UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

Form 8-K

CURRENT REPORT
PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

Date of Report (Date of earliest event reported): June 9, 2020

Mammoth Energy Services, Inc.

(Exact name of registrant as specified in its charter)

001-37917
(Commission File No.)

Delaware	**32-0498321**
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
14201 Caliber Drive, Suite 300 Oklahoma City, Oklahoma (Address of principal executive offices)	**73134** (Zip Code)

(405) 608-6007
(Registrant's telephone number, including area code)

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)
☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)
☐ Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))
☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of The Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock	TUSK	The Nasdaq Stock Market LLC

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§232.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§240.12b-2 of this chapter).

Emerging Growth Company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(s) of the Exchange Act. ☐

Item 8.01 Other Events

After over a year of requests under the Freedom of Information Act, Mammoth Energy Services, Inc. (the "Company") recently received a copy of a detailed independent assessment of the reasonableness of the emergency master services agreement dated October 19, 2017 between the Company's subsidiary Cobra Acquisitions LLC ("Cobra") and Puerto Rico Electric Power Authority ("PREPA") for repairs to PREPA's electrical grid as a result of Hurricane Maria (the "MSA"). This report, titled "Reasonableness Analysis of Cobra Acquisitions, LLC Emergency Contract – Cost Validation Report" dated March 28, 2019 (the "Rand Report"), was prepared at the request of the Federal Emergency Management Agency ("FEMA") by the Homeland Security Operational and Analysis Center ("HSOAC"), a federally funded research and development center operated by the RAND Corporation for the U.S. Department of Homeland Security. FEMA's request for the Rand Report followed a December 22, 2017 Determination Memorandum produced by FEMA that found the MSA to be reasonable.

The 77-page Rand Report's comprehensive analysis and findings are significant and contain, among others, the following conclusions:

Selection of Cobra was reasonable

"Having examined [the foregoing] aspects regarding the reasonableness of PREPA's emergency procurement process, HSOAC finds that selecting Cobra for the MSA was reasonable considering FEMA policy on emergency situations and existing regulations regarding contracting." (page 14)

PREPA adhered to procurement statutes and policies in awarding the contract to Cobra

"PREPA adhered to Puerto Rican legal statutes regarding emergency situations and remained consistent with their own internal policies." (page 14)

"Thus, according to this evaluation of the procurement process HSOAC concludes that PREPA engaged in a reasonable procurement process given the circumstances following Hurricane Maria." (page 14)

Cobra's rates were reasonable

"We conclude that Cobra's blended rates fall within representative ranges for high voltage emergency repair work. This conclusion is delivered from analytical investigation which combined knowledge of work conditions, assumptions into wage burdens, evaluation of the equipment quantities and workforce structures, different assumptions about fuel costs, and inclusion of the best benchmark data and current adjustment factors available at this time." (page 48)

"Cobra's blended rates fall within estimated ranges in all scenarios we considered." (page 47)

Other key findings:

"Cobra was uniquely positioned for rapid response to the crisis, deploying heavy equipment to seaports to barge transports on the day after contract signature (10/20/17). Transmission work on the island began on 10/31/17, two weeks after Cobra was awarded the contract. Furthermore, a fully equipped crew of 463 lineman and 200 support staff arrived on the island within 3 weeks of contract signing (11/13/17). This fully equipped crew was composed of quantities of linemen and security which greatly exceeded the levels proposed in the MSA. This timely delivery of quantities of work and support labor, in excess of the levels initially proposed quickly (three weeks after the MSA was signed), clearly reflects responsiveness to requirements for both immediate availability and contract flexibility." (page 22)

"Overall, we concluded that work crew headcounts and equipment quantities offered by Cobra were sufficiently large to complete required electricity work and thus, HSOAC deemed quantities presented in Cobra's bid document to be reasonable." (page 27)

"Results show that Cobra's average hourly labor rate lay between low and high benchmarks and did not exceed any individual labor category except for groundman. By comparison, MasTec and PowerSecure's crew weighted hourly rates were higher than Cobra's and exceed benchmark ranges for most individual labor categories and overall. These results indicate that Cobra's labor rates were competitive relative to others who submitted proposals for the MSA." (page 36)

"PREPA's requested solution delineated four critical requirements for emergency work – transmission repair capabilities, aircraft assets for installation in mountainous terrain, self-logistics resources, and ability to perform with minimal upfront payment. PREPA stated that Cobra was selected as the only company with experience in installation of transmission equipment and towers in mountainous terrain environments. Cobra had five helicopters, which could be deployed as emergency repair assets. Additionally, Cobra was able to provide its own logistical support – including supplies, equipment, fuel, food, water, housing, etc., and had crews and equipment ready to deploy." (page 13)

The Rand Report adds further validation to the conclusions contained in the December 23, 2017 letter from FEMA to the Government of Puerto Rico (the "December 2017 Letter") that (i) under the exigent circumstances after Hurricane Maria, PREPA awarded the MSA in compliance with the emergency procurement provisions of Puerto Rico and related executive orders and (ii) the costs under the MSA were reasonable.

The foregoing descriptions of the Rand Report and the December 2017 Letter do not purport to be complete and are qualified in their entirety by reference to the full text of the Rand Report and December 2017 Letter which are included as Exhibit 99.1 and Exhibit 99.2, respectively, to this Current Report on Form 8-K and incorporated by reference herein.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

99.1	Report titled "Reasonableness Analysis of Cobra Acquisitions, LLC Emergency Contract – Cost Validation Report" dated March 28, 2019.
99.2	Letter dated December 23, 2017 from Federal Emergency Management Agency to Government of Puerto Rico.

Signature

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

MAMMOTH ENERGY SERVICES, INC.

Date: June 9, 2020

By: /s/ Mark Layton

Mark Layton

Chief Financial Officer and Secretary

Project Report

Reasonableness Analysis of Cobra Acquisitions, LLC Emergency Contract

Cost Validation Report

Ismael Arciniegas Rueda, Mark Hanson, Marygail Brauner, Ike Chang, Max Izenberg, Thao Liz Nguyen, Kelly Klima

Homeland Security Operational Analysis Center
An FFRDC operated by the RAND Corporation under contract with DHS

PR-3083/5-DHS
March 28, 2019
Prepared for the Federal Emergency Management Agency (FEMA)

HSOAC
HOMELAND SECURITY
OPERATIONAL ANALYSIS CENTER

Executive Summary: Reasonableness Analysis of Cobra Acquisitions, LLC Emergency Contract

On September 20, 2017, Puerto Rico was impacted by Hurricane Maria, resulting in significant, widespread damage to the island's electrical system. Puerto Rico Electric Power Authority (PREPA), the sole provider of electricity on the island, responded to the crisis by signing a Master Service Agreement (MSA) contract with Cobra Acquisitions, LLC (Cobra).[1] The MSA stipulated that the contractor would deliver an emergency restoration of power and perform critical repairs to the transmission infrastructure on the island. The dire circumstances and need for quick response did not allow time for a request for proposal (RFP) process. An MSA is a contracting process available under these circumstances. On December 22, 2017, FEMA produced a Determination Memorandum (DM) that found the MSA contract to be reasonable.[2] The Office of the Inspector General (OIG) verbally questioned the DM' conclusions because it did not find enough details in the DM's analysis. As a result, the Federal Emergency Management Agency (FEMA) requested that the Homeland Security Operational and Analysis Center (HSOAC) perform a detailed independent assessment of the reasonableness of Cobra's MSA.

In performing this independent assessment, HSOAC reviewed all documents provided by FEMA to determine the reasonableness of the selection process of Cobra. This inquiry cross referenced PREPA's procurement process with existing FEMA policies regarding reasonableness for contracts. PREPA's Emergency Procedures and the emergency procurement provisions of the Commonwealth of Puerto Rico were also examined in this investigation. Having thoroughly reviewed the available documentation at the time of the selection, HSOAC found the information to be sufficient to assess PREPA's procurement process; we find the procurement process for the MSA contract to be qualitatively reasonable.

Additionally, HSOAC reviewed and analyzed the quantities and rates for the labor and equipment that Cobra provided to PREPA for service delivery. Quantitative analysis models focused on the following aspects of Cobra's billable rate schedule:

- Cost drivers of Cobra's blended rates
- Quantities of labor and equipment proposed to perform the emergency repairs

[1] Emergency Master Service Agreement for PREPA Electric Grid Repairs-Hurricane Maria. Puerto Rico Electric Power Authority (PREPA), October 19, 2017.

[2] Analysis provided by FEMA to HSOAC. Eligibility Determination Memorandum Applicant, PA ID 000 UA2QU-00 FEMA-4339-DR-PR. Project Worksheet 00251. Dec 22, 2017.

- Scale and cost of support functions (e.g. logistics, security, and management)

HSOAC performed separate analyses on the unit rates, adjustment factors, and quantities used as inputs to the calculation of Cobra's blended rates for the MSA contract. These cost components were benchmarked with a series of comparisons against data from other emergency response proposals, industry surveys, Bureau of Labor and Statistics wages[3], and RSMeans[4] wages and work crew data. HSOAC standardized the data across varying sources throughout the quantitative analysis process, combining statistical findings with investigation into situational factors, unknowns, and assumptions about services appropriate to high voltage system repair. HSOAC generated representative blended rate ranges for comparison to Cobra's blended rates. HSOAC concludes that, under a range of assumptions and use of best available benchmark data, Cobra's billable rates to PREPA fall within those ranges and are therefore reasonable for the emergency repair work proposed by Cobra under the MSA.

Per FEMA's request, HSOAC conducted an independent analysis focused on the procurement process of Cobra's MSA and on its contract rates. This report does not cover the implementation of the MSA contract. Therefore, it is outside of the scope of this report whether or not the labor and equipment provided by Cobra was employed to perform the actual tasks assigned under the MSA.

[3] U.S. Bureau of Labor Statistics, "Occupational Employment Statistics," webpage. As of December 6, 2018: https://www.bls.gov/oes/

[4] RSMeans. *Facilities Construction Costs with RSMeans data,* Rockland, MA: The Gordian Group, 2018.

Preface

On October 30, 2017, the Commonwealth of Puerto Rico elected to participate in alternative procedures for large project funding under Public Assistance (PA) Categories C-G, pursuant to section 428 of the Stafford Act, for permanent work efforts following Hurricane Maria. In accordance with *Public Assistance Alternative Procedures (Section 428): Guide for Permanent Work* (U.S. Department of Homeland Security, 2018a), the role of the Expert Panel is to provide an independent validation of cost estimates for the Public Assistance projects which are submitted for review.

On December 22, 2017, FEMA produced a Determination Memorandum (DM) that found an MSA contract signed between PREPA and Cobra LLC, to provide emergency restoration services to PREPA's electric systems, to be reasonable. The Office of the Inspector General (OIG) verbally questioned the DM's conclusions because it did not find enough details in the DM's analysis. As a result, the Federal Emergency Management Agency (FEMA) requested that the Homeland Security Operational and Analysis Center (HSOAC) perform a detailed independent assessment of the reasonableness of Cobra's MSA.

This report provides analysis on the reasonableness of Puerto Rico Electric Power Authority's (PREPA's) Master Service Agreement with Cobra Acquisitions, LLC (Cobra). The findings should be of interest to other public utilities using MSAs for emergency work. This research initiative was sponsored by FEMA and conducted within the Acquisition and Development Program (ADP) of the HSOAC federally funded research and development center (FFRDC). For more information on the HSOAC program, contact the Program Director, Dr. Isaac Porche by email at isaac.porche@associates.hq.dhs.gov.

Comments or questions on this draft report may also be addressed to the lead author, Dr. Ismael Arciniegas Rueda, at irueda@rand.org, and principal investigators, Jessie Riposo, at riposo@rand.org, Kyle Siler-Evans at ksilerev@rand.org, and Mike McMahon at mmcmahon@rand.org.

About the Homeland Security Operational Analysis Center

The Homeland Security Act of 2002 (Section 305 of Public Law 107-296, as codified at 6 U.S.C. § 185), authorizes the Secretary of Homeland Security, acting through the Under Secretary for Science and Technology, to establish one or more FFRDCs to provide independent analysis of homeland security issues. The RAND Corporation operates the Homeland Security Operational Analysis Center (HSOAC) as an FFRDC for the U.S. Department of Homeland Security (DHS) under contract HSHQDC-16-D-00007.

HSOAC leverages a unique team of subject matter experts who provide the government with objective analysis and advice in support of homeland security issues. Our team is composed of active professionals and leading academics who are recognized within their fields as experts on policy development, decision making, alternative approaches, and provide thought leadership in core areas and issues of significance. HSOAC also supports numerous federal, state, local, tribal, and public and private-sector organizations which are part of the homeland security enterprise. HSOAC research initiatives are conducted by mutual consent with DHS and are organized as a set of discrete projects and corresponding tasks. The following report presents the results of research and analysis conducted under 70FBR218F00000141, "Expert Analysis of FEMA Cost Estimate Development Process and Validation for FEMA-4339-DR-PR and FEMA-4340-DR-VI (Hurricane Maria) Remediation / Reconstruction".

The results presented in this report do not necessarily reflect official DHS opinion or policy.

For more information on HSOAC, see www.rand.org/hsoac.

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Acknowledgments

The authors would like to thank HSOAC's R.J. Briggs and Parousia Rockstroh for their thoughtful inputs in the making of this report. Additionally, the authors would like to thank RAND analyst, Karlyn Stanley, J.D., for her expert review of the contracts and the use of MSAs for emergency work, and RAND librarian, Anita Szafran, for her dedicated research. The authors would like to thank (b)(6) who provided insightful reviews and comments that enabled us to refine the report. Finally, the authors are grateful to (b)(6) for his thorough edit of this report.

Abbreviations

ADP	Acquisition and Development Program
BLS	Bureau of Labor Statistics
CCF	Construction Cost Factor
CEF	Cost Estimating Format
CONUS	Continental United States
DHS	U.S. Department of Homeland Security
DM	Determination Memorandum
ECCF	Equipment Construction Cost Factor
EW	Emergency Work
FFRDC	Federally Funded Research and Development Center
FEMA	Federal Emergency Management Agency
HSOAC	Homeland Security Operational Analysis Center
IDC	Indirect Costs
MSA	Master Service Agreement
LCCF	Labor Construction Cost Factor
O&M	Operations and Maintenance
O&P	Overhead and Profit
OIG	Office of the Inspector General
OT	Overtime
PA	Public Assistance
PAPPG	Public Assistance Program and Policy Guide
PREPA	Puerto Rico Electric Power Authority
PW	Project Worksheet
QFD	Quality Functional Deployment
RFI	Request for Information

RFP	Request for Proposal
SOC	Standard Occupation Classification
SME	Subject Matter Expert
SOW	Scope of Work
ST	Straight Time
WBS	Work Breakdown Structure

1. The Need: Background and Scope

Background

On September 20, 2017, Puerto Rico was impacted by Hurricane Maria, causing widespread damage to the power infrastructure (Government of Puerto Rico, 2018). The Puerto Rico Electric Power Authority (PREPA) is the primary provider of electricity on the island and is required to undergo a comprehensive review of cost reasonableness prior to receiving FEMA funding for labor and equipment procurements (U.S. Department of Homeland Security, 2018a, 2018b).

In the wake of Hurricane Maria, PREPA sought to obtain fast and effective contractor support to repair the electrical system and restore power. In the first iteration, PREPA issued the contract opportunity under a Master Service Agreement (MSA). An MSA is a general business agreement which describes the terms that a government entity or contracting organization must comply with to be considered eligible for a given contract opportunity.[5]

Following an evaluation of six submitted proposals, PREPA awarded the contract to Cobra Acquisitions, LLC (Cobra) under an MSA to deliver emergency repairs to PREPA's electric system. The contract was dated October 19, 2017 and was defined as valid for a period of 12 months or an expenditure ceiling of $200 million, whichever event occurred first. PREPA retained the option to renew the terms of the agreement on a month-to-month basis (PREPA, 2017b).

On December 22, 2017, FEMA produced a Determination Memorandum (DM) that found the MSA contract to be reasonable.[6] The Office of the Inspector General (OIG) verbally questioned the conclusions in the DM due to a lack of supporting analysis. As a result, the Federal Emergency Management Agency (FEMA) requested that the Homeland Security Operational and Analysis Center (HSOAC) perform a detailed independent assessment of the reasonableness of Cobra's MSA.

Definitions

HSOAC assessed the reasonableness of the Cobra MSA contract through complementary qualitative and quantitative analyses that considered FEMA definitions and industry standards.

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[5] Note this general business agreement appears in FEMA documents, i.e. a document on FEMA cooperatives in Texas, https://comptroller.texas.gov/purchasing/docs/txmas/fema-cooperative.pdf. In general an MSA is a short-term contract. In February 2018, PREPA initiated a request for proposals (RFP) process for additional restoration of electrical services.

6 Analysis provided by FEMA to HSOAC. Eligibility Determination Memorandum Applicant, PA ID 000 UA2QU-●● FEMA-4339-DR-PR. Project Worksheet 00251. Dec 22, 2017.

In this section, we provide definitions of reasonableness in light of FEMA policy guidance and introduce terms we refer to when assessing the reasonableness of Cobra's blended rates.

Reasonableness

Per FEMA's definition, "a cost is reasonable if, in its nature and amount, it does not exceed that which would be incurred by a prudent person under the circumstances prevailing at the time the decision was made to incur the cost" (U.S. Department of Homeland Security, 2018c). When examined from a contract procurement perspective, we define reasonableness as compliance with the established practices and policies regarding PREPA's circumstantial incurrence of cost. In our quantitative analysis, HSOAC defined the reasonableness of blended rates as being appropriate to the scope of services under the MSA and falling within a range of representative blended rate estimates as illustrated in Figure 1.2 and discussed further below.

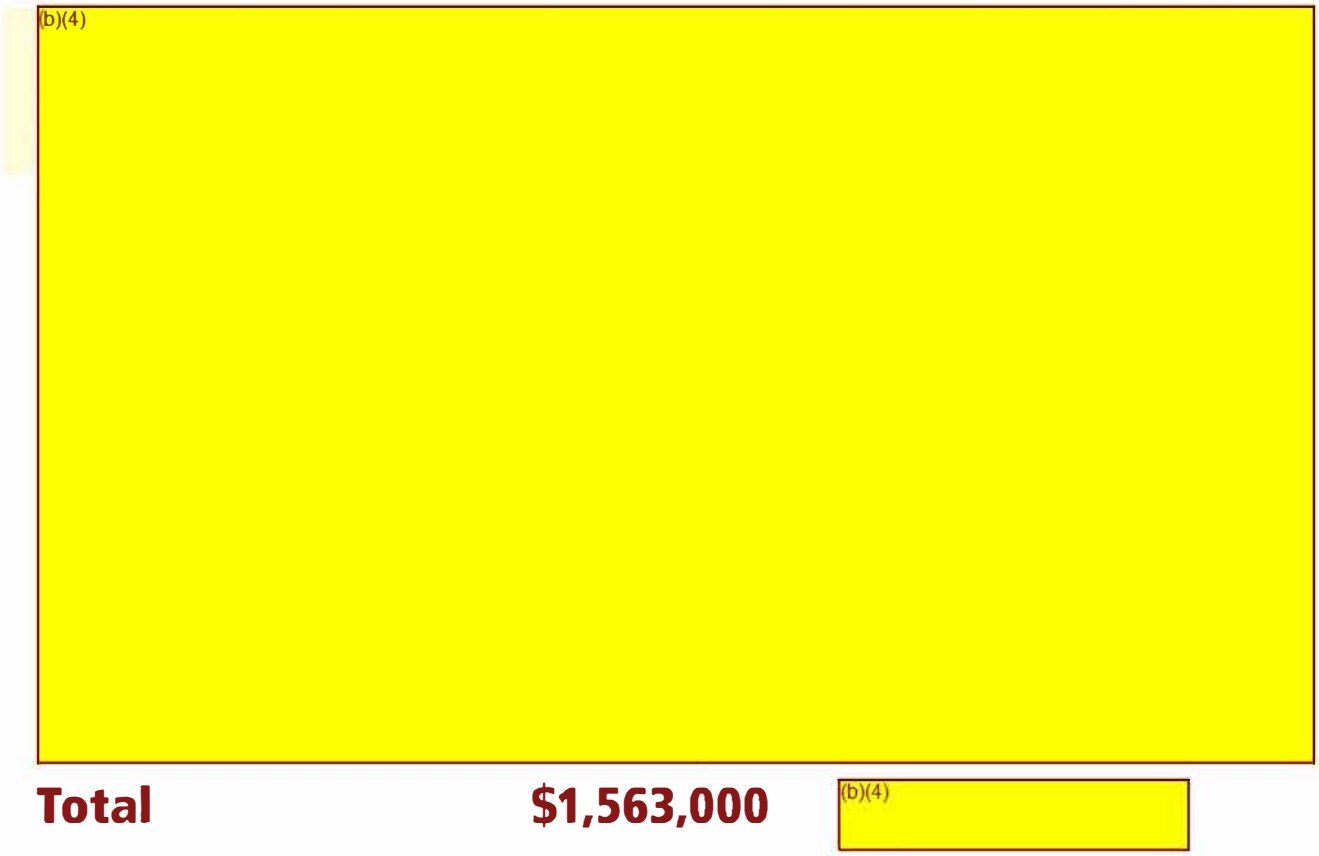
Blended rates

Blended rates express total resource costs (e.g. labor and equipment) per labor headcount[7]. In this analysis, blended rates are calculated according to a function that combines labor and equipment quantities, base rates (e.g., hourly labor rate, or daily equipment rate) and an adjustment factor that produces a rate composite to be billed according to the number of linemen for a given day. The adjustment factor applied in the calculation is called a construction cost factor (CCF) in this report. A derivation of the blended rate equation is provided in Appendix A and the calculation of a CCF is in Appendix B.

