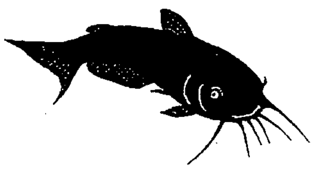
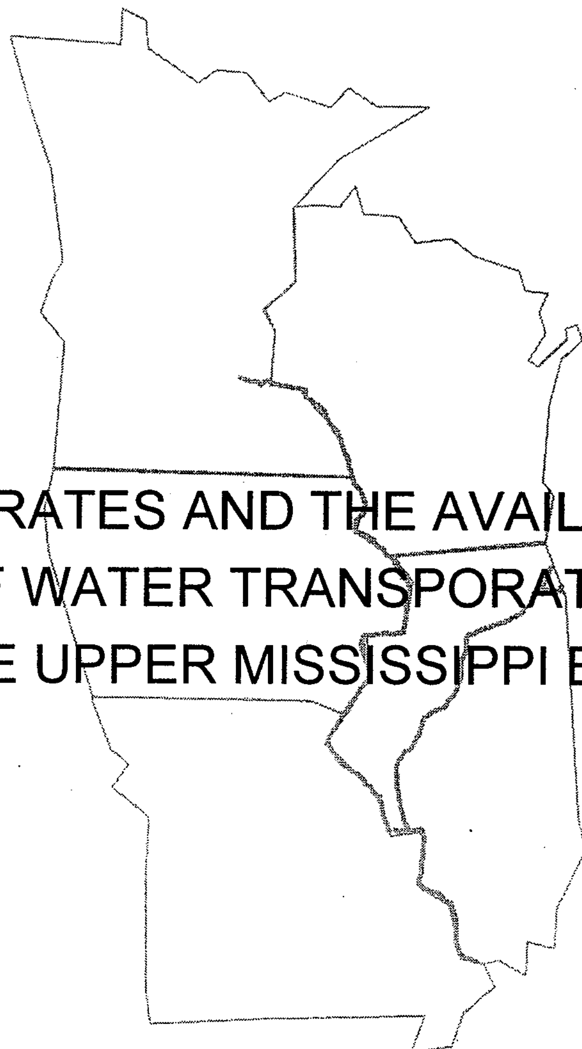
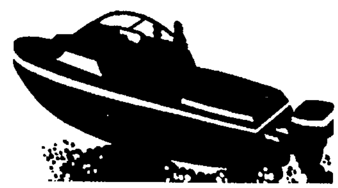
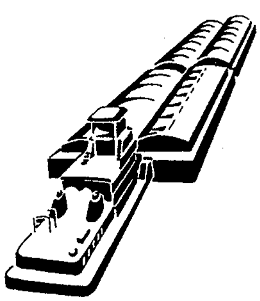
Upper Mississippi River - Illinois Waterway System Navigation Study







RAIL RATES AND THE AVAILABILITY OF WATER TRANSPORATION: THE UPPER MISSISSIPPI BASIN



INTERIM REPORT

September 1997

US Army Corps
of Engineers

Rock Island District
St. Louis District
St. Paul District

RAIL RATES AND THE AVAILABILITY OF WATER TRANSPORTATION: THE UPPER MISSISSIPPI BASIN

Revised
June, 1996

Prepared for the
Tennessee Valley Authority
and the U.S. Army Corps of Engineers

Executive Summary

The availability of commercial navigation throughout the upper Mississippi basin has a variety of economic impacts both within that region and across the nation as a whole. In addition to generating incomes for those who provide these services, barge transportation is the mode of choice for thousands of shippers who move in excess of 100 million tons of bulk commodities over this waterway each year. The direct savings to shippers stemming from the availability of barge transportation are significant. Because the dollar value of these benefits is so great, and because these benefits are generally perceived to represent direct efficiency gains, it is this type of saving which usually serves as the focus of any economic assessment of upper Mississippi River navigation.

Nonetheless, both anecdotal and empirical evidence suggests that the economic impacts of upper Mississippi River navigation may extend beyond those groups who directly provide or purchase barge transportation. To the contrary, the continued availability of water transport appears to have a significant impact on the pricing behavior of other surface transportation modes - at least when these modes are reasonably close to the river. In particular, there is a large body of economic literature which suggests that available barge transportation effectively constrains railroad pricing for the transportation of commodities that are appropriately moved by barge. These barge-constrained rail prices have come to be called "water-compelled" rates. Because these lower rates tend to represent a *transfer* of welfare from one group of economic agents to another, rather than a fundamental efficiency gain, they are often given only minimal weight in policy decisions. Nonetheless, the magnitude of these transfers is estimated to exceed one billion dollars annually, so that an evaluation of the water-compelled rate effects of upper Mississippi River navigation is essential to any policy discussion which may impact the availability or pricing of navigation along this waterway.

In developing an empirical methodology for identifying and measuring water-compelled railroad rates, there are a number of issues that must be considered on a commodity-by-commodity basis. Is the commodity in question appropriately transported by barge or are there commodity or shipment characteristics which preclude the use of water transportation? Does (or could) this commodity originate or terminate in markets which are served by both barge and railroad transportation? Does the good in question have close substitutes which are available at alternate origins or destinations both on and off the river? Apart from any barge influence, do individual rail carriers have the market power necessary to effectively manipulate prices?

Through a preliminary treatment of these questions, we selected twenty-five broadly defined commodity groupings to serve as the focus of our investigation of "water-compelled" railroad rates on the upper Mississippi. Data were collected, cleaned, and transformed to provide the base of information necessary to statistically estimate pricing patterns for railroad movements from, to, and within, this region. The preliminary set of commodities included a wide range of agricultural outputs, forest products, chemicals and petroleum products, primary and secondary metals, and scrap materials. A full list is provided in Table 3.1. For some of these commodities, the data describing rail movements was insufficient to support statistical inference. For others (particularly heavy petroleum products), available barge transportation is wholly dominant, so that no true competitive relationship could be discerned.[1] Likewise, in some cases, the availability of water transport appears to exercise no impact on railroad pricing practices. In the final analysis, we identify fourteen commodities for which upper Mississippi River navigation yields significant water-compelled effects on rail road rates. A list of these commodities and a summary of the water-compelled impacts is provided in Table ES.1 below.

[1] Analogously, we observed pipe-line dominance in the movement of some commodities such as gasoline and anhydrous ammonia which precluded any effective rail-barge competition.

