

**UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD**

TOYOTA MOTOR CORPORATION,
Petitioner

v.

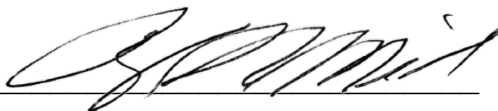
INFOGATION CORPORATION,
Patent Owner.

U.S. PATENT NO. 6,292,743

DECLARATION OF WILLIAM R. MICHALSON, PH.D.

Declaration

I declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

By: 

William R. Michalson, Ph.D.

I, William R. Michalson, do hereby declare:

1. I am making this declaration at the request of Toyota Motor Corporation in the matter of Toyota Motor Corporation's petition for inter partes review of U.S. Patent No. 6,292,743 (the '743 patent).

2. I am being compensated for my work in this matter at my standard hourly rate of \$525 for consulting services. My compensation in no way depends on the outcome of this proceeding or the content of my testimony.

3. In preparing this Declaration, I considered the following materials:

Exhibit	Description
1001	U.S. Patent No. 6,292,743 to Pu
1002	Prosecution File History of U.S. Patent No. 6,292,743
1003	Declaration of William Michalson, Ph.D.
1004	International Publication No. WO 96/00373 ("Behr")
1005	National Intelligent Transportation Systems (ITS) Architecture: Standards Requirements Package 03 (Information Service Provider Wireless Interfaces) (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214063822/http://www.itsa.org/public/archdocs/NAR/srp.zip (http://www.itsa.org/public/archdocs/NAR/srp.zip on or before February 14, 1997))
1006	National Intelligent Transportation Systems (ITS) Architecture: Logical Architecture Volume 1 (Description) (retrieved from the Wayback Machine in association with the Wayback URL:

	https://web.archive.org/web/19970214054941/http://www.itsa.org/public/archdocs/NAR/logical.zip (http://www.itsa.org/public/archdocs/NAR/logical.zip on or before February 14, 1997))
1007	National Intelligent Transportation Systems (ITS) Architecture: Logical Architecture Volume 2 (Process Specifications) (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214054941/http://www.itsa.org/public/archdocs/NAR/logical.zip (http://www.itsa.org/public/archdocs/NAR/logical.zip on or before February 14, 1997))
1008	National Intelligent Transportation Systems (ITS) Architecture: Logical Architecture Volume 3 (Data Dictionary) (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214054941/http://www.itsa.org/public/archdocs/NAR/logical.zip (http://www.itsa.org/public/archdocs/NAR/logical.zip on or before February 14, 1997))
1009	National Intelligent Transportation Systems (ITS) Architecture: Implementation Strategy Appendix A (Detailed Market Package Definitions) (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214063148/http://www.itsa.org/public/archdocs/NAR/is.zip (http://www.itsa.org/public/archdocs/NAR/is.zip on or before February 14, 1997))
1010	National Intelligent Transportation Systems (ITS) Architecture: Executive Summary (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214054553/http://www.itsa.org/public/archdocs/NAR/exsum.zip

	(http://www.itsa.org/public/archdocs/NAR/exsum.zip on or before February 14, 1997))
1011	National Intelligent Transportation Systems (ITS) Architecture: Standards Development Plan (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214063304/http://www.itsa.org/public/archdocs/NAR/sdp.zip (http://www.itsa.org/public/archdocs/NAR/sdp.zip on or before February 14, 1997))
1012	National Intelligent Transportation Systems (ITS) Architecture: Mission Statement (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214055038/http://www.itsa.org/public/archdocs/NAR/mission.zip (http://www.itsa.org/public/archdocs/NAR/mission.zip on or before February 14, 1997))
1013	U.S. Patent No. 5,982,298 (Lappenbusch)
1014	U.S. Patent No. 6,680,694 (Knockeart)
1015	U.S. Patent No. 5,059,965 (Geiser)
1016	U.S. Patent No. 5,237,323 (Saito)
1017	Japan Patent Application Publication No. JPH10-221091 (JP091)
1018	Japan Patent Application Publication No. JPH08-110230 (JP230)
1019	ITS Brochure (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970624013455/http://www.its.dot.gov/architecture/brochure.html (http://www.its.dot.gov/architecture/brochure.html on or before June 24, 1997))
1020	Overview of the National Architecture

	(retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970131030735/https://www.its.dot.gov/architecture/overview.html (https://www.its.dot.gov/architecture/overview.html on or before January 31, 1997))
1021	National ITS Architecture Documents (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214033013/http://www.itsa.org/public/archdocs/national.html (http://www.itsa.org/public/archdocs/national.html on or before February 14, 1997))
1022	ITSA Homepage (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214032637/http://www.itsa.org/index.html (http://www.itsa.org/index.html on or before February 14, 1997))
1023	ITSA Public Programs, Notices & Announcements (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214032150/http://www.itsa.org:80/public/notice.html (http://www.itsa.org/public/notice.html on or before February 14, 1997))
1024	ITSA Benefits of Membership (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970214032110/http://www.itsa.org/public/benefits.html (http://www.itsa.org/public/benefits.html on or before February 14, 1997))

1025	The U.S. Department of Transportation's ITS Standards Program 1996 Status Report (retrieved from the Wayback Machine in association with the Wayback URL: https://web.archive.org/web/19970624010219/http://www.its.dot.gov/standards/docs/REPORT96.htm (http://www.its.dot.gov/standards/docs/REPORT96.htm on or before June 24, 1997))
1026	ITS Deployment Guidance for Transit Systems (April 1997)
1027	U.S. Patent No. 6,240,360 (Phelan)
1028	U.S. Patent No. 6,591,263 (Becker)
1029	Federal Register Notice 96-4184
1030	Federal Register Notice 97-18983
1031	U.S. Patent No. 6,098,016 (Ishihara)
1032	Public Roads Magazine, Vol. 61 No. 2 (September/October 1997)
1034	U.S. Patent No. 4,502,123 (Minami)
1035	R.L. French, "Automobile navigation: Where is it going?," Aerospace and Electronic Systems Magazine, pp. 6-12, May 1987 (French)
1036	"Route Guidance Systems for Improving Urban Travel and Location Choices," Transportation Research Part A: General, Vol. 22A, No. 4, pp.275-281, Pergamon Press, 1988 (Boyce)
1037	B. Coppock et. al., History of GIS, Geographical Information Systems: Principles and Applications, Vol. 1, Longman Group, pp. 21-34, 1991 (Coppock)
1038	Peuquet, A Conceptual Framework And Comparison Of Spatial Data Models, Cartographica, Vol. 21, No. 4, pp. 66-113, 1984 (Peuquet)
1039	P. Davies, et.al., "Assessment of Technologies for Relieving Urban Traffic Congestion," National Cooperative Highway Research Program Report 340, Transportation Research Board, December 1991 (Davies)

1040	Kopitz, RDS: The Radio Data System, 1999
1041	The Proceedings of the 1992 Annual Meeting of IVHS America Vol. 2, 1992 (TRAVTEK)
1042	Lanter, User-Centered Graphical User Interface Design for GIS, National Center for Geographic Information and Analysis Report 91-6, 1991
1043	White, Car Navigation Systems, Geographical Information Systems: Principles and Applications, D.J. Maguire, et. al., eds., Vol. 2, pp. 115-125, Longman Group, 1991
1044	“Automobile navigation system using beacon information,” IEEE 1989 Vehicle Navigation and Information Systems Conference, pp. 139-145, Toronto, 11-13 Sep 1989 (Saito)
1045	Guzolek, J.; Koch, E.; “Real-time route planning in road networks,” 1989 Vehicle Navigation and Information Systems Conference, pp. 165-169, Toronto, Ont., Canada, 11-13 Sep 1989 (Guzolek)
1046	Rosen, D.A.; Mammano, F.J.; Favout, R.; “An electronic route-guidance system for highway vehicles,” IEEE Transactions on Vehicular Technology, vol. 19, no. 1, pp. 143-152, Feb 1970 (Rosen)
1047	UK Patent Application GB 2,079,453, filed July 1980 (Wootton)
1048	Certified Translation of JP091
1049	Certified Translation of JP230

I. Professional Background

4. All of my opinions stated in this Declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching the technology referenced in this Declaration.

5. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I understand that a copy of my current curriculum vitae, which details my education and professional and academic experience, is being submitted as EX1032. The following provides a brief overview of some of my experience that is relevant to the matters set forth in this Declaration.

6. I have summarized in this section my educational background, career history, and other qualifications relevant to this matter.

7. I am currently a tenured Professor of Robotics Engineering in the Robotics Engineering Department of Worcester Polytechnic Institute (WPI). Additionally, I have appointments as a Professor of Computer Science, Electrical and Computer Engineering, and Mechanical Engineering at WPI. As part of my appointments, I perform research and teach in the areas of navigation, communications, and computer system design. I supervised the WPI Center for Advanced Integrated Radio Navigation (CAIRN), where I was developing a Public Safety Integration Center focused on the integration of communications, navigation, and information technologies for public safety applications. Currently, I direct the Robot Communication and Navigation Laboratory where my research focuses on the development, testing, and evaluation of communication and

navigation systems for both civilian and military applications with a special emphasis on techniques focused on indoor, underground, or otherwise GPS-deprived situations. My interests in communication, navigation, and computing have led me to play an active role in the development of the Robotics Program at WPI, where I teach robotics courses at the graduate and undergraduate level.

8. Prior to joining the faculty of WPI, I worked at the Raytheon Company from 1981-1991, with a leave of absence between 1985-1988 to complete my Doctoral Degree (Ph.D.) in Electrical Engineering from the Worcester Polytechnic Institute. Prior to my leave of absence, I worked as an Engineer in the Cursive Displays Department and VLSI Design Department of the Computer and Displays Laboratory within Raytheon's Equipment Division. After receiving my Ph.D., I returned to the Equipment Division of the Raytheon Company where I was promoted to the title of Engineer, Design and Development. I was subsequently selected to sit on the engineering staff of the newly-formed System Engineering Department of the Division's Computer and Displays Laboratory. In this capacity, I acted primarily as a consultant to other departments within the laboratory, and my responsibilities ranged from leading the hardware and software development of supercomputer-class computer systems to performing applied research into the exploitation of new technology.

9. I earned a B.S. from the Syracuse University in 1981, an M.S. and a Ph.D. in Electrical Engineering from WPI in 1985 and 1989, respectively.

10. I have more than 40 years of experience in the field of computer technology, specifically in the specialized field of signal and data processing. I have consulted and served, including being qualified by courts, as an expert for numerous patent cases, including in patent cases involving motion sensing, positioning, map navigation technologies, and wireless communications, a listing of which is set forth in my current curriculum vitae, which is attached as Exhibit 1033. I hold a commercial General Radio Operator's license (with Ship RADAR Endorsement), an Extra Class Amateur Radio operator's license, and have held a Commercial Radiotelegraph Operators license. I was first licensed as a Radio Amateur in 1974 and have been involved in the design, implementation, and repair of radio systems, including radio-controlled systems, since that time.

11. I have been involved with numerous projects involving remote objects which require wireless tracking, control, and telemetry. These objects include land vehicles, sea vehicles, and air vehicles. Starting with my work at the Raytheon Company, I was involved with the tracking of aircraft in both military and civilian air traffic control systems. I have worked on the guidance and control systems for multiple missile systems as well as the guidance and tracking systems for fire

control systems and on spaceborne systems for tracking ballistic missiles. In my work at WPI, I have been involved with numerous projects related to tracking land, sea, and air vehicles using the GPS and/or inertial guidance systems. Some of this work has involved the use and control of rotorcraft for applications, such as firefighting and landmine detection and destruction. All of these projects involve interacting with these systems remotely via wireless communications.

12. GPS and GPS-related technologies have dominated the bulk of my research since 1992. I have been involved in numerous academic and consulting projects involving navigation technologies and their association with geographic information system technologies. Examples of academic projects include (1) a container tracking system in 2003 which explored the application of tracking and communications technologies to track shipping containers, (2) an automotive based system in 2000 which combined GPS and map data in an automotive environment, (3) a remote hazard detection system in 1996 that combined GPS and radio communications to remotely identify hazards to the engineer operating a freight train, and (4) a differential GPS system in 1995 that combined GPS and radio technologies to allow determining the precise path of vehicles operating off-road during forest operations. As a consultant, I have worked with the combination of GPS and radio communications in the context of space shuttle docking operations,

transfer of traffic information to GPS devices in a vehicle, combinations of GPS and cellular communications for the tracking of individuals, and map-based handheld tracking devices.

13. I am a named inventor on nine patents, including patents on map navigation devices, geolocation systems, and high resolution and precision location systems. I have authored, or co-authored, over 100 journal papers and conference publications, including papers and publications regarding positioning and navigation systems and methods. I am also the co-author of a chapter entitled “An Approach for Implementing a Reconfigurable Optical Interconnection Network for Massively Parallel Computers” in Optical Interconnection – Foundations and Approaches by C. Tocci and H. J. Caulfield Eds., Artech House, 1994. I am currently under contract to write a book tentatively entitled “Radionavigation and the Global Positioning System,” which covers the physical principles upon which radionavigation system are based as well as the hardware and software required to perform navigation. At WPI, I have taught courses in Sensors, Circuits, and Systems, Digital Circuit Design, Embedded Computing, Computer Architecture, Computer, and Navigation. In addition, I have advised projects involving computers, navigation, and communications for a large variety of applications in the air, on land, and on the sea.

14. I have received several awards and recognition for my work, including becoming an Elected Senior Member of the IEEE. In addition, I was awarded the Joseph Samuel Satin Distinguished Fellowship for the 1994-1995 academic year, and the Aldo Miccioli Fellowship from the Raytheon Company's Equipment Division. I am also a member of the Institute of Navigation, the Royal Institute of Navigation, the American Society of Engineering Educators, The Society of Automotive Engineers, the National Marine Electronics Association, and the National Academy of Inventors.

15. My curriculum vitae, attached as Exhibit A, includes a list of publications on which I am a named author. It contains further details regarding my experience, education, publications, and other qualifications provide to an expert opinion in connection with this proceeding.

16. For time spent in connection with study, analysis, and testimony on this matter, I will be compensated in the amount of \$525 per hour, in addition to reasonable out-of-pocket expenses. My compensation does not depend on the outcome of this case.

17. If asked, I will be prepared to present a basic tutorial to explain the terms and concepts related to the opinions set forth in my expert report, as well as

to provide further background on the state of the art, the level of skill in the art, and the Asserted Patents. That tutorial may include demonstrative exhibits.

II. Background of Navigation Systems

18. The '743 patent is generally focused on vehicle navigation systems, and more specifically, on various features and combinations of features implemented in a vehicle navigation systems. Since the '743 patent must be analyzed with respect to the knowledge of one of ordinary skill in the art at the time of the invention disclosed, it is important to understand the background that one of ordinary skill in the art would have had at the time of the invention as well as the general state of the art at the time. Further, the state of the art and background of a person of ordinary skill at the time informs the “scope and content of the prior art” aspect of the analysis of obviousness. A person of ordinary skill in the art would be able to bring the below technological background to bear on the solution of engineering problems within the scope of the background. Further, this state of the art and background of a person of ordinary skill in the art forms a basis for identifying common sense solutions to routine engineering problems within the scope of the background.

19. By the time of the '743 patent, the navigation space had already undergone significant development and was quite robust. As I have detailed

herein, the specific modifications proposed by the inventors of the '743 patent were already known before the filing of the '743 patent. However, before moving to the specific invalidity analysis, it is important to note that the background technology that forms the foundation for the '743 patent was just that, foundational and extremely well known. The foundational technology features include:

- Moving map navigation systems in vehicles and in portable platforms
- Points of Interest database that allowed users to customize which POIs are displayed on a map
- “Connected” traffic data systems
- Broadcast traffic data systems
- Maintaining historical speed database and incorporating historical speed data into route calculations
- Calculating a route between a starting point and an ending point
- Calculating a route that considers traffic data
- Calculating a route that considers a user-defined geographic or specific road avoidance

20. The following sections describe the state of technology in these areas as it existed by the 1997-1999 timeframe and demonstrates that persons of ordinary skill in the art would not have considered the foundational technologies relating to the '743 Patent to be innovative. Instead, they were part of the building blocks that anyone in this space was familiar with and could build upon.

21. **Vehicle Navigation Systems in General**

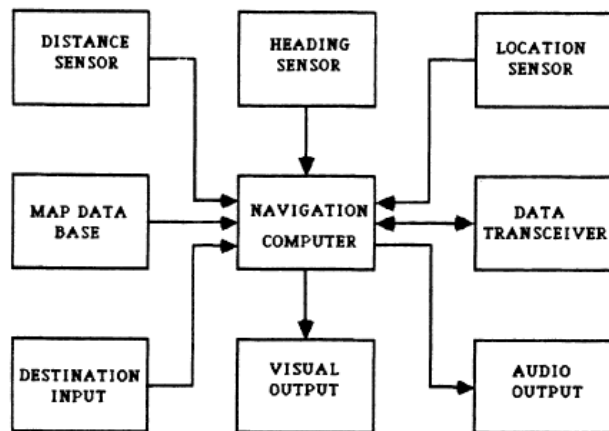
22. Providing navigation systems in vehicles was not a new idea by 1997.

Indeed, many practitioners had developed map-based navigation systems before that date. Early systems generally determined position based on inertial navigation sensors using a technique called dead-reckoning, used radio navigation sensors such as the Long-Range Navigation (LORAN) system deployed by the US Coast Guard (or radio systems like the then-new Global Positioning System, or GPS), or used some combination of these technologies. But by the mid-90s, GPS was the dominant positioning technology used in consumer navigations systems. These systems were implemented in a number of different formats including in-dash vehicle systems, GPS-enabled laptop-based systems, and portable navigation systems.

23. An early example is US Patent 4,502,123, which was issued to Minami et.al. (“Minami,” EX1034) on February 26, 1985. In this patent “a navigation system arranged to display a road map in accordance with road map information from a cassette tape, and the present location of a motor vehicle equipped with the navigation system” is described. EX1034 at abstract. This early system contained inertial and odometry sensors, a map database on cassette tape, a cathode ray tube monitor for displaying maps, a keyboard for entering information, and a computer system with CPU, RAM, ROM and the necessary programming

needed to realize the navigation system. *See generally id.* at Figs. 1-11 and supporting text. As is still common today, when using this system “the user who may be the motor vehicle driver or an occupant, will be informed with the present location and the travelling locus both shown on the map displayed on the CRT screen.” *Id.* at 11:10-12.

