BEFORE THE STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
PUBLIC UTILITIES COMMISSION

In re Review of Bell Atlantic's TELRIC Studies.	Docket No. 2681

Implementation of the Requirements of the Federal Communications Commission's Triennial Review Order	Docket No. 3550

REBUTTAL TESTIMONY OF

MATTHEW G. MERCURIO, Ph.D.

ON BEHALF OF AT&T COMMUNICATIONS OF RHODE ISLAND, INC.

FEBRUARY 24, 2004

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I. INTRODUCTION OF WITNESS

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Matthew G. Mercurio. My business address is 1201 Eye Street NW, Suite 400, Washington, DC 20010.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed by a financial and litigation consulting firm, FTI Consulting, Inc. as a Manager in the Network Industries Strategies division.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND.

A. I hold a Bachelor of Arts degree in economics and mathematics from Boston University. I also hold a Masters of Arts and a Ph.D., both in economics, from Princeton University.

Q. PLEASE DESCRIBE YOUR WORK EXPERIENCE.

A. From 1996 through 2002, I held the positions of Senior Economist and then Vice President at Economists Incorporated, a consulting firm in Washington, DC specializing in antitrust and regulatory economics. At Economists Incorporated I specialized in empirical econometric and statistical analyses of microeconomic problems, focusing on analysis that provided expert advice to legal counsel, businesses, trade associations, and government agencies. I developed econometric models for competitive analysis, damage estimates, cost modeling, and survey analysis. In the course of this work, I gained familiarity with many of the regulatory issues surrounding AT&T's local market entry, including issues concerning the unbundling of incumbent local exchange company ("Incumbent" or "ILEC") networks. In 2003, I joined FTI consulting as a Manager in the

1		Network Industries and Strategies division where I have continued with
2		substantially the same types of work. A copy of my resume is provided as Exhibit
3		MGM-1.
4	**Q.**	**HAVE YOU PREVIOUSLY TESTIFIED OR FILED TESTIMONY**
5		**BEFORE A PUBLIC UTILITY OR PUBLIC SERVICE COMMISSION?**
6	A.	I have testified or filed testimony before the commissions in the states of
7		Maryland, New Hampshire, New York, New Jersey, California, and Maine.
8		Additionally, I have filed testimony before the Federal Communications
9		Commission ("FCC").
10	**II.**	**PURPOSE OF TESTIMONY**
11	**Q.**	**WHAT IS THE PURPOSE OF YOUR TESTIMONY?**
12	A.	My testimony describes the significant flaws I have uncovered in my analysis of
13		the surveys of employee work times which Verizon relies on in this proceeding to
14		estimate the times necessary to perform certain tasks related to the provision of
15		hot cuts in Verizon's NRC Model.
16	**Q.**	**WHAT SPECIFIC ISSUES WITH REGARD TO VERIZON'S SURVEYS**
17		**DO YOU ADDRESS?**
18	A.	Specifically, I address:
19		(1) Conceptual errors in the fundamental design of the Verizon Surveys;
20		(2) Errors in the execution of the Verizon surveys;
21		(3) Problems with the results and analysis of the Verizon surveys; and
22		(4) The unreliability of Verizon's cost estimates.
23		In each of these areas, I find fundamental problems in Verizon's approach.
24		Individually and as a whole, these conceptual and statistical problems lead me to

1		conclude that the Verizon work time estimates, and any subsequent analyses using
2		those work times, are completely and totally unreliable.
3	**Q.**	**FOR WHAT PURPOSE DID VERIZON CONDUCT ITS SURVEYS IN**
4		**THE INSTANT PROCEEDING?**
5	A.	Verizon conducted its surveys to determine the time it takes for its personnel to
6		perform various work activities for the hot cut processes for which it performed
7		cost studies in the instant proceeding. Verizon used these surveys to determine
8		work times for its National Marketing Center ("NMC"), Regional CLEC
9		Coordinating Center ("RCCC") and CO Frame work centers. Verizon used the
10		work times modeled in its May 2002 "standard scenario" filing in Docket No.
11		2681 for its Assignment Processing Center ("APC") and Recent Change Memory
12		Administration Center ("RCMAC") work activities.
13	**Q.**	**HOW DID VERIZON CONDUCT ITS SURVEYS?**
14	A.	According to Verizon's initial testimony in this proceeding, the Verizon surveys
15		were developed by "Service Cost personnel" using "process workflows and
16		discussions with work center supervisory personnel." The surveys were then
17		distributed to the relevant personnel responsible for the provisioning of hot cuts.

18	**III.**	**CONCEPTUAL ERRORS IN THE FUNDAMENTAL DESIGN OF THE**
19		**VERIZON SURVEYS**
20	**Q.**	**ARE SURVEYS SUCH AS THE ONES VERIZON CONDUCTED FOR**
21		**THE PURPOSES OF THIS PROCEEDING LIKELY TO PRODUCE**
22		**MEANINGFUL RESULTS?**
23	A.	No. The accuracy of self-reported work times is the subject of considerable
24		research. One bias commonly found in survey research is the "Hawthorne Effect,"
25		which says that respondents tend to respond differently simply because they have

1   been selected for a survey. Because of the special recognition which has been

2   given them, respondents tend to answer in the way they believe will most please

3   the researcher.

4 **Q.   IN PARTICULAR WHAT WOULD BE THE LIKELY CONSEQUENCE**
5 **OF THE "HAWTHORNE EFFECT" WITH REGARD TO THE VERIZON**
6 **SURVEYS IN THIS PROCEEDING?**
7

8 A.   It is likely that the survey respondents would *overestimate* the relevant work

9   times. Given the substantial reductions in Verizon's workforce over the past

10   twelve months, it would be expected that the survey responses would be biased

11   upwards, tending to exaggerate the need for manual work required in the

12   provision of Verizon's services. Indeed, instructions given to Verizon employees

13   and managers participating in the survey made clear that survey results would be

14   used to develop non-recurring charges for Verizon's ordering and provisioning

15   processes. Verizon's senior management explained the purpose of the survey to

16   the Directors supervising the effort as follows: "The identification of work times

17   and costs to perform these functions will help insure that Verizon recovers the

18   proper costs incurred to order, provision, wire or otherwise install service – no

19   more and no less." Based upon the survey instructions Verizon provided in

20   Virginia, similar to those provided in this case, the FCC concluded that surveyed

21   Verizon employees likely felt "encouraged to overestimate times for completing

22   activities."[1] The same is true here.

