USPS-T-41

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POSTAL RATE COMMISSION
WASHINGTON, D.C. 20268-0001

POSTAL RATE AND FEE CHANGES, 1997

Docket No. R97-1

DIRECT TESTIMONY
OF
WILLIAM M. TAKIS
ON BEHALF OF
UNITED STATES POSTAL SERVICE

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DIRECT TESTIMONY
OF
WILLIAM M. TAKIS

AUTOBIOGRAPHICAL SKETCH

My name is William M. Takis. I am a Principal Consultant in Price Waterhouse LLP's Gateway Office, located at 1616 North Fort Myer Drive, Arlington, VA 22209.

As a Principal Consultant in Price Waterhouse's Finance and Economics Consulting Practice, I am responsible for directing many of our firm's projects in the areas of cost analysis and rate design for regulated utilities. My work has focused on cost of service studies (both marginal and embedded), cost of capital studies, rate design analyses, and other related financial and economic studies for utilities in the electric, natural gas, telecommunications, and water supply industries. I have performed these studies for numerous utilities in the United States and abroad.

In addition to my role in the Finance and Economics Consulting Practice, I am also a member of Price Waterhouse's Center for Postal Consulting (CPC). Over the past eleven years, I have directed numerous cost analysis projects for the United States Postal Service, focusing on the following areas:

- mail processing
- surface transportation
- air transportation
- window service
- recovery of prior years losses
- new product introductions.

I have also written several papers and articles concerning my work in regulated industries which have been published in various journals and presented at industry conferences.

I have a B.A. in Economics from Williams College and an M.A. in Economics from the University of Maryland. In addition, I have completed most of the requirements for a Ph.D. in Economics at Maryland, including core coursework and comprehensive theory exams. I have also passed the Ph.D. field exam in Industrial Organization.

I have appeared before the Postal Rate Commission on two separate occasions, both in Docket MC95-1. In USPS-T-12, I presented testimony concerning a variety of costing issues, concentrating on Standard Class letter-shaped mail processing costs. In USPS-RT-4, I presented rebuttal testimony concerning costing issues for Standard Class Enhanced Carrier Route mail.

I. PURPOSE AND SCOPE OF TESTIMONY

The purpose of this testimony is to present the results of a comprehensive analysis of incremental costs for the U.S. Postal Service. This analysis, conducted for each of the Postal Service's subclasses and special services, as well as specific groups of products, allows the Postal Service and the Commission to perform *incremental cost tests* (described more fully below) for individual and groups of postal products.

My testimony should be examined in conjunction with Dr. Panzar's testimony in this Docket (USPS-T-11). Dr. Panzar presents a conceptual discussion of the proper role of incremental costs in postal ratemaking, as well as the theoretical underpinnings for their estimation. I build on Dr. Panzar's testimony by taking his theoretical prescriptions and implementing them in the context of the Postal Service's current request in this Docket. While our testimonies overlap in some respects, we both believe it is critical to reinforce the proper theoretical bases for calculating incremental costs, as well as the proper role of incremental costs in postal pricing analysis.

As noted by Dr. Panzar, the key role of incremental costs in postal ratemaking is to perform *incremental cost tests*. Estimates of incremental costs are required for checking whether there is any cross-subsidization among postal products. My testimony generates incremental costs for individual and groups of products to be used in performing these incremental cost tests.

The remainder of my testimony is organized into several major sections. Section II provides a general overview of the analytical approach used in estimating incremental costs, including an introduction to important definitions and concepts, as well as links to the theoretical underpinnings for incremental cost estimation provided by Dr. Panzar. Section III provides an overview of how I implement these conceptual/theoretical approaches in the context of the Postal Service's current operating plan (a detailed

description of my analysis is contained in my workpapers). Section IV contains a summary of the results of my analysis, as well as a detailed discussion of these results.

II. DEVELOPMENT OF INCREMENTAL COSTS -- OVERVIEW

A. The Concept of Incremental Costs

In concept, incremental cost is very simple. It is merely the cost caused by the provision of the entire amount of a product. Furthermore, there is a precise relationship between incremental cost and the other measure of caused costs, marginal cost. In a firm without fixed costs, incremental cost for a product is the sum of the marginal costs for each unit produced. Mathematically, this can be expressed as:

$$IC(V_i) = \int_{(V^*-V_i)}^{V^*} MC_i dV \qquad (1)$$

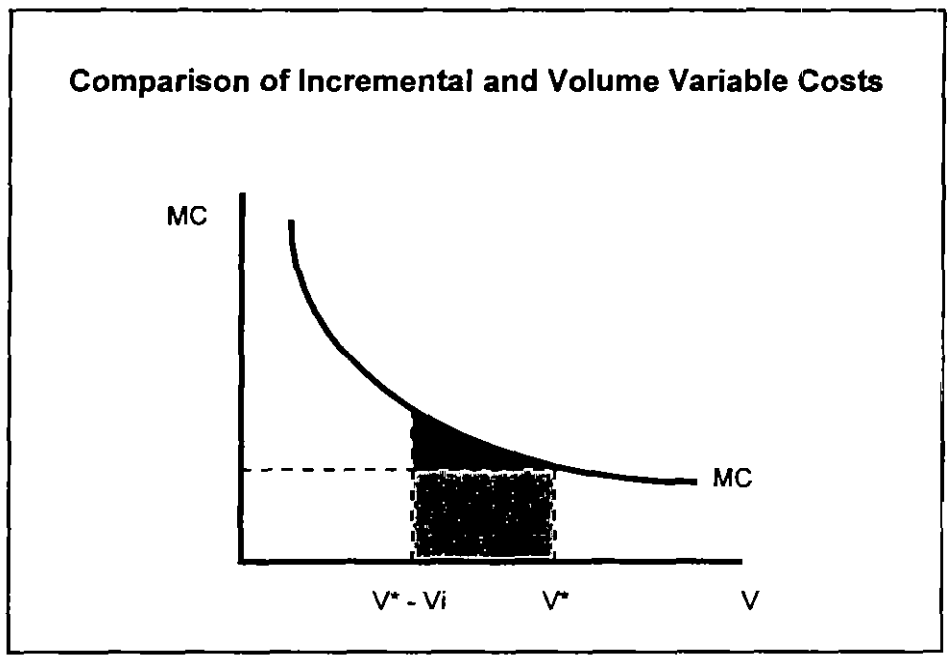
where: $IC(V_i)$ = incremental costs of product (i)
V_i = volume of product (i)
V^* = total volume
MC_i = marginal cost of product (i)

In the event that there are specific fixed costs in the production of a particular product, then the incremental cost would include that fixed cost (F_i):

$$IC(V_i) = \int_{(V^*-V_i)}^{V^*} MC_i dV + F_i \qquad (2)$$

These expressions demonstrate that incremental cost relies upon the existence of the same cost structure as marginal cost. In other words, the same types of assumptions that are required for the calculation of marginal costs also are required for the calculation of incremental costs. Marginal costs are the measurement of the cost generated by the addition of another unit of output, given the existing cost structure. Incremental costs are the costs generated by the provision of all units of an output, given the existing cost structure.

The relationship between incremental costs, marginal costs, and in the case of the Postal Service, volume variable costs, can be seen in the following exhibit.



This graph depicts a marginal cost curve for a generic base year cost component. Specifically, it shows the effects of removing subclass (*i*) from total volume (V*). The total volume remaining after removing subclass (*i*) is given as ($V^* - V_i$) The lightly shaded rectangle is the volume variable costs associated with subclass (*i*). The sum of the darkly-shaded triangular area and the lightly shaded rectangle (i.e., the area under the marginal cost curve from ($V^* - V_i$) to V*) represents incremental costs (less any specific fixed costs associated with the subclass in question). The difference between volume variable costs and incremental costs depends (partially) on the size of the darkly-shaded triangular area. Its size will depend upon the curvature of the marginal cost curve and the distance we move along the curve. Even though the marginal cost curve may be sharply curved, if we only move a short distance along the curve, little of the curvature will come into play, and incremental costs will be close to volume variable costs.