Cobra proposed two blended rates for high voltage electrical repair services. The "Blended Rate, skilled lineman and equipment" proposed by Cobra amounts to (b)(4) per person, per day; this rate covers both the lineman daily wages and daily equipment costs incurred by Cobra for high voltage repair services. Cobra also proposed the "Total Rate per Blended Lineman" which includes the additional cost of support staff and living expenses, for a total amount of (b)(4) per person, per day. Support staff perform management, logistics and security functions in support of the electrical repairs by skilled linemen. The denominator for both of these blended rates is the number of linemen in the workforce proposed by Cobra (250 linemen). Figure 1.1 illustrates the composition of these blended rates, according to data from Cobra's proposal (see Table 1.1.)

[7] In general, the Blended Daily Rate = (Labor Daily Total Cost + Equipment Daily Total Cost) / Labor Headcount.

Figure 1.1 Illustration of the Composition of a Blended Rate



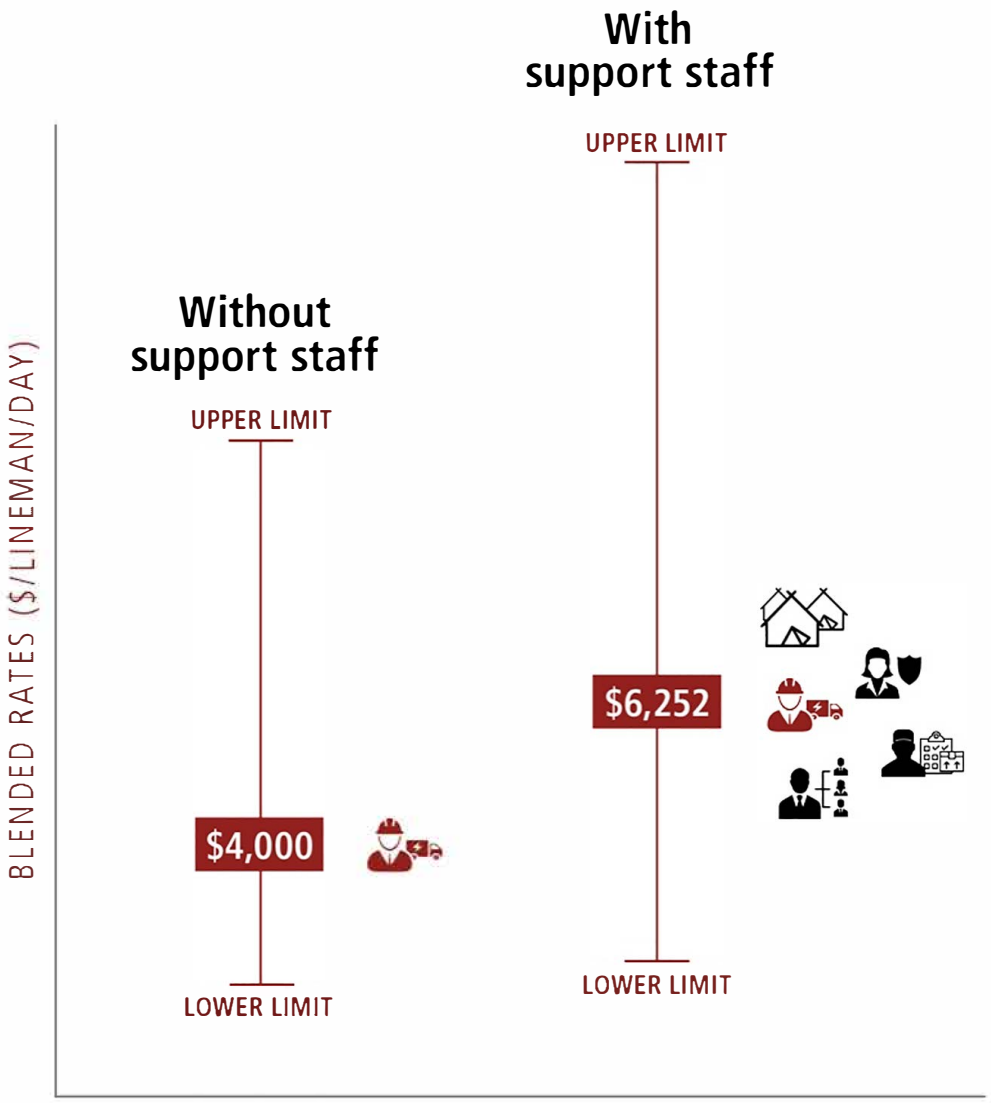
Representative Blended Rate Ranges

We assess reasonableness of Cobra's blended rates after comparing them to a range of representative blended rates. We judge a blended rate to be reasonable if it falls within a range of blended rates that represent the variation observed across benchmark data, adjusted by appropriate construction cost factors, and for labor and equipment quantities appropriate to high voltage system repair tasks, as illustrated in Figure 1.2. Benchmarks for equipment and labor are derived from industry standard databases such as RSMeans, Bureau of Labor Statistics, and competitive bid data. Benchmarks are adjusted by CCFs that account for overhead, profit, contingencies, risk and indirect costs (IDC) that comprise a fully burdened wage according to published guidance from FEMA (U.S. Department of Homeland Security, 2009). A representative range intends to accommodate variation among the above factors to reflect a range of current market prices for similar goods and services relevant to high voltage system repair.

Because Cobra did not provide details on how labor and equipment quantities would be applied to perform repair services, we developed several scenarios relevant to electrical system repair and computed several representative blended rate ranges for comparison to Cobra's proposed rates. An example calculation of a blended rate range is provided for a common work

crew that performs electrical repair work in Appendix L. Additional guidance on producing representative blended rates for various electrical system repairs is provided in Appendix M.

Figure 1.2 Illustration of Ranges for Representative Blended Rates



Scope

Per FEMA's request, this report assesses the reasonableness of Cobra's MSA contract with PREPA. Accordingly, HSOAC (1) reviewed the procurement process for Cobra's MSA contract and (2) analyzed the quantities and rates agreed to by PREPA in the signed MSA (PREPA, 2017b). Cobra's rate and equipment schedules, reported in the MSA in Exhibit B and Exhibit C, are presented in Table 1.1 and Table 1.2.

HSOAC generated representative blended rate ranges for comparison to Cobra's blended rates. Our analysis analyzed whether Cobra's billable rates to PREPA fall within those ranges

and are therefore reasonable for the emergency repair work proposed by Cobra under the MSA. This report does not cover the implementation of the MSA contract on the ground. Therefore, it is outside of the scope of this report whether the labor and equipment provided by Cobra was employed to perform the actual tasks assigned under the MSA.

Table 1.1 Cobra's Rate Schedule (MSA Contract Exhibit B)

Line Item	Qty	Billable Daily Rate	Extended Daily Billable Rate	Rate per Blended Linemen
Blended Rate, skilled lineman and equipment, Transmission/Distribution/Substation	250	(b)(4)	(b)(4)	(b)(4)
550 Man Camp, All-inclusive/lodging, power, water, meals, laundry	1	(b)(4)	(b)(4)	(b)(4)
Security Team	104	(b)(4)	(b)(4)	(b)(4)
Logistics team (island)	50	(b)(4)	(b)(4)	(b)(4)
Management Team, Operations & Safety	30	(b)(4)	(b)(4)	(b)(4)
Total			$1,563,000	(b)(4)

Table 1.2 Cobra's Equipment Schedule (MSA Contract Exhibit C)

Equipment Type	Qty
55'-60' 4x2/ tracked	80
100-105 6x6/ tracked	6
47' 4x4 4047/ tracked	40
80' 6x6 General/ tracked	3
Truck Cranes: 50 ton Manitex	2
Pressure Diggers	5
Pullers: 3500-4000# four drum	10
Tensioners: 72" bullwheel	10
Pick Up Trucks	60
Specialty Trucks: Reel Trailer, small	20
Specialty Trucks: Flat bed haul truck	4
Specialty Trucks: Standard Haul Truck	12
Specialty Trucks: Heavy Haul Truck Wet Kit	2
Specialty Trucks: 132# Load King Low Boy	2
Specialty Trucks: 80k Stretch	6
Specialty Trucks: 60k Drop Deck	6
Rotary Aircraft: MD 500	5

Note that Cobra provided rates to PREPA as "blended rates"—a single value to cover labor, equipment, and fixed costs for their services awarded under the MSA. Subsequently, in response to an RFP in February 2018, Cobra and other companies provided blended rates for similar work in Puerto Rico. We use the RFP data, which was competitively bid, as an important source of information to assess the reasonableness of the MSA contract.

Data

FEMA selected RSMeans as the primary construction database for cost estimates Puerto Rico (U.S. Department of Homeland Security, 2009). The RSMeans data includes costs for labor, materials, and equipment for common construction tasks. Each calendar quarter, RSMeans publishes updated cost data based on a 30-city national average, as well as locational adjustments for over 900 different cities and localities. We use the RSMeans national average costs, under the assumption that emergency work performed by Cobra would largely rely on labor from the continental U.S.

We were not able to match all the labor and equipment assets used on the Cobra MSA to existing RSMeans values. Nevertheless, our quantitative analysis remained compliant with

FEMA guidance (e.g., U.S. Department of Homeland Security, 2009) by leveraging a variety of benchmark data sources for unit labor and equipment rates. Additional data sources included the Bureau of Labor Statistics (BLS) and competitive bid documents from the February 2018 PREPA RFP.

Given that different data sets also included different subsets of costs (i.e., some datasets already account for some factors identified in the CEF), all data were adjusted by application of an appropriate CCF to ensure accurate comparison within the same reference frame.

Organization of This Report

Section 2 describes how HSOAC assessed the reasonableness of the procurement process that led to the MSA contract with Cobra for emergency work. The section concludes with the results on the reasonableness of the procurement process. Sections 3 and 4 present HSOAC's analysis for separate components of Cobra's blended rates. Section 3 presents HSOAC's analysis of bid quantities and concludes with results on the reasonableness of labor and equipment quantities Cobra proposed in the MSA. Section 4 presents HSOAC's analysis of remaining inputs to the blended rate (i.e. equipment rates, labor rates and CCFs) and their combination to produce representative blended rate ranges under different scenarios and assumptions for comparison to Cobra's proposed rates. The section concludes with results on the reasonableness of Cobra's blended rates. The Appendices contain supporting details for the analysis presented in Sections 3 and 4.

2. Assessment and Results of the Procurement Process

This section discusses the methods for determining the reasonableness of the procurement process for Cobra's MSA for emergency work. As previously discussed, the MSA was used because the need was urgent and did not allow time for a formal RFP by PREPA. We assess the reasonableness of Cobra selection considering PREPA's emergency policies, the existing conditions following Hurricane Maria, and corresponding FEMA policies (44 CFR § 13, 2010). We conclude this section with the results of our assessment.

Methodology to Determine if the Procurement Process was Reasonable

In making our assessment on the reasonableness of the emergency work procurement process (e.g. Category B), HSOAC staff considered and reviewed the following dynamics and information sources: post-Hurricane conditions in Puerto Rico, laws and regulations of Puerto Rico pertaining to emergency preparedness, PREPA's policies and bidding process, existing bid documentation, and FEMA guidance on reasonableness of emergency contract work. This component of our analysis was aimed at addressing one main question: Did PREPA follow their own Emergency Procedures given Puerto Rico Executive Orders?

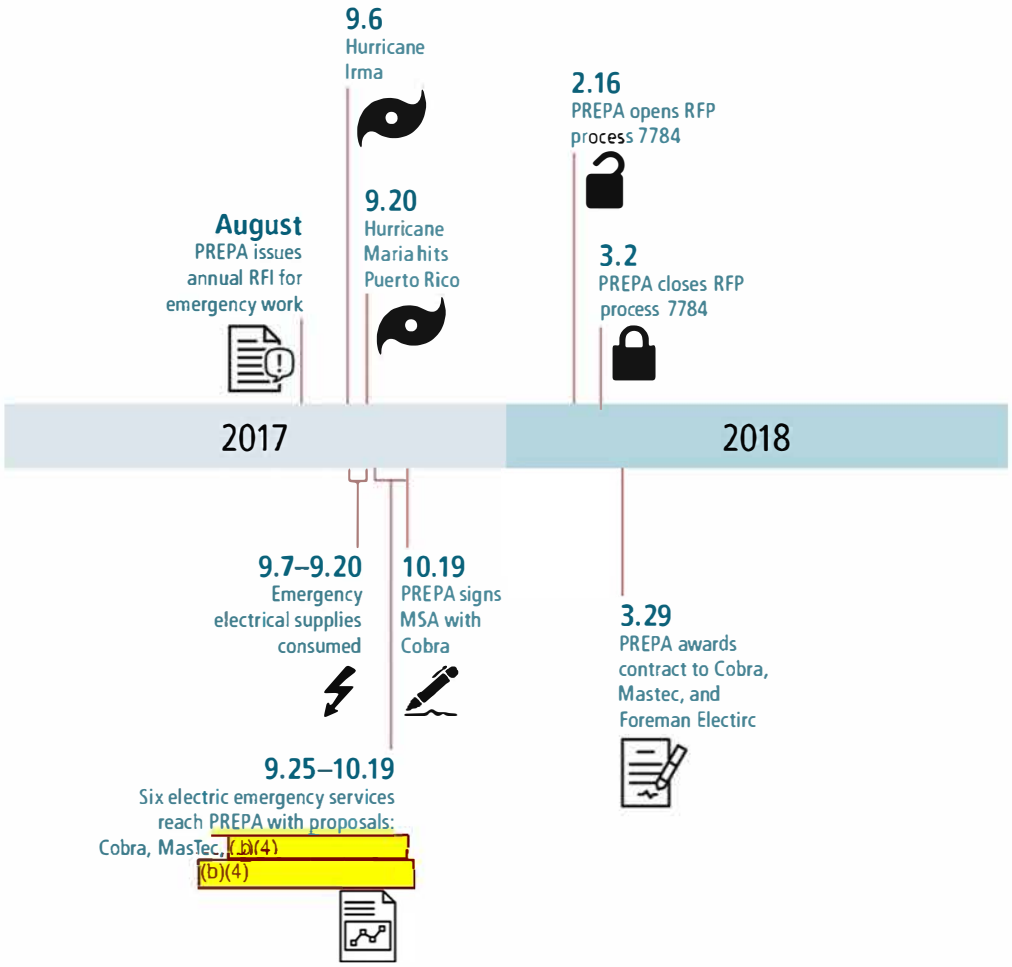
Pre-storm Conditions in Puerto Rico that Affected the Procurement Process

PREPA systems generate, transmit, and distribute most of the electrical power on the island (excluding privately owned electrical generators and distribution facilities; (PREPA, 2019)). Prior to the 2017 hurricane season, PREPA experienced numerous problems which left the organization's assets vulnerable to crisis situations (Government of Puerto Rico, 2018). For example, PREPA declared bankruptcy in July 2017 (Hirsch and Brown, 2017). It is plausible that PREPA's financial difficulties would have been known to potential subcontractors. In August 2017, PREPA issued their annual Request for Information (RFI) to 40 potential subcontractors for emergency maintenance and repair of electrical transmission and distribution infrastructure; only three firms delivered responses to this request (PREPA, 2017c). Furthermore, it appears that PREPA lacked both mutual aid agreements as well as the funds to pay for mutual aid (Glanz and Robles, 2018).

PREPA was critically unprepared to deal with the aftermath of back-to-back hurricanes. PREPA stated that emergency supplies and equipment originally in PREPA's 2017 emergency plans were depleted by Hurricane Irma and the required materials were not available to support a

system recovery from Hurricane Maria.[8] Additionally, as discussed in the Governor's report (Government of Puerto Rico, 2018), it would be extremely difficult (if not impossible) for PREPA to maintain local storage of the materials required for an entire ground-up rebuilding of the electric system. Figure 2.1 shows the events in 2017 that led to the signing of the Cobra MSA in October 2017. Also shown are PREPA's efforts in 2018 to compete additional electrical repair work according to an RFP process initiated four months later.

Figure 2.1 Timeline of Events that Led to the Cobra Contracts



Geographic and logistical challenges significantly exacerbated the post-Maria crisis. Situated approximately 1000 miles from the continental United States, Puerto Rico is a mountainous island (highest point is 4,390 ft) with numerous regions that are inaccessible to conventional

[8] "As a result of the remediation work done after Hurricane Irma in the days before Hurricane Maria struck, PREPA's stores of materials (which were self-reported as at capacity at the commencement of the 2017 hurricane season) were severely depleted and insufficient to address the massive damage to the system that existed after September 20th." (PREPA, 2017c, p.4)

vehicles and transportation. Given that logistical self-support would be an inherent requirement for contractors proposing to work on the electrical infrastructure, an effective repair solution would not only need to supply people and equipment, but also construction materials, housing, water, food, fuel, medical aid, and security. With local police departments struggling to maintain order amidst widespread food and water shortages, the challenge of establishing work area security presented a significant roadblock to repair efforts (Ovalle, 2017).

Post-storm Conditions Exempting PREPA from Following Normal Contracting and Procurement Laws and Regulations

Puerto Rico procurement laws maintain conditional statutes which are intended to allow for more flexible solutions during extreme emergencies like Hurricane Maria. These statutes state that competitive bidding procedures can be suspended on a case-by-case basis to ensure that required emergency materials, supplies, equipment, and services can be quickly purchased and delivered (22 L.P.R.A. § 205(2)(b)).

On September 17th, 2017 (after Irma and prior to Maria), the governor of Puerto Rico issued an executive order, "declaring a state of emergency due to impending Hurricane Maria, as well as deploying the National Guard to provide support during this emergency" (OE-2017-047). Section 2 states "This Emergency Declaration meets the requirements to enable all agencies and municipalities to activate the special emergency procurement procedures to purchase any materials and services that may be essential to respond to the emergency." Additionally, on September 28th, 2017 (eight days after Maria) the governor issued Executive Order OE-2017-53 exempting public utilities from competitive contractual regulations for 30 days after the end of the emergency. The order provided a significant degree of flexibility for contracting of emergency repairs, but nevertheless contained several requirements to be met within the procurement initiatives:

- Contracts must be dated and in writing specifying the work to be completed and the dollar amount to be paid
- Signatures of responsible parties are required
- Work must be completed 90 days after the end of the emergency when operations return to normal
- Contracts must be registered with the office of the Comptroller of Puerto Rico 30 days after the end of the emergency
- Lease agreements must end no later than 30 June 2018

PREPA used their January 2017 regulation, "Procedure for Purchases by Request of Quotations or Offer Exemptions from The Formal Auction Process of The Electric Energy Authority of Puerto Rico" (PREPA, 2017a) for the Cobra contract. This regulation required PREPA to have accomplished the followed business tasks before an emergency:

- Initiate a Contingency Plan
- Identify qualified suppliers
- Coordinate with qualified suppliers the acquisition of essential goods and services to cover emergencies
- Develop the Contingency Plan

The regulation also specified procedures to be executed after the emergency:

- Emergency requirements to be submitted to Head of Supply Division
- Evaluate and approve the emergency request
- Proceed in accordance with the delegated function, after the approval
- Submit the documents to the Chief of the Supplies Division with the construction estimates and an explanatory memorandum with required approvals that:
    - Justifies the emergency purchase
    - Lists reasons for choosing identified supplier
    - Describes the emergency that caused purchase of goods and services
- Head of supply division must verify all necessary documentation that has been received and forward to purchasing department
- Purchasing department must maintain records of all contracts and transactions over $100,000

PREPA's Selection Based on Bid Documents

PREPA's response to FEMA (PREPA, 2017c) described in detail their compliance with existing regulations. They stated that while it was impractical to fully comply (i.e. no access to communication and information technologies) their procedures were permitted under the governor's executive order (OE-2017-53).