Table ES.1

Commodity	*STCC*	*Effective Range at Origin*	*Effective Range at Destination*	*Affected Railroad Tonnage (in millions)*	*Regional Rail Tonnage (in millions)*	*Total U.S. Rail Tonnage (in millions)*	*Mean Revenue per Ton-Mile Transfer (in cents)*	*Total Dollar Value of Water Competition (in millions)*	*Annual Class I Railroad Revenues (in millions)*
Corn	1132	50 miles	105 miles	30.9	34.8	63.4	1.154	$113.6	$915
Wheat	1137	180 miles	120 miles	18.4	20.5	51.8	2.007	$189.8	$834
Soybeans	1144	105 miles	40 miles	8.4	9.3	17.3	1.012	$21.9	$196
Coal	11212	n/a	10 miles[1]	59.6	261.0	602.4	0.288	$506.8	$6,944
Lime Stone	14219	40 miles	55 miles	4.3	5.4	51.0	0.695	$3.8	$260
Soybean Products	20923	60 miles	60 miles	7.2	8.6	13.9	1.203	$31.9	$194
Potash	28125	20 miles	n/a	5.6	7.1	12.3	2.069	$7.4	$365
Urea	28181	40 miles	40 miles	2.0	2.2	6.8	1.236	$10.3	$235
Sup. Phosphates	28712	35 miles	35 miles	1.8	2.9	12.1	1.331	$11.2	$171
Liquid Fertilizer	28713	n/a	130 miles	1.0	1.1	3.6	2.059	$8.0	$64
Dry Fertilizer	28714	80 miles	100 miles	1.1	1.1	3.2	0.611	$1.0	$72
I&S Plate I	33121	70 miles	20 miles	4.2	4.3	16.0	3.048	$36.3	$231
I&S Plate II	33123	65 miles	65 miles	3.7	3.9	10.3	2.700	$47.0	$228
I&S Scrap	40211	20 miles	20 miles	4.1	6.1	20.4	2.911	$37.7	$289
MEANS		**63.75 miles**	**61.54 miles**				**1.59**		
TOTALS				**152.3**	**368.3**	**884.5**		**$1,065.8**	**$10,998**

[1] The analysis identifies two distinct destination distances as important. The first of these is ten miles from the nearest waterway. The second significant distance is at 85 miles. See Section 4.2 for a full discussion.

The availability of barge transportation exercises its most powerful effect on rail rates when both the shipment origin and destination are located at or very near the waterway. Because the cost of delivery escalates as the origin or destination distance to water increases, the effects of barge transportation on available rail rates declines until finally, the impact of available navigation is exhausted. However, for those shippers located within the effective range of the river, available barge transportation results in a reduction in rates and a direct transfer of economic welfare from rail carriers to rail shippers. Consider, as an example, the case of soybeans. Table ES.1 indicates available water transportation constrains railroad rates anytime the shipment origin is within 105 miles of the nearest available waterway or the shipment destination is within 40 miles of a navigation resource. On average, for those soybean shippers located within this range, available barge transportation reduces the per ton-mile railroad rates by a little more than one cent. Within the period of investigation (1992), there were nearly 8.4 million tons of soybeans shipped by rail to, from, or within the region affected by upper Mississippi River navigation and the impact of this navigation alternative was a $21.9 million reduction in railroad shipping charges.

Clearly, the water-compelled impacts for the movement of coal into and within the upper Mississippi basin dominate the results reported in Table ES.1. The overall impact of available navigation on railroad rates averages only a little more that one quarter cent per ton-mile and the geographic influence of available upper Mississippi navigation is limited to only ten miles. Nonetheless, the large quantity of coal moving to destinations which are within this ten mile proximity combined with relatively long shipment distances resulted in savings of over $500 million during the period of investigation.. Apart from featuring a significant navigation resource, the upper Mississippi basin is also the region in which eastern and western rail carriers compete most vigorously for the delivery of coal. Critics may, therefore, attempt to attribute the pattern of observed rail rates to the fierce intramodal competition which exists within this region. However, as explained in Section 3 and Appendix A.1, the specified model explicitly accounts for the important effects of competition. Even so, there is still strong evidence of water-compelled rate effects for the railroad movement of coal

Available barge transportation also dampens railroad rates for the movement of a number of farm products. Here, rates for the movement of wheat are the most greatly affected. Estimates indicate that available water transportation resulted in savings of more than $189 million to wheat shippers in 1992. While still significant, the water-compelled effects on rates for the movement of corn, soybeans, and soybean products are considerably smaller. In total, the availability of water transportation is estimated to have reduced shipper payments for the movement of these four commodities by more than $357 million during the period of investigation.

Because of the symbiotic nature of agricultural production and fertilizer distribution, it is not surprising that available water transportation also significantly affects railroad rates for the movement of a number of fertilizers and fertilizer materials. Water-compelled effects for a number of fertilizer products extend to a distance of between 20 and 100 miles from the river and, together, generate reductions in rail rates which totaled nearly $38 million in 1992. However, markets for urea and other nitrogen sources are extremely complicated and extremely competitive, so that barge-rail interactions do not, by themselves, define the competitive environment for these products.

In addition to coal, farm products, and fertilizers, our research indicates water-compelled rate effects for four additional commodities including limestone, two classes of primary iron and steel products, and scrap metal. It is also likely that modest water-compelled effects exist for the movement of other commodities within markets which are too isolated to support sound statistical inference. It is impossible to detect and document these effects without a comprehensive and exhaustive examination of each of these individual markets. Nonetheless, the research contained within this study identifies the most prominent areas in which upper Mississippi barge-rail competition effectively lowers observed railroad rates. It identifies the geographical extent of this competition and yields estimates of the economic transfers which result therefrom.

1. Introduction and Motivation

Commercial navigation on the upper reaches of the Mississippi River extends 857 miles from Minnesota's Twin Cities to the river's confluence with the Ohio at Cairo, Illinois. Each year, thousands of barges loaded with over 100 million tons of bulk commodities are moved to, from or within the upper Mississippi River basin.[1] The impact of this navigation resource is multifaceted and pronounced. The barge industry, on the Mississippi as a whole, directly employs thousands of individuals, while many thousands more are employed in servicing barge operations. Consequently, the barge industry adds millions of dollars in commerce to local and regional economies throughout the upper Mississippi Basin.

