2017

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Paper # 17-
Submission Date: 31 July 2016
Word Count = 5,232
Figures and Tables = 1 figure and 4 tables @ 250 = 1250
Total Word Count = 6,482

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Abstract: Alternative Contracting Methods (ACM) usage has grown to the point where the industry has sufficient experience to provide a definitive set of best practices to both promote consistency in the nation's procurement system and to leverage the lessons learned by early ACM adopters. The barrier to achieving this goal is that there is no uniform agreement on the definition of what constitutes a best practice. This paper proposes both an objective definition and a framework for identifying and analyzing ACM practices that have been found to be effective by peer-reviewed research to determine if a given practice deserves to be termed as best practice. The framework is based on the series of indexes that are used to rank candidate practices in order of their importance and their effectiveness. The 24 ACM practices evaluated were identified from 6 NCHRP Synthesis reports on ACM topics. The paper finds that only 4 of the 24 candidates meet the objective criteria to be termed a best practice. These were 1) Formalizing and institutionalizing agency ACM procedures, 2) Use of 2-step best-value award procedures, 3) Appointing an agency ACM champion, and 4) Offering stipends for unsuccessful competitors.

INTRODUCTION

The National Cooperative Highway Research Program (NCHRP) has invested a large amount of its resources funding research on alternative contracting methods (ACM) over the past two decades. A cursory search of the Transportation Research Information Database (TRID) showed that since 1996 there were at least 24 research projects, synthesis studies and similar work funded on the topics of "alternative contracting methods" and "innovative project delivery." There were also nearly 50 papers published on the topic of alternative contracting and "effective practices" or "best practices." Those two facts alone argue for a consolidation of the collective advancement in the alternative contracting body of knowledge in a manner that provides a succinct synthesis of those practices that have been found to add value to the project development and delivery process for practitioners. Therefore, the purpose of this paper is to provide a highly focused analysis of the literature on the subject of alternative contracting methods that is aimed at distilling a set of practices that have been proven to be effective by the fact that they have been physically implemented on transportation projects by multiple agencies and have been authoritatively evaluated by rigorous research methods which quantified their success.

BACKGROUND

In the past 30 years, the highway construction industry has been tinkering with the traditional design-bid-build (DBB) low bid award process in a quest for a more efficient, less adversarial approach to delivering transportation projects (1). The Utah Department of Transportation's (DOT) used design-build (DB) contracting as a means to complete the upgrade for I-15 in time for the 2002 Winter Olympics (2), which served as the initial impetus for other state DOTs to experiment with DB and with other ACMs. In 2010, the Federal Highway Administration (FHWA) initiated its Every Day Counts (EDC) program. The initiative was aimed at increasing the use of previously proven ACMs to accelerate the delivery of infrastructure renewal projects. Construction Manager/General Contractor (CMGC), DB, and Alternative Technical Concepts (ATC) were three ACMs that were highlighted as approaches to "get in, get out, and stay out." The FHWA Administrator articulated the EDC program's central theme as pursuing "better, faster, and smarter ways of doing business" (3). In 2011, FHWA advertised for state DOTs that were interested in becoming "early adopters" and authorized funding for technical assistance to facilitate the implementation of the ACMs each agency wanted to try. Part of that effort involved developing an on-line database of ACM resources (4) containing a plethora of documents. While the value of the collection is unquestionable, there is no single document where a practitioner can get guidance on which practices have been proven to work and which are yet to be tested. This paper will attempt to fill a small portion of that gap in the body of ACM knowledge. But before the results of the paper's analysis can presented, it is important to address the proliferation of ACM terminology.

SEMANTICS

It is important to note that ACM definitions are not standardized from state to state and are often a function of each DOT's enabling legislation (5). It is literally impossible to cover all possible definitions in a paper of this length, instead the reader is referred to the prior cited website (ref) for detailed

definitions of each ACM. For example, FHWA prefers to use the term CMGC to differentiate heavy civil projects with a minimum percentage of contractor self-performance from Construction Manager-at-Risk (CMAR) which is common in the commercial building industry where the CMAR often subcontracts all the construction work (6). However, the Arizona, Florida, and Maryland DOTs, to name three, use CMAR for highway projects, and the legislation in Washington State calls the ACM GC/CM and caps contractor self-performance at a maximum 50% (7).