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[1]   *Virginia UNE Arbitration Order* at ¶572.

1 **Q.** **WHAT IMPACT ON VERIZON'S RESULTS DOES THE USE OF**
2 **VERIZON'S SURVEY TECHNIQUE HAVE?**

3 A.   This technique tends to produce overestimates. This can be seen by comparing the

4   results of this technique to those of alternative, more reliable approaches. An

5   alternative, more elaborate and accurate approach to measuring hours at work is

6   the comprehensive time-diary. This approach tends to produce more valid results

7   because it does not focus undue attention on the activity that is to be measured. In

8   this approach, respondents recall all of their time activities for a week or more, for

9   all of the hours in a workday. The time-diary approach does not focus on the

10   length of time for a particular activity, which subjects the task to undue emphasis

11   in the reporting process which in turn creates the potential for biased estimate of

12   the time it takes to perform the task. In this alternative approach, respondents

13   have no cues about which activities the interviewer might be pleased or interested.

14   Moreover, in the time-diary approach, the task for respondents is focused on the

15   sequence of activities and when they occur, rather than the strained focus on a

16   particular activity. While respondents still report their activities for particular time

17   period, there is no particular emphasis on which activities are of survey interest,

18   because all activities are potentially of interest. In a paper and subsequent book,

19   Robinson and Godbey strongly endorse the time-diary approach as the best means

20   for collecting accurate information about work activities.[2] The data-intensive

21   time-diary approach involves distributing thousands of time diaries to respondents

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[2]   See Robinson, J. P., & Godbey, G. *Time for life - The surprising ways Americans use their time*. University Park: Pennsylvania State University Press (1997) and John Robinson, "The Validity and Reliability of Diaries versus Alternative Time Use Measures," in F. Thomas Juster and Frank Stafford, Eds., Time, Goods, and Well-Being, Ann Arbor, MI, Institute for Social Research, The University of Michigan, 1985, pp. 35-62.

1   who enter information in 15-minute increments for one day, as opposed to merely

2   filling out surveys or asking questions about the time required for particular

3   activities after the fact. Robinson compared self-estimates of workweeks with

4   time-diary results, using the latter as an objective standard, and found respondents

5   tended to overestimate their workweeks when self-reporting their work activities.

6   A well known example of use of the time diary approach is the Nielsen

7   survey used by the broadcasting industry. Based on diary entries by Nielsen

8   survey families, viewership of television programs is rated. These ratings are used

9   by the broadcast industry to determine whether a particular television program

10 delivered the viewers promised to companies advertising during the program. If a

11 particular program does not deliver the promised viewership as determined by

12 Nielsen ratings, advertisers are given free time on upcoming programs. Billions of

13 dollars of television advertising revenue are apportioned using the Nielsen diary

14 approach.

15 **Q.   IS THE APPROACH VERIZON EMPLOYS IN THE SURVEYS**
16 **SUBMITTED IN THIS PROCEEDING SIMILAR TO THE TIME DIARY**
17 **APPROACH?**
18
19 A.   No, not at all. Verizon's survey procedures are clearly *not* the same as the time-

20   diary approach. A time diary approach would ask the Verizon technicians to

21   report *all* of their activities over substantial period of time, without reference to

22   which particular activity (among all of the many responsibilities of Verizon's

23   technicians) the surveyor has a particular interest in. This minimizes the likely

24   bias in the reporting of one particular activity or set of activities since the

25   technician is being asked to provide time estimates for *all* activities.

6

| 1 | Q. | **ARE THERE OTHER METHODS FOR REDUCING BIAS IN** |
| 2 | | **WORKPLACE SURVEYS?** |

3 A.   Yes. The time and motion approach is another way of reducing bias in workplace

4   surveys. Another group of survey researchers comments "The most valid method

5   for obtaining task performance information is an observed time-motion study." [3]

6   Therefore, a potential limitation of the timings contained Verizon's survey is that

7   they are based on self-reported data. The reliance on self-reported data—as a

8   consequence of the use of self-administered, mailed questionnaires—is a well-

9   recognized disadvantage of the use of this method for survey administration."[4]

10   This should raise an immediate "red flag" concerning Verizon's survey approach

11   to determining hot cut labor times.

12 Q.   **WHY IS SURVEY DESIGN IMPORTANT?**

13 A.   Proper survey design is essential to ensure that the results of a survey are

14   meaningful. Indeed, most problems with survey analysis can be traced back to the

15   design of the project, including the questionnaire itself. One of the principal

16   elements of good survey design is the clarity with which the surveyor conveys his

17   intent to the survey participants. This is accomplished when the particular

18   information a survey seeks to measure is expressed clearly and concisely. The

19   questionnaires should include plain and unambiguous instructions on how to

20   complete the questionnaire properly, and the questions must be clearly understood

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[3]   See Dana Marie Grzybicki, MD, PhD; Thomas L. Reilly, BS; Alison R. Hart, BS; Colleen O. Galvis, MS; Stephen S. Raab, MD "National Practice Characteristics and Utilization of Pathologists' Assistants", Archives of Pathology and Laboratory Medicine, Vol. 125, July 2001 pp. 905-912.

[4]   Ibid.

1   by the respondent. In my opinion Verizon's survey design falls well short of

2   acceptable standards in these crucial areas of survey design.

3   **Q.   WHAT FLAWS HAVE YOU IDENTIFIED IN THE FUNDAMENTAL**
4   **DESIGN OF VERIZON'S SURVEY?**

5   A.   In the first place, the Verizon survey does not clearly and concisely identify the

6   specific tasks for which the technicians were asked to provide time estimates. The

7   actual survey questionnaire in fact offers only vague guidelines about what

8   specific activities are included in each task for which time is to be measured. For

9   example, on Verizon's questionnaire for RCCC activities in the bulk hot cut

10   process (See Verizon's Response to ATT 1-59 and Proprietary Exhibit MGM-2

11   attached to this testimony) question #2 reads "ANALYZE HOT CUT ORDER."