The characteristics of the six submitted proposals following Hurricane Maria are shown in Table 2.1. Bidders provided their proposed rates in three different ways—hourly, daily, and blended. Five of the competing companies offered services to perform distribution repair and three offered transmission repair capabilities. Only two of the options retained aircraft assets as a component of their bids. Additionally, Cobra was the only company that committed medical personnel as support staff within their offer.

Table 2.1 Proposal Characteristics of Companies Applying for Emergency Electrical Work

Company	Rates	Distribution	Transmission*	Aircraft*	Self Logistics*	Up-Front Payment*	Medical	Proposal Date	Signed MSA
Cobra	Blended	Yes	Yes	Rotary/Fix Wing	Camp	$15M	Yes	14-Oct-17	19-Oct-17
(b)(4)	Daily	Yes	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	no date	
MasTec	Hourly	Yes	Yes	Unmanned aerial vehicle (UAV)	Camp	$20M	Unspecified	19-Oct-17	
(b)(4)	Hourly	Yes	Yes	Unspecified	Yes	$25M	Unspecified	29-Sep-17	
	Daily	Yes	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	27-Sep-17	
	Hourly	Yes	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	25-Sep-17	

* Denotes key PREPA requirement for the contract

PREPA's requested solution delineated four critical requirements for emergency work - transmission repair capabilities, aircraft assets for installation in mountainous terrain, self-logistics resources, and ability to perform with minimal upfront payment. PREPA stated that Cobra was selected as the only company with experience in installation of transmission equipment and towers in mountainous terrain environments (Mammoth Industries, 2017). Cobra had five helicopters which could be deployed as emergency repair assets (Lozano, 2017). Additionally, Cobra was able to provide its own logistical support - including supplies, equipment, fuel, food, water, housing, etc., and had crews and equipment ready to deploy.

Financial requirements were also a driving factor in the selection of Cobra. Cobra asked for an initial payment of $15 million, which was less than two other companies (see Table 2.1). PREPA compared Cobra rates with three of the companies—(b)(4) (b)(4) The Cobra rate proposal offered a blended daily rate (as opposed to the individual hourly rates offered by the other contractors). PREPA evaluated Cobra's rate structure and found it to be comparable with the rates offered by the other contractors (PREPA 2017c). See also Table 4.3 in this report for comparison.

Standards of reasonableness are not explicitly defined for MSA contracts in FEMA's *Public Assistance Program and Policy Guide* (PAPPG) (U.S. Department of Homeland Security, 2018b). However, there are minimal reasonableness standards under which PREPA's actions in procurement were found to be compliant. These standards are as follows:

- Applicant participated in ethical business practices: PREPA learned of Cobra from an independent party.
- Applicant complied with procurement requirements: The previous discussion shows PREPA followed their governing documents to establish a contingency plan with suppliers, equipment, and supplies. PREPA also followed their regulations for emergencies after Maria devastated the electrical infrastructure.

Other factors that apply in determining reasonableness of a contracting process can be obtained from the PAPPG. (U.S. Department of Homeland Security, 2018b). According to these guidelines, the contract is deemed reasonable if:

- Cost was typical for similar work based on historical documents, local average costs, and published national costs.
- Higher costs could be justified (e.g. because of shortage of material after the hurricane or environmental complexities).
- Urgent conditions existed where "FEMA evaluates the length of time the circumstances existed compared to the length of time costs were incurred" (U.S. Department of Homeland Security, 2018b).
- Sound business practices were followed.
- Procurement complied with established practices and policies.

Results on Reasonableness of the Procurement Process

Having examined these aspects regarding the reasonableness of PREPA's emergency procurement process, HSOAC finds that selecting Cobra for the MSA was reasonable considering FEMA policy on emergency situations and existing regulations regarding contracting.

PREPA adhered to Puerto Rican legal statutes regarding emergency situations and remained consistent with their own internal policies. In consideration of FEMA's existing requirements on the actions of PREPA, HSOAC noted that FEMA requirements for mutual aid agreements[9] did not apply at the time the MSA was signed. PREPA explicitly stated they could not rely on these agreements because those organizations required logistical support which PREPA could not supply (PREPA, 2017c). PREPA also noted that the mutual aid agreements after Hurricane Georges in 1998 were of limited value as workers were neither experienced in mountainous repairs nor did they have appropriate assets to conduct related operations (PREPA, 2017c). Thus, PREPA opted for an MSA contract with Cobra.

PREPA's selection conforms with the spirit of FEMA's procurement process standards. Cobra both (1) supplied a labor and equipment force that no other competitors offered, and (2) was the lowest upfront cost provider. Because Hurricane Maria did not permit for a delay in response, and in consideration of the standards which were applied in a second round of competitive solicitation, PREPA's actions were consistent with the spirit of FEMA's procurement process standards (U.S. Department of Homeland Security, 2018b).

A salient feature of an MSA is that it establishes the major terms between client and vendor, but with added flexibility to negotiate lesser or other terms, as needed, for individual work authorizations. As a result, the work is greatly expedited because the client under MSA does not have to go through procurement cycle for every future request. Our Subject Matter Expert (SME) has indicated that MSAs are a standard contracting mechanism used by electric utilities for the conditions under which this Cobra contract was written.[10]

Thus, according to this evaluation of the procurement process HSOAC concludes that PREPA engaged in a reasonable procurement process given the circumstances following Hurricane Maria.

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[9] Mutual aid agreements and assistance agreements are agreements between agencies, organizations, and jurisdictions that provide a mechanism to quickly obtain emergency assistance in the form of personnel, equipment, materials, and other associated services. The primary objective is to facilitate rapid, short-term deployment of emergency support prior to, during, and after an incident. A signed agreement does not obligate the provision or receipt of aid, but rather provides a tool for use should the incident dictate a need. (https://emilms.fema.gov/IS703A/RES0102130text.htm)

[10] (b)(6) email discussion with authors January 2018.

3. Assessment and Results of Reasonableness of Bid Quantities

In the next two sections, we describe our methodology for analysis of Cobra's blended rates and their input components. We begin in this section with an assessment of labor and equipment quantities. Our results are presented at the end of the section.

Methodology to Determine if the Bid Quantities were Reasonable

Leveraging available data, HSOAC experts developed methods to answer the following question: Were the bid quantities in Cobra's MSA reasonable, given Puerto Rico's and PREPA's conditions at the time of the disaster?

With regard to quantities for work crew (labor and equipment) and support crew (logistics, security and management) we focused on two factors of greatest relevance in the immediate aftermath of Hurricane Maria: (1) *responsiveness* to requirements of PREPA, and (2) *sufficiency* to support execution of the contract. Meeting these two conditions thus establish reasonableness of quantities bid by Cobra. In previous unpublished HSOAC analysis, we considered a third factor, *production efficiency*. We note that the RFP process was initiated approximately 6 months after the MSA was signed and as such this factor may have been more appropriate to consider at that time. We base our analysis on the assumption that a qualified, experienced firm utilizes an optimal mix of labor skills to tackle a specific type of work productively and efficiently, i.e. emergency restoration of electrical transmission (Chaney and Ossa, 2013).[11] We test variations of this assumption in Section 4.

Reasonableness as Responsiveness

We have defined ***responsiveness*** of bid quantities as the degree to which quantities proposed and delivered by Cobra addressed the critical requirements of PREPA. These critical requirements are: (1) the capability to perform transmission work, (2) capability to work in austere, remote, and rugged environments (e.g., by providing aircraft), (3) self-provided logistics,

[11] Chaney and Ossa (Chaney and Ossa, 2013) demonstrate in well established markets (such as construction), a deeper division [specialization] of labor across among work teams leads to an increase in firm productivity. Thus, we concluded a well-established construction company such as Cobra will maintain an optimal mix of specialized labor to tackle a work task under certain conditions to maintain its productivity and competitiveness among other contractors. We thus assume that this optimal mix is reflected in labor mix provided in the subsequent Cobra RFP for emergency transmission work and that same labor mix was applied to the MSA contract scope of work.

(4) a willingness to work with PREPA without onerous upfront payment[12], (5) immediate availability to begin work, and (6) contract flexibility (Lozano 2017).

To determine the responsiveness of each quantity of service delivery (work labor, work equipment, support labor) to PREPA requirements, we performed a matrix analysis which is a variant of the quality functional deployment (QFD) method commonly used in systems engineering. Our QFD matrix presented in the findings section will describe how the customer's need (PREPA requirement) is addressed by one or more system features (bidder's delivered quantity). The existence of at least one quantity factor (column) addressing every PREPA requirement (row) indicates that the delivered quantity was at least minimally responsive to the requirements of PREPA.

We also considered how the labor and equipment proposed and delivered by Cobra compared with quantities proposed by other bidders on the MSA.[13] Finally, we made a qualitative assessment of the timeline of key events for the delivery of crews and equipment by Cobra. Significant delays would indicate non-responsiveness to the extreme hardship experienced by PREPA customers during the post-Maria outage. This qualitative analysis complements the QFD analysis and comparative assessment results are presented below.

Reasonableness as Sufficiency

We define ***sufficiency*** as the ability of the provided labor and equipment to: (1) meet the requirements listed in the MSA and (2) create typical crews identified by RSMeans to perform electrical repair work. To assess sufficiency, we considered the proposal separately for: (1) the work labor and equipment and (2) the support crew.

Work Labor & Equipment

To assess sufficiency of bid quantities for labor and equipment, we conducted a constraints analysis. While the MSA lists equipment type and quantities, it does not break down the labor by job title. As such, we assume the same work crew mix in the MSA as those provided in Cobra's response to PREPA's RFP in February 2018. We then incorporate data on this optimal labor mix

[12] Although this requirement is not directly relevant to bid quantities, we deem that Cobra bid quantities would be responsive to this requirement to the degree that Cobra was willing to incur the costs of deploying such quantities without seeking a large upfront payment. Hence, we included the requirement of *willingness to work with PREPA without onerous upfront payment* in the QFD matrix on bid quantities.

[13] PREPA deemed Cobra, MasTec and PowerSecure to be the three most qualified MSA bidders based on their prior experience with emergency transmission work (U.S. Department of Homeland Security, 2018e). Hence, our analysis focuses on bid quantities from these three bidders.

revealed by Cobra's response to the RFP into our analysis of the MSA.[14] Second, we examined the job roles and specific equipment provided by Cobra to determine sufficiency for performing the work. We examined possible constraints on labor and equipment by comparing conceptual work crews from RSMeans with the labor and equipment quantities proposed by Cobra in the MSA. We derived the RSMeans conceptual work crews from list of common electrical repairs to overhead transmission systems (see Table C.1). Work crews are assemblies of labor and equipment units that are capable of performing specific work tasks; an RSMeans B87 crew, for example, is a combination of workers and equipment that clears brush to gain access to transmission lines for subsequent repairs. The tasks we consider are primarily electrical repairs performed by electrical crews, but we include B87 recognizing that debris removal may be required to gain access to the system following a storm.

To perform the constraints analysis, we mapped labor and equipment assumed from Cobra's proposal documents to the RSMeans work crews in Table 3.1 to assemble the crews that could complete the repairs and noted any deficiencies as potential constraints.

[14] Earlier HSOAC analyses on a different equipment mix (Cobra bid in response to RFP) and labor mix (MasTec bid in response to the RFP) employed similar methods and results suggested that sufficiency as a quantities measure is robust against reasonable variations on labor/equipment mix.

Table 3.1 RSMeans Standard Crews Used for Electricity Transmission Construction Work

R5	R6	R7
1 Electrician Foreman	1 Electrician Foreman	1 Electrician Foreman
4 Electrician Linemen	4 Electrician Linemen	5 Electrician Groundman
2 Electrician Operators	2 Electrician Operators	1 Crew Truck
4 Electrician Groundmen	4 Electrician Groundmen	
1 Crew Truck	1 Crew Truck	
1 Flatbed truck	1 Flatbed truck	
1 Pickup truck	1 Pickup truck	
0.2 Hyd. Crane (55 Ton)	0.2 Hyd. Crane (55 Ton)	
0.2 Hyd. Crane (12 Ton)	0.2 Hyd. Crane (12 Ton)	
0.2 Earth Auger, Truck-Mtd	1 Tractor w/ Winch	
1 Tractor w/ Winch	3 Cable trailers	
	0.5 Tensioning rig	
	0.5 Cable pulling rig	
R8	**R10**	**R11**
1 Electrician Foreman	1 Electrician Foreman	1 Electrician Foreman
3 Electrician Linemen	4 Electrician Linemen	4 Electrician
2 Electrician Groundmen	1 Electrician Groundmen	1 Equip Operator (crane)
1 Pickup Truck	1 Crew Truck	1 Common Laborer
1 Crew Truck	3 Tram Cars	1 Crew Truck
		1 Hyd. Crane, 12 Ton
B87		
1 Laborer		
4 Equipment Operator		
2 Feller Buncher, 100 hp		
1 Log Chipper, 22" tree		
1 Dozer, 105 hp		
1 Chainsaw, gas, 36" long		

Support Crew

The key driver in the sufficiency analysis of support staff is the requirement for self-provided logistics. The ideal, self-provided logistics solution can sustain operations without impositions on local hospitality, transportation, medical or police resources (PREPA, 2017c). In evaluating sufficiency with respect to support staff, we compared support staff headcount and the daily billable costs Cobra proposed in the MSA contract versus those that Cobra and MasTec proposed in response to the RFP. All three proposals were similar in scope given that each offered a solution for performance of emergency transmission work for PREPA.

For an analogous comparison, we analyzed the Cobra's support staff headcount with a similar situation and against industry benchmarks to determine if the support staff levels were sufficient. This evaluation weighed security spending percentages in the MSA against an extreme historical case of high security costs in reconstruction.

Results on Reasonableness of Bid Quantities

Below, we present results of our analysis of reasonableness of quantities in terms of responsiveness and sufficiency.

Reasonableness as responsiveness

Since the MSA did not involve a formal RFP process, reasonableness of quantities is determined by their responsiveness to PREPA requirements. These requirements were documented as: (1) the capability to perform transmission work, (2) the capability to work in austere, remote, and rugged environments, (3) self-provided logistics, (4) a willingness to work with PREPA without onerous upfront payment, (5) immediate availability and (6) contract flexibility (Lozano 2017).

As described in the methods section above, we employed a QFD process in Table 3.2 to determine the manner in which each quantity factor (column) addresses the PREPA requirements (rows). Given that every PREPA requirement is addressed by at least one quantity factor, HSOAC determined the quantities that Cobra proposed for the MSA are reasonable by responsiveness.

Table 3.2 QFD Matrix: Responsiveness of Cobra Quantities to PREPA Requirements

PREPA Requirement	Work crew labor	Work crew equipment	Support crew labor
No 1 and 2: Capability to perform **transmission** work in rugged and **austere** environment	Guaranteed 250 lineman, in line with other bidders	273 pieces of standard equipment, including 129 tracked vehicles and 5 helicopters ideally suited for rugged, inaccessible terrain	65 armed law enforcement officers and 10 SWAT/SOF forces to secure crew safety and property
No 3: Self-Provided Logistics		2 barges arrive to fully equip work crew (arrive island within 3 weeks of contract signing)	104 Security Staff 50 Logistics Staff 5 EMT/Medics
No 4: Immediate Availability	Advanced work crew (12 linemen) commences transmission work within 2 weeks of contract signing	Work crews fully equipped within 3 weeks of contract signing	Advanced support team (30 staff) commences work within 2 weeks of contract signing
	Full work crew (463 lineman) in place for work within 3 weeks of contract signing		Full security staff in place within 3 weeks of contract signing
No 5: Willingness to work given no onerous upfront payment from PREPA	Yes	Yes	Yes
No 6: Contract Flexibility	Increased linemen from 250 to 649 (170% increase in headcount) to support heavier workload by 12/17	Increased number of helicopters from 5 to 8 without increasing blended rate	Increased number of security staff from 104 to 194 by 12/17

Note: Work crew labor, work crew equipment, support crew labor to PREPA Requirements by Cobra (PREPA, 2017c)

Work Crew and Equipment Comparative Discussion

To assess further the reasonableness of Cobra's labor and equipment quantities, we compared quantities offered by the winning bidders of contracts resulting from both the MSA and RFP processes. Cobra's initial written proposal of 250 work crew was consistent with options offered by the remaining two qualified proposers. PowerSecure guaranteed 300 workers, whereas MasTec based their cost estimate on 200-350 workers, but did not guarantee a headcount. (U.S. Department of Homeland Security, 2018e).

In Exhibit C of PREPA, 2017b, Cobra proposed 273 pieces of equipment to the work effort, with 129 designated as tracked vehicles that are ideally suited for rugged and austere terrain. Furthermore, this count of tracked equipment is greater in number and percentage to overall equipment than both Cobra and MasTec proposals in the follow-on RFP for transmission work ((PREPA, 2017b) and (U.S. Department of Homeland Security, 2018e, 2018f and 2018g)). The

Cobra proposal offered five helicopters[15], a key enabler of transmission work in rugged areas inaccessible even to tracked vehicles (PREPA, 2017c), but also a key cost driver for blended rate cost. In contrast, other bidders on the MSA did not provide a quantity of tracked equipment or helicopters in their proposals.

Support Crew Quantity Comparative Discussion

A key requirement on the winning MSA contractor was that it should provide a self-sustaining crew that did not burden the local population or essential services such as police, medical and transportation. On this basis, we deemed the support crew quantities provided by Cobra to be responsive to that requirement. To make this determination, we analyzed how the support crew quantities compared against other competitors in the MSA and whether the quantities proposed by Cobra were the most responsive to this requirement.

Among all the bidders for the MSA, Cobra's proposal was unique in not only specifying headcounts for security and logistics staff, but also providing a detailed breakout of job titles of support crew and the specialized equipment assets used for their individual roles. Exhibit C of the MSA (PREPA, 2017b) provided the following specified job titles and quantities for support crew:

- 1 Project Manager
- 1 Deputy Project Manager
- 2 Operations Specialists
- 10 Quick Reaction Force
- 65 Former Federal/State law enforcement officers
- 5 Medic/EMTs
- 20 Guards

Our analysis first compared the support staff headcount and daily billable costs of the winning bidder of the MSA contract (Cobra) and the contract following the RFP (Cobra and MasTec). The tables in Appendix F: Assessment of Labor Headcount from PREPA MSA vs. RFP show that Cobra proposed a much higher headcount *and* billable dollar amount for security and logistics under the MSA than the two winning proposals in response to contracts signed in March 2018 following the RFP. We estimated the daily extended billable rate[16] for the work labor and support staff in all three cases and calculated the proportions of spending for each labor category. The higher headcount and dollar amounts devoted to area security and logistics in the MSA proposal are deemed to be reasonable in meeting the requirement of self-sufficiency given

[15] Later, the number of helicopters was increased to 8 with no increase in daily billing rate for lineman (FEMA, 2017).

[16] Extended billable rate is defined as the quantity (headcount) of each labor type multiplied by billable rate for that labor type. We ignore lodging costs in this analysis.

the tenuous situation and logistical bottlenecks post-Maria. For these reasons, we thus deemed the high support crew quantities proposed in the MSA to be responsive, particularly to the requirement of self-sufficiency

Timeliness and flexibility are part of our QFD analysis. We assessed the timeliness in the delivery quantities of labor and equipment as well as the quantities themselves. This timeliness analysis addresses whether quantities delivered were responsive to both immediate availability and contract flexibility requirements. Our focus was on the early stages of the MSA's period of performance, i.e. late 2017. This focus is due to our accessibility to Cobra progress report data during this period as well as the dire humanitarian crisis facing the island at that time. [17] We utilized this progress report data to build a focused timeline of key events surrounding the delivery of crews and equipment in the days immediately following Hurricane Maria (see Table 3.3). Results of our timeliness analysis were also applied to cells within the QFD matrix in Table 3.2.

Cobra was uniquely positioned for rapid response to the crisis, deploying heavy equipment to seaports to barge transports on the day after contract signature (10/20/17). Transmission work on the island began on 10/31/17, two weeks after Cobra was awarded the contract. Furthermore, a fully equipped crew of 463 lineman and 200 support staff arrived on the island within 3 weeks of contract signing (11/13/17) (Table 4.3). This fully equipped crew was composed of quantities of linemen and security which greatly exceeded the levels originally proposed in the MSA. This timely delivery of quantities of work and support labor, in excess of the levels initially proposed quickly (three weeks after the MSA was signed), clearly reflects responsiveness to requirements for both immediate availability and contract flexibility. Table 3.3 is represented graphically in Figure 3.1 below.