The other semantic issue is the definition of "best practice," which when used is often followed by the rejoinder "according to whom?" Again, there are many definitions to be found in the literature. However, Michaelson and Stacks (8) provide one that consists of two objective criteria, which permit the analyst to identify a best practice from a practice that a given author believes to be sound. Their definition is: "A method or technique that has *consistently* shown *results superior* to those achieved with other means, and that is used as *a benchmark*." The terms "superior to other means" and "used as a benchmark" furnish a means to distinguish a best practice from all other practices when evaluating the content of a particular document. As one would expect, to be both consistently superior and a benchmark is a pretty lofty standard and will not often be attained. Hence, the definition is deemed appropriate.

Since NCHRP editors often discourage researchers from using the term "best practice" in research reports, the term "effective practice" has come into use to identify in the course of the research in literature practices that are observed and are documented as commonly used. Accardo (9) offers a definition that appears to be appropriate for effective practices: "Research-based practices identified through high quality quantitative study, but not yet meeting the strict criteria needed to become a benchmark." When compared to the best practice definition by Michaelson and Stacks (8), both definitions use an objective criterion, "benchmark" to differentiate between effective and best as well as the requirement that the practice be "identified through high quality quantitative study" to qualify as "effective." Therefore, the paper will identify effective practices found in the literature, which are validated as actually in use based on DOT survey and documentation information. From that set, each will be tested to determine whether or not it qualifies as a best practice.

METHODOLOGY

The methodology was developed to provide a rigorous means to differentiate between commonly observed ACM practices and effective practices per the above definition. The primary research instrument was textual content analysis of material found in the academic literature and a separate content analysis of material found in state DOT ACM documents like DB manuals, etc. "Researchers regard content analysis as a flexible method for analyzing text data" (10). Content analysis develops a foundation on which quantitative measurements of ACM practices can be made from the frequency of their appearance in the text as well as the context in which a given practice is discussed. Neuendorf (11) advocates using content analysis to develop "valid inferences from a message, written or visual, using a set of procedures." The research protocol involved creating a set of standard categories into which words that appear in the ACM document's text can be categorized. Then, the frequency of their appearance becomes the means "to infer the content of the document" (12) . This study conducted its content analysis in three stages. First, the researchers collected a set of ACM effective practices that were identified in six NCHRP Syntheses (13,14,15,16,17,18). NCHRP requires the authors of syntheses to identify commonly observed practices that were reported to be effective based on a survey of all state DOTs (19). Additionally, the reports all contain comprehensive literature reviews. The analysis yielded 24 candidate practices, and each synthesis included a survey of state DOTs regarding the use of the practices. The coverage of the synthesis reports is nationwide and represents a summary of the national experience for each topic.

Secondly, the candidate ACM practices were allocated into one of three categories based on a breakdown found in a report sponsored by the Connecticut Academy of Science and Technology on the subject of project deliverability (20) (Lownes et al. 2012). The documents were classified into the following categories:

1. Organizational structure
2. Project delivery method selection process
3. Contracting techniques

Each given practice was then evaluated to determine if it qualified as a candidate for classification as an effective practice per the previously cited definition of "identified through high quality

quantitative study" but does not qualify as a national benchmark. The last stage was to impose an additional condition to the definition for purposes of this particular study. The condition was that the practice had to have been observed as used by more than one state DOT by using the survey results from the six NCHRP Syntheses, compiling a comprehensive list of all synthesis survey respondents that reported using the given practice.

Once the list of candidates was identified in each category, they were ranked using a rubric termed the "Importance Index" (II) (20) (Assaf and Al-Hejji, 2006). In essence, the II is a combination of the frequency at which a specific practice was observed in the content analysis of the literature and its influence measured by the number of state DOTs that have adopted the practice. As such, the II holds that practices that are used frequently and are of high influence are more important that low frequency, low influence practices. This permits an objective ranking of candidate effective practices, which can then be used to infer the relative importance of adopting a specific ACM effective practice. The II is derived by first computing a Frequency Index (FI) and an Adoption Index (AI) based on Equations 1 and 2 to furnish input in the II calculation shown in Equation 3:

$$\textit{Frequency Index (FI) (\%)} = \sum(n/N) * 100/T_n \qquad \textit{[Eqn 1]}$$

Where: n = Number of observations of a practice in a specific category
N = Total observations of all practices in a specific category
T_n = Total observations of all practices in all categories

$$\textit{Adoption Index (AI) (\%)} = \sum(d/D) * 100/T_d \qquad \textit{[Eqn 2]}$$

Where: d = Number of DOTs using a practice in a specific category
D = Total DOTs using all practices in a specific category
T_d = Total DOTs using all practices in all categories

$$\textit{Importance Index (II) (\%)} = (FI * AI) \qquad \textit{[Eqn 3]}$$

The result is a list of ranked candidate practices within each category as well as a second list of all 24 practices ranked as a total population. This was done because each of the categories describes a separate facet of ACM implementation and it is important to understand the relative importance within each category. The overall ranking informs the analyst regarding those practices which when combined enhance the effectiveness of the ACM program.