24. By 1987 there was enough activity in the area of automobile navigation systems, that R. L. French wrote the seminal paper “Automobile navigation: Where is it going?” *See* R.L. French, “Automobile navigation: Where is it going?,” Aerospace and Electronic Systems Magazine, pp. 6-12, May 1987 (“French,” EX1035). He begins by stating that “Automobile navigation systems based on dead reckoning, map matching, satellite positioning and other navigation technologies are under active development.” *Id.* at 6. In this 1987 paper, French describes an architecture for such a system that remains essentially the same to this day. *Id.* at Figure 2:



25. Regarding user interface, French explains that “[m]ost systems proposed or developed to date use detailed map displays or some combination of symbolic graphics, alphanumeric messages, and audio signals.” *Id.* at 8. In early systems, the displays “projected simple combinations of arrows and words on the windshield.” *Id.* at 9. Other systems “used a plasma display panel to give route guidance in the form of shaped arrows along with street names, etc.” *Id.* at 9. By 1984, Ford, Chrysler and General Motors demonstrated systems “which displayed detailed map images.” *Id.* at 9. By 1986, the EVA system by Bosch-Blaupunkt recognized some of the additional complexities associated with providing driver guidance. In the EVA system, “[t]urns at complicated intersections, lane changes, etc., are specified to the driver in the form of simplified diagrams which show lane boundaries and use arrows to indicate the path to be taken.” *Id.* at 9. Some of this complexity was also addressed by 1986 in the ALI-SCOUT system which

incorporated a feature known as the “Wolfsburg wave” which “is essentially a bar graph that, in this application, gives a "count down" to the exact point where the vehicle is to turn, thus clearly delineating among closely spaced turns.” *Id.* at 9.

26. According to Boyce, systems “for finding the required best routes by applying minimum path algorithms to network representations of the highway system” had been specified as early as 1970, meaning that this problem was known, understood and had proposed solutions by that time. *See* D.E. Boyce, “Route Guidance Systems for Improving Urban Travel and Location Choices,” *Transportation Research Part A: General*, Vol. 22A, No. 4, pp.275-281, Pergamon Press, 1988 (“Boyce,” EX1036) at p. 276. This was done in systems such as the ETAK Navigator. Boyce describes the 1986 ETAK Navigator as a system similar to that described above, noting that “[d]igital map data stored on tape cassettes are input to an on-board computer similar to an IBM PC in capacity and displayed on a CRT.” *Id.* at 277. In the ETAK system, “[a]s the vehicle is driven, the map scrolls across the CRT and the vehicles location remains stationary in the center. An input destination can also be displayed.” *Id.* at 277.

27. Regarding routing algorithms and the need for calculating alternative paths, Boyce describes some of the features of the Comprehensive Automobile Traffic Control Project in Japan from 1973 to 1979. Specifically, he states that

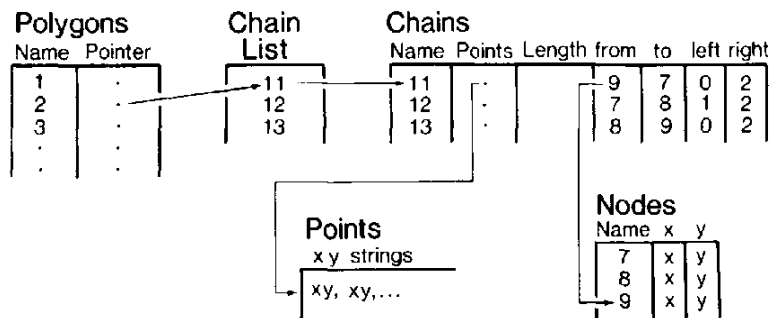
“[a] system for computing routing alternatives from each intersection to a specified destination was devised and implemented.” *Id.* at 277. The need for drivers to be able to make decisions about possible alternative routes was clearly known, and being addressed by practitioners, by the time Boyce wrote his overview in 1987. Indeed, given information about road conditions and/or delays, it was known that estimated travel times for different alternate routes between an origin and destination could be determined. As Boyce points out, “These estimates could be used by drivers to decide their best departure times, or to avoid unusual conditions caused by accidents or other traffic flow interruptions.” *Id.* at 278.

28. The above references (and the works they cite) point out a number of systems that were focused at automobile navigation. Thus, there were a number of prior art systems that had been widely used since the 1980s. These systems generally contained a searchable database containing map and point of interest information and computer hardware and software for receiving user input, executing instructions, performing searches and computations, and displaying information on a map. These systems were also capable of receiving and displaying information relating to points of interest from an external source.

29. Systems that used databases containing map information were commonly known as Geographic Information Systems, or GIS. “Computer-based

GIS have been used since at least the late 1960s.” *See*, B. Coppock *et. al.*, *History of GIS*, Geographical Information Systems: Principles and Applications, Vol. 1, Longman Group, pp. 21-34, 1991 (“Coppock,” EX1037) at p. 21.

30. By the mid-1980s, it was known that there were many ways that GIS data could be stored and that the manner in which data are stored impacts the time and computer resources required to effectively use the data. *See generally*, Peuquet, *A Conceptual Framework And Comparison Of Spatial Data Models*, Cartographica, Vol. 21, No. 4, pp. 66–113, 1984 (“Peuquet,” EX1038). For example, Figure 9b of Peuquet, reproduced below, shows that by 1984 it was known that GIS data could be stored in data structures that contain geographic information.



31. These databases, either pre-programmed into the navigation device; conveyed on memory cards, cassettes or CDROMs; or transmitted in real-time to the driver could be used to aid the driver in making routing and other decisions. For example, databases could also contain traffic related information. By 1991, it

was known that “[d]river information systems can assist motorists in making decisions on appropriate route choice and in following the chosen route for a particular trip.” See P. Davies, et.al., “Assessment of Technologies for Relieving Urban Traffic Congestion,” National Cooperative Highway Research Program Report 340, Transportation Research Board, December 1991 (“Davies,” EX1039) at p. 4. To this end, it was recognized by 1991 that including information about road condition, maintenance, weather and other factors affecting traffic was important. Other examples include:

- The database in the ROUTE system contained “network information, together with current data on highway maintenance and construction activities, and road and weather conditions.” *Id.* at 5.
- The database in the ANTIOPE system included “maps, showing the congestion on major roads in selected areas, that are updated at hourly intervals based on data collected by the highway patrol.” *Id.*
- In the ATIS system, data from a variety of sources of traffic information was aggregated at a central facility and then disseminated to motorists. *Id.*

32. As described above, it was well known that drivers might want to modify their routing decisions before, or during, travel. One typical example was replanning due to the presence of traffic congestion. It was well-known that if traffic related information was more efficiently communicated to motorists,

motorists would be better able to use this information in making their route planning decisions. For example, by 1991, it was recognized that “[t]raffic information broadcasting systems can potentially play an important role in keeping the motorist updated on current network traffic conditions, enabling him to adapt and replan his route as necessary.” *Id.* Such “[s]ystems can be used to warn drivers of various conditions including recurring congestion, short-term holdups caused by a traffic incident, or preplanned activities liable to cause congestion, such as highway construction and maintenance.” *Id.*

33. One major effort related to the dissemination of traffic information was the development of the radio data system (RDS) in the early 1980s. The radio data system traffic message channel (RDS-TMC) was developed at that time to satisfy the well-known need of disseminating traffic information to motorists. *See* Kopitz, *RDS: The Radio Data System*, 1999 (EX1040) at 122. “The objective of RDS-TMC is to broadcast traffic and travel information (TTI) messages on VHF/FM broadcast transmissions using RDS.” *Id.* While RDS-TMC was initially developed and fielded in Europe, as of 1991 “[i]n the U.S., Chrysler has been carrying out trials of RDS traffic information in the Detroit metropolitan area.” EX1039 at 6.

34. By 1992, these RDS systems had advanced to the point that they permitted motorists to determine routes between desired locations that took into consideration traffic congestion to ensure that motorists could travel efficiently from place to place. One example system was the TravTek system. TravTek provided a wide variety of features for assisting drivers: 1) navigation with color electronic maps showing location of the car and the location of any destination, 2) real-time traffic information, including information on congestion and incidents, 3) route selection and guidance using real-time traffic information to provide the fastest time route, 4) onboard information listings for more than 7,000 establishments, including restaurants, hotels, dry cleaners, ATM machines, and all the places drivers might want to go to in their TravTek car. *See The Proceedings of the 1992 Annual Meeting of IVHS America Vol. 2, 1992 ("TRAVTEK," EX1041) at p. 569.*

35. The use of graphical user interfaces and databases was also known and used in the creation of interactive user interfaces. An obvious application of this technology was to manage geographic information, which led to the development of graphical systems for GIS applications. *See Lanter, User-Centered Graphical User Interface Design for GIS*, National Center for Geographic Information and Analysis Report 91-6, 1991 (EX1042).

36. By the early 1990s, real-time information, geographic information systems and databases became key components in the transportation industry, specifically in the field of Intelligent Vehicle Highway Systems. For example, in 1991, White identified automobile navigation as “a demanding application of digital maps,” and noted that “[a] few systems are commercially available and many prototypes exist. These systems determine location using wheel rotation sensors, solid state compasses, inertial devices (gyros and other novel devices), radio location or some combination of them.” *See White, Car Navigation Systems, Geographical Information Systems: Principles and Applications*, D.J. Maguire, et. al., eds., Vol. 2, pp. 115-125, Longman Group, 1991 (EX1043).

37. White also explained that the “primary use of navigation systems is in finding the location of destinations, usually specified by street address but also by street intersection or major landmark.” *Id.* at 121. To fulfill this purpose, it was necessary to design the navigation system in such a way that it could interact with a user, receiving inputs from the user and providing guidance information to the user. “In the Bosch Travelpilot and the Etak Navigator, for example, there are 12 buttons for input and the user only needs to enter a few characters before selecting from a list of possible cities or street names.” *Id.* at 121. And the users could also find “the nearest hardware store or service station.” *Id.* White also noted the

availability of radio navigation systems such as the Global Positioning System and LORAN. *Id.* at 118-119, 124.

38. In sum, by the mid- to late-1990s, all of the foundational concepts and technology needed to develop location based systems that allowed users to use a graphical user interface to interactively search databases of geographical and point of interest information to retrieve point of interest information, in particular, time sensitive information (such as traffic conditions) were well known and had, in fact, been commercially implemented.

39. The following sections describe the state of technology in these areas as it existed by 1991 and demonstrates that persons of ordinary skill in the art would not have considered any of these foundational technologies to be innovative. Instead, they were part of the building blocks that anyone in this space was familiar with and could build upon.

40. **Provision of electronic maps**

41. As described above, the ability to provide electronic map information in a vehicle navigation device was well-known.

42. As early as 1980, Wootton described a system containing “a map data storage means for storing map data defining and describing the respective road sections of a road system on a predetermined map section, each such road section

being a length of road lying between adjacent points at which an approaching driver has different courses of action open to him.” *See* H.J. Wootton, “Route selection and guidance apparatus and method,” UK Patent Application GB 2,079,453, filed July 1980 (“Wootton,” EX1047) at 2:20.

43. This was typical of automotive navigation systems of the time. Indeed, in 1987, French remarked that “[m]ost systems proposed or developed to date use detailed map displays or some combination of symbolic graphics, alphanumeric messages, and audio signals.” *See* EX1035 at 8. Other examples cited by French include “satellite-based navigation systems demonstrated by Ford [27], General Motors [28], and Chrysler [7], all of which displayed detailed map images.” *Id.* at 9.

44. In 1989, Saito described a system in which “location is continuously indicated on the digital road map display.” *See* Saito, T.; Shima, J.; Kanemitsu, H.; Tanaka, Y.; “Automobile navigation system using beacon information,” IEEE 1989 Vehicle Navigation and Information Systems Conference, pp. 139-145, Toronto, 11-13 Sep 1989 (“Saito,” EX1044) at 139. In this system, “[t]he shortest route between any two pints can be calculated from stored data and indicated on the digital map.” *Id.* at 139. Electronic maps were displayed to the user on a CRT-based display – “The core of the man-machine interface is the display unit” – “The

display changes automatically when the vehicle moves from one navigation map to another.” *Id.* at 140; *see also id.* at Figs. 3 and 4.

45. **Display of vehicle position on an electronic map**

46. In addition to showing map information on an electronic map, these systems would also typically provide an indication of the exact position of the vehicle to the driver. For example, in the system described by Saito, “[t]he dead reckoning device calculates the present position of the vehicle from directional and distance data. The calculated position is displayed on the navigation map.”

EX1044 at 139. As remains the case today for many systems, “the position of vehicle location mark on the CRT is updated every second.” *Id.* at 141.

47. Certainly by 1989 it was well-known that “[f]or in-vehicle applications, the route guidance system must also accurately track the position of the vehicle, so it can present the next driving maneuver at the appropriate time and so it can determine whether the driver has deviated from the prescribed route, which might trigger a re-routing requirement.” *See* Guzolek, J.; Koch, E.; “Real-time route planning in road networks,” 1989 Vehicle Navigation and Information Systems Conference, pp. 165-169, Toronto, Ont., Canada, 11-13 Sep 1989 (“Guzolek,” EX1045) at 165.

48. **Calculating an Optimum Route**

49. As early as 1970 the value of computing optimal routes was known. Rosen divided the problem into two categories, “static” and “dynamic.” *See* Rosen, D.A.; Mammano, F.J.; Favout, R.; “An electronic route-guidance system for highway vehicles,” IEEE Transactions on Vehicular Technology, vol. 19, no. 1, pp. 143-152, Feb 1970 (“Rosen,” EX1046) at 144. Using this characterization, “[t]he static routing problem is exemplified by the difficulties unfamiliar drivers have while traversing the highway network over a ‘best route’ (e.g., minimum-time path) using only conventional maps and signs.” *Id.* at 144. “The dynamic routing problem is exemplified by the difficulties both familiar and unfamiliar drivers have while seeking best routes through highway networks (mainly urban) wherein traffic and other conditions are varying with time.” *Id.* at 144.

50. As discussed by Rosen, by 1970 it was known how to determine optimal routes in a network of highways. “Best route solutions can be obtained by assigning numerical values to the links of the network and exercising minimum path algorithms. Numerical values can represent minimum travel time, distance, or other link characteristics.” *Id.* at 150. “Also developed under this phase was an algorithm for the solution of best routes through a highway network. A FORTRAN IV program for the solution of best routes was written and compiled on Philco model 212 computers. The program determines the minimum path and the

exit branch which connects each pair of nodes in a matrix representation of a roadway network.” *Id.* at 147.

51. In 1980, the system discussed by Wootton directly addresses determining optimal routes, “[r]oute selection and guidance apparatus for a vehicle includes a digital data processor 18 controlled by programs stored in a ROM 30 to select an optimum route between driver-selected journey starting and finishing positions, using driver-selected optimisation [sic] criteria.” EX1047 at Abstract.

52. The concept of using different selectable criteria for determining an optimal route is also discussed by Guzolek who presents a route planning system that can “[d]etermine the best routes in the road network using different optimization criteria.” EX1045 at 165. In his system, “[a] Route Planner's main responsibility is to determine an ‘optimum’ route between some origin and destination. Optimum in this sense refers to the best route as measured against some criteria.” *Id.* at 165. Some of the criteria cited by Guzolek include minimum time, minimum distance, fewest turns and avoiding/encouraging the use of freeways. Once calculated, this optimal route “can be explicated into a set of directions that may be used for route guidance.” *Id.* at 165. In terms of computer algorithms for determining the optimal route, Guzolek teaches that “[t]he primary tool for finding the “best route” is a well known AI graph search technique called

A* which was introduced by Nilsson[1].” *Id.* at 166. “When implemented with proper heuristics, the A* algorithm has been shown to produce the optimum path while considering the fewest number of nodes in the graph.” *Id.* at 166. In addition to the original A* algorithm, Guzolek also describes refinements in which the A* algorithm “has been modified in order to optimize its performance within the physical resource limits of the host computer.” *Id.* at 167.

53. Other practitioners echo similar concepts. “The shortest route between any two given points is calculated using data regarding link length and flow direction at intersection (e.g. no right-hand turn etc.).” Saito at 142. Thus, the concepts of calculating optimal routes, the algorithms that are still used today for computing an optimal route, and the concept of allowing the user to select criteria for determining the optimal route were each well known prior to the 1990s.

54. **Displaying the Multiple Links of a Route to the User**

55. Presenting a route to the driver also was well-known foundational technology. The first paragraph of Wootton’s 1980 patent application states that “[t]his invention relates to an apparatus and method for providing a driver of a driver-controlled vehicle with information identifying successive sections of a route to be followed, so as to enable the vehicle to be driven from a selected starting point to a selected finishing point.” EX1047 at 1:5-7. One of skill in the

art understands that “successive sections” are the links that are so commonly associated with computer representations of road maps. When Wootton describes this capability, he further states that “said instruction producing means includes driver-operable route selection means for enabling a driver to select from said various routes a specific one along which he wishes to be guided, said instruction producing means being operative on selection of route to produce in sequence and as required by said activating means the successive route-stage instructions apertaining [sic] to the selected route.” *Id.* at 2:3-6. In the system described by Wootton, “[f]urther successive guidance instructions are produced in turn by the processor each time an indication (automatic or driver-originated) is received by the processor that the last instruction has been correctly acted upon, and the identity and relevant particulars of the next road section ahead have been subsequently received by the processor from the data storage unit 32.” *Id.* at 5:43-47.

56. There were many systems which presented information about the multiple links of a route to a driver. For example, some systems displayed routes, or links of routes, “on the navigation maps in a flashing green color.” EX1044 at 142.

57. **Providing Route Guidance Instructions for a User**

58. Fundamental to the automobile navigation systems known in the art was the ability to provide route guidance instructions to the driver of the automobile. All of the cited references describe such systems. For example, in 1980 when describing his invention Wootton states that “[t]he selected route is stored in the storage unit 32, and serves to provide with an instruction during each route-stage, each instruction being announced to the driver.” EX1047 at Abstract. Specifically, Wootton’s system includes an “*instruction producing means* for producing in sequence from a pre-planned route individual route-stage instructions each defining an action to be taken by a driver of a vehicle at the end of an associated route-stage.” *Id.* at 1:44-46.

59. Thus, the technology required to provide route guidance instructions for a user was well-known and was implemented in many systems starting at least as early as 1980.

60. **Providing Route Guidance Instructions Sequentially to the User**

61. At least as early as 1970 it was known that guidance instructions could be supplied sequentially to the drivers of vehicles. “In the vehicle, the routing instruction is displayed to the driver in the form of a symbol or word message, which gives the maneuver the driver should make at the upcoming intersection or interchange to reach his destination optimally.” EX1046 at 143.

“The received instruction (turn right, turn left, etc.) is displayed visually.” *Id.* at 147.

62. In 1980 Wootton discloses that “[t]he selected route is stored in the storage unit 32, and serves to provide with an instruction during each route-stage, each instruction being announced to the driver when a vehicle-position feedback signal from a feedback device 40 corresponds with a position reference signal contained in the instruction.” Wootton at Abstract.

63. Thus, the technology required for providing route guidance instructions sequentially to a user was well-known and was implemented in many systems starting at least as early as 1970.

64. **Providing Advance Warning for Upcoming Maneuvers on the Route**

65. As early as 1970 it was understood that drivers needed sufficient notice of upcoming maneuvers so they could avoid missing turns. Rosen addresses this problem, noting that “research is currently underway to determine the optimum information lead distance (ILD) for giving the driver the ERGS routing symbols on an approach to a highway decision point.” EX1046 at 146.

