

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC,
Petitioner,

v.

MAKOR ISSUES & RIGHTS LTD.,
Patent Owner.

Case IPR2017-00817
Patent No. 6,480,783 B1

Before HYUN J. JUNG, BEVERLY M. BUNTING, and
ROBERT L. KINDER, *Administrative Patent Judges*.

KINDER, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a); 37 C.F.R. § 42.73

Google, LLC¹ (“Petitioner”) filed a Petition pursuant to 35 U.S.C. §§ 311–319 to institute an *inter partes* review of claims 20, 22, and 23 of U.S. Patent No. 6,480,783 B1 (“the ’783 patent”). Paper 2. Makor Issues & Rights Ltd. (“Patent Owner”) filed a Preliminary Response. Paper 6. Applying the standard set forth in 35 U.S.C. § 314(a), we instituted an *inter partes* review of all challenged claims. (Paper 7, “Dec.”).

During the trial, Patent Owner filed a Patent Owner Response (Paper 11, “PO Resp.”), and Petitioner filed a Reply to the Patent Owner Response (Paper 16, “Pet. Reply”). An oral hearing was held on May 3, 2018, and a copy of the transcript has been made part of the record. Paper 21 (“Tr.”).²

We have jurisdiction under 35 U.S.C. § 6. This Decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of the claims for which we instituted trial. Based on the final trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that claims 20, 22, and 23 of the ’783 patent are unpatentable.

I. BACKGROUND

A. *Real Party in Interest*

Petitioner names itself and Waze Inc. as the real parties-in-interest. Pet. 2.

¹ Petitioner submitted an updated mandatory notice indicating that “Google Inc. converted from a corporation to a limited liability company and changed its name to Google LLC on September 30, 2017.” Paper 9.

² Both parties requested to present arguments collectively for IPR2017-00815–818. See Papers 18, 19.

B. The '783 patent (Ex. 1001)

The '783 patent is titled “Real Time Vehicle Guidance and Forecasting System Under Traffic Jam Conditions.” Ex. 1001, (54). The '783 patent issued on November 12, 2002, from U.S. Patent Application No. 09/528,134 filed on March 17, 2000. *Id.* at (45), (21), (22).

The '783 patent generally relates to “[a] system and method for real time vehicle guidance by [a] Central Traffic Unit [(CTU)].” *Id.* at Abst. (57). The Specification describes a vehicle guidance system, which includes vehicles equipped with Individual Mobile Units (IMUs) including Global Positioning System (GPS) units for determining their present position. *Id.* The IMUs are linked communicatively to the CTU computer server. *Id.* The system uses a group of Sample Mobile Units (SMUs) equipped with RF transmitters that communicate their position to the CTU at predetermined time intervals. *Id.* The CTU uses the reported positions of the sample vehicles to create and maintain a network of real time traffic load disposition information for various geographical areas. *Id.* The IMUs may use the real time traffic load disposition information to determine an optimal travel route. *Id.* As explained in the '783 patent, “[t]he CTU broadcasts the updated traffic data collected from a number of sample vehicles via Multicast Broadcasting System thereby enabling the IMUs to dynamically update the desired optimal travel routes.” Ex. 1001, 1:10–14.

The Specification of the '783 patent also describes the ability to detect a bottleneck or traffic jam situation when it arises and to estimate a current travel time for a corresponding section of road. *Id.* at Abst. (57). The '783 patent describes three methods for determining travel time over a road segment: (i) theoretical travel times, (ii) regular empirical travel times, and

(iii) current travel times. Ex. 1001, 11:46–12:38. Theoretical travel times are based on a calculation of road or section length and maximum speed allowed on the section. *Id.* at 11:46–58. Theoretical travel times are replaced by regular empirical travel times after the CTU monitors all SMU vehicles and records their travel times along sections of roads. *Id.* at 11:59–62. These regular travel times are averaged and transformed into empirical speed coefficients and stored in a central database associated with a number of categories such as type of road, day of the week, or month. *Id.* at 11:62–66. After sufficient data has been accumulated to estimate accurately regular empirical travel times along a section, the CTU will provide those regular empirical travel times rather than theoretical travel times. *Id.* at 12:5–10.

Current travel times are times obtained from a number of vehicles that have recently traveled along a section of road. Ex. 1001, 12:11–22. The travel times are monitored in real time and the corresponding data for these times are stored in special data structures. *Id.* The data structures for the current travel times contain Exit Lists (EXLs), which are multicasted at short time intervals from the CTU to end-user databases and made available for use by route-finding routines. *Id.* at 12:12–22. A goal of the current travel time monitoring and use “is to detect bottleneck situations, and to modify estimated Current Travel Time (CTT) accordingly.” *Id.* at 12:29–31. The ’783 patent describes “[t]he criterion for using CTT rather than Regular Travel Times (RTT) for various sections is that EXL contains recent enough data.” *Id.* at 12:31–33.

C. Illustrative Claim

Petitioner challenges claims 20, 22, and 23. Each of these claims is dependent from independent claim 12.³ Claims 12 and 20, reproduced below, are illustrative of the claims at issue:

12. Method of operating a central traffic guidance unit comprising method of calculating an optimal fastest short and long range composite travel route for a predetermined extended time period corresponding to client's position or requested starting and destination points;

collecting GPS data at predetermined time intervals from sample vehicles moving within a predefined geographical region;

providing a map database containing digital road maps of a predefined geographical region together with predetermined relevant data on road factors;

processing in real time said GPS data and transforming them into appropriately structured data suitable for being stored on using a computer system operatively connected to a communications system;

storing and updating statistical data on traffic loads on individual roads;

subdividing said statistical data into subdivisions according to time factors;

collecting GPS data and computing individual statistical travel time estimates (regular times) for predetermined roads, and storing the results according to said subdivisions;

³ On February 12, 2018, we issued a final written decision in IPR2016-01535 determining that Petitioner has demonstrated by a preponderance of the evidence that claims 12–14 and 18 of the '783 patent are unpatentable under 35 U.S.C. § 103 based on Xu and Peterson. IPR2016-01535, Paper 32, 47. Patent Owner elected not to appeal this determination. See Tr. 47:22–49:3.

periodical updating of the said statistical data using statistical criteria for determining volumes of data necessary for obtaining valid and reliable estimates;

computing real time traffic jam identification at various locations of the individual roads by utilizing the sample vehicles for measuring time delays; and

transmitting real time traffic load data updates.

Id. at 22:50–23:14.

20. The method in claim 12 further comprising continuous tracking sample data lists for each corresponding road section by maintaining current status Entry List classified by current IDs and entry times of all sample vehicles, past and current duration of travel on the given section, wherein Exit times of all sample (reporting) vehicles which left that road section within a given time interval are registered in Exit Lists containing also the vehicles IDs and past travel history interval with all appropriate travel times for statistical prediction computations.

Id. at 24:8–17.

D. Related Proceedings

The parties state that the '783 patent is asserted in *Makor Issues & Rights Ltd. v. Google Inc.*, Case No. 1:16-cv-00100 (D. Del.). Pet. 2–3; Paper 4, 1. Including the instant proceeding, Petitioner has filed the following related petitions:

1. IPR2016-01535 (U.S. Patent No. 6,480,783 B1);
2. IPR2016-01536 (U.S. Patent No. 6,615,130 B1);
3. IPR2016-01537 (U.S. Patent No. 6,615,130 B1);
4. IPR2017-00815 (U.S. Patent No. 6,480,783 B1);
5. IPR2017-00816 (U.S. Patent No. 6,480,783 B1);
6. IPR2017-00817 (U.S. Patent No. 6,480,783 B1);
7. IPR2017-00818 (U.S. Patent No. 6,615,130 B1).

E. Evidence Relied Upon

Petitioner relies on the following references:

U.S. Patent No. 6,401,027 B1, filed May 24, 1999, issued June 4, 2002 (Ex. 1006, “Xu”);

U.S. Patent No. 5,845,227, filed Feb. 9, 1996, issued Dec. 1, 1998 (Ex. 1007, “Peterson”);

TravTek System Architecture Evaluation, July 1995 (Ex. 1004, “TravTek”);

Danko A. Roozemon, *Forecasting Travel Times Based on Actuated and Historic Data* (1997) (Ex. 1005, “Roozemon”);

Brian L. Smith and Michael J. Demetsky, Short-Term Traffic Flow Prediction: Neural Network Approach, *Transportation Research Record*, 1994 (Ex. 1019, “Smith”); and,

A.T. Vemuri and M. M. Polycarpou, *Short-Term Forecasting of Traffic Delays in Highway Construction Zones Using On-Line Approximators*, *Mathematical and Computer Modelling* Vol. 27 (1998) (Ex. 1020, “Vemuri”).

Petitioner relies on the declaration and rebuttal declaration of Michael S. Braasch, Ph.D. (Exs. 1003, 1034). Patent Owner relies on the declaration of Alex A. Kurzhanskiy, Ph.D. (Ex. 2001). The parties rely on other exhibits as discussed below.

F. Instituted Grounds of Unpatentability

We instituted the instant trial based on the following grounds of unpatentability (Dec. 40):

References	Basis	Claim(s) Challenged
TravTek and Roozemon	§ 103(a) ⁴	20
TravTek, Roozemon, and Smith	§ 103(a)	22, 23
Xu, Peterson, and TravTek	§ 103(a)	20
Xu, Peterson, and Vemuri	§ 103(a)	22, 23

G. Claim Construction

The Board interprets claims of an unexpired patent using the broadest reasonable construction in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard). Under the broadest reasonable interpretation standard, and absent any special definitions, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech. Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms or phrases must be set forth with reasonable

⁴ The relevant sections of the Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284 (Sept. 16, 2011), took effect on March 16, 2013. Because the application from which the ’783 patent issued was filed before that date, our citations to Title 35 are to its pre-AIA version.

clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). In the absence of such a definition, limitations are not to be read from the specification into the claims. *See In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993).

