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## WHO ARE WE TALKING TO? SITUATING CONSTRUCTION ENGINEERING AND MANAGEMENT KNOWLEDGE

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### ABSTRACT

Gathering knowledge from expert practitioners is a hallmark of construction engineering and management research. However, the knowledge gathered is dependent on the knowledge of the people we talk to. Accordingly, this paper uses a content analysis of 12 months' recent technical article and case study publications in the Journal of Construction Engineering and Management to explore characteristics of research respondents that authors publishing in this journal feel are important to document. Authors report some subset of research respondents' job type or role, years experience, subject matter expertise, geography or nationality, organization and sector details, project type, professional qualifications, sex, race and ethnicity, ability, and language. Accordingly, this paper recommends that researchers should report at least these categories, and also that researchers should also discuss research limitations that may result from the types of people they collect knowledge from. This change will make visible voices that are dominant or underrepresented in construction engineering and management research. In addition, by eliminating an otherwise unstated limitation, this change will result in improved construction engineering and management science.

23

24

## 25 INTRODUCTION

26 Upon learning that I am a civil engineer, a friend's 5-year-old child asked me, "How strong is a bridge?" The  
27 answer, of course, is *it depends*. It depends on (for example) what the bridge is made of, and how much of those  
28 materials were used. It depends on how the bridge is supported, how old it is, if any maintenance has been done  
29 since it was built, on the surrounding climate and physical geography, and on the quality of construction.  
30 Similarly, when researchers talk to people to discover new knowledge of construction engineering and  
31 management, the answers they get are contingent upon the knowledge and experiences of those individuals. In  
32 both cases, different compositions bring about different conclusions.

33 Acknowledging the importance of context does not mean that there is no way to measure the strength of a bridge,  
34 and it also does not mean that we cannot gain useful knowledge by talking to expert practitioners. Indeed, and as  
35 described in this paper, learning from expert practitioners is a hallmark of construction, engineering, and  
36 management (CEM) research. It does, however, mean that answers to our research questions must come  
37 embedded in relevant contextual factors. Otherwise, the answers may be just as problematic as the 5-year-old's  
38 question.

39 In this paper, I make two claims. First, I claim that the CEM knowledge we gain from research respondents is  
40 *situated* (Haraway 1988). In other words, different people know different things, and accordingly we can learn  
41 different things from them. For example, a steel worker knows things about jobsite safety that a site safety  
42 manager doesn't, and vice versa. My second claim is that this attention to situated knowledge is already well  
43 established in our research community. However, despite the (as I will show) near-universal nature of this  
44 recognition, our past work lacks both the theoretical underpinning that would help us develop guidelines for

45 situating CEM knowledge, and the needed methodological guidelines themselves. This paper contributes to  
46 filling this gap.

47 To do so, and inspired by Pawley (2017), in this paper I outline best methodological practice for making visible  
48 and considering the diverse characteristics of the people we either describe or draw knowledge from in CEM  
49 research. Practically, and because of the current demographics of our industry, by doing so we will typically  
50 show that our knowledge is drawn from people whose sociodemographic profiles fit the dominant majority. This  
51 is an uncomfortable truth. However, by acknowledging this or any limitation of our work, we take a step towards  
52 better science.

53 Importantly, and as I will show through a content analysis of recent JCEM publications, our research community  
54 is already on board with the idea of situating CEM knowledge. Accordingly I would emphasize that this paper is  
55 not in the least intended to imply that the CEM community has avoided engaging with the (lack of) diversity of  
56 our research subjects, and even less that any malicious intention is or has been at work when we have fallen short  
57 of the methodological ideals described here. Indeed, and in the interest of transparency, it is worth noting that my  
58 own past JCEM papers have not met all the criteria I propose here.

59 What I do intend in this paper is to amplify the already-ongoing commitment JCEM authors have towards  
60 avoiding the assumption that people are homogenous. Put more simply, we must describe relevant characteristics  
61 of our research respondents, because it matters for the knowledge we will discover. In doing so we improve the  
62 rigor of our science and of the knowledge we produce (Barad 2007). In contrast, failing to do so is an  
63 unacceptable and readily avoided unstated research limitation.