66. This concept of announcing guidance instructions prior to a maneuver was also discussed by Wootton “[t]he first control signal (“announce guidance

instruction") operates to cause the said second guidance instruction to be announced to the driver, so that he may shortly act upon it.” EX1047 at 5:23-24. “Position feedback signals are derived directly or indirectly from position feedback devices 40, which may give output signals dependent upon elapsed-time 40A, distance travelled 40B, or actual vehicle position 40C- 40F.” *Id.* at Abstract.

67. In 1989 Guzolek also describes the need to give drivers advance notice of upcoming maneuvers. “For in-vehicle applications, the route guidance system must also accurately track the position of the vehicle, so it can present the next driving maneuver at the appropriate time and so it can determine whether the driver has deviated from the prescribed route, which might trigger a re-routing requirement.” EX1045 at 165.

68. The technology required for providing advance warning for upcoming maneuvers on the route was well-known and was implemented in many systems starting at least as early as 1970.

69. **Visibly Displaying Upcoming Maneuvers to the User**

70. The ability to display upcoming maneuvers to the users was also well-known in the art. As early as 1970 it was known that systems can be designed such that “[t]he received instruction (turn right, turn left, etc.) is displayed visually (Fig. 10).” EX1046 at 147. Expanding on this theme, Rosen writes “[s]imple

instructions such as right turn, straight, left turn, etc., are presented to the driver by simple graphical symbols grouped at the left. For more complicated situations, for example, traffic circles, the verbal portion of the display may be used; 1st right, 2nd right, 3rd right. When it is necessary to give the driver more than one instruction, a combination graphical symbol and verbal instructions may appear.” *Id.* at 148.

71. French describes the ERGS vehicle as having “back-illuminat[ing] various combinations of arrows and words on a guidance panel.” EX1035 at 9.

72. In the ALI-SCOUT system optimal routes are “presented in visual form as turning instructions.” EX1036 at 277.

73. The technology required for displaying upcoming maneuvers to a driver was well-known and was implemented in many systems starting at least as early as 1985.

74. **Calculating Alternative Routes (For Example, to Avoid Congestion)**

75. The concept of calculating alternative routes was also a well-known foundational concept from at least as early as 1970. Specifically, Rosen discusses the situation involving recalculation as a consequence of driver error. “If a driver failed to follow or elected to ignore a routing instruction, the next instrumented

intersection would route him to his destination from that point.” EX1046 at 147.

Indeed, Rosen specifically describes the effect of traffic congestion. “One of the most prominent symptoms of this class of problems is the congestion and delay on certain routes, while potential alternate routes are operating below capacity.” *Id.* at 144.

76. Recognizing that changes in road conditions can change, Wootton notes that it may be necessary to not only to search for a route, but that “searching can be carried out very quickly and at any time before or during a journey to meet changed or changing conditions, as forecast or actually met on the roads.” EX1047 at 7:39-41. According to Wootton, these changes may be initiated by the driver, and the new route selected at any time, “[i]n the event that the driver finds that road, weather, or other conditions are undesirably impeding his progress along the route, it is possible for him to request the processor, whilst continuing to store the presently selected route, to work out a new route between his present vehicle position and his destination [sic] B, either via some driver-selected intermediate position which lies off the present selected route, or avoiding the road sections ahead on which travelling difficulties are known (for example, from a broadcast traffic news bulletin) to exist. The newly selected route can be adopted by depressing the ‘Cancel’ button.” *Id.* at 7:1-6.

77. Additionally, it may be desirable for a driver to have the ability to select their route from a number of candidate routes. According to Wooton, “[i]n one form of guidance apparatus according to the present invention said instruction producing means is arranged to store a plurality of sets of route-stage instructions for enabling a driver to be guided along various routes respectively; and said instruction producing means includes driver-operable route selection means for enabling a driver to select from said various routes a specific one along which he wishes to be guided.” *Id.* at 2:1-5.

78. Saito also recognizes that drivers may wish to change their route. For example, “[i]f information regarding delays on or impassibility of the indicated route is received from beacons, an alternative route is also displayed.” EX1044 at 139. “A feature of the system is that an alternative route is calculated and displayed if signals from an IB (information beacon) advise of congestion or closure of the planned route.” *Id.* at 142. “IB (information beacon) data concerning congestion is expressed as a congestion factor (corresponding to link flow rate). When such information is received, the shortest route from the preceding node to D is calculated (as above) in terms of total link cost (distance x congestion factor) and displayed on the CRT.” *Id.* at 143.

79. Like others, Guzolek recognizes that drivers may need to replan their routes and identifies the need to “[p]erform real-time tactical navigation in conjunction with in-vehicle route guidance when the driver deviates from the strategically planned route.” EX1045 at 165. Specifically, this need “arises if an en-route vehicle deviates from the previously planned route (e.g., makes a wrong turn or misses a freeway exit). In this case the driver may need a new set of directions to enable him to get to his destination and thus path planning is again required.” *Id.* at 165. As was the case with earlier systems, “[d]etours may be input to the system by the driver, or received via radio broadcast if the vehicle is so equipped.” *Id.* at 168.

80. The technology required to calculate alternative routes both before and during travel to, for example, avoid congestion was well-known and was implemented in a number of systems starting at least as early as 1970.

III. Introduction

81. The '743 Patent (EX1001) describes a distributed navigation system with a server that calculates optimal routes using real-time data. EX1001, 1:5-8. The specification of the '743 Patent states that prior art systems required “all geographical data transmitted by the server” to be “in a proprietary format” rather

than “using a natural language” for the “road names and turning directions” of the route information. *Id.*, 1:62-63, 3:35-39. This was incorrect. *See, infra*, Sec. X.

82. More specifically, the '743 Patent says that it provides a solution in which the system uses a “natural language” to describe optimal routing information that is transmitted from the server to the client in a non-proprietary format. *Id.*, 3:11-27. The “natural language” content, in one example, includes “using pre-defined generic terms such as road names and turning directions.” *Id.*, 3:37-40. The client interprets this routing data, reconstructs the optimal route from the non-proprietary natural language description, and displays the reconstructed route using a local mapping database. *Id.*, 3:40-48. As shown in below for claim 1, many prior art navigation systems existed that already implemented or described this solution.

IV. Relevant Legal Standards

83. I have been asked to provide my opinions as to whether claims 1-19, 21, and 22 of the '743 Patent would have been obvious to a person of ordinary skill in the art (“POSITA”) at the time of the filing of the '743 Patent.

84. I am an engineer and an educator by training and profession. The opinions I express in this declaration involve the application of my technical

knowledge and experience to the evaluation of certain prior art with respect to the '743 Patent. In addition, I understand that the following legal principles apply.

85. It is my understanding that, in determining whether claims of the '743 Patent are anticipated or obvious in this proceeding, the claim terms are generally given their ordinary and customary meaning as understood by a POSITA, in view of the specification and prosecution history. That is, a POSITA would read the claim terms in the context of the entire patent specification in which they appear, as well as the prosecution history of the patent.

86. It is my understanding that a claim is unpatentable under 35 U.S.C. § 103 if the claimed subject matter as a whole would have been obvious to a POSITA at the time of the alleged invention. I also understand that an obviousness analysis takes into account the scope and content of the prior art, the differences between the claimed subject matter and the prior art, and the level of ordinary skill in the art at the time of the invention.

87. In determining the scope and content of the prior art, it is my understanding that a reference is considered relevant prior art if it falls within the field of the inventor's endeavor. In addition, a reference is prior art if it is reasonably pertinent to the particular problem with which the inventor was involved. A reference is reasonably pertinent if it logically would have

commended itself to an inventor's attention in considering his problem. If a reference relates to the same problem as the claimed invention, that supports use of the reference as prior art in an obviousness analysis.

88. To assess the differences between prior art and the claimed subject matter, it is my understanding that 35 U.S.C. § 103 requires the claimed invention to be considered as a whole. This "as a whole" assessment involves showing that one of ordinary skill in the art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would have selected the elements from the prior art and combined them in the claimed manner.

89. It is my further understanding that several rationales may be applied for combining references or modifying a reference to show obviousness of claimed subject matter. These rationales include: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; a predictable use of prior art elements according to their established functions; applying a known technique to a known device (method or product) ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in

the prior art that would have led one of ordinary skill to modify a prior art reference or to combine prior art teachings to arrive at the claimed invention.

V. Prosecution History

90. The '743 Patent application was filed on January 6, 1999. The Challenged Claims were allowed in July 2001, but the examination did not include prior art that was available at the time, and that included the features that the Examiner could not find in the prior art used for the examination.

91. After the original 28 claims were rejected in the first Office Action, the Applicant amended independent claims 1 and 15 to include “non-proprietary,” and argued that the independent claims were patentable because the cited prior art did not disclose “formatting the optimal route into a non-proprietary, natural language description and downloading the non-proprietary, natural language description to the client.” EX1002, 87-91, 110-125. The Examiner then allowed the claims without any detailed explanation. Instead, the Examiner just stated “[t]his communication is responsive to phone interview of 6/8/01.” *Id.*, 145. Whether the Examiner accepted the Applicant’s argument (regarding the step of “formatting the optimal route into a non-proprietary, natural language description and downloading the non-proprietary, natural language description to the client”) or not, the prosecution history shows that prior art that included disclosure of “non-

proprietary, natural language description” elements and all other features of the claims were never considered by the Examiner.

92. The '743 Patent was also challenged in an earlier IPR: IPR2017-00819 filed by Google. Google's Petition challenged claim 15 on two separate grounds: Behr in view of U.S. Patent No. 6,680,694 (“Knockeart”); and U.S. Patent No. 6,212,474 (“Fowler”) in view of U.S. Patent No. 6,334,089 (“Hessing”). *Google Inc. et al. v. InfoGation Corp.*, IPR2017-00819, Paper 16, 4 (PTAB 2017). The Board denied institution because Google didn't address how Behr or Fowler discloses a “non-proprietary format” for route guidance information. *Id.*, 18-20, 22. The Decision did, however, point out that Google did not argue and the Board took no position on whether it would have been obvious to use a non-proprietary format for the natural language route guidance messages of Behr and Fowler. *Id.*, fn5, fn6.

93. On dissent, Judge Plenzler stated that the '743 Patent has no disclosure of a non-proprietary format other than as a natural language description. *Id.*, Dissenting Opinion, 2. Accordingly, “it is at least reasonably likely that a description in Fowler that is similar to the description in the '743 patent, which allegedly supports the ‘non-proprietary, natural language description’ limitation, teaches the ‘non-proprietary, natural language description’ limitation.” *Id.*, 2.

VI. Person of Ordinary Skill in the Art

94. It is my understanding that when interpreting the claims of the '743 Patent I must do so based on the perspective of a person of ordinary skill in the art (POSITA) at the relevant priority date. My understanding is that the earliest claimed priority date of the '743 Patent is January 6, 1999, as stated on the face of the patent.

95. It is my opinion that a person of ordinary skill in the art ("POSITA") at the filing date for the '743 Patent would have had a bachelor's degree in electrical engineering, computer science, or a related discipline, and at least two years of experience working with navigation systems, or an equivalent advanced education in the field of navigation systems.

96. I base this opinion on my experience working on systems similar to that described in the '743 patent, and my experience teaching and working with engineers performing engineering development work on similar systems.

97. Based on my education, training, and professional experience in the field of the claimed invention, I am familiar with the level and abilities of a person of ordinary skill in the art at the time of the claimed invention. Additionally, I met at least these minimum qualifications to be a person having ordinary skill in the art at least as of January 6, 1999. Further, although my qualifications may exceed

those of the hypothetical person having ordinary skill in the art defined above, my analysis and opinions regarding the '743 Patent have been rendered from the perspective of a person having ordinary skill in the art at the time of the invention.

VII. Claim Construction

98. As set forth in the Relevant Legal Standards section above, it is my understanding that the claim terms are generally given their ordinary and customary meaning as understood by a POSITA, in view of the specification and prosecution history. That is, a POSITA would read the claim terms in the context of the entire patent specification in which they appear, as well as the prosecution history of the patent.

99. It is my opinion that no claims require construction beyond their plain and ordinary meaning.

VIII. Challenging Patentability

A. GROUND 1: Claims 1-7, 12-16, and 21-22 are obvious by Behr in view of ITS Architecture/Lappenbusch

i. Overview of Behr

100. Behr (EX1004), entitled “Electronic Navigation System and Method,” discloses “a method and system for providing route guidance and other information from a base unit (12) to a remote unit (16, 18, 20) in response to a request from the

remote unit.” EX1004, Abstract. Behr is in the same field of route guidance as the '743 Patent.

101. Behr's route guidance method starts with the remote unit sending a query message including “an origin point and a destination point, from which the route calculator 66 (Fig. 1) of the base unit 12 is to calculate the route.” *Id.*, 20:27-39, 21:21-24. The base unit, *i.e.*, a server (*id.*, 9:16-21), calculates the route, formats it in accordance with a protocol, and sends the formatted route to the mobile unit. *Id.*, 22:11-29.

102. In calculating the route, the base unit uses an included map database 72, and real-time traffic information. *Id.*, 17:25-18:20, 15:37-16:2. The formatted route sent to the mobile unit includes a “set of driving instructions” that use natural language descriptions of road names, turning instructions, etc., as shown in FIG. 12 below. *Id.*, 30:24-33:22.

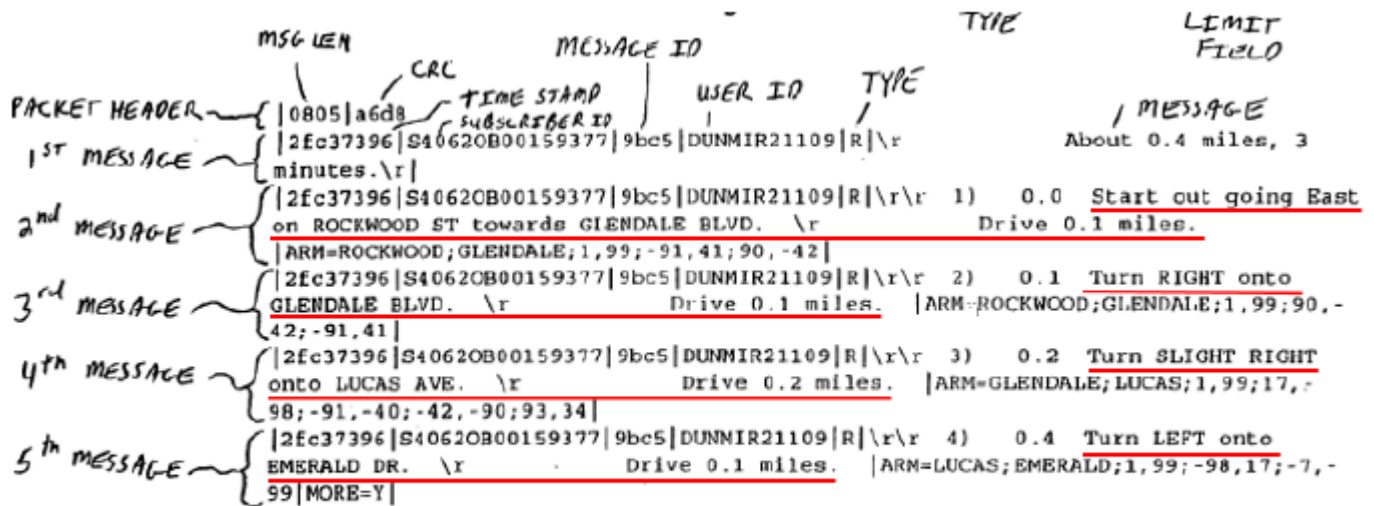


Fig. 12

Id., FIG. 12 (annotated)

ii. Overview of ITS Architecture

103. Exhibits 1005-1012 (“ITS Architecture”) are documents included in the National Intelligent Transportation Systems (ITS) Architecture¹ that was published in 1997 by the U.S. Department of Transportation in partnership with the Intelligent Transportation Society of America (ITSA). EX1019, 2.

a. The ITS Architecture was a Publicly Accessible Publication

¹ Exhibits 1005-1012 are the documents included in the National ITS Architecture that I have cited in this Declaration. All of the documents constituting the entire National ITS Architecture are accessible via ITSA’s website, shown in Exhibit 1021.

104. The ITS Architecture was publicly accessible to anyone interested, including anyone who was of ordinary skilled in the art of intelligent transportation systems (including navigation and route guidance systems). The ITS Architecture's existence was certainly known to a POSITA at the time of the '743 Patent and prior, as it was the product of an industry-wide collaboration that was publically mandated by Congress. EX1019, 2-3; EX1020. The National ITS Architecture was also well-publicized across the navigation industry, such as via magazine publications and government notices published to the general public. *See, e.g.*, EX1032, 8-40; EX1029, 5 ("6. National ITS System Architecture"); EX1030, 3 (IV. National ITS System Architecture"). A POSITA would have been able to easily locate the ITS Architecture documents. Exhibits 1005-1012 were themselves accessible and downloadable from ITSA's website, by navigating from ITSA's homepage to the "Public Programs, Notices & Announcements" link and subsequently a clearly labeled "National ITS Architecture Documents" link. EX1021; EX1022; EX1023, 1. By the time of the 1997 publication of Exhibits 1005-1012 on ITSA's website, ITSA had "hundreds of member organizations participating both nationally and through a growing network of state chapters." EX1024, 2. These hundreds of member organizations and their many constituents would have therefore been able to easily locate the documents on ITSA's website.

The U.S. Department of Transportation publically promoted the ITS Architecture and directed interested parties to ITSA to access it. EX1019, 8 (“Copies of the original architecture documentation are available through ITS America, and at reading rooms around the country.”). Further, the government issued numerous public notices announcing federal funding to the private and public sector for initiatives that comply with the National ITS Architecture, and directed interested parties to ITSA’s website to obtain electronic copies of the National ITS Architecture. *See, e.g.*, EX1029, 5; EX1030, 3.