Petitioner proposes a construction for one claim term — “GPS data.” Pet. 8–9. In Reply, Petitioner provides a proposed claim interpretation of “traffic jam.” Pet. Reply 1–9. In turn, Patent Owner proposes a construction of the claim limitation “traffic jam.” PO Resp. 4–9. Having considered the evidence presented, we determine that only express construction of the terms “GPS data” and “traffic jam” are necessary for purposes of this Decision. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy”). We further note that these two terms appear in claim 12, and each has already been construed in IPR2016-01535 – our determinations below are consistent with the interpretations in that proceeding but based on the final trial record of this proceeding. *See* IPR2016-01535, Paper 32, 8–17.

1. “GPS data”

Claim 12 requires the method of operating a central traffic guidance unit, to comprise, in pertinent part, the step of “collecting GPS data at predetermined time intervals from sample vehicles moving within a predefined geographical region.” Ex. 1001, 22:55–57.

Petitioner contends that “GPS data” means “data that was determined using signals received from GPS satellites or that is related to use of such signals.” Pet. 9. Petitioner relies on the Specification, which provides examples of GPS data as: “present positions, the position time, their IDs, and

their speed vectors at specific time intervals.” *Id.* (quoting Ex. 1001, 2:67–3:3). Petitioner argues that these examples demonstrate that information may either be generated from a GPS signal, derived from multiple GPS signals over time, or are related to use of such signals. *Id.* at 9.

In our Decision on Institution, we determined that the additional language (“or that is related to use of such signals”) is not reasonable. Dec. 9. Our review of the passage in the ’783 patent cited by Petitioner (Ex. 1001, 2:67–3:3) reveals that it discloses how “SMU vehicles communicate to CTU their GPS data” and not as Petitioner suggests how the GPS data is determined. Dec. 9. Thus, we determined that the additional clause Petitioner proposes extends the meaning of GPS data to capture data or information in a manner unrelated to the ’783 patent. *Id.* Neither party has challenged our initial determination.

Based on the final trial record, and for the reasons set forth in the Decision on Institution, as well as in the Final Decision in IPR2017-01535, we construe “GPS data” to mean *data that was determined using signals received from GPS satellites*. See Dec. 9. See also IPR2016-01535, Paper 32, 9 (construing “GPS data” in claim 12).

2. “Traffic jam”

Claim 12 requires “computing real time traffic jam identification at various locations of the individual roads by utilizing the sample vehicles for measuring time delays.” Ex. 1001, 23:11–13.

Patent Owner’s Contentions

Patent Owner contends that

“traffic jam” means an abnormal slowdown or bottleneck – one that is worse than a statistically computed, regular travel time on a section of a route. . . . A typical or routine slowdown, *e.g.*, the

typical daily congestion during rush hour, does not qualify as a “traffic jam” within the ambit of the ’783 Patent claims.

PO Resp. 4. Patent Owner asserts that its proposed construction distinguishes “traffic jam” and “routine congestion” based on the language of claim 12 as well as the Specification. *Id.* at 4–5. Specifically, Patent Owner argues that “[a] person of ordinary skill in the art would understand that ‘statistical travel time estimates (regular times) for predetermined roads’ would necessarily include regularly-occurring congestion.” *Id.* at 5. Patent Owner supports its position by first noting that “claim 12 further goes on to recite the computation of ‘traffic jams,’ by using ‘sample vehicles to measure time delays,’ which a person of ordinary skill in the art would understand must therefore be distinct from regular, statistical, congestion.” *Id.* (citing Ex. 2001 ¶ 7).

Patent Owner also directs us to column 12 of the ’783 patent that distinguishes between the use of “Current Travel Times” and “Regular Travel Times” – the former being used when an unpredictable change in traffic conditions is detected, but the latter being typically used for route guidance using empirical statistical travel times. *Id.* at 5–6. Patent Owner notes that in the absence of a bottleneck, the “Regular Travel Times” will be used for route guidance. *Id.* (citing Ex. 1001, 12:31–38, 16:43–45). Patent Owner argues that “[i]t is during atypical slowdowns that ‘current travel times, which reflect sudden and unpredictable changes in traffic conditions,’ are used instead of Regular Travel Times.” *Id.* at 6. Patent Owner points to two such examples, when (1) there is a sufficient number of vehicles reporting a bottleneck in a sufficiently recent time period, and (2) when vehicles have spent considerably more time in a section than a

corresponding Regular Travel Time. *Id.* at 5–6 (citing Ex. 1001, 12:35–38). Patent Owner concludes that “[t]he ‘traffic jam’ determination that is disclosed and claimed in the ’783 Patent is a determination of an *abnormal* slowdown.” *Id.* at 6 (citing Ex. 2001 ¶¶ 8–9). Based on its understanding, Patent Owner thus defines “traffic jam” as an “unpredictable (irregular or abnormal) slowdown of all traffic on a segment during a time frame, relative to the regular, statistically established travel time for that segment during that time frame.” *Id.* at 7 (citing Ex. 2001 ¶¶ 10–11).

Petitioner’s Contentions

Petitioner did not propose a construction for the term “traffic jam” in its Petition, but addresses Patent Owner’s position in its Reply. *See* Pet. Reply 1–9. Petitioner contends that we should adopt the “plain and ordinary” meaning of “traffic jam,” and that Patent Owner has proposed an “improperly narrow construction” of traffic jam. *Id.* at 1. Petitioner argues that Patent Owner’s proposed construction is also not supported by the Specification, not supported by extrinsic evidence, and it is inconsistent with Patent Owner’s own expert testimony. *Id.* at 1–7.

Petitioner first contends that Patent Owner’s construction is improper “because it is narrower than Makor’s assertions during litigation.” *Id.* at 2. Petitioner next argues that the Specification does not provide a lexicographer definition for “traffic jam,” and further does not articulate the outermost boundaries for “traffic jam.” *Id.* at 2–3. Petitioner contends that the Specification’s discussion of “Current Travel Times” and “bottlenecks” cannot be used to import limitations into the claim term “traffic jam” because the claim language does not refer to the former two terms. *Id.* Also, Petitioner argues that, although “traffic jam” and “bottleneck” may be

overlapping, they are not otherwise coextensive because the “patent uses ‘traffic jam’ and ‘bottleneck’ side-by-side in the same sentence.” *Id.* at 3–4 (citing Ex. 1001, Abst. (“information on current traffic jams and slow-down bottleneck situations”)). Thus, according to Petitioner, “[e]ven if it was legally proper to construe ‘traffic jam’ and ‘bottleneck’ as coextensive (which it is not), the narrow constructions still could only be proper if the outermost limits of ‘bottleneck’ were narrowly limited as it is sometimes used in the preferred embodiment.” *Id.* at 4. Even still, Petitioner notes that the term “bottleneck” would also have to be construed according to its ordinary meaning, which Petitioner maintains is far broader than the narrow constructions. *Id.*

Petitioner also argues that the claim language does not impart a special meaning to “traffic jam” because the claim “simply recites ‘computing individual statistical travel time estimates,’ a computation which is necessary regardless which construction is applied.” *Id.* at 6 (citing Ex. 1034 ¶ 10). Next, Petitioner argues “the claimed ‘real time traffic jam identification’ makes no reference to using the ‘statistical travel time estimates.’” *Id.* (quoting Ex. 1001, 12:26–35). Thus, according to Petitioner, “the claim is necessarily broader than solely contemplating a comparison of real time traffic to statistical travel times to identify traffic jams.” *Id.*

Finally, Petitioner relies on dictionary definitions of “traffic jam” to argue the ordinary meaning encompasses “congestion, and resultant stoppage, of traffic, e.g. at a busy junction,” (Ex. 1031, 4) “a number of vehicles so obstructed that they can scarcely move,” (Ex. 1032, 3), and “a long line of vehicles on a road that cannot move, or that can only move very

slowly,” (Ex. 1033, 3). Pet. Reply 6–7. Petitioner points out that Patent Owner’s expert similarly agreed that, in ordinary contexts, “traffic jam” would encompass “historical congestion or realtime congestion that also had a historical analog.” *Id.* at 7 (citing Ex. 1029 and Ex. 1030, 19:16–20:17). Apart from arguing “the term must be given its ordinary meaning,” (Pet. Reply 5) and providing various dictionary definitions set forth above, Petitioner does not explicitly provide any definition for “traffic jam” or explain what the ordinary meaning should be within the bounds of the Specification. *See generally* Pet. Reply.

In construing the claims, our analysis begins with, and remains centered on, the language of the claims themselves. *See Interactive Gift Express, Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1331 (Fed. Cir. 2001). “[C]laims are not to be read in a vacuum, and limitations therein are to be interpreted in light of the specification in giving them their ‘broadest reasonable interpretation.’” *In re Marosi*, 710 F.2d 799, 802 (Fed. Cir. 1983) (quoting *In re Okuzawa*, 537 F.2d 545, 548 (CCPA 1976)). “[T]he broadest *reasonable* interpretation must be reasonable in light of the claims and specification.” *PPC Broadband, Inc. v. Corning Optical Commc’ns RF, LLC*, 815 F.3d 747, 755 (Fed. Cir. 2016). The broadest reasonable interpretation does not mean the broadest possible interpretation, our construction “cannot be divorced from the specification and the record evidence.” *In re NTP, Inc.*, 654 F.3d 1279, 1288 (Fed. Cir. 2011).