12   By way of further description, the questionnaire continues "-Fix any order

13   problems with NMC (provide details in "Comments" section.)" and "-Verify

14   facilities; if order is IDLC, notify NMC to cancel order." From these latter

15   descriptions it is clear that the completion of this task is open-ended by its very

16   nature. For example, what is included in the activity "fixing orders with the

17   NMC"? If there are problems, at what point has the respondent "fixed" them?

18   Has he "fixed" them when he has satisfactorily notified the NMC that there is a

19   problem, or after the NMC has gotten back to him? In fact, this issue arises

20   throughout the survey where many of the tasks involve contacting other groups.

21   In addition, several respondents provided long time estimates for this task, yet few

22   of them provide any details in the Comments section. In the absence of further

23   information that might have been included in the Comment section, we have no

24   way to know whether the long time estimates reflect a different understanding of

8

1	the question or a particularly complicated order. I have included two pages from
2	this survey response in Exhibit MGM-2 of my testimony.
3	Furthermore, the Verizon survey Questionnaire offers no clear guidance as
4	to when a task begins and where a task ends. Thus, even if two technicians take
5	the same time to perform a particular task, they may enter different times based
6	on different opinions as to when the task in question actually starts and stops. For
7	example, on Verizon's questionnaire for NMC activities in the bulk hot cut
8	process (see Verizon's Response to ATT 1-59 and Exhibit MGM-2) question #4
9	reads "CREATE ORDER MANUALLY, IF NECESSARY." There is no further
10	detail offered in the questionnaire for this task as to when the task is over, i.e.,
11	when the manual order is written, delivered to the next step, or processed. There
12	is also not a clear indication as to when the task begins. Before the respondent
13	created the manual order, the order had to have been brought to his attention as a
14	non-flow through order that does not require a query back to the CLEC. At some
15	point, the task of look for, or looking at the order and analyzing it stops and its
16	"creation" for internal processing begins. Nothing on the survey instrument
17	indicates where that point is. Thus it is not clear that the technicians have reported
18	work times for identical tasks. I have included a copy of this survey in Exhibit
19	MGM-2 of my testimony.

20 **IV. ERRORS IN THE EXECUTION OF THE VERIZON SURVEYS**

21 **Q. WHAT OTHER FACTORS ARE IMPORTANT IN EVALUATING**
22 **WHETHER VERIZON'S SURVEY RESULTS ARE ACCURATE?**

23 A. The number of respondents is a critical factor.

1	Q	**WHY IS THE NUMBER OF RESPONDENTS TO A SURVEY**
2		**IMPORTANT?**
3		
4	A.	First, a larger number of sample observations will be more representative of the

5   population being surveyed, and thus more likely to yield results that faithfully

6   represent that population. All of the measures of statistical confidence used to

7   evaluate the quality of survey estimates are positively related to the number of

8   observations. In other words, the larger the number of observations in a survey,

9   the greater the confidence in the results. Second, surveys with only a small

10   number of sample points are necessarily more prone to outliers or influential

11   observations. For example, if a technician accidentally reports an incorrect time of

12   15 minutes for a particular task when the actual time is 1.5 minutes, the

13   seriousness of this error varies dramatically according to the total number of

14   sample points. With only 5 or 10 observations, this error is more likely to cause

15   serious bias in the overall results.

16	Q.	**WHAT FLAWS HAVE YOU IDENTIFIED WITH REGARD TO THE**
17		**EXECUTION OF THE VERIZON SURVEY?**
18		
19	A.	First, the Survey relies on responses from a very small number of employees, in

20   many cases. For 5 out of the 39 work tasks, there is only one single observation.

21   For 16 out of the 39 work tasks, there are less than ten observations. In

22   combination with the high variability of the work time estimates (which I will

23   discuss in greater detail below), these low sample sizes contribute to the

24   exceedingly poor statistical significance of the results. The particular question at

25   hand here is to determine the extent of economies of scale and scope with regard

1		to the performance of large numbers of CLEC hot cuts. As such, the survey
2		should attempt to capture the results from a large sample of observations.
3	**V.**	**PROBLEMS WITH THE RESULTS AND ANALYSIS OF THE VERIZON**
4		**SURVEYS**
5	**Q.**	**WHAT FLAWS HAVE YOU IDENTIFIED WITH REGARD TO THE**
6		**RESULTS AND ANALYSIS OF THE VERIZON SURVEY?**
7	A.	First, Verizon "trims" the highest 10% as well as the lowest 10% of all
8		observations for each work time activity. This procedure is completely invalid
9		from a statistical perspective, as it tends to *artificially* reduce the variability of the
10		survey estimates. After all, taken to the extreme, such a trimming procedure
11		would leave only a few observations with virtually no variability. Because the
12		variability of the work time estimates is one of the fundamental ways in which we
13		can judge the quality of the survey results, Verizon's trimming procedure tends to
14		make the survey results look significantly more reliable than they actually are.
15		In addition, Verizon offers no justification whatsoever for the choice of a
16		10% cutoff. It does not appear that Verizon selected the 10% figure based on any
17		valid statistical analysis of the survey whatsoever, e.g. visual inspection of the
18		raw data, standard deviations with and without the trimming procedure, etc.
19		Verizon simply deletes 1/5 of the data. More importantly, it is difficult to
20		conceive why such a simple survey regarding basic hot cut procedures should
21		contain outliers. If the outliers are a result of the technicians' inability to
22		understand the survey questionnaire, then the solution is to design a better one,
23		not eliminate the results. If the outliers are a result of unusual orders which took

| 1 | | longer than normal, then these are simply valid responses which contribute to the |

| 2 | | overall average work times and should not be eliminated in any case. |

3	Q.	**VERIZON JUSTIFIES THE TRIMMING PROCEDURE THROUGH A**
4		**COMPARISON TO THE REMOVAL OF THE HIGH AND LOW VALUES**
5		**FROM JUDGES SCORES IN OLYMPIC COMPETITION. IS THIS A**
6		**VALID ANALOGY?**

| 7 | A. | Absolutely not. This comparison is totally inappropriate since Olympic scores are |

| 8 | | based on personal human opinions regarding the artistic and technical merit of a |

| 9 | | performance, not the timing of physical activities. Although two judges may |

| 10 | | differ profoundly on their assessment of the artistic merit of a certain skater's |

| 11 | | performance, one can hardly expect them to disagree significantly in their |

| 12 | | estimate of the duration of the same performance. Similarly, although two |

| 13 | | technicians perform a task in a slightly different way, there is no judgment |

