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July 13, 2020

VIA ELECTRONIC FILING

Mr. Adam Teitzman, Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

In re: *Petition by Duke Energy Florida, LLC for Approval of Actual Storm Restoration Costs and Associated Recovery Process Related to Hurricane Michael and Tropical Storm Alberto*; Docket No. 20190110-EI

Dear Mr. Teitzman:

On behalf of Duke Energy Florida, LLC ("DEF"), please find enclosed for electronic filing in the above-referenced docket, DEF's *revised*[1] redacted direct testimony and redacted exhibits of the Office of Public Counsel's witness, Helmuth Schultz, III.

Thank you for your assistance in this matter. Please feel free to call me at (813) 227-8114 should you have any questions concerning this filing.

Respectfully,

Shutts & Bowen LLP

/s/ Daniel Hernandez

Daniel Hernandez

Enclosure (as noted)

[1] A revised version is being filed due to technological issues with the redactions contained within the version previously filed on July 10, 2020 (DN 03727-2020).

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Petition by Duke Energy Florida, LLC, for limited proceeding for recovery of incremental storm restoration costs related to Hurricane Michael.	Docket No. 20190110-EI Filed: June 19, 2020

REDACTED

DIRECT TESTIMONY

OF

HELMUTH SCHULTZ III

ON BEHALF OF THE OFFICE OF PUBLIC COUNSEL

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DIRECT TESTIMONY

OF

Helmuth W. Schultz, III

On Behalf of the Office of Public Counsel

Before the

Florida Public Service Commission

Docket No. 20190110-EI

I. STATEMENT OF QUALIFICATIONS

Q. PLEASE STATE YOUR NAME, OCCUPATION, AND BUSINESS ADDRESS.

A. My name is Helmuth W. Schultz, III. I am a Certified Public Accountant licensed in the State of Michigan and a senior regulatory consultant at the firm Larkin & Associates, PLLC, ("Larkin") Certified Public Accountants, with offices at 15728 Farmington Road, Livonia, Michigan, 48154.

Q. PLEASE DESCRIBE THE FIRM LARKIN & ASSOCIATES, P.L.L.C.

A. Larkin performs independent regulatory consulting primarily for public service/utility commission staffs and consumer interest groups (public counsels, public advocates, consumer counsels, attorney generals, etc.). Larkin has extensive experience in the utility regulatory field providing expert witnesses in over 600 regulatory proceedings, including water and sewer, gas, electric and telephone utilities.

Q. HAVE YOU PREPARED AN EXHIBIT WHICH DESCRIBES YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE?

A. Yes. I have attached Exhibit No. HWS-1, which is a summary of my background, experience and qualifications.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE FLORIDA PUBLIC COMMISSION AS AN EXPERT WITNESS?

A. Yes. I have provided testimony before the Florida Public Service Commission ("Commission" or "FPSC") as an expert witness in the area of regulatory accounting and storm recovery in numerous cases as listed in Exhibit No. HWS-1.

Q. BY WHOM WERE YOU RETAINED, AND WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. Larkin was retained by the Florida Office of Public Counsel ("Citizens" or "OPC") to review the request for recovery of the 2018 storm costs in this docket, which is a request for $196,234,000 of costs, inclusive of interest, associated with Hurricane Michael and Tropical Storm Alberto, submitted for recovery by Duke Energy Florida, LLC (the "Company" or "Duke")[1]. Accordingly, I am testifying on behalf of the OPC who is the statutory representative of the customers of Duke.

[1] Company Exhibit No. TM-1.

II. CASE BACKGROUND

Q. PLEASE SUMMARIZE YOUR UNDERSTANDING OF THE COMPANY'S REQUEST.

A. Docket No. 20190110-EI is described as a petition by Duke for recovery of incremental storm costs during the restoration of service associated with Hurricane Michael and Tropical Storm Alberto. The net costs sought for recovery by Duke for Hurricane Michael and Tropical Storm Alberto are $190,774,000 and $571,000, respectively.

Q. CAN YOU PLEASE DESCRIBE YOUR UNDERSTANDING OF THE TIMING OF DUKE'S RECOVERY OF THE COSTS THAT ARE APPROVED IN THIS DOCKET?

A. Yes. Through a series of settlements, DEF is effectively already receiving cash recovery of the costs that they claim they should recover in the petition they filed on November 22, 2019. In 2017, Duke entered into a settlement entitled Revised and Restated Stipulation and Settlement Agreement ("RRSSA"). It was approved by the Commission in Order No. PSC-2017-0451-AS-EU. This settlement contains a provision in Paragraph 38.c that is commonly referred to as the Storm Cost Recovery Mechanism or "SCRM." This provision allows the company to file an ***estimated*** amount of storm cost recovery as soon as possible on an ***interim*** basis and upon that initial approval, Duke can begin collecting the storm restoration costs, subject to the determination of final approved costs in the final hearing. Duke did just that and, pursuant to Order No. PSC-2019-0268-PCO-EI, Duke was authorized to recover the estimated Michael and Alberto costs on a purely interim basis. The Commission approved the collection of the $191 million in revenue without any evidence or proof

of expenditures (per the SCRM) with the full expectation that Duke would be required to prove-up its actual costs. It is my understanding that this front-ended cost recovery process was never intended to shift the burden of proof away from Duke and onto the customers, nor was it intended to create a presumption of correctness with the Company's invoices or its estimates.

Q. IS IT TRUE THAT THE SCRM MECHANISM MEANS THAT DUKE IS EFFECTIVELUY RECOVERING THE COST FOR HURRICANE MICHAEL AND TROPICAL STORM ALBERTO NOW?

A. Yes, that is absolutely true. Another provision in the RRSSA, Paragraph 16, required Duke to return the tax savings associated with the December 2017 Tax Cuts and Jobs Act ("TCJA") to customers, net of certain accelerated depreciation costs. This net tax savings amount is $154.7 million annually. Less than two weeks after the execution of the RRSSA, Hurricane Irma struck Florida, and Duke and the signatories subsequently agreed to use the TCJA savings to pay for the restoration costs. This has resulted in recovery of approximately $352 million in costs associated with Hurricane Irma at the rate of $154.7 million per year. The original intent of this post-RRSSA stipulation was to also include the replenishment of the storm reserve in the amount of $132 million in the recovery using the customers' TCJA funds. Unfortunately, in October 2018, Hurricane Michael struck and created additional significant costs. The parties then decided, pursuant to another stipulation, that the replenishment of the storm reserve would be deferred until after the cost of Michael was fully recovered. This means that in the Spring of 2020 (after Irma was fully paid for) the customers' annual tax savings began paying the cost of Michael at the rate of approximately $12.9 million per month.

In effect, Duke is currently receiving full cost recovery (including a carrying cost in the form of a short-term debt rate) of Hurricane Michael storm restoration costs.

Q. DOES THIS CREATE A CONCERN FOR YOU AND WHAT IS YOUR RECOMMENDED METHOD OF ADDRESSING THIS CONCERN?

A. Yes. I believe that the SCRM approach, while a reasonable method of recovery that keeps customer bills moderated, has created a situation where the Company has an inadequate incentive to control costs in the times immediately preceding, during and after a storm event. Some of my adjustments are designed to correct this situation and to hold the Company to its burden of proof in instances where it has failed to demonstrate that it adhered to at least a minimum standard of care in controlling costs. I also demonstrate where Duke has inadequately justified the costs it seeks to classify as recoverable under the SCRM in order to retain the revenues it is recovering associated with those costs. I am recommending that the Commission order Duke to refund any dollars that have been over-collected as a result of the Commission's July 2019 provisional, interim rate approval, where the invoice and contractor management process has not been prudently managed or when the Company has failed to meet its burden of proof.

Q. PLEASE SUMMARIZE WHAT THE COMPANY HAS INCLUDED IN ITS REQUEST TO THE FLORIDA PUBLIC SERVICE COMMISSION?

A. On April 30, 2019 Duke filed a petition seeking recovery of $221 million (retail) before interest and regulatory assessment fees in incremental storm restoration costs related to Hurricane Michael beginning the first billing cycle of July 2019. On November 22,

2019, Duke filed a revised petition along with direct testimony requesting recovery of $191 million as Recoverable Storm Costs plus estimated interest costs of $5 million for a total of $196 million. The revised petition also included a new request for $571,000 of costs associated with Tropical Storm Alberto. As I discussed earlier, the use of a series of negotiated mechanisms delayed the actual beginning date of cash recovery of the storm restoration costs for these storm events to the Spring of 2020.

Q. ARE YOU AWARE OF DUKE SUBMITTING A SUPPLEMENTAL FILING IN MAY 2020?

A. Yes, I am. I reviewed that filing and, while my schedules are based on the filing made in November 2019, some of the changes made by Duke are already incorporated into my recommendations. For example, the $1.7 million adjustment to distribution costs for invoices not applicable to restoration in Florida were the result of the discovery process. I have also reflected the $940,000 reclassification, again something identified during discovery. There is an adjustment to overhead charges of $718,000 for transmission which is very similar to an adjustment where I recommend an increase in restoration costs. The other changes consist of a $499,000 increase in transmission contractor costs, a net increase of $100,000 in various other transmission costs and a $400,000 decrease to distribution contractor costs to account for a reduction in an estimated cost. The increases requested by Duke are a concern since its filing of what is effectively a second supplemental petition on May 19, 2020 did not provide an opportunity for follow up discovery and is, in fact, not supported by any documentation supplied to date. The decrease is also a concern since, as is discussed throughout my

testimony, Duke has been recovering costs from ratepayers based on the earlier filed costs and this is evidence as to why there is a need for an in-depth review of costs.

Q. WILL YOU BE ADDRESSING THE ENTIRETY OF THE COMPANY'S REQUEST?

A. Yes, I am. The type of costs requested will be discussed by classification as well as the overall appropriateness of the request to keep all of the revenues provisionally authorized. I will discuss the appropriateness of the request first. I will then discuss the requested recovery of the storm costs. To the extent any of the storm costs are determined to be inappropriate, the current provisional collection of costs must be reduced by refunding the recommended disallowance. I have not challenged the interest costs. Finally, I will identify the total amount that the Commission should find has been over-collected and should, therefore, be refunded to customers.

III. STORM RESTORATION COSTS

Q. HOW HAVE YOU PRESENTED YOUR ANALYSIS OF STORM RESTORATION COSTS?

A. My analysis of costs is presented in a format similar to that shown on the Company's summary provided on Company Exhibit No. TM-2. That summary separates the costs by type of cost. My analysis also includes separate schedules analyzing the various cost categories.

Q. PLEASE BRIEFLY DESCRIBE THE ISSUES YOU WILL BE ADDRESSING IN THIS PROCEEDING.

A. I am addressing the sufficiency of Duke's evidence offered in support of its provisional, interim recovery of costs related to payroll, overhead, benefits, contractors, line clearing, materials and supplies, logistics and other items as reflected in its petition. In addition to evaluating recoverability of costs through the SCRM, I will address the capitalization of costs. As part of my analysis, I relied on my experience in analyzing storm costs in other jurisdictions, past review of storm costs in Florida, and Rule 25-6.0143, Florida Administrative Code ("F.A.C."), which addresses what costs can be included and excluded from a utility's request for recovery of storm related costs. Additionally, I factored into my analysis and consideration the Company's application of the Storm Cost Settlement Agreement approved in Docket No. 20170272-EI ("Agreement") and the proper application of that Agreement.

Q. WOULD YOU IDENTIFY SOME IMPORTANT CONSIDERATIONS THAT WERE FACTORED INTO YOUR EVALUATION OF COSTS?

A. Yes. The first major factor is the chronology of the Hurricane Michael timeline. When determining whether the costs and the response were appropriate, the following dates as presented by the Company need to be considered:

- October 5 (Friday): Organization was put on notice for potential activation. Operational leaders and Meteorology team continued to monitor forecast updates.

- October 6 (Saturday): Operational leaders and Meteorology team continued to monitor forecast updates.

- October 7 (Sunday): Duke Energy's Incident Management Team and storm organization fully activated.

- October 8 (Monday): Restoration resource commitments secured via existing vendor contracts and the first SEE mutual assistance call. Off-system resources prepare for travel.

- October 9 (Tuesday): Off-system resources travel to mustering sites and other designated locations a safe distance from Hurricane Michael's path.

- October 10 (Wednesday): Hurricane Michael made landfall. Off-system resources travel to mustering sites and other designated locations a safe distance from hurricane Michael's path.

- October 11 (Thursday): Restoration work commenced.[2]

Power was restored by 4:30 pm October 14 to all but 14,800 customers (compared to a peak of 71,000 who were without power) and was restored to essentially all customers available to receive power by October 18.[3] This timeline provides an insight as to when it would be reasonable for Duke to begin and end incurring the majority of costs associated with the restoration of service, especially those costs paid to external sources.

Another major factor I considered is the timing of how another utility responded to Hurricane Michael with acquiring external resources and in the restoration of service to customers. Hurricane Michael had a significant impact on not only Duke but also Florida Public Utilities Company ("FPUC").

[2] Company response to Citizens' Interrogatory No. 1-1.
[3] November 22, 2019 Petition at Page 5, Paragraph 13.

The next major factor is information included in the filings by Duke and how the Company replied to discovery and whether the costs were sufficiently supported. This is a critical factor as the costs in question are significant and the Company has a fiduciary duty to its ratepayers to make sure that the costs are reasonable and prudently incurred. This factor took into consideration my familiarity with previous issues and areas of concern in evaluating Duke's cost request in Docket No. 20170272-EI and the Agreement that resulted from that proceeding. In that docket, the areas upon which I focused were the time allowed for travel, the amount of costs for mobilization, demobilization and standby time in relation to the total costs incurred and capitalization of restored plant. Following up on what transpired in Docket No. 20170272-EI, consideration was given to the Company's review of costs. These are just some of the major points considered.

Q. HOW DID YOU FACTOR IN THE TIMING OF HOW ANOTHER UTILITY RESPONDED TO HURRICANE MICHAEL AS PART OF YOUR ASSESSING DUKE'S RESPONSE?

A. It is common for a utility to claim that getting contractor crews in place prior to a storm impacting its system. I noted as part of my review of FPUC that mobilization was minimized and that a significant amount of the billings began after the storm impacted FPUC's system. This suggests that being overly proactive in committing contractors to respond is a distinct possibility.

Q. PLEASE SUMMARIZE YOUR RECOMMENDED ADJUSTMENTS?

A. As discussed earlier an added issue is the past and current collection of storm costs from Duke's ratepayers. The ongoing collection that was provisionally authorized on an interim basis only is based on the premise that the filing was 100% accurate. Based

on Duke's November 22, 2019 Petition for recovery and the April 30, 2019 Second Implementation Stipulation, the Michael and Alberto storm costs approved by the Commission plus the $132 million replenishment of the storm reserve are assumed to be completed no later than by the last billing cycle of December 2021. My recommendation to return customer overpayments via a refund should be interpreted to mean I am recommending the return of the money associated with the customers' overpayments in whatever manner is approved by the Commission and in a way that benefits the customers either by a direct bill credit or a shortening of the overall storm cost and reserve replenishment recovery period.

I recommend a reduction of $4,000 to Duke's request for payroll expense for costs, identified by Duke as non-incremental, that Duke did not adjust for, even though they are not incremental costs. This is discussed further below. I recommend a reduction of $450,000 to Duke's storm request related to labor burdens/incentives to reflect the appropriate classification as capital associated with capitalized distribution payroll since Duke failed to do so. I am recommending an increase to the restoration cost category of $715,000 since Duke capitalized more than what was reflected as incurred. I recommend returning to customers $6,105,055 related to distribution line contractor costs to adjust for Duke's failure to prudently control and prevent excessive mobilization/demobilization and excessive standby time. Likewise, customers are owed a refund of $1,929,118 for costs that were charged in error to the interim storm restoration estimate. I also recommend increasing the amount of contractor costs to be capitalized by $2,566,399. I recommend a reduction to Duke's storm request and a resulting refund of $430,524 related to distribution line clearing invoices that Duke failed to justify. Customers are owed a refund of $6,360,621 in distribution logistics

costs because Duke failed to provide sufficient supporting documentation. Other Distribution costs should be reduced by $199,000 because no supporting documentation was provided. A reduction and refund of $65,387 is made for a transmission line contractor cost that was a duplicate payment. I am also recommending an adjustment and refund of $3,243,044 to Transmission-Other for a cost only identified as "Non-Vendor" where Duke failed to provide any explanation, justification or supporting information. I further recommend a reduction and refund of $977,489 to transmission logistic costs because supporting documentation could not be located. Finally, I recommend a reduction and refund of $34,445,227 of transmission costs for an unsupported incremental adjustment made by Duke to the capital project cost total. Duke can still recover this cost from customers over the life of the project, but the amount should be returned to current customers as a refund since the initial interim revenue collection estimate was significantly overstated. In total, I recommend a net reduction of at least $56,083,000 to Duke's overall storm restoration and reserve replenishment request and a corresponding refund to customers. On a jurisdictional basis, storm restoration costs should be reduced by a net amount of at least $44,675,000 and the refund should be at least $44,675,000 plus interest at the same rate applied by Duke in its request. If this refund is effectuated by shortening the recovery period, then based on collection at the rate of $12.9 million per month, it would reduce the recovery period by 3.5 months. Otherwise, a credit on the bill of this amount would be appropriate. I should note that, aside from the specific adjustments I have summarized here, there remain evidentiary deficiencies for some portions of the ongoing provisional, interim revenue collection. For this reason, additional refunds may be necessary. The specific adjustment or refund amounts are generally identified in the

body of my testimony on a total company basis but are jurisdictionalized in my schedules. I am not recommending that any specific adjustment be refunded to retail customers on a "total company" or "system" basis.

a. Payroll

Q. WHAT HAS THE COMPANY REQUESTED FOR RECOVERY OF PAYROLL COSTS AS PART OF ITS REQUEST?

A. Duke's storm restoration cost request includes $2,383,000 of regular payroll costs and $5,160,000 of overtime payroll costs. Excluded from Duke's request is $1,827,000 of payroll that was deemed non-incremental ($1,142,000 regular and $681,000 overtime); therefore, the net total payroll being requested is $974,486 prior to an adjustment for capitalization. Additionally, the request includes a net request for Labor Burdens/Incentives of $3,377,000, consisting of $4,193,000 of incurred costs reduced by $816,000 determined to be non-incremental. Based on Rule 25-6.0143, F.A.C., (the "Rule") only incremental costs are to be included in the request for recovery of storm costs.

Q. IN YOUR OPINION, WHAT INCREMENTAL PAYROLL COSTS ARE RECOVERABLE UNDER RULE 25-6.0143(1), F.A.C.?

A. Rule 25-6.0143, F.A.C., identifies the costs that are allowed and those that are prohibited from storm cost recovery including through the use of the Incremental Cost and Capitalization Approach methodology ("ICCA"). Rule 25-6.0143(1)(d) provides that "the utility will be allowed to charge to Account No. 228.1 costs that are incremental to cost normally charged to non-cost recovery clause operating expenses

in the absence of the storm." This means costs that are recovered as part of base rates are not incremental and are, therefore, not recoverable under the Rule. Additionally, Rule 25-6.0143(1)(f)1 prohibits "base rate recoverable payroll and regular payroll-related costs for utility managerial and non-managerial personnel" from being charged to the reserve and it prohibits recovery of "bonuses or any other special compensation for utility personnel not eligible for overtime." Based upon my 40-plus years of experience as an accountant in the utility field, incremental payroll costs are costs, as stated in the Rule, that are incremental to those normally charged to non-cost recovery clause operating expenses in the absence of a storm. This definition requires an evaluation to compare the amount of payroll currently included in a utility's applicable base rates to the amount of payroll charged to base rate O&M accounts during the period in which the storm occurred. This comparison will establish whether the payroll charged to the reserve is in excess of what is included in base rates such that those payroll dollars are incremental and thus eligible for storm cost recovery.

Q. ARE THERE CONCERNS WITH WHAT THE COMPANY IS REQUESTING?

A. Yes, there is a minor concern. According to Company witness Tom Morris, the payroll amount included in the Company's request included payroll dollars excluding bonuses adjusted for non-incremental payroll. This was determined by means of the three-year historical average (October 2015 to October 2017) of non-storm O&M base regular and overtime payroll compared to the actual non-storm amount charged to O&M base regular and overtime payroll in October 2018 for Transmission and Distribution ("T&D"). If the calculated average was higher than the amount incurred in October 2018, that difference was removed from reported restoration costs as the non-

incremental amount and charged to Income Statement O&M.[4] However, the Company failed to remove $4,000 of the non-incremental overtime as determined using the above described methodology.

Q. IS THE COMPANY-PROPOSED METHODOLGY CONSIDERED REASONABLE IN DETERMINING AN APPROPRIATE LEVEL OF PAYROLL TO BE INCLUDED IN STORM COST RECOVERY AND IN COMPLIANCE WITH RULE 25-6.0143, F.A.C?

A. Typically, I would make that determination based on the payroll that was factored into base rates when rates were last established. However, since DEF's base rates have resulted from a series of negotiated "black box" outcomes between 2010 and 2017, determining a base rate payroll starting point has proven to be a contentious issue. As a means of compromise, the use of the monthly average in comparison to the storm month costs in O&M is considered a reasonable surrogate to make a determination of whether or not the storm payroll includes non-incremental payroll dollars.

Q. WHAT IS THE ORIGIN OF THE COMPANY'S PROPOSED METHODOLGY?

A. As I stated earlier, there were issues identified in Docket No. 20170272-EI that were similar in nature to issues in this proceeding. In the 2017 docket, I proposed the use of payroll from Duke's last filed rate case and Duke proposed the use of an average of payroll costs for the month of storm from the last three years. The basis for Duke's

[4] November 22, 2019 testimony of Tom Morris at pages 7 and 8.

position was that the Rule specified the benchmark for tree trimming would be determined in that manner. In resolving that issue for the 2017 case and going forward, the averaging methodology was included in the Storm Restoration Cost Process Improvements ("Process Improvements") contained in the Agreement and approved by the Commission.

Q. ARE THE PROCESS IMPROVEMENTS ENUMERATED IN THE AGREEMENT APPLICABLE TO THE COST INCLUDED IN THE COMPANY'S CURRENT REQUEST?

A. No. They would not be since the Agreement was executed after Hurricane Michael impacted Duke. However, I would note that the Company has selectively used the Agreement as a basis for costs that are being requested for recovery in this docket. For example, the response to Citizens' Interrogatory No. 4-128 referenced the Agreement as justification for including exempt overtime in the Company's request.

Q. IF THE AGREEMENT IS NOT APPLICABLE TO THIS REQUEST AND YOU INDICATED THAT YOUR PREFERENCE WAS TO USE PAYROLL INCLUDED IN DUKE'S BASE RATES IN DETERMINING THE INCREMENTAL AMOUNT, WHY HAVEN'T YOU IDENTIFIED THAT AS AN ISSUE?

A. First, Duke did not provide the base rate costs as requested in response to Citizens' Interrogatory No. 1-27. Instead, the response rationalized not providing the information by referencing Duke's multiple settlements that have been executed and by stating the method was consistent with the ICCA. Rule 25-6.0143(1)(d), F.A.C.,

provides specific guidance as to what costs are recoverable. Specifically, under the ICCA, costs charged to cover storm-related damages shall exclude those costs that normally would be charged to non-cost recovery clause operating expenses in the absence of a storm. There is no specific method for determining incremental payroll under the ICCA as Duke alleges. In fact, Rule 25-6.0143(1)(f)(1) specifically prohibits base rate recoverable regular payroll and regular payroll-related costs for utility managerial and non-managerial personnel. Since Duke chose not to provide the payroll included in current base rates, it has effectively failed to justify inclusion of any payroll as part of its request.

Q. BASED ON YOUR EXPLANATION, SO FAR IT WOULD SEEM AN ISSUE DOES EXIST, SO AGAIN, I WOULD ASK WHY HAVEN'T YOU IDENTIFIED THAT AS AN ISSUE?

A. In an attempt to reasonably address issues in this docket and since Duke was relying on the Agreement as justification for determining what costs should be allowed as incremental or for recovery, I believe that a fair and reasonable guideline for evaluating costs is to follow the Process Improvements agreed to by Duke and OPC in the 2019 Agreement, especially with respect to costs. I would note that, in response to Citizens' Interrogatory No. 2-48, Duke explains how non-incremental amounts were determined for as follows:

> Even though the Storm Settlement was finalized after both Michael and Alberto occurred, *Distribution and Transmission took efforts to incorporate that agreement into the calculation of the non-incremental costs.*
>
> For regular payroll, overtime, labor burdens and Vegetation Management the non-incremental amounts were calculated using a three-year average (2015-2017) of the actual O&M costs incurred in the month of the storm and that

> was compared to the actual O&M costs incurred in the month of the storm in 2018 for Distribution and Transmission respectfully. If the three-year average was higher than the amount incurred in 2018, then that net difference became the non-incremental amount. If the three-year average was less than the amount incurred in 2018, then no non-incremental costs were removed.
>
> If the non-incremental amount exceeded the actual amount charged to the storm project, the non-incremental amount was capped at the amount charged to the storm project.
>
> Incentives/Bonuses charged to the storm project were removed and considered non-incremental.
>
> Overhead allocations related to Duke Energy Florida are considered non-incremental except for the portion that becomes part of the capital calculation. Fleet allocation costs related to Duke Energy Florida are comprised of 4 components (Repair & Maintenance, Leasing/Ownership Costs, Depreciation, Fuel). Only the fuel component can be recovered through the storm reserve. Therefore, the remaining three components are considered non-incremental and removed. Transmission removed all of their fleet allocation costs.

(Emphasis added)

Duke has the burden of justifying why it should retain the funds that customers are providing up-front to recover its estimated storm restoration costs. I respect the Company's decision to factor the Agreement provisions into its effort to meet that burden. I also believe that it would be reasonable and consistent for the Commission to recognize the Process Improvements across-the-board. For that reason, I will follow this approach in my evaluation of costs and my recommendations throughout this testimony. That said, if it is determined that adhering to the provisions of the Agreement is not required or allowed by the Commission (i.e. Duke could pick and choose which provisions to apply), then I recommend the Company's request be reduced by $5,716,000, absent evidence of the amount of O&M payroll included in base rates and the amount of O&M payroll incurred in 2018 .

Q. THE DISCOVERY RESPONSE YOU HAVE JUST CITED INDICATES THAT INCENTIVES/BONUSES WERE REMOVED AND CONSIDERED NON-INCREMENTAL. IS THAT CONSISTENT WITH YOUR UNDERSTANDING REGARDING WHETHER THERE ARE ANY INCENTIVES/BONUSES INCLUDED IN THE COMPANY'S REQUEST FOR RECOVERY?

A. Rule 25-6.0143(1)(f),2, F.A.C., specifically states "[b]onuses or *any other special compensation* for utility personnel not eligible for overtime pay." (Emphasis added.) Thus, these costs are prohibited from being charged to the reserve. That means both types of extra compensation costs should be excluded. However, Duke has included overtime for exempt supplemental compensation as stated in its response to Citizens' Interrogatory No. 4-128. The discovery specifically asked if any special compensation was included. In reply, Duke stated the following:

> Regular payroll did not include any special compensation. Overtime includes exempt supplemental compensation in accordance with page 15 – Exempt Supplemental Compensation of the Incremental Cost Methodology Addendum in the Storm Cost Settlement Agreement approved in Order No. PSC-2019-0232-AS-EI.

Based on that response, the exempt overtime incentive compensation must be excluded to comply with the Rule; however, Duke has side-stepped the Rule and has chosen to include these costs because of the Agreement. While I would typically have an issue with a utility including this type of cost, I am not objecting to inclusion here since I believe compliance with the Agreement is reasonable – again, that is ***if*** Duke consistently applies the provisions of the Agreement throughout its filing.

Q. WHAT ADJUSTMENT ARE YOU PROPOSING TO THE COMPANY'S REQUEST FOR PAYROLL COSTS?

A. As shown on Exhibit No. HWS-2, Schedule B, and with the understanding that the Process Improvements should be applied on a consistent basis, I am recommending the total payroll be reduced by $4,000. This adjustment is based on correcting Duke's adjustment as filed to exclude non-incremental payroll consistent with the calculation provided in its response to Citizens' POD 3-20. If application of the Agreement is not applied consistently, then payroll should be reduced by $5,716,000.

b. <u>Labor Burdens/Incentives</u>

Q. ARE YOU RECOMMENDING AN ADJUSTMENT TO THE REQUESTED LABOR BURDENS/INCENTIVE COSTS?

A. I am not recommending an adjustment to the costs reported; however, I am recommending an adjustment to the estimated interim revenue collection amount. In its response to Citizens' Interrogatory No. 2-48, Duke states the labor burdens non-incremental amounts were calculated using a three-year average (2015-2017) of the actual O&M costs incurred in the month of the storm. That average was then compared to the actual O&M costs incurred in the month of the storm in 2018 for Distribution and Transmission, respectfully. This calculation is consistent with the Process Improvements and, upon review of that calculation, I agree the adjustment was properly determined. However, Duke capitalized $1,078,978 of Labor Burden/Incentive costs for transmission and none for distribution even though distribution reflected $987,000 of capitalized internal labor. There is a definite connection between labor and Labor Burden/Incentives; therefore, an adjustment is required to reflect capitalization of the

related labor burden costs. In fact, Company witness Tom Morris identifies this connection in his direct testimony at page 8, lines 16 – 23.

Q. WHAT ADJUSTMENT ARE YOU RECOMMENDING FOR CAPITALIZATION OF LABOR BURDEN/INCENTIVES ASSOCIATED WITH DISTRIBUTION PAYROLL?

A. I am recommending a capitalization adjustment of $450,000 related to non-incremental distribution labor. The calculation is shown on Exhibit HWS-2, Schedule C and is based on identification of the ratio of non-incremental distribution labor burden/incentive dollars to non-incremental distribution labor dollars and then applying the result of 45.59% to the $987,000 of capitalized distribution labor.

Q. WHAT WOULD YOU RECOMMEND AS AN ADJUSTMENT IF THE PROCESS IMPROVEMENTS ARE NOT APPLIED CONSISTENTLY?

A. Since payroll above the minimum filing requirements ("MFR") level was not supported by Duke, then the corresponding amount of Labor Burdens/Incentives would not be justified because those costs are directly related to payroll. Therefore, absent consistent application of the Process Improvements, the requested recovery for restoration should be reduced by $3,331,000. This is the net amount of Labor Burdens/Incentives as shown on Company Exhibit No. TM-2. Absent consistent application of the provisions of the Agreement and the exclusion of the unsupported payroll, there cannot be any associated Labor Burdens/Incentives allowed.

c. Overhead Allocation

Q. DO YOU HAVE ANY CONCERNS WITH THE ACCOUNTING FOR THE REQUESTED OVERHEAD COSTS?

A. Yes, I do. Duke was asked if the overhead costs were for affiliate employees who do not charge DEF for any normal day-to-day services. The Company's response to Citizens' Interrogatory No. 4-130 states as follows:

> Overhead allocations include costs from DEF management and supervision. These costs are identified by the resource type and responsibility center and those costs are removed as non-incremental or as part of the capital calculation. For Hurricane Michael all overhead allocations for Distribution were removed from storm recovery and only $40k were included for Transmission as it related to Affiliate employees.

In reviewing the amount of costs charged and the adjustment identified as non-incremental, there was an unaccounted-for balance of $12.422 million. Duke's response to Citizens' Interrogatory No. 4-136 provided a breakdown by type of costs included in the $14.5 million and $90.6 million of capitalized distribution and transmission costs, respectively. The capitalized distribution costs included $2,237,649 for Hurricane Michael and $10,764 for Tropical Storm Alberto for a total overhead distribution of $2,248,413. The capitalized transmission costs included $10,846,984 of overhead costs. The total for distribution and transmission was $13,095,397. That means the capitalized costs for Overhead Allocations on a net basis are $673,397 ($13,095,937-$12,422,000) higher than what was available to be capitalized. It is not possible to capitalize an amount greater than what was available to be capitalized. For example, if you only have $4 in your pocket, you cannot pull $5 out to pay for something that cost $5.

Q. WHAT DO YOU MEAN THE COSTS CAPITALIZED ON A NET BASIS ARE $673,397 HIGHER THAN WAS AVAILABLE?

A. My Exhibit HWS-2, Schedule D demonstrates there are four categories of overhead costs; two of them have a negative balance and two have a positive balance, with the net balance being $673,397. The two with negative balances should be corrected, by reversing the Company's capitalization adjustment.

Q. ARE YOU RECOMMENDING AN ADJUSTMENT TO THE REQUESTED OVERHEAD COSTS?

A. Yes. I recommend an adjustment of $715,000 for the two negative costs on Exhibit HWS-2, Schedule D, which reduces the amount of distribution costs capitalized and increases the amount of restoration costs to be recovered. As noted earlier, Duke's May 19, 2020 second revised petition increased transmission overhead costs by $718,000. The increase, while not supported by any type of documentation, is not being contested since it is approximately the same amount that I am recommending increasing restoration costs. The unknown, due to lack of time for proper discovery on a last-minute filing, is whether this is simply coincidental or did the Company discover that it capitalized more than was available to be capitalized and then made an adjustment to account for the accounting disparity. I am not recommending that both adjustments be made, since at this time I believe both adjustments are offered to correct the same problem.

d. Employee Expenses

Q. WHAT IS INCLUDED IN THE AMOUNT THAT DUKE HAS REQUESTED FOR EMPLOYEE EXPENSES?

A. Duke's Exhibit No. TM-2 identifies $11,274,000 of employee expenses incurred as part of the storm restoration effort. No adjustment was made for costs that would be classified as non-incremental. The Company's response to Citizens' Interrogatory No. 4-136 identified $446,002 of transmission related employee expenses that were capitalized. No amount of distribution related employee expenses were identified as capital-related.

Q. ARE YOU RECOMMENDING AN ADJUSTMENT TO THE REQUESTED EMPLOYEE EXPENSE COSTS?

A. No, I am not. The amount of employee expenses is significant and is made up of numerous payments. Based on my review of the documentation, I did not find the amounts to be unreasonable.

e. Contractor Costs

Q. WHAT IS THE AMOUNT OF STORM RESTORATION COSTS IDENTIFIED AS BEING ASSOCIATED WITH CONTRACTORS AND WHAT AMOUNT OF CONTRACTOR COSTS WERE CAPITALIZED?

A. Company Exhibit No. TM-2 identifies $252,643,000 of contractor costs for Hurricane Michael and $441,000 of contractor costs for Tropical Storm Alberto. None of these costs were labeled as non-incremental and, based on the Company's response to Citizens' Interrogatory No. 4-136, $98,746,815 of contractor costs were capitalized for

transmission and no specific amount was identified as capitalized contractor costs for distribution.

Q. WHAT IS THE COMPANY'S EXPLANATION FOR WHY THERE IS NO SPECIFIC CAPITAL AMOUNT IDENTIFIED FOR DISTRIBUTION, AND DO YOU AGREE WITH IT?

A. The Company determined its capitalized distribution using a formulistic approach. In its response to Citizens' Interrogatory No. 4-136, Duke stated that since work orders are not created for distribution, the costs cannot be broken out by type. My interpretation of this response is that Duke cannot identify how much of the capital cost is attributed to regular payroll, overtime payroll, labor burdens/incentives, employee expenses, contractor costs or internal fleet costs. Adding to this is the fact that, apart from the Company including specific line amounts for materials and overheads in capitalized distribution, there is no indication labor related costs, such as labor burdens/incentives, employee expenses or internal fleet costs, are even factored into the capitalized amount. Duke did estimate a labor amount; however, it appears to have ignored the labor related costs. In determining the amount of payroll to be capitalized, labor burdens/incentives are always included in establishing depreciable plant balances associated with these types of plant restoration activities. Thus, I do not agree that Duke's "inability to identify" explanation supports this portion of the estimated interim collection of storm restoration costs. In effect, it overstates the actual amount that should be properly expensed for cost recovery. I can understand why there is no indication of capitalizing labor burdens/incentives, and that is because Duke cannot identify what internal labor costs were capitalized. The inquiry should not stop there

since Duke has the burden of proof in seeking any cost recovery, and an adjustment for labor additives that more accurately reflect actual cost should be made.

Q. HAVE YOU SEEN EVIDENCE OF COMPANY CAPITALIZING FOREIGN OR EXTRNAL CONTRACTOR COSTS RELATED TO ITS REQUEST FOR STORM COST RECOVERY?

A. Yes. In the filing for Docket No. 20190155-EI and Docket No. 20190156-EI FPUC capitalized external contractor costs. Similar to Duke here, FPUC was requested to explain whether a formula was utilized to determine the amount capitalized and, if so, provide an explanation of the process and a detailed calculation of the capitalization for poles and wire. FPUC's response explained that FPUC set up work orders for the capitalization of poles and when materials were issued the cost were charged to the work order. The associated labor was then based on employee labor that was directly charged to the capital work order. FPUC employees who were in charge of contractor crews were called "bird dogs" and charged their time to the work orders. The FPUC "bird dog" employees had oversight and monitored contractor crews. The FPUC "bird dog" employees allocation of time served as a basis for allocating external contractor costs. I would note that FPUC is a much smaller utility and still had the internal resources to oversee and monitor contractor crews.

Q. ARE THERE ANY INTERNAL LABOR AND CONTRACTOR COSTS INCLUDED IN THE CAPITALIZED DISTRIBUTION COSTS?

A. Yes, there are. The Company determines the capitalized amount based on an average of internal labor rates and native contractor rates. This averaging process compounds the issue with the capitalization of storm costs.

Q. WHAT ARE NATIVE CONTRACTORS AND HOW DO THEY DIFFER FROM FOREIGN CONTRACTORS?

A. Native contractors perform services for the Company on a day-to-day, year-round basis under "blue sky" or non-storm (non-emergency) conditions. They are also sometimes referred to as "embedded crews." A foreign contractor crew is simply a vendor or contractor crew that is not a native or embedded crew.

Q. WHY DOES THE AVERAGING OF JUST INTERNAL RATES AND NATIVE CONTRACTOR RATES CREATE A FURTHER ISSUE?

A. Duke's response to Citizens' Interrogatory No. 4-133 explained the simple average as follows:

> A simple average is then calculated as shown in the response to Citizen's Third Request for Production of Documents No. 24. The average native contractor non-storm rate is combined with the DEF internal Distribution labor rate and divided by two to derive the simple average rate.

Determining the appropriate average rate was an issue in Duke's last storm case in Docket No. 20170272-EI. In the Agreement, as part of the Incremental Cost Methodology Addendums, it was agreed that the average rate would be a simple average of hourly foreign and native contractor costs. This addendum was one of seven addendums. The Company has adopted as part of this filing five of those addendums, while excluding this averaging provision for capital costs, as well as a provision to

adjust non-vegetation contractors' costs based on a three-year average. It appears that the effect of this cherry picking is to undeniably increase the amount of storm restoration costs being sought for recovery by Duke.

Q. IN EXPLAINING THE CAPITALIZATION PROBLEM, YOU INDICATED THERE ARE TWO PROCESS IMPROVEMENTS THAT DUKE DID NOT FOLLOW. WHY WASN'T THE NON-VEGETATION CONTRACTOR PROCESS IMPROVEMENT DONE?