The disagreement between the parties as to the scope of “traffic jam” is focused on whether the term should be construed in a broader lay sense as proposed by Petitioner (Pet. Reply 5–7) or whether the term should be construed in accordance with the more specific descriptions found in the

Specification as proposed by Patent Owner (PO Resp. 4–9). As addressed in more detail below, we decline to adopt Patent Owner’s proposed claim construction in whole because it adds unnecessary ambiguity. For example, “irregular or abnormal” do not add clarity to the definition. PO Resp. 7. If a feature is not necessary to give meaning to what the inventor means by a claim term, it would be “extraneous” and should not be read into the claim. *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The Specification, however, does convey that the term “traffic jam” is not used in a layman’s sense, but instead used as a description of a situation arising from a data comparison meeting certain criteria as discussed below.

We first examine the claim as a whole with a focus on the disputed language. The claim language itself requires “computing *real time* traffic jam identification at various locations of the individual roads *by utilizing the sample vehicles for measuring time delays.*” Ex. 1001, 23:10–12 (emphasis added). By qualifying the claimed traffic jam as being determined in real time, and by also by using “sample vehicles to measure time delays,” a person of ordinary skill in the art would understand that traffic jams are more immediate, e.g., real time, than the regular, statistical congestion described in the ’783 patent. PO Resp. 5 (citing Ex. 2001 ¶ 7) (“[C]laim 12 further goes on to recite the computation of ‘traffic jams,’ by using ‘sample vehicles to measure time delays,’ which a person of ordinary skill in the art would understand must therefore be distinct from regular, statistical, congestion.”). The claim also requires “collecting GPS data” and “computing individual statistical travel time estimates (regular times) for predetermined roads.” Ex. 1001, 23:3–5. Reading the claim as a whole

suggests that a “traffic jam” must be a sudden unpredictable change of traffic on a segment as compared to these regular times. See Ex. 2001 ¶ 7.

The Specification confirms our interpretation. For example, the Specification describes a “real time traffic Guidance System, which is capable of providing [an] optimal route from the present position of a vehicle to a desired target destination when traffic jams may be present.” Ex. 1001, 2:13–21. The Specification also describes “a true real time system” that collects and stores three types of data, including: (1) temporary changes in road conditions, (2) regular predictable changes such as everyday slowdowns in rush hour, and (3) “[s]udden unpredictable changes such [as] traffic accidents, traffic congestion due to sudden and drastic changes in traffic arrangements.” *Id.* at 2:36–48. The Specification describes “Travel Times Data” similarly separated into three categories, including a third category of “[s]udden unpredictable changes such [as] traffic accidents, traffic congestion due to sudden and drastic changes in whether [sic] conditions, etc.” *Id.* at 9:47–10:7. The third category of data is meant to encompass traffic jam situations because the Specification further describes, “[a]s to factors in the third category, it appears that even empirical travel times may be unsuitable for describing *traffic conditions arising from sudden and unexpected circumstances which might drastically influence traffic conditions.*” *Id.* at 10:37–50 (emphasis added). As explained in the Specification, “[t]his last feature provides the present invention with truly real time capabilities.” *Id.* Based on these descriptions, the term “traffic jam” is meant to convey real time traffic conditions arising from sudden and unexpected circumstances that might drastically influence traffic conditions.

Moreover, the Specification describes using GPS data of vehicles to obtain “Regular Empirical Travel Times,” which are described as times correlated to regular predictable changes for a particular segment, such as everyday slowdowns in rush hour. *Id.* at 11:59–12:10. The Specification teaches that data from regular travel times may be stored in a central database and attached to sections of roads according to a number of categories, such as type of road or day of the week. *Id.* at 11:60–12:4, 12:31–33. The regular travel time described in the Specification corresponds to the claim limitation of “collecting GPS data and computing individual statistical travel time estimates (regular times) for predetermined roads, and storing the results.” *Id.* at 23:3–6. This language specifically ties the regular time value to “predetermined roads,” and additional claim limitations require storing the results of the regular times according to subdivisions based on time factors. As discussed below, regular times are used to determine whether a traffic jam situation exists.

The Specification further describes detecting a “bottleneck situation,” which we determine is used synonymously with “traffic jam.” *Id.* at 12:26–38. For example, the Abstract describes updating travel times based on “new information on current traffic jams and slow-down bottlenecks.” *Id.* at Abst. The Specification uses the terms “traffic jam” and “slow-down bottleneck” in the same context to convey situations where sample vehicles have spent considerably more time than “a regular time stored in the database.” Ex. 1001, Abst., 12:36–37 (“considerably more time on S than the corresponding [Regular Travel Times] RTT”). In one embodiment for detecting a bottleneck, or traffic jam, a “Current Travel Time” (CTT) is used and compared to the “Regular Travel Time” (RTT) when a time interval is

“short enough to consider the detected bottleneck to be current” and when each vehicle “has spent considerably more time” on a segment “than the corresponding RTT.” *Id.* at 12:29–38. Such a situation is “interpreted as a bottleneck” or traffic jam. *Id.*

The traffic jam discussion in the Background of the Invention is not particularly probative of how that term should be construed in the context of the ’783 patent. The background explains how another patent (U.S. Patent No. 5,699,056) defines a situation as a jam. *See* Ex. 1001, 1:48–52 (“defines a situation as a jam if the average speed is less than a predetermined value”). The context makes clear that the ’783 patent distinguishes how it determines a traffic jam compared to the ’056 patent. *See id.* at 1:53–2:10 (“solution contains a number of problematic points that require further development” and “[a]verage speeds will in this case give no indication of this dynamic change, the same being true of a dissipating jam”). We do not view the discussion of “a jam” in the Background of the Invention as particularly helpful in determining the scope of the claim term “traffic jam” because that description also dissuades using average speeds that are “incapable of catching a trend.” *Id.* at 2:7.

Thus, the Specification consistently equates a traffic jam to situations where sudden and unpredictable changes in traffic conditions result in considerably more time spent on a segment, as compared to regular times. *See id.* at Abst., 2:43–45, 10:5–7, 10:37–43, 12:36–37. Based on the Specification discussed above, and reading claim 12 as a whole, we determine that “traffic jam identification” based on measured time delays of sample vehicles requires a baseline “regular time” for comparison to determine whether or not a traffic jam condition exists. Based on the final

trial record, we construe “traffic jam,” broadly, but reasonably, as *a sudden unpredictable change of traffic in a segment as compared to regular times, i.e., individual statistical travel time estimates.*

II. ANALYSIS

Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must establish the facts supporting its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

A. Principles of Law

A claim is unpatentable under § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966). We analyze the following grounds based on obviousness in accordance with the above-stated principles.

B. Level of Ordinary Skill in the Art

In determining the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (citation omitted). In that regard, Petitioner’s expert, Dr. Braasch, testifies that:

a POSITA would have had a combination of experience and education in electrical engineering and navigation systems. This typically would consist of a minimum of a bachelor degree in electrical engineering or a related engineering field plus 2-5 years of work and/or research experience in the field of electrical engineering and its subfield of navigation systems.

Ex. 1003 ¶ 20. Patent Owner does not contest this level of skill for the person of ordinary skill in the art.

Based on the final trial record before us, we adopt generally Dr. Braasch’s assessment of a person of ordinary skill in the art. Namely, that the person of ordinary skill in the art would have (1) a bachelor of science in electrical engineering or a related engineering field, and (2) 2–5 years of experience in the field of navigation systems.

C. Obviousness Grounds Based on TravTek

We instituted review on the basis that claim 20 would have been unpatentable as obvious over TravTek and Roozemonnd under 35 U.S.C. § 103(a). Dec. 22. We also instituted review of dependent claims 22 and 23 on the basis that these claims would have been unpatentable as obvious over TravTek, Roozemonnd, and Smith under 35 U.S.C. § 103(a). Based on the

final trial record before us, we are not persuaded that Petitioner has established by a preponderance of the evidence that claim 20 is unpatentable over TravTek and Roozemonnd or that claims 22 and 23 are unpatentable over TravTek, Roozemonnd, and Smith for the reasons explained below. *Id.* at 27.

1. TravTek (Ex. 1004)

TravTek has a date stamp indicating publication in July 1995. Pet. 4; Ex. 1004, 2. Petitioner also provides the Declaration of Lisa Rowlison de Ortiz (Ex. 1018), the Head of Catalog and Metadata Services at University of California-Berkeley Library, as evidence that TravTek was publicly available on January 2, 1997, or earlier. Pet. 4–5.

TravTek describes a system providing motorists in Orlando, Florida with traffic information and route selection. Ex. 1004, 8, 20, 31.⁵ The “Foreword” of TravTek describes “an advanced driver information and traffic management system that provided a combination of traveler information services and route navigation and guidance support to the driver.” *Id.* at 4. “One of the primary objectives of the TravTek system was to provide drivers with routes that minimized their individual travel times to their destinations.” *Id.* at 38. TravTek states that “[l]ink travel time data were received automatically from the probe vehicles, freeway management system, and arterial control management system.” *Id.* at 5 (Form DOT F 1700.7). TravTek explains that “the time required for the TravTek vehicle

⁵ For articles cited by Petitioner, we rely on Petitioner’s inserted page numbering set forth at the bottom right of each page. See 37 C.F.R. § 42.63(d)(2).

to travel a link was determined by monitoring the time it crossed the beginning and end of the link.” *Id.* at 88.

“Using information provided by the TMC, software in the vehicle continuously determined the optimum route that minimized the travel time to a destination.” *Id.* at 38. TravTek further discloses that “the double ended search process continued to search for a minimum travel time path . . . until a connected path was formed between the origin and the destination.” *Id.* at 79. In a similar manner, TravTek describes rerouting drivers around areas of congestion and incidents. *Id.* Vehicles in the network would receive once a minute updates of the travel times on links in the TravTek network, and additionally “the vehicle continuously searched for routes that provided a significant time savings to the driver.” *Id.*

2. *Smith (Ex. 1019)*

Smith discloses that “a relatively new mathematical model, the neural network, offers an attractive alternative because neural networks can model undefined, complex, nonlinear surfaces.” Ex. 1019, 1. Smith notes that although historical traffic volume models perform adequately, “[t]he backpropagation model was clearly superior” because it was more responsive to dynamic conditions.” *Id.* Smith refers to “intelligent vehicle highway systems (IVHS)” and explains how it is “imperative” in such systems to predict traffic rather than simply monitoring it:

It is imperative that surveillance data be used to manage the system in a proactive rather than a reactive manner. Proactive traffic management will require the ability to predict traffic conditions. Previous predictive modeling approaches can be grouped into three categories: (a) historical, data-based algorithms; (b) time-series models; and (c) simulations.