| 14 | | component to the work time estimates. |

15	Q.	**WERE YOU ABLE TO MAKE COMPARISONS BETWEEN THE**
16		**VARIABILITY OF THE SURVEY ESTIMATES WITH AND WITHOUT**
17		**VERIZON'S TRIMMING PROCEDURE?**

| 18 | A. | Yes. Table 1 in Exhibit MGM-3 of my testimony compares the standard |

| 19 | | deviations of each of Verizon's work time estimates before and after Verizon's |

| 20 | | trimming procedure. The table demonstrates clearly how Verizon's trimming |

| 21 | | procedure drastically reduces the apparent (but not the actual) level of variability |

| 22 | | of the survey estimates. |

| 23 | Q. | **ARE THE WORK TIME ESTIMATES FROM VERIZON'S SURVEY** |
| 24 | | **STATISTICALLY SIGNIFICANT?** |

| 25 | A. | In many cases, no. I performed a t-test, a standard test of statistical significance, |

| 26 | | on each of the work time estimates from Verizon's survey. The results of those |

| 27 | | tests are presented in Table 2 of Exhibit MGM-3 to my testimony. The accepted |

1		benchmark for statistical reliability of such estimates is that at a minimum, the
2		mean estimate must be statistically significantly different from zero at acceptable
3		confidence levels. In other words, if the width of either side of a standard 95%
4		confidence interval around the estimate in question is bigger than the estimate
5		itself, the estimates are generally held to be unreliable. Based on the reported
6		"trimmed mean" results, more than 28% of the time estimates for individual tasks
7		(11 out of 39) in Verizon's survey are not statistically significantly different from
8		zero. Using the raw data, I was able to recompute these averages without
9		Verizon's trimming procedure; based on the full sample mean results, more than
10		half of the time estimates (20 out of 39) are not statistically significant. It is my
11		opinion that these results alone are strong enough to render Verizon's survey
12		unreliable for the purpose for which it was intended.
13	**Q.**	**WHAT IS THE PRACTICAL MEANING OF YOUR FINDINGS?**
14	A.	The time estimates reported by the respondents vary so widely from one to
15		another that we have no confidence that the respondents were estimating the time
16		for the same task.
17	**Q.**	**ARE THERE ANY OTHER INDICATIONS THAT THE RESULTS OF**
18		**VERIZON'S SURVEY ARE UNRELIABLE?**
19	A.	Yes. For each work activity, I collected the observation representing the fastest
20		and the slowest work time estimates. Because comparisons would not be useful
21		when different numbers of lines are involved, I relied exclusively on survey
22		observations for which only one line was involved. Even within this group of
23		observations, the level of variability from high to low estimate is as great as a
24		factor of 43. In other words, for certain activities one technician's reported work

1		time was 43 times longer than another technician. The only reasonable
2		explanation for such an absurd result is that the technicians simply did not
3		understand the questionnaires, and thus recorded the times for totally different
4		tasks.
5	**Q.**	**WHAT DOES VERIZON PURPORT TO DEMONSTRATE BY THE**
6		**REGRESSION ANALYSES PERFORMED USING ITS SURVEY**
7		**RESULTS?**
8	A.	Verizon is attempting to extrapolate from the results of its survey to make
9		predictions regarding the relationship between the time required to process a hot
10		cut (or a batch of several hot cuts) and the number of lines associated with that hot
11		cut. Given the emphasis in this proceeding on the identification of economies of
12		scale with regard to the provisioning of large numbers of hot cuts, one would
13		presume that Verizon's regressions would attempt to identify and quantify these
14		economies of scale. However, Verizon's linear regression model constrains the
15		work times for each additional line to be constant, no matter how many lines are
16		in the order. Thus Verizon's regressions by their very design make it impossible
17		to identify any economies of scale in the provision of hot cuts.
18	**Q.**	**HOW WERE VERIZON'S REGRESSIONS CONDUCTED?**
19	A.	Verizon ran a regression for each activity associated with a bulk project and a
20		separate set of regressions for each activity associated with an individual order.
21		For each activity in a bulk project, Verizon specified a regression model with the
22		time to perform the activity on a particular project as the dependent variable and
23		number of lines on that project as the independent variable. The project, which
24		presumably contains several orders, is the unit of observation. For example, there
25		were nine different projects that were analyzed with respect to the bulk hot cut

1 activity "PREWIRE LINES." The information for each project was reflected on a

2 separate survey response. There were nine different survey responses reflecting

3 nine different projects performed by Verizon employees for the purposes of the

4 survey. The number of lines in each project varied from as little as 13 to as many

5 as 106.

6   Verizon ran a separate regression for each activity involved in an

7 individual hot cut order. In its regression for individual hot cuts, the activity

8 "PREWIRE LINES," was performed 63 times, and Verizon conducted a similar

9 regression using these 63 observations.

10   The estimate of the intercept in these regressions represents the "fixed"

11 component of the work time, i.e., the time required to perform the task for the first

12 line in an order. The slope estimate in these regressions represents the

13 "incremental" component of the work time, i.e., the additional time required to

14 perform the task for each additional line.

15 **Q.** **ARE THE REGRESSIONS VERIZON EMPLOYS TO DETERMINE THE**
16   **COSTS ASSOCIATED WITH HOT CUTS ON INITIAL LINES VERSUS**
17   **HOT CUTS ON ADDITIONAL LINES (WITHIN A SINGLE ORDER)**
18   **RELIABLE?**

19 A. No. Verizon's approach to this task is flawed for several reasons. First, just as

20 Verizon's estimates of the mean work times suffer from low sample sizes and

21 poor statistical significance, so do the regressions, which rely on the exact same

22 data. Of the 21 regressions Verizon performs, in 11 of them the slope parameter is

23 not statistically significant. In 9 of the 21 cases the intercept is not statistically

24 significant. These results alone are enough to call into question the entire

25 regression approach Verizon employs here.

1   More importantly, however, even for the few regressions which do

2   produce statistically significant results, Verizon's approach is fundamentally

3   flawed because of their reliance on a *linear* specification for these regressions.

