Legal Department

J. PHILLIP CARVER
General Attorney

BellSouth Telecommunications, Inc.
150 South Monroe Street
Room 400
Tallahassee, Florida 32301
(404) 335-0710

December 9, 2002

Mrs. Blanca S. Bayó
Director, Division of the Commission Clerk and
Administrative Services
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

Re: Docket No. 000121A-TP (OSS)

Dear Ms. Bayó:

Enclosed is an original and 15 copies of a memorandum prepared by National Economic Research Associates, which we ask that you file in the referenced docket. This memorandum was prepared as part of a presentation that was made during a conference call with Commission Staff in November, 2002. The Commission Staff has requested that BellSouth file the memorandum in the above-noted docket.

A copy of this letter is enclosed. Please mark it to indicate that the original was filed and return the copy to me. Copies have been served to the parties shown on the attached Certificate of Service.

Sincerely,

J. Phillip Carver

J. Phillip Carver (KA)

Enclosures

cc: All parties of record
Marshall M. Criser, III
Nancy B. White
R. Douglas Lackey

CERTIFICATE OF SERVICE
Docket No. 000121A-TP

I HEREBY CERTIFY that a true and correct copy of the foregoing was served via U. S. Mail this 9th day of December, 2002 to the following:

Jason K. Fudge
Tim Vaccaro
Staff Counsel
Florida Public Service Commission
Division of Legal Services
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850
Tel. No. (850) 413-6181
Fax. No. (850) 413-6250
jfudge@psc.state.fl.us

AT&T
Virginia C. Tate
Senior Attorney
1200 Peachtree Street
Suite 8100
Atlanta, GA 30309
Tel. No. (404) 810-4922
vtate@att.com

Verizon, Inc.
Kimberly Caswell
P.O. Box 110, FLTC0007
Tampa, FL 33601-0110
Tel. No. (813) 483-2617
Fax. No. (813) 223-4888
kimberly.caswell@verizon.com

Nanette Edwards (+)
Regulatory Attorney
ITC^DeltaCom
4092 S. Memorial Parkway
Huntsville, Alabama 35802
Tel. No. (256) 382-3856
Fax. No. (256) 382-3936
nedwards@itcdeltacom.com

Scott A. Sapperstein
Intermedia Communications, Inc.
One Intermedia Way
M.C. FLT-HQ3
Tampa, Florida 33647-1752
Tel. No. (813) 829-4093
Fax. No. (813) 829-4923
sasapperstein@intermedia.com

Charles J. Pellegrini
Katz, Kutter, Haigler, Alderman, Bryant & Yon, P.A.
106 East College Avenue
Suite 1200
Tallahassee, FL 32301
Counsel for Intermedia
Tel. No. (850) 577-6755
Fax No. (850) 222-0103
jpellegrini@katzlaw.com
Counsel for Intermedia
charlesp@katzlaw.com

Peter M. Dunbar, Esquire
Karen M. Camechis, Esquire
Pennington, Moore, Wilkinson, Bell & Dunbar, P.A.
Post Office Box 10095 (32302)
215 South Monroe Street, 2nd Floor
Tallahassee, FL 32301
Tel. No. (850) 222-3533
Fax. No. (850) 222-2126
pete@penningtonlawfirm.com

Brian Chaiken
Supra Telecommunications and
Information Systems, Inc.
2620 S. W. 27th Avenue
Miami, FL 33133
Tel. No. (305) 476-4248
Fax. No. (305) 443-1078
bchaiken@stis.com

Michael A. Gross
Vice President, Regulatory Affairs
& Regulatory Counsel
Florida Cable Telecomm. Assoc.
246 East 6th Avenue
Tallahassee, FL 32303
Tel. No. (850) 681-1990
Fax. No. (850) 681-9676
mgross@fcta.com

Susan Masterton
Charles J. Rehwinkel
Sprint
Post Office Box 2214
MS: FLTLHO0107
Tallahassee, Florida 32316-2214
Tel. No. (850) 599-1560
Fax. No. (850) 878-0777
susan.masterton@mail.sprint.com