Id.

Smith explains that traffic predictions can also be used for “route guidance.” *Id.* (“the rationale behind using predictive information (for route guidance) is that travelers’ decisions are affected by future traffic conditions expected to be in effect when they reach downstream sections of the network.”). Smith describes several ways to predictively model traffic conditions, such as by using both historical and current traffic data to predict traffic. *Id.* at 1–2. Smith also discusses the use of “time-series” analysis techniques to predict traffic such as through use of measurements that can be stored for use in predicting the system’s condition at a time plus a given prediction interval. *Id.* at 2. As part of its description of time-series modeling, Smith describes a time-series technique known as the “autoregressive integrated moving average (ARIMA) method.” *Id.* Smith describes the drawbacks of ARIMA models in traffic applications, but Smith also notes “ARIMA models require very little computational time for execution, which makes them useful for applications in real-time traffic management.” *Id.*

3. *Roozemon*d (Ex. 1005)

Petitioner alleges *Roozemon*d contains a copyright notice indicating it first published in 1997 (Ex. 1005, 1) and “[t]he WorldCat and University of California-Berkeley Library listings for *Roozemon*d confirm the publication date of 1997.” Pet. 5 (citing Exs. 1012 (WorldCat website listing for *Roozemon*d) and 1013 (OskiCat UCB Library Catalog listing for *Roozemon*d)).

*Roozemon*d describes a model of forecasting the travel times of links for dynamic route planning systems. Ex. 1005, 1. *Roozemon*d describes that in order “to forecast properly we use both historic data and current data

from monitoring devices as input for our dynamic model.” *Id.* Roozemonnd describes “combining the best of both worlds” by forecasting “travel times in the near future based largely on current data as well as [forecasting] travel times for some time ahead based on current and historic data.” *Id.*

Roozemonnd further describes using different data as input for travel time calculations based on time spans. *Id.* at 7. Roozemonnd describes using historical data for time spans larger than a couple of hours, using actuated data for shorter time-spans such as 15 minutes, and also using a mixed, or fuzzy, decision making process for intermediate cases. *Id.*

Roozemonnd also describes use of a “rolling horizon approach” where a forecast “is subdivided into several stages or projection horizons with a limited time span; in each stage, reliable short-term forecasts and not-as-reliable medium- and long-term forecasts of traffic conditions are available when each user enters that stage.” *Id.* Such an approach enables calculation of a more optimal route, according to Roozemonnd. *Id.*

4. Discussion

As noted above, each of claims 20, 22, and 23 depend from Claim 12. Claim 12 recites “computing real time traffic jam identification at various locations of the individual roads by utilizing the sample vehicles for measuring time delays.” Ex. 1001, 23:10–12 (“traffic jam limitation”). Patent Owner challenges whether the combinations of references, and in particular whether TravTek, teaches the traffic jam limitation of claim 12. In IPR2015-01535, based on a similar record and arguments, we determined that Petitioner failed to establish by a preponderance of the evidence that claim 12 is unpatentable over TravTek and Roozemonnd. We reach the same determination in this proceeding based on the final trial record before us. As

such, and because Petitioner relies on TravTek for teaching the traffic jam limitation in each combination, we are not persuaded that Petitioner has established by a preponderance of the evidence that claim 20 is unpatentable over TravTek and Roozemonnd, or that claims 22 and 23 are unpatentable over TravTek, Roozemonnd, and Smith.

Petitioner examines claim 12 at pages 10–26 of the Petition. According to Petitioner, the TravTek system uses time delays measured by sample vehicles to compute real-time traffic on the roads and the current conditions are used in the routing (and rerouting) calculations. Pet. 25–26 (citing Ex. 1004, 76, 44, 20). Petitioner contends TravTek teaches calculating an optimal route using “current (real-time) traffic information” and TravTek provides output displays in the form of “[c]ongestion level displays and map color displays in the vehicle.” *Id.* at 26 (quoting Ex. 1004, 63, 29).

Patent Owner disputes Petitioner’s analysis because TravTek allegedly fails to teach the traffic jam limitation. PO Resp. 10–12. Patent Owner argues “[t]here is no disclosure in TravTek that compares current road conditions from sample vehicles with a regular travel time in order to determine abnormal congestion, or ‘real time traffic jam[s]’ recited in claim 12.” *Id.* at 10. According to Patent Owner, “TravTek takes current link time from the probe vehicles and continuously computes link time travel ratios,” but “[t]hese ratios are computed by comparing the current link time with a ‘Free flow link time’ in a Dynamic Link Message.” *Id.* The Dynamic Link Message is defined as (Current link time) / (Free flow link time). See Ex. 1004, 63. Both parties agree the “free flow link time” is based on the

speed limit alone. PO Resp. 10–11; *see* IPR2016-01535, Tr. 11:15–18; 13:7–9.

According to Patent Owner and Dr. Kurzhanskiy, TravTek does not teach computing real time traffic jam identification by utilizing sample vehicles for measuring time delays because the comparison of “Current Link Time with Free flow link time, has no concept of what would be normal congestion versus abnormal congestion, that is, a ‘traffic jam’ as that term is understood” in the disputed claims. Ex. 2001 ¶ 14; PO Resp. 10–11. As argued by Patent Owner, “[a] comparison with free flow link time, which is based on the speed limit alone, is indifferent as between statistically normal and abnormal conditions.” PO Resp. 11.

In response to Patent Owner’s arguments, Petitioner presents three theories in its Reply as to how and why TravTek teaches the traffic jam limitation. *See* Pet. Reply 10–12. First, Petitioner contends “TravTek identifies ‘atypical’ traffic . . . because an originally-selected route would have been calculated using statistical travel times and therefore re-routing would occur when the system identifies that actual travel times differ from the statistical travel times.” *Id.* at 11. Second, Petitioner argues that “TravTek providing ‘link travel times when incidents or unusual traffic conditions occurred,’” teaches the traffic jam limitation because “this disclosure references selecting travel times that are ‘unusual’ compared to TravTek’s ‘historical data base’ of travel times.” *Id.* Finally, Petitioner argues that TravTek also discloses a “traffic jam identification” by comparing actual travel times to free flow travel times, because at certain times, the normal speed may equal the theoretical speed on some road segments. Thus, at such times any identification by TravTek’s system that

actual/current travel times are worse than free flow travel times is a differentiation between normal and abnormal congestion. *Id.* at 12.

These theories deviate from the arguments presented in the original Petition as to how TravTek's output displays, in the form of congestion level displays and map color displays in the vehicle, teaches this limitation.

Compare Pet. 34 with Pet. Reply 10–12. Patent Owner did not specifically object to these theories as new arguments, and because these new arguments were arguably necessitated by our interpretation of “traffic jam,” we address them in our analysis below after discussing positions raised during oral hearing. *See* Tr. 28:7–14.

We also note that Petitioner further modified its arguments during oral hearing to create an additional theory as to why TravTek would read upon the traffic jam limitation. *See* Tr. 26:4–28:17, *id.* at 27:25–28:2 (“JUDGE KINDER: Can you show me where you made this argument though in your original petition? MR. BERTA: It is not”). New arguments may not be raised during oral hearing because Patent Owner has no effective opportunity to review these arguments and respond. Accordingly, we do not consider arguments raised for the first time during oral hearing.

Based on the final record, Petitioner has not provided sufficient arguments or credible evidence establishing how TravTek teaches the traffic jam limitation. Specifically, Petitioner has not persuasively shown how TravTek teaches the use of measured time delays of sample vehicles for computing a real time traffic jam. As explained above, we construe the term “traffic jam” to mean “a sudden unpredictable change of traffic in a segment as compared to regular times, i.e., individual statistical travel time estimates,” and thus the claimed “measuring time delays” must also be in

relation to regular times. Claim 12 also requires that traffic jam identification is determined by utilizing the sample vehicles for measuring time delays. Petitioner has not directed us to record evidence sufficient to show that TravTek teaches these limitations.

Petitioner's analysis of TravTek picks and chooses pieces of the reference while ignoring its overall structure and operation. For example, with respect to the traffic jam limitation, the original Petition is void of any discussion of the data fusion process actually used to determine potential congestion in TravTek. *See* Pet. 25–26; Ex. 1004, 57–63. Petitioner instead relied on the data fusion process as teaching a different claim limitation, i.e., the “regular times” claim limitation, which correlates with regular predictable changes in traffic congestion. Pet. 23–24. TravTek explains that “[d]ata fusion was the process by which all incoming traffic information was received and evaluated *to derive an estimate* on a minute by minute basis of the link travel times in the system.” Ex. 1004, 57 (emphasis added). TravTek teaches routing around areas of congestion, but such a function does not inherently teach or suggest the traffic jam limitation because the data fusion process does not make a comparison between vehicle times to determine if an unpredictable change in link time exists, as further explained below. The data fusion process also does not compare current probe vehicle times with historic travel times as argued by Petitioner. *See* Pet. Reply 11–12.