A. I do not know why this was not done since the necessary information was available based on the Company's responses to Citizens' Interrogatory No. 1-10 and 1-11.

Q. ARE THERE ANY OTHER ISSUES WITH CONTRACTOR COSTS?

A. Yes. As I noted earlier, Duke identified in its response to Citizens' Interrogatory No. 4-136 that there was a total of $98,746,815 of contractor costs that were capitalized for transmission. Company Exhibit No. TM-2 identifies the amount capitalized applicable to all types of costs for transmission as $90,596,000. This is a difference of $8,150,815 ($98,746,815 - $90,596,000) between the discovery response and the Company's filing exhibit. This ignores the fact that the $98,746,815 is for contractors only and the $90,596,000 is for all transmission costs. Based on my review of the Company's response to Citizens' Interrogatory No. 4-136, it appears that, after determining a capital cost of $80,105,179 for the 230 kV Line, Duke reduced the amount to be capitalized by $34,445,227 by classifying it as the "Incremental Portion." It would appear that Duke first charged these costs to account 186, and after a review of the accumulated costs, the costs were reduced by non-incremental costs and capital costs.

Then, after further review of the original calculated capital amount was done, the amount for the 230 kV Line was subsequently reduced by $34,445,227 and then returned to the restoration costs included in account 186 and ultimately charged to account 228.1 for recovery from current customers using the SCRM. Based on the Company's response to Citizens' Interrogatory No. 4-127, any justification for doing this is invalid since Duke states that it accounted for the costs in accordance with ICCA and the Agreement. This again shows how the Company selectively applied its interpretation to what costs the calculations apply and how they should be accounted for. With the transmission capital calculation, Duke ignored the provisions in the Agreement for determining the distribution amount as explained earlier. This indicates that Duke determined that, under normal conditions, the cost of rebuilding the 230 kV Line would have been lower than what Duke initially recorded as the actual cost and thus it removed part of the capital cost called for by the Agreement and returned $34,445,227 to the restoration costs (expense) requested for recovery by relying on its interpretation of ICCA. This is a critical issue since, even though Duke has determined an actual capital cost for the replacement of the 230 kV Line, it reduced that actual cost and increased storm restoration costs for the same amount. This is not in accordance with Generally Accepted Accounting Principles ("GAAP"). This raises a significant concern since the adjustment was made without any explanation in Duke's direct testimony. It was also omitted from the Company's response to Citizens' Interrogatory No. 4-136 even though Duke stated in testimony its accounting is in accordance with GAAP. This will be discussed in greater detail later in my testimony in Section III.h at pages 64-65.

Q. IS THERE ANY DOUBT THAT *ALL* OF THE COSTS LISTED AS CAPITAL COSTS IN THE COMPANY'S RESPONSE TO CITIZENS' INTERROGATORY NO. 4-136 WERE CAPITAL COSTS?

A. No. As will be discussed later in Section III.h at pages 64-65, my review of contractor costs found the costs to be project-oriented. The specific projects are identified as being the 230 kV Line and the Access Road.

1. <u>Line Contractors</u>

Q. WHAT AMOUNT OF CONTRACTOR COSTS ARE CUSTOMERS NOW PAYING FOR IN CURRENT RATES FOR LINE CONTRACTORS?

A. Based on its response to Citizens' Interrogatory No. 150, Duke incurred $95,796,918 in transmission line contractor costs and $90,600,346 in distribution line contractor costs. There was no adjustment for non-incremental costs. Duke did identify an adjustment of $98,746,815 of contractor costs being capitalized for transmission but it did not separate the capitalized amount by type, such as contractors, line clearing contractors, logistics and other. The amount of distribution costs the customers should be currently paying for have not been justified. This presents a greater issue since Duke uses an average of internal labor and native contractor rates to calculate the capitalized amount. This means that the correct amount customers should currently be paying for contractors has not been justified since it is not known, let alone separable by type of contractor. I would note that since the formula approach for distribution excludes line clearing, logistics or other contractor costs, it must be assumed the capitalized labor amount is made up of strictly internal labor and native contractor rates. These rates ignore not only the conditions that existed when the capital work was performed but it

also ignores the fact that external contractors are performing capital work at higher rates per hour. This means that costs that should be capitalized are likely to have been understated, and correspondingly that costs that are now being collected from current customers are overstated. It is difficult to totally quantify this error other than to note that it is occurring. This circumstance contributes to the cloud over the process that Duke has used to separate capital costs from those costs which should be expensed and charged to customers for storm cost recovery.

Q. DID YOU IDENTIFY ANY CONCERNS WITH LINE CONTRACTOR COSTS INCLUDED IN DUKE'S STORM COST RECOVERY FILING?

A. Yes. There are multiple concerns with the amount being recovered from current customers. First, there are simply costs being charged that should never have been imposed on the customers. Next, there is a concern with requiring customers to pay for an excessive amount of mobilization/demobilization costs, along with standby time. Finally, the proper capitalization of restoration costs is an issue.

Q. ARE THERE OTHER CONCERNS YOU IDENTIFIED WITH DUKE'S STORM COST RECOVERY FILING?

A. Yes, there are. Citizens' Interrogatory No. 1-2, asked Duke to provide an excel spreadsheet of all invoiced costs by type. The Company's response provided a summary of the costs by type but not in the level of detail expected. I requested a listing of each invoice similar to what was provided to me by Duke in Docket No. 20170272-EI. Duke was asked to supplement this with an explanation of what was being sought and the information was still not provided in the requested format.

Citizens' Interrogatory No. 5-150 requested a listing of all invoiced costs. After its initial response which provided a summary by vendor and further discussion, Duke provided the requested information in the format sought. Duke interpreted the requests to be for costs in a high-level summary format despite what Duke provided in Docket No. 20170272-EI. As part of the initial discovery request, I agree that the use of the word summary and my assumption that Duke knew from the prior case what was being requested could have led to an interpretation different from the intent of the request. However, the discovery request included in the Fifth set was clear and, based on interim discussions, the Company should have understood exactly what was being asked. This delay in getting detail is a concern since it hampered my review process. This impairment is problematic since approval of the costs for recovery is important to both the Company and the customers, and the appropriateness of the costs is crucial since ratepayers have been paying for those costs while this docket is open. At this point, it appears that the OPC is the only party who routinely performs this type of in-depth review and that makes the provision of information to the OPC even more crucial. This problem could be avoided in future storm cost recovery proceedings if the Commission orders the Company to include certain essential information sooner in the process. In my conclusion, I will discuss my recommendations for the specific types of critical, essential information that should be provided at the time a petition for recovery is filed.

Q. WHAT OTHER CONCERNS DID YOU IDENTIFY IN THIS AREA?

I also have concerns with respect to costs in general, with a special emphasis on the lack of monitoring and tracking of storm work by Duke. The Company's response to Citizens' Interrogatory No. 1-3 provides a summary of the review or "audit" process

performed by Duke in reviewing and approving costs. One item listed is mileage which is calculated for mobilization/demobilization based on MapQuest/Google maps to validate mileage driven. However, a review of the audits done and provided in response to Citizens' POD 1-14 did not identify documentation supporting this task being performed. I would note that some invoices supplied in response to Citizens' POD 1-4 did include the referenced MapQuest/Google maps but again there was no indication that mileage and travel time was verified.

Duke was asked to provide any changes to policies and procedures related to Hurricane Michael implemented since Docket No. 20170272-EI. The Company's response to Citizens' Interrogatory No. 1-4 was that no changes were implemented. In Docket No. 20170272-EI, there was an issue raised that Duke did not have any guidelines and did not have any limitations on the hours that can be charged by outside contractors once travel begins. This issue was addressed in the Process Improvements, with Duke agreeing that contracted and invoiced travel would limit what customers could be charged to actual time with no minimum hours. Nothing approximating this Process Improvement (which I agree was implemented after the 2018 storm season) was followed. In fact, the Company's response to Citizens' Interrogatory No. 1-7 stated that it does not have a specific policy surrounding mobilization/demobilization travel time. The Company's response to Citizens' interrogatory No. 1-8 stated that "DEF's billing system does not have the ability to distinguish cost of regular hours versus mobilization/demobilization." Similarly, the Company's response to Citizens' Interrogatory No. 1-9 states that DEFs billing system does not have the ability to distinguish standby costs. Another discovery request was made to identify when outside contractors were acquired, to provide the date and time the respective crews

began restoration work, and when crews completed restoration activities prior to demobilizing. The Company's response to Citizens' Interrogatory No. 4-137 states as follows:

> As a general practice, DEF, when engaging mutual assistance and/or contractors for emergency restoration, does not currently break out or track restoration start/stop times. Due to the nature of emergency assistance, general practice with agreements during Hurricane Michael were based on labor hours to prepare, respond, and return to home base.

This is a concern since contractors could bill excessively for travel and standby time, and if it is not monitored, Duke has no ability to justify those charges. In my experience, other large utilities have historically made at least ***some*** minimal efforts to monitor and limit standby time. As a matter of good business practice and stewardship of costs that are going to be passed on to its customers, Duke should have been doing this. Citizens' Third Set of Interrogatories included a number of specific requests, on specific invoices, that asked Duke to confirm the amount charged for mobilization/demobilization and/or if charges were for the actual performance of restoration activities. A generic response was provided by the Company for the various requests as follows:[5]

> As general practice, Duke Energy, when engaging mutual assistance/contractors for emergency restoration, does not break out or specify standby / mobilization / demobilization charging and therefore does not track costs in that manner. At this time, utility emergency assistance practice is that the assistance period commences when personnel and/or equipment is initially incurred by the responding company to the requesting utility's needs. Due to the nature of emergency assistance, practice agreements are based on labor hours to prepare, respond, and return to home base.

[5] Response to Citizens' Interrogatory Nos. 3-51, 3-54, 3-63, 3-73, 3-76, 3-80, 3-83, 3-85, 3-103, 3-108, 3-109, 3-113, 3-114, 3-115 and 3-116.

Q. **DOES THIS FAILURE TO MONITOR TRAVEL AND STANDBY TIME ALSO IMPACT OTHER AREAS OF THE COMPANY'S REQUEST?**

A. Yes. As stated earlier, there are two issues with the capitalization of costs. One is the cost for distribution uses internal labor and native contractor rates under blue sky days in determining the capitalized labor. This ignores the fact that costs during storm restoration are higher because of the external contractors performing restoration and capital work. This monitoring failure also does not remotely mirror or even approximate the Process Improvements agreed to that Duke has applied to other costs included in its filing in this docket. The second issue is that, after determining the capital costs for the 230 kV Line, Duke reduced the actual capital costs with an Incremental Portion adjustment by $34,445,227. In his testimony, Duke witness Tom Morris stated the following regarding the transmission cost capitalized:

> For Transmission Operations, specific projects were issued for capital work, allowing real-time tracking of those projects. As capital work was performed, associated labor, material and equipment costs were charged to the capital projects.[6]

This adjustment should not have been made since it understates the actual capital costs paid for the reconstruction of the 230 kV Line. This will be discussed later in my testimony in Section III.h at pages 64-65.

Q. WHAT COSTS HAVE YOU DISCOVERED SO FAR THAT SHOULD NOT HAVE BEEN CHARGED TO CUSTOMERS?

[6] Testimony of Tom Morris at page 15, lines 8-11.

A. A discovery request was made to Duke to explain why the two selected invoices included charges for October 10 and October 11 since the contractor was released on October 9. The Company's response to Citizens' Interrogatory No. 3-78 stated that Company K was released to Carolinas on October 9 and the time for October 10 and 11 should have been charged to DEP [a Duke-affiliate IOU in the Carolinas]; therefore, a refund of at least $141,793 should be made. Another discovery request was made for Duke to confirm that the two specific invoices did not include any storm restoration work. The Company's response to Citizens' Interrogatory No. 3-79 stated that Company K was released before arrival to Florida and they were not onboarded to restore power. Despite the $141,793 identified as an adjustment, Duke's response indicates the time for October 10 and 11 should be charged to DEP. Both invoices were for time on October 10 and 11; therefore, I am adjusting the restoration costs for a total refund adjustment of $525,931 ($384,138 and $141,793). In the May 2020 second supplemental petition filing, it appears that Duke removed these costs.

Duke was also asked about the billing by Company M and whether that contractor provided any restoration work. The Company's response to Citizens' Interrogatory No. 3-81 stated that, after further review, Company M was not acquired by DEF but provided restoration services for Duke Energy Carolinas, therefore, a refund adjustment of $422,362 should be made. A second question related to Company M was posed regarding another invoice and the charges. The Company's response to Citizens' Interrogatory No. 3-82 stated that, after further review, Company M was not acquired by DEF but provided restoration services for Duke Energy Carolinas, therefore, a refund adjustment of $55,396 should be made. Based on the invoices supplied in the Company's response to Citizens' POD 1-4 and the supplied listing of invoices, Exhibit

HWS-2, Schedule F, Page 6e reflects $1,221,963 as being billed by Company M. Therefore, I am recommending a refund adjustment of $1,221,963. This also appears to have been part of the $1.7 million adjustment by Duke in its supplemental filing made in May 2020. If it were not for the OPC's review, I do not believe this $1.7 million error would not have been discovered.

The next adjustment is for a duplicate billing. The invoice summary included [redacted]

Even though I have made these specific adjustments, I would note that there are a number of invoices that should be adjusted because various contractors did not provide any actual restoration work for Duke. In this case, those contractors either did not make it to Florida or arrived and then were released. The Commission should require Duke to conduct an additional review of these invoices (for example vendors P, V, G and N as discussed below) and demonstrate that customers are not being overcharged beyond the specific instances that I have pointed out in my testimony.

Q. COULD YOU IDENTIFY SOME ADDITIONAL EXAMPLES OF THIS OCCURRING?

A. Yes. The billing for Company P was questioned in three interrogatories. The Company's response to Citizens' Interrogatory No. 3-85 was the standard response I referred to earlier that said standby/ mobilization/demobilization was not tracked. The

Company's response to Citizens' Interrogatory No. 3-86 stated that Company P mobilized from Texas to Jacksonville where its crews stayed on standby until they were released on October 11, 2018. Company P billed Duke $2,880,809, and Duke's customers are currently paying for this cost, yet they received no benefits whatsoever from this contractor. Conveniently, Duke's Carolina ratepayers benefitted from Floridians picking up the tab because, based on the Company's response to Citizens' Interrogatory No. 3-86, Company P was released from the Carolinas on October 15, 2018.

Similarly, Company V charged Florida ratepayers $91,626 and a crew from Company G billed Florida ratepayers $93,557. The Company's response to Citizens' Interrogatory No. 3-100 stated that Company V was released before arrival in Florida and Duke does not know if they went elsewhere. The Company's response to Citizens' Interrogatory No. 3-64 stated that Company G was rerouted from Georgia on October 11th to the Carolinas. Another example of Duke's Florida customers being charged where no restoration work was performed is Company N which was paid $1,099,852. The Company's response to Citizens' Interrogatory No. 3-83 stated that Company N arrived at the mustering site on October 10 and was on standby until October 11, at which time the crews were released to the Carolinas.

Florida customers should not have been charged the costs discussed above since they did not receive any restoration services and, in some instances, the contractors never reached Florida. Adding to these problems is that three of the companies were released to the Carolinas with the end result being Duke Energy Carolina ratepayers were saved from paying the mobilization costs which were directly imposed on Duke's Florida customers using the streamlined SCRM cost recovery method contained in the RRSSA.

These examples illustrate that, if the Commission does not hold Duke to a strict burden of proof and forces the OPC to uncover the buried, improper invoices, it effectively shifts the burden of proof to the OPC and requires the customers to try to claw back costs from current, ongoing cost recovery that is only authorized on a provisional, interim basis. The examples that I have listed are proof that improper costs end up being charged to customers because Duke may not have enough incentive to monitor costs to protect its customers.

Q. PLEASE EXPLAIN YOUR EVALUATION OF THE MOBILIZATION/ DEMOBILIZATION AND STANDBY CHARGES WITH WHICH YOU WERE CONCERNED.

A. The Company's response to Citizens' POD No. 4 provided invoices for line contractor costs. Included with most invoices were time sheets. A review of the invoices and time summaries that accompanied the invoices and time sheets identified some of the mobilization/ demobilization and standby costs charged by contractors.

Standby time can be used to determine how prepared a utility is for storm restoration activities. Duke has stated that it does not track standby time; therefore, there is a concern with this failure to monitor this significant cost element of restoration costs such that ratepayers who are currently paying for these costs are being improperly charged. If contractor crews are standing by for an excessive amount of time waiting for assignment, this could be a strong indication that Duke is not properly monitoring crew activities and/or managing its resources efficiently. As a result, it is the utility ratepayers (and in this case, the Duke Florida ratepayers) who suffer because (1) they are experiencing the power outages, and (2) they ultimately pay excessive storm

restoration expenses and they are not properly protected from the Company's improper stewardship of the provisional, interim cost recovery process. A prudent utility should monitor standby time to evaluate its own performance and to help it develop a system that will minimize wasteful standby time, without regard to the cost recovery mechanism. It is not reasonable to expect ratepayers to have to pay for contractors to just sit around or to have those costs dumped into an upfront cost recovery process that does not impose any burden on the utility to protect customers from overpayments.

For mobilization/demobilization in this docket, I reviewed invoices, time sheets, time summaries and the Company's audits of contractors to estimate the amount of time charged. There are instances where minimally sufficient information was not included on the various documents to even allow a reasonable estimate to be made; thus I am confident that my recommendation is conservative. The Commission should give Duke a proper incentive to maintain a log of the travel time so Duke can determine whether contractors are taking advantage of the situation by overbilling for travel time. These hours and costs can amount to significant costs because unlike the work time for restoration, there are no checks and balances in place. This incentive is most effectively delivered in the form of a disallowance for inadequately monitored and non-justified mobilization time.

Q. DID YOU ASK IF THE COMPANY MAINTAINS A LOG OF CONTRACTOR TRAVEL?

A. Yes. The Company's response to Citizens' Interrogatory No. 4-143 stated the following:

> External crew deployment is logged via the Resource on Demand (RoD) database. External crew rosters are loaded into RoD when crews arrive to ensure accurate head count. Subsequent crew movements and assignments are logged in RoD up to and including release from the system. DEF does not maintain logs monitoring external crew's work once on-boarded to the system, as maintenance of such logs would increase restoration times and costs.

Despite Duke's claim that it has the log on the RoD database, the Company is unable to provide any detail regarding mobilization/demobilization and standby time as stated in the Company's multiple discovery responses identified earlier in my testimony.

Q. WHAT DID YOU FIND IN YOUR REVIEW THAT INDICATES THAT MOBILIZATION/DEMOBILIZATION IS EXCESSIVE?

A. The travel time was found to be excessive. One example was with Company AA where multiple crews traveled from various origins and the time allowed was excessive when compared to normal travel time. Because there were multiple crews traveling and additional information was required, I requested Duke to identify the origin of the crews. The Company's response to Citizens' Interrogatory No. 3-117 identified 6 crews from Mississippi and 1 from Florida. The time listed on the time sheets for travel on October 9 and October 10 ranged from 24 to 32 hours. The MapQuest search showed that, for the identified origination points, the travel time to Dunnellon, Florida is 9 to 10 hours. The number of miles ranged from 588 miles to 673 miles. A conservative and reasonably generous approach assumes a travel distance of 673 miles and the 10 hours results in an average normal travel time of 67 miles per hour ("mph"). In determining the time Duke wants its customers to pay for, I conservatively applied the lower 24-hour time from the range found on the time sheets and the same longer distance of 673 miles, which yields an average travel speed of 28 mph.

Q. AREN'T YOU JUST SECOND-GUESSING DUKE AND ITS CONTRACTORS IN THE COMFORT OF A BLUE-SKY DAY TWO YEARS LATER IN THIS ANALYSIS?

A. No, not at all. To the contrary, I am giving them the benefit of the doubt and accounting for delays inherent in the aftermath of the storm. The difference I have illustrated above is significant and is not an exercise of second-guessing. The argument often advanced by utilities – including those in Florida – is that the big trucks take longer and that explains why the travel time is different. While performing a review of storm costs in a utility docket in Massachusetts, I requested the utility to provide any evidence to support a similar claim. The utility provided two studies in their possession upon which it relied. I have attached the studies as Exhibit HWS-3 and Exhibit HWS-4. The studies concluded that larger trucks traveled slower than cars. The first study set the large truck rate of speed to be 6.7 mph less and the second study set the comparable rate of speed at 7.8 mph less. To make a comparison in the case of Company AA, I reduced the average normal travel time of 67 mph to 59 mph using the 7.8 mph differential generated from the study and rounded up to 8 mph. Based on an average speed of 59 mph, the travel time for 673 miles would be approximately 11.5 hours. With an added allowance of 2 hours for stopping and rest, 13.5 hours would be considered reasonable, not the lower 24 hours billed to Duke. The result is that the derived proxy lower travel time that I am conservatively allowing is ***still*** 1.78 times the normal travel time for large trucks.

Q. DID YOU ASK DUKE IF THEY HAD ANY STUDIES REGARDING THE TIME REQUIRED FOR TRAVEL?

A. Yes, I did. Citizens' Interrogatory No. 1-7 was asked if the Duke had a policy for determining whether mobilization/demobilization travel time was considered reasonable and whether the Company performed or had performed for them a study to support that policy. The response was as follows:

> DEF Distribution does not have a specific policy surrounding mobilization/demobilization travel time. However, during the planning process, the distance of responding crews is taken into consideration prior to acquiring.
>
> DEF Transmission applied the same policies with regard to managing mobilization/demobilization and travel time as were used in response to hurricane Irma and reviewed in Docket No 20120272-EI. In short, as is standard industry practice, contractors were able to begin charging their time to DEF after they were engaged to assist with the restoration efforts. Travel time was managed by DEF's logistics personnel, who would communicate the required arrival time and destination; travel time was considered reasonable if the contractors arrived as directed.

The Company's response did not answer the question regarding any study. Moreover, based on Duke's failure to answer the question or produce a study when asked now (and before the filing of rebuttal testimony), it must be assumed that a DEF study does not exist.

Q. DID YOU MAKE ADDITIONAL COMPARISONS TO SEE HOW THE TRAVEL TIME DUKE ALLOWED CUSTOMERS TO BE CHARGED COMPARED TO WHAT SHOULD BE CONSIDERED A REASONABLY GENEROUS AMOUNT OF TRAVEL TIME?

A. Yes. Using another example of travel related to Company AA, a discovery request asked Duke to identify the origin of travel. The Company's response to Citizens'

Interrogatory No. 3-118 identified 4 crews that traveled from Lexington, Kentucky to Crawfordville, Florida. The documents supporting the invoice identified mobilization on October 9 and October 10 totaling 26 hours. According to MapQuest, the distance is 671 miles and a travel time of 10 ½ hours for an average speed of 63.9 mph. Adjusting that travel time by 8 mph results in an average speed of 55.9 mph. The 671 miles divided by 55.9 mph results in travel time of 12 hours. Adding two hours for stops increases the reasonable travel time to 14 hours compared to the allowed time of 26 hours. To be conservative, I reduced the 26 hours allowed by 4 hours to 22 hours allowed. That equates to an allowance of 22 hours which is 1.57 times the reasonable time of 14 hours.

Q. WHY WOULD YOU ADJUST THE 26 HOURS ALLOWED TO 22 HOURS ALLOWED?

A. In making the comparisons, I am trying to be conservative. The October 11 time identified was 20 hours, so since it exceeded the normal 16 hours per day, I assumed that some standby occurred on October 11. Otherwise, there is no justification for 20 hours being billed in a single day.

Q. PLEASE CONTINUE WITH SOME MORE EXAMPLES OF COMPARISONS THAT YOU MADE.

A. Another Company AA example is related to its crews traveling from Tennessee and Georgia to Crawfordville, Florida. Based on supporting documents, the travel time for October 9 and October 10 was 32 hours. Using the Company's response to Citizens' Interrogatory No. 1-119 and MapQuest, I determined the travel distance to between

391 miles to 411 miles and the travel time to be 6 1/2 hours to 7 hours. Normal travel speed is estimated to be 58.7 mph (411 miles/7 hours) compared to the travel speed allowed by Duke of 17.1 mph (411 miles/24 hours) after allowing 8 hours of standby on October 10. Applying a reduced travel time of 24 hours and comparing that to a reasonable travel time of 9 hours (7 hours plus 2 hours for stops) shows Duke's allowed travel time for Company AA being 2.67 times higher. The bottom line is that this results in Duke's ratepayers overpaying for the services this contractor actually provided.

Another example is Company BB's Invoice No. [redacted] which included billing for October 8 through October 13. This contractor arrived on October 10 meaning the crews travelled for two to three days. I assumed Dallas, Texas as the origin and Dunnellon, Florida as the destination. Texas is the billing location for Company BB and receipts suggested this is the direction that this contractor or some of the crews came from. MapQuest indicates travel time of 15 1/2 hours to travel 993 miles. That equates to 64 mph. The travel time for the various crews for October 8 ranged from 8-17 hours, for October 9 ranged from 16-17 hours and for October 10 ranged from 12-16 hours. That said, I assumed the lower hours for each day which totaled to 36 hours – more than double the MapQuest travel time. If I deduct half of day 3 for standby, the travel time was 30 hours. That 30 hours, when compared to a reasonable travel time of 18 1/2 hours (consisting of 15 1/2 hours for travel plus 3 hours for stops) indicates Duke allowed 1.62 times what should reasonably and conservatively have been allowed for this contractor.

One more example is Company A where I rely on the time report found on Bates page 6230. The travel was from Louisville, Kentucky to Perry, Florida with 33 hours being

billed for October 9 and October 10. MapQuest indicates the trip is 699 miles which takes 11 hours, averaging 63.5 mph. Making the adjustment for trucks of 8 mph, the speed would be 55.5 mph. The time for traveling 699 miles at an average speed of 55.5 mph results in 12.6 hours. Rounding up to 13 hours for travel and adding 3 hours for stops, the reasonable travel time is 16 hours. In making the comparison, I allowed for 8 hours of standby based on 16 hours charged on October 10. The conservative adjusted billed time of 25 hours is still 1.56 times the 16 hours of reasonable travel time which includes stop time.

What these examples indicate is that the conservatively adjusted travel time recommended is still more than 50% higher than it should be. Ratepayers should not be paying for these unreasonable costs and a refund is justified.

Q. ARE YOU RECOMMENDING A DISALLOWANCE OF COSTS FOR THE EXCESSIVE RATES AND THE EXCESSIVE STANDBY AND/OR MOBILIZATION/DEMOBILIZATION?

A. Yes, I am. The portion of costs that I isolated to travel and related stopping time only for distribution contractors is $18,315,164. I am recommending a reduction of $6,105,055 to this amount, which results in a recommended cost of $12,210,100 for the distribution contractors' travel time that could be estimated. This adjustment is very conservative given the excess time I have identified and because I am confident the total adjustment I have calculated is necessarily understated due to Duke's failure to generate or provide sufficient documentation and tracking of travel time for its contractors.

Q. HOW DID YOU DETERMINE YOUR ADJUSTMENT?

A. My calculation is shown on Exhibit No. HWS-2, Schedule F, Page 6g. As indicated in my examples, the charges that Duke allowed its contractors to charge customers were in excess of 150% of what would be reasonable travel and stopping time. I divided the identified costs of $18,315,164 by 1.5 to determine the $12,210,110 amount that is considered reasonable. The difference of $6,105,055 is a very conservative necessary adjustment.

Q. WHY SHOULD THE COMMISSION ACCEPT YOUR RECOMMENDED ADJUSTMENT?

A. Storms impact customers as well as the Company's system providing service to those customers. By failing to even minimally monitor these charges in the up-front SCRM cost recovery opportunity provided by the RRSSA settlement, Duke is effectively forcing its customers to needlessly to pay for bloated restoration costs. I recognize that Duke has an obligation to restore service. However, Duke also has an obligation to operate prudently and I strongly believe that obligation should not be based on a blank check policy. In this instance, Duke has failed to properly monitor costs utilizing tools that would be sound business practices even without the Process Improvements it agreed to in 2019. Additionally, as demonstrated above Duke has selectively applied those 2019 Process Improvements where it increased its recovery but chose not to hold itself to the reasonable standards that mirror the one Process Improvement that would save customers money by limiting compensation for travel time to actual time, with no minimum hours. Allowing contractors to charge for minimum hours, regardless of actual travel, is in my opinion a major contributor to the excessive time being billed

and ultimately paid for by customers. This demonstrates a greater cause of bloated billing than even the claimed slow truck speeds.

Q. ARE YOU RELYING ON ANYTHING OTHER THAN THE STUDIES YOU REFERENCED THAT SUPPORTS YOUR POSITION THAT ALLOWED TRAVEL TIMES ARE NOT DUE TO SLOW MOVING TRUCKS?

A. Yes. My personal observation and common sense are relied on. I have traveled a significant number of miles over the 50 years I have been driving. I have clocked the line trucks on roads just because companies have taken the position they travel significantly slower than a passenger vehicle. My observation has been that the trucks, even in caravans, travel at, near or in some cases over the allowed speed limit. Assuming that 50% more time is applicable just because there is an incoming storm event would mean the trucks are averaging approximately 38 mph if a truck averages 8 mph less than a passenger car that averages 65 mph excluding stop time (65 mph-8 mph)/1.5. Common sense dictates that the contractor trucks are not traveling 38 mph especially if they are on expressways that in some cases have a minimum speed for vehicles. In addition, these trucks would be going against the direction of traffic that is trying to flee from a storm event.

Q. ARE YOU MAKING ANY RECOMMENDATION WITH RESPECT TO ACCOUNTING FOR CONTRACTOR TIME?

A. Yes, I am. I am recommending that Duke be required to separately identify the amount of hours and costs that are associated with mobilization/demobilization and with standby time. The failure to track this portion of the bill is imprudent and inconsistent

with what a prudent business would do ***in the absence of a guaranteed pass-through recovery***. This is essential information that is beneficial not only to the Company, but also to the Commission and will assure ratepayers are not overpaying for restoration costs. This information will also provide critical insight into how Duke is planning and controlling costs (or failing to do so) before, during, and after storm restoration activities.

Q. PLEASE EXPLAIN YOUR CONCERN WITH THE CAPITALIZATION OF CONTRACTOR COSTS.

A. Outside contractors perform a significant amount of work during storm restoration for utilities. For example, Company Exhibit TM-2 reflects $144.475 million of transmission restoration costs of which $109.058 million or 75.5% is for contractor costs. The distribution function reflects $171.502 million of which $143.440 million or 83.6% is for contractor costs. The capitalized costs for transmission and distribution were calculated differently. Company witness Tom Morris explains that the process followed for transmission costs established specific projects for capital work, allowing for real-time tracking of the projects. As the capital work was performed, the associated labor, material and equipment costs were charged to the capital projects.[7] The Company's response to Citizens' Interrogatory No. 4-136 provides a detailed summary of the cost components for transmission. Notable is the fact that contractor costs of $57,758,670 represent 72.1% of the total $80,105,179 costs for Duke's 230 kV Line. Similarly, the contractor costs for the Access Road work are $40,988,145 which

[7] Testimony of Tom Morris at page 15, lines 8-11.

represent 92.4% of the total $44,354,821 costs capitalized for the entire Access Road work.

With respect to the distribution, these costs were determined by formulaic approach as shown and described in the Company's responses to Citizens' Interrogatory Nos. 1-31, 1-36, 4-133, 4-134, 4-136 and Citizens' POD 3-24. A key factor of those costs is the labor rate in developing the capitalized costs. That rate is based on a simple average (unweighted) calculated based on internal labor and native contractor rates that are then multiplied by the number of hours for each unit of property to come up with an estimated capital labor to install.[8] The issue is that the rate utilized by Duke does not come close to reflecting the actual costs associated with replacing plant after a storm. Not only does this methodology produce a simple average rate that excludes external contractors with higher rates, it also overstates the impact of the internal payroll labor rates which dominates the restoration costs charged. This is explained in the next Q&A.

Q. WHAT DO YOU MEAN THE AVERAGE IGNORES THE INTERNAL PAYROLL DOMINATING THE RESTORATION COSTS?

A. The Company's response to Citizens' POD 3-24 provided the breakdown of the average calculation. The internal rate included is the base rate and not an overtime rate. It is easy to see on Company Exhibit No. TM-2 that regular payroll charged is less than overtime payroll. As a result, both components of the labor calculation are understated, which means the rate applied results in an understatement of costs. An additional

[8] Testimony of Tom Morris at page 16, lines 21-24.

adjustment is necessary because contractors performed significant amounts of capital work as part of their services in restoring Duke's system. It is not realistic to assume that even in a "blue-sky" circumstance that higher cost contractor labor would not be used on a project of this magnitude. Therefore, the type of labor actually used to perform this work must be capitalized, otherwise storm recovery costs will be overstated, and capital costs will be understated. Second, there is an issue with Duke's method of capitalizing restoration costs. As discussed earlier, the method used by Duke ignores the fact that, if the capital work was performed by Duke employees incurring incremental time, then that work would be at an overtime rate and not at a base payroll rate.

Q. WHY DOES IT MATTER WHETHER THE CAPITALIZATION COSTS ARE ACCURATE?

A. If the Company is allowed to understate the capital amount, current ratepayers will pay for capital costs that will benefit future ratepayers. This is a concern commonly referred to as intergenerational inequity. Current ratepayers should not bear the total costs of plant that will be used over thirty to forty years by future customers who are not receiving service from Duke today. The Commission should also be vigilant in preventing the storm cost recovery mechanism from creating an incentive to overstate – and recover outside of a base rate case and during a base rate freeze – currently recoverable "expenses." Because Duke has understated its capitalized plant, it is accelerating the recovery, during a base rate freeze, of that plant cost which should be capitalized as part of the restoration costs it is seeking to recover immediately instead of over the life of the plant. It is more appropriate to evenly recover the cost of that

plant over the life of that capital asset being installed and not over the shorter period requested by Duke. Under GAAP, the cost of plant to be capitalized is the actual cost. Under the circumstances of this docket (i.e. storm restoration), it is difficult to capture the actual cost; however, that does not justify making an improper estimate of the replacement plant using an understated cost per hour. Duke's method of capitalization does not comply with GAAP requirements for capitalization of plant based on actual costs, and an adjustment must be made to correct this error.

Q. DUKE CAPITALIZED DISTRIBUTION COSTS BASED ON THE ASSUMPTION OF RATES THAT ARE APPLICABLE ON A "BLUE SKY" DAY. IS IT SUFFICIENT TO ACCOUNT FOR THE CAPITAL COSTS UNDER THIS PREMISE?

A. No. As discussed above, this not only ignores GAAP requirements, it also ignores the fact that the costs were incurred under extraordinary circumstances that cause costs to be higher. Duke is of the opinion that this is allowable under the Rule. However, reference to the Rule is inappropriate since Duke is seeking other costs based on the agreed to Process Improvements and not on the Rule provisions. In addition, Duke's accounting and assertion is selectively inconsistent with the Process Improvements principle that states capitalization of costs is to be based on a simple average of hourly foreign and native contractors. On the other hand, my adjustment is consistent with the objective principles found in the Agreement. If Duke is opposed to applying the reasonable business practices underlying all the provisions of the Process Improvements across the board, then its capitalization calculation (absent the Process Improvements) would not include any internal payroll. Therefore, I have

recommended a total disallowance of payroll for lack of justification that the payroll was incremental. To clarify, if the Duke labor costs were not incremental, then the costs cannot be considered as part of the storm restoration costs. If the Duke labor is not incremental, then it cannot be capitalized which means the amount capitalized would have to be based on contractor labor only since that is the only labor dollars that are incremental.

Q. WHAT ARE YOU RECOMMENDING FOR AN ADJUSTMENT TO THE CONTRACTOR COSTS FOR THE CAPITALIZATION OF RESTORATION COSTS?

A. As shown on Exhibit No. HWS-2, Schedule F, Pages 14 and 15, I am recommending that capitalization of contractor costs should be reduced by the amount charged against the reserve or $2,566,399. This adjustment as calculated on Exhibit No. HWS-2, Schedule F, Page 14 consists of an additional capital cost for distribution poles of $2,035,884 for Hurricane Michael, $22,196 for distribution poles for Tropical Storm Alberto and an additional capital cost for distribution wires of $530,455 for Hurricane Michael as shown on Exhibit No. HWS-2, Schedule F, Page 15. This adjustment for capitalization reduces the storm restoration costs (and requires a refund) in the amount of $2,566,399.

Q. ARE THERE CONCERNS WITH THE REQUESTED TRANSMISSION LINE CONTRACTOR COSTS?

A. Yes, there are. The purported support provided by Duke as justification for these costs was very limited, and in some case Duke provided no detail at all. It was clear that

these costs were based on project type and on a contractual commitment. For example, the support for $4,987,789 for a Transmission Contractor T invoice consisted of only a form that identified a total cost, an amount paid to-date and an amount currently due. "Backup" for this invoice consisted of 2 pages; the first is an invoice summary page with the same information already listed on the invoice and the second page is a cost to date and remaining cost. (Bates 13098-13100) This provides no level of detail explaining the nature of the expenditures, and effectively is no different than simply writing a number on the back of an envelope. Certainly, this is insufficient documentation for any regulatory agency to approve as being a prudently incurred storm cost and to require ratepayers to pay.

Q. HAVE YOU SEEN THIS TYPE OF LIMITED INFORMATION PRESENTED AS SUPPORTING DOCUMENTATION BEFORE?

A. Yes, I have. This is not uncommon for a utility to attempt this kind of short cut. Contractors usually provide some level of detail with their invoices. Absent any detail to the invoices, it is not obvious what a company would be paying for or what it received. That's just good sound business practice. In this case, all that is clear is that Duke paid Transmission Contractor T a total of $47,422,764 and that there were contract modifications from time to time. I would also note that I found one billing by Contractor T that was for services beginning October 8 which was prior to the storm. [redacted] I question how a significant commitment for a transmission facility rebuild was made prior to the storm and then included for recovery in the storm cost recovery docket.

Q. CAN YOU ELEABORATE ON THE CONCERN THAT YOU HAVE RELATED TO THE OCOTBER 8, 2018 BILLING FOR TRANSMISSION FACILITY CONSTRUCTION SERVICES?

A. Yes. I have a concern about an invoice that billed for services related to a major transmission line rebuild and access road work prior to the storm event. This was for work being done when the storm was transitioning from Tropical Storm into a Category 1 hurricane south of the western tip of Cuba and even before anyone knew the storm would hit the precise area where the construction activity would occur. I believe that Duke needs to explain how this could occur.

Q. IS THERE DOCUMENTATION OF COSTS FOR ANOTHER TRANSMISSION LINE CONTRACTOR OF A SIMILAR NATURE?

A. Yes. Another contractor billed Duke for $44,863,733 and the major invoice amounts had limited supporting documentation, no detail behind a bill or in a number of instances no invoices could be located. The invoices for the transmission Line Contractors are listed on Exhibit HWS-2, Schedule F, Page 2.