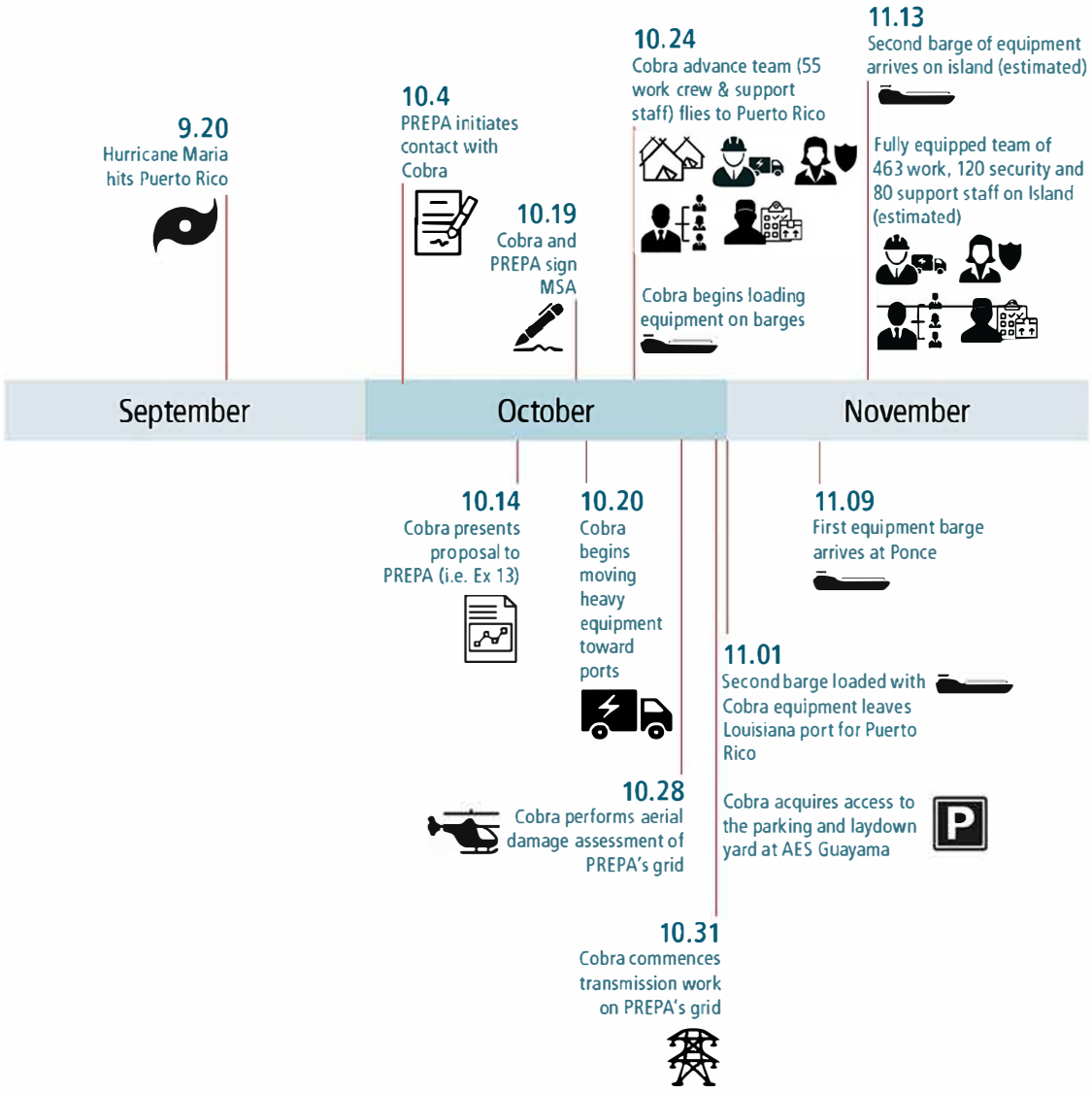
[17] The first few weeks were the time of greatest suffering on the island, as only 40% of PREPA customers had power by 11/13 (about two months after landfall) (Ferris, 2018).

Table 3.3 Timeline of Key Events Surrounding Initial Delivery of Crew and Equipment

Date	Event
09/20/2017	Hurricane Maria hits Puerto Rico,
10/04/2017	PREPA initiates contact with Cobra
10/14/2017	Cobra presents proposal to PREPA (i.e. Ex 13)
10/19/2017	Cobra and PREPA sign MSA
10/20/2017	Cobra begins moving heavy equipment toward ports
10/24/2017	Cobra advance team (55 work crew & support staff) flies to Puerto Rico
10/24/2017	Cobra begins loading equipment on barges
10/28/2017	Cobra performs aerial damage assessment of PREPA's grid
10/31/2017	Cobra commences transmission work on PREPA's grid
11/01/2017	Second barge loaded with Cobra equipment leaves Louisiana port for Puerto Rico
11/01/2017	Cobra acquires access to the parking and laydown yard at AES Guayama
11/09/2017	First equipment barge arrives at Ponce
11/13/2017	Second barge of equipment arrives on island (estimated)
11/13/2017	Fully equipped team of 463 work, 120 security and 80 support staff arrive on Island (estimated)

Source: Cobra Daily Reports

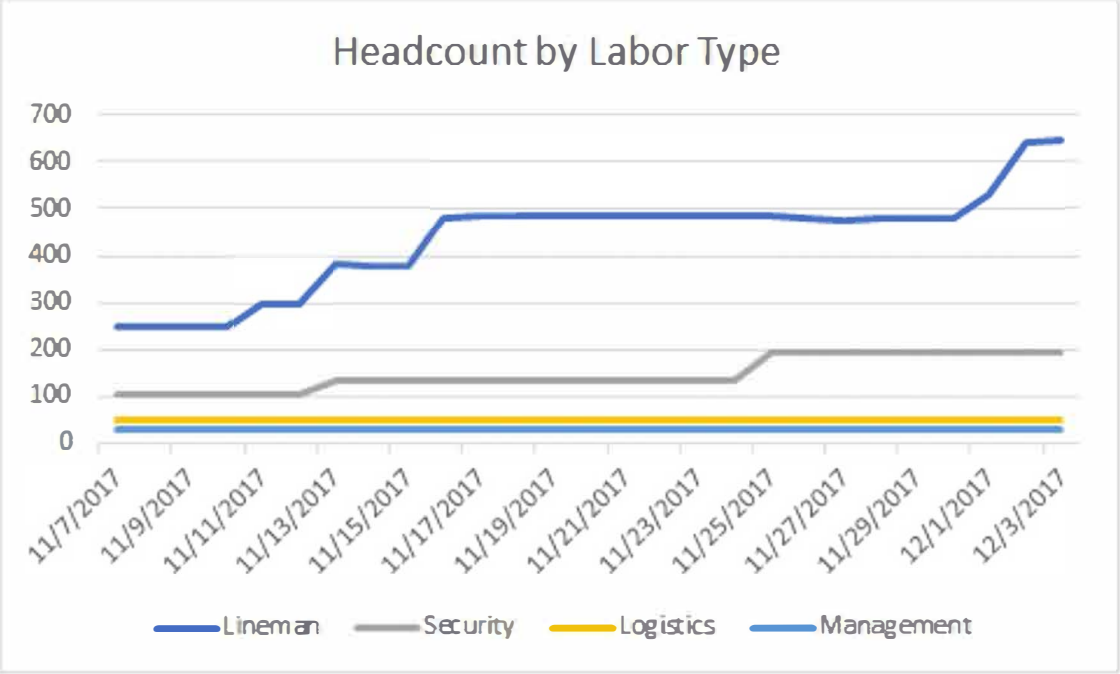
Figure 3.1 Graphical Timeline of Key Events Surrounding Initial Delivery of Crew and Equipment in 2017 (Source: Cobra Daily Reports)



We also determined whether quantities delivered were responsive to the requirement of contract flexibility with the MSA. Such flexibility would be demonstrated by the ability of the contractor to change quantities of resources and staff without renegotiation (PREPA, 2017b). Our delivery timeline demonstrates that Cobra was able to quickly (i.e. less than a month after contract signature) activate many more resources (i.e. labor and equipment), than it originally proposed. Most notably, Cobra increased the headcount of linemen from 250 to 649 by early December based on MSA invoices in 2017. Security staff also increased from 104 to 194,

enabling Cobra to increase the number of work sites from one in early November to six simultaneously operational locations in early December (Cobra MSA invoices). Cobra demonstrated responsiveness to contract flexibility and immediate availability in its ability to dramatically increase the number of linemen (almost triple) and security staff (almost double) at a time of critical need in a short period of time. Figure 3.2 shows the labor headcount by labor type, e.g. lineman (work), security, logistics, management according to 2017 invoices.

Figure 3.2 Cobra Headcount by Labor Type (Linemen, Security, Logistics, Management) Based on 2017 Cobra Invoices



Reasonableness as Sufficiency

Below we report results on our assessment of sufficiency of quantities. We report results separately for (1) the work crew and equipment and (2) the support staff.

Work Crew and Equipment

To determine sufficiency with respect to work crew labor levels, we observe the actual headcount of linemen delivered by Cobra and compare with the number called out by the contract. Exhibit B of the MSA indicates 250 linemen proposed by Cobra. According to Cobra invoices, 250 linemen were deployed by 11/9/17. Thus, we deem the work headcount delivered

by 11/9/17 to be contractually sufficient. The delivery of more than 250 lineman by mid-November indicates a more than contractually sufficient headcount delivered.[18]

To establish sufficiency with respect to work crew skill mix and equipment mix, we reviewed bid quantities alongside RSMeans standard crew specifications to identify limiting constraints for performing electricity construction work.

We summarize results of our constraint analysis on labor mix bids in Table 3.4. This table lists possible constraints categorized by the labor skill type and equipment Cobra proposed relative to the structure of corresponding RSMeans standard crews required to perform electrical system repair. For example, on a RSMeans R5 crew, Cobra's key limitation is the number of hydraulic cranes they listed.

Table 3.4 Results of Conceptual Work Crew Constraints Analysis

RSMeans Standard Crew	Potential labor or equipment constraint
R5	Electrician Operator, Hyd. Crane
R6	Electrician Operator, Hyd. Crane
R7	Electrician Groundmen
R8	Electrician Groundmen
R10	MISSING: Tram Car
R11	Electrician Operator, Hyd. Crane
B87	MISSING: Feller Buncher

Our evaluation found that Cobra could generally supply labor and equipment for the required work crews to perform electrical system repairs, but with some notable constraints. For example, Cobra lacked certain brush-clearing equipment (i.e. feller bunchers) that a RSMeans B87 crew requires, but these may be more applicable to new construction (e.g., felling trees) rather than recovery and repair of existing electric infrastructure (e.g., clearing fallen trees). Also, because Cobra did not offer tram cars, Cobra may need to complete certain tasks in the manner that differs from that envisioned by RSMeans for a R10 crew. We assumed that these firms have the ability to rent equipment, hire additional personnel, and adjust work schedules as needed to overcome these constraints.

[18] HSOAC was not able to determine whether the headcount of linemen deployed by Cobra was sufficient to perform the actual scope of work assigned under the MSA. Such information would be likely be contained in contract release documentation generated during the period of performance of the MSA. Such documentation was not available to HSOAC during the time of this analysis.

Overall, we concluded that work crew headcounts and equipment quantities offered by Cobra were sufficiently large to complete required electricity repair work and thus, HSOAC deemed quantities presented in Cobra's bid documents to be reasonable.

Support Crew

We qualitatively concluded that Cobra had the capability and incentive to provide high support crew headcount to address security and logistics risks for repair crews on the island. Risks posed by the tenuous security situation and degraded transportation infrastructure was well-known at the time of the MSA award (PREPA, 2017c). We postulate that rational self-interest (i.e. to protect against threat to bonding capacity), reinforced by a legal obligation to ensure crew safety, would lead to a willingness by Cobra management to mitigate such risks with adequate manpower for security and logistics. Extra security would not only mitigate risks to crew safety but also serve to protect and secure equipment and supplies against threats of theft or vandalism. Additional logistics staff would also help to mitigate bottlenecks in the movement of personnel, equipment and supplies due to damage and closures of roads, ports and storage facilities (Mulero, 2017a and 2017b). The MSA framework allows for billing invoices to reflect the costs of such additional support labor through a higher billable rate, thus compensating Cobra for much of the financial costs of providing adequately high support crew quantities (PREPA, 2017b).

Based on data available to us, we are not aware of any security incidents or logistics bottlenecks to indicate an insufficient headcount devoted to security and logistics. No security or safety issues were documented in Cobra daily status reports from 11/08/17, at which time an advanced team of 55 work and support crew (including security) had begun transmission work on the island. We are also not aware of significant logistics bottlenecks which delayed efforts by Cobra work crews (Cobra status reports, 2017).

In a quantitative analysis on support crew quantities, we considered percentages of daily billable hours to support staff, which accounted for more than 25% of Cobra's total billable costs. Due to the high headcount, 15% of the daily billable labor rate is for security. For reference, FEMA suggests a CEF factor for security and safety (if not itemized in the Part A) of 4-6% for permanent work projects (U.S. Department of Homeland Security, 2009). As a second comparison, logistics staff represented about 9% of the labor-only daily billable rate in the MSA versus 2% for responses in the subsequent RFP by Cobra and MasTec (Table F.4).

There are limited data available to support definitive conclusions on the reasonableness of the logistics and security components of the MSA contract. The comparisons above show logistics and security make up a large share of the overall cost, though this may be expected given the unique conditions and requirements immediately following hurricane Maria.

4. Assessment and Results of Reasonableness of Blended Rates

The previous section focused attention on the labor and equipment quantities proposed by Cobra under the MSA. In this section, we discuss the HSOAC methodology for benchmarking labor and equipment rates as well as developing ranges of representative blended rate estimates for comparison to Cobra's billable rates. We considered several blended rate formulations for comparison to Cobra's rates:

1. Work crews only (e.g. linemen, equipment operators, laborers and equipment).
2. Support staff only (e.g. management, logistics and security personnel).
3. Work crews plus support staff.

We performed several sensitivity tests on labor rates, equipment rates, and labor and equipment quantities, and we computed representative blended rates under varied assumptions relevant to high voltage system repair. Next, we compared Cobra's "Blended Rate, linemen and equipment" and "Total Rate per Blended Lineman" to ranges that span these representative blended rates, judging Cobra's rates to be reasonable when they fall within these ranges. We present results of our assessment of reasonableness of Cobra's rates under the MSA at the end of this section.

Methodology for Constructing Representative Blended Rates

In addition to labor and equipment quantities, blended rates require labor and equipment base rates and adjustment factors (CCFs) as inputs to the calculation. Below we describe how we benchmarked these additional inputs and combined them to produce representative blended rates for comparison to Cobra's proposed rates.

Labor Rate Benchmarks

We combined data from RSMeans and BLS to define ranges of labor base rates for both work crews and support staff for the time period of the MSA. Given that RSMeans and BLS data points are collected and presented in different manners, we were required to standardize the data to perform comparisons. Our approach for aligning benchmark data followed the techniques which were used in previous unpublished HSOAC analysis of subsequent emergency work contracts awarded by PREPA.

For RSMeans labor data, we use standard union wage rates (Facilities Cost Book, 2018 Q4 data, national average costs). BLS occupational wage datasets are compiled annually for the continental U.S. and territories and released approximately 14 months after collection; in this study, we used the latest release, which reflects prevailing wages for late 2017 and early 2018.

To assess possible concern for the time of data collection with respect to the MSA period of performance (the MSA spans two data collection periods) we reviewed the changes in daily rates for RSMeans data as reported for 2017 and for 2018 (See Table J.1).

RSMeans labor rates are available as "bare cost" rates: they include employer paid fringe benefits, but do not account for overhead and profit. Fringe benefits include vacation pay, employer-paid health and welfare costs, pension costs, plus certain training and industry advancement costs (RSMeans, 2018). BLS wage data do not include fringe benefits. A CCF was applied to standardize wage data from these different sources for use in a common reference frame, and to become inputs to comparable blended rate estimates. In addition to accounting for the wage components listed above, the CCF allowed further rate adjustment to match the emergency work conditions in Puerto Rico. Details of the development of CCFs are discussed further below.

Given that the work categories across BLS and RSMeans datasets have different descriptions which also differ from PREPA labor categories, we developed a correspondence map for RSMeans and BLS categories according to PREPA categories based on similarity of labor descriptions. We present the results of this mapping exercise in Appendix D.

Cobra did not distinguish between labor rates for individual labor categories within the MSA. As such, it is not possible to evaluate Cobra labor unit rates directly. However, Cobra provided FEMA with an average hourly rate for emergency repair services for an 11-man work crew. This data point was included in a spreadsheet compiled by FEMA entitled "EMERGENCY REPAIR SERVICES – HURRICANE MARIA, Cobra Acquisitions Rates & Proposal Comparison" (U.S. Department of Homeland Security, 2018). In that same spreadsheet, hourly rates for foreman, journeyman, lineman, equipment operator, and groundman were provided for MasTec and PowerSecure, Cobra's competitors on the MSA. We used this additional information to assess both the reasonableness of Cobra rates at a work crew level and by comparison to rates proposed by MasTec and PowerSecure (see Table 4.6). To conduct this analysis, we assumed that labor was organized according to the structure of a RSMeans R5 Standard Crew, which is a common 11-man crew for transmission repair work (see Table C.1). We used benchmark data from BLS and RSMeans (see Appendix E) and CCFs appropriate to these wage bases. We calculated comparable, crew-level rates for Cobra, Mastec and PowerSecure as well as ranges bounded by available benchmark data weighted according to the structure of a RSMeans R5 crew.

Non-construction labor categories are not represented as well as construction labor categories by RSMeans. We assumed that related support staff positions are best represented by a combination of "skilled labor" with a 2017 base (i.e., "bare cost") hourly rate of (b)(4) and "helper" with a base hourly rate of (b)(4) Our support staff positions factored in related fringe benefits. When matching positions from the MSA contract with comparable RSMeans classifications, we considered environmental monitors, safety monitors and security guards as "helpers", while other staff roles were considered "skilled".

Equipment Rate Benchmarks

Several additional bidders responded to the RFP for emergency work which was issued subsequently to the original MSA (PREPA, 2018). Given that these RFP bids were proposed under similar conditions for emergency work in Puerto Rico by experienced firms in a competitive process, we assumed equipment rates in these bids to be accurate benchmark data for analysis of rates in the MSA. Furthermore, the MSA and contracts following the RFP were signed within six months of each other. As such, the changes in rates across this short period of time were assumed to be minimal and not likely to exceed differences observed in RSMeans comparisons of labor and equipment rates presented in Table J.1.

Table 4.1 summarizes hourly equipment rates gathered from the RFP bids and MSA bids. We used high and low equipment rates from the RFP bidders in our analysis, noting that rates for several items bid under the MSA are much higher (i.e., haul semi-tractor, pressure digger, stringing equipment). Considering the non-competitive context for the MSA, we do not include values bid under the MSA among our equipment benchmarks. Instead, we consider the five proposals PREPA deemed to be competitive in the subsequent RFP process. Six specific equipment items from those bidders are listed in Table 4.1. High and low rates for each unit of equipment we analyzed are summarized in Table E.3. In instances where equipment bid data was not available for the blended rate scenarios which we considered, we sourced existing data from RSMeans.

Table 4.1 Equipment Bids for Transmission Construction under Emergency Conditions for MSA and RFP

	RFP				MSA		
Equipment Description	ARC (Hourly)	Cobra (Hourly)	Fluor (Hourly)	Foreman[19] (Hourly)	MasTec (Hourly)	Power Secure[20] (Hourly)	Southern Electric (Hourly)
Haul Semi Tractor	(b)(4)	(b)(4)		(b)(4)	(b)(4)	(b)(4)	(b)(4)
Aircraft MD 500	(b)(4)	(b)(4)		(b)(4)	(b)(4)		
55' - 60' 4x2 / tracked	(b)(4)	(b)(4)		(b)(4)	(b)(4	(b)(4	
100' – 105' 6x6 / tracked	(b)(4)	(b)(4)		(b)(4)	(b)(4)		
60T Truck Crane		(b)(4)	(b)(4)	(b)(4)	(b)(4)		
Pressure Diggers		(b)(4)					(b)(4)

Our analysis of rates in the MSA does not consider additional costs of mobilization and demobilization, nor does it account for materials costs. Cobra's MSA contract identifies these resources as separate, reimbursable expenses. Additionally, we assume that equipment costs for support staff are built into their labor rates.

While Cobra's MSA contract also identifies fuel costs as separate reimbursable costs, some documents provided to HSOAC by FEMA suggest that fuel costs were included in the blended rates that Cobra proposed. In these documents, we observed that fuel costs contributed to approximately 1.3% of total extended daily costs. We explored the possible impact that fuel costs have on blended rates in Section 4 of this report.