We understand TravTek as disclosing a ratio of (current link time) / (free flow link time) (Ex. 1004, 63) and the data fusion process determines the current link time input to this equation – the data fusion process itself does not compare times. *Id.* at 57–63. TravTek's ratio or formula, however,

does not rely upon *a time delay measurement derived from sample vehicles*. First, the free flow link time is based on a posted speed limit and not regular times obtained from vehicle probe data. *See* Ex. 1004, 58–60, 63. Second, the data obtained from a probe vehicle is one of six data sources that might be used in estimating the current link time. *Id.* Each of the six data sources has “an associated score that determined its priority of consideration,” and the score of the data source begins to decay with time. Ex. 1004, 58. TravTek uses a data fusion process to determine which of these six data sources should be used to estimate the current link time. *Id.* at 58, 59. TravTek describes that “[a]t any point in time, the data source with the maximum score was considered the best estimate and the data from that source was assigned to the link travel time.” *Id.* at 59. The link travel time ratio (current link time) / (free flow link time) is described as “1 of 32” encoded ratios. Ex. 1004, 63–64 (Table 4). As explained in more detail below, even if vehicle probe data is used in the data fusion process, Petitioner’s arguments and evidence fail to demonstrate that the vehicle probe data is used to measure time delays to determine if unusual congestions exists as compared to regular times.

The Petition and Reply lack sufficient analysis of the data fusion process and evidence demonstrating how it would relate to the traffic jam limitation as we have construed it. *See* Pet. 25–26 (citing Ex. 1004, 76, which states a vehicle may function as a probe to determine current travel times “for integration in the current link travel time data base” but providing no additional explanation). Petitioner’s conclusory analysis does not explain how the vehicle probe data would be used in the data fusion process for measuring time delays of vehicles for determining whether a traffic jam

condition exists. Although Petitioner cites to TravTek's mention of congestion level displays that represent the status of each traffic link (Pet. 26), this argument is not persuasive for several reasons, including that these outputs are based on the ratio that may or may not use vehicle probe data. Further, even if vehicle probe data has been used, the level of congestion depicted on the display is not representative of real time delays of sample vehicles compared to regular times. Instead, the displayed congestion represents a ratio of current link time, which is determined through a data fusion process that may or may not use vehicle probe data, compared to the free flow link time, or posted speed limit. Ex. 1004, 63 ("Congestion level displays . . . were determined both by the types of links represented and by the associated ratio."). Further, TravTek teaches that the data fusion process only derives an estimate of the link travel times in the system. Ex. 1004, 57, 126 ("It selected the travel time source believed to provide the 'best' estimate of actual conditions on the link.").

Even if vehicle probe data is used in the ratio above (as an input to the numerator "current link time"), it is not used as the claim requires and Petitioner has not shown how probe data from vehicles is compared to a regular time. See Pet. Reply 11–12; Ex. 1004, 58–63. Whether the vehicle probe data of TravTek is used is dependent on a "fuzzy logic" process involving "quality of data and aging" and not whether any time delay between vehicles may exist, as required. Ex. 1004, 58 ("[f]uzzy logic . . . deals with ambiguities and vagueness in data"), 59 ("A weight and decay time was assigned to each of the six data source[s]. . . . At any point in time the data source with the maximum score was considered the best estimate and the data from that source was assigned the link travel time."), 126.

Based on the final trial record, Petitioner's arguments and evidence do not establish persuasively how TravTek compares vehicle probe data to a regular time in order to determine time delays. For example, "[t]he link travel times were encoded as 1 of 32 ratios," and Petitioner has not established how these ratios can represent time delays between vehicles in order to determine whether an unpredictable change in traffic conditions may exist, i.e., a traffic jam, as compared to regular travel times. Instead, we are more persuaded by Patent Owner's argument and evidence that "[t]here is no disclosure in TravTek that compares current road conditions from sample vehicles with a regular travel time" in order to determine congestion. PO Resp. 10.

Petitioner also cites TravTek's use of "historical data" as a basis for teaching the traffic jam limitation. *See, e.g.*, Pet. Reply 11–12; Tr. 24:21–29:2. We find this position unpersuasive. TravTek notes that historical data is one of the "six different data sources," and "historical travel times were sometimes the only candidates for input to the data fusion process." Ex. 1004, 58, 60. Petitioner does not persuasively show how this historical data would meet the traffic jam limitation. Using historical data as the current link time in the ratio above $((\text{Current link time}) / (\text{Free flow link time}))$ would result in a ratio based on historical time divided by the posted speed limit (free flow link time). TravTek's single link travel time ratio represents one data point, and Petitioner does not explain persuasively how this data point relates to determining a real time traffic jam based on measuring time delays of vehicles – there is no way to determine current real time delay using just historical data and Petitioner directs us to no teaching

in TravTek of a direct comparison of this historic data to current vehicle link probe times.

5. Summary

Petitioner does not rely on Roozemonnd or Smith to rectify this deficiency in TravTek. Considering the final record before us, we conclude that Petitioner has not proven by a preponderance of the evidence that claim 12 is unpatentable as obvious based on the combination of TravTek and Roozemonnd or based on the combination of TravTek, Roozemonnd, and Smith. Claims 20, 22 and 23 depend from claim 12, and likewise include the traffic jam limitation, which we determine is not taught by TravTek. Accordingly, Petitioner has not proven by a preponderance of the evidence that claim 20 is unpatentable as obvious based on the combination of TravTek and Roozemonnd. Petitioner has also not proven that claims 22 and 23 are obvious based on the combination of TravTek, Roozemonnd, and Smith.

D. Obviousness Ground Based on Xu, Peterson, and TravTek

We instituted review on the basis that claim 20 would have been unpatentable as obvious over Xu, Peterson, and TravTek under 35 U.S.C. § 103(a). Dec. 35. Based on the final trial record before us, we are persuaded that Petitioner has established by a preponderance of the evidence that claim 20 is unpatentable as obvious over Xu, Peterson, and TravTek for the reasons explained below.

1. Xu (Ex. 1006)

Xu “relates to traffic data collection and intelligent routing systems for highway vehicles and, in particular, to a system and method for remotely

collecting real-time traffic data and providing traffic forecasts and travel guidance for drivers of vehicles equipped to utilize the system.” Ex. 1006, 1:6–11. The Specification, in particular the Background of the Invention, states that “[t]here are several known methods for collecting traffic data.” *Id.* at 3:23–24. Xu goes on to describe external vehicle sensing systems used to collect traffic volume and vehicle speed, then Xu states “a method for collecting dynamic traffic data using equipment installed in vehicles is required.” *Id.* at 3:47–48.

Xu describes a traffic data collection system where “[e]ach vehicle **20** is equipped with an in-vehicle device **21** which receives global positioning information data from [GPS] satellites **42**.” *Id.* at 6:31–34. In-vehicle device relays road positions of the vehicle to a traffic service center (TSC). *Id.* at 6:40–45. As depicted in Xu Figure 1 below, “[t]he [TSC] **60** uses the road positions of all vehicles **20** and the information obtained from the external party data sources to provide real-time road traffic conditions for the roadway system **10** and broadcasts the traffic conditions via the communication station **50**.” *Id.* at 6:49–54.

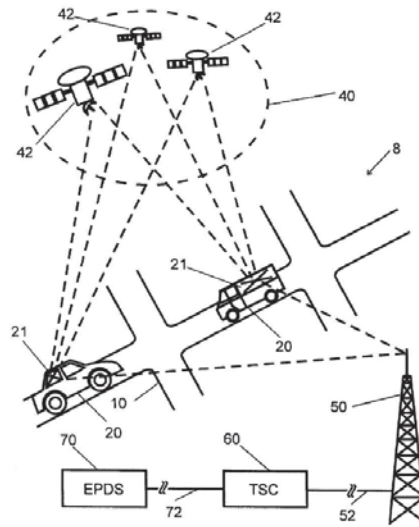


Figure 1

Xu Figure 1 represents a block diagram of the remote traffic data acquisition and intelligent vehicle highway system.

The TSC uses positions of vehicles and information obtained from the external party data sources to provide real-time road traffic conditions to vehicles, which then use the information to provide real-time optimum route planning. *Id.* at 6:50–60. Xu notes that optimal travel routes may be recommended based on either real-time or forecast traffic conditions. *Id.*

Xu also discloses providing route planning optimization along multiple links of a route. *Id.* at 5:18–26. Xu further describes how abnormal traffic conditions may affect travel forecasts. *Id.* at 12:66–13:6. Xu states that “[i]f there is congestion on a link which is not normally congested and the congestion is completely due to traffic volume, the [TSC] receives a plurality of traffic data indicating that the link is experiencing an unusual congestion, by comparing the current traffic status with the normal traffic condition.” *Id.* Xu then uses the traffic data related to the unusual congestion to adjust the next traffic forecast. *Id.*

2. *Peterson (Ex. 1007)*

Peterson “provides a method and apparatus for supplying traffic information to users and more particularly to such a method and apparatus for assisting the users in selecting shortest elapsed time routes between various origin and destination combinations.” Ex. 1007, 1:13–17. Peterson enables vehicle tracking and management, ensuring that “routing is up to the minute, dynamic, constantly keeping track of the current traffic and recalculating the user’s route considering all changes.” *Id.* at 1:17–22.

Peterson teaches performing route-calculations at a central computer. *Id.* at 9:64–10:8 (“The central computer calculates the least time route based on giving weight to sensor data in the near horizon and historical in the far horizon.”). Peterson also estimates route travel times using current travel times for the beginning portion of the route and statistical travel times for the remaining portion of the trip. *Id.* Peterson describes that “[g]enerally, the most accurate predictor of elapsed time now is the sensed velocities; two hours from now the probability based most accurate velocity is one hundred percent historical patterns.” *Id.*

3. *Discussion*

Petitioner argues that each of the limitations of claims 12 (the underlying independent claim) and claim 20 are found in the proposed combination of Xu, Peterson, and TravTek. Pet. 43–68. Notably, in IPR2017-01535, Paper 32, 47, we determined that Petitioner has demonstrated by a preponderance of the evidence that claim 12 of the ’783 patent is unpatentable under 35 U.S.C. § 103 based on Xu and Peterson. Below, we first address the uncontested limitations. Next, we examine the

contested limitations as well as Petitioner's uncontested rationale for combining the references.