4   What this means is that Verizon's approach presumes that there is a fixed

5   component of each hot cut order, i.e., a setup time incurred regardless of the

6   number of lines in the order, and a constant increment of time component for each

7   additional line in the order (or project), *which does not decrease as the number of*

8   *lines increases*. The entire impetus for this proceeding is to quantify the

9   economies of scope and scale which may be available to CLECs as ILECs process

10   larger and larger volumes of hot cuts. Thus, the fundamental assumption is that

11   the time per line should *decrease* as the number of lines in a hot cut order or

12   project increases. But Verizon's linear regression model constrains the work times

13   for each additional line to be constant, no matter how many lines are involved. In

14   Verizon's model specification the total work times increase *linearly* with the

15   number of lines. To explain why this approach is incapable of generating

16   meaningful results we need only look at the implied work time estimates based on

17   Verizon's regressions (see Verizon's submission "12-08-03 VZ Initial Panel

18   Testimony-Ex. III-B.xls"). For the CO bulk hot cut projects, the time per line (the

19   slope estimate of the regression) for the task "ANALYZE HOT CUT ORDER" is

20   0.22 minutes, i.e., after the fixed setup time this task takes 0.22 additional minutes

21   per line. The same estimate for individual orders for the task "ANALYZE HOT

22   CUT ORDER" is 0.03 minutes. In other words, Verizon's batch order process

23   takes *eight times longer per line* than its individual process, the opposite of the

16

1   result that common sense would predict. In two cases, the estimate for a single

2   line bulk project, i.e., the fixed time component of the project is *negative*. Indeed,

3   because of these significant negative intercept estimates, in both of these cases it

4   is not until the project includes 10 lines that the total work time estimate positive.

5   For one of the RCCC bulk activities, the per-line slope estimate itself is negative,

6   meaning that the *more* lines in the project, the *faster* the project is completed!

7   These nonsensical results are due to a mismatch between the linear

8   regression form and the fundamental realities of batch order processing. The

9   reason for Verizon's poor regression results is that its own survey data indicate

10   economies of scale which their regression ignores. I attempted several other more

11   appropriate functional forms for these equations which would allow for scale

12   economies, but because of the poor quality of the data (resulting from the poor

13   survey design) and the limited number of observations, these efforts did not

14   produce statistically significant results either. My conclusion is that the Verizon

15   data and the Verizon regressions are totally unreliable for the purpose for which

16   they are intended.

17   **VI.   THE UNRELIABILITY OF VERIZON'S COST ESTIMATES**

18   **Q.   VERIZON STATES THAT THE COST ESTIMATES COMPUTED IN**
19   **THIS PROCEEDING UTILIZING THE UNDERLYING SURVEY**
20   **ESTIMATES ARE ESTIMATED WITH "GENERALLY QUITE SMALL"**
21   **PRECISION LEVELS. DOES THIS CHANGE YOUR CONCLUSIONS**
22   **REGARDING THE APPLICABILITY OF THE SURVEY RESULTS IN**
23   **THIS MATTER?**
24
25   A.   Absolutely not.

1   In the first place, Verizon incorrectly estimates the precision levels of its final cost

2   estimates, and their own testimony proves this. Verizon's cost estimates are

3   computed as follows:

4   **Average Work Activity Cost = Average Work Time × Typical Occurrence**

5   **Factor (TOF) × Forward-Looking Adjustment Factor (FLAF) × Wage ×**

6   **Common Overhead (COH) × Gross Revenue Factor (GRF)**

7   In computing the precision levels of these Work Activity Cost estimates, Verizon

8   presumes that the only variable element (in statistical language, the only "random

9   variable") in the computation of the cost is the Average work time. However,

10   several other elements in this computation are variable as well, some in fact much

11   more so than Verizon's survey work time estimates themselves. For example,

12   with regard to Typical Occurrence Factors, Verizon's testimony states explicitly

13   that these are also estimates: "Current average work times are adjusted within the

14   NRC Model by multiplying the average time it takes to perform an activity (when

15   it in fact occurs) by the frequency with which the activity is expected to be

16   performed in the current environment — i.e., *the estimated percentage of cases in*

17   *which the activity will be required*. The result is an average time required for the

18   activity across all orders — those in which it is required, and those in which it is

19   not. To determine this Typical Occurrence Factor, *Verizon polled the relevant*

20   *managers associated with the ordering, wiring, and provisioning of hot cuts*.

21   (emphasis added). In other words, the Typical occurrence factors are also

22   estimates, albeit less formal ones than those estimates presented in the work times

23   surveys. But a poll is simply another word for a survey sample. Gallup polls

1	routinely provide measures of statistical confidence for all of their surveys –
2	Where are the standard errors of Verizon's Typical Occurrence Factors?
3	Another example is Verizon's Forward Looking Adjustment Factors. Verizon's
4	Panel Testimony states "The subject matter experts within the functional
5	organization most familiar with the hot cut processes were asked to identify the
6	impacts of any known system or process improvements expected over the three-
7	year planning period." In other words, the FLAFs are estimates. The fact that
8	Verizon does not report variances or standard deviations for the FLAFs is simply
9	because the procedure used to estimate the FLAFs was even more informal than
10	Verizon's survey results (many of which also relied on only a few observations,
11	as I demonstrated above). Indeed, there is no reason to expect the variability
12	around these estimated FLAFs to be any less than the variance around the survey
13	work estimates, and much reason to suspect that the variability may be far greater.
14	Although Verizon does not present enough detail in its testimony regarding the
15	data or methods used to calculate the Common Overhead Factors or the Gross
16	Revenue Loading Factors, I have no doubt that there are significant elements of
17	variability in these factors which Verizon has simply ignored in its computations
18	of Average Work Activity Costs.
19	As such, Verizon's estimates of the variability of these Work Activity Cost
20	estimates contained in Verizon Exhibit III-D are *egregiously* understated, and
21	should not be relied on for any purpose.
22	Second, even assuming in arguendo that these additional factors have no
23	variability, Verizon's argument boils down to the assertion that because the

1   underlying survey estimates are multiplied by several other numbers in order to

2   compute the final cost estimates, and because these multiplications result in a

3   final estimate with lower variability, the numerous flaws in the survey described

4   in this testimony should simply be ignored. Note that using Verizon's "logic", the

5   following events would have the effect of lowering the variability of the implied

6   final cost estimates:

7   (1) An increase in the wages of Verizon technicians;

8   (2) Presenting the results in terms of the rate per 100 hot cuts instead of per single

9   hot cut;

10   (3) An increase in Verizon's non-hot cut related overhead costs.