Q. ARE YOU RECOMMENDING A REFUND ADJUSTMENT TO TRANSMISSION LINE CONTRACTOR COSTS?

A. Yes. The costs charged by Contractor T included a payment of $65,387 and another payment for $266,332. The payment for $266,332 was part of two invoices; one for $200,945 and another for $65,387. The $65,387 was paid in a single payment as part of a combined payment. I am recommending customers receive a refund for the duplicated payment they are currently paying for. In my discussion in the capitalization

section of my testimony, I recommend an adjustment that in essence would impact the transmission contractor costs in total, part of which would apply to line contractors.

2. Line Clearing Costs

Q. WHAT AMOUNT IS DUKE REQUESTING FOR LINE CLEARING?

A. In its response to Citizens' Interrogatory No. 5-150, Duke is requesting $13,500,000 for line clearing costs. This consists of $4,446,000 of transmission-related costs for Hurricane Michael, $9,032,000 of distribution-related costs for Hurricane Michael and $22,000 of distribution costs for Tropical Storm Alberto. Based upon the Company's schedules which reflected a line reporting error, the only adjustment for non-incremental cost is an adjustment to transmission for $940,000. This is an adjustment made by Duke in its May 2020 second supplemental petition filing.

Q. DO YOU HAVE ANY CONCERNS WITH RESPECT TO DUKE'S PROCESSING OF DISTRIBUTION LINE CLEARING INVOICES?

A. Yes. The concern with travel and excess mobilization/demobilization discussed above in my discussion on line contractors also exists here. An example is [redacted] where the detail showed the travel maps for traveling to Florida for two different days. The first travel map (Bates 11) indicated the distance from [redacted] to Lamont/Monticello, Florida to be 674 miles requiring 10 hours of travel. The contractor's time sheets reflected 16 hours of travel being billed. The second travel map (Bates 14) indicated the distance from Lamont/Monticello, Florida to Dunnellon, Florida to be 131 miles requiring 2 hours and 14 minutes of travel. The contractor's time sheets reflected 16 hours of travel being

billed. Duke's request to make its customers pay for 32 hours of travel in this instance when the trips are listed as 12 1/2 hours is not considered reasonable and the excess should be refunded to ratepayers.

Another example is Duke's request to recover from ratepayers [redacted] as storm costs that Duke paid to [redacted] even though this contractor provided no restoration work. Not only did this contractor bill for excessive travel, it also submitted seven invoices for October 9 through October 11 that ended with them going to the Carolinas to provide service and never providing service to Florida customers. What makes those seven bills even more of a concern is that another crew for this contractor began mobilizing to Florida on October 8 only to be released on October 9 so they could proceed to Georgia to assist another utility. Since the crew was released on October 9, I would ask why were the other seven crews mobilized to come to Florida to only standby, perform no work, and then be released to go to the Carolinas?

Q. ARE YOU RECOMMENDING ANY REFUND ADJUSTMENTS TO DISTRIBUTION LINE CLEARING COSTS?

A. Yes. I am recommending that at a minimum $430,524 be refunded. While additional refunds for excessive mobilization is likely warranted and additional adjustments should be made for costs where supporting documentation could not be located, I have not quantified an adjustment at this time; however, I reserve the right to recommend one as more information on this issue is provided.

Q. ARE THERE CONCERNS WITH THE REQUESTED TRANSMISSION LINE CLEARING COSTS?

A. Yes. Similar to the distribution line clearing costs, current customers are paying for an excessive amount of travel and standby time associated with mobilization/demobilization. Additionally, in numerous instances, customers are being charged for costs based only on invoices that were submitted without the time sheets required for verification of the hours billed or any other supporting documentation.

Q. ARE YOU RECOMMENDING ANY ADJUSTMENTS TO TRANSMISSION LINE CLEARING COSTS?

A. Not at this time. I have not quantified an adjustment that I believe would be justified; however, I reserve the right to recommend one as more information is provided.

3. <u>Logistics</u>

Q. WHAT AMOUNT OF LOGISTIC COSTS IS DUKE CURRENTLY CHARGING CUSTOMERS FOR?

A. Duke is charging customers $43,462,000 for logistic costs for Hurricane Michael. Logistic costs are costs related to the establishment and operation of storm restoration sites, and to support employees and contractors who are working on storm restoration (i.e., lodging, meals, transportation, etc.). Duke did not identify any of these costs to be either non-incremental or costs which should be capitalized. The filing reflected $41,411,269 as being distribution-related and $2,050,346 as transmission-related.

Q. ARE THERE ANY CONCERNS WITH THE LOGISTIC COSTS BEING REQUESTED?

A. Yes, there are concerns. While the invoices provided by Duke purportedly support distribution costs totaling $40,378,712, the identity of the cost and level of detail was not discernable. For example, support for [redacted] costs included two 'back-of-the-envelope" invoices (with no supporting cost detail) totaling $12,721,241. These invoices – representing costs customers are currently paying only on a provisional, interim basis – are useless in trying to justify these costs since the documents provide no information as to what services or costs Duke paid for or received. The first invoice (Bates 680-682) consisted of a one line billing for $12,079,838, a partial billing for $9,059,879, which is the amount questioned, and a third billing for $3,019,960 that could not be identified in the listing for this contractor. (Bates Nos. 680-682) The second billed amount in question is a single line invoice for $3,661,362 and an accompanying two page email that indicated it was approved for payment. (Bates Nos. 673-675) This is contrary to the purely provisional and interim nature of the current SCRM rate.

The transmission logistic charges had only one invoice that could be located in the summary of charges totaling $2,050,346, identified as logistics costs. That invoice did not match the listed cost. In addition, some invoices requested as part of a discovery request could not be located in the Company's response to Citizens' POD 1-16 that purported to provide supporting documents. Furthermore, there were invoices provided that could not be located on the listing of costs. This missing supporting documentation is troublesome. There is no doubt that costs were incurred, yet the level of detail and support are questionable and insufficient to meet a company's burden of proof. These amounts are not insignificant, and the Commission should deny Duke's recovery of

these costs until it can at least a minimum show adequate cost support and justification. These costs do not meet such a minimum threshold.

Q. ARE YOU PROPOSING A REFUND ADJUSTMENT TO THE COMPANY'S LOGISTIC EXPENSE FOR THE DIFFERENCE?

A. Yes. I am recommending that $6,360,621 or 50% of the unidentifiable costs be excluded from the Company's distribution logistics recovery request and refunded to Duke's customers.

Support for a majority of the transmission logistics costs being requested totaling $2,050,346 also could not be located. As Duke has not met its burden of proof to support these costs, I am recommending that [redacted] which are currently being collected by Duke be refunded to its customers since the Company failed to provide any supporting justification. This is a reduction of $977,489.

4. <u>Other Contractor Costs</u>

Q. WHAT AMOUNT OF OTHER CONTRACTOR COSTS HAS DUKE INCLUDED IN ITS REQUEST?

A. Duke included a total of $9,311,000 of other contractor costs for Hurricane Michael. This includes $425,000 for aviation contractors, $99,000 for contractor materials, $8,585,000 for materials and other supplies and 202,000 that is not identifiable. The transmission portion of the total Other Contractor Costs is $6,764,932.

Q. ARE THERE ANY CONCERNS WITH THE OTHER CONTRACTOR COSTS REQUESTED?

A. The amount that is unidentified is certainly of concern. In its response to Citizens' Interrogatory No. 5-150, Duke listed the $199,020 as "No Vendor Name" with a notation that it relates to accrual of costs. This cost is unsupported and should be refunded to ratepayers. Other than that, I have not identified another issue with the remaining distribution costs; however, I reserve the right to make additional recommendations as more information is made available.

The transmission cost listing also includes an amount identified as "Non-Vendor." This unidentified $3,243,044 is significant and should be disallowed as being unsupported. It is possible that the estimate adjustment of $400,000 in Duke's May 2020 second supplemental petition filing is applicable to the $3,243,044; however, because there was no detail for the "Non-Vendor" amount and no detail in that supplemental filing, I can only speculate on this.

Q. ARE YOU RECOMMENDING ANY ADJUSTMENTS TO THE OTHER CONTRACTOR COSTS?

A. Yes, I am. An adjustment (and refund) of $199,020 and $3,243,044 to distribution and transmission, respectively, is recommended. This adjustment is necessary since the costs for No Vendor Name and Non-Vendor are unsupported.

Q. WHAT ARE YOU RECOMMENDING FOR AN OVERALL ADJUSTMENT TO THE CONTRACTOR COSTS?

A. As shown on Exhibit No. HWS-2, Schedule F, I am recommending the contractor costs being currently collected from customers on a provisional, interim basis be reduced and refunded in the amount of $56,344,000. This adjustment is calculated on Exhibit No. HWS-2, Schedule F, Page 1, and consists of a reduction to transmission for the capitalization adjustment of $34,445,227, a $65,387 reduction to transmission line contractor costs for a duplicated payment, a reduction of $977,489 for unsupported transmission logistics cost and a reduction of $3,243,044 for unsupported Other Transmission costs, for a total transmission cost reduction of $38,731,147.

Distribution contractor cost reductions include a reduction of $1,929,118 for line contractor charges applicable to DEP and a duplicate billing, a reduction of $6,105,055 for excessive travel charges for line contractors, a reduction of $2,566,339 for additional capitalization of line contractor costs associated with Hurricane Michael, a reduction of $22,196 for additional capitalization of line contractor costs associated with Hurricane Alberto, a reduction of $430,524 to distribution line clearing contractors for unjustified travel and standby time, a reduction of $6,360,621 for 50% of unsupported logistic costs and a reduction of $199,020 for unsupported other distribution contractor costs, for a total distribution cost reduction (and refund) of $17,612,873.

f. Materials & Supplies

Q. WHAT DID YOU DETERMINE FROM YOUR REVIEW OF THE COSTS FOR MATERIALS AND SUPPLIES THAT WERE INCLUDED IN THE COMPANY'S REQUEST FOR RECOVERY?

A. Duke's Exhibit No. TM-2 identifies $27,142,000 of material costs for Hurricane Michael and $57,000 for Tropical Storm Alberto. The Company's exhibit identifies an adjustment of $940,000 for non-incremental costs. However, in its response to Citizens' Interrogatory No. 4-132, Duke stated that the adjustment was on the wrong line and should have been reflected as an adjustment to transmission line clearing. Therefore, the amount charged to the storm was $27.198 million prior to capitalization. The Company's response to Citizens' Interrogatory No. 4-136 indicates distribution costs capitalized was $3,816,814 and transmission costs capitalized was $13,078,150. The net amount included in the restoration cost sought for recovery is $10.303 million, subject to a caveat that the $34,445,227 capital cost returned to the restoration amount cannot be readily identified by Duke.

Q. APART FROM THE FAILURE OF DUKE TO BE ABLE TO IDENTIFY WHAT WAS EXCLUDED FROM THE CAPITAL AMOUNT AS PART OF THE INCREMENTAL REDUCTION TO THE 230 kV LINE CAPITAL AMOUNT, ARE THERE ANY CONCERNS WITH THE LEVEL OF MATERIALS AND SUPPLIES BEING CHARGED TO DUKE'S REQUEST?

A. I have not identified any specific concerns; however, my review is continuing, and I reserve the right to recommend an adjustment as more information is provided.

g. Internal Fleet Costs

Q. WHAT IS DUKE REQUESTING FOR INTERNAL FLEET COSTS?

A. Duke's Exhibit No. TM-2 identifies $282,000 of internal fleet costs for Hurricane Michael and $18,000 for Tropical Storm Alberto. Duke's exhibit indicates that restoration costs were reduced $81,000 for Hurricane Michael and $15,000 for Tropical Storm Alberto resulting in $204,000 of costs included as part of the restoration request prior to capitalization. The Company's response to Citizens' Interrogatory No. 4-136 does not identify any fleet costs being capitalized for distribution; however, $151,549 of costs were capitalized to transmission subject to the caveat associated with the incremental adjustment to the 230 kV Line.

Q. DO YOU HAVE ANY CONCERNS WITH THE LEVEL OF VEHICLE AND FUEL COSTS BEING REQUESTED?

A. No, I do not. After a review of the costs and the supporting detail provided, I have not identified any issues that would require an adjustment to the Company's request concerning vehicle and fuel costs.

h. Capitalizable Costs

Q. YOU INDICATED EARLIER THAT THERE IS AN ISSUE WITH THE CAPITALIZED COSTS IN GENERAL. WOULD YOU EXPLAIN THE ISSUE?

A. Yes, as stated earlier, Duke established projects for the transmission rebuild that took place. The rebuild of the 230 kV Line accumulated capital costs totaling $80,105,179. The fact these costs were charged directly to the project and that they were actual costs is not an issue. The issue is that after accumulating the costs Duke removed

$34,445,227 from the project and essentially transferred those dollars to its requested storm restoration amount in order to recover them from current customers, outside of a rate case. This adjustment was made with no explanation and no justification. Additionally, in the Company's response to Citizens' Interrogatory No. 1-136, the only reference was that the amount was labeled "Incremental Portion" and a statement that "The incremental portion was calculated and removed at the total project costs level, not at the category level." This adjustment appears to be arbitrary and unjustified, and Duke has not provided any explanation or support. This shifting of costs is not supported by the record; therefore, capital costs should be increased $34,445,227 and storm restoration costs should be reduced by $34,445,227, and that amount should be refunded to ratepayers. I have included this adjustment in my overall recommended adjustment to contractor costs.

Q. ARE YOU MAKING ANY RECOMMENDATIONS TO IMPROVE THE METHOD OF RECOVERING STORM COSTS?

A. Yes, I am. Duke does not appear to have a set policy for capitalization of storm costs or a standard methodology in place. A prudent utility should have a capitalization policy in place and develop a method for capitalizing storm restoration costs. Duke should be no different. That methodology should factor in contractor rates and crew sizes since contractors perform capital restoration work. This is essential since contractor rates are significantly higher than either regular or overtime rates of Duke's employees.

VI. RECOMMENDATIONS

Q. ARE YOU MAKING ANY RECOMMENDATIONS TO IMPROVE THE PROCEDURE FOR SEEKING RECOVERY OF STORM COSTS?

A. Yes, I am. In addition to my previous recommendation regarding record keeping associated with mobilization/demobilization and with standby time, I recommend the Commission mandate additional filing requirements when a utility seeks to recover storm costs. Duke incurred a significant amount of costs that included substantial non-productive costs for mobilization and standby time that served only to bloat the invoiced cost that its customers are now paying, during the time for restoring service to customers after Hurricane Michael. When a utility begins recovering storm costs on an interim and unproven basis, the supporting cost documentation and testimony should be provided simultaneously with the petition seeking cost recovery. This would significantly reduce the need for additional discovery by Commission staff and intervening parties and would provide the requisite support for the recovery that is being requested from ratepayers prior to payment being made. It is only common sense and good practice that anyone paying for something to know what they are paying for before having to make a payment. Massachusetts utilities, when seeking recovery of storm costs, are required by the Massachusetts Department of Public Utilities to include all supporting documentation at the time the petition and testimony are filed. I strongly recommend this be implemented in Florida as it will accelerate the schedule for the utility's request and will eliminate discovery as well as any misinterpretation of requests for this critical information and reduce the risk that customers are materially over paying for costs that cannot and will not be ultimately justified after interim recovery is completed or substantially underway.

Q. BASED ON YOUR TESTIMONY, PLEASE SUMMARIZE YOUR RECOMMENDED ADJUSTMENTS?

A. My recommended adjustments are as follows:

- A reduction (and refund) of $4,000 to Duke's request for payroll for cost identified as non-incremental;
- A reduction (and refund) of $450,000 to Duke's request for labor burden/incentives cost recovery being reclassified as capitalized dollars;
- An increase (or refund offset) of $715,000 for overhead cost recovery because the filing reflects more costs capitalized than existed;
- A reduction to contractor costs (and refund) of $1,929,118 for duplicated costs and Carolina costs improperly charged to storm restoration;
- A reduction to line contractor costs (and refund) of $6,105,055 for an excessive amount of mobilization/demobilization time;
- A reduction of $2,588,535 ($2,566,339 + $22,196) to Duke's request related to capitalization of distribution line contractor costs;
- A reduction (and refund) of $430,524 to Duke's request for line clearing cost recovery;
- A reduction (and refund) of $6,559,641 to Duke's request for unsupported distribution logistics and other contractor costs;
- A reduction of $65,387 to Duke's request for transmission line contractor costs that were duplicated,
- A reduction of $4,220,533 to Duke's request for unsupported transmission logistics and other contractor costs and

- A reduction (and refund) of $34,455,227 for Duke's unsupported reclassification from transmission capital costs to storm restoration costs.

For the quantified amounts identified above, I recommend a total reduction of $56.083 million to Duke's overall storm restoration and reserve replenishment request and a refund of $56.083 million.

I reserve the right to adjust these recommendations upon receipt of additional information.

Q. DOES THAT CONCLUDE YOUR TESTIMONY?

A. Yes it does.

QUALIFICATIONS OF HELMUTH W. SCHULTZ, III

Mr. Schultz received a Bachelor of Science in Accounting from Ferris State College in 1975. He maintains extensive continuing professional education in accounting, auditing, and taxation. Mr. Schultz is a member of the Michigan Association of Certified Public Accountants

Mr. Schultz was employed with the firm of Larkin, Chapski & Co., C.P.A.s, as a Junior Accountant, in 1975. He was promoted to Senior Accountant in 1976. As such, he assisted in the supervision and performance of audits and accounting duties of various types of businesses. He has assisted in the implementation and revision of accounting systems for various businesses, including manufacturing, service and sales companies, credit unions and railroads.

In 1978, Mr. Schultz became the audit manager for Larkin, Chapski & Co. His duties included supervision of all audit work done by the firm. Mr. Schultz also represents clients before various state and IRS auditors. He has advised clients on the sale of their businesses and has analyzed the profitability of product lines and made recommendations based upon his analysis. Mr. Schultz has supervised the audit procedures performed in connection with a wide variety of inventories, including railroads, a publications distributor and warehouser for Ford and GM, and various retail establishments.

Mr. Schultz has performed work in the field of utility regulation on behalf of public service commission staffs, state attorney generals and consumer groups concerning regulatory matters before regulatory agencies in Alaska, Arizona, California, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Kentucky, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Jersey, New Hampshire, New York, Nevada, North Dakota, Ohio, Pennsylvania, Rhode Island, Texas, Utah, Vermont and Virginia. He has presented expert testimony in regulatory hearings on behalf of utility commission staffs and intervenors on numerous occasions.

Partial list of utility cases participated in:

U-5331	Consumers Power Co. Michigan Public Service Commission
Docket No. 770491-TP	Winter Park Telephone Co. Florida Public Service Commission
Case Nos. U-5125 and U-5125(R)	Michigan Bell Telephone Co. Michigan Public Service Commission
Case No. 77-554-EL-AIR	Ohio Edison Company Public Utility Commission of Ohio
Case No. 79-231-EL-FAC	Cleveland Electric Illuminating Public Utility Commission of Ohio
Case No. U-6794	Michigan Consolidated Gas Refunds Michigan Public Service Commission
Docket No. 820294-TP	Southern Bell Telephone and Telegraph Co. Florida Public Service Commission
Case No. 8738	Columbia Gas of Kentucky, Inc. Kentucky Public Service Commission
82-165-EL-EFC	Toledo Edison Company Public Utility Commission of Ohio
Case No. 82-168-EL-EFC	Cleveland Electric Illuminating Company, Public Utility Commission of Ohio
Case No. U-6794	Michigan Consolidated Gas Company Phase II, Michigan Public Service Commission
Docket No. 830012-EU	Tampa Electric Company, Florida Public Service Commission

Case No. ER-83-206	Arkansas Power & Light Company, Missouri Public Service Commission
Case No. U-4758	The Detroit Edison Company - (Refunds), Michigan Public Service Commission
Case No. 8836	Kentucky American Water Company, Kentucky Public Service Commission
Case No. 8839	Western Kentucky Gas Company, Kentucky Public Service Commission
Case No. U-7650	Consumers Power Company - Partial and Immediate Michigan Public Service Commission
Case No. U-7650	Consumers Power Company - Final Michigan Public Service Commission
U-4620	Mississippi Power & Light Company Mississippi Public Service Commission
Docket No. R-850021	Duquesne Light Company Pennsylvania Public Utility Commission
Docket No. R-860378	Duquesne Light Company Pennsylvania Public Utility Commission
Docket No. 87-01-03	Connecticut Natural Gas State of Connecticut Department of Public Utility Control
Docket No. 87-01-02	Southern New England Telephone State of Connecticut Department of Public Utility Control

Docket No. 3673-U	Georgia Power Company Georgia Public Service Commission
Docket No. U-8747	Anchorage Water and Wastewater Utility Alaska Public Utilities Commission
Docket No. 8363	El Paso Electric Company The Public Utility Commission of Texas
Docket No. 881167-EI	Gulf Power Company Florida Public Service Commission
Docket No. R-891364	Philadelphia Electric Company Pennsylvania Office of the Consumer Advocate
Docket No. 89-08-11	The United Illuminating Company The Office of Consumer Counsel and the Attorney General of the State of Connecticut
Docket No. 9165	El Paso Electric Company The Public Utility Commission of Texas
Case No. U-9372	Consumers Power Company Before the Michigan Public Service Commission
Docket No. 891345-EI	Gulf Power Company Florida Public Service Commission
ER89110912J	Jersey Central Power & Light Company Board of Public Utilities Commissioners
Docket No. 890509-WU	Florida Cities Water Company, Golden Gate Division Florida Public Service Commission
Case No. 90-041	Union Light, Heat and Power Company Kentucky Public Service Commission

Docket No. R-901595	Equitable Gas Company Pennsylvania Consumer Counsel
Docket No. 5428	Green Mountain Power Corporation Vermont Department of Public Service
Docket No. 90-10	Artesian Water Company Delaware Public Service Commission
Docket No. 900329-WS	Southern States Utilities, Inc. Florida Public Service Commission
Case No. PUE900034	Commonwealth Gas Services, Inc. Virginia Public Service Commission
Docket No. 90-1037* (DEAA Phase)	Nevada Power Company - Fuel Public Service Commission of Nevada
Docket No. 5491**	Central Vermont Public Service Corporation Vermont Department of Public Service
Docket No. U-1551-89-102	Southwest Gas Corporation - Fuel Before the Arizona Corporation Commission
	Southwest Gas Corporation - Audit of Gas Procurement Practices and Purchased Gas Costs
Docket No. U-1551-90-322	Southwest Gas Corporation Before the Arizona Corporation Commission
Docket No. 176-717-U	United Cities Gas Company Kansas Corporation Commission
Docket No. 5532	Green Mountain Power Corporation Vermont Department of Public Service
Docket No. 910890-EI	Florida Power Corporation Florida Public Service Commission

Docket No. 920324-EI	Tampa Electric Company Florida Public Service Commission
Docket No. 92-06-05	United Illuminating Company The Office of Consumer Counsel and the Attorney General of the State of Connecticut
Docket No. C-913540	Philadelphia Electric Co. Before the Pennsylvania Public Utility Commission
Docket No. 92-47	The Diamond State Telephone Company Before the Public Service Commission of the State of Delaware
Docket No. 92-11-11	Connecticut Light & Power Company State of Connecticut Department of Public Utility Control
Docket No. 93-02-04	Connecticut Natural Gas Corporation State of Connecticut Department of Public Utility Control
Docket No. 93-02-04	Connecticut Natural Gas Corporation (Supplemental) State of Connecticut Department of Public Utility Control
Docket No. 93-08-06	SNET America, Inc. State of Connecticut Department of Public Utility Control
Docket No. 93-057-01**	Mountain Fuel Supply Company Before the Public Service Commission of Utah
Docket No. 94-105-EL-EFC	Dayton Power & Light Company Before the Public Utilities Commission of Ohio

Case No. 399-94-297**	Montana-Dakota Utilities Before the North Dakota Public Service Commission
Docket No. G008/C-91-942	Minnegasco Minnesota Department of Public Service
Docket No. R-00932670	Pennsylvania American Water Company Before the Pennsylvania Public Utility Commission
Docket No. 12700	El Paso Electric Company Public Utility Commission of Texas
Case No. 94-E-0334	Consolidated Edison Company Before the New York Department of Public Service
Docket No. 2216	Narragansett Bay Commission On Behalf of the Division of Public Utilities and Carriers, Before the Rhode Island Public Utilities Commission
Case No. PU-314-94-688	U.S. West Application for Transfer of Local Exchanges Before the North Dakota Public Service Commission
Docket No. 95-02-07	Connecticut Natural Gas Corporation State of Connecticut Department of Public Utility Control
Docket No. 95-03-01	Southern New England Telephone Company State of Connecticut Department of Public Utility Control
Docket No. U-1933-95-317	Tucson Electric Power Before the Arizona Corporation Commission

Docket No. 5863*	Central Vermont Public Service Corporation Before the Vermont Public Service Board
Docket No. 96-01-26**	Bridgeport Hydraulic Company State of Connecticut Department of Public Utility Control
Docket Nos. 5841/ 5859	Citizens Utilities Company Before Vermont Public Service Board
Docket No. 5983	Green Mountain Power Corporation Before Vermont Public Service Board
Case No. PUE960296**	Virginia Electric and Power Company Before the Commonwealth of Virginia State Corporation Commission
Docket No. 97-12-21	Southern Connecticut Gas Company State of Connecticut Department of Public Utility Control
Docket No. 97-035-01	PacifiCorp, dba Utah Power & Light Company Before the Public Service Commission of Utah
Docket No. G-03493A-98-0705*	Black Mountain Gas Division of Northern States Power Company, Page Operations Before the Arizona Corporation Commission
Docket No. 98-10-07	United Illuminating Company State of Connecticut Department of Public Utility Control
Docket No. 99-01-05	Connecticut Light & Power Company State of Connecticut Department of Public Utility Control

Docket No. 99-04-18	Southern Connecticut Gas Company State of Connecticut Department of Public Utility Control
Docket No. 99-09-03	Connecticut Natural Gas Corporation State of Connecticut Department of Public Utility Control
Docket No. 980007-0013-003	Intercoastal Utilities, Inc. St. John County - Florida
Docket No. 99-035-10	PacifiCorp dba Utah Power & Light Company Before the Public Service Commission of Utah
Docket No. 6332 **	Citizens Utilities Company - Vermont Electric Division Before the Vermont Public Service Board
Docket No. G-01551A-00-0309	Southwest Gas Corporation Before the Arizona Corporation Commission
Docket No. 6460**	Central Vermont Public Service Corporation Before the Vermont Public Service Board
Docket No. 01-035-01*	PacifiCorp dba Utah Power & Light Company Before the Public Service Commission of Utah
Docket No. 01-05-19 Phase I	Yankee Gas Services Company State of Connecticut Department of Public Utility Control
Docket No. 010949-EI	Gulf Power Company Before the Florida Office of the Public Counsel
Docket No. 2001-0007-0023	Intercoastal Utilities, Inc. St. Johns County - Florida

Docket No. 6596	Citizens Utilities Company - Vermont Electric Division Before the Vermont Public Service Board
Docket Nos. R. 01-09-001 I. 01-09-002	Verizon California Incorporated Before the California Public Utilities Commission
Docket No. 99-02-05	Connecticut Light & Power Company State of Connecticut Department of Public Utility Control
Docket No. 99-03-04	United Illuminating Company State of Connecticut Department of Public Utility Control
Docket Nos. 5841/ 5859	Citizens Utilities Company Probation Compliance Before Vermont Public Service Board
Docket No. 6120/6460	Central Vermont Public Service Corporation Before the Vermont Public Service Board
Docket No. 020384-GU	Tampa Electric Company d/b/a/ Peoples Gas System Before the Florida Public Service Commission
Docket No. 03-07-02	Connecticut Light & Power Company State of Connecticut Department of Public Utility Control
Docket No. 6914	Shoreham Telephone Company Before the Vermont Public Service Board
Docket No. 04-06-01	Yankee Gas Services Company State of Connecticut Department of Public Utility Control

Docket Nos. 6946/6988	Central Vermont Public Service Corporation Before the Vermont Public Service Board
Docket No. 04-035-42**	PacifiCorp dba Utah Power & Light Company Before the Public Service Commission of Utah
Docket No. 050045-EI**	Florida Power & Light Company Before the Florida Public Service Commission
Docket No. 050078-EI**	Progress Energy Florida, Inc. Before the Florida Public Service Commission
Docket No. 05-03-17	The Southern Connecticut Gas Company State of Connecticut Department of Public Utility Control
Docket No. 05-06-04	United Illuminating Company State of Connecticut Department of Public Utility Control
Docket No. A.05-08-021	San Gabriel Valley Water Company, Fontana Water Division Before the California Public Utilities Commission
Docket No. 7120 **	Vermont Electric Cooperative Before the Vermont Public Service Board
Docket No. 7191 **	Central Vermont Public Service Corporation Before the Vermont Public Service Board
Docket No. 06-035-21 **	PacifiCorp Before the Public Service Commission of Utah
Docket No. 7160	Vermont Gas Systems Before the Vermont Public Service Board

Docket No. 6850/6853 **	Vermont Electric Cooperative/Citizens Communications Company Before the Vermont Public Service Board
Docket No. 06-03-04** Phase 1	Connecticut Natural Gas Corporation Connecticut Department of Public Utility Control
Application 06-05-025	Request for Order Authorizing the Sale by Thames GmbH of up to 100% of the Common Stock of American Water Works Company, Inc., Resulting in Change of Control of California-American Water Company Before the California Public Utilities Commission
Docket No. 06-12-02PH01**	Yankee Gas Company State of Connecticut Department of Public Utility Control
Case 06-G-1332**	Consolidated Edison Company of New York, Inc. Before the NYS Public Service Commission
Case 07-E-0523	Consolidated Edison Company of New York, Inc. Before the NYS Public Service Commission
Docket No. 07-07-01	Connecticut Light & Power Company Connecticut Department of Public Utility Control
Docket No. 07-035-93	Rocky Mountain Power Company Before the Public Service Commission of Utah
Docket No. 07-057-13	Questar Before the Public Service Commission of Utah
Docket No. 08-07-04	United Illuminating Company Connecticut Department of Public Utility Control
Case 08-E-0539	Consolidated Edison Company of New York, Inc. Before the NYS Public Service Commission

Docket No. 080317-EI	Tampa Electric Company Before the Florida Public Service Commission
Docket No. 7488**	Vermont Electric Cooperative, Inc. Before the Vermont Public Service Board
Docket No. 080318-GU	Peoples Gas System Before the Florida Public Service Commission
Docket No. 08-12-07***	Southern Connecticut Gas Company Connecticut Department of Utility Control
Docket No. 08-12-06***	Connecticut National Gas Company Connecticut Department of Utility Control
Docket No. 090079-EI	Progress Energy Florida, Inc. Before the Florida Public Service Commission
Docket No. 7529 **	Burlington Electric Company Before the Vermont Public Service Board
Docket No. 7585****	Green Mountain Power Corporation Alternative Regulation Before the Vermont Public Service Board
Docket No. 7336****	Central Vermont Public Service Company Alternative Regulation Before the Vermont Public Service Board
Docket No. 09-12-05	Connecticut Light & Power Company Connecticut Department of Utility Control
Docket No. 10-02-13	Aquarion Water Company of Connecticut Connecticut Department of Utility Control
Docket No. 10-70	Western Massachusetts Electric Company Massachusetts Department of Public Utilities

Docket No. 10-12-02	Yankee Gas Services Company Connecticut Department of Utility Control
Docket No. 11-01	Fitchburg Gas & Electric Light Company Massachusetts Department of Public Utilities
Case No.9267	Washington Gas Light Company Maryland Public Service Commission
Docket No. 110138-EI	Gulf Power Company Before the Florida Public Service Commission
Case No.9286	Potomac Electric Power Company Maryland Public Service Commission
Docket No. 120015-EI	Florida Power & Light Company Before the Florida Public Service Commission
Docket No. 11-102***	Western Massachusetts Electric Company Massachusetts Department of Public Utilities
Docket No. 8373****	Green Mountain Power Company Alternative Regulation Before the Vermont Public Service Board
Docket No. 110200-WU	Water Management Services, Inc. Before the Florida Public Service Commission
Docket No. 11-102/11-102A	Western Massachusetts Electric Company Massachusetts Department of Public Utilities
Case No.9311	Potomac Electric Power Company Maryland Public Service Commission
Case No.9316	Columbia Gas of Maryland, Inc. Maryland Public Service Commission

Docket No. 130040-EI**	Tampa Electric Company Before the Florida Public Service Commission
Case No.1103	Potomac Electric Power Company Public Service Commission of the District of Columbia
Docket No. 13-03-23	Connecticut Light & Power Company Connecticut Public Utility Regulatory Authority
Docket No. 13-06-08	Connecticut Natural Gas Corporation Connecticut Public Utility Regulatory Authority
Docket No. 13-90	Fitchburg Gas & Electric Light Company Massachusetts Department of Public Utilities
Docket No. 8190**	Green Mountain Power Company Before the Vermont Public Service Board
Docket No. 8191**	Green Mountain Power Company Alternative Regulation Before the Vermont Public Service Board
Case No.9354**	Columbia Gas of Maryland, Inc. Maryland Public Service Commission
Docket No.2014-UN-132**	Entergy Mississippi Inc. Mississippi Public Service Commission
Docket No. 13-135	Western Massachusetts Electric Company Massachusetts Department of Public Utilities
Docket No. 14-05-26	Connecticut Light & Power Company Connecticut Public Utility Regulatory Authority
Docket No. 13-85	Massachusetts Electric Company and Nantucket Electric Company D/B/A/ as National Grid Massachusetts Department of Public Utilities

Docket No. 14-05-26RE01***	Connecticut Light & Power Company Connecticut Public Utility Regulatory Authority
Docket No.2015-UN-049**	Atmos Energy Corporation Mississippi Public Service Commission
Case No.9390	Columbia Gas of Maryland, Inc. Maryland Public Service Commission
Docket No. 15-03-01***	Connecticut Light & Power Company Connecticut Public Utility Regulatory Authority
Docket No. 15-03-02***	United Illuminating Company Connecticut Department of Public Utility Control
Case No.9418***	Potomac Electric Power Company Maryland Public Service Commission
Case No.1135***	Washington Gas Public Service Commission of the District of Columbia
Docket No. 15-03-01***	Connecticut Light & Power Company Connecticut Public Utility Regulatory Authority
Case No.1137	Washington Gas Public Service Commission of the District of Columbia
Docket No. 160021-EI	Florida Power & Light Company Before the Florida Public Service Commission
Docket No. 160062-EI	Florida Power & Light Company Before the Florida Public Service Commission
Docket No. 15-149	Western Massachusetts Electric Company Massachusetts Department of Public Utilities

Docket No. 8710	Vermont Gas Systems Inc. Before the Vermont Public Service Board
Docket No. 8698	Vermont Gas Systems Inc. Alternative Regulation Before the Vermont Public Service Board
Docket No. 16-06-042	United Illuminating Company Connecticut Department of Public Utility Control
Docket No. A.16-09-001	Southern California Edison Before the California Public Utilities Commission
Case No. 17-1238-INV**	Vermont Gas Systems Inc. Before the Vermont Public Utility Commission
Case No. 17-3112-INV**	Green Mountain Power Company Before the Vermont Public Utility Commission
Docket No. 17-10-46**	Connecticut Light & Power Company Connecticut Public Utility Regulatory Authority
Docket No. 20170141-SU	KW Resort Utilities Corp. Before the Florida Public Service Commission
Docket No. 2017-0105	The Hawaii Gas Company Before the Hawaii Public Utility Commission
Docket No. 20160251-EI**	Florida Power & Light. Company Before the Florida Public Service Commission
Case No. 18-0409-TF**	Vermont Gas Systems Inc. Before the Vermont Public Utility Commission
Docket No. 2018-00008	Maine Water Company (Tax Docket). Before the Maine Public Utility Commission

Docket No. 18-05-16**	Connecticut Natural Gas Company Connecticut Public Utility Regulatory Authority
Docket No. 18-05-10**	Yankee Gas Services Company Connecticut Public Utility Regulatory Authority
Docket No. 20170272-EI**	Duke Energy Florida LLC. (Storm Case) Before the Florida Public Service Commission
Docket No. 20170271-EI**	Tampa Electric Company. (Storm Case) Before the Florida Public Service Commission
Docket No. 20180039-EI***	Gulf Power Company (Tax Docket).
Docket No. 20180044-EI***	Peoples Gas System (Tax Docket).
Docket No. 20180045-EI***	Tampa Electric Company (Tax Docket).
Docket No. 20180046-EI***	Florida Power & Light Company (Tax Docket).
Docket No. 20180047-EI***	Duke Energy Florida LLC (Tax Docket).
Docket No. 20180048-EI***	Florida Public Utilities Company (Tax Docket). Before the Florida Public Service Commission
Docket No. 20180061-EI	Florida Public Utilities Company. (Storm Case) Before the Florida Public Service Commission
Docket No. 20180049-EI**	Florida Power & Light Company. (Storm Case) Before the Florida Public Service Commission
Case No. 19-0513-TF***	Vermont Gas Systems Inc. Before the Vermont Public Utility Commission
RPU-2019-0001	Interstate Power & Light Before the Iowa Utilities Board
D.P.U. 18-153	Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid Massachusetts Department of Public Utilities
Case No.9605***	Washington Gas Light Company Maryland Public Service Commission

Docket No. 20200069-EI	Duke Energy Florida LLC. (SPP) Before the Florida Public Service Commission
Docket No. 2019-0085**	Hawaiian Electric Company, Inc. Before the Hawaii Public Utilities Commission

* Certain issues stipulated, portion of testimony withdrawn.
** Case settled.
*** Assisted in case and hearings, no testimony presented
**** Annual filings reviewed and reports filed with Board.

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Summary
Exhibit No. HWS-2
Schedule A
Page 1 of 4

(000's)

Line No.	Description	Company Requested Trans.	Dist.	Cust. Serv.	Total	**Per OPC**	Adjustment
	Storm Restoration Costs Per Co.						
1	Regular Payroll	1,079	1,258	46	2,383	2,383	0
2	Overtime Payroll	1,460	3,581	119	5,160	5,160	0
3	Burdens/Incentives	1,792	2,287	114	4,193	4,193	0
4	Overhead Allocations	12,266	1,577	38	13,881	13,881	0
5	Employee Expenses	5,436	5,791	47	11,274	11,274	0
6	Contractors	109,058	143,881	145	253,084	233,774	(19,310)
7	Materials & Supplies	13,222	13,968	8	27,198	27,198	0
8	Internal Fleet Costs	165	135	0	300	300	0
9	Other	(3)	0	1	(2)	(2)	0
10	Uncollectible Account Expense	0	0	0	0		
11	Total	144,475	172,478	518	317,471	298,161	(19,310)
	Non-Incremental						
12	Regular Payroll	(362)	(760)	(20)	(1,142)	(1,142)	0
13	Overtime Payroll	(29)	(625)	(27)	(681)	(685)	(4)
14	Burdens/Incentives	(110)	(638)	(68)	(816)	(816)	0
15	Overhead Allocations	(1,378)	(43)	(35)	(1,456)	(1,456)	0
16	Employee Expenses	0	0	0	0	0	0
17	Contractors	0	0	0	0	(940)	(940)
18	Materials & Supplies	(940)	0	0	(940)	0	940
19	Internal Fleet Costs	(1)	(95)	0	(96)	(96)	0
20	Other	0	0	(1)	(1)		
21	Non-Incremental Adjustment	(2,820)	(2,161)	(151)	(5,132)	(5,135)	(4)
22	Capitalized Costs	(90,596)	(14,501)	0	(105,097)	(141,866)	(36,769)
23	Requested Recoverable Costs	51,059	155,816	367	207,242	151,160	(56,083)
24	Effective Jurisdictional Factor	70.203%	99.561%	100.000%			
							Difference
25	Requested Recoverable Retail Costs	35,845	155,132	367	191,345	146,670	(44,675)
26	Interest				4,889		
27	Total Requested				196,234		

Note: Company amounts are from Company Exhibit No. TM-2, Page 1 of 2.