Far more important, from a national standpoint, is the contribution of upper Mississippi River navigation to aggregate national economic development (NED) benefits. For thousands of commercial shippers, the combined terminal, transfer, and line-haul cost associated with routings which utilize barge transportation represents the best or least cost alternative. In the absence of upper Mississippi River navigation, these shippers could expect to expend hundreds of millions of additional dollars to acquire substitute transportation services or, in the extreme, relocate to origins or destination which are served by another navigable waterway.[2] Generally, these navigation related savings are assumed to stem from the inherent cost advantage enjoyed by barge transportation in certain specific markets. Therefore, these savings represent legitimate additions to aggregate economic welfare which would be unavailable in the absence of this commercial navigation.

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[1] This figure include movements which originate or terminate on the Missouri and Illinois Rivers, the upper Mississippi's two most prominent tributaries.

[2] Preliminary estimates indicate that available barge transportation on the upper Mississippi River system may result in direct user savings approaching $800 million annually.

Many of the capital structures which facilitate navigation on the upper Mississippi River are approaching the end of their projected usefulness. Moreover, many of these structures are incompatible with the barge sizes and tow configurations that are in evidence on other segments of the inland waterway system. Consequently, transportation policy analysts at all levels of government are in the process of evaluating the potential benefits and costs of modifying or replacing some number of these structures. Very clearly, this analysis must consider the national economic development benefits associated with any changes in the navigational capacity of the upper Mississippi. However, the deregulation of the railroad industry and the continually emerging competitive interdependence of available navigation and railroad rates means that structural changes to the capacity of the upper Mississippi may now affect a much larger group of shippers. Both empirical and anecdotal evidence suggests that available barge transportation effectively constrains the exercise of market power by rail carriers when extant rail-rail competition may, otherwise, be insufficient to do so.[3] These "water-compelled" rail rates can confer significant benefits to railroad shippers and impose costs (in the form of lost economic profits) on rail carriers. This dramatically amplifies the potential regional impacts of any policy decision regarding the rehabilitation or reconstruction of upper Mississippi River navigation structures. Accordingly, the competitive impacts of all policy alternatives which might enhance or diminish the viability of upper Mississippi River navigation should be considered.

While academic economists have been quick to identify the competitive relationship between rail and barge that has emerged over the past two decades, there have been only scant attempts to quantify the value of barge competition on the various components of the inland waterway system. In 1990, the Tennessee Valley Authority (TVA) contracted with the Center for Business and Economic Research at the University of Tennessee for a study designed to shed light upon, if not fully resolve, the many issues inherent in the topic of water-compelled rail rates. The UT-TVA study successfully

[3] See MacDonald (1987, 1989), Burton (1993), and Burton and Wilson (1995).

identified measurable water-compelled effects for three broadly defined commodity groups which are directly attributable to the availability of commercial navigation on the Missouri River.

The TVA-UT results are entirely consistent with a variety of more general estimates which have appeared in both academic and non-academic publications. Nonetheless, the constraints inherent in this early work caused it to come under rather harsh criticism. More recently, TVA has reformulated this Missouri River analysis to accommodate superior data and a more comprehensive model specification. In doing so, each of the substantive criticisms of the initial study have been addressed. Again, the results are qualitatively consistent with earlier estimates. However, the degree of detail and accuracy is substantially improved.

As the Corps of Engineers studies the potential impacts of lock replacement or rehabilitation on the upper Mississippi, it provides a new and, potentially, much richer context in which to re-examine the competitive relationship between railroad and barge transportation. Many of the techniques and data sources evident in the more recent Missouri River study have been included in this work. At the same time, the ability to consider a broader range of commodities and the availability of more advanced geographic data, have made it possible to incorporate additional refinements in the model specification and analysis which follows. In Section 2, we review the emergence of water compelled railroad rates as a source of Regional Economic Development (RED) benefits. Section 3 provides a theoretical sketch of railroad pricing behavior, a description of data and sources, and a brief discussion of our empirical model. Estimation results are presented in Section 4, while Section 5 offers a few concluding remarks. Finally, a thorough discussion of data set constructions and a complete set of statistical results are provided in three appendixes.

2. Water Compelled Rates as a Source of RED Benefits

Prior to 1980 and the implementation of the Staggers Rail Act of that year, the Interstate Commerce Commission (ICC) maintained regulatory control over railroad rates so that any discussion of benefits owing to waterborne competition would have been largely inappropriate. Presumably, the ICC sanctioned rail rates based on some quasi-optimal departure from marginal cost pricing aimed at minimizing market distortions while providing rail carriers with an adequate rate of return on capital.[4] Under such a scenario, the increased availability of barge transportation might affect transfers of wealth from shippers in regions without a water alternative to shippers located at or near a waterway improvement. However, the absence of extant super-normal rail profits would preclude any transfer of welfare from carrier to shipper or the achievement of any aggregate welfare gains.[5]

With deregulation, the outcome outlined above is replaced by an environment in which rail carriers are presumed to act to maximize firm profits. This profit maximization dictates that railroads charge different rates for the transport of different commodities within different regions of the country if the demand elasticities in these markets are different, if there is no opportunity for arbitrage, and if the railroads have sufficient market power to affect rates at all. Assuming these conditions are met, the railroads will impose a set of often disparate prices which will maximize profits in each market and, consequentially, maximize total profits for the firm. Except to the extent that there are common costs

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[4] Burton and Wilson (1994), in fact, demonstrate that the regulatory agenda of the Interstate Commerce Commission extended far beyond simple attempts to mimic an efficient allocation of transport resources through the Commission's efforts to "equalize" the positions of competing shippers and competing transport modes.

[5] In a formal sense, the improved availability of water transportation would increase the elasticity of demand for rail services in that region. All else being equal, this greater elasticity would lead to a lower price-cost margin in the region with improved navigation. If all price-cost deviations are scaled so that railroads are allowed only the necessary rate of return, then lower water-compelled rates in one region would lead to higher rates in another region or the railroads would be left with inadequate profits.

which are affected by the volume of traffic in some combination of markets, these profit maximizing rates exist independent of each other. It follows, then, that increased waterborne competition in one market may reduce prices in that market without affecting prices in other markets which lie beyond the range of effective barge competition. The most obvious result is a loss of railroad profits in favor of rail shippers within the affected region. Further, the railroads cannot recover these lost profits by imposing higher prices elsewhere. If they possess the power to impose profitable prices increases, they would have already exercised it. Instead, improved water transportation leads to a transfer of wealth from the providers of rail transport to its consumers. This does not imply that the railroads are earning zero economic profits, even in the affected market, only that the level of rail profits is less than it would have been in the absence of the navigation improvement.