## 64 POINT OF DEPARTURE: Improving CEM Science with Situated 65 Knowledge

66 We value scientific knowledge because we typically think of it as universal knowledge; in other words, it is the  
67 same no matter who discovered it or who knows it. For example, gravity does not change depending on who is  
68 measuring it. Still, many scholars have noted the ways in which people's involvement in science shapes the truths  
69 we find (Latour 1988). For example, Pickering (1999) shows how the theoretical traditions physicists adhere to  
70 shape the experiments they undertake and the observations they make. These two reinforce each other, making it  
71 more difficult for differing theories or data points to be noticed. The empirically validated theory that emerges  
72 does so because it appears superior to all others, and is then thought of as scientific truth. Still, social forces (the  
73 pre-existing theoretical preferences of scientists) have shaped that truth.

74 The extremes of these two theoretical positions suggest a dichotomy that appears even in physics, that purest of  
75 the pure sciences. On one hand, we have a universalist position where only one truth is possible (gravity); on the  
76 other, we have a relativist position where truths are instead socially constructed (Pickering's *Constructing the*  
77 *Quark*). But extreme versions of either of these positions are absurd and less than helpful if our goal is the pursuit  
78 of useful knowledge and technique (or, engineering). A project schedule, for example, is not a singular reflection  
79 of reality. Instead, its structure is dependent on the experience and motivations of the people who build it, the  
80 software tools they use, the social power implied in getting the needed permits in a certain timeframe, etc etc. In  
81 other words, there are multiple ways to represent a given project's reality, and furthermore that project reality is  
82 itself socially shaped. But acknowledging this does not mean that a reasonably created project schedule could  
83 look like anything at all (as the opposite extreme, relativism, might suggest).

84 In another CEM example, this tension between universal and relative positions is also built into the CEM practice  
85 in the bidding process. Here, different organizations are given the same information about a client's engineering  
86 problem, and are invited to propose a solution. If there were only one possible best answer (a universalist  
87 position), every bidder would submit the same thing. Instead, many different viable solutions are typically  
88 proposed. But this does not mean that every proposed solution is a viable one (a relativist position); accordingly,  
89 we require bids to be responsive and responsible before they can be considered.

90 Haraway solves this dilemma of dichotomy with the concept of *situated knowledge*, suggesting that “only partial  
91 perspective promises objective vision” (Haraway 1988 p. 583). This is a middle ground between relativism and  
92 universalism, and is a particularly useful frame for CEM knowledge. Rather than seeking the universal, it seeks  
93 to translate knowledges between and across different communities, in ways that recognize both differences and  
94 commonalities between those communities. The dual goals of this translation in our context is better CEM  
95 projects and better CEM project outcomes. We need the power implicit in theoretical knowledges of the ways in  
96 which the built environment gets built, in order to build a better built environment for all those who live in it (that  
97 is, everyone). And – and this is the key point of this paper – the knowledges we need are heterogeneous  
98 multiplicities, neither infinite/relative nor yet singular/universal. That is, the knowledges we need to solve  
99 problems come from different sources, and can direct us toward more than one solution simultaneously. In  
100 Haraway’s words, “objectivity turns out to be about particular and specific embodiment and definitely not about  
101 the false vision promising transcendence of all limits and responsibility...*it allows us to become answerable for*  
102 *what we learn how to see* (Haraway 1988 pp. 582–583, emphasis added).”

103 In this section, I have argued that the structure of CEM practice reflects the principles underlying the theory of  
104 situated knowledge. As CEM researchers, then, adopting this theoretical position means that we are better  
105 matching our science to reality; said differently, it means that we are doing better science.