It can also be shown through the use of similar graphs that in the absence of specific fixed costs, the following relationships hold between volume variable and incremental costs for an individual cost component:

- Incremental costs are greater than volume variable costs if marginal costs are declining with volume;
- Incremental costs are smaller than volume variable costs if marginal costs are rising with volume;
- Incremental costs are equal to volume variable costs if marginal costs are constant.

The precise mathematical relationships between incremental and volume variable costs will be derived below.

B. General Methods for Estimating Incremental Costs

One of the primary advantages of the Postal Service's approach to its BY1996 cost analysis is that it permits calculation of product-specific cost in the absence of component-level volume measures. Postal costs are generated in a series of cost components, each reflecting a different activity in the process of providing mail service. The measurement of product-specific costs would thus seem to require product-specific volume measures for each of these components. Yet, in many instances such volume measures are virtually impossible to obtain without bringing the operational function to a complete halt. The BY1996 cost analysis circumvents this problem by using cost drivers, which are measurable. A cost driver is an intermediate variable that varies directly with volume and generates cost through its provision.

The identification of the cost driver for each cost component greatly facilitates the calculation of volume variable cost and this information will be used in the incremental cost calculation.[1] The use of these cost drivers implies a two-step approach:[2]

Step 1: Find the amount of the driver caused by a particular class of mail V_i:

$$D_i = g(V^*) - g(V^* - V_i) \tag{3}$$

where g( ) is a function relating volume to the driver.

Step 2: Find the amount of cost caused by D_i:

$$IC_i = C(D^*) - C(D^* - D_i) \tag{4}$$

where D^* is the current total amount of the driver need to produce V^* and C( ) is a cost funtion.

Alternatively, the incremental costs in a component can be found by integrating the marginal cost curve for that component over the region defined by a product's share of the driver and adding any specific fixed costs associated with providing the driver:

$$IC_i = \int_{D^*-D_i}^{D^*} \frac{\partial C}{\partial D}\, dD + F_i \tag{5}$$

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1 For a complete discussion, see Bradley, M.D., Colvin, J., and Panzar, J.C., "Issues in Measuring Incremental Cost in a Multi-Function Enterprise," in Managing Change in the Postal and Delivery Industries (Crew, M.A., and Kleindorfer, P.R., eds.) (Boston: Kluwer Academic Publishers, 1997).

2 The reduction in total cost from removing the driver would include any relevant specific fixed costs.

As expressed by these formulas, the incremental cost bears a close conceptual relationship with existing postal cost measures. Volume variable cost is also found through use of the marginal cost curve. The key difference is that volume variable cost is calculated from the marginal cost of the last unit, regardless of the amount of the driver associated with any individual class:

$$VVC_i = \left[\frac{\partial C}{\partial D}(D^*)\right] D_i - \int_{D^*-D_i}^{D^*} \left[\frac{\partial C}{\partial D}(D^*)\right] dD \qquad (6)$$

In practical terms, the calculation of incremental cost for a cost component requires the following algorithm:

Step 1: Identify any fixed costs in a cost component that are common and not allocable to products. In some cases this covers the entire component, and the incremental cost analysis is complete for that component.

Step 2: Identify any product-specific fixed costs within a component and allocate them to the relevant product's incremental costs.

Step 3: Determine the amount of the driver that would not be required when each particular class is removed. For example, in carrier load time this would imply estimating the reduction in the number of letters, flats, and parcels loaded from the elimination of, say, First-Class Mail.

Step 4: Calculate the reduction in cost generated by reduction in the cost driver. When added to any product specific costs, this is the incremental cost for the product in the component. Note that this approach does <u>not</u> simply divide up total component costs in proportion to relative volumes (or anything else, for that matter). In the case of declining marginal costs, we would expect the sum of the incremental costs to be less than total cost.

This is the general procedure I have used to calculate incremental costs, and it is described in greater detail in the following section of my testimony, as well as in my workpapers.

C. Conceptual Issues in Estimating Incremental Costs

In the preceding discussion, I have presented a very broad overview of the general theoretical approach to estimating incremental costs. However, there are several conceptual issues that must be kept in mind as well, as I describe fully below.

1. Importance of Maintaining Consistency with the Postal Service's Cost Analysis Framework

From the discussion above, it is easy to see that there exist important links between incremental costs (which are developed in my testimony) and volume variable costs (which are developed as part of the Postal Service's BY1996 cost analysis). Therefore, it is imperative that any approach to estimating incremental costs starts with, and ultimately is consistent with, the analyses that determine volume variable costs in BY1996. If incremental costs are not consistent with these volume variable costs, then the fundamental relationships described in equations 1 through 6 above will not hold.

The importance of maintaining consistency with the Postal Service's cost analysis framework can be traced back to Dr. Panzar's concept of the "operating plan". For the Postal Service, the calculation of both incremental and marginal cost presupposes the existence of a set of procedures for the collection, processing, transportation, and delivery of mail. This set of procedures, called the "operating plan" by Dr. Panzar, serves as the reference point for the calculation of volume variable and incremental cost. Because the BY1996 cost analysis reflects the current operating plan, it is important that incremental costs be consistent with the operating plan. The approach

used in this analysis of incremental costs maintains this important link by basing incremental costs for each cost component on the specific analytical framework used to estimate volume variable costs for the base year, as described in greater detail in the following section of the testimony and in my workpapers.

2. "Actual" v. "Ideal" Operating Plan

As Dr. Panzar points out, the incremental cost test clearly requires an estimate of incremental costs based on the enterprise's *actual* operating plan, rather that some hypothetical best practice technique, such as that employed by a hypothetical cost minimizing entrant into the market. This is an important point for the calculation of incremental cost because it clarifies the conditions under which the calculations should take place.

There are two primary reasons why the incremental cost test should rely on the actual operating plan:

- The primary purpose of the incremental cost test is to check for cross-subsidy -- do the revenues from a particular product (or group of products) cover the total costs of producing that product (or group)? An incremental cost test based on an "ideal" firm's cost structure does not answer this question. Even if the revenues cover the incremental costs of the hypothetical firm, they may or may not cover the actual incremental costs of the Postal Service, upon whom the incremental cost test must be performed.

- Relatedly, the interest in cross-subsidization stems from its impact on incentives for efficient entry into the market. The cost structure of an "ideal" firm has no bearing on the decision-making process of potential entrants, as potential entrants must make rational, profit maximizing decisions based on information about their cost structure relative to that of the incumbent (i.e., the Postal Service

in this case). Were the Postal Service to pass the incremental cost test based on the cost structure of an "ideal" entrant, but fail the incremental cost test based on its actual operating plan, the resulting prices may inappropriately discourage efficient entry.

3. "Reconfiguration" Issues

Closely related to Dr. Panzar's concept of the operating plan are issues concerning the "reconfiguration" of Postal operations and the estimation of incremental costs. Specifically, it could be argued that when a particular class or subclass is "eliminated", then the remaining operations within the Postal Service should be "re-optimized" or "reconfigured" in order to calculate incremental costs. Such arguments however, open the possibility for an almost endless number of "what if" reconfiguration scenarios, making it difficult to generate a well-grounded measurement of incremental costs.

Moreover, any massive reconfiguration might violate the current *service characteristics* implicit in the operating plan. The *service characteristics* of the operating plan are the characteristics of the products which consumers receive when they purchase postal products. For example, service characteristics include quality levels, such as overnight delivery of Express Mail, distance-independent First-Class Mail rates, particular hours of post office operation, the average waiting time of customers in line at window service units, and six-day delivery. These service characteristics should not be altered when calculating incremental costs, because if they were altered, then the fundamental quality characteristics of other products may be affected.[3] For example, some may argue that the elimination of Standard Class Bulk Rate Regular Other and Carrier Route might be accompanied by a reduction in the current 6-day delivery standards. However, such a reconfiguration would alter service quality for First-Class Mail. I do not consider such reconfigurations that might alter service characteristics in my testimony.