In a more generic setting, one might expect that a structural change which enhances competition between rivals and lowers price would lead to aggregate gains in economic welfare which extend beyond a simple transfer of wealth form seller to buyer. Indeed, there may be NED benefits attributable to a reduction of railroad rates for existing and new railroad customers. However, it is our judgment that the magnitude of these welfare gains is likely to be extremely small. In order for a change in rail rates to induce substantial changes in welfare it would be necessary for output quantities to vary considerably as rail prices change. Empirical evidence suggests that this is not the case. Even long-run elasticities of supply with respect to transport rates are very low and, in the short-run these elasticities probably approach zero. Because falling transport rates cannot significantly affect the quantities of agricultural inputs and outputs produced each year, the number of kilowatt hours of electricity generated, or the number of new housing starts, it is likely that such declines would lead to only marginal welfare gains for the economy as a whole.[6]

[6] If this discussion is expanded to include export markets, it is possible to demonstrate additional welfare gains from increased rail-barge competition. Still, the magnitude of these potential gains is relatively small. For a full exposition of this topic see "Water-Compelled Railroad Rates and the Calculation of Navigation Project

3. MODELS, DATA, AND ESTIMATION TECHNIQUES

3.1 THEORETICAL SETTING

Based on the discussion in the previous section, it is assumed that all rail carriers act to maximize current period profits in each of the markets in which they operate. Further, it is assumed that there are no opportunities for the resale of rail services, and that railroads possess some degree of market power, so that they may establish differential rates when customers in distinct markets have different demand elasticities. Markets are distinguished from one another by geographic location and by commodity or shipment characteristics. Though the demands of individual shippers may be discontinuous, market demand curves are assumed to be continuous and well behaved functions of railroad prices, the pricing and availability of competing transport modes, commodity characteristics, and the down-stream demand for shippers' products. Railroad costs of providing service in a particular market during some time period are assumed to be a function of the quantity of service provided, shipment characteristics, route characteristics, and factor prices. These functions are also assumed to be continuous, twice differentiable and, otherwise, well behaved. These market demand and cost functions may be combined to yield a current period profit function form which the railroad may determine the profit maximizing price. This optimal price is, of course, a function of the same variables which determine demand and costs. This relationship may be summarized by:

(1) $P_i^* = f(\mathbf{M}_i, A_i, S_i, \mathbf{R}_i, F_i)$

where P_i^* is the profit maximizing price to be charged to the i^{th} customer. $\mathbf{M}_i$ is the set of variables denoting the pricing and availability of both intramodal and intermodal transport alternatives as defined by the origin/destination pair and the commodity characteristics. A_i is the aggregate demand for the shipped commodity. S_i is a set of shipment characteristics such as shipment size, special handling

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Benefits: A Preliminary Application to the Upper Mississippi River Basin," (1994), Available from the requirements or equipment considerations. $\mathbf{R}_i$ is a set of route characteristics including the frequency of interchange or line density and $\mathbf{F}_i$ denotes a set of factor prices.[7]

3.2 Data and Estimation

The principal data source for the estimation of equation (2) is the Interstate Commerce Commission's annual Carload Waybill Sample for 1992. Unlike early efforts, this research is based on the master version of the waybill sample rather than the public use version. The data set includes all shipments which have either their origin or destination within the upper Mississippi River Basin All data remain fully disaggregated. Inter-commodity variations are captured through separate estimations for each good. All commodity groups are defined at the five digit Standard Transportation Commodity Code (STCC) level. A summary of those commodities considered by this research is included in Table 3.1below.

Table 3.1

STCC	*Commodity*	*STCC*	*Commodity*
1132	Corn	28712	Super Phosphates[8]
1137	Wheat	28713	Liquid Fertilizers
1144	Soybeans	28714	Dry Fertilizers
11212	Coal	28918	Anhydrous Ammonia
14111	Sand	29114	Lubricating Oils
14219	Limestone	29116	Asphalt
14412	Crushed Stone	29914	Petroleum Coke
20923	Soybean By-Products	32411	Portland Cement
24115	Wood Chips	33121	I&S Plate and Bar
28123	Sodium Hydroxide	33123	I&S Plate and Bar
28125	Potash	33126	I&S Pipe
28181	Urea	33311	Copper
28184	Ethyl Alcohol	40211	I&S Scrap

Tennessee Valley Authority or the U.S. Army Corps of Engineers.

[7] For a good discussion of the importance of traffic density, see Braeutigam, el al., 1985.

[8] Includes DAP, MAP, and TSP

To account for the dependent variable and the various explanatory components contained in Equation (1), the actual empirical specification includes the following variables.[9]

Table 3.2

Variable	*Description*	*Expected Sign*
RTM_i	Revenue per ton-mile for shipment *i*[10]	Dependent variable
$UCAR_i$	The number of carloads in shipment *i*	Negative
$TONS2CAR_i$	The average tonnage per carload in shipment *i*	Negative
$TDIS_i$	The total shipment distance for shipment *i*	Negative
OD2W	Straight-line origin distance to nearest navigation[11]	Positive
$TD2W_i$	Straight-line destination distance to nearest navigation	Positive
$NUMRR_i$	The number of railroads participating in shipment *i*	Positive/Negative[12]
$RRCON_i$	Carrier concentration in originating and terminating markets	Positive
$DENSITY_i$	State-to-state route density for the carrier or carrier combination responsible for shipment *i*	Positive/Negative[13]
$SYSCAR_i$	Zero/one dummy variable assuming a value of one if equipment was railroad owned, zero otherwise	Positive
QTR_{it}	Quarterly dummy variables for the first, second, and third quarters	Commodity dependent
Cd_{ij}	Zero/one dummy variables denote whether or not carrier *j* participated in shipment *I*	No a priori expectations

[9] Again, a more lengthy description of variable construction is provided in the methodological appendix to this study.

[10] To account for the use of ICC Accounting Rule Eleven and other reporting anomalies, observations for which the RTM was greater than two standard deviations above the mean were deleted from the estimation process.

[11] In fact, a number of different distance-to-water measures were included in model specifications, depending on the commodity in question.

[12] Generally, the additional costs of interchange would cause us to anticipate a positive coefficient estimate. However, to the extent that pricing coordination dampens carriers' abilities to capture profits, this variable may display a positive sign.

[13] The expected sign depends on whether the carrier and route in question are beyond or short of the optimal traffic density.