11   Obviously, these factors have nothing to do with the reliability of Verizon's

12   estimates. The decrease in variability of Verizon's final estimates is simply the

13   result of increasing the scale of the survey estimates. This statistical fact does not

14   repair the numerous conceptual flaws in Verizon's survey which I have

15   enumerated in this testimony. In short, Verizon has proffered these arguments

16   regarding the "reliability" of the final cost estimates solely to divert attention from

17   their exceedingly poor survey results. Notwithstanding, I reiterate my conclusion

18   that the Verizon survey estimates and any other cost estimates based on those

19   estimates are totally unreliable for use in this proceeding.

20 **VII.   CONCLUSION**

21 **Q.   PLEASE SUMMARIZE YOUR TESTIMONY.**

22 A.   The survey Verizon relies on to estimate work times in the instant proceeding

23   suffers from several severe flaws.

1   First, the design of the survey questionnaire itself violates well-known and

2   accepted principles of survey design. The questionnaires are too vague and

3   imprecise to draw meaningful answers as to what the survey is seeking to

4   measure.

5   Second, the execution of the surveys is also flawed. The surveys simply do

6   not have enough responses for many of the work activities to generate a

7   meaningful degree of statistical confidence. Tables 1 and 2 in Exhibit MGM-3

8   clearly show that more than half of Verizon's survey estimates using the standard

9   deviation based on the full, untrimmed sample, as appropriate, are not statistically

10   significant.

11   Finally, Verizon's analysis of the surveys is biased in several ways. The

12   trimming procedure Verizon employs only serves to mask the poor quality of the

13   survey results. The regressions Verizon employs to determine the costs associated

14   with hot cuts on initial lines versus hot cuts on additional lines (within a single

15   order) presume as a simple matter of mathematics no economies of scale with

16   regard to the processing of hot cuts for multiple line orders. The entire impetus for

17   this proceeding is to quantify such economies of scope and scale, i.e., the work

18   time per line should *decrease* as the total number of lines in a hot cut order

19   increases. Verizon's linear regression model assumes that the work times remain

20   constant with the number of lines. Indeed, Verizon's own survey data indicate

21   economies of scale which their regressions ignore. These regressions also suffer

22   from all of the same flaws I have identified with regard to the average work time

23   estimates.

1   Any one of these flaws alone would be enough to raise questions about the

2   reliability of the survey results. Taken together, in my opinion they render the

3   results of Verizon's survey completely unreliable for use in this proceeding for

4   any purpose.

5 **Q.   DOES THIS CONCLUDE YOUR TESTIMONY?**

6 A.   Yes it does.

Career Highlights

Matt Mercurio is a manager in FTI's Washington DC office. Dr. Mercurio specializes in applying microeconomic analysis and rigorous econometrics to policymaking, regulatory issues, and public and private litigation. His particular areas of expertise include computation of economic damages in price fixing and competitive practices litigation, the use of empirical methods in market definition, estimation of industry level econometric models of demand and supply, and time-series forecasting techniques. Dr. Mercurio has experience in matters before numerous government agencies, including the DOJ, FTC, FCC, ITC, DOC, and other regulatory proceedings.

Prior to joining FTI, Dr. Mercurio was a Vice President at Economists Incorporated in Washington, DC where he specialized in empirical econometric and statistical analysis that provided expert advice to legal counsel, businesses, trade associations, and government agencies. He has developed econometric models for competitive analysis, damage estimates, cost modeling, and survey analysis.

Selected Expertise

- Worked on Niacin and Choline Chloride as part of *In Re: Vitamins* litigation and Methionine in related litigation. Worked on numerous aspects of these three cases, including assistance in the drafting of affirmative and rebuttal reports incorporating econometric analysis of damages due to alleged price fixing conspiracy.

- Assisted with competitive analysis for defendants of foreclosure claim in plastic golf cleats industry in Green Keepers, Inc. v. Softspikes, Inc. and MacNeill Engineering Worldwide, Inc.

- Submitted declarations and other economic analysis relating to alleged monopolization and attempted monopolization of the west coast swimming pool chemicals distribution market in *POOL WATER PRODUCTS and AQUA TRI v. OLIN CORPORATION and SUPERIOR POOL PRODUCTS*, CASE NO. SA CV 92-563 (Declaration Filed July 20, 1998).

- Assisted in economic analysis and report on HCFA "Inherent Reasonableness" survey methodology and data, used as the basis for proposed adjustments to the Medicare reimbursements for several durable medical products, including blood glucose strips.

- Prepared an economic analysis of issues related to reimbursement rates, access, and quality issues for the Roche HIV-1 Viral Load test, including implications of HCFA "gap-fill" methodologies and possible national fee cap.

- Assisted in analysis of econometric work on behalf of defendants in the alleged monopolization of psychiatric hospitals in the Dallas area by NME in *Timberlawn v. Tenet Healthcare, et al.*

- Performed detailed analyses of 1992 and 1996 Surveys of Consumer Finances data to investigate restraint of trade claims.

- Prepared testimony on behalf of respondent Hyundai in Sunset Review (No. 713-TA-556): Dynamic Random Access Memory Semiconductors from Korea, United States International Trade Commission, September 2000.

- Testified before the International Trade Commission on behalf of the Coalition for Fair Lumber Imports in Certain Softwood Lumber Products From Canada (No. 701-TA-414), April, 2002.

- Testified before the U.S. International Trade Commission on behalf of respondent steel importers from Korea, Brazil, Japan, UK, Italy, and other European countries in Section 201 ("safeguard") action (No. 201-TA-073), November 8, 2001.

- Assisted in the clearance of merger of two large telecommunications equipment manufacturers (DSC and Alcatel) - overlap in digital cross connects (DCSs).

- Worked on the acquisition of Union Carbide by Dow Chemical: Hart-Scott-Rodino review by Federal Trade Commission.

- Worked on the acquisition of Infinity Broadcasting Corporation by Westinghouse Electric Corporation. Hart-Scott-Rodino review by the Department of Justice.

- Worked on Solution 6/CMS proposed acquisition of Elite Information Group (time and billing software systems): Hart-Scott-Rodino review by the Federal Trade Commission.

- Submitted a paper to the FCC on behalf of the Newspaper Association of America (NAA) on structural change in media markets since 1975 and the potential benefits of joint ownership to assist the Commission in reviewing its Newspaper-Broadcast Cross-Ownership rule.

- Performed a statistical analysis of potential effects of FCC's proposed digital "must-carry" rules, In the Matter of Carriage of Transmissions of Digital Television Broadcast Stations, Amendments to Part 76 of the Commission's Rules, CS Docket No. 98-120.

