UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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COLAS SOLUTIONS, INC.
Petitioner

v.

BLACKLIDGE EMULSIONS, INC.
Patent Owner

_____

Case IPR2017-01242
Patent 7,918,624 B2

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SUBMISSION OF NOTICE OF APPEAL

Via PTAB E2E
Patent Trial and Appeal Board

Via USPS Priority Express Mail
Director of the United States Patent and Trademark Office
c/o Office of the General Counsel, 10B20
Madison Building East
600 Dulany Street
Alexandria, VA 22314

Via CM/ECF
United States Court of Appeals for the Federal Circuit

Pursuant to 35 U.S.C. §§ 141 and 142 and 37 C.F.R. §§ 90.2(a) and 90.3(a)(l), Patent Owner/Appellant, Blacklidge Emulsions, Inc., hereby notifies the Board of its Notice of Appeal to the United States Court of Appeals for the Federal Circuit for review of the Final Written Decision (IPR 2017-01242) of the Patent Trial and Appeal Board entered on October 23, 2018. Copies of the Final Written Decision and the Notice of Appeal are attached.

This appeal is being timely filed, i.e. within sixty-three days of the Final Written Decision. See 37 C.F.R. § 90.3(a)(l). Simultaneously with this submission, the Notice of Appeal is being filed with the Director of the United States Patent and Trademark Office and the Notice of Appeal and docketing fee of $500.00 are being electronically filed with the Clerk of Court for the United States Court of Appeals for the Federal Circuit.

Dated: December 26, 2018

Respectfully Submitted,

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Paper 66
Entered: October 23, 2018

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ASPHALT PRODUCTS UNLIMITED, INC.,
Petitioner,

v.

BLACKLIDGE EMULSIONS, INC.,
Patent Owner.

Case IPR2017-01242
Patent 7,918,624 B2

Before MITCHELL G. WEATHERLY, JAMES A. TARTAL, and TIMOTHY J. GOODSON, *Administrative Patent Judges.*

GOODSON, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background

Asphalt Products Unlimited, Inc. ("Petitioner") filed a petition (Paper 1, "Pet.") requesting *inter partes* review of claims 1–25 of U.S. Patent No. 7,918,624 B2 (Ex. 1001, "the '624 patent") on the following grounds:

Reference(s)	Basis	Claims
Pasquier[1]	§ 102	1–5, 12, 14–18, 25
Pasquier and SBH[2]	§ 103	1–5, 9, 12–18, 21, 22, 24, 25
Pasquier, SBH, and US DOT[3]	§ 103	6, 19
Pasquier, SBH, and Durand[4]	§ 103	7, 8, 10, 20
Pasquier, SBH, US DOT, and Potti[5]	§ 103	11, 23[6]

Pet. 26–66. Petitioner further asserts that three additional prior art references described by Petitioner as "optional" to its obviousness

[1] European Patent App. Pub. No. EP 0 859 030 A1 (Ex. 1003). The original French version of this document is in Exhibit 1028. Exhibit 1003 is the English translation.

[2] The Shell Bitumen Handbook (5th ed. 2003) (Ex. 1008).

[3] US DOT Specification FP96-2001 (Ex. 1010).

[4] U.S. Patent No. 5,769,567 (Ex. 1011).

[5] Juan José Potti, José Luis Peña, Francisco Guzmán, "Emulsiones termoadherentes para riegos de adherencia," Carreteras: Revista Técnica de la Asociación Española de la Carretera, July–Aug. 2003, at 17 (Ex. 1006). The original Spanish version of this document is in Exhibit 1017. Exhibit 1006 is the English translation.

[6] In a table summarizing the grounds at the start of the Petition, Petitioner also lists claim 19 in this ground. Pet. 7. However, as we noted in our Decision on Institution, the Petition does not reference Potti in its challenge to claim 19. *See* Paper 23, 2–3 n.2. Instead, Petitioner's challenge to claim 19 refers to its arguments for claim 6, which are based on Pasquier, SBH, and US DOT. *See* Pet. 58, 65. Petitioner's summary table does include claim 19 in the ground based on the combination of Pasquier, SBH, and US DOT. *See* Pet. 6. Thus, we consider Petitioner's inclusion of claim 19 in the ground that includes Potti in the table on page 7 of the Petition to be a typographical error.

challenges reflect the background knowledge of an ordinarily skilled artisan at the time of the alleged invention: Corte,[7] BAEM,[8] and Gordillo.[9] *See, e.g.*, Pet. 49 (describing Corte, BAEM, and Gordillo as "optional[]" references in the obviousness challenge to claim 1). Blacklidge Emulsions, Inc. ("Patent Owner") filed a Preliminary Response. Paper 10 ("Prelim. Resp.").

We initially instituted an *inter partes* review on a subset of the asserted grounds. *See* Paper 23 ("Dec. on Inst."). Specifically, we determined based on the preliminary record that Petitioner had demonstrated a reasonable likelihood of prevailing in its obviousness challenges, but that Petitioner had not demonstrated a reasonable likelihood of prevailing in its anticipation challenge. *Id.* at 11–26. Based on those determinations, and in accordance with the Board's practice at that time, we instituted an *inter partes* review only as to the obviousness challenges. *Id.* at 26. Subsequently, pursuant to the holding in *SAS Inst., Inc. v. Iancu*, 138 S.Ct. 1348, 1355–57 (2018), we modified our institution decision to institute review of all grounds presented in the Petition. Paper 48, 2. We also authorized supplemental briefing to permit the parties to address the added ground. Paper 51.

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[7] Corte, Jean-Francois, "Development and uses of hard-grade asphalt and of high-modulus asphalt mixes in France," Transportation Research Circular 503: Perpetual Bituminous Pavements, at 12 (Ex. 1007).

[8] A Basic Asphalt Emulsion Manual, Manual Series No. 19, Third Edition (Ex. 1009).

[9] Jaime Gordillo et al., "Comparison of Different Test Methods for the Obtention and Characterisation of Residual Binders of Pure and Modified Bitumen Emulsions," Second World Congress on Emulsion, 23–26 Sept. 1997 (Ex. 1012).

The briefing in this proceeding includes the Petition, an Amended Patent Owner Response (Paper 38, "PO Resp."), a Patent Owner Supplemental Response (Paper 54, "PO Supp. Resp."), a Petitioner Reply (Paper 45, "Reply"), and a Petitioner Supplemental Reply (Paper 57, "Supp. Reply"). We held an oral hearing, a transcript of which is included in the record. Paper 65 ("Tr.").

Patent Owner filed a Contingent Motion to Amend, and the parties submitted additional briefing in connection with that motion. We address Patent Owner's Motion to Amend in Section III. Aside from the Motion to Amend, no motions remain pending. During the proceeding, Patent Owner filed a Motion to Disqualify Dr. Alan James as Petitioner's Expert Witness and to Strike His Declaration, and we denied that motion. *See* Paper 15; Paper 22.

The evidentiary record in this proceeding is extensive. In addition to the numerous cited prior art references and documents evidencing the state of the art during the relevant time frame, the parties have provided the testimony of several witnesses. The table below summarizes the witnesses, their roles in this proceeding, and the exhibits in which their testimony is presented:

Witness	Role	Exhibit(s)
Alan James, Ph.D.	Petitioner's technical expert	Ex. 1002 (declaration of Apr. 3, 2017); Ex. 1040 (declaration of July 15, 2017); Ex. 1041 (declaration of Aug. 30, 2017); Ex. 1093 (declaration of Apr. 17, 2018); Ex. 2079 (transcript of deposition of Dec. 19, 2017).

Witness	Role	Exhibit(s)
Laci-Tiarks-Martin	Director of Operations at PRI Asphalt Technologies, Inc., which was retained by Petitioner to conduct testing	Ex. 1013 (declaration of Mar. 15, 2017).
R. Steele Yeargain, III	Vice President of Petitioner	Ex. 1042 (declaration of Aug. 16, 2017); Ex. 1094 (declaration of Apr. 16, 2018).
William F. O'Leary	Patent Owner's technical expert	Ex. 2010 (declaration of Aug. 18, 2017); Ex. 2078 (declaration of Jan. 24, 2018); Ex. 2092 (declaration of Feb. 9, 2017 from IPR2016-01031); Ex. 2093 (declaration of June 15, 2018); Ex. 1092 (transcript of deposition of Mar. 8–9, 2018); Ex. 1095 (transcript of deposition of June 27, 2018).
Roy B. Blacklidge	Inventor of '624 patent and President of Patent Owner	Ex. 2081 (declaration of Sept. 28, 2008 from file history of U.S. Patent No. 7,503,724); Ex. 1096 (transcript of deposition of Apr. 19, 2017 from IPR2016-01031).[10]
R. Grover Allen, Ph.D.	Technical Director of Patent Owner	Ex. 2005 (declaration of July 5, 2017); Ex. 2077 (declaration of Jan. 24, 2018); Ex. 2094 (declaration of June 15, 2018).

[10] The parties stipulated that Mr. Blacklidge's testimony from Case IPR2016-01031 would be admissible in this proceeding. *See* Paper 43, 1.

Witness	Role	Exhibit(s)
Michael Jenkins	Director of Technical Marketing of Patent Owner	Ex. 2006 (declaration of July 5, 2017).
Jarrod Gray	Chief Financial Officer of Patent Owner	Ex. 2020 (declaration of Aug. 18, 2017).
Douglas C. Fergusson	Executive Vice President and General Manager of Patent Owner	Ex. 2090 (declaration of Feb. 8, 2017).

We have jurisdiction under 35 U.S.C. § 6. Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must prove unpatentability by a preponderance of the evidence. *See* 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–25 of the '624 patent are unpatentable. *See* 35 U.S.C. § 316(e).

B. Related Proceedings

The parties identify the following *inter partes* review proceedings as related:

- *Colas Solutions, Inc. v. Blacklidge Emulsions, Inc.*, Case IPR2016-01032, relating to the '624 patent;

- *Colas Solutions, Inc. v. Blacklidge Emulsions, Inc.*, Case IPR2016-01031, relating to U.S. Patent No. 7,503,724 B2 ("the '724 patent"), of which the '624 patent is a continuation;
- *Asphalt Products Unlimited, Inc. v. Blacklidge Emulsions, Inc.*. Case IPR2017-01241, relating to the '724 patent.

Pet. 3–4; Paper 7, 2. In Case IPR2016-01032, which involved a different petitioner and different prior art references, we issued a Final Decision determining that no claim of the '624 patent had been shown to be unpatentable. *See Colas Solutions, Inc. v. Blacklidge Emulsions, Inc.*, Case IPR2016-01032, slip op. at 32 (PTAB Nov. 2, 2017) (Paper 40). An appeal of that decision is pending in the U.S. Court of Appeals for the Federal Circuit as *Colas Solutions, Inc. v. Blacklidge Emulsions, Inc.*, Case No. 18-1359.

The parties also identify the following four district court proceedings as related:

- *Blacklidge Emulsions, Inc. v. Russell Standard Corporation*, Case Number 1:12-cv-00643, N.D. Ohio;
- *Colas Solutions, Inc. v. Blacklidge Emulsions, Inc.*, Case Number 1:16-cv-00548, S.D. Ohio;
- *Blacklidge Emulsions, Inc. v. Phillips Oil Co. of Central Ohio, Inc.*, Case Number 2:12-cv-00406, S.D. Ohio; and
- *Blacklidge Emulsions, Inc. v. Akzo Nobel Surface Chemistry LLC*, Case Number 1:17-cv-173, S.D. Miss.

Pet. 3–4; Paper 7, 2; Paper 9, 2.