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3 Changes in quality characteristics imply changes in costs required to meet those quality levels.

However, if the Postal Service were to eliminate a product (or group of products), it would certainly change its operations. Logically, there must be some degree of reconfiguration of operations when calculating incremental costs; otherwise, there would be no incremental costs at all. For example, I assume that the removal of any particular postal product at a window service unit will result in a reduction in the number of clerk hours and a corresponding cost savings. I *do not* assume that the Postal Service will maintain all of its present costs if some could be eliminated after removing a particular subclass or group of subclasses from its current product line without threatening the service standards of its remaining products (i.e., its service characteristics). In fact, the costs which can be removed *are* incremental costs -- they are the additional costs caused by the product in question.

Therefore, to meet the dual objectives of maintaining consistency with the assumptions that support the volume variable cost calculations in the Postal Service's BY1996 cost analysis and to avoid the need to consider almost endless "reconfiguration" scenarios of the Postal Service's operating plan, I employ a two-pronged approach. First, in deciding how to address any particular cost component in terms of an analytical approach to estimating incremental costs, I rely on the analytical framework used to develop volume variable costs in most cases. This can include explicit use of the equations used in the BY1996 cost analysis (e.g., purchased transportation, mail processing labor and equipment, etc., as I discuss in greater detail in later sections of my testimony) or direct use of the variabilities used in developing BY1996 costs with an assumed functional form (e.g., window service, "space" components, etc., as I describe below). By employing these same analytical frameworks used to develop volume variable costs for BY1996, I assume that the Postal Service keeps its current technology constant in response to changes in mail volume (consistent with

assumptions used to develop 1996BY volume variable costs).[4] For example, if First-Class Mail were eliminated, I do not assume that the Postal Service would shut down or radically reconfigure its existing network of post offices when analyzing how window service costs would change.[5] Instead, I mimic the assumptions used in developing the 1996BY volume variable costs with regards to how cost change in response to changes in volume within the existing technology of the Postal Service. This approach allows me to maintain consistency with the assumptions used in generating the postal Service's BY1996 costs and avoid difficulties associated with "massive" restructuring scenarios.

The second part of my approach, however, addresses those cost components in which there are relatively large specific fixed costs, and the assumption that the operations within the component will not change radically if a particular product is eliminated cannot be supported. In these components, it would be inappropriate to use an "equation-based" approach to estimate incremental costs. For example, consider the case of the Eagle Network. This network actually serves Express, Priority, and First-Class Mail, but it is only necessary for Express.[6] Consistent with the assumptions used to develop BY1996 volume variable costs, I assume that if Express Mail were eliminated, then the Eagle Network would be shut down, and Priority and First-Class Mail would be diverted onto commercial flights with no degradation of service quality. Therefore, I treat the specific fixed costs associated with the premium costs of the Eagle network (i.e., costs over and above standard commercial airline costs) as incremental to Express Mail.[7] This example illustrates my development of incremental

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4 In technical terms, I assume that the Postal Service's production function remains unchanged. Therefore, I only contemplate movements *along* the marginal cost curve as volume declines, rather than *shifts* in the marginal cost curve.

5 Here, I am granting the possibly dubious assumption that it could radically reconfigure its retail network without altering the service characteristics of other classes of mail.

6 It is my understanding that Priority and First-Class Mail are "filler" on the Eagle Network, and could meet their service standards if they traveled on standard commercial flights.

7 In this case, to calculate the incremental costs of Express Mail, an adjustment must be made to account for the additional costs that would be incurred in the commercial air transportation network by the volume of Priority and First-Class Mail that would be displaced if Express Mail and the Eagle Network were eliminated.

costs when there are relatively large specific fixed costs in a particular component and the elimination of a product would result in elimination of significant operations.[8]

This general approach of analyzing each component on a case-by-case basis, using the analytical techniques embodied in the BY1996 volume variable cost analysis wherever possible, and assigning specific fixed costs to products if the elimination of a product would result in the operation being "shut down", forms the basis of my incremental cost calculations, as I describe in detail in the remaining sections of my testimony and in my workpapers. This approach eliminates the need to consider a seemingly infinite number hypothetical "reconfigurations" of Postal operations.

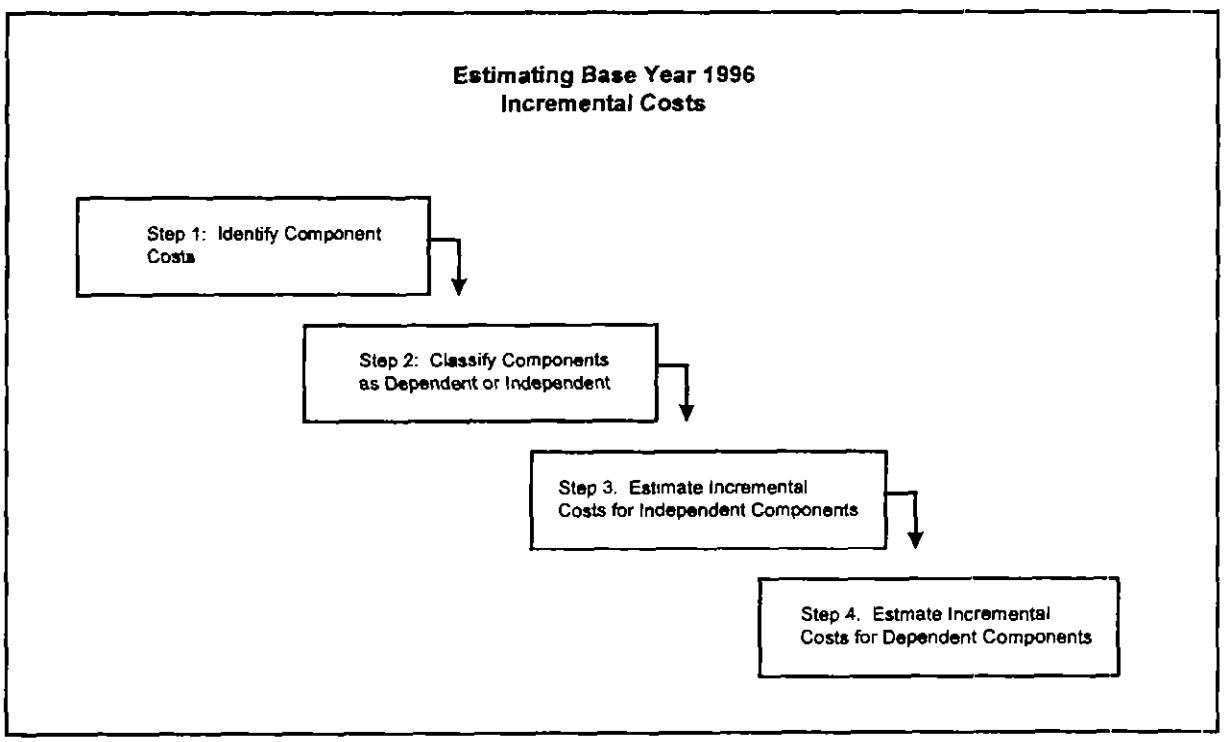
8 Additional examples of components/pools with large specific fixed costs that would be eliminated if an entire product were eliminated include manual mail processing operations for Priority and Express Mail, as well as the Christmas time transportation costs for Priority Mail associated with the CNET, as I discuss later in my testimony and in my workpapers.

III. ESTIMATING INCREMENTAL COSTS -- GENERAL APPROACHES

The purpose of this Section is to describe how I have incorporated the general concepts discussed in the previous section into an approach for estimating the incremental costs of the Postal Service's various products. Because of the complexities of this analysis, I provide an overview of the approach here, leaving the details of the analysis of each cost component for my workpapers. In the following section, I describe my approach to estimating incremental costs for BY1996. I then discuss how I use these BY1996 estimates to generate estimates for TY1998(AR).

A. Estimating Incremental Costs for BY1996

I employ a four step process to estimate incremental costs in BY1996, as shown in the following flowchart:



Each of these steps is described below.