105. By at least 1997 (the archived publication date), a person of ordinary skill in the art exercising reasonable diligence would have been able to locate the ITS Architecture documents, by for example, browsing the website of ITSA which is an industry-wide public-private membership based organization, or by being directed to it from the Department of Transportation’s public website or numerous government-issued public notices.

b. The ITS Architecture

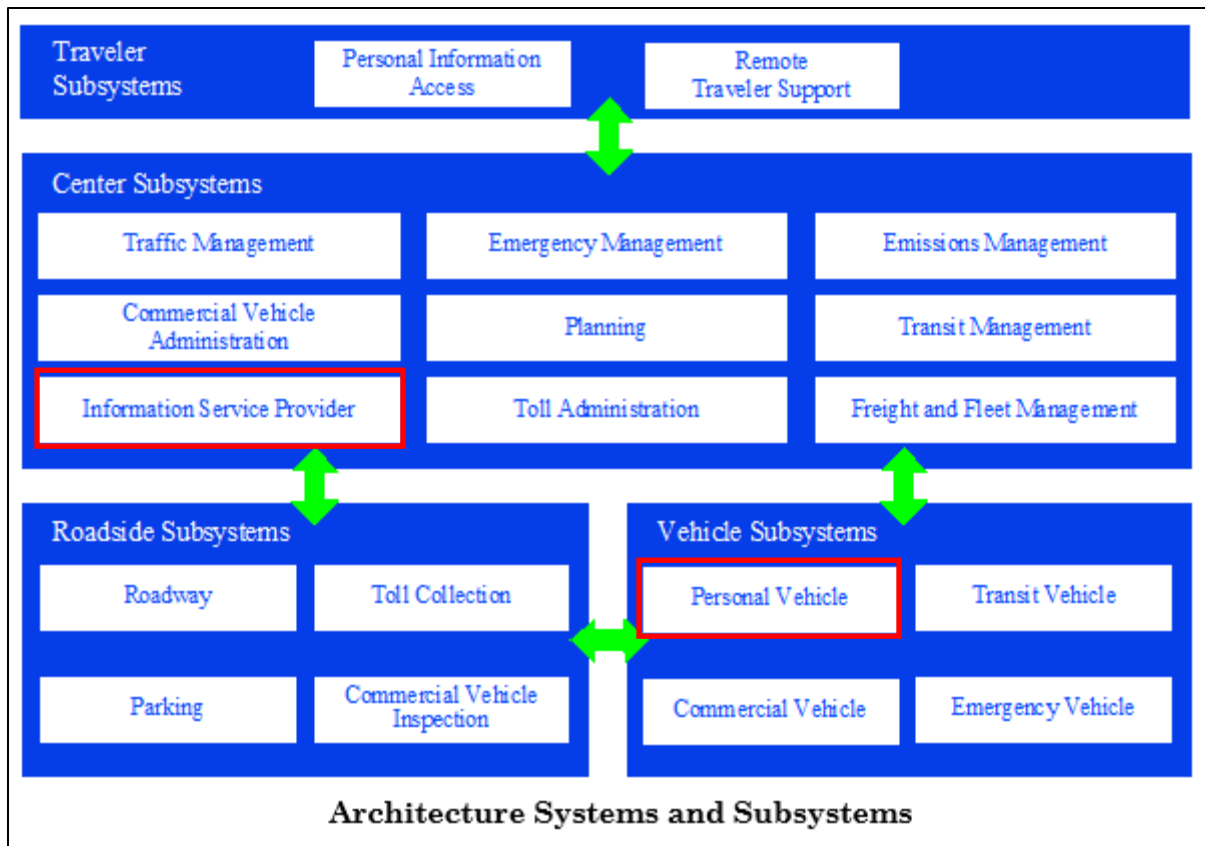
106. The ITS Architecture “provides a common structure for the design of intelligent transportation systems.” EX1010, 3. “The architecture defines the functions (e.g., gather traffic information or *request a route*) that must be performed to implement a given user service, the physical entities or subsystems

where these functions reside (e.g., the roadside or the vehicle), the interfaces/information flows between the physical subsystems, and the communication requirements for the information flows (e.g., wireline or wireless)” (emphasis added). *Id.* The ITS Architecture “identifies and specifies the requirements for the standards needed to support national and regional interoperability, as well as product standards needed to support economy of scale considerations in deployment.” *Id.* The ITS Architecture specifically identifies a route guidance message as using a standardized format, which I discuss below.

107. The ITS Architecture was developed based on the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, the law that identified the “need for... compatibility among intelligent [transportation] technologies implemented throughout the States.” EX1019, 2-3. ISTEA specifically directed the Secretary of Transportation to “develop and implement *standards and protocols* to promote widespread use and evaluation of ITS technology” and “promote *compatibility* among ITS technologies implemented throughout the States.” EX1025, 3 (emphasis added); *see also id.* (“Development of non-proprietary standards will make accessible the necessary technical information by which new and innovative companies can break into the ITS market to both products and services. Building to these standards will also ensure interoperability among multiple vendor products

much like the integration of a home stereo system.”). The Architecture was funded, developed, and published as “a guide [to] developing standards and making deployment decisions that will result in efficiency, economies of scale, and national interoperability.” EX1019, 2; *see also* EX1021 (ITS Architecture “identifies and specifies the requirements for the standards needed to support national and regional interoperability, as well as product standards needed to support economy of scale considerations in deployment”). “Standardization of interfaces is a *requirement* for successful implementation of the... National Architecture... so that systems that provide similar functions to the traveling public can use *interoperable equipment* and readily exchange information.” EX1025, 4 (emphasis added).

108. The ITS Architecture defines 19 interconnected subsystems (physical entities), including a Vehicle (VS) and an Information Service Provider (ISP). EX1010, 5-6. In addition, the ITS Architecture defines the processes for each subsystem functionality to implement a User Service, and specifications of the Data Flows and data structures for these processes. EX1006, 10, 19; EX1010, 3-4.



EX1010, 6 (annotated)

109. Of the User Services defined in the ITS Architecture, one is route guidance, EX1010, 2, in which the ISP calculates and provides an optimal (*e.g.*, “safest, least used, etc.”) route for a vehicle “using current... traffic conditions.” EX1006, 172-175; *see also* EX1005, 6-7, 13-17. In my view, the ITS Architecture is therefore analogous art to the ’743 Patent because both are in the same field of endeavor of route guidance. The ITS Architecture discloses establishing a wireless link between the vehicle subsystem and the ISP for this service. EX1005, 6.

Using this link, the vehicle subsystem transmits a Trip Request message to the ISP.

EX1005, 14 (“Driver... interacts with the corresponding subsystem to issue a Trip Request message to the ISP.”).

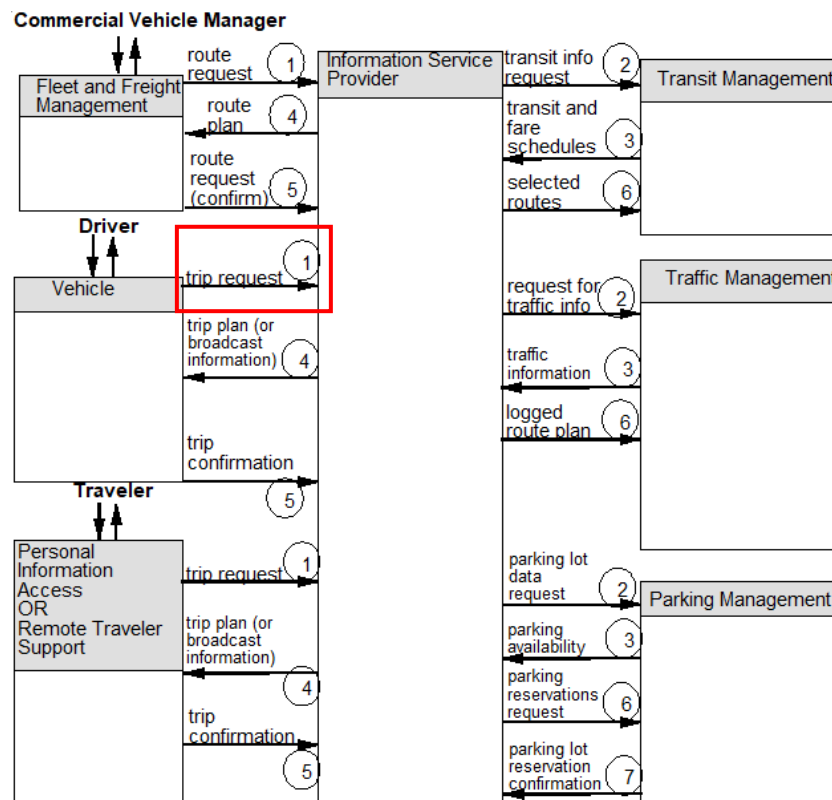
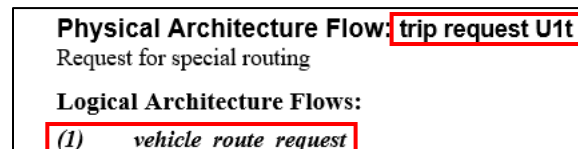


Figure 9 - Physical Architecture for Route Guidance

EX1005, 15 (annotated)

110. The Trip Request message is defined in the ITS Architecture as a vehicle_route_request message:



EX1005, 35-36 (annotated); *see also id.*, 5 (“Typically the physical architecture flow or highest level logical architecture data flows represent individual messages.”). The vehicle_route_request message “include[s] the necessary source and destination data from which a route can be computed.” EX1005, 35-36.

111. The ITS Architecture requires that, upon receiving the Trip Request message, the ISP accesses “current... traffic data” from a Traffic Management subsystem. EX1005, 13-15.

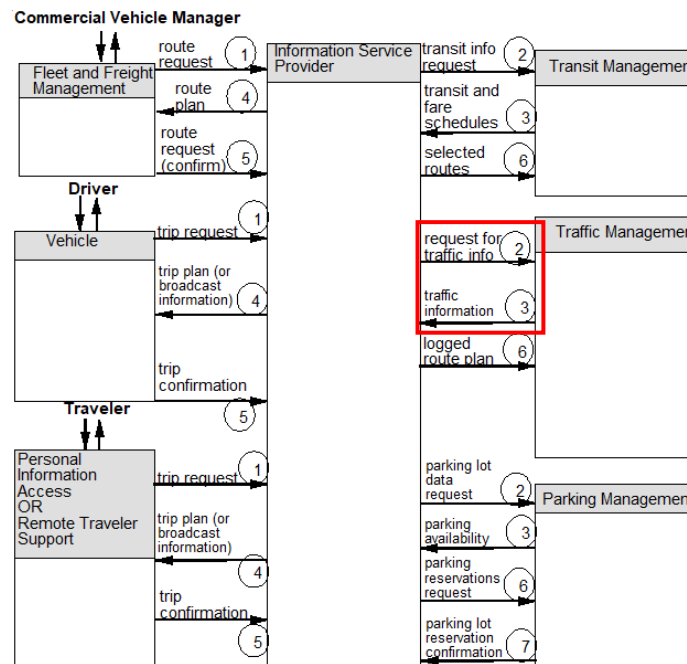


Figure 9 - Physical Architecture for Route Guidance

EX1005, 15 (annotated).

112. The ISP also accesses “current weather conditions” to calculate the best route. EX1008, 146; EX1007, 182-183 (input data for ISP’s route calculation

process includes fws_current_weather). The ISP then calculates the best route based on the real-time data and start and end route designations. EX1005, 13-15; EX1006, 175-177. Specifically, the ISP “processes a route and sends it to the requesting subsystem in the Trip Plan message” for subsequent display. EX1005 at 14; EX1006, 180 (route “visual[ly] output”); EX1005, 13 (“presenting the selected route to the driver... in the vehicle subsystem”).

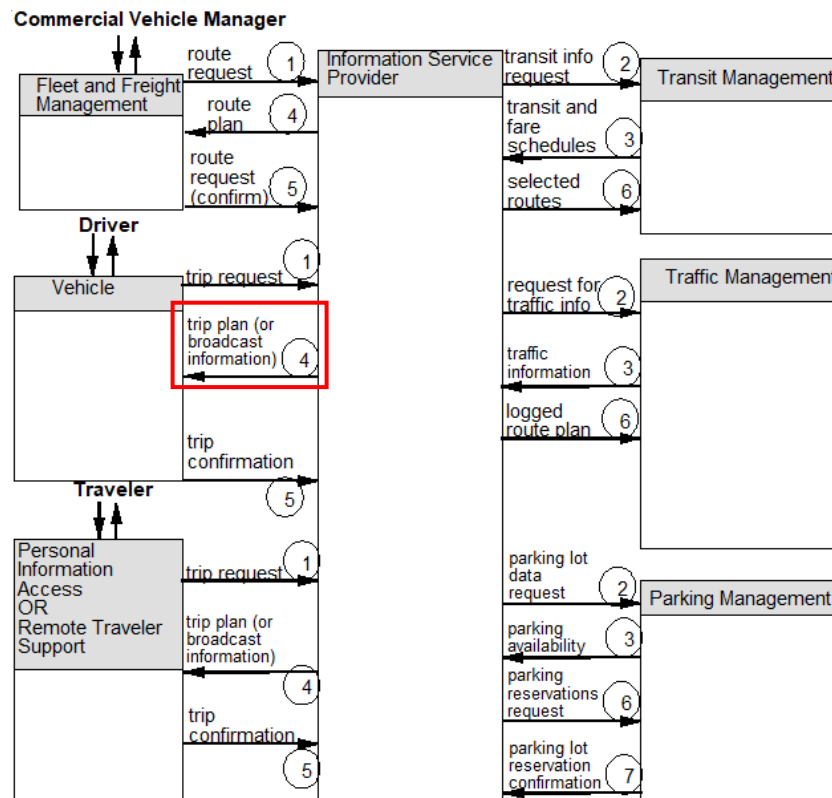


Figure 9 - Physical Architecture for Route Guidance

EX1005, 15 (annotated).

113. The Trip Plan message is defined in the ITS Architecture as a vehicle_guidance_route message:

Physical Architecture Flow: trip plan U1t A sequence of links and special instructions indicating efficient ways of navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans. (1) vehicle_guidance_route
--

EX1005, 44 (annotated); *see also id.*, 5 (“Typically the physical architecture flow or highest level logical architecture data flows represent individual messages.”).

114. The ITS Architecture discloses using a standardized (*i.e.*, non-proprietary) format for the vehicle_guidance_route message. EX1005, 42-43. The ITS Architecture discloses that its defined interfaces and data flows are bases for standardization, and specifically discussed 11 high-priority standards packages. EX1010, 14-16; EX1005, 3-4; EX1011, 16. “Each package is a special grouping of standards requirements and contextual information intended to be used” for standardization. EX1005, 3; *see also id.*, 4 (standards requirements package identifies “some subset of the National ITS Architecture” for standardization); EX1011, 8 (standardization of “data flows and interfaces defined in the architecture documents”). Standards Requirements Package 03 identifies vehicle_guidance_route, and its defined data structure, as a standardized message under the ITS Architecture. EX1005, 18-19 (“decomposition for the interfaces covered in this package”), 42-43, 120-121; *see also* EX1011, 77 (“trip plan” standardized under “Standard Pkg” 03). At least via Standards Requirements

Package 03, the ITS Architecture discloses using a standardized format for the vehicle_guidance_route message.

iii. Overview of Lappenbusch

115. The Lappenbusch reference (EX1013), “Interactive Traffic Display and Trip Planner,” discloses a user interface that “allows a user to find a shortest-time route between designated locations.” EX1013, Abstract. Lappenbusch is in the same field of route guidance as the ’743 Patent. Lappenbusch’s user interface is embodied by server computers 38 and a client computer, with the servers providing relevant data in a “common” (*i.e.*, non-proprietary) format that is “independent of the particular formats used within the various monitoring systems.” *Id.*, 3:41-49, 5:8-29, 7:2:19-28.

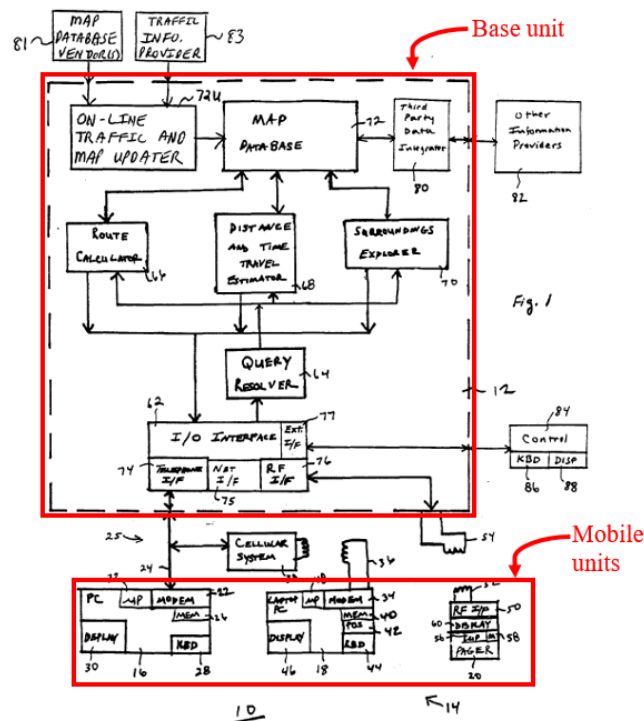
iv. Claim 1

a. 1[pre] “A method for providing an optimal route using real-time information for a navigation system comprising a client and a server, said server coupled to a computer network, said method comprising the steps of:”

116. If the preamble of claim 1 was treated as a limitation (I am informed that the preamble is not a limitation in this claim), Behr discloses the preamble of claim 1. Behr shows a system that provides route guidance from a base unit located at a central location to a mobile unit. EX1004, 1:3-6, 3:35-38, 4:5-8, 6:24-

27, 7:5-7, 7:20-21, 7:28-30, 7:38-39, 8:15-17, 12:9-12, 12:24-25, 38:30-41:8,

FIGS. 1-2 and 41. FIG. 1 of Behr shows the navigation system including the base unit (*server*) and mobile units (*client*):



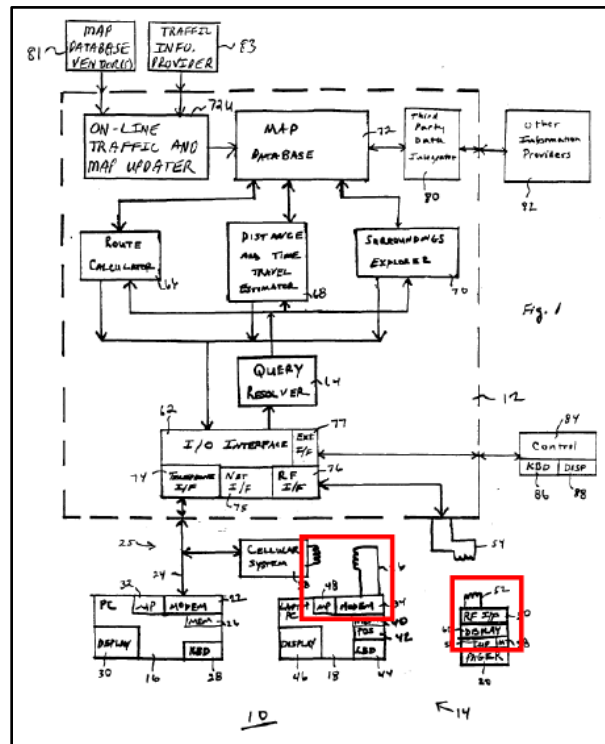
EX1004, 12:9-20, FIG. 1 (annotated).