- Submitted a report to the FCC entitled "An Economic Analysis of the SBC-Ameritech Merger" (joint with Gregory Rosston) accompanying joint comments of Attorneys General of Michigan, Indiana, Missouri, and Wisconsin. Report cited several areas of potential competitive concerns with the merger, also proposed conditions for FCC approval of the merger.

- Developed an econometric model of digital switching costs for use in cost proxy models, joint with Steven E. Siwek. Used to support LD companies in 251 proceedings.

- Assisted in analysis of "FCC Staff Model of the Telecommunications Industry" for possible use in local competition provisions of the Telecommunications Act of 1996.

- Assisted in the design of statistically valid sampling procedure for study of work times of various local telephony activities. Provided affidavit and testimonial support of these procedures before the Maryland PUC.

- Carried out an 18-month project to provide economic and econometric analysis of Municipal Securities Rulemaking Board (MSRB) non-public database of individual transactions for the purpose of defining and investigating certain structural relationships in the municipal securities market.

Speeches & Publications

- *Report of Gregory L. Rosston and Matthew G. Mercurio, An Economic Analysis of the SBC-Ameritech Merger*, Submitted ex Parte along with comments of the Attorneys General of the States of Indiana, Michigan, Missouri and Wisconsin, FCC CC Docket No. 98-141, April 26, 1999.

- *A Probability Model of the Effects of the Commission's Proposed Digital Must-Carry Rules on the C-SPAN Networks*, In the Matter of Carriage of Transmissions of Digital Television Broadcast Stations, Amendments to Part 76 of the Commission's Rules, CS Docket No. 98-120, October 1998.

- The Development of Digital Switching Costs Suitable for Use in Cost Proxy Models, with Steven E. Siwek, June 1998.

Education

Dr. Mercurio received his Ph.D. in Economics from Princeton University in 1996. He also holds a Masters degree in economics from Princeton and a BA in Economics in Mathematics from Boston University. He is a member of the ABA antitrust section. Dr. Mercurio has also taught a course in statistics at The Johns Hopkins University Zanvyl Krieger School of Public Policy at their DC campus

EXHIBIT MGM-3

				Trimmed std dev	Full std dev
**TABLE I – COMPARISON OF "TRIMMED" AND FULL RESULTS – STANDARD DEVIATION**					
Org	**Type**	**UNE**	**Activity**	**Trimmed std dev**	**Full std dev**
CO	BULK	2 WIRE	ANALYZE HOT CUT ORDER	1.32	14.6816
CO	BULK	2 WIRE	COMPLETE ORDER	2.51	23.6011
CO	BULK	2 WIRE	IF THROWBACK IS REQUIRED, RECORD TIMES FOR THIS ACTIVITY	0.37	9.387
CO	BULK	2 WIRE	PERFORM HOT CUT ON DUE DATE	1.75	20.46
CO	BULK	2 WIRE	PREWIRE LINES	4.05	44.78
CO	BULK	2 WIRE	PULL DISCONNECTED WIRE ON DD+1	2.63	29.23
CO	INDIVIDUAL	2 WIRE	ANALYZE HOT CUT ORDER	2.13	4.79
CO	INDIVIDUAL	2 WIRE	COMPLETE ORDER	1.11	3.23
CO	INDIVIDUAL	2 WIRE	PERFORM HOT CUT ON DUE DATE	2.12	5.77
CO	INDIVIDUAL	2 WIRE	PREWIRE LINE	2.73	8.61
CO	INDIVIDUAL	2 WIRE	PULL DISCONNECTED WIRE ON DD+1	1.92	3.46
NMC	BULK	2 WIRE	CANCEL OR MODIFY DUE DATE ON ORDER, IF NECESSARY	2.79	5.23
NMC	BULK	2 WIRE	CREATE ORDER MANUALLY IF NECESSARY	16.53	45.78
NMC	BULK	2 WIRE	NEGOTIATE DUE DATE AND FALL OUT DATE WITH FRAME	2.08	5.10
NMC	BULK	2 WIRE	QUERY CLEC ABOUT NON FLOW THROUGH ORDER	7.18	7.18
NMC	BULK	2 WIRE	REFER ASSIGNMENT PROBLEM TO CLEC, APC, OR NMC	6.07	12.35
NMC	BULK	2 WIRE	VERIFY ORDER FROM CLEC SPREADSHEET	4.96	10.63
NMC	INDIVIDUAL	2 WIRE	CANCEL OR MODIFY DUE DATE ON ORDER, IF NECESSARY	2.63	5.009
NMC	INDIVIDUAL	2 WIRE	CREATE ORDER MANUALLY IF NECESSARY	13.79	26.544
NMC	INDIVIDUAL	2 WIRE	QUERY CLEC ABOUT NON FLOW THROUGH ORDER	5.48	16.873
NMC	INDIVIDUAL	2 WIRE	REFER ASSIGNMENT PROBLEM TO CLEC, APC, OR NMC	7.14	9.91
RCCC	BULK	2 WIRE	ANALYZE HOT CUT ORDER	0.19	3.6577
RCCC	BULK	2 WIRE	COMPLETE ORDER	0.14	2.0571
RCCC	BULK	2 WIRE	COORDINATE HOT CUT ON DUE DATE	0.50	6.0543
RCCC	BULK	2 WIRE	CREATE AND DISTRIBUTE PROJECT SPREADSHEET	0.07	2.1228
RCCC	BULK	2 WIRE	DOCUMENT ORDER ACTIVITY	0.31	4.4842
RCCC	BULK	2 WIRE	NEGOTIATE DUE DATE AND FALL OUT DATE WITH FRAME	0.44	4.3466
RCCC	BULK	2 WIRE	PERFORM REQUIRED PRE-TESTING	0.31	3.0074
RCCC	BULK	2 WIRE	RESOLVE ORDER PROBLEMS AND RESCHEDULE	0.15	3.4107
RCCC	INDIVIDUAL	2 WIRE	ANALYZE HOT CUT ORDER	1.62	4.8359
RCCC	INDIVIDUAL	2 WIRE	COMPLETE ORDER	1.34	6.6985
RCCC	INDIVIDUAL	2 WIRE	COORDINATE HOT CUT ON DUE DATE	5.40	21.4946
RCCC	INDIVIDUAL	2 WIRE	IF ORDER INCLUDES IDLC, VERIFY DISPATCH ON DD+1	1.79	4.8181
RCCC	INDIVIDUAL	2 WIRE	PERFORM REQUIRED PRE-TESTING	1.68	6.9924