C. The '624 Patent

The '624 patent relates generally to a method of providing an adhesive tack coat between pavement layers. Ex. 1001, 1:15–18. The method includes applying an asphalt emulsion as the tack coat that, when cured, exhibits a relatively hard surface that resists adhering to the tires of construction vehicles but still functions as an adhesive layer. *Id*. at 4:56–5:6.

Claims 1, 14, and 25 are the independent claims. Claim 1 is directed to a method for bonding a layer of asphalt pavement material to a substrate layer, claim 14 is for a method of forming a low-tracking tack coating, and claim 25 recites a pavement structure that incorporates the bonding layer. *Id*. at 13:63–14:22, 15:1–22, 16:26–37. Claim 1 is illustrative, and is reproduced below with labels as added by Petitioner for ease of reference:

> 1. A method for bonding a layer of asphalt pavement material to a substrate layer, the method comprising:
>
> [a] providing an emulsion comprising at least a first phase which includes an asphalt composition, a second phase comprising water, and emulsifying and stabilizing additives, *the asphalt composition in the emulsion effective for providing a coating having a penetration value less than about 40 dmm and a softening point greater than about 140 ° F. (60 ° C.) when applied to the substrate layer and cured*;
>
> [b] applying the emulsion to an exposed surface of the substrate layer in an amount which is sufficient to provide a coating on the exposed surface of the substrate layer, the coating and emulsion including an amount of the asphalt composition effective to bond the asphalt pavement layer to the substrate layer;
>
> [c] providing heated asphalt pavement material to provide the asphalt pavement layer, the asphalt pavement material heated to a temperature sufficient to soften the coating on the substrate layer to form a bonding surface on an exposed surface of the coating;

> [d] applying the heated asphalt pavement material to the exposed coating surface to form the asphalt pavement layer and to soften the exposed coating surface forming a bond between the asphalt pavement layer and the substrate layer.

Id. at 13:63–14:22 (emphasis and labels added); *see also* Pet. 27, 37–39 (showing labels for particular elements). The emphasized portion of claim 1, which is substantively recited in all claims, identifies characteristics of a cured asphalt emulsion and represents one of the central points in dispute between the parties.

The '624 patent describes the particular asphalt emulsion used to make a "low-tracking" tack coat that reduces or avoids the problems associated with the tack coat adhering to the wheels of construction vehicles. *Id*. at 4:56–5:17. Such vehicle tracking "reduces the effectiveness of the tack coat by displacing a portion of the intended volume from the area awaiting a new pavement layer." *Id*. at 2:16–18. Additionally, "[i]nsufficient adhesion between a new layer of pavement and an existing base course . . . can cause pavement separation and cracking during construction [and] subsequent failures and premature deterioration of the pavement structure." *Id*. at 2:19–24.

The Specification describes two approaches for obtaining such a tack coat. In one approach, an emulsion is prepared with a "hard pen" asphalt component having a pen value of "from about 5 dmm to about 15 dmm pen, with a softening point between about 150° F. (66° C.) and about 160° F. (71° C.)." *Id*. at 7:44, 63–65. The Specification describes asphalt emulsions incorporating asphalt compositions defined by the "Performance Grade" values of from PG-91 (about 5 pen) to PG-82 (about 40 pen). *Id*. at 9:59–10:1. Beginning with these hard pen asphalts in the emulsion, the

Specification describes resulting "tack coat properties" including pen values from about 1 dmm to about 40 dmm and a minimum softening point of 140° F. (60° C.). *Id*. at 10:35–40. The Specification also describes two examples of "the emulsion of the invention using a 13 dmm pen asphalt," but does not reveal the pen value or the softening point of the resulting cured tack coat. *Id*. at 12:30–13:55.

The second approach is to use a softer asphalt in the emulsion "in the range of mid or soft pen asphalt" and add "polymeric, waxes, or other equivalent additives" to achieve the properties of the "final cured tack coat." *Id*. at 8:51–63. The Specification describes that "[e]xamples of such polymeric additives are EVA, SBS, SB, SBR, SBR latex, polychloroprene, isoprene, polybutadiene, acrylic and acrylic copolymers, and other equivalent additives that produce the hard pen characteristics of the final cured tack coat." *Id*. at 8:59–63. The Specification does not, however, describe examples of making a cured tack coat exhibiting the claimed pen and softening point values using emulsions of mid or soft pen asphalt and the specific additives listed.

II. ANALYSIS

A. Claim Interpretation

"A claim in an unexpired patent that will not expire before a final written decision is issued shall be given its broadest reasonable construction in light of the specification of the patent in which it appears." 37 C.F.R. § 42.100(b) (2016); *see also Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (affirming that USPTO has statutory authority to construe claims according to Rule 42.100(b)). When applying that standard, we interpret the claim language as it would be understood by one of ordinary

skill in the art in light of the specification. *In re Suitco Surface, Inc.*, 603 F.3d 1255, 1260 (Fed. Cir. 2010). Thus, we give claim terms their ordinary and customary meaning. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007) ("The ordinary and customary meaning 'is the meaning that the term would have to a person of ordinary skill in the art in question.'" (citation omitted)). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

In our Decision on Institution, we considered Petitioner's proposal that the phrase "a penetration value less than about 40 dmm" means "a penetration value less than 47 dmm." *See* Pet. 11. We determined that the intrinsic and extrinsic evidence of record did not support Petitioner's proposal, and applied the term's ordinary and customary meaning. *See* Dec. on Inst. 8–10. Similarly, we declined to adopt Petitioner's proposal that the phrase "a softening point greater than about 140 ° F. (60 ° C.)" should be construed as "a softening point greater than 57°C," and we instead applied the ordinary and customary meaning of that phrase. *See* Pet. 11; Dec. on Inst. 10–11. The parties' post-institution briefing does not further address the construction of these phrases. *See* PO Resp. 19; Reply 2. We maintain the construction of these phrases set forth in our Decision on Institution for the reasons stated therein.

We determine that no other terms require express construction to resolve the disputed issues in this proceeding.

B. Level of Ordinary Skill in the Art

In determining the level of skill in the art, we consider the educational level of the inventor, the type of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the educational level of active workers in the field. *Daiichi Sankyo Co., Ltd. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007) (citing *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F2d 693, 696 (Fed. Cir. 1983)).

Petitioner contends, with citation to the testimony of Dr. James, that a person of ordinary skill in the art would have "a bachelor's degree or the equivalent in the fields of chemistry, chemical engineering, materials science, or an equivalent, as well as having five (5) years of additional academic or commercial research in the field of asphalt binders and/or asphalt emulsion technology." Pet. 10 (citing Ex. 1002 ¶¶ 9–12).

Patent Owner's expert, Mr. O'Leary, disagrees with Petitioner's and Dr. James's definition and describes a person of ordinary skill in the art as

> someone with a bachelor of science degree or the equivalent in civil or chemical engineering, as well as having approximately 5 years of practical experience comprising some combination of asphalt binder testing and/or characterization, asphalt mixture testing and/or characterization, pavement design, and field experience such as quality control monitoring of the construction of pavement materials. Alternatively, a person having ordinary skill in the art may have 10 years of practical experience comprising some combination of asphalt binder testing and/or characterization, asphalt mixture testing and/or characterization, pavement design, and field experience instead of a four year college degree.

Ex. 2078 ¶ 60; *see also* Ex. 2093 ¶¶ 38–40 (providing additional testimony regarding the level of ordinary skill in the art).

The primary difference in these proposals is that Petitioner's and Dr. James's proposal requires an academic degree, while Mr. O'Leary's definition allows additional work experience to substitute for an academic degree. In this regard, Petitioner acknowledges that its definition would exclude the sole named inventor of the '624 patent from qualifying as a person of ordinary skill in the art because Mr. Blacklidge does not have an academic degree. Tr. 19:19–20:3. The Federal Circuit has found clear error when a court's determination of the level of skill in the art conflicted with the background of the inventors. *Daiichi Sankyo*, 501 F.3d at 1256–57. Petitioner is unable to point us to any cases in which a court or tribunal has adopted or upheld a definition of the level of ordinary skill in the art that would exclude the inventor of the patent at issue. Tr. 20:4–7.

Petitioner's definition would also exclude Mr. O'Leary, even though Dr. James considers Mr. O'Leary as "someone who has attained a certain level of skill in the field of asphalt emulsions in general." Ex. 1093 ¶ 12. Petitioner argues that an understanding of chemistry is important, and that Mr. O'Leary's inadequate chemistry background detracts from the reliability of his opinions. Tr. 20:8–24; *see also* Ex. 1093 ¶¶ 12–16 (Dr. James pointing to alleged errors or gaps in Mr. O'Leary's chemistry knowledge stating that "Mr. O'Leary's lack of formal education in chemistry impedes his ability to provide a reliable opinion on topics involving formulation chemistry"). Petitioner's and Dr. James's criticisms go to the weight to be given Mr. O'Leary's opinions, but do not persuade us that the level of educational attainment for a person of ordinary skill in the art should be set above what was obtained by known practitioners in this field such as Mr. O'Leary and Mr. Blacklidge.

We adopt Mr. O'Leary's statement of the level of ordinary skill in the art (Ex. 2078 ¶ 60), which is consistent with the level of ordinary skill in the art we specified in our Final Decision in an earlier proceeding involving the '624 patent. *See Colas Solutions, Inc. v. Blacklidge Emulsions, Inc.*, Case IPR2016-01032, slip op. at 9–10 (PTAB Nov. 2, 2017) (Paper 40).

C. The Anticipation Challenge

Petitioner argues that Pasquier anticipates claims 1–5, 12, 14–18, and 25. Pet. 26–48; Supp. Reply 2–9. Patent Owner disputes those contentions. *See* PO Supp. Resp. 4–14.

1. Legal Standard

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). Whether a reference discloses the claimed subject matter is assessed from the perspective of an ordinarily skilled artisan. *See Dayco Prods., Inc. v. Total Containment, Inc.*, 329 F.3d 1358, 1368 (Fed. Cir. 2003) ("'[T]he dispositive question regarding anticipation [i]s whether one skilled in the art would reasonably understand or infer from the [prior art reference's] teaching' that every claim element was disclosed in that single reference.").

2. Overview of Pasquier

Pasquier relates to asphalt emulsions used to make a tack coat to which tires of road construction equipment do not stick. Ex. 1003, Abstract. Pasquier describes that the "purpose of the tack coats is to stick to each other

the different layers that make up the road." *Id*. at 2:20.[11] Pasquier describes the goals of its tack coats as follows: "The purpose of the invention is to provide a tack coat that sticks the layers perfectly to each other without sticking to the wheels of the construction equipment so as to avoid bituminous products from being carried onto surrounding roads without making the implementation techniques more complicated." *Id*. at 2:47–50.

Pasquier acknowledges that conventionally using hard or very hard asphalt (10 to 30 dmm) in an emulsion may achieve a tack coat that is not sticky, but remains "very fragile . . . little cohesive because a bitumen with this hardness is not very film-forming, and has little adhesion to the support." *Id*. at 3:5–9. Pasquier addresses this problem by adding substances from one of two groups, for example, "group a)" including parafins, waxes of petroleum, among others, or "group b)" including polyethylene glycol among others. *Id*. at 3:30–39.

Pasquier's tack coat is made from various exemplary emulsions, most of which are based on 10/20 hard-pen bitumen. *Id*. at 4–5, Tables 1–3, 5. For example, Table 1 from Pasquier is reproduced below.

[11] When citing to Pasquier, we refer to the page numbers of the original document, which are also shown in the English translation of Pasquier in Exhibit 1003. However, when we refer to line numbers, we refer to those shown in Exhibit 1003 rather than the line numbers of the original French-language version of Pasquier.

