Railware]**

80. It is my understanding that Railware has asked the Court to construe the claim terms: (i) “release code,” which is used in the ’782 patent and ’835 patent, (ii) “removal code,” which is used in the ’835 patent, (iii) “secret code,” which is used in the ’835 patent and the ’115 patent, and (iv) “secret release code,” which is used in the ’835 patent. SEPTA has offered no constructions for these claim terms, and has, instead, asserted that each of these claim terms is indefinite. The below charts illustrate this, as well as the Parties’ respective positions on the construction of these claim terms.

**'782 Patent**

| <u>Term(s)</u> | <u>Railware's Proposed Construction</u>                                                                           | <u>SEPTA's Proposed Construction</u>       |
|----------------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| "release code" | A code that is not readily available to the terminal user ( <i>i.e.</i> , the dispatcher).<br><br>Not indefinite. | No construction offered.<br><br>Indefinite |

**'835 Patent**

| <u>Term(s)</u>        | <u>Railware's Proposed Construction</u>                                                                                                             | <u>SEPTA's Proposed Construction</u>       |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| "removal code"        | A code that is not readily available to the user of the railway [traffic] control apparatus ( <i>i.e.</i> , the dispatcher).<br><br>Not indefinite. | No construction offered.                   |
| "release code"        |                                                                                                                                                     | Indefinite                                 |
| "secret release code" |                                                                                                                                                     |                                            |
| "secret code"         | A code that is not readily available to the user of the railway control apparatus ( <i>i.e.</i> , the dispatcher).<br><br>Not indefinite.           | No construction offered.<br><br>Indefinite |

**'115 Patent**

| <u>Term(s)</u> | <u>Railware's Proposed Construction</u>                                                                                                   | <u>SEPTA's Proposed Construction</u>       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| "secret code"  | A code that is not readily available to the user of the railway control apparatus ( <i>i.e.</i> , the dispatcher).<br><br>Not indefinite. | No construction offered.<br><br>Indefinite |

81. It is my opinion that a POSITA would have understood the claim terms "release code," "removal code," "secret code," and "secret release code," (collectively the "Code Terms")

as a code that is not readily available to the dispatcher (as that individual is referred to in each respective claim, noted in the above charts), consistent with Railware’s proposed construction.

The intrinsic and extrinsic evidence supports this construction.

a. **The Specifications of the Asserted Patents Support Railware’s Proposed Construction.**

82. The specifications of the Asserted Patents support Railware’s proposed construction. The specifications of the Asserted Patents consistently and repeatedly describe the Code Terms as “secret,” “automatically” generated and transmitted, and saved to “internal storage.” When taken together, these concepts support the construction that the Code Terms mean a code that is not readily available to the dispatcher (as that individual is referred to in each respective claim, noted in the above charts).

83. First, the Asserted Patents repeatedly and consistently refer to the Code Terms as “secret” across all embodiments.

84. Specifically, the Asserted Patents state “the code generator 101B is configured to produce [a] removal code []such as a cipher which is . . . **secret**.” ’782 patent at 5:58-60 (emphasis added); *see also id.* at 9:65-10:1 (“the railway traffic control terminal 105 . . . enables safety measures so that the block cannot be removed without the input of the **secret code** generated.”); 10:10-13 (“The remove button is disabled without the input of the **secret code**”); 10:15-22 (“the maintenance worker transmits the random **secret code** to the railway traffic control center 105 (S1305).”); ’835 patent at 6:3-5; *id.* at 10:22-25; *id.* at 10:35-38; *id.* at 10:41-48; ’115 patent at 6:6-9; *id.* at 10:22-25; *id.* at 10:34-37; *id.* at 10:39-46.

85. By repeatedly and consistently describing the code as “secret,” it is my opinion that a POSITA would understand from the Asserted Patents that the Code Terms are codes that

are not readily available to the dispatcher (*i.e.*, “secret” from the dispatcher (as that individual is referred to in each respective claim, noted in the above charts)).

86. Second, the Asserted Patents describe that the code is saved to *internal* storage of the railway control apparatus.

87. Specifically, the Asserted Patents state “the railway control apparatus 105 may then generate a release code and save it to an internal storage.” ’782 patent at 7:2-3; *see also, id.* at 8:29-31; ’835 patent at 7:16-19, 8:47-50; ’115 patent at 7:20-22, 8:50-53.

88. Third, the Asserted Patents describe the generation and transmission of the codes within the unconventional network architecture as “largely automated” such that the code is “automatically transmitted” by the railway control apparatus to the railway field worker. ’782 patent at 2:58-62; *see also, e.g., id.* at 2:53-55; 5:58-64, 7:1-10, 7:32-55, 8:54-59, 10:1-5; ’835 patent at 2:64-3:2, 2:59-61, 6:3-10, 7:15-27, 7:49-8:6, 9:7-12, 10:26-30; ’115 patent at 3:4-9, 2:66-3:1, 6:6-13, 7:20-30, 7:53-8:9, 9:9-14, 10:25-29.

89. The fact that the code is saved to internal storage of the railway control apparatus, largely automated, and automatically transmitted to the railway field worker further supports my opinion that a POSITA would understand the Code Terms to mean a code that is not readily available to the dispatcher because these operations explicitly do not involve displaying the code to the dispatcher (as that individual is referred to in each respective claim, noted in the above charts).

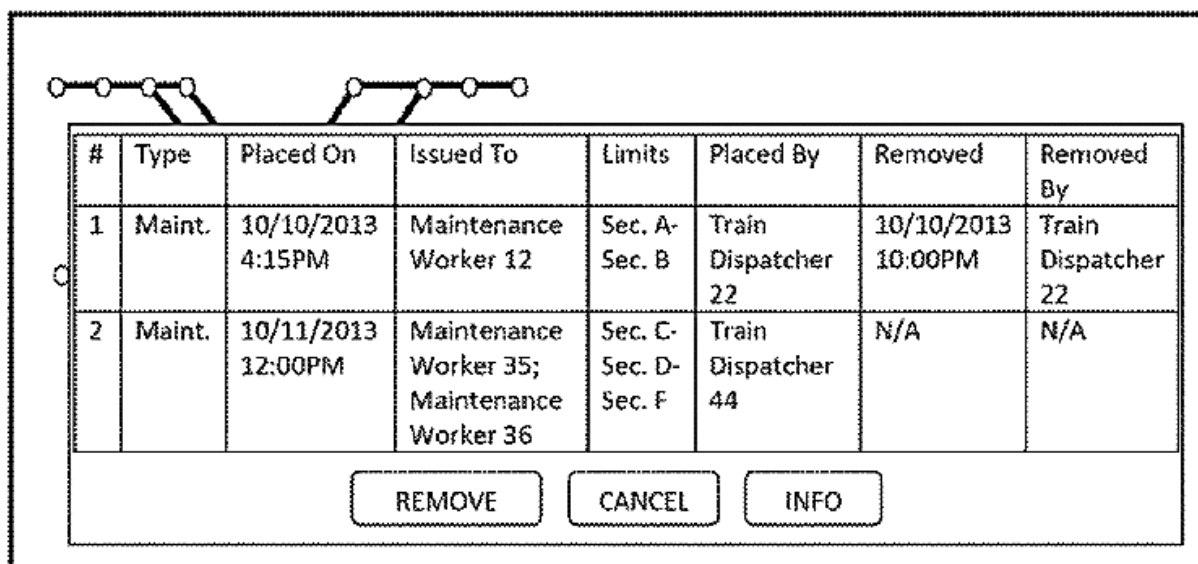
90. Additionally, the Figures of the Asserted Patents support the construction because none of the Figures displays any code to the dispatcher (as that individual is referred to in each respective claim, noted in the above charts) prior to receiving the code from elsewhere (*e.g.*, the railway field worker or the railway control apparatus).

91. The Figures of the Asserted Patents, which show screen shots of the railway control apparatus and the railway field worker's terminal support the construction.

92. The Figures of the Asserted Patents never show the code displayed to the dispatcher (as that individual is referred to in each respective claim, noted in the above charts) prior to receiving the code (*e.g.*, from the railway field worker or the railway control apparatus).

93. Figure 7, for example, shows various details about blocks that are displayed to the dispatcher on the railway control apparatus:

**FIGURE 7**



| # | Type   | Placed On             | Issued To                                             | Limits                       | Placed By                 | Removed               | Removed By                |
|---|--------|-----------------------|-------------------------------------------------------|------------------------------|---------------------------|-----------------------|---------------------------|
| 1 | Maint. | 10/10/2013<br>4:15PM  | Maintenance<br>Worker 12                              | Sec. A-<br>Sec. B            | Train<br>Dispatcher<br>22 | 10/10/2013<br>10:00PM | Train<br>Dispatcher<br>22 |
| 2 | Maint. | 10/11/2013<br>12:00PM | Maintenance<br>Worker 35;<br>Maintenance<br>Worker 36 | Sec. C-<br>Sec. D-<br>Sec. F | Train<br>Dispatcher<br>44 | N/A                   | N/A                       |

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'782 patent, Fig. 7.

94. Notably absent from Figure 7 is any code that is associated with the blocks.

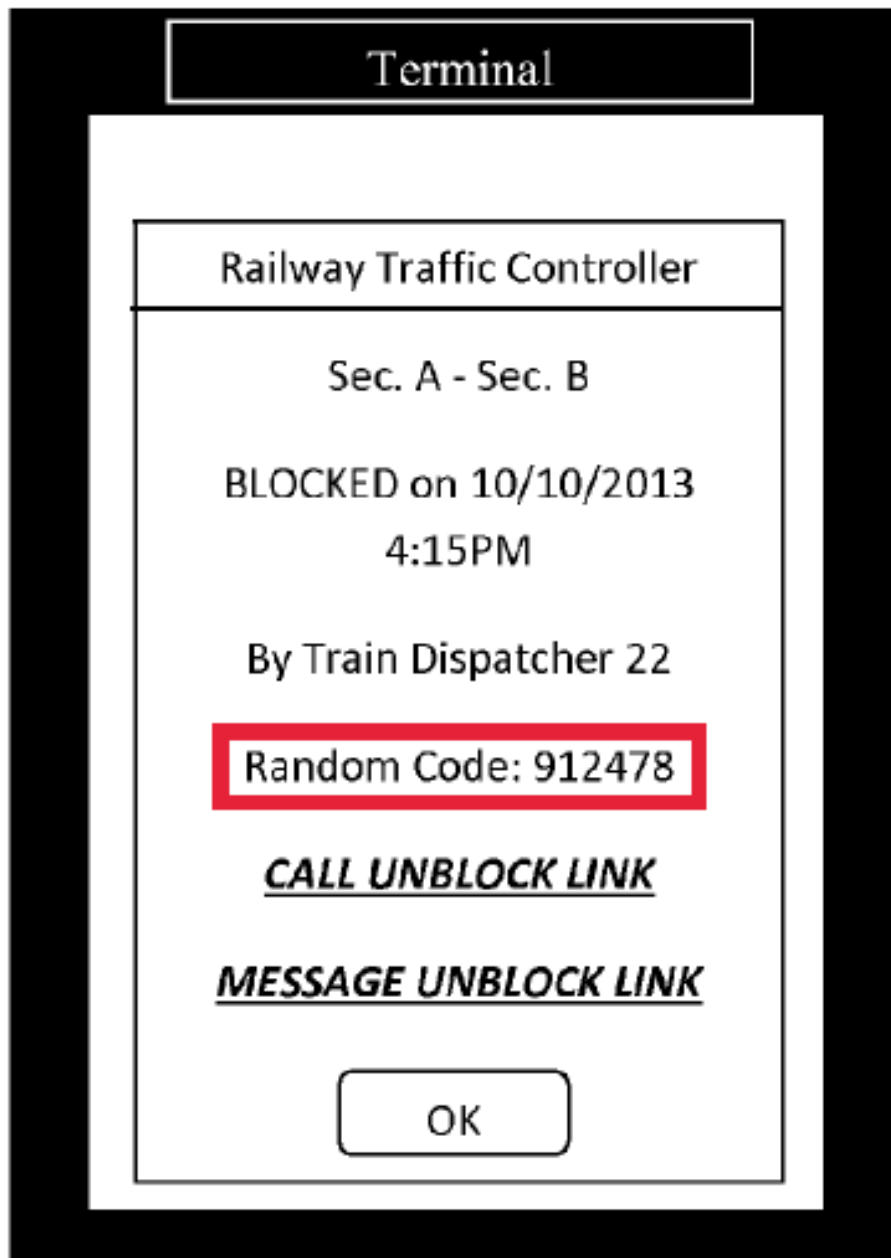
95. Figure 7 does include a sequential numbering of the blocks in the left-hand column, labeled "#." This left-hand column is a sequential number, which is effectively a "Form D" number (as I described above in the background section) and identifies a particular block and *is* readily available to the dispatcher at all times.

96. But the # column shown in Figure 7 is distinct from the Code Terms as used throughout the specification.

97. The fact that Figure 7 displays a sequential “Form D” number, but does not display the code to the dispatcher on the railway control apparatus, further supports my opinion that a POSITA would understand the Code Terms to mean a code that is not readily available to the dispatcher (as that individual is referred to in each respective claim, noted in the above charts).

98. In contrast, Figure 10, which shows the railway field worker’s terminal, shows the code (called a “random code” in Figure 10) displayed to the railway field worker (not the dispatcher (as that individual is referred to in each respective claim, noted in the above charts)).

## FIGURE 10



'782 patent, Fig. 10 (my annotations in red).

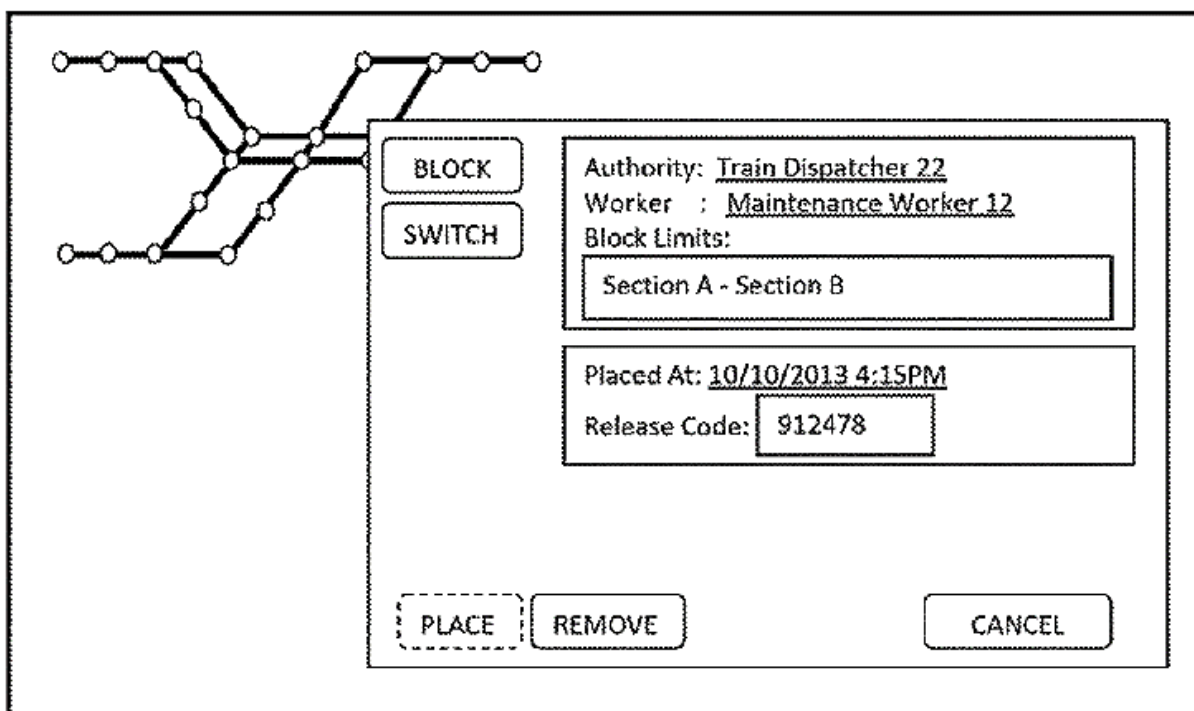
99. It is not until the railway field worker seeks to remove the block that the dispatcher receives the code for the first time, as explained in the specification:

In order for a block on a certain track to be lifted, the release code has to be input into the railway traffic control apparatus. The terminal 102 sends the release code to the railway traffic control apparatus 105. The release code is then input into the block remover 101C. After which, the block is removed and traffic to that section of rail is then allowed.

*Id.* at 7:14-20; '835 patent at 7:31-37; '115 patent at 7:35-41.

100. Figure 8, which illustrates a specific embodiment, “shows the user interface of the railway traffic control terminal 105 as the railway traffic controller inputs the release code to remove the block on certain track sections,” stands in further contrast to Figure 7.

**FIGURE 8**



'782 patent, Fig. 8.

101. As illustrated in Figure 8, only after the railway field worker transmits the code or provides the code to the dispatcher is the dispatcher able to enter the code into the railway control apparatus, to remove the block. *Id.* at 8:28-29 (“Without the input of release code, the

remove option is not available to be selected.”); *see also, e.g., id.* at 2:55-57, 3:30-33, 5:67-6:3, 7:8-10, 7:35-38, 7:55-60, 8:28-31, 8:46-53, 10:15-19, 10:23-36; ’835 patent at 8:47-50, 2:61-63, 3:37-41, 6:11-16, 7:24-27, 7:52-56, 8:6-12, 8:47-50, 8:65-9:6, 10:38-48, 10:49-64; ’115 patent at 8:50-51, 3:1-3, 3:43-46, 6:16-19, 7:27-30, 7:56-59, 8:9-13, 8:50-53, 9:1-9, 10:39-42, 10:47-78.

102. Similarly, in the embodiments in which the railway field worker can automatically return the removal or release code back to the railway control apparatus, the dispatcher may *never* see the removal or release code. In such embodiments, the removal or release code would not be readily available to the dispatcher because the dispatcher would never see the removal or release code. Such embodiments include embodiments where the block removal user interface is provided within a mobile application or web page through which the railway field worker can enter the removal or release code manually or orally, or where the code is returned automatically through an embedded link or the like, or where the railway control apparatus includes a voice or speech interface part or the like that can process a voice message from the railway field worker to extract the removal or release code and release the block. *See, e.g.,* ’782 patent at 3:11-29; ’835 patent at 3:20-38; ’115 patent at 3:26-42.

103. Railware’s proposed construction is consistent with a stated goal of the Asserted Patents to give “the railway worker [] more control over the traffic through the rail block in which the worker is working.” ’782 patent at 11:12-14; ’835 patent at 11:40-43; ’115 patent at 11:37-39.

104. It is my opinion that a POSITA would understand that the code is not readily available to the dispatcher, given the problems addressed by the Asserted Patents.

105. The Asserted Patents acknowledge that “railway transportation is run under strict operational guidelines or rules,” such as the “Form D” number. ’782 patent at 1:21-22; ’835 patent at 1:28-29; ’115 patent at 1:36-37.

106. Form D numbers, alone, are inherently unreliable because they are known to the dispatcher at all times.

107. The Asserted Patents note that “one study reported that there were 39 roadway worker accidents that occurred between January 1997 and the end of 2011, in which 41 roadway workers perished.” ’782 patent at 2:29-31; ’835 patent at 2:34-36; ’115 patent at 2:41-44.

108. Form D numbers were in operation during this entire span of time, yet accidents and fatalities persisted.

109. The Asserted Patents note that “even with all of the[] safety features present in a railway system, railway accidents occur, with many of them being fatal . . . . There remains a need for further safety measures to protect the lives of railway workers.” ’782 patent at 2:27-39; ’835 patent at 2:33-45; ’115 patent at 2:40-52.

110. The Federal Railroad Administration (“FRA”) agreed. The FRA stated in a 2016 Final Rule:

In [two accidents in 2007 and 2013] the train dispatchers did not maintain the required blocking devices, allowing train movements into the roadway work groups’ established working limits without the relevant RWIC’s knowledge. . . . Despite the fact that FRA’s regulations already prohibit the actions that led to these accidents, FRA recognizes more can be done to try to prevent these types of mistakes from causing future tragedies.

Federal Railroad Administration, *Railroad Workplace Safety; Roadway Worker Protection Miscellaneous Revisions (RRR)* at 75-76 (May 26, 2016).

111. The FRA specifically noted that railroads should “ensure appropriate safety redundancies are in place in the event of miscommunication or error,” including “where working limits were no longer protected due to dispatcher error.” *Id.* at 82.

112. The FRA explained it would “scrutinize a railroad’s PTC development and safety plans to determine if the plans left any opportunity for a single point human failure with regard to incursions into work zones (e.g., any opportunity for a dispatcher to remove a blocking device in error . . . .)” *Id.* at 85.

113. Along these lines, each of the claims of the Asserted Patents requires an unconventional network architecture for generating, transmitting, receiving and using one of the Code Terms that is transmitted to the railway field worker that is working on the track, but otherwise remains “secret” from the dispatcher (as that individual is referred to in each respective claim, noted in the above charts). ’782 patent at 5:58-64, claims 1, 5; ’835 patent at 6:3-10, claims 1-7, 9 -16, 18-41; ’115 patent at 6:6-13, claims 20-36.

114. It is my opinion that a POSITA would understand that, by keeping the code secret from the dispatcher, the Asserted Patents prevent the very miscommunications, mistakes or errors that plagued the industry and that the FRA ultimately acknowledged in its Final Rule report.

115. It is my opinion that a POSITA would readily understand, given this context, that the claimed Code Terms—which, *inter alia*, is “secret,” saved to “internal storage,” “automatically transmitted” to the railway field worker, and only after the railway field worker transmits the code to the railway control apparatus or provides the code to the dispatcher for the dispatcher to be able to enter the code into the railway control apparatus, to remove the block—

must not be readily available to the dispatcher, or else the objects of the unconventional, distributed network architecture would not be achieved.

116. The fact that the code is not “readily available” is further evident from the Asserted Patents’ description of what happens when the railway field worker cannot provide the code for some reason.

117. The specifications of the Asserted Patents support the construction because the specifications disclose, within an unconventional network architecture for generating, transmitting, receiving and using the claimed codes, a failsafe in which the code may be “retrieved” from the internal storage, for example, if the railway field worker is unable to provide the code. ’782 patent at 10:19-22; ’835 patent at 10:44-48; ’115 patent at 10:42-46.

118. Specifically, the Asserted Patents state, “[i]f there is no maintenance worker available to transmit the random secret code, the code can be retrieved from the train traffic control terminal 105 by the train traffic controller (S1306).” ’782 patent at 10:19-22; ’835 patent at 10:44-48; ’115 patent at 10:42-46.

119. A POSITA would understand that by using the words “retrieved from the railway control apparatus,” the otherwise “secret” nature of the “release code” creates hurdles for the dispatcher to obtain the code and such a mechanism for retrieving the code is employed only in limited circumstances. By forcing the “release code” to be “retrieved from the train traffic control apparatus” (as opposed to simply displaying the “release code” in full view of the dispatcher), the Asserted Patents make clear that the claimed Code Terms cover a code that is not “readily” available to the dispatcher. This is consistent with the Asserted Patents’ stated goal to give the railway field worker more control over the release of blocks.

120. Thus, the dispatcher must not have the code prior to (1) receiving the code from a railway field worker or (2) going through a retrieval process to obtain the code when, for example, there is no railway field worker to provide the code. '782 patent at 10:15-22 ("If there is an eligible maintenance worker available, the maintenance worker transmits the random secret code to the railway traffic control center 105 (S1305). If there is no maintenance worker available to transmit the random secret code, the code can be retrieved from the train traffic control terminal 105 by the train traffic controller (S1306)."); '835 patent at 10:41-48 (similar); '115 patent at 10:39-46 (similar).

121. A POSITA would understand that by using the words "retrieved from the railway control apparatus," the otherwise "secret" nature of the code creates hurdles for the dispatcher to obtain the code and such a mechanism for retrieving the code is employed only in limited circumstances. This is a fundamental concept of the inventions of the Asserted Patents that achieves the goal of giving the railway field worker more control over the blocks on the track while the railway field worker is working on the track. '782 patent at 11:12-14; '835 patent at 11:40-43; '115 patent at 11:37-39.

122. By forcing the code to be "retrieved from the train traffic control apparatus" (as opposed to simply displaying the code in full view of the dispatcher), the Asserted Patents make clear that the claimed code is not "readily" available to the dispatcher (as that individual is referred to in each respective claim, noted in the above charts).

**b. The Claim Language of the Asserted Patents Supports Railware's Proposed Construction.**

123. Consistent with the specifications, it is my opinion that the claim language of the Asserted Patents support this construction.

124. For example, independent claim 5 of the '782 patent specifies that the “release code” is generated and transmitted “to an electronic contact address accessible by the railway field worker via operation of the user interface of the user terminal.” '782 patent at claim 5.

125. Claim 5 and the other claims specifically do not say that the “release code” is displayed to the dispatcher. Further, claim 5 requires that a track block be removed “only upon receiving the release code from the user terminal in return.” *Id.*

126. Similarly, with respect to the '835 patent, independent claims 1, 10, and 19 each specify that the “removal code” is generated and transmitted “to an electronic contact address accessible by the railway field worker via operation of the user interface of the user terminal.” '835 patent at claims 1, 10, 19.

127. The claims specifically do not say that the “removal code” is displayed to the dispatcher.

128. Claims 20, 30, and 40 of the '835 patent further support Railware's proposed construction. Each of claims 20, 30, and 40 expressly require that the claims “secret release code”/“secret code” is “secret.” *Id.* at claims 20, 30, 40. This express recitation of secrecy makes clear to a POSITA that the “secret release code”/“secret code” is not readily available to the dispatcher, particularly because the claims also recite that the “secret release code”/“secret code” is expressly transmitted to the user terminal of the railway field worker. *Id.* Given that the Asserted Patents have the “secret release code”/“secret code” sent to the railway field worker, a POSITA would understand that the “secret release code”/“secret code” is secret from the dispatcher (as that individual is referred to in each respective claim, noted in the above charts).

129. Similarly, with respect to the '115 patent, claims 20, 30, and 31 each expressly require that the code be “secret.” '115 patent at claims 20, 30, and 31. This express recitation of

secrecy makes clear to a POSITA that the “secret code” is not readily available to the dispatcher, particularly because the claims also recite that the “secret code” is transmitted to the user terminal of the railway field worker. *Id.*

130. Independent claims 20, 30, and 31 each also specify that the “secret code” is generated and transmitted “to a remote user terminal.” *Id.* at claims 20, 30, and 31. The claims specifically do not say that the “secret code” is displayed to the dispatcher. If, on the other hand, the dispatcher had ready access to the “secret code,” then the code would not be “secret” at all, and the dispatcher could remove the block at any time and particularly due to miscommunication, mistake or error.

131. Considering the above, my opinion is that the proper construction of the Code Terms is a code that is not readily available to the dispatcher (as that individual is referred to in each respective claim, noted in the above charts), which is consistent with Railware’s proposed construction.

**c. The Patent Trial And Appeal Board’s Decisions Further Confirm Railware’s Proposed Construction.**

132. I understand that the Patent Trial and Appeal Board (the “Board”) issued three decisions denying institution of *inter partes* review of the Asserted Patents. I have reviewed these decisions, and it is my opinion that these decisions support Railware’s proposed construction.

133. I understand that the Board did not adopt an explicit construction for the Code Terms in order to deny institution. *See Decision Denying Institution of Inter Partes Review*, IPR2023-01179, Paper 8 at n.11 (P.T.A.B. Jan. 22, 2024) (“for purposes of this Decision we need not resolve whether Patent Owner’s proposed express construction of ‘release code’ is the

proper meaning of the term in light of the Specification, which we note does not appear to expressly address how a person of ordinary skill in the art would have distinguished a code that is ‘readily available’ to the dispatcher from a code that was not ‘readily available.’”).

134. Despite not adopting a construction, the Board determined that, Amtrak failed to show that the Code Terms “encompass[] a non-public code that is received by any railway personnel that may be used to release a track block without further limitations on the accessibility to the code by, for example, the dispatcher prior to a release of a track block.” *Id.* at 19. In other words, the Code Terms require “limitations on the accessibility to the code by, for example, the dispatcher prior to a release of a track block.” *See id.* This supports Railware’s proposed construction.

135. I disagree, however, with the Board’s statement that the specifications “do[] not appear to expressly address how a person of ordinary skill in the art would have distinguished a code that is ‘readily available’ to the dispatcher from a code that was not ‘readily available.’” *Id.* at n.11. As an initial matter, I understand that the question of indefiniteness was not before the Board, and therefore the Board did not need to and did not analyze whether the claims provided a POSITA with reasonable certainty as to the scope of the claims. However, as discussed above, a POSITA would understand, based on the stated goals of the Asserted Patents, the unambiguous claim language, the described embodiments, the Figures, and the repeated emphasis on secrecy and the like, when the code would be considered readily available to the dispatcher and when it would not.

136. In my opinion, the Board’s conclusion in denying institution is consistent with and supportive of Railware’s proposed construction of the Code Terms, because Railware’s

proposed construction encompasses the concept of “limitations on the accessibility to the code” in slightly different, but more understandable, terms (*i.e.*, “not readily available”).

137. Considering the above, my opinion is that the proper construction of the Code Terms is a code that is not readily available to the dispatcher (as that individual is referred to in each respective claim, noted in the above charts), consistent with Railware’s proposed construction.

**d. SEPTA’s Indefiniteness Arguments are Incorrect; the Code Terms Inform a POSITA with Reasonable Certainty About the Scope of the Inventions Claimed.**

138. Again, I understand that indefiniteness is not an issue that should be considered by the Court as part of the claim construction process. I also understand that SEPTA failed to timely provide its positions on indefiniteness under the Court’s Scheduling Order. However, should the Court allow SEPTA to raise indefiniteness issues as part of this process, I provide the following.

139. It is my understanding that SEPTA contends that the Code Terms, as well as the term “second secret code,” are indefinite. I disagree.

140. I have reviewed SEPTA’s Identification of Proposed Constructions of Claim Terms. I note that SEPTA does not provide any basis in that document for its position that the Code Terms or the “second secret code” term are indefinite. I have also reviewed SEPTA’s Supplemental Preliminary Invalidity Contentions, which consist of a series of thirty-seven (37) charts, and note that SEPTA’s discussion of indefiniteness with respect to the Code Terms and the term “second secret code” is cursory and lacking in detail or explanation. Based on these SEPTA’s submissions, I do not understand SEPTA’s positions.

141. I have also reviewed a ninety-two (92) page document that SEPTA styled as a “cover pleading” to its Supplemental Preliminary Invalidity Contentions. While this document provides more detail than the other documents, I have been informed that this document was served by SEPTA beyond the Court-ordered deadline, and is therefore not part of the current case. I understand from counsel that, absent a Court Order to the contrary, SEPTA has likely waived its indefiniteness arguments discussed therein on the Code Terms and the term “second secret code.” Nevertheless, based on the limited information provided by SEPTA to date and a host of assumptions, I provide my opinions on the indefiniteness of the Code Terms and the term “second secret code” below. As I will explain in more detail below, I disagree with SEPTA’s positions.

142. To the extent that SEPTA is permitted to or does expand upon, supplement, or introduce new or additional explanation regarding its positions, I reserve the right to supplement or amend my opinions to address such positions.

143. It is my opinion that the Code Terms, as well as the term “second secret code,” are not indefinite because these terms, viewed in light of the claims, specification and prosecution history, inform a POSITA about the scope of the invention with reasonable certainty.

144. As discussed above, it is my opinion that the context in which the claimed Code Terms are used throughout the specifications and claims make it such that it would have been clear to a POSITA what the terms mean, and more specifically that the Code Terms must mean a code that is not readily available to the dispatcher, which is consistent with Railware’s proposed construction.

145. Further, it is also my opinion that the context in which the claimed “second secret code” term is used throughout the specification and the claims of the ’115 patent make it such

that it would have been clear to a POSITA what the term means. That is, a POSITA would understand that “second secret code” refers to the string of characters relayed from the railway field worker back to the railway control apparatus or the dispatcher (via message, voice, embedded link, or otherwise). A POSITA would further understand that the use of the word “secret” in “second secret code” is done not to indicate the secrecy of the “second secret code,” itself, but rather to indicate the “second secret code’s” relationship to the “secret code” described earlier in the claims. That is, that to release the block, the “secret code” (which was sent to the railway field worker) and the “second secret code” (that was provided or sent from the railway field worker back to the dispatcher or the railway control apparatus) must be the same. *See*, ’115 patent at Fig. 13, step S1309; *id.* at 10:47-61.

**i. SEPTA’s arguments regarding code secrecy are incorrect.**

146. Again, I understand that indefiniteness is not an issue that should be considered by the Court as part of the claim construction process. I also understand that SEPTA failed to timely provide its positions on indefiniteness under the Court’s Scheduling Order. However, should the Court allow SEPTA to raise indefiniteness issues as part of this process, I provide the following.

147. I have reviewed SEPTA’s Supplemental Preliminary Invalidity Contentions. Therein, SEPTA has asserted that the Asserted Patents “do[] not make clear . . . whether the . . . [Code Terms]<sup>4</sup> must be secret as a definitional matter . . . in order to fall within the scope of the claimed invention.” SEPTA’s Supplemental Preliminary Invalidity Contentions at 60. In other

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<sup>4</sup> SEPTA uses the defined term “Release Code” in their cover pleading. However, it is my understanding that the terms signified therein are identical to the terms I refer to as “Code Terms” throughout this Declaration.

words, SEPTA seems to argue that the Asserted Patents fail to inform, with reasonable certainty, those skilled in the art about whether the Code Terms are “secret.” I disagree.

148. As indicated in paragraphs 81 to 131, above, it is my opinion that the Asserted Patents are resolute in their indication that the Code Terms are secret.

149. For example, the ’835 patent states “the code generator 101B is configured to produce [a] removal code []such as a cipher which is . . . secret.” ’835 patent at 6:3-5. This is reinforced repeatedly throughout the specification. *Id.* at 10:22-25 (“Once the place button is selected, the railway traffic control [terminal] *apparatus* 105 . . . enables safety measures so that the block cannot be removed without the input of the secret code generated.”); 10:35-36 (“The remove button is disabled without the input of the secret code.”); 10:42-44 (“the maintenance worker transmits the random secret code to the railway traffic control [center] *apparatus* 105 (S1305).”).

150. The same is true of the ’782 patent. ’782 patent at 5:58-60 (“the code generator 101B is configured to produce [a] removal code []such as a cipher which is . . . secret.”), *see also id.* at 9:65-10:1 (“the railway traffic control terminal 105 . . . enables safety measures so that the block cannot be removed without the input of the secret code generated.”); 10:10-13 (“The remove button is disabled without the input of the secret code.”); 10:15-22 (“the maintenance worker transmits the random secret code to the railway traffic control center 105 (S1305).”).