To test the criterion proposed by Accardo (9) regarding "high quality quantitative study," a Research Index (RI) and a Verification Index (VI) are computed using Equations 4 and 5 based on the Assaf and Al-Hejji's (21) II theory.

$$\textit{Research Index (RI) (\%)} = \sum(c/C) * 100/T_c \qquad \textit{[Eqn 4]}$$

Where: c = Number of literature citations reporting a practice in a specific category
N = Total literature citations using all practices in a specific category
T_c = Total literature citations using all practices in all categories

$$\textit{Verfication Index (VI) (\%)} = (PI * II) \qquad \textit{[Eqn 5]}$$

Figure 1 is a flow chart showing the logic used in the research methodology.

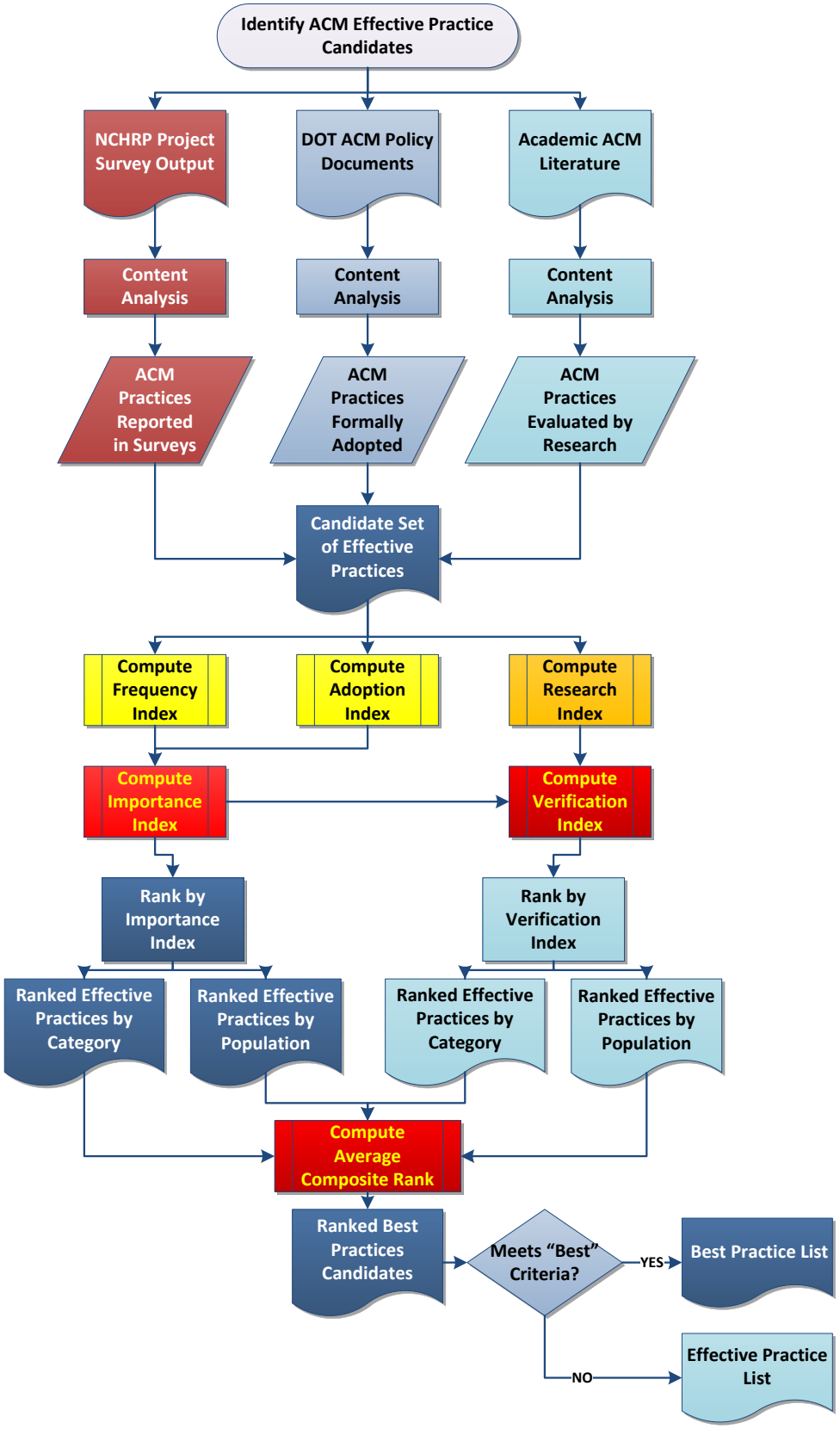

Figure 1: Best Practice Determination Flow Chart

RESULTS OF THE ANALYSIS

The six surveys administered received responses from every state DOT except Connecticut and Wyoming, plus the District of Columbia, Puerto Rico, and American Samoa. Table 1 shows the survey results by source. Table 2 shows the candidate practices and synthesis, literature, and policy document data. Table 3 contains a summary of the ranking analysis described in the methodology.

Table 1: Survey Result Sources.

NCHRP Synthesis Survey	Year	ACMs Sampled in Survey	Number of DOT Survey Responses	Number DOTs Using ACM
376: *Quality Assurance in Design-Build Projects*	2008	DB	47	31
402: *Construction Manager-at-Risk Project Delivery for Highway Programs*	2010	CMR, CMGC, DB, P3	47	11
429: *Geotechnical Information Practices in Design-Build Projects*	2012	DB, P3, CMGC, ATC	42	35
438: *Expedited Procurement Procedures for Emergency Construction Services,*	2012	DB, CMGC, ATC	42	25
455: *Alternative Technical Concepts for Contract Delivery Methods*	2014	DBB-ATC , DB, CMGC, P3, ATC	41	24
473: *Indefinite Delivery/Indefinite Quantity Contracting Practices*	2015	DB, CMGC, IDIQ	43	37

Table 2: Candidate Practices and Synthesis, Literature, and Policy Document Data.

Candidate Effective Practices			