Donna Canzano McNulty (+)
MCI WorldCom, Inc.
325 John Knox Road
The Atrium, Suite 105
Tallahassee, FL 32303
Tel. No. (850) 422-1254
Fax. No. (850) 422-2586
donna.mcnulty@wcom.com

Brian Sulmonetti
MCI WorldCom, Inc.
6 Concourse Parkway, Suite 3200
Atlanta, GA 30328
Tel. No. (770) 284-5493
Fax. No. (770) 284-5488
brian.sulmonetti@wcom.com

William Weber, Senior Counsel
Covad Communications
1230 Peachtree Street, N.E.
19th Floor, Promenade II
Atlanta, Georgia 30309
Tel. No. (404) 942-3494
Fax. No. (508) 300-7749
wweber@covad.com

John Rubino
George S. Ford
Z-Tel Communications, Inc.
601 South Harbour Island Blvd.
Tampa, Florida 33602
Tel. No. (813) 233-4630
Fax. No. (813) 233-4620
gford@z-tel.com

Joseph A. McGlothlin
Vicki Gordon Kaufman
McWhirter, Reeves, McGlothlin,
Davidson, Decker, Kaufman, et. al
117 South Gadsden Street
Tallahassee, Florida 32301
Tel. No. (850) 222-2525
Fax. No. (850) 222-5606
jmcglothlin@mac-law.com
vkaufman@mac-law.com
Represents KMC Telecom
Represents Covad
Represents Mpower

Jonathan E. Canis
Michael B. Hazzard
Kelley Drye & Warren, LLP
1200 19th Street, N.W., Fifth Floor
Washington, DC 20036
Tel. No. (202) 955-9600
Fax. No. (202) 955-9792
jacanis@kelleydrye.com
mhazzard@kelleydrye.com

Tad J. (T.J.) Sauder
Manager, ILEC Performance Data
Birch Telecom of the South, Inc.
2020 Baltimore Avenue
Kansas City, MO 64108
Tel. No. (816) 300-3202
Fax. No. (816) 300-3350

John D. McLaughlin, Jr.
KMC Telecom
1755 North Brown Road
Lawrence, Georgia 30043
Tel. No. (678) 985-6262
Fax. No. (678) 985-6213
jmclau@kmctelecom.com

Andrew O. Isar
Miller Isar, Inc.
7901 Skansie Avenue
Suite 240
Gig Harbor, WA 98335-8349
Tel. No. (253) 851-6700
Fax. No. (253) 851-6474
aisar@millerisar.com

Richard D. Melson
Hopping Green Sams & Smith
Post Office Box 6526
Tallahassee, FL 32314
Tel. No. (850) 222-7500
Fax. No. (850) 224-8551
rickm@hgss.com

Norman H. Horton, Jr. (+)
Messer, Caparello & Self
215 South Monroe Street
Suite 701
Post Office Box 1876
Tallahassee, FL 32302-1876
Represents e.spire
Tel. No. (850) 222-0720
Fax. No. (850) 224-4359
nhorton@law.fla.com

Renee Terry, Esq.
e.spire Communications, Inc.
7125 Columbia Gateway Drive
Suite 200
Columbia, MD 21046
Tel. No. (301) 361-4298
Fax. No. (301) 361-4277

Mr. David Woodsmall
Mpower Communications, Corp.
175 Sully's Trail
Suite 300
Pittsford, NY 14534-4558
Tel. No. (585) 218-8796
Fax. No. (585) 218-0635
dwoodsmall@mpower.com

Suzanne F. Summerlin, Esq.
1311-B Paul Russell Road
Suite 201
Tallahassee, FL 32301
Tel. No. (850) 656-2288
Fax. No. (850) 656-5589
summerlin@nettally.com

Dulaney O'Roark III (+)
WorldCom, Inc.
Six Concourse Parkway
Suite 3200
Atlanta, GA 30328
Tel. No. (770) 284-5498
De.ORoark@mci.com

Claudia E. Davant
AT&T
State President Legislative and
Regulatory Affairs
101 N. Monroe Street
Suite 700
Tallahassee, FL 32301
Tel. No. (850) 425-6360
Fax. No. (850) 425-6361
cdavant@att.com

Wayne Stavanja/Mark Buechele
Ann Shelfer
Supra Telecommunications
1311 Executive Center Drive
Suite 200
Tallahassee, FL 32301
Tel. No. (850) 402-0510
Fax. No. (850) 402-0522