1. Identify Component Costs

As noted in the previous section of my testimony, one of the fundamental tenets of my analysis is a close adherence to the principles underlying the development of BY1996 costs. My general framework for estimating incremental costs follows a component by component approach. Therefore, my first step involves identifying accrued costs for various cost segments, components, and cost pools. This approach allows me to develop incremental costs consistent with the methodologies used by the Commission to estimate volume variable costs by component in its previous decisions and by other Postal Service witnesses in this Docket.

2. Classify Components as Dependent or Independent

My second general step involves categorizing each component into the following two groups:

- *"Independent" Components:* A component is considered "independent" if it has its own distribution key for the distribution of its volume variable costs to individual classes and subclasses of mail and if there exists a variability estimate for the component. Good examples of this type of "independent" component include many of the components within purchased transportation (CS 14) and mail processing (CS 3.1).

- *"Dependent" Components:* Components are considered "dependent" if the two criteria for "independent" components are not met and they obtain their distribution key and/or variability estimate from another component or components. One example of this type of component is Supervision of Window

Service (CS 2.2), which obtains its variability from the variability of window service clerks in CS 3.2.

3. Estimate Incremental Costs for Independent Components

My third step involves estimating the incremental costs for each independent component and set of products using one of three general techniques:

- *Equation-Based Components:* The incremental costs for these components follow the development of volume variable costs for this Docket through the use of a specific analytical framework (i.e., a specific functional form for econometric estimation). As detailed in my workpapers, the estimated parameters from these equations can be used to estimate hypothetical accrued costs for the component under the assumption that a given subclass (and the associated amount of the cost driver) is removed. The difference between the actual accrued costs and these estimated accrued costs is equal to incremental costs, as I discussed in the previous section of my testimony. Specific components that use this approach include much of mail processing labor (CS 3.1), purchased transportation (CS 14), and carrier load time (CS 7). The analytical support for the estimation of the volume variabilities for these components in this Docket are provided by other witnesses, including Dr. Bradley (USPS-T-13 and USPS-T-14) and Witness Baron (USPS-T-17).

- *Components Using Constant Elasticity Assumptions*: These components are assumed to be "constant elasticity" components for incremental cost analysis. The constant elasticity assumption (as opposed to an equation-based approach) is necessary because, while these components have variability estimates and distribution keys (criteria for independent components), the analytical approach for the development of their variabilities does not lend itself well to incremental

cost analysis.[9] One example of a constant elasticity component is window service (CS 3.2). Although this component has clear volume variabilities and distribution keys, as developed in this Docket by Witness Brehm (USPS-T-21), the development of these variabilities does not use one functional form that lends itself to incremental cost analysis.[10]

- *"Other" Components:* These components use a variety of analytical techniques to estimate incremental costs. The different "classifications" are described fully in my workpapers and include (but are not limited to) the following:

  - *Single Subclass Stops:* Many of the carrier components (CS 7) use the Commission's "single subclass stop" approach to estimating incremental costs.[11]
  - *Specific Fixed:* Advertising (CS 16) costs are among those which are fixed, but which are also (in certain cases) specific to subclasses, and so are incremental to those subclasses.
  - *Incremental Equals Volume Variable:* Many supply (CS 16) and training components (CS 3) are assumed to be 100% volume variable, meaning that their marginal costs are constant and, hence, that their incremental cost are equal to their volume variable costs.

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9 By using the constant elasticity assumption, I am essentially making a first order approximation of an unknown functional form using a relatively flexible form. This approach can be further supported empirically by the fact that the current approach to estimating volume variable costs in BY1996 in many cases uses single elasticities that have not changed over time for various components (e.g., space support equipment-related variabilities have remained unchanged for the past several rate cases).

10 As described more fully by Witness Brehm (USPS-T-21), the overall variability estimates for the various cost pools within CS 3.2 are made up of three separate variability estimates, one of which is developed through a survey with no explicit functional form, one though new analysis presented by Witness Brehm with a definite functional form, and one through assumption. Therefore, the composite variability (i.e., the product of these three variabilities) does not have a specific functional form that can be used for incremental costing purposes, and I use a constant elasticity assumption.

11 Please see Dr. Panzar's testimony in Docket R90-1 (USPS-REM-T-2) for an analysis of why single subclass ratios should be used for incremental cost analysis.

My workpapers contain a complete categorization of each component according to whether it is dependent or independent and, if independent, which technique is used to estimate its incremental costs.

4. Estimate Incremental Costs for Dependent Components

The incremental costs of dependent components are calculated using a methodology which parallels the determination of the volume variable costs of dependent components. This methodology, well known to the Commission, involves the application of piggyback factors to the incremental costs of the "base" components (the components from which the dependent components take their variability) in order to arrive at the incremental costs of the dependent components. The piggyback factor itself is generally the ratio of the volume variable costs of the dependent component to the volume variable costs of the base components.

5. Flowchart for Developing BY1996 Incremental Costs

A flowchart describing this four-step process in greater detail is contained in Exhibit USPS-41A. The chart demonstrates graphically how accrued costs are first identified by component and then separated based on whether they are dependent or independent. The independent components are treated according to whether they are equation-based, constant elasticity, or classified as "other". Portions of the equation-based and constant elasticity components are volume variable by definition, and the relevant methodologies are applied to determine which portion of their costs are incremental and which can be treated as common or fixed. The "other" components may be volume variable or they may be entirely fixed. Those that are volume variable are treated according to their classification, while those that are fixed are either determined to be specific (and fully included in incremental costs) or non-specific (and fully excluded from incremental costs). Dependent component costs are implicitly set aside in a piggyback pool until after the incremental costs of their independent bases

are determined. Their incremental costs are then calculated through the application of piggyback factors to their base independent components. The final step in calculating incremental cost is, of course, to add up the individual component incremental costs for each subclass.

B. Estimating Incremental Costs for TY1998(AR)

In the preceding section, I provided an overview of the development of incremental costs for BY1996. However, the incremental cost test must be performed in the test year (after rates). Therefore, I must also develop estimates for TY1998(AR). These estimates should be used to perform the incremental cost tests.

There are several fundamental difficulties in performing the same type of analysis for TY1998(AR) that I described above in relation to BY1996:

- *Roll-Forward Treatment of Cost Pools:* The roll-forward model, as described by Witness Patelunas (USPS-T-15), provides component-level data, not cost pool-level data, as is needed for implementing the approach used in estimating BY1996 incremental costs. For example, the variabilities within purchased transportation (CS 14) are developed by Dr. Bradley (USPS-T-13) on an individual pool level (e.g., intra-SCF highway, inter-BMC rail, etc.), but the roll-forward aggregates these pools to a component level (e.g, purchased highway transportation). Because it would be difficult to aggregate variabilities in any meaningful way, I would be forced to develop some imprecise method of disaggregating TY1998(AR) component level data into individual cost pools.

- *Availability of Driver Information at Cost Pool Level:* Related to the roll-forward treatment of costs, volumes and cost driver information are not available at the individual pool level in the test year.

Therefore, in estimating incremental costs for TY1998(AR), I use a simple "ratio approach" by multiplying BY1996 costs by the ratio of volume variable costs in TY1998(AR) to volume variable costs in BY1996 for each subclass. This approach can be expressed mathematically as:

$$IC_{i,TY} = IC_{i,BY} * \left[\frac{VVC_{i,TY}}{VVC_{i,BY}}\right] \quad (7)$$

Although this approach is simple, it has the following advantages over more complicated approaches that would attempt to use the base year approach in the test year:

- the ratio approach eliminates the need to generate costs / volumes (driver amounts) information at the cost pool level;

- the ratio approach is consistent with the roll-forward in that it preserves the relationships between volume variable and incremental costs while taking into account volume and program effects on volume variable costs.