117. The base unit (*server*) is coupled to at least one wireless communication network. EX1004, 16:18-38, 1:3-6, 20:10-26. The base unit calculates the best route using real-time information that includes traffic information, from information providing servers 82. EX1004, 17:39-18:3, 11:22-26, 18:4-13, 15:37-16:2, 19:27-36, FIG. 1.

b. 1[a] “establishing a wireless connection between the client and the server;”

118. Behr’s mobile unit (*client*) communicates with the base unit (*server*) using a wireless communication system, like cellular telephone or radio frequency transmission. EX1004, 1:3-6, 3:35-38, 8:23-26, 11:31-36, 14:34-37, 15:19-24. The mobile unit can have a modem configured to communicate information over a wireless transmission network like advanced radio data information services (ARDIS), cellular digital packet data (CDPD), RAM mobile data network, or cellular telephone system. *Id.* at 13:1-12, 14:2-12, 15:19-36, 20:15-24. The mobile unit can have an RF interface coupled to an antenna for receiving RF signals from an antenna coupled to the base unit. *Id.* at 14:34-37, 15:19-36. The base unit has an I/O interface. *Id.* at 15:37. The I/O interface has a telephone interface that couples the base unit to the commercial telephone system, an RF interface that couples the base unit with RF communication devices like an antenna, and a network interface that couples the base unit to wireless and/or wireline communication networks like CDPD, TCP/IP, ARDIS, or RAM. *Id.* at 16:2-22. Behr teaches a common example in which mobile unit and the base unit establishes communication with each other via the cellular telephone system. *Id.* at 20:11-26,

FIG. 2 step 100. A mobile unit including a modem coupled to the microprocessor to connect with the base unit is shown in FIG. 1 of Behr reproduced below:



Id., 12:9-20, 15:19-24, FIG. 1 (annotated). Therefore, it is my opinion that Behr discloses this element.

c. 1[b] “transmitting start and end route designations from the client to the server;”

119. Behr’s mobile unit (*client*) transmits start and end route designations to the base unit (*server*). Behr explains that the client sends a request (“query”) to the server for a navigation route, and the request “specif[ies] an origin point and a destination point.” EX1004, 20:27-21:7; *see also id.* at 23:18-23, 25:37-12, 25:20-

23. The navigation server calculates a best route based on these designations. *Id.*, 20:27-21:7.

d. 1[c] “accessing real-time information by the server;”

120. Behr’s navigation server (base unit) accesses real-time information. EX1004, 17:39-18:3, 11:22-26, 18:4-13, 15:37-16:2, 19:27-36. Behr explains that the navigation server includes a route calculator, a map database, and an on-line traffic and map updater. EX1004, 15:37-16:2, 17:25-18:20. The route calculator calculates a route between the origin and the destination using the large up-to-date map database. *Id.* at 4:22-30, 6:27-32, 7:9-11, 7:24-27, 8:1-8, 9:28-30, 15:37-38, 17:25-39, 21:21-24, 22:11-16, 26:34-27:2; 39:25-27, FIG. 2 step 114. The map database includes an accurate, complete, and up-to-date representation of geographic information like addresses, street names, navigation attributes (including turn restrictions, one-way streets, physical dividers, relative heights, and freeway sign text). *Id.* at 17:31-39. The map database of the base unit is maintained based on automatic, real time database updates. *Id.* at 11:22-26. The traffic and map updater receives updated information from map database vendors and traffic information providers and ensures that the map database is current. *Id.* at 17:39-18:3.

e. 1[d] “calculating the optimal route by the server, based on the real-time information and said start and end route designations;”

121. Behr discloses that the navigation server includes a route calculator, a map database, and an on-line traffic and map updater. EX1004, 15:37-16:2, 17:25-18:20. Behr’s navigation server (base unit) performs this operation/step. In response to the origin and destination data (start and end route designations) received from the mobile unit, the route calculator calculates a route between the origin and the destination using the large up-to-date map database. *Id.* at 4:22-30, 6:27-32, 7:9-11, 7:24-27, 8:1-8, 9:28-30, 15:37-38, 17:25-39, 21:21-24, 22:11-16, 26:34-27:2; 39:25-27, FIG. 2 step 114. The map database of the base unit includes an accurate, complete, and up-to-date representation of geographic information like addresses, street names, navigation attributes (including turn restrictions, one-way streets, physical dividers, relative heights, and freeway sign text). *Id.* at 17:31-39. The base unit’s map database is maintained via automatic, real time database updates. *Id.* at 11:22-26. The traffic and map updater receives updated information from map database vendors and traffic information providers and ensures that the map database is current. *Id.* at 17:39-18:3.

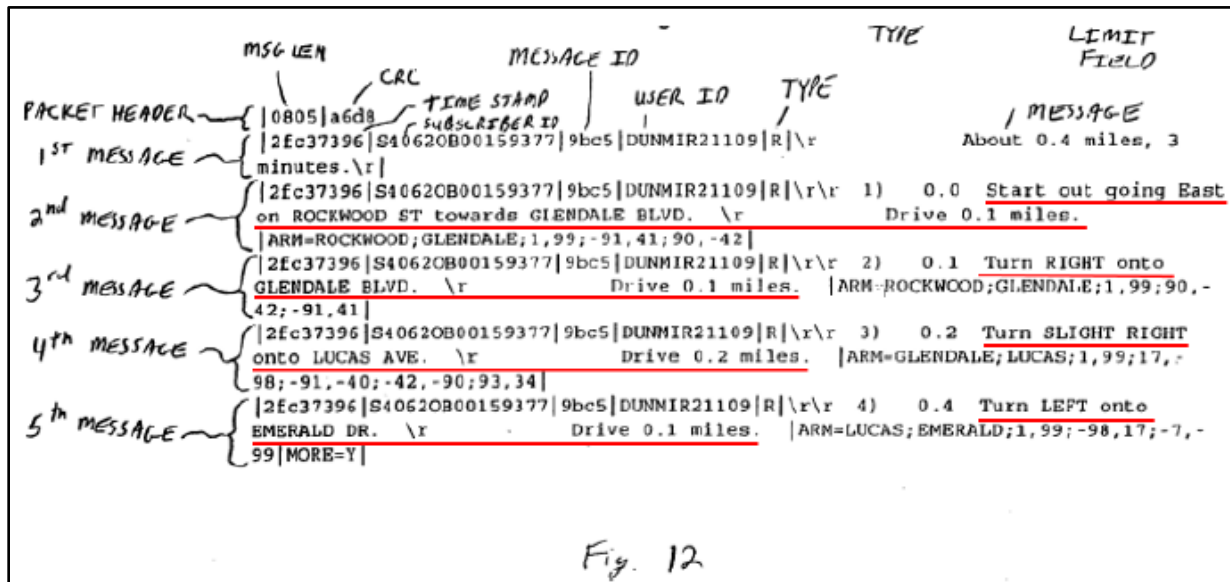
122. The route calculator takes into account routing restrictions like toll road avoidance, turn restrictions at a specified time of day, and other restrictions

that may be specified by an operator at the base unit in response to a temporary condition or that may be added to the map database when the restrictions become nationally available. *Id.* at 18:4-13. The base unit includes a third-party data integrator that receives additional data like on-line yellow pages information, news, weather, and traffic advisory information from other information providers for responding to queries. *Id.* at 15:37-16:2, 19:27-36. So for at least the above reasons, Behr's navigation server calculated optimal routes based on real-time information, as was conventional in the art at the time.

f. 1[e] “formatting the optimal route into a non-proprietary, natural language description;”

123. Behr explains that the server of the base unit formats a response message including route guidance information. EX1004, 4:30-32, 6:32-36, 9:20-21, 13:28-30, 18:21-25, 22:19-27, 27:24-35, 30:20-22, FIG. 2 step 116. The route guidance information has navigation instructions from the origin to the destination. *Id.* at 6:36-7:6, 7:15-19. The navigation instructions are divided into several lines of text, each separated by carriage return/newline characters. *Id.*, 8:32-36, 26:29-37, 30:24-30. Each response message may correspond to a single maneuver or be the complete text of the navigation instructions. *Id.* at 30:28-30. Accordingly, Behr discloses this element.

124. Behr includes many examples of response messages that include non-proprietary, natural language text navigation instructions. *Id.* at 8:32-36, 30:24-26, FIGS. 12, 14, 20, 22, 24, 26, 28, 30. Behr's examples of the plain text description for each link in the route (using predefined generic terms like road names and turning directions) are very similar to the examples in the '743 patent specification (EX1001, 3:35-40; 10:10-21 (the natural language description "includes at least the street name...")). FIG. 12 of Behr illustrates some of Behr's many examples of using non-proprietary, natural language text for each link along the optimal route:



Id., FIG. 12 (annotated)

125. Behr's FIG. 20 also illustrates more of Behr's examples of using non-proprietary, natural language text for each link along the optimal route:

```
|0753|2bc6|2ef5d987|IDSDIVISION|9d98|BOBD|R|\r          About 9.1 miles,
20 minutes.\r|~
|2ef5d987|IDSDIVISION|9d98|BOBD|R|\r\r 1) 0.0 Start out going
Northwest on S FLINT RIDGE WAY. \r          Drive a short distance.
|ARM=FLINT RIDGE;WHITE FIR;1,99;-79,-61;24,-96|~
|2ef5d987|IDSDIVISION|9d98|BOBD|R|\r\r 2) 0.0 Turn LEFT onto E WHITE
FIR LN. \r          Drive 0.1 miles. |ARM=FLINT RIDGE;WHITE FIR;1,99;-
79,-61;24,-96|~
|2ef5d987|IDSDIVISION|9d98|BOBD|R|\r\r 3) 0.1 Turn RIGHT onto S LONE
PINE LN. \r          -- Drive 0.1 miles. |ARM=WHITE FIR;LONE --
PINE;1,99;67,-73|~
|2ef5d987|IDSDIVISION|9d98|BOBD|R|\r\r 4) 0.2 Turn LEFT onto E
SOMERSET LN. \r          Drive a short distance. |ARM=LONE
PINE;SOMERSET;1,99;-93,-35;38,-92|MORE=Y|~

Fig. 20
```

Id., FIG. 20 (annotated), *see also* FIGS. 22, 24, 26, 28, 30

126. As shown in FIGS. 12 and 20 of Behr (and in the other examples in the figures), a POSITA would have easily recognized that the text driving instructions for the optimal route are divided into multiple parts or messages, with each message including a natural language description of the street name and a turning orientation. *Id.* at FIG. 12, 8:30-9:6 (“responses may include, for example, textual navigational directions” that are “adaptable to any system” and “support for many different mobile unit platforms”), 11:27-36 (the format of route requests and responses is “independent of specific hardware” and “using any commonly available hardware devices”), 15:27-36 (“independently of particular hardware configurations... and of the communication system”), 38:30-41:8, FIGS. 15-38 and

41. Also, a POSITA would have recognized that, much like the '743 patent's preferred embodiment in which the calculated route is "compressed" prior to transferring to the vehicle's computer (8:45-53), Behr teaches the same known option in which the natural language description of the route can be converted to a "compressed form" for transmission to the mobile device and then expanded to the full natural language text at the mobile device. *Id.* at 29:7-24, 36:13-38:29.

127. In the earlier IPR filed by Google, the Board held that "Petitioner fails to show a reasonable likelihood of demonstrating that Behr discloses formatting that is not specific to the particular mapping database used on the client." IPR2017-00819, Paper 16 at 19. Google's petition did not address this, but Behr, does disclose a messaging format "adaptable to any system." EX1004, 9:1-2. The "adaptable to any system" format certainly indicates a non-proprietary format; it has to be or else it wouldn't be "adaptable to any system." Regardless, a POSITA would have at least found it obvious to implement a non-proprietary format in view of the ITS Architecture or Lappenbusch.

Behr in view of the ITS Architecture

128. As I have explained above, the ITS Architecture includes a navigation system that has a route guidance user service in which a server (Information Service Provider (ISP)) calculates and provides an optimal (*e.g.*,

“safest, least used, etc.”) route to a client (vehicle subsystem) “using current... traffic conditions” (using real-time information). EX1006 at 172-175; *see also* EX1005 at 6-7, 13-17.

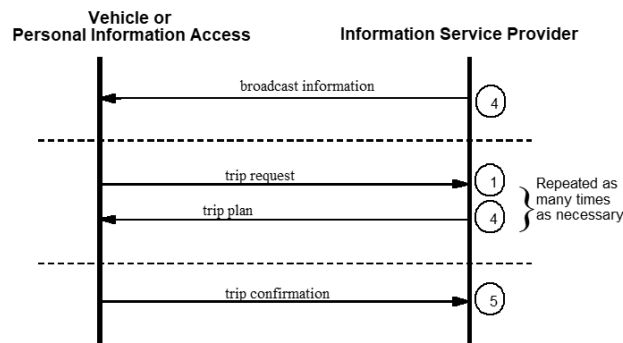


Figure 10 - Route Guidance Transaction Set

EX1005 at 16

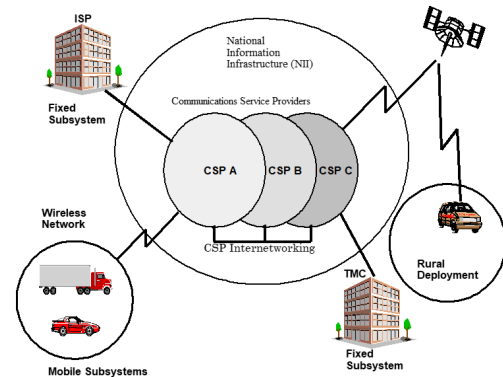


Figure 13 - ITS Communications Network Topology

EX1005 at 45

129. The ISP “processes a route and sends it to the requesting subsystem in the Trip Plan message.” EX1005 at 14. The Trip Plan message is defined in the Architecture as a vehicle_guidance_route message:

Physical Architecture Flow trip plan U1t
A sequence of links and special instructions indicating efficient ways of navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.
(1) vehicle_guidance_route

EX1005, 41 (annotated); *see also id.*, 5 (“Typically the physical architecture flow or highest level logical architecture data flows represent individual messages.”). The vehicle_guidance_route message provides the “efficient” (*optimal*) route based on the “traffic conditions” (*real-time information*). EX1005 at 42-43; *see*

also EX1006 at 175 (“routes are selected using a variety of parameters, e.g. safest, least used, etc. and traffic data.”).

130. The Architecture discloses using a standardized (*non-proprietary*) format for the calculated route, `vehicle_guidance_route`. EX1005, 42-43. In fact, a fundamental objective of the Architecture was “[t]o provide a framework for the definition of appropriate standards.” EX1012, 10. To do this, the Architecture required its subsystem interfaces be “open and flexible to prevent unnecessary restriction to implementation choice” and to provide a system “that is both compatible and interoperable across the nation.” EX1012, 1. By utilizing open and standardized interfaces and data definitions, the Architecture’s subsystems had to be modular and interchangeable to ensure that users “do not become captive to proprietary systems.” EX1012, 10; *see also* EX1032, 18 (“architecture prevents “vendor lock-in”).

131. The Architecture disclosed that its defined interfaces and data flows were bases for standardization, and specifically identified 11 high-priority standards packages. EX1010, 14-16; EX1005, 3-4; EX1011, 16. “Each package is a special grouping of standards requirements and contextual information intended to be used” for standardization. EX1005, 3; *see also id.*, 4 (standards requirements package identifies “some subset of the National ITS Architecture” for

standardization); EX1011, 8 (standardization of “data flows and interfaces defined in the architecture documents”); EX1032, 19 (ITS Architecture identifies the “[d]ata standards” and “message sets” for standardization, to “provide uniform formats for data sharing across ITS applications” and “define message content... amount various ITS elements and subsystems”).

132. Standards Requirements Package 03 included the ISP wireless interfaces, and specifically described the recognized need to standardize a “Message Set² for... Route Guidance.” EX1011, 94. The 03 package specified vehicle_guidance_route, and its defined data structure, as a standardized message under the Architecture. EX1005, 18-19 (“decomposition for the interfaces covered in this package”), 42-43, 120-121; *see also* EX1011, 77 (“trip plan” standardized under “Standard Pkg” 03).

² A “message set” defines the “standard format” in which data is transmitted.

EX1026, 72; *see also* EX1032, 17.

(1) *vehicle_guidance_route*

This data flow is used within the Provide Driver and Traveler Services function and is a special form of "route" for vehicle guidance only. It contains a subset of the data items included in the "route" data flow to meet the requirements of in-vehicle infrastructure based guidance as opposed to the more general requirements for a route need as part of a trip planning activity. The data flow consists of the following data items each of which is defined in its own DDE:

- (2)*route_identity*
- (2)*route_segment_description*
- (2)*route_segment_end_point*
- (3)*location_identity*
- (2)*route_segment_estimated_travel_time*
- (2)*route_segment_report_position_points*
- (3)*list_size*
- (3)*route_segment_way_point*
- (4)*location_identity*
- (2)*route_segment_start_point*
- (3)*location_identity*
- (2)*vehicle_identity*

EX1005 at 42-43

133. Standards Requirements Package 03 of the ITS Architecture therefore disclosed using a standardized format for the *vehicle_guidance_route* message (*formatting the optimal route into a non-proprietary description*), which was open and therefore interoperable with any suppliers' software (*i.e.*, local mapping database), EX1011, 3, to ensure that users "do not become captive to proprietary systems." EX1012, 10; *see also* EX1032, 19 ("Standards and protocols establish a common vocabulary so that ITS elements can understand each other," without which subsystems are "incapable of seamless informaton exchange"). Thus, "[t]he architecture... allows ITS products from competing vendors to work together" such that "'vendor lock-in,' functional isolation, and obsolescence—all

of which can be experienced with closed proprietary solutions—are less likely with adherence to a national framework.” EX1032, 18. In other words, the ITS Architecture discloses standardizing messages, including the route guidance message, “to ensure interoperability of conforming products from competing vendors” and “reassure purchasers that their systems will be compatible with other ITS elements.” EX1032, 11-12.

134. A POSITA would have found it obvious to implement Behr’s natural language description route information as an open standardized (*i.e.*, non-proprietary) format, as taught by the ITS Architecture, for a number of reasons.

135. For example, the ’743 Patent, Behr, and the ITS Architecture all pertain to the same field of route guidance systems, as I discussed above. In addition, the three disclosures all address problems of compatibility between the different subsystems (*i.e.*, remote client and route calculation server) providing the route guidance service. EX1001, 2:35-42 (“Another problem with the current systems is that the proprietary server cannot be used with navigation systems and mapping databases provided by other manufacturers.”); EX1004, 3:29-34 (“There is a further need for a routing and information system which is independent of any particular hardware configuration and which may be implemented on any suitably equipped data processing apparatus...”); EX1012, 10 (“The objective of the ITS

architecture development effort is to create an integrated system architecture whose component subsystems satisfy the ITS architecture goals, ensure nationwide compatibility and interoperability, support the necessary range of implementations, and allow for cost-effective expansion and modernization”).

136. Also, a POSITA implementing Behr’s natural language route guidance message would have been motivated to provide that message in a standardized, *i.e.*, non-proprietary, format as taught by the ITS Architecture, in order to improve compatibility and interoperability. To be sure, the ITS Architecture expressly provides such a motivation so as to ensure that users “do not become captive to proprietary systems.” EX1012, 10. Standardizing the “data flows and interfaces defined in the architecture documents” (EX1011, 8), including the specifically identified vehicle_guidance_route message, would “allow[] multiple suppliers of equipment and software that will directly connect to other ITS subsystems.” EX1011, 3 (emphasis added); *see also id.*, 4 (“Open standards will further benefit the consumer by enhancing competition for the range of products necessary to implement the ITS user services.”), 6 (“Potential Benefits...”). Accordingly, a POSITA implementing Behr’s route guidance system would have been motivated to use a non-proprietary route guidance message as expressly taught by the ITS Architecture, to improve interoperability,

compatibility, and consumer choice and “ultimately provide enhanced service to the consumer.” *Id.*, 6; *Zup v. Nash Mfg.*, 896 F.3d 1365, 1371 (Fed. Cir. 2018) (“motivation to combine may be found explicitly or implicitly in market forces; design incentives; the interrelated teachings of multiple patents; any need or problem known in the field of endeavor at the time of invention and addressed by the patent; and the background knowledge, creativity, and common sense of the person of ordinary skill” (internal quotation marks and citations omitted)).