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Summary - OPC
Exhibit No. HWS-2
Schedule A
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(000's)

OPC

Line No.	Description	Michael Trans.	Michael Dist.	Alberto Dist.	Cust. Serv.	Total
	Storm Restoration Costs Per Co.					
1	Regular Payroll	1,079	1,208	50	46	2,383
2	Overtime Payroll	1,460	3,381	200	119	5,160
3	Burdens/Incentives	1,792	2,170	117	114	4,193
4	Overhead Allocations	12,266	1,532	45	38	13,881
5	Employee Expenses	5,436	5,743	48	47	11,274
6	Contractors	104,772	128,416	441	145	233,774
7	Materials & Supplies	13,222	13,911	57	8	27,198
8	Internal Fleet Costs	165	117	18	0	300
9	Other	(3)	0	1	0	(2)
10	Uncollectible Account Expense	0	0	0	0	0
11	Total	140,189	156,478	977	517	298,161
	Non-Incremental					
12	Regular Payroll	(362)	(710)	(50)	(20)	(1,142)
13	Overtime Payroll	(29)	(429)	(200)	(27)	(685)
14	Burdens/Incentives	(110)	(597)	(41)	(68)	(816)
15	Overhead Allocations	(1,378)	0	(43)	(35)	(1,456)
16	Employee Expenses	0	0	0	0	0
17	Contractors	(940)	0	0	0	(940)
18	Materials & Supplies	0	0	0	0	0
19	Internal Fleet Costs	(1)	(80)	(15)	0	(96)
20	Other					0
21	Non-Incremental Adjustment	(2,820)	(1,816)	(349)	(150)	(5,135)
22	Capitalized Costs	(124,326)	(17,482)	(57)	0	(141,865)
23	Requested Recoverable Costs	13,043	137,181	571	367	151,161
	Effective Jurisdictional Factor	70.203%	99.561%	99.561%	100.000%	
	Requested Recoverable Retail Costs	9,156	136,578	569	367	146,670

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Summary - Michael
Exhibit No. HWS-2
Schedule A
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(000's)

Line No.	Description	Company Requested Trans.	Dist.	Cust. Serv.	Total	**Per OPC**	Adjustment
	Storm Restoration Costs Per Co.						
1	Regular Payroll	1,079	1,208	46	2,333	2,333	0
2	Overtime Payroll	1,460	3,381	119	4,960	4,960	0
3	Burdens/Incentives	1,792	2,170	114	4,076	4,076	0
4	Overhead Allocations	12,266	1,532	38	13,836	13,836	0
5	Employee Expenses	5,436	5,743	47	11,226	11,226	0
6	Contractors	109,058	143,440	145	252,643	233,333	(19,310)
7	Materials & Supplies	13,222	13,911	8	27,141	27,141	0
8	Internal Fleet Costs	165	117	0	282	282	0
9	Other	(3)	0	1	(2)	(2)	0
10	Uncollectible Account Expense	0	0	0	0	0	0
11	Total	144,475	171,502	518	316,495	294,852	(19,310)
	Non-Incremental						
12	Regular Payroll	(362)	(710)	(20)	(1,092)	(1,092)	0
13	Overtime Payroll	(29)	(429)	(27)	(485)	(485)	0
14	Burdens/Incentives	(110)	(597)	(68)	(775)	(775)	0
15	Overhead Allocations	(1,378)	0	(35)	(1,413)	(1,413)	0
16	Employee Expenses	0	0	0	0	0	0
17	Contractors	0	0	0	0	(940)	(940)
18	Materials & Supplies*	(940)	0	0	(940)	0	940
19	Internal Fleet Costs	(1)	(80)	0	(81)	(81)	0
20	Other	0	0	(1)	(1)	(1)	0
21	Non-Incremental Adjustment	(2,820)	(1,816)	(151)	(4,787)	(4,787)	0
22	Capitalized Costs	(90,596)	(14,444)	0	(105,040)	(141,786)	(36,746)
23	Requested Recoverable Costs	51,059	155,242	367	206,668	148,279	(56,056)

Note: Company amounts are from Company Exhibit No. TM-2, Page 1 of 2.
Amount on line 18 should be on line 17 based on response to OPCs' Interrogatory No. 4-132.

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Summary - Alberto
Exhibit No. HWS-2
Schedule A
Page 4 of 4

Line No.	Description	Trans.	Dist.	Cust. Serv.	Total	**Per OPC**	Adjustment
			Company Requested				
	Storm Restoration Costs Per Co.						
1	Regular Payroll		50		50	50	0
2	Overtime Payroll		200		200	200	0
3	Burdens/Incentives		117		117	117	0
4	Overhead Allocations		45		45	45	0
5	Employee Expenses		48		48	48	0
6	Contractors		441		441	440	(1)
7	Materials & Supplies		57		57	57	0
8	Internal Fleet Costs		18		18	18	0
9	Other		0		0	0	0
10	Uncollectible Account Expense	0	0		0	0	0
11	Total	0	976	0	976	975	(1)
	Non-Incremental						
12	Regular Payroll		(50)		(50)	(50)	0
13	Overtime Payroll		(196)		(196)	(200)	(4)
14	Burdens/Incentives		(41)		(41)	(41)	0
15	Overhead Allocations		(43)		(43)	(43)	0
16	Employee Expenses		0		0	0	0
17	Contractors		0		0	0	0
18	Materials & Supplies		0		0	0	0
19	Internal Fleet Costs		(15)		(15)	(15)	0
20	Other		0		0	0	0
21	Non-Incremental Adjustment	0	(345)	0	(345)	(349)	(4)
22	Capitalized Costs		(57)		(57)	(79)	(22)
23	Requested Recoverable Costs	0	574	0	574	547	(27)

Note: Company amounts are from Company Exhibit No. TM-2, Page 2 of 2.

Duke Energy Florida, LLC
Storm Restoration Costs

(000's)

Docket No. 20190110-EI
Regular Payroll
Exhibit No. HWS-2
Schedule B

Line No.	Description	Costs	Non Increm.	Net Cost	Est. Capital	Restore Costs
	Per Company					
	Regular Payroll					
1	Transmission - Michael	1,079	(362)	717	(352)	365
2	Distribution - Michael	1,208	(710)	498	(249)	249
3	Distribution - Alberto	50	(50)	0		0
4	Cust. Service - Michael	46	(20)	26		26
5	Total	2,383	(1,142)	1,241	(601)	640
	Overtime Payroll					
6	Transmission - Michael	1,460	(29)	1,431	(341)	1,090
7	Distribution - Michael	3,381	(429)	2,952	(738)	2,214
8	Distribution - Alberto	200	(196)	4	0	4
9	Cust. Service - Michael	119	(27)	92		92
10	Total	5,160	(681)	4,479	(1,079)	3,400
11	Total Labor Per Co.	7,543	(1,823)	5,720	(1,680)	4,040
	Per OPC					
	Regular Payroll					
12	Transmission - Michael	1,079	(362)	717	(352)	365
13	Distribution - Michael	1,208	(710)	498	(249)	249
14	Distribution - Alberto	50	(50)	0		0
15	Cust. Service - Michael	46	(20)	26		26
16	Total	2,383	(1,142)	1,241	(601)	640
	Overtime Payroll					
17	Transmission - Michael	1,460	(29)	1,431	(341)	1,090
18	Distribution - Michael	3,381	(429)	2,952	(738)	2,214
19	Distribution - Alberto	200	(200)	0	0	0
20	Cust. Service - Michael	119	(27)	92		92
21	Total	5,160	(685)	4,475	(1,079)	3,396
22	Total Labor Per OPC	7,543	(1,827)	5,716	(1,680)	4,036
23	OPC Adjust. L.22-L.11	0	(4)	(4)	0	(4)

Source: Lines 1-11 are from Company Exhibit No. TM-2.

Duke Energy Florida, LLC
Storm Restoration Costs

(000's)

Docket No. 20190110-EI
Burdens/Incentives
Exhibit No. HWS-2
Schedule C

Line No.	Description	Costs	Non Increm.	Net Cost	Capital	Restore Costs
	Per Company					
	Burdens/Incentives					
1	Transmission - Michael	1,792	(110)	1,682	(1,079)	603
2	Distribution - Michael	2,170	(597)	1,573		1,573
3	Distribution - Alberto	117	(41)	76		76
4	Customer Service	114	(68)	46		46
5	Total	4,193	(816)	3,331	(1,079)	2,252
	Per OPC					
	Burdens/Incentives					
6	Transmission - Michael	1,792	(110)	1,682	(1,079)	603
7	Distribution - Michael	2,170	(597)	1,573	(450)	1,123
8	Distribution - Alberto	117	(41)	76		76
9	Customer Service	114	(68)	46		46
10	Total	4,193	(816)	3,331	(1,529)	1,802
11	OPC Adjust. L.10-L.5	0	0	0	(450)	(450)
	Non-incremental Labor				Capital	
12	Transmission - Michael	2,539	(391)	2,148		
13	Distribution - Michael	4,589	(1,139)	3,450	987	
	Percentage of Non=Incremental Burden/Incentive Costs					
14	Transmission - Michael			78.31%		
15	Distribution - Michael			45.59%	450	

Source: Lines 1-5 are from Company Exhibit No. TM-2.

Duke Energy Florida, LLC
Storm Restoration Costs

(000's)

Docket No. 20190110-EI
Overhead Allocations
Exhibit No. HWS-2
Schedule D

Line No.	Description	Costs	Non Increm.	Net Cost	Capital	Restore Costs
	Per Company					
	Overhead Allocations					
1	Transmission - Michael	12,266	(1,378)	10,888	(10,847)	41
2	Distribution - Michael	1,532	0	1,532	(2,238)	(706)
3	Distribution - Alberto	45	(43)	2	(11)	(9)
4	Customer Service	38	(35)	3		3
5	Total	13,881	(1,456)	12,422	(13,095)	(673)
	Per OPC					
	Overhead Allocations					
6	Transmission - Michael	12,266	(1,378)	10,888	(10,847)	41
7	Distribution - Michael	1,532	0	1,532	(1,532)	0
8	Distribution - Alberto	45	(43)	2	(2)	0
9	Customer Service	38	(35)	3		3
10	Total	13,881	(1,456)	12,422	(12,380)	42
11	OPC Adjust. L.10-L.5	0	0	0	715	715

Source: Lines 1 and 5 are from Exhibit TM-2.
Capital amounts are from the response to Citizens' Interrogatory No. 4-136.

Duke Energy Florida, LLC
Storm Restoration Costs

(000's)

Docket No. 20190110-EI
Employee Expenses
Exhibit No. HWS-2
Schedule E

Line No.	Description	Costs	Non Increm.	Net Cost	Capital	Restore Costs
	Per Company					
	Employee Expenses					
1	Transmission - Michael	5,436	0	5,436	(446)	4,990
2	Distribution - Michael	5,743	0	5,743	0	5,743
3	Distribution - Alberto	48	0	48	0	48
4	Customer Service	47	0	47		47
5	Total	11,274	0	11,274	(446)	10,781
	Per OPC					
	Employee Expenses					
6	Transmission - Michael	5,436	0	5,436	(446)	4,990
7	Distribution - Michael	5,743	0	5,743	0	5,743
8	Distribution - Alberto	48	0	48	0	48
9	Customer Service	47	0	47		47
10	Total	11,274	0	11,274	(446)	10,781
11	OPC Adjust. L.10-L.5	0	0	0	0	0

Source: Lines 1 and 5 are from Company Exhibit TM-2.

Duke Energy Florida, LLC
Storm Restoration Costs

(000's)

Docket No. 20190110-EI
Contractors
Exhibit No. HWS-2
Schedule F

		Michael				Alberto	
Line No.	Description	Trans.	Dist.	Cust. Service	Total	Dist.	Total
	Per Company						
1	Line Contractors	95,797	90,600		186,397	415	186,812
2	Tree Trimming	4,446	9,032		13,478	22	13,500
3	Aviation		425		425		425
4	Contractor Materials		97		97	2	99
5	Materials/Supplies/Other	6,765	1,675	145	8,585		8,585
6	Logistics	2,050	41,411		43,462		43,462
7	Unidentified		200		200	2	202
8		109,058	143,440	145	252,643	441	253,084
9	Less : Capitalized Costs	(98,727)			(98,727)	(57)	(98,784)
10	Plus : Capitalized Costs Adjustment	27,202			27,202		27,202
11	Co. Contractor Costs	37,533	143,440	145	181,118	384	181,502
12							0
13	Company Request	37,533	143,440	145	181,118	384	181,502
	Per OPC						
14	Line Contractors	95,732	82,566		178,298	415	178,712
15	Tree Trimming	4,446	8,602		13,047	22	13,070
16	Aviation		425		425		425
17	Contractor Materials		97		97	2	99
18	Materials/Supplies/Other	3,522	1,675	145	5,342		5,342
19	Logistics	1,073	35,051		36,124		36,124
20	Unidentified		1		1	2	3
		104,772	128,416	145	233,333	441	233,774
21	Less : Capitalized Costs	(98,727)			(98,727)	(22)	(98,749)
22	Less : Capitalized Costs Adjustment	(34,445)	(2,566)		(37,012)	(57)	(37,069)
23	Plus : Co. Capital Cost Adjustment	27,202			27,202		27,202
24	Contractor Costs	(1,198)	125,850	145	124,797	362	125,158
							0
25	Contractor Adjustment	(38,731)	(17,591)	(0)	(56,322)	(22)	(56,344)

Lines 1-8 are from response to Citizens' IR 5-150.

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Transmission Contractors - Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Expenses & Materials	Total	IR 150	Description
	Michael									
1	[redacted]							0	65,387	Ltd detail
2				Duplicates above invoice since total is $200,945 + 65,387					266,332	
3								0	315,793	Ltd detail
4								0	342,716	
5								0	109,860	
6								0	2,919,000	Ltd detail
7								0	4,983,259	Ltd detail
8								0	2,584,830	Ltd detail
9								0	4,987,789	Ltd detail
10								0	11,930,051	Ltd detail
11								0	7,080,058	Ltd detail
12								0	4,301,799	
13								0	640,876	Ltd detail
14								0	3,089,569	
15								0	1,864,134	
16								0	473,001	Ltd detail
17								0	709,502	Ltd detail
18			2448		249,463	113,983	1,156	364,603	364,603	10/8-10/18
19			2566.25		251,226	141,761	1,220	394,207	394,207	
20								0	289,839	10/10-10/16
21								0	1,044,363	No detail
22								0	668,020	
23								0	853,121	No detail
24							3,980,252	3,980,252	3,980,252	No detail
25								0	44,100	No detail
26					144,576	216,257	37,706	398,539	398,539	Ltd Detail
27								0	146,273	No detail
28								0	6,509,317	
29								0	331,725	No detail
30								0	6,078,513	
31								0	6,944,155	
32								0	5,259,727	
33					63,252	86,800	346,743	496,795	496,795	Ltd detail
34								0	5,179,672	
35								0	4,132,239	
36								0	2,507,083	
37			14996	107	1,606,144	726,605	38,115	2,370,864	2,370,864	WE 10/14
38								0	761,217	
39								0	(761,217)	
40								0	760,750	
41							139,137	139,137	139,137	
42								0	18,231	
43								0	52,289	
44									49,416	
45		[redacted]		Invoices under $25,000				0	45,810	
46									19,242	
47									25,031	
48									3,174	
49								0	26,478	
50	Total Transmission Costs				2,314,662	1,285,406	4,544,328	8,144,396	95,796,918	
51				Duplicated Cost				(65,387)	(65,387)	
					2,314,662	1,285,406	4,544,328	8,079,009	95,731,531	

Invoice detail is from response to Citizens' POD No. 1-4.

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20160251-EI
Transmission Tree Trimming - Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average	Labor/ Fringe	Equip	Exp. & Mat.	Total		IR 43	Description	MOB/ DEMOB	
	Michael												
1	[redacted]									13,853			
2						9,284	4,370	13,654	x	29,484	WE 9/29/18		
3								0		5,818			
4			1035	64	65,820	9,083	1,556	76,460		76,460	WE 10/13/18	20,032	M
5								0		3,955			
6								0		-			
7								0		51,240			
8								0		6,204			
9			372	49	18,283	6,184	2,207	26,673		26,673	WE 10/13/18	4,128	M
10								0		7,832			
11			640	50	31,765	15,604	2,814	50,183		50,183	WE 10/13/18	6,353	M
12								0		6,225			
13			576	49	28,195	10,660	3,140	41,995		41,996	WE 10/13/18	7,049	M
14								0		41,996			
15								0		7,381			
16			790	43	33,789	10,727	2,984	47,499		47,499	WE 10/13/18	9,837	M
17			553	47	25,898	11,178	2,385	39,462		39,462	WE 10/13/18	5,901	M
18								0		5,885			
19								0		24,058			
20								0		7,279			
21								0	x	42,283	WE 10/20/18		
22								0		6,560			
23			770	43	32,760	9,199	0	41,959		41,959	WE 10/20/18	10,211	D
24			483	43	20,965	9,282		30,247		30,247	WE 10/20/18	3,950	D
25								0		3,316			
26								0		20,829			
27								0		5,320			
28			480	40	18,990	19,204	761	38,956		38,956	WE 10/13/18	No TS	
29								0		5,372			
30								0		5,230			
31			640	39	24,998	10,564	749	36,312		36,312	WE 10/13/18	No TS	
32								0		5,289			
33			640	39	24,839	9,557		34,397		34,397	WE 10/13/18	No TS	
34								0		5,524			
35			640	37	23,400	10,668		34,068		34,068	WE 10/20/18	No TS	
36								0		5,377			
37			900	34	30,688	10,008		40,696		40,696	WE 10/20/18	No TS	
38								0		5,377			
39			480	40	18,990	22,370		41,361		41,361	WE 10/20/18	No TS	
40								0		5,377			
41								0		5,377			
42			640	39	24,998	11,857		36,855		36,855	WE 10/20/18	No TS	
43								0		9,691			
44								0		3,400			
45								0		22,774			
46								0		3,669			
47			348	32	11,190	16,497	1,350	29,038		29,039	WE 10/27/18	No TS	
48								0		3,871			
49							1,103	1,103	x	34,518	WE 10/27/18	No TS	
50							1,161	1,161	x	25,224	WE 11/10/18	No TS	
51								0		21,051			
52			420	32	13,424	11,479	2,618	27,521		54,947	WE 11/10/18	No TS	
53								0		3,435			
54								0		3,400			
55								0		22,495			
56								0		3,400			
57			300	31	9,308	16,778	2,369	28,454		28,454	WE 11/3/18	No TS	
58								0		3,400			
59							3,811	3,811	x	37,179	WE 11/3/18	No TS	
60								0		19,764			
61								0		14,558			
62								0		15,395			
63								0		1,208			
64								0		15,090			
65								0		17,818			
66								0		12,151			
67								0		(42,283)			
68								0		(27,426)			
69								0		(41,996)			

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20160251-EI
Transmission Tree Trimming - Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average	Labor/ Fringe	Equip	Exp. & Mat.	Total		IR 43	Description	MOB/ DEMOB	
70	[redacted]							0		29,502			
71								0		20,227			
72								0		115,989			
73								0		107,120			
74								0		7,500			
75								0		121,678			
76								0		70,520			
77										121,518			
78										131,126			
79										11,315			
80										32,805			
81										128,678			
82										623,455			
83										71,310			
84										66,520			
85										50,280			
86										47,071			
87										3,401			
88										45,334			
89										47,163			
90										26,005			
91										55,417			
92										32,034			
93			780	34	26,248	17,868	6,307	50,423		50,423	WE 11/3/18	No TS	
94			960	34	32,212	16,161	5,624	53,997		53,997	WE 10/27/18	No TS	
95			1,200	43	51,714	17,378	389	69,481		69,481	WE 10/20/18	No TS	
96			792	34	26,853	14,338	6,946	48,138		48,138	WE 11/10/18	No TS	
97			108	31	3,299	3,376	0	6,675		6,675	WE 11/10/18	No TS	
98			795	42	33,257	9,775	99	43,131		43,131	WE 10/13/18	No TS	
99			720	34	24,190	11,728	6,174	42,092		42,092	WE 11/17/18	No TS	
100			**1,472**	48	71,054			71,054		71,054	WE 10/13/18	No TS	
101			1,600	50	79,803			79,803		79,803	WE 10/20/18	No TS	
102			360	50	18,150			18,150		18,150	WE 10/27/18	No TS	
103			708	52	36,872			36,872		36,872	WE 11/3/18	No TS	
104			360	54	19,323			19,323		19,323	WE 11/10/18	No TS	
105			612	54	33,129			33,129		33,129	WE 11/17/18	No TS	
106			**576**	42	24,318	4,270		28,588		28,588	10/14-10/15	No TS	
107								0		2,965			
108								0		14,723			
109			675	40	26,863	5,564		32,427		32,427	10/14-10/16		
110								0		2,698			
111			619	47	29,009	13,274		42,283		42,283	10/14-10/18	10,545	D
112			2,378	42	98,954	12,538		111,492		111,492	10/9-10/12		
113										759			
114										2,201			
115										1,053			
116										615			
117										43,142			
118										36,790			
119										850			
120										32,991			
121					33 Invoices under $10,000					98,804			
122					24 Invoices under $10,000					98,623			
123					22 Invoices under $6,000					52,790			
124										14,116			
125										14,207			
126										10,644			
127										3,513			
128					3 Invoices under $10,000					10,012			
129					4 Invoices under $10,000					7,326			
130													
131			25,422	43	1,093,550	356,453	58,917	1,508,919		4,445,628		78,006	

Invoice detail is from response to Citizens' POD No. 1-6.

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20160251-EI
Transmission Logistics - Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Labor	Lodging/ Catering	Location Costs/ Other	Total		IR 151
	Michael							
1	[redacted]							8,160
2								71,964
3								45,756
4								4,011
5								7,670
6								42,085
7								33,591
8								20,077
9								12,548
10								11,197
11								128,520
12								14,040
13								10,800
14								13,950
15								12,600
16							a	161,728
17								387,627
18								11,713
19								10,356
20								5,257
21								24,718
22							a	178,318
23								77,500
24							a	93,000
25			102,980		4,979	107,959		108,114
26								29,500
27								15,500
28								35,000
29								74,378
30			Invoices under $10,000					66,621
31								48,500
32								36,000
33								2,448
34			4 Invoices under $10,000					16,626
35			Invoices under $10,000					10,515
36								10,000
37								2,000
38								1,823
39								161
40								107
41			Not in listing from Q-3 confidential for IR-2					205,870
42			102,980	-	4,979	107,959		2,050,347
43		**Recommended adjustment for lack of support**					a	(977,489)
44								1,072,858

Sources: Invoice detail was provided in Company response to Confidential Citizens' POD No. 16.

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20160251-EI
Transmission Other - Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor		Total	IR 150
1	[redacted]	[redacted]	[redacted]	-	59,029
2					11,808
3					31,244
4			2 invoices under $10,000		959
5					10,800
6					700
7					15,850
8					107,100
9					120,120
10					31,700
11					17,160
12					31,700
13					8,580
14					25,740
15					16,050
16					63,400
17					15,850
18					26,000
19					36,400
20					36,400
21					7,755
22					5,200
23					5,200
24					20,800
25					32,100
26					1,145
27					24,855
28					26,000
29					16,744
30			17 invoices under $10,000		14,257
31			6 Invoices under $25,000		106,200
32					700
33					105,755
34					86,588
35					5,000
36					209,124
37					313,971
38					42,501
39					159,271
40					167,118
41					106,006
42					101,771
43					84,921
44					83,757
45					31,914

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20160251-EI
Transmission Other - Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor				Total	IR 150
46	[redacted]						33,985
47				4 Invoices under $25,000			26,991
48							13,380
49							87,215
50							24,090
51				5 Invoices under $25,000			14,787
52				2 Invoices under $25,000			17,187
53				253 invoices under $10,000			484,992
54				3 invoices under $10,000			2,558
55							8,120
56				5 Invoices under $25,000			46,072
57							1,050
58				16 Invoices under $25,000			56,410
59							457,500
60				2 Invoices under $25,000			664
61				13 invoices under $10,000			27,517
62							3,243,044
63		See logistics					(205,870)
64		-		-	-	-	6,764,933
65		Adjustment for unsupported cost					(3,243,044)
66							3,521,889

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Distribution Contractors Line-Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Exp. & Materials	Total	Filing Cost IR 150	Description	Dates	Bates	MOB/ DEMOB
	Michael												
1	[redacted]		27,215	188	5,108,362	1,818,005		6,926,367	5,194,773	D	10/15-10/19	6898	720,971
2			25,269	189	4,770,451	1,716,944		6,487,394	4,865,546		10/11-10/14	6642	
3			23,088	200	4,625,049	1,350,210		5,975,259	4,481,444	M	10/8-10/11	5909	4,625,049
4			17,406	134	2,340,100	1,274,266		3,614,365	2,710,774		10/22-10/28	6268	
5			15,003	133	1,993,143	1,126,911		3,120,054	2,340,041	D	10/29-11/4	8368	456,206
6									1,731,591				
7									1,621,849				
8									1,493,815				
9			6,042	201	1,216,548	445,060		1,661,608	1,246,206	M	10/10-10/10	6322	1,189,970
10			7,423	143	1,062,871	400,594		1,463,464	1,097,598		10/17-10/21	8162	
11						1,045,229	175,167	1,220,396	1,030,927	M/D Mileage is in equipment			
12									903,591				
13									780,014				
14									415,402				
15						276,426	228,721	505,147	405,275	Mileage	10/10-10/18	8156	
16									365,866				
17			1,594	243	387,702	78,917		466,619	349,964		10/11-10/12		
18								0	189,469				
19			1,254	89	111,505	73,495		185,000	135,675	M	10/8-10/11		
20						117,039	38,220	155,259	124,077	M Mileage is in equipment			
21									116,655				
22									99,872				
23				#DIV/0!				0	80,721			8465	
24									49,325				
25				#DIV/0!				0	43,370	No detail found			
26				#DIV/0!				0	40,817	No detail found			
27									31,182				
28								0	21,680				
29								0	14,457				
30								0	7,227				
31				Bill revised, no detail showing the revised bill amount					4,721			8482	
32								0	(5,731)				
33			3,120	114	355,556	120,592	3,147	479,295	359,471		10/19 W	2313	
34			3,040	114	345,169	120,208		465,377	349,033		10/21 W	2338	
35			3,040	114	345,750	119,440		465,190	348,893		10/24 W	2395	

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Distribution Contractors Line-Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Exp. & Materials	Total	Filing Cost IR 150	Description	Dates	Bates	MOB/ DEMOB
36	[redacted]	[redacted]	3,016	114	342,344	120,208		462,552	346,914		10/22 W	2358	
37	[redacted]	[redacted]	3,008	114	342,563	119,824		462,387	346,790		10/25 W	2402	
38	[redacted]	[redacted]	2,996	114	341,102	120,208		461,310	345,982				
39	[redacted]	[redacted]	2,906	114	330,359	119,824		450,183	337,637		10/26 W	2411	
40	[redacted]	[redacted]	2,720	113	308,651	119,824		428,475	321,356		10/27 W	2422	
41	[redacted]	[redacted]	2,680	113	303,941	119,824		423,765	317,824		10/28 W	2433	
42	[redacted]	[redacted]	2,586	113	292,874	119,824		412,698	309,523		10/29 W	2449	
43	[redacted]	[redacted]	2,443	114	277,584	117,307		394,891	296,168		10/30 W	2460	
44	[redacted]	[redacted]	2,317	112	259,216	104,556	23,010	386,782	290,086	M	10/10 M/SB	2155	259,216
45	[redacted]	[redacted]	2,288	112	256,043	113,408	2,145	371,596	278,697		10/11 W	2167	
46	[redacted]	[redacted]	2,288	112	256,238	113,408		369,646	277,234		10/13 W	2219	
47	[redacted]	[redacted]	2,288	112	256,043	113,408		369,451	277,088		10/12 W	2196	
48	[redacted]	[redacted]	2,256	112	253,050	112,368		365,418	274,064		10/15 W	2261	
49	[redacted]	[redacted]	2,247	112	251,737	112,368		364,105	273,078		10/14 W	2243	
50	[redacted]	[redacted]	2,234	112	251,041	111,328		362,369	271,777		10/16 W	2301	
51	[redacted]	[redacted]	2,221	112	249,510	110,093		359,603	269,702		10/17 W	2324	
52	[redacted]	[redacted]	2,208	114	251,656	104,912		356,568	267,426		10/31 W	2471	
53	[redacted]	[redacted]	2,192	112	246,095	108,208		354,303	265,727		10/18 W	2289	
54	[redacted]	[redacted]	2,168	114	247,623	102,368		349,991	262,493		11/1 W	2482	
55	[redacted]	[redacted]	2,080	113	235,809	99,312		335,121	251,341		11/2 W	2493	
56	[redacted]	[redacted]	1,888	113	212,814	117,136	1,770	331,720	248,790	D	11/3 D	2504	212,814
57	[redacted]	[redacted]	1,430	112	160,027	70,880	10,725	241,632	241,632	M	10/9 M/SB	2143	160,027
58	[redacted]	[redacted]	[redacted] is included in the above invoice totaling $241,632					0	181,224				
59	[redacted]	[redacted]							119,824				
60	[redacted]	[redacted]							116,344				
61	[redacted]	[redacted]							115,597				
62	[redacted]	[redacted]							112,546				
63	[redacted]	[redacted]							107,119				
64	[redacted]	[redacted]							105,941				
65	[redacted]	[redacted]							103,174				
66	[redacted]	[redacted]							100,453				
67	[redacted]	[redacted]							98,723				
68	[redacted]	[redacted]							96,695				
69	[redacted]	[redacted]							92,899				
70	[redacted]	[redacted]							92,411				
71	[redacted]	[redacted]							92,363				
72	[redacted]	[redacted]							91,355				

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Distribution Contractors Line-Billing Summary
Exhibit HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Exp. & Materials	Total	Filing Cost IR 150	Description	Dates	Bates	MOB/ DEMOB
73	[redacted]								91,026				
74									90,592				
75									89,901				
76									89,142				
77									88,576				
78									87,498				
79									83,780				
80									82,930				
81									65,586				
82			0	0	0		32,632	32,632	32,632			2513	
83			24,941	131	3,275,286	1,378,237	68,122	4,721,645	3,541,234	M 10/8-10	10/8-10/13		1,179,135
84			10,279	147	1,516,105	558,493	13,896	2,088,493	1,566,370	D 10/14-16	10/14-10/16		923,321
85								0	1,180,411				
86			15,600	54	841,985			841,985	765,066	M/D Assessor	10/10-10/14		
87								0	522,123				
88								0	255,022				
89			22,039	136	2,993,797	1,416,251	66,263	4,476,311	3,357,233	D	10/17-11/4	1209	389,524
90			12,694	132	1,672,016	930,179	67,438	2,669,633	2,002,225	M	10/8-10/18	1159	222,734
91									1,119,078				
92			(b)	No Audit					667,408				
93			18,826	117	2,208,576	729,746	74,735	3,013,056	2,259,792	M	10/8-10/13	4925	958,407
94									753,264				
95			6,432	113	729,740	241,936	7,310	978,986	734,240	M/D?	10/14-10/20	5038	423,729
96								0	244,747				
97			1,279	119	151,814	43,011	12,092	206,917	130,799	M/SB	10/9-10/13	4480	60,773
98									76,118				
99			480	102	48,735	15,930	4,529	69,194	69,194	D	10/14-10/15	4482	48,735
100				#DIV/0!				0	55,241				
101							41,809	41,809	41,809	Expenses		5062	
102			3,068	209	640,194	87,252	10,400	737,845	553,384	M/SB	10/8-10/11	1661	640,194
103			1,860	214	397,702	56,179	6,200	460,081	345,061	M/SB	10/8-10/11	1744	397,702
104			1,860	202	375,710	48,479	6,200	430,389	322,792	M/SB	10/8-10/11	1650	375,710
105			1,740	209	364,052	49,408	5,800	419,260	314,445	M/SB	10/8-10/11	1765	364,052
106			1,560	209	326,570	46,510	5,200	378,279	283,710	M/SB	10/8-10/11	1691	326,570
107			1,500	221	330,807	42,167	3,750	376,724	282,543	M/SB	10/8-10/11	1680	330,807
108									184,461				
109									115,020				

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Distribution Contractors Line-Billing Summary
Exhibit HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Exp. & Materials	Total	Filing Cost IR 150	Description	Dates	Bates	MOB/ DEMOB
110	[redacted]								107,597				
111									104,815				
112									94,570				
113									94,181				
114			120	241	28,964	2,254	47,012	78,230	78,230	M/SB	10/8-10/11	1743	28,964
115			8,456	74	627,305	192,114		819,419	747,895		10/11-10/14	3888	
116			10,870	57	621,386	60,120	23,079	704,584	704,584	Assessors		11466	
117			3,664	55	200,382	20,582	8,991	229,955	229,955	Assessors		11530	
118			1,925	98	188,431	47,772	425	236,629	212,966		10/10-10/11	3684	
119			1,810	83	150,487	36,102		186,589	167,930		10/10-10/11	3740	
120			1,390	91	126,555	38,317	6,512	171,384	154,246	SB	10/9-10/11	3626	126,555
121									83,099				
122			471	69	32,533	5,652	1,103	39,288	39,288	Assessors	11/26-1/23		
123									23,663				
124									18,659				
125									17,138				
126				#DIV/0!				0	12,589				
127			7,584	137	1,041,072	200,640	44,455	1,286,167	964,625	M/SB	10/9-10/14	3037	317,648
128			7068	128	905,320	187,260	25,072	1,117,652	838,239	D	10/15-10/21	3262	206,476
129			(a)						321,542				
130			(b)	#VALUE!				0	279,413				
131			2,814	124	348,215	89,352	12,436	450,004	450,004	M	10/9-10/13	4281	135,500
132			2,800	107	299,040	86,912	11,713	397,665	298,249	SB/W	10/9-10/13	4337	179,424
133			2,422	108	260,533	96,980	33,244	390,758	293,083	M/SB/D	10/10-10/15	4005	176,522
134			2,322	108	251,931	121,686	15,632	389,249	285,094	M/SB	10/9-10/13	4066	151,571
135			1,494	106	158,520	78,435	8,427	245,382	184,036	M/SB/D	10/9-10/13	3907	122,232
136			1,382	114	158,127	40,725	8,004	206,856	160,575	M/SB/D	10/9-10/13	4208	95,654
137			1,014	111	112,763	39,199	6,786	158,747	124,931	M/SB/D	10/9-10/14	4235	78,067
138			920	106	97,773	40,664	8,990	147,427	113,363	M/SB/D	10/8-10/13	4420	70,142
139									104,155				
140									99,416				
141									97,694				
142									61,345				
143									46,281				
144									34,064				
145			(e)						33,816				

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Distribution Contractors Line-Billing Summary
Exhibit HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Exp. & Materials	Total	Filing Cost IR 150	Description	Dates	Bates	MOB/ DEMOB
146	[redacted]		3,344	135	450,113	162,432	0	612,545	459,409		10/22-10/28	9242	0
147			2,552	136	348,130	109,526	10,818	468,474	351,356	Mob/SB	10/9-10/14	9083	14,190
148			2580	129	332,642	131,354	861	464,857	348,643	Dem	10/26-11/3	9303	31,459
149			1728	126	217,046	74,176	542	291,764	218,823	10/18SB	10/15-10/18	9178	54,262
150									153,136				
151									117,119				
152									116,214				
153			800	138	110,546	34,416	0	144,962	108,722		10/19-10/20	9219	
154									72,941				
155									36,241				
156				#DIV/0!				0	17,797				
157				#DIV/0!				0	4,261				
158				#DIV/0!				0	288				
159			4032	84	339,173	250,507	7,200	596,880	447,660		10/22-10/28	486	
160			3454	85	293,363	214,248	9,840	517,451	388,088	M/SB/M	10/9-10/14	300	146,596
161			2304	72	166,544	142,832		309,376	232,032		10/15-10/18	420	
162			1728	99	170,785	107,124	480	278,389	208,792		10/19-10/21	422	
163									149,220				
164									129,363				
165									77,344				
166				#DIV/0!					69,597				
167				#DIV/0!	36,320	31,068	1,440	68,828	68,828	D		545	36,320
168									16,372				
169				#DIV/0!					925,967				
170				#DIV/0!					401,735				
171				#DIV/0!					258,259				
172				#DIV/0!					167,244				
173			6935	95	660,820	200,711	30,922	892,452	803,207	SB 47,120	10/9-10/19	2544	
174			2233	90	200,025	56,868	25,944	282,837	254,553		11/7-12/2	2676	
175			2080	88	183,289	57,406	15,313	256,008	230,407		12/3-12/30	2713	
176			1678	87	145,230	53,025	33,062	231,318	208,186		12/31-1/27	2746	
177									89,245				
178			261	80	20,750	6,637	6,627	34,014	30,613		2/4-2/12	2793	
179									28,284				
180									25,601				
181									23,132				
182			(e)						3,401				

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Distribution Contractors Line-Billing Summary
Exhibit HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Exp. & Materials	Total	Filing Cost IR 150	Description	Dates	Bates	MOB/ DEMOB
183	[redacted]		2030	67	136,425	348,558	(Hydrovac)	484,983	484,983	SB/D - 3773	10/23-11/20	771	-
184			1743	68	119,318	331,553	29,721	480,591	480,591	SB/M/D-72,95	10/22-11/23	788	-
185								-	73,930				-
186			766	71	54,398	93,772	(4,480)	143,690	69,760	M-4612.5	10/11-10/21	621	-
187			681	72	49,320	87,170		136,490	69,140	M	10/10-10/20	687	4,985
188								-	68,780				-
189								-	67,350				-
190			333	73	24,348	39,450		63,798	63,798	M-1,630	10/10-10/14	663	-
191			640	69	44,160	87,200		131,360	62,580		10/12-10/15	734	-
192									6,380				-
193									2,800				-
194									2,200				-
195			8586	100	859,775	287,930	57,422	1,205,127	903,845	M/SB/D-26	10/8-10/16	1	449,615
196									301,282				
197			855	80	68,329	21,505	3,723	93,557	93,557	All Carolina	10/10-10/11	260	68,329
198			2752	126	346,845	86,585	8,388	441,818	397,636	M/D	10/10-10/11	1405	346,845
199			2605	126	327,871	85,941	8,550	422,362	361,061	M/D	10/10-10/11	1384	327,871
200			648	145	93,983	45,552	756	140,291	126,262	W/D	10/14-10/16	1445	56,854
201			512	130	66,527	39,808	1,728	108,063	97,257	M/SB	10/10-10/11	1439	66,527
202									61,302				
203			264	131	34,582	20,526	288	55,396	55,396		10/13 D	1434	
204			256	130	33,264	19,804	864	53,932	54,032	M	10/12 M	1426	33,264
205									44,182				
206									14,029				
207			(c)						10,806				
208			5743.5	120	687,084	337,718	75,051	1,099,852	824,889	M/SB	10/8-10/11	1553	687,084
209									274,963				
210			6880.5	105	724,709	270,897	18,772	1,014,378	912,941		10/11-10/21	8786	123,076
211									101,438				
212			1926	65	125,036	77,759		202,795	202,795		12/10-12/23	1981	
213			1930	68	130,778	58,153		188,931	188,931		11/27-12/9	1951	
214			1793.5	63	113,545	61,778	14,155	189,478	170,796		11/12-11/23	1879	
215			1565	63	97,973	64,821		162,794	162,794		1/2-1/16	2082	
216			1542.5	62	95,128	46,328	14,531	155,988	140,389		10/26-11/11	1830	
217			36	41	1,475	23,604		25,079	25,079		12/23 & 31	2000	
218			24	69	1,645		18,674	20,319	20,319			1958	
219									18,682				
220			0	0	0	397	17,583	17,979	17,979			2089	
221			(a)						15,599				