106 Having accepted that CEM knowledge is neither perfectly relative nor perfectly universal, the next difficulty is  
107 operationalizing the insight of situated knowledge in CEM research practice. This is a larger project than can be  
108 accomplished with a single paper or methodological recommendation. Still, as a first step in this project, in this  
109 paper I make recommendations for the ways in which CEM researchers describe the people they draw knowledge  
110 from. By providing these descriptions, CEM researchers are situating the knowledge they gather, and are making  
111 claims regarding the generalizability and limitations of their conclusions. This is an important methodological  
112 project, because as the content analysis below shows, more than half the papers published in this journal depend  
113 on expert knowledge of some kind. Phrased as a formal research question, I ask *which identity and expertise*  
114 *categories CEM researchers feel are relevant to their research*. I answer this question using a content analysis of

115 a year's publications in JCEM, and use the answer to develop recommendations for situating future CEM  
116 research.

## 117 DESCRIBING PEOPLE IN THE JOURNAL OF CONSTRUCTION 118 ENGINEERING AND MANAGEMENT

119 The full text of every technical article or case study published in JCEM between July 2018 and June 2019 was  
120 reviewed to identify papers that either collected data from or about people. JCEM published 157 technical articles  
121 and case studies during this timeframe. Excluded papers (those that did not collect data from or about people)  
122 were theoretical or mathematical models, or analyzed secondary data that was available from an existing database.  
123 Papers that asked experts to validate results as part of a larger undertaking were included, as were more empirical  
124 papers based on data describing or drawn from research participants. For example, the data set included papers  
125 that used a case study or expert interviews to validate a mathematical model, papers that used sensors to promote  
126 worker safety, and papers that issued surveys to gather knowledge from practitioners. While looking at a single  
127 year limits our description of the ways in which JCEM papers describe people, there is no reason to believe this  
128 year was unusual, or that it would not adequately represent recent practice in the research community.

129 A full 61% (95 papers) of this set of papers collected data from or about people. Of these, 76 drew knowledge  
130 from respondents about a construction technology or technique, and 19 attempted to generate knowledge about a  
131 group of people affiliated with construction. In an example of the former, Siebelink et al. (2018) interviewed  
132 construction practitioners to build knowledge about BIM maturity in the Dutch construction industry. In an  
133 example of the latter, Hwang et al. (2018) used wearable sensors to study workers' emotional states during  
134 construction tasks.

135 From each paper, text that described the various research populations that data were drawn from was extracted for  
136 analysis. This was iteratively and qualitatively coded (Miles et al. 2013; Saldaña 2009) into categories that  
137 emerged from the papers' text. These categories represented different ways in which authors described their

138 respondents. Many papers listed multiple characteristics of respondents. Table 1 shows counts and relative  
139 frequencies of papers that reported different identity characteristics for respondent selection, description, or  
140 analysis.

141 Table 1 About Here

142

143 Of these 95 papers, eight indicated their respondents were subject matter experts without providing further  
144 descriptions of expertise; two more papers only indicated that respondents possessed expertise but provided no  
145 additional details whatsoever. Only four contained no details regarding expert qualifications. In other words,  
146 virtually all (96%) authors publishing papers in JCEM between July 2018 and June 2019 that drew knowledge  
147 from people felt that it was important to situate the data and knowledge they were presenting.

148 No single category from Table 1 was used by all authors. However, three quarters of authors felt it was important  
149 to report the job type or role (such as engineer, architect, construction manager, or owner) of research  
150 respondents. Nearly half reported the years of experience respondents had, and 40% indicated that the  
151 respondents had particular subject matter expertise. For example, this could include expertise on PPP or BIM, or  
152 knowledge of particular case study projects. The few authors that provided information on ability were reporting  
153 characteristics of people being studied (students, construction workers, etc.) rather than people being surveyed for  
154 subject matter expertise. Details on professional experience were provided much more often than were personal  
155 identity descriptors of respondents.

156 Most commonly, construction researchers report the characteristics of respondents but do not use them as analytic  
157 categories. However, in a few cases identity categories were used in analysis. For example Simmons et al.  
158 (2018) considered gender as an analytic category, Pereira et al. (2018) find worker age to be a significant safety  
159 indicator, and Nguyen (2019) used job role as an analytic category in research considering team behavior in  
160 construction projects. Taken together, these studies indicate the rich possibilities of future research that not only  
161 reports these descriptors but uses them during analysis.