137. In addition, a POSITA would have had a reasonable expectation of success in implementing Behr’s natural language route guidance message as a non-proprietary format, as taught by the ITS Architecture. The two references disclose nearly identical processes for providing route guidance information, in which a client device transmits a routing request including start and end designations to a server, the server uses real-time information to calculate the optimal route, and the server returns the calculated route to the client for display, as I have explained above. While the ITS Architecture suggests a particular data structure for its non-proprietary message, it notes that this structure is merely a framework with “a large number of optional data fields.” EX1011, 4. Moreover, there is a complete functional overlap between the contents of Behr’s message and that suggested in the ITS Architecture, with both providing route guidance information for display.

The ITS Architecture's non-proprietary message "provide[s] information from which guidance can be produced in a form which is understandable by the driver, e.g. lane selection, right/left turns, etc." EX1008, 234. A POSITA would have no reason to doubt that using a non-proprietary format for a route guidance message as taught by the ITS Architecture would be equally operable and successful in achieving the aforementioned benefits thereof in the nearly identical system of Behr, which is similarly directed to providing compatibility and "adaptab[ility] to any system." EX1004, 9:1-2.

Behr in view of Lappenbusch

138. A POSITA would also have found it obvious to implement a non-proprietary format in view of, as one example, the teachings of Lappenbusch.

139. Lappenbusch discloses a navigation system having a server that provides data used by the client's navigation function "in a common format that is independent of the particular formats used within the various monitoring systems." EX1013 at 7:51-55; *see also*, 5:21-29, 3:41-49, 9:22-25, 2:19-28. This "make[s] it possible for users to access information in a format that is chosen for their particular needs, specifically standard PC file formats" and overcomes problems in conventional systems in which "data... is available only in different formats,

depending on the particular proprietary format used by each monitoring system.”

EX1013 at 9:22-25, 2:19-28.

140. Based on Lappenbusch’s teachings, a POSITA would have found it obvious to implement Behr’s natural language description route information in a common (*i.e.*, non-proprietary) format, for many reasons.

141. For one, the ’743 Patent, Behr, and Lappenbusch all pertain to the same field of endeavor of route guidance systems, as I explained above. In addition, the three disclosures all address problems of compatibility between the different entities (*i.e.*, remote client and information providing server) of the route guidance system. EX1001, 2:35-42 (“Another problem with the current systems is that the proprietary server cannot be used with navigation systems and mapping databases provided by other manufacturers.”); EX1004, 3:29-34 (“There is a further need for a routing and information system which is independent of any particular hardware configuration and which may be implemented on any suitably equipped data processing apparatus...”); EX1013, 2:19-28. To be sure, Lappenbusch specifically addresses the problem of different subsystems providing data in different proprietary formats, thereby limiting the accessibility to information for route guidance. EX1013, 2:19-28.

142. Furthermore, a POSITA implementing Behr's natural language route guidance message would have been motivated to provide that message in a common or non-proprietary, format as taught by Lappenbuch, in order to improve compatibility and access to information. EX1013, 7:51-55, 9:22-25. A POSITA would have found such a motivation to implement a non-proprietary format for server-provided information throughout the route guidance art. *See, e.g., supra*, Sec. VIII.A.iv (motivation to combine with ITS Architecture). Lappenbusch, explicitly provides such a motivation so as to "*make it possible for users to access information in a format that is chosen for their particular needs.*" *Id.*, 9:22-25. EX1012, 10. U.S. Patent No. 6,240,360 to Phelan (EX1027) similarly teaches using a standardized protocol for transmitting server-provided navigation information to a client device such that there is no "need to have knowledge of the map server software provided on the map server, and vice versa." EX1027, 4:7-12, Abstract, 7:65-8:38, FIGS. 1-3. As a result, "servers providing information do not have to deal with maps, map ownership issues or mapping software, and *information from several different sources* can be integrated on a single screen." EX1027, 9:21-30; *see also* EX1028, 5:29-41 ("Preferably, *information content, communications protocols, and information geographic referencing would all be in accordance with existing industry standards and evolving Intelligent*

Transportation Systems (ITS) open systems standards. Source providers of general travel conditions information 20 would include traffic operations centers, traveler information centers, or any other information service provider..."); *id.*, 5:5-19 ("...present invention does not rely on any proprietary communications protocols or non-public geographic referencing methods, but rather provides open communications and geographic referencing methods to ensure the broadest application of the invention and broadest availability to travelers..."). Therefore, a POSITA implementing Behr's route guidance system would have been motivated to use non-proprietary server-provided messages to improve interoperability, compatibility, and access to information from different sources, as described above. I am informed that motivation to combine teachings may be found explicitly or implicitly in market forces, design incentives, the interrelated teachings of multiple patents, any need or problem known in the field of endeavor at the time of invention and addressed by the patent, and/or the background knowledge, creativity, and common sense of the person of ordinary skill.

143. In addition, a POSITA would have had a reasonable expectation of success in implementing Behr's natural language route guidance message as a non-proprietary format. The two references both disclose a route guidance system in which information for route guidance is received from a server. A POSITA would

have no reason to doubt that using a non-proprietary format, as taught by Lappenbusch, for a route guidance message would be equally operable and successful in achieving the aforementioned benefits thereof in the system of Behr.

g. 1[f] “downloading said non-proprietary, natural language description to the client;”

144. Behr discloses that the response, which is “formatted in accordance with a data communications protocol,” is transmitted from the base unit (server) to the mobile unit (client). EX1004, 22:19-29. Accordingly, Behr discloses this feature.

h. 1[g] “reconstructing the optimal route by the client using a local mapping database; and”

145. Behr’s mobile unit includes an on-board database with information and maps for a limited metropolitan area, and accordingly discloses this element. EX1004, 38:30-40:7, 39:1-5, 39:20-22. The mobile unit uses the on-board database to reconstruct the optimal route, for example, by comparing the route information received from the base unit with map information stored in the on-board database. *Id.*, 39:6-31, FIG. 41 step S3. The route information transmitted from server (base unit) to a remote mobile unit can “include which of the streets is included in the route to be travelled so that for example, that street may be highlighted in the graphical display.” *Id.*, 28:7-10. The mobile unit obtains maps for a route and

maps for an area not covered by the on-board database from the base unit, in order to supplement the on-board database. *Id.*, 39:6-20, FIG. 41. If any part of the route is not adequately covered by the maps stored in the on-board database, the mobile unit requests, from the base unit, stripmaps for the portions of the route which are not adequately covered by the maps stored in the on-board database. *Id.*, 39:37-40:1, FIG. 41 step S5.

146. A POSITA would have plainly recognized from Behr, that each of the mobile units can have different maps stored in the on-board database due to Behr's explanation that a mobile unit may need to receive stripmaps to update its on-board database in order to reconstruct the optimal route from the on-board database. A POSITA would have understood that Behr's system provides similar functionality and features of the '743 Patent because Behr's system also "alleviates the need to have specific pre-defined turn-by-turn mapping databases installed on the client" and "can be used with any mapping database installed on the client navigation system." EX1001, 2:46-50.

i. 1[h] "displaying said optimal route on a display system coupled to the client."

147. Behr discloses that the mobile unit includes a display that displays the route guidance information. EX1004, 4:30-33, 7:30-33, 8:8-14, 9:30-36, 13:1-3,

13:31-34, 14:31-32, FIG. 1. For example, the mobile unit includes a graphical display that shows map portions and textual information providing travel directions. *Id.*, 9:32-36, 9:38-10:8, 32:30-35, FIGS. 6-10. As shown in Figure 1, the mobile unit includes a display and a microprocessor. *Id.* at FIG. 1. A POSITA would have recognized that the display is coupled to the microprocessor for displaying the route guidance information. *See id.*, FIG. 6-10. Accordingly, Behr discloses this element.

148. Behr also described the conventional option in which the mobile unit includes an on-board database containing maps for a metropolitan area and requests from the base unit, as needed, stripmaps for the portions of the route which are not adequately covered by the maps stored in the on-board database. EX1004, 38:30-41:8, FIG. 41. As part of the mobile unit's operation to reconstruct the optimal route for displaying to the user, Behr's mobile unit determined whether portions of the route were adequately covered by comparing the route information received from the base unit with map information stored in the on-board database. *Id.*, 39:27-31, FIG. 41 step S3. If any part of the route was not adequately covered by the maps stored in the on-board database, the mobile unit requested, from the base unit, stripmaps for the portions of the route which were not adequately covered by the maps stored in the on-board database. *Id.*, 39:37-40:1, FIG. 41 step

S5. Behr further disclosed that the mobile unit receives selected map portions for display, and displaying the route by highlighting streets on the display. *Id.*, 12:2-7, 28:7-10. Accordingly, Behr disclosed the client displaying the optimal route on a display.

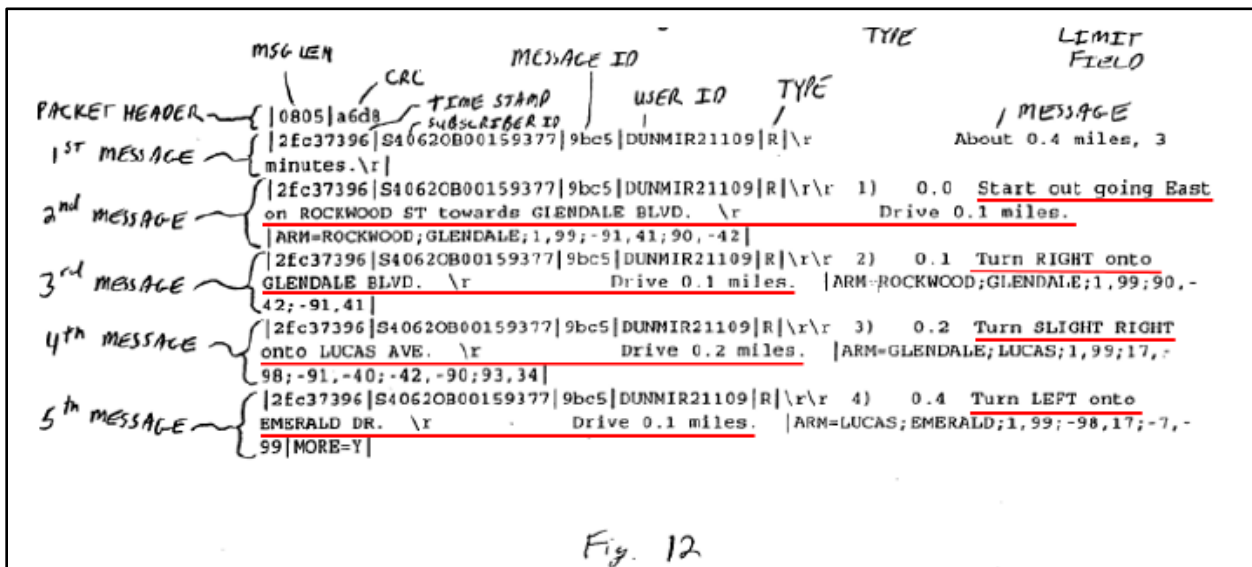
v. Claim 2

- a. “The method of claim 1, wherein said step of formatting includes the step of dividing the optimal route into one or more links, wherein each link includes at least a street name and a turning orientation.”**

149. Behr explains that the route guidance information in the formatted response message includes navigation instructions divided into several lines of text, each separated by carriage return/newline characters. EX1004, 8:32-36, 26:29-37, 30:24-30. Each response message or line thereof may correspond to a single maneuver from one road to another. *Id.*, 30:28-30, 31:27-29, FIG. 12. That is, each line may correspond to a particular link. The maneuver arm information conveyed in each line specifies “the road being driven on at the beginning of the maneuver” and “the road being driven on at the end of the maneuver.” *Id.*, 31:27-29. Further, each maneuver includes a turning orientation, in both a message field (e.g., “Turn RIGHT onto GLENDALE BLVD.” (FIG. 12)) as well as the x_2 , y_2 values corresponding to the “to” road being turned onto. *Id.*, FIG. 12, 32:2-16.

With respect to the latter, the x_2 , y_2 values indicate a turning angle or orientation from the current road to the “to” road. *Id.*, 32:2-16. Accordingly, Behr discloses this element.

150. An example of the links divided into separate lines “by carriage return/newline characters” in the formatted response message is shown in FIG. 12 of Behr:



Id., FIG. 12 (annotated)

151. Each of the 3rd-5th messages corresponds to a different “link” or maneuver from one street to the next. Each of these messages includes a street name and a turning orientation:

Message	Street Name	Turning Orientation
---------	-------------	---------------------

3 rd	GLENDALE BLVD.	Right (90, -42)
4 th	LUCAS AVE.	SLIGHT RIGHT (17, - 98)
5 th	EMERALD DR.	LEFT (-98, 17)

152. The ITS Architecture also formats its non-proprietary vehicle_guidance_route message by dividing the route into segments (*one or more links*).

```
route_identity
+ route_segment_number{route_segment_description
    + route_segment_end_point
    + route_segment_estimated_travel_time
    + route_segment_report_position_points
    + route_segment_start_point}
+ vehicle_identity.
```

EX1005 at 120 (annotated)

vi. **Claim 3**

- a. **“The method of claim 2, wherein said step of reconstructing includes the steps of: searching said local mapping database for a closest match of said street name and said turning orientation for each of said links; and building the optimal route by combining each of said closest matches from said searching step.”**

153. Behr's mobile unit includes an on-board database with information and maps for a limited metropolitan area. EX1004, 38:30-40:7, 39:1-5, 39:20-22. The mobile unit uses the on-board database to reconstruct the optimal route, e.g., by comparing the route information received from the base unit with map information stored in the on-board database. *Id.*, 39:6-31, FIG. 41 step S3. The route information transmitted from server (base unit) to remote mobile unit can "include which of the streets is included in the route to be travelled so that for example, that street may be highlighted in the graphical display." *Id.*, 28:7-10. To supplement the on-board database, the mobile unit obtains maps for a route and maps for an area not covered by the on-board database from the base unit. *Id.*, 39:6-20, FIG. 41. If any part of the route is not adequately covered by the maps stored in the on-board database, the mobile unit requests, from the base unit, stripmaps for the portions of the route which are not adequately covered by the maps stored in the on-board database. *Id.*, 39:37-40:1, FIG. 41 step S5. Accordingly, Behr discloses this feature.

vii. Claim 4

- a. "The method of claim 1, wherein said accessing step comprises the step of accessing a traffic database comprising current traffic conditions; and querying said traffic database for determining current traffic"**

conditions between locations defined by said start and end route designations.”

154. Behr’s base unit includes an on-line traffic and map updater 72U that “receives updating information from map database vendor(s) 81 and traffic information providers 83 and maintains map database 72 current.” EX1004, 17:39-18:3; *see also id.*, 19:27-36.

155. The ITS Architecture also discloses this feature. Specifically, the ITS Architecture discloses that upon receiving the Trip Request message, the ISP (*server*) queries a Traffic Management subsystem (*traffic database*) for “current... traffic data” (*current traffic conditions*) “relevant to the route request” (*conditions between locations defined by said start and end route designations*). EX1005, 13-15.

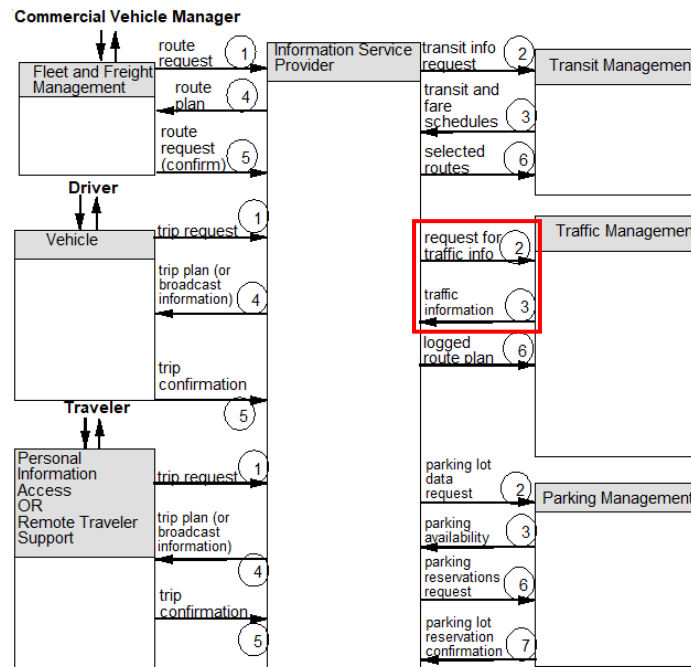


Figure 9 - Physical Architecture for Route Guidance

EX1005 at 15 (annotated). Accordingly, both Behr and the ITS Architectures disclosed this feature.

viii. Claim 5

- a. **“The method of claim 1, wherein said real-time information includes one or more from the set of: current traffic conditions; highway ramp configurations; current weather conditions; constriction information; road restrictions; detour information; and event traffic information.”**

156. Behr discloses real-time information, including at least current traffic conditions and current weather conditions, being taken into account in its route calculation. EX1004, 17:39-18:3, 19:27-36. The map database of the base unit is maintained via automatic, real time database updates. *Id.*, 11:22-26. The traffic and

map updater receives updated information from map database vendors and traffic information providers and ensures that the map database is current. *Id.* at 17:39-18:3.

ix. Claim 6

- a. “The method of claim 1, wherein said wireless connection is accomplished using a cellular network.”**

157. Behr discloses this feature - wireless communication between the mobile unit and the base unit via a cellular network. EX1004, 8:23-26 (“cellular”).

x. Claim 7

- a. “The method of claim 1, wherein said transmitting step includes the step of entering into a keypad data entry field, said start and stop route designations including a name for one or more of: a city; a state; a country; and a street.”**

158. Behr explains that “a user manipulates [a] keyboard 28 to formulate a request... seek[ing] the route between an origin and a destination. The keyboard 28 thus provides an input means at the mobile unit for providing an origin and a destination.” EX1004, 13:20-25. The input origin or destination includes at least an address, which a POSITA would understand to include at least a name of a city and a street. *See, e.g., id.*, 17:16-21 (“address... definition of cross streets”).

xi. Claim 12

- a. “The method of claim 1, wherein said downloading step comprises the step of compressing said natural language description.”**

159. Behr explains that its response message, including the natural language route guidance, is compressed using, e.g., a “current phrase compression table,” “the current dictionary,” or “the L-Z (Lev-Zempel) compression algorithm.” EX1004, 29:7-24; *see also id.*, 36:13-27.

160. The ITS Architecture also explains that “[t]he ISP and receiving subsystem may use a data compression/decompression process at both ends to minimize the communications cost of this potentially large [route] message.” EX1005, 14.

xii. Claim 13

- a. “The method of claim 1, wherein said calculating step further comprises the step of reading user-specific data in calculating the optimal route.”**

161. Behr discloses a route determination that accounts for user-specified data, like user settings for avoiding tolls, avoiding left turns, avoiding limited access roads, or specifying a time of day for starting the route. EX1004, 27:7-10.