151. The same is true of the ’115 patent. ’115 patent at 6:6-8 (“the code generator 101B is configured to produce [a] removal code []such as a cipher which is . . . secret.”); *see also id.* at 10:22-25 (“Once the place button is selected, the railway traffic control terminal 105 . . . enables safety measures so that the block cannot be removed without the input of the secret code generated.”); 10:34-35 (“The remove button is disabled without the input of the secret code.”);

10:40-42 (“the maintenance worker transmits the random secret code to the railway traffic control center 105 (S1305).”).

152. Furthermore, it is my opinion that the Asserted Patents inform, with reasonable certainty, those skilled in the art that “secret,” as applied to the Code Terms, means a code that is not readily available to the dispatcher, which is consistent with Railware’s proposed construction.

153. Moreover, as discussed above, it is my opinion that a POSITA would understand what “not readily available” means based on, *inter alia*, the stated goals of the Asserted Patents, the unambiguous claim language, the described embodiments, the Figures, and the repeated emphasis on secrecy and the like, when the code would be considered readily available to the dispatcher and when it would not.

154. Specifically, it is my view that a POSITA would understand a code to not be “readily available” to the dispatcher in instances, for example, where the code is not displayed on the dispatcher’s terminal, prior to the dispatcher receiving the code back from the railway field worker. As discussed above, this understanding is supported by the specifications of the Asserted Patents. *Compare* Figure 7 of the Asserted Patents (illustration of a screen shot of the railway control apparatus prior to return of the code, showing no code viewable by the dispatcher) *with* Figure 8 of the Asserted Patents (illustration of a screen shot of the railway control apparatus after return of the code, showing a code viewable by the dispatcher). This is consistent with the stated goals of the Asserted Patents, which are to give the railway field worker more control over the release of blocks and to reduce errant, mistaken or premature block removal by the dispatcher. ’782 patent at 11:12-14; ’835 patent at 11:40-42; ’115 patent at 11:37-39. Thus, a POSITA would understand with reasonable certainty whether a code qualifies as not readily

available to the dispatcher based on whether the dispatcher can see or easily access the code before it is time for removal the block.

155. Therefore, it is my opinion that the Asserted Patents inform, with reasonable certainty, those skilled in the art about whether the Code Terms are “secret.”

**ii. SEPTA’s arguments regarding code generation and composition are incorrect.**

156. Again, I understand that indefiniteness is not an issue that should be considered by the Court as part of the claim construction process. I also understand that SEPTA failed to timely provide its positions on indefiniteness under the Court’s Scheduling Order. However, should the Court allow SEPTA to raise indefiniteness issues as part of this process, I provide the following.

157. SEPTA also asserts “nothing in the specification presents any data structure for the . . . [Code Terms] or specific algorithm for generating it.” SEPTA’s Supplemental Preliminary Invalidity Contentions at 59. In other words, SEPTA seems to argue that the Asserted Patents fail to inform, with reasonable certainty, those skilled in the art about the contents of the Code Terms or how they are created. I disagree.

158. As discussed above, there is substantial discussion of the Code Terms throughout the Asserted Patents, including descriptions of the Code Terms, how they are created, and their contents. I incorporate my discussion of the Code Terms above.

159. The Asserted Patents describe the Code Terms and how they are created.

160. As a specific example, the ’782 patent states “[t]he code generator 101B is configured to produce removal code (such as a cipher which is random, pseudo-random, secret, etc.[)], and stored on the terminal.” ’782 patent at 5:58-60.

161. The '835 patent and '115 patents similarly state “[t]he code generator 101B is configured to produce a removal or release code, such as a cipher which is random, secret, etc., and stored on the computer.” ’835 patent at 6:3-6; ’115 patent at 6:6-9.

162. Thus, a POSITA would readily understand the that the Code Terms are created by a code generator, which can produce a random or pseudo-random cipher that is secret.

163. It is my opinion that a POSITA would understand the Asserted Patents to not be limited to any particular method of generating the string of symbols, and any method of generating the string of symbols to serve as the Code Terms would be within the scope of the inventions.

164. Additionally, it is my opinion that, by using terms “such as” and “etc.,” a POSITA would understand these descriptors to be exemplary, except in the case of “secret,” which, as discussed above, is fundamental to the goals of the Asserted Patents.

165. Therefore, it is my opinion that the Asserted Patents describe the Code Terms and how they are created.

166. The Asserted Patents also describe the contents of the Code Terms such that a POSITA would readily understand what the Code Terms are. As an initial matter, based on my knowledge and experience, a POSITA would readily understand that, as used in the Asserted Patents, a “code” means “a system of signals or symbols for communication.” Merriam-Webster’s Collegiate Dictionary, 11th Ed. (2012) at 239 ; *see also* Collins English Dictionary, 9th Ed. (2007) at 328 (“a system of letters or symbols, and rules for their association by means of which information can be represented or communicated for reasons of secrecy, brevity, etc.”); Concise Oxford English Dictionary, 11th Ed., Revised (2009) at 276 (“a series of letters or numbers assigned to something to classify or identify it.”) A POSITA would understand that

symbols can be letters, numbers, or other characters. A POSITA would, therefore, understand the contents of the Code Terms to be symbols, such as letters, numbers, or other characters.

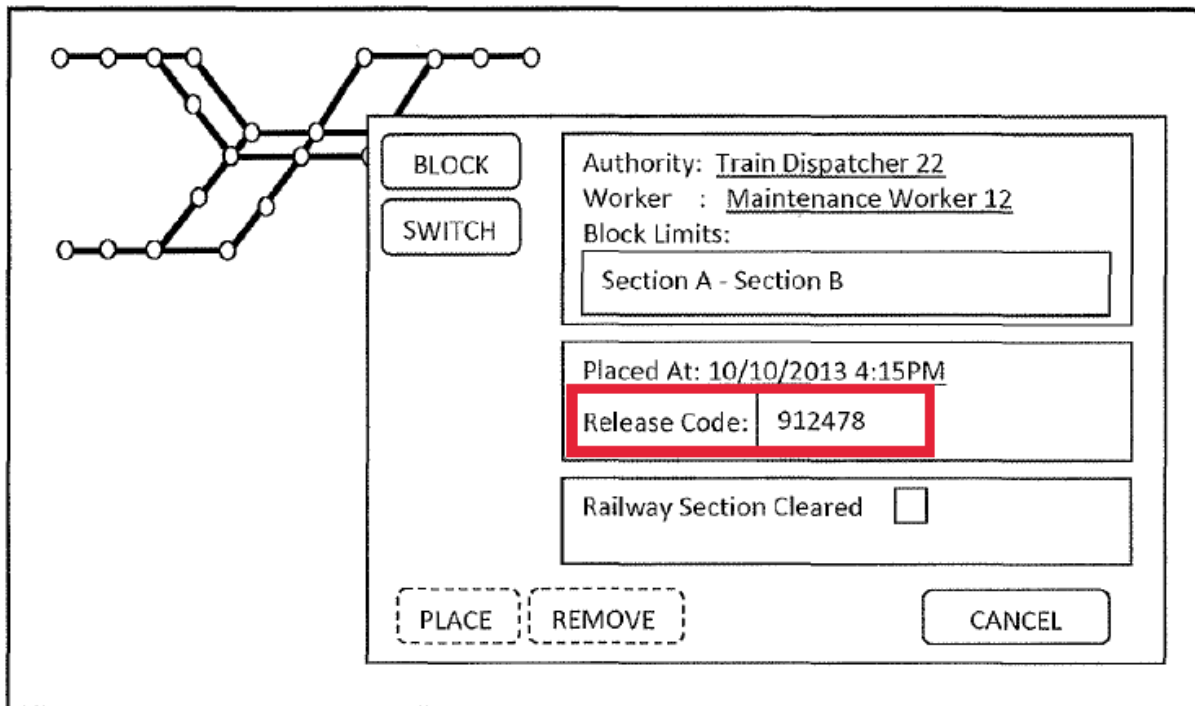
167. In support of this opinion, Figures 8, 9, and 10 each show examples of specific codes. I provide annotated versions of these figures below with examples of specific codes highlighted with red boxes.

**FIGURE 8**

The screenshot shows a railway track diagram on the left with a switch mechanism. A pop-up window is displayed on the right, containing the following information:

- BLOCK** and **SWITCH** buttons.
- Authority:** Train Dispatcher 22
- Worker :** Maintenance Worker 12
- Block Limits:** Section A - Section B
- Placed At:** 10/10/2013 4:15PM
- Release Code:** 912478 (highlighted with a red box)
- PLACE** (dashed button), **REMOVE**, and **CANCEL** buttons at the bottom.

**FIGURE 9**



BLOCK

SWITCH

Authority: Train Dispatcher 22

Worker : Maintenance Worker 12

Block Limits:

Section A - Section B

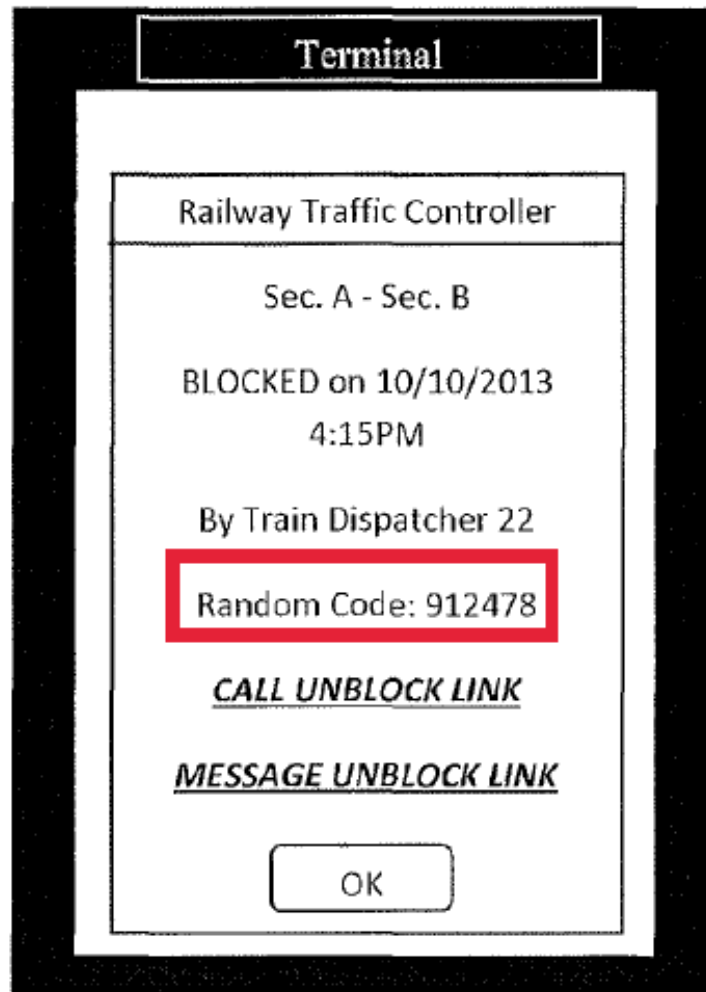
Placed At: 10/10/2013 4:15PM

Release Code: 912478

Railway Section Cleared ☐

PLACE REMOVE CANCEL

**FIGURE 10**



168. Therefore, it is my opinion that the Asserted Patents inform, with reasonable certainty, those skilled in the art about the contents of the Code Terms and how they are created.

**iii. SEPTA’s arguments regarding “second secret code” are incorrect.**

169. Again, I understand that indefiniteness is not an issue that should be considered by the Court as part of the claim construction process. I also understand that SEPTA failed to timely provide its positions on indefiniteness under the Court’s Scheduling Order. However,

should the Court allow SEPTA to raise indefiniteness issues as part of this process, I provide the following.

170. Although not proposed for construction by either Party, SEPTA seems to assert, with respect to the '115 patent, that the term “second secret code” is unclear as to how the “second secret code” remains unknown to the dispatcher “throughout the temporal scope of these claims.” SEPTA’s Supplemental Preliminary Invalidity Contentions at 65. In other words, SEPTA seems to argue that the Asserted Patents fail to inform, with reasonable certainty, those skilled in the art as to how “second secret code” remains unknown to the dispatcher. I disagree.

171. To begin, SEPTA’s emphasis on whether or not the “second secret code” is “secret” is misplaced, and itself indicates a fundamental misunderstanding by SEPTA of the specification and claims of the '115 patent. A POSITA would not share in SEPTA’s misunderstanding.

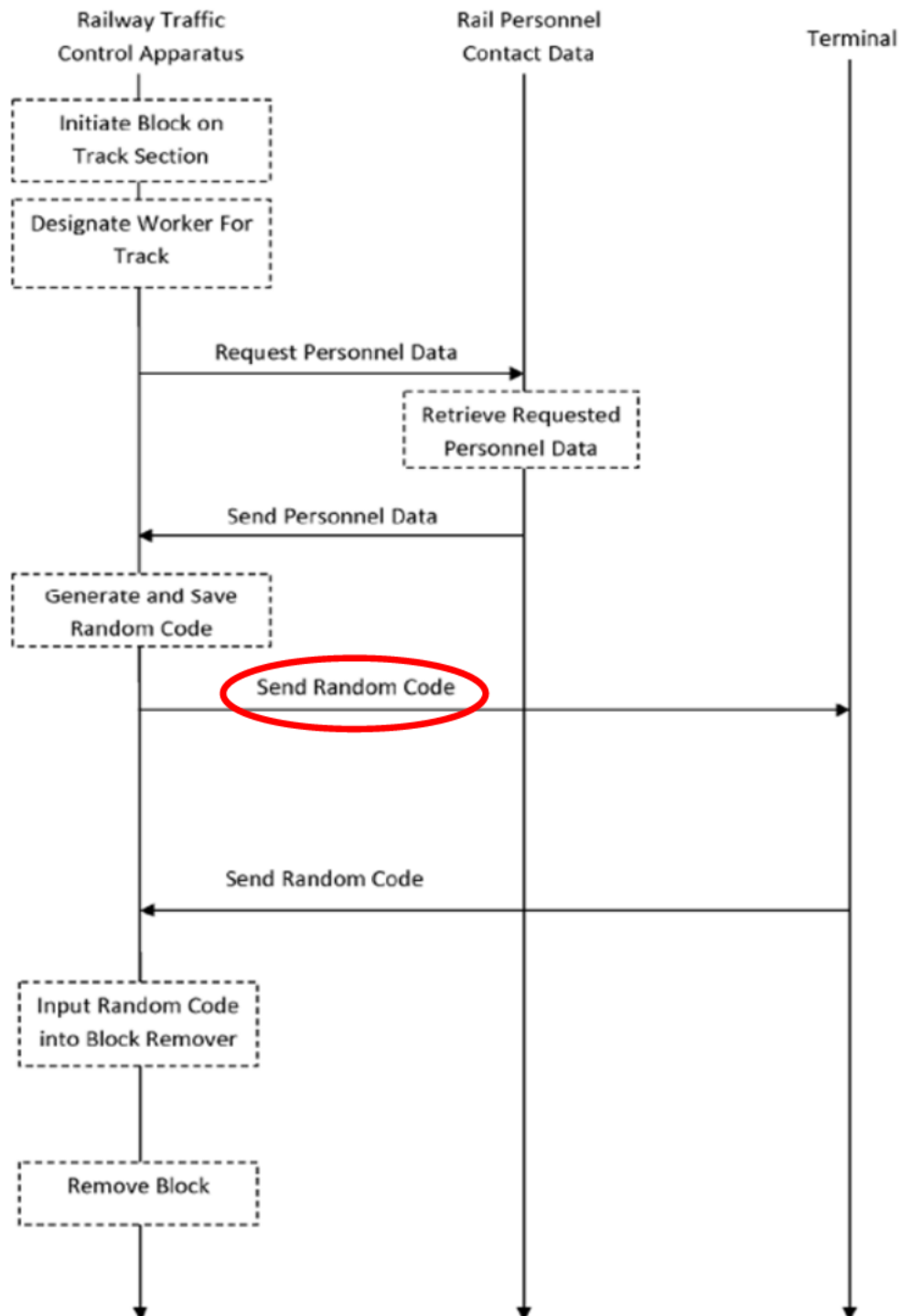
172. Rather, it would be clear to a POSITA that “second secret code” refers to the string of characters relayed from the railway field worker back to the dispatcher or the railway control apparatus (via message, voice, embedded link, or otherwise). A POSITA would further understand that the use of the word “secret” in “second secret code” does not indicate endless secrecy of the “second secret code,” itself, but rather signifies the “second secret code’s” relationship to the “secret code” described earlier in the claims. This is due to the fact that the railway control apparatus is configured such that, prior to releasing a block, it will compare the “second secret code” (*i.e.*, the string of characters relayed from the railway field worker back to the dispatcher or the railway control apparatus) with the “secret code” that the railway control apparatus generated, transmitted to the remote user terminal of the railway field worker, and saved in its internal memory or the like.

173. This understanding finds grounding in the specification of the '115 patent.

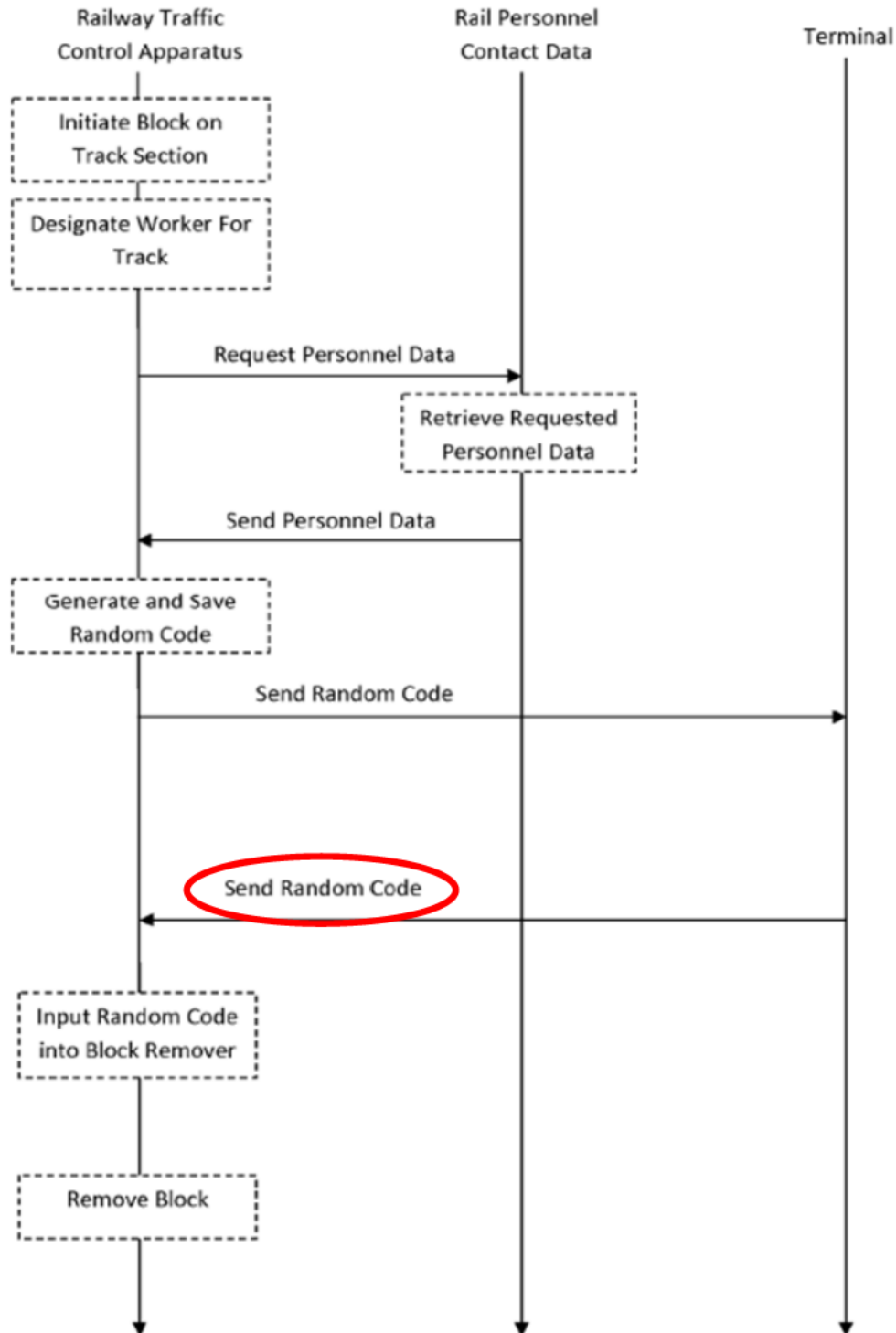
174. For example, and as discussed in detail above, the claims and specification of the '115 patent are clear that a “secret code” will be generated by the railway control apparatus and transmitted to the remote user terminal of the railway field worker. *See, e.g.*, '115 patent at Fig. 4; *id.* at Fig. 12, step S1213; *id.* at 10:25-29.

175. The claims and specification of the '115 patent are also clear that, once the secret code is received by the remote user terminal of the railway field worker, the railway field worker must return that secret code to the dispatcher or the railway control apparatus in order for the block to be removed. *See, e.g.*, '115 patent at 10:39-42; claims 20-23, 31-34.

176. For example, claim 20 states clearly that the railway control apparatus is configured to “transmit the secret code to a remote user terminal.” *Id.* at claim 20. This is also clearly illustrated in Fig. 4 of the '115 patent:

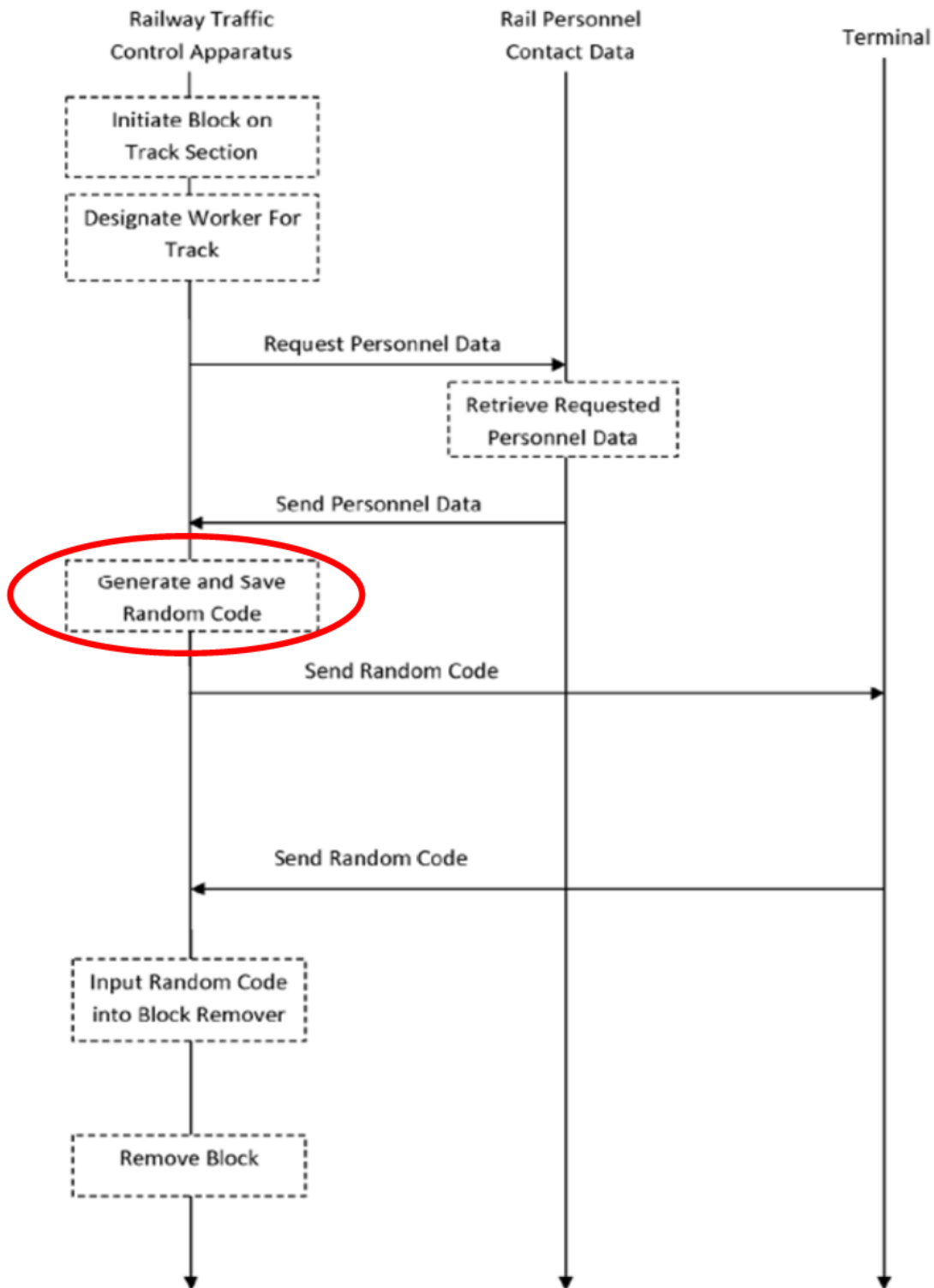
**FIGURE 4**

177. Further, claim 22 – which incorporates the elements of claim 20 (and 21) – is clear that the railway control apparatus is configured to “receive a second secret code.” *Id.* at claim 22. The received “second secret code” is clearly the return transmission of the code back from the railway field worker as illustrated in Fig. 4.

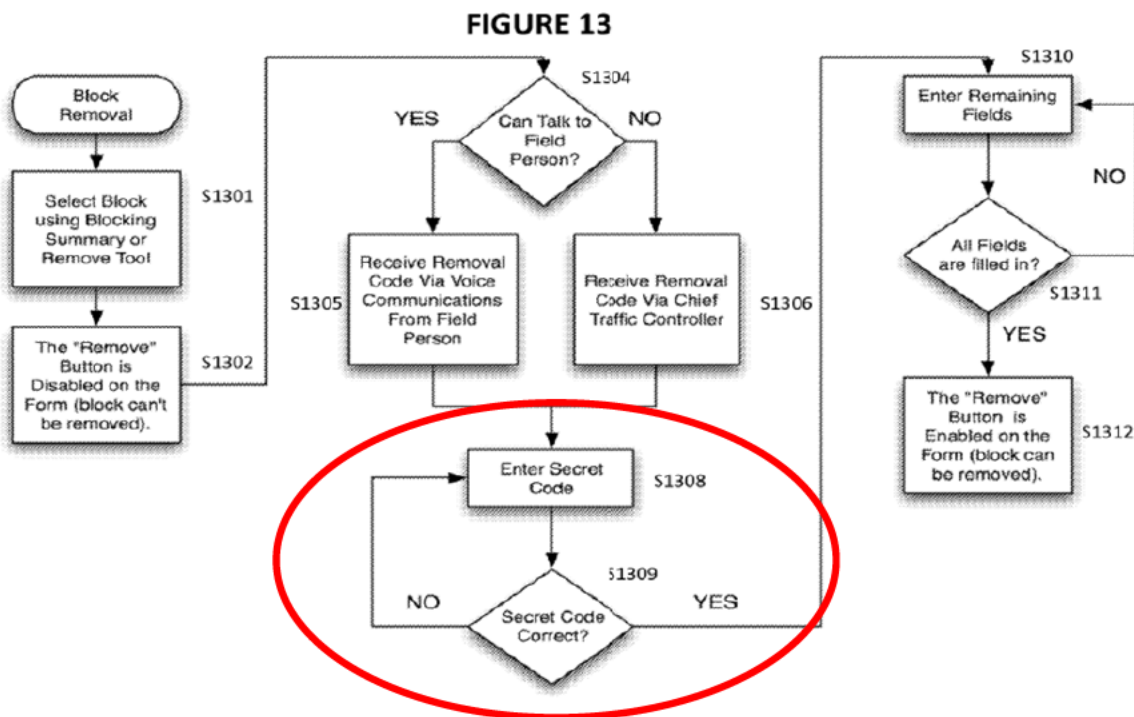
**FIGURE 4**

178. The claims and specification of the '115 patent are also clear that, prior to the block being removed, the system must compare the “second secret code” relayed from the railway field worker back to the railway control apparatus with the “secret code” stored in the systems memory or the like in order to determine that this string of characters matches the “secret code,” and is therefore the correct code for releasing the block. *See, e.g.*, '115 patent at 10:47-61 (“Once the secret code is received. . .”); claims 20-23, 31-34.

179. For example, Figure 4 illustrates that, in one embodiment of the inventions, the original (and correct) “secret code” is saved in the system. The below illustrates:

**FIGURE 4**

180. Further, Figure 13 demonstrates that, in one embodiment of the inventions, “secret code” must be determined to be the correct code prior to the block being released. The below illustrates:



181. Accordingly, SEPTA’s alleged indefiniteness position misses the point in a way that a POSITA would not. It is, therefore, my opinion that the Asserted Patents provide the requisite reasonable certainty as to the meaning of “second secret code.”

182. Thus, it is my opinion that the Asserted Patents provide reasonable certainty regarding the scope of the claimed inventions as to the Code Terms, as well as “second secret code.”

**2. “railway control apparatus” and “railway traffic control apparatus”  
[’782 patent claim 5; ’835 patent claims 1, 10, 19, 20, 30, 40; ’115  
patent claims 20, 30; proposed by SEPTA]**

183. It is my understanding that SEPTA has asked the Court to construe the terms:

(i) “railway control apparatus,” which is used in the ’782 patent, ’835 patent, and ’115 patent, and (ii) “railway traffic control apparatus,” which is used in the ’835 patent. SEPTA has offered the same construction for each term. Railware proposes that the terms do not need construction, or should be afforded their plain and ordinary meaning. The below chart illustrates this, as well as the Parties’ respective positions on the construction of these terms.

| <u>Railware’s Proposed Construction</u>                  | <u>SEPTA’s Proposed Construction</u>                                   |
|----------------------------------------------------------|------------------------------------------------------------------------|
| No construction necessary or plain and ordinary meaning. | centralized traffic control (CTC) console used by the train dispatcher |

184. It is my opinion that the claim terms “railway control apparatus” and “railway traffic control apparatus” do not require construction.

185. It is my opinion that a POSITA would readily understand the claim terms “railway control apparatus” and “railway traffic control apparatus” without further construction.

186. As an initial matter, the claim terms themselves are self-descriptive. A POSITA would readily understand that a “railway control apparatus” is an apparatus or collection of hardware and software components that controls a railway. Similarly, “a railway traffic control apparatus” is an apparatus or collection of hardware and software components that controls railway traffic. These are commonly understood words being used according to their commonly understood meaning.

187. As detailed below, my opinion is supported by the intrinsic and extrinsic evidence.

a. **The Claim Language of the Asserted Patents Supports Railware’s Proposal that No Construction Is Necessary.**

188. Each of the claims in which “railway control apparatus” and “railway traffic control apparatus” are used provides clarifying context as to the meaning of these terms.

189. For example, claim 5 of the ’782 patent states that the railway control apparatus can “place a block on one or more specified track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections.” ’782 patent at claim 5.

190. Additionally, claim 5 of the ’782 patent states that the railway control apparatus “generat[es] a release code” and “transmit[s] the release code.” ’782 patent at claim 5.

191. Additionally, claim 5 of the ’782 patent states that the railway control apparatus “permit[s] the block to said one or more track sections to be removed . . . only upon receiving the release code from the user terminal in return.” ’782 patent at claim 5

192. A POSITA would understand from these claims that the railway control apparatus is an apparatus or collection of hardware and software components that controls a railway (*e.g.*, through placing and removing blocks).

193. The claims of the ’835 patent contain similar support. *See, e.g.*, ’835 patent at claim 1 (“the railway traffic control apparatus controlling, by said centralized control operation, one or more interlocks amongst the plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, to block railway traffic to the specified track sections and thereby to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections;” “a block removal part to remove . . . by said centralized control

operation from the railway control apparatus, the block placed by the block placing part on said one or more track sections.”).

194. The claims of the ’835 patent further support my opinion that a POSITA would appreciate that what comprises an “apparatus” is broadly understood and encompasses a number of hardware (such as processor and memory components) and software components beyond just the dispatcher’s console.

195. For example, claim 1 of the ’835 patent states that the “railway traffic control apparatus” is “configured for centralized control of traffic of a centrally controllable railway network including plural railways and a plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, for controlling access to railway tracks.” A POSITA would readily understand that in order to be configured to control traffic of a centrally controllable railway network, the “railway traffic control apparatus” would have to include a variety of hardware and software components beyond just the dispatcher’s console.

196. Further, claim 40 of the ’835 patent recites a “processor,” a “memory device,” and “wherein the processor is configured by execution of computer program instructions to cause the railway control apparatus to” perform certain functions. ’835 patent at claim 40.

197. Further, in claim 22 of the ’835 patent, the railway traffic control apparatus specifically causes a block to be placed “by causing one or more of the plurality of railway traffic interlocks to display a STOP signal.” ’835 patent at claim 22. This further demonstrates that a POSITA would understand the railway traffic control apparatus to encompass more than just the dispatcher’s console because the railway traffic control apparatus must interact with and control various components in the railway network including interlocks that are dispersed throughout the railway network, far from the dispatcher’s console.

198. The claims of the '115 patent contain similar support. *See, e.g.*, '115 patent at claim 20 (railway control apparatus comprises “a processor for controlling a plurality of track sections in the railway network, wherein each track section is associated with a corresponding interlock and is disposed in any of said plural railways of said railway network that is managed by centralized control operation from the railway control apparatus, the processor controlling, by said centralized control operation, one or more interlocks amongst the plurality of railway interlocks dispersed in said plural railways of said railway network, to block railway traffic to one or more specified track sections.”).

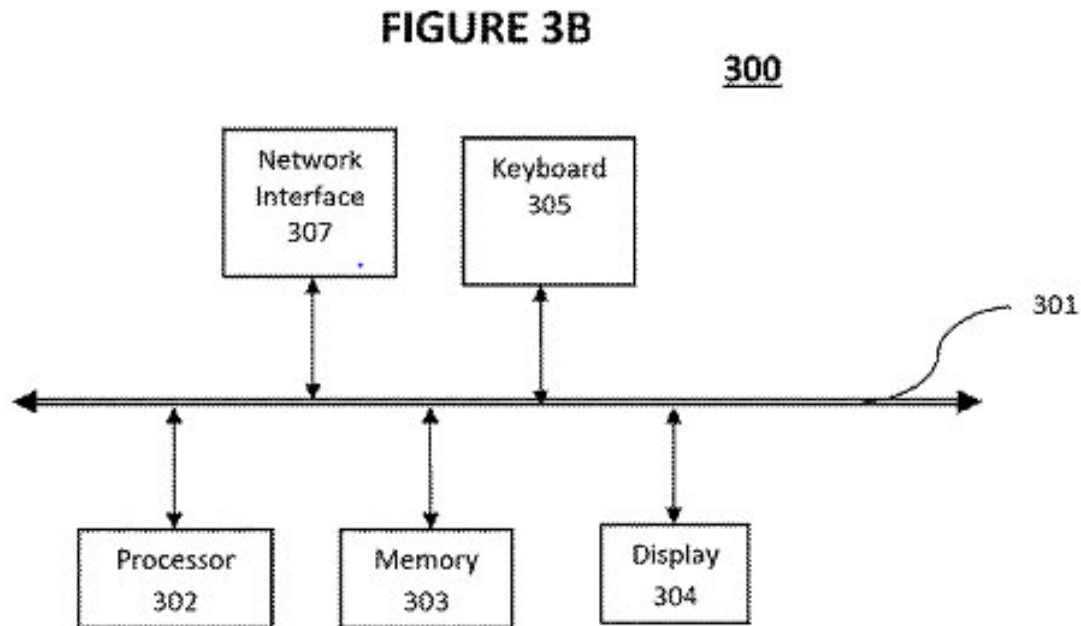
199. The claims of the '115 patent further support my opinion that a POSITA would appreciate that what comprises an “apparatus” is broadly understood and encompasses a number of hardware (such as processor and memory components) and software components beyond just the dispatcher’s console. For example, claim 20 of the '835 patent recites a “processor for controlling a plurality of track sections in the railway network,” “a memory device storing computer-executable instructions, wherein execution of the computer-executable instructions by the processor causes the railway control apparatus to” perform certain functions. '115 patent at claim 20.