IV. RESULTS OF INCREMENTAL COST ANALYSIS

In this section of the testimony, I present the results of the incremental cost analysis described in the previous section. I first present incremental costs for BY1996 and TY1998(AR) for the each of the major subclasses of mail and special services. I then present similar estimates for specific groups of products. For each set of estimates, I also provide a detailed explanation of the results and incremental cost relationships (and in particular, relationships to volume variable costs).

A. Incremental Costs for Major Subclasses and Special Services

1. General Results

Exhibit USPS-41B presents the following cost information for the major subclasses and special services:

- total incremental costs for BY1996
- total volume variable costs for BY1996
- total and average (unit) incremental costs for the TY1998(AR)
- total and average (unit) volume variable costs for the TY1998(AR)

The workpapers to my testimony provide more detail of these cost estimates by major component analyzed.

When analyzing these results, several items must be considered. The first is the similarity between incremental and volume variable costs for most of the major subclasses and special services. To the extent that volume variable costs per piece are a good proxy for marginal cost, this means that average incremental costs are quite close to marginal cost. The reason why they are so close can be seen by re-examining the relationship between incremental, volume variable, and specific-fixed costs. Recall

that incremental costs differ from volume variable costs by the change in marginal cost plus specific fixed costs. I showed above that :

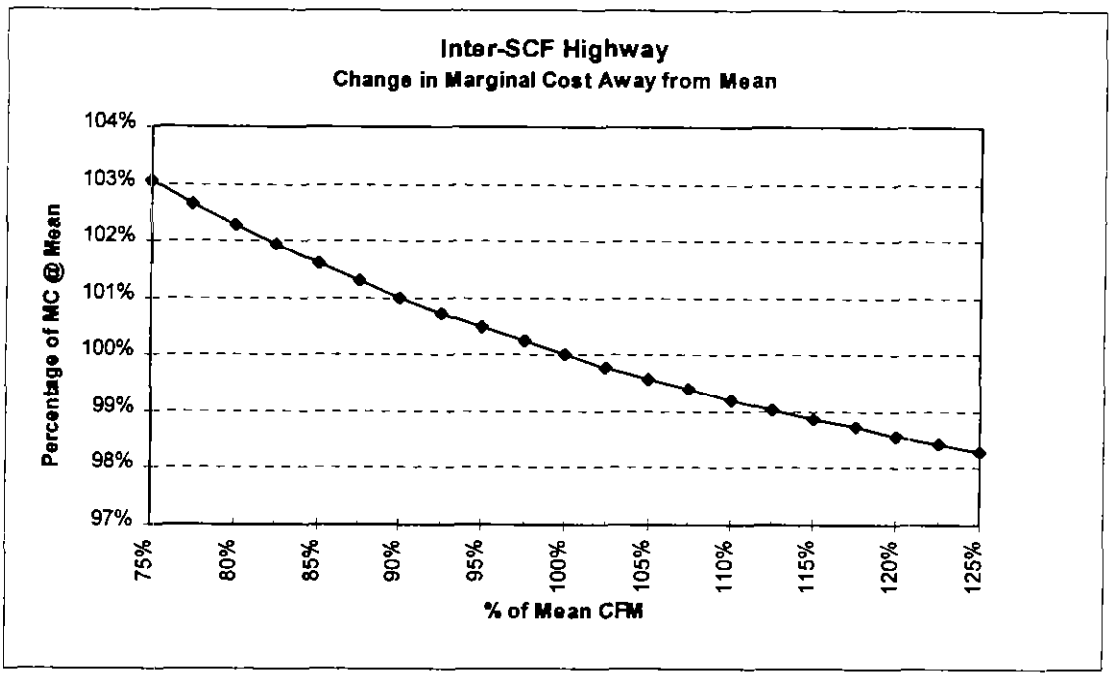
$$IC_i = \int_{D^* - D_i}^{D^*} \frac{\partial C}{\partial D} dD + F_i \qquad (8)$$

but:

$$VVC_i = \left[\frac{\partial C}{\partial D}(D^*)\right] D_i - \int_{D^* - D_i}^{D^*} \left[\frac{\partial C}{\partial D}(D^*)\right] dD \qquad (9)$$

where the star indicates that the marginal cost is calculated at current volumes. These equations illustrate three important points. Incremental cost will be close to volume variable cost when: (1) the driver increment is small; (2) marginal cost does not change much as the driver changes; and (3) specific fixed costs are relatively small.

A small difference between incremental cost and volume variable cost would occur when the marginal cost does not vary much with changes in the driver (all else being equal). To get a sense of how much marginal cost should vary as the driver varies, it is useful to examine purchased transportation. We would expect the difference to be largest in a transportation area in which the estimated equation produces a low variability. Consider the Inter-SCF (Highway) cost component. The estimated variability for this component is approximately 65.74 percent (USPS-T-13). Nevertheless, the effect on marginal cost is relatively small as we move away from the mean level of CFM. As the accompanying graph shows, a deviation of 25 percent below the mean raises the marginal cost by only approximately 3 percent.



This relationship indicates that if a particular class requires 25 percent of the cubic foot-miles of Inter-SCF transportation, removing its volume from the system would raise the marginal cost of this transportation by only approximately 3 percent.

This analysis can be made more formal by considering the elasticity of marginal cost with respect to the driver in a simple, constant elasticity cost function. Suppose that the cost function is given by:

$$In\ C = \alpha + \beta\ InD \tag{10}$$

This means that marginal cost is given by:

$$\frac{\partial C}{\partial D} = \beta e^{\alpha} D^{\beta-1} \tag{11}$$

and the elasticity of marginal cost is given by:

$$\varepsilon_{MC,D} = \frac{\frac{\partial}{\partial D}\left[\frac{\partial C}{\partial D}\right]D}{\partial C/\partial D} = \frac{(\beta-1)\beta e^{a} D^{\beta-2} D}{\beta e^{a} D^{\beta-1}} = \beta - 1 \qquad (12)$$

This equation demonstrates that the responsiveness of marginal cost to changes in the driver is inversely related to the estimated volume variability. For example, a volume variability of 65 percent implies that removal of 10 percent of the driver increases marginal cost by only 3.5 percent. Moreover, even that small increase in marginal cost is only applicable to the last amount of the driver removed. This means that an appreciable difference between incremental and volume variable cost requires either an elasticity that is very low (e.g., less than 50%) or the dominance of a cost component by one class of mail.

2. Subclass Results

Although incremental costs are, in general, relatively close to volume variable costs, when this relationship is viewed on a subclass by subclass basis, several interesting relationships arise. As discussed above, volume variable costs may be noticeably different from incremental costs in certain cases. Generally, there can be three possible causes for such variation (as I have discussed above):

- large specific fixed costs associated with the particular class or subclass;
- marginal cost changes significantly as the driver changes; or
- the driver increment is relatively large.

The following section describes results in various subclasses in which the relationship between incremental and volume variable costs vary. In each case, the difference can be explained by one of the three characteristics above.

a. Priority and Express Mail

As can be seen in Exhibit USPS-41B, incremental costs for both Priority and Express mail are significantly above volume variable costs. These differences occur due to variation in several cost areas, including:

- transportation costs;
- mail processing costs;
- carrier costs;
- computerized track and trace costs; and
- advertising costs.

Because of the unique characteristics of Priority and Express Mail, there are large specific fixed costs associated with these classes in all of the above categories, which increase incremental costs over volume variable costs. In addition, in the case of certain mail processing operations, marginal costs change significantly as the driver changes. The remainder of this section further details these differences between volume variable and incremental costs for Priority and Express Mail in each category above.

Specific fixed costs make up a relatively large portion of the differences between incremental and volume variable costs for Priority and Express Mail. The magnitude of specific fixed costs in each category is illustrated in the table below.