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Distribution Contractors Line-Billing Summary
Exhibit HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Exp. & Materials	Total	Filing Cost IR 150	Description	Dates	Bates	MOB/ DEMOB
222	[redacted]		5848	67	390,100	189,965		580,065	579,220		10/19-11/12	3281	
223	[redacted]		1310	60	79,036	41,110		120,146	120,146			3522	
224	[redacted]		225	82	18,499	9,077	1,388	28,964	28,963		10/9-10/11	3586	
225	[redacted]	744,460	164	73	12,036	3,772		15,808	16,130	IR-14	10/10-1 Day	5218	
226	[redacted]		591	124	73,343	18,488	1,751	93,582	93,582		10/8-10/14	8949	36,858
227	[redacted]		477.5	131	62,531	11,160	1,303	74,995	74,995		10/9-10/14	9001	25,209
228	[redacted]		448.5	119	53,568	16,286	3,833	73,687	73,687		10/9-10/14	8874	33,861
229	[redacted]		450	128	57,773	12,128	509	70,410	70,410		10/9-10/14	9027	16,048
230	[redacted]		344	126	43,460	16,111	638	60,209	60,209		10/9-10/14	9067	23,246
231	[redacted]		368	127	46,782	9,139	980	56,902	56,902		10/9-10/14	8929	21,866
232	[redacted]		348	127	44,108	8,643	1,532	54,283	54,283		10/9-10/14	9042	19,266
233	[redacted]	530,165	276	131	36,150	9,139	808	46,098	46,098		10/9-10/14	8981	23,183
234	[redacted]					This is 10% of total bill.		0	102,885		10/9-10/14	5458	
235	[redacted]		843	79	66,402	20,271		86,673	86,672		10/29-11/2	5760	
236	[redacted]					This is 25% of total bill.		0	55,748		10/9-10/14	5788	
237	[redacted]		464	74	34,276	14,063		48,339	48,339		11/5-11/9	5771	
238	[redacted]					This is 10% of total bill.		0	44,637		10/15-10/18	5634	
239	[redacted]		472	72	34,089	9,056		43,146	43,146		10/22-10/27	5782	
240	[redacted]		330	74	24,383	10,774		35,157	35,157		11/12-11/15	5777	
241	[redacted]					This is 10% of total bill.		0	28,695		10/19-10/20	5685	
242	[redacted]							0	21,926				
243	[redacted]	488,488						0	21,282				
244	[redacted]		2912	102	296,336	80,662	7,140	384,138	345,724		10/10-10/11	1357	
245	[redacted]	(a)							38,414				
246	[redacted]	398,317		See below balance of invoice.					14,179	(b)	10/10-10/11	1302	
247	[redacted]			#DIV/0!				0	396,307				
248	[redacted]		2202	57	125,461	46,001	38,619	210,081	210,082	D 10/19	10/14-10/19	1373	20,056
249	[redacted]	395,998	1888	57	107,930	40,086	37,900	185,916	185,916	M 10/9-10	10/8-10/13	1364	43,904
250	[redacted]		3237	90	290,147	76,670	2,608	369,425	277,069		10/9-10/14	8534	
251	[redacted]	369,425							92,356				
252	[redacted]		3681.5	85	314,038	21,047	1,777	336,861	297,922	Audit	10/9-10/17		
253	[redacted]	336,861							38,939				
254	[redacted]		3055	71	216,687	14,330	2,208	233,224	174,918	Audit	10/9-10/14		
255	[redacted]	(a)							58,306				
256	[redacted]			#DIV/0!				0	27,778				
257	[redacted]			#DIV/0!				0	23,799				
258	[redacted]							0	6,394				
259	[redacted]							0	6,255				

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Distribution Contractors Line-Billing Summary
Exhibit HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Exp. & Materials	Total	Filing Cost IR 150	Description	Dates	Bates	MOB/ DEMOB
260	[redacted]							0	5,560				
261								0	2,939				
262								0	2,676				
263								0	2,000				
264								0	1,706				
265								0	1,104				
266		313,496						0	61				
267			962	153	147,196	26,186	18,356	191,739	191,739	M/D-All No W	10/10-10/11	3595	147,196
268			1056	111	116,915	45,582	5,222	167,718	85,059		10/9-10/11	1649	116,915
269								0	42,530				
270		167,718						0	40,130				
271			136.5	1,005	137,234			137,234	100,000	Audit	10/8-10/13		
272		137,234						0	37,234				
273			1002	111	110,837	29,463	1,493	141,793	127,614	(b)			
274			544	158	85,966	16,736		102,702	102,702	M/D-All No Work		3619	85,966
275		110,992						0	8,289				
276			557.5	80	44,385	6,690		51,075	51,075		10/29-11/3	8771	
277			341	82	28,060	4,092		32,152	32,152		10/9-10/14	8764	
278		102,267						0	19,041				
279			472	156	73,656	17,214	756	91,626	91,626	Mob & Rel	10/9-1 day	3265	73,656
280			360	160	57,623	11,126	18,256	87,005	75,913	M		2518	57,623
281		87,005			Audit suggests all time was mob/dem			0	11,092				
282			209	83	17,367	6,623	1,035	25,025	25,025	SB	10/10-10/12	5295	
283								0	23,626				
284			484,031	126	61,228,618	24,573,300	1,728,049	87,529,967	90,600,346				19,146,525
285		[redacted]	(3,914)		(407,174)				(525,931)				
286			(7,037)		(903,073)				(1,221,963)				(831,361)
287			Duplicated billing						(181,224)	(1,929,118)			
288			473,080	127	59,918,372	Percentage Reviewed		96.61%	88,671,228	Pertcentage of Labor		30.57%	18,315,164
					Mobilization/Demobilization Adjustment				(6,105,055)	Estimated Actual Time			12,210,110
					Capitalization Adjustment				(2,566,339)				
					OPC Recommended Distribution ine Contractor				79,999,834	Adjustment Recommended			(6,105,055)

Invoice detail is from response to Citizens' POD No. 1-4 and 1-14.

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Distribution Contractors Line-Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equip	Expenses & Materials	Total	Filing Cost IR 150
	Alberto								
1	[redacted]		880	148	129,989	43,263	2,400	175,652	175,652
2								0	8,393
3								0	9,104
4								0	2,381
5									3,535
6								0	7,565
7									8,575
8									7,243
9									6,849
10									6,715
11									1,770
12									1,542
13									6,376
14									8,561
15									6,322
16									5,896
17									22,686
18									24,593
19									6,719
20									25,572
21									1,322
22									13,492
23									4,747
24									8,489
25									9,727
26									13,466
27									17,494
28			880	148	129,989	43,263	2,400	175,652	414,788
29									
30						Capitalization Adjustment			(22,196)
31						OPC Recommended Distribution ine Contra			392,593

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Line Clearing
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equipment	Expenses	Total	IR 150	Description	Mob/Dem
	Michael										
1	[redacted]		2,689	106	284,549	48,465	11,280	344,294	344,294		
2			1,379	113	156,443	57,031	6,383	219,857	219,857		
3			1,596	107	170,765	35,876	5,257	211,898	211,898		
4			1,377	108	149,282	37,205	7,238	193,725	193,725		
5			1,520	106	161,631	23,222	3,905	188,758	188,757		
6			1,280	114	146,270	36,099	3,725	186,094	186,094		62,165
7			1,092	109	118,682	34,580	4,315	157,577	157,578		
8			1,170	107	124,705	21,236	4,073	150,014	150,013		
9				#DIV/0!				0	148,773		
10			1,036	109	112,705	31,562	3,651	147,918	147,918		
11			966	115	111,240	17,880	2,415	131,535	131,535		
12			664	109	72,243	56,775	1,725	130,743	130,743		
13			910	117	106,170	21,355	3,105	130,630	130,630		
14			686	135	92,933	22,835	3,795	119,563	119,563		
15			790	109	85,907	21,443	3,163	110,512	110,512		
16			792	116	92,121	16,888	1,265	110,274	110,274		
17			770	108	83,279	18,880	0	102,159	102,159		
18			470	122	57,537	39,482	2,293	99,312	99,312		
19			560	123	68,847	22,126	2,933	93,905	93,905		
20			441	129	56,870	25,643	2,933	85,445	85,445		
21			418	134	56,142	15,422	3,824	75,388	75,388		
22			416	119	49,482	21,370	3,623	74,475	74,475		
23			361	129	46,563	12,890	3,278	62,730	62,730		
24			336	108	36,200	16,224	5,434	57,858	57,858		
25			324	123	39,769	14,650	2,616	57,035	57,035		
26			176	144	25,407	5,317	690	31,414	31,414		
27			158	157	24,733	4,624	259	29,616	29,616		
28			150	145	21,770	7,482	288	29,539	29,539		
29					5 Invoices under $25,000			0	44,424	44,424	
30			2,608	52	134,607	9,657	22,075	166,339	167,129		
31			2,256	47	105,788	34,096		139,885	166,338		
32			2,225	52	114,756	7,485	14,994	137,235	139,885		
33			1,914	52	98,755	13,088	20,310	132,153	137,235		
34				#DIV/0!				0	132,153		
35			1,958	52	102,408	9,305	19,159	130,871	132,025		
36			2,016	52	104,212	9,266	15,952	129,429	130,871		
37			1,743	52	91,235	5,981	15,774	112,990	129,430		
38			2,090	45	94,315	19,920	0	114,235	112,990		
39			1,660	47	78,319	29,964	0	108,283	112,430		
40			1,691	51	86,601	6,017	14,994	107,613	108,283		
41			1,440	51	73,636	9,424	15,233	98,293	107,613		
42			1,672	47	78,156	18,662	0	96,817	98,293		
43				#DIV/0!				0	96,817		
44			1,245	52	64,653	7,804	15,774	88,231	94,207		
45			1,152	52	59,529	8,784	12,707	81,020	88,231		
46			1,238	43	53,795	18,456	0	72,251	81,020		
47			1,001	53	52,595	5,078	13,384	71,057	72,251		
48			1,098	45	49,022	16,298	0	65,320	71,057		
49			1,120	47	52,255	11,168	0	63,423	65,320		
50			901	51	46,047	8,780	.	54,826	63,423		
51			901	45	40,100	13,147	0	53,247	54,826		
52			624	44	27,672	8,856	0	36,528	53,247		
53			488	56	27,527	6,475	0	34,002	36,528		
54			473	56	26,349	7,534	0	33,883	34,002		
55			612	46	27,995	5,301	0	33,296	33,883		
56				#DIV/0!				0	33,296		
57			282	55	15,544	3,161	0	18,705	32,732		
58					18 Invoices under $25,000			0	130,594		

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Line Clearing
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Equipment	Expenses	Total	IR 150	Description		Mob/Dem
59	[redacted]		3,128	40	123,939	111,820	0	235,759	212,183			
60			3,168	43	136,898	22,653	0	159,551	159,551			
61			2,802	44	122,514	20,024	0	142,538	142,538			
62			1,746	57	99,008	13,321	2,297	114,627	114,627			
63			1,792	40	70,786	16,804		87,591	87,591			
64			1,444	49	70,036	21,210	2,189	93,435	87,548			
65			1,696	39	66,620	15,904	0	82,524	82,524			
66			644	43	27,912	3,538	0	31,450	31,450			
67				#DIV/0!				0	29,957			
68			512	43	22,036	5,776	0	27,812	27,812			
69			487	52	25,324	1,890	0	27,214	27,214			
70			544	42	22,968	3,283	0	26,251	26,251			
71									23,576			
72					10 Invoices under $25,000			0	57,051			
73								0	(31,450)			
74		[redacted]		#DIV/0!				0	211,994	No invoice		
75									121,806			677
76			664	45	29,645	0	63,910	93,555	93,555	10/11-10/14	MOB	29,645
77			1,916	42	81,150	22,447	58,811	162,408	40,602	10/15-10/18	D	30,749
78			504	46	23,276	10,556	1,501	35,333	35,332	10/11-10/14	All SB	23,276
79			5,048	37	185,044	33,469	18,741	237,254	237,254	10/9-10/11	M	123,424
80			1,527	55	83,264	56,841	30,097	170,202	170,202	WE 10/13 & 10	M/D	30,263
81					14 Invoices under $25,000			0	84,359	84,359		
82			608	42	25,668	1,895	14,894	42,457	42,457	10/9-10/11	M/Rel	25,668
83			608	41	24,763	1,257	13,423	39,444	39,444	10/9-10/11	M/Rel	24,763
84			506	43	21,771	2,019	14,263	38,053	38,053	10/9-10/11	M/Rel	21,771
85			532	43	22,851	1,509	12,727	37,088	37,088	10/9-10/11	M/Rel	22,851
86			450	45	20,109	1,893	11,213	33,214	33,214	10/9-10/11	M/Rel	20,109
87			446	45	20,211	1,222	11,363	32,796	32,796	10/9-10/11	M/Rel	20,211
88			456	41	18,584	806	9,493	28,883	28,883	10/9-10/11	M/Rel	18,584
89			312	60	18,864	5,831	1,690	26,385	26,385	10/8-10/9	M/Rel	18,864
90					8 Invoices under $25,000				152,205			
91			1,680	41	69,500	10,150	12,717	92,367	92,367	10/9-10/13	MOB	27,800
92			2,053	37	76,260	16,710	10,459	103,429	51,715	10/15-10/21	D/SB	15,601
93								0	51,715			
94	[redacted]				36 Invoices under $10,000				90,712			
95												
96			92,208		5,767,114	1,383,100	563,605	7,713,819	9,032,133			516,421
97									(430,524)			
98												
99	Total				0	0	0	0	8,601,609			
100												
101						Costs Verified		85.40%				

Sources: Invoice detail was provided in Company response to Confidential Citizens' POD No. 6.

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Line Clearing
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Hours	Average Rate	Labor/ Fringe	Expenses	Equip	Total	IR 150
	Alberto								
1	[redacted]							0	4,615
2								0	1,159
3								0	16,129
									308
									93
									22,305

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Logistics
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor		??	Labor	Lodging/ Catering	Location Costs/ Other	Total	IR 150
		Michael							
1	[redacted]			9,059,879				9,059,879	9,059,879
2			(a)		5,352,870			5,352,870	5,352,870
3			(b)		4,857,413			4,857,413	4,857,413
4			(b)			4,625,836		4,625,836	4,625,836
5			(a)		4,615,449			4,615,449	4,615,449
6				3,661,362				3,661,362	3,661,362
7							336,741	336,741	336,741
8						30,594	254,412	285,006	285,006
9								0	248,294
10						184,530		184,530	184,530
11						10,478	171,242	181,720	181,720
12								0	0
13						6,450,144		6,450,144	6,450,144
14								0	322,306
15	[redacted]							0	119,764
16								0	8,722
17				Labor & Equip & Tanker			60,780	60,780	60,780
18				Labor & Equip & Tanker			60,780	60,780	60,780
19				Labor & Equip & Tanker			60,780	60,780	60,780
20				Labor & Equip & Tanker			60,780	60,780	60,780
21				Labor & Equip & Tanker			60,780	60,780	60,780
22				Labor & Equip & Tanker			40,520	40,520	40,520
23				Debris Removal			138,403	138,403	138,403
24				Debris Removal			131,743	131,743	131,743
25				Gaines Oil			46,494	46,494	46,494
26				Kerry Puhl Lawnworks			33,496	33,496	33,496
27				Harvard Services Group			26,746	26,746	26,746
28								0	21,383
29								0	8,346
30								0	6,365
31					42 Invoices under $5,000			0	79,372
32									68,535
33				Vehcles rented			24,739	24,739	26,299
34									16,515
35		3 other slips do not match							9,745
36									6,682
37									3,514
38									2,615
39									359
40					Labor & mileage		10938	10,938	10,938
41					Labor & mileage		10783	10,783	10,783
42									8,535
43									6,573
44					4 Invoices under $10,000				27,728
45					3 Invoices under $10,000				25,392
46					11 Invoices under $5,000				21,584
47									10,272
48									6,350
49									1,485
50									560
51				12,721,241	14,825,732	11,301,582	1,530,157	40,378,712	41,411,269
52		Adjustment		(6,360,621)					(6,360,621)
53									
54									35,050,649

Sources: Invoice detail was provided in Company response to Confidential Citizens' POD No. 16.

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Contractor Materials/Supplies/Fuel
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Materials	Fuel	Other	Total	IR 150
1							$ 193,815
2							$ 155,218
3							$ 145,814
4			545,652				$ 50,805
5							$ 128,026
7							$ 71,369
8						0	$ 51,328
9						0	$ 44,322
10			499,983	36 Invoices under $25,000			$ 204,938
11							$ 115,688
12							$ 83,614
13							$ 73,253
14							$ 70,144
15			368,852	8 Invoices under $25,000			$ 26,154
16				87 Invoices under $25,000			$ 121,692
17				3 Invoices under $25,000			$ 32,730
18				Invoices under $25,000			$ 28,316
19				16 Invoices under $25,000			$ 16,798
20							$ 13,000
21							$ 5,160
22				2 Invoices under $25,000			$ 4,973
23							$ 4,400
24							$ 4,275
25				2 Invoices under $25,000			$ 3,979
26							$ 3,846
27							$ 3,500
28							$ 3,461
29							$ 3,071
30				3 Invoices under $25,000			$ 2,990
31							$ 1,803
32							$ 1,005
33							$ 940
34							$ 927
35							$ 700
36							$ 600
37							$ 576
38							2112
39							$ 1,675,339

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Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Contractor Materials/Supplies/Fuel
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Materials	Fuel	Other	Total	IR 150
	[redacted]	Aviation					
1		[redacted]					104,522
2							82,393
3		$ 221,601					34,686
4		[redacted]					75,838
5		$ 148,562					72,724
6		[redacted]					54,562
7							424,724
		Contractor Materials					
8		[redacted]					96,600
		Unidentified					
9		[redacted]					199,020
10							1,028
11							200,048
12		Unsupported request					(199,020)
13		Recommended Allowance					$ 1,028

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20160251-EI
Cust. Oper. Cont. - Billing Summary
Exhibit No. HWS-2
Schedule F

Line No.	Invoice Reference	Vendor	Labor/ Fringe	Equip	Exp. & Materials	Total	IR 150	Description
	Michael							
1	[redacted]						5,845	
2							12,067	
3							51	
4							51	
5							3,480	
6							123,471	Move to DEF Stor
7							144,966	

Line No.	Description	Per Company Amounts	Per OPC Amounts	Per Company Amounts	Per OPC Amounts
	Poles				
1	Hours	63,040	63,040	416	416
2	Hourly Contractor Labor Rate		126.66		147.72
3	Avg Int Labor & Native Cont Rate	94.36	94.36	94.36	94.36
4	Average Contractor Rate Differential		32.30		53.36
5	Contractor Capitalized Amount	5,948,499	7,984,384	39,254	61,449
7	Per Company		5,948,499		39,254
8	Contractor Capitaliztion Adjustment		2,035,884		22,196

Source: Company amounts are from response to Citizens' Interrogatory No. 1-31.

Line No.	Description	Per Company Amounts	Per OPC Amounts
	Wires		
1	Hours	16,425	16,425
2	Hourly Contractor Labor Rate		126.66
3	Avg Int Labor & Native Cont Rate	94.36	94.36
4	Average Contractor Rate Differential		32.30
5	Contractor Capitalized Amount	1,549,867	2,080,322
7	Per Company		1,549,867
8	Contractor Capitaliztion Adjustment		530,455

Source: Company amounts are from response to Citizens' Interrogatory No. 1-36.

REDACTED

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20160251-EI
Distribution Contractors Legend
Exhibit No. HWS-2
Schedule F

Line No.	Vendor	Reference	Folder
1	[redacted]		POD 4 Con Disk 3
2			POD 4 Con Disk 3
3			POD 4 Con Disk 3
4			POD 4 Con Disk 3
5			POD 4 Con Disk 3
6			POD 4 Con Disk 3
7			POD 4 Con Disk 1
8			POD 4 Con Disk 1
9			POD 4 Con Disk 1
10			POD 4 Con Disk 1
11			POD 4 Con Disk 1
12			POD 4 Con Disk 1
13			POD 4 Con Disk 1
14			POD 4 Con Disk 1
15			POD 4 Con Disk 1
16			POD 4 Con Disk 1
17			POD 4 Con Disk 1
18			POD 4 Con Disk 2
19			POD 4 Con Disk 2
20			POD 4 Con Disk 2
21			POD 4 Con Disk 2
22			POD 4 Con Disk 2
23			POD 4 Con Disk 2
24			POD 4 Con Disk 2
25			POD 4 Con Disk 2
26			POD 4 Con Disk 2
27			POD 4 Con Disk 2
28			POD 4 Con Disk 2
29			POD 4 Con Disk 2
30			POD 4 Con Disk 2
31			
32			
33			
34			
35			
36			
37			Not Provided
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			POD 4 Con Disk 3
50			

Duke Energy Florida, LLC
Storm Restoration Costs

Docket No. 20190110-EI
Materials & Supplies
Exhibit No. HWS-2
Schedule G

(000's)

Line No.	Description	Trans.	Dist.	Cust. Service	Alberto	Total
	Per Company					
1	Materials & Supplies	13,222	13,911	8	57	27,198
2	Less : Capitalized Costs	(13,078)	(3,811)		(6)	(16,895)
3	Less: Non-Incremental Costs					
4	Co. Revised Vehicle & Fuel	144	10,100	8	51	10,303
	Per OPC					
5	Materials & Supplies	13,222	13,911	8	57	27,198
6	Non-Incremental Costs	0	0	0	0	0
7	Capitalized Costs	(13,078)	(3,811)		(6)	(16,895)
8	Vehicle & Fuel Costs	144	10,100	8	51	10,303
9	OPC Adjustment (L.8 - L. 4)	0	0	0	0	0

Source: Lines 1 is from Exhibit TM-2.
Line 2 is from Company response to Citizens' Interrogatory No. 136.

Duke Energy Florida, LLC
Storm Restoration Costs

(000's)

Docket No. 20190110-EI
Internal Fleet Costs
Exhibit No. HWS-2
Schedule H

Line No.	Description	Trans.	Dist.	Cust. Service	Alberto	Total
	Per Company					
1	Internal Fleet Costs	165	117	0	18	300
2	Less: Non-Incremental Costs	(1)	(80)		(15)	(96)
3	Less : Capitalized Costs	(151)				(151)
4	Recoverable Cost Per Co.	13	37	0	3	53
	Per OPC					
5	Internal Fleet Costs	165	117	0	18	300
6	Less: Non-Incremental Costs	(1)	(80)		(15)	(96)
7	Less : Capitalized Costs	(151)				(151)
8	Internal Fleet Costs	13	37	0	3	53
16	OPC Adjustment (L.8 - L. 4)					

Source: Lines 1 and 2 are from Exhibit TM-2.
Line 3 is from Company response to Citizens' Interrogatory No. 136.

Duke Energy Florida, LLC
Storm Restoration Costs Hurricane Michael & TS Alberto

Docket No. 20190110-EI
Capitalizable Costs
Exhibit No. HWS-2
Schedule I

Line No.	Description	Michael Transmission	Michael Distribution	Alberto Distribution	Total	OPC Adjustment
	Capitalizable Costs					
1	Regular payroll*	351,600	249,000	0	600,600	
2	Overtime*	340,986	738,000		1,078,986	
3	Labor Burdens/Incentives	1,078,978			1,078,978	450,015
4	Overhead Allocations	10,846,984	2,237,649	10,764	13,095,397	(715,000)
5	Employee Expenses	446,002			446,002	
6	Contractors*	98,746,815	7,408,453	40,386	106,195,654	2,588,535
7	Materials	13,078,150	3,810,878	5,936	16,894,964	
8	Fleet Loading	151,459			151,459	
9	Incremental Portion	(34,445,227)			(34,445,227)	34,445,227
10	Total	90,595,747	14,443,980	57,086	105,096,813	36,768,777
		34,445,227	450,015			
		(715,000)	2,566,339	22,196		
11	OPC Recommended Capital	124,325,974	17,460,334	79,282	141,865,590	141,865,590
	Capitalizable Materials					
12	Units of Property		2,781,663	4,333		
13	Warehouse Burden 17%		472,883	737		
14	Working Stock 20%		556,333	867		
15	Total	0	3,810,879	5,937		
16	Estimated Incremental Portion					
17	Regular payroll	(96,856)				
18	Overtime	(93,932)				
19	Labor Burdens/Incentives	(297,228)				
20	Overhead Allocations	(2,988,035)				
21	Employee Expenses	(122,861)				
22	Contractors	(27,201,935)				
23	Materials	(3,602,658)				
24	Fleet Loading	(41,723)				
25	Incremental Portion					
26	Total	(34,445,227)				

* Michael Distribution labor and contractor costs were allocated based on 50% of non-incremental regluar payroll and 25% of non-incremental overtime with remainder listed as contractos.

Source: Lines 1-9 are from Company response to OPC' Interrogatory No. 136.
Line 10 reconciles to Exhibit No. TM-2.

Empirical Analysis of Truck and Automobile Speeds on Rural Interstates: Impact of Posted Speed Limits

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Number of Words: 3,273 (including Abstract)
Number of Figures: 14
Number of Tables: 2
Total Word Count: 7,270

Submitted: July 2009

ABSTRACT

Posted speed limit settings on rural highways have always been a point of contention with different stakeholders having very different perspectives (motorist, enforcement, commercial trucking, etc.). In particular, the effect of the posted speed limit on safety has been widely studied, primarily using accident data bases. The results reported in the literature are often inconclusive or even contradictory. In addition, many speed-related safety and environmental objectives are in conflict with mobility goals. An important aspect of this research relates to the impact of posted speed limits on actual traffic behavior. This study investigated the speed distributions for both heavy trucks and light vehicles (cars) at 19 rural interstate highway sites across the United States. The speed limit configurations were selected to encompass the full range of posted limits (55 mph to 75 mph) and to include both uniform and differential speed limits (e.g., 55 for trucks and 70 for cars). The results of the study describe the actual distribution of speeds for trucks and cars across the various speed limit configurations. In addition, the mean speeds, 85^{th} percentile speeds, compliance rates and observed speed differentials are reported for the individual sites and for each speed limit configuration. The final set of data demonstrates the effect of increased fuel costs on the distribution of truck and car speeds. The results of the study provide an important contribution to the discussion of appropriate maximum speed limits, as well as the natural differential speeds that exist between heavy trucks and light vehicles.

Keywords: trucking, safety, speed limits, operations, differential speed limits

BACKGROUND

The determination of appropriate speed limits has been an issue for over 100 years, and likely existed prior to horseless carriages ("Trot Only" signs for horses). There is a large literature base on the effect of speed on safety (*1, 2, 3, 4*). In addition, there is increasing attention on the effect of travel speed with respect to fuel conservation and the environment (*5*). Today, the setting and posting of traffic speed limits is vested in local and state agencies, even for federal highways and interstates. Across the United States, there are large differences in the posted speed limits on similarly designed highways (Figure 1). For example, it is legal for a heavy truck to go 15 miles per hour faster on some two-lane highways in Texas than on a rural interstate in California or Illinois. Similarly, there is a 20 mph difference in the speed limit on the same highway (I-10) when a truck crosses the state line from California to Arizona. The highway design speed is the same on both sides of the state line, but the posted speed limits are very different (55 mph versus 75 mph for trucks). Some states have speed differentials between heavy trucks and other vehicles on rural interstate highways (e.g., 15 mph in California) and other states have uniform speed limits for trucks and other vehicles (65, 70 or 75 mph). Although there are many strongly held views relating to appropriate maximum speed limits, there is actually very little conclusive support for any of the various configurations in use today.

Figure 1 Differences in Posted Speed Limits on Different Roadways

There is currently an extensive amount of data being collected by state and federal highway departments on the amount of traffic volume on highways, including interstates. The documentation often provides the volume information by vehicle

classification (heavy trucks versus light vehicles). In addition, data are continuously being collected on traffic speed on various roadways. However, although it appears to be technically feasible, speed data separated by vehicle classification (e.g., heavy trucks versus light vehicle) is rarely collected and analyzed. As part of a complete discussion of appropriate speed limits, it is important to understand how posted limits affect traffic behavior. It is also important to understand how truck traffic differs from other vehicles with respect to speed. The objective of this study was to collect empirical data on the separate distributions of truck and car speeds on rural interstates that have different speed limit configurations.

This effort was funded by the American Transportation Research Institute (ATRI) and is a continuation of an ongoing study of the effects of speed differentials between heavy trucks and other vehicles on rural interstate highways. The previous work was conducted by the author under contract with the Mack Blackwell Rural Transportation Center at the University of Arkansas (*6, 7*). During that effort, data were collected from the Midwest region (Arkansas, Missouri, and Illinois). The objective of the current study was to broaden the geographic regions and to include all posted speed limit configurations that occur on rural interstates in the United States.

RESEARCH METHOD

Nineteen rural interstate locations were selected across the United States that provide the full range of different speed configurations that exist on rural interstates. Some of the locations had uniform speed limits for trucks and cars, others had speed differentials. The posted speed limits for cars were 65, 70 and 75 mph and the posted limits for trucks were 55, 60, 65, 70 and 75 mph. The speed differentials levels that were studied included 0, 5, 10 and 15 mph. Figure 2 illustrates the locations where speed data were collected. The data collection sites are labeled with the posted speed limits (e.g., 55/65 for the truck and car speed, respectively).

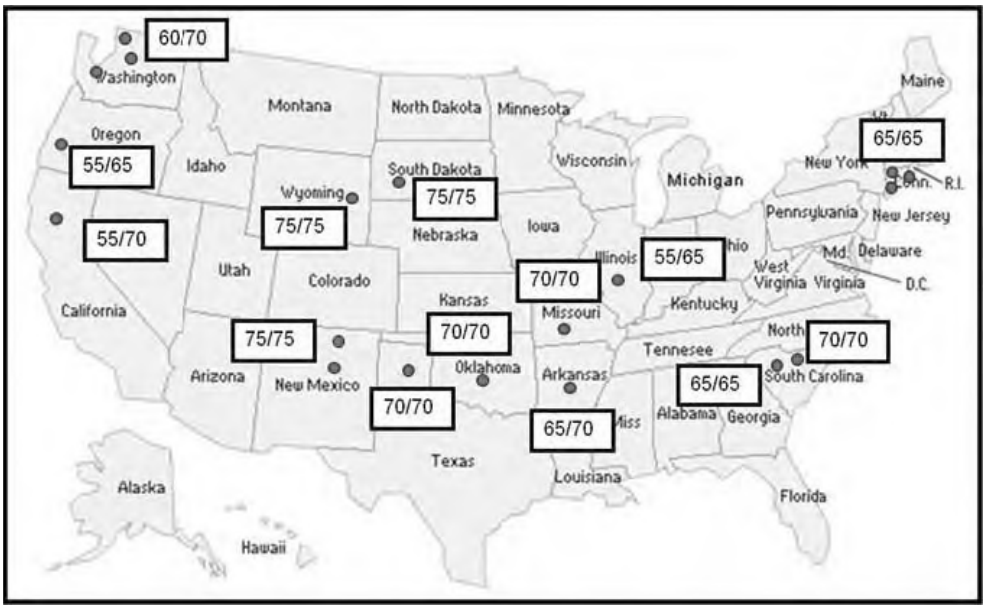

Figure 2 Locations of the Data Collection Sites

The data were collected in both travel directions (N-S/E-W) at each site. No significant design or operational difference was observed between the directions at any site and the measurements were combined. Three sites (I-5 in Washington, I-84 in Connecticut, and I-85, South Carolina, I-5 Washington) were six-lane highways (three lanes in each direction). All other highways were four-lane interstate highways.

All sites were on rural interstate highways that were flat and relatively straight for at least two miles prior to the site. The data collected do not represent traffic behavior on highways that have lower design speeds due to different highway geometries. The data were collected during weekdays (Monday thru Friday) in the morning (9:00-11:00) or afternoon (2:00-4:00). During the data collection periods, the weather was clear and visibility was good. The speeds of both trucks and cars were measured with a Prolaser II, Doppler lidar, manufactured by Kustom Signals, Inc. When collecting traffic speed data, the relative levels of enforcement can obviously affect the result. Although it is difficult to characterize the enforcement levels at the various sites, there were no speeding citations observed to be administered at any site during any of the data collection periods.

Only heavy combination trucks (class 8) were included as "trucks." Similarly, in this paper, the term "cars" refers to personal vehicles (sedans, SUVs, mini-vans, etc.). In addition, only the speeds of "unrestricted" vehicles were measured; vehicles restricted by a leading vehicle were not measured. For this reason, the average speeds presented in this report might be slightly higher than the total mean traffic speeds. A pilot study indicated that this constrain affected the light vehicle averages only slightly (less than 0.1 mph) and did not affect the truck speed estimates. This is due to the fact that light vehicles are sometimes slowed by trucks, but the reverse seldom occurs.

RESULTS

Table 1 presents the data for each of the sites in increasing order of the posted truck speed limit. Figure 3 illustrates the proportion of unrestricted trucks and cars that were observed to be travelling at various speeds on I-5 in California where the truck and car speed limits are 55 mph and 70 mph, respectively. This represents the highest posted speed differential in the United States. From Table 1, it can be seen that the average speeds were 61.2 mp and 72.6 mph, respectively for trucks and cars. The observed speed differential was, therefore, 11.4 mph. Figure 4 shows the observed distribution for I-40 in New Mexico that has the highest speed limit configuration of 75 mph for both trucks and cars. The average speeds were observed to be 68.9 mph and 76.8 mph for trucks and cars, respectively. The observed speed differential was 8.1 mph, even though it is a uniform speed limit configuration. This is likely due to the fact that many large commercial trucks have engine speed limiters that restrict the truck's speed (*8, 9, 10, 11*).

Figure 5 shows the average speeds for trucks and cars at all of the sites. The sequence of the sites is based on the increasing posted speed limits for trucks. The graph illustrates that the average speeds of the cars are relatively unaffected by the posted speed limits. Figures 6, and 7 illustrate the distributions across sites with similar maximum speed limits for trucks (55, 60, 65, 70, 75 mph) and cars (65, 70, and 75 mph), respectively. Figure 8 presents the average speeds for each of the posted speed limit configurations. Although, for trucks, there was a 20 mph difference between the highest and lowest posted limit, there was only a 6.3 mph increase in the average speed. Similarly, although there was a 10 mph difference for cars, the change in average speed was less only 3.7 mph.