A = No. of DOTs in Synthesis survey using practice**; B** = No. literature citations on practice**; C** = No. of DOT ACM Policy/Procedure Documents that include practice**.**	**A**	**B**	**C**
Organizational Practices			
Appoint a champion for alternative contracting practices.	15	7	12
Centralized ACM project development and execution	5	4	5
Centralized ACM project development and decentralized execution.	9	5	9
Decentralized ACM project development and execution	10	5	4
Outsource ACM project document development and/or program management	12	4	12
Provide formal ACM training for DOT staff	8	5	10
Provide formal ACM training for design and construction industry partners	3	4	7
Establish quantitative performance measures	11	4	7
Formal industry outreach during development of ACM policy and procedures	13	2	7
Project Delivery Method Selection			
Formalize the ACM decision process and institutionalize it as a standard operating procedure within the agency project development process documents.	11	6	25
Formal risk analysis and register as part of ACM selection process	2	4	13
Make ACM selection decision as early as practical in project development process	8	4	11
Include ACM for small projects to permit local contractors to gain experience.	4	6	6
Select CMGC for projects with large amount of utility issues and make CMGC contractor responsible for utility coordination.	6	7	3
Contracting Methods			
Use 2-step best-value award procedures	44	6	16
Use in-house design on CMGC projects.	2	4	4
Use in-house design on small and/or emergency CMGC projects.	2	4	2
Use in-house design with IDIQ contractor on emergency projects to achieve benefits from CMGC.	2	4	2
Confidential one-on-one meetings before submission of bid or proposal	15	5	15
Offer stipends to responsive but unsuccessful proposers.	26	3	21
Reduce bonding requirements to match annual amount that will be at risk of default to increase competition	2	2	2
Advance release of draft ACM RFP for industry comment.	16	4	16
Early contractor involvement via DBB ATC process	2	3	2
Over-the-shoulder reviews of design deliverables	7	5	10