Construction Cost Factors (CCFs)

PREPA established standard base rates for labor and equipment in a subsequent RFP (PREPA, 2018) to the Cobra MSA and required respondents to bid in terms of multipliers to these rates. These multipliers, the CCFs, account for the difference between PREPA base rates and the contractor's unit costs. We use these CCFs to align labor data from BLS, RSMeans, and PREPA equipment bids to produce estimates that produce a representative range of blended rates. Our approach to developing accurate CCFs and combining them with benchmark data is detailed in Appendix B and summarized below.

[19] Data for Foreman were scaled to an hourly rate.

[20] Data for PowerSecure were bid without fuel.

For development of the CCFs, we began with a base rate of 1, then we sequentially accounted for appropriate burdens, as in the CEF for Large Projects (U.S. Department of Homeland Security, 2009), including factors such as overhead and profit, contingencies and risk, and indirect costs not defined in the MSA or RFP for emergency work. Given that the percentage value of each component can vary, we developed a range of values for CCFs based on high and low assumptions for each cost component (see Appendix I).

Our labor calculations accounted for overtime as appropriate (40 hours straight time, 72 hours overtime, allowing for double-time Sundays for the high values). In accordance with the assumptions for emergency work specified in both the MSA and subsequent RFP, we estimated that CCFs are to be considered within an operations framework of 16-hour days in a 7-day week with no loss in productivity. With regard to equipment assets, we accounted for differential costs that arise from extended use in the field relative to standard time cost conventions. Unlike the RFP bids which accounted for the cost of fuel, we consider possibilities that equipment rates for the MSA were made with and without associated fuel costs. Furthermore, in seeking to accommodate benchmark datasets from a variety of sources, we developed CCFs for three cost bases to facilitate comparison in a common frame: BLS, RSMeans, and PREPA rates. These rates differed because BLS wage rates do not include fringe benefits while RSMeans rates do include fringe benefits, and because PREPA standard rates do not necessarily reflect market prices.

We also factored in two further considerations for calculation of labor CCFs. First, we allowed for possible cost savings which could be obtained from local labor. Second, bidders may offer location bonuses in consideration for the remoteness of work locations. These considerations are applicable regardless of whether labor is from Puerto Rico or the continental U.S., as even local labor standards may require additional compensation for the inconvenience of working several days at a time in the mountains, or on adjacent islands of Vieques or Culebra.

Blended Rates Formulations and Assessment

As presented in Table 1.1, Cobra refers to two primary categorizations in the calculation of blended rates ("Blended Rate, skilled linemen and equipment" and "Total Rate per Blended Lineman"). For both categories, we developed comparable blended rate estimates built from labor costs which were computed using BLS and RSMeans wage rates and multiplied by the appropriate labor CCFs. Equipment cost ranges were computed using a combination of bid data and equipment costs from RSMeans, further adjusted by the appropriate equipment CCFs. We separately computed representative blended rates for the formulations above – some to reflect the costs of work crews for construction repair work alone, others to reflect costs for support staff, and also to combine costs for both work crews and support staff. To account for contradictory information on whether equipment was bid with or without fuel as a separately reimbursable expenses, we computed blended rates for both interpretations. For the ranges of representative rates for each of these formulations, we test quantity assumptions for the blended rate

calculations as further described below. In instances where Cobra's proposed rate falls within the range, we judge their rate to be reasonable under the assumptions and inputs used in computation of these parameters. The method which we applied to manipulate data for this analysis is found Appendix M.

The Roster-Basis of Blended Rates

As discussed in the previous section, reasonableness of quantities is judged primarily on basis of responsiveness and sufficiency with regards to the MSA requirements. Accordingly, we computed a range of blended rate estimates for "Blended Rate, skilled linemen and equipment" based on the entire list of labor and equipment offered by Cobra under the MSA. We call this the "roster-based" blended rate range, as the quantities reflect all labor and equipment assets offered by Cobra. The analogy is to a roster of players and equipment for a sports team, which includes backup players and additional equipment items that are not always in use. We assert that a large roster of linemen and repair equipment may be judged to be appropriately responsive and sufficient in the face of uncertainty and risk following disaster, just as a sports team with a "deep bench" will be better prepared for a challenging contest than one without backup players and surplus gear. Owing to its size and open structure, the roster basis of quantities is expected to generate a wide range of blended rate estimates covering the varied conditions, uncertainty and risk Cobra faced in the immediate aftermath of Hurricane Maria.

We computed different roster-based ranges of blended rates using quantities given in the Cobra MSA. Additionally, we analyzed similarly sized workforces but with labor mixes proportional to Cobra and MasTec contracts awarded under the subsequent RFP. Given that the number of Cobra's linemen grew from 250 in early November 2017 to 649 in early December 2017, we also calculated a roster-based blended rate range that reflects the enhanced work crew Cobra provided at that time. While Cobra did not offer a crew of 649 linemen in the MSA, we include this scenario for comparison.

The Players-on-the-Field Basis of Blended Rates

We tested the sensitivity of a blended rate based on Cobra's MSA roster to the addition of one of each individual labor and equipment unit (results are presented in Appendix H). High-cost items (e.g. helicopters) disproportionately influence the blended rate result, introducing the possibility that the roster formulation may not appropriately account for variation in cost for these items according to work requirements on a given day. In our sports team analogy, the roster includes all players that are on the roster, even if they may be on the bench during a game along with equipment that is not in use. While this formulation may be acceptable to a sports franchise, it may not align with FEMA policy. Given the potential influence of some expensive but potentially idle equipment, the roster-basis could generate an unreasonably high blended rate, especially when the work itself is not considered. While the MSA prioritized responsiveness and sufficiency of quantities in the immediate aftermath of Maria, we considered the potential

concern for production efficiency[21] among our comparisons, its potential impact on costs, and how a prudent person might interpret variation in costs per FEMA guidance on reasonableness over the entire period of the MSA.

Thus, we included an additional set of scenarios in our analysis attuned more specifically to high voltage repair work itself. We generated additional sets of representative blended rates based on these scenarios. In our analogy, we identify "players" and organize them according to the structure of RSMeans Standard Crews (see Table 3.1). The "game" is a common electrical system repair listed in Table C.1. that requires a RSMeans Standard Crew to complete. Accordingly, the blended rate for the "players on the field" depends only upon the quantities of labor and equipment required for transmission system repair. Given that Cobra invoices are paid only for the workers on a job on any given day, we reasoned that the "players on the field" basis may better reflect a range of blended rates for specific high voltage work or repair services performed under the MSA and is conveniently computed based on the structure of electrical crews found in RSMeans. Note that we do not evaluate whether the electrical work assigned under the MSA was actually completed, only whether Cobra's proposed blended rates appear to be appropriate for this work given the labor and equipment required.

Finally, we varied assumptions within the "players on the field" framework to generate two different construction settings – transmission repairs by crews working in rugged terrain that requires helicopters and helicopter crews, and repairs on flat terrain that does not require helicopters or additional crews. The representative blended rates for these scenarios are calculated according to methods described in Appendix M. Using benchmark data and associated CCFs and different workforce structures, a range of representative rates was generated for each of these scenarios to be compared to Cobra's billable rates.

Support Staff Blended Rates

To assess reasonableness of the "Total Rate per Blended Lineman" proposed by Cobra under the MSA, we considered the additional cost impact of support staff. Cobra did not specify unit level details for support staff, but instead provided daily average rates for their support staff teams, namely management/operations/safety, logistics, and security. The lack of information creates a challenge for determining unit quantities which are required to represent the labor mix for a blended rate.

Using both the information proposed for quantities on these teams as well as the labor categories presented in Table D.3, we took a heuristic approach to estimate the blended rate for Cobra support staff. Two of our researchers independently hypothesized compositions of these support staff structures. The differences between hypotheses were then discussed and adjudicated by a third researcher for approval on final assumptions. These resulting support staff structures

[21] Production efficiency occurs when a good or service is produced at the lowest possible cost. Production inefficiency occurs when inputs are underutilized for a given task. See Koopmans, 1951.

were combined with available benchmark data for labor to compute representative blended rate ranges for support staff.

In all, we have several perspectives from which to assess Cobra's blended rates. To assess blended rates along quantity metrics of responsiveness and sufficiency, we have representative "roster based" blended rates, both with and without support staff. To account for possible concerns for production efficiency of transmission repair work we have representative "players on the field" blended rates, also with and without support staff. Representative blended rates generated under each perspective allow for comparison of Cobra's rate schedule according to different quantities metrics appropriate to conditions covered by the MSA. In the immediate aftermath of the disaster, for example, a blended rate may be judged reasonable if it is enclosed by a range of representative blended rates computed on the roster basis, as this range implies responsiveness and sufficiency in the face of greater uncertainty and risk. This blended rate may reflect substantially higher number of support staff, advanced equipment assets (i.e. helicopters) and ad-hoc work crews that are not well-described by RSMeans for post-disaster electrical repairs. Contrastingly, as the recovery initiatives progress and conditions become more predictable and secure, a representative range of blended rates that reflects more efficient and task-defined "players on the field" scenarios with smaller support staff requirements may be more suited to assessment of Cobra's rates.

Results on Reasonableness of Blended Rates

This section presents results of our assessment of reasonableness of Cobra's "Blended Rate, skilled linemen and equipment" and "Total Rate per Blended Lineman". We present results of labor and equipment rate benchmarking and CCF development, and finally for their composition as blended rates according to alternative scenarios for high voltage repair work performed under post-disaster conditions in Puerto Rico. We present results for both "roster" and "players on the field" formulations of blended rates, with and without support staff. We compare Cobra's billable blended rates to these representative blended rates to assess reasonableness of the rates Cobra proposed under the MSA.

Summary of Benchmarks and CCFs

Labor Rate Benchmarks

Appendix E presents high and low values used to bound ranges for labor wages. In our analysis, we assumed that labor arriving to support recovery efforts were from the continental U.S. Following the approach of previous unpublished HSOAC analysis, we organized results according to the labor categories PREPA used to request proposals from bidders. These categories included Foreman, Transmission Lineman, Heavy Equipment Operator, Winch Truck Operator, Groundman and Diggers (Common Labor).

Labor Rate Comparisons

Table 4.2 presents Cobra's proposed rate interpreted as an RSMeans R5 crew-weighted average hourly labor rate. Cobra's rate is compared to an estimated range based on BLS and RSMeans benchmark data and CCF values appropriate to the wage base. Comparable rates proposed by Cobra's competitors are also presented. Results show that Cobra's average hourly labor rate lay between low and high benchmarks and did not exceed any individual labor category except for groundman. By comparison, MasTec's and PowerSecure's crew-weighted hourly rates were higher than Cobra's and exceed benchmark ranges for most individual labor categories and overall. These results indicate that Cobra's labor rates were competitive relative to others who submitted proposals for the MSA.

Table 4.2 R5 Crew-Weighted Hourly Labor Rates for MSA Proposals

R5 Crew Labor		Reasonable Range ($/person-hour)		MSA Proposals ($/person-hour)		
Labor Category	Headcount	Low	High	MasTec	PowerSecure	Cobra
Foreman	1	(b)(4)	(b)(4)	(b)(4)	(b)(4)	-
Lineman	4	(b)(4)	(b)(4)	(b)(4)	(b)(4)	-
Operator	2	(b)(4)	(b)(4)	(b)(4)	(b)(4)	-
Groundman	4	(b)(4)	(b)(4)	(b)(4)	(b)(4)	-
Weighted Average		(b)(4)	(b)(4)	(b)(4)	(b)(4)	(b)(4)
Unweighted Average				(b)(4)	(b)(4)	(b)(4)

Equipment Rate Benchmarks

Table E.3 summarizes low and high bids for each of the six equipment items in response to the RFP described above. Because key equipment was bid competitively for emergency work in Puerto Rico, we judge their unit costs to be appropriate as benchmarks in our blended rate calculations. Where equipment prices are not available from these bidders, we used equipment costs from RSMeans. We note that that there exists a higher variance for more expensive items (e.g., helicopters), and according to an analysis of the sensitivity of roster-based blended rates to equipment quantities, these items contribute disproportionately to the estimates of the blended rates (Appendix H). Thus, we consider an expanded set of scenarios for comparison to Cobra's rate schedule, as discussed further below.

Construction Cost Factors

We report the input values and final CCFs for both labor and equipment in Appendix I. The CCFs include inputs in general categories of (1) overhead and profit (including location factor) and (2) other indirect costs including many of the factors included in Parts B-H of FEMA's CEF,

such as Temporary Services, Risk/Contingency, and Access, Storage and Staging.[22] For equipment, we account for fuel costs in the daily O&M cost inputs to the CCF. Variation in assumptions across these inputs produces a range of CCF values suited to adjustment of labor and equipment benchmarks to generate representative ranges of blended rates. CCFs for different rate bases are also presented that allow combinations of benchmark data from different sources (i.e. BLS, RSMeans, bidders who responded to the PREPA RFP).

Blended Rate Comparisons

To provide broad perspective on the reasonableness of Cobra's billable blended rates, we present several blended rate formulations for comparison. First, we present ranges of blended rate estimates for support staff teams (i.e. management, logistics, security) and compare these to Cobra's proposed support staff team blended rates.

Next, we present representative blended rate ranges for comparison to both "Blended Rate, skilled lineman and equipment" and "Total Rate for Blended Lineman". For each of these rates, we present ranges built from complete "roster" quantities and also for various "players on the field" crew structures suited to specific high voltage system repairs. We calculated these ranges by using low and high CCF values, benchmark base wage data from BLS, RSMeans and bid proposals, and under different labor and equipment quantities and fuel cost assumptions. In each case, Cobra's blended daily rate fell within the representative range of blended rates we estimated, both with and without support staff.

Blended Rates for Support Staff

Table 4.3 summarizes our estimations into how BLS labor categories were found to correspond to Cobra's support staff teams, as given by the quantities enumerated in the MSA proposal. The breakdown in the proposal was 30 personnel for management/operations/safety, 50 for logistics, and 104 for security, for a total headcount of 184. In keeping with our heuristic approach, we assume the following statements: staff supported 5-10 worksites, one logistics manager/QC manager oversaw 1-2 worksites, there were 9-18 security guards per site, there was between a 6:1 and 7:1 ratio of security guards to security manager, each program manager managed 2-3 projects, and there were 1-2 project manager(s) per site.

[22] The FEMA Center of Excellence is updating FEMA's published guidance (U.S. Department of Homeland Security, 2018b, 2018c) on the CEF factors for Hurricane Maria. Some of these CEF factors, and thus some of the CCF factors, will be updated for Puerto Rico's Hurricane Maria conditions. When these updates are published, we anticipate that final CCF values may change (note, for instance the CEF Part A location factor may be higher than 1.0). As discussed in previous unpublished HSOAC analysis, other changes to final CCFs may be possible with updated guidance from the FEMA Center of Excellence. Our judgment on reasonableness that traces to assumptions in labor and equipment CCFs is thus based on best available data and guidance at this time.

Table 4.3 Mapping of Support Staff Quantities to BLS Labor Categories

Cobra Support Staff Team	BLS Labor Category	Estimated Quantity
Management	Superintendent	1-2
	Program Manager	2-3
	Project Manager	8-9
Operations	Project Controls Manager	1-5
	Project Controls Specialist	1-3
	QC Manager	1-3
Safety	Environmental Manager	1
	Environmental Monitor	1-3
	Safety Manager	1-2
	Safety Monitor	3-6
Logistics	Logistics Manager	5-10
	Logistics Specialist	30-40
	Fleet Manager	4-10
Security	Security Manager	12-14
	Security Guard	90-95

Figure 4.1 illustrates the comparison of Cobra's rates for support staff to representative blended rate ranges for support staff working under emergency conditions, using information presented in Appendix E, labor CCFs presented in Appendix I, and headcounts for support staff teams presented in Table 1.1. Cobra's daily blended rates all remained within low-high range of estimated blended rates for all support staff teams.

Figure 4.1 Comparison of Cobra Blended Rates to Representative Ranges for Support Staff

Roster and Work-Based Blended Rates

In this section we present two broad sets of results, first for blended rates that assume equipment items were bid without consideration of fuel costs (i.e., fuel is assumed to be a separately reimbursable cost), and second for blended rates that assume equipment items were bid with fuel (i.e., fuel is included in the blended rate). Figures 4.2 through 4.7 illustrate how Cobra's rates compare to representative ranges of blended rates where equipment was bid without fuel costs included. Figures 4.8 through 4.13 illustrate how Cobra's rates compare to representative ranges of blended rates where equipment was bid with fuel costs included.

Figure 4.2 and Figure 4.3 illustrate how Cobra's blended rates compare to three representative ranges of blended rates that include all labor and equipment offered (i.e. "roster basis" of blended rates). Given the fact Cobra did not provide relevant details within the MSA regarding workforce structure, HSOAC researchers made assumptions based on examples provided elsewhere. The first example, "MasTec RFP 250," reflects the labor and equipment structure of MasTec's proposal with PREPA in the subsequent RFP, scaled to Cobra's workforce size in the MSA. The second example, "Cobra RFP 250," describes Cobra's labor and equipment structure for the subsequent RFP as scaled to Cobra's workforce size in the MSA. The third example, "Cobra RFP 649," assumes the same equipment quantities proposed in the MSA for the second example, but increases the number of linemen to 649, as was observed in the weeks following contract execution. As discussed previously, roster-based blended rates represent quantities for unspecified work and associate with metrics of responsiveness and sufficiency to perform broad tasks of electrical system repair, such as those expected for the flexible scope of services in the MSA. As shown in both Figure 4.2 and Figure 4.3, Cobra's rates fall within representative ranges for all these examples. The models in Figure 4.2 do not include the additional costs for support staff in the calculation of range limits. The models in Figure 4.3 include the additional costs for support staff in the calculation of range limits. Recall that Cobra's proposed rate for "Blended Rate, skilled linemen and equipment" was $4,000/person-day, as shown in Figure 4.2. Cobra's proposed rate for "Total Rate per Blended Lineman", a rate that includes costs of support staff, was (b)(4), as shown in Figure 4.3.

Figure 4.2 Comparison of Cobra's "Blended Rate, skilled linemen and equipment" to Representative Ranges for Roster-Based Models without Support Staff and Equipment without Fuel

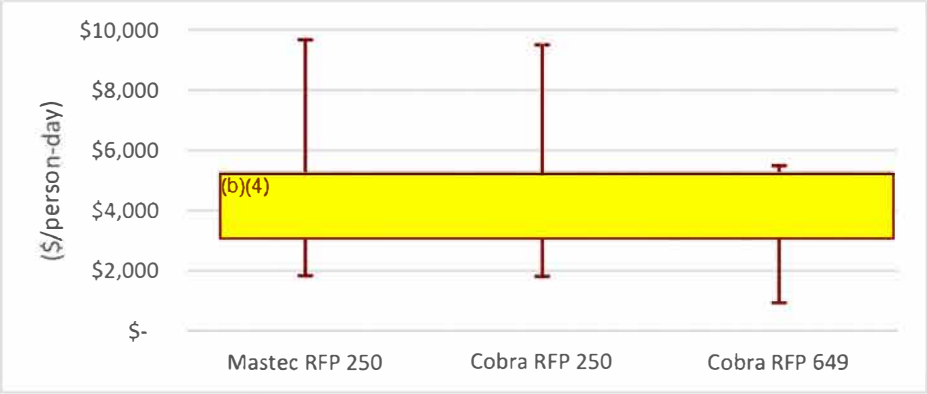
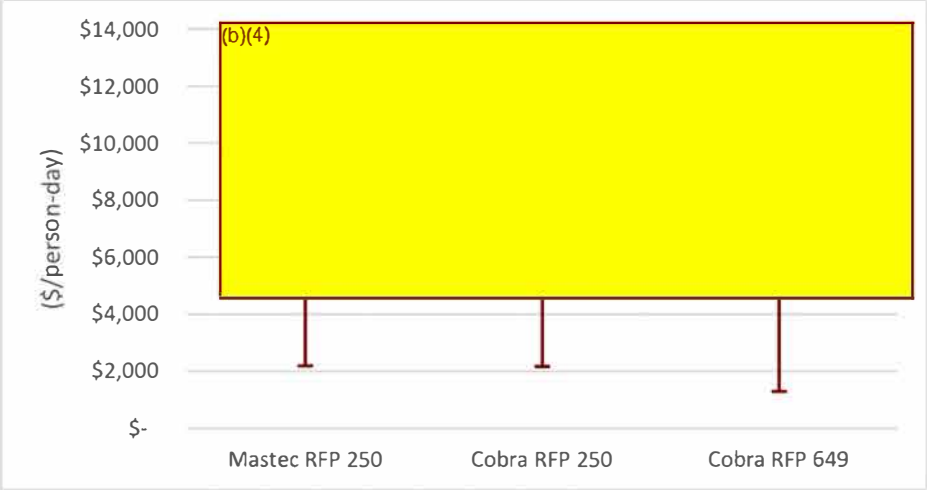


Figure 4.3 Comparison of Cobra's "Total Rate per Blended Lineman" to Representative Ranges for Roster-Based Models with Support Staff and Equipment without Fuel



While the MSA was executed under conditions that reflected greater uncertainty following Hurricane Maria, and PREPA demanded labor and equipment quantities for a flexible scope of services, we remind readers of the potential concern for productive efficiency, namely the influence of high-cost equipment on blended rates when the work itself is not considered in the estimation of a blended rate. Therefore, we present representative ranges of blended rates based on specific high voltage system work tasks and structured according to the associated RSMeans Standard Crews.