TABLE 1

Phases	Components	Quantities in kgs
Bituminous phase	Bitumen 10/20	450
	Poly ethylene glycol 600	50
Aqueous phase	Water	495.5
	Emulsamine L60	2.5
	Hydrochloric acid at 37%	2

Pasquier's Table 1 reflects an exemplary emulsion for making a tack coat that avoids tracking by construction vehicles.

Id. at 4. Pasquier uses polyethylene glycol—a water-soluble polymer—as a viscosity modifier and stabilizing additive that can be added to either the asphalt phase or the water phase, with Pasquier specifically noting that the addition of polyethylene glycol results in an emulsion that "is much more stable than a pure hard bitumen emulsion." *Id.* at 5:26–29, 5:34–35. Pasquier further notes that its hard-pen emulsion provides a tack coat having strengthened consistency at temperatures below 70°C such that the "residual layer [is] not affected by temperature up to 70°C." *Id.* at 3:11–25.

3. Analysis

Each of independent claims 1, 14, and 25 is challenged as anticipated by Pasquier. Each of those claims requires an asphalt composition that provides a coating or bonding layer having "a penetration value less than about 40 dmm and a softening point greater than about 140° F. (60° C.)" when cured. Ex. 1001, 14:2–4 (claim 1), *id.* at 15:8–10 (claim 14), *id.* at 16:36–37 (claim 25).

Petitioner admits that "Pasquier does not expressly disclose" the penetration value and softening point of the "coating" of claim 1. Pet. 29. Petitioner relies on inherency for these limitations. *Id.* at 27. Specifically, Petitioner argues that Pasquier inherently teaches those characteristics

because an ordinarily skilled artisan "would have known that Pasquier's asphalt emulsion would necessarily and inevitably produce a residual tack coat having a final residual pen value of less than 20 dmm and a R&B softening point greater than about 140° F. (60° C.)." *Id.* at 30. Regarding the "coating" of claim 14 and the "bonding layer" of claim 25, Petitioner refers back to its arguments for claim 1. *Id.* at 46, 48.

Patent Owner counters that Pasquier does not anticipate claims 1, 14, and 25 or their respective dependent claims 2–5, 12, and 15–18 because Petitioner has not established that Pasquier inherently describes the characteristics of the cured "coating" or "bonding layer." PO Supp. Resp. 5–12. We agree with Patent Owner.

"[A]nticipation by inherent disclosure is appropriate only when the [single prior art] reference discloses prior art that must *necessarily* include the unstated limitation." *Transclean Corp. v. Bridgewood Servs., Inc.*, 290 F.3d 1364, 1373 (Fed. Cir. 2002) (citation omitted). "Inherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Cont'l Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1269 (Fed. Cir. 1991) (internal quotation marks and citations omitted). Rather, "[t]he inherent result must inevitably result from the disclosed steps." *In re Montgomery*, 677 F.3d 1375, 1380 (Fed. Cir. 2012).

Petitioner's evidence tends to show that Pasquier's asphalt emulsion, when cured, would ***likely*** exhibit a penetration value and softening point within the claimed range, but does not establish that it would ***inevitably*** have those characteristics. In support of its inherency arguments, Petitioner points to disclosures in the '624 patent, SBH, and Corte indicating that hard

pen asphalts would be expected to have softening points greater than 140° F. Pet. 30–32 (citing Ex. 1001, 2:66–3:3; Ex. 1008, 44; Ex. 1007, 16). Yet the relied-upon statement in the '624 patent by its own terms describes what is "typical" for hard asphalt compositions, not what pen values and softening points are necessarily present after curing. Ex. 1001, 2:66–3:3. The table in SBH on which Petitioner relies is titled "[s]pecifications for paving grade bitumens with penetrations from 20 to 330 dmm." Ex. 1008, 44. The table does not list specifications for 10/20 pen bitumen, but for 20/30 bitumen, the closest grade listed, SBH indicates a softening point of 55–63°C. *Id.* While Petitioner argues that the table shows the well-understood inverse correlation between softening point and penetration value (Pet. 31), the values listed in the table do not provide strong support for Petitioner's contention that a 10/20 pen bitumen, as taught in Pasquier, would inevitably yield a cured tack coat having a softening point greater than about 60° C. Indeed, as Patent Owner notes, another table in SBH indicates that at least some asphalts with penetration values between 10 and 20 dmm have softening points below 60° C. PO Supp. Resp. 6 (reproducing SBH's Figure 2.3 with annotations).

Corte's table is titled "Typical Hard Asphalt Characteristics (Before Aging)." Ex. 1007, 16. That table indicates that a 10/20 grade asphalt having a penetration index of +0.5 would typically have a softening point of 62–72°C. *Id.* Corte's table does support that a typical 10/20 grade asphalt would have a softening point within the claimed range, but this is yet further evidence of what is typical or likely, not what is necessarily present. For example, an asphalt having a lower penetration index than the +0.5 reported in Corte may have a softening point outside the claimed range. *See*

generally Ex. 1002 ¶¶ 19–20 (testimony of Dr. James explaining the relationship between penetration value, softening point, and penetration index). Pasquier does not specify a particular penetration index for the asphalt, instead stating, as Patent Owner points out, that "all road or industrial bitumen types can be used." PO Supp. Resp. 5 (quoting Ex. 1003, 5:20–22).

Petitioner also relies on its "testing of select Pasquier formulations" resulting in a sample having a penetration value of 10 dmm and a softening point of 72°C. Pet. 32 (citing Ex. 1013). According to Petitioner, this testing establishes "that Pasquier's 10/20 pen asphalt material would necessarily have a softening point greater than about 140°F (60°C)." This testing does not convince us that Pasquier's formulations would necessarily result in a cured tack coat having the claimed rheological properties because, as Patent Owner points out, the formulations that were tested departed from Pasquier's examples in some respects. *See* PO Supp. Resp. 10–11. For example, the tested formulations used Redicote E-9 as the emulsifier rather than the Emulsamine L60 disclosed in Pasquier. *See* Ex. 1002 ¶ 118; Ex. 1003, 3:67–68). In addition, the tested recipes used more hydrochloric acid than disclosed in Pasquier. Ex. 1002 ¶ 119. Dr. James explained why these adjustments were necessary and why he believes an ordinarily skilled artisan would have made them. *See* Ex. 1002 ¶¶ 118–119. Nevertheless, these departures from the formulations set forth in Pasquier undermine Petitioner's reliance on the tests to show inherent characteristics of Pasquier's cured tack coat.

Petitioner's remaining arguments are premised on certain assumed properties and conditions that are typical or normal rather than necessarily

present. For example, Petitioner argues that "*when taking the normal PI range for paving-grade asphalts into account*, 10/20 asphalts would inevitably have softening points greater than 'about 60°C.'" Pet. 32 (emphasis added). Elsewhere, Petitioner asserts that an ordinarily skilled artisan "would have known that Pasquier's residual tack coat would *generally* reflect the characteristics of the base asphalt." Pet. 34 (emphasis added). Dr. James similarly qualifies his conclusion of inherency by testifying that:

> a skilled artisan would have expected Pasquier's tack coat residue—*when low quantities of the PEG 600 additive were utilized in the emulsion recipe* (e.g., 1% PEG 600 b/w of asphalt)—to *generally* reflect the characteristics of the base asphalt and thus exhibit a penetration value less than about 20 dmm and a softening point greater than about 60°C.

Ex. 1002 ¶ 149 (emphasis added). The qualifying conditions that an ordinarily skilled artisan would have placed on Pasquier's asphalt emulsion to ensure that it "generally" met the claimed penetration values falls short of the showing of necessity or inevitability that is required to establish anticipation by inherency.

In reply, Petitioner points to Pasquier's teaching that the "residual layer [is] not affected by temperature up to 70ºC." Supp. Reply 1 (quoting Ex. 1003, 3:14). According to Petitioner, "Pasquier's teaching would motivate skilled artisans to produce an 'asphalt residue with a softening point at 70 degrees or more.'" *Id.* (citing Ex. 2079, 289:22–290:1). This argument is unpersuasive because it presents an obviousness argument in the context of an anticipation challenge.

Petitioner further argues that disclosure of at least one embodiment that would necessarily and inevitably produce a residual tack coat having the

claimed pen value and softening point is sufficient to establish anticipation. *Id.* at 4–5 (citing *Toro Co. v. Deere & Co.*, 355 F.3d 1313, 1321 (Fed. Cir. 2004)). Yet Petitioner has not identified at least one embodiment in Pasquier that would necessarily produce a cured tack coat having the claimed rheological properties. Petitioner argues that Pasquier's teaching to use a 10/20 pen asphalt "necessarily disclose[s] numerous distinct embodiments," and the majority of those embodiments would have the claimed penetration and softening point values. *Id.* at 5. We disagree that disclosure of a 10/20 pen bitumen constitutes a disclosure of multiple distinct embodiments including the individual penetration values within that range. *See* Tr. 23:11–16 (Petitioner explaining its argument that "the different species in that 10/20 grade would be a 10 pen, and 11 pen, a 12 pen, 13 pen, 14 pen, up to 20"). Pasquier describes the formulation in its Table 1 as a single example having "Bitumen 10/20" in a specified quantity. *See* Ex. 1003, 3:60–62, 4:1–4. The same is true of Pasquier's examples 2, 3, and 5. *See id.* at 4:10–22, 5:7–10. Pasquier's description of four individual examples having 10/20 pen bitumen in particular amounts is inconsistent with Petitioner's position that each of those individual examples should be considered numerous distinct embodiments. Petitioner's argument is also at odds with the testimony of its expert, Dr. James, that "Pasquier provides five examples of its emulsions." Ex. 1002 ¶ 81.

For the reasons explained above, we conclude that Petitioner has not demonstrated by a preponderance of the evidence that Pasquier anticipates independent claims 1, 14, and 25 or their respective dependent claims 2–5, 12, and 15–18.

D. The Obviousness Challenges

1. Legal Standard

In *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1 (1966), the Supreme Court set out a framework for assessing obviousness under § 103 that requires consideration of four factors: (1) the "level of ordinary skill in the pertinent art," (2) the "scope and content of the prior art," (3) the "differences between the prior art and the claims at issue," and (4) "secondary considerations" of nonobviousness such as "commercial success, long felt but unsolved needs, failure of others, etc." *Id.* at 17–18; *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 407 (2007).

We discussed the first *Graham* factor in Section II.B above. We now turn to a discussion of the remaining *Graham* factors.