		TABLE 2 – RESULTS OF TESTS OF STATISTICAL SIGNIFICANCE						
org	type	activity	trimmed mean	trim std dev	T-test for Significance of Trimmed Mean	full mean	full std dev	T-test for Significance of Full Mean
CO	BULK	ANALYZE HOT CUT ORDER	2.00	1.32	Yes	2.18	14.68	No
CO	BULK	COMPLETE ORDER	2.60	2.51	No	2.73	23.60	No
CO	BULK	IF THROWBACK IS REQUIRED, RECORD TIMES FOR THIS ACTIVITY: PERFORM THROWBACK	0.23	0.37	No	0.50	9.39	No
CO	BULK	PERFORM HOT CUT ON DUE DATE	3.33	1.75	Yes	3.65	20.46	No
CO	BULK	PREWIRE LINES	12.00	4.05	Yes	11.85	44.78	No
CO	BULK	PULL DISCONNECTED WIRE ON DD+1	6.84	2.63	Yes	6.73	29.23	No
CO	INDIVIDUAL	ANALYZE HOT CUT ORDER	3.21	2.13	Yes	3.51	4.79	Yes
CO	INDIVIDUAL	COMPLETE ORDER	1.21	1.11	Yes	1.65	3.23	Yes
CO	INDIVIDUAL	PERFORM HOT CUT ON DUE DATE	4.88	2.12	Yes	5.26	5.77	Yes
CO	INDIVIDUAL	PREWIRE LINE	9.49	2.73	Yes	10.12	8.61	Yes
CO	INDIVIDUAL	PULL DISCONNECTED WIRE ON DD+1	3.43	1.92	Yes	3.60	3.46	Yes
NMC	BULK	CANCEL OR MODIFY DUE DATE ON ORDER, IF NECESSARY	9.86	2.79	Yes	8.86	5.23	Yes
NMC	BULK	CREATE ORDER MANUALLY IF NECESSARY	23.57	16.53	Yes	34.26	45.78	Yes
NMC	BULK	NEGOTIATE DUE DATE AND FALL OUT DATE WITH FRAME, INFORM CLEC, GET CLEC CONFIRMATION	11.76	2.08	Yes	12.23	5.10	Yes
NMC	BULK	QUERY CLEC ABOUT NON FLOW THROUGH ORDER	5.25	7.18	No	5.25	7.18	No
NMC	BULK	REFER ASSIGNMENT PROBLEM TO CLEC, APC, OR NMC	9.77	6.07	Yes	11.38	12.35	Yes
NMC	BULK	VERIFY ORDER FROM CLEC SPREADSHEET	25.44	4.96	Yes	24.45	10.63	Yes
NMC	INDIVIDUAL	CANCEL OR MODIFY DUE DATE ON ORDER, IF NECESSARY	7.41	2.63	Yes	6.80	5.01	Yes
NMC	INDIVIDUAL	CREATE ORDER MANUALLY IF NECESSARY	29.61	13.79	Yes	33.37	26.54	Yes
NMC	INDIVIDUAL	PERFORM THROWBACK	40.00	.	No	40.00	.	No
NMC	INDIVIDUAL	QUERY CLEC ABOUT NON FLOW THROUGH ORDER	8.67	5.48	Yes	11.86	16.87	Yes
NMC	INDIVIDUAL	REFER ASSIGNMENT PROBLEM TO CLEC, APC, OR NMC	8.94	7.14	Yes	9.90	9.91	Yes
RCCC	BULK	ANALYZE HOT CUT ORDER	1.29	0.19	Yes	1.25	3.66	No
RCCC	BULK	ANALYZE THROWBACK	0.06	.	No	0.06	.	No
RCCC	BULK	COMPLETE ORDER	0.71	0.14	Yes	0.71	2.06	No
RCCC	BULK	COMPLETE THROWBACK	0.06	.	No	0.06	.	No
RCCC	BULK	COORDINATE HOT CUT ON DUE DATE	1.63	0.50	Yes	1.72	6.05	No
RCCC	BULK	COORDINATE THROWBACK	0.18	.	No	0.18	.	No

			trimmed mean	trim std dev	T-test for Significance of Trimmed Mean	full mean	full std dev	T-test for Significance of Full Mean
org	type	activity	trimmed mean	trim std dev	T-test for Significance of Trimmed Mean	full mean	full std dev	T-test for Significance of Full Mean
RCCC	BULK	CREATE AND DISTRIBUTE PROJECT SPREADSHEET	0.32	0.07	Yes	0.37	2.12	No
RCCC	BULK	DOCUMENT ORDER ACTIVITY	0.24	0.31	No	0.38	4.48	No
RCCC	BULK	NEGOTIATE DUE DATE AND FALL OUT DATE WITH FRAME, INFORM CLEC, GET CLEC CONFIRMATION	0.53	0.44	No	0.63	4.35	No
RCCC	BULK	PERFORM REQUIRED PRE-TESTING	0.45	0.31	Yes	0.48	3.01	No
RCCC	BULK	RESOLVE ORDER PROBLEMS AND RESCHEDULE	0.21	0.15	No	0.28	3.41	No
RCCC	INDIVIDUAL	ANALYZE HOT CUT ORDER	3.64	1.62	Yes	3.99	4.84	Yes
RCCC	INDIVIDUAL	ANALYZE THROWBACK	8.00	.	No	8.00	.	No
RCCC	INDIVIDUAL	COMPLETE ORDER	2.78	1.34	Yes	3.53	6.70	Yes
RCCC	INDIVIDUAL	COORDINATE HOT CUT ON DUE DATE	4.95	5.40	Yes	8.44	21.49	Yes
RCCC	INDIVIDUAL	IF ORDER INCLUDES IDLC, VERIFY DISPATCH ON DD+1	5.80	1.79	Yes	6.86	4.82	Yes
RCCC	INDIVIDUAL	PERFORM REQUIRED PRE-TESTING	2.52	1.68	Yes	3.30	6.99	Yes
					28.21%			**51.28%**

TABLE 2 – RESULTS OF TESTS OF STATISTICAL SIGNIFICANCE (CONTINUED)