200. As such, it is my opinion that a POSITA would understand from these examples that what comprises an “apparatus” is broadly understood and encompasses a number of hardware (such as processor and memory components) and software components beyond just the dispatcher’s console.

b. **The Specifications of the Asserted Patents Support Railware's Proposal that No Construction Is Necessary.**

201. It is my opinion that a POSITA would appreciate that what comprises an “apparatus” is broadly understood and encompasses a number of hardware (such as processor and memory components) and software components, which the specification of the Asserted Patents supports. *See, e.g.*, ’782 patent at 6:42-54; 5:32-39; ’835 patent at 6:57-7:2; 5:42-51; ’115 patent at 6:60-7:5; 5:45-54.

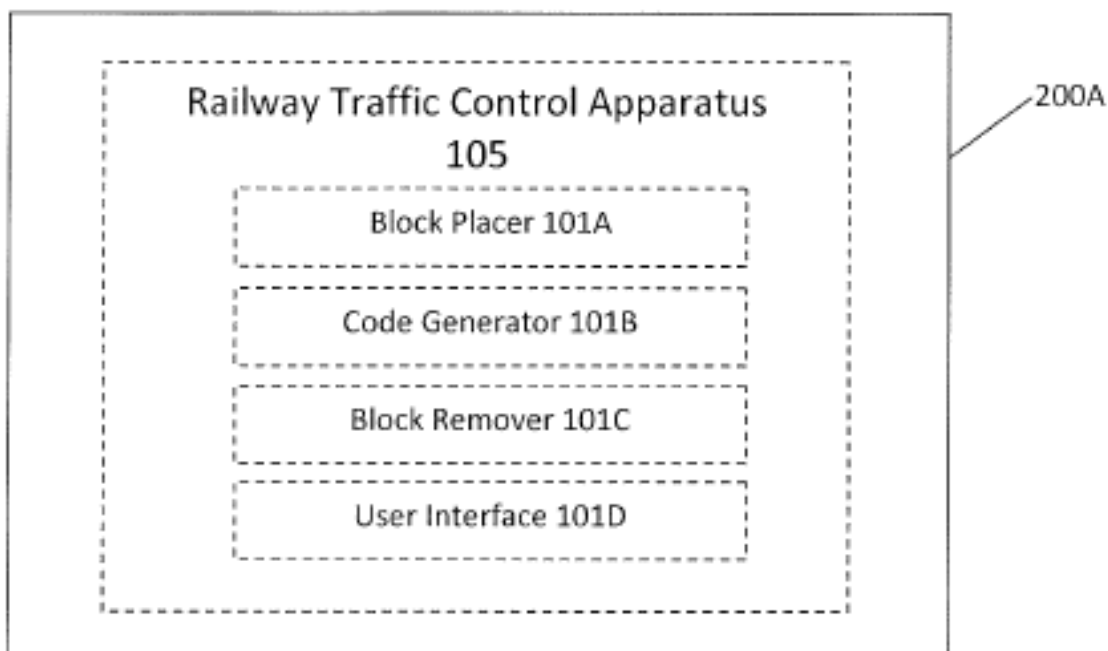
202. For example, Fig. 3B of the Asserted Patents illustrate embodiments whereby the “railway control apparatus” and “railway traffic control apparatus” are comprised of processor, memory, display, keyboard, and network interface components.



203. Likewise, Figure 2 of each of the Asserted Patents illustrate an embodiment whereby the “railway control apparatus” and “railway traffic control apparatus” are comprised of block placer, code generator, block remover, and user interface components.

(Amended)

**FIGURE 2**



204. The discussion in the specifications are also consistent with the usage of related terms at the time of the Asserted Patents. For example, a commonly used railroad dictionary at the time defines “centralized traffic control” to mean “a system of rail operation by means of which the movement of trains over routes and through blocks on a designated section of track or tracks is directed by signals controlled from a designated central point.” Railway Age’s Comprehensive Railroad Dictionary, 2nd Ed. (2002) at 55.

205. This is further supported through how contemporaneous dictionaries have defined the term “apparatus,” such as (i) “a set of materials or equipment designed for a particular use,” Merriam-Webster’s Collegiate Dictionary, 11th Ed. (2012) at 59; (ii) “a collection of

instruments, machines, tools, parts, or other equipment used for a particular purpose,” Collins English Dictionary, 9th Ed. (2007) at 76; (iii) “the technical equipment or machinery needed for a particular activity or purpose,” Concise Oxford English Dictionary, 11th Ed., Revised (2009) at 62. Here, the claim terms themselves make clear that the “particular purpose” that the apparatus is being used for is railway control or railway traffic control.

**c. SEPTA’s Proposed Construction of “railway control apparatus” and “railway traffic control apparatus” as a “centralized traffic control (CTC) console used by the train dispatcher” Is Inconsistent with the Claims and the Specifications and Improperly Reads Limitations into the Claims Beyond how a POSITA Would Understand the Claim Terms.**

206. I understand that SEPTA has proposed that terms “railway control apparatus” and “railway traffic control apparatus” to both be construed to mean “centralized traffic control (CTC) console used by the train dispatcher.” As discussed above, I disagree that a POSITA would understand these terms to have the meaning that SEPTA proposes for a variety of reasons. Specifically, SEPTA’s proposed construction is inconsistent with the claims and the specifications and improperly reads limitations into the claims beyond how a POSITA would understand the claim terms.

207. Based on my knowledge and experience and review of the documents provided to me, including SEPTA’s contentions regarding non-infringement, it appears to me that SEPTA’s construction is formed primarily to advance arguments it makes in support of the various non-infringement positions, rather than grounding its proposed construction in the perspective of a POSITA or any intrinsic or extrinsic evidence.

208. It is my view that SEPTA’s focus on limiting the terms “railway control apparatus” and “railway traffic control apparatus” to both be construed to mean “centralized

traffic control (CTC) console used by the train dispatcher” is an attempt by SEPTA to buttress its non-infringement positions by creating an improper and unsupported limitation in the Asserted Patents (that does not exist), which would require, *inter alia*, the operations performed by the “railway control apparatus” or “railway traffic control apparatus” to be performed exclusively within a singular “console” to the exclusion of any sort of distributed or networked computing environment for railway traffic control that a POSITA would understand was common in CTC systems at the time the Asserted Patents were filed (and is still common today). But the Asserted Patents do not support SEPTA’s construction, and SEPTA’s proposed construction is problematic for a host of reasons.

209. First, SEPTA’s proposal introduces considerable ambiguity by invoking a new term, “console,” which is not part of the claims. The term “console” is used only two (2) times in each of the Asserted Patents. It is done so identically across all of the Asserted Patents, and refers to a “control console” that “may include a map of the entire rail system controlled by the CTC,” and through which “the dispatcher has control of each interlock signal.” ’782 patent at 1:52-56; ’835 patent at 1:59-62; ’115 patent at 1:66-2:2. Accordingly, a POSITA would understand the “console” referred to in the background section of the Asserted Patents to refer to the interface through which a dispatcher interacts with the rest of the railway control apparatus. Stated differently, a POSITA would not understand the “console” to necessarily be synonymous with the “railway control apparatus”/“railway traffic control apparatus” itself (as SEPTA proposes), but rather one of the many components that make-up the apparatus for controlling the railway, which includes various backend systems, such as servers, memories, network connections, railway traffic signals, interlockings, and the like.

210. Second, as discussed in my analysis above at paragraphs 188 to 205, the terms “railway control apparatus” and “railway traffic control apparatus” refer to more than simply the console used by the dispatcher, as SEPTA proposes. A POSITA would understand the “railway control apparatus” and “railway traffic control apparatus” to refer more broadly to the complete collection of hardware and software components used to control the railway, beyond just the dispatcher’s console. A POSITA would understand that the “console” referenced in SEPTA’s proposed construction and in the background sections of the Asserted Patents can be part of the “railway control apparatus” and “railway traffic control apparatus,” but the console is not coextensive with or the same as the “railway control apparatus” or “railway traffic control apparatus.”

211. Further, as noted in my analysis above, claim 1 of the ’835 patent states that the “railway traffic control apparatus” is “configured for centralized control of traffic of a centrally controllable railway network including plural railways and a plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, for controlling access to railway tracks.” A POSITA would readily understand that in order to be configured to control traffic of a centrally controllable railway network, the “railway traffic control apparatus” would have to include a variety of hardware and software components beyond just the dispatcher’s console.

212. The specification further supports my opinion that SEPTA’s proposed construction is incorrect, inconsistent with the specifications of the Asserted Patents, and should be rejected.

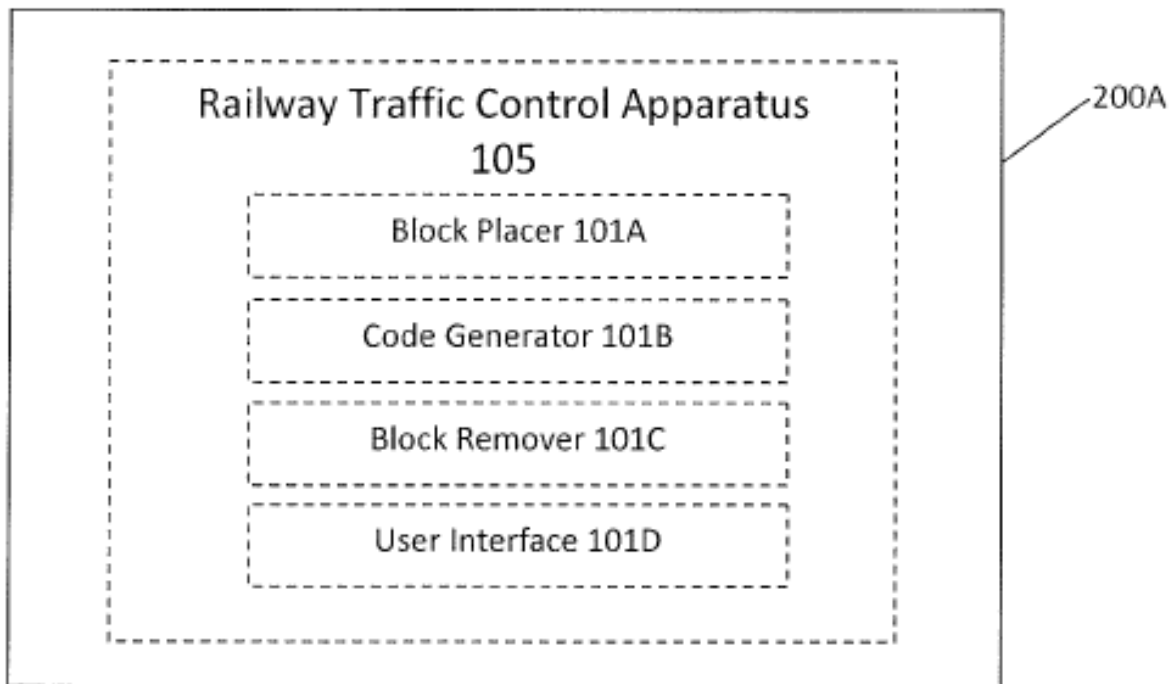
213. For example, Figures 1A and 2A show the “railway traffic control apparatus 105” containing the specific traffic control parts discussed above in paragraphs 188 to 200 with

respect to the claims. *See, e.g.*, Figs. 1A and 1B (showing the “Block Pacer 101A,” “Code Generator 101B,” and “Block Remover 101C” as part of the railway traffic control apparatus).

214. Figure 2, shown below, shows an exemplar embodiment where the “user interface 101D” as further included as part of the “railway traffic control apparatus 105.” Fig. 2.

(Amended)

**FIGURE 2**



215. Consistent with my understanding, the “User Interface 101D” (*e.g.*, the interface of the “terminal” including the display, keyboard, mouse, graphical user interface and the like with which the dispatcher interacts with the railway control apparatus) is shown as only one part of the railway traffic control apparatus. The terminal and the railway traffic control apparatus are not necessarily coextensive or one in the same thing. Rather, the terminal can be simply one of the several components (hardware and software) that make-up the apparatus that controls the railway. A POSITA would understand this distinction.

216. Further to that point, a POSITA would understand from the teachings in the specifications that variations can be introduced without departing from the scope of the inventions, and would inform a POSITA that other technical environments are within the scope of the inventions, including environments where the dispatcher's terminal or console is not synonymous with the railway control apparatus or railway traffic control apparatus. This is further contrary to SEPTA's proposed construction, which effectively collapses the terms "railway control apparatus," "railway traffic control apparatus," "terminal," and "console" into one.

217. Additionally, the specification of the '782 patent states that "[t]he drawings show examples of implementations of the subject matter of this patent disclosure in several computing environments. However, it should be understood that the subject matter of this disclosure can be utilized by any computing device including but not limited to PDAs (personal digital assistants), cell phones, personal, notebook and workstation computers, kiosks, other information terminals, WIC (or another) pager, etc. In addition, the subject matter of this disclosure might be provided as services in a modular fashion by other devices connected by a communication network." '782 patent at 4:44-53.

218. The specification of the '835 and '115 contain similar statements. *See* '835 patent at 4:54-64; '115 patent at 4:57-67.

219. The specifications of the Asserted Patents further state "[t]he aforementioned specific embodiments are illustrative, and many variations can be introduced on these embodiments without departing from the spirit of the disclosure or from the scope of the appended claims. For example, elements and/or features of different examples and illustrative embodiments may be combined with each other and/or substituted for each other within the

scope of this disclosure and appended claims.” ’782 patent at 10:37-44; ’835 patent at 10:65-11:5; ’115 patent at 10:62-11:2.

220. It is therefore my opinion that a POSITA would understand the claims and specifications to support Railware’s proposed construction and not SEPTA’s overly narrow proposed construction.

221. SEPTA’s own documents support Railware’s construction and not SEPTA’s. For example, according to SEPTA’s document entitled [REDACTED]

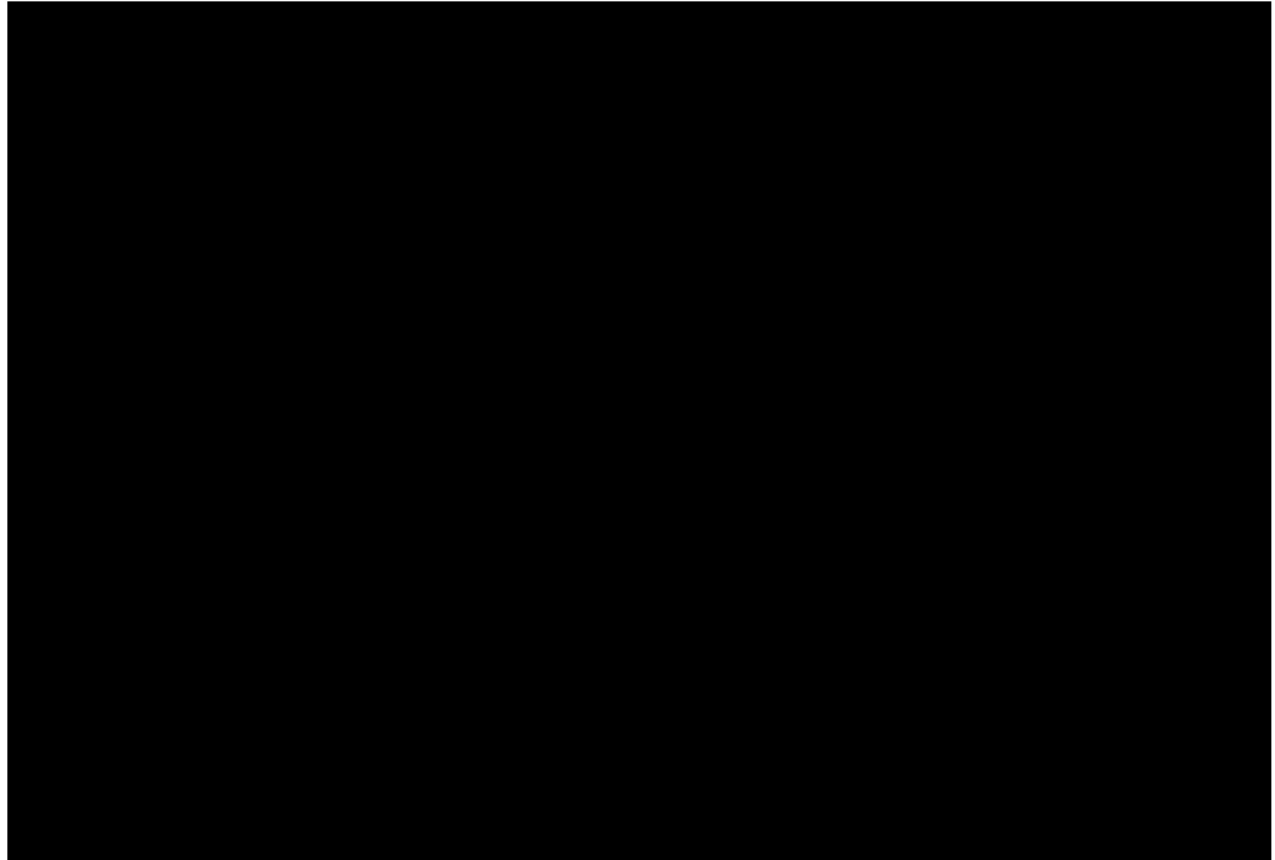
[REDACTED], [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] SEPTA\_0004897. The image below, from that same document, shows the extent of SEPTA’s system that, like the claimed “railway control apparatus”/“railway traffic control apparatus,” is “configured for centralized control of traffic of a centrally controllable railway network”:



222. This figure illustrates that the CTC system (*e.g.*, a “railway control apparatus”/“railway traffic control apparatus”) is much more than just the dispatcher’s “console” (labeled above as “”).

223. This further supports my opinion that a POSITA would not understand the terms “railway control apparatus”/“railway traffic control apparatus” would mean only the “centralized traffic control (CTC) console used by the train dispatcher.” Rather, a POSITA would readily understand that the terms “railway control apparatus”/“railway traffic control apparatus” to be an apparatus or collection of hardware and software components that controls a railway. These terms do not require any further construction and are self-descriptive.

224. Thus, it is my opinion that claim terms “railway control apparatus” and “railway traffic control apparatus” require no construction. It is further my opinion that SEPTA’s

proposed construction is inconsistent with the claims and specifications of the Asserted Patents and should be rejected.

**B. Claim Construction Issues Common to the '835 Patent and the '115 Patent**

225. I now address the claim terms and issues that are common across the '835 patent and the '115 patent.

1. **“user terminal” [’835 patent, claims 1, 20, 30, 40; proposed by SEPTA and Railware; ’835 patents, claims 23, 33, 41; proposed by Railware] and “remote user terminal” [’115 patent, claims 20, 30, 31; proposed by SEPTA and Railware; ’115 patent, claims 24-27, 29, 35, 36; proposed by Railware]**

226. It is my understanding that both Parties have asked the Court to construe the terms (i) “user terminal,” as this term is used in the '835 patent, as well as (ii) “remote user terminal,” as this term is used in the '115 patent. Railware proposes that both terms be construed as “user terminal of a railway field worker.” SEPTA proposes that both terms be construed as “railway field worker’s mobile user device.” The below chart illustrates this, as well as the Parties’ respective positions on the construction of these terms.

| <u>Railware’s Proposed Construction</u> | <u>SEPTA’s Proposed Construction</u>      |
|-----------------------------------------|-------------------------------------------|
| user terminal of a railway field worker | railway field worker’s mobile user device |

227. I have reviewed SEPTA’s Identification of Proposed Constructions of Claim Terms. It is my opinion that the terms “user terminal” and “remote user terminal” should be construed as “user terminal of a railway field worker” in line with Railware’s proposed construction.

228. As detailed below, my opinion is supported by the intrinsic and extrinsic evidence.

a. **The Claim Language of the '835 Patent and the '115 Patent Support Railware's Proposal that the "user terminal" and "remote user terminal" Are Those of the Railway Field Worker.**

229. To begin, it is my understanding that the Parties are in agreement that both the "user terminal" and the "remote user terminal" refer to the user terminal of the railway field worker.

230. To that end, claim 20 of the '835 patent is clear that the "user terminal" in question is the terminal that the railway traffic control apparatus "transmit[s] the secret release code to." '835 patent at claim 20. This usage is consistent across claims 1, 20, 23, 30, 33, 40 and 41 of the '835 patent as well. A POSITA would understand, from this claim language alone, that the "user terminal" in these claims is to be understood as the terminal where the railway field worker receives the release or removal code generated by the railway control apparatus.

231. Likewise, claim 20 of the '115 is also clear that the "remote user terminal" in question is the terminal that the railway traffic control apparatus "transmit[s] the secret release code to." '115 patent at claim 20. This usage is also consistent across all claims of the '115 patent. A POSITA would understand, from this claim language alone, that the "remote user terminal" in these claims is to be understood as the terminal where the railway field worker receives the release or removal code generated by the railway control apparatus.

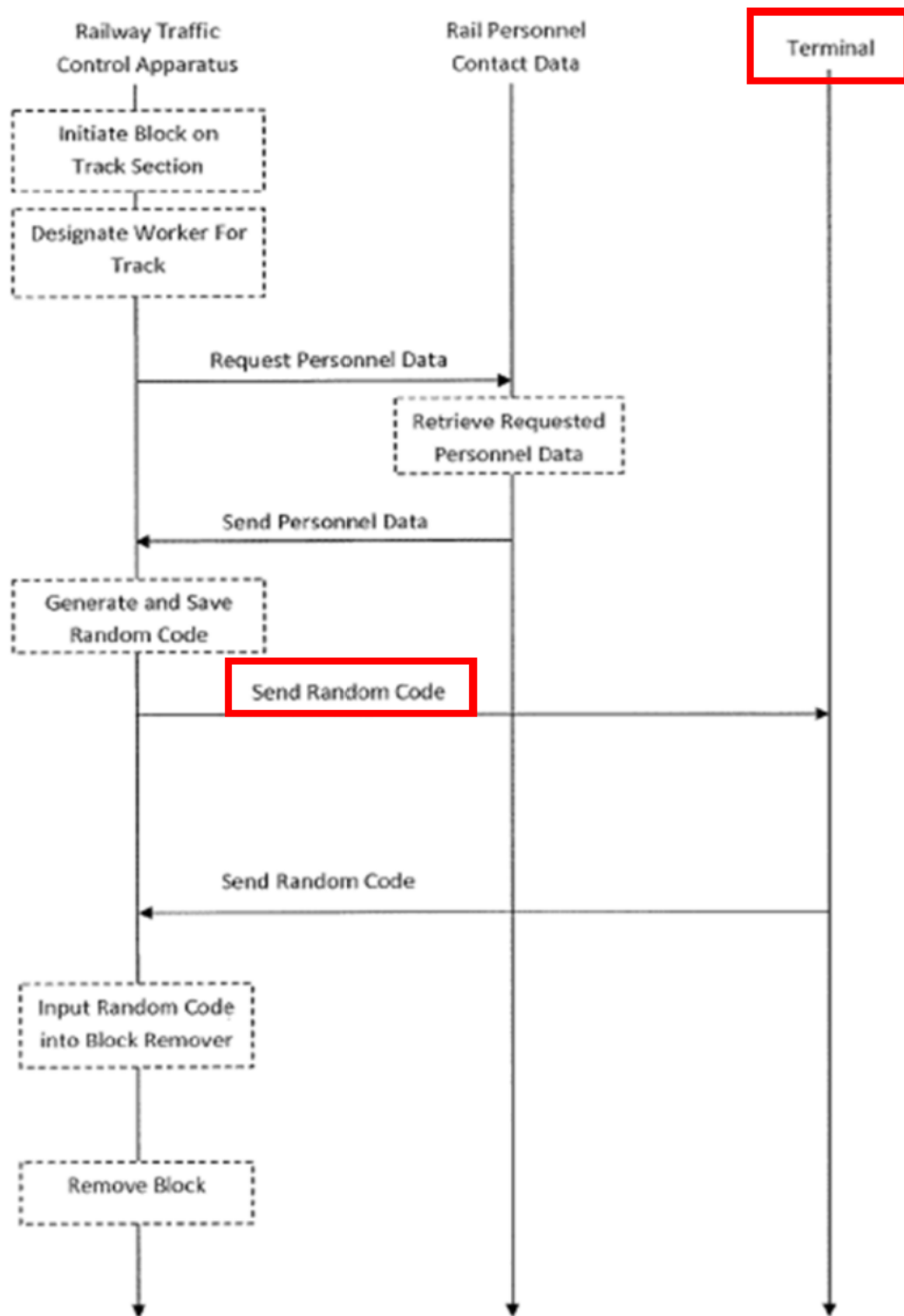
232. The '115 patent further specifies that the user terminal is "remote." *See, e.g.*, '115 patent at claim 20. A POSITA would understand that the term "remote" means that the terminal may be at some distance from the railway control apparatus, which can mean the user terminal of the railway field worker in the context of the inventions claimed. As one example, a POSITA would understand that claim 20 is directed to a "railway control apparatus for centralized control

of traffic of a centrally controllable railway network” and that the “remote user terminal” is “remote” with respect to the “centralized” “railway control apparatus.” Because the “railway control apparatus” is the system through which the dispatcher controls the railway network, a POSITA would readily understand that the “remote user terminal” refers to the user terminal of a railway field worker in the context of the claimed inventions of the ’115 patent.

**b. The Specifications of the ’835 Patent and the ’115 Patent Support Railware’s proposal that the “user terminal” and “remote user terminal” Are Those of the Railway Field Worker.**

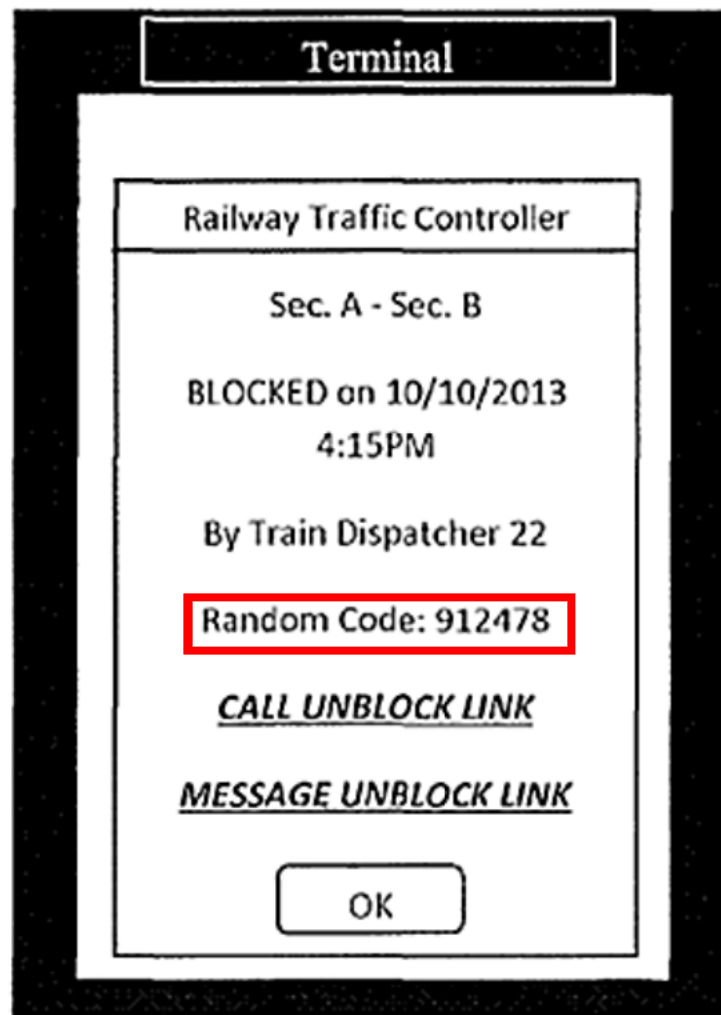
233. The specification and figures in the ’835 patent and the ’115 patent provide further support that the “user terminal” and “remote user terminal” refer to the user terminal of a railway field worker.

234. For example, Figure 4 of both patents (annotated below) depicts an embodiment whereby the terminal of the railway field worker (indicated by the right-hand vertical line labeled “Terminal”) receives the code from the railway control apparatus. Below illustrates:

**FIGURE 4**

235. As a further example, Figure 10 of both patents depicts an embodiment whereby the terminal of the railway field worker displays the release or removal code to the field worker. Below illustrates.

**FIGURE 10**



236. Accordingly, it is my opinion that the specifications of both patents make clear that the claimed “user terminal” in the ’835 patent and the “remote user terminal” in the ’115 patent is the user terminal of a railway field worker, as the Parties agree.

c. **SEPTA’s Proposed Construction of “user terminal” and “remote user terminal” as “mobile user device of the railway field worker” in the ’835 and ’115 Patents is Inconsistent with the Claims and the Specifications and Improperly Reads Limitations into the Claims Beyond how a POSITA Would Understand the Claim Terms.**

237. In view of the above analysis, I understand that the sole dispute between the Parties is whether the terms “user terminal” and “remote user terminal” should be replaced in the construction to mean “mobile user device.” It is my opinion that a POSITA would not understand the terms to necessarily be limited to a “mobile user device” and that such a construction injects unnecessary surplusage and uncertainty into the meaning of the claims. Specifically, SEPTA’s proposed construction is inconsistent with the claims and the specifications and improperly reads limitations into the claims beyond how a POSITA would understand the claim terms.

238. The term “mobile user device” is not a term that is used in the claims of either the ’835 patent or the ’115 patent. Rather, that term is used exclusively in the claims of the ’782 patent. Therefore, introduction of a new term for the ’835 patent and the ’115 patent is confusing.

239. Moreover, the ’835 patent describes the user terminal of the railway field worker in broad terms. Specifically, the specification of the ’835 patent states that “the terminal 103 could be *any communication device* such as but *not limited to*, mobile phone or smartphone, tablet, pager, PDA, *etc.*” ’835 patent at 9:23-25 (emphasis added). The specification of the ’115 patent indicates the same. ’115 patent at 9:25-27. From these disclosures, a POSITA would understand that the railway field worker’s user terminal is broadly understood to be any

communication device and not necessarily just a “mobile user device” (however SEPTA seems to interpret the phrase “mobile user device”).

240. The specification of the ’835 patent also broadly identifies the components of the user terminal, stating “terminal device 200 includes a controller (or processor) 202 that communicates with a number of other components, including storage 203, display 204, input/output (such as mouse, touchpad, stylus, microphone and/or speaker with voice/speech interface and/or recognition software, etc.) 205 and a network interface 206, by way of an internal bus 201.” ’835 patent at 6:33-39. The specification of the ’115 patent indicates the same. ’115 patent at 6:36-42. Again, a POSITA would understand this recitation of components to apply broadly to any device that contains such components.

241. My opinion is further supported through how contemporaneous dictionaries have defined terms such as “terminal,” which include definitions such as (i) “combination of a keyboard and output device (as a video display unit) by which data can be entered into or output from a computer or electronic communications system,” Merriam-Webster’s Collegiate Dictionary, 11th Ed., 1289 (2012), (ii) “of or relating to an end, extremity, boundary, or terminus,” *id.*, (iii) “a part that forms the end,” *id.*, (iv) “computing a device having input/output links with a computer but situated at a distance from the computer,” Collins English Dictionary, 9th Ed. (2007) at 1663, (v) “[a] device at which a user enters data or commands for a computer and which displays the received output,” Concise Oxford English Dictionary, 11th Ed., Revised (2009) at 1487, (vi) “[a] functional unit in a system or communication network at which data may enter or leave,” IBM Dictionary of Computing, 9th Ed. (1993) at 686, (vii) “[a] point in a system or communication network at which data can either enter or leave,” *id.*, (viii) “[a] device, usually equipped with a keyboard and display device, capable of sending and receiving

information. . . .” *id.* This is consistent with the ’115 patent’s description of the terminal 105 discussed above.

242. In contrast, SEPTA’s proposal that the “user terminal” and “remote user terminal” be construed as the “railway field worker’s mobile user device” is inconsistent with the claim language, the specification, and the figures contained in the ’835 patent and the ’115 patent. A POSITA would not understand the terms “user terminal” or “remote user terminal” as used therein to be limited only to a “mobile user device” of the railway field worker.

243. Unlike the ’782 patent, the claims of the ’835 patent and the ’115 patent do not use the term “mobile” or “mobile user device” once. This alone would suggest to a POSITA that “remote user terminal” is not limited to only a “mobile user device.”

244. Furthermore, the specifications of the ’835 patent and the ’115 patent are clear that the inventions described therein are intended to capture several configurations of technology, including “any computing device including but not limited to PDAs (personal digital assistants), cell phones, personal, notebook and workstation computers, kiosks, other information terminals, [WIC (or another)] pager, etc.” ’835 patent at 4:56-61; 115 patent at 4:60-64 (same). Further, the “subject matter of this disclosure might be provided as services in a *modular fashion* by other devices connected by a communication network.” ’835 patent at 4:61-64 (emphasis added); ’115 patent at 4:64-67 (same). As such, a POSITA would not understand the claim language at issue to necessarily require that the “user terminal” or “remote user terminal” be a “mobile user device,” as SEPTA contends.

245. Accordingly, it is my view that a POSITA would not understand the terms “user terminal” or “remote user terminal” to be limited only to a “mobile user device” of the railway field worker. Therefore, SEPTA’s construction should not be adopted. Rather, it is my opinion

that “user terminal” and “remote user terminal” should be construed as “user terminal of a railway field worker,” in line with Railware’s proposed construction.

**C. Claim Construction Issues Specific to the ’782 Patent**

246. I now address the claim terms and issues that are specific to the ’782 patent.

**1. “user terminal” [’782 patent, claim 5; proposed by Railware and SEPTA]**

247. It is my understanding that both Parties have asked the Court to construe the term “user terminal,” as applied to claim 5 of the ’782 patent. The below chart illustrates this, as well as the Parties’ respective positions on the construction of this term.

| <u>Railware’s Proposed Construction</u>                          | <u>SEPTA’s Proposed Construction</u>      |
|------------------------------------------------------------------|-------------------------------------------|
| user terminal of a terminal user ( <i>i.e.</i> , the dispatcher) | railway field worker’s mobile user device |

248. I have reviewed SEPTA’s Identification of Proposed Constructions of Claim Terms. It is my opinion that the term “user terminal” should be construed as the “user terminal of a terminal user (*i.e.*, the dispatcher),” in line with Railware’s proposed construction.