J. Phillip Carver

J. Phillip Carver (KA)

(+) Signed Protective Agreement

#237366

NATIONAL ECONOMIC RESEARCH ASSOCIATES
ONE MAIN STREET
CAMBRIDGE, MASSACHUSETTS 02142
TEL: 617.621.0444 FAX: 617.621.0336
INTERNET. http://www.nera.com

n/e/r/a
Consulting Economists

To: Florida SQM Files

From: Bill Taylor and Andy Banerjee

Re: Florida Staff Concerns Regarding Penalty Functions

Date: December 6, 2002

As we understand it, the Florida PSC staff has raised some basic concerns with the remedy aspects of the current BellSouth Service Quality Performance Plan. In particular, they ask, once a sub-measure is found to be out of compliance, how should the extent of the failure be determined:

- Should the extent of the failure be premised on the change necessary to satisfy the compliance test or the change necessary to achieve point-estimate parity?
- How should the extent of the failure be defined:
  - Number of disparate transactions?
  - Proportion of disparate transactions?
  - Other?
- Once the extent of the failure is defined, how should it be quantified? Should the measure be based on
  - ILEC/ALEC means
  - Means and standard deviations
  - Other aspects of the ILEC/ALEC distributions.

To answer these questions, we must recall the purpose of a service quality measurement plan and the role that penalty payments play in achieving that purpose. In this memo, we identify the economic role that penalty payments play in a service quality measurement plan and compare the basic structures of the BellSouth and ALEC coalition plans with respect to that role.

I. PENALTY THEORY.

Broadly speaking, the *economic* purpose of service quality penalty payments is to offset any incentive the ILEC might otherwise have to provide lower wholesale service quality to its competitors than that which it provides to its retail customers. If the incentives are set correctly, then the ILEC will comply with the requirements of the Telecommunications Act in its own self-interest, rather than in response to regulatory or judicial complaints and enforcement. In theory, penalties should be established that just offset the ILEC's expected gain from imposing the higher costs of inferior wholesale service on its competitors. Of course, precise measurement of such expected gains is impossible, and even conceptually, those gains are likely to differ in specific circumstances.[1] However, consideration of this goal will help in designing the *structure* of payment mechanisms, even if other considerations are required to determine the precise level of payments.

A. Penalties should be TRANSACTIONS-BASED.

To a first approximation, ALECs are harmed (and ILECs gain a competitive advantage) when (and only when) a failure of service quality parity affects the transaction between the ALEC and the retail customer: i.e., which causes the customer to return to the ILEC or which increases the cost to the ALEC to retain the customer. Disparities which—if not corrected—have no such effect on customers confer no competitive advantage on the ILEC and do not cause the ALEC to incur additional costs. From this perspective, it is only failed transactions that matter and thus that require that a penalty be assessed. Using a penalty that is a function of failed transactions is thus (approximately) the same as a penalty that is a function of the number of customers retained by the ILEC that would have been lost to a CLEC if the ILEC supplied wholesale services at parity with its retail services. Thus,

[1] Sometimes a missed appointment would cause a potential ALEC customer to return to the ILEC; sometimes it would be irrelevant. Conversely, sometimes an appointment which is kept might cause a disgruntled ALEC customer to stay with the ALEC.

B. Penalties should be a function of the NUMBER OF FAILED TRANSACTIONS.

Here, "number of failed transactions" is shorthand for the number of transactions that would have to be improved in order that ILEC and ALEC service be perceived by the end-user customer as at parity. Three questions (and answers) arise in this context:

- Why should penalties depend only on the number of failed transactions, without consideration for the degree to which individual transactions differ from parity?
  - Differences in service quality affect ALECs when they cause customers to misjudge the ALEC's inherent quality and either return to the ILEC or demand lower prices or other costly terms to compensate for lower quality. To a first approximation, assume that any measured difference in quality (that is statistically significant) imposes such a cost: i.e., raises the probability that customer will be affected.
  - Quantifying disparity as the number of failed transactions thus maps into the number of affected customers. Penalty incentives based on the number of affected customers are at least directionally correct:
    - if the number of affected customers is zero, the penalty should be zero, and
    - twice as many affected customers results in twice the penalty.
  - For an individual transaction, a large disparity in quality (e.g., a large difference in a provisioning interval) would presumably make it more likely that the end-user customer would be affected (e.g., would return to the ILEC). However,
    - A large average disparity (averaged across transactions) does not unambiguously measure the ALEC's competitive disadvantage. Compare:
      - a very large disparity for one customer averaged with parity for all other customers with moderate disparity for all customers. In the former case, the ALEC would lose only one customer; in the latter, many customers.
      - large negative disparities for some customers and large positive disparities for others averages to no disparity. However, the ALEC would presumably lose all of the negative-disparity customers.
    - The effect of an average disparity on the ALEC depends on the number and distribution of individual failed transactions.
- Why should the penalty depend on the number and not the proportion of failed transactions?

- the ALEC loses (and the ILEC gains) from discrimination in proportion to the number of affected customers.

- one could use the total number of transactions to scale the proportion of failed transactions, but that formula would be equivalent to using the number of failed transactions.

- Should the number of failed transactions be measured from parity or from the detection point? (That is, should we count the number of failed transactions necessary to change in order to reach parity as (i) the number necessary so that the truncated Z-test does not reject the hypothesis of parity or (ii) the number necessary so that the truncated Z-statistic is zero?) There are at least three possibilities:

1. Measuring the penalty from the detection point.

Use the standard 5% (fixed) critical value for the truncated-Z test. Count the number of failed transactions necessary to change in order that the Z statistic equals the critical value. Base the penalty on that number of failed transactions. The justification for this approach is that the ILEC would only pay a penalty for those failed transactions unambiguously associated with providing less-than-parity service. For example, suppose the ILEC experienced 18 failed transactions, and if it had only experienced 15 such transactions, the truncated-Z test would have accepted the null hypothesis of parity service. If the penalty were based on failed transactions measured from the detection point, we would use 3 transactions. An ILEC having only 15 failed transactions would not be providing less-than-parity service beyond a reasonable doubt: i.e., over 100 months of independent measurements, in only 5 of those months will an ILEC that provides parity service exhibit that many (i.e., 15) failed transactions due to random statistical variation. Hence, it is only the 3 failed transactions (beyond the 15) that can be unambiguously associated with out-of-parity service in a given month.

2. Measuring the penalty from the detection point balancing Type (I) and Type (II) errors.

Use the Balancing Critical Value outlined in the SEEM plan. Count the number of failed transactions necessary to change in order that the Z statistic equals the BCV, and base the penalty calculation on this number. The justification for this method is the same as the previous case, except that we have equalized the probabilities of making mistakes that favor the ILEC and those that favor the ALEC. That is, instead of a 5 percent of reasonable doubt, we use a different standard such that the probability that an ILEC providing parity service fails the truncated-Z test is the same as the probability that an ILEC providing out-of-parity service passes the test.

For most sample sizes, using the critical value that balances these two types of errors results in a substantially higher probability of incorrectly rejecting parity than would be used for scientific purposes or in litigation, where the standard is generally 5 percent. Basing a penalty calculation on the number of failed transactions necessary for the truncated-Z statistic to just equal the BCV would generally result in a larger expected penalty than if the 5 percent critical value were used. Hence an ILEC providing parity service can expect, on average, to pay a higher penalty using the BCV than would ordinarily be assessed using conventional statistical measures and a conventional measure of reasonable doubt. In this sense, measuring the penalty from the BCV is a middle ground between using the 5 percent critical value and the point estimate of parity.

3. Measuring the penalty from the point estimate of parity.

Measuring the penalty from the point estimate of parity (i.e., counting the number of failed transactions necessary to be reversed so that the truncated-Z statistic equals 0) effectively applies a much lower standard of reasonable doubt. By counting every failed transaction above the point estimate of parity as subject to penalty, this method counts for penalty purposes, failed transactions that from a statistical point of view are consistent with parity service. If one calculated the expected ILEC penalty payment under the null hypothesis of parity service, it would be disturbingly large using this measure.