While the relationship between the origin and destination distances to water and the observed rail rate may be continuous over some range of distances, these effects may be presumed to end abruptly. At some critical distance, escalating motor carrier charges render the barge-truck alternative ineffective as a competitive influence. Therefore, beyond this distance the coefficient estimates for $OD2W_i$ and $TD2W_i$ should be zero. To account for this discontinuity, the actual estimated models embody a spline function. The specific construction of this function and process for determining the appropriate critical distances are discussed in appendix A.1. However, the process mandates the inclusion of two additional dummy variables, $OCDUM_i$ and $TCDUM_i$, Finally, we add a quadratic term on shipment distance, TDIS2, to produce the sort of gentle distance-rate taper typically hypothesized, so that the model estimated for each of the individual commodities may be written as:

$$(2)\ RTM_i = \beta_0 + \beta_1(UCAR_i) + \beta_2(TONS2CAR_i) + \beta_3(TDIS_i) + \beta_4(TDIS2_i) + \beta_5(OD2W_i) + \beta_6(TD2W_i) + \beta_7(OCDUM_i) + \beta_8(TCDUM_i) + \beta_9(NUMRR_i) + \beta_{10}(RRCON_i) + \beta_{11}(DENSITY_i) + \beta_{12}(SYSCAR_i) + \sum\delta_t QTR_{it} + \sum\gamma_j CD_{ij} + \varepsilon_i$$

Past work indicates that any heteroskedasticity generally owes to inter-commodity or inter-regional variations in the error structure. Given that we account for both factors by estimating Equation (2) separately for each commodity group and have limited our investigation to the upper Mississippi River basin, there is little need to correct for any heteroskedasticity which may be evident. Consequently, we use Ordinary Least Squares to fit Equation (2) and also rely on the OLS estimates in calculating the standard errors.[14]

[14] The reader will recall that heteroskeadisticity does not bias the OLS estimators. It merely reduces their efficiency. Indeed, adoption of asymptotically unbiased estimators will not change coefficient estimates at all.

A prudent observer might also voice concern over the potential truncation of sample data and a possible selection bias resulting therefrom. In some settings, a portion of the relevant population is unobservable. The failure to adequately account for this truncation may bias OLS estimators and lead to unsupported conclusions. If our attempt, in this analysis, was to explain observed rates for all transport modes or the modal decisions of all shippers based on a sample of railroad rates alone, then it would be necessary to test, and perhaps control, for self-selection into the population of rail shippers. However, given that our sole aim is to predict *railroad* rates, the waybill sample is, in no way, truncated, so that controls for selection bias are unnecesary.

4. Estimation Results

The majority of this section is devoted a discussion of the competitive relationship between rail rates and the availability of barge transportation, including the estimated magnitudes of water-compelled rate effects. These results are, however, preceded by a brief a general description of the estimation process and the regression results for other dependent variables. A full set of regression outputs are included in the statistical appendix to this study.

4.1 General Results

Of the twenty-five commodities originally included in this investigation, full results are reported for only fourteen. The remaining eleven commodities were excluded from the final analysis for a variety of reasons. For nine of the omitted commodities (sand, crushed stone, wood chips, sodium hydroxide, ethyl alcohol, anhydrous ammonia, cement, steel pipe, and copper) no competitive relationship between the availability of barge transportation and railroad rates was found. This is not to say that such relationships do not exist in some cases. However, there is enough unexplained variation in the data for these commodities to render the results of the distance-to-water variable(s) insignificant. In the other two cases (asphalt and petroleum coke), barge transportation was entirely dominant.[15] The 1992 waybill data contain thousands of observations for both commodities. However, when these data are refined to include only the Mississippi River basin, the number of observations drops to a level which fails to sustain sound empirical inference. The most plausible explanation for this result is that at or near navigable waterways, these two commodities are rarely shipped by rail.

Model Results are reported for the remaining fourteen commodities. In seven casees the coefficient estimate for $UCAR_i$ is statistically significant and in each of these cases the coefficient is negative as expected.[16] Moreover, those commodities for which this variable fails to attain significance are commodities which are seldom shipped under multiple car or unit train rates. Similarly, $TON2CAR_i$ is negative in and statistically significant in twelve of fourteen cases. $TDIS_i$, as might be expected is negative and statistically significant for all fourteen commodities commodities and the coefficient estimates for the quadratic term, $TDIS2_i$ are positive and significant in all but one case. Coefficient estimates for $NUMRR_i$ are positive for six of the eight cases in which this variable is statistically significant, indicating that when the number of carriers is an important determinant of rates, it is most often because of its impact on shipment cost. For six of the fourteen commodities, estimates for $RRCON_i$ are positive and significant, as expected. However, in an equal number of cases, the coefficient estimates are *negative* and significant. We can offer no explanation for this anomaly. Coefficient estimates for $DENSITY_i$ are positive for eight of the ten commodities where this

[15] Likewise, we have determined that pipe-line shipping dominates markets for the transport of light petroleum products and for anhydrous ammonia.
[16] For the purpose of this discussion, statistical significance is determined at the ten percent level.

variable attains significance, indicating that, in most cases, additional traffic density leads to higher unit costs.[17] Finally, SYSCAR is positive and significant in six of thirteen cases.[18]

4.2 WATER-COMPELLED RAIL RATE ANALYSIS

Before beginning a commodity-by-commodity summary of the estimated water compelled rate effects, it will be useful to review the hypothesized relationship between available barge competition and rail rates and to briefly discuss the general method by which aggregate water compelled rail rates impacts are calculated. Figure 4.1 isolates the hypothesized relationship between revenue per ton-mile and shipment distance to water by treating all other variables as constant. In this figure, the vertical axis denotes the unit revenue obtained by the rail carrier(s), while the horizontal axis indicates the shipment distance from the nearest navigation resource. For the purposes of this illustration, we assume that the marginal cost of rail service is equal to that of barge transportation so that rail carriers may compete effectively for all traffic. Given that barge service is competitively priced at marginal cost, the competing rail carrier is indifferent as to whether or not it accepts a shipment originating or terminating along the river. If it does so, it must also price at marginal cost, so that its economic profits on the movement would equal zero. On the other hand, as the origin or destination moves further form the navigation resource, the rail carrier can begin to increase its price. As long as the rail rate does not exceed the combined cost of transferring the shipment to and from a navigation facility