Table 3: Results of Effective Practice Ranking Analysis

Candidate Effective Practices	Rank By Category		Rank By Population	
Index	II	VI	II	VI
Organizational Practices				
Appoint a champion for alternative contracting practices.	1	1	5	4
Centralized ACM project development and execution	2	2	18	18
Centralized ACM project development and decentralized execution.	3	7	10	12
Decentralized ACM project development and execution	4	3	16	15
Outsource ACM project document development and/or program management	5	4	6	7
Provide formal ACM training for DOT staff	6	5	11	13
Provide formal ACM training for design and construction industry partners	7	6	19	19
Establish quantitative performance measures	8	8	12	14
Formal industry outreach during development of ACM policy and procedures	9	9	9	16
Project Delivery Method Selection				
Formalize the ACM decision process and institutionalize it as a standard operating procedure within the agency project development process documents.	1	1	1	1
Formal risk analysis and register as part of ACM selection process	2	2	13	11
Make ACM selection decision as early as practical in project development process	3	5	4	3
Include ACM for small projects to permit local contractors to gain experience.	4	3	14	6
Select CMGC for projects with large amount of utility issues and make CMGC contractor responsible for utility coordination.	5	4	15	9
Contracting Methods				
Use 2-step best-value award procedures	1	1	2	2
Use in-house design on CMGC projects.	2	2	20	20
Use in-house design on small and/or emergency CMGC projects.	3	4	21	21
Use in-house design with IDIQ contractor on emergency projects to achieve benefits from CMGC.	4	3	22	22
Confidential one-on-one meetings before submission of bid or proposal	5	5	8	8
Offer stipends to responsive but unsuccessful proposers.	6	6	3	5
Reduce bonding requirements to match annual amount that will be at risk of default to increase competition	7	7	23	24
Advance release of draft ACM RFP for industry comment.	8	8	7	10
Early contractor involvement via DBB ATC process	9	10	24	23
Over-the-shoulder reviews of design deliverables	10	9	17	17

Table 3 provides a seemingly consistent set of results between the category rankings and the overall rankings of practices. In most cases, the top few practices in each category are also highly ranked within the entire population. The one exception is the CMGC related practices, which was 2 in the category but 20 in the population. This is easily explained by the fact that CMGC is relatively new to the ACM scene and does not enjoy wide-spread implementation (22). One would expect this disparity to change over time. In the Organizational Practice category, Table 3 leads one to infer that when implementing ACMs it is important to have a designated champion and some form of centralized project development at the DOT level. When selecting a project delivery method, Table 3 indicates the importance of developing a formal ACM decision process institutionalized in the agency project development policy documents and making the decision based on formal risk analysis as early as possible in that process. Lastly, in the Contracting Methods category, the use of 2-step best-value award procedures, confidential one-on-one meetings during procurement, and offering stipends for unsuccessful competitors are clearly important practices.

Table 4 shows the ranking of the computed average composite rank for each practice. This last metric it merely the mathematical average of the four values for each practice shown in Table 3. The final calculation is done to normalize the various importance rankings into a single measure that indicates those effective practices which might qualify for classification as best practices based on the Michaelson and Stacks (8) definition.

231 Table 4: Average Composite Effective Practice Rankings.

Candidate Effective Practices	Average Composite Ranking
Formalize the ACM decision process and institutionalize it as a standard operating procedure within the agency project development process documents.	1.00
Use 2-step Best-value award procedures	1.50
Appoint a champion for alternative contracting practices.	2.75
Make ACM selection decision as early as practical in project development process	3.75
Offer stipends to responsive but unsuccessful proposers.	5.00
Outsource ACM project document development and/or program management	5.50
Confidential one-on-one meetings before submission of bid or proposal	6.50
Include ACM for small projects to permit local contractors to gain experience.	6.75
Formal risk analysis and register as part of ACM selection process	7.00
Centralized ACM project development and decentralized execution.	8.00
Select CMGC for projects with large amount of utility issues and make CMGC contractor responsible for utility coordination.	8.25
Advance release of draft ACM RFP for industry comment.	8.25
Provide formal ACM training for DOT staff	8.75
Decentralized ACM project development and execution	9.50
Centralized ACM project development and execution	10.00
Establish quantitative performance measures	10.50
Formal industry outreach during development of ACM policy and procedures	10.75
Use in-house design on CMGC projects.	11.00
Use in-house design on small and/or emergency CMGC projects.	12.25
Provide formal ACM training for design and construction industry partners	12.75
Use in-house design with IDIQ contractor on emergency projects to achieve benefits from CMGC.	12.75
Over-the-shoulder reviews of design deliverables	13.25
Reduce bonding requirements to match annual amount that will be at risk of default to increase competition	15.25
Early contractor involvement via DBB ATC process	16.50