We would never base a *test* for parity service on whether the truncated-Z test were greater than 0; such a test would have a 50 percent probability of Type I error (finding discrimination when there is none) and flipping a coin does just as well. Moreover, measuring the penalty from the point estimate of parity (truncated-Z statistic equals 0) is not "statistically neutral" as suggested in the Staff Notice because some number of failed transactions are associated with statistical sampling error and not inconsistent with an ILEC providing parity service. It is also statistically not "neutral" because random statistical fluctuations in the number of failed transactions around the parity point are not treated symmetrically in the penalty process. Positive random fluctuations (where the ILEC appears to provide better service to the ALEC) are ignored while negative random fluctuations (where the reverse is true) are penalized.

Thus, using the number of failed transactions necessary to change to reach (measured) parity has the undesirable characteristic of making the ILEC pay for transactions that would be observed (with reasonable probability) if the ILEC were providing parity service. To base the penalty on transactions that are consistent with parity service greatly increases the cost of Type I error to the ILEC: that is, an ILEC providing parity service will expect to pay, on average over time or across measures, a significant penalty, despite its conformance with the rules.

The situation differs from the speed trap case[2] in that the standard for speeding is a nonstochastic (55 MPH) while the standard in question here is a random variable (parity). That is, when the radar test detects that a speeding motorist is guilty, it is perfectly clear of what she is guilty: exceeding 55 MPH by an amount that is statistically significant but subject to measurement error. In the SEEM case, when the truncated-Z statistic detects discrimination, there is no nonstochastic equivalent of the 55 MPH standard.

II. THE BELLSOUTH PENALTY PLAN.

On the surface, BellSouth's Plan may not appear to be transactions-based because penalties are based on the parity gap (the difference between the Z-statistic and the Balancing Critical Value). Thus, one might (incorrectly) think that the plan uses a means-based penalty function. But that inference would be incorrect. The BellSouth Penalty Plan is fundamentally based on the number of failed transactions.

The discussion of the linear programming (LP) procedure in the BellSouth Supplemental Comments shows that the proportion of failed transactions is approximately bounded by the parity gap divided by four. Thus, the BellSouth proposal is based on a conservative approximation to the number of failed transactions which, in turn, is a reasonable

[2] If the Highway Patrol issues a ticket in a 55 MPH zone whenever the measured speed exceeds 60 MPH, the penalty is generally assessed on the difference between the measured speed and 55 MPH.

measure of the number of customers affected by the lack of parity. This desirable property is examined in greater detail below.

- **The Plan bounds a calculation based on the number of failed transactions.** The LP method calculates a conservative measure of the number of transactions that would have to be corrected for the truncated Z-statistic to equal its critical value. The number is conservative in two ways:

  - because among all ways of changing transactions from failed to successful that make the Z-statistic equal to the critical value, the LP method chooses the one that results in the greatest number of transactions. One could equally-well argue for use of the minimum number of improved transactions so that the Z-statistic equals the critical value, and

  - because dividing the parity gap by four generally overstates the number of failed transactions in a large number of simulations.

- **Because it is transactions-based, the penalty varies automatically with the severity of the discrimination.** The larger the parity gap, the larger is the [bounding] number of failed transactions that must be fixed in order to pass the truncated Z-test. Thus, the larger the number of affected customers and the larger the size of the economically efficient penalty.

A. Dividing the Parity Gap by Four Provides a Reasonable Approximation to the Number of Failed Transactions

As stated above, the LP procedure in the BellSouth Supplemental Comments shows that the proportion of failed transactions is approximately bounded by the parity gap divided by four. Simulations show that dividing the parity gap by four provides, in effect, an *upper* bound for the number of failed transactions calculated by the LP procedure.[3] Stated another way, BellSouth's method of calculating that number by dividing the parity gap by four runs the risk of actually overstating the number of failed transactions and, therefore, obliging BellSouth to make larger remedy payments than warranted. Despite this fact, the property noted for BellSouth's method of dividing the parity gap by four (relative to the LP procedure) should actually be considered desirable for several reasons.

[3] They also show that there is no difference between the maximum and the minimum number of failed transactions that need to be corrected.

- Where a large number of measures and submetrics is involved, BellSouth's proposed method is computationally far less expensive and more manageable than the LP procedure.