## THE METHODOLOGICAL RECOMMENDATION

In sum, while CEM researchers virtually always report some details on research respondents, there is not a standard profile of characteristics that researchers report on. Partially, this is because papers report on characteristics of direct interest to their research questions. For example, a study on PPP naturally solicited input from experts with PPP experience (Mazher et al. 2018), and a paper on the construction reword in Singapore naturally solicited inputs from experts from Singapore (Hwang et al. 2019). Still, every research project has a subject matter of interest and relevant geography, and it is reasonable enough to suggest that if these categories are worth reporting for some research, they are likely worth reporting for all research. At the very least, this will enable future metaanalyses that can identify the respondent identity categories that matter to results, and thereby identify gaps in our knowledge. The first part of the methodological recommendation made here, then, is to *require CEM researchers to describe any and all people they draw knowledge from, and to reflect on how these categories of respondents may improve and limit research results.*

It may sometimes be the case that researchers are not able to provide this information. This could be, for example, because they are drawing information from an existing dataset that did not record the needed details on the respondents, or because respondents declined to provide this information. While this lack of information should be seen as a serious research limitation, it does not mean that this research should not be carried out. Instead, this leads to the second part of the methodological recommendation made here, which is simply that *if it is not possible or appropriate to describe identity categories for any particular paper, the authors should be prepared to justify and discuss this limitation in the manuscript.* For example, this might include a description of the demographics of the industry segment that respondents were selected from, or a statement describing the limitations of a secondary dataset that was used in analysis.

Practically speaking, there are an enormous number of ways in which we might reasonably describe our research respondents. Furthermore, as described above, there is still a paucity of research that uses sociodemographics as analytic categories and that could thereby provide empirical evidence of which categories matter in which



186 situations. Until this important and much needed literature can be expanded, I instead propose that we depend on  
187 the judgment of recent JCEM authors who have, after all, made their best effort in reporting the respondent  
188 characteristics that they felt were important for qualifying experts. From the content analysis presented here,  
189 Table 1 lists identity categories that recent JCEM authors felt were important to report. As such, and as the third  
190 part of this paper’s methodological recommendation, it would seem reasonable that *it is best practice for our*  
191 *papers to collect and report all categories of descriptive data identified in Table 1 in all our papers. As described*  
192 *there, these include job type or role, years experience, subject matter expertise, geography or nationality,*  
193 *organization and sector details, project type, professional qualifications, sex, race and ethnicity, ability, and*  
194 *language.* Of course, depending on the research question, particular papers may need to report on additional  
195 relevant categories.

196 Finally, an immediately apparent identity category that did not appear in our dataset is gender (as distinct from  
197 sex (Poleacovschi and Javernick-Will 2014), which was reported by 15 papers in the dataset); it would seem  
198 reasonable to add this category to the list. There are doubtless other categories that would be useful to document.  
199 The community should watch for these and add them to this list as they become apparent. For example, questions  
200 that identify respondent age/generation, urban vs. rural context, household income, first-generation college  
201 students, political views, or religious affiliation may also be needed. As such, the fourth and final part of this  
202 methodological recommendation is that *the categories listed in Table 1 should not be seen as a final set, but*  
203 *rather as a starting point that should be updated and revisited as we continue our efforts towards improved CEM*  
204 *science.*

205 More detailed recommendations for how to efficiently report on each of the identified category are provided  
206 below, following a discussion of possible objections to this methodological practice.

## 207 POTENTIAL CRITICISMS & REBUTTALS

### 208 IT MAY BE UNNECESSARY

209 A potential criticism of providing more categorical information on respondents is that it may be unnecessary.  
210 From this perspective, it might be argued that the various descriptors of respondents presented in Table 1 do not  
211 impact results enough to matter. Even those who acknowledge that identity may influence some parts of life may  
212 not feel that these identity categories impact perspectives on CEM topics. Indeed, very little existing research has  
213 sought to unpack how much respondent identity matters in CEM research. This is an important gap in our  
214 literature. After all, we simply do not know how gender impacts the way construction managers secure private  
215 financing, or how scheduler race influences project scheduling practices, or etc. It may indeed be true that race  
216 and gender do not predetermine such things. However, what limited evidence we do have in this space suggests  
217 that some combination of forces – whatever they may be – does act to make identity differences relevant to CEM  
218 knowledge. For example, research has shown that Hispanic construction workers in the US are more likely to  
219 accept dangerous work, and are less likely to ask for safety assistance (Hallowell and Yugar-Arias 2016).