2. Summary of Petitioner's Cited References

a) Pasquier

The primary reference in Petitioner's obviousness challenges is Pasquier, the disclosure of which was summarized in Section II.C.2 above.

b) SBH

SBH is the Fifth Edition of an industry handbook, the First Edition of which was published in 1949. Ex. 1008, iv. SBH is a lengthy reference, but Petitioner chiefly relies on SBH to support its assertions regarding the relationship between penetration value and softening point, and the relationship of the properties of a tack coat residue to those of the base asphalt used in the emulsion. *See* Pet. 14–15. Regarding the former, SBH states that "[p]enetration grade bitumens are specified by the penetration and softening point tests. Designation is by penetration range only, e.g. 40/60 pen bitumen has a penetration that ranges from 40 to 60 inclusive and a softening point of 48 to 56°C." Ex. 1008, 43–45. As to the latter, SBH

discloses that "[i]t is generally assumed that the bitumen produced when an emulsion breaks is the same as the bitumen that was used to produce the emulsion, but there are exceptions." *Id.* at 99.

c) US DOT

US DOT is a standard specification for construction of roads and bridges on federal highway projects. Ex. 1010, iii. As relevant to Petitioner's challenges (*see* Pet. 19), US DOT describes minimum lay-down temperatures for asphalt ranging from 255ºF to 295ºF depending on the road surface temperature (Ex. 1010, 241) and specifies an asphalt application rate of 0.03 to 0.15 gallons per square yard (*id.* at 303).

d) Durand

Durand describes a process for forming a bonding layer to bond a bituminous coated material layer on a support. Ex. 1011, at [57]. The process includes applying a surface-active agent on the support, applying a bituminous emulsion on the surface-active agent, and applying a breaking agent on the emulsion. *Id.* As relevant to Petitioner's challenges (*see* Pet. 20), Durand describes that its "hard bitumen emulsion," which is made of "class 35/60" bitumen, has an application temperature that "ranges between 60 and 80 C." Ex. 1011, 5:20–31.

e) Potti

Potti describes that a disadvantage of conventional tack coats is that "the residual binder remaining on the surface is far too tacky, making it stick to the tires of works vehicles." Ex. 1006, 17. Potti describes an emulsion called "Probiclean" that purportedly addresses this problem by binding the pavement layers without sticking to tires. *Id.* In describing the application of Probliclean, Potti states that the "[t]ime of opening to job site traffic [is] 30–60 minutes." *Id.* at 25.

f) Corte

Corte describes the development and uses in France of "[h]ard-grade paving asphalts, i.e., those having a penetration at 25ºC lower than 25 [dmm]." Ex. 1007, 12. In a table titled "Typical Hard Asphalt Characteristics (Before Aging)," Corte reports a softening point of 62 ºC to 72 ºC for a 10/20 asphalt. *Id.* at 16.

g) BAEM

BAEM is a technical manual jointly published by the Asphalt Institute and the Asphalt Emulsion Manufacturers Association. Ex. 1009, iii. Its purpose is "to impart a basic understanding of asphalt emulsions to those who work with the product" and "to be useful in choosing the emulsion that best fits a project's specific conditions." *Id.*

h) Gordillo

Gordillo explains that "[t]he performance of bituminous emulsions in their different uses in roads is related to their design and, especially, to the properties of their residual binder." Ex. 1012, 2. Gordillo compares five different test methods of obtaining residual binders. *Id.* at 3. After surveying and comparing the methods, Gordillo concludes that "[w]hen the emulsions analysed are made from pure bitumen or from modified bitumen without fluxes, the residues obtained with each method reproduce quite well the properties of the original binders. . . ." *Id.* at 7.

3. Claim 1

Petitioner contends that claim 1 would have been obvious "based upon Pasquier in view of [SBH], and optionally, in further view of Corte, BAEM, Gordillo, and/or US DOT." Pet. 49.

a) Unrebutted Aspects of Petitioner's Contentions

Patent Owner does not rebut Petitioner's arguments on several limitations in claim 1.[12] We first address those uncontested limitations.

Neither party argues that the preamble is limiting, but to the extent it is, we find that Pasquier discloses a method of bonding a layer of asphalt pavement material to a substrate layer. *See* Ex. 1003, 2:20–21; *see also* Pet. 27.

Regarding element [a] of claim 1, we find that Pasquier discloses providing an emulsion comprising a first phase that includes an asphalt composition. For example, in Table 1, Pasquier describes an emulsion that includes a bituminous phase having "Bitumen 10/20." Ex. 1003, 4:1–4; *see also* Pet. 27–28. We further find that Pasquier discloses an emulsion that comprises a second phase comprising water and emulsifying additives. For example, Pasquier's emulsion described in Table 1 includes an aqueous phase having water and Emulsamine L60, which is an emulsifier. Ex. 1003, 4:1–4; Ex. 1002 ¶ 118; *see also* Pet. 28. The remaining aspects of element [a] are disputed, and those disputed limitations are discussed below in Sections II.D.3.b)–c).

Regarding element [b], we find that Pasquier teaches to use its tack coat to bond two layers of asphalt. *See* Ex. 1003, 2:20–21; *see also* Pet. 53.

[12] The scheduling order in this proceeding reminded Patent Owner that "any arguments for patentability not raised in the [Patent Owner Response] will be deemed waived." Paper 24, 6; *see also In re Nuvasive, Inc.*, 842 F.3d 1376, 1380–81 (Fed. Cir. 2016) (holding that a patentee waived an argument by presenting it only in the preliminary proceeding and not during the trial, despite the Board cautioning the patentee that arguments not briefed in the response would be deemed waived).

We further find that the rate at which to apply the emulsion in order to form a tack coat was within the knowledge of persons of ordinary skill in the art. *See* Ex. 1002 ¶¶ 156, 204; Ex. 1010, 303; *see also* Pet. 53. Moreover, we find persuasive Petitioner's contention that the US DOT reference teaches such an application rate and that a skilled artisan would have been motivated to combine Pasquier and US DOT's teaching regarding application rates because the purpose of the US DOT reference is to set out standards for constructing roads. *See* Ex. 1002 ¶ 204; Ex. 1010, iii, 303; *see also* Pet. 53.

Regarding elements [c] and [d], we find that these are standard steps for constructing roads using a tack coat that were within the background knowledge of ordinarily skilled artisans. *See* Ex. 1002 ¶¶ 158–160, 205–206; *see also* Pet. 54–55. The evidence supports Petitioner's assertion that it was known that tack coats are used in hot mix asphalt roadways, in which the asphalt material is applied at an elevated temperature. *See* Pet. 54 (citing Ex. 1002 ¶ 205; Ex. 1008, 190–93, 279; Ex. 1009, 1; Ex. 1010, 241). Moreover, we find persuasive Petitioner's contention that the SBH, BAEM, and US DOT references teach these steps and that a skilled artisan would have been motivated to combine Pasquier and those teachings because Pasquier's stated purpose is to "achieve a tack coat for road construction" and the secondary references provide more detailed information on using emulsions for road building. *See* Ex. 1003, 2:4; Ex. 1002 ¶¶ 158–160, 205–206; Ex. 1008, 190–193; Ex. 1009, 1; Ex. 1010, 241; *see also* Pet. 54–55.

b) Stabilizer

Element [a] in claim 1 recites that the second phase includes "stabilizing additives." We are persuaded by Petitioner's contention that

Pasquier teaches this limitation to a person of ordinary skill in the art. *See* Pet. 28–29, 50. In particular, Pasquier teaches that "emulsions composed from hard or hardened bitumen types with the addition of polyethylene glycol . . . are absolutely remarkable" in that such emulsions are "more stable than a pure hard bitumen emulsion." Ex. 1003, 5:31–35. Pasquier's Tables 1, 2, 4, and 5 list polyethylene glycol in the bituminous phase (*id.* at 4:2, 4:12; 5:2, 5:7), but Pasquier also teaches that "[p]olyethylene glycol may be added equally to the aqueous phase or the bituminous phase during manufacturing." *Id.* at 5:26–27.

Moreover, in Pasquier's Table 5 embodiment, the aqueous phase includes calcium chloride. *Id.* at 5:9; *see also* Pet. 42–43; Reply 6–8. Dr. James testifies that calcium chloride is an additive that ordinarily skilled artisans knew to use in cationic rapid-set emulsions to provide extra storage stability. Ex. 1002 ¶ 170; Ex. 1093 ¶¶ 90–91. This testimony is supported by SBH, which describes that "[s]ettlement can be reduced by equalising the densities of the two phases. One way of achieving this is to add calcium chloride to the aqueous phase." Ex. 1008, 100; *see also id.* at 112, Fig. 6.7. Mr. O'Leary agreed in his deposition that this statement reflects what an ordinarily skilled artisan would understand as a use of calcium chloride in an asphalt emulsion. *See* Ex. 1092, 18:17–19:3; *see also id.* at 12:9–13:1, 17:23–18:5.

We have considered Patent Owner's counter-arguments on this limitation but we do not find them persuasive. Patent Owner contends that "PEG [i.e., polyethylene glycol] is not a stabilizer when added to the aqueous phase of an asphalt emulsion." PO Resp. 24. Patent Owner acknowledges that Pasquier teaches that polyethylene glycol can be used as

a stabilizer when added to the asphalt phase, but Patent Owner asserts that Pasquier does not teach that PEG stabilizes the emulsion when added to the aqueous phase. *Id.* at 25. This argument is unpersuasive in view of Pasquier's disclosure that "[p]olyethylene glycol may be added equally to the aqueous phase or the bituminous phase during manufacturing." Ex. 1003, 5:26–27. Pasquier discloses only a few lines later that polyethylene glycol promotes stability and says nothing to suggest that this benefit only obtains when polyethylene glycol is added in the asphalt phase. Ex. 1003, 5:31–35. We also note that record evidence supports Petitioner's Reply argument that the prior art recognized that polyethylene glycol enhances stability when added to the aqueous phase of a hard-pen emulsion. *See* Reply 5; Ex. 1051 ¶¶ 8, 12–15.

Patent Owner also points to its testing, which purportedly shows increasing the quantity of polyethylene glycol in the aqueous phase from 0.5% to 5% had no effect on stability. PO Resp. 26–27 (citing Ex. 2078 ¶¶ 127–130). As Petitioner notes, however, Patent Owner performed no testing on an emulsion formulation without polyethylene glycol, which means Petitioner's testing lacks a basis for comparing stability between formulations including polyethylene glycol versus those excluding polyethylene glycol. *See* Reply 6; Ex. 1092, 164:17–165:9.

Patent Owner further contends that "Dr. James admitted that he did not consider PEG to be a stabilizer" and that Mr. O'Leary testified that an ordinarily skilled artisan would not consider PEG to be a stabilizer. PO Resp. 27 (citing Ex. 2079, 39:3–8, 70:12–73:2; Ex. 2078 ¶¶ 72, 135, 137). This argument mischaracterizes Dr. James's testimony. In the cited portions of Dr. James's deposition, he was asked whether he had "call[ed]

polyethylene glycol a stabilizer" to certain persons during his consulting work and he responded that he did not recall mentioning polyethylene glycol as a stabilizer. *See* Ex. 2079, 71:7–72:6. Dr. James further explained that "I don't necessarily think that polyethylene glycol is a particularly good stabilizer such that I would recommend it to someone." *Id.* at 72:24–73:2. Labeling that testimony an admission that polyethylene glycol is not a stabilizer is like saying a waiter who declined to recommend a brownie sundae because it is not a particularly good dessert has admitted that the brownie sundae is not a dessert.

Dr. James also testified that water soluble polymers including the polyethylene glycol specifically mentioned in Pasquier would improve storage stability through their thickening effect. *Id.* at 273:21–274:22; *see also* Ex. 1002 ¶ 82 (discussing Pasquier's disclosure of polyethylene glycol as a stabilizing additive); Ex. 1093 ¶ 77 ("Pasquier and other prior art references recognize polyethylene glycol to be a 'stabilizer' . . . when added to the aqueous phase of an asphalt emulsion."). We credit Dr. James's testimony over Mr. O'Leary's contrary testimony on this issue. *See* Ex. 2078 ¶ 72 ("I disagree with Dr. James that a PHOSITA would consider Pasquier to be describing PEG as a stabilizer."); *see also id.* ¶¶ 135, 137. Mr. O'Leary's categorical statement that "as far as I am aware, PEG has never been considered to be a stabilizer in asphalt emulsions" (*id.* ¶ 72) is at odds with the disclosure of Pasquier itself. Ex. 1003, 5:31–35. Even Patent Owner acknowledges that "Pasquier explains that PEG improves the stability of the emulsion when added to the first asphalt phase." PO Resp. 25.