162. The ITS Architecture also teaches that its route calculation process uses user-specific “preference and constraints specified in the route request.”

EX1006 at 177. This “enable[s] the requester to influence the route that the process chooses.” *Id.* For example, the requester may specify a constraint prioritizing the use of urban roads. *Id.* In this case, “the process will calculate a route that uses route segments that are urban roads and will ignore those that are freeways.” *Id.* In addition, the ITS Architecture discloses calculating the routes based on whether the user is a driver of an emergency vehicle or a commercial vehicle. *Id.*

163. In particular, the route request is embodied as a vehicle_route_request message, which includes user-specific constraints, like “constraint_on_acceptable_travel_time” and “constraint_on_urban.” EX1005, 35-36.

(2)constraint_on_acceptable_travel_time
(2)constraint_on_ahs_lanes
(2)constraint_on_eta_change
(2)constraint_on_interstate
(2)constraint_on_load_classification
(2)constraint_on_special_needs
(2)constraint_on_urban
(2)constraint_on_vehicle_type
(2)departure_time
(3)time
(2)desired_arrival_time
(3)time
(2)destination
(2)origin
(3)route_point

(2)preferred_alternate_routes
(2)preferred_route_segments
(2)preferred_routes
(2)vehicle_identity
(2)vehicle_location_for_dynamic_guidance
(3)location_identity

EX1005, 35-36.

xiii. Claim 14

a. “The method of claim 1, wherein said computer network is the Internet.”

164. Behr discloses that its navigation server (base unit) is connected to the Internet. EX1004, 16:18-25 (“The I/O interface 62 may further include a network interface 75 for coupling the base unit 12 to one or more wireless or wireline communication networks such as... TCP/IP (transmission control protocol/Internet protocol)”). That is, Behr discloses a network interface connecting to a network using TCP/IP, which a POSITA would understand is a communication protocol for accessing the Internet.

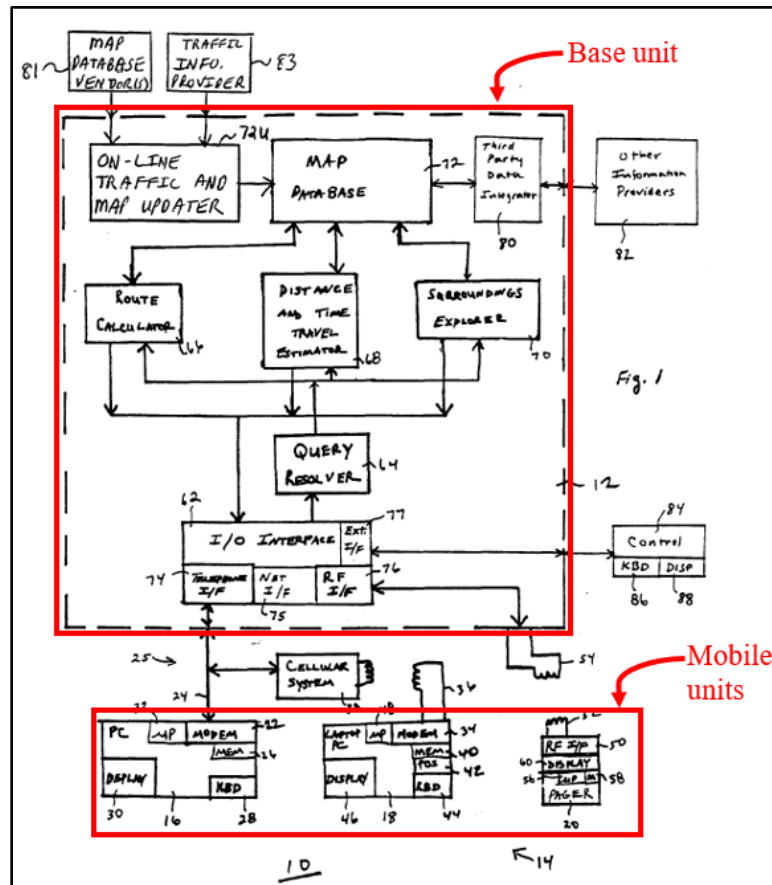
xiv. Claim 15

a. 15[pre] “A mobile navigation system comprising:”

165. Behr discloses the preamble of claim 15, as a system for providing route guidance from a base unit located at a central location to a mobile unit.

EX1004, 1:3-6, 3:35-38, 4:5-8, 6:24-27, 7:5-7, 7:20-21, 7:28-30, 7:38-39, 8:15-17,

12:9-12, 12:24-25, 38:30-41:8, FIGS. 1-2 and 41. FIG. 1 of Behr shows the navigation system including the base unit (*server*) and mobile units (*client*):



EX1004, 12:9-20, FIG. 1 (annotated)

166. The base unit (*server*) is coupled to one or more wireless communication networks. EX1004, 16:18-38, 1:3-6, 20:10-26. Furthermore, the base unit calculates the optimal route using real-time information, including traffic information. EX1004, 17:39-18:3, 11:22-26, 18:4-13, 15:37-16:2, 19:27-36.

b. 15[a] “a navigation computer;”

167. Behr's mobile unit is a navigation computer. The mobile unit includes a microprocessor that responds to program instructions and data stored in memory. EX1004, 12:17-22, 12:27-32, 14:1-32, 14:37-39, *see also* 13:1-3, 13:20-20, FIG. 1. Under the control of a program comprising instructions stored in memory, the mobile unit sends to the base unit a request for a route between an origin and a destination. EX1004, 14:22-27, 13:22-30, FIG. 41 and 38:30-41:8. The microprocessor displays information, including geographical route/map information, on a display based on the information transmitted from the base unit to the mobile unit. EX1004, 14:39-15:3, 31:16-23, 38:30-39:15 ("maps" in an "on-board database" for display), FIG. 41.

c. 15[b1] "a wireless transceiver coupled to said navigation computer for connecting with a navigation server,"

168. *See* Claim 1[a].

d. 15[b2] "said navigation server for calculating optimal routes based on real-time information,"

169. *See* Claim 1[d].

e. 15[b3] "said optimal routes being formatted using a non-proprietary, natural language description;"

170. *See* Claim 1[e].

f. 15[c] "a mapping database coupled to said navigation computer for reconstructing said optimal route from said non-proprietary, natural language description; and"

171. See Claim 1[g].

g. 15[d] “a display screen coupled to said navigation computer for displaying said optimal route using said mapping database.”

172. See Claim 1[h].

xv. Claim 16

a. 16[a] “The mobile navigation system of claim 15, further comprising: a GPS receiver coupled to said navigation computer for monitoring position;”

173. Behr explains that its mobile unit includes a GPS receiver, *i.e.*, a position locator 42 that provides the current location using the “GPS (Global Positioning System).” EX1004, 14:14-22, FIG. 1.

b. 16[b] “a telephonic device coupled to said wireless transceiver and said navigation computer for making and receiving telephone calls; and”

174. Behr discloses this feature, e.g., “[a] modem 34 is coupled to an antenna 36 for sending and receiving cellular telephonic calls in conjunction with the cellular telephone system 38.” EX1004, 13:23-25, FIG. 1.

c. 16[c] “a keypad coupled to said navigation computer for entering start and end route designations”

175. Behr explains that “a user manipulates [a] keyboard 28 to formulate a request... seek[ing] the route between an origin and a destination. The keyboard

28 thus provides an input means at the mobile unit for providing an origin and a destination.” EX1004, 13:30-25, FIG. 1.

xvi. Claim 21

a. 21[pre] “A method for providing an optimal route using real-time information from a server of a navigation system, the navigation system also comprising a client and said server coupled to a computer network, said method comprising the steps of:”

176. *See* Claim 1[pre], 1[c], 1[d].

b. 21[a] “establishing a wireless connection with the client;”

177. *See* Claim 1[a].

c. 21[b] “receiving at the server start and end route designations from the client;”

178. *See* Claim 1[b].

d. 21[c] “calculating at the server the optimal route based on real-time information at the server and said start and end route designations;”

179. *See* Claim 1[d].

g. 21[d] “formatting at the server the optimal route into a non-proprietary, natural language description;”

180. *See* Claim 1[e].

h. 21[e] “downloading from the server said non-proprietary, natural language description to the client so that the client can reconstruct the optimal route using a

local mapping database and display said optimal route on a display system coupled to the client.”

181. *See* Claim 1[f], 1[g], 1[h].

xvii. Claim 22

a. 22[pre] “A method for providing an optimal route using real-time information at client of a navigation system, the navigation system also comprising a client and said server coupled to a computer network, said method comprising the steps of:”

182. *See* Claim 1[pre], 1[c], 1[d].

b. 22[a] “establishing a wireless connection with the server;”

183. *See* Claim 1[a].

c. 22[b] “transmitting start and end route designations from the client to the server;”

184. *See* Claim 1[b].

d. 22[c] “receiving from the server an optimal route formatted in a non-proprietary, natural language description and calculated based on real-time information and said start and end route designations;”

185. *See* Claim 1[d], 1[e], 1[f].

e. 22[d] “reconstructing the optimal route using a local mapping database; and”

186. *See* Claim 1[g].

f. 22[e] “displaying said optimal route on a display system coupled to the client.”

187. *See* Claim 1[h].

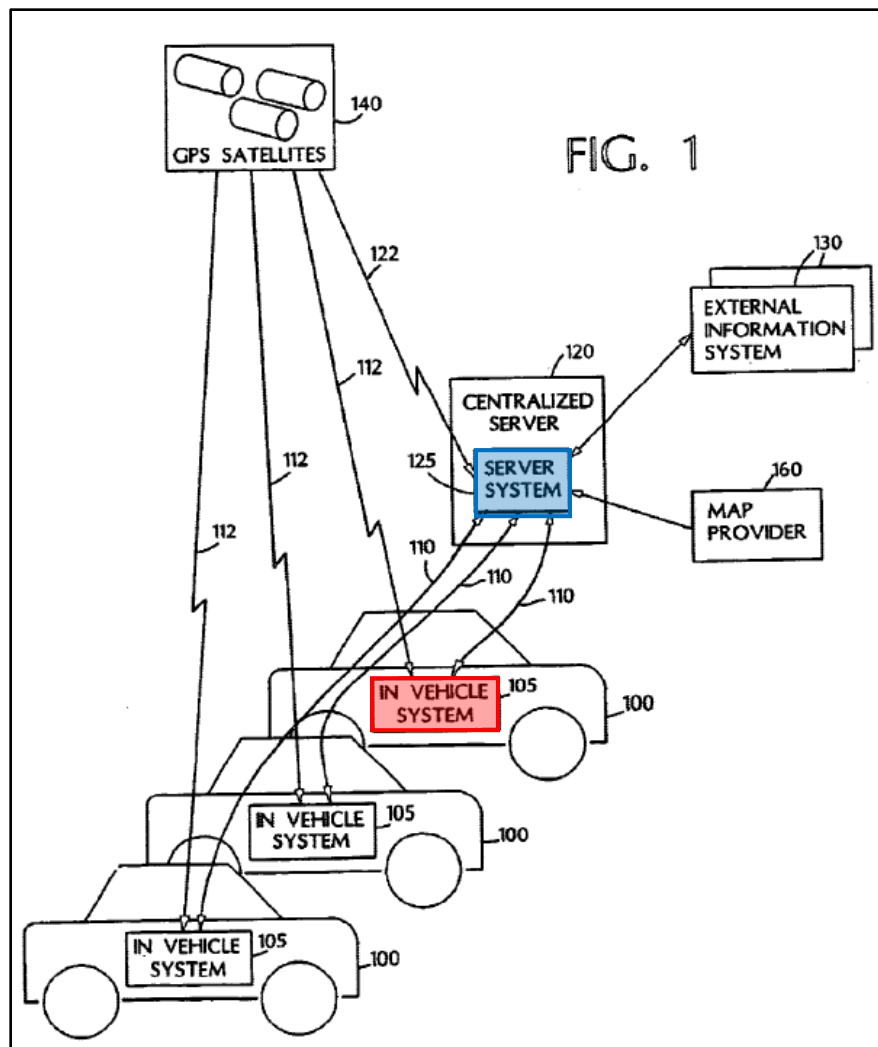
B. GROUND 2: Claims 1-7, 12-16, and 21-22 are obvious by Behr in view of ITS Architecture/Lappenbusch and (Knockeart or Ishihara)

188. In addition to the Behr/ITS Architecture/Lappenbusch combination's teachings of reconstructing the route by the client using a local mapping database (claim element 1(g)), the Knockeart and Ishihara references also teach this feature.

i. Overview of Knockeart

189. The Knockeart reference (EX1014), "Vehicle Information System," describes an in-vehicle navigation system that transmits a specified destination to a centralized server and receives and displays a computed route that it gets in return. EX1014, Abstract. Knockeart is in the same field of route guidance as the '743 Patent.

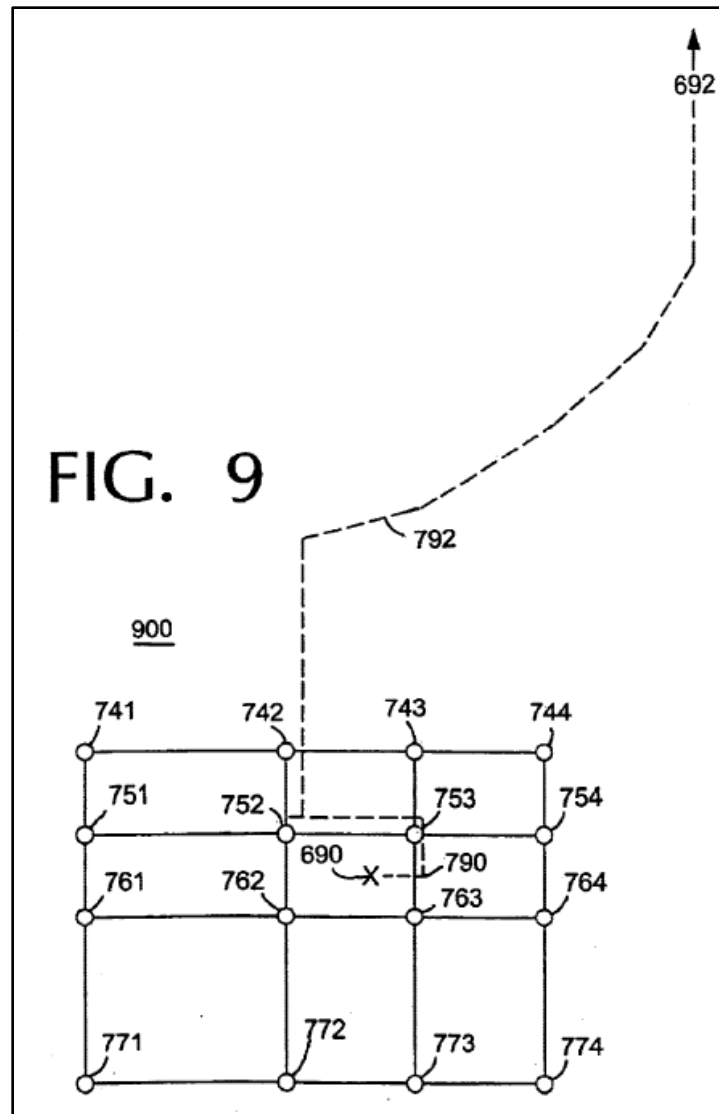
190. The route guidance begins with a user putting in a destination into the in-vehicle system 105 (annotated red below), which is then transmitted wirelessly along with a starting location, to a server system 125 (annotated blue). EX1014, 9:64-10:13.



EX1014, FIG. 1

191. The server calculates the best route from the starting location to the destination, using its map data and traffic information received from the external information system 130. EX1014, 10:14-54, 8:53-60, FIG. 7, 21:51-56. The calculated route “is downloaded from the server system to the in-vehicle system in the form of a sequence of links joined by nodes... correspond[ing] to a node in the

server's road network 700.” *Id.*, 10:55-11:4. The server also provides, to the in-vehicle system, “spot maps” that show more detail around the starting location, maneuver points, and the destination. *Id.*, 11:19-32, 22:33-44. The in-vehicle system subsequently “displays the spot map along with an indication of the vehicle's estimated location and a representation of the planned route.” *Id.*, 23:4-7; *see also* 11:44-64.



EX1014, FIG. 9

192. The in-vehicle system has a preloaded main roads network that includes main and larger roadways, similar to the road network stored in the server. *Id.*, 11:65-12:5. While traveling toward the destination, if the driver goes off the planned route, the in-vehicle system re-plans the route by determining an optimal

11:20-31, 24:48-62, 17:54-62, FIG. 16.



EX1014, FIG. 10

ii. Overview of Ishihara

193. The Ishihara reference (EX1031), “Dynamic Route Guidance Apparatus,” describes “[a] vehicle route guide system in which a vehicle transmits a destination to a control center, and the control center obtains an optimum route in consideration of current traffic conditions and notifies the vehicle of the route.” EX1031, Abstract. Ishihara is in the same field of route guidance as the ’743 Patent.

194. Ishihara’s vehicle system has road map data (*i.e.*, a local map database) in addition to Universal Traffic Management Systems (UTMS) link and node data, which is “road link data controlled by a control center.” *Id.*, 4:37-48. The vehicle stores a correspondence table that has a mapping between the local map data and the server (control center) map data (*i.e.*, UTMS data). *Id.*, 4:48-65.

195. The two sets of map data differ in that the local map data is “more detailed” than the UTMS data. *Id.*, 5:21-23. Because the UTMS data is not as detailed, routes calculated based only on the UTMS data may not be ideal since the nearest UTMS link to the destination may be incorrectly identified. *Id.*, 1:24-35.

196. Ishihara fixes this problem by using its local map database to identify the correct UTMS link that is closest to the destination. when a user inputs destination data for seeking an optimum route, the vehicle system searches for an optimum route using its local map data, and identifies a UTMS link that is “located

on the searched route and is nearest to the destination.” *Id.*, 5:6-17. The vehicle then sends this destination UTMS link to the control center, which “calculates a recommended route with the minimum cost which goes from the present position of the vehicle to the [destination] UTMS link, and notifies the vehicle of the route.” *Id.*, 5:19-38, 5:62-67. The control center uses real-time traffic data to determine the best route. *Id.*, Abstract, 5:66-6:3. Upon receiving the best UTMS route, the vehicle combines the route based on the local mapping database (FIG. 4A) with the received route (FIG. 4B) to reconstruct the best route (FIG. 4C). *Id.*, 6:11-25, FIGs. 4A-4C.

iii. Claim 1

a. 1[pre] “A method for providing an optimal route using real-time information for a navigation system comprising a client and a server, said server coupled to a computer network, said method comprising the steps of:”

197. *See* Ground 1, Claim 1[pre].

b. 1[a] “establishing a wireless connection between the client and the server;”

198. *See* Ground 1, Claim 1[a].

c. 1[b] “transmitting start and end route designations from the client to the server;”

199. *See* Ground 1, Claim 1[b].

d. 1[c] “accessing real-time information by the server;”

200. *See* Ground 1, Claim 1[c].

e. 1[d] “calculating the optimal route by the server, based on the real-time information and said start and end route designations;”

201. *See* Ground 1, Claim 1[d].

f. 1[e] “formatting the optimal route into a non-proprietary, natural language description;”

202. *See* Ground 1, Claim 1[e].

g. 1[f] “downloading said non-proprietary, natural language description to the client;”

203. *See* Ground 1, Claim 1[f].

h. 1[g] “reconstructing the optimal route by the client using a local mapping database; and”

204. *See*, Ground 1, Claim 1[g]

205. In addition, to the extent that Behr is considered to not expressly disclose reconstructing the optimal route using a local mapping database, such a feature was commonly known in similar prior art navigation systems.