- Where performance failures are detected, ALECs are assured of receiving no less than the compensation that they are entitled to, and of possibly receiving more. Most crucially, simulations show that BellSouth's proposed method produces a number of failed transactions that is, in fact,

  - no less than that produced by the LP procedure when the number of failed transactions that need to be corrected would take the truncated Z-statistic back to the balancing critical value,

  - is close to and, for some measures, no less than that produced by the LP procedure when the number of failed transactions that need to be corrected would reduce the truncated Z-statistic to zero.[4]

For all of these reasons, the total affected volume (i.e., the number of failed transactions) and the remedy payment to ALECs are both likely to be larger (or, sometimes, minimally lower) than when those calculations are made by the theoretically sound LP procedure. In view of this property, BellSouth's proposed method of dividing the parity gap by four to calculate both the total affected volume and the remedy payment is both theoretically defensible and computationally tractable.

III. THE ALEC COALITION PENALTY PLAN.

The ALEC Coalition claims to have come up with a payment function which supposedly addresses the Staff's interest in accounting for severity of a performance failure on BellSouth's part. Moreover, it claims that such a penalty scheme is "transaction-based," as has been requested by Staff. However, as is clear from the discussion below, it is transaction-based in name only, and the basic form of the Plan has other disturbing characteristics:

[4] This latter property addresses any concern that BellSouth may receive the benefit of "statistical error" if the number of failed transactions that need to be corrected would only reduce the truncated Z-statistic to the balancing critical value. As in the highway patrol example, where a speeding ticket is based on the difference between the recorded speed and 55 MPH (regardless of the speed chosen for the actual detection point), here too BellSouth's proposed method would commit BellSouth to correcting failed transactions to the point of zero disparity.

- The penalty function depends critically on parameters which have no theoretical basis and must be specified arbitrarily,

- The penalty function can take on negative values for some reasonable values of the parameters.

- The penalty function does not depend on the number or proportion of failed transactions.

- The penalty can decrease even though the number of ALEC transactions increases for some reasonable values of the parameters.

- Even for small or zero disparity, the penalty is strictly positive. and increases with the number of ALEC transactions.

- The ALEC Coalition's payment function essentially makes the minimum payment and the maximum payment both functions of the number of ALEC transactions, not—as it would be proper— the number or proportion of *failed* ALEC transactions. In that respect, the number of ALEC transactions itself acts merely as a multiplier, and has nothing *per se* to do with any performance disparity or its severity.

IV. CONCLUSIONS

To achieve the economic goal of setting proper incentives for the ILEC to provide parity service voluntarily, the penalty portion of the Plan should depend upon the number of affected customers. Basing payments on the number of failed transactions is a reasonable approximation to this ideal; basing a plan on measures of mean disparity or on the total number of ALEC transactions is not.

Despite its appearance, the BellSouth penalty proposal effectively depends on the number of failed transactions, in the sense that its penalty function is based on a conservative bound to the number of failed transactions. On the other hand, the ALEC Coalition's proposed payment function depends on mean disparity and is linked to the number of ALEC transactions. Those characteristics, however, neither makes the proposed payment function transaction-based (in the true sense of the term) nor yields sensible payment outcomes (those the ALECs themselves would find acceptable) for plausible values of the parameters. Irrespective of the details, the *form of the function* does not meet Staff's goal of modeling severity of performance disparities in setting penalty levels in a transactions-based plan. Moreover, because payments under the plan do not reflect the number of failed transactions or affected customers, the proposed ALEC penalty function does not set ILEC incentives to provide parity service.

ANALYSIS OF THE ALEC COALITION PLAN

A. Specification of ILEC Payment Function for Performance Failures

The ALEC Coalition proposes the following payment function:

$$P = p_{\min} + (p_{\max} - p_{\min})\left(\frac{d-1}{m-1}\right)^{\lambda} \tag{1}$$

where P is the payment BellSouth must make, $p_{\min}$ and $p_{\max}$ are the minimum and maximum payments, respectively, d is the disparity level (measured in the ALEC Coalition's scheme as a ratio of ALEC and ILEC performance means, either in interval form or percent form), m is the disparity level at which $p_{\max}$ is paid, and λ is a factor that determines the shape of the payment function.[5]