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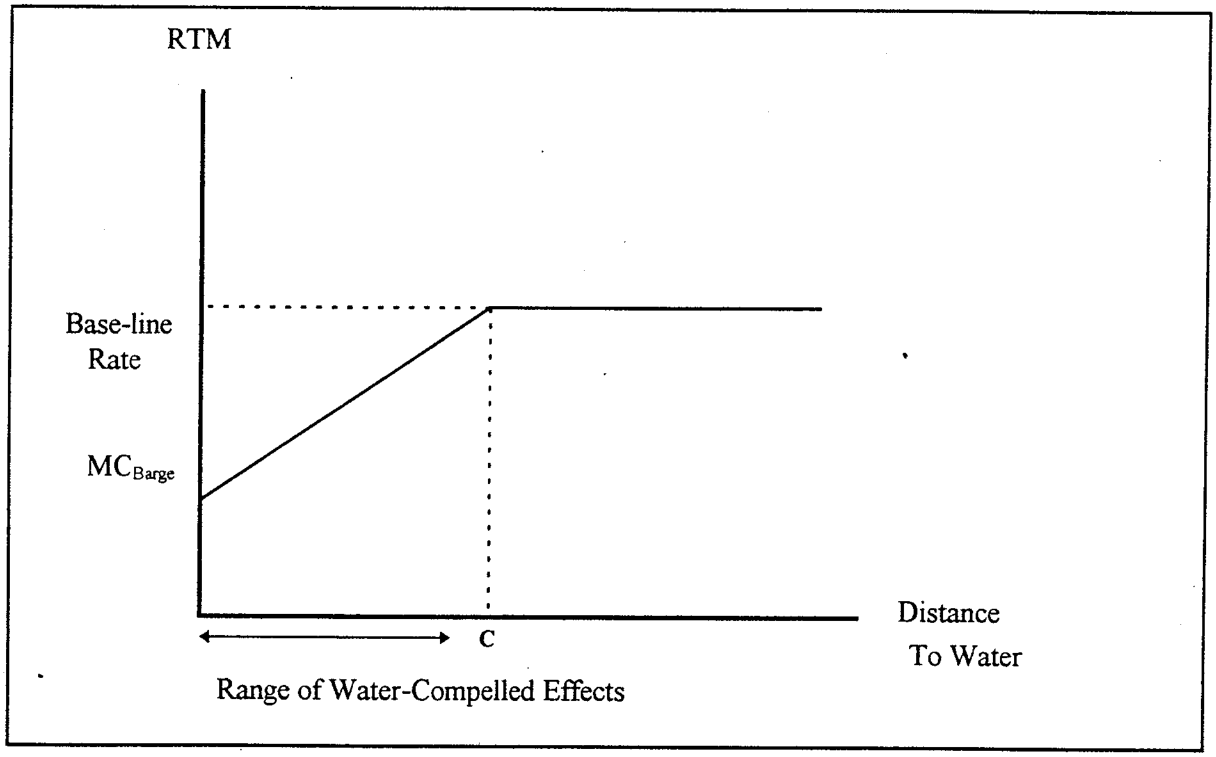
[17] The reader will recall that these estimates are based on 1992 data. We can only expect that estimates based on more recent data would yield results which further reflect diminishing railroad capacity.

[18] SYSCAR is not included in the estimated relationship for liquid fertilizers because all records for the movement of this commodity indicate the use of private cars. For three of thirteen commodities (urea, super phosphates, and dry fertilizers) the coefficient estimates for SYSCAR are negative and significant. Anecdotal information indicates that the results for these two commodities reflects a desire on the part of Class I railroads to discourage the use of private cars in fertilizer transport. They may also reflect the use of private cars as vehicles for temporary storage.

Figure 4.1



and shipping it by barge, the rail carrier can retain the traffic, while earning economic profits. Note, however, that the rate charged in this situation is still less than the profit maximizing base-line rate the railroad would charge in the absence of the water alternative. This Constrained railroad price is the water-compelled rate. Finally, some origins and destinations are sufficiently removed from the nearest waterway, so that the cost of transferring the shipment to a navigation facility and then shipping it by barge is too high to, in any way, constrain the rail rate below the full profit maximizing level. In Figure 4.1, this distance is denoted on the horizontal axis as point *C*. Beyond this point, the availability of the navigation resource is irrelevant.

In order, then, to estimate the value of water-compelled rates three pieces of information are needed. We must be able to identify the profit maximizing rate which would apply in the absence of the water resource. We must be able to predict the movement of rail rates as the origin or destination becomes more removed from the nearest waterway and we must be able to estimate the maximum distance at which available navigation has any impact on observed rail rates.

The fitted regression equations yield the information from which we may plot the discontinuous rate path depicted in Figure 4.1. Appendix A.1 fully describes the process by which this path is fitted. Essentially, however, we develop an iterative process, by which the data themselves simultaneously search out the slope of the rate path and point of discontinuity which offer the best fit. This process yields both the maximum effective range of the navigation influence and the base-line rate as a part of estimation process. Finally, to estimate the magnitude of the water compelled effect for a particular movement, we need only subtract the fitted or observed rate from the estimated base-line rate to obtain the difference. Again referring to Figure 4.1, this final step is analogous to measuring the vertical distance between the fitted rate path and the base-line rate.

STCC 1132 - Corn Table 4.1 presents summary statistics for corn movements observed within the Mississippi River basin. It also summarizes the water-compelled rate effects estimated by the procedure outlined above. The number of tons of corn moved by rail within the effective range of any navigation impact is larger than similar figures for any other agricultural commodity and is second only to coal among all commodities for which water-compelled effects are identified. However, the per ton-mile effect of available navigation is somewhat smaller than that identified for wheat and the effective ranges are somewhat shorter. Consequently, the aggregate savings to corn shippers is also somewhat smaller for corn than for wheat, totaling roughly $114 million for 1992. This result is similar to those obtained by MacDonald (1987).

Table 4.1

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	3.400 cents	Shipment Distance	659
Carloads	26.4	Participating Railroads	1.19
Shipment Tons	2,549	Origin Miles to Water	91.4
Tons per Car	96	Dest. Miles to Water	301.7
WATER COMPELLED RATE EFFECTS			
STCC 1132 - CORN		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$113.6 million	12.4%
Rail Tonnage Affected		30.9 million	48.7
Mean Water-Compelled Effect per Ton-Mile		1.154 cents	
Water Competitive Range - Origin		50 miles	
Water Competitive Range - Destination		105 miles	

STCC 1137 - Wheat Table 4.2 provides summary statistics on railroad movements of wheat in or out of the Mississippi River basin, as well as a summary of water-compelled rate effects for this commodity. The aggregate value of water-compelled rail rates to wheat shippers totals more than $189 million for the period of investigation. While the wheat tonnage is measurably less than the volume of corn which moved by rail, the per ton-mile effect and impact range are both significantly greater. This is important because, as a comparison of Tables 4.1 and 4.2 indicates, wheat generally originates considerably farther from the river than does corn.