To support its arguments, Petitioner identifies the relevant passages in the cited references that purportedly meet the corresponding claim limitation, and explains the significance of each passage with respect to the corresponding claim limitation. *See* Pet. 46–63. Petitioner also provides an articulated reasoning with rational underpinning to support its conclusion of obviousness. *Id.* We have reviewed the information provided by the parties and are persuaded, based on the final record, that Petitioner has proven by a preponderance of the evidence that claim 20 would have been obviousness based on the combination of Xu, Peterson, and TravTek.

a. Uncontested Limitations

We previously instructed Patent Owner that “any arguments for patentability not raised in the [Patent Owner Response] will be deemed waived.” Paper 8, 7; *see also* 37 C.F.R. § 42.23(a) (“Any material fact not specifically denied may be considered admitted.”); *In re NuVasive, Inc.*, 842 F.3d 1376, 1379–82 (Fed. Cir. 2016) (holding patent owner waived an argument addressed in the preliminary response by not raising the same argument in the patent owner response). Additionally, the Board's Patent Trial Practice Guide states that the Patent Owner Response “should identify all the involved claims that are believed to be patentable and state the basis for that belief.” Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012).

With the complete trial record before us, we note that we have reviewed arguments and evidence advanced by Petitioner to support its unpatentability contentions where Patent Owner chose not to address certain

limitations in its Patent Owner Response. In this regard, the record now contains persuasive arguments and evidence presented by Petitioner, many of which are unrebutted, regarding the manner in which the asserted prior art teaches corresponding limitations of claims 12 and 20 against which that prior art is asserted.

For example, Petitioner relies on Xu's disclosure of a system with a centralized computer system that uses vehicle positions to determine real-time traffic conditions and provides those positions to vehicles, which then use the received information to plan routes. Pet. 46 (citing Ex. 1006, 1:6–12, 6:50–60). Petitioner relies on Peterson for its teaching of performing route calculations server-side rather than client-side and estimating route travel times using current travel times for the beginning of the route and statistical travel times for the remaining portion of the route. *Id.* at 47 (citing Ex. 1007, 9:64–10:8). Petitioner identifies the claimed optimal fastest short and long range composite travel route for a predetermined extended time period of claim 12 as being taught by Xu's use of computing a route that comprises multiple links, and Peterson's weighted approach of identifying the sensed velocities as the most accurate predictor of current elapsed time now but using historical patterns in a later time such as two hours from now. *Id.* at 48. According to Petitioner, Xu's disclosure of vehicle position data being reported to the traffic service center at predetermined reporting intervals teaches collecting GPS data at predetermined time intervals from sample vehicles as required by claim 12. *Id.* at 54.

Based on the preponderance of the evidence before us, we conclude that the prior art identified by Petitioner teaches or suggests all uncontested

limitations of claims 12 and 20. The limitations that Patent Owner contests in the Patent Owner Response are addressed below.

b. Contested Limitations

Traffic Jam Limitation

As noted above, Claim 12 requires, in pertinent part, the traffic jam limitation. Ex. 1001, 23:10–12. Petitioner argues that this limitation is satisfied by the disclosure in Xu of a traffic service center that uses the road position of all vehicles to provide real-time road traffic conditions and further that received traffic data is used to identify congestion on a link or road. Pet. 59 (citing Ex. 1006, 12:66–13:6). Petitioner contends that Xu teaches the traffic jam limitation because Xu discloses how congestion on a link can be determined from traffic volume and unusual congestion may be used to adjust the traffic forecast. *Id.* Petitioner also contends that traffic volume, and thus congestion, are determined using the road positions of all vehicles, specifically relying on Xu’s disclosure: “The traffic service center 60 uses the road positions of all vehicles 20 and the information obtained from the external party data sources to provide real-time road traffic conditions.” Ex. 1006, 6:50–5 (referred to as “the Xu sentence”); Pet. 59.

Further, Petitioner’s expert explains that a person of ordinary skill in the art would have understood that Xu’s traffic service center 60 performs the process of comparing the current traffic status with the normal traffic condition, and the data used to adjust the next traffic forecast provides real time traffic jam identification at various locations of the individual roads. Ex. 1003 ¶ 157 (citing Ex. 1006, 12:54–13:6; 6:50–55, 4:11–37, 11:46–60).

Patent Owner argues that “Xu does not disclose or suggest” the traffic jam limitation. PO Resp. 16 (emphasis omitted). Xu, in Patent Owner’s

view, collects position data in real-time, and uses the gathered position data for future forecasting and not identification of traffic jam conditions in real-time. *Id.* at 16–18. Patent Owner asserts that the Xu sentence is the only citation that “can be stretched to suggest that data collected from vehicles may be used for traffic forecasting (if indeed that is what the passage is suggesting at all).” *Id.* at 16–17. The crux of Patent Owner’s argument is that the Xu sentence

fails to disclose *how* it actually would “use[]” the static positions of the vehicle for real-time traffic determination – if indeed the “road positions” are intended to be part of the determination of real-time road traffic conditions at all, rather than merely a statement of the geographic locus to be used for each vehicle’s report.

Id. at 17 (citing Ex. 2001 ¶¶ 26–27, 29) (emphasis added).

Patent Owner also understands the following passage of Xu as teaching that road positions and other sources are utilized in long-term forecasts, and only external data is used for real-time determinations:

An external party interface 64 is provided to connect the external party data sources 70 to receive real-time information about weather or road conditions. The real-time information is processed by an external party data integrator 65 for incorporation into real-time traffic forecasts. The traffic forecasts are computed by a traffic forecaster 68 using the collected vehicle position data for *normal* road conditions.

Id. at 17–18 (quoting Ex. 1006, 8:23–30). Taken together, Patent Owner argues that the Xu sentence and this passage teach that vehicle position is used “only for longer-term / normal / average conditions” and not to calculate immediate congestion. *Id.* at 18 (citing Ex. 2001 ¶ 28). Patent Owner contends that other passages in Xu regarding measurements from

vehicles teach using this data in calculating average travel time for the link, at a specific time and day, and using this average to predict travel time for the link. *Id.* at 18–19 (citing Ex. 1006, 4:56–5:16). Patent Owner further contends that “[c]urrent traffic conditions in Xu are simply not determined based upon data from vehicles.” *Id.* at 20. As to the passage in Xu stating that “the traffic service center receives a plurality of traffic data indicating that the link is experiencing an unusual congestion” (Ex. 1006, 13:2–4), Patent Owner argues that this passage “does not at all tie to the positions of the vehicles determined by GPS (as opposed to the data from ‘third-party sources’). Nothing in Xu in any way indicates that the real-time data so received at the traffic center comes from the vehicles.” PO Resp. 19 (citing Ex. 2001 ¶ 29).

Petitioner, in its Reply, takes the position that Xu discloses the traffic jam limitation under both the plain meaning of the term “traffic jam” and also adopting Patent Owner’s more narrow interpretation. Pet. Reply 19, n.2. Petitioner supports its position with the testimony of Dr. Braasch that “Xu clearly discloses identifying real-time traffic jam conditions under both the proposed narrow constructions and the plain and ordinary meaning of the term ‘traffic jam,’” because “Xu discloses that its system identifies ‘unusual congestion, by comparing the current traffic status with the normal traffic condition.’” Ex. 1034 ¶ 39 (quoting Ex. 1006, 12:66–13:6). We agree with this position and, as such, our analysis below is not dependent on the scope of the term “traffic jam” addressed above – the limitation is taught by Xu in view of our interpretation of “traffic jam,” but also would be taught under either party’s proposed construction.

Petitioner in Reply argues that the Xu sentence clearly establishes that vehicle data based on GPS providing road positions of all vehicles is used “to provide real-time road traffic conditions,” as stated in Xu. Pet. Reply 19 (quoting Ex. 1006, 6:50–55) (emphases omitted). Furthermore, Petitioner contends that Patent Owner’s arguments are inconsistent with the disclosure of Xu. *Id.* In this regard, Petitioner directs us to other passages in Xu that, when taken with the Xu sentence, support its position. Pet. Reply 19–23. For example, Petitioner notes that the abstract of Xu states “[i]n-vehicle devices . . . transmit the time-related vehicle locations to a traffic service center’ and that ‘[t]he traffic service center collects the data from all equipped vehicles . . . [to] process the data and provide a real-time traffic forecasts [sic].’” Pet. Reply 19 (quoting Ex. 1006, Abst.) (emphases omitted).

Petitioner also points to the passage in Xu that teaches how the “communication system ‘forwards road traffic data reported from all vehicles 20 . . . to the traffic service center’ and that this data is used to provide ‘an optimum travel route based on real-time traffic conditions.’” *Id.* at 19–20 (quoting Ex. 1006, 7:37–52; 8:26–36; 12:66–13:6) (emphasis omitted). Petitioner argues that external party data is incorporated into real-time traffic forecasts, not the sole basis for real-time traffic forecasts, and such external data sources are “impractical” for a large-scale traffic forecasting system. *Id.* (quoting Ex. 1006, 8:23–30, 3:43–53, 6:26–31) (emphasis omitted). Petitioner argues that Xu uses vehicle time delay information to “calculate both historic and real-time travel time estimates.” *Id.* at 21 (citing Ex. 1006, Abst. 6:50–60, 7:32–53) (emphasis omitted). We

find Petitioner’s contentions persuasive on the final record before us for the reasons set forth below.