Behr in view of ITS Architecture/Lappenbusch and Knockeart

206. The Knockeart reference explains that the route received from the server may have “a compact representation,” such that it is reconstructed “by referencing stored street names or by using references to nodes in the main roads

network that is already stored in the vehicle.” EX1014, 29:61-67. A server-provided route may also refer to “predefined sequences of road segments, maneuver points, and way points” or previously downloaded routes stored in the in-vehicle systems. *Id.*, 30:5-17. Therefor, in all of these cases, the in-vehicle system reconstructs the route by using the locally stored mapping data (whether it be the preloaded main roads network, or previously downloaded road or route sequences) that are compactly represented in the server-provided route. That is, the in-vehicle system uses the references (*e.g.*, shortened index values) to its local mapping database to reconstruct the route from the local mapping database.

207. A POSITA would have been motivated to incorporate one or more of these data compacting techniques into Behr’s system for the explicit reasons provided in the reference, *i.e.*, “to reduce the amount of data” and thereby allow the route to “be downloaded quickly from the server to the vehicle.” EX1014, 29:61-65. A POSITA would have had a reasonable expectation of success in making the combination. For example, a POSITA would have reasonably expected that using references to the vehicle’s locally stored data to construct the route (as Knockeart teaches) would have further compressed the routing information that is transmitted in Behr’s system. Like Knockeart, Behr also recognizes the benefit of reducing the amount of data transmission to provide a

more efficient transmission. EX1004, 29:7-24, 36:13-19; *see also* EX1001, 8:45-

53. A POSITA would have understood that the combination would not have altered or hindered the similar functions performed by the system of Behr.

208. Knockeart also explains at least two other ways in which it uses a local mapping database to reconstruct the route. For one, Knockeart suggests using “spot maps” downloaded from the server (and therefore stored in the vehicle) to display the route to the driver. EX1014 at 11:38-64, 7:5-6, 23:4-7, 30:45-48, FIG. 9. A POSITA would have understood that, naturally, to use the downloaded maps throughout the duration of the route guidance, the maps would have to be stored locally. A POSITA would have recognized that the predictable modification to Behr (as suggested by the teachings of Knockeart regarding displaying spot maps for the route) would have included the mobile unit using the maps downloaded to, or otherwise stored at, Behr’s on-board database to provide a display of the optimal route. *Id.*

209. Another way that Knockeart suggests use of a local mapping database to reconstruct the route is via its preloaded main roads network. EX1014, 11:65-12:5. As I explained above, Knockeart teaches to re-plan the route when the driver is off-route, using the preloaded roads network to determine an optimal path to a waypoint of the server-calculated route. *Id.*, 12:6-32, 24:48-62, 17:54-62, FIG. 16,

32:65-33:43, FIG. 10. In that case, the in-vehicle system reconstructs the optimal route using the combination of its preloaded main roads network and the server-calculated route. *Id.*

210. A POSITA would have recognized that implementing Behr's system in a manner that uses a preloaded in-vehicle roads network to reconstruct the optimal route as taught by Knockeart (and described above) would provide a system that can quickly re-maneuver an off-route vehicle "back onto the originally planned route," without having to contact the server system. EX1004, 9:30-10:5; EX1014, 12:6-26.

211. Many reasons would have prompted a POSITA to combine these features (as suggested by Knockeart) with the teachings of Behr. First, a POSITA would have been prompted to implement Behr's system in a manner that uses the in-vehicle database to display spot maps for the calculated route (as suggested by Knockeart) to provide a system that allows an operator to use the maps on which the planned route and the vehicle's location are dynamically displayed to decide when and where to turn in order to follow the planned route. EX1004, 9:30-10:5; EX1014, 1:43-46. Second, a POSITA would have been prompted to implement Behr's system in a manner that uses the in-vehicle database to display spot maps for the calculated route (as suggested by Knockeart) to provide useful, updated

information to an operator of a vehicle during difficult maneuvers with turn-by-turn instructions. EX1004, 10:1-5; EX1014, 2:28-30. Third, a POSITA would have been prompted to implement Behr's system in a manner that incorporates Knockeart's teachings regarding storing the spot maps at the in-vehicle storage database so as to timely retrieve and display (as needed) the pertinent/updated spot maps in addition to the textual navigation instructions and the maneuver arms. EX1004, 38:30-39:15; EX1014, 11:49-51. Fourth, a POSITA would have been prompted to implement Behr's system in a manner that incorporates Knockeart's teachings because doing so would be merely the application of a known technique (*e.g.*, Knockeart's suggestion for displaying spot maps for a route using an in-vehicle storage database) to a known device (*e.g.*, Behr's navigation system that provides stripmaps at the client device to update the local mapping database) ready for improvement to yield predictable results. I am informed that when a patent simply arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious. Here, both Behr and Knockeart disclose navigation systems, and a POSITA would have recognized that applying Knockeart's teachings to Behr's system would have led to predictable results

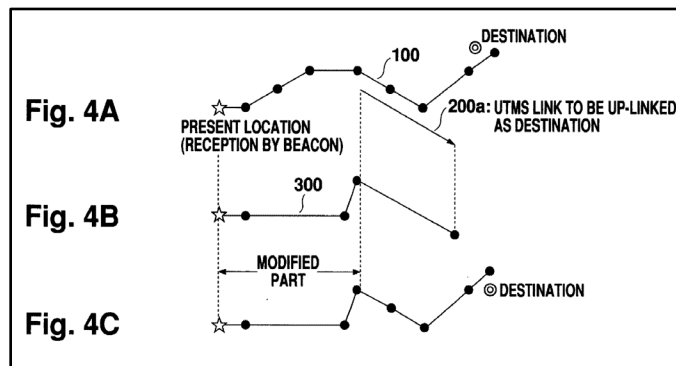
without significantly altering or hindering the functions performed by the system of Behr.

Behr in view of ITS Architecture/Lappenbusch and Ishihara

212. In addition to Knockeart, Ishihara also discloses the feature of reconstructing the route using the local mapping database.

213. FIG. 4B of Ishihara “shows a recommended route with the minimum cost, obtained by the control center,” *i.e.*, as UTMS links. EX1031, 6:17-19. FIG. 4C, meanwhile, shows the reconstructed route (“final guidance route”) obtained using the local mapping database. EX1031, 6:19-25. The route is reconstructed “such that the part of the searched route from the present position to the start of the UTMS link 200a is replaced by the corresponding [local mapping database] part.”

Id.



EX1031, FIGS. 4A-4C

214. A POSITA would have found it obvious to incorporate Ishihara's teaching of its local mapping database into the combined Behr-ITS Architecture system, described above. To this end, the combined Behr-ITS Architecture system uses a non-proprietary format for routing information such that users "do not become captive to proprietary systems." EX1012, 10. As a result, this would "allow[] multiple suppliers of equipment and software that will directly connect to other ITS subsystems." EX1011, 3. The combined Behr-ITS Architecture would provide a system in which the remote unit (*e.g.*, vehicle subsystem) and the route calculation server could be from different suppliers with respectively different proprietary software (*i.e.*, map databases). It has long been a recognized problem with the use of different software, as explained by Ishihara, that the route obtained by the server may not be the most direct route to the destination. EX1031, 1:24-35. Accordingly, a POSITA would have identified Ishihara's solution to this problem, namely, reconstructing the server-calculated route that factors current traffic conditions, using the local mapping database that might provide the most direct route to the destination. EX1031, 6:14-25. A POSITA would have reasonably expected that Ishihara's solution applied to the Behr-ITS Architecture system would have provided "an optimum route for the current traffic condition" that is also "the shortest route avoiding any detour." *Id.*, 6:26-33.

i. 1[h] “displaying said optimal route on a display system coupled to the client.”

215. *See* Ground 1, Claim 1[h]

216. In addition, to the extent that Behr is considered to not expressly disclose displaying the optimal route using Behr’s in-vehicle mapping database (e.g., using the “stripmaps” downloaded to, or otherwise stored at, the in-vehicle system), such a feature was commonly known in similar prior art navigation systems. Knockeart discloses reconstructing the server-provided optimal route using a local mapping database, as discussed above, and then displaying the route on a display system 20. EX1014, FIGS. 9 and 10.

iv. Claim 2

217. *See* Ground 1, Claim 2.

v. Claim 3

218. *See* Ground 1, Claim 3.

vi. Claim 4

219. *See* Ground 1, Claim 4.

vii. Claim 5

220. *See* Ground 1, Claim 5.

viii. Claim 6

221. *See* Ground 1, Claim 6.

ix. Claim 7

222. *See* Ground 1, Claim 7.

x. Claim 12

223. *See* Ground 1, Claim 12.

xi. Claim 13

224. *See* Ground 1, Claim 13.

xii. Claim 14

225. *See* Ground 1, Claim 14.

xiii. Claim 15

226. *See* Ground 1, Claim 15 and Ground 2, Claim 1[g].

xiv. Claim 16

227. *See* Ground 1, Claim 16.

xv. Claim 21

228. *See* Ground 1, Claim 21 and Ground 2, Claim 1[g].

xvi. Claim 22

229. *See* Ground 1, Claim 22 and Ground 2, Claim 1[g].

**C. GROUND 3: Claims 8 and 9 are obvious over Behr in view of ITS
Architecture/Lappenbusch, Knockeart/Ishihara, and Geiser**

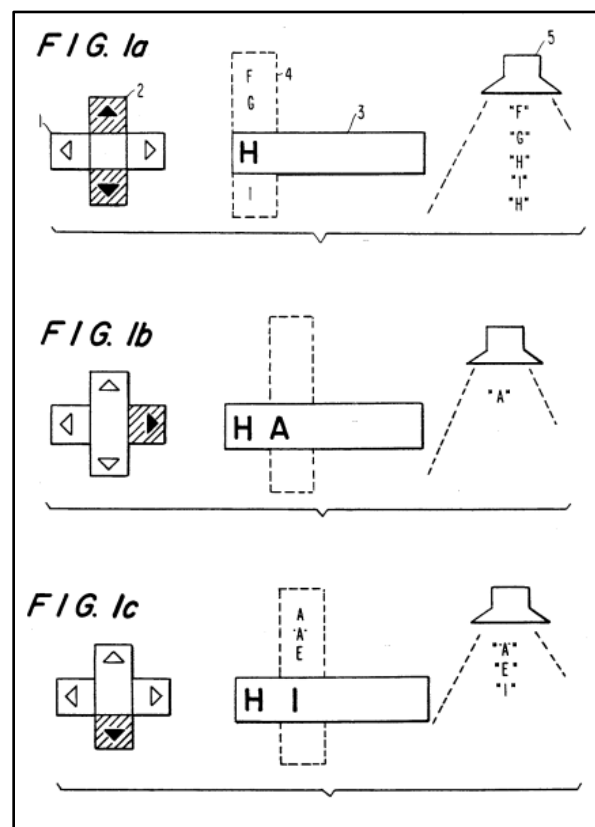
i. Claim 8

- a. “The method of claim 7, wherein said step of entering comprises the steps of: comparing data entered into the keypad data entry field with a database of allowable entries; determining a set of conforming data items associated with said entered data; applying a criterion to said set of conforming data items to determine an anticipated data item; and displaying said anticipated data item in the data entry field.”**

230. As I have explained above with respect to claim 7, Behr discloses user input to a keyboard to specify the start and stop route endpoints. EX1004, 13:20-25. Although Behr does not provide details on validating or predictive data entries, Geiser discloses the remaining features of claim 8.

231. Geiser includes a navigation device that determines a subset of anticipated letters for entry in defining a navigation destination, based on certain criteria. EX1015, 2:67-68, 3:2-25, FIGs. 1a-1c. As an example, shown in FIGs. 1a to 1c, a first letter, “H,” of a destination is input. EX1015, FIG. 1a. For the second letter, the system compares the entered data (“H”) with allowable entries (i.e., the alphabet) and determines a subset of eight confirming data items, i.e., the letters “A,” “E,” “I,” “O”, “O”, “U”, “u”, and “Y.” EX1015, 3:4-9, 3:66-4:8. This subset is determined to conform with the rule that only these letters can follow the letter “H” grammatically. A particular criterion (i.e., alphabetic order, as shown in FIGs.

1a and 1c) is then applied to this subset of eight letters to determine one anticipated letter to be displayed. In this case, as "A" is first alphabetically among the subset, it is determined and displayed in the data entry field, and the subsequent letters of the subset are sequentially scrolled in alphabetical order (FIG. 1c):



EX1015, FIGs. 1a-1c.

232. As another example, the conforming data items may be the possible subset of letters that can occur in a particular letter position among destination

locations limited by the preceding letter positions. EX1015, 3:10-25; *see also* 4:16-19.

233. A POSITA would have found it obvious to apply Geiser's above-described predictive data entry method into the keypad entry of Behr, as no more than the application of a known technique to improve similar devices in the same way. Behr, Geiser, and the '743 Patent are all directed to analogous art, *i.e.*, route guidance systems. *See, supra*, Secs. III, VIII.A.i; EX1015, 1:7-9. As Behr does not specify a particular method for its keyboard inputs of route endpoints, a POSITA would have looked to Geiser's comparable device that has the asserted improvement of claims 8 and 9 (below). A POSITA could have applied Geiser's input method in the same way to Behr's input mechanism, with a predictable expectation of a destination search with increased efficiency and less distractions. EX1015, 1:55-58, 1:68-2:3, 2:18-20.

ii. Claim 9

a. "The method of claim 8, wherein said criterion defines a data item in said set of conforming data items that appears first alphabetically."

234. As I explain above, Geiser applies an alphabetical order criterion to display the letter that appears first alphabetically. EX1015, FIGs. 1a-1c.

D. GROUND 4: Claims 10 and 11 are obvious over Behr in view of ITS Architecture/Lappenbusch, Knockeart/Ishihara, Geiser, and Saito

i. Claim 10

- a. “The method of claim 8, wherein said criterion defines a data item in said set of conforming data items that is used most frequently.”**

235. The Behr-Geiser combination suggests an alphabetical order criterion, and not a frequency of use criterion, for determining an anticipated data item. A POSITA would have found it obvious to apply a frequency of use criterion, such as taught by Saito, as a simple substitution of one known element for another to obtain predictable results. Saito discloses reading and displaying data based on frequency of use, with the most frequently used (*i.e.*, “having the greatest number of past references”) being displayed first. EX1016, 2:51-3:7. A POSITA could have substituted Geiser’s alphabetical criterion with Saito’s frequency of use criterion to predictably achieve a system in which “the hit ratio” for Geiser’s anticipated data item (destination character) “is raised and it is possible to shorten the search time.” EX1016, 3:7-14.

ii. Claim 11

- a. “The method of claim 8, wherein said criterion defines a data item in said set of conforming data items that is used most recently.”**

236. Saito teaches reading and displaying map data or maps based on history of use, with the most recently used (i.e., “a last map referred to”) being displayed first. EX1016, 5:57-60. A POSITA would have found it obvious to apply a most recently used criterion, like taught by Saito, as a simple substitution of one known element for another to obtain predictable results. Saito teaches outputting data based on history of use, with the most frequently used being displayed first. EX1016, 5:57-60. A POSITA could have substituted Geiser’s alphabetical criterion with Saito’s frequency of use criterion to predictably achieve a system in which the process of searching is “simplified” and “shorten[ed].” EX1016, 5:57-6:7.

E. GROUND 5: Claims 17 and 18 are obvious over Behr in view of ITS Architecture/Lappenbusch, Knockeart/Ishihara, and JP091

i. Claim 17

a. “The mobile navigation system of claim 15, wherein said display screen is used to display the mapping database in a head right configuration.”

237. JP091 teaches a head right configuration for a navigation display of mapping data. EX1048, ¶¶ [0024] (“As for the road map displayed on the screen 31, the traveling direction is indicated by a vertex serving as the most acute angle at a mark m on a triangle shape indicating the position of the vehicle, the traveling

direction matches the lateral direction (horizontal direction) of the screen 31, and **here the right side is set to the front**”), [0027] (“Note that in the display example in FIG. 5, the map is displayed having **the right side of the screen set to the traveling direction**”). A POSITA would have been motivated to incorporate the head right configuration of JP091 into the Behr system to provide the expected benefit of “[i]ncreasing the amount of information displayed ahead of the traveling direction” thereby allowing the driver “to easily confirm the route on which the vehicle will travel.” *Id.*, ¶¶ [0025] – [0026].

ii. Claim 18

a. “The mobile navigation system of claim 15, wherein said display screen is used to display the mapping database in a head left configuration.”

238. JP091 teaches a head left configuration for a navigation display of mapping data. EX1048 at ¶¶ [0024] (“As for the road map displayed on the screen 31, the traveling direction is indicated by a vertex serving as the most acute angle at a mark m on a triangle shape indicating the position of the vehicle, the traveling direction matches the lateral direction (horizontal direction) of the screen 31”), [0027] (“Note that in the display example in FIG. 5, the map is displayed having the right side of the screen set to the traveling direction, **but the map may be displayed having the left side set to the same**”). A POSITA would have been

motivated to incorporate the head right configuration of JP091 into the Behr system to provide the expected benefit of “[i]ncreasing the amount of information displayed ahead of the traveling direction” thereby allowing the driver “to easily confirm the route on which the vehicle will travel.” *Id.*, ¶¶ [0025] – [0026].

F. GROUND 6: Claim 19 is obvious over Behr in view of ITS Architecture/Lappenbusch, Knockeart/Ishihara, and JP230

i. Claim 19

- a. “The mobile navigation system of claim 16, further including a clock coupled to said navigation computer, wherein said navigation computer is programmed to set said clock to an accurate local time in accordance with a time from said GPS receiver and a current time zone.”**

239. Although Behr does not address synchronizing a clock with the local time, JPH08-110230 (JP230) discloses this claimed feature. JP230 discloses reading out a time generated by a GPS receiver 1, and correcting it based on time difference data corresponding to a current time zone. EX1049, Abstract, ¶ [0011]. The corrected time is displayed. *Id.*, Summary, ¶ [0011]. A POSITA would have been motivated to incorporate JP230’s clock correction method into the Behr system to provide the expected benefit of automatically correcting the remote unit’s time in a “convenient” and “simple” manner. *Id.*, ¶¶ [0005], [0006].

IX. Conclusion

240. For the reasons I set forth above, it is my opinion that claims 1-19 and 21-22 of the '743 Patent would have been obvious to a POSITA based on the prior art discussed above.