Specific Fixed Costs Associated with Priority and Express Mail (BY1996)

Specific Fixed Costs	Priority	Express
Transportation		
CNET (premium)	$64,236 million	
Eagle Network (premium)		$107,196 million
Western Network (premium)		$14,436 million
Mail Processing		
Manual Priority	$152,363 million	
SPBS Priority	$14,381 million	
Express		$54,191 million
LDC 48 Express		$2,186 million
Express Specific Fixed		$12,284 million
Window Service Express		$5,529 million
CS 7 – Express Mail		
Time at Stop EM Box Collection		$6,123 million
Drop/PU Express Mail Facility		$5,289 million
Drive EM Boxes (SPR Only)		$1,045 million
EM Collection (MLR Only)		$347 million
CS 9 –Express Mail		$12,184 million
Computerized Track and Trace		$12,306 million
Advertising	$50,704 million	
Total Specific Fixed	$281,684 million	$233,116 million

Both Priority and Express Mail utilize air transportation networks which confer incremental costs to the products and contribute to the difference between volume variable and incremental costs for these mail classes. As discussed in Section II of my testimony, the premium costs associated with the Eagle Network and the Western Network are specific fixed and incremental to Express Mail, and the premium costs associated with the C-Net are specific fixed and incremental to Priority Mail.[12]

In addition to differences in transportation costs, differences between incremental and volume variable costs for Priority and Express Mail can also be seen in mail processing

costs. In the case of mail processing, two of the reasons for variation discussed above are relevant:

- there are relatively large specific fixed costs for certain operations; and
- marginal cost changes significantly as the driver changes for certain operations.

As in the case of transportation costs, both Priority and Express mail have high specific fixed costs for several mail processing operations which affect the relationship between volume variable and incremental costs. The costs of dedicated manual operations including Manual Priority, SPBS Priority, Express, and LDC 48 Express are treated as incremental to the respective products. These operations are discussed in more detail by Dr. Bradley (USPS-T-14), but in general, these operations would be shut down if Priority and Express mail were eliminated. Therefore, I assume that the costs associated with these operations are specific fixed and incremental to the two products according to the assignment shown in the table.

In addition, however, relatively low manual and mechanized mail processing variabilities for Priority and Express Mail (discussed by Dr. Bradley (USPS-T-14)) also contribute to differences between volume variable and incremental costs. Thus, in these operations, marginal cost changes significantly as the driver changes. These effects are summarized in the following table:

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12 The Christmas Network (C-Net) is an air transportation network designed to carry Priority Mail during December. Specific treatment of the C-Net in the incremental cost calculations is discussed in my workpapers.

Manual Mail Processing Operations

Priority and Express Mail (BY1996)

	Manual Priority	SPBS Priority	Manual Express	LDC 48 Express
Variabilities	44.8%	80.0%	44.8%	45.0%
Volume Variable Cost	$80.6 million	$27.7 million	$26.7 million	$1.1 million
Incremental Cost	$203.5 million	$39.3 million	$70.4 million	$2.9 million

A difference between incremental and volume variable costs can also be seen in CS 7 and in Computerized Track and Trace costs for Express Mail. Like transportation and mail processing, there are specific fixed costs associated with CS 7 which increase the gap between incremental and volume variable costs for Express Mail. CS 7 activities including Time at Stop Box Collection, Drop/PU Express Mail Facility, Drive EM Boxes (SPR Only), and EM Collection (MLR Only) are all specific fixed costs that are incremental to Express Mail. Computerized Track and Trace dedicated for Express Mail is also an incremental but not volume variable cost associated with this subclass.

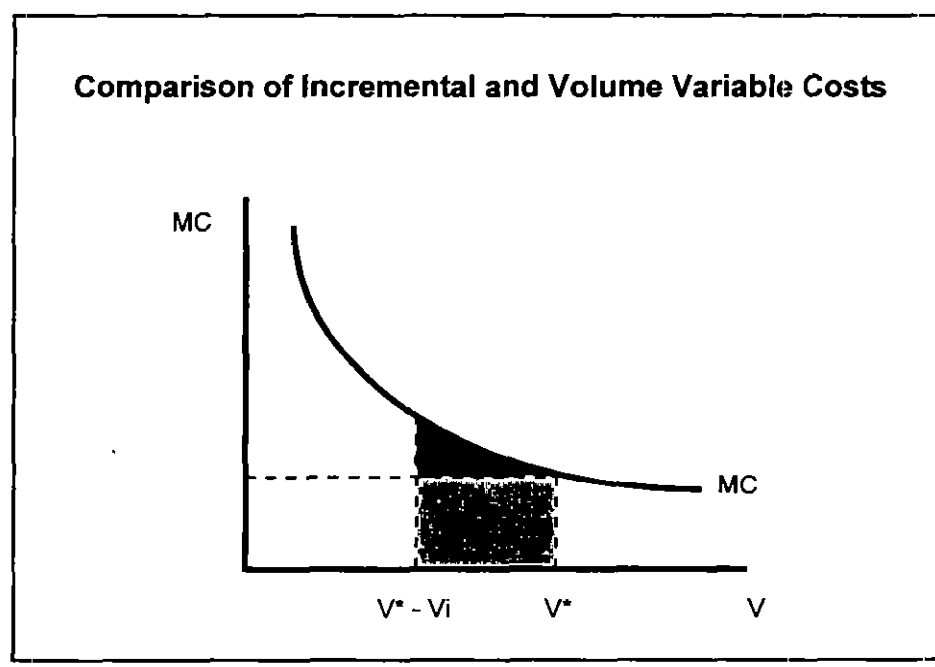
Finally, Priority Mail has significant advertising costs which are also specific fixed costs and therefore not volume variable. Thus, all the factors discussed above combine to make incremental costs significantly higher than volume variable costs for Priority and Express Mail.

b. First-Class Mail, Periodicals, and Standard Mail

As shown in Exhibit USPS-41B, the relationships between incremental and volume variable costs for the individual subclasses within First-Class, Periodicals, and Standard Mail letters are very different. For example, incremental costs for First-Class letters and

parcels are approximately 8.80 percent higher than volume variable costs in TY1998(AR), while the ratios of incremental costs to volume variable costs for Periodicals Regular Rate, Standard A Bulk Rate Regular - Carrier Route, and Standard B Zone Rate Parcels are much smaller (1.38 percent, 4.44 percent, and 1.01 percent, respectively).

The reason for this relationship stems from the issues I discussed on pages 3 and 4 of my testimony above. Recall the graph I presented there, which I reproduce here:



In any situation where there exist significant economies of scale and a significant change in volume as a result of eliminating a particular subclass, the difference between incremental and volume variable cost will be relatively large (i.e., the area of the darkly-shaded triangle in the graph).[13]

13 This difference would only be exacerbated by the presence of specific fixed costs, which increase incremental costs but do not affect volume variable costs.

This is exactly the situation occurring in the individual subclasses within First-Class, Periodicals, and Standard Mail, as can be seen in the following table:

Volumes and Incremental Costs

	Percent of Volumes (TY1998(AR))	IC/VVC Ratio (TY1998(AR))
First-Class L,F&P	48.96 %	1.088
Standard A - RR CR	14.71 %	1.044
Periodicals - RR Pub.	3.66 %	1.013
Standard B - Zone Rate	0.12 %	1.010

As can be readily seen from the table, the four example subclasses I have chosen have very different volumes, and therefore, amounts of "drivers" associated with them. When the amount of volume eliminated as a result of eliminating the subclass is relatively large when compared to total Postal Service volume, then we would expect the resulting ratio of incremental to volume variable cost to be large (*all else being equal*), as we are moving a relatively large distance "up the marginal cost curve".[14] For example, First-Class letters, flats, and parcels make up 48.96 percent of total volume

[14] This assumption of "all else being equal" is very important. For example, a particular subclass may have a relatively small amount of the driver, but relatively large incremental costs due to the presence of specific fixed costs or a relatively low variability. For example, incremental costs for Express Mail (relatively low volumes) are well above volume variable costs because of the treatment of the Eagle Network described above. As another example, consider differences between Standard A BRR-CR and BRR-Other:

	Percent of RPW Volume (TY1998(AR))	IC/VVC Ratio (TY1998(AR))	Single Subclass Stop Ratio for City Carriers
Standard A BRR-Other	19.29 %	1.022	1.65 %
Standard A BRR-CR	14.71 %	1.044	4.47 %

Even though the volume reduction will be higher after the removal of BRR-Other (i.e., more movement along the marginal cost curve), the ratio of incremental cost to volume variable cost is higher for BRR-CR partially because of the higher single stop ratios for BRR-CR (all of the cost of which are considered incremental).