More broadly, Dr. James's detailed explanations through his multiple declarations and depositions in this proceeding evidence a formidable command of the chemistry of asphalt emulsions. Indeed, Mr. O'Leary agreed that he "would consider [Dr. James] to be one of the foremost experts in emulsion chemistry in the world." Ex. 1092, 41:21–24. Dr. James has bachelor's and doctorate degrees in chemistry, has authored "50 or so" publications relating to asphalt chemistry, and received "the Hall of Fame Award from the Asphalt Emulsion Manufacturers Association for [his] contributions to the study of asphalt emulsion," among other accolades. Ex. 1002 ¶¶ 2–5. Mr. O'Leary has a significant amount of work experience in the field, but has no academic degree related to emulsion chemistry. Ex. 2010 ¶¶ 5–17. In some instances during his depositions, Mr. O'Leary contradicted or was unable to defend statements in his declarations pertaining to emulsion chemistry. *E.g.*, *compare* Ex. 2078 ¶ 138 ("I also disagree with Dr. James that Emulsamine L60 or Redicote E-9 could be considered stabilizers."), *with* Ex. 1092, 38:4–7 ("He says Emulsamine is—I don't know whether it acts as a stabilizer or not. I don't know—you know, I can't answer that. I don't know."), 39:18–23 ("I've never used Emulsamine L60. I've not used it in practice, so I can't testify about Emulsamine L60, whether it's an emulsifier or—or not—I—I mean, I know it's an emulsifier. Or whether it has a stabilizing effect, I don't know that."); *compare* Ex. 2078 ¶ 140 ("I disagree with Dr. James's opinion that a PHOSITA would consider calcium chloride used in Pasquier's formulations to be stabilizers."), *with* Ex. 1092, 18:17–19:15 (agreeing that SBH teaches to use calcium chloride to the aqueous phase to reduce settlement and that this teaching reflects what an ordinarily skilled artisan would understand as a use

of calcium chloride in an asphalt emulsion). For these reasons, on topics relating to emulsion chemistry, we find Dr. James to be more credible than Mr. O'Leary.

Based on the foregoing, we find that Pasquier teaches a second phase including "stabilizing additives" as recited in element [a].

c) Penetration Value and Softening Point

Element [a] in claim 1 recites that "the asphalt composition in the emulsion [is] effective for providing a coating having a penetration value less than about 40 dmm and a softening point greater than about 140 ° F. (60 °C.) when applied to the substrate layer and cured." Ex. 1001, 14:2–4. As discussed in Section II.C.3, Petitioner did not show that this limitation was inherent in Pasquier, which deficiency disposed of Petitioner's anticipation challenges. Nevertheless, we determine that Petitioner's arguments concerning this limitation for its obviousness challenges are persuasive. *See CRFD Research, Inc. v. Matal*, 876 F.3d 1330, 1345 (Fed. Cir. 2017) ("Even if a reference's teachings are insufficient to find anticipation, that same reference's teachings may be used to find obviousness.").

The limitation reciting the rheologicial properties of the cured tack coat appears to be "the mere quantification of the results of a known process." *Southwire Co. v. Cerro Wire LLC*, 870 F.3d 1306, 1312 (Fed. Cir. 2017). In *Southwire*, a prior art reference named Summers disclosed the claimed steps of creating a cable containing a lubricant, but did not disclose the degree to which its embodiments reduced the pulling force necessary for installation. *Id.* at 1311. In affirming the Board's obviousness determination, the Federal Circuit noted that "[s]imply because Summers

never quantified the reduction in pulling force achieved by its disclosed embodiments does not preclude the possibility, or even likelihood, that its process achieved at least a 30% reduction [as claimed], especially since its stated purpose was the same as that of the [challenged] patent." *Id.* at 1311–12. Similarly, here, Pasquier teaches substantially identical techniques for creating a tack coat as the claimed method and Pasquier's stated purpose of eliminating tracking is the same as that of the '624 patent. And as discussed in greater detail below, we find that Petitioner has presented persuasive evidence that an ordinarily skilled artisan would expect that an emulsion created according to Pasquier's teachings would likely yield a cured tack coat having a penetration value and softening point within the claimed ranges.

Regarding penetration value, Pasquier teaches to make emulsions from a 10/20 pen bitumen. *E.g.*, Ex. 1003, 4:2, 4:12, 4:17, 5:7, 5:20. The 10/20 value of Pasquier's bitumen describes the penetration value of the base asphalt, but Petitioner has presented substantial evidence establishing that a skilled artisan would expect the penetration value of Pasquier's cured tack coat to be similar to the penetration value of the base asphalt. That evidence includes teachings in the prior art references, expert testimony, and test results. For example, SBH explains that "[i]t is generally assumed that the bitumen produced when an emulsion breaks is the same as the bitumen that was used to produce the emulsion, but there are exceptions." Ex. 1008, 99; *see also* Ex. 1009, 26 ("The same desirable characteristics in the base asphalt cement should show up in the residual asphalt after emulsification and coalescence."). With citation to these and other prior art references, Dr. James testifies that skilled artisans understood before November 2005

that a tack coat residue "will generally exhibit properties similar to those of the asphalt used in the emulsion, subject to variances caused by additives (e.g. polymers, waxes, etc.) included in the emulsified composition." Ex. 1002 ¶ 150; *see also id.* ¶¶ 151–153, 203. Dr. James also explains why a skilled artisan following Pasquier's teachings would expect such additives to have minimal impact on the pen value of the residual tack coat. *Id.* ¶ 152.

Regarding softening point, the evidence supports Petitioner's argument that there was a known relationship between penetration value and softening points, and a 10/20 pen asphalt would have been expected to exhibit a softening point greater than 60°C. *See* Pet. 51–52; Ex. 1007, 16 (listing 62°C to 72°C as a typical softening point for 10/20 grade asphalt); Ex. 1002 ¶¶ 19, 142–144. Further, as with penetration value, a skilled artisan would have expected the softening point of the cured tack coat to be similar to that of the base asphalt. Ex. 1002 ¶¶ 150–154. Looking at the disclosure of Pasquier specifically, Pasquier describes that an advantage of its tack coat emulsion is that it provides a "residual layer not affected by temperature up to 70° C." Ex. 1003, 3:14. Pasquier links this reduced heat susceptibility to the use of a hard pen asphalt, such as a 10/20 pen bitumen: "The reduction of the heat susceptibility is achieved either by means of an additive group a) in a high penetrability bitumen, or by using a hard bitumen for instance of class 10/20 or 15/25." *Id.* at 5:19–20. We credit Dr. James's testimony that

> [w]hile Pasquier does not mention explicitly softening point as determined in the laboratory using the ring and ball method, from the objective for a product "not soft" at 70° C, a skilled artisan would readily understand from Pasquier's teachings that a hard asphalt having a high softening point should be utilized.

Ex. 1002 ¶ 148.

Petitioner's testing of tack coats formulated based on Pasquier's teachings provides further support for Petitioner's arguments that a skilled artisan would have expected Pasquier's cured tack coat to have a penetration value within the claimed range of less than about 40 dmm, as well as a softening point within the claimed range of greater than about 60°C. In that testing, three asphalt emulsions recipes were prepared based on Pasquier's Example 1. *See* Ex. 1002 ¶¶ 113–117.

Of the three recipes tested, Recipe #2 tracked Pasquier's Example 1 most closely, differing only in the type of emulsifier and the amount of hydrochloric acid. *Id.* ¶ 117. Dr. James explains that the Emulsamine L60 listed in Pasquier was not available in the U.S. market at the time of testing, so based on Pasquier's teaching that "[o]ther emulsifiers than the one mentioned in the examples may be used" (Ex. 1003, 5:17), he substituted Redicote E-9, a traditional tallow diamine emulsifier. Ex. 1002 ¶ 118. In view of its widespread availability and utilization in the industry, Dr. James testifies that "one of ordinary skill in the art would consider Redicote E-9 a suitable replacement for Emulsamine L60." *Id.* Dr. James further explains that the use of a different emulsifier made it necessary to add more HCl than listed in Pasquier's Example 1 in order to achieve the pH target specified for the cationic soap solution. *Id.* ¶ 119; *see also* Ex. 2079, 106:17–109:15 (Dr. James's deposition testimony elaborating on why a larger amount of hydrochloric acid was used and explaining that excess hydrochloric acid would not affect residue properties because excess acid would be eliminated by high temperatures during recovery of the residue).

In Recipes #1 and #3, only 1% by weight polyethylene glycol was used rather than 10% as in Recipe #2 and Pasquier's Example 1. Ex. 1002

¶ 116. Dr. James points out that this modification of Pasquier's Example 1 is taught in Pasquier itself, insofar as it discloses that the amount of the polyethylene glycol additive can vary between 1% and 15%. *Id.* ¶ 113 (citing Ex. 1003, 3:49–50). Recipes #1 and #3 differ from each other in when the polyethylene glycol was added: in Recipe #1, it was added to the asphalt phase; in Recipe #2, it was added to the aqueous phase. *Id.* ¶ 116. Dr. James points out that these variations were also taught in Pasquier itself. *Id.* ¶ 113; Ex. 1003, 5:26–27 ("Polyethylene glycol may be added equally to the aqueous phase or the bituminous phase during manufacturing.").

The base asphalt used for the testing had a penetration value of 10 dmm and a softening point of 72°C. Ex. 1002 ¶ 120. Dr. James explains how this base asphalt was prepared and testifies that it is "functionally equivalent to the 10/20 pen asphalt disclosed in Pasquier." *Id.* After the emulsions were prepared and their residues were recovered using two different methods, the residues were tested for penetration value and softening point. *See id.* ¶¶ 121–131. The test results are reported in the table below:

Asphalt Emulsion Residues			
Sample	**Recovery Method**	**Penetration Value (dmm)**	**Softening Point (°C)**
Base Asphalt	n/a	10	72.0
Recipe 1 (1% PEG 600)	Distillation	12	67.0
	Evaporation	10	70.6
Recipe 2 (10% PEG 600)	Distillation	22	63.2
	Evaporation	17	68.6
Recipe 3 (10% PEG 600)	Distillation	13	71.2
	Evaporation	11	76.8

Id. ¶ 132. These results show that each recipe and each recovery method yielded a residue having a penetration value within the claimed range of less

than about 40 dmm and a softening point within the claimed range of greater than about 60°C. We credit Dr. James's testimony that these results are "consistent with the understanding of those skilled in the art at the time of Pasquier that small quantities of liquid or semi-solid additives are not likely to substantially change the consistency of the asphalt cement." *Id.*

Patent Owner argues that Petitioner's testing is unreliable because Dr. James deviated from Pasquier's teachings by using a different emulsifier and more hydrochloric acid. *See* PO Resp. 38–43. However, as summarized above, Dr. James explained why he made those modifications. We find his explanations and his testimony that the modifications are within the level of ordinary skill in the art to be credible, particularly in view of Pasquier's teaching that different emulsifiers can be used. Ex. 1003, 5:17; Ex. 1002 ¶ 118–119.