249. It is my opinion that the “user terminal” referred to in claim 5 of the ’782 patent is the “terminal” where the terminal user (*i.e.*, the dispatcher) places and removes blocks on tracks.

250. I understand from counsel that the same term is generally used to refer to the same thing across patents in a single family. I also understand, however, that the same terms appearing in different claims are not presumed to have the same meaning if it is clear from the claims, specification, and prosecution history that the terms have different meanings at different portions of the claims.

251. Thus, while the term “user terminal” appears in all three of the Asserted Patents, it is my opinion that the usage of “user terminal” in claim 5 of the ’782 patent would be understood by a POSITA to have a different meaning from its usage in the ’835 patent, the ’115 patent, and claim 1 of the ’782 patent. Specifically, it is my opinion that the “user terminal” referred to in claim 5 of the ’782 patent is the “terminal” where the terminal user (*i.e.*, the dispatcher) can control the railway network by entering instructions for the railway control apparatus to place and remove blocks on tracks and **not** the user terminal of the railway field worker (which is how the term is used in the ’835 and ’115 patents, and that I discuss above at paragraphs 226 to 245 of this Declaration).

252. As detailed below, my opinion is supported by the intrinsic and extrinsic evidence.

a. **The Specification of the ’782 Patent Supports Railware’s Proposed Construction.**

253. According to claim 5, the “user terminal” is used by the terminal user to enter instructions for the railway control apparatus to perform the operations of “plac[ing] a block on one or more specified track sections,” “generating . . . a release code,” “transmitting the release code to an electronic contact address accessible by the railway field worker,” and “permitting the block . . . to be removed.” ’782 patent at claim 5. Each of the above operations are associated with the dispatcher’s terminal, not the railway field worker’s terminal. The specification confirms this.

254. For example, Figures 1A, 1B, and 2 each show that the block placer, code generator, and block remover are part of the railway control apparatus, and that the railway control apparatus includes a “user interface 101D,” which “is configured preferably for the ease

of use for the railway traffic controller [*e.g.*, the dispatcher].” ’782 patent at Figs. 1A-2, 6:4-5. The ’782 patent further states “the adaptation may include a RTC user interface to permit a user (*e.g.*, *train dispatcher*) to specify a track section(s) to be blocked, specify an instruction to the centralized railway control system to block the railway traffic to the specified track section(s).” ’782 patent at 3:1-5 (emphasis added).

255. The ’782 patent also states that “[t]he user interface 101D may be a mobile application, a web page or some other software component, on a terminal device. Such terminal preferably is configured to communicate through a computer or data network to obtain content and data from an external source.” ’782 patent at 6:9-13.

256. Figure 3B further states “an exemplary constitution of a computer 300 which can be configured by appropriate programming to operate as the railway traffic control apparatus 105 (FIG. 1A). The computer 300 shown in FIG. 3B includes a processor 302, and various elements connected to the processor 302 by an internal bus 301, such as a memory 303, display 304, keyboard 305 and network interface 306. The processor 302 processes incoming requests transmitted through the network interface 306. The network interface 306 enables the railway traffic control terminal to communicate with other network-connected devices such as a terminal (*e.g.*, the terminal 103 of FIG. 1A or FIG. 1B) and receive data or service requests.” ’782 patent at 6:42-54; *see also, id.* at 6:60-7:10.

257. Based on my knowledge and experience, a POSITA would understand that, as used in claim 5 of the ’782 patent and the related portions of the specification, the “user terminal” or “terminal” is the device by which the dispatcher interacts with the rest of the railway control apparatus for placing and removing blocks and controlling railway traffic.

258. Extrinsic sources also support my opinions. For example, a contemporaneous dictionary defines “terminal” as “combination of a keyboard and output device (as a video display unit) by which data can be entered into or output from a computer or electronic communications system.” Merriam-Webster’s Collegiate Dictionary, 11th Ed. (2012) at 1289. Similar definitions across similar source further confirm this understanding, including: (i) “of or relating to an end, extremity, boundary, or terminus,” *id.*, (ii) “a part that forms the end,” *id.*, (iii) “computing a device having input/output links with a computer but situated at a distance from the computer,” Collins English Dictionary, 9th Ed. (2007) at 1663, (iv) “[a] device at which a user enters data or commands for a computer and which displays the received output,” Concise Oxford English Dictionary, 11th Ed., Revised (2009) at 1487, (v) “[a] functional unit in a system or communication network at which data may enter or leave,” IBM Dictionary of Computing, 9th Ed. (1993) at 686, (vi) “[a] point in a system or communication network at which data can either enter or leave,” *id.*, (vii) “[a] device, usually equipped with a keyboard and display device, capable of sending and receiving information. . . .” *id.* This is consistent with the ’782 patent’s description of the terminal 105 discussed above and as used in claim 5. ’782 patent at 6:42-54.

b. **The Claim Language of the ’782 Patent Supports Railware’s Proposed Construction.**

259. The claim language also supports Railware’s proposed construction. Indeed, a POSITA would understand that “user terminal” referred to in claim 5 of the ’782 patent refers back to the “terminal” that is introduced earlier in the claim. Specifically, there is only one “terminal” described in claim 5, namely “a terminal user interface on a *terminal* to permit a terminal user of *the terminal* [to] request the railway control apparatus to place a block on one or

more specified track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections.” (Emphasis added.) This language follows through in the next claim element, where “the user terminal” is also referenced, namely “via operation of the user interface of the *user terminal*.” (Emphasis added.) And, then finally, the last claim element again refers to “the user terminal,” namely “receiving the release code from the *user terminal* in return.” (Emphasis added.) All of the references to “user terminal” (highlighted in green in screenshot below) relate back to “a terminal”/“the terminal” (also highlighted in green in the screenshot below) introduced earlier in claim 5:

5. A method to enhance railway control, to protect safety of railway workers on or near railway tracks, said method comprising:  
 configuring a mobile user device of a railway field worker to provide a device user interface to display information received via a network from a railway control apparatus and to permit the railway field worker to respond to prompts displayed thereon;  
 providing a terminal user interface on a terminal to permit a terminal user of the terminal request the railway control apparatus to place a block on one or more specified track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections;  
 generating by the railway control apparatus a release code and transmitting the release code to an electronic contact address accessible by the railway field worker via operation of the user interface of the user terminal;  
 and  
 permitting the block to said one or more track sections to be removed by the railway control apparatus only upon receiving the release code from the user terminal in return.

260. As discussed above, each of these references to “terminal” (in green) refers to the terminal of a terminal user (*i.e.*, the dispatcher), not the terminal or device of the railway field worker, as SEPTA proposes. Indeed, each of these operations in claim 5 is associated with the

dispatcher's terminal through which they can control the railway network by placing and removing blocks.

261. Therefore, the claims further support my opinion that “user terminal” as referenced in claim 5 of the '782 patent would be understood by a POSITA to mean “user terminal of a terminal user (*i.e.*, the dispatcher).”

**c. SEPTA's Proposed Construction is Inconsistent with the Plain Language of Claim 5 and the Specification of the '782 Patent.**

262. It is my opinion that SEPTA's proposed construction of “user terminal” in claim 5 of the '782 patent as “railway field worker's mobile user device” is incorrect, contradicted by the plain language of claim 5, and inconsistent with the specification of the '782 patent.

263. SEPTA's proposal that the “user terminal” be construed as “railway field worker's mobile user device” is inconsistent with the plain claim language of claim 5. Specifically, claim 5 recites a “mobile user device of a railway field worker” separately from “terminal”/“user terminal.”

264. Stated differently, claim 5 separately introduces “mobile user device” and “terminal”/“user terminal” to refer to different aspects of the claimed invention. '782 patent at claim 5. The claim specifically associates “mobile user device” with the “railway field worker” and “terminal”/“user terminal” with the dispatcher's terminal for controlling the railway network by placing and removing blocks. '782 patent at claim 5.

265. To illustrate this point, below is a color-coded image of claim 5, in which “mobile user device of the railway field worker” is shown in blue highlighting, “railway control apparatus” is shown in yellow highlighting, and “terminal”/“user terminal” is shown in green highlighting.

5. A method to enhance railway control, to protect safety of railway workers on or near railway tracks, said method comprising:

configuring a mobile user device of a railway field worker to provide a device user interface to display information received via a network from a railway control apparatus and to permit the railway field worker to respond to prompts displayed thereon;

providing a terminal user interface on a terminal to permit a terminal user of the terminal request the railway control apparatus to place a block on one or more specified track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections;

generating by the railway control apparatus a release code and transmitting the release code to an electronic contact address accessible by the railway field worker via operation of the user interface of the user terminal; and

permitting the block to said one or more track sections to be removed by the railway control apparatus only upon receiving the release code from the user terminal in return.

266. From this claim language, a POSITA would understand that the “terminal”/“user terminal” and “mobile user device” are different devices, with “mobile user device” being the railway field worker’s device (noted in blue and specifically stated in the claim as “mobile user device *of a railway field worker*”) and “terminal”/“user terminal” being the “terminal”/“user terminal” of the dispatcher through which the dispatcher interacts with the “railway control apparatus” (noted in green and yellow, respectively).

267. Under SEPTA’s proposed construction, claim 5 would include two separate and distinct terms for the same device—*i.e.*, the device of the railway field worker, and nothing for the dispatcher.

268. SEPTA's proposed construction is nonsensical and inconsistent with the basic principles of claim construction. Specifically, under SEPTA's construction, both the "mobile user device" and the "terminal"/"user terminal" would refer to the railway field worker's device.

269. Additionally, under SEPTA's proposed construction, SEPTA ignores that there are two names for the referenced user interfaces. Specifically, the "mobile user device" has a "device user interface" and the "terminal"/"user terminal" has a "terminal user interface." Under SEPTA's proposed construction, the "device user interface" and the "terminal user interface" would be the same thing, despite being two different and distinct terms in claim 5.

270. Further, under SEPTA's proposed construction, claim 5 would not include *any* term that refers to the dispatcher's terminal for controlling the railway network by placing and removing blocks. This is not only inconsistent with the plain language of the claim, but the specification, which consistently describes exemplar embodiments of the inventions in terms of providing for the interaction between the field worker's device, on the one hand, and the dispatcher's terminal, on the other.

271. Therefore, it is my opinion that SEPTA's proposed construction of "user terminal" as "railway field worker's mobile user device" is incorrect, inconsistent with the plain language of claim 5, and contrary to the specification of the '782 patent.

272. Separately, it is possible that SEPTA may be relying on the fact that there are certain exemplary figures in the specification that label the railway field worker's device as a "terminal" and the dispatcher's computer as a "computer" or "apparatus." *See, e.g.*, Fig. 1A. This, however, still does not support SEPTA's proposed construction in view of the plain language of claim 5 and the specification of the '782 patent.

273. Indeed, the '782 patent is not so strict in its use of these terms. For example, the '782 patent refers, at various points, to where the dispatcher sits as a “terminal.” *See, e.g.*, '782 patent at 5:24-25, 6:58, 7:28, 7:38, 7:40, 7:48, 8:22, 8:31, 8:43, 8:50, 8:55, 8:66, 9:8, 9:27-30, 9:33, 9:36, 9:39, 9:44. More, the '782 patent refers to the “railway traffic control *terminal* 105” no less than 33 times. Therefore, the specification of the '782 patent is clear that the term “terminal” can apply to the user terminal of the dispatcher. And, this is consistent with how the term is clearly used in claim 5 of the '782 patent.

274. I also understand that SEPTA may rely on amendments that were made during the reissue proceedings of the '835 and '115 patents. While these amendments may have made certain language in the reissue patents more consistent, they do not change how a POSITA would understand claim 5 of the '782 patent because those amendments are not part of the specification of the '782 patent, and the language of claim 5 of the 782 patent makes clear to a POSITA what is being claimed by the term “terminal”/“user terminal” in claim 5.

275. Accordingly, it is my opinion that “user terminal” of claim 5 should be construed as “user terminal of a terminal user (*i.e.*, the dispatcher),” and SEPTA’s proposed construction should be rejected.

**2. “from the user terminal in return” [’782 patent, claim 5; proposed by SEPTA]**

276. It is my understanding that SEPTA has asked the Court to construe the term “from the user terminal in return,” as this term is applied in claim 5 of the '782 patent. Railware proposes that the term does not need construction, or should be afforded its plain and ordinary meaning. The below chart illustrates this, as well as the Parties respective positions on the construction of these terms.

| <u>Railware's Proposed Construction</u>                  | <u>SEPTA's Proposed Construction</u>                       |
|----------------------------------------------------------|------------------------------------------------------------|
| No construction necessary or plain and ordinary meaning. | transmitted from the user terminal (as previously defined) |

277. It is my opinion that the claim term “from the user terminal in return” does not require construction beyond Railware’s proposed construction for “user terminal” discussed above.

278. It is my opinion that a POSITA would readily understand the claim term “from the user terminal in return” without further construction.

279. As an initial matter, the claim term is self-descriptive. As discussed in my analysis of “user terminal,” above, it is my opinion that a POSITA would readily understand the meaning of the terms “user terminal” and “terminal” in the context of the ’782 patent to mean the “user terminal of a terminal user (*i.e.*, the dispatcher).” Based on this understanding, a POSITA would readily understand the meaning of “from the user terminal in return.” A POSITA would understand this phrase to mean that the railway control apparatus must receive back a release code via the user terminal of the dispatcher before a block will be removed by the railway control apparatus.

280. As detailed below, my opinion is supported by the intrinsic and extrinsic evidence.

a. **The Claim Language of the ’782 Patent Supports Railware’s Proposal that No Construction Is Necessary.**

281. To begin, this is not a term at all as proposed by SEPTA, but rather an (incomplete) phrase that derives much of its meaning from the rest of language in the claim element that it modifies. Below is a reproduction of the full claim language at issue:

5. A method to enhance railway control, to protect safety of railway workers on or near railway tracks, said method comprising:

configuring a mobile user device of a railway field worker to provide a device user interface to display information received via a network from a railway control apparatus and to permit the railway field worker to respond to prompts displayed thereon;

providing a terminal user interface on a terminal to permit a terminal user of the terminal request the railway control apparatus to place a block on one or more specified track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections;

generating by the railway control apparatus a release code and transmitting the release code to an electronic contact address accessible by the railway field worker via operation of the user interface of the user terminal; and

permitting the block to said one or more track sections to be removed by the railway control apparatus only upon receiving the release code from the user terminal in return.

282. The language highlighted in green is the language that SEPTA proposes for construction. However, it is my view that, at a minimum, the language in yellow would also be considered by a POSITA in determining what the green language means.

283. In both cases, the highlighted language is clear on its face.

284. It is my opinion that a POSITA would understand “from the user terminal in return,” as indicating that the railway control apparatus (the broader system for controlling the railway network) must receive back a release code, and that the receipt of that code must be done through the user terminal of the dispatcher in order to release a block.

**b. The Specification of the '782 Patent Supports Railware's Proposal that No Construction Is Necessary.**

285. This understanding is consistent with the specification of the '782 patent.

286. As discussed in detail above (*see* paragraphs 36 to 48, which I incorporate here by reference), the specification of the '782 patent describes numerous ways through exemplar embodiments in which the release code may be returned to the dispatcher or the railway control apparatus, including having the railway field worker automatically return the release code to the railway control apparatus (*e.g.*, through a text, embedded link, voice message, etc.) or having the railway field worker provide the release code first to the dispatcher (*e.g.*, through oral communication or otherwise), who then manually enters the release code into the user terminal of the dispatcher, so that the block can be removed by the railway control apparatus.

287. Given the breadth of descriptions regarding how the removal or release code can be returned or transmitted, and the figures that specifically show embodiments in which the dispatcher enters the code into the user terminal, a POSITA would not understand the claim language of claim 5 to be limited to requiring that the “release code” be transmitted to the railway control apparatus only via the user terminal of the railway field worker, as SEPTA proposes. Indeed, consistent with the specification of the '782 patent, the code can be returned in a number of different ways, including through the railway field worker providing it to the dispatcher orally to enter into the dispatcher’s terminal, through the railway field worker interacting with features on the user terminal, and the like. *See e.g.*, '782 patent at 3:13-34.

288. My opinion is further supported through how contemporaneous dictionaries have defined terms such as “return,” which include definitions such as (i) “the act of returning something to a former place, condition, or ownership,” Merriam-Webster’s Collegiate Dictionary, 11th Ed. (2012) at 1065-66, (ii) “to give, take, or carry back; replace or restore,”

Collins English Dictionary, 9th Ed. (2007) at 1381, and (iii) “give or send back or put back in place,” Concise Oxford English Dictionary, 11th Ed., Revised (2009) at 1230.

289. Thus, it is my opinion that “from the terminal” and “from the user terminal” to require no construction beyond Railware’s proposed construction for “user terminal” discussed above with respect to the ’782 patent.

**c. SEPTA’s Proposed Construction Is Inconsistent with the Claims and the Specification of the ’782 Patent and Improperly Reads Limitations into the Claims Beyond how a POSITA Would Understand the Claim Terms.**

290. I understand that SEPTA has proposed that the term “from the user terminal in return” be construed to mean “transmitted from the user terminal (as previously defined).” As discussed above, I disagree that a POSITA would understand these terms to have the meaning that SEPTA proposes for a variety of reasons. Specifically, SEPTA’s proposed construction is inconsistent with the claims and the specifications and improperly reads limitations into the claims beyond how a POSITA would understand the claim terms.

291. Based on my knowledge and experience and review of the documents provided to me, including SEPTA’s contentions regarding non-infringement, it appears to me that SEPTA’s proposed construction is formed primarily to advance arguments it makes in support of its various non-infringement positions, rather than grounding its proposed construction in the perspective of a POSITA or in any intrinsic or extrinsic evidence.

292. I understand that SEPTA intends to argue that it does not infringe the Asserted Patents because “in the [accused systems and methods], to release a block, the railway field worker provides the dispatcher with the code verbally by means of a separate radio call over a

separate radio network, not through the railway field worker's mobile user device." *See, e.g.,* Non-Infringement Contentions Chart A, at 11.

293. It is my view that SEPTA's focus on limiting the term "from the user terminal in return" to "***transmitted*** from the user terminal (as previously defined)" is a further attempt by SEPTA to buttress this non-infringement position by creating an improper and unsupported limitation in the Asserted Patents (that does not exist), which would require, *inter alia*, any release code to be transmitted only directly from the device of the railway field worker to the railway control apparatus, thereby potentially excluding SEPTA's radio-based return operation. But the specification and claims do not support this construction, and SEPTA's proposed construction is, again, problematic for a host of reasons.

294. First, SEPTA's proposed construction is flawed because it incorporates its flawed understanding of how "user terminal" would be understood by a POSITA with respect to claim 5 of the '782 patent. Stated simply, SEPTA's proposed construction incorrectly points to the opposite end of the system than what is plainly called for by the plain language of claim 5 of the '782 patent. I explain why this is problematic, and why a POSITA would not have this same misunderstanding as SEPTA, above in paragraphs 248 to 275 of this Declaration.

295. Second, SEPTA's reading improperly adds a limitation into claim 5 that is not present by requiring that the "release code" from claim 5 can only be ***transmitted*** from the terminal of the railway field worker to the railway control apparatus, and in no other way. This limitation is not in the claims at issue at all. And as discussed above, the '782 patent provides a broad description of how the release code can be returned to the user terminal or railway control apparatus, including having the code provided orally to the dispatcher, who then manually enters the code into the user terminal of the dispatcher. *See e.g.,* 782 patent at 3:13-34.

296. Third, SEPTA's proposed construction is inconsistent with the specification of the '782 patent because, as discussed above, the '782 patent discloses numerous ways through exemplar embodiments in which the release or removal code may be returned to the dispatcher or the railway control apparatus, including having the railway field worker automatically return the release or removal code to the railway control apparatus (*e.g.*, through a text, embedded link, voice message, etc.) or having the railway field worker provide the release or removal code first to the dispatcher (*e.g.*, through oral communication or otherwise), who then manually enters the release code into the user terminal of the dispatcher, so that the block can be released by the railway control apparatus. SEPTA's proposed construction seemingly limits the claim to only the "automatic" embodiments.

297. Additionally, SEPTA's reading seemingly implies that the "release code" from claim 5 must be transmitted *directly from* the terminal of the railway field worker to the railway control apparatus. But requiring the "release code" to be transmitted directly from the terminal of the railway field worker to the railway control apparatus (*i.e.*, with no intervening steps) would render impossible and read-out other aspects of the inventions that contemplate that the release code is transmitted from the terminal of the railway field worker to the railway control apparatus through an intermediary – specifically a network – such as the one illustrated in Figures 1A and 1B, illustrated below.

**FIGURE 1A**

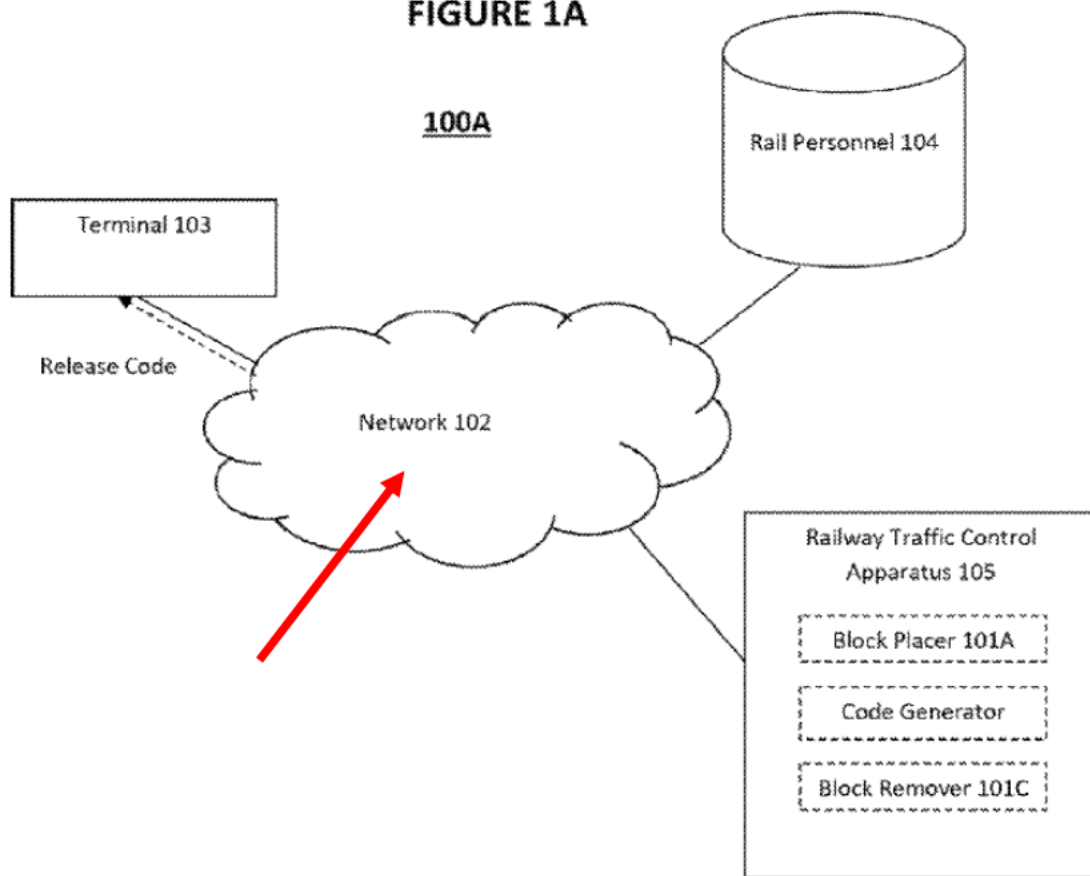
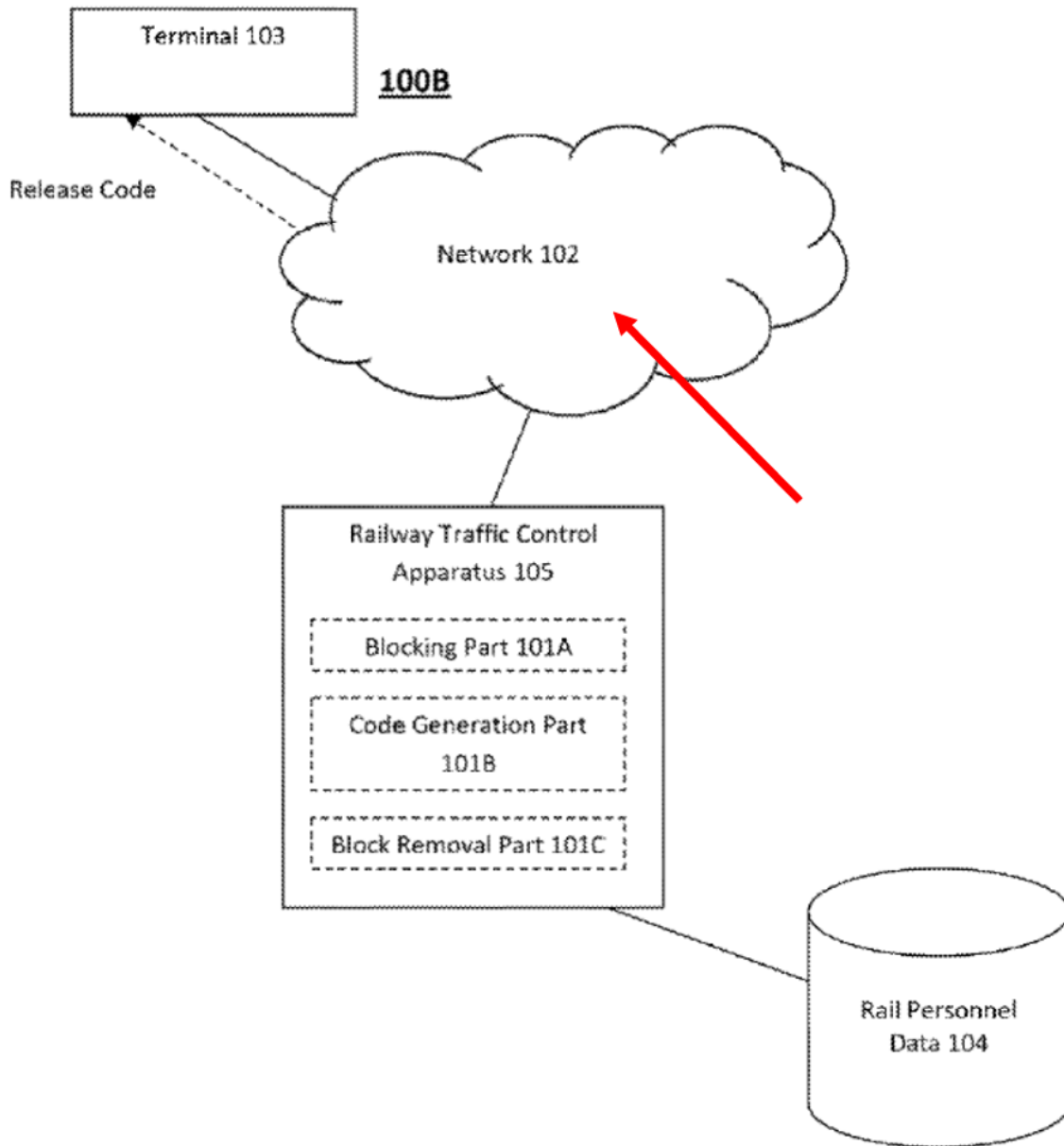


**FIGURE 1B**

298. Further, it my understanding that SEPTA's proposed construction would read-out Railware's own commercial embodiment, EEPS, which was the foundation for and genesis of the Asserted Patents. In Railware's commercial embodiment, the release code is provided by the

field worker through a phone call, who then enters the release code into the railway control apparatus. This is consistent with the exemplar embodiments in the '782 patent (discussed above), where the dispatcher enters the code into the dispatcher's "user terminal" to return the code to the railway control apparatus to release the block. Under SEPTA's proposed construction, the release code must be returned *only* by transmitting it directly from the railway field worker's device, which is inconsistent with Railware's commercial embodiment and the exemplar embodiments of the '782 patent. This further indicates that SEPTA's proposed construction is inconsistent with the '782 patent.

299. Based on this, it is my view that a POSITA would not understand claim 5 of the '782 patent to require that the "release code" from claim 5 can only be transmitted from the terminal of the railway field worker to the railway control apparatus, and in no other way.

300. Accordingly, it is my opinion that "from the user terminal in return" does not require construction beyond Railware's proposed construction for "user terminal" discussed above with respect to the '782 patent, and that SEPTA's proposed construction should be rejected.

**3. "to respond to prompts displayed thereon" and "to respond to the message to release the block" ['782 patent, claims 5 & 6; proposed by SEPTA]**

301. It is my understanding that SEPTA has asked the Court to construe the terms: (i) "to respond to prompts displayed thereon" and (ii) "respond to the message to release the block," as these terms are applied in claims 5 and 6 of the '782 patent. Railware proposes that the terms do not need construction, or should be afforded their plain and ordinary meaning. The below chart illustrates this, as well as the Parties' respective positions on the construction of these terms.

| <u>Terms:</u>                                  | <u>Railware's Proposed Construction</u>                  | <u>SEPTA's Proposed Construction</u>                                                         |
|------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------------------------|
| to respond to prompts displayed thereon        | No construction necessary or plain and ordinary meaning. | to respond through the mobile user device user interface to prompts displayed thereon        |
| to respond to the message to release the block | No construction necessary or plain and ordinary meaning. | to respond through the mobile user device user interface to the message to release the block |

302. It is my opinion that the claim terms “to respond to prompts displayed thereon” and “to respond to the message to release the block” do not require construction. It is my opinion that a POSITA would readily understand the claim terms “to respond to prompts displayed thereon” and “to respond to the message to release the block” without further construction.

303. To begin, the claim terms themselves are self-descriptive. A POSITA would readily understand “to respond to prompts displayed thereon” in the context of the invention described in claim 5 of the '782 patent to indicate that a user device of a railway field worker must be configured to permit the worker to respond to prompts displayed on the user device. Likewise, a POSITA would readily understand “to respond to the message to release the block” in the context of the invention described in claim 6 of the '782 patent to indicate that a railway field worker must be able to respond in some way to a message in order for a block to be released.

304. As detailed below, my opinion is supported by the intrinsic and extrinsic evidence.

305. As with other purported “terms” that SEPTA has offered for construction, both of these terms are not terms at all as proposed by SEPTA, but rather (incomplete) phrases that

derive much of their meaning from the rest of language in the claim element that they modify.

Below is a reproduction of the full claim language at issue.

***Claim 5***

5. A method to enhance railway control, to protect safety of railway workers on or near railway tracks, said method comprising:

configuring a mobile user device of a railway field worker to provide a device user interface to display information received via a network from a railway control apparatus and to permit the railway field worker to respond to prompts displayed thereon;

providing a terminal user interface on a terminal to permit a terminal user of the terminal request the railway control apparatus to place a block on one or more specified track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections;

generating by the railway control apparatus a release code and transmitting the release code to an electronic contact address accessible by the railway field worker via operation of the user interface of the user terminal; and

permitting the block to said one or more track sections to be removed by the railway control apparatus only upon receiving the release code from the user terminal in return.

***Claim 6***

6. The method of claim 1, further comprising:

displaying, upon the railway control apparatus placing the block of railway traffic to said one or more specified track sections and transmitting the release code to the electronic contact address accessible by the railway field worker, a message through the device user interface provided on the mobile user device and permitting the railway field worker to respond to the message to release the block.

306. The language highlighted in green is the language that SEPTA proposes for construction. However, it is my view that, at a minimum, the language in yellow would also be considered by a POSITA in determining what the green language means.

a. **The Claim Language of the '782 Patent Supports Railware's Proposal that no Construction Is Necessary.**

307. In both cases, the highlighted language is clear on its face.

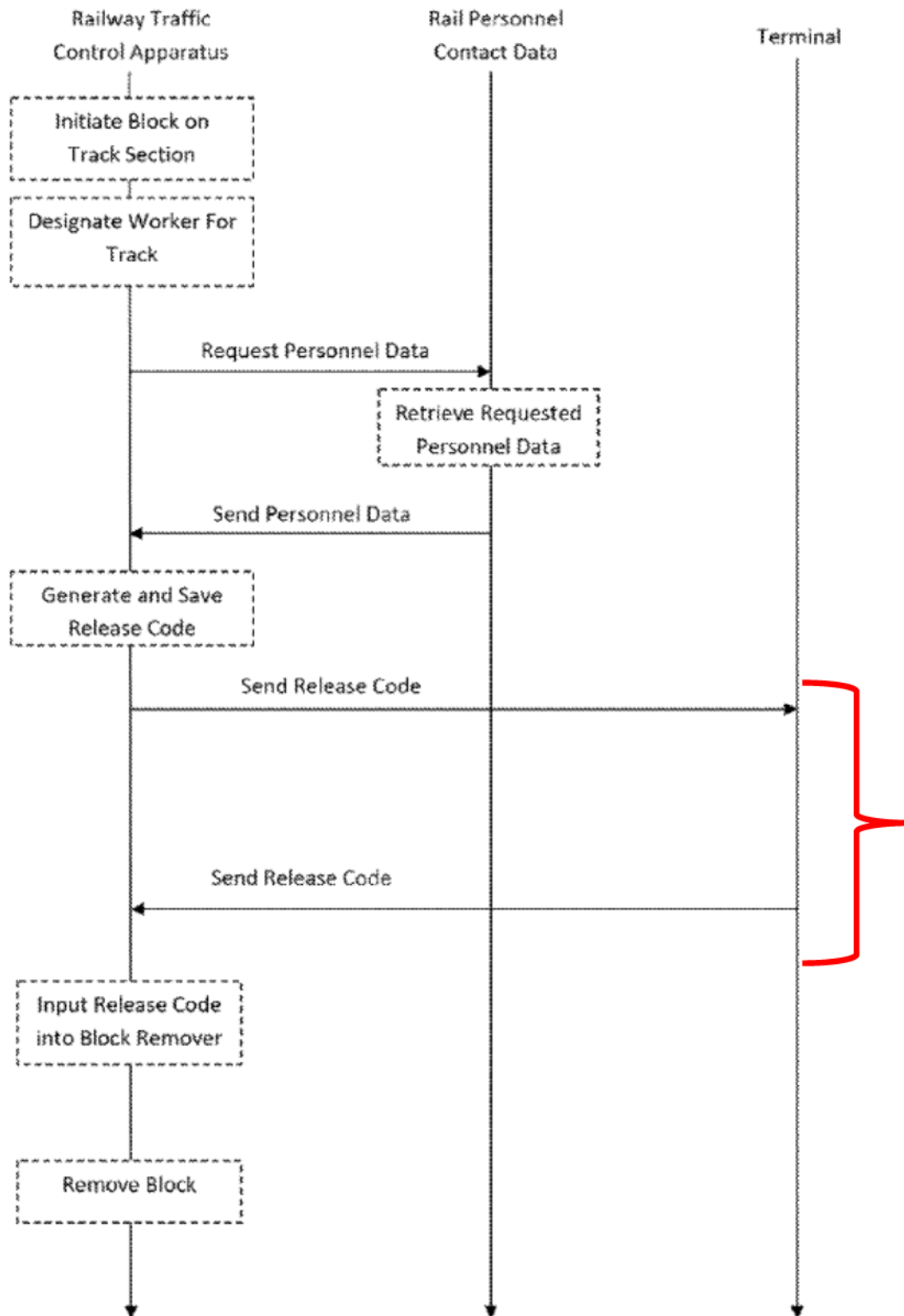
308. It is clear to me from the claim language of claim 5 that a POSITA would understand “to respond to prompts displayed thereon” to indicate that a user device of a railway field worker must be configured to permit the worker to respond to prompts displayed on the user device. Importantly, however, the claim does not require that the response take any particular format or serve any particular purpose. Rather, a POSITA would understand the claim to simply be providing a standard type of user interface.