Figure 4.4 presents results for tasks named in Table C.1 as performed by electrical crews listed in that same table—namely, R5, R6, R7, R8, R10, and R11 crews. A brush clearing crew, B87, is also included to account for the possibility that debris may need to be removed in order to access the transmission system before performing electrical repairs. In this baseline scenario,

work is completed on flat terrain without support staff. Cobra's "Blended Rate, skilled linemen and equipment" appears at the top of the range for nearly all work crews under these assumptions.

Figure 4.4 Comparison of Cobra's "Blended Rate, skilled lineman and equipment" to Representative Ranges for High Voltage System Repairs on Flat Terrain without Support Staff and Equipment without Fuel

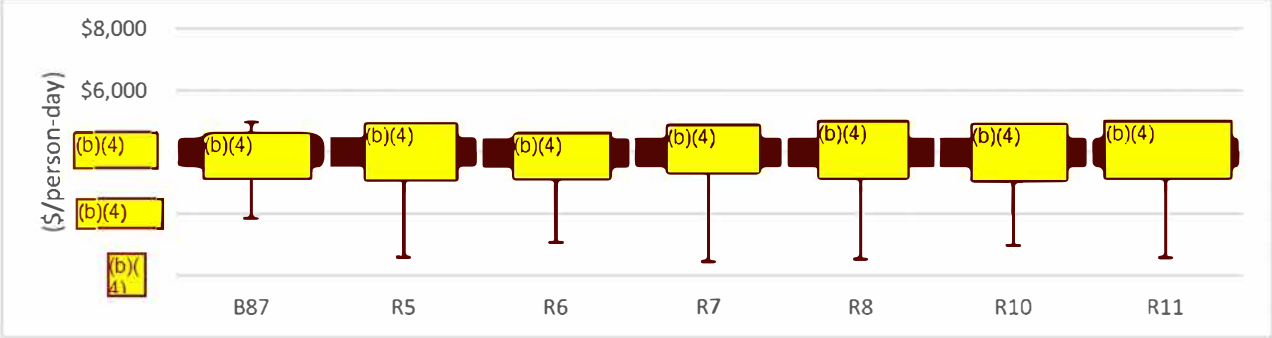


Figure 4.5 shows results for the same electrical repairs performed on flat, accessible terrain with support staff. That is, Cobra's "Total Rate per Blended Lineman" is compared to representative ranges of work performed according to RSMeans electrical crew structures with support staff costs added to the estimates. Under these assumptions, Cobra's proposed rate from the perspective of only the RSMeans R7 crew—a materials handling and disposal crew—is at the upper limits of a representative range of blended rates under these assumptions.

Figure 4.5 Comparison of Cobra's "Total Rate per Blended Lineman" to Representative Ranges for High Voltage System Repairs on Flat Terrain with Support Staff and Equipment without Fuel

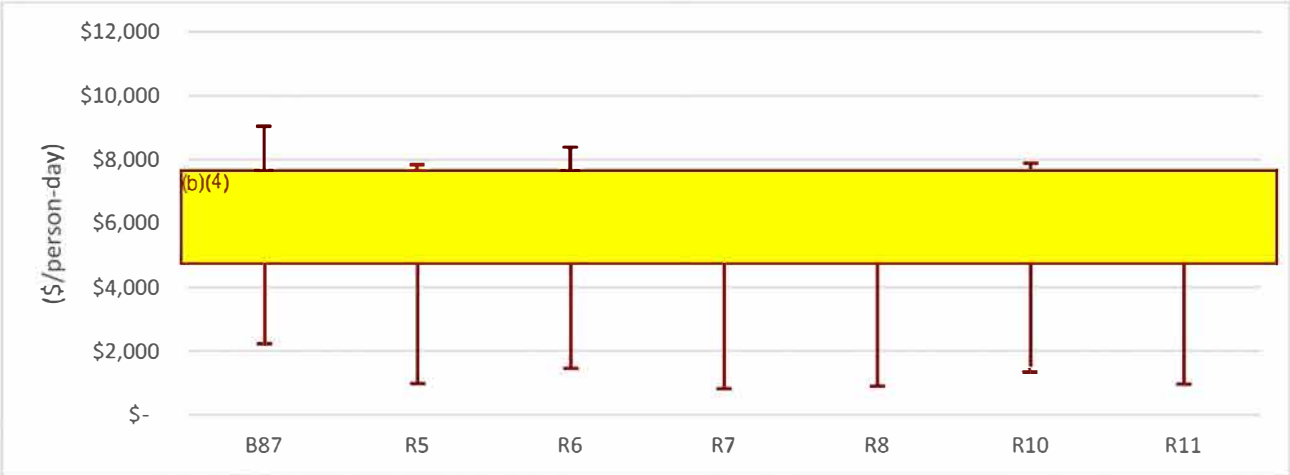


Figure 4.6 shows results reflecting the same electrical repairs as above but performed on rugged terrain with MD500 helicopters and helicopter crews. Given PREPA's selection of Cobra for factors that include this capability, we suggest that helicopter-assisted electrical repair scenarios are central to our analysis of reasonableness of Cobra's blended rates. We assume that helicopters can be used to support work otherwise associated with RSMeans R5, R6, R7, R8, R10 and R11 Standard Crews on flat terrain. We assume that helicopters do not support the work of brush clearing crews, i.e. RSMeans B87 crew. We assume that helicopters are flown at least 5 hours on any day that they are used. Thus, Figure 4.6 presents Cobra's "Blended Rate, skilled lineman and equipment" compared to representative ranges of blended rates for work performed by the RSMeans electrical crews listed above, as assisted by MD500 helicopters and helicopter crews. Note that results presented in Figure 4.6 do not include additional costs for support staff or fuel. Cobra's "Blended Rate, skilled lineman and equipment" falls within the representative range for all crews under these assumptions.

Figure 4.6 Comparison of Cobra's "Blended Rate, skilled lineman and equipment" to Representative Ranges for High Voltage System Repairs on Rugged Terrain without Support Staff and Equipment without Fuel

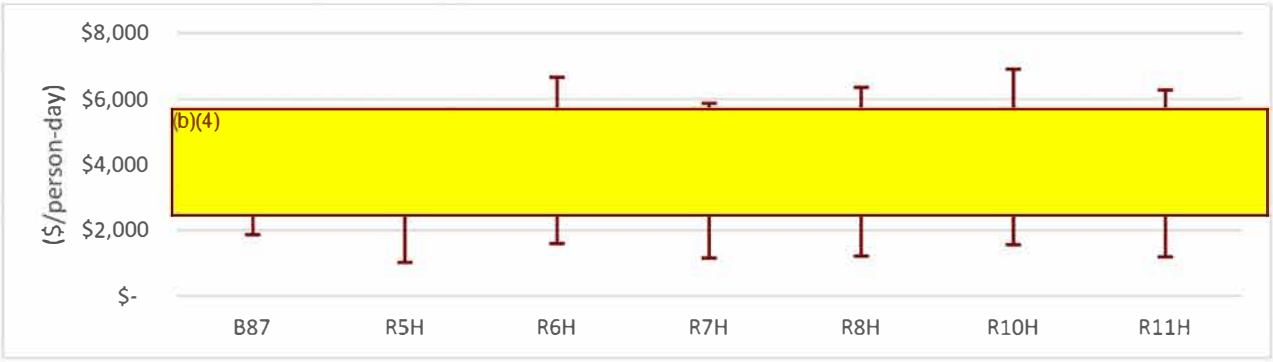
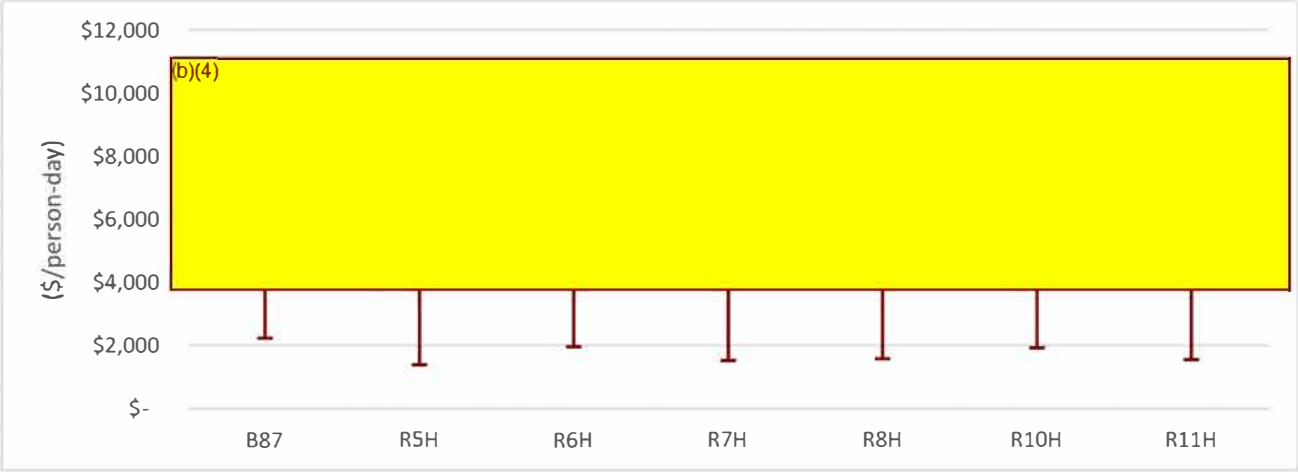


Figure 4.7 shows results reflecting the same electrical repairs as above, performed on rugged terrain with helicopters, and also including costs of support staff. Again, we assume that helicopters can be used to support work otherwise performed by RSMeans electrical crews on flat terrain, but not support the work performed by brush clearing crews. We assume that helicopters are flown at least 5 hours on any day that they are used. Thus, Figure 4.7 presents Cobra's "Total Rate per Blended Lineman" as compared to representative ranges of blended rates for work performed by electrical crews assisted by MD500 helicopters and helicopter crews, as well brush clearing crews. The additional costs of support staff are included, but not costs for fuel. Cobra's "Total Rate per Blended Lineman" blended rate falls within range for all crews under these assumptions.

Figure 4.7 Comparison of Cobra's "Total Rate per Blended Lineman" to Representative Ranges for High Voltage System Repairs on Rugged Terrain with Support Staff and Equipment without Fuel



In the following, we present results for blended rate comparisons where equipment costs include fuel. Figure 4.8 and Figure 4.9 illustrate how Cobra's blended rates compare to three representative ranges of blended rates that include all labor and equipment offered (i.e. "roster basis" of blended rates). As before, "MasTec RFP 250," reflects the labor and equipment structure of MasTec's proposal with PREPA in the subsequent RFP, scaled to Cobra's workforce size in the MSA. "Cobra RFP 250," describes Cobra's labor and equipment structure for the subsequent RFP as scaled to Cobra's workforce size in the MSA. "Cobra RFP 649," assumes the same equipment quantities proposed in the MSA for the second example but increases the number of linemen to 649. Figure 4.8 does not include additional costs of support staff in the calculation of range limits. Figure 4.9 includes the additional costs of support staff. As shown in both Figure 4.8 and Figure 4.9, Cobra's rates fall within representative ranges for all these examples.

Figure 4.8 Comparison of Cobra's "Blended Rate, skilled linemen and equipment" to Representative Ranges for Roster-Based Models without Support Staff and Equipment with Fuel

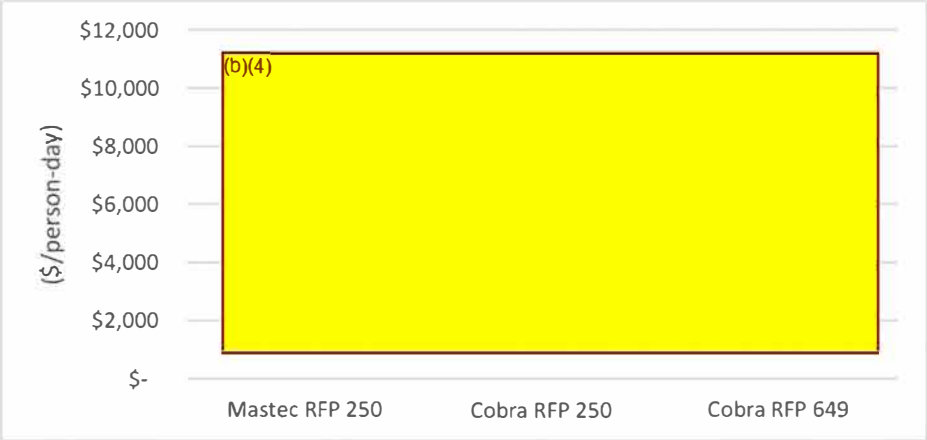


Figure 4.9 Comparison of Cobra's "Total Rate per Blended Lineman" to Representative Ranges for Roster-Based Models with Support Staff and Equipment with Fuel

Again, we present representative ranges of blended rates based on specific high voltage system work tasks and structured according to the associated RSMeans Standard Crews. In Figure 4.10 through Figure 4.13, results reflect blended rate ranges where equipment costs include fuel costs. Figure 4.10 presents results for tasks named in Table C.1 as performed by electrical crews listed in that same table—namely, B87, R5, R6, R7, R8, R10, and R11 crews. In this baseline scenario, work is completed on flat terrain without support staff, but equipment is assumed to be bid with fuel costs included. Cobra's "Blended Rate, skilled linemen and equipment" appears at the top of the range for nearly all work crews under these assumptions.

Figure 4.10 Comparison of Cobra's "Blended Rate, skilled lineman and equipment" to Representative Ranges for High Voltage System Repairs on Flat Terrain without Support Staff and Equipment with Fuel

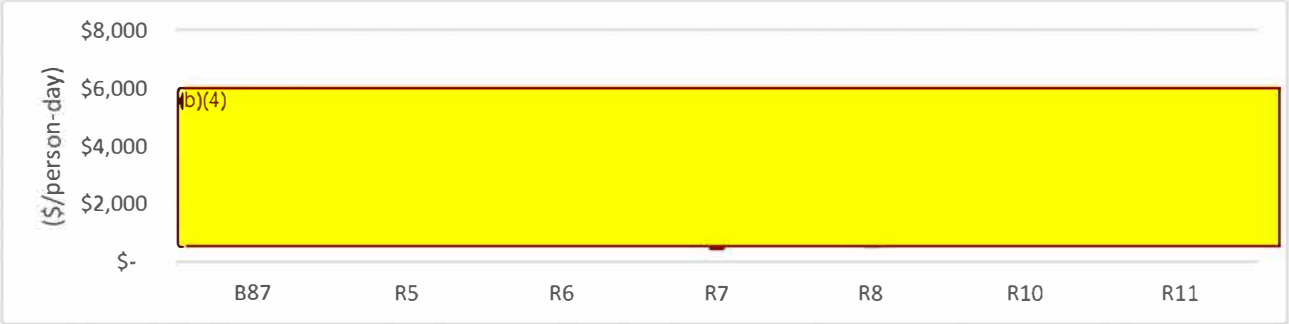


Figure 4.11 shows results for the same electrical repairs performed on flat, accessible terrain with support staff, that is Cobra's "Total Rate per Blended Lineman" is compared to representative ranges of work performed according to RSMeans electrical crew structures with support staff and fuel costs added to the estimates. Under these assumptions, Cobra's proposed rate for an RSMeans R7 crew is at the upper limits of a representative range of blended rates.

Figure 4.11 Comparison of Cobra's "Total Rate per Blended Lineman" to Representative Ranges for High Voltage System Repairs on Flat Terrain with Support Staff and Equipment with Fuel

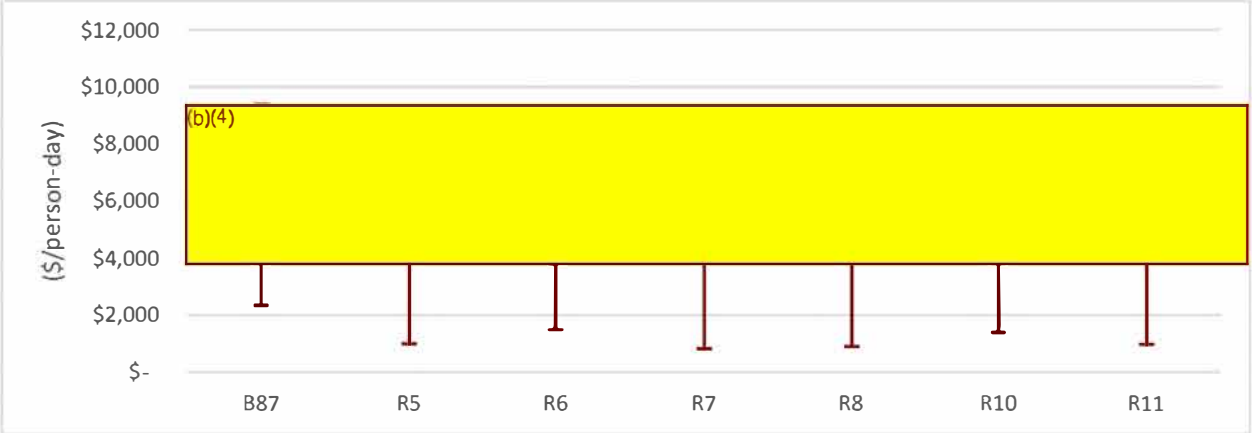


Figure 4.12 shows results reflecting the same electrical repairs as above but performed on rugged terrain with MD500 helicopters and helicopter crews. We again assume that helicopters can be used to support work otherwise associated with RSMeans R5, R6, R7, R8, R10 and R11 Standard Crews on flat terrain. We assume that helicopters do not support the work of brush clearing crews, i.e. RSMeans B87 crew. We assume that helicopters are flown at least 5 hours on any day that they are used. Thus, Figure 4.12 presents Cobra's "Blended Rate, skilled lineman and equipment" compared to representative ranges of blended rates for work performed by the RSMeans electrical crews listed above, as assisted by MD500 helicopters and helicopter crews. Figure 4.12 presents results that do not include additional costs for support staff but do include

fuel costs. Cobra's "Blended Rate, skilled lineman and equipment" falls within the representative range for all crews under these assumptions.