Relatedly, Patent Owner argues that its own testing, carried out by Mr. O'Leary, found that it was unnecessary to add as much acid as Dr. James did in order to reach the target pH value. PO Resp. 40–41 (citing Ex. 2078 ¶¶ 105, 131). A skilled artisan would not add as much acid as Dr. James used, according to Patent Owner and Mr. O'Leary, because it would corrode storage and application equipment. *Id.* at 42 (citing Ex. 2078 ¶ 132). Yet Mr. O'Leary's testing of emulsions that used the amount of hydrochloric acid specified in Pasquier still yielded residues having pen values and softening points within the claimed ranges. *See* Ex. 2078 ¶¶ 127, 131. The table below, reproduced from Mr. O'Leary's declaration, summarizes the results of both Petitioner's testing (shown in the "PRI" columns) and Patent Owner's testing (shown in the "BETA" columns):

SUMMARY OF TEST RESULTS												
				PRI (Recipes)			BETA (Runs)					
Test	Method	Min	Max	#1	#2	#3	#1	#2	#3	#4	#5	#6
Penetration Value (dmm)	ASTM D5	---	20	12	22	13	11	11	11	16	11	13
Softening Point (°C)	ASTM D36	65	---	67.0	63.2	71.2	72	72	72	61	72	70
24-hour Storage Stability	ASTM D244	---	1				21.4	62.1	64.1	8.0	56.5	0.4
5-day Storage Stability	ASTM D244	---	5				62.8	67.1	60.2	24.8	60.2	0.6
Viscosity	ASTM D88		100				10	11	12	11	11	135
Sieve Test	T 59	---	0.3				0.0	0.06	0.04	0.0	0.0	0.11
Solubility	T 44	97.5	---				99.9	99.9	99.9	99.9	99.8	99.9
DSR	T 315	1.0	---				1.97	2.09	2.0	0.55	1.89	2.26
DSR, phase angle	T 315	Report					86.1	86.0	82.9	89.0	87.1	83.1
Emulsion pH @ 25C		Report					2.65	2.65	2.57	2.95	2.61	2.69
Residue %	ASTM D6997	50	---				46.9	46.2	48.1	46.2	44.4	49.5

Id. ¶ 127.

The first two rows reflect that every tested residue had a penetration value and softening point within the claimed range. In this respect, as Petitioner points out in Reply, Patent Owner's testing validates Petitioner's testing because both sets of results "demonstrate that an emulsion produced according to Pasquier's teachings with a typical, commercially available 10–15 pen asphalt will produce a residual tack coat falling within the claimed penetration and softening point parameters." Reply 15.

Patent Owner also challenges Petitioner's testing on the basis that it fails to show that Pasquier's tack coats would function as viable tack coats. PO Resp. 32. Patent Owner argues that its own testing shows that

Pasquier's emulsions lack the emulsifiers and stabilizers to form a tack coat with sufficient stability and viscosity. *Id.* at 32–33 (citing Ex. 2078 ¶¶ 127–132). According to Patent Owner, ordinarily skilled artisans understood that an emulsion's viscosity must fall within a limited range to produce a viable tack coat because it must be fluid enough for spray application but viscous enough to avoid flowing off the road surface. *Id.* at 30–31 (citing Ex. 2078 ¶¶ 46, 74; Ex. 1008, 110). Patent Owner argues that Mr. O'Leary's testing shows that emulsions containing polyethylene glycol added to the aqueous phase had viscosities of 12 s or less, which is below the 20 s viscosity that is generally accepted as a minimum. PO Resp. 31 (citing Ex. 2078 ¶¶ 127–128).

Patent Owner does not tether these arguments to the language of claim 1, and we find no requirement in the claim for a particular degree of stability or viscosity. The absence in claim 1 of any required amount of stability or viscosity stands in contrast to the quantitative measurements the claim specifies for other properties, including penetration value and softening point.[13] Moreover, Petitioner's testing was not intended to

[13] Patent Owner's viscosity arguments may be understood as an effort to show that the tested emulsions based on Pasquier's teachings are not viscous enough to be applied "in an amount which is sufficient to provide a coating on the exposed surface of the substrate layer" as set forth in limitation [b]. *See* Tr. 65–67. Patent Owner asserts that Dr. James "admitted that a tack coat emulsion with insufficient viscosity would run off a substrate pavement layer on application and would fail to form the required exposed coating or bonding layer of the claims." PO Resp. 31 (citing Ex. 2079, 62:7–64:11). Yet Dr. James explained in the cited portion of his deposition that runoff is rarely a problem for tack coats because the application rate is low. Ex. 2079, 63:8–12, 64:18–20. Petitioner also persuasively argues that emulsions having a low viscosity are desirable for application on a granular base, which is an application that is encompassed in claim 1. *See* Reply 19–20.

produce a commercially viable tack coat, nor to demonstrate any particular performance with respect to stability or viscosity. *See* Ex. 1002, 80 n.4 (Dr. James explaining, with respect to the testing, that it "was not the intention to produce an emulsion meeting any particular specification of quality in respect of viscosity, sieve residue, settlement, etc."). Rather, the testing was intended to confirm that emulsions formulated in accordance with Pasquier's teachings would produce tack coats having pen values and softening points within the claimed range and to support Dr. James's opinion that the small quantities of additives contemplated in Pasquier are unlikely to substantially change the consistency of the asphalt. *Id.* ¶¶ 110, 114, 132; Reply 20. As summarized above, we find that those points are supported by Petitioner's testing as well as Patent Owner's testing.

For the foregoing reasons, we determine that Petitioner has demonstrated that an ordinarily skilled artisan would have expected a tack coat made using Pasquier's teachings to have a penetration value and softening point within the ranges recited in claim 1.

d) Secondary Considerations of Nonobviousness

Patent Owner argues that that objective evidence of nonobviousness in the form of long-felt need, industry skepticism, and praise for the invention, supports the patentability of the claimed invention. *See* PO Resp. 52–67. Petitioner did not address secondary considerations in its Reply, but included a brief section in its initial petition rebutting the secondary

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Further, Petitioner presents persuasive evidence that ordinarily skilled artisans knew how to optimize an emulsion's viscosity for the desired application. *See* Reply 21 (citing Ex. 1092, 129:5–138:21; Ex. 1008, 99–101).

considerations arguments it expected Patent Owner would make. *See* Pet. 66–69; Tr. 14:13–15.

(1) Long-Felt Need

Patent Owner argues that its invention solved a long-felt need for a trackless tack coat. PO Resp. 52. In this regard, Patent Owner points to Dr. James's testimony that in the 1990s, the industry became interested in technologies to ameliorate the tracking problems associated with tack coats made from soft asphalt. *Id.* (citing Ex. 1002 ¶ 30). Patent Owner argues that although Dr. James identified European suppliers with products that purportedly solved the tracking problem, Dr. James was unable to "confirm that any of their products resulted in a tack coat having a penetration value of about 40 dmm or less and a softening point of about 60 ºC or more." *Id.* at 53 (citing Ex. 2079, 90:7–94:8). Patent Owner contends that the prior art recognized the limited storage stability of trackless tack emulsions made with hard pen asphalts, and that Patent Owner's insight was that "using a stabilizer was key" to a successful trackless tack coat. *Id.* at 54–56. Patent Owner argues that the inventor "surprisingly found that the penetration value and softening point of the resulting coating were important parameters for achieving trackless coating with strong bonding characteristics" and that the "prior art failed to recognize the importance of these parameters." *Id.* at 57–58.

We are not persuaded that the claimed invention fulfilled a long-felt need that was unmet by the prior art. "Where the differences between the prior art and the claimed invention are as minimal as they are here, . . . it cannot be said that any long-felt need was unsolved." *ZUP, LLC v. Nash Manufacturing, Inc.*, 896 F.3d 1365, 1374 (Fed. Cir. 2018) (quoting *Geo. M.*

Martin Co. v. All. Mach. Sys. Int'l LLC, 618 F.3d 1294, 1304–05 (Fed. Cir. 2010)). The evidence of record indicates that the claimed invention was not the first to achieve the goal of a trackless tack coat. Most notably, Pasquier taught "a tack coat that sticks the layers perfectly to each other without sticking to the wheels of the construction equipment so as to avoid bituminous products from being carried into surrounding roads." Ex. 1003, 2:46–50. Several of the exemplary emulsions Pasquier taught for doing so used a 10/20 pen bitumen. *Id.* at 4:2, 4:12, 4:17, 5:7, 5:20. Petitioner presented other evidence of prior art trackless tack coats made from hard pen base asphalts. *See, e.g.*, Ex. 1005, 27 (noting the tracking problem for traditional tack coats and "present[ing] the properties of a new type of tack coat capable of withstanding works vehicles known generically under the term heat-adhesive emulsions . . .[, which are] made from very hard types of bitumen"); Ex. 1006, 17 (describing that "a generation of emulsions have been developed which are known as 'heat adhesive' emulsions, which make it possible to guarantee interlayer adhesion by minimizing the damage to tack coats cause by job site traffic" and stating that Probiclean is "typical of a type of emulsion where the residue 'binds the pavement layers together but does not stick to tires'"); *see also* Ex. 1002 ¶¶ 33–39 (Dr. James summarizing the products offered by French and Spanish companies before 2005 that used hard pen asphalts to create tack coats that alleviated tracking problems).

Patent Owner's long-felt need argument emphasizes the rheological properties of the cured tack coat that are recited in claim 1, but Petitioner has shown that those properties are the likely and expected result of using a hard pen base asphalt in formulating a tack coat as taught in Pasquier. In

particular, as discussed in Section II.D.3.c), Petitioner has demonstrated that an ordinarily skilled artisan would have expected an emulsion formulated according to Pasquier's teachings to result in a cured tack coating having a penetration value and softening point within the claimed ranges. "[W]here a claimed invention represents no more than the predictable use of prior art elements according to their established functions, as here, evidence of secondary indicia are frequently deemed inadequate to establish non-obviousness." *ZUP*, 896 F.3d at 1375 (quoting *Ohio Willow Wood Co. v. Alps S., LLC*, 735 F.3d 1333, 1344 (Fed. Cir. 2013)).

As to Patent Owner's arguments concerning the stability of its invention, we are not persuaded that the prior art trackless tack coats suffered from the stability problems that Patent Owner asserts, nor are we persuaded that the claimed invention presented any improvement over the prior art in that regard. Pasquier's emulsion formulations contain a stabilizer, as Mr. O'Leary acknowledges (Ex. 1092, 33:4–8), and Pasquier touts stability as one of the "absolutely remarkable" features of its emulsions. Ex. 1003, 5:31–35. The other prior art trackless tack coats are also described as exhibiting favorable stability. *See* Ex. 1005, 33 (reporting that the emulsions described therein "have been stored over a period of more than one month, only suffering light sedimentations"); Ex. 1006, 26 (listing 10% maximum sedimentation after 7 days). Patent Owner faults Petitioner for failing to produce evidence of the commercial viability of the prior art trackless tack coats, PO Resp. 53, but the references themselves provide evidence of commercial viability. *See, e.g.*, Ex. 1006, 24 (disclosing that Probiclean was applied on more than 14 million square meters of road in Spain between 2001 and 2003). Dr. James's testimony provides additional

evidence in this regard, as he was active in the industry during the relevant time period and he was personally aware of these products on the European market. *See* Ex. 1002 ¶¶ 28–39.

Moreover, Patent Owner does not explain how or why any feature of the claimed invention provides a stability improvement over the prior art. Claim 1 includes only the generic recitation that the aqueous phase includes "stabilizing additives." Ex. 1001, 13:67–14:1. The relevant description in the Specification is similarly non-specific. *See, e.g.*, *id.* at 8:12–19 ("The emulsifiers and/or stabilizers maintain the asphalt material in a stable suspension and control the breaking time. . . . The stabilizers may include polycarboxylate polymers, preservatives, etc."); *id.* at 8:26–28 ("Long term stabilizers and/or other additives that are beneficial for a particular application also may be incorporated in the emulsion."). When asked at the hearing where the patent describes how to make emulsions stable, Patent Owner responded that "I don't think it makes any specific references. . . . I am not telling you that we tell you how to make it stable. That's something that, frankly, any good emulsion person should be able to do." *Id.* at 71:14–72:2.