220 Regardless of the findings of this much needed future research, and as shown in the content analysis presented  
221 here, existing CEM research that involves people already tends to report respondent characteristics like years of  
222 experience, job title, geography, or industry. While it is rare that any of these categories are the focus of analysis,  
223 they are virtually required by researchers and reviewers because the CEM community feels these details tell us  
224 something important about the research respondents. In combination with the (still limited) evidence on the  
225 importance of identity in construction, this strongly supports the importance of providing these details. And on a  
226 final practical note, even if in the future some identity categories were proven to not be relevant to CEM  
227 knowledge, adding these few details to papers in the meantime does not take much space and would seem to be  
228 the conservative way forward.

## 229 IT MAY RAISE UNWARRANTED VALIDITY CONCERNS

230 Given the demographics of construction, if we describe our respondents in more detail we will typically find that  
231 (for example) the vast majority of research respondents from the United States are white, non-disabled, English  
232 speaking, cis-gendered, American males. Indeed, this is an accurate demographic portrayal of the industry as it  
233 currently is (BLS 2019a; b; Chan 2013; Comu et al. 2011). But – and related to the previous criticism – if identity

234 categories do not matter, by showing them we may raise unwarranted validity concerns. For example, we do not  
235 report on the color shirt that respondents were wearing, either, and even if no one happened to be wearing a blue  
236 shirt when we collected data, we would not be concerned that there is bias in our data. Still, someone new to the  
237 research community might be misled regarding the non-importance of blue shirts if we report this detail.

238 To address this concern, authors can add a statement to explain how and why the respondent pool they have  
239 talked to is and is not ideal for answering the research questions, and what it may mean for the research findings.  
240 It is simple enough to add a few lines to a manuscript to address this issue. For example, this might include some  
241 text comparing the demographics of the general population, of the wider construction community, and of the  
242 research respondent sample. Encouraging the research community to reflect on the ways identity does and does  
243 not influence our research can only make our findings more accurate. Indeed, these reflections may even inspire  
244 new research questions that can help us better determine the influence of identity in construction.

## 245 IT IS TOO MUCH WORK

246 Preparing a journal manuscript is not a small undertaking. As such, adding requirements for more details  
247 complicates an already arduous task. This is a fair criticism. However, the change I advocate for is a small one.  
248 It only requires asking a handful of descriptive questions, reporting these answers in addition to the respondent  
249 details it is already typical to include in a manuscript, and reflecting a bit on what this may mean for results and  
250 future research directions. Especially as there is reason to believe that this additional information and reflection  
251 may improve our research, the extra effort is quite worthwhile.

## 252 IT IS UNCOMFORTABLE

253 Researchers may be uncomfortable asking respondents questions about topics such as race, gender, and ability.  
254 Demographics are usually asked at the end of data collection, in part to minimize this discomfort. These are  
255 personal topics. Still, most people are used to answering demographic questions for surveys and other purposes.  
256 If this part of data collection is framed as routine, respondents will act accordingly. In interviews, researchers  
257 may prefer to give respondents a sheet of paper with a short list of demographic questions to answer. And of

258 course, respondents should always be given the option to not answer demographic questions. When this occurs,  
259 researchers should never assume what the answers would have been, but instead should report a count of people  
260 who declined to answer. Ultimately, the benefit to the research means any slight social discomfort of asking such  
261 questions is worthwhile.

## 262 IT IS DIFFERENT

263 Finally, it is true that this recommendation is different than what our research community has done in the past,  
264 and will require each of us to report more identity information on research respondents than we have done in the  
265 past. However, and as described previously, all but 4% of JCEM papers that described or drew knowledge from  
266 research respondents in our dataset already provided at least some descriptions of those respondents. Regardless,  
267 any healthy research community can and should strive to continuously improve the rigor of its research. The  
268 methodological change described here is a step in this direction.