Table 1 Statistical Measures for Highways

State	Hwy	Speed Limit		Sample Size		Average Speed (mph)		Std Dev.		85th % Speed		Compliance		Differential
		Trucks	Cars	Trucks	Cars	Trucks	Cars	Trucks	Cars	Trucks	Cars	Trucks	Cars	
CA	I - 5	55	70	277	213	61.2	72.6	3.62	4.78	65	77	3.2	8.9	11.4
IL	I - 57	55	65	262	878	64.2	73.2	4.00	5.67	68	79	0.0	7.2	9.0
OR	I - 5	55	65	273	288	60.9	70.0	2.87	4.52	64	75	1.5	14.9	9.1
WA	I – 5 *	60	70	139	111	63.3	71.7	3.04	4.07	67	76	17.3	34.2	8.4
WA	I – 5	60	70	154	146	64.5	71.6	2.67	3.52	67	75	22.0	35.6	7.1
WA	I - 90	60	70	246	159	62.9	72.9	3.28	4.09	66	76	22.0	26.4	10.0
CT	I - 395	65	65	184	129	66.4	72.7	3.80	4.53	70	78	45.2	5.4	6.3
CT	I – 84*	65	65	156	144	66.0	73.6	3.16	5.21	69	78	50.0	5.6	7.6
CT	I - 95	65	65	212	121	66.1	72.0	3.44	4.68	70	70	43.4	8.6	5.9
SC	I – 85*	65	65	433	574	67.2	69.9	4.12	5.29	71	76	35.1	20.6	2.7
AR	I - 40	65	70	169	362	66.7	73.5	3.69	4.32	70	78	32.5	21.8	6.8
SC	I - 26	70	70	276	588	69.0	72.5	4.00	5.32	73	77	64.5	28.6	3.5
MO	I - 44	70	70	247	611	68.6	72.6	4.55	4.95	73	77	69.6	31.4	4.0
TX	I - 40	70	70	131	89	68.6	71.4	3.63	3.98	72	75	76.3	75.3	2.8
OK	I - 40	70	70	168	173	69.4	72.9	3.38	3.84	72	76	57.7	38.7	3.5
NM	I - 25	75	75	36	120	68.9	76.8	5.97	4.24	75	81	86.1	38.3	7.9
NM	I - 40	75	75	276	239	68.0	75.5	4.20	4.75	73	80	98.2	51.1	7.5
SD	I - 90	75	75	193	213	67.0	74.7	4.00	4.21	71	79	98.9	54.9	7.7
WY	I - 90	75	75	140	164	69.8	75.3	4.85	4.45	75	79	91.4	47.9	5.5

* six-lane highways

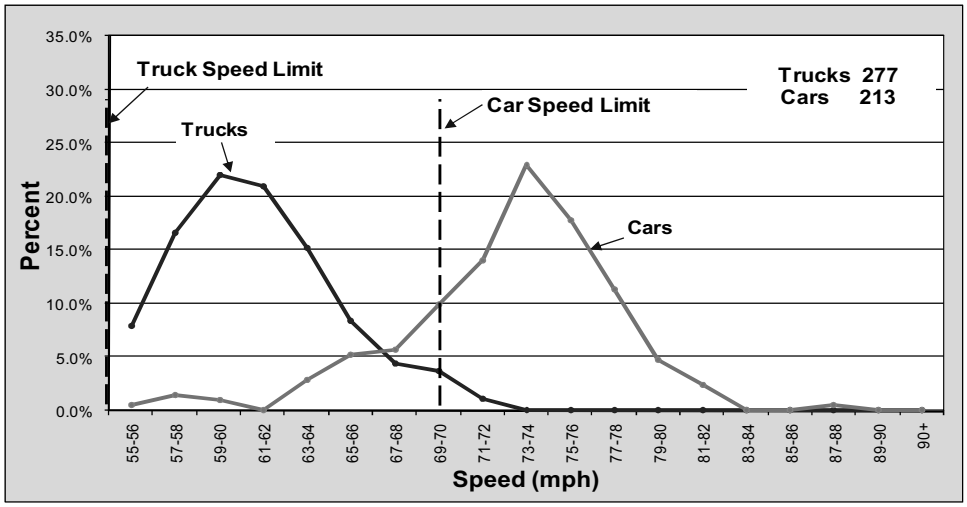

Figure 3 Distribution of Speeds on I-5 in California (Trucks, 55 mph; Cars, 70 mph)

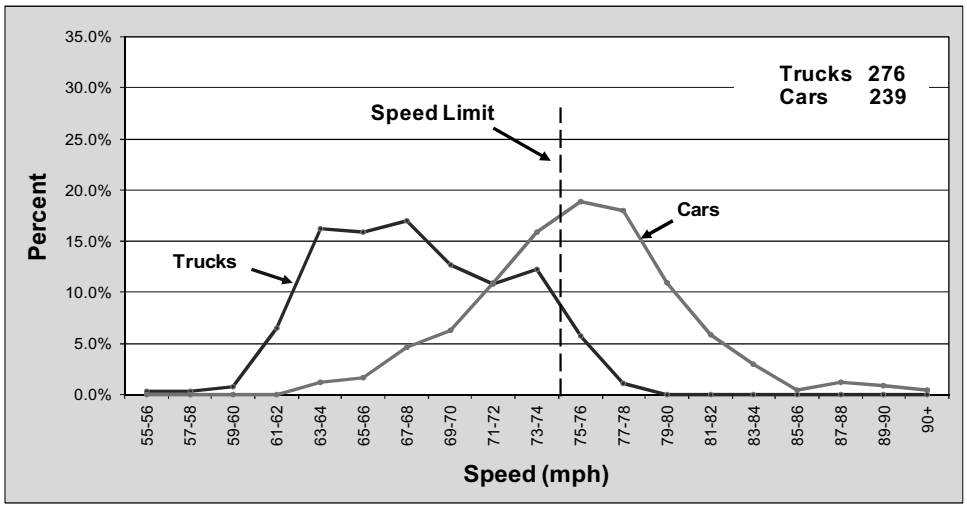

Figure 4 Distribution of Speeds on I-40 in New Mexico (Trucks and Cars, 75 mph)

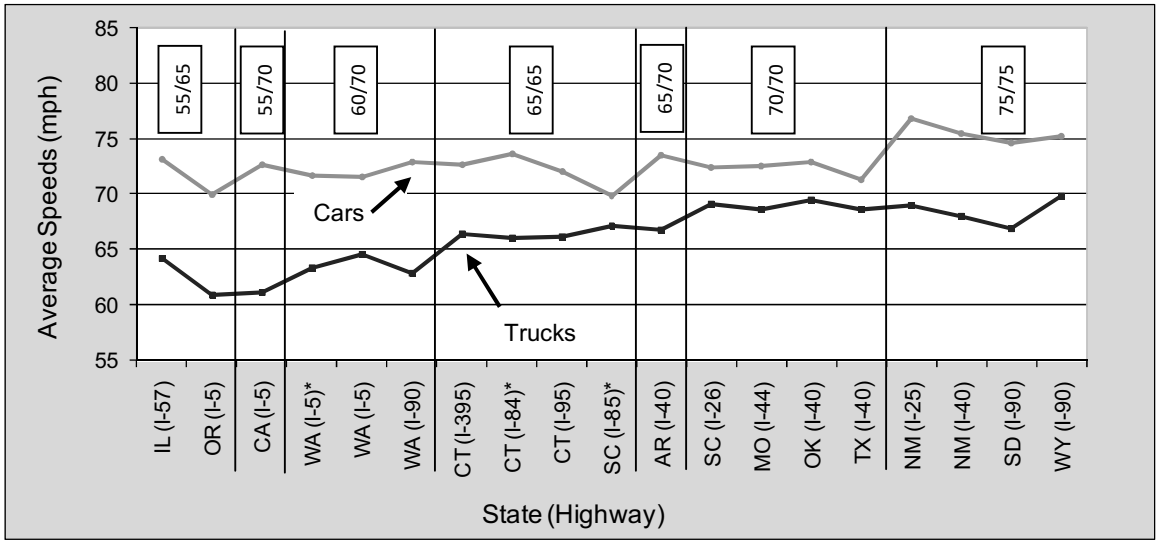

Figure 5 Average Speeds for Trucks and Cars for Sites

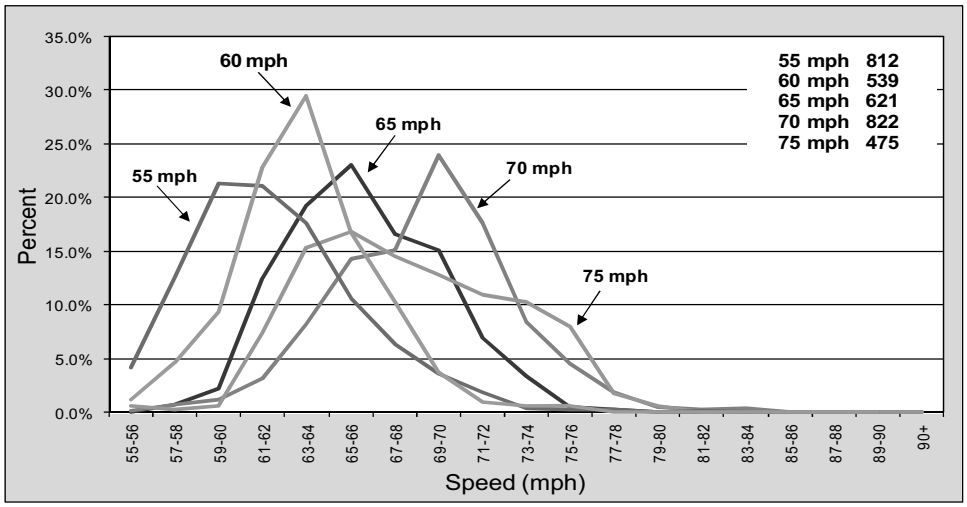

Figure 6 Speed Distribution by Posted Speed Limit – Trucks (mph)

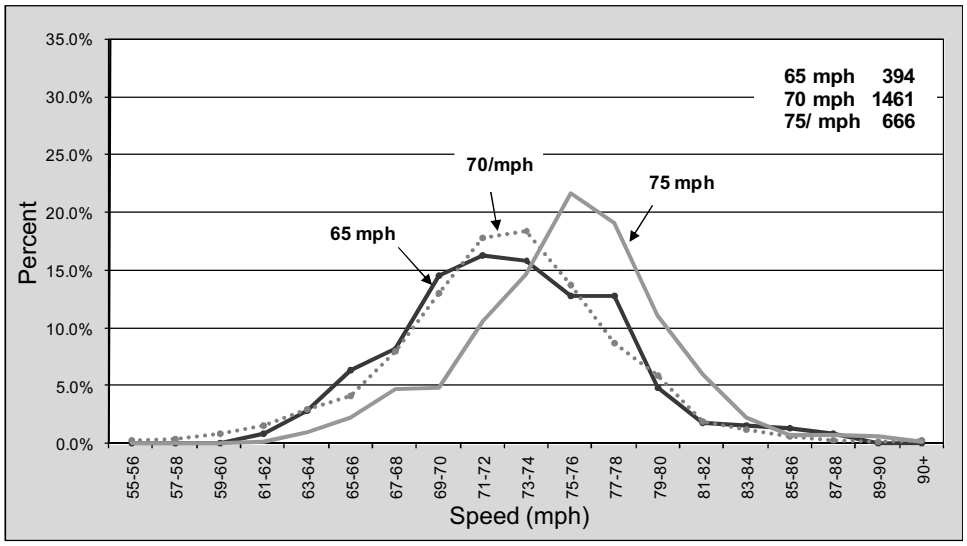

Figure 7 Speed Distribution by Posted Speed Limit – Cars (mph)

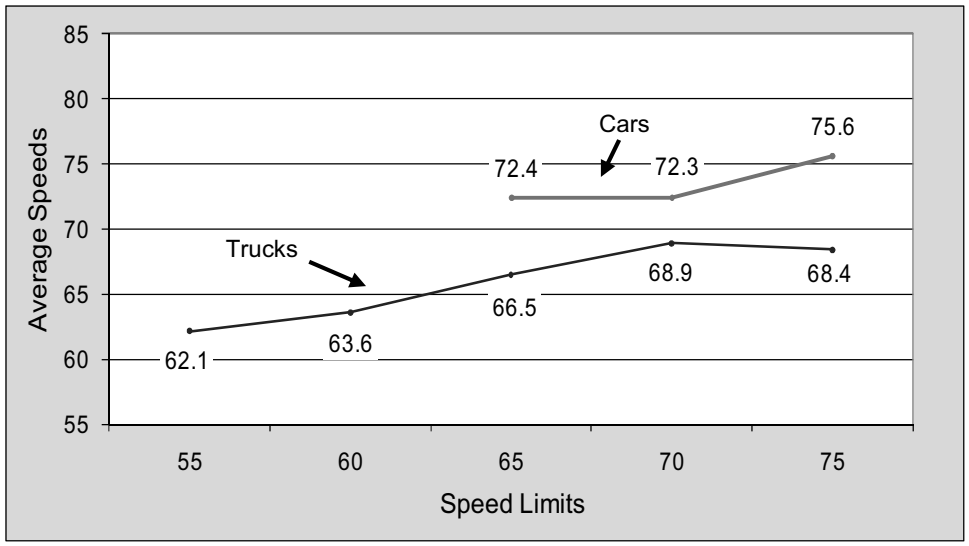

Figure 8 Average Speed by Posted Speed Limit

Figure 9 illustrates the observed speed differentials between trucks and cars as a function of the posted speed differential. The data illustrate that even for the uniform speed configuration there is an effective (i.e., "natural") differential between trucks and cars. The research studies that have investigated the safety effects of speed differentials by comparing the data from different states (e.g., with and without differentials) have not taken this fact into account. It is not surprising, therefore, that the results of these studies have been inconclusive. Similarly, any analysis that is based on different posted limits also relies on the assumption that the traffic behavior is affected or attenuated by the limits. That is, to the extent that the traffic behavior is based on the design speed of the highway rather than the posted limit, the distribution of speeds would be relatively similar, even though the posted limits are different. If the traffic speed is relatively unaffected by the posted limits, safety studies that rely on archival accident data bases and posted limits would have limited utility

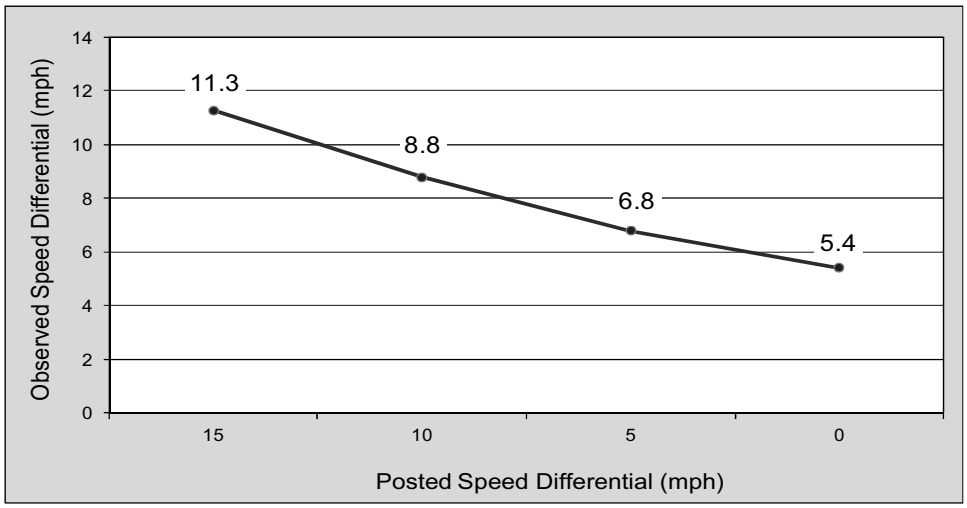

Figure 9 Observed Speed Differentials for Different Posted Differentials

Another statistical characteristic of the traffic speeds that is important in the context of establishing appropriate speed limits is the 85th percentile speed. The document, *Design Speed, Operating Speed and Posted Speed Practices* published by the National Cooperative Highway Research Program (*12*), states that "the [highway design] profession has a goal to set posted speed limits near the 85th percentile speed." (p. 2) An important characteristic of the concept of using the 85th percentile as a "design speed" is the assumption that the measurements are of "free flowing," uninhibited traffic. Strictly speaking, that would refer to the speed adopted by motorists if there were no posted speed limit, which is obviously not the case.

Figure 10 illustrates the 85th percentile speeds for trucks and cars for all sites. As with the graphs of the average speeds, this figure illustrates that the 85th percentile speed for cars is relatively insensitive to the posted speed limit, particularly for 65 versus 70 mph limits.

Figure 11 presents the 85th percentile speeds for the various posted speed limits configurations. The data indicate that the 85th percentile speed for trucks increased by only one (1) mph when the posted speed limit increases by five (5) mph (from 70 to 75 mph). Again, this is likely related to the fact that the majority of commercial trucks have speed limiters.

Figure 12 gives the compliance rates for trucks and cars as a function of the posted speed limits. Compliance increases for both trucks and cars as the posted limits increase. However, it should be noted that there is virtually no compliance on the interstates with a 55 mph posted truck speed. For example, there were no trucks observed in Illinois that were going at or below the posted limits (compliance is zero). Similarly, the observed compliance for cars in Illinois was only seven percent.

One of the factors that can affect the drivers' choices of speed is the cost of fuel. To evaluate this factor, data were collected under different fuel costs to compare the speed distributions. Speed data for both trucks and cars were collected on I-40 in Arkansas during June, 2004 (diesel, $1.79/gal.; gasoline, $1.80/gal.), January 2008 (diesel, $3.30/gal., gasoline,$3.00/gal.) and June 2008 (diesel, $4.70/gal.; gasoline, $4.04/gal.). Tables 13 and 14 provide the speed distributions for trucks and cars as a function of the price of fuel. Table 2 provides the mean and standard deviation for the speed data. It is important to note that the effect of "surcharges" that some commercial fleets charge their customers to offset higher fuel prices is not taken into account. Therefore, the cost of fuel at the site does not necessarily represent the cost paid by all truck owners.

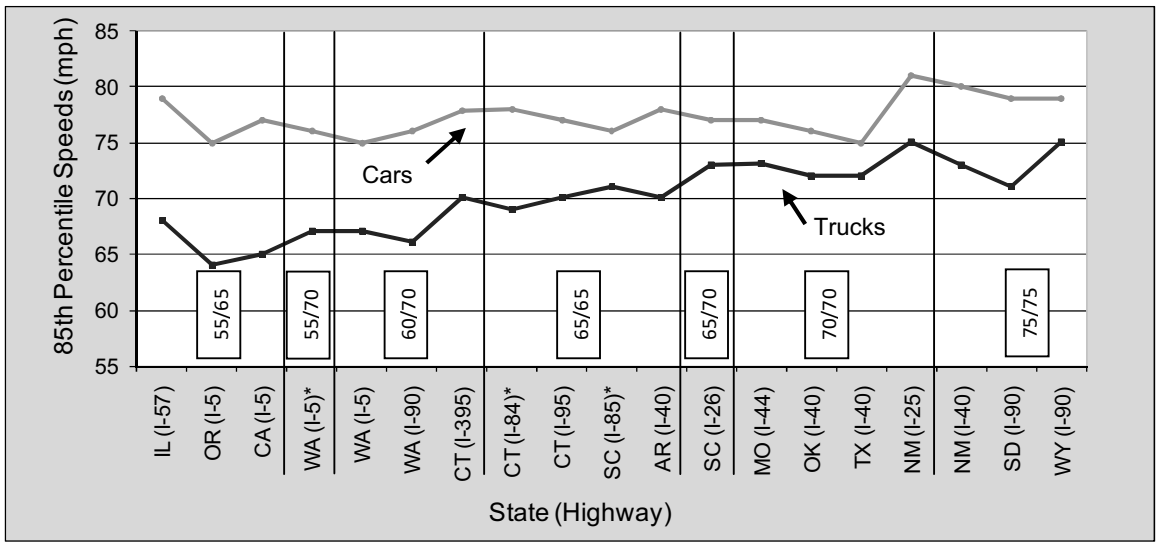

Figure 10 85th Percentile Speed for Trucks and Cars Speeds for All Sites

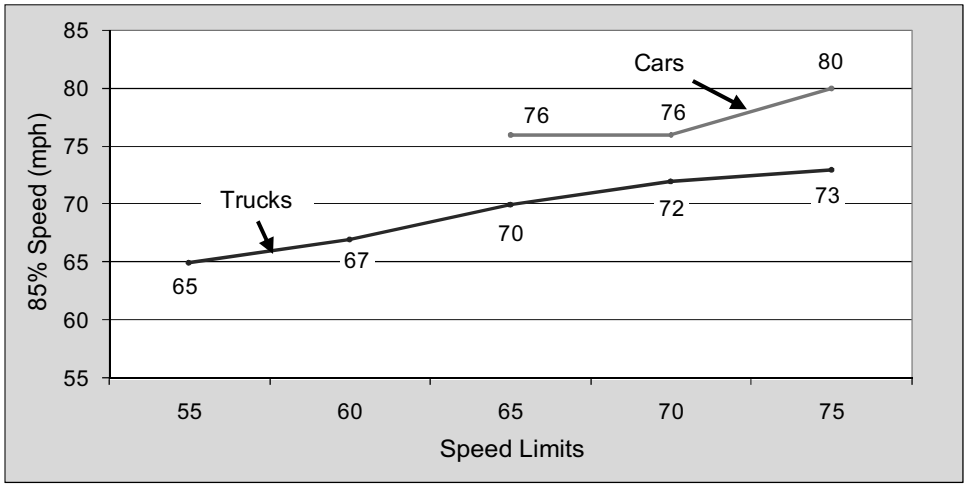

Figure 11 85th Percentile Speed by Posted Speed Limit

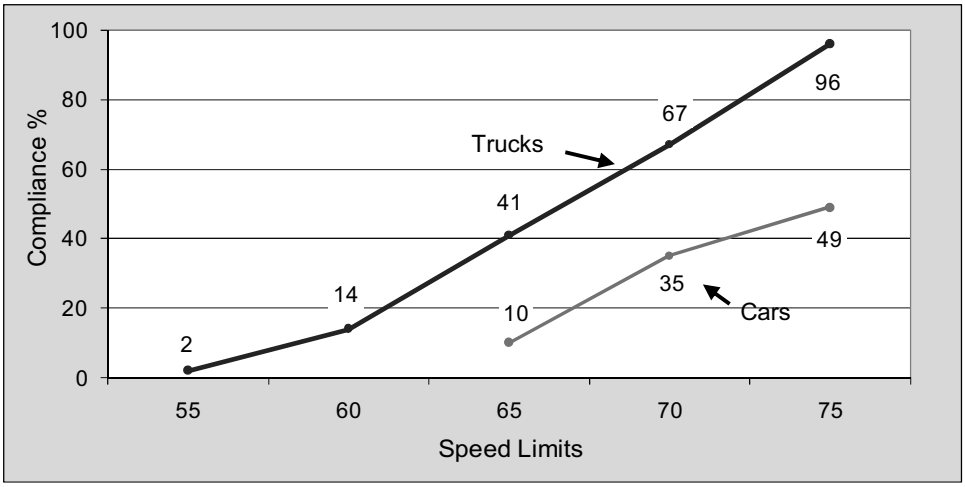

Figure 12 Compliance for Trucks and Cars by Posted Speed Limit

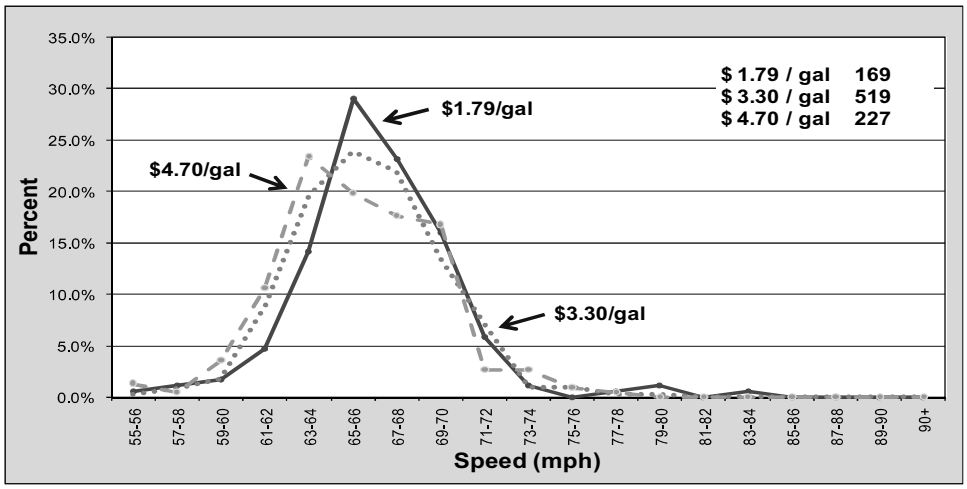

Figure 13 Comparison of Speed Distribution for Different Fuel Costs for Trucks

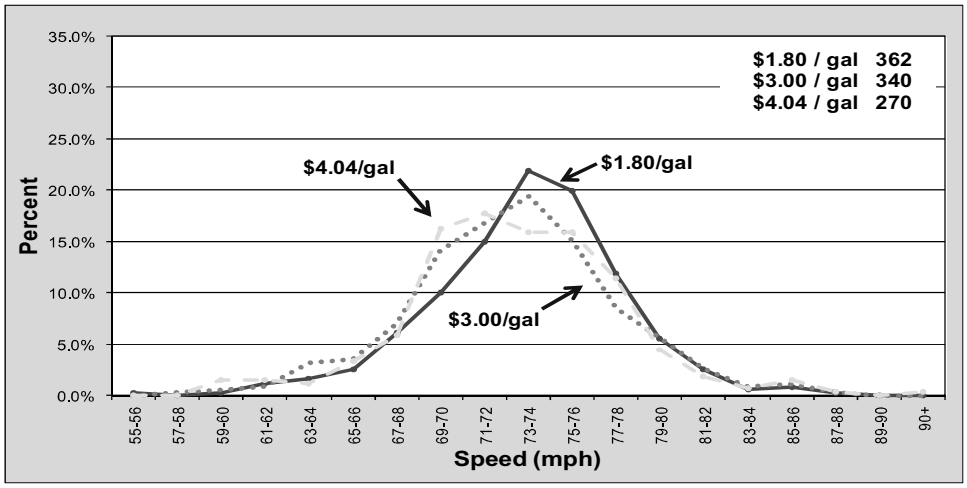

Figure 14 Comparison of Speed Distributions for Different Fuel Costs for Cars

Table 2 Comparison of Seed Distributions for Different Fuel Costs for Trucks and Cars

	Trucks (Diesel)			Cars (Regular)		
	$1.79	$3.30	$4.70	$1.80	$3.00	$4.04
Average	66.7	66.2	65.7	73.5	72.8	72.9
Std Dev	3.69	3.24	3.68	4.32	4.68	4.82

The data indicate that although the distribution of vehicle speed changed when the price of fuel increased for both trucks and cars, the change was very small (less than one mph). For the trucks, in particular, it appears that the change was primarily for the larger fleets that lowered the settings on their speed limiting devices (e.g., from 65 to 62 mph). For both the trucks and the cars, it appears that the "medium" speed vehicles lowered their speed; whereas the "faster" vehicles continued to travel at the same speed as with lower fuel costs.

SUMMARY

This study is part of an ongoing effort to evaluate the impact of maximum speeds and speed differentials between heavy trucks and other vehicles (cars) on rural interstates. The goal of this portion of the effort was to provide empirical data on the speed distributions of trucks and cars to describe the actual speed behavior of traffic on rural interstates with different speed limit configurations. Posted speed limits for trucks vary from 55 mph in some states (e.g., California) to 75 mph in many of the Midwest and Western states. Speed data were collected at 19 rural interstates sites across the United States that had posted speed limits of 55, 60, 65, 70 and 75 mph for trucks and 65, 70 and 75 mph for cars. Speed data were collected at sites with speed differentials of zero (uniform), 5, 10 and 15 mph. The report provides graphs of the speed distributions and summary statistics for trucks and cars at each site.

The summary statistics include: average (mean) speeds, 85th percentile speeds, compliance and observed speed differentials. A number of conclusions can be drawn from the results of the study. First, both the average and the 85th percentile speeds for cars are relatively unaffected by the posted speed limits on rural interstates. For example, the observed compliance rate of cars on interstate in Illinois with a 55 mph speed limit was seven (7) percent. The corresponding observed compliance rate for trucks on the same Illinois interstate that had a 55 mph posted limit for trucks was zero (0) percent. The compliance rate for trucks on rural interstates with a uniform 75 mph posted limit was 96 percent; however, the compliance rate for cars on these higher speed interstates was still only 49 percent. Although average truck speed did increase with each increase in the posted limit, the 20 mph range for the posted truck speed limits (55 to 75 mph) resulted in only a 7 mph increase in the average speed for trucks (61.7 to 68.8 mph). The final conclusion of the study is that, although the cost of fuel does alter the speed distributions for both trucks and cars to some extent, the reduction in average speed was relatively small (1 mph for trucks and 0.5 mph for cars).

The objective of this study was to provide information that commercial companies, regulatory agencies and the general public can use in the discussions related to posted and natural speed differentials on rural highways. To have a meaningful discussion, it is necessary to understand the speed characteristics of trucks and cars for the different speed limit configurations.

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7-2004

EVALUATING SPEED DIFFERENCES BETWEEN PASSENGER VEHICLES AND HEAVY TRUCKS FOR TRANSPORTATION-RELATED EMISSION MODELING

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EVALUATING SPEED DIFFERENCES BETWEEN PASSENGER VEHICLES AND HEAVY TRUCKS FOR TRANSPORTATION-RELATED EMISSION MODELING

Abstract
Heavy vehicles emit emissions at different rates than passenger vehicles. They may behave differently on the road as well, yet they are often treated similarly to passenger vehicles in emissions modeling. Although not frequently considered in calculating emission rates, differences in the operating speeds of passenger vehicles and heavy trucks may influence emissions. The main goal of this research project was to evaluate whether heavy trucks typically travel at significantly different operating speeds than passenger vehicles and what impact differences in on-road speeds would have on emissions. Average speeds and spot speeds were collected for heavy trucks and passenger vehicles for four arterial segments and spot speeds were collected for two freeway segments in Des Moines, Iowa. Average and spot speeds were collected for four arterial segments and three freeway segments in the Minneapolis/St. Paul, Minnesota metropolitan area. The results of this research show that heavy trucks and passenger vehicles operate differently on the road. Average and spot speeds were compared for heavy trucks and passenger vehicles by facility. Average and spot speeds for heavy-duty trucks were lower than for passenger vehicles for all locations. Differences could have consequences for project level and regional emissions modeling particularly since the ability to demonstrate conformity is based on the ability to correctly estimate and model vehicle activity.

Keywords
Arterial highways; Average travel speed; Exhaust gases; Freeways; Heavy duty trucks; Mathematical models; Operating speed; Passenger vehicles; Spot speed

Disciplines
Civil Engineering

Evaluating Speed Differences Between Passenger Vehicles and Heavy Trucks for Transportation-Related Emissions Modeling

DTFH61-03-P-00336

Sponsored by the Transportation Environmental Research Program,
Federal Highway Administration

Center for Transportation Research and Education

Department of Civil, Construction and Environmental Engineering

Iowa State University

Final Report • July 2004

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Technical Report Documentation Page

1. Report No. DTFH61-03-P-00336	**2. Government Accession No.**	**3. Recipient's Catalog No.**	
4. Title and Subtitle Evaluating Speed Differences Between Passenger Vehicles and Heavy Trucks for Transportation-Related Emissions Modeling		**5. Report Date** July 2004 **6. Performing Organization Code**	
7. Author(s) Shauna L. Hallmark, Hillary Isebrands		**8. Performing Organization Report No.**	
9. Performing Organization Name and Address Center for Transportation Research and Education Iowa State University 2901 South Loop Drive, Suite 3100 Ames, IA 50010-8634		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.**	
12. Sponsoring Organization Name and Address Federal Highway Administration U.S. Department of Transportation Washington, DC 20590		**13. Type of Report and Period Covered** Final Report **14. Sponsoring Agency Code**	
15. Supplementary Notes This report is available in color at www.ctre.iastate.edu.			

16. Abstract

Heavy vehicles emit emissions at different rates than passenger vehicles. They may behave differently on the road as well, yet they are often treated similarly to passenger vehicles in emissions modeling. Although not frequently considered in calculating emission rates, differences in the operating speeds of passenger vehicles and heavy trucks may influence emissions.

The main goal of this research project was to evaluate whether heavy trucks typically travel at significantly different operating speeds than passenger vehicles and what impact differences in on-road speeds would have on emissions. Average speeds and spot speeds were collected for heavy trucks and passenger vehicles for four arterial segments and spot speeds were collected for two freeway segments in Des Moines, Iowa. Average and spot speeds were collected for four arterial segments and three freeway segments in the Minneapolis/St. Paul, Minnesota metropolitan area.

The results of this research show that heavy trucks and passenger vehicles operate differently on the road. Average and spot speeds were compared for heavy trucks and passenger vehicles by facility. Average and spot speeds for heavy-duty trucks were lower than for passenger vehicles for all locations. Differences could have consequences for project level and regional emissions modeling particularly since the ability to demonstrate conformity is based on the ability to correctly estimate and model vehicle activity.

17. Key Words average speeds—emissions—heavy-duty trucks—passenger vehicles—speed differences		**18. Distribution Statement** No restrictions.	
19. Security Classification (of this report) Unclassified.	**20. Security Classification (of this page)** Unclassified.	**21. No. of Pages** 43	**22. Price** NA

EVALUATING SPEED DIFFERENCES BETWEEN PASSENGER VEHICLES AND HEAVY TRUCKS FOR TRANSPORTATION-RELATED EMISSIONS MODELING

DTFH61-03-P-00336

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ACKNOWLEDGEMENTS

The project team would like to thank the Federal Highway Administration and Mr. Michael Koontz for support of this project. Special thanks to Brittany, Bryce, Brandon, Garrett, Joanna, Xudong, Jon, Scott, and Debbie for assistance with data collection.

EXECUTIVE SUMMARY

Heavy-duty trucks make up slightly more than 3% of the on-road vehicle fleet. In contrast, they account for more than 7% of vehicle miles traveled (VMT) on roadways in the United States. Even more significantly, they are estimated to contribute a significant proportion of regulated ambient emissions, which includes particulate matter (PM), carbon monoxide (CO), oxides of nitrogen (NO_x), and volatile organic compounds (VOC).

Heavy vehicles emit emissions at different rates than passenger vehicles. They may behave differently on the road as well, yet they are often treated similarly to passenger vehicles in emissions modeling. Although not frequently considered in calculating emission rates, differences in the operating speeds of passenger vehicles and heavy trucks may influence emissions. Emission rates from the MOBILE software model are correlated to average speed. Depending on the pollutant, emissions rates are generally higher at lower average speeds, less sensitive for mid-range speeds, and higher as speeds increase. Typically, average speeds are output for a roadway link or facility type from travel demand forecasting models and a single average speed is input to MOBILE to represent all vehicle types. However, since emission rates are correlated to average vehicle speed, systematic differences in operating speed between heavy vehicles and passenger vehicles have the potential to adversely affect emissions and the ability to estimate and reduce pollution levels.

The main goal of this research project was to evaluate whether heavy trucks typically travel at significantly different operating speeds than passenger vehicles and what impact differences in on-road speeds would have on emissions. Average speeds and spot speeds were collected for heavy trucks and passenger vehicles for four arterial segments and spot speeds were collected for two freeway segments in Des Moines, Iowa. Average and spot speeds were collected for four arterial segments and three freeway segments in the Minneapolis/St. Paul, Minnesota metropolitan area.

Average and spot speeds were compared for heavy trucks and passenger vehicles by facility. Average heavy-truck speeds were lower than passenger vehicle speeds for all arterial segments in Des Moines. Average speed differences ranged from 0.8 mph to 15.1 mph; although, not all differences were statistically significant at the 95% confidence level. Average speeds for passenger vehicles were higher than average speeds for heavy trucks for all segments in Minneapolis/St. Paul, with differences ranging from 5.9 mph to 11.4 mph. All differences were significant at the 5% level of significance.

Spot speeds for heavy trucks were also lower in all cases than for passenger vehicles. Passenger vehicle speeds were higher and statistically different from heavy-duty truck spot speeds at the 95% confidence level for all Des Moines locations except for the Interstate 35 site. Heavy-truck speeds were 0.8 mph to 6.1 mph lower than passenger vehicle speeds. Spot speeds for passenger vehicles were also higher than for heavy trucks

for all Minneapolis/St. Paul locations. Speed differences ranged from 0.2 mph to 3.9 mph; although, not all differences were statistically significant.

The impact that differences in on-road speeds would have on emissions was also evaluated using MOBILE version 6.2. Misspecification of average truck speed is the most significant at lower and higher speed ranges. For instance, if average speeds for heavy trucks were actually 10 mph lower than average passenger vehicle speeds, using the average speed for passenger vehicles at 26 mph to estimate heavy-duty truck emissions would result in emission rates that are 66%, 14%, and 47% lower for CO, NO_x, and VOC than the actual emission rates would be if trucks speeds were modeled separately at 16 mph.

1. INTRODUCTION

1.1 Background

Heavy-duty trucks make up slightly more than 3% of the on-road vehicle fleet. In contrast, they account for more than 7% of vehicle miles traveled (VMT) on roadways in the United States. Even more significantly, they are estimated to contribute a significant proportion of regulated ambient emissions, which includes particulate matter (PM), carbon monoxide (CO), oxides of nitrogen (NO_x), and volatile organic compounds (VOC). United States Environmental Protection Agency (USEPA 2000) estimates that highway vehicles contribute 32% of NO_x emissions, with heavy trucks producing up to 38% of that amount. Another source indicates that heavy trucks contribute as much NO_x as passenger vehicles (Sawyer et al. 2000). The total estimated highway vehicle contribution to VOCs is 30%, 9% of which comes from heavy trucks. They also contribute 13% of the carbon monoxide emissions attributed to highway vehicles. Nationally, heavy trucks are also responsible for 65% and 75% of the highway vehicle contribution to PM_{10} and $PM_{2.5}$ respectively (USEPA 2000).

Kirchstetter et al. (1999) reported on an emissions study in the Caldecott tunnel near San Francisco that compared heavy-duty diesel and light-duty vehicles in two tunnel bores. The heavy-duty truck volume in Bore 1 was approximately 4.2%. An estimated 56% of the trucks had three or more axles. The second tunnel had only 0.3% heavy-duty trucks. Emissions were monitored and the resulting information used to create estimates of the on-road contribution of heavy trucks. Study results indicated that heavy-duty diesel trucks emit 15 to 20 times the number of particles per unit mass of fuel burned than light-duty vehicles. Using the results and values for the number of heavy trucks on the road and diesel fraction of fuel sales, they estimated that in California, heavy duty diesel trucks emit 80% of $PM_{2.5}$ and 45% of the on-road vehicle contribution to NO_x.

Heavy vehicles emit emissions at different rates than passenger vehicles. They may behave differently on the road as well, but they are often treated similarly to passenger vehicles in emissions modeling. The USEPA's emission factor model MOBILE requires use of default values or specification of local values for a number of vehicle activity variables. Agencies frequently collect variables to tailor MOBILE to reflect local conditions. However, variables such as average speed, soak time distribution, or trip length distribution are often collected for passenger vehicles and then broadly applied to all vehicle categories since it is difficult to obtain data that are more representative of individual vehicle classes.

The most recent version of MOBILE is 6.2, which estimates average, in-use fleet emission factors for VOC, CO, and NO_x. Emission rates are correlated to average speed (USEPA 2002). Typically, average speeds are output for a roadway link or facility type from travel demand forecasting models or measured in the field for project level analysis. A single average speed is typically specified to represent all vehicle activity for a facility without differentiating between vehicle types. Consequently, the methodology to estimate average speeds is the same for both heavy trucks and passenger vehicles due to a lack of more refined data to differentiate vehicle activity.

Differences in heavy trucks and passenger vehicle operation are usually considered in design of highway facilities and other aspects of transportation engineering, such as calculation of intersection clearance time. The effect of steep upgrades or downgrades on heavy-truck speeds is well documented. Truck speeds may be significantly below those of passenger vehicles depending on the magnitude and length of the upgrade. AASHTO (2001) reports that trucks typically increase their average speed by up to 5% on downgrades and decrease speed by 7% or more on upgrades as compared to their normal operation on level grade. Trucks also have lower acceleration rates and require increased time to reach cruising speeds than passenger vehicles. Acceleration capability is more significantly influenced by grade than for passenger vehicles (Fancher and Gillespie 1997).

Differences in average speeds between heavy trucks and passenger vehicles, however, are not documented. Vehicle speeds are a crucial input to MOBILE, and emission factors are significantly influenced by the specified average speed (Chatterjee et al. 1997). Consequently, systematic differences in operating speed between heavy trucks and passenger vehicles have the potential to adversely affect emissions and the ability to estimate and reduce pollution levels (Ross et al. 1998). If speed inputs are mis-specified, there may be severe underestimates or overestimates of emissions since vehicle speeds are a crucial input to MOBILE (Chatterjee et al. 1997).

1.2 Project Objectives

The main goal of the research was to evaluate whether heavy trucks and passenger vehicles operated differently on the road. Average vehicle speeds, in particular, are critical inputs to MOBILE, and significant differences in the way different categories of vehicles are modeled could have important consequences in evaluating project level and regional emissions. Specifically, the objectives of the research were the following:

- Conduct field studies to compare on-road speeds of heavy trucks and passenger vehicles on arterials and freeways
- Evaluate differences in on-road average and spot speeds
- Evaluate the impact that differences in operating speeds would have on emissions

2. DATA COLLECTION

Differences in the on-road operating speeds of passenger vehicles and heavy trucks were evaluated by collecting and analyzing average speed and spot speed data for different categories of vehicles in the metropolitan Des Moines, Iowa and Minneapolis/St. Paul, Minnesota areas. Des Moines represents a medium-sized urban area and Minneapolis/St. Paul represents a major metropolitan area.

The speed input variable used for MOBILE is average link speed. Average speeds were collected for all arterial sections along with spot speeds. Spot speeds were only collected on freeways, because the use of average speed studies on freeway segments was not feasible. Although spot speeds cannot be used directly in current mobile source emission models, comparing differences in spot speeds provides a measure of whether there are significant differences in the way heavy trucks operate on the road in comparison to passenger vehicles. Additionally, future modal emissions models, such as USEPA's forthcoming MOVES model, will require instantaneous vehicle activity information.