STCC 1144 - Soybeans Both the summary statistics and estimated water-compelled rail rate effects for movement of soybeans are more similar to those for corn than for wheat. These results are summarized in table 4.3 below. The primary difference between soybeans and corn owes to the comparatively modest volume of soybean traffic over which navigation has any influence. The per ton-mile effect of available barge transportation on railroad rates is very nearly equal for the two goods and the effective water-compelled ranges (save for their transposition) are roughly equivalent, but the difference in the volume of traffic causes the aggregate effect for soybeans to be much smaller. Still, for 1992, the magnitude of these effects places soybeans fifth among the fourteen commodities for which water-compelled rail rates are identified.

Table 4.2

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	4.930 cents	Shipment Distance	630
Carloads	23.59	Participating Railroads	1.28
Shipment Tons	2289	Origin Miles to Water	216.3
Tons per Car	97.6	Dest. Miles to Water	68.7
WATER COMPELLED RATE EFFECTS			
STCC 1137 - WHEAT		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$189.8 million	22.7%
Rail Tonnage Affected		18.4 million	35.5%
Mean Water-Compelled Effect per Ton-Mile		2.01 cents	
Water Competitive Range - Origin		180	
Water Competitive Range - Destination		120	

Table 4.3

Variable	*Mean33333*	*Variable*	*Mean*
Revenue per Ton-Mile	5.480 cents	Shipment Distance	381
Carloads	23.11	Participating Railroads	1.19
Shipment Tons	2,218	Origin Miles to Water	79
Tons per Car	95.04	Dest. Miles to Water	102
WATER COMPELLED RATE EFFECTS			
STCC 1144 - SOYBEANS		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$21.9 million	11.1%
Rail Tonnage Affected		8.4 million	48.5%
Mean Water-Compelled Effect per Ton-Mile		0.1942 cents	
Water Competitive Range - Origin		105	
Water Competitive Range - Destination		40	

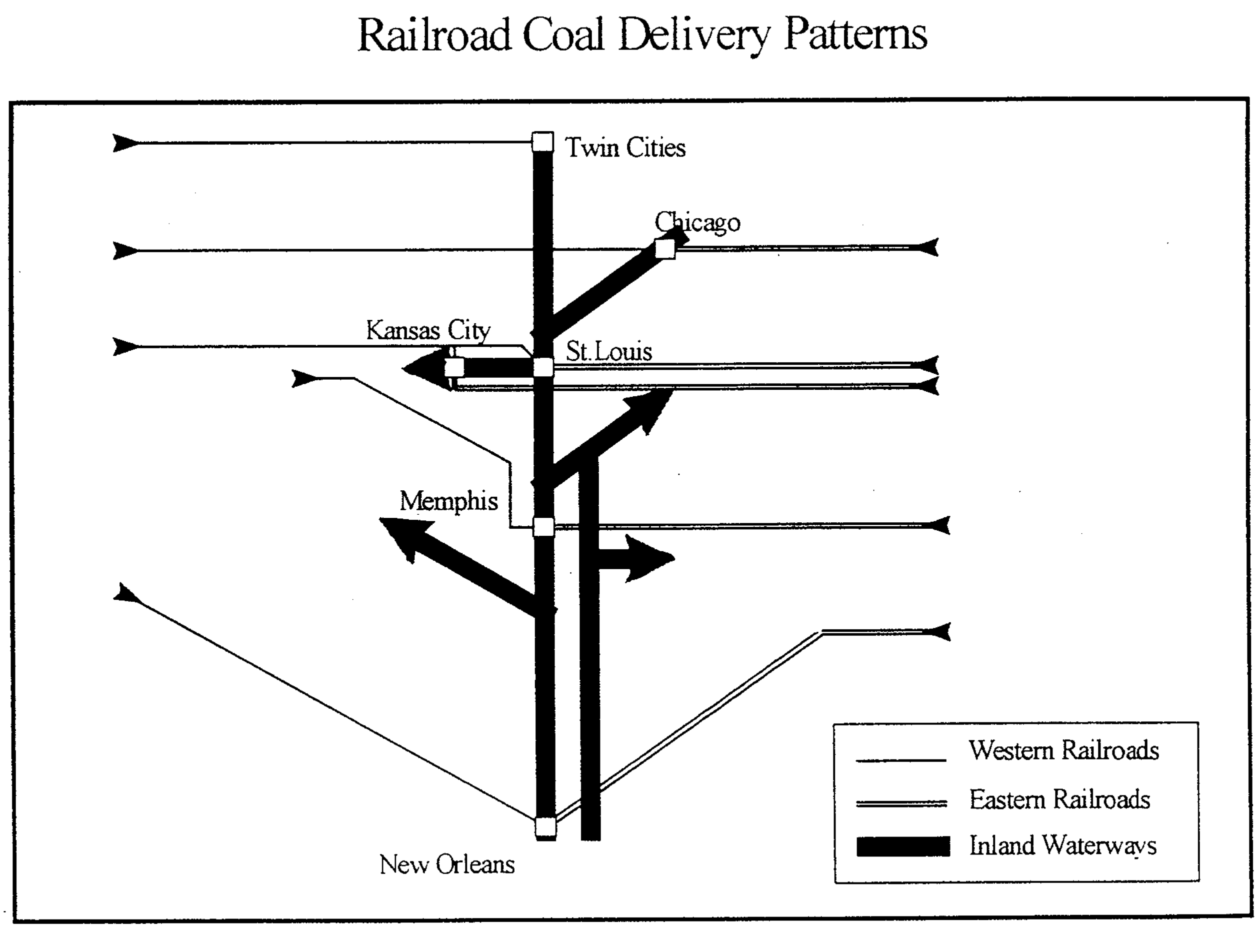
STCC 11212 - Coal The water-compelled 33rate effects for railroad movements of coal are more than two and one half times greater than the second most affected commodity. In 1992, nearly sixty million tons of coal is estimated to have moved into, out of, or within the Mississippi River basin under rates which were made lower by available barge transportation. While this affected tonnage is less than twenty-three percent of the total coal movements into the region in that year, the estimated water-compelled effects still amount to more than $500 million. These results are summarized in Table 4.4 below.