## 269 IT IS NOT ALWAYS POSSIBLE

270 Sometimes it will not be feasible to discover respondent characteristics. Similarly, even if we seek a diverse pool  
271 of research respondents it may not be possible to identify and speak to all the types of people we would like to.  
272 And indeed, until much more research has been carried out, we may not even know all of the pertinent identity  
273 and expertise categories we should consider! In the future, we will no doubt discover the answers to this latter  
274 question. In the meantime, we can at least systematically report the types of identity and expertise characteristics  
275 that JCEM authors already employ (see Table 1). Even if this undertaking merely emphasizes limitations in our  
276 samples (for example, if we are only able to interview males, or if we are only able to speak to people with  
277 experience on public projects, or only people from a single geography), at least we will move towards better  
278 science through improved transparency. Simply by recognizing and reporting on these limitations, our research  
279 improves. In other words, we may well not be able to achieve or even describe perfection, but we can certainly  
280 take steps to move in the right direction (Sen 2009).

## 281 HOW TO ASK THE QUESTIONS

282 Table 2 below provides an example set of questions that can be modified and used to seek the knowledge  
283 categories described in Table 1. It is important to note that there are many possible variants of these questions. A  
284 particular tension of data collection is whether or not the researcher should provide a list of categories to the  
285 respondent (for example, male and female) or simply leave an open space for respondents to fill in. While  
286 providing pre-determined response options simplifies analysis, race and gender theorists (Hyde 2005; Omi 2014)  
287 would suggest that leaving these questions open ended avoids forcing respondents into inappropriate categories.

288 An alternative to providing response options is to permit respondents to fill in answers. This will likely lead to  
289 more answer categories, and to respondents who become confused about the names of the different categories  
290 described below. As a compromise between these two approaches, providing an Other option can include a space  
291 for respondents to describe themselves if the provided options are insufficient. Importantly, the questions below  
292 provide a limited list of racial identities; as time passes, the most recent census or the National Science  
293 Foundation may provide a good guide for updating these questions. It is also worth noting that non-US  
294 populations will likely require different questions that better describe race and ethnicity as they are locally  
295 understood. Finally, while it is not common, some respondents will prefer not to respond to some or all questions.  
296 In this case, researchers should not guess the answer based on appearances, but should instead report these  
297 individuals as a group that declined to answer.

298 Table 2 About Here

## 299 HOW TO HANDLE MINORITY GROUPS IN DATA ANALYSIS & 300 WRITING

301 As I have shown, CEM researchers recognize the importance of describing the people they collect research data  
302 from. They report these details in order to establish the expertise of their respondents. But of course, respondent

303 identity and expertise is a complex thing. To take examples from the content analysis, if we believe that  
304 geographic location, job type, and gender are important attributes to consider, then we may reasonably enough  
305 come to believe that the intersections of these identity categories also matter (Collins 2015; Crenshaw 1990). As  
306 an example, a female executive from China may not have the same knowledge as a male executive from China.

307 When sample sizes are large, it is simple enough to use identity to create subsets of the data. In this case it is  
308 reasonably straightforward to determine if identity categories have significant impacts on results. However, large  
309 sample sizes can be difficult or impossible to achieve when dealing with minority populations. This research  
310 design problem is compounded when considering intersectional identities. For example, it would be difficult to  
311 impossible to identify several hundred disabled African American transgender construction managers with  
312 experience on PPP projects. This difficulty does not mean that we cannot consider identity when using  
313 quantitative methods. At a minimum, we can still report the characteristics of the people the data does represent.  
314 We may also be able to investigate if the responses of minority individuals are outliers or not. If resources allow,  
315 we may also target these individuals for qualitative research designs. For example, follow up interviews could  
316 explore the experiences of these individuals and better capture minority experiences that statistics, by its nature,  
317 may not represent well. Fortunately enough, a recent NSF project entitled Learning from Small Numbers (NSF  
318 2015; Pawley 2019) has developed methodological guidance for exactly this situation. Researchers are referred  
319 there for more guidance on this issue. Regardless of method, if identity is being used as an analytic category,  
320 identities with compound minority statuses (or, intersectional identities) should not be ignored.