Average speeds were collected using the chase car method where data collectors follow a specific vehicle over a study section and record the time for the vehicle to traverse the entire section. In order to accomplish this, the chase vehicle enters the traffic stream far enough upstream of the data collection location to select a vehicle to follow. The chase vehicle then follows the test vehicle over the length of the study section and then exits the traffic stream, turns around, and starts the procedure over. This method works well on arterials and lower functional class roadways because of the multiple access points to turn around and wait for a test vehicle. Freeway sections have limited access, so chase vehicles need to enter and leave the freeway significantly up- or downstream of the study location. The time to complete a "loop" is significant and requires either the use of a large number of chase vehicles or a very long data collection period. The use of a large number of different drivers was not feasible, and collecting data over a long period of time results in sample runs collected under changing traffic conditions. Additionally, it was assumed that under non-congested freeway conditions, spot speeds approximate average speeds over short sections.

2.1 Site Selection

Arterial and freeway locations were selected to facilitate data collection and to provide a representative sample of facility conditions. Roadway sections with truck volumes at 3% or higher of reported average daily traffic (AADT) volumes were selected. Locations with a significant volume of trucks were necessary to ensure that a sufficient sample of heavy trucks could be collected. Truck AADT volumes were based on Iowa Department of Transportation (DOT) or Minnesota DOT AADT counts. Locations with tangent sections and a flat grade with no significant vertical curves were selected to facilitate the use of a radar gun.

Arterial study locations consisted of sections of roadways between two adjacent signalized intersections. Arterial locations were on four-lane divided highways. Sites

were selected so that chase vehicles could turn around upstream and downstream of the study locations. It was also necessary to have adequate position for a vehicle to park so that data collectors could position the radar gun. Freeway study locations were selected so that spot speeds could be collected from overpasses. The locations were also selected to avoid horizontal or vertical curvature. Study locations are shown in Figures 1 and 2 for the Des Moines Area and Figure 3 for the Minneapolis/St. Paul area. Photos showing each location are provided in Appendix A.

2.2 Data Collection

Data were typically collected in the off-peak period. The times data were collected along with information such as speed limit, AADT, direction, section length, etc. and are presented in Tables 1 and 2. Average speeds and spot speeds were both collected at all arterial sections except Highway 65 in Minneapolis/St. Paul. Only average speeds were collected for Highway 65 due to technical difficulties with the radar gun. Spot speed studies were collected midblock, and average speed studies were always collected in the direction of the spot speed study along arterials. In several cases, average speeds were collected in the opposite direction as well. Results were recorded and analyzed separately when average speed data were collected in both directions.

The methodology used to collect average and spot speeds is described in the sections 2.3 and 2.4. Volume and vehicle classification counts were collected concurrently with speed studies as described in section 2.5. All speed and volume data were collected in metropolitan Des Moines and metropolitan Minneapolis/St. Paul between October 2003 and June 2004. Data were collected at four principal arterials and two freeway segments in Des Moines and four arterials and three freeway locations in Minneapolis/St. Paul.

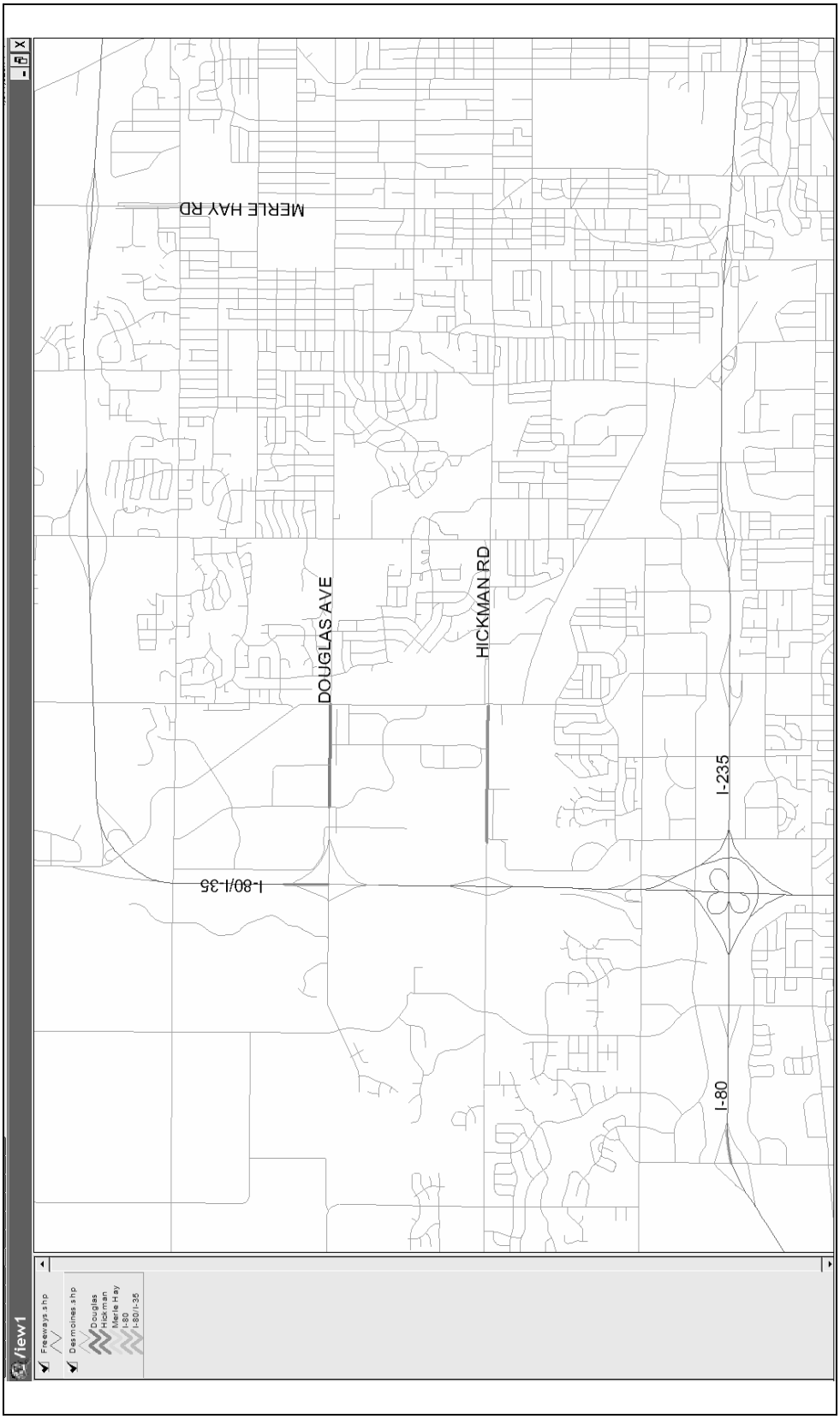

Figure 1. Data collection sites in Des Moines not including Highway 163

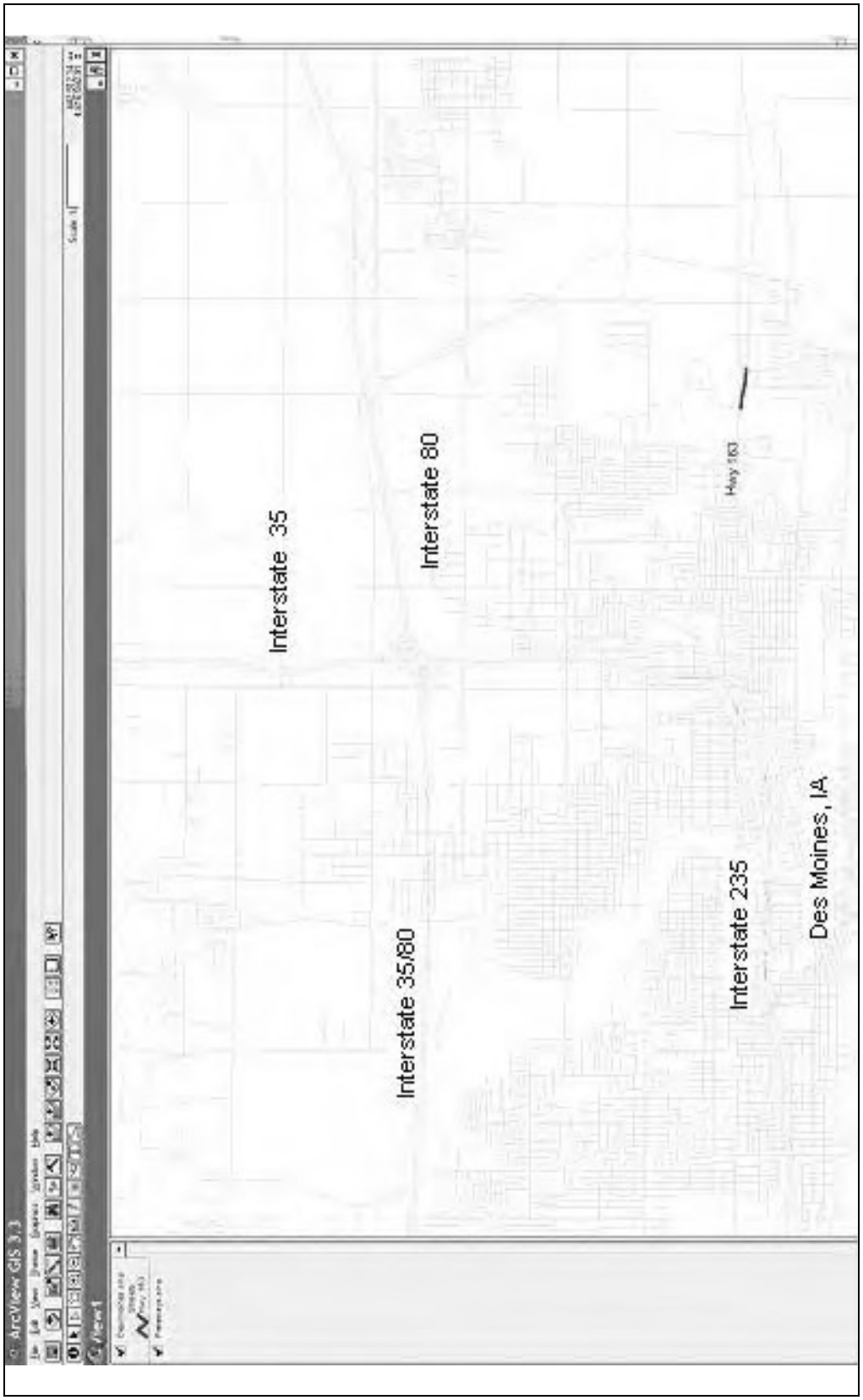

Figure 2. Data collection sites on Highway 163 in Des Moines

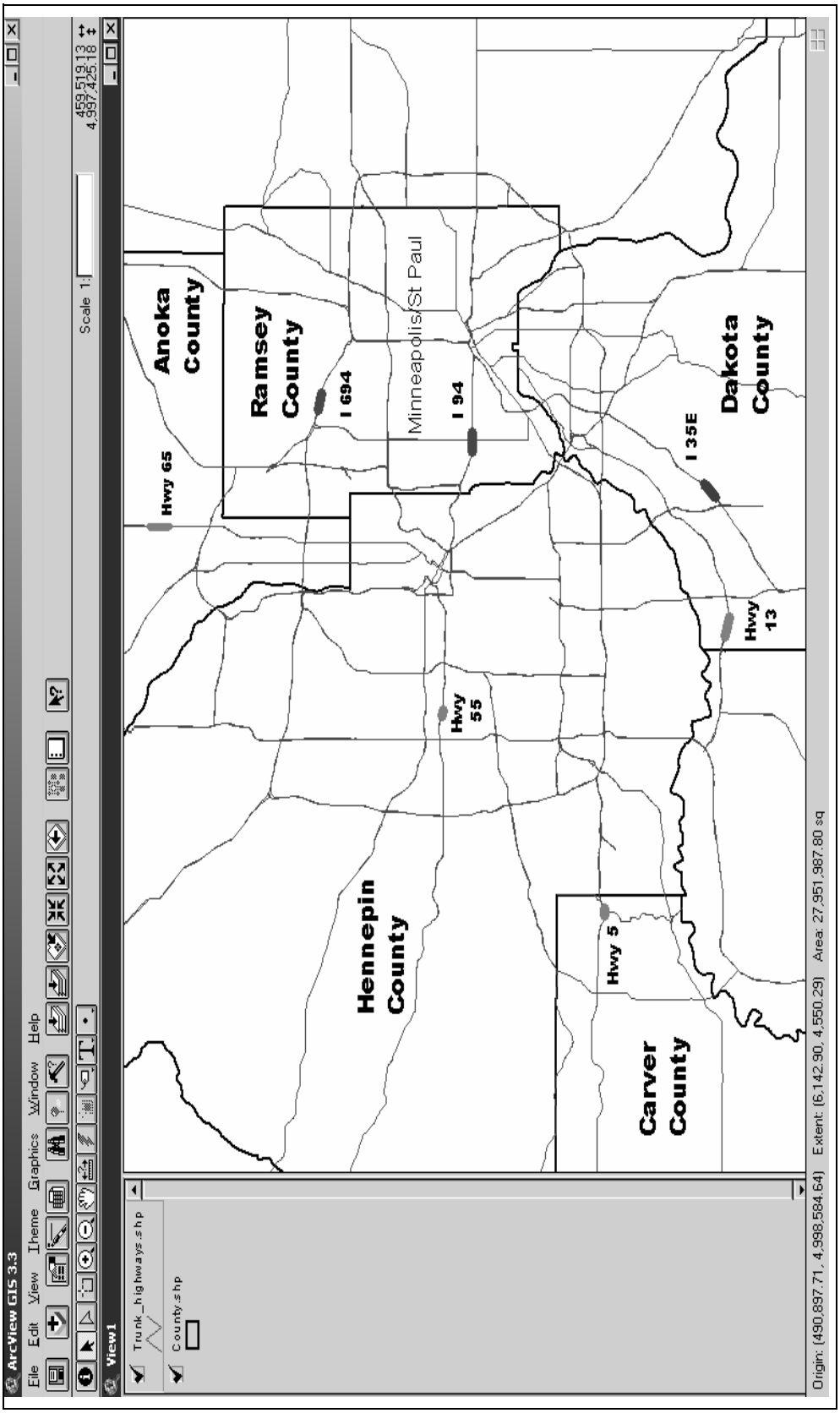

Figure 3. Data collection sites in Minneapolis/St. Paul

Table 1. Des Moines site specific information

Hickman Road (US 6) from NW 114th St to NW 100th St *Date:* October 31, 2003 *Time:* 1:30 p.m. to 3:30 p.m. *Direction of spot speed study:* eastbound *Direction of average speed study:* eastbound *Functional class:* principal arterial (4-lane) *AADT*: 21,000 *Percent trucks*: 4% *Posted speed limit*: 50 mph *Section length:* 4,321 feet	**Merle Hay Road (Highway 28) from Sutton Drive to Meredith Drive** *Date:* November 7, 2003 *Time:* 1:30 p.m. to 3:30 p.m. *Direction of spot speed study:* southbound *Direction of average speed study:* southbound and northbound *Functional class:* principal arterial (4-lane) *AADT*: 28,200 *Percent trucks*: 4% *Posted speed limit*: 40 mph *Section length:* 1,595 feet
Interstate 80 at 74th Street *Date:* November 13, 2003 *Time:* 1:30 p.m. to 3:30 p.m. *Direction of spot speed study:* westbound *Functional class:* Interstate (4-lane) *AADT*: 51,700 *Percent trucks*: 16% *Posted speed limit*: 65 mph	**Interstate 80/35 at Douglas Avenue** *Date:* November 19, 2003 *Time:* 11:30 a.m. to 1:30 p.m. *Direction of spot speed study:* northbound/eastbound *Functional class:* Interstate (6-lane) *AADT*: 72,200 *Percent trucks*: 18% *Posted speed limit*: 65 mph
Douglas Avenue from 100th to 109th Street *Date:* January 8, 2004 *Time:* 9:30 a.m. to 11:30 a.m. *Direction of spot speed study:* eastbound *Direction of average speed study:* eastbound and westbound *Functional class:* principal arterial (4-lane) *AADT*: 15,900 *Percent trucks*: 3% *Posted speed limit*: 45 mph *Section length:* 3,280 feet	**Highway 163 from Copper Creek Drive to Hickory Blvd** *Date:* January 8, 2004 *Time:* 1:30 p.m. to 3:30 p.m. *Direction of spot speed study:* westbound *Direction of average speed study:* eastbound and westbound *Functional class:* principal arterial (4-lane) *AADT*: 20,500 *Percent trucks*: 5% *Posted speed limit*: 50 mph *Section length:* 2,118 feet

Table 2. Minneapolis/St. Paul site specific information

Highway 13 from Washburn Avenue to CR 5, Burnsville, Dakota County *Date:* June 2, 2004 *Time:* 9:30 a.m. to 12 p.m. *Direction of spot speed study:* eastbound *Direction of average speed study:* eastbound *Functional class:* principal arterial (4-lane) *AADT*: 47,000 *Percent trucks*: 7% *Posted speed limit*: 55 mph *Section length:* 3,643 feet	**Highway 5 from Great Plains Blvd to Market Blvd (Hwy 101 S), Chanhassen, Carver County** *Date:* June 2, 2004 *Time:* 1:30 p.m. to 3:30 p.m. *Direction of spot speed study:* westbound *Direction of average speed study:* westbound and eastbound (collected on sidewalk with observers able to watch vehicles progress from one intersection to the next) *Functional class:* principal arterial (4-lane) *AADT*: 45,000 *Percent trucks*: 3% *Posted speed limit*: 55 mph *Section length:* 1,312 feet
Highway 55 from Winnetka Ave (CR 156) to Rhode Island Ave, Golden Valley, Hennepin County *Date:* June 2, 2004 *Time:* 4 p.m. to 6 p.m. *Direction of spot speed study:* eastbound/westbound *Direction of average speed study:* westbound and eastbound (collected on pedestrian overpass with observers able to watch vehicles progress from one intersection to the next) *Functional class:* principal arterial (4-lane) *AADT*: 39,000 *Percent trucks*: 3% *Posted speed limit*: 55 mph *Section length:* 841 feet	**Highway 65 from 105th Avenue to 109th Avenue, Blaine, Anoka County** *Date:* June 3, 2004 *Time:* 10 a.m. to 12 p.m. *Direction of spot speed study:* none *Direction of average speed study:* southbound *Functional class:* principal arterial (4-lane) *AADT*: 49,000 *Percent trucks*: 3% *Posted speed limit*: 55 mph *Section length:* 2,640 feet
Interstate 694 at Exit 34B, Shoreview, Ramsey County *Date:* June 3, 2004 *Time:* 10:45 a.m. to 12:15 p.m. *Direction of spot speed study:* southbound/eastbound *Functional class:* Interstate (six-lanes) *AADT*: 96,000 *Percent trucks*: 6% *Posted speed limit*: 60 mph	**Interstate 35E at Cliff Road (CR 32), Eagan, Dakota County** *Date:* June 3, 2004 *Time:* 1:55 p.m. to 3:30 p.m. *Direction of spot speed study: eastbound* *Functional class:* Interstate (six-lane) *AADT*: 70,000 *Percent trucks*: 4% *Posted speed limit*: 70 mph
Interstate 94 at Snelling (TH 51)/Lexington, St. Paul, Ramsey County *Date:* June 8, 2004 *Time:* 3 p.m. to 5 p.m. *Direction of spot speed study:* westbound *Functional class:* Interstate (6-lanes) *AADT*: 157,000 *Percent trucks*: 4% *Posted speed limit*: 55 mph	

2.3 Average Speed Study Methodology

The chase car method was used to collect average speeds along the arterial study links for all locations except for Highway 5 and Highway 55 in Minneapolis/St. Paul. Data were collected from signalized intersection to signalized intersection along the study link. Data were collected in both directions (southbound/northbound or eastbound/westbound) of travel when possible since drivers had to make a round trip to complete the loop. Each chase vehicle consisted of one driver and one timer using a stopwatch to record travel time along the link. Travel time was recorded from the time a queued vehicle began moving forward, once the signal turned green at the upstream intersection, until it came to a complete stop at the downstream intersection. If the sampled vehicle did not stop or queue at either the upstream or downstream intersection, travel time was recorded from the time it crossed the respective stopbar.

Travel time, therefore, included actual time to accelerate and decelerate, operational delay, and time to traverse the link, but did not include stopped-time delay. Ordinarily, stopped delay would be included in average speed studies. However, since average speeds were being compared across vehicle types and sample sizes were limited by practical constraints, it was not possible to collect a representative sample of both categories of vehicles stopping at different points during the red phase. If total intersection delay were included and one type of vehicle arbitrarily ended up spending more time in queue, average speed results would be significantly biased. Stopped delay was assumed to be similar for all vehicles types and it was determined that collection of intersection delay minus stopped delay would better meet study objectives. However, it can be included by estimating average stopped delay per vehicle and adding this value to individual vehicle travel times.

Chase car drivers were instructed to randomly select a vehicle approaching the upstream study intersection and follow that vehicle through the study section. They were instructed to select heavy trucks whenever they were present in the traffic stream. This resulted in oversampling of heavy trucks in proportion to their percentage in the traffic stream but was necessary to collect enough heavy-duty truck samples. Data collectors were instructed to discard samples when the sampled vehicle turned before the end of the test section or if an unusual incident had occurred that affected normal traffic operation, such as a vehicle stopped in the roadway.

The direct observation method was used at Highway 5 and Highway 55 in Minneapolis/St. Paul. In the direct observation method (ITE 2000), observers are positioned at an elevated vantage point and measure travel time directly between two points at a known distance from each other. Data collectors were located at an elevated location along a sidewalk adjacent to Highway 5 and on a pedestrian overpass on Highway 55. Data collectors were able to observe vehicles from the stopbar of the upstream intersection to the stopbar of the downstream intersection. Data collectors randomly selected passenger vehicles and selected heavy trucks when they appeared in the traffic stream. Travel time was collected in the same manner as for the chase car

method. This direct observation method resulted in a significantly larger sample size than the chase car method.

2.4 Spot Speed Study Methodology

Spot speeds were collected using Genesis-VP radar gun from Decatur Electronics. As described previously, spot speed data were collected midblock for arterial test segments and at overpasses with dedicated pedestrian facilities for freeways. An attempt was made to collect data for at least 100 vehicles to ensure that the samples were large enough to meet the assumptions of normality for the two sample t-test.

Spot speeds were collected in one direction during the study period (i.e., eastbound). Data were typically collected for a two-hour period in order to collect data for a minimum of 100 vehicles. Type of vehicle was noted as the following:

- PC: passenger cars, sport utility vehicles (SUV), and passenger vans (FHWA Classes 2 and 3)
- SU: 2-axle single unit trucks (FHWA Class 5)
- Semi: this category included heavy trucks larger than single unit (FHWA Classes 6 to 13)

Data for other vehicle types, such as buses or motorcycles, were not collected. FHWA vehicle classes are shown in Appendix B (USDOT 2001).

The radar gun operator randomly selected free-flowing passenger vehicles from the traffic stream. Heavy trucks were selected whenever they appeared in the traffic stream and were traveling under free-flow conditions. Consequently, heavy trucks were sampled at a higher rate in proportion to their ratio in the traffic stream than passenger vehicles.

2.5 Volume and Vehicle Classification Counts

Volume and classification counts were also collected during spot speed studies using Jamar Technologies DB-400 Intersection Counter. Volume data were collected in the direction of the spot speed study. For instance, if the spot speed study was for the eastbound approach, the volume count corresponded to the eastbound approach, accordingly. The vehicle classification count included two categories of vehicles. Passenger cars included cars, passenger vans, sport utility vehicles, pickup trucks, and motorcycles. Heavy trucks included all heavy-duty vehicles 2-axle 6-wheel and larger. Buses were included as heavy trucks.

3. ANALYSIS AND RESULTS

Initially, data were collected for two categories of heavy trucks: single unit and semi. However, data for both truck categories were eventually combined since neither category alone had sufficient vehicle samples to complete meaningful statistical comparisons. The heavy truck category included FHWA classes 5 to 13. The passenger vehicle category included FHWA classes 2 and 3. Motorcycles and buses were not included in the data collection. S-PLUS statistical software (version 6.2.1) was used for the statistical analyses.

3.1 Average Speed Studies

During data collection, the variable recorded was the time in seconds for each vehicle to traverse the study section as described in the data collection section. Average speed for each vehicle was calculated by the following formula:

$$v_{avg} = \frac{l_s}{t_{veh}} \quad (1)$$

where:

v_{avg} = average speed for the individual vehicle in miles per hour (mph)
l_s = length of study section in miles
t_{veh} = time for individual vehicle to traverse section
(converted from seconds to hours)

Average speeds for passenger vehicles were compared against heavy-duty trucks for each study location. Exploratory data analysis was used to determine whether data for each vehicle type and location were normally distributed. Normal probability quantile-quantile (QQ) and probability density curve plots were constructed using S-PLUS and evaluated. QQ normal and probability density curve plots for each dataset are presented in Appendix C.

A two-sided t-test was used to compare average passenger vehicle speeds against average heavy-truck speeds when both datasets did not significantly violate assumptions of normality. The Wilcoxon rank sum test was used to compare average speeds between the two vehicle types when one or both datasets were significantly non-normal. The Wilcoxon rank sum test is a non-parametric test similar to the t-test, but it does not require assumptions of normality.

Results for the Des Moines study locations are presented in Table 3. As shown, average heavy-truck speeds were lower than passenger vehicle speeds for all locations. Average speed differences ranged from 0.8 mph to 15.1 mph. Although mean passenger vehicle speeds were higher than heavy-duty truck spot speeds in all cases, not all differences were statistically significant at the 95% confidence level. For the southbound approach

on Merle Hay Road, the difference in average speeds was only 0.8 mph and was not statistically significant at the 5% level of confidence. Although data were collected during off-peak hours, the southbound approach still experienced significant queuing at the downstream intersection. It is expected that, under these conditions, less variation in average vehicle speeds would occur. The difference in average speeds for the eastbound section of Highway 163 was 4.5 mph, and the difference for the westbound direction was 2.0 mph. However, t-test results indicate that the differences were not statistically significant. In these two cases, the inability to determine statistically significant differences may have been due to small samples sizes.

Results for the Minneapolis/St. Paul study locations are shown in Table 4. Average speeds for passenger vehicles were higher than average speeds for heavy trucks for all locations and all directions. All differences were significant at the 5% level of significance. Speed differences ranged from 5.7 mph to 11.4 mph.

Table 3. Results for Des Moines average speed study

Location	Min Speed (mph)	Mean Speed (mph)	Max Speed (mph)	Std	Number of Samples	Speed Difference (mph)	t-test Results	Wilcoxon Results
Douglas (EB) PC	20.0	37.3	43.9	7.4	24	15.1	t = 3.50	
Douglas (EB) HDT	19.1	22.2	37.8	4.8	13		p = 0.00	
Douglas (WB) PC	19.8	34.6	54.2	10.5	33	6.6		z = 2.26
Douglas (WB) HDT	15.9	28.0	45.4	10.2	16			p = 0.02
Hickman (EB) PC	50.5	58.5	72.8	5.4	17	14.8	t = 2.87*	
Hickman (EB) HDT	24.5	43.7	58.7	14.0	8		p = 0.02*	
Highway 163 (EB) PC	34.6	42.2	60.5	6.6	11	4.5	t = 1.41	
Highway 163 (EB) HDT	14.1	37.7	49.3	8.9	15		p = 0.17	
Highway 163 (WB) PC	31.3	43.7	54.7	6.9	9	2.0	t = 0.60	
Highway 163 (WB) PC	29.3	41.7	54.6	8.4	18		p = 0.55	
Merle Hay (NB) PC	20.1	29.8	37.4	4.2	8	4.5	t = 3.52	
Merle Hay (NB) HDT	20.6	25.3	29.8	3.1	26		p = 0.00	
Merle Hay (SB) PC	27.5	31.3	40.7	3.4	19	0.8		z = 0.13
Merle Hay (SB) HDT	24.0	30.5	32.5	3.0	8			p = 0.89

Notes: PC includes passenger cars, sport utility vehicles, and passenger vans.
HDT includes vehicles 2A6 and larger.
*Welch's t-test (approximate t-test) used when variances were not equal.

Table 4. Results for Minneapolis/St. Paul average speed study

	Min Speed (mph)	Mean Speed (mph)	Max Speed (mph)	Std	Number of Samples	Speed Difference (mph)	t-test results	Wilcoxon Results
Highway 13 (EB) PC	21.4	38.3	60.8	12.8	16	9.9		z = 2.68
Highway 13 (EB) HDT	15.3	28.4	53.3	11.8	37			p = 0.01
Highway 5 (EB) PC	19.6	38.5	53.6	8.8	30	5.7	t = 2.34	
Highway 5 (EB) HDT	18.1	32.8	53.0	9.6	28		p = 0.02	
Highway 5 (WB) PC	16.9	43.0	61.6	9.2	35	9.2	t = 3.62	
Highway 5 (WB) HDT	22.5	33.8	51.1	9.1	20		p = 0.0	
Highway 55 (EB) PC	18.7	45.3	68.3	11.7	44	11.2	t = 4.83*	
Highway 55 (EB) HDT	19.9	34.1	55.4	8.5	32		p = 0.0*	
Highway 55 (WB) PC	28.0	37.8	58.9	7.2	32	5.9	t = 2.42*	
Highway 55 (WB) HDT	16.6	31.9	52.6	10.8	27		p = 0.02*	
Highway 65 (SB) PC	17.2	34.8	50.6	7.2	13	11.4		z = 2.51
Highway 65 (SB) HDT	14.3	23.4	35.9	9.5	10			p = 0.01

Notes: PC includes passenger cars, sport utility vehicles, and passenger vans.
HDT includes vehicles 2A6 and larger.
* Welch's t-test (approximate t-test) used when variances were not equal.

3.2 Spot Speed Studies

Spot speed data were collected using a radar gun which reports spot speed in mph. Exploratory data analysis was used to determine whether data for each vehicle type for each location were normally distributed. Normal probability quantile-quantile (QQ) and probability density curve plots were constructed using S-PLUS tools and evaluated. QQ normal and probability density curve plots for each dataset are presented in Appendix C. In all cases, datasets were normal or nearly normal. Thus, spot speeds for passenger vehicles were compared against heavy-duty trucks for each site and each direction using a two-sided t-test.

Results for the Des Moines data are provided in Table 5. As shown, mean passenger vehicle speeds were higher and statistically different from heavy-duty truck spot speeds at the 95% confidence level except for the Interstate 35 site. At this location, the mean speeds were statistically different at the 10% confidence level. Depending on the location, heavy-truck speeds were 0.8 mph to 6.1 mph lower than passenger vehicle speeds. Mean heavy-duty truck and passenger vehicle speeds were closer on the two freeway segments than on the arterial study sites (0.8 mph for the I-35 site and 1.2 mph for the I-80 location); although, heavy-truck speeds were still lower.

Results for the Minneapolis/St. Paul data are shown in Table 6. Spot speeds for passenger vehicles were higher for all locations than for heavy trucks. Speed differences ranged from 0.2 mph to 3.9 mph depending on the location. Differences in spot speeds were only statistically significant at the 5% level of significance for the Interstate 35E and Interstate 94 locations. Differences were statistically significant at the 10% level of significance for Interstate 35E, Interstate 94, and Highway 5. Average speeds for passenger vehicles were higher for Interstate 694, Highway 13, and Highway 55 (eastbound and westbound) but were not statistically different at the 10% level of significance.

Table 5. Results for Des Moines spot speed study

Location	Min Speed (mph)	Mean Speed (mph)	Max Speed (mph)	Std	Number of Samples	Speed Difference (mph)	t-test results
Douglas (EB) PC	32.0	44.0	56.0	4.8	167	6.1	t = 5.57
Douglas (EB) HDT	24.0	37.9	45.0	5.4	22		p = 0.00
Hickman (EB) PC	24.0	45.9	61.0	5.2	142	2.4	t = 3.09
Hickman (EB) HDT	34.0	43.5	55.0	4.8	60		p = 0.00
Highway 163 (WB) PC	34.0	47.8	63.0	4.8	160	1.9	t = 2.05
Highway 163 (WB) HDT	36.0	45.9	55.0	4.4	29		p = 0.04
I-80 (WB) PC	46.0	67.9	82.0	4.5	233	1.2	t = 2.43
I-80 (WB) HDT	57.0	66.7	77.0	3.6	104		p = 0.02
I-35 (NB) PC	61.0	69.5	97.0	4.5	249	0.8	t = 1.82
I-35 (NB) HDT	53.0	68.7	75.0	3.7	131		p = 0.07
Merle Hay (SB) PC	29.0	38.5	48.0	4.4	104	5.1	t = 5.63
Merle Hay (SB) HDT	24.0	33.4	42.0	4.2	30		p = 0.00

Notes: PC includes passenger cars, sport utility vehicles, and passenger vans.
HDT includes vehicles 2A6 and larger.

Table 6. Results for the Minneapolis/St. Paul spot speed studies

Location	Min Speed (mph)	Mean Speed (mph)	Max Speed (mph)	Std	Number of Samples	Speed Difference (mph)	t-test results
Interstate 694 (SB/EB) PC	54.0	63.1	72.0	3.7	163	0.6	t = 1.02
Interstate 694 (SB/EB) HDT	55.0	62.5	69.0	3.5	58		p = 0.31
Interstate 35E (EB) PC	60.0	70.0	87.0	4.3	167	2.5	t = 3.91
Interstate 35E (EB) HDT	60.0	67.5	76.0	3.4	60		p = 0.00
Interstate 94 (WB) PC	50.0	61.4	72.0	3.8	71	3.9	t = 4.93
Interstate 94 (WB) PC	50.0	57.5	70.0	4.4	42		p = 0.00
Highway 5 (WB) PC	34.0	47.6	62.0	6.4	81	2.9	t = 1.88
Highway 5 (WB) HDT	30.0	44.7	52.0	5.3	20		p = 0.06
Highway 13(EB) PC	44.0	53.5	65.0	4.0	133	0.8	t = 0.84
Highway 13 (EB) HDT	41.0	52.7	62.0	5.7	25		p = 0.40
Highway 55 (WB) PC	31.0	41.3	56.0	6.9	40	0.2	t = 0.06
Highway 55 (WB) HDT	19.0	41.1	53.0	5.7	15		p = 0.95
Highway 55 (EB) PC	28.0	45.5	61.0	8.0	60	2.7	t = 1.01
Highway 55 (EB) HDT	35.0	42.8	55.0	7.1	10		p = 0.32

Notes: PC includes passenger cars, sport utility vehicles, and passenger vans.
HDT includes vehicles 2A6 and larger.

3.3 Volume and Vehicle Classification

Volume and percentage of heavy trucks from the DB-400 Intersection Counter were downloaded, and vehicles per lane per hour (veh/ln/hr) and percentage of heavy trucks were calculated. Results are summarized in Table 7 for the Des Moines locations. Volume varied from 166 veh/ln/hr at Douglas Avenue to 639 veh/ln/hr at Merle Hay Road. Heavy-duty truck volumes varied from 3% to 26% during the study period.

Volume and vehicle classification data for Minneapolis/St. Paul are shown Table 8. Volume varied from 536 veh/ln/hr at I-35E to 1,469 veh/lan/hr at I-694. Heavy-duty truck volumes varied from 3% to 21% of the total volume during the study period.

Table 7. Traffic volumes and vehicle classification for Des Moines

Location	Total Volume	Data Collection Period (hrs)	Number of Lanes	veh//ln/hr	Heavy Trucks (%)
Douglas (EB)	718	2.17	2	166	3%
Hickman (EB)	2,238	2.17	2	516	5%
Highway 163 (WB)	914	1.92	2	238	6%
Merle Hay (SB)	2,873	2.25	2	639	3%
I-80 (WB)	1,749	1.92	2	456	26%
I-35 (NB)	3,832	2.08	3	615	19%

Table 8. Traffic volumes and vehicle classification for Minneapolis/St. Paul

Location	Total Volume	Data Collection Period (hrs)	Number of Lanes	veh/ln/hr	Heavy Trucks (%)
Highway 13 (EB)	2,911	2.50	2	583	21%
Highway 5 (WB)	1,891	1.16	2	815	5%
Highway 55 (EB)	2,897	1.25	2	1,159	3%
I-694 (SB/EB)	4,405	1.50	2	1,469	14%
I-35E (EB)	2,057	1.28	3	536	6%

4. EMISSIONS ANALYSIS

The impact of differences in heavy-duty truck versus passenger vehicle average speeds on emissions was modeled using MOBILE6.2. The USEPA recently released emission rate model MOBILE6.2 estimates average in-use fleet emission factors VOC, CO, and NO_x. Twenty-eight individual vehicle types can be modeled, including gas, diesel, and natural gas fueled passenger vehicles, heavy trucks, buses, and motorcycles for calendar years 1952 to 2050. The vehicle classes included in MOBILE6 are shown in Appendix D.

Emissions can be modeled at different average speeds from 2.5 mph to 65 mph on arterials. However, the user-specified average speed applies to all vehicle types. Modeling speeds differently for individual vehicle classes requires that the model is run for each desired speed value and output is specified by vehicle type. If emissions are reported at a specific average speed, output can be set to report for individual vehicle classes, and then the information can be extracted for the desired speed and vehicle type. Emission rates can also be allocated by four roadway categories: (1) freeways, (2) arterials (includes both arterials and collectors), (3) local roads, and (4) freeway on- and off-ramps (USEPA 2003).

4.1 Sensitivity Analysis

A sensitivity analysis was performed using a series of MOBILE6.2 model runs to demonstrate differences in emissions that would result from differences in average speeds between heavy-duty trucks and passenger vehicles. A minimum ambient temperature of 50º F and a maximum temperature of 70º F were used with a scenario date of January 2004, and only arterial roadways were considered. The data output from MOBILE6.2 was expanded to include emission rates by vehicle type. The average speed for the first MOBILE run was specified at 2.5 mph, the second at 3 mph, and then the average speed of subsequent runs was increased at 1 mph increment up to 65 mph. All other model parameters were MOBILE6.2 defaults. Emission rates were calculated for a passenger vehicle category and a heavy-duty truck category. The passenger vehicle category included LDGV, LDGT1, LDGT2, LDGT3, LDGT4, LDDV, and LDDT12. The heavy-duty truck category included all HDDV classes and all HDGV classes. Emission rates were weighted by class according to the fraction of VMT that they are assigned in MOBILE6.2 defaults.

The results of the speed-sensitivity analysis are provided in Figures 4, 5, and 6 for VOC, NO_x, and CO. As shown in Figure 4, CO emission rates are lower for the heavy-duty truck category than for the passenger vehicles, except in the lowest speed ranges. CO emissions are highest at low speeds, lowest at mid-range speeds, and then increase slightly with increasing speed. The lowest emissions for passenger vehicles occur between 20 mph and 40 mph. For heavy trucks, CO emissions are lowest at approximately 35 mph to 55 mph. NO_x emissions are significantly higher for heavy-duty trucks than for passenger vehicles, as shown in Figure 5. As shown, NO_x emission rates for passenger vehicles are slightly higher at lower speeds but remain fairly constant from

approximately 15 mph to 65 mph. Heavy-duty truck emissions follow a pronounced U-shaped curve with significantly higher emissions at the lower and higher speed ranges and lower emissions at mid-speed ranges. VOC emissions are shown in Figure 6. As illustrated, VOC emissions are significantly higher at lower speed ranges for passenger vehicles until approximately 15 mph. Emission rates then gradually decrease as speed increases. VOC emission rates follow a similar trend for heavy-duty trucks, with less pronounced increases at lower speed ranges. VOC emissions for trucks are lower than for passenger vehicles at all speed ranges.