Figure 4.12 Comparison of Cobra's "Blended Rate, skilled lineman and equipment" to Representative Ranges for High Voltage System Repairs on Rugged Terrain without Support Staff with Fuel

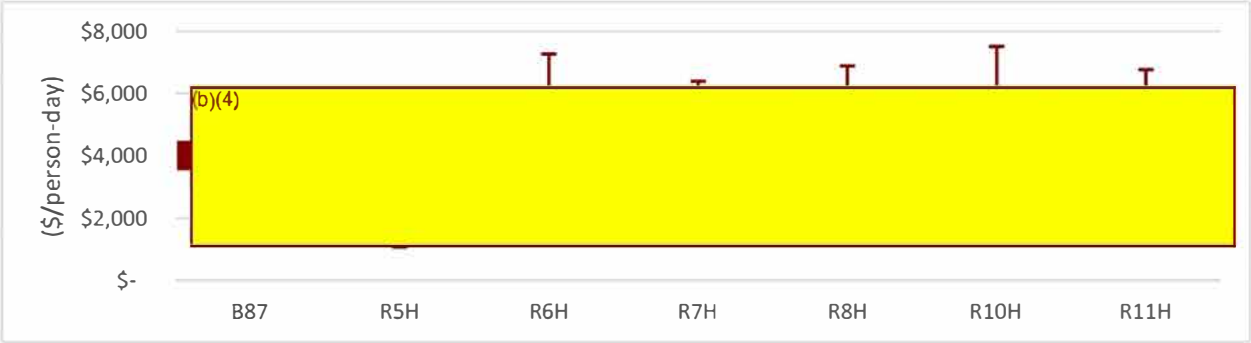
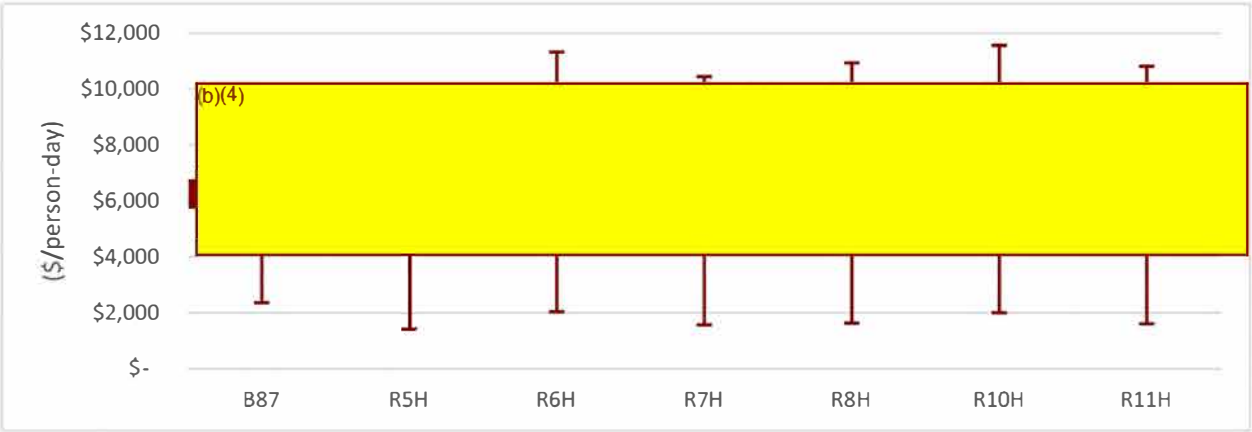


Figure 4.13 shows results reflecting the same electrical repairs as above, performed on rugged terrain with helicopters, and also including costs of support staff and fuel costs. Again, we assume that helicopters can be used to support work otherwise performed by RSMeans electrical crews, but not support the work performed by brush clearing crews. We assume that helicopters are flown at least 5 hours on any day that they are used. Thus, Figure 4.13 presents Cobra's "Total Rate per Blended Lineman" as compared to representative ranges of blended rates for work performed by electrical crews assisted by MD500 helicopters and helicopter crews. The additional costs of support staff and fuel costs are included. Cobra's "Total Rate per Blended Lineman" blended rate falls within range for all crews under these assumptions.

Figure 4.13 Comparison of Cobra's "Total Rate per Blended Lineman" to Representative Ranges for High Voltage System Repairs on Rugged Terrain with Support Staff and Equipment with Fuel



Together, then, Cobra's proposed blended rates were assessed in consideration of the situational uncertainty which prevailed in the days immediately following Maria, as well as conditions when repairs may have allowed for more precise cost estimation and against industry standard comparisons for productive work, and for varied work conditions and contradictory information. Cobra's blended rates fall within estimated ranges in all scenarios we considered.

We conclude that Cobra's blended rates fall within representative ranges for high voltage emergency repair work. This conclusion is delivered from analytical investigation which combined knowledge of work conditions, assumptions into wage burdens, evaluation of the equipment quantities and workforce structures, different assumptions about fuel costs, and inclusion of the best benchmark data and current adjustment factors available at this time.

Conclusion

HSOAC reviewed all documents provided by FEMA to assess the reasonableness of the selection process of Cobra for emergency repair work. HSOAC cross referenced PREPA's procurement process with FEMA's policy on reasonableness of contract proposals, PREPA's own Emergency Procedures and the Commonwealth of Puerto Rico emergency procurement provisions at the time of the selection process. Based on the available documentation at the time of the analysis, HSOAC found PREPA's procurement process to be reasonable.

HSOAC performed separate analyses on the unit rates, adjustment factors, and quantities used in the calculation of Cobra's blended rates for the MSA contract. These cost components were benchmarked against data from other emergency response proposals, industry surveys, Bureau of Labor and Statistics wages, and RSMeans wage and crew data. HSOAC performed a detailed quantitative analysis using best available benchmark data to generate representative blended rate ranges for comparison to Cobra's blended rates. HSOAC concludes that, under a range of assumptions, Cobra's billable rates to PREPA fall within those representative ranges and are therefore reasonable for the emergency repair work performed by Cobra under the MSA.

Per FEMA's request, HSOAC independent analysis focused on the procurement process of Cobra's MSA and on its contract rates. This report does not cover the implementation of the MSA contract. Therefore, it is outside of the scope of this report whether or not the labor and equipment provided by Cobra was employed to perform the actual tasks assigned under the MSA.

Appendix A: Formula Derivation for Blended Rates

This appendix presents HSOAC's derivation of the blended rate equation, as reported in previous unpublished HSOAC analysis. The formula and its derivation are as follows:

Blended Rate =
(Labor Daily Total + Equipment Daily Total) / Headcount, where

Labor Daily Total =
*summation across all Labor that makes up the group (HourlyLaborRate * NumberofHoursWorkedPerDay)*

Equipment Daily Total =
*summation across all Equipment that makes up the group (DailyEquipmentRate * PercentofDayEquipmentIsUsed)*

We make the assumption that *NumberofHoursWorkedPerDay* is constant among all labor types (e.g., an equipment operator and a foreman both work the same amount of time each day) and thus the *Headcount* can be defined as the number of labor units contained in the group. We also make the simplifying assumption that *PercentofDayEquipmentIsUsed* is 100%, given that equipment assets are typically rented on a daily basis. These assumptions are consistent with the blended rate calculations provided by bidders for the contract.

To combine hourly labor and daily equipment rates from different benchmark sources, *Hourly Labor Rate* and *Daily Equipment Rate* must be adjusted according to an appropriate *Construction Cost Factor*, or *CCF* (See Appendix B).

Appendix B: Definitions and Calculations of Construction Cost Factors (CCFs)

This appendix describes how we calculate construction cost factors (CCFs) and combine them with labor and equipment benchmark data to produce comparable labor and equipment rates. Per FEMA policies, cost reasonableness is determined by comparison of prices against other rate benchmarks (U.S. Department of Homeland Security, 2018b). In adhering to FEMA guidance (U.S. Department of Homeland Security, 2009), HSOAC collects benchmark data from a variety of data sources including RSMeans, Bureau of Labor Statistics (BLS), and information drawn from various bid documents. A key challenge is accurately converting benchmark data from base rates to contractors' unit costs to accommodate this comparison. The CCF accounts for additional considerations such as overhead and profit, contingencies, risk and indirect costs that comprise a fully burdened rate. HSOAC defines the labor and equipment rates for each labor and equipment element as the product of two factors: a standard base rate for the element and an associated CCF (e.g. a CCF for hourly labor or daily equipment):

HourlyLaborRate = *BaseHourlyLaborRate * CCF_HourlyLaborRate*

DailyEquipmentRate = *BaseDailyEquipmentRate * CCF_DailyEquipment*

Mathematically, we calculated labor CCFs (LCCFs) for emergency work (EW) relative to a BLS hourly wage rate of 1:

Straight Time Base with O&P =
*(Wages + Fringe Benefits + Workers Compensation + Wage Taxes (e.g. FICA) + Home Office Overhead + Subcontractor or Installer Profit + Small Tools Allowance + Location pay/bonus) * Location Factor,*

Other Burdens =
*(1 + Temporary Services Allowance) * (1+Contingency) * (1 + Access, Storage and Staging Allowances) * (1 + General and Administrative) * (1 + Insurance and Performance Bonds) * (1 + General Contractor Fee) * (1 + Escalation) * (1 + Construction Permit Fees and Taxes),*

$LCCF_{ST}$ = *Straight Time Base with O&P * Other Burdens,*

$LCCF_{OT}$ = *(Straight Time Loaded Base – Fringe Benefits) * Other Burdens * OT Premium, where OT Premium is 1.5 for Low and Typical values and (2 + 1.5 * 6) / 7 for High values (assuming Sundays may be double-time), and*

$LCCF_{EW}$ = $(40*LCCF_{ST} + 72*LCCF_{OT})/112$, where units of constants in this last expression are hours.

In the defined values shown above, OT represents overtime and ST denotes straight time[23]. In order to convert any BLS CCF into a CCF for RSMeans rates, we divide out fringe benefits:

LCCF (RSMeans) = LCCF- *Fringe Benefits * Other Burdens*

Finally, to obtain CCFs for PREPA standard rates, we apply the offset factor:

LCCF (PREPA) = *LCCF(RSMeans) * (1+Offset between PREPA Rates and RSMeans Rates).*

Given that CCFs for equipment (ECCFs) must be relative to the corresponding RSMeans daily rates, we have applied the same "Other Burdens" value in calculation of the daily rate. Additionally, the extra time where equipment is deployed in the field for emergency work affects the daily rate calculation. Given that operations and maintenance (O&M) costs continually increase, we calculated the percentage of total equipment costs derived from O&M on a daily basis and included it to the base rate. Furthermore, taking into consideration that weekly rates in RSMeans are calculated for five-day work weeks, we were required to account for the fact that rentals make use of equipment over a seven-day week, and thereby amortize the non-O&M costs by two additional days.

$ECCF_{EM}$ = *(Pct. O&M Costs/day + 5/7 * (1- Pct. of O&M Costs/day)) * Other Burdens,*

$ECCF_{ST}$ = *Other Burdens*

As above, to convert to ECCFs suitable to use with PREPA rates, apply the offset factor:

ECCF (PREPA) = *LCCF(RSMeans) * (1+Offset between PREPA Rates and RSMeans Rates)*

[23] Note that our calculations for *Straight Time Base with O&P* mirror the costs that would appear in CEF part A while *Other Burdens* captures the contributions of CEF parts B-H.

Appendix C: Common Electrical System Repair Tasks and Work Crews

Below we summarize common electrical repairs on overhead electrical transmission systems, where work is related to support structures, wiring/cables, and hardware that connects to the cables and structures. We also include RSMeans line items for example work tasks and the corresponding RSMeans Standard Crew. The tasks below are primarily performed by electrical crews. However, one non-electrical crew, B87, is also included. A B87 crew removes debris that may be required to gain access to the system following a storm.

Table C.1 Common Electrical System Repair Tasks included in RSMeans

Task	RSMeans Line Example	RSMeans Standard Crew
Clear right of way	337113800100	B87
Replace/repair transformer	337323201090	R11
Handling and disposal of material	337113230570 3371391310930	R7
Replace/repair insulators and hardware	337139131020 337139132150	R5 R8
Replace/repair lightning arresters	337539138080	R11
Replace/repair conductors	337139130650	R6
Replace/repair overhead groundwire	337139131340 337139130520	R5 R10
Retention conductors	337139132840 337139132820	R6 R5

Appendix D: Rates and Category Mapping Tables for Labor Rate Analysis

Below we present summaries of our correspondence map between PREPA labor categories and RSMeans labor descriptions along with RSMeans 2017 labor rates (Table D.1). In Table D.2 we present 2017 labor rates available from BLS (BLS, 2019) for work crews. In Table D.3 we present 2017 labor rates available from BLS for support staff (BLS, 2019).

Table D.1 2017 Labor rates from RSMeans (2018)

PREPA Labor Description	RSMeans Labor Description	RSMeans "Bare Cost" Hourly Rate
Foreman	Electrician Foreman	(b)(4)
Transmission Lineman	Electrician Lineman (Electrician)	(b)(4)
Heavy Equipment Operator	Equipment Operator, Crane or Shovel	(b)(4)
Winch Truck Operator	Equipment Operator, Medium Equipment	(b)(4)
Ground-man	Electrician Groundman (Helpers Average)	(b)(4)
Diggers	Common Laborer	(b)(4)

Adapted from previous unpublished HSOAC analysis.

Table D.2 2017 Labor Rates for Work Crews in Bureau of Labor Statistics (BLS, 2019)

PREPA Labor Description	BLS Labor Category	SOC Code	Percentile of Labor Category	BLS-CONUS[24] Hourly Rate	BLS-PR Rate Hourly Rate
Foreman	Construction Managers	11-9021	50%	(b)(4)	(b)(4)
Transmission Lineman	Electrical Power-Line Installers and Repairers	49-9051	75%	(b)(4)	(b)(4)
Heavy Equipment Operator	Excavating and Loading Machine and Dragline Operators	53-7032	50%	(b)(4)	(b)(4)
Winch Truck Operator	Industrial Truck and Tractor Operator	53-7051	50%	(b)(4)	(b)(4)
Ground-man	Electrical Power-Line Installers and Repairers	49-9051	50%	(b)(4)	(b)(4)
Diggers	Construction Laborers	47-2061	50%	(b)(4)	(b)(4)

Adapted from previous unpublished HSOAC analysis.

24 The CONUS BLS rates were computed by taking the average of the SOC rates within the respective percentile for each labor category in BLS weighted by the number of workers in the category by state.

Table D.3 2017 Labor rates from Bureau of Labor Statistics for Support Staff (BLS, 2019)[25]

PREPA Labor Description	BLS Labor Category	SOC Code	Percentile of Labor Category	BLS-CONUS26 Hourly Rate	BLS-PR Rate Hourly Rate
Management Superintendent	Construction Managers	11-9021	90	$81.64	$81.91
Program Manager	Construction Managers	11-9021	75	$63.30	$51.20
Project Manager	Construction Managers	11-9021	50	$48.80	$65.28
Operations QC Manager	Industrial Production Manager	11-3051	75	$63.30	$65.28
Project Controls Manager	Industrial Production Managers	11-3051	75	$63.30	$65.28
Project Controls Specialist	Industrial Production Managers	11-3051	50	$48.80	$51.20
Safety Environmental Manager	Environmental Scientists and Specialists	19-2041	75	$44.01	$27.75
Environmental Monitor	Environmental Scientists and Specialists	19-2041	50	$33.69	$18.53
Safety Manager	Occupational Health and Safety Specialists	29-9011	75	$42.74	$22.96
Safety Rep	Occupational Health and Safety Technicians	299012	50	$24.08	$12.74
Logistics Logistics Manager	Logistics Manager	11-3071.03	75	$57.60	$52.95
Logistics Specialist	Logistician	11-3071	50	$44.38	$34.62
Fleet Manager	Transportation, Storage and Distribution Managers	11-3071.01	50	$44.38	$34.62
Security Security manager	Security Manager	11-9199.07	50	$52.33	$26.49
Security Guard	Security Guard	33-9032	50	$13.11	$8.71

[25] Development of data in this table follows methods introduced in previous unpublished HSOAC analysis.

26 The CONUS BLS rates were computed by taking the average of the SOC rates within the respective percentile for each labor category in BLS, weighted by the number of workers in the category by state.

Appendix E: Summary of Labor and Equipment Rate Ranges

This appendix includes summary tables for labor and equipment rate benchmarks used to identify reasonable ranges, as adapted from previous unpublished HSOAC analysis. The BLS labor rates are often lower because they exclude fringe benefits while the RSMeans rates include these in their "bare cost" rates. Also, BLS compiles rates for all labor, both union and non-union, whereas standard union rates for RSMeans data benchmarks are to be used per FEMA guidance on the CEF.[27]

Table E.1 2017 Hourly Labor Rate Ranges from BLS and RSMeans for Work Crews

PREPA Labor Category	Low Rate[28]	High Rate[29]
Foreman	$44.21	$58.70
Transmission Lineman	$40.38	$58.20
Heavy Equipment Operator	$21.33	$56.10
Winch Truck Operator	$16.22	$53.75
Ground-man	$34.15	$37.80
Diggers	$17.33	$39.85

[27] We reviewed the change of RSMeans rates over the 2017-2018 period for labor categories relevant to transmission construction. We note that costs published by RSMeans are national averages that can be adjusted by location factors. Gordian is currently updating location factors for Puerto Rico. Updated location factors are expected to affect "bare cost" values for Puerto Rico, and thus labor rates and calculations that depend on them. Results presented in this report are based on best available information at this time.

28 BLS (2019)

29 Standard Union from RSMeans (2018)

Table E.2 Hourly Labor Rates from BLS and RSMeans for Support Staff

BLS Labor Category	Low Rate	High Rate
Superintendent	$51.45[30]	$81.64[31]
Program Manager	$51.45[30]	$63.30[31]
Project Manager	$48.80[31]	$51.45[30]
Project Controls Manager	$51.45[30]	$63.30[31]
Project Controls Specialist	$51.45[30]	$63.30[31]
QC Manager	$48.80[31]	$51.45[30]
Environmental Manager	$44.01[31]	$51.45[30]
Environmental Monitor	$33.69[31]	$37.10[30]
Safety Manager	$42.74[31]	$51.45[30]
Safety Monitor	$24.08[31]	$37.10[30]
Logistics Manager	$51.45[30]	$57.60[31]
Logistics Specialist	$44.38[31]	$51.45[30]
Fleet Manager	$44.38[31]	$51.45[30]
Security Manager	$51.45[30]	$52.33[31]
Security Guard	$13.11[31]	$37.10[30]

[30] Standard Union rates from RSMeans (2018)

[31] BLS (2019)

Table E.3 2017 Equipment Rates Ranges from RFP Bids

PREPA Equipment Description	Low Bid	Low Bid Source	High Bid	High Bid Source
Haul Semi Tractor	$68.88	(b)(4)	$114	(b)(4)
Aircraft MD 500	$1,897.50	(b)(4)	$2,530	(b)(4)
55' - 60' 4x2 / tracked	$82.56	(b)(4)	$110	(b)(4)
100' – 105' 6x6 / tracked	$103.32	(b)(4)	$286	(b)(4)
60T Truck Crane	$250	(b)(4)	$424	(b)(4)
Pressure Diggers	$80.36	(b)(4)	$80.36	(b)(4)

Appendix F: Assessment of Labor Headcount from PREPA MSA vs. RFP

The tables in this appendix compare headcount quantities from PREPA's MSA (Cobra) against RFP responses by Cobra and MasTec. We have provided these datapoints to support our assessment of reasonableness in terms of responsiveness.

Table F.1 Labor Headcounts Comparison of PREPA Emergency Work (Master Service Agreement & RFP)

	Cobra (MSA)	Cobra (RFP)	MasTec (RFP)
Work (Lineman)	(b)(4)	(b)(4)	(b)(4)
Security	(b)(4)	(b)(4)	(b)
Logistics	(b)(4	(b)(4)	(b)(
Management	(b)(4)	(b)(	(b)(
Total	**434**	**345**	**370**

Table F.2 Labor Percentage Headcounts Comparison of PREPA Emergency Work (Master Service Agreement & RFP)

	Cobra (MSA)	Cobra (RFP)	MasTec (RFP)
Work (Lineman)	58%	88%	84%
Security	24%	0%	2%
Logistics	12%	6%	3%
Management	7%	6%	11%

Table F.3 Labor Only Extended Daily Billable Amounts[32] comparison of PREPA emergency work (Master Service Agreement & RFP)

	Cobra (MSA)	Cobra (RFP)	MasTec (RFP)
Work (Lineman)	(b)(4)	(b)(4)	(b)(4)
Security	(b)(4)	(b)(4)	(b)(4)
Logistics	(b)(4)	(b)(4)	(b)(4)
Management	(b)(4)	(b)(4)	(b)(4)
Total	$1,408,000	$1,171,267	$1,400,924

Table F.4 Percentage of Labor Only Extended Daily Billable Amounts Comparison of PREPA Emergency Work (Master Service Agreement & RFP)

	Cobra (MSA)	Cobra (RFP)	MasTec (RFP)
Work (Lineman)	71%	91%	90%
Security	15%	0.1%	1%
Logistics	9%	2%	2%
Management	5%	7%	6%

[32] Extended Daily Billable rate is the daily billable rate for a labor type (Lineman, Security, Logistics, Management) multiplied by the headcount for that labor type. We excluded lodging cost in the calculations to focus on labor comparisons only.

Appendix G: Constraints Analysis of Cobra Labor and Equipment Quantities

Table G.1 of this appendix lists possible constraints on labor and equipment that Cobra proposed for the MSA. Possible constraints are categorized by the labor skill type and equipment relative to the corresponding RSMeans conceptual crews relevant to emergency electrical repair work. For example, on an R5 crew, Cobra's key limitation is the number of hydraulic cranes listed. Certain brush-clearing equipment (i.e. feller bunchers) that a RSMeans B87 crew requires and tram cars for a RSMeans R10 crew also stand out as constraints on standard crew support according to definitions by RSMeans.