321 Finally, given the current demographics in construction, reporting details on each respondent may unintentionally  
322 make underrepresented individuals identifiable. In this case, researchers may consider reporting the majority  
323 demographics without providing specifics of minority respondents. This compromise allows us to maintain  
324 confidentiality while still noting the limitations imposed upon the results by a lack of diversity in research  
325 respondents.

## 326 CONCLUSIONS

327 Functionally, and given the current demographics of the US CEM profession, a diversity-blind (Bonilla-Silva  
328 2006) perspective means that while our studies claim generalizability to people *in general*, or construction  
329 managers *in general*, or construction workers *in general*, we are usually talking about white, non-disabled,  
330 English speaking, cis-gendered, American males, which is not a representative category. And, we are often not  
331 even recording details of professional experience that would better define their expertise. As a community, we  
332 should shift away from pretending that insights from this population can be unthinkingly generalized to all people  
333 just because we are not asking questions about identity and expertise categories. Instead, we should ask  
334 researchers to more closely describe the population(s) they are working with. As Pawley (2017) suggests, this  
335 may help us to better see places where diverse populations are being excluded, and will make it harder to ignore  
336 and perpetuate the systematic disadvantaged experienced by some groups. And as argued here, this change will  
337 also improve CEM science by eliminating an otherwise unspoken research limitation.

338 Adopting this methodological perspective does not mean that all CEM research should or even could be only  
339 about diversity. Studies about PPP, construction safety, etc. are important and fundamental to our research  
340 community. And given the current demographics of our industry, it is likely that white, non-disabled, English  
341 speaking, cis-gendered, American males will remain the majority of the people we gather research data from for  
342 some time. Still, if we are designing projects and technologies based on the insights and knowledge from a  
343 particular segment of the population, we ought to make this limitation explicit, and reflect on how it may be  
344 biasing our findings and recommendations.

345 Functionally, the recommendation for future CEM research is that researchers should consider each category  
346 identified by authors of recent JCEM publications as they collect data and complete their analyses. From the  
347 content review presented here, these categories are job type or role, years experience, subject matter expertise,  
348 geography or nationality, organization and sector details, project type, professional qualifications, sex, race and  
349 ethnicity, ability, and language. Examples of each of these categories are provided here in Table 1, and example  
350 questions for each category, which may be modified to best suit each research project, are provided in Table 2.  
351 When it is not possible to collect or report this data, it should be seen as a research limitation that requires

352 discussion in all publications. And finally, this list should be seen a starting point that should be updated as we  
353 gain more knowledge; for example, respondent gender is an immediately apparent omission that should  
354 reasonably be included.

355 This methodological recommendation does not mean that researchers should seek out token (Niemann 2016)  
356 members of underrepresented groups or irrelevant professional categories in the name of diversity. Instead,  
357 researchers should consider what they might learn from different types of people, and what this means for  
358 generalizability of their findings. Accordingly, the recommendation is not necessarily that researchers should  
359 automatically collect all the types of information listed in Table 1, and nor yet do researchers have to diversify  
360 their respondent pools. However, if they do not, authors should be prepared to justify this research design choice  
361 in the manuscript and to reviewers. For example, a valid justification might include a description of the limited  
362 diversity in the larger respondent pool of the construction community or wider research population, and comment  
363 regarding how the research sample is similar or different to that larger pool. Finally, if we believe that the  
364 identities and expertise of our respondents may influence our research, we should also recognize that our own  
365 identities and expertise matter too. Many research communities are moving towards including reflexive  
366 statements in articles; in the future, ours may wish to consider this, too.