Study results indicated that heavy-duty truck average speeds are lower than passenger vehicle average speeds. The consequences of modeling heavy-duty trucks using the same average speeds as passenger vehicles are the most significant in the lower and higher speed ranges. If passenger vehicle speeds were specified as 26 mph, emission rates for heavy-duty trucks at that speed would be 7.76 g/m for CO, 8.95 g/m for NO_x, and 0.99 g/m for VOC. If average speeds for heavy trucks were actually 10 mph lower, emission rates at 16 mph for heavy trucks would be 12.9 g/m for CO, 10.22 g/m for NO_x, and 1.46 g/m for VOC resulting in differences of 66%, 14%, and 47% respectively. If heavy trucks traveled 5 mph slower than passenger vehicles, emission rates at 21 mph would be 9.76 g/m for CO, 9.42 g/m for NO_x, and 1.18 g/m for VOC. Truck emission would be underestimated by 26%, 5%, and 19% respectively. If passenger vehicle average speeds were specified as 65 mph, emission rates for heavy trucks at that speed would be 7.78 g/m for CO, 15.76 g/m for NO_x, and 1.13 g/m for VOC. If heavy truck average speeds were 5 mph lower than passenger vehicles, emission rates at 60 mph would be 6.5 g/m for CO, 13.23 g/m for NO_x, and 1.15 g/m for VOC. Emissions would be overestimated for heavy trucks by 16% for both CO and NO_x and underestimated by 2% for VOC. The actual impact would depend on the percentage of trucks for a specific facility.

4.2 Comparison of Emission Differences for Several Test Locations

Emissions differences were compared for several of the study locations in Des Moines. Differences were evaluated for both eastbound and westbound directions of the Douglas location and both eastbound and westbound directions of the Highway 163 location. Signal timings were collected for the downstream intersection of each section, and stopped delay per vehicle was calculated using Highway Capacity Software 2000 for each section. The average speed per vehicle from field studies was recalculated with stopped delay per vehicle included in the total travel time. Mean passenger vehicle and heavy truck speed were also recalculated. MOBILE6.2 runs were made using the average vehicle speed and emission rates calculated for the passenger vehicle and heavy truck vehicle categories, as described in the previous paragraph. Emission rates for heavy trucks were calculated first assuming that heavy trucks travel at the same average speed as passenger vehicles, and then emission rates were calculated for the actual heavy truck average speed. Results are presented in Table 9. As shown, emission rates are estimated assuming that heavy trucks travel at the same average speed as passenger vehicles, underestimating emission rates by 3% to 40% for VOC and 3% to 55% for CO. Emission rates for NO_x were underestimated by 4% and 12% for the Douglas location and overestimated by 1% to 2% at the Highway 163 location.

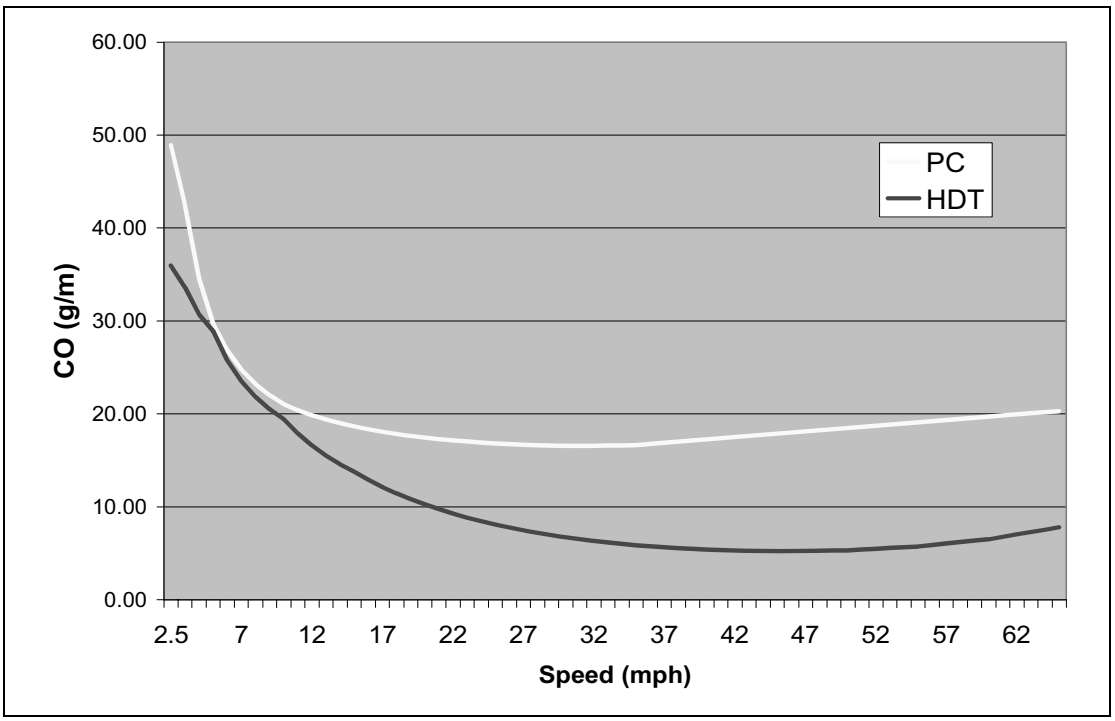

Figure 4. Carbon monoxide emission rates by vehicle category

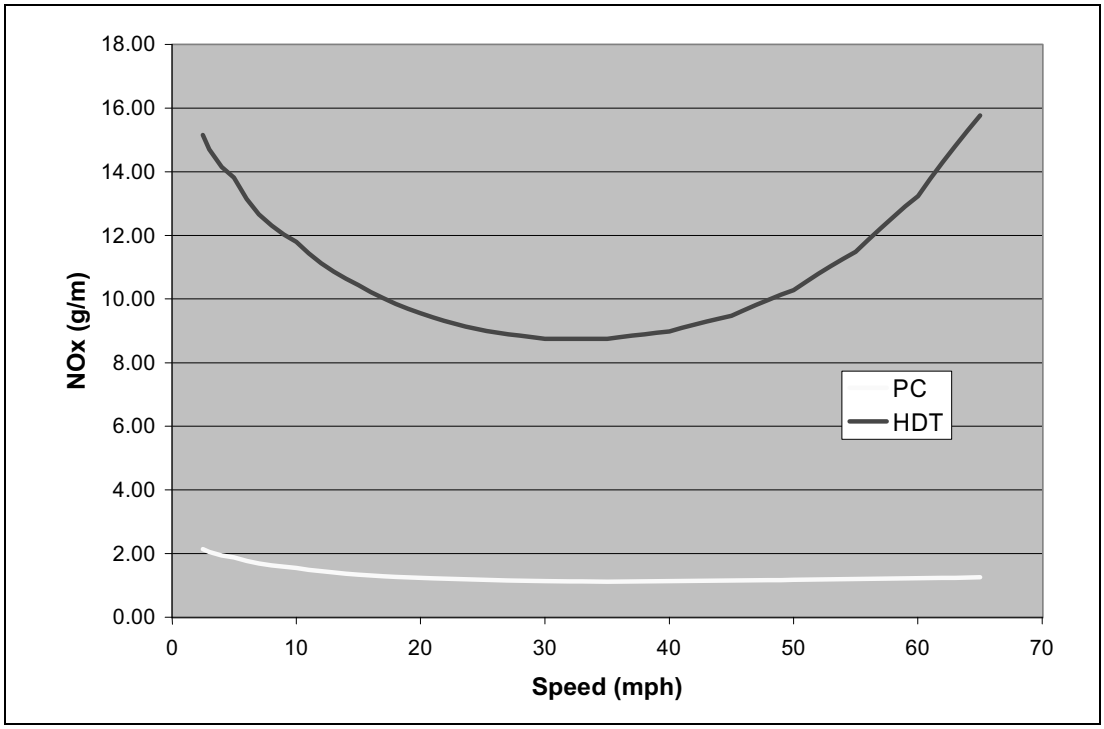

Figure 5. Oxides of nitrogen emission rates by vehicle category

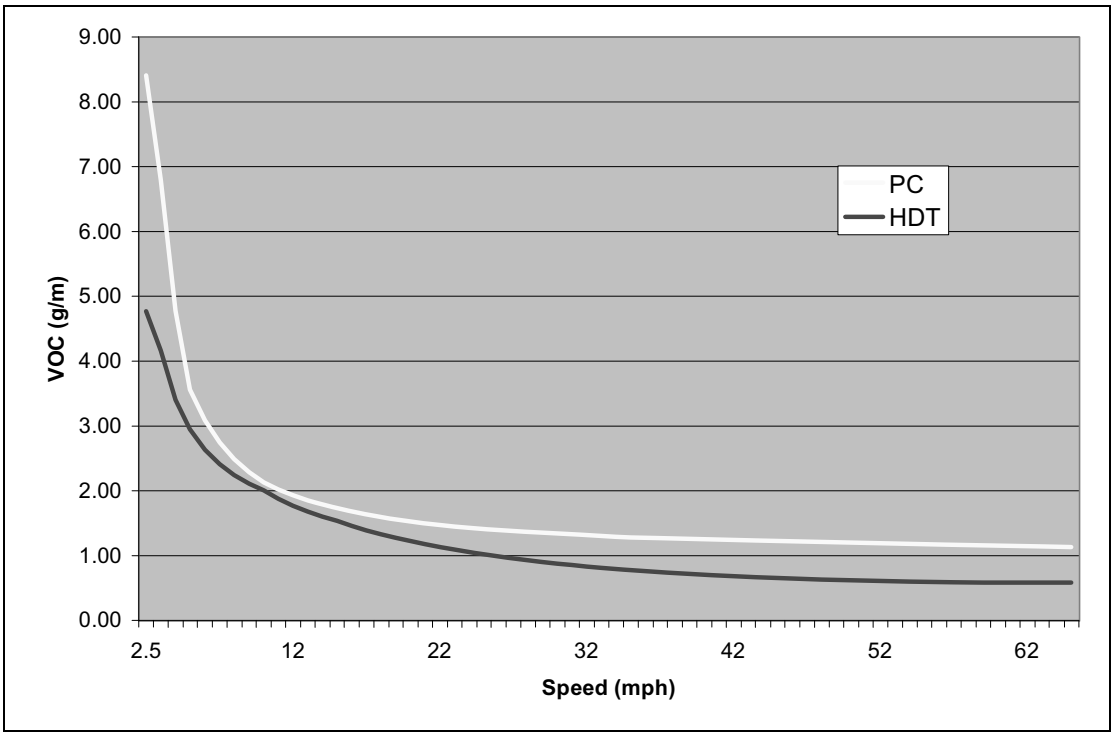

Figure 6. Volatile organic compounds emission rates by vehicle category

Table 9. Comparison of emission rates using heavy-duty trucks average speeds versus assuming average speed of passenger vehicles

	Adjusted Average Speed (mph)		Heavy Duty Truck CO Emission Rate (g/m)			Heavy Duty Truck NO_x Emission Rate (g/m)			Heavy Duty Truck VOC Emission Rate (g/m)		
Location	**PC**	**HDT**	**Assuming Avg Speed of PC**	**Heavy Truck Avg Speed**	**Change**	**Assuming Avg Speed of PC**	**Heavy Truck Avg Speed**	**Change**	**Assuming Avg Speed of PC**	**Heavy Truck Avg Speed**	**Change**
Douglas EB	26.2	17.3	7.67	11.92	55.3%	8.93	9.97	11.6%	0.98	1.37	40.1%
Douglas WB	28.1	23.5	7.17	8.65	20.6%	8.84	9.15	3.5%	0.93	1.07	16%
Hwy 163 EB	38.0	34.2	5.55	5.97	7.5%	8.89	8.75	-1.6%	0.73	0.79	8.3%
Hwy 163 WB	38.5	36.9	5.50	5.65	2.7%	8.91	8.84	-0.8%	0.72	0.75	3.1%

5. SUMMARY AND CONCLUSIONS

Heavy vehicles emit emissions at different rates than passenger vehicles. They may behave differently on the road as well, yet they are often treated similarly to passenger vehicles in emissions modeling. Although not frequently considered in calculating emission rates, differences in the operating speeds of passenger vehicles and heavy trucks may influence emissions. Emission rates from MOBILE are correlated to average speed. Typically, average speeds are output for a roadway link or facility type from travel demand forecasting models and a single average speed is input to MOBILE to represent all vehicle types. However, since emission rates are correlated to average vehicle speed, systematic differences in operating speed between heavy vehicles and passenger vehicles have the potential to adversely affect emissions and the ability to estimate and reduce pollution levels.

This research project evaluated whether heavy trucks travel at significantly different operating speeds than passenger vehicles and what impact differences in on-road speeds would have on emissions. Average speeds and spot speeds were collected for heavy trucks and passenger vehicles for four arterial segments, and spot speeds were collected for two freeway segments in Des Moines, Iowa. Average and spot speeds were collected for four arterial segments and three freeway segments in the Minneapolis/St. Paul, Minnesota metropolitan area. Only one category was used to represent heavy trucks since the number of average speed samples that could be collected at a particular location was limited. It is expected that some differences would occur between different categories of heavy trucks.

Average time was collected in the form of travel time and included actual time to accelerate, decelerate, operational delay, and time to traverse the link, but it did not include stopped-time delay. Ordinarily, stopped delay would be included in average speed studies. However, since average speeds were being compared across vehicle types and sample sizes were limited by practical constraints, it was not possible to collect a representative sample of both categories of vehicles queued for different amounts of time during the red phase. It was assumed that stopped delay would be similar for all vehicle types and that collection of intersection delay minus stopped delay would better meet study objectives. Stopped delay can be included by estimating average stopped delay per vehicle and adding this value to all travel times.

Average and spot speeds were compared for heavy trucks and passenger vehicles by facility. Average heavy-duty truck speeds were lower than passenger vehicle speeds for all arterial segments in Des Moines. Average speed differences ranged from 0.8 mph to 15.1 mph; although, not all differences were at the 95% confidence level. Average speeds for passenger vehicles were higher than average speeds for heavy trucks for all segments in Minneapolis/St. Paul, with differences ranging from 5.9 mph to 11.4 mph. All differences were significant at the 5% level of significance.

Spot speeds for heavy trucks were also lower than for passenger vehicles in all cases. Passenger vehicle speeds were higher and statistically different from heavy-duty truck

spot speeds at the 95% confidence level for all Des Moines locations except for the I-35 site. Heavy-truck speeds were 0.8 mph to 6.1 mph lower than passenger vehicle speeds. Spot speeds for passenger vehicles were also higher than for heavy trucks for all Minneapolis/St. Paul locations. Speed differences ranged from 0.2 mph to 3.9 mph; although, not all differences were statistically significant.

The impact that differences in on-road speeds would have on emissions was also evaluated using MOBILE6.2. Misspecification of average truck speed is the most significant at lower and higher speed ranges. For instance, if average speeds for heavy trucks were actually 10 mph lower than average passenger vehicle speeds, using the average speed for passenger vehicles at 26 mph to estimate heavy-truck emissions would result in emission rates that are 66%, 14%, and 47% lower for CO, NO_x, and VOC than the actual emission rates would be if trucks speeds were modeled separately at 16 mph.

Significant differences in heavy-truck speeds were found at a number of the locations studied. Most data were collected during off-peak conditions, but higher volumes and congestion occurred at three locations. Significant congestion and/or significant idling time at intersections would tend to minimize differences in average speeds between the two vehicle classes. However, emission differences are more pronounced in the lower speeds for all pollutants.

Whether heavy-truck and passenger vehicle average speeds should be modeled separately and whether data should be collected to determine speed differences depends on the individual situation. However, the conclusion of this research is that heavy trucks and passenger vehicles operate differently on the road. Differences could have consequences for project level and regional emissions modeling particularly since the ability to demonstrate conformity is based on the ability to correctly estimate and model vehicle activity.

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APPENDIX A: PHOTOS OF DATA COLLECTION LOCATIONS

Highway 5 in Chanhassen, MN (looking east)

Highway 55 in Golden Valley, MN (looking west)

Highway 13 in Burnsville, MN (looking east)

Interstate 80 East/35 North in Urbandale, IA (looking north)

Interstate 80 in West Des Moines, IA (looking east)

Hickman Rd (US 6) in Urbandale, IA (looking east)

Merle Hay Road (IA 28) in Urbandale, IA (looking south)

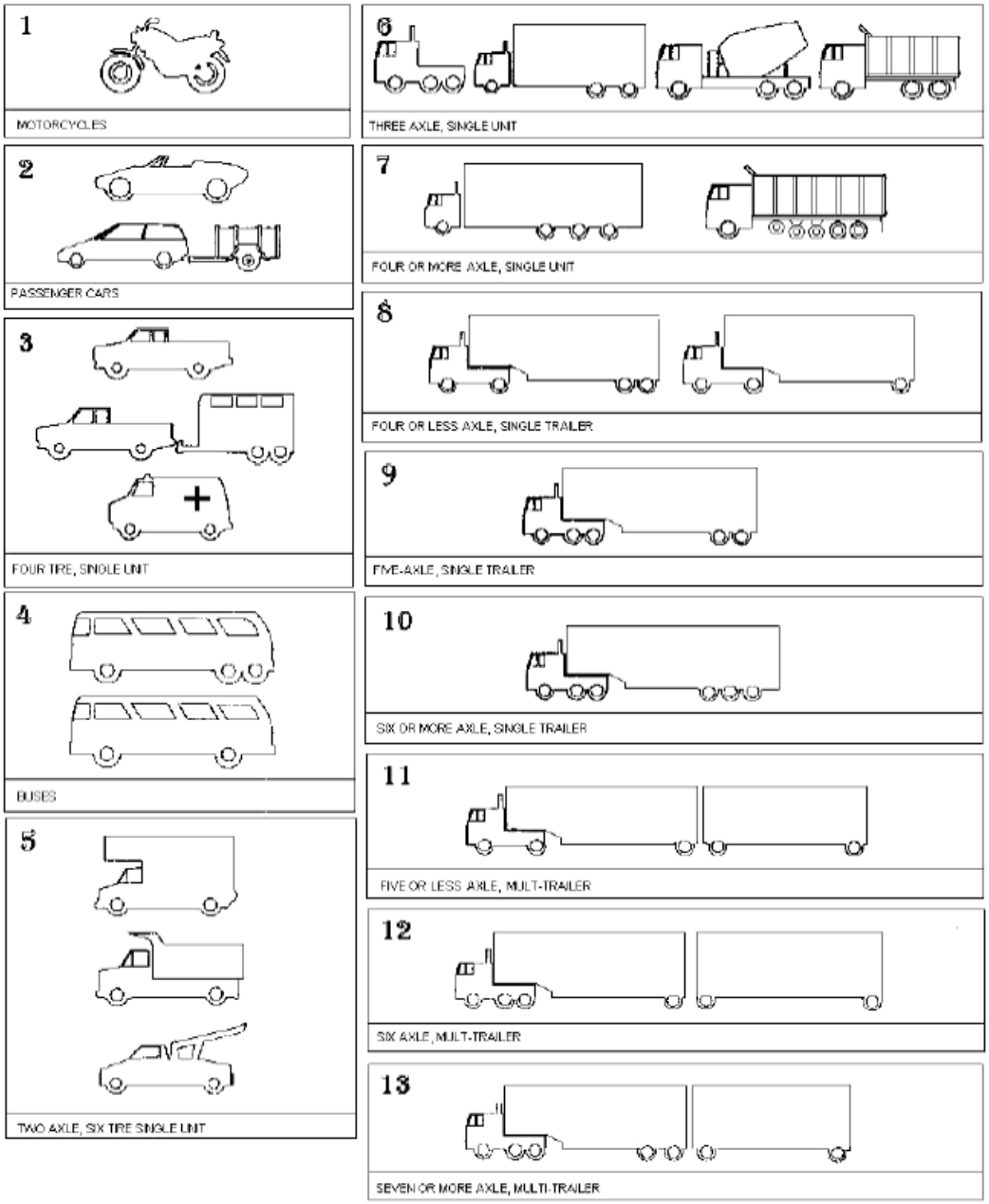
Interstate 35E in Eagan, MN (looking west)

Douglas Avenue in Urbandale, IA (looking east)

Highway 163 in Pleasant Hill, IA (looking east)

APPENDIX B: FHWA VEHICLE CLASSIFICATION SCHEME (USDOT 2001)

The FHWA Classification scheme is divided into categories based on whether the vehicle carries passengers or commodities. Commodity carriers (Non-passenger vehicles) are further subdivided by number of axles and number of units, including both power and trailer units. Note that the addition of a light trailer to a vehicle does not change the classification of the vehicle. A pictorial representation of the classification scheme is given below:



Vehicle Class Definitions

Class 1- **Motorcycles:** All two- or three-wheeled motorized vehicles. Typical vehicles in this category have saddle type seats and are steered by handle bars rather than wheels. This category includes motorcycles, motor scooters, mopeds, motor-powered bicycles, and three-wheeled motorcycles.

Class 2- **Passenger Cars:** All sedans, coupes, and station wagons manufactured primarily for the purpose of carrying passengers and including those passenger cars pulling recreational or other light trailers.

Class 3- **Other Two-Axle, Four-Tire, Single-Unit Vehicles:** All two-axle, four-tire, vehicles other than passenger cars. Included in this classification are pickups, panels, vans, and other vehicles such as campers, motor homes, ambulances, hearses, carryalls, and minibuses. Other two-axle, four-tire single unit vehicles pulling recreational or other light trailers are included in this classification.

Class 4- **Buses:** All vehicles manufactured as traditional passenger-carrying buses with two axles and six tires or three or more axles. This category includes only traditional buses (including school buses) functioning as passenger-carrying vehicles. Modified buses should be considered to be trucks and be appropriately classified.

Note: In reporting information on trucks, the following criteria should be used:

a. Truck tractor units traveling without a trailer will be considered single unit trucks.

b. A truck tractor unit pulling other such units in a “saddle mount” configuration will be considered as one single unit truck and will be defined only by axles on the pulling unit.

c. Vehicles shall be defined by the number of axles in contact with the roadway. Therefore, “floating” axles are counted only when in the down position.

d. The term “trailer” includes both semi- and full trailers.

Class 5- **Two-Axle, Six-Tire, Single-Unit Trucks:** All vehicles on a single frame, including trucks, camping and recreational vehicles, motor homes, etc., having two axles and dual rear wheels.

Class 6- **Three-axle Single-Unit Trucks:** All vehicles on a single frame, including trucks, camping and recreational vehicles, motor homes, etc., having three axles.

Class 7- **Four or More Axle Single-Unit Trucks:** All trucks on a single frame with four or more axles.

Class 8- **Four or Less Axle Single-Trailer Trucks:** All vehicles with four or less axles consisting of two units, one of which is a tractor or straight truck power unit.

Class 9- **Five-Axle Single-Trailer Trucks:** All five-axle vehicles consisting of two units, one of which is a tractor or straight truck power unit.

Class 10- **Six or More Axle Single-Trailer Trucks:** All vehicles with six or more axles consisting of two units, one of which is a tractor or straight truck power unit.

Class 11- **Five or Less Axle Multi-Trailer Trucks:** All vehicles with five or less axles consisting of three or more units, one of which is a tractor or straight truck power unit.

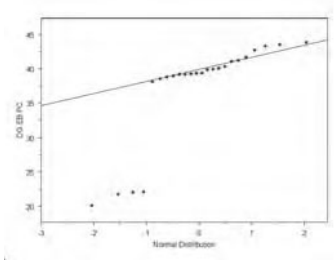
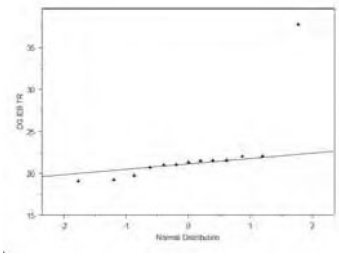
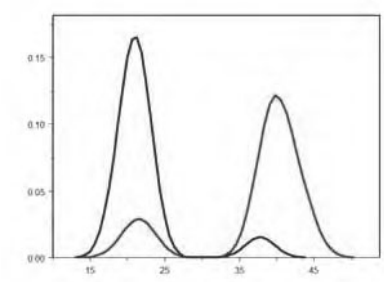
Class 12- **Six-Axle Multi-Trailer Trucks:** All six-axle vehicles consisting of three or more units, one of which is a tractor or straight truck power unit.

Class 13- **Seven or More Axle Multi-Trailer Trucks:** All vehicles with seven or more axles consisting of three or more units, one of which is a tractor or straight truck power unit.

APPENDIX C: DATA ANALYSIS PLOTS FOR AVERAGE SPEED

Des Moines

Douglas

Eastbound		
		
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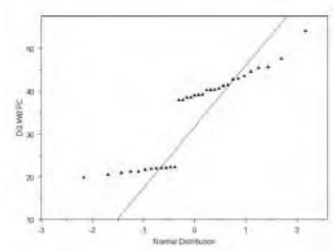
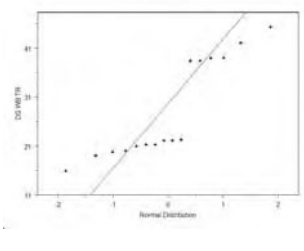
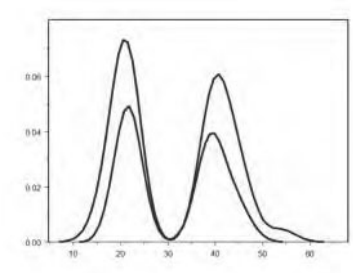
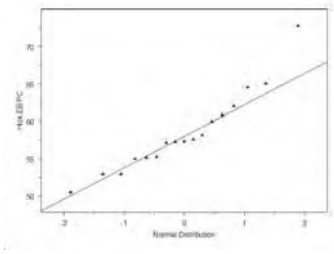
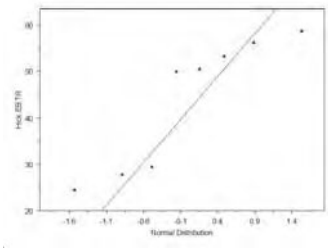
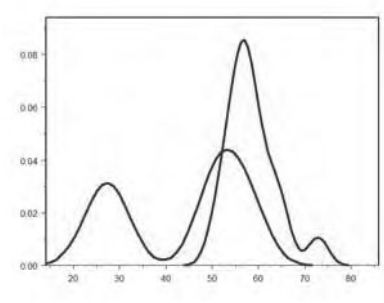
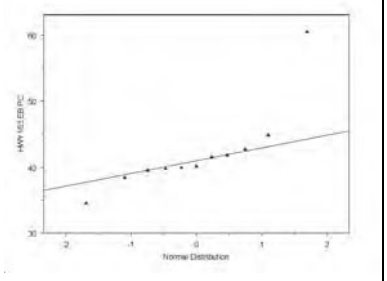
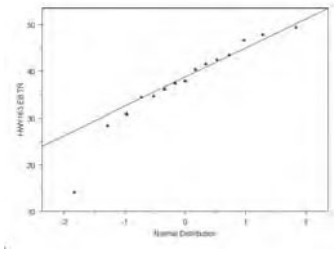
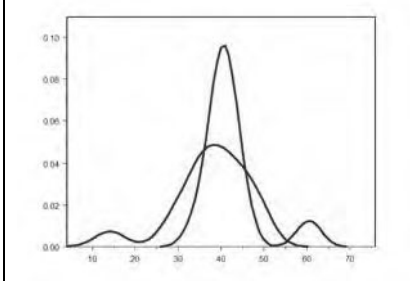
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)

Hickman

Eastbound		
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)

Des Moines

Highway 163

Eastbound		
		
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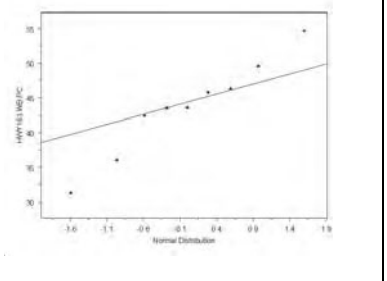
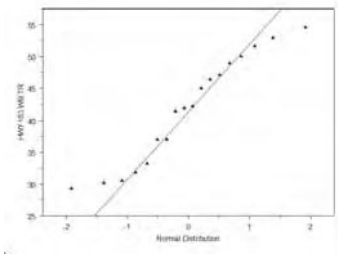
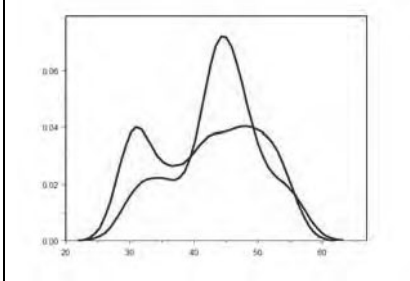
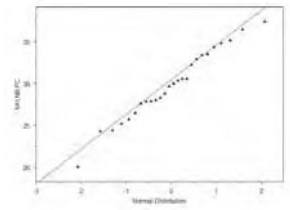
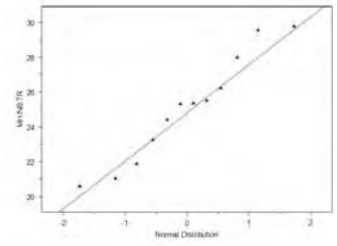
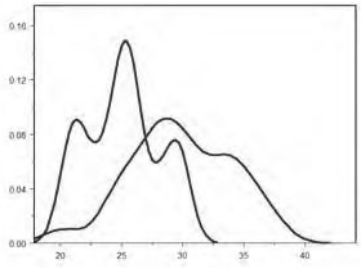
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)

Des Moines

Merle Hay

Northbound		
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)
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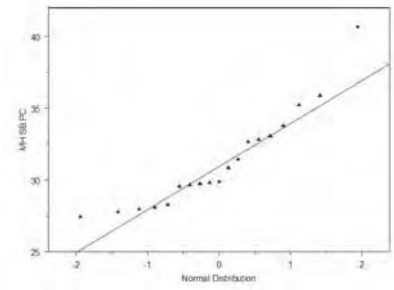
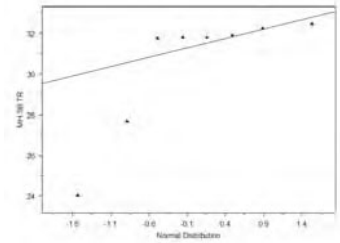
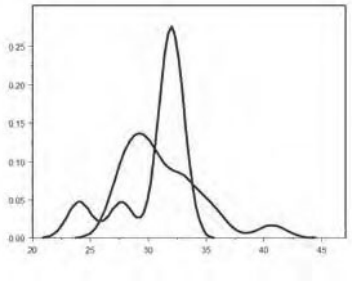
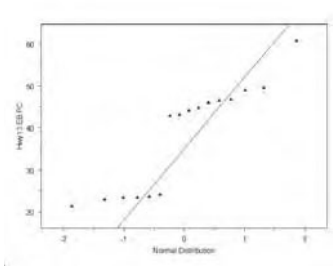
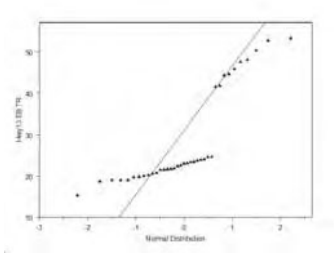
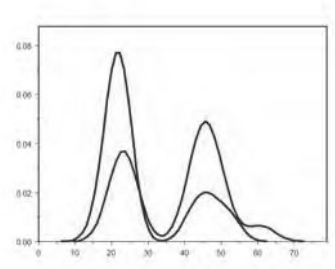
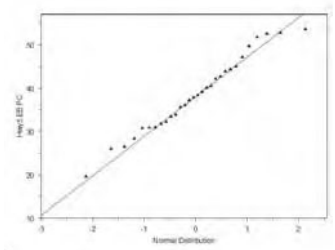
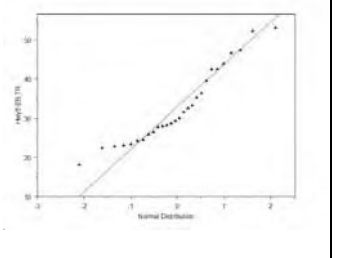
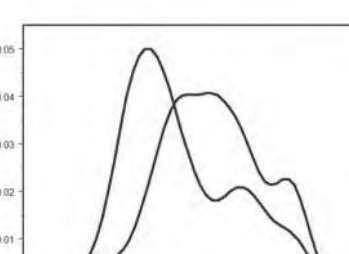
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)

Minneapolis/St. Paul

Highway 13

Eastbound		
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)

Highway 5

Eastbound		
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)
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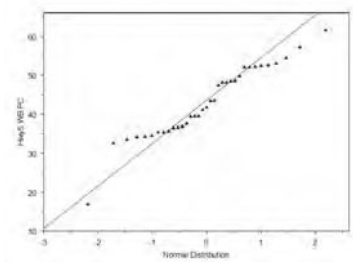
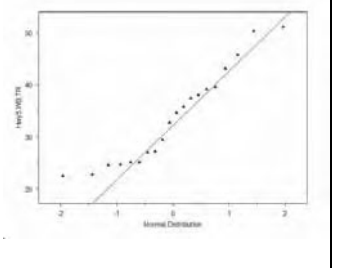
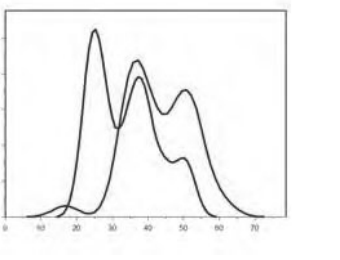
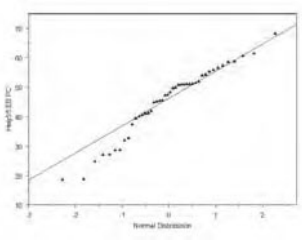
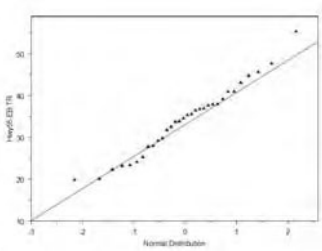
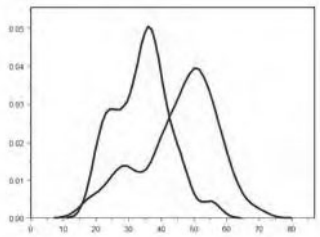
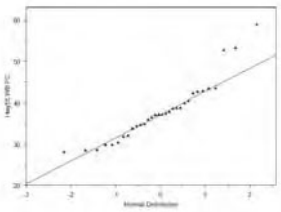
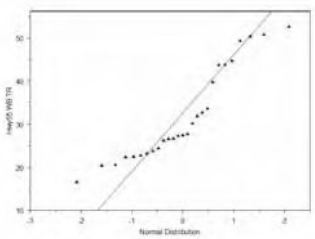
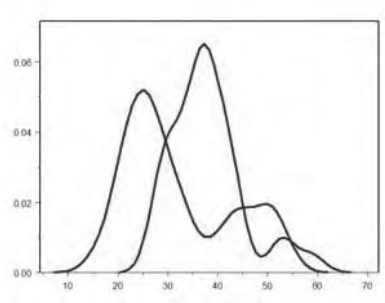
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)

Minneapolis/St. Paul

Highway 55

Eastbound		
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)
Westbound		
		
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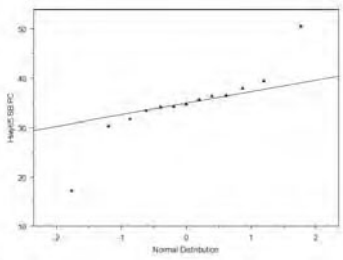
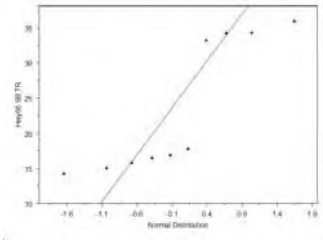
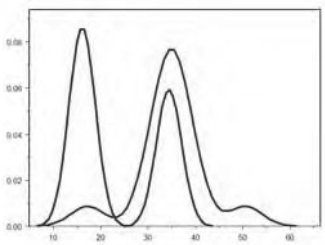
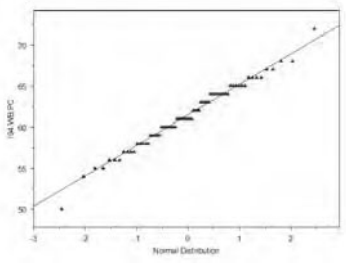
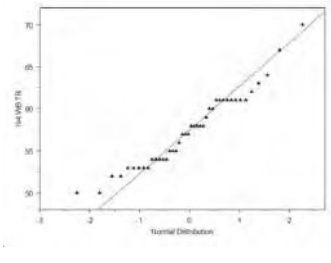
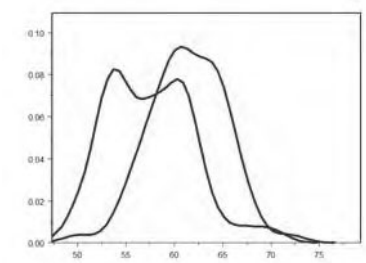
Highway 65

Southbound		
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)

Minneapolis/St. Paul

I-94

Southbound		
		
PC QQ Normal Plot	HDT QQ Normal Plot	Probability Density Curve for PC (red) vs. HDT (blue)

APPENDIX D: MOBILE6 VEHICLE CLASSIFICATIONS (USEPA 2003)

Number	Abbreviation	Description
1	LDGV:	Light-Duty Gasoline Vehicles (Passenger Cars)
2	LDGT1:	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDGT2:	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDGT3:	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
5	LDGT4:	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, greater than 5,751 lbs. ALVW)
6	HDGV2b:	Class 2b Heavy-Duty Gasoline Vehicles (8,501-10,000 lbs. GVWR)
7	HDGV3:	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
8	HDGV4:	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
9	HDGV5:	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
10	HDGV6:	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
11	HDGV7:	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
12	HDGV8a:	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
13	HDGV8b:	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
14	LDDV:	Light-Duty Diesel Vehicles (Passenger Cars)
15	LDDT12:	Light-Duty Diesel Trucks 1and 2 (0-6,000 lbs. GVWR)
16	HDDV2b:	Class 2b Heavy-Duty Diesel Vehicles (8,501-10,000 lbs. GVWR)
17	HDDV3:	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
18	HDDV4:	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
19	HDDV5:	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
20	HDDV6:	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
21	HDDV7:	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
22	HDDV8a:	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
23	HDDV8b:	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
24	MC:	Motorcycles (Gasoline)
25	HDGB:	Gasoline Buses (School, Transit, and Urban)
26	HDDBT:	Diesel Transit and Urban Buses
27	HDDBS:	Diesel School Buses
28	LDDT34:	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)