The ALEC Coalition attempts to make this payment function supposedly transaction-based by assuming—arbitrarily and without any support—that the minimum and maximum payments, $p_{\min}$ and $p_{\max}$, are functions of the number of ALEC transactions. To this end, they specify the following functions for $p_{\min}$ and $p_{\max}$:

$$p_{\min} = f \cdot n_A^{\ \alpha} \qquad \text{and} \qquad p_{\max} = \phi \cdot p_{\min} \tag{2}$$

where the parameter f is chosen to set $p_{\min}$ at some desired level for sample size n_A (the number of ALEC transactions), α is a proportionality or scaling factor,[6] and ϕ is an arbitrarily chosen multiplier representing the ratio of $p_{\max}$ to $p_{\min}$.

---

[5] With $\lambda = 0$, $P = p_{\max}$, i.e., BellSouth is obliged to make the maximum payment. With $\lambda = 1$, the payment function is linear and is some markup above $p_{\min}$ that depends on where the disparity level d is with respect to the maximum payment disparity level m. With $0 < \lambda < 1$ and $\lambda > 1$, the payment function is concave (increasing at a decreasing rate) and convex (increasing at an increasing rate), respectively, up to the point $d = m$.

[6] With $\alpha = 0$, $p_{\min}$ is simply equal to f, and there is no link to the number of ALEC transactions. However, for other values of that parameter (generally positive), that link is restored, and the shape of the function (i.e., how $p_{\min}$ behaves with changes in the number of ALEC transactions) depends on the value of α. In its

(continued...)

Having linked the minimum and maximum payments to each other and to the number of ALEC transactions in this fashion, the ALEC Coalition then proposes to scale both of those payments upward for repeated performance failures (suggesting also that $p_{\max}$ be scaled upward even more than $p_{\min}$ in order to more strongly discourage larger disparity levels). To this end, the ALEC Coalition introduces *duration factors* t_m and t_x for $p_{\min}$ and $p_{\max}$, respectively. It specifies these factors as follows:

$$t_m = 1 + 0.5N \qquad \text{and} \qquad t_x = 1.5t_m \tag{3}$$

where N is the number of months during which the performance failure lasts (or is "repeated"). Note that by this specification, $p_{\max}$ increases 50 percent faster than $p_{\min}$. Given these additional specifications, the ALEC Coalition proposes the following payment function that is supposedly transaction-based and takes account of repeated performance failures:

$$P = t_m f n_A^{\alpha} + (t_x f n_A^{\alpha} - t_m \phi f n_A^{\alpha})\left(\frac{d-1}{m-1}\right)^{\lambda} \tag{4}$$

B. Evaluation of ALEC Coalition's Proposed Payment Function

The first point to note about the payment function specified in equation (4) is that it depends on a variety of parameters which need to be arbitrarily specified because there are neither good theoretical nor good empirical reasons to select their values. In the ALEC Coalition's demonstration of this payment function, the selected values are $m = 2,\quad \lambda = 1,\quad \alpha = 0.25,\quad \phi = 15$, and t_m and t_x are as specified in equation (3).[7] As for f and n_A, the ALEC Coalition conducts limited simulations by choosing arbitrary values for both. In particular, the ALEC Coalition makes no attempt to explain its particular choices for these parameters. This pervasive feature of the proposed payment function is its biggest weakness:

(...continued)

demonstration of the payment function, the ALEC Coalition assumes $\alpha = 0.25$, but allows for other values. If $\alpha = 1$, $p_{\min}$ would vary directly with the number of ALEC transactions, n_A.

[7] The ALEC Coalition justifies its selection for the value of m by stating that the "maximum payment should apply when ALEC service is 'twice as bad'."

the parameter values have no theoretical basis and the *ad hoc* specification itself obliges the decision-maker to make highly arbitrary choices. For example, for the 8 parameters in the model, if the decision-maker could choose from among 4 values for each, then there could be as many as $4^8 = 65{,}536$ possible combinations of values. Even if the decision-maker could *a priori* rule out a substantial number of these combinations (for whatever reasons), there would still be a rather large number of parameter value combinations to choose from, making the whole process extremely arbitrary and clearly open to questioning.