(pieces) in TY1998(AR), which is by far the largest individual subclass I analyze. Therefore, by analogy with the graph, the difference between ($V^* - V_i$) and V^* is relatively large for First-Class letters, flats, and parcels. The difference between ($V^* - V_i$) and V^* is smaller for the other subclasses mentioned above, and *all else being equal*, we would expect to see their ratio of incremental to volume variable costs to be lower, as is confirmed in the table.

c. Special Services

The relationships between volume variable costs and incremental costs for special services also exhibit interesting results. In this section, I highlight the reasons for some of the more significant differences between incremental and volume variable costs.

- *Registry*: In TY1998(AR), incremental costs for registry are approximately 61.36 percent higher than volume variable costs. Part of this difference can be explained by the unique nature of manual mail processing operations for registry. Specifically, there are two simultaneous effects that combine to generate this result. First, approximately 61 percent of the driver (total pieces handled) within the manual registry mail processing cost pool is associated with registry mail. This result implies that if the registry special service is removed, we are making a significant movement "up the marginal cost curve". Second, Dr. Bradley (USPS-T-14) reports a relatively low variability for manual registry mail processing operations (approximately 15 percent). These two results, combined with the fact that manual mail processing operations make up a significant portion of volume variable costs for registry, help explain the relatively large difference between incremental and volume variable costs.

- *Money Orders:* As with registry, the TY1998(AR) incremental costs for money orders are significantly above volume variable costs (approximately 35.45

percent higher). This result can (in part) be attributed to the relatively large specific fixed costs associated with money orders stemming from the Postal Service's Special Money Order Division located in St. Louis. It is my understanding that this facility serves as the clearing house for all money order business, and its cost are considered specific fixed. These costs totaled approximately $4 million in BY1996. Furthermore, a significant portion of window service costs are considered specific-fixed to money orders (approximately $29.5 million in BY1996).

- *Accountables*: Several of the "accountables" categories within special services exhibit the opposite result – volume variable costs are actually greater than incremental costs. For example, TY1998(AR) incremental costs for certified, COD, insurance, and special handling categories all exhibit this relationship. These results can be attributed to the presence of decreasing returns to scale within the delivery function for accountables. Recall that in the second section of my testimony, I stated that incremental costs are generally less than volume variable costs if marginal costs are increasing. It is my understanding that the Commission found in Docket R90-1 that carrier load time generally exhibits increasing marginal costs for "accountables". Therefore, incremental costs are below volume variable costs for city carrier load time, as shown in the following table:

City Carrier Letter Route Load Costs for "Accountables"

	Volume Variable Costs BY1996	Incremental Costs BY1996
Certified	$52.7 million	$35.3 million
Insurance	$1.7 million	$1.3 million
COD	$1.1 million	$0.97 million

B. Incremental Costs for Product Groups

I have also developed incremental cost estimates for specific groups of products, which are contained in Exhibit USPS-41C. In deciding upon the specific groups to be analyzed from the myriad of possible combinations of subclasses, I was guided by the following considerations:

- *Groups that Share Operations:* As noted by Dr. Baumol in his testimony in Docket R90-1 (Tr. REM2/1040-42), "[t]he most important criterion in determining what subclass groups should be considered is whether the proposed members of a group are characterized by economies (or diseconomies) of scope and, in particular, whether their supply entails any common fixed costs."

- *Highly Competitive Groups of Products:* The penalties for cross-subsidies are most severe for highly competitive products (i.e., inappropriately discouraging efficient entry), and therefore, groups of highly competitive products should be considered.

Taking these criteria together, I chose the following groups:

- Total First-Class Mail
- Total Periodicals (Second Class)
- Total Standard A (Third Class)
- Total Standard B (Fourth Class)
- Priority / Express Mail Combined
- Regular Rate Standard A (Third Class Bulk Regular Rate Carrier Route and Other combined)

I chose the four class-level groupings because of the shared production technologies across the individual subclasses within the group. For example, individual subclasses

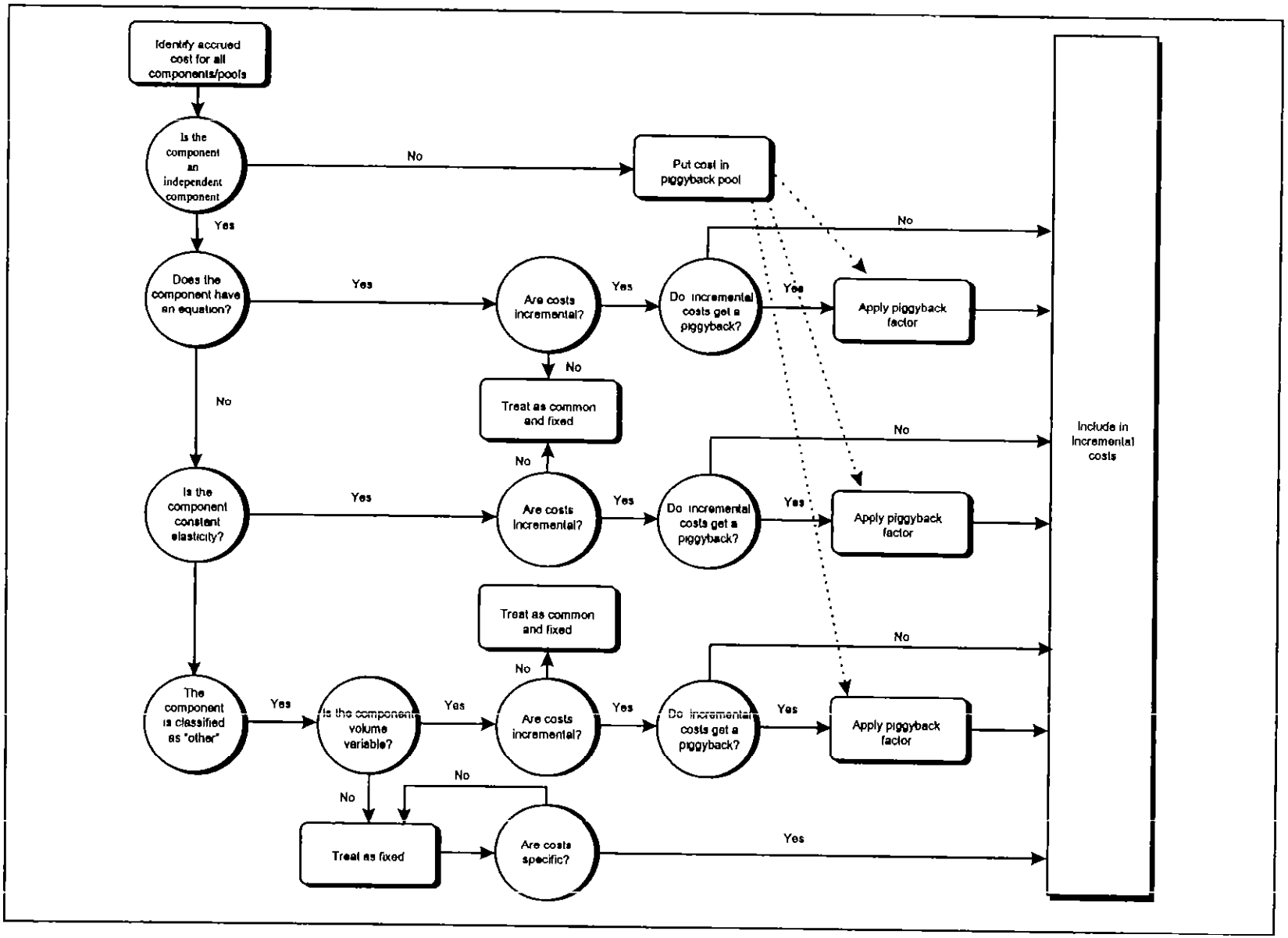
within Standard A (Third Class) share many of the same production technologies (e.g., the BMC network, mail processing operations, purchased transportation, etc.). Each of these class groupings also exhibit various degrees of competition. I chose the Priority / Express Mail group because of the shared production technologies of the two products (e.g., the Eagle Network), and because of the highly competitive market for overnight and 2-Day service. Finally, I chose the Regular Rate Standard A (Third Class Bulk Regular Rate Carrier Route and Other combined) group because of the shared production technologies (e.g., mail processing operations, purchased transportation, city carriers, etc.) and the competitive nature of the individual subclasses in the group.