309. Similarly, while claim 6 specifies that the response to the prompt must serve a particular purpose (“to release the block”), the plain language of claim 6 does not require that the response take any particular format or come from any particular source.

b. **The Specification of the '782 Patent Supports Railware's Proposal that no Construction Is Necessary.**

310. This understanding is consistent with the specification of the '782 patent.

311. For example, Figure 4 illustrates the release code must be sent, and then returned, prior to the release of the block.

**FIGURE 4**

**CONTAINS INFORMATION DESIGNATED AS  
HIGHLY CONFIDENTIAL – ATTORNEYS’ EYES ONLY**

**WABTEC EX1025**

312. As discussed in detail above (*see* paragraphs 36 to 48, which I incorporate here by reference), the specification of the '782 patent describes numerous ways through exemplar embodiments in which the release code may be returned to the dispatcher or the railway control apparatus, including having the railway field worker automatically return the release code to the railway control apparatus (*e.g.*, through a text, embedded link, voice message, etc.) or having the railway field worker provide the release code first to the dispatcher (*e.g.*, through oral communication or otherwise), who then manually enters the release code into the user terminal of the dispatcher, so that the block can be released by the railway control apparatus.

313. Given the breadth of description regarding how the release code can be returned, a POSITA would not understand “to respond to prompts thereon” as recited in claim 5 to be so limited as SEPTA proposes (*i.e.* limited to “respon[ses] through the mobile user device user interface”). Notably, nothing in the specification of the '782 patent is limited to only allowing the “release code” to be returned to the railway control apparatus automatically by interacting with prompts or messages displayed on the user terminal of the railway field worker, as SEPTA proposes.

314. The same conclusion is true with respect to claim 6 and its use of the claim language “to respond to the message to release the block.” Given the breadth of description regarding how the release or removal code can be returned to release a block, a POSITA would not understand the claim language “to respond to the message to release the block” to be limited to any particular form in which the release or removal code is returned to the railway control apparatus to remove the block. Rather, a POSITA would understand “to respond to the message to release the block” broadly to include any sort of response to release the block, including by

orally providing the code to the dispatcher (*e.g.*, through oral communication or otherwise via the railway field worker's user terminal or some other device).

315. My opinion is further supported through how contemporaneous dictionaries have defined terms such as "respond," as also discussed above with regard to the claim term "to respond to prompts displayed thereon." This is further supported through how contemporaneous dictionaries have defined terms such as "prompt," which include definitions such as (i) "something that prompts," Merriam-Webster's Collegiate Dictionary, 11th Ed. (2012) at 994, (ii) "to urge (someone to do something)," Collins English Dictionary, 9th Ed. (2007) at 1297, (iii) "*computing* a word or symbol on a VDU screen to show that input is required," Concise Oxford English Dictionary, 11th Ed., Revised (2009) at 1149, (iv) "a visual or audible message sent by a program to request a user's response," IBM Dictionary of Computing, 9th Ed. (1993) at 540.

c. **SEPTA's Proposal Is Inconsistent with the Claims and the Specification of the '782 Patent and Improperly Reads Limitations into the Claims Beyond how a POSITA Would Understand the Claim Terms.**

316. I understand that SEPTA has proposed that the term "to respond to prompts displayed thereon" be construed to mean "to respond through the mobile user device user interface to prompts displayed thereon." Similarly, I understand that SEPTA has proposed that the term "respond to the message to release the block" be construed to mean "to respond through the mobile user device user interface to the message to release the block." As discussed above, I disagree that a POSITA would understand these terms to have the meaning that SEPTA proposes for a variety of reasons. Specifically, SEPTA's proposed construction is inconsistent with the

claims and the specification and improperly reads limitations into the claims beyond how a POSITA would understand the claim terms.

317. Based on my knowledge and experience and my review of the documents provided to me, it appears to me that SEPTA's proposed construction is formed primarily to advance arguments it makes in support of its various non-infringement positions, rather than grounding its proposed construction in the perspective of a POSITA or in any intrinsic or extrinsic evidence.

318. As discussed in paragraph 292 of this Declaration, I understand that SEPTA intends to argue that it does not infringe the Asserted Patents because "in the [accused systems and methods], to release a block, the railway field worker provides the dispatcher with the code verbally by means of a separate radio call over a separate radio network, not through the railway field worker's mobile user device." *See, e.g.*, Non-Infringement Contentions Chart A, at 11.

319. It is my view that SEPTA's focus on limiting the terms "to respond to prompts displayed thereon" and "respond to the message to release the block" to only describe configurations whereby the railway field worker must respond to the prompt/message directly through the user interface provided on the worker's mobile device to release the block is a further attempt by SEPTA to buttress its non-infringement position by creating an improper and unsupported limitation in the Asserted Patents (that does not exist), which would require, *inter alia*, any release code to only be transmitted directly from the device of the railway field worker that received the code to the railway control apparatus, thereby potentially excluding SEPTA's radio-based return operation. But the specifications and claims do not support this construction, and SEPTA's proposed construction is problematic for a host of reasons.

320. First, SEPTA's proposed construction is inconsistent with the plain language of the claims because it improperly imports limitations into the claims. Specifically, SEPTA's proposed construction imports limitations that require that the "response" to the prompts occur in a specific way, *i.e.* "through the mobile user device user interface." No such limitation is found in the claims.

321. Second, SEPTA's proposed construction is inconsistent with the specification of the '782 patent because, as discussed above, the '782 patent discloses numerous ways through exemplar embodiments in which the release or removal code may be returned to the dispatcher or the railway control apparatus, including having the railway field worker automatically return the release or removal code to the railway control apparatus (*e.g.*, through a text, embedded link, voice message, etc.) or having the railway field worker provide the release or removal code first to the dispatcher (*e.g.*, through oral communication or otherwise), who then manually enters the release or removal code into the user terminal of the dispatcher, so that the block can be released by the railway control apparatus. SEPTA's proposed construction seemingly limits the claim to only the "automatic" embodiments.

322. To that end, SEPTA's proposed construction that both "to respond to prompts displayed thereon" and "respond to the message to release the block" be construed such that the *only way* a railway field worker may respond to the message/prompt to release a block is directly through the user interface provided on the worker's mobile device is far narrower than contemplated by the '782 patent. Stated differently, the '782 patent is not so rigid as SEPTA claims, and indeed, all of the intrinsic evidence cited by SEPTA on this point is clear that what is discussed therein is exemplary and not exhaustive. SEPTA also ignores important disclosures of

the '782 patent that I discuss above, including the multitude of ways by which the release or removal code may be returned to the dispatcher or the railway control apparatus.

323. More, as discussed above, SEPTA's proposed construction would read-out Railware's own commercial embodiment, EEPS. In Railware's commercial embodiment, the release code is provided by the field worker back to the dispatcher through a phone call, not necessarily through the mobile user device user interface, as SEPTA contends. This further indicates that SEPTA's proposed construction is inconsistent with the Asserted Patents.

324. Further, the '782 patent specifically reinforces that several means of communication may be utilized, and may be utilized in "a modular fashion by other devices connected by a communication network." *See* '782 patent at 4:44-53.

325. Accordingly, it is my opinion that neither "to respond to prompts displayed thereon" nor "respond to the message to release the block" requires construction, and that SEPTA's proposed construction is improper and should be rejected.

#### **D. Claim Construction Issues Specific to the '835 Patent**

326. I now address the claim terms and issues that are specific to the '835 patent.

##### **1. "from the terminal" and "from the user terminal" ['835 patent, claims 20, 30, 41; proposed by SEPTA]**

327. It is my understanding that SEPTA has asked the Court to construe the terms: (i) "from the terminal" and (ii) "from the user terminal," as these terms are applied in claims 20, 30, and 41 of the '835 patent. Railware proposes that the terms do not need construction, or should be afforded their plain and ordinary meaning. SEPTA has offered the same construction for each term. The below chart illustrates this, as well as the Parties' respective positions on the construction of these terms.

| <u>Railware's Proposed Construction</u>                  | <u>SEPTA's Proposed Construction</u>                       |
|----------------------------------------------------------|------------------------------------------------------------|
| No construction necessary or plain and ordinary meaning. | transmitted from the user terminal (as previously defined) |

328. It is my opinion that the claim terms “from the terminal” and “from the user terminal” do not require construction beyond Railware’s proposed construction for “user terminal” discussed above with respect to the ’835 patent. It is my opinion that a POSITA would readily understand the claim terms “from the terminal” and “from the user terminal” without further construction.

329. The claim terms “from the terminal” and “from the user terminal” are self-descriptive.

330. A POSITA would readily understand that “from the terminal” and “from the user terminal” are simply identifying prepositional phrases. These terms, in the context of claims 20, 30, and 41 of the ’835 patent, are used to simply identify that the secret code/secret release code is the *same code* that was transmitted to the user terminal of the railway field worker in a prior step.

331. As detailed below, my opinion is supported by the intrinsic and extrinsic evidence.

a. **The Claim Language of the ’835 Patent Supports Railware’s Proposal that No Construction Is Necessary.**

332. To begin, both terms are incomplete phrases that derive much of their meaning from the rest of language in the claim element that they modify. Below is a reproduction of the full claim language at issue:

**Claim 20**

20. A railway traffic control apparatus configured for centralized control of traffic of a centrally controllable railway network including plural railways and a plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, the railway traffic control apparatus comprising a processor and configured to:

place a block on one or more sections of railway track in any of said plural railways constituting said railway network that is managed by centralized control operation from the railway traffic control apparatus, the railway traffic control apparatus controlling, by said centralized control operation, one or more interlocks amongst the plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, to prevent trains from traversing the one or more sections of railway track;

generate a secret release code associated with the blocked one or more sections of railway track;

transmit the secret release code to a user terminal via a network;

receive the secret release code via the network; and

responsive to receiving the secret release code from the terminal, remove the block from the one or more sections of railway track.

**Claim 30**

30. A method for controlling railway access using a railway traffic control apparatus configured for centralized control of traffic of a centrally controllable railway network including plural railways and a plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, the method comprising:

placing a block on one or more sections of railway track in any of said plural railways constituting said railway network that is managed by centralized control operation from the railway traffic control apparatus, the railway traffic control apparatus controlling, by said centralized control operation, one or more interlocks amongst the plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, to prevent trains from traversing the one or more sections of railway track;

generating a secret release code associated with the blocked one or more sections of railway track;

transmitting the secret release code to a user terminal via a network;

receiving the secret release code via the network; and responsive to receiving the secret release code from the terminal, removing the block from the one or more sections of railway track.

**Claim 41**

41. The system of claim 40, wherein the processor configured by execution of computer program instructions additionally causes the railway control apparatus to:

receive the secret code from the user terminal via the network;

verify the secret code by comparing the secret code received from the user terminal with the secret code stored in the memory device;

receive an instruction to remove the block from the selected track sections, after verifying the secret code; and

responsive to the instruction to remove the block received after verifying the secret code, transmit a block removal signal to the corresponding railway traffic interlocks.

333. The language highlighted in green is the language that SEPTA proposes for construction. However, it is my view that, at a minimum, the language in yellow would also be considered by a POSITA in determining what the green language means.

334. In both cases, the highlighted language is clear on its face.

335. It is clear to me from this claim language that a POSITA would understand “from the terminal” and “from the user terminal” as indicating that the secret code/secret release code discussed in the claims is simply the same code that was transmitted to the user terminal of the railway field worker in a prior step.

336. In other words, the secret code/secret release code is “the code from the terminal” in the sense that it is the same code that was sent to the user terminal of the railway field worker, and not some other code (such as the version of the code that was stored in internal storage of the railway control apparatus at the time the code was generated). It is my opinion that a POSITA would not understand “from the terminal” or “from the user terminal” to be requiring a particular transmission device or particular way for returning the secret code/secret release code to the dispatcher/railway control apparatus, as SEPTA seems to propose.

337. My opinion is further supported by the other limitations in the claims. For example, in claim 20 and 30, the immediately preceding step states “receiving the secret release code via the network.” This step is the claimed step that actually described how the secret release code is received. The only limitation placed on “receiving the secret code” in this step is that it must be “via the network.” There is no limitation in this step that the code be received from any particular transmitter, such as the user terminal.

338. While the “receiving” step in claim 41 does state “receive the secret code from the user terminal via the network,” it is still my opinion that the “from the user terminal” is nothing

more than an indicator that the received “secret code” is the same secret code that was transmitted to the user terminal in a prior step in claim 40 (from which claim 41 depends). This is supported by the subsequent limitations in claim 41 which recite, *inter alia*, “verify the secret code by comparing the secret code received from the user terminal with the secret code stored in the memory device.” This limitation is clearly using “from the user terminal” to contrast the secret code that was received from the field with the secret code that was stored in the memory device. “From the user terminal” is *not* being used to identify a specific transmission device or specific way for the code that was received.

339. Accordingly, it is my opinion that the claims support my opinion that the terms “from the terminal” and “from the user terminal” do not require construction beyond Railware’s proposed construction for “user terminal” discussed above with respect to the ’835 patent.

**b. The Specification of the ’835 Patent Supports Railware’s Proposal that No Construction Is Necessary.**

340. The specification further supports my opinion that the terms “from the terminal” and “from the user terminal” do not require construction beyond Railware’s proposed construction for “user terminal” discussed above with respect to the ’835 patent.

341. As with the ’782 patent, discussed above, the ’835 patent describes numerous ways through exemplar embodiments in which the release or removal code may be returned to the dispatcher or the railway control apparatus, including having the railway field worker automatically return the release code to the railway control apparatus (*e.g.*, through a text, embedded link, voice message, etc.) or having the railway field worker provide the release or removal code first to the dispatcher (*e.g.*, through oral communication or otherwise), who then manually enters the release code into the user terminal of the dispatcher, so that the block can be

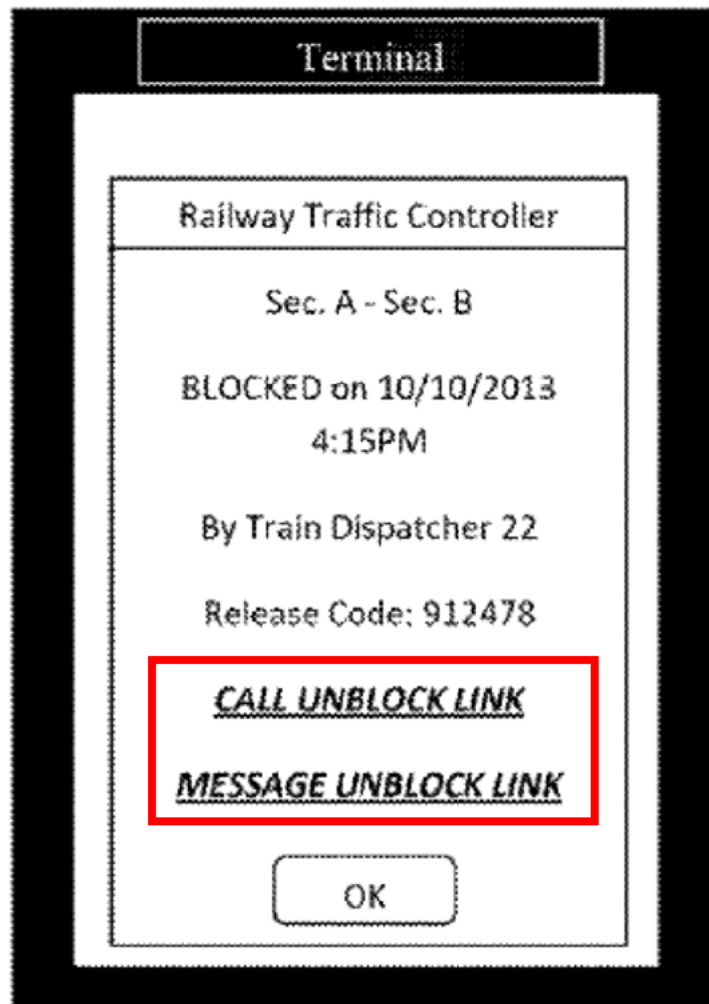
removed by the railway control apparatus. Specifically, the '835 patent provides that the “block removal user interface may be provided in any of various ways.” '835 patent at 3:19-20.

342. In some exemplar embodiments, the maintenance or railway field worker can interact directly with their own remote user terminal to lift a block. For example, in some exemplar embodiments, the maintenance or railway field worker may be able to directly release the block through a block removal user interface “provided within a mobile application or webpage through which the railway field worker can enter the removal code manually or orally.” *Id.* at 3:20-24.

343. Similarly, in some exemplar embodiments, the removal code may be “embedded in a link in a message transmitted by email or messaging to the electronic contact address of the railway field worker, and the railway field worker can simply cause the removal code to be entered by activating the link in the message received by the railway field worker.” *Id.* at 3:24-30.

344. Such an exemplar embodiment is shown, for example, in Figure 10 of the '835 patent, which shows “an example of a user interface display that may be provided on the field worker side or triggering block removal.” (*Id.* at 4:30-32):

**FIGURE 10**



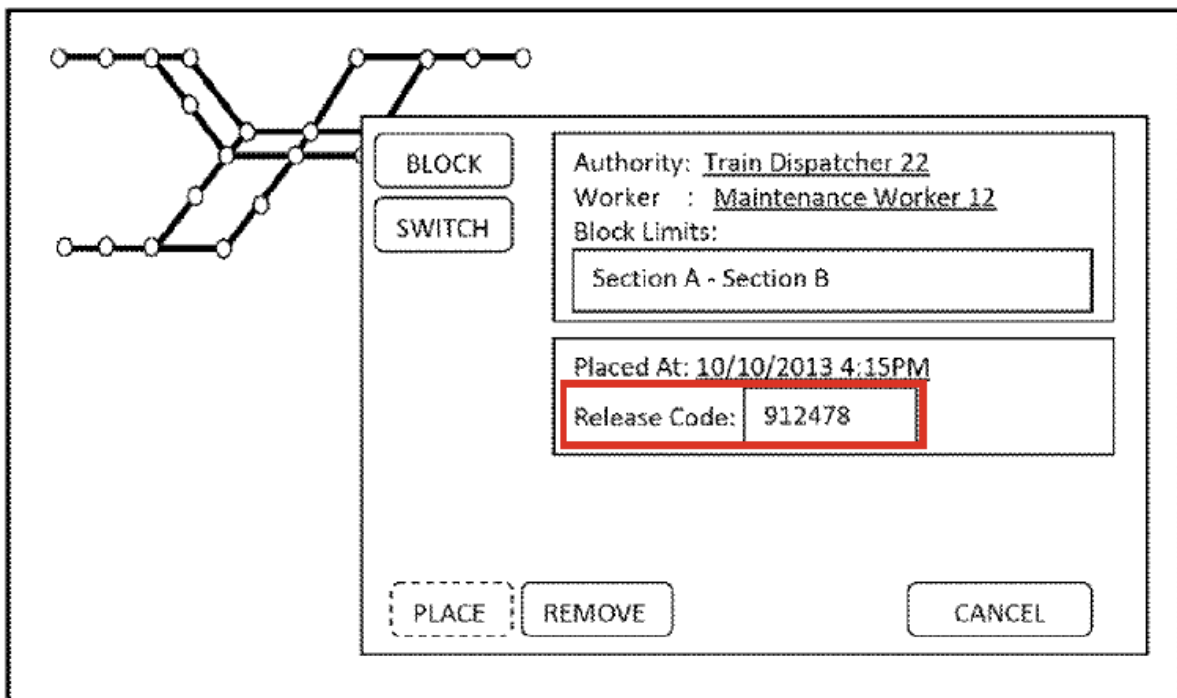
345. In other exemplar embodiments, “the block removal user interface may be provided on the same user terminal on which the block placing part is disclosed.” *Id.* at 3:30-32.

346. Again, the '835 patent discloses a number of different exemplar embodiments in this configuration. For example, “a voice or speech interface part may be disposed on the system-side to process a voice message (such as received via a telephone call from terminal 103

of the railway field worker), extract the removal code from the voice message, and enter the block removal code.” *Id.* at 3:32-37.

347. As another example, the ’835 patent makes clear that the maintenance or railway field worker may simply call the dispatcher and provide the removal or release code to the dispatcher, who then enters the code into the dispatcher’s terminal to remove the block through the railway control apparatus. For example, “FIG. 8 shows the user interface of the railway traffic control [terminal] *apparatus* 105 as the railway traffic controller inputs the release code to remove the block on certain track sections” (*Id.* at 8:40-43):

**FIGURE 8**



348. Further, the ’835 patent provides that “in a case where there are multiple workers assigned for a certain track section, there may be provided multiple unique release codes which would then all be required to be input into the train traffic control [terminal] *apparatus* 105 by

the train traffic controller in order to be able to remove blocks on certain track sections.” *Id.* at 8:58-64. Further, the ’835 patent makes clear that “[t]he user interface 101D is configured preferably for the ease of use for the railway traffic controller (*RTC*). As shown by way of examples in FIGS. 6-9 and 11, the user interface 101D displays information and tools needed to enable/disable blocks on rail sections.” *Id.* at 6:17-21. This description demonstrates that the user interface 101D, which is the dispatcher’s user interface, can control the removal of blocks, such as the ways discussed above, including with respect to Figure 8 above.

349. In each of the above exemplar embodiments where the dispatcher is involved in the removal of the block, it is not until the railway field worker seeks to remove the block that the dispatcher receives the code for the first time. As explained in the specification:

***Once*** the secret code is received, the secret code may be input to the designated field (S1308) . . . . [T]he railway traffic control [terminal] *apparatus* 105 checks that all information input into all fields is correct and that all fields are filled in. ***After*** this check is performed by the railway traffic control [terminal] *apparatus* 105, the remove button is enabled on the form (01312) and the railway traffic controller may remove the block on the corresponding track section.

*Id.* at 10:49-64 (emphasis added in bold italics). By using words like “once” and “after,” the specification makes clear that, in embodiments where the dispatcher is involved in the removal of the block, the dispatcher cannot remove the block until the dispatcher receives the code from the railway field worker.

350. In sum, the specification of the ’835 patent makes clear that the dispatcher does not have ready access to the removal or release code to lift the block until that code is provided by a maintenance or railway field worker. Further, the removal or release code can be returned to the railway control apparatus in any number of ways, including automatically by the railway field worker or manually by returning the code to the dispatcher, who then inputs the removal or

release code into the dispatcher's terminal to release the block. A POSITA would understand the terms "from the terminal" and "from the user terminal" in light of these various descriptions of how the code can be returned, and would not view the terms "from the terminal" and "from the user terminal" to limit the claims to any particular transmission device or particular way for returning the code to the dispatcher/railway control apparatus.

351. Thus, it is my opinion that "from the terminal" and "from the user terminal" require no construction beyond Railware's proposed construction for "user terminal" discussed above with respect to the '835 patent.

**c. SEPTA's Proposed Construction Is Inconsistent with the Claims and the Specification of the '835 Patent and Improperly Reads Limitations into the Claims Beyond how a POSITA Would Understand the Claim Terms.**

352. I understand that SEPTA has proposed that the terms "from the terminal" and "from the user terminal" both be construed to mean "transmitted from the user terminal (as previously defined)." As discussed above, I disagree that a POSITA would understand these terms to have the meaning that SEPTA proposes for a variety of reasons. Specifically, SEPTA's proposed construction is inconsistent with the claims and the specification and improperly reads limitations into the claims beyond how a POSITA would understand the claim terms.

353. Based on my knowledge and experience and review of the documents provided to me, it appears to me that SEPTA's construction is formed primarily to advance arguments it makes in support of its various non-infringement positions, rather than grounding its proposed construction in the perspective of a POSITA or in any intrinsic or extrinsic evidence.

354. As discussed in paragraphs 292 and 318 of this Declaration, I understand that SEPTA intends to argue that it does not infringe the Asserted Patents because "in the accused

[systems and methods], the railway field worker communicates the work zone key verbally to the CTC dispatcher over a separate radio network.” *See, e.g.*, Non-Infringement Contentions Chart B, at 87.

355. It is my view that SEPTA’s focus on limiting the terms “from the terminal” and “from the user terminal” to be construed to only cover configurations whereby the secret code/secret release code is only transmitted back to the railway control apparatus/railway traffic control apparatus directly from the user terminal of the railway field worker to which the code was transmitted, is a further attempt by SEPTA to buttress its non-infringement positions by creating an improper and unsupported limitation in the Asserted Patents (that does not exist), which would require, *inter alia*, any secret code/secret release code to only be transmitted directly from the device of the railway field worker to the railway control apparatus, thereby potentially excluding SEPTA’s radio-based return operation. But the specifications and claims do not support this construction, and SEPTA’s proposed construction is, again, problematic for a host of reasons.

356. First, SEPTA’s reading improperly adds a limitation into the claim language at issue by requiring that the “secret release code” from claims 20 and 30, and the “secret code” in claim 41, be ***transmitted*** from the user terminal of the railway field worker to the railway control apparatus/railway traffic control apparatus. This limitation is not in the claims at issue. The claims are, on their face, agnostic as to how the code is transmitted to the railway control apparatus, only specifying that the code must be “receiv[ed].”

357. Second, SEPTA’s proposed construction would render certain portions of the claim nonsensical if SEPTA’s proposed construction were inserted into the claims. For example, a claim element in claim 41 reads: “verify the secret code by comparing the secret code received

from the user terminal with the secret code stored in the memory device.” Should SEPTA’s proposed construction be adopted, and SEPTA’s construction be substituted in for the existing “received from the user terminal” language, the claim element would then read: “verify the secret code by comparing the secret code *received transmitted* from the user terminal with the secret code stored in the memory device.” This is a nonsense statement.

358. Third, SEPTA’s proposed construction is inconsistent with the specification because, as discussed above, the Asserted Patents, including the ’835 patent, describe numerous ways through exemplar embodiments in which the release or removal code may be returned to the dispatcher or the railway control apparatus, including having the railway field worker automatically return the release or removal code to the railway control apparatus (*e.g.*, through a text, embedded link, voice message, etc.) or having the railway field worker provide the release or removal code first to the dispatcher (*e.g.*, through oral communication or otherwise), who then manually enters the release code into the user terminal of the dispatcher, so that the block can be released by the railway control apparatus. SEPTA’s proposed construction seemingly limits the claims to only the “automatic” embodiments.

359. Further, as discussed above, SEPTA’s proposed construction would read-out Railware’s own commercial embodiment, EEPS. In Railware’s commercial embodiment, the release code is provided by the field worker back to the dispatcher through a phone call, not necessarily through the mobile user device user interface, as SEPTA contends. This further indicates that SEPTA’s proposed construction is inconsistent with the Asserted Patents.

360. Based on this, it is my view that a POSITA would not understand claims 20, 30, and 41 to require that the secret release code/secret code can only be transmitted from the user

terminal of the railway field worker to the railway control apparatus/railway traffic control apparatus.

361. Thus, it is my opinion “from the terminal” and “from the user terminal” require no construction beyond Railware’s proposed construction for “user terminal” discussed above with respect to the ’835 patent, and that SEPTA’s proposed construction should be rejected.

**2. “railway traffic controller” [’835 claims 2, 11; proposed by SEPTA]**

362. It is my understanding that SEPTA has asked the Court to construe the term “railway traffic controller,” as this term is used in claims 2 and 11 of the ’835 patent. Railware proposes that the term does not need construction, or should be afforded its plain and ordinary meaning. The below chart illustrates this, as well as the Parties’ respective positions on the construction of these terms.

| <u>Railware’s Proposed Construction</u>                  | <u>SEPTA’s Proposed Construction</u> |
|----------------------------------------------------------|--------------------------------------|
| No construction necessary or plain and ordinary meaning. | train dispatcher                     |

363. It is my opinion that the claim term “railway traffic controller” does not require construction. It is my opinion that a POSITA would readily understand the claim term “railway traffic controller” without further construction.

364. As an initial matter, the claim term itself is self-descriptive. A POSITA would readily understand this term in the context of the inventions described in claims 2 and 11 of the ’835 patent to indicate that the railway traffic control apparatus must contain a “railway traffic controller user interface.”

365. As detailed below, my opinion is supported by the intrinsic and extrinsic evidence.

a. **The Claim Language of the '835 Patent Supports Railware's Proposal that No Construction Is Necessary.**

366. As with other purported “terms” that SEPTA has offered for construction, this “term” is not a term at all, but rather an (incomplete) phrase that derives much of its meaning from the rest of language in the claim element that it modifies. Claims 2 and 11 of the '835 patent uses the term “railway traffic controller user interface,” not “railway traffic controller” standing alone. The below, in green, illustrates the proposed language for construction. The below, in yellow, illustrates what I believe a POSITA would consider to be the full phrase at issue:

2. The centralized railway control system of claim 1, wherein the railway traffic control apparatus further comprises: a [RTC] *railway traffic controller (RTC)* *user interface* to permit a user to specify said one or more track sections to be blocked, specify an instruction to the centralized railway control system to block the railway traffic to the specified track sections, and specify identifying information of the railway field worker to be performing work in the specified track sections.

367. As is clear from the language of the claim, the term “railway traffic controller” is being used to describe the “user interface” discussed in the claims. A POSITA would appreciate this.

368. A POSITA would also readily understand that a “railway traffic controller” is the individual or entity that is controlling railway traffic. A POSITA would further appreciate that, based on the claim language at issue, the “railway traffic controller” is doing so by interfacing with the “user interface” discussed above. *See* '835 patent at claim 20.

**b. The Specification of the '835 Patent Supports Railware's Proposal that No Construction Is Necessary.**

369. It is my opinion that Railware's proposed construction is further supported by the specification of the '835 patent, which states that "[t]he user interface 101D is configured preferably for the ease of use for the railway traffic controller (*RTC*). As shown by way of examples in FIGS. 6-9 and 11, the user interface 101D displays information and tools needed to enable/disable blocks on rail sections." '835 patent at 6:17-21.

370. This is further supported through how contemporaneous dictionaries have defined terms such as "controller" as (i) "one that controls or has power or authority to control <air traffic>," Webster's Collegiate Dictionary, 11th Ed. (2012) at 272, and (ii) "a person [who] directs, regulates or restrains," Collins English Dictionary, 9th Ed. (2007) at 367.

371. In light of the above, SEPTA's proposed construction of "train dispatcher" is simply unnecessary, confusing, and adds new and unnecessary language and ambiguity into the claims at issue.

372. More, it would appear to me that focusing the construction of this term on "train dispatcher," as SEPTA proposes, rather than the user interface, is not consistent with how the terms are used in the claims.

373. As such, it is my opinion that SEPTA's proposed construction only adds surplusage, ambiguity, and confusion to the plain language of the claims.

374. Accordingly, it is my opinion that "railway traffic controller" does not require construction, and that SEPTA's proposed construction is improper and should be rejected.

**3. “via the network” [’835 patents, claims 20, 30, 41; proposed by SEPTA]**

375. It is my understanding that SEPTA has asked the Court to construe the term “via the network,” as this term is used in claims 20, 30, and 41 of the ’835 patent. Railware proposes that the terms do not need construction, or should be afforded their plain and ordinary meaning. The below chart illustrates this, as well as the Parties’ respective positions on the construction of these terms.

| <u>Railware’s Proposed Construction</u>                  | <u>SEPTA’s Proposed Construction</u>                          |
|----------------------------------------------------------|---------------------------------------------------------------|
| No construction necessary or plain and ordinary meaning. | via the same network used to transmit the secret release code |

376. It is my opinion that the claim term “via the network” does not require construction. It is my opinion that a POSITA would readily understand the claim term “via the network” without further construction.

377. As an initial matter, the claim term is self-descriptive. A POSITA would readily understand this term in the context of the inventions described in claims 20, 30, and 41 of the ’835 patent to indicate that the railway traffic control apparatus must be able to send a secret code to the device of the railway field worker and the railway field worker must be able to return or provide that code through one or more networks in order for the block to be removed.

378. As detailed below, my opinion is supported by the intrinsic and extrinsic evidence.

**a. The Claim Language of the ’835 Patent Support Railware’s Proposal that No Construction Is Necessary.**

379. As with other purported “terms” that SEPTA has offered for construction, this “term” is not a term at all, but rather an (incomplete) phrase that derives much of its meaning

from the rest of language in the claim element that it modifies. Below is a reproduction of the full claim language at issue:

**Claim 20**

*20. A railway traffic control apparatus configured for centralized control of traffic of a centrally controllable railway network including plural railways and a plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, the railway traffic control apparatus comprising a processor and configured to:*

*place a block on one or more sections of railway track in any of said plural railways constituting said railway network that is managed by centralized control operation from the railway traffic control apparatus, the railway traffic control apparatus controlling, by said centralized control operation, one or more interlocks amongst the plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, to prevent trains from traversing the one or more sections of railway track;*

*generate a secret release code associated with the blocked one or more sections of railway track;*

*transmit the secret release code to a user terminal via a network;*

*receive the secret release code via the network; and*

*responsive to receiving the secret release code from the terminal, remove the block from the one or more sections of railway track.*

**Claim 30**

30. A method for controlling railway access using a railway traffic control apparatus configured for centralized control of traffic of a centrally controllable railway network including plural railways and a plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, *the method comprising:*

*placing a block on one or more sections of railway track in any of said plural railways constituting said railway network that is managed by centralized control operation from the railway traffic control apparatus, the railway traffic control apparatus controlling, by said centralized control operation, one or more interlocks amongst the plurality of railway traffic interlocks dispersed in said plural railways constituting said railway network, to prevent trains from traversing the one or more sections of railway track;*

*generating a secret release code associated with the blocked one or more sections of railway track;*

*transmitting the secret release code to a user terminal via a network;*

*receiving the secret release code via the network; and responsive to receiving the secret release code from the terminal, removing the block from the one or more sections of railway track.*

**Claim 41**

41. The system of claim 40, wherein the processor configured by execution of computer program instructions additionally causes the railway control apparatus to:

*receive the secret code from the user terminal via the network;*

*verify the secret code by comparing the secret code received from the user terminal with the secret code stored in the memory device;*

*receive an instruction to remove the block from the selected track sections, after verifying the secret code; and*

*responsive to the instruction to remove the block received after verifying the secret code, transmit a block removal signal to the corresponding railway traffic interlocks.*

380. The language highlighted in green is the language that SEPTA proposes for construction. However, it is my view that, at a minimum, the language in yellow would also be considered by a POSITA in determining what the green language means.