For these reasons, we are not persuaded that the claimed invention satisfied a long-felt need.

(2) Skepticism and Praise

Patent Owner argues that various state departments of transportation were skeptical that a trackless coating could serve as a bonding layer, but were impressed with Patent Owner's product in testing and eventually adopted specifications that encompassed the properties of Patent Owner's claimed tack coat. PO Resp. 56–63. Patent Owner's evidence of initial

industry skepticism and subsequent praise does provide some objective indicia of nonobviousness. However, the weight we give to that evidence is diminished because the DOTs were comparing Patent Owner's product to conventional tack coats, not trackless tack coats as described in Pasquier or others that were available in the European market.

For example, the South Carolina and Texas DOT representatives Patent Owner quotes were skeptical of the very concept of a trackless tack coat. *See id.* at 59 ("How can it work if it doesn't track?"); *id.* at 60 ("As a rule of thumb, if you can walk on the tack coat without it sticking to your boots, the tacked surface is not ready to be paved over."). Similarly, what impressed the DOT personnel in testing was lack of tracking compared to conventional emulsions. *See id.* at 57 (test reports indicating that "the non-tracking characteristics of the tack coat were found to be impressive" and "the new tack did an excellent job of not tracking"); *id.* at 61 (test reports indicating that "non-tracking was always in mind with all the foreman's [sic] giving very positive feed back" and another in which the foreman "was amazed in the results" because there was no tracking and no signs of tack buildup on the tires of the construction trucks). Patent Owner does not present any evidence that the industry participants who were aware of Pasquier or the other trackless tack coats in the European market were skeptical of Patent Owner's invention or impressed by its results.

Thus, Patent Owner's evidence tends to show that its tack coat represented a significant advance over conventional tack coats, but says little about nonobviousness of the claimed invention compared to closer prior art such as Pasquier.

e) Conclusion Regarding Claim 1

After weighing the evidence and arguments of record concerning each of the *Graham* factors, we conclude that the comparatively modest evidence of nonobviousness is inadequate to overcome the strong evidence of obviousness. *See Leapfrog Enterprises, Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007). Petitioner has shown that Pasquier teaches an ordinarily skilled artisan to make and use a tack coat as recited in claim 1, and that an ordinarily skilled artisan would expect that Pasquier's emulsion would have the claimed properties when cured. In our view, Pasquier is sufficient by itself to render the claim obvious to a person of ordinary skill in the art. The additional prior art references discussed in connection with this ground reflect the background knowledge of an ordinarily skilled artisan at the time of the alleged invention. *See Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015) ("Art can legitimately serve to document the knowledge that skilled artisans would bring to bear in reading the prior art identified as producing obviousness."). However, our findings above also reflect that if certain limitations are deemed insufficiently disclosed in Pasquier, Petitioner has shown that SBH or the additional prior art references discussed in connection with this ground teach such limitations, and Petitioner has presented a sufficient reason to combine those teachings from the additional references with Pasquier. Accordingly, we determine that Petitioner has shown by a preponderance of the evidence that claim 1 would have been obvious to a person of ordinary skill in the art based on the combination of Pasquier and SBH.

4. Claims 14 and 25

The other independent claims of the '624 patent share many limitations in common with claim 1. In its challenges to claims 14 and 25, Petitioner relies on its arguments regarding claim 1 to establish that the cited references teach the subject matter that those claims share with claim 1. Pet. 65–66. In addition to limitations that are shared with claim 1, claim 14 recites that "the first phase compris[es] from about 30% to about 70% of the total weight of the emulsion." Ex. 1001, 15:12–13. We find that Petitioner has shown that Pasquier's emulsions have asphalt phases within this range.[14] *See* Pet. 64, 45–46; Ex. 1003, 4:1–5; Ex. 1002 ¶ 164. As for claim 25, we agree with Petitioner that "[b]esides being an apparatus claim, independent claim 25 is not materially different from independent claim 1." *Id.* at 66. Patent Owner's rebuttal regarding claims 14 and 25 is the same as its arguments regarding claim 1. *See* PO Resp. 20–43 (arguing independent claims 1, 14, and 25 together). Those arguments are unpersuasive for the reasons discussed in Section II.D.3.

We determine that Petitioner has shown by a preponderance of the evidence that claims 14 and 25 would have been obvious to a person of ordinary skill in the art based on the combination of Pasquier and SBH, with additional references reflecting the background knowledge of ordinarily skilled artisans.

5. Claims 11 and 23

Claim 11 depends from claim 1 and recites that

[14] Further, the asphalt phase still falls within the claimed range even with the modifications to the amount of polyethylene glycol Petitioner made in its testing. *See* Ex. 1002 ¶ 164.

> the asphalt composition of the first phase is selected to provide cure time of the emulsion from about 5 to about 60 minutes; and the coating applied to the substrate layer is allowed to cure for at least the cure time to form a traffic bearing surface before the heated asphalt pavement material is applied to the substrate.

Ex. 1001, 14:54–59. Claim 23 depends from claim 14 and recites substantially the same limitation found in claim 11. *Id.* at 16:14–19.

After reviewing the evidence and arguments regarding these claims, we determine that Petitioner has demonstrated that the claims would have been obvious based on the cited combination of Pasquier, SBH, US DOT, and Potti.

Petitioner acknowledges that Pasquier does not disclose specific cure times. Pet. 62. However, Potti teaches that a tack coat made from Probiclean emulsion cures sufficiently to be open to traffic within 30–60 minutes. *See id.*; Ex. 1006, 25. Potti describes Probiclean as "a heat-adhesive emulsion, cationic rapid-setting, for tack coats" that "has the particularity that it does not stick to the tires of job site vehicles." Ex. 1006, 19.

Dr. James explained that "heat-adhesive emulsions" was the name used in the Spanish market for hard-pen emulsions used to form a non-tracking tack coat. *See* Ex. 2079, 298:11–20; *see also* Ex. 1005, 27 (noting the tracking problem for traditional tack coats and "present[ing] the properties of a new type of tack coat capable of withstanding works vehicles known generically under the term heat-adhesive emulsions . . .[, which are] made from very hard types of bitumen"). Heat-adhesive emulsions were generally made from an asphalt of less than 40 pen. *See* Ex. 2079, 298:21–299:9. We credit Dr. James's testimony that "the emulsifier type and dosage

used in Pasquier's examples would produce a cationic rapid-set emulsion, the most reactive of the emulsion grades." Ex. 1002 ¶ 226.

We further credit Dr. James's testimony that an ordinarily skilled artisan would have expected Pasquier's hard-pen cationic rapid-set emulsion to exhibit a cure time within the claimed range, based on Potti's disclosure that its trackless tack coat made from a hard-pen, cationic rapid-set emulsion cured within 30–60 minutes. *Id.*; *see also* Ex. 1093 ¶ 123 (Dr. James testifying that "[a]lthough we are not given specific information about Potti's formulation beyond the nature of the asphalt composition and the rapid-set classification, I nevertheless consider Pasquier and Potti to be sufficiently similar to consider Potti to be a reliable predictor for cure time of hard-pen emulsions used as tack coats").

Patent Owner counters that Petitioner did not provide a reason to combine Pasquier and Potti in the claimed manner, and a skilled artisan would not have expected success in doing so because Potti does not indicate that it includes the additives Pasquier teaches are necessary. PO Resp. 48–50. Patent Owner further argues that Potti teaches away from the asserted combination because it instructs that Probiclean should never be combined with other types of emulsions. *Id.* at 50 (citing Ex. 1006, 25). These arguments misapprehend the nature of Petitioner's obviousness challenge, which is not premised on a modification of Pasquier based on Potti. Rather, Potti's relevance in the challenge Petitioner has framed is simply to demonstrate that it was known in the prior art that tack coats created from hard-pen asphalt emulsions would likely cure within 60 minutes. *See* Pet. 62; Reply 23–24.

Patent Owner further argues that Petitioner did not determine cure times of the emulsions it formulated based on Pasquier's teachings, and therefore "Petitioner provides no factual basis demonstrating that Pasquier's emulsions would have met all claim limitations, including the claimed time to traffic." PO Resp. 43–44. We disagree. There is no requirement for a patent challenger to establish the presence of every limitation through empirical testing. As summarized above, the evidentiary basis supporting Petitioner's obviousness challenge includes the time to traffic Potti reports, and the testimony of Dr. James that skilled artisans would have expected Pasquier to exhibit a similar cure time because both are hard-pen, cationic rapid-set emulsions.

Patent Owner also argues that cationic rapid-set emulsions made with hard asphalts do not necessarily cure in less than 60 minutes, and that numerous variables affect the breaking rate and cure time of an emulsion. PO Resp. 45–46. According to Patent Owner, because "Potti fails to disclose information regarding any of these variables, aside from indicating asphalt penetration grade and emulsifier category," there is no basis for Dr. James's testimony that Pasquier's emulsion would achieve a similar break and cure time as Potti's. *Id.* at 46–47. However, as Petitioner points out, the claim itself specifies that it is the selection of the asphalt composition that determines the cure time. Ex. 1001, 14:54–56 ("the asphalt composition of the first phase is selected to provide cure time of the emulsion from about 5 to about 60 minutes"); Reply 22. That recitation echoes the description in the Specification, which states that "the asphalt composition of the asphalt phase and any additives are selected so that the emulsion cures to provide a low tack surface, typically in about 10 minutes

to one hour, depending on weather conditions (i.e., surface temperature, wind, humidity, exposure to direct sunlight, etc.)." Ex. 1001, 6:5–9. This disclosure is consistent with Dr. James's reliance on the commonality between Pasquier's and Potti's hard-pen emulsions to opine that Pasquier would likely have a similar cure time to Potti.

Looked at another way, because Pasquier teaches emulsions having asphalt phases with the characteristics claimed and described in the '624 patent, a skilled artisan would expect Pasquier's emulsion to yield similar cure times as the emulsions of the '624 patent. To the extent it is necessary to employ techniques beyond selecting asphalt compositions having the claimed characteristics in order to provide a cure time of less than 60 minutes, Patent Owner does not point to, and we do not find, any disclosure in the '624 patent of those techniques. *See Southwire*, 870 F.3d at 1312 (affirming Board's obviousness determination when there was no focus on the allegedly distinguishing limitation in the specification and no evidence that the limitation "was something other than an observed result of an old process"). Thus, we are not swayed by Patent Owner's argument that Pasquier and Potti provide insufficient information to support Petitioner's arguments that the claimed cure time would have been obvious.

For the foregoing reasons, we determine that Petitioner has established by a preponderance of the evidence that claims 11 and 23 would have been obvious based on Pasquier, SBH, US DOT, and Potti.

6. Remaining Dependent Claims

Petitioner provides a detailed explanation of where the cited references teach the features of claims 2–10, 12, 13, 15–22, and 24. Pet. 56–65. Where Petitioner relies on references other than Pasquier in a

capacity beyond showing background knowledge of a skilled artisan, Petitioner provides sufficient reasoning as to why a skilled artisan would have been motivated to combine those teachings with Pasquier. *See id.* Patent Owner does not address Petitioner's challenges to these dependent claims separate from its arguments discussed above regarding the claims from which they depend. After reviewing the arguments and evidence of record, we determine that Petitioner has established by a preponderance of the evidence that claims 2–5, 9, 12, 13, 15–18, 21, 22, and 24 would have been obvious based on Pasquier and SBH; that claims 6 and 19 would have been obvious based on Pasquier, SBH, and US DOT; and that claims 7, 8, 10, and 20 would have been obvious based on Pasquier, SBH, and Durand.