367 Luckily, and as described in this paper, describing research respondents is a relatively simple way to make a real  
368 change towards better research and a more just society. Researchers do not have to change the topics they are  
369 interested in; we do not even have to try to collect additional data to achieve parity across the various and many  
370 intersectional identity categories that may be relevant, nor yet consider identity categories as additional analytic  
371 categories. These would, of course, be admirable and useful things to do! More researchers interested in topics  
372 of diversity will bring new insights, and more diverse voices providing expert opinion will improve our  
373 understanding of construction engineering, projects, and organizations. However, as a first and minimum step,  
374 we can at least better describe the populations we are talking to and about, and (as is good research practice)  
375 reflect upon ways that this limits or biases our results. Some tools for doing so can be found in this article.



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## 381 DATA AVAILABILITY STATEMENT

382 Some or all data, models, or code that support the findings of this study are available from the corresponding  
383 author upon reasonable request.

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449      TABLE 1: JCEM PAPERS

Emergent Category	Examples from Papers	Paper Count	Relative Frequency
Job Type or Role	Engineer, Architect, Owner, CM, Trade, Contractor, Professor, Construction Professional	71	75%
Years Experience	Years Working Experience, Age, Jobsite Tenure	46	48%
Subject Matter Expertise	PPP, Safety, Case Knowledge, IPD, Demolition, BIM	38	40%
Geography/Nationality	Country, State, City	30	32%
Organization or Sector Details	Public, Private, Organizational Revenue, Organizational Size	20	21%
Project Type	Toll Roads, Heavy Civil, Industrial, Buildings, Project Size	18	19%
Institutional Qualifications	Degrees, Publications, ASCE Membership, Recommended by Agency, Union Membership	17	18%
Sex	Male, Female	15	16%
Race & Ethnicity	Caucasian, Hispanic	5	5%
Ability	Non-Vision Impaired, Healthy	3	3%
Language	Non-English, English as a Second Language	2	2%
No Respondent Details Provided	-	4	4%
Count of Papers that Gather Data from or about People in JCEM between July 2018 and June 2019	95		

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<b>Emergent Category from JCEM Content Analysis</b>	<b>Sample Questions</b>	<b>Sample Answer Options</b>
Sex & Gender	What is your sex?	Female, Male, Other, Prefer not to respond
	With what gender do you identify?	Woman, Man, Other, Prefer not to respond
	Which best describes your sexual orientation?	Bisexual, Gay, Lesbian, Hetersexual, Asexual, Other, Prefer not to respond
Race & Ethnicity	What is your identified race (please choose all that apply)?	American Indian or Alaskan Native, Asian (including Indian subcontinent and Philippines), Black or African American (including African and Caribbean), Native Hawaiian or Other Pacific Islander, White (including Middle Eastern), Prefer not to respond
	What is your identified ethnicity?	Hispanic or Latino, Not Hispanic or Latino, Prefer not to respond
Ability	Do you have a documented disability?	Yes, No, Prefer not to respond
Language	What is your first language?	Free response or options constrained by research question
	What language(s) are spoken in your home?	Free response or options constrained by research question
Job Type or Role	What is your current professional role?	Engineer, Architect, Owner, CM, Trade, Contractor, Professor, Construction Professional, etc.
Subject Matter Expertise	Questions that define the expertise required for research questions	
	How many <subject matter> projects have you worked on?	Free response or options constrained by research question
Years Experience	How many relevant years professional experience do you possess?	Free response or options constrained by research question
Institutional Qualifications	Qualifications that define the expertise required for research questions (Degrees, Memberships, Publications, etc.)	
Geography/ Nationality	Please list all the countries/states where you gained your construction experience.	Free response or options constrained by research question

	What is your nationality?	Free response or options constrained by research question
	Please list all the places you live or have lived that you feel are important to your identity.	Free response
	Where do you currently reside?	Free response or options constrained by research question
	Where is the project you are currently working on?	Free response or options constrained by research question
	Where is your primary office located?	Free response or options constrained by research question
Project Type	What types of projects have you worked on?	Toll Roads, Heavy Civil, Industrial, Buildings, Size, etc.
	What type of project are you currently working on?	
Organization or Sector Details	What kinds of organization have you worked for?	Public, Private, Revenue, Size, etc.
	What kind of organization do you currently work for?	

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