381. In both cases, the highlighted language is self-explanatory.

382. Based on the above claim language, it is clear to me that a POSITA would understand “via the network” to indicate that that the railway traffic control apparatus must be able to send a secret code to the device of the railway field worker and the railway field worker must be able to return or provide that code through one or more networks in order for the block to be removed.

**b. The Specification of the '835 Patent Supports Railware's Proposal that No Construction Is Necessary.**

383. This understanding is consistent with the specification of the '835 patent, including Figures 1A and 1B, which illustrate exemplary embodiments of the inventions.

384. For example, both figures illustrate that the communication with a device of the railway field worker happens via a network.

**FIGURE 1A**

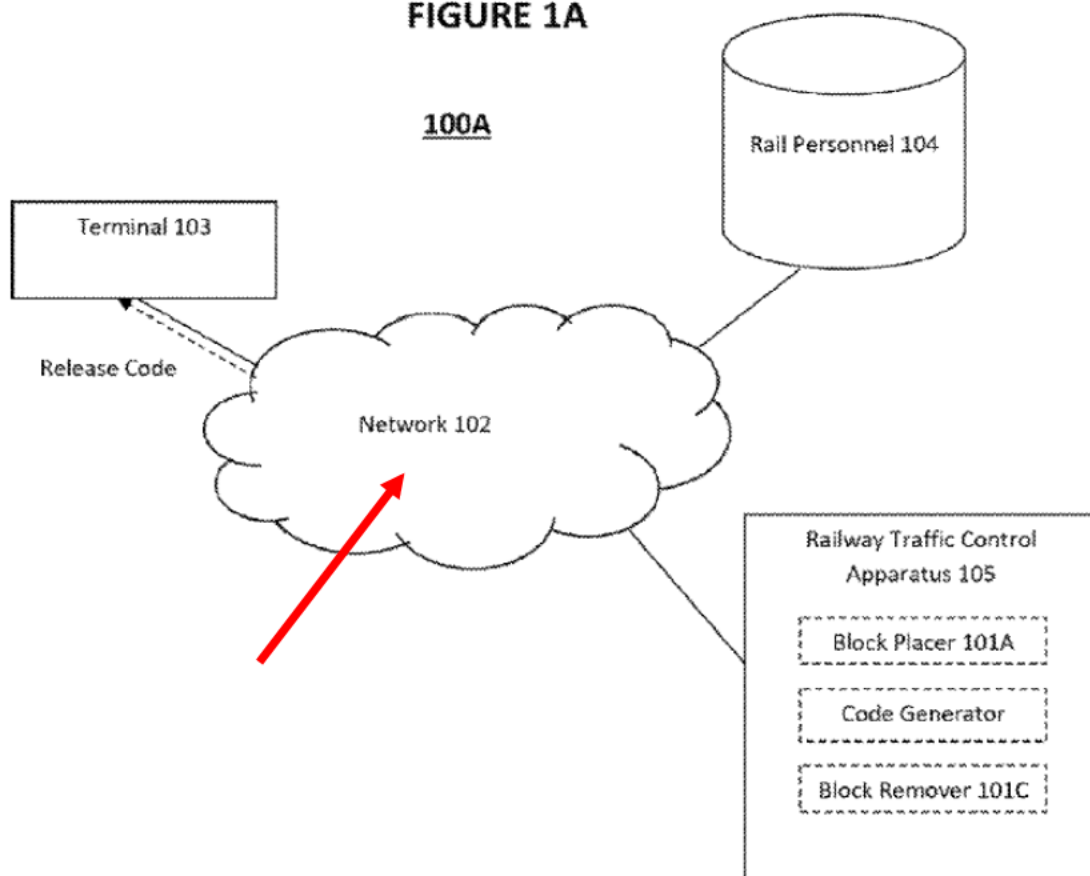
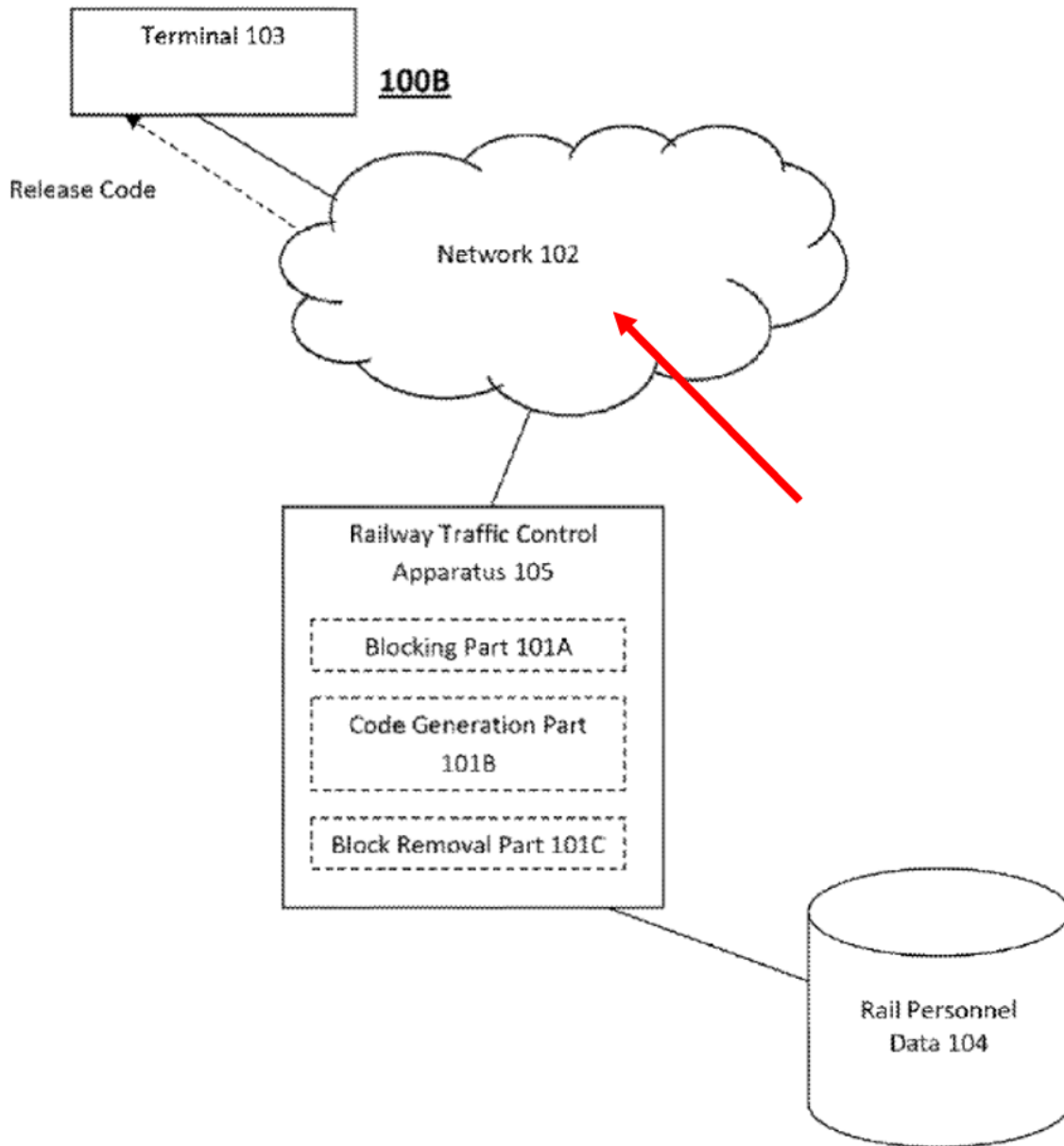


**FIGURE 1B**

385. Further, it is my view that a POSITA would appreciate that what comprises a “network” is broadly understood from the specification, and includes a number of combinations of various communications systems and hardware and software components. *See, e.g.*, ’835

patent at 5:4-22 (“The network 102 can be any data network, a local area network, a wide area network or any type of network such as an intranet, an extranet (for example, to provide controlled access to external users, for example through the Internet), a private or public cloud network, the Internet, etc., or a combination thereof. Further, other communications links (such as a virtual private network, a wireless link, etc.) may be used as well for the network 102.

In addition, the network 102 preferably uses TCP/IP (Transmission Control Protocol/Internet Protocol), but other protocols such as SNMP (Simple Network Management Protocol) and HTTP (Hypertext Transfer Protocol) can also be used.”); *see also id.* at 4:54-65 (“The drawings show examples of implementations of the subject matter of this patent disclosure in several computing environments. However, it should be understood that the subject matter of this disclosure can be utilized by any computing device including but not limited to PDAs (personal digital assistants), cell phones, personal, notebook and workstation computers, kiosks, other information terminals, [WIC (or another)] pager, etc. In addition, the subject matter of this disclosure might be provided as services in a modular fashion by other devices connected by a communication network.”)

386. As discussed in detail above (*see* paragraphs 341 to 351, which I incorporate here by reference), the specification of the ’835 patent describes numerous ways through exemplar embodiments in which the release code may be returned to the dispatcher or the railway control apparatus, including having the railway field worker automatically return the release code to the railway control apparatus (*e.g.*, through a text, embedded link, voice message, etc.) or having the railway field worker provide the release code first to the dispatcher, who then manually enters the release code into the user terminal of the dispatcher, so that the block can be removed by the railway control apparatus.

387. This further supports my opinion that a POSITA would appreciate that what comprises a “network” is broadly understood to include each of these communications systems and hardware and/or software components supporting them.

388. Furthermore, I have been informed that, in the context of patent drafting, the indefinite article “a” means “one or more” absent limiting language in the claims or the specification that would otherwise limit that definition. Based on my review of the claims and specification of the ’835 patent, I have found no language that could be construed as such a limitation. This further supports my opinion.

389. My opinion is further supported through how contemporaneous dictionaries have defined the term “network,” such as (i) “[a]n interconnected or interrelated chain, group, or system,” Merriam-Webster’s Collegiate Dictionary, 11th Ed. (2012) at 833, (ii) “[a] system of computers, peripherals, terminals, and databases connected by communications lines,” *id.*, (iii) “[a]n interconnected group or system,” Collins English Dictionary, 9th Ed. (2007) at 1094, (iv) “computing a system of interconnected computer systems, terminals, or other equipment allowing information to be exchanged,” *id.*, (v) “computing (of computers, terminals, etc.) to connect or be connected,” *id.*, (vi) “a number of interconnected computers, machines, or operations,” Concise Oxford English Dictionary, 11th Ed., Revised (2009) at 961.

c. **SEPTA’s Proposed Construction Is Inconsistent with the Claims and the Specification of the ’835 Patent and Improperly Reads Limitations into the Claims Beyond how a POSITA Would Understand the Claim Terms.**

390. I understand that SEPTA has proposed that the term “via the network” be construed as “via the same network used to transmit the secret release code.” As discussed above, I disagree that a POSITA would understand these terms to have the meaning that SEPTA

proposes for a variety of reasons. Specifically, SEPTA's proposed construction is inconsistent with the claims and the specification and improperly reads limitations into the claims beyond how a POSITA would understand the claim terms.

391. Based on my knowledge and experience and review of the documents provided to me, it appears to me that SEPTA's construction is formed primarily to advance arguments it makes in support of its various non-infringement positions, rather than grounding its proposed construction in the perspective of a POSITA or in any intrinsic or extrinsic evidence.

392. As discussed in paragraphs 292, 318 and 354 of this Declaration, I understand that SEPTA intends to argue that it does not infringe the Asserted Patents because "in the accused [systems and methods], the railway field worker communicates the work zone key verbally to the CTC dispatcher over a separate radio network." *See, e.g.*, Non-Infringement Contentions Chart B, at 87.

393. It is my opinion that SEPTA's focus on limiting the term "via the network" to only describe configurations whereby the railway traffic control apparatus receives a secret code from the device of the railway field worker *only through the same network* that was used to transmit the secret code to the device of the railway field worker is a further attempt by SEPTA to buttress this non-infringement position by creating an improper and unsupported limitation in the Asserted Patents (that does not exist), which would potentially exclude SEPTA's radio-based return operation. But the Asserted Patents do not support this construction, and SEPTA's proposed construction is, again, problematic for a host of reasons.

394. First, SEPTA's proposed construction improperly adds a limitation into the claim language at issue by requiring that the railway traffic control apparatus must be able to receive a secret code from the device of the railway field worker through the *same network* that was used

to transmit the secret code to the device of the railway field worker. This limitation is not in the claims at issue. The claims are, on their face, agnostic as to whether the same, or a different, network is utilized to transmit the secret code back to the railway traffic control apparatus.

395. Second, the intrinsic evidence cited by SEPTA on this point, much of which I rely on in my discussion above, does not provide any support for SEPTA's proposed construction. Rather, the intrinsic evidence, in this case the specification of the '835 patent, runs directly contrary to SEPTA's proposed construction.

396. This is because the specification is clear that, for example, "[t]he network 102 can be any data network, a local area network, a wide area network or any type of network such as an intranet, an extranet (for example, to provide controlled access to external users, for example through the Internet), a private or public cloud network, the Internet, etc., *or a combination thereof*." '835 patent at 5:4-22 (emphasis added). Accordingly, the specification contemplates the potential use of multiple networks in the inventions described, rather than a single network as SEPTA proposes.

397. Further, as discussed above, SEPTA's proposed construction would read-out Railware's own commercial embodiment, EEPS. In Railware's commercial embodiment, the release code is provided by the field worker back to the dispatcher through a phone call, not necessarily through the mobile user device user interface, as SEPTA contends. This further indicates that SEPTA's proposed construction is inconsistent with the Asserted Patents.

398. A POSITA would therefore understand from the specification that the "same network" need not be utilized for both transmission and return of the secret code.

399. Accordingly, it is my opinion that "via the network" does not require construction, and that SEPTA's proposed construction should be rejected.

\* \* \* \*

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge.

Respectfully submitted,

Dated: March 14, 2025

A handwritten signature in black ink, appearing to read 'Mehdi Ahmadian', is written above a horizontal line.

Mehdi Ahmadian, Ph.D.

# **EXHIBIT 1**

**MEHDI AHMADIAN**

J. Bernard Jones Chair and Director  
Fellow, ASME, SAE International, ISCM, IIAV; Associate Fellow, AIAA

Center for Vehicle Systems & Safety  
College of Engineering, MC – 0901  
Virginia Polytechnic Institute and State University  
Blacksburg, VA 24061  
(540) 239-1264  
[ahmadian.vt@gmail.com](mailto:ahmadian.vt@gmail.com)  
<http://www.CVeSS.me.vt.edu>

**Education**

- Ph.D. Mechanical Engineering, State University of New York at Buffalo, 1984
- MBA Business Administration, Pennsylvania State University – Behrend College, 1994
- M.S. Mechanical Engineering, State University of New York at Buffalo, 1982
- B.S. Mechanical Engineering, State University of New York at Buffalo, 1980

**Qualifications**

Dr. Ahmadian's expertise includes product liability and patent litigations involving vehicular systems for automobiles, heavy trucks, and railroad equipment. He has been involved in conceptualization, design, engineering, research, and testing of various components related to active safety systems for ground vehicles.

For nearly three decades, as an independent consultant, Dr. Ahmadian has served as an expert witness and case consultant for a broad spectrum of cases. His legal consulting has included case review, design analysis, vehicle inspection, claim construction, inter partes reviews (IPR), discovery report preparation, deposition, and courtroom testimony. Additionally, he has conducted numerous Professional Development Seminars (short courses) for the Society of Automotive Engineers (SAE International) and his clients on topics directly related to vehicle dynamics, including tires, steering systems, brake systems, axle suspensions, and active safety systems. The seminars are attended by practicing engineers.

Dr. Ahmadian is J. Bernard Jones Chair of Mechanical Engineering at Virginia Tech, where he also holds the position of Director of the Center for Vehicle Systems and Safety (CVeSS), and the Railway Technologies Laboratory (RTL). He is the founding director of CVeSS, RTL, Virginia Institute for Performance Engineering and Research (VIPER), and the Advanced Vehicle Dynamics Laboratory (AVDL). Before joining Virginia Tech in 1995, Dr. Ahmadian worked in the transportation industry for eight years, including serving as the Lead Design Engineer for steerable locomotive trucks (bogies) at General Electric Transportation System from 1993 to 1995. He also held various engineering and management positions at Lord Corporation from 1987 to 1993. Dr. Ahmadian has co-authored eight books, four book chapters, more than 175 archival journal papers, more than 230 refereed conference publications, and more than 155 un-refereed conference publications. He has made more than 400 technical presentations, including numerous major keynote and plenary lectures and invited presentations. He holds 12 U.S. and international patents, with an additional patent application pending. He has served as Editor-in-Chief of the *Journal of Vibration and Control* (2013 – 2023), Editor of the *International Journal of Vehicle System Dynamics* (2008 – 2022), Editor-in-Chief of *Shock and Vibration* journal (2011 – 2016), Editor-in-Chief of *Advances in Automobile Engineering* (2010 – 2014). He has also served on the editorial board of numerous journals including Associate Editor for the *ASME Journal of Vibration and Acoustics* (1989 – 1996), the *AIAA Journal* (2000 – 2008), and *Shock and Vibration* (2003 – 2011). Dr. Ahmadian is a Fellow of the American Society of Mechanical Engineers (ASME), Fellow of the SAE International, Fellow of the International Society for Condition Monitoring (ISCM), Fellow of the International Institute of Acoustics and Vibration (IIAV), and Associate Fellow of the American Institute for Aeronautics and Astronautics (AIAA).

His most recent professional awards include the 2024 SAE Medal of Honor (the *highest* recognition of life-time achievement bestowed on *one* SAE member per year), the 2023 Virginia Tech Alumni Award for Research Excellence, regarded as the most prestigious Virginia Tech award for significant life-long research contributions. He is also the recipient of the 2019 SAE Magnus Hendrickson Innovation Award, the seminal SAE International award in vehicle dynamics and suspension technologies; the SAE International 2019 Top Contributor Award; the 2015 SAE International Lloyd L. Withrow Distinguished Speaker Award; the 2014 SAE International L. Ray Buckendale Award (the ultimate recognition in vehicle

engineering) with a plenary lecture on “Integrating Electromechanical Systems in Commercial Vehicles for Improved Handling, Stability, and Comfort”; the 2013 COMVEC Best Presentation Award; the 2013 Simulation Multi-Conference Best Paper Award; and the 2008 SAE International Forest R. McFarland Award. Dr. Ahmadian is an active member of the SAE International and ASME and has held various volunteer leadership positions within both professional societies during the past two decades. Some of his most recent professional volunteer positions include Member of SAE International Executive Nominating Committee (ENC); Chair of the SAE International Fellows Selection Committee, and the longest-serving member of the SAE International Commercial Vehicle Engineering Congress (COMVEC) Executive Council.

## **Experience**

Virginia Polytechnic Institute and State University (Virginia Tech):

J. Bernard Jones Chair: April 2020 – present

*Dan Pletta Professor*: March 2014 – April 2020

*Professor*: August 2001 – March 2014

*Associate Professor*: August 1998 – August 2001

*Assistant Professor*: May 1995 – August 1998

*Founding Director*, Advanced Vehicle Dynamics Laboratory: August 1995 – January 2005

*Founding Director*, Center for Vehicle Systems and Safety: January 2005 – present

*Founding Director*, Railway Technologies Laboratory: August 2004 – present

*Founding Director*, Virginia Institute for Performance Engineering and Research: January 2003 – 2006

Army Research Laboratory and Aberdeen Test Center:

*Visiting Scientist*: August 2002 – July 2003

General Electric Transportation Systems

*Project Manager & Senior Mechanical Systems Engineer*: Feb. 1993 – May 1995

Lord Corporation

*Staff Engineer and Section Manager*: March 1991 – February 1993

*Senior Engineering Specialist*: February 1989 – March 1991

*Engineering Specialist*: August 1987 – February 1989

Clemson University, Department of Mechanical Engineering

*Assistant Professor*: August 1984 – August 1987

Air Force Wright Aeronautical Laboratories

*Summer Faculty Research Fellow*: May 1986 – August 1986

State University of New York at Buffalo

*Graduate Research Assistant and Graduate Teaching Assistant*: August 1980 – August 1984

## **Awards**

|                                                          |                                                                                                                                                 |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| SAE Medal of Honor                                       | The <u>highest</u> recognition of life-time achievement bestowed on <u>one</u> SAE member per year                                              |
| Alumni Award for Research Excellence                     | Regarded as the most prestigious Virginia Tech award for significant life-long research contributions, 2023                                     |
| Magnus Hendrickson Innovation Award                      | Recipient of the Magnus Hendrickson Innovation Award, the seminal SAE International Award in Vehicle Dynamics and Suspension Technologies, 2019 |
| SAE International 2019 Top Contributor of the Year Award | Awarded annually by the SAE International to the top 35 contributors from more than 250,000 members in 2019 (the inaugural class)               |
| Lloyd L. Withrow Award                                   | Recipient of the SAE International Lloyd L. Withrow Distinguished Speaker Award, 2015                                                           |

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| L. Ray Buckendale Award                         | Recipient of the 61 <sup>st</sup> SAE International L. Ray Buckendale Award; The highest technical distinction of the SAE International Commercial Engineering Congress and Exhibition Congress (COMVEC); delivered a plenary lecture, entitled "Integrating Electromechanical Systems in Commercial Vehicles for Improved Handling, Stability, and Comfort," at 2014 COMVEC, Rosemont, IL, October 7 – 9, 2014 |
| Best Presentation Award                         | SAE International Commercial Engineering Congress and Exhibition (COMVEC), Rosemont, IL, October 1 – 3, 2013                                                                                                                                                                                                                                                                                                    |
| Best Paper Award                                | Simulation Multi-Conference, Toronto, Ontario, July 7 – 10, 2013                                                                                                                                                                                                                                                                                                                                                |
| Forest R. McFarland Award                       | Recipient of the SAE International Forest R. McFarland Award. Recognizes individuals for their outstanding contributions toward planning, development, and dissemination of technical meetings, conferences, and professional development programs, 2008                                                                                                                                                        |
| Manager's Award                                 | Recipient of the GE Transportation Systems Manager's Award for exceptional leadership of a business-critical project, 1995                                                                                                                                                                                                                                                                                      |
| General Manager's Award                         | Recipient of the GE Transportation Systems General Manager's Award, the highest distinction awarded to one technical contributor annually for exceptional contributions to a critical project that advances technology and increases market share, 1994                                                                                                                                                         |
| Gustav H. and Grete Zimmer Memorial Scholarship | University of Buffalo, Mechanical Engineering Department, awarded to distinguished juniors and seniors, 1978 – 1980                                                                                                                                                                                                                                                                                             |

### **Editorship**

|                  |                                                                                          |
|------------------|------------------------------------------------------------------------------------------|
| Editor-in-Chief  | <i>Journal of Vibration and Control</i> , January 2014 – December 2023                   |
| Editor           | International Journal of <i>Vehicle System Dynamics</i> , January 2008 – December 2022   |
| Editor-in-Chief  | <i>Shock and Vibration</i> , October 2011 – December 2016                                |
| Editor-in-Chief  | <i>Advances in Automobile Engineering</i> , May 2012 – August 2014                       |
| Senior Editor    | <i>Journal of Vibration and Control</i> , January 2014 – August 2014                     |
| Editor           | <i>Advances in Mechanical Engineering</i> , January 2008 – August 2014                   |
| Editor           | <i>Smart Materials Research</i> , May 2010 – August 2014                                 |
| Editor           | <i>Mechanical Engineering</i> , October 2010 – March 2014                                |
| Associate Editor | <i>Shock and Vibration</i> , March 2003 – October 2011                                   |
| Associate Editor | <i>AIAA Journal</i> , December 2000 – 2008                                               |
| Associate Editor | <i>ASME Journal of Vibration and Acoustics</i> , 1989 – 1996                             |
| Editorial Board  | <i>Advances in Theoretical and Applied Mechanics</i> , February 2012 – present           |
| Editorial Board  | <i>Nonlinear Analysis and Differential Equations</i> , January 2013 – present            |
| Editorial Board  | <i>Journal of Theoretical and Applied Vibration and Acoustics</i> , April 2018 – present |

### **Professional Society Leadership**

|                          |                                                                                                 |
|--------------------------|-------------------------------------------------------------------------------------------------|
| COMVEC Executive Council | SAE International Commercial Vehicle Engineering Congress & Exhibition (COMVEC), 2006 – present |
|--------------------------|-------------------------------------------------------------------------------------------------|

|                                                           |                                                                                                                                                                                   |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standards Executive Committee                             | SAE International Standards Executive Council, 2020 – present                                                                                                                     |
| European Research Council Member                          | Member of the international committee for evaluation of high-value, multiyear proposals, 2018 – present                                                                           |
| IAVSD Board Member                                        | International Association of Vehicle System Design (IAVSD), Elected Board Member, 2017 – present                                                                                  |
| IAVSD Vice Chair                                          | International Association of Vehicle System Dynamics (IAVSD), Elected Officer, 2017 – present                                                                                     |
| COMVEC Technical Taskforce Chair                          | Chair of taskforce committee for significantly improving technical content of the SAE International Commercial Vehicle Engineering Congress & Exhibition (COMVEC), 2023 – present |
| IFTToMM TC Member                                         | International Federation for the Promotion of Mechanism and Machine Science (IFTToMM) Technical Committee for Transportation Machinery, 2020 – present                            |
| National Academy of Engineers                             | ECP Brake Committee, 2016 – 2017                                                                                                                                                  |
| National Academy of Engineers                             | U.S. Transportation R&D Planning and Management Committee, 2015 – 2016                                                                                                            |
| National Academy of Engineers                             | FRA R&D Strategic Plan Review Committee, 2015 – 2016                                                                                                                              |
| Executive Nominating Committee                            | SAE International, January 2016 – 2020                                                                                                                                            |
| SAE Fellow Selection Committee                            | SAE International, 2016 – 2018 (Chair of Committee, 2017 – 2018)                                                                                                                  |
| SAE Membership Board                                      | SAE International, 2012 – 2017                                                                                                                                                    |
| COMVEC Activity Committee                                 | SAE International Commercial Vehicle Engineering Congress & Exhibition (COMVEC), 2005 – present                                                                                   |
| ASME RTD Chair                                            | ASME Rail Transportation Division (RTD) Chair, April – December 2022                                                                                                              |
| ASME RTD Executive Committee                              | ASME Rail Transportation Division (RTD), 2017 – 2023                                                                                                                              |
| ASME RTD Secretary                                        | ASME Rail Transportation Division (RTD), 2019 – 2023                                                                                                                              |
| General Committee                                         | ASME Rail Transportation Division (RTD), 1999 – 2023                                                                                                                              |
| Total Quality Response Team (TQRT)                        | SAE International, 2011 – 2018                                                                                                                                                    |
| Accreditation Board for Engineering and Technology (ABET) | Visitor, January 2006 – December 2013                                                                                                                                             |
| IIUM Program Reviewer University, Malaysia                | IIUM University, Malaysia, Program Reviewer, Automotive Engineering, 2008 – 2018                                                                                                  |
| Truck and Bus Human Factors Committee                     | SAE International, 2002 – 2010                                                                                                                                                    |
| Transportation Committee                                  | ASME Dynamic Systems and Control Division, 1998 – 2020                                                                                                                            |

|                                                          |                                                                                                |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Vehicle Design Committee                                 | ASME Design Engineering Division, 2002 – 2020                                                  |
| Dynamics of Structures and Systems                       | ASME Applied Mechanics Division, 1991 – 1999                                                   |
| SAE International Chassis and Suspension Committee Chair | SAE International, Chair (2005 – 2014), Vice Chair, (2004 – 2005)                              |
| ASME Virginia Section Chair                              | American Society of Mechanical Engineers (ASME), Chair (1988 – 2002), Vice Chair (1986 – 1988) |

### **Technical Conference Leadership**

|                                                                    |                                                                                                                                                                                                                            |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Organizer & Moderator                                              | Smart Engineering Executive Panel, SAE International Commercial Vehicle Engineering Congress & Exhibition (COMVEC), September 19 – 21, 2023                                                                                |
| Conference Co-Chair                                                | The 2023 International Association of Vehicle System Dynamics (IAVSD) Bi-Annual Conference, Ottawa, Canada, August 21 – 25, 2023                                                                                           |
| Scientific Committee Co-Chair                                      | The 2023 International Association of Vehicle System Dynamics (IAVSD) Bi-Annual Conference, Ottawa, Canada, August 21 – 25, 2023                                                                                           |
| IFTToMM TC Member                                                  | Member of Technical Committee for Transportation Machinery, the 16 <sup>th</sup> International Federation for the Promotion of Mechanism and Machine Science (IFTToMM) World Congress, Tokyo, Japan, November 5 – 10, 2023 |
| Conference Chair                                                   | ASME Joint Rail Conference, April 11 – 13, 2023, Baltimore, MD                                                                                                                                                             |
| Symposium Chair                                                    | 2nd RailTEAM Symposium on Railroad Infrastructure Diagnosis & Prognosis, Roanoke, VA, May 23 – 24, 2022                                                                                                                    |
| Chair                                                              | Product Development Track - Vehicles of the Future - Challenges in Requirements, Development, and Testing, SAE International Commercial Vehicle Engineering Congress & Exhibition (COMVEC), Chicago, IL, 2021              |
| COMVEC Technical Paper Chair and Guest Editor                      | SAE International Commercial Vehicle Engineering Congress & Exhibition (COMVEC), Chicago, IL, 2020, and Special issue of the SAE International Journal of Commercial Vehicles                                              |
| 5th International Conference on Dynamics, Vibration and Control    | Co-Chair, Shijiazhuang, China, 2018                                                                                                                                                                                        |
| COMVEC Technical Program Chair                                     | SAE International Commercial Vehicle Engineering Congress & Exhibition (COMVEC), Chicago, IL, 2014 – 2015 and 2009 – 2010                                                                                                  |
| COMVEC Technical Program Vice-chair                                | Activity Committee, SAE International Commercial Vehicle Engineering Congress & Exhibition, Chicago, IL, 2013 – 2014, and 2007 – 2008                                                                                      |
| European Conference of Mechanical Engineering Scientific Committee | ECME'13, Paris, France, 2013                                                                                                                                                                                               |

|                                                                                                    |                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Truck Handling, Dynamics, and Control Symposium Organizer                                          | SAE International, Greenville, SC, 2012; Greenville, SC, 2005, and Baltimore, MD, 2003                                                                                              |
| American Control Conference Publicity Chair                                                        | American Control Conference, San Francisco, CA, 2011                                                                                                                                |
| Vibration and Control of Smart Structures Symposium Organizer                                      | American Society of Mechanical Engineers (ASME), International Design Engineering Technical Conference & Computer and Information in Engineering Conference, Washington, D.C., 2011 |
| The 14 <sup>th</sup> , 15 <sup>th</sup> , and 16 <sup>th</sup> SPIE International Conference Chair | Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring, San Diego, CA, 2007, 2008, and 2009                                                               |
| Advanced Suspension Systems Symposium Chair                                                        | Advanced Suspension Systems, Detroit, MI, 2008                                                                                                                                      |
| Commercial Vehicle Chassis and Suspensions Symposium Organizer                                     | Commercial Vehicle Engineering Congress & Exhibition, Chicago, Illinois, November 2005, 2006, and 2007                                                                              |
| Active and Passive Structures and Integrated Systems Conference Vice-chair                         | The 13th SPIE International Symposium on Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring San Diego, CA, 2006                                       |
| Automotive Dynamics Stability and Controls Conference                                              | SAE International, Organizing Committee, Detroit, MI, 2006                                                                                                                          |
| Damping and Isolation Conference Vice-chair                                                        | The 12th SPIE International Symposium on Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring, San Diego, CA, 2005                                      |
| International Conference on Mechanical Engineering and Mechanics                                   | Organizing Committee, Nanjing University of Science and Technology, China, 2005                                                                                                     |
| Vehicle Design Session Organizer                                                                   | American Society of Mechanical Engineers (ASME), International Mechanical Engineering Conference and Exposition (IMECE), Design Engineering Division, Orlando, FL, 2005             |
| Smart Structures and Materials Organizing Committee                                                | The 9 <sup>th</sup> , 10 <sup>th</sup> , and 11 <sup>th</sup> Annual International Symposium on Smart Structures and Materials, San Diego, CA, 2002, 2003, and 2004                 |
| Active Vibration Control and Actuation using Smart Materials Symposium Organizer                   | American Society of Mechanical Engineers (ASME), International Mechanical Engineering Congress and Exposition, Washington, D.C., 2003                                               |
| Transportation Noise and Vibrations Symposium Organizer                                            | The 17 <sup>th</sup> biennial Conference on Mechanical Vibration and Noise, Las Vegas, Nevada, 1999                                                                                 |
| Advanced Automotive Technologies Symposium Organizer                                               | American Society of Mechanical Engineers (ASME), Winter Annual Meeting, New Orleans, Louisiana, 1994                                                                                |

**Professional Society Membership**

|                                                                         |                                               |
|-------------------------------------------------------------------------|-----------------------------------------------|
| American Society of Mechanical Engineers (ASME)                         | Member (1984 – 1996), Fellow (1996 – present) |
| SAE International                                                       | Member (2001 – 2012), Fellow (2012 – present) |
| International Society for Condition Monitoring (ISCM)                   | Fellow, 2021 – present                        |
| International Institute of Acoustics and Vibration (IIAV)               | Fellow, 2021 – present                        |
| American Institute of Aeronautics and Astronauts (AIAA)                 | Associate Fellow, 1984 – present              |
| American Railway Engineering and Maintenance-of-Way Association (AREMA) | Member, 2011 – present                        |
| American Society of Education for Engineers (ASEE)                      | Member, 1984 – 2001                           |
| Tau Beta Pi National Engineering Honorary Society                       | Member, 1979 – present                        |

**Patents**

1. Kinetic Energy-Harvesting Device for Powering and Charging Railway and Other Applications, U.S. Patent US2022/0337124 A1, September 10, 2024.
2. Dual-action rotary dynamic load stabilization pneumatic valve system, U.S. Patent 9,975,392, May 22, 2018.
3. A Compact Lightweight Double-piston Magnetorheological (MR) Damper with large adjustable dynamics force, Chinese Patent # ZL 201110420869.8, December 25, 2013.
4. A Compact Lightweight Double-piston Magnetorheological (MR) Damper, Chinese Patent # ZL 201110418073.9, January 9, 2014.
5. Doppler Sensor for the Derivation of Torsional Slip, Friction, and Related Parameters, U.S. Patent 8,294,883, October 23, 2012.
6. Doppler Sensor for the Derivation of Torsional Slip, Friction and Related Parameters, U.S. Patent 7,705,972, April 27, 2010.
7. No Jerk Semiactive Suspension System, U.S. Patent 6,115,658, September 5, 2000.
8. No Jerk Semi-Active Skyhook Control Methods and Apparatus, Canadian Patent Application, No. 09/225,147, December 17, 1999.
9. Self-Steering Locomotive Truck, U.S. Patent 6,006,674, December 28, 1999.
10. Self-Steering Locomotive Truck, U.S. Patent 5,746,135, May 5, 1998.
11. Self-Steering Locomotive Truck, U.S. Patent 5,613,444, March 25, 1997.
12. Electromagnetically Operated Pneumatic Valve Assembly for an Electrical Contactor Actuator, U.S. Patent 5,409,036, April 25, 1995.