Second, although the ALEC Coalition purports the demonstrate the reasonableness of this payment function by reporting selected estimates of payments for its chosen set of parameters, such a demonstration is extremely inadequate for understanding the behavior of the payment function, particularly as the number of ALEC transactions changes. The best way to make that evaluation is to resort to elementary calculus, by taking the first derivative of the payment function with respect to the number of ALEC transactions, n_A. This is shown below, making the simplifying assumption (as does the ALEC Coalition) that $\lambda = 1$. With the proportionality factor defined that way, also let the ratio $\frac{d-1}{m-1} = k \leq 1$, and define the relationship between t_x and t_m more generally as $t_x = \beta t_m$, $\beta > 1$ (a value of 1.5 is assumed in equation (3)). Then,

$$\frac{\partial P}{\partial n_A} = \alpha t_m f n_A{}^{\alpha-1} + \left[\alpha t_x f n_A{}^{\alpha-1} - \alpha t_m \phi f n_A{}^{\alpha-1}\right]k$$

This can be shown to be reduced to

$$\frac{\partial P}{\partial n_A} = \alpha t_m f n_A{}^{\alpha-1}\left[1 + (\beta - \phi)k\right] \quad \text{which is } \begin{cases} > \\ = 0 \\ < \end{cases} \text{ as } \quad (\phi - \beta)k \begin{cases} < \\ = 1 \\ > \end{cases} \tag{5}$$

These derivatives yield some interesting insights into the proposed payment function. Perhaps the most striking of these is the possibility that the payment that BellSouth is supposed to make to an ALEC for performance failures can actually become negative for certain reasonable choices of parameters in the payment function! Consider the sign condition in equation (5). That shows that as the number of ALEC transactions increases, BellSouth's payment may become negative if $(\phi - \beta)k > 1$. This condition could be satisfied for a whole range of (arbitrary) values for the parameters. In fact, in its own presentation to Staff, the ALEC Coalition chose the values $(\phi = 15, \quad \beta = 1.5)$ and set *m* (which is in the denominator of *k*) at 2. Since, in the numerator of *k*, the disparity level *d* is 1 (i.e., no disparity) if the ALEC mean is equal to the BellSouth mean, it could make sense to assume for purposes of illustration that $d = 1.5$, i.e., there is some disparity.[8] In that event, $k = 0.5$. Using these values, the term $(\phi - \beta)k = 6.75 > 1$.

Thus, with these ALEC Coalition parameters, the first derivative in equation (5) implies that the payment may *decrease* with an increase in the number of ALEC transactions and, after a point, even result in a *negative* payment to the ALEC (i.e., imply a payment by the ALEC to BellSouth). In fact, as $d \to m$, i.e., as $k \to 1$ (the level of disparity at which maximum payment is due), this condition results in an even stronger such payment reduction and negative payment effects! It is unimaginable that the ALEC Coalition would voluntarily set itself up to lose payment or receive a negative payment from BellSouth as the number of ALEC transactions increased. The only conclusion can be that, even with ALEC Coalition-specified parameter values, the proposed payment function delivers an unexpected and spurious range of payment outcomes and, therefore, cannot be taken seriously.

The flip side of this finding is that payments may actually *increase* with the number of ALEC transactions as the disparity level falls toward the level of no disparity, i.e., $d \to 1$. This is equally untenable since, for a certain selection of parameter values, BellSouth could find itself obliged to make increasing levels of payments to ALECs simply because the number of ALEC transactions was increasing, *even though* the level of disparity itself was almost negligible.

The larger point, of course, is that the ALEC Coalition's payment function is designed to yield escalating levels of penalty payments as the number of ALEC transactions increases. This makes no sense since the severity of any performance disparity should only be accounted for in terms of the number of *failed* (not total) ALEC transactions. However, even with a

[8] This corresponds to the ALEC Coalition's idea that when smaller means are better (e.g., for the order provisioning interval), values of *d* greater than one indicate disparity.

payment function designed to generate escalating levels of payments for ALECs, the proposed payment function simply does not deliver for certain plausible (and ALEC Coalition-specified) values of the parameters in it.

All of these algebraic findings have been verified in simulations using assumed values for the parameters (in nearly all cases, using those from the ALEC Coalition's own presentation).