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233 Table 4 is merely a starting point for applying the best practice decision criteria and not the final
234 decision-maker. It primarily speaks to the notion of identifying superior results. Checking the Table 3
235 outcomes for the top three effective practices in Table 4 shows that each was number one in both rankings
236 within its own category and within the top 5 across the population. Hence these three are arguably
237 superior to the rest. Regarding qualifying as a benchmark, Table 2 shows that using 2-step best value
238 award procedures was observed in 44 DOTs as well as formally adopted and institutionalized in 16 of the
239 reviewed DOT ACM manuals. Six peer-reviewed research studies validated its effectiveness. When
240 combined with the fact that the vast majority of DOTs reported using it, the practice qualifies it as a
241 national standard. Formalizing the ACM process also was verified by 6 research studies and found in 25
242 DOT ACM policy documents, which serves as testimony to the reason for doing so. Again, when
243 combined with the fact that this practice received the highest average composite ranking certainly
244 qualifies it as a best practice. Appointing an ACM champion was found in 7 research studies and
245 observed in 15 DOT survey responses. The practice relates to the two other practices about having
246 centralized project development. The champion is typically in charge of the central project development
247 process. Lastly, giving a single individual the responsibility to direct the agency's ACM program has
248 been found by research to encourage consistency and permits lessons learned across the agency to be
249 applied to all its ACM projects (22,23,24,25). Therefore, while not as clear as the previous two best
250 practices, appointing an ACM champion should be found to be a best practice.
251 Looking at the next few practices, the fourth highest composite rank involves picking the ACM as
252 early as possible. It was only reported by 8 DOTs and found in 11 DOT manuals. Therefore it is difficult
253 to declare it as qualifying as a national standard and while it has certainly been proven to be effective, it
254 cannot be used as a bench mark. However the fifth ranked practice of offering stipends was reported by
255 26 DOTs and found in 21 DOT manuals. The practice was found to be effective in 4 research studies

making it both superior and a benchmark (23,24,25,26). After that it becomes problematic to make an airtight case for the remaining set of effective practices to be classified as best practices.

LIMITATIONS, CONCLUSIONS AND RECOMMENDATIONS

This paper's primary contribution is to propose a framework for classifying ACM best practices based on objective criteria of recorded superior results and benchmark suitability. The framework uses content analysis of three independent sources of information, which is then compared using a series of indexes that are adapted from II theory proposed by Assaf and Al-Hejji (21). Best practices are selected from a population of ACM effective practices that are "research-based practices identified through high quality quantitative study, but not yet meeting the strict criteria needed to become a benchmark" (9).

The conclusions outlined below have one limitation and it relates to the source of the initial population of candidate effective practices. All came from research conducted by the NCHRP synthesis program and as such are specifically related to ACMs as practiced by US state DOTs and may not be applicable to other parts of the world or other industries. It must be noted that the synthesis results are peer-reviewed by a panel of 8 practitioners before being accepted for publication, providing a high level of confidence that practices identified as effective in a synthesis are indeed so.

The study resulted in several conclusions with respect to the issue of identifying best practices in ACMs. First, a uniform definition that differentiates a best practice from all other effective practices was developed. In essence, if a given practice does not meet the criteria to be used as a benchmark, it must be considered merely as effective. Secondly, the framework for objectively differentiating between effective and best practices was found to be useful and the methodology presented can be generalized to the same type of analysis of ACM practices in other industries and markets. It can also be generalized to other areas of NCHRP research where the terms effective practices and best practices can be used. The use of Importance Index theory proved to be very flexible and was easily adjusted to suit the needs of this particular analysis.

The final conclusions are specific to the analysis. The following ACM practices are found deserving of the best practice designation and as such, can be used to benchmark ACM implementation.

- Formalize the ACM decision process and institutionalize it as a standard operating procedure within the agency project development process documents.
- Use 2-step Best-value award procedures
- Appoint a champion for alternative contracting practices.
- Offer stipends to responsive but unsuccessful proposers.

As the interest in implementing ACM use grows, the need for an agency to tailor its project development and delivery process to leverage ACM's potential benefits increases. Therefore, the findings of this paper can potentially be used to guide an agency new to ACM in formulating its policy and procedure for organizing, selecting project delivery methods, and developing specific contracting methods for ACM projects. Many states like, Utah, Minnesota, and Virginia, have institutionalized their ACM procedures in accordance with the first best practice listed above. Other states are still in the experimental stage, having tried one or two pilot projects, and thus can use these findings in the context of their initial ACM experience to revise their ACM procedures. Lastly, there remain a few states, Iowa and Oklahoma that have shown little interest in ACMs. Nebraska used to be in that category but recently obtained enabling legislation to pilot ACMs (27). Those agencies can use the 4 best practices and 20 effective practices discussed in this paper as a starting point for the road to ACM implementation, knowing full well that they represent the collective national experience in alternative procurement.

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