**Major Keynote Lectures and Plenary Addresses**

1. The 8th International Conference on Condition Monitoring in Non-Stationary Operations (CMMNO 2024), Wenzhou, China, May 11 – 14, 2024.
2. Intelligent Transportation: From Model T to Autonomous Vehicles, University of Toledo's 2023 Theodore "Ted" Keith Annual Distinguished Lecture (one individual selected annually by a university committee in recognition of the nominees' life-long technical leadership and achievements), October 27, 2024.
3. The 2023 International Association of Vehicle System Dynamics (IAVSD) Bi-Annual Conference, "Dynamics performance of long combination vehicles with active control systems," Ottawa, Canada, August 21 – 25, 2023.
4. Iranian Society of Acoustics and Vibration (ISAV), "Low-Profile Magnetorheological Fluid Mounts," Tehran, Iran, December 8 – 9, 2021. (Virtual)
5. The 7th International Conference on Condition Monitoring and Asset Management, Plenary Lecture, "LiDAR System Applications for Improving Condition Monitoring and Asset Management of Railways," London, England, September 6 – 10, 2021. (Virtual)
6. International Conference on Rail Transportation (ICRT2021) "Achieving Improved Understanding of Wheel-Rail Interface Dynamics Through Roller Rig Testing," Chengdu, China, July 5 – 6, 2021. (Virtual)
7. The 9th ECCOMAS Thematic Conference on Smart Structures and Materials, Plenary Lecture, "Advancing Vehicle Safety Through Smart Systems," SMART 2019, Paris, France, July 8 – 12, 2019.
8. Ahmadian, M., "Railroad Track Monitoring Technologies," The First Annual Symposium on Railroad Infrastructure Diagnosis and Prognosis Symposium, University of Nevada, Las Vegas, NV, October 16 – 17, 2018.
9. The 2017 International Association of Vehicle System Design (IAVSD) Conference, State of the Art Lecture, "Magneto-Rheological Semiactive Suspensions for Improving Ground Vehicle's Ride Comfort, Stability, and Handling," Rockhampton, Queensland, Australia, August 14 – 18, 2017.
10. The 2016 Annual North Carolina Trucking Association Meeting (NCTA), "Trucking Ahead Toward Higher Productivity and Better Safety: A review of current and future technologies," Ashville, NC, October 11 – 12, 2016.
11. The 2014 SAE International Commercial Vehicle Engineering Congress (COMVEC), "Integrating Electromechanical Systems in Commercial Vehicles for Improved Handling, Stability, and Comfort," L. Ray Buckendale Lecture, Rosemont, IL, October 7 – 9, 2014.
12. The 2014 SAE International Commercial Vehicle Engineering Congress (COMVEC), "Effective Methods for Controlling Noise and Vibrations in Commercial Trucks: Passive and Semiactive Approaches," Rosemont, IL, October 1 – 3, 2013.
13. The 2012 International Conference on Advanced Vehicle Technologies and Integration, "The Magic of Magneto Rheological Fluids: Past, Present, and Future," Changchun, China, July 16-19, 2012.
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#### **Refereed Conference Publications**

1. Chen, Y., Pan, Y., and Ahmadian, M., "Electromagnetic Energy Harvesting Tie: Design, Implementation, and Field Testing," the AREMA 2024 Annual Conference and Exposition, Louisville, KY, September 15 – 18, 2024.
2. Kumar, N., Radmehr, A., Ahmadian, M., "Assessment of contact patch on curving forces in two-point contact condition," the AREMA 2024 Annual Conference and Exposition, Louisville, KY, September 15 – 18, 2024.
3. Ahmadian, M., Chen, Y., and Pan, Y., "Laboratory and Field Evaluation of an Energy Harvesting Tie for Energy Generation on Railroad Tracks," Railways 2024, Prague, Czech Republic, September 1 – 5, 2024.

4. Radmehr, A., Mirzaei, M., Larson, I., Holton, C., and Ahmadian, M., "Railroad Track Gage Widening Assessment Using On-board Doppler LiDAR Velocity Measurements and Unsupervised Machine Learning Technique," the 28th Symposium of the International Association of Vehicle System Dynamics, IAVSD 2023, Ottawa, Canada, August 21 – 25, 2023.
5. Chen, Y., Neighborgall, C., Zheng, X., and Ahmadian, M., "Field Testing and Performance Evaluation of Roll Stability Control System of Double-trailer Trucks," the 28th Symposium of the International Association of Vehicle System Dynamics, IAVSD 2023, Ottawa, Canada, August 21 – 25, 2023.
6. Radmehr, A. and Ahmadian, M., "Real-Time Wheel Wear Estimation using Non-Contact Measurements," Proceedings of the 20th International Wheelset Congress (IWC), Chicago, IL, May 8 – 11, 2023.
7. Zhang, Z., Chen, Y., and Ahmadian, M., "Interconnected Roll Stability Control System for Semitrucks with Double Trailers," 2023-01-0906, ISSN: 0148-7191, e-ISSN: 2688-3627, WCX SAE International World Congress Experience, Detroit, MI, April 18 – 20, 2023.
8. Ahmadian, M., Radmehr, A., and Hosseini, S-M, "Non-Destructive Evaluation of Track Stability Using Doppler Lidar Systems," 30th American Society for Nondestructive Testing (ASNT) Research Symposium, St. Louis, MS, June 20 – 23, 2022.
9. Radmehr, A., Yu, P., Tajaddini, A., and Ahmadian, M., "Wheel-Rail Contact Force and Wear Analysis Under Wet and Oil-Contaminated Conditions," the 2022 ASME Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022.
10. Molzon, M. and Ahmadian, M., "Development of a Mobile Robot System for the Visual Inspection of Railcar Undercarriage Equipment," the 2022 ASME Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022.
11. Hosseini, S-M, Radmehr, A., and Ahmadian, M., "Data Visualization using Google Earth Engine Coupled with Unsupervised Learning, A Practical Approach to Detecting Track Instability," the 2022 ASME Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022.
12. Radmehr, A., Yu, P., Tajaddini, A., and Ahmadian, M., "Experimental Evaluation of the Effect of Rail Cant Angle on the Wheel-Rail Contact Forces, Traction Coefficients, and Contact Patch Shapes," the 2022 ASME Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022.
13. Zhang, Z., Sun, N., Chen, Y., and Ahmadian, M., "Detailed Modeling of Pneumatic Braking in Long Combination Vehicles," SAE International Commercial Vehicle Engineering Congress & Exhibition, 02-14-03-0020, Chicago, IL, September 14 – 16, 2021. (<https://doi.org/10.4271/02-14-03-0020>)
14. Yu, P., Radmehr, A., Tajaddini, A., and Ahmadian, M., "An Experimental Study of the Influence of the Amount of Top-of-Rail Friction Modifiers on Traction," Proceedings of the 2021 ASME Joint Rail Conference, JRC2021-58347, St. Louis, Mo, April 20 – 21, 2021. (<https://doi.org/10.1115/JRC2021-58347>)
15. Pan, Y., Mast, T., Holton, C., and Ahmadian, M., "Performance Evaluation of a Novel Optical Sensing System for Detecting Rail Lubricity Conditions," Proceedings of the 2021 ASME Joint Rail Conference, JRC2021-58435, St. Louis, Mo, April 20 – 21, 2021. (<https://doi.org/10.1115/JRC2021-58435>)
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22. Yu, P., Zuo, L., and Ahmadian, M., "Design and Bench Tests of a Smart Railroad Tie for Energy Harvesting," Proceedings of the 2020 ASME Joint Rail Conference, St. Louis, MO, April 19 – 22, 2020. (<https://doi.org/10.1115/JRC2020-8133>)
23. Tan, Y., Hosseini, S-M, Chen, Y., and Ahmadian, M., "Simulation Evaluation of Fouled Ballast Thermal Characteristics," Proceedings of the 2020 ASME Joint Rail Conference, St. Louis, MO, April 19 – 22, 2020.
24. Dama, N. and Ahmadian, M., "Discrete Element Modeling of Railway Ballast for Studying Railroad Tamping Operation," Proceedings of the 2020 ASME Joint Rail Conference, St. Louis, MO, April 19 – 22, 2020.
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172. Song, X., Ahmadian, M., and Southward, S. C., "An Adaptive Semiactive Control Algorithm for Vehicle Suspension Systems," Proceedings of the ASME 2003 International Mechanical Engineering Congress and Exposition, Washington, D.C., November 16 – 21, 2003.
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193. Ahmadian, M., "The Noise and Vibration Benefits of Soft-Mounted Locomotive Cabs," Proceedings of the 2001 IEEE/ASME Joint Rail Conference, Toronto, Canada, April 2001.
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199. Ahmadian, M., Poynor, J. C., and Gooch, J. M., "Application of Magneto Rheological Dampers for Controlling Shock Loading," Proceedings of the 1999 ASME International Congress and Exposition, Nashville, TN, November 1999.
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201. Wei, H. and Ahmadian, M., "What Role does the Steerable Linkage Stiffness Play in the Operation of a Steerable Truck?" Proceedings of the ASME Rail Transportation Division, Chicago, Illinois, September 1999.
202. Ahmadian, M. and Jeric, K. M., "The Application of Piezoceramics for Reducing Noise and Vibrations in Vehicle Structures," Proceedings of the 1999 SAE International Off-Highway Equipment Congress and Exposition, Indianapolis, IN, September 1999.
203. Ahmadian, M., Jeric, K. M., and Inman, D. J., "An Experimental Evaluation of Smart Damping Materials for Reducing Structural Noise and Vibrations," Proceedings of the 1999 ASME Design Engineering Technical Conference, Las Vegas, NV, September 1999.
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205. Simon, D. E. and Ahmadian, M., "Application of Magneto-Rheological Dampers for Heavy Truck Suspensions," Proceedings of the 32nd International Symposium on Automotive Technology and Automation (ISATA), Vienna, Austria, June 1999.
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207. Ahmadian, M., "Filtering Effects of Mid-Cord Offset Measurements on Track Geometry Data," Proceedings of the 1999 IEEE/ASME Joint Rail Conference, Dallas, TX, April 1999.
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222. Yang, S. and Ahmadian, M., "Nonlinear Analysis of Hunting Stability in High-speed Rail Vehicles," Proceedings of the ASME Rail Transportation Division, Atlanta, GA, November 1996.
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229. Ahmadian, M. and Inman, D. J., "Some Stability Results for General Linear Lumped – Parameter Dynamic Systems," Proceedings of the 1985 ASME Winter Annual Meeting, Miami Beach, FL, November 1985.
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**Un-refereed Conference Publications/Presentation (based on abstract only)**

1. Mirzaei, M., Holton, C., Ahmadian, M., "From Data to Information: The Twists and Turns of Assessing Track Stability," Big Data in Railroad Maintenance Planning 2024 Conference, Newark, DE, December 11 – 12, 2024.
2. Ahmadian, M., Southward, S., Mantovani, G., and Sahju, A., "In-motion Detection, Isolation, and Classification of Wheel Cracks using Air-coupled Ultrasonic Acoustic Emission (UAE) Methods," MxV Rail University Day, August 6 – 7, 2024.
3. Mantovani, G., Kumar, N., Ahmadian, M., "Virginia Tech-Federal Railroad Administration Roller Rig Measurement Capabilities and Efforts to Improve its Capabilities," 2024 Pacific Southwest Region 9 UTC Annual Congress, Las Vegas, NV, March 11 – 12, 2024.
4. Kumar, N., Radmehr, A., Mantovani, G., and Ahmadian, M., "Experimental Evaluation of Loss of Braking due to Leaves on Railroad Tracks," 2024 Pacific Southwest Region 9 UTC Annual Congress, Las Vegas, NV, March 11 – 12, 2024.
5. Chen, Y., Mirzaei, M., Holton, C., and Ahmadian, M., "Application of Laser-induced Fluorescence Technique for Measuring Lubricity Conditions on Rail Gage Face," 2024 Pacific Southwest Region 9 UTC Annual Congress, Las Vegas, NV, March 11 – 12, 2024.
6. Mirzaei, M., Radmehr, A., Holton, C., and Ahmadian, M., "Leveraging Non-contact Doppler LiDAR Sensors and Unsupervised Algorithms for In-motion Assessment of Railroad Track Stability," 2024 Pacific Southwest Region 9 UTC Annual Congress, Las Vegas, NV, March 11 – 12, 2024.
7. Ahmadian, M., Radmehr, A., Mirzaei, S. M. H., "Condition Monitoring of Railroad Tracks in Revenue Service using Doppler Lidar Systems," the 8th International Conference on Condition Monitoring in Non-Stationary Operations (CMMNO 2024), Wenzhou, China, May 10 – 13, 2024.
8. Chen, Y., Mirzaei, S. M. H., Holton, C., Ahmadian, M., "Non-contact Detection and Evaluation of Rail Gage-face Lubricant using Optical Sensing Methods," the TTC Annual Conference, Pueblo, CO, November 7 – 8, 2023. (poster presentation)
9. Radmehr, A., Kumar, N., Ahmadian, M., "Experimental Evaluation of Wheel/Rail Contact, Third Body Layer, and Surface Finish on Risk of Derailment," the TTC Annual Conference, Pueblo, CO, November 7 – 8, 2023. (poster presentation)
10. Ahmadian, M., "Safety Evaluation of Interconnected Roll Stability Control Systems for Articulated Commercial Vehicles," The 16th IFToMM World Congress, Tokyo, Japan, November 5 – 11, 2023.

11. Radmehr, A. and Ahmadian, M., "Can Machine Learning Methods Improve the Identification of Unstable Tracks?" Big Data in Railroad Maintenance Planning 2022, Newark, DE, December 14 – 15, 2022.
12. Neighborgall, C., Chen, Y., and Ahmadian, M., "Field Tests and Simulation Results on Off-Tracking of a Long Combination Vehicle," the SAE International Commercial Vehicle Engineering Congress & Exhibition, Indianapolis, IN, September 20 – 22, 2022.
13. Shaju, A., Southward, S. C., and Ahmadian, M., "A Research Perspective on Truck Platooning and Autonomous Driving," SAE International Commercial Vehicle Engineering Congress & Exhibition, Indianapolis, IN, September 20 – 22, 2022.
14. Ahmadian, M., "An Overview of Some of the Dynamics and Control Challenges of Truck Platooning and Autonomous Driving," SAE International Commercial Vehicle Engineering Congress & Exhibition, Indianapolis, IN, September 20 – 22, 2022.
15. Mast, T., Radmehr, A., Hosseini, S-M. Hosseinian, Holton, C., and Ahmadian, M., "Onboard Installation of LiDAR Doppler Systems for Track Instability Measurements," the 2022 ASME Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022.
16. Radmehr, A. and Ahmadian, M., "Early Diagnosis of Track Stability through Non-contact LiDAR Measurements and Unsupervised Machine Learning Algorithms," 2nd RailTEAM Symposium on Railroad Infrastructure Diagnosis & Prognosis, Roanoke, VA, May 23 – 24, 2022.
17. Molzon, M. and Ahmadian, M., "Improving Trackside Inspection of Rolling Stock Using a Track Crawler Robot: A Step Toward Better Diagnosis and Prognosis of Railcars," 2nd RailTEAM Symposium on Railroad Infrastructure Diagnosis & Prognosis, Roanoke, VA, May 23 – 24, 2022.
18. 2nd RailTEAM Symposium on Railroad Infrastructure Diagnosis & Prognosis, Roanoke, VA, May 23 – 24, 2022.
19. Pan, Y. and Ahmadian, M., "Design and Field Testing of an Energy Harvester Tie: Enabling Rail Safety and Connectivity," the 2022 ASME Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022.
20. Hosseini, S-M. Hosseinian and Ahmadian, M., "Unleashing the Power of Statistical Data-driven Models for Analyzing Complex Engineering Data," the 2022 ASME Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022.
21. Ahmadian, M., Radmehr, A., and Pan, Y., "Long- and Short-term effect of Top of Rail Friction Modifiers (TORFM) on Traction," International Collaborative Research Initiative Monthly Meeting, January 2022.
22. Hosseini, S-M. Hosseinian, Radmehr, A., Mast, T. Holton, C., and Ahmadian, M., "Evaluating Track Stability using Unsupervised Machine Learning Models," Big Data in Railroad Maintenance Planning 2021, Newark, DE, December 15 – 16, 2021.
23. Ahmadian, M., "Machine Learning: A New Frontier for Rail Maintenance Planning, Diagnostics, and Prognostics," Big Data in Railroad Maintenance Planning 2021, Newark, DE, December 15 – 16, 2021.
24. Neighborgall, C., Van Kat, Z., Chen, Y., and Ahmadian, M., "Trailer Brake Type Effect on Braking Distance of Class 8 A-Double Tractor-Trailer," the SAE International Commercial Vehicle Engineering Congress & Exhibition, Chicago, IL, September 14 – 16, 2021.
25. Zhang, Z., Chen, Y., and Ahmadian, M., "Dimensionless and Parametric Analysis of Lateral Dynamics of Trucks with Single and Double Trailers," the SAE International Commercial Vehicle Engineering Congress & Exhibition, Chicago, IL, September 14 – 16, 2021.
26. Zhang, Z., Sun, N., Chen, Y., and Ahmadian, M., "Detailed Modeling of Pneumatic Braking in Long Combination Vehicles," the SAE International Commercial Vehicle Engineering Congress & Exhibition, Chicago, IL, September 14 – 16, 2021.

27. Hosseini, S-M. Hosseinian Ahangarnejad, A., Radmehr, A., and Ahmadian, M., "A Statistical Approach to Modeling Rail-Wheel Traction using Big Data," Big Data in Railroad Maintenance Planning 2020, Newark, DE, December 16, 2020. (Virtual)
28. Chen, Y., Zheng, X., Zhang, Z., and Ahmadian, M., "Effect of Uneven Loading on Roll Stability of Multi-trailer Trucks," the SAE International Commercial Vehicle Engineering Congress & Exhibition, Chicago, IL, September 15 – 17, 2010.
29. Ahmadian, M. and Southern, B. M., "Reducing Vehicle Noise and Vibration through Tunable Magnetorheological Fluid-Elastic Mounts," the 27th International Congress on Sound and Vibration ICSV27, Prague, Czech Republic, July 12 – 17, 2020, postponed to July 11 – 16, 2021.
30. Afzalan, M., Jazizadeh, F. K., and Ahmadian, M., "Track Condition Assessment using Scalable On-board Data: A Machine Learning Perspective," Big Data in Railroad Maintenance Planning 2019, Newark, DE, December 11 – 12, 2019.
31. Jazizadeh, F. K., Afzalan, M., and Ahmadian, M., "Determining Track Condition from Onboard Data in Revenue Service through Machine Learning: Fondest Hopes, Wildest Dream," Big Data in Railroad Maintenance Planning 2019, Newark, DE, December 13 – 14, 2019.
32. Neighborgall, C., Mast, T., Peterson, A. W., and Ahmadian, M., "Qualitative Assessment of Rail Lubricity," The First Annual Symposium on Railroad Infrastructure Diagnosis and Prognosis Symposium, University of Nevada, Las Vegas, NV, October 16 – 17, 2018.
33. Tan, Y., Chen, Y., Peterson, A. W., and Ahmadian, M., "Monitoring and Detecting Fouled Ballast using Forward Looking Infrared Radiometer (FLIR) Technology," The First Annual Symposium on Railroad Infrastructure Diagnosis and Prognosis Symposium, University of Nevada, Las Vegas, NV, October 16 – 17, 2018.
34. Radmehr, A., and Ahmadian, M., "VT-FRA Roller Rig: Designed and Commissioned to Serve the Railroad Industry," The First Annual Symposium on Railroad Infrastructure Diagnosis and Prognosis Symposium, University of Nevada, Las Vegas, NV, October 16 – 17, 2018.
35. Afzalan, M., Jazizadeh, F. K., and Ahmadian, M., "Towards Automated Monitoring of Track Using Machine Learning," The First Annual Symposium on Railroad Infrastructure Diagnosis and Prognosis Symposium, University of Nevada, Las Vegas, NV, October 16 – 17, 2018.
36. Mast, T., Neighborgall, C., Peterson, A. W., and Ahmadian, M., "The Application of Laser Technology for Railroad Top of Rail (TOR) Friction Modifier Detection and Measurements," The First Annual Symposium on Railroad Infrastructure Diagnosis and Prognosis Symposium, University of Nevada, Las Vegas, NV, October 16 – 17, 2018.
37. Dama, N., Jain, A., and Ahmadian, M., "Advanced Modeling of Railway Ballast for Improving Railroad Tamping Operation," The First Annual Symposium on Railroad Infrastructure Diagnosis and Prognosis Symposium, University of Nevada, Las Vegas, NV, October 16 – 17, 2018.
38. Jazizadeh, F. K., Afzalan, M., and Ahmadian, M., "Developing Machine Learning Methods for Facilitated Track Condition Assessment using Repeated Inspection Data," The First Annual Symposium on Railroad Infrastructure Diagnosis and Prognosis Symposium, University of Nevada, Las Vegas, NV, October 16 – 17, 2018.
39. Chen, Y., Peterson, A. W., and Ahmadian, M., "A Case Study on Lateral Characteristics of Trucks with Double and Triple Trailers," SAE International Commercial Engineering Congress and Exhibition, Rosemont, IL, September 11 – 13, 2018.
40. Chen, Y., Peterson, A. W., and Ahmadian, M., "Development of a Simulation Model for Evaluating Lateral Characteristics for Trucks with Double and Triple Trailers," SAE International Commercial Engineering Congress and Exhibition, Rosemont, IL, September 11 – 13, 2018.
41. Chen, Y., Peterson, A. W., and Ahmadian, M., "A Simulation-based Comparative Study on the Low-speed Offtracking of Long Combination Vehicles," SAE International Commercial Engineering Congress and Exhibition, Rosemont, IL, September 11 – 13, 2018.

42. Chen, Y., Peterson, A. W., and Ahmadian, M., "Achieving Pneumatic Antiroll Bar through Re-designing a Commercial Airspring Suspension for Semi-truck," SAE International Commercial Engineering Congress and Exhibition, Rosemont, IL, September 11 – 13, 2018.
43. Peterson, A. W., and Ahmadian, M., "Design and Implementation of a Shaft-mounted Steering Robot for Repeatable and Limit-steer Testing of Commercial Vehicles," SAE International Commercial Engineering Congress and Exhibition, Rosemont, IL, September 11 – 13, 2018.
44. Mast, T., Neighborgall, C., Peterson, A., and Ahmadian, M., "The Application of Optical Sensors for Railroad Top of Rail (TOR) Friction Modifier Detection and Measurements," 1<sup>st</sup> Annual AAR Transportation Technology Center, Inc., Student Showcase, Pueblo, CO, July 16, 2018.
45. Afzalan, M., Jazizadeh, F. K., and Ahmadian, M., "Predictive Machine Learning Models for Rail-Vehicle Dynamic Simulation," 1<sup>st</sup> Annual AAR Transportation Technology Center, Inc., Student Showcase, Pueblo, CO, July 16, 2018.
46. Radmehr, A., and Ahmadian, M., "VT-FRA Roller Rig Design and Measurement Capabilities," 1<sup>st</sup> Annual AAR Transportation Technology Center, Inc., Student Showcase, Pueblo, CO, July 16, 2018.
47. Korn, A., and Ahmadian, M., "Evolution: From Active Safety Systems to Highly Automated Vehicles," Attorneys Information Exchange Group (AIEG) Conference, Orlando, FL, April 19 – 21, 2017.
48. Ahmadian, M., Afzalan, M., and Jazizadeh, F., "Predictive Machine Learning Models for Rail-Vehicle Dynamic Simulation," Big Data in Railroad Maintenance Planning 2017, Newark, DE, December 14 – 15, 2017.
49. Hossienipour, M., and Ahmadian, M., "The Virginia Tech Roller Rig: Commissioning Report," 2017 ASME Joint Rail Conference (JRC), Philadelphia, PA, April 4- 7, 2017.
50. Nouri, A., Southward, S. C., and Ahmadian, M., "Correlation-Based Detection and Classification of Rail Wheel Defects Using Air-Coupled Ultrasonic Acoustic Emission," ASNT Spring Research Symposium, New Orleans, LA, April 11 – 14, 2016.
51. Peterson, A. W. and Ahmadian, M., "Lessons Learned from Track and City Road Testing of a Semitruck," SAE International Commercial Engineering Congress and Exhibition, Rosemont, IL, October 6 – 8, 2015.
52. Peterson, A. W. and Ahmadian, M., "Can Pneumatically Balanced Suspensions Improve Tire Life?" SAE International Commercial Engineering Congress and Exhibition, Rosemont, IL, October 6 – 8, 2015.
53. Ahmadian, M., "Practical Electro-mechanical Energy Harvesters for Industrial Applications," Center for Energy Harvesting Materials and Systems, Annual Industrial Advisory Board Review, Roanoke, VA, September 13 – 16, 2015.
54. Ahmadian, M., "Non-contact Measurement of Track Geometry using Low-power LIDAR Systems," Association of American Railroad (AAR) Annual Review, Colorado Springs, CO, March 31 – April 1, 2015.
55. Doseck, M., Peterson, A. W., and Ahmadian, M. "Advantages of Synchronous and Relational Vehicle Test Data." SAE International Commercial Engineering Congress and Exhibition, Rosemont, IL, October 7 – 9, 2014.
56. Ahmadian, M. "Importance of Networking Through Technical Conferences." SAE International Executive Council Meeting, September 16, 2014.
57. Iranmanesh, A., West, R. L., Ahmadian, M., "Structural Design Optimization of Railroad ASME Joints Using Parametric Finite Element Analysis," Proceedings of the 2014 ASME Joint Rail Conference, Pueblo, CO, April 2 – 4, 2014.
58. Ahmadian, M., Zhang, X., "The Common Pitfalls of Heavy Vehicle Testing," SAE International Commercial Engineering Congress and Exhibition, Rosemont, IL, October 1 – 3, 2013.

59. Ahmadian, M., "Design, Development, and Control of Advanced Suspensions for Improving Vehicle Handling and Agility," International Engineering Symposium, Birmingham, AL, September 8 – 11, 2013.
60. Adjerid, K., and Ahmadian, M., "Dynamic Characterization of a Tunable Magneto-Rheological Fluid – Elastic Mount in Squeeze Mode," Virginia Tech Interdisciplinary Research Symposium, Blacksburg, VA, November 2, 2012.
61. Nagode, C., Ahmadian, M., and Taheri, S., "Vibration Energy Harvester Systems for Freight Rail," 7<sup>th</sup> Annual Energy Harvesting Workshop and the 2<sup>nd</sup> Annual CEHMS Conference, Blacksburg, VA, August 2012.
62. Nagode, C., Ahmadian, M., and Taheri, S., "Vibration Energy Harvester Systems for Freight Rail Cars," 7<sup>th</sup> Annual Energy Harvesting Workshop and the 2<sup>nd</sup> Annual CEHMS Conference, Blacksburg, VA, August 2012.
63. Taheri, M., and Ahmadian, M., "Dynamic Model of Three-Piece Truck Friction Wedge Dampers," 2<sup>nd</sup> Annual ISVT Conference, Blacksburg, VA, August 27, 2012.
64. Ahmadian, M., "FRA Non-contact LIDAR-based Tachometer," FRA 2012 R&D Review, Washington, DC, May 22-23, 2012.
65. Ahmadian, M., "Evaluation of Wheel/Rail Contact Mechanics and Dynamics," FRA 2012 R&D Review, Washington, DC, May 22-23, 2012.
66. Tamaddoni, S. H., Ahmadian, M., and Taheri, S., "Application of Linear Quadratic Game Theory in Driver Steering Modeling and Optimal VSC Design," SAE International Heavy Truck Handling, Dynamics & Control Symposium, Greenville, SC, May 15-17, 2012.
67. Mahmoodi, N. and Ahmadian M., "Active Control of Structures with Adaptive Modified Positive Position Feedback," *Proceedings of the International SPIE 2011 Smart Structures/NDE Conference*, San Diego, CA, March 2011.
68. Liam C. and Ahmadian M., "Testing and Modeling of Shock Mitigating Seats for High-speed Craft," FAST 2011 Conference, Honolulu, HI, September 26 – 28, 2011.
69. Ahmadian, M., Nagode, C., and Taheri, S., "High Output Energy Harvesting Devices for Vehicular Applications," IWPMA 2011 and 6<sup>th</sup> Annual Energy Harvesting Workshop, Roanoke, VA, August 7-11, 2011.
70. Peterson, A. W., and Ahmadian, M., "Simulation and Testing of Wave-Adaptive Modular Vessels," MACC 2011 Conference, Hampton, VA, June 14-15, 2011.
71. Liam C. and Ahmadian M., "Testing and Modeling of Shock Mitigating Seats for High-speed Craft," MACC 2011 Conference, Hampton, VA, June 14 – 15, 2011.
72. Hopkins, B., Taheri, S., Ahmadian, M., and Reid, A., "An Integrate Rollover Mitigation Strategy for Military Trucks." Ground Vehicle Systems Engineering and Technology Symposium, Dearborn, MI, August 17 – 18, 2010.
73. Farjoud, A., Mahmoodi, S. N., Ahmadian, M., "Nonlinear Model of Squeeze Flow of MR Fluids Using Perturbation Techniques," Poster presentation, *The 12<sup>th</sup> International Conference on Electro-Rheological Fluids and Magneto-Rheological Suspensions*, Philadelphia, PA, August 2010
74. Farjoud, A., Mahmoodi, S. N., and Ahmadian, M., "Nonlinear model of squeeze flow of Magneto-rheological fluids using perturbation methods," To be presented at *Thirteenth Conference on Nonlinear Vibrations, Dynamics, and Multibody Systems*, Blacksburg, VA, May 2010.
75. Nagode, C., Ahmadian, M., and Taheri, S., "Effective energy harvesting devices for railroad applications," *Proceeding of the International SPIE 2010 Smart Structures/NDE Conference*, San Diego, CA, March 7 – 11, 2010.
76. Mahmoodi, S. N. Craft, M. J., and Ahmadian, M., "Active vibration control with optimized modified acceleration feedback equipped with adaptive line enhancer," *Proceeding of the International SPIE 2010 Smart Structures/NDE Conference*, San Diego, CA, March 7 – 11, 2010.