First, the record does not persuade us that Xu only uses information from third party, or other external, sources to identify current traffic conditions. Petitioner’s analysis considers Xu as a whole; however, Patent Owner’s argument narrowly focuses on one example described in Xu, and fails to consider Xu as a whole, from the perspective of an ordinarily skilled artisan. A prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular example it is describing. *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). Furthermore, in an obviousness analysis, we must consider the combination of references, as a whole, in light of the general knowledge of an ordinarily skilled artisan. *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

One stated objective of Xu is to create “a method for collecting dynamic traffic data using equipment installed in vehicles” as opposed to just relying on the prior art “methods for collecting traffic data” such as “sensing systems” that “are installed along highways,” using “[v]ideo cameras” or “pulsed laser range image technology.” Ex. 1006, 3:23–48. Given that a purpose of Xu was to use dynamic traffic data obtained from GPS receivers installed in vehicles, we are persuaded by Petitioner that one of ordinary skill in the art, in considering Xu as a whole, would understand Xu as providing a basis for using that same dynamic traffic data for determination of real time traffic conditions. *Id.*; *see also id.* at 2:63–67, 4:17–22; Ex. 1034 ¶¶ 29–36. For example, Xu explains how current traffic conditions may impact traffic forecasts and “the [TSC] receives a *plurality*

of traffic data indicating that the link is experiencing an unusual congestion, by comparing the current traffic status with the normal traffic condition.”

Ex. 1006, 12:66–13:6 (emphasis added); Ex. 1034 ¶ 33 (“the ‘plurality of traffic data’ is the traffic data previously disclosed in Xu . . . both external party data sources and time delay data collected from probe vehicles”).

Based on the final record, Petitioner presents persuasive arguments and credible evidence to support a finding that the “plurality of traffic data” would include dynamic vehicle position data and that “time delays” are determined by comparing the current traffic status as determined by vehicle position with the normal traffic condition. Ex. 1006, 13:2–5 (“comparing the current traffic status with the normal traffic condition”); Ex. 1003 ¶¶ 157–59; Ex. 1034 ¶¶ 29–36.

For example, we credit the testimony of Dr. Braasch that vehicle position data would be a source of real time traffic conditions indicative of unusual congestion. See Ex. 1034 ¶¶ 29–36; Ex. 1006, 12:66–13:6. We are also persuaded by Petitioner’s argument that Xu’s “communication system ‘forwards road traffic data reported from all vehicles 20 . . . to the traffic service center’ and that this data is used to provide ‘an optimum travel route based on real-time traffic conditions.’” Pet. Reply 19–20 (citing Ex. 1006, 7:37–52; 8:26–36; 12:66–13:6). Also persuasive is the cross-examination testimony of Dr. Kurzhanskiy that “one of the plurality of traffic data that could be being [sic] used to detect unusual congestion is vehicle probe position data.” *Id.* at 20 (quoting Ex. 1030, 82:19–83:7) (also agreeing “that Xu discloses that vehicle position data is a form of traffic data that the system collects”). For these reasons, the record persuades us that Xu teaches the traffic jam limitation.

Data Lists Limitation

Claim 20 requires,

continuous tracking sample data lists for each corresponding road section by maintaining current status Entry List classified by current IDs and entry times of all sample vehicles, past and current duration of travel on the given section, wherein Exit times of all sample (reporting) vehicles which left that road section within a given time interval are registered in Exit Lists containing also the vehicles ID and past travel history interval with all appropriate travel times for statistical prediction computations.

Ex. 1001, 24:8–14 (“the data lists limitation”).

Regarding the Entry List and Exit List limitations of claim 20 (Ex. 1001, 24:8–14), Petitioner contends⁶ that the claimed “entry times” and “exit times” are taught by Xu’s disclosure of “traffic forecaster 68 . . . determines a time at which the vehicle was on the source node of the last link and a time the vehicle was on the sink node of the link.” Pet. 61 (quoting Ex. 1006, 11:47–60); Ex. 1003 ¶ 161. Petitioner contends that Xu discloses that “the travel time . . . for each link are computed from time to time from each vehicle 20 to provide a database for forecasting traffic conditions for the

⁶ Petitioner also argues that the limitations of claim 20 recite “non-functional descriptive material that is not entitled to any patentable weight,” because the recited limitations do not functionally change either the data storage system or the communication system used in the method, and because the recited lists/data do not alter how the process steps are to be performed. Pet. 60 (internal quotations omitted); Ex. 1003 ¶ 160; Tr. 29:21–31:3. For purposes of this Decision, we need not decide whether the limitations of claim 20 are entitled to patentable weight because the prior art teaches the “data structures” as claimed, regardless of patentable weight. See PO Resp. 13 (“The entry list and exist list are data structures used in the algorithm of method 12.”).

roadway system 10.” Pet. 61 (citing Ex. 1006, 11:57–60, 12:9–13:21, 4:57–5:26), Ex. 1003 ¶¶ 161–65. In its Reply, Petitioner responds that “[e]ven if given patentable weight, the lists should be interpreted as conventional ‘data structures,’ and Xu discloses such data structures.” Pet. Reply 23; Tr. 33:11–23 (“Dr. Braasch is the only expert to talk about this issue and he talks about database tables are, in fact, basically what a person of ordinary skill in the art would believe meets the term of a list because it’s in a list form in a database.”).

Petitioner contends that although Xu does not expressly mention storing IDs to identify vehicles, a person of ordinary skill in the art would have been prompt [sic] to implement Xu’s system so that vehicles transmitted their Vehicle ID’s along with their positions (as suggested by TravTek), so that Xu’s server-side computing systems could then correlate positions to specific vehicles, determine a driving route from a vehicle’s current location, and transmit a route to the intended vehicle.

Pet. 63 (citing Ex. 1003 ¶¶ 166–67). Petitioner relies on TravTek’s disclosure “that ‘[a]ll vehicles could report in during a 1 min probe report’ and that the report included a ‘Vehicle ID’ along with vehicle position data.” Pet. 63 (quoting Ex. 1004, 36, 46, 55).

Patent Owner contends that “[t]here is no disclosure or suggestion in Xu, however, for maintaining Entry Lists and Exit Lists, as recited in claim 20.” PO Resp. 22. According to Patent Owner, Xu fails to teach “for each corresponding road section” “maintaining *current* status Entry List classified by *current* IDs and entry times of all sample vehicles . . .” as recited in claim 20. *Id.* at 22. Patent Owner contends “this claimed feature sets forth a running list for each corresponding road section of the sample vehicles thereon.” *Id.* Patent Owner contends that to the extent “it were possible to

restructure the information within the Xu and TravTek references to create the recited entry lists and exit lists, the Petition makes no showing as to why or how such a restructuring would have been obvious to a person having ordinary skill in the art at the time of the invention.” *Id.*

Based on the final trial record before us, Petitioner has established persuasively that Xu in light of Peterson and TravTek maintains a database for forecasting traffic conditions that contains data of “entry times” (time at which the vehicle was on the source node) and “exit times” (the last link and a time the vehicle was on the sink node of the link). *See* Pet. 61; Ex. 1006, 11:50–55. By Patent Owner’s own admission the entry and exist list are simply conventional data structures. *See* PO Resp. 13 (“The entry list and exist list are data structures used in the algorithm of method 12.”). Although the data is claimed as a “list,” it is nonetheless a data structure that does not affect the operation of the claimed method, and the arrangement could be in any conventional data structure output. We find persuasive Dr. Braasch’s testimony that database tables of Xu would be identified by a person of ordinary skill in the art as a list as claimed. Ex. 1034 ¶ 25 (“POSITA would have considered the abstract ‘list’ concepts . . . by conventional computer storage systems storing the data”).

c. Rationale to Combine

Based on the final record, we are also persuaded that Petitioner has articulated an adequate reason supported by rational underpinnings to combine Xu, Peterson, and TravTek, as well as established sufficiently that the combination of Xu, Peterson, and TravTek would render the limitations required by claims 12 and 20 obvious. Pet. 51–53, 63. Patent Owner has

not challenged Petitioner's reasons for combining the references in the manner proposed in the Petition.

Petitioner provides multiple reasons that would have prompted a person of ordinary skill in the art to implement the well-known practice of server-side route computation, as suggested by Peterson, in the navigation system disclosed by the combination of Xu. For example, Petitioner contends that "a POSITA would have been prompted to modify Xu to perform server-side route calculation because doing so would reduce the amount of computing power required at in-vehicle computers." Pet. 51. Petitioner also contends that "POSITA would have recognized that applying Peterson's suggestions to Xu's system would have led to predictable results without significantly altering or hindering the functions performed by Xu's system." *Id.* at 52–53. Petitioner's analysis, along with the supporting testimony of Dr. Braasch, establish that a person of ordinary skill in the art would have had a reasonable expectation of success in combining the three references. *See* Ex. 1003 ¶¶ 132–36, 161, 166, 167.

d. Summary

For the foregoing reasons, we are persuaded by Petitioner's arguments and evidence and find that Xu discloses the traffic jam limitation.⁷

⁷ While each of the findings and determinations set forth above are supported by the final trial record in this proceeding, we also note that the issue of whether Xu teaches the traffic jam limitation was finally decided in IPR2017-01535. Patent Owner has elected not to appeal that decision and Patent Owner is therefore collaterally estopped from challenging our prior determination related to the traffic jam limitation – as admitted by Patent Owner's counsel during oral hearing. *See* Tr. 47:22–49:3; *see also* *MaxLinear, Inc. v. CF CRESPE LLC*, 880 F.3d 1373, 1376 (Fed. Cir. 2018)

Similarly, we are persuaded by Petitioner's arguments and evidence and find that the combination of Xu and TravTek teaches the data lists limitation.