III. CONTINGENT MOTION TO AMEND

Patent Owner proposes new claims 26–28 as substitutes for independent claims 1, 14, and 25 if those claims are found unpatentable. Paper 33 ("Mot. to Amend"). In addition to the motion itself, the briefing concerning Patent Owner's motion to amend includes Petitioner's Opposition to Patent Owner's Contingent Motion to Amend (Paper 44, "Opp. to Mot. to Amend"); Patent Owner's Response in Support of Contingent Motion to Amend (Paper 53, "PO Resp. re Mot. to Amend"); and Petitioner's Surreply to Patent Owner's Contingent Motion to Amend (Paper 58, "Surreply re Mot. to Amend").

Proposed substitute claim 26 is reproduced below, with underscoring to show additions to the language of claim 1:

> 26. A method for bonding a layer of asphalt pavement material to a substrate layer, the method comprising:
>
> providing an emulsion comprising at least a first phase which includes an asphalt composition, a second phase comprising

> water, and emulsifying and stabilizing additives, the asphalt composition in the emulsion effective for providing a coating having a penetration value less than about 40 dmm and a softening point greater than about 140 ° F. (60 ° C.) when applied to the substrate layer and cured, the emulsion having a maximum 24 hours storage stability settlement of 1% by mass and a maximum 5 days storage stability settlement of 5% by mass;
>
> applying the emulsion to an exposed surface of the substrate layer in an amount which is sufficient to provide a coating on the exposed surface of the substrate layer, the coating and emulsion including an amount of the asphalt composition effective to bond the asphalt pavement layer to the substrate layer;
>
> providing heated asphalt pavement material to provide the asphalt pavement layer, the asphalt pavement material heated to a temperature sufficient to soften the coating on the substrate layer to form a bonding surface on an exposed surface of the coating;
>
> applying the heated asphalt pavement material to the exposed coating surface to form the asphalt pavement layer and to soften the exposed coating surface forming a bond between the asphalt pavement layer and the substrate layer.

Id. at 2–3. Substitute claims 27 and 28 add the same underscored language to claims 14 and 25, respectively, and make no further changes. *Id*. at 3–5. Thus, the only difference in claim scope between the proposed amended claims and the original independent claims is the additional requirement that "the emulsion [has] a maximum 24 hours storage stability settlement of 1% by mass and a maximum 5 days storage stability settlement of 5% by mass." For convenience, we refer to this as the "storage stability" limitation.

Petitioner opposes the motion to amend on the basis that the substitute claims are unpatentable under 35 U.S.C. § 103. The obviousness grounds Petitioner presents in its opposition to the motion to amend are similar to

those discussed above for independent claims 1, 14, and 25, except that they additionally rely on Antoine.[15] *See* Opp. to Mot. to Amend 5. Petitioner also adds Louisiana Standard Specifications[16] as a further "optional" background reference. *Id.*

We find that Petitioner has shown that the substitute claims would have been obvious in view of the cited combinations. The subject matter that the substitute claims have in common with original independent claims 1, 14, and 25 has been discussed above in Section II.D.3.–4., and will not be repeated here. As to the "storage stability" limitation, we find that this claim language recites common standards of stability for emulsions used in road building. *See*, *e.g.*, Ex. 1081, 739–40 (Louisiana Standard Specifications specifying 24-hour settlement rate of 1% and 5-day settlement rate of 5% for certain emulsions); Ex. 1092, 141:3–13, 144:2–6 (Mr. O'Leary agreeing that 5% is a common standard for maximum 5-day settlement and that 1% is the typical standard for the 24-hour storage stability test); Ex. 1093 ¶ 66 (Dr. James testifying that "a 24-hour settlement maximum of 1% by mass and a 5-day settlement maximum of 5% by mass . . . are common parameters provided by state specifications in North America for a variety of emulsion grades"). We find persuasive Petitioner's contention, based on Dr. James's testimony, that an ordinarily skilled artisan would have been motivated to optimize Pasquier's formulations "to produce an appropriately viscous,

[15] European Patent App. Pub. No. EP 1 275 698 A1 (Ex. 1051). The original French version of this document is in Exhibit 1090. Exhibit 1051 is the English translation.

[16] State of Louisiana Department of Transportation and Development, "Louisiana Standard Specifications for Roads and Bridges," 2000 ed. (Ex. 1081).

storage stable formulation based upon the intended application or local specifications." Opp. to Mot. to Amend 6 (citing Ex. 1093 ¶ 68).

We further find that Petitioner has shown that a skilled artisan would have expected success in producing an emulsion that would satisfy the storage stability limitation. Pasquier touts stability as one of the advantages of its emulsion formulations. Ex. 1003, 5:31–35. Pasquier describes one example formulation including calcium chloride in the aqueous phase, which was known to skilled artisans to promote stability. Ex. 1003, 5:9; Ex. 1008, 100. Pasquier also teaches to include as an additive a water-soluble polymer, such as polyethylene glycol, glycol ethers, and polyols. Ex. 1003, 3:25, 3:36–39. Pasquier's Tables 1–5 list polyethylene glycol in the asphalt phase, but Pasquier teaches that "[p]olyethylene glycol may be added equally to the aqueous phase or the bituminous phase during manufacturing." *Id.* at 5:26–27.

Dr. James explains that water-soluble polymers can increase viscosity, and "most thickeners used in asphalt emulsions fall into the class of water-soluble polymers." Ex. 1093 ¶¶ 82–83. It was known that "[i]ncreasing the viscosity of the aqueous phase will also reduce the rate of settlement." Ex. 1008, 100; *see also* Ex. 1093 ¶ 92 ("Settlement in emulsion depends partly on the viscosity and particle size, with small particles settling more slowly and more viscous emulsions retarding settlement as compared to less viscous emulsions.").

Although Pasquier indicates that its emulsions are stable (*see* Ex. 1003, 5:31–35), Pasquier does not disclose the particular settlement rate its emulsions achieve. However, Antoine reports settlement rates for emulsions having similar formulations as Pasquier's. In Antoine's Table 1,

settlement rate after seven days is shown for three hard-pen emulsions: two emulsions containing water-soluble polymers and one emulsion with no water-soluble polymer. Ex. 1051 ¶¶ 12, 14. Like the formulations described in Pasquier, Antoines's emulsions are made from 10/20 pen bitumen and Emulsamine L60. Ex. 1051 ¶ 12. Recipe 1 contained no emulsion and had a 10% settlement rate. *Id.* Recipe 2, which included 57.5% Bitumen 10/20 and 2.5% "polyethylene glycol having a molecular weight 600," had a 5% settlement rate. *Id.* Recipe 3, with 59% Bitumen 10/20 and 1% polyvinyl alcohol, had 0% settlement rate. *Id.* Polyvinyl alcohol is a type of polyol, one of the kinds of water-soluble polymers mentioned in Pasquier. Ex. 1093 ¶ 86; Ex. 1003, 3:39. Considering the data shown in Table 1, Antoine notes that the inclusion of a water-soluble polymer improves settling rate, the "improvement being more pronounced with polyvinyl alcohol." Ex. 1051 ¶ 15. We credit Dr. James's testimony that "[b]ased upon the teachings of Pasquier combined with the Shell Bitumen Handbook and/or Antoine, a skilled artisan would consider it predictable to produce a storage stable emulsion using a 10/20 base asphalt, water, an emulsifier, and a water-soluble polymer as a stabilizer." Ex. 1093 ¶ 106.

We also credit Dr. James's testimony that ordinarily skilled artisans "had the knowledge and the tools to optimize asphalt emulsion formulas to meet storage stability" requirements set forth by state specifications and that adapting recipes to meet such local requirements "is a routine operation for emulsion formulators." Ex. 1093 ¶¶ 97, 104. On that issue, Dr. James's testimony is in accord with Patent Owner's explanation at the hearing that the '624 patent does not describe how to make emulsions stable because "[t]hat's something that, frankly, any good emulsion person should be able

to do." Tr. 71:14–72:2. The paucity of disclosure in the '624 patent regarding how to make a storage stable emulsion supports Petitioner's argument that whatever optimization is needed for Pasquier's emulsions, which are substantially similar to those disclosed and claimed in the '624 patent, to meet standard storage stability requirements would have been within the level of ordinary skill in the art. *See Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1570 (Fed. Cir. 1997) (affirming summary judgment of invalidity despite patentee's argument that prior art lacked sufficient technical detail because the challenged "patent itself does not disclose the level of detail that [the patentee] would have us require of the prior art").

Patent Owner's responsive arguments largely echo the arguments it presented in favor of its original claims, and are unpersuasive for reasons already discussed. Patent Owner argues that Petitioner has not shown a viable prior art tack coat that cures to the claimed penetration value and softening point. PO Resp. re Mot. to Amend 11–19. This argument relies on the stability characteristics of the emulsions Dr. James formulated for testing, which were then replicated by Patent Owner. Yet as discussed above, Dr. James's testing was intended to address other features of the claims, not stability. Petitioner relies on other evidence to establish that the cited combinations sufficiently disclose the claimed stability parameters.

Patent Owner further argues that Petitioner has not identified a tack coat formed from an emulsion containing a stabilizer in the aqueous phase. PO Resp. re Mot. to Amend 19–31. We disagree. As discussed above, Pasquier describes using calcium chloride in the aqueous phase and teaches to use polyethylene glycol in either the asphalt or aqueous phases. Antoine discloses using water-soluble polymers in the aqueous phase and teaches

that polyvinyl alcohol, another water-soluble polymer in the polyol class mentioned in Pasquier, is even more effective than polyethylene glycol in promoting stability.

With respect to dependent claims 11 and 23, Patent Owner argues that Potti does not suggest that the claimed stability and cure times would have been obvious in Pasquier's emulsions. PO Resp. re Mot. to Amend 35–39. We agree with Petitioner that skilled artisans would have been motivated to optimize Pasquier's teachings to produce a hard-pen, trackless tack coat emulsion meeting state specifications and curing as fast as possible, and that known techniques for decreasing cure time would have predictably led to cure times within 60 minutes considering Potti's disclosure. Surreply re Mot. to Amend 28–29.

For the foregoing reasons, we deny Patent Owner's motion to amend.

IV. ORDER

For the reasons given, it is:

ORDERED that claims 1–25 of U.S. Patent 7,918,624 B2 have been shown to be *unpatentable*;

FURTHER ORDERED that Patent Owner's Contingent Motion to Amend is *denied*; and

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

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CERTIFICATE OF SERVICE

I hereby certify that the original foregoing NOTICE OF APPEAL is being served via Priority Mail Express and hand delivery this 26th day of December, 2018 to:

Director of the United States Patent and Trademark Office
c/o Office of the General Counsel
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, Virginia 22313-1450

&

Director of the United States Patent and Trademark Office
c/o Office of the General Counsel, Room 10B20
Madison Building East, 600 Dulany Street
Alexandria, Virginia 22314

I also hereby certify that a true and correct copy of the foregoing NOTICE OF APPEAL is being served via Priority Mail Express this 26th day of December, 2018, on counsel for Asphalt Products Unlimited, Inc. as follows:

Robert Waddell
Michael K. Leachman
Jones Walker LLP
600 Jefferson Street, Suite 1600
Lafayette, Louisiana 70501

I hereby certify that on this 26th day of December, 2018, I electronically filed the NOTICE OF APPEAL and docketing fee of $500 with the Clerk of the United States Court of Appeals for the Federal Circuit by using the CM/ECF system.

Dated: December 26, 2018

Respectfully Submitted,

/s/ Ryan D. Levy

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