77. Rastgaar Aagaah M., Ahmadian M. and Southward, S. C., "Robustness of Orthogonal Eigenstructure Control to Actuators Failure," *SPIE Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring*, San Diego, CA, March 7 – 11, 2010. (Presentation only)
78. Farjoud, A. and M. Ahmadian, "Shim Stack Deflection Analysis in Hydraulic Dampers Using Energy Methods", *Active and Passive Smart Structures and Integrated Systems 2010*, SPIE – The International Society for Optical Engineering, San Diego, CA, March 7 – 11, 2010.
79. Craft, M., M. Ahmadian, A. Farjoud, W. Burke, and C. Nagode, "Force Characterization of a Modular Squeeze – Mode Magneto-Rheological Device", *Active and Passive Smart Structures and Integrated Systems 2010*, The International Society for Optical Engineering, San Diego, CA, March 7 – 11, 2010.
80. Tammadoni, S., Taheri, S., and Ahmadian, M., "Cooperative Optimal Vehicle Stability Controller Based on Nash Differential LQ Game Strategy," *Proceedings of the 2009 IEEE Conference on Decision and Control*, Shanghai, PP. R. China, December 16 – 18, 2009.
81. Mahmoodi, S. N., Jalili, N., and Ahmadian, M., "Subharmonic Resonances of Piezoelectrically Actuated Microcantilevers," *Proceedings of the 2009 ASME Dynamic Systems and Control Conference*, Hollywood, CA, October 12 – 14, 2009.
82. Ahmadian, M. "Preparing Engineers for the Future Transportation Industry," *Proceedings of the SAE International Commercial Vehicle Engineering Congress & Exhibition*, Chicago, Illinois, October 6 – 7, 2009.
83. Lee, H. W., Holton, C., Sandu, C., and Ahmadian, M., "An Empirical Approach to Model the Friction Coefficient for Wheel – Rail Contact," poster presentation, the NSF CMMI Research and Innovation Conference 2009; June 22 – 25, 2009; Honolulu, Hawaii.
84. Mahmoodi, S. N., Rastgaar Aagaah, M., and Ahmadian, M., "Active Vibration Control of Aerospace Structures Using a Modified Positive Position Feedback Method," *Proceedings of the 2009 American Control Conference*, Saint Louis, MO, June 10 – 12 2009.
85. Mahmoodi, S. N. and Ahmadian, M., "Vibration Control of Piezoelectrically Actuated Microcantilevers," *Proceeding of the International SPIE 2009 Smart Structures/NDE Conference*, San Diego, CA, March 9 – 12, 2009.
86. Reader, D. M., Southward, S. C., Ahmadian, M., "Nonlinear MR model inversion for Semi-active control enhancement," *Proceedings of the SPIE 2009 Smart Structures and Materials/NDE*, San Diego, CA, March 9 – 12, 2009. (Full Paper)
87. Ahmadian, M. and Southern, B. M., "Design and Performance Analysis of a Squeeze-mode MR Mount," *Proceedings of the SPIE 2009 Smart Structures and Materials/NDE*, San Diego, CA, March 9 – 12, 2009. (Presentation Only).
88. Farjoud, A., Ahmadian, M., and Cavey, R. H., "Rheometer characterization of MR fluids in squeeze mode," *Proceedings of the SPIE 2009 Smart Structures and Materials/NDE*, San Diego, CA, March 9 – 12, 2009. (Full Paper)
89. Mahmoodi, S. N. and Ahmadian, M., "Vibration Control of Piezoelectrically Actuated Microcantilevers," *Proceedings of the SPIE 2009 Smart Structures and Materials/NDE*, San Diego, CA, March 9 – 12, 2009. (Full Paper)
90. Rastgaar M., Ahmadian M., and Southward S. C., "Active Vibration Cancellation of Tonal Disturbance using Orthogonal Eigenstructure Control," *SPIE Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring*, SPIE Vol. 7288, 72880P, San Diego, CA, March 8–12, 2009. (Presentation Only)
91. Lee, H. W., Holton, C., Sandu, C., and Ahmadian, M., "Feasibility Assessment for Estimating Rail Frictional Performance Through the Measurement of Wheel Slip using Optical Fiber Doppler LIDAR Techniques," poster presentation, the 14<sup>th</sup> Annual Meeting of the Association of American Railroads, Pueblo, CO, March 2 – 4, 2009.
92. Ihsan, S. I., Faris, W. F., and Ahmadian, M., "Analysis of Semiactive Suspension Systems using a Half-Car Model," *FISITA 2008*, Munich, Germany, September 14 – 19, 2008. (Poster Presentation)

93. Southward, S. C., Ahmadian, M., and Reader, D., "High-Performance Semi-active MR Suspensions using Invertible Volterra Filter Models," 14<sup>th</sup> Annual Automotive Research Center (ARC) Conference, May 20 – 21, 2008, Ann Arbor, MI. (Presentation Only)
94. Ahmadian, M., "Laboratory Evaluation of Heavy Truck Suspension Kinematics and Dynamics," Advanced Suspension Systems 2008, Dearborn, MI, May 19 – 20, 2008. (Presentation Only)
95. Ahmadian, M., "The Magic of MR Fluids: A Review of the State of the Art in Magnetorheological (MR) Fluid Technologies & Its Application in Vehicle Suspension Systems," Advanced Suspension Systems 2008, Dearborn, MI, May 18, 2008. (1/2 – day workshop)
96. Rastgaar M., Ahmadian M., Southward S. C., "Application of Orthogonal Eigenstructure Control to Flight Control Design," *SPIE Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring*, SPIE Vol. 6928, 69280P, San Diego, CA, March 10–13, 2008. (Presentation Only)
97. Ahmadian, M. and Blanchard, E. D., "A Non-dimensional Evaluation of Semiactive Suspensions for Improving Vehicle Ride, Handling, and Stability," IAVSD, the 20<sup>th</sup> IUTAM International Symposium on Dynamics of Vehicles on Road and Tracks, Berkeley, CA, August 13 – 17, 2007. (Poster Presentation)
98. Ahmadian, M., "A Reflection on Technologies that Could Benefit the Railroad Industry," *the ASME International Mechanical Engineering Congress and Exposition*, Chicago, IL, November 5 – 10, 2006. (Presentation Only)
99. Koo, J. H., Shukla, A., and Ahmadian, M., "Dynamic Performance Analysis of Nonlinear Tuned Vibration Absorbers," The 1<sup>st</sup> International Conference on Nonlinear Science and Complexity (NSC 2006), August 7 – 12, 2006, Beijing, China (Presentation Only).
100. Ahmadian, M. and Koo, J. H., "Magneto Rheological Tuned Vibration Absorbers: Can They Solve All Your Vibration Problems?" Proceedings of the 10<sup>th</sup> International Conference on Electrorheological Fluids and Magnetorheological Suspensions (ERMR 2006), Lake Tahoe, NV, June 18 – 22, 2006. (Full Paper)
101. Ahmadian, M. and Goncalves, F. D., "The Effect of Dwell Time on the Rheological Behavior of MR Fluids," Proceedings of the 10<sup>th</sup> International Conference on Electrorheological Fluids and Magneto-rheological Suspensions, Lake Tahoe, NV, June 18 – 22, 2006. (Full Paper)
102. Koo, J. H. and Ahmadian, M., "Qualitative Analysis of Magneto-rheological Tuned Vibration Absorbers: Experimental Approach," Proceedings of the 10<sup>th</sup> International Conference on Electrorheological Fluids and Magnetorheological Suspensions (ERMR 2006), Lake Tahoe, NV, June 18 – 22, 2006. (Presentation Only)
103. Ahmadian, M., Dillard, D. A., and Plaut, R. H., "ASME Jointless Insulated ASME Joint Designs and Performance – Durability Evaluation," Transportation Research Board Meeting, Washington, D.C., January 22 – 26, 2006. (Presentation Only)
104. Eckstein, A. C., Lambrecht, S. W., Lohse-Busch, H. H., Plaut, R. H., Dillard, D., and Ahmadian, M., "Analysis, Characterization, and Design of Adhesively Bonded Insulated ASME Joints for Rail Applications," Transportation Research Board Meeting, Washington, D.C, January 22 – 26, 2006. (Presentation Only)
105. Ahmadian, M., "On the Development of Fuzzy Skyhook Control for Semiactive Magneto Rheological System," *Proceedings of the SPIE 2005 Smart Structures and Materials/NDE*, San Diego, CA, March 6 – 10, 2005. (Full Paper)
106. Goncalves, F. D., Ahmadian, M., "A study on MR fluids subjected to high shear rates and high velocities," *Proceedings of the SPIE 2005 Smart Structures and Materials/NDE*, San Diego, CA, March 6 – 10, 2005. (Full Paper)
107. Ahmadian, M., Goncalves, F. D., and Sandu, C., "An Experimental Analysis of Suitability of Various Semiactive Control Methods for Magneto Rheological Vehicle Suspensions," *Proceedings of the SPIE 2005 Smart Structures and Materials/NDE*, San Diego, CA, March 6 – 10, 2005. (Full Paper)
108. Ahmadian, M., Song, X., and Sandu, C., "Designing an Adaptive Semiactive Magneto Rheological Seat Suspension for Heavy Truck Applications," *Proceedings of the SPIE 2005 Smart Structures and Materials/NDE*, San Diego, CA, March 6 – 10, 2005. (Full Paper)

109. Koo, J. H. and Ahmadian, M., and Elahinia, M. H., "Semi-active Controller Dynamics in a Magneto-Rheological Tuned Vibration Absorber," *Proceedings of the SPIE 2005 Smart Structures and Materials/NDE*, San Diego, CA, March 6 – 10, 2005. (Full Paper)
110. Ahmadian, M. Boggs, C. M., "Safety Effects of Operator Seat Design in Large Commercial Vehicles, Project Completion," Transportation Research Board Annual Meeting, Washington, D.C., January 8 – 14, 2005. (Poster Session and Demonstration)
111. Goncalves, F. D., Ahmadian, M., Carlson, J. D., "Behavior of MR fluids at high velocities and high shear rates," *Proceeding of the 9<sup>th</sup> International Conference on Electrorheological Fluids and Magneto-rheological Suspensions*, Beijing, China, August 29 – September 3, 2004 (Full Paper).
112. Elahinia, M., Koo, J. H., and Ahmadian, M., "Experimental Study for Controlling Shape Memory Alloy Actuated Manipulator" *10<sup>th</sup> Nonlinear Vibrations, Stability and Dynamics of Structures*, Blacksburg, VA, July 25 – 29, 2004 (Presentation Only).
113. Hou, B., Sandu, C., and Ahmadian, M., "Dynamics and Control of a High-speed Transfer Arm," *10<sup>th</sup> Nonlinear Vibrations, Stability and Dynamics of Structures*, Blacksburg, VA, July 25 – 29, 2004 (Presentation Only).
114. Worley, M. E., Sandu, C., and Ahmadian, M., "Vehicle Dynamics Simulation in Dymola Software," *2<sup>nd</sup> Annual Virginia Tech Undergraduate Research and Potential Graduate Student Conference*, Blacksburg, VA, April 13, 2004 (Presentation Only).
115. Ahmadian, M., Gravatt, J. W., "A Comparative Analysis of Passive Twin Tube and Skyhook MRF Dampers for Motorcycle Front Suspension," *Proceedings of the SPIE 2004 Smart Structures and Materials/NDE*, San Diego, CA, March 14 – 18, 2004. (Full Paper)
116. Ahmadian, M., Vahdati, N., "Effect of Hybrid Semiactive Control on Steady State and Transient Dynamics of Vehicle Suspensions," *Proceedings of the SPIE 2004 The International Society of Optical Engineering*, San Diego, CA, March 14 – 18, 2004. (Full Paper)
117. Ahmadian, M., Norris, J. A., "High-Velocity Behavior of Magneto Rheological Fluids," *Proceedings of the SPIE 2004 Smart Structures and Materials/NDE*, San Diego, CA, March 14 – 18, 2004. (Full Paper)
118. J. H. Koo, Goncalves, F. D., "Ahmadian, M., "An Investigation of the Response Time of Magneto-Rheological Fluid Dampers," *Proceedings of the SPIE 2004 Smart Structures and Materials/NDE*, San Diego, CA, March 14 – 18, 2004. (Full Paper)
119. Elahinia, M. H., Henneke, E. G., II, and Ahmadian, M., "Stress-Based Sliding Mode Control of a Rotary SMA-Actuated Manipulator," *Proceedings of the SPIE 2004 Smart Structures and Materials/NDE*, San Diego, CA, March 14 – 18, 2004. (Full Paper)
120. Ahmadian, M. Boggs, C. M., "Safety Effects of Operator Seat Design in Large Commercial Vehicles, Project in Progress," Transportation Research Board Annual Meeting, Washington, D.C., January 10 – 16, 2004. (Poster Session and Demonstration)
121. Ahmadian, M. and Koo, J. H., "On the Application of Magneto-Rheological (MR) Dampers for Reducing Floor Vibrations," *Acoustical Society of America Annual Meeting*, Austin, TX, November 9 – 14, 2003.
122. Elahinia M. H., Seigler T. M., Leo D. J., and Ahmadian M., "Sliding Mode Control of a Shape Memory Alloy Actuated Manipulator," *Proceedings of the 5th International Conference on Intelligent Materials*, Pennsylvania State University, State College PA, June 2003.
123. Seigler, M. Elahinia, M. H. Leo, D. J., and Ahmadian, M., "Stress Based Control of a Single – degree-of-freedom SMA-Actuated Arm," *Proceedings of the 5th International Conference on Intelligent Materials*, Pennsylvania State University, State College PA, June 2003.
124. Koo, J. H., Ahmadian, M., and Setareh, M., "An Experimental Evaluation of Magneto-Rheological Dampers for Semi-active Tuned Vibration Absorbers," *Proceedings of the SPIE 2003 Smart Structures and Materials/NDE*, San Diego, CA, March 2003. (Full Paper)
125. Ahmadian, M., "The Latest Trends in Reducing Noise and Vibrations in Large Commercial Vehicles: A Tutorial," *Proceedings of the 2002 ASME International Congress and Exposition*, New Orleans, LA, November 2002. (Short abstract)

126. Ahmadian, M., Appleton, R., and Norris, J. A., "Designing Magneto-Rheological Recoil Dampers in a Fire-out-of-Battery Recoil System," *Proceedings of the 11<sup>th</sup> Symposium on Electromagnetic Launch Technology*, France, May 2002. (Full Paper)
127. Ahmadian, M. and Simon, D. E., "An Analytical Experimental Evaluation of Magneto Rheological Suspensions for Heavy Trucks," *Proceedings of the 17<sup>th</sup> IUTAM International Symposium on Dynamics of Vehicles on Road and Tracks*, Lyngby, Denmark, August 20 – 24, 2001. (Full Paper)
128. Ahn, Y. K., Kim, Y. C., Yang, B. S., and Ahmadian, M., "Optimal Design of Mount Using an Enhanced Genetic Algorithm and Simplex Method," *Proceeding of the 8<sup>th</sup> International Congress on Sound and Vibration*, July 2 – 6, 2001, Hong Kong, China. (Full Paper)
129. Ahmadian, M. and Jeric, K. M., "Effect of Shunted Piezoelectric Materials on Increasing Transmission Loss," *Proceedings of the SPIE 8<sup>th</sup> Annual International Symposium on Smart Structures and Materials*, Newport Beach, CA, March 2001. (Full Paper)
130. Ahmadian, M., Jeric, K. M., and Inman, D. J., "Application of Shunted Piezoceramics for Damped and Undamped Structures," *Proceedings of the SPIE 8<sup>th</sup> Annual International Symposium on Smart Structures and Materials*, Newport Beach, CA, March 2001. (Full Paper)
131. Inman, D. J., Ahmadian, M., and Claus, R. O., "Simultaneous Health Monitoring and Control of Panels," *Proceedings of the 71<sup>st</sup> Shock and Vibration Symposium*, Arlington, VA, November 2000. (Full Paper)
132. Inman, D. J., Ahmadian, M., and Claus, R. O., "Suppressing Plate Vibrations with Smart Materials," *Proceedings of the 71<sup>st</sup> Shock and Vibration Symposium*, Arlington, VA, November 2000. (Full Paper)
133. Ahmadian, M., DeGuilio, A. P., Inman, D. J., Claus, R. O., "Application of Smart Damping Materials and Fiber Optic Sensors for Structural Vibration Reduction," *13<sup>th</sup> Annual Fiber Optics Biomedical Optics Research Review*, Blacksburg, VA, April 2000. (Extended abstract)
134. Ahmadian, M. and Poynor, J. C., "Application of Magneto-Rheological Dampers for Controlling Gun Recoil," *Proceedings of the Fourth Army Research Office Workshop on Smart Structures*, State College, PA, August 1999. (Extended abstract)
135. Yang, S. and Ahmadian, M., "Analysis of Hopf Bifurcation in Rail Vehicle Dynamics," *Proceedings of the third European Nonlinear Oscillations Conference (ENOC)*, Copenhagen, Denmark, August 1999. (Extended abstract)
136. Ahmadian, M., Song, X. and Reichert, B.A., "Damping Properties of Magneto-Rheological Fluids," *Proceedings of the Third Army Research Office Workshop on Smart Structures*, Blacksburg VA, August 1997. (Extended abstract)
137. Ahmadian, M., Song, X., and Reichert, B.A., "Semiactive Control of Structural Resonance," *Proceedings of the Eleventh Symposium on Structural Dynamics and Control*, Blacksburg VA, May 1997. (Full Paper)
138. Ahmadian, M., Song, X., and Reichert, B.A., "Semiactive Control of Multibody Systems," *Proceedings of the Eleventh Symposium on Structural Dynamics and Control*, Blacksburg VA, May 1997. (Full Paper)
139. Ahmadian, M., "Track Testing of an Innovative Steerable Locomotive Bogie for Heavy Freight Application," *Proceedings of the ASME Rail Transportation Division*, Atlanta GA, November 1996. (Extended abstract)
140. Sardar, H. and Ahmadian, M., "A Modified Model Referenced Adaptive Control Scheme for Active Vibration Control in Machining," *ASME IMECE 96, Materials Division*, Atlanta GA, November 1996. (Extended abstract)
141. Ahmadian, M., Miller, L. R., Southward, S. C., and Roemer, M. J., "Performance Analysis of Active Mounts for Structural Vibration Reduction," *Proceedings of Recent Advances in Active Control of Sound and Vibration*, Virginia Polytechnic Institute and State University, Blacksburg, VA, April 1993. (Full Paper)
142. Miller, L. R., Ahmadian, M., and Vahdati, N., "A New Approach to Meeting Engine Vibration Requirements—Active Mounts," *Aerotech'92*, Anaheim, CA, October 1992. (Short abstract)

143. Pitman, F. M. and Ahmadian, M., "Some Results on Decentralized Control of Large-Scale Modular Structures," *Proceedings of the 6th VPI & SU/AIAA Symposium on Dynamics and Control of Large Structures*, Blacksburg, VA, June 1987. (Full Paper)
144. Ahmadian, M., "A New Computational Scheme for Dynamic Analysis of Spinning Spacecraft," *Proceedings of the 28th Structures, Structural Dynamics and Materials Conference*, Monterey, CA, April 1987. (Extended abstract)
145. Ahmadian, M., "Adaptive Control for Industrial Robots," *Automated Manufacturing Exhibition and Conference*, Greenville, SC, November 1986. (Full Paper)
146. Ahmadian, M. and Inman, D. J., "On the Dynamics of Pseudo-Symmetric Systems," *The 23rd Annual Meeting of the Society of Engineering Science*, Buffalo, NY, August 1986. (Short abstract)
147. Ramamurthi, K. and Ahmadian, M., "Model Referenced Adaptive Control of a Robot Manipulator," *Proceedings of the 1986 International Federation of Automatic Control (IFAC) Symposium on Control of Distributed Parameter Systems*, Los Angeles, CA, June 1986. (Full Paper)
148. Ahmadian, M. and Huang, S. M., "Computational Comparison of Stability Techniques Available for Multiple-Parameter Dynamic Systems," *Proceedings of the 10th U.S. National Congress of Applied Mechanics*, Austin, TX, June 1986. (Short abstract)
149. Ahmadian, M. and Chou, S. H., "Stability Analysis of Multidimensional Time-Varying Systems," *Proceedings of the 10th U.S. National Congress of Applied Mechanics*, Austin, TX, June 1986. (Short abstract)
150. Ahmadian, M., "Stability Results for Lumped Parameter Time-Varying Systems," *The 27th Structures, Structural Dynamics, and Materials (SDM) Conference*, San Antonio, TX, May 1986. (Extended abstract)
151. Ahmadian, M., "On the Computational Efficiency of Stability Techniques Applied to Linear Discrete Dynamic Systems," *The 27th Structures, Structural Dynamics, and Materials (SDM) Conference*, San Antonio, TX, May 1986. (Extended abstract)
152. Ahmadian, M., "Some Stability Results for Multiple – Parameter Time-Varying Systems," *Proceedings of the 22nd Annual Meeting of the Society of Engineering Science*, The Pennsylvania State University, State College, PA, October 1985. (Short abstract)
153. Ahmadian, M., "On the Time Response of Multidegree – of – Freedom Second – Order Systems," *The 22nd Society of Engineering Science Meeting*, State College, PA, October 1985. (Short abstract)
154. Ahmadian, M. and Inman, D. J., "Closed-Loop Stability of Large Space Structures with Reduced-Order Controllers," *Proceedings of the 5th VPI & SU/AIAA Symposium on Dynamics and Control of Large Structures*, Blacksburg, VA, June 1985. (Full Paper)
155. Ahmadian, M. and Inman, D. J., "On the Stability of General Linear Dynamic Systems," *Proceedings of the 21st Annual Meeting of the Society of Engineering Science*, Blacksburg, VA, October 1984. (Short abstract)
156. Ahmadian, M. and Inman, D. J., "Controllability and Observability of Flexible Gyroscopic Systems," *Proceedings of the 21st Annual Meeting of the Society of Engineering Science*, Blacksburg, VA, October 1984. (Short abstract)
157. Ahmadian, M. and Inman, D. J., "Modal Analysis in Non-Conservative Dynamic Systems," *Proceedings of the 2nd International Modal Analysis Conference*, Orlando, FL, February 1984. (Full Paper)

#### **Invited Colloquiums**

1. Mirzaei, M., Holton, C., Ahmadian, M., "From Data to Information: The Twists and Turns of Assessing Track Stability," Big Data in Railroad Maintenance Planning 2024 Conference, Newark, DE, December 11 – 12, 2024.
2. Ahmadian, M., Southward, S., Mantovani, G., and Sahju, A., "In-motion Detection, Isolation, and Classification of Wheel Cracks using Air-coupled Ultrasonic Acoustic Emission (UAE) Methods," MxV Rail University Day, August 6 – 7, 2024.

3. Ahmadian, M., Radmehr, A., Mirzaei, S. M. H., "Condition Monitoring of Railroad Tracks in Revenue Service using Doppler Lidar Systems," the 8th International Conference on Condition Monitoring in Non-Stationary Operations (CMMNO 2024), Wenzhou, China, May 10 – 13, 2024.
4. Ahmadian, M., "Safety Evaluation of Interconnected Roll Stability Control Systems for Articulated Commercial Vehicles," The 16th IFToMM World Congress, Tokyo, Japan, November 5 – 11, 2023.
5. Radmehr, A. and Ahmadian, M., "Can Machine Learning Methods Improve the Identification of Unstable Tracks?" Big Data in Railroad Maintenance Planning 2022, Newark, DE, December 14 – 15, 2022.
6. Ahmadian, M., "An Overview of Some of the Dynamics and Control Challenges of Truck Platooning and Autonomous Driving," SAE International Commercial Vehicle Engineering Congress & Exhibition, Indianapolis, IN, September 20 – 22, 2022.
7. Radmehr, A. and Ahmadian, M., "Early Diagnosis of Track Stability through Non-contact LiDAR Measurements and Unsupervised Machine Learning Algorithms," 2nd RailTEAM Symposium on Railroad Infrastructure Diagnosis & Prognosis, Roanoke, VA, May 23 – 24, 2022.
8. Ahmadian, M., Radmehr, A., and Pan, Y., "Long- and Short-term effect of Top of Rail Friction Modifiers (TORFM) on Traction," International Collaborative Research Initiative Monthly Meeting, January 2022.
9. Ahmadian, M., "Machine Learning: A New Frontier for Rail Maintenance Planning, Diagnostics, and Prognostics," Big Data in Railroad Maintenance Planning 2021, Newark, DE, December 15 – 16, 2021.
10. Zhang, Z., Chen, Y., and Ahmadian, M., "Dimensionless and Parametric Analysis of Lateral Dynamics of Trucks with Single and Double Trailers," the SAE International Commercial Vehicle Engineering Congress & Exhibition, Chicago, IL, September 14 – 16, 2021.
11. Ahmadian, M., "Achieving Vehicle Safety Through Autonomy," University of Toledo, College of Engineering Distinguished Speaker Series, February 26, 2021.
12. Hosseini, S-M. Hosseinian Ahangarnejad, A., Radmehr, A., and Ahmadian, M., "A Statistical Approach to Modeling Rail-Wheel Traction using Big Data," Big Data in Railroad Maintenance Planning 2020, Newark, DE, December 16, 2020. (Virtual)
13. Ahmadian, M., "Achieving Vehicle Safety Through Smart Systems," University of California, Riverside, College of Engineering Distinguished Speaker Series, November 13, 2019.
14. Ahmadian, M., "Emergency Collision Avoidance Maneuvers for Long Combination Vehicles: What is Possible and What is Not," 2019 SAE International Commercial Vehicle Engineering Congress (COMVEC), Indianapolis, IN, September 9 – 11, 2019.
15. Ahmadian, M., "Simulation Evaluation on the Rollover Propensity of Multi-trailer Trucks at Roundabouts," 2019 SAE International Commercial Vehicle Engineering Congress (COMVEC), Indianapolis, IN, September 9 – 11, 2019.
16. Ahmadian, M., "Reaching Higher Levels of Railroad Engineering and Productivity through Intelligent Technologies," Invited Lecture, Frauscher Sensor Technology USA, Inc., Princeton, NJ, August 1, 2018.
17. Ahmadian, M., "Traction Measurements on VT-FRA Roller Rig," Invited Lecture, ICRI Monthly Discussions, March 2, 2018.
18. Ahmadian, M., "Railroad Engineering Research: from Torch and Hammer to Super Sensitive LIDAR Systems," Distinguished Seminar Series in Railroad Infrastructure, University of Nevada Las Vegas, November 14, 2017.
19. Ahmadian, M., "Bridging the Gap between Academic Research and Rail Industry's Need Through Affiliated Programs, with Effect on Rail Tanker Car Safety, National Research Council (NRC) Workshop, Ottawa, ON, Canada, August 25, 2017.

20. Ahmadian, M., "Evolution: From Active Safety Systems to Highly Automated Vehicles," Attorneys Information Exchange Group (AIEG) Conference, Orlando, FL, April 19 – 21, 2017.
21. Ahmadian, M., "Application of Non-contacting LIDAR Sensors for Track Geometry Assessment," LTK Engineering Services, Ambler, PA, August 2016.
22. Ahmadian, M., "Integration of Real-time Condition Monitoring Systems for Maintaining and Sustaining Railroad Infrastructure," Defense Materials, Manufacturing and Infrastructure Standing Committee (DMMI), The National Academies Science, Washington, DC, May 2016.
23. Ahmadian, M., "Top-of-rail Lubricity Measurements: Tests Results and Discussion," Norfolk Southern, Roanoke, VA, February 2016.
24. Ahmadian, M., "Application of Non-contacting LIDAR Sensors for Track Geometry Assessment," Transportation Review Board Annual Meeting, Washington, DC, January 2016.
25. Ahmadian, M., "Non-dimensional Analysis of Semiactive Magneto-Rheological Suspensions for Optimizing Vehicle Ride, Handling, and Stability," Villanova University, April 2015.
26. Ahmadian, M., "Overview of Railroad Research Activities at Virginia Tech's Railway Technologies Laboratory," Marshall University, April 2015.
27. Ahmadian, M., "Simulation and Analysis of Geometric and Dynamic Parameters Influencing Truck Maneuvering and Stability in Roundabouts," Segrave Industries, May 2015.
28. Ahmadian, M., "Comprehensive Evaluation of Dynamically Balanced Pneumatic Suspensions for Improved Heavy Truck Rollover Stability," FedEx Ground, May 2015.
29. Ahmadian, M., "Magneto Rheological Fluid Behavior in Squeeze Mode," Rice University, March 2011.
30. Ahmadian, M., "A Walk down the Memory Lane with Magneto-Rheological Technology for Vehicle Applications," Michigan Technological University, November 2011.
31. Ahmadian, M., "Magneto Rheological Tuned Vibration Absorbers: Can They Solve all your Vibration Problems?," Lawerance Technological University, February 2009.
32. Ahmadian, M., "Closed-form Analysis of Vehicle Suspension Ride and Handling Performance," EUROMECH 500, Lyngby, Denmark, June 2008.
33. Ahmadian, M., "Advanced Systems for Improving Rail Operation Safety and Efficiency," Lockheed Martin Maritime Systems and Sensors, Manassas, VA, December 2008.
34. Ahmadian, M., "Recent Trends in Applications of Smart Materials for Automotive Applications," IIUM College of Engineering, Kuala Lumpur, Malaysia, May 2008
35. Ahmadian, M., "A Non-dimensional Evaluation of Semiactive Suspensions for Simultaneously Improving Vehicle Ride, Handling, and Stability," University of Toledo, March 2006.
36. Ahmadian, M., "Smart Devices for Improving Heavy Truck Dynamics and Safety," SAE International Symposium on Truck Handling, Dynamics, and Control, Greenville, SC, May 2005.
37. Ahmadian, M., "Application of Semiactive Magneto-Rheological Suspensions for Improving Vehicle Ride, Handling, and Stability," Michelin Americas Research & Development Corporation, Greenville, SC, May 2005.
38. Ahmadian, M., "Center for Vehicle Systems & Safety," The Goodyear Tire and Rubber Company, Akron, OH, February 2005.
39. Ahmadian, M., "The Virginia Institute for Performance Engineering and Research: What's all the Excitement About?," Danville Rotary Club, Danville, VA, January 2005.
40. Ahmadian, M., "The Virginia Institute for Performance Engineering and Research (VIPER)," Ford Motor Company, Dearborn, MI, June 2004.
41. Ahmadian, M., "Biodynamics: Human Body's Reaction to Noise and Vibrations," ASME Virginia Section, Roanoke, VA, January 2004.
42. Ahmadian, M., "Magneto-Rheological Fluids and Applications," Smart Materials Short Course, Center for Intelligent Material Systems and Structures, Blacksburg, VA, May 12 – 14, 2003.

43. Ahmadian, M., "Semiactive Control of Rollover Dynamics in High CG Vehicles," SAE International TOPTEC on Heavy Vehicle Rollover and Crash Avoidance, Baltimore, MD, April 22 – 23, 2003.
44. Ahmadian, M., "On the Application of Magneto Rheological Dampers to Recreational Vehicles," Detroit Steel Products, Inc., Morristown, IN, March 2003.
45. Ahmadian, M., "Absorbing Shipboard Shocks with Magneto-Rheological Dampers," Northrop Grumman Newport News, Newport News, VA, October 2002.
46. Ahmadian, M., "Controlling Gun Recoil with Magneto-Rheological Devices," United Defense, L.P., Minneapolis, MN, June 2002.
47. Ahmadian, M., "What can Magneto-Rheological Technology do for you?" Naval Surface Warfare Center, Dahlgren, VA, April 2002.
48. Ahmadian, M., "Benefits of Magneto Rheological for Automotive Applications," Paulstra Corporation, Grand Rapids, MI, January 2002.
49. Ahmadian, M., "An Innovative Approach to Measuring Driver Fatigue due to Heavy Truck Seats," The ROHO Group, Belleville, IL, October 2001.
50. Ahmadian, M., "Magneto Rheological Devices: What They Do and How They Work," Volvo Corporation, Gothenburg, Sweden, August 2001.
51. Ahmadian, M., "Working with Advanced Vehicle Dynamics Laboratory," DaimlerChrysler Corporation, Rochester Hills, MI, June 2001.
52. Ahmadian, M., "The Magic of Magneto-Rheological Fluids," ASME Virginia Section, Roanoke, VA, September 2000.
53. Ahmadian, M., "On the Development of a .50 caliber Gun Recoil Demonstrator for Controlling Recoil Dynamics with Magneto-Rheological Dampers," Naval Surface Warfare Center, Dahlgren, VA, April 2000.
54. Ahmadian, M., "Application of Magneto-Rheological Devices for High-Frequency Vibration Control," Bridgestone–Firestone Corporation, Akron, OH, April 2000.
55. Ahmadian, M., "Advanced Technologies for Improving Railway Operations," Norfolk Southern, Inc., Roanoke, VA, February 2000.
56. Ahmadian, M., "The Many Uses of Magneto-Rheological Systems for Automotive Applications," Visteon Corporation, Dearborn, MI, October 1999.
57. Ahmadian, M., "An Assessment of Power Hop Phenomenon in Heavy – axle Off-Road Vehicles," Goodyear Tire and Rubber Company, Akron, OH, March 1999.
58. Ahmadian, M., "Magneto-Rheological Suspensions for Passenger Automobiles," Delphi Automotive Systems Corporation, Dayton, OH, November 1998.
59. Ahmadian, M., "Railroading Across the U.S. and Abroad," ASME Virginia Section, Roanoke, VA, September 1998.
60. Ahmadian, M., "Application of Magneto-Rheological Fluids for Railroad Applications," Datong Railroad Institute, Datong, China, October 1998.
61. Ahmadian, M., "Recent Advances in Railroad Technologies around the World," Shijiazhuang Railway Institute, Shijiazhuang, China, October 1998.
62. Ahmadian, M., "The Potential Benefits of Magneto-Rheological Technology for the Chinese Railway," Shijiazhuang Railway Institute, Shijiazhuang, China, October 1998.
63. Ahmadian, M., "Magneto-Rheological Fluids: An Innovative Material for Controllable Systems," Institute of Mathematical Modeling, The Technical University of Denmark, Lyngby, Denmark, March 1998.
64. Ahmadian, M., "Semiactive Control of Magneto-Rheological Seat Suspensions," Virginia Tech Department of Electrical Engineering, Blacksburg, VA, October 1997.
65. Ahmadian, M., "Practical Applications of Active Mounts for Structural Vibration Reduction," University of Maryland at Baltimore County, April 1996.

66. Ahmadian, M., "A Substructural Active Control Technique for High-Order Systems," Department of Mechanical Engineering, Virginia Tech, May 1994.
67. Ahmadian, M., "Design and Performance Analysis of Electromechanical Active Mounts for Structural Vibration," Purdue University, West Lafayette, IN, April 1993.
68. Ahmadian, M., "How to Get Rid of Those Annoying Noises and Vibrations," University of Michigan, Flint, MI, March 1993.
69. Ahmadian, M., "Dynamic and Control Analysis of a Tractor Semitrailer System with Semi-active Primary Suspensions," Department of Aeronautical and Astronautical Engineering, University of Illinois, Urbana, IL, May 1989.
70. Ahmadian, M., "Dynamic and Control Analysis of a Tractor Semitrailer System with Semi-active Primary Suspensions," Department of Mechanical and Aerospace Engineering, State University of New York at Buffalo, Buffalo, NY, April 1989.
71. Ahmadian, M., "Control of Robots: Fondest Hopes, Wildest Dreams," Society of Manufacturing Engineering – Robotics International, Charlotte, NC, February 1986.

(Last Revised: March 2025)

## **EXHIBIT 2**

### MATERIALS CONSIDERED

In developing my opinions in this matter, I reviewed and/or relied upon the documents cited or discussed in my Declaration and any exhibits or attachments thereto, as well as the following documents:

- Legal filings and pleadings generated in this matter, including the public docket, as well as the following claim construction related documents:

Railware's Proposed Claim Terms for Construction, dated February 10, 2025

SEPTA's Identification of Claim Terms for Construction, dated February 10, 2025

Railware's Claim Constructions, Supporting Evidence, and Identification of Claim Construction Experts, dated February 24, 2025

SEPTA's Identification of Proposed Constructions of Claim Terms, dated February 24, 2025

- Discovery responses generated in this matter, including:

SEPTA's Responses and Objections to Plaintiff's First Set of Interrogatories to SEPTA (Nos. 1-7), dated September 12, 2024

SEPTA's First Supplemental Responses and Objections to Plaintiff's First Set of Interrogatories to SEPTA (Supplementing Nos. 1-4, 7), dated October 23, 2024

SEPTA's Responses and Objections to Plaintiff's Second Set of Interrogatories to SEPTA (Nos. 8-9), dated December 2, 2024

SEPTA's First Supplemental Responses and Objections to Plaintiff's Second Set of Interrogatories to SEPTA Nos. 8-9, dated January 27, 2025 and exhibits thereto

Railware's Preliminary Infringement Contentions, dated December 16, 2024, and exhibits thereto

SEPTA's Invalidity Charts 1-37

SEPTA's Supplemental Preliminary Invalidity Contentions "Cover Pleading," dated February 27, 2025

- U.S. Patent Nos. 9,517,782 (the "'782 patent"), RE47,835 (the "'835 patent"), RE49,115 (the "'115 patent"), also referred to in my Declaration as the Asserted Patents, and the associated file histories of each
- U.S. Patent No. 9,403,545 (the "'545 patent") and the associated file history

- Legal filings and pleadings generated in the *Railware v. National Railroad Passenger Corporation d/b/a Amtrak*, No. 1:22-cv-5013 (SDNY) case
- Legal filings and pleadings generated in IPR2023-01179, IPR2023-01180, and IPR2023-01181
- Dictionary sources, including the following:

Collins English Dictionary, 9th Ed. (2007)

Concise Oxford English Dictionary, 11th Ed., Revised (2009)

Merriam-Webster's Collegiate Dictionary, 11th Ed. (2012)

IBM Dictionary of Computing, 9th Ed. (1993)

Railway Age's Comprehensive Railroad Dictionary, 2nd Ed. (2002)

- Other publicly available sources, including the following:

[https://www.thedp.com/article/2010/10/reporters\\_notebook\\_taking\\_a\\_look\\_at\\_septa\\_control](https://www.thedp.com/article/2010/10/reporters_notebook_taking_a_look_at_septa_control)

<https://x.com/SEPTAPHILLY/status/1250759355416432640/photo/1>

NORAC Operating Rules, 6th ed., 6 (Jan. 1, 1997)

Federal Railroad Administration, Railroad Workplace Safety; Roadway Worker Protection Miscellaneous Revisions (RRR) at 75-76 (May 26, 2016)

- Documents produced in this matter, including the following bates numbers:

SEPTA\_0004280  
SEPTA\_0004487  
SEPTA\_0245223  
SEPTA\_0245319  
SEPTA\_0245343  
SEPTA\_0245373

RAILWARE\_(SEPTA)\_0006651  
RAILWARE\_(SEPTA)\_0034111  
RAILWARE\_(SEPTA)\_0034125