We are also persuaded by Petitioner's contentions and find that the combination of Xu, Peterson, and TravTek, in light of the knowledge of one of ordinary skill in the art, teaches the remaining limitations as recited in claims 12 and 20, and further find that Petitioner has presented valid reasons to modify Xu supported by rational underpinnings. Namely, that applying Peterson's suggestions to Xu's system would have led to predictable results without significantly altering or hindering the functions performed by Xu's system.

Based on the preponderance of the evidence before us, we conclude that the prior art identified by Petitioner teaches all the limitations of claim 20, as well as the claim as a whole.

E. Obviousness Ground Based on Xu, Peterson, and Vemuri

We instituted review on the basis that claims 22 and 23 would have been unpatentable as obvious over Xu, Peterson, and Vemuri under 35 U.S.C. § 103(a). Dec. 35, 39. Based on the final trial record before us, we are persuaded that Petitioner has established by a preponderance of the evidence that claims 22 and 23 are unpatentable as obvious over Xu, Peterson, and Vemuri for the reasons explained below. Xu and Peterson are outlined above. After we provide an overview of Vemuri, we discuss the parties' contentions and evidence.

(citations omitted) ("It is well established that collateral estoppel, also known as issue preclusion, applies in the administrative context.").

1. *Vemuri (Ex. 1020)*

Vemuri is a paper that presents a method for short-term forecasting of traffic delays in highway construction zones using data from presence detectors. Ex. 1020, 1. Vemuri describes traffic systems generating short-term travel-time forecasts using time-series data:

Most of the current algorithms for computing traffic delays . . . address the estimation of current travel time only. This paper presents a method for short-term forecasting of traffic delays in highway construction zones using data from presence detectors. The method is based on . . . estimating the travel time between the two detectors. The travel time estimates are then considered as time-series data, and the problem of short-term forecasting of traffic delay is formulated as a time-series evolution problem.

Id. In Vemuri's system a road is divided into "links," each defined as "the segment of the freeway between two neighboring detector stations." *Id.* at 3. Vemuri discloses that "in order to provide accurate information to motorists, the travel times for subsequent downstream links needs to be predicted ahead in time." *Id.* Vemuri explains that short-term predictions may be obtained by "'extrapolating' the current behavior of the highway system into the short-term future," and that such "[p]rediction of travel time . . . is essentially a time series prediction problem." *Id.* at 5. Vemuri explains that time series prediction models, such as the "simple autoregressive moving average models (ARMA)," were known, and "referred to [the different models] as on-line approximators." *Id.* at 6. Vemuri discusses a prediction method that adopts an on-line approximator relying on "only the previous

travel time data of some link *l* to predict the future travel time in link *l*.” *Id.* at 11.

2. Discussion

Petitioner argues that each of the limitations of claims 22 and 23 are found in the proposed combination of Xu, Peterson, and Vemuri. Pet. 63–70. To support its arguments, Petitioner identifies the relevant passages in the cited references that purportedly meet the corresponding claim limitation, and explains the significance of each passage with respect to the corresponding claim limitation. *Id.* Petitioner also provides an articulated reasoning with rational underpinning to support its conclusion of obviousness. *Id.* We have reviewed the information provided by the parties and are persuaded, based on the final record, that Petitioner has proven by a preponderance of the evidence that claims 22 and 23 would have been obviousness based on the combination of Xu, Peterson, and Vemuri.

a. Uncontested Limitations

With the complete trial record before us, we note that we have reviewed arguments and evidence advanced by Petitioner to support its unpatentability contentions where Patent Owner chose not to address certain limitations in its Patent Owner Response. In this regard, the record now contains persuasive arguments and evidence presented by Petitioner, many of which are unrebutted, regarding the manner in which the asserted prior art teaches corresponding limitations of claims 22 and 23 against which that prior art is asserted. See Pet. 63–70. Based on the preponderance of the evidence before us, we conclude that the prior art identified by Petitioner teaches or suggests all uncontested limitations of claims 22 and 23. The

limitations that Patent Owner contests in the Patent Owner Response are addressed in detail below.

b. Contested Limitations

Traffic Jam Limitation

As noted above, Claims 22 and 23 depend from Claim 12 and Claim 12 requires, in pertinent part, the traffic jam limitation. Ex. 1001, 23:10–12. Patent Owner challenges whether Xu teaches the traffic jam limitation as addressed above. See PO Resp. 16. For the same reasons set forth above, and based on the final trial record before us, we are persuaded by Petitioner’s arguments and evidence and find that Xu teaches the traffic jam limitation as required by claim 12.

Exit List Limitation

Claim 22 and 23 each recite, in pertinent part, “regressing a set of registered travel times of all vehicles on a corresponding exit list based on their registered entry times.” Ex. 1001, 24:30–32, 24:36–38 (“the exit list limitation”). Patent Owner challenges whether the combination of references teaches this limitation. PO Resp. 23.

Petitioner relies on the combination of Xu, Peterson, and Vemuri as teaching this limitation whereas Vemuri discloses regression prediction techniques, such as traffic systems generating short-term travel-time forecasts using time-series data and Xu provides exit lists in the form of a database linked to exit times. Pet. 61 (citing Ex. 1006, 11:47–60), 64. According to Petitioner, “[a] POSITA would have understood Vemuri’s various prediction models (including time series models and neural network models) to disclose regression techniques.” *Id.* at 65 (citing Ex. 1003 ¶¶ 169–70).

Patent Owner largely repeats its arguments addressed above – “nothing in Xu (nor Peterson) discloses or suggests a ‘corresponding exit list,’ or addresses how it would have been obvious to provide one.” PO Resp. 23. According to Patent Owner “[t]here is therefore no disclosure or suggestion in the proposed combination of Xu, Peterson, and Vemuri for ‘regressing a set of registered travel times of all vehicles on a corresponding exit list based on their registered entry times.’” *Id.*

For the same reasons set forth above, and based on the final trial record before us, Petitioner has established persuasively that Xu in light of Peterson and Vemuri maintains a database for forecasting traffic conditions that contains data of “entry times” (time at which the vehicle was on the source node) and “exit times” (the last link and a time the vehicle was on the sink node of the link).” *See* Pet. 61; Ex. 1006, 11:50–55. As noted above, the claimed “entry times” and “exit times” are taught by Xu’s disclosure of “traffic forecaster 68 . . . determines a time at which the vehicle was on the source node of the last link and a time the vehicle was on the sink node of the link.” Pet. 61 (quoting Ex. 1006, 11:47–60); Ex. 1003 ¶ 161. We agree with Petitioner that Xu discloses that “the travel time . . . for each link are computed from time to time from each vehicle 20 to provide a database for forecasting traffic conditions for the roadway system 10.” Pet. 61. Based on the foregoing, we agree with Petitioner that Xu teaches an “exit list” data structure and its use, as taught by Vemuri, in performing the claimed exit list limitation. *See* Pet. 64–70. We do not find persuasive Patent Owner’s unsupported attorney arguments to the contrary. *See* PO Resp. 23.

c. Rationale to Combine

Based on the final record, we are also persuaded that Petitioner has articulated an adequate reason supported by rational underpinnings to combine Xu, Peterson, and Vemuri, as well as established sufficiently that the combination of Xu, Peterson, and Vemuri would render the limitations required by claims 22 and 23 obvious. Pet. 51–53, 64–67. Patent Owner has not challenged Petitioner’s reasons for combining the references in the manner proposed in the Petition.

As noted above, Petitioner also provides multiple reasons that would have prompted a person of ordinary skill in the art to implement the well-known practice of server-side route computation, as suggested by Peterson, in the navigation system disclosed by the combination of Xu. See Pet. 51. We also find persuasive Petitioner’s contention that “[a] POSITA would have been prompted to modify Xu’s system to use its current travel times ‘for short-term forecasting of the future travel times as opposed to estimating the present travel times,’ using any of the traditional prediction models suggested in Vemuri.” *Id.* at 65. For example, Petitioner contends that “modifying Xu in this manner would achieve Vemuri’s known benefits of ‘providing accurate information to motorists’ because ‘the travel times for subsequent downstream links need to be predicted ahead in time.’” *Id.* (quoting Ex. 1020, 2, 3, 11).

d. Summary

For the foregoing reasons, we are persuaded by Petitioner’s arguments and evidence and find that Xu discloses the traffic jam limitation. Similarly, we are persuaded by Petitioner’s arguments and evidence and find that the combination of Xu, Peterson, and Vemuri teach the exit list limitation. We

are also persuaded by Petitioner's contention that the combination of Xu, Peterson, and Vemuri, in light of the knowledge of one of skill in the art, teaches or suggests the remaining limitations as recited in claims 22 and 23, and find that Petitioner has presented valid reasons to modify Xu supported by rational underpinnings.

Based on the preponderance of the evidence before us, we conclude that the prior art identified by Petitioner teaches all the limitations of claims 22 and 23, as well as each claim as a whole.

III. CONCLUSION

Petitioner has not demonstrated by a preponderance of the evidence that claim 20 of the '783 patent is unpatentable under 35 U.S.C. § 103 based on TravTek and Roozmond. Petitioner has also not demonstrated by a preponderance of the evidence that claims 22 and 23 of the '783 patent are unpatentable under 35 U.S.C. § 103 based on TravTek, Roozmond, and Smith.

Petitioner has demonstrated by a preponderance of the evidence that claim 20 of the '783 patent is unpatentable under 35 U.S.C. § 103 based on Xu, Peterson, and TravTek. Petitioner has also demonstrated by a preponderance of the evidence that claims 22 and 23 of the '783 patent are unpatentable under 35 U.S.C. § 103 based on Xu, Peterson, and Vemuri.

IV. ORDER

Accordingly, it is:

ORDERED that claims 20, 22, and 23 of the '783 patent are unpatentable; and

FURTHER ORDERED that because this is a Final Written Decision, parties to the proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

Case IPR2017-00817

Patent 6,480,783 B1

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