Table G.1 Results of Conceptual Work Crew Constraints Analysis

RSMeans Standard Crew	Potential labor or equipment constraint
B87	MISSING: Feller Buncher
R5	Electrician Operator, Hyd. Crane
R6	Electrician Operator, Hyd. Crane
R7	Electrician Groundmen
R8	Electrician Groundmen
R10	MISSING: Tram Car
R11	Electrician Operator, Hyd. Crane

Appendix H: Results of One-Way Sensitivity Analysis of Cobra's Labor and Equipment Roster

This appendix summarizes results of a one-way sensitivity analysis of blended rates estimated on a "roster" basis (i.e. a complete list of work crew labor and equipment offered by Cobra on the MSA.). Table H.1 shows the percentage change on the blended rate estimate after adding one unit of labor to each labor category. Table H.2 shows the percentage change on the blended rate estimate after adding one unit of equipment to each equipment category. Results suggest that blended rates are relatively insensitive to changes to the labor mix as well as changes in equipment quantities except for helicopters. A one-unit change in the number of helicopters affects the blended rate estimate by roughly an order of magnitude. The implication is that a representative blended rate, and therefore, a range of such rates produced for comparison to Cobra's billable rate, may need to consider variation in expensive equipment and the work that requires it.

Table H.1 Percent Change of Blended Rate with One Additional Unit of Labor

PREPA Labor Category	Percent change
General Foreman	-0.22%
Foreman	-0.23%
Lineman	-0.23%
Heavy Equipment Operator	-0.25%
Groundman	-0.31%
Apprentice	-0.29%
Diggers (Common Labor)	-0.33%

Table H.2 Percent Change of Blended Rate with One Additional Unit of Equipment

PREPA Equipment Category	Percent Change
Haul Semi Tractor	0.15%
Aircraft MD 500	**2.87%**
55'60' 4x2 / tracked	0.11%
100'105' 6x6 / tracked	0.36%
60T truck crane	0.32%
Pressure diggers	0.13%
pickup truck	0.05%
flatbed haul truck	0.03%
standard haul truck	0.09%
Reel carrier, 4 reel	0.03%
Tensioner	0.27%
Puller	0.46%

Appendix I: CCF Ranges

This appendix summarizes work that was first introduced in previous unpublished HSOAC analysis. Its contents summarize the assumptions for construction cost factors (CCFs), which when applied to labor or equipment unit rates, such as from BLS, RSMeans and bid data, provide comparable benchmarks for labor and equipment rates used in our analysis. Data for the ranges in this report come from three sources: FEMA (principally the CEF Guide for Large Projects Instructional Guide V2.1), RSMeans (2018), and Compass International (2018). With respect to the Location Bonus, we could not locate any external, authoritative data. Leveraging our own experience and judgment, we elected to supply a range based on our existing knowledge into the applicable dynamics. The ranges reported and calculated here should not be viewed as absolute: actual practices may differ.[33] Table I.1 presents CCF values for labor while Table I.2 presents CCF values for equipment.

[33] These values are not in line with the FEMA Center of Excellence (COE) guidance, and need to be updated when those are made officially available.

Table I.1 Labor Construction Cost Factor Build-up

	Element	Low	High	Accumulates to factor for:
Overhead and Profit	Wages (direct pay)	1	1	*BLS wage*
	Fringe Benefits (e.g. vacation) #	15%	30%	*RSMeans base rate*
	Workers Comp. #,^	15%	20%	*RSMeans base rate with O&P*
	Wage Overhead (e.g. FICA) ^	18%	18%	
	Home Office Overhead #,^	15%	20%	
	Installer Profit ^	5%	15%	
	Location Factor *	0.30	1.00	*CEF Part A*
Other indirect costs, escalation, and contingency per CEF Parts B-H	Temporary Services (B.1) *	0%	1%	
	Risk/Contingency (C.1) *	2%	10%	
	Access, Storage and Staging (C.3) *	0%	12%	
	General & Administrative (Corp Overhead) (D.1) *	8%	8%	
	Insurance and Performance Bonds (D.2) *	3%	3%	
	GC Profit (D.3) *	3%	3%	
	Escalation (E)[34] *	2%	2%	
	Construction Permit Fees / Tax (F.2) *	9%	9%	
	Small Tools Allowance #	2%	6%	*Firm's straight rate CCF without overtime*
	Location Bonus *(R)*	0%	10%	
CCFs	Straight Time Average CCF	0.65	3.45	
	CCF on 8 hrs. OT (overhead removed)	0.76	5.42	
	Emergency, from BLS Wages	0.72	4.72	Assumes standard pay + overtime, with 16 hour days, 7 days per week
	Emergency, from RSMeans Base	0.63	3.63	

Sources: ^ = RSMeans, * = FEMA, (R) = RAND Estimate

The data used in the calculation of ranges was provided by FEMA (FEMA, 2009) and RSMeans (RSMeans, 2018). HSOAC made ancillary calculations using data where necessary.

[34] Escalation is a function of project length. Here, a 2-month project length is assumed.

Table I.2 Equipment Construction Cost Factor Build-up

	Element	Low	High	Accumulates to factor for…
	RMS Means Standard Weekly Rate at 5 Days/Week	1	1	
Time	Percentage O&M Cost in Rental Rate / Day ^, *(R)*	20%	41%	*These values reflect equipment bid with fuel. O&M factors are set to zero for equipment bid without fuel*
	Base Rental Rate Adjusted for 6 days/week	67%	49%	*RSMeans base rate adjusted for 10-hour days, 6 days per week*
	Base Rental Rate Adjusted for 7 days/week	57%	42%	*RSMeans base rate adjusted for 16-hour days, 7 days per week*
Other indirect costs, escalation, and contingency per CEF Parts B-H	Temporary Services (B.1) *	0%	1%	
	Risk/Contingency (C.1) *	2%	10%	
	Access, Storage and Staging (C.3) *	0%	12%	
	Insurance and Performance Bonds (D.2) *	3%	3%	
	General & Administrative (Corp Overhead) (D.1) *	8%	8%	
	GC Profit (D.3) *	3%	3%	
	Escalation (E) *	2%	2%	
	Construction Permit Fees / Tax (F.2) *	9%	9%	
	Equipment Tax *	12%	12%	*Firm's equipment CCF*
	Offset from RSMeans and PREPA Standard Rates ^, *(R)*	-44%	60%	*Include only for PREPA CCFs*
CCF	Emergency, from RSMeans Rates	1.11	1.46	*O&M, rental rate based on 16 hours days, 7 days per week. These values are appropriate for equipment bid with fuel; the range becomes 1.03-1.25 for equipment bid without fuel.*
	Emergency, from PREPA Standard Rates	0.62	2.34	*These values are appropriate for equipment bid with fuel; the range becomes 0.58-2.01 for equipment bid without fuel.*

Appendix J: Standard Union Prices for RSMeans Crews Across 2017-2018

This appendix contains the Standard Union Prices for RSMeans Crews during the 2017-2018 period of the MSA. RSMeans values for crews are annually updated by Gordian. As such, all rates are expressed in 2017 dollars by applying an adjusted discount rate of 2.5% to 2018 rates. After an adjustment, only rates for pickup trucks, crew trucks, and 12T cranes changed by more than 5% across the period. There are zero instances where individual labor rates changed more than 3% or crew rates changed more than 2% overall.

Table J.1 Adjusted Standard Union Prices for RSMeans Crews, 2017-2018

Crew Item (Quantity)	Daily Costs (Standard Union)		Percentage change between years
B87	**201735, Full Year**	**201836, Full Year, Adjusted[37]**	**2017 to 2018**
Common Building Laborer (1)	$318.80	$320.19	0.4%
Equipment Operator, Medium Equipment (4)	$1,720.00	$1,719.12	-0.1%
Feller Buncher, 100 Horsepower (2)	$1,620.80	$1,566.92	-3.4%
Log Chipper, 22" tree (1)	$764.80	$750.85	-1.9%
Dozer, 105 Horsepower (1)	$608.00	$594.46	-2.3%
Chainsaw, gas, 36" long (1)	$46.40	$45.48	-2.0%
Total	**$5,078.80**	**$4,997.02**	**-1.6%**
R5			
Electrician Foreman (1)	$469.60	$472.29	0.6%
Electrician Linemen (Electrician) (4)	$1,862.40	$1,873.56	0.6%
Electrician Operators (Electrician) (2)	$931.20	$936.78	0.6%
Electrician Groundmen (Helpers Average) (4)	$1,209.60	$1,212.12	0.2%
Crew Truck (1)	$166.00	$150.49	-10.3%
Flatbed truck (1)	$197.20	$194.46	-1.4%
Pickup truck (1)	$115.20	$107.15	-7.5%
Hyd. Crane (55 Ton) (0.2)	$198.76	$191.39	-3.8%
Hyd. Crane (12 Ton) (0.2)	$99.20	$91.99	-7.8%
Earth Auger, Truck-Mtd (0.2)	$74.76	$75.24	0.6%
Tractor w/ Winch (1)	$361.80	$359.29	-0.7%
Total	**$5,685.72**	**$5,664.77**	**-0.4%**
R6			
Electrician Foreman (1)	$469.60	$472.29	0.6%

35 RSMeans (2018) reflecting data collected in 2017

36 RSMeans (2019) reflecting data collected in 2018

37 Discount rate is 2.5%

Electrician Linemen (Electrician) (4)	$1,862.40	$1,873.56	0.6%
Electrician Operators (Electrician) (2)	$931.20	$936.78	0.6%
Electrician Groundmen (Helpers Average) (4)	$1,209.60	$1,212.12	0.2%
Crew Truck (1)	$166.00	$150.49	-10.3%
Flatbed truck (1)	$197.20	$194.46	-1.4%
Pickup truck (1)	$115.20	$107.15	-7.5%
Hyd. Crane (55 Ton) (0.2)	$198.76	$191.39	-3.8%
Hyd. Crane (12 Ton) (0.2)	$99.20	$91.99	-7.8%
Earth Auger, Truck-Mtd (0.2)	$74.76	$75.24	0.6%
Tractor w/ Winch (1)	$361.80	$359.29	-0.7%
Tensioning rig (0.5)	$474.70	$462.83	-2.6%
Cable pulling rig (0.5)	$2,678.33	$2,611.37	-2.6%
Total	**$9,079.15**	**$8,973.36**	**-1.2%**
R7			
Electrician Foreman (1)	$469.60	$472.29	0.6%
Electrician Groundmen (Helpers Average) (5)	$1,512.00	$1,515.15	0.2%
Crew Truck (1)	$166.00	$150.49	-10.3%
Total	**$2,147.60**	**$2,137.93**	**-0.5%**
R8			
Electrician Foreman (1)	$469.60	$472.29	0.6%
Electrician Linemen (Electrician) (3)	$1,396.80	$1,405.17	0.6%
Electrician Groundmen (Helpers Average) (2)	$604.80	$606.06	0.2%
Pickup truck (1)	$115.20	$107.15	-7.5%
Crew Truck (1)	$166.00	$150.49	-10.3%
Total	**$2,752.40**	**$2,741.16**	**-0.4%**
R10			
Electrician Foreman (1)	$469.60	$472.29	0.6%
Electrician Linemen (Electrician) (4)	$1,862.40	$1,874.73	0.6%
Electrician Groundmen (Helpers Average) (1)	$302.40	$303.22	0.2%
Crew Truck (1)	$166.00	$150.49	-10.3%
Tram Cars (3)	$433.80	$427.90	-1.4%
Total	**$3,234.20**	**$3,229.02**	**0.2%**
R11			
Electrician Foreman (1)	$469.60	$472.29	0.6%
Electrician (4)	$1,862.40	$1,873.56	0.6%
Equipment Operator, Crane or Shovel (1)	$448.80	$448.11	-0.2%
Common Building Laborer (1)	$318.80	$320.19	0.4%
Crew Truck (1)	$166.00	$150.49	-10.3%
Hyd. Crane, 12 Ton (1)	$496.00	$459.96	-7.8%
Total	**$3,761.60**	**$3,724.60**	**-1.0%**

Appendix K: Cobra's Headcount by Labor Type During 2017 Period of Performance

The table below lists Cobra's headcounts by labor type during a specified period of performance in the initial timeframe of the MSA.

Table K.1 Cobra Headcount by Crew Type During 2017 Period of Performance

Invoice Date	Lineman	Security	Logistics	Management
11/7/2017	250	104	50	30
11/8/2017	250	104	50	30
11/9/2017	250	104	50	30
11/10/2017	250	104	50	30
11/11/2017	300	104	50	30
11/12/2017	299	104	50	30
11/13/2017	381	134	50	30
11/14/2017	380	134	50	30
11/15/2017	380	134	50	30
11/16/2017	483	134	50	30
11/17/2017	486	134	50	30
11/18/2017	486	134	50	30
11/19/2017	485	134	50	30
11/20/2017	485	134	50	30
11/21/2017	486	134	50	30
11/22/2017	485	134	50	30
11/23/2017	485	134	50	30
11/24/2017	485	134	50	30
11/25/2017	486	194	50	30
11/26/2017	480	194	50	30
11/27/2017	477	194	50	30
11/28/2017	484	194	50	30
11/30/2017	483	194	50	30
12/1/2017	533	194	50	30
12/2/2017	644	194	50	30
12/3/2017	649	194	50	30

Appendix L: Example Calculation of a Representative Blended Rate Range

Table L.1., below, illustrates the calculation of the low and high values of a representative range of blended daily rates for quantities of labor and equipment specified for a R5 Standard Crew (RSMeans 2018), given unit rates from RSMeans (2018) and BLS (2019) and bidders on the subsequent RFP from PREPA. A R5 Standard Crew is identified in several unit lines in the RSMeans database for facilities construction costs for work by skilled electrical linemen to install insulators, hardware, conductor and overhead ground wire as well as pulling and tensioning high voltage lines. Calculations require labor and equipment CCFs appropriate to emergency repair work and benchmarks from the data sources named above.

Table L.1 Example Calculation of a Representative Blended Rate Range

Labor	Daily Quantity (QL)	Hourly Wages (W)		Hrs	LCCF		QL*W*Hrs*LCCF	
		Low[38]	High[39]		Low	High	Low	High
Electrician Foreman	1	44.21	58.70	16	0.72	3.63	509.30	3,409.30
Electrician Lineman	4	40.38	58.20	16	0.72	3.63	1,860.71	13,521.02
Electrician Operator	2	21.33	56.10	16	0.72	3.63	491.44	6,516.58
Electrician Groundman	4	34.15	37.80	16	0.72	3.63	1,573.63	8,781.70
Sum	**11**					**sum**	**4,435.08**	**32,228.59**
Equipment	**Daily Quantity (QE)**	**Hourly Rental (R)**			**ECCF**		**QE*R*Hrs*ECCF**	
		Low	**High**	**Hrs**	**Low**	**High**	**Low**	**High**
Crew Truck58	1	15.84	15.84	16	1.03	1.25	261.04	316.80
Flatbed Truck58	1	27.12	27.12	16	1.03	1.25	446.94	542.40
Pickup Truck58	1	15.84	15.84	16	1.03	1.25	261.04	316.80
Hyd. Crane 55T [40]	0.2	250.00	424.00	16	0.58	2.01	464.00	2,727.17
Hyd. Crane 12T58	0.2	68.20	68.20	16	1.03	1.25	224.79	272.80
Earth Auger, Truck Mounted[41]	0.2	80.36	103.60	16	0.58	2.01	149.15	666.36
Tractor w/winch[42]	1	60.00	145.00	16	0.58	2.01	556.80	4,663.20
						sum	**2,363.76**	**9,505.52**
The range of blended rates ($/person-day) is bounded by low and							**Low**	**High**
high values of **(sum_QL*R*Hrs*LCCF + sum_QE*R*Hrs*ECCF) / sum_QL**							**618.08**	**3,794.01**

38 The low labor rate benchmarks are from BLS (2019)

39 The high labor rate benchmarks as well as equipment benchmarks for crew truck, flatbed truck, pickup truck, 12 Ton hydraulic crane are from RSMeans (2018)

40 The low equipment benchmark for 55T hydraulic crane is from Cobra (2018) and high benchmark is from Foreman 2018)

41 The low equipment rate benchmark for truck-mounted earth auger is from ARC (2018) and high is from Cobra (2018)

42 The low equipment rate benchmark for tractor with winch is from ARC (2018) and the high is from Higher (2018)

Appendix M: Vector Methods for Combining Blended Rate Inputs

In this appendix, we have defined the blended rate inputs as vectors, both for the sake of conciseness but also to allow for additional methods of analysis. A more detailed algebraic derivation of blended rates was reported in previous unpublished HSOAC analysis, and has been reproduced in Appendix A of this report. Here, we use vectors to represent one-dimensional matrices of rate, CCF, and quantities to compute different formulations of blended rates under different assumptions, given data reflecting these assumptions in tabular form. The dot-product of vectors is calculated with the SUMPRODUCT function in Microsoft Excel.

Let **B** be the blended rate computed from vectors **E, F, H, L and R**, where:

R is the vector of hourly labor and equipment rental rates
H is the vector of daily hours (e.g. 8 hours for a regular work day)
F is the vector of construction cost factors
E is the vector of equipment quantities
L is the vector of labor headcounts

thus, $\mathbf{B = (R \cdot H \cdot L \cdot F + R \cdot H \cdot E \cdot F) / (L)}$, where " · " denotes the dot-product of the component vectors.

A blended rate can be computed by using any list of rates, hours, CCFs and quantities. This capability includes lists that describe subsets of quantities, such as those relating to a specific work crew. In this report, we identify crew quantities for equipment and labor based upon the specifications which have been defined by RSMeans standard crews. The crew blended rate $\mathbf{B_{crew}}$ is computed using vectors $\mathbf{L_{crew}}$, $\mathbf{E_{crew}}$, **F, H and R**, where:

R is the vector of hourly labor and equipment rental rates
H is the vector of daily hours (e.g. 8 hrs for a regular work day)
F is the vector of construction cost factors
E is the vector of equipment quantities *for the crew*
L is the vector of labor headcounts *for the crew*

thus, $\mathbf{B_{crew} = (R \cdot H \cdot L_{crew} \cdot F + R \cdot H \cdot E_{crew} \cdot F) / (L_{crew})}$

Blended rates can also be constructed in instances where a combination of crews is deemed necessary for completion of a specific job. The scaled project-level blended rate **S** is computed using three vectors, **P, B, C.** These vectors represent the various standard crews and their assets

needed to complete a given construction project. These values are establishing according to a Work Breakdown Structure (WBS):

P is the crew profile for a category of work, assembled according to WBS
$\mathbf{B}_{crew,i}$ is the vector of blended rates for i crews
$\mathbf{C}_i$ is the vector of crew i size
S is the blended rate, scaled to the work given by profile **P**

thus, $\mathbf{S} = (\mathbf{B}_{crew,i} \cdot \mathbf{C} \cdot \mathbf{P}) / (\mathbf{P} \cdot \mathbf{C})$

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U.S. Department of Homeland Security
Region II
FEMA-4336-DR-PR
FEMA-4339-DR-PR
P.O. Box 70105
San Juan, P.R. 00936-8105

FEMA

December 23, 2017

Mr. José I. Marrero, Esq., CPA
Governor's Authorized Representative
Government of Puerto Rico
P.O. Box 9023228
San Juan, PR 00902-3228

RE: FEMA-4339-DR-PR
Puerto Rico Electric Power Authority – Emergency Power Restoration
Review of Contract and Funding for Cobra Energy

Dear Mr. Marrero:

Cobra Energy entered into a contract with the Puerto Rico Electric Power Authority (PREPA) on October 19, 2017 to perform emergency repairs to the transmission and distribution systems throughout Puerto Rico as a result of Hurricane Maria. Since the start of the incident period, the majority of Puerto Rico has been without power and there are limited resources available for power restoration on the island. Cobra Energy is currently performing critical emergency repairs to transmission lines that are essential to the restoration of the overall system to transmit and distribute electric power throughout Puerto Rico.

At the request of PREPA, the Federal Emergency Management Agency (FEMA) reviewed the Cobra Energy contract, amendment, and rates for service. Under the exigent circumstances after Hurricane Maria, PREPA awarded this contract in compliance with the emergency procurement provisions of the Commonwealth of Puerto Rico and Executive Orders issued as a result of the disaster. FEMA has also determined the costs under this contract to be reasonable.

FEMA prepared Project Worksheet (PW) #251 for emergency repairs to transmission and distribution lines for $200,000,000 including the Cobra Energy and anticipate it will be obligated soon. As of today, Cobra Energy has billed PREPA $174 million and has indicated that it cannot continue to provide services without assurances that payment is forthcoming. Puerto Rico must provide an SF-270 draw down request to FEMA with validated, supporting documentation within 1 day of the obligation of PW #251.

Should you have any questions or require further assistance, please contact Mrs. Ana Luz Morales, Infrastructure Branch Director, at (787) 296-3500 or ana.morales@fema.dhs.gov.

Sincerely,

Michael Byrne
Federal Coordinating Officer
FEMA-4339-DR-PR