Exhibit USPS-41C presents group incremental cost results for both BY1996 and TY1998(AR). I use the same ratio methodology described above to generate TY1998(AR) estimates, using group totals for volume variable costs for both the base year and the test year as the basis for the ratios.

The important point to remember when analyzing these results is that the incremental costs for each group do not merely equal the sum of incremental costs for each of the subclasses in the groups. This result stems from the fact that the movement along the marginal cost curve within each component is a result of the reduction in the *combined* volume of the subclasses, and therefore, it is inappropriate to simply add the individual subclass incremental costs together to approximate group incremental costs.

Overview of Incremental Cost Development

Exhibit USPS-41A



Estimated Incremental Costs for BY1996 and TY1998(AR) -- Subclasses

	[1] BY1996 VVC ($000s)	[2] BY1996 IC ($000s)	[3] BY1996 IC/VVC Ratio	[4] TY1998 (AR) VVC ($000s)	[5] TY1998(AR) Estimated IC ($000s)	[6] 1998 GFY Volumes (000s)	[7] TY1998(AR) VVC/Piece ($/piece)	[8] Estimated TY1998 (AR) IC/Piece ($/piece)
FIRST-CLASS MAIL								
LETTERS FLATS AND PARCELS	15,851,159	17,246,764	1 088	16,846,153	18,329,361	95,550,984	0 176	0.1918
CARDS	555,129	570,256	1.027	592,933	609,090	5,523,046	0.107	0.1103
PRIORITY MAIL	1,584,229	1,875,142	1.184	2,194,585	2,597,579	1,152,413	1.904	2.2540
EXPRESS MAIL	342,823	588,319	1 717	413,255	709,601	62,721	6 589	11.3136
MAILGRAMS	432	425	0 985	508	500	4,757	0 107	0 1052
SECOND-CLASS MAIL:								
WITHIN COUNTY	75,056	76,665	1 021	81,360	83,104	901,870	0 090	0 0921
OUTSIDE COUNTY:								
REG RATE PUB	1,448,904	1,468,913	1.014	1,578,996	1,600,802	7,147,574	0.221	0 2240
NONPROFIT PUB	317,766	322,044	1 013	331,724	336,190	2,161,077	0 153	0.1556
CLASSROOM PUB	14,874	14,976	1 007	12,783	12,850	47,452	0.269	0.2708
THIRD-CLASS MAIL:								
SINGLE PIECE RATE	188,355	188,614	1 001	-	-	-	-	-
BULK RATE-REG: CR	1,821,927	1,902,749	1.044	1,885,382	1,969,019	28,686,161	0.066	0.0686
BULK RATE-REG: OTHER	4,164,366	4,254,028	1.022	5,192,942	5,304,750	37,627,555	0.138	0.1410
BULK RATE NON-PROFIT: CR	136,575	137,386	1.006	125,122	125,865	2,571,283	0.049	0.0490
BULK RATE NON-PROFIT: OTHER	969,720	983,326	1.014	1,107,575	1,123,115	10,550,968	0.105	0.1064
FOURTH-CLASS MAIL:								
PARCELS ZONE RATE	694,997	701,986	1 010	761,146	768,800	234,660	3 244	3.2762
BOUND PRINTED MATTER	285,041	286,224	1 004	346,168	347,604	574,742	0.602	0.6048
SPECIAL 4TH-CLASS RATE	226,526	227,681	1 005	256,914	258,224	200,511	1 281	1.2878
LIBRARY RATE	47,835	47,844	1 000	49,111	49,120	28,728	1 710	1 7098
U S. POSTAL SERVICE	196,097	197,053	1.005	-	-	-	-	-
FREE MAIL---BLIND & HANDICAPPED & SERVICEMEN	26,406	26,450	1.002	31,780	31,833	56,390	0 564	0.5645
INTERNATIONAL MAIL	1,158,518	1,186,234	1.024	1,207,118	1,235,997	1,008,682	1.199	1.2278
SPECIAL SERVICES:								
REGISTRY	83,098	134,086	1 614	76,778	123,888	14,288	5.374	8 6708
CERTIFIED	283,016	256,660	0.914	326,040	297,982	292,720	1.114	1.0180
INSURANCE	36,296	35,661	0.983	48,287	47,442	30,600	1 578	1.5504
COD	19,683	19,479	0 990	16,988	16,812	3,886	4 372	4.3262
SPECIAL DELIVERY	3,494	3,493	1 000	-	-	-	-	-
MONEY ORDERS	122,986	166,580	1.354	147,365	199,601	236,570	0 623	0 8437
STAMPED ENVELOPES	10,930	10,930	1.000	12,308	12,308	460,000	0 027	0.0268
SPECIAL HANDLING	1,136	1,135	0.999	1,283	1,282	-	-	-
POST OFFICE BOX	529,560	529,575	1.000	595,854	595,871	15,081	39 510	39 5114
OTHER	146,217	148,815	1.018	213,424	217,216	-	-	-

Column [1]: Alexandrovich WP-B
Column [2]: Takis WP Section IV
Column [3]: Column 2 / Column 1
Column [4]: Patelunas WP E, Table D
Column [5]: Column 3 * Column 4
Column [6]: Exhibit USPS-6A
Column [7]: Column 4 / Column 6
Column [8]: Column 5 / Column 6

Estimated Incremental Costs for BY1996 and TY1998(AR) -- Groups

		[1] BY1996 VVC ($000s)	[2] BY1996 IC ($000s)	[3] BY1996 IC/VVC Ratio	[4] TY1998 (AR) VVC ($000s)	[5] TY1998(AR) Estimated IC ($000s)
TOTAL FIRST	1/	16,406,288	17,938,068	1.093	17,439,086	19,067,294
TOTAL SECOND	2/	1,856,600	1,886,949	1.016	2,004,843	2,037,615
TOTAL THIRD	3/	7,280,943	7,682,231	1.055	8,311,021	8,769,081
TOTAL FOURTH	4/	1,254,399	1,280,388	1.021	1,413,339	1,442,621
PRIORITY/EXPRESS	5/	1,926,852	2,467,375	1.281	2,607,840	3,339,395
THIRD BULK REG/BULK CR	6/	5,986,293	6,236,372	1.042	7,078,324	7,374,023

Row 1/: TOTAL FIRST refers to the grouping of products including First-Class letters, flats, and parcels and First-Class cards

Row 2/: TOTAL SECOND refers to the grouping of products including second-class within county, outside county regular rate, nonprofit, and classroom.

Row 3/: TOTAL THIRD refers to the grouping of products including third-class single piece, bulk regular carrier route, bulk regular other, bulk nonprofit carrier route, and bulk nonprofit other.

Row 4/: TOTAL FOURTH refers to the grouping of products including fourth-class zone rate parcels, bound printed matter, special rate, and library rate.

Row 5/: PRIORITY/EXPRESS refers to the grouping of products including Priority Mail and Express Mail.

Row 6/: THIRD BULK REG/BULK CR refers to the grouping of products including third-class bulk regular carrier route and bulk regular other

Column [1]: Exhibit USPS-41B, column 1

Column [2]: Takis WP Section IV

Column [3]: *Column 2 / Column 1*

Column [4]: Exhibit USPS-41B, column 4

Column [5]: Column 3 * Column 4