Table 4.4

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	3.3395 cents	Shipment Distance	565
Carloads	68.67	Participating Railroads	1.39
Shipment Tons	6974	Origin Miles to Water	236
Tons per Car	99.01	Dest. Miles to Water	112
WATER COMPELLED RATE EFFECTS			
STCC 11212- COAL		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$518 million	7.4%
Rail Tonnage Affected		59.6 million	9.9%
Mean Water-Compelled Effect per Ton-Mile		0.695 cents	
Water Competitive Range - Origin		n/a	
Water Competitive Range - Destination		10	

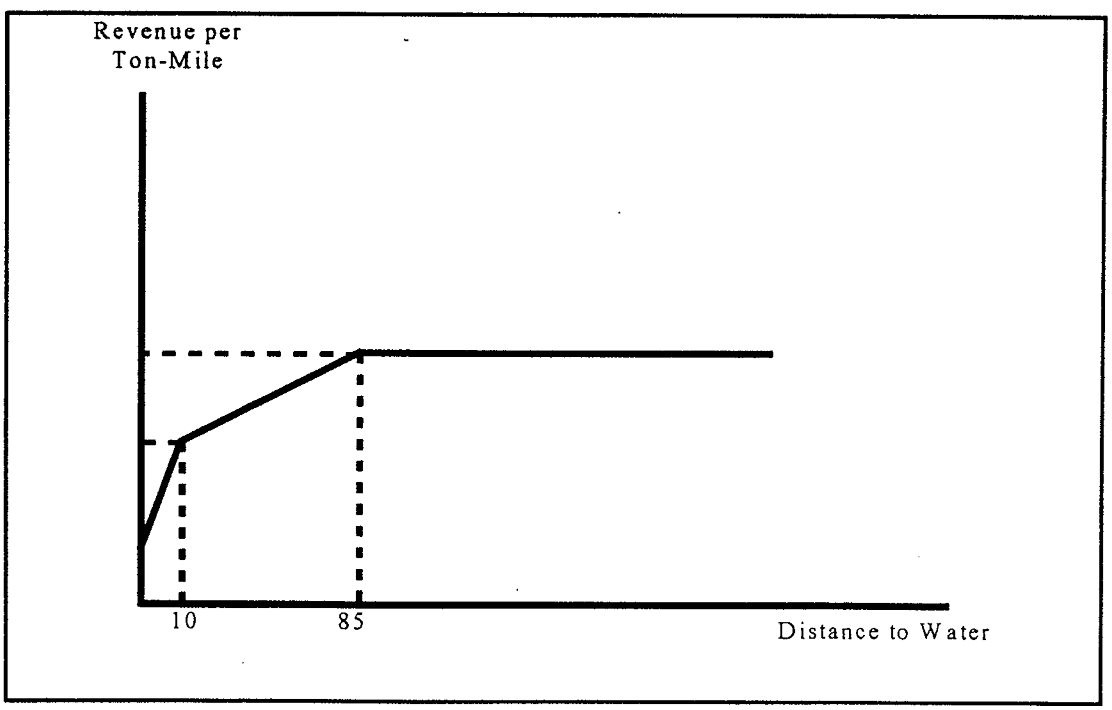
Markets for both the transportation and delivery of coal are extremely competitive and increasingly dynamic. The availability of barge transportation is only one of the factors which works to dampen railroad prices for the movement of coal in the upper Mississippi basin. As Figure 4.2 indicates, the Mississippi basin in general and upper Mississippi in particular is a region which is overlapped by both eastern and western rail carriers. Therefore, it is a region in which eastern coal from Pennsylvania, West Virginia, and Kentucky competes head to head with western coal from the Powder River Basin of Wyoming and Montana. The model from which the water-compelled effects are

Figure 4.2



estimated accounts for intramodal rail competition by including $RRCON_i$ within the specification. The estimation results suggest that increased participation by greater numbers of more equally positioned railroads contributes significantly to lower railroad rates for the movement of coal. This is precisely the result of the convergence of eastern and western railroads in the upper Mississippi basin. Nonetheless, initial estimates suggested that water-compelled rate effects extend up to a distance of 85 miles from the waterway. Given that coal cannot be effectively trucked in volume over such a distance, it seemed that the model still confused the effects of intramodal competition with the intermodal competition provided by barge. In order to further distinguish between these two effects, we introduced a second discontinuity into the models specification and, again, allowed the iterative process to search out the best fit. The results of this process are illustrated in Figure 4.3 below. As this figure and the supporting empirical results indicate, within an 85 mile range of the upper Mississippi River, eastern and western railroads compete vigorously for the delivery of coal. However, the resulting rates should not be attributed to the availability of water transportation. Nonetheless, within a range of ten mile's from the upper Mississippi, rail rates fall even faster. This second discontinuity and the savings it represents are directly correlated with the proximity of coal customers to navigable waterways.

Figure 4.3



There is one final issue which must be resolved. The relation between railroad rates and the availability of commercial navigation may be judged as causal only if there is no other reasonable explanation for this correlation. Because those utilities located nearest to the river are some of the larger coal burning customers, it might be argued that they receive lower rail rates because of their size and importance, not because the availability of waterborne transport. To account for this possibility, the specification for coal includes one additional variable, ANTONS which is defined as the annual coal tonnage railed to the destination county. Indeed, the coefficient estimate for this variable is negative and statistically significant, reflecting the superior bargaining position of large coal receivers. Nonetheless, the coefficient estimates for the variables denoting the availability of water remain extremely strong. Thus, we must conclude that the results reported in Table 4.4 genuinely reflect the affects available barge transportation.

STCC 14219 - Limestone In contrast to crushed stone and other non-metallic mineral commodities, rail rates for the movements of limestone within the upper Mississippi basin display an observable sensitivity to the availability of commercial navigation. These results are summarized in Table 4.5 below. The average rate differential is a little more than one half cent per ton-mile and the volume of affected tonnage is not excessive. Even so, the availability of water transportation results in a welfare transfer of nearly $4 million over the period of investigation and it is interesting to note that nearly 80% of all lime stone shipments within the region are to and from locations which fall within the effective range of barge competition.

STCC 20923 - Soybean By-Products Table 4.6 provides relevant summary statistics and water-compelled effects for the movement of soybean by-products. The magnitude of the per ton-mile water-compelled effect is very nearly the same as that which is estimated for unprocessed soybeans, so is the affected 1992 tonnage However, the range of this impact at the origin is significantly smaller. Nonetheless, the value of water-compelled impacts for rail movements of this commodity is estimated at nearly $32 million, for 1992 placing it fourth in importance among all commodities in terms of water-compelled effects

Table 4.5

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	3.729 cents	Shipment Distance	197
Carloads	14.57	Participating Railroads	1.71
Shipment Tons	1326	Origin Miles to Water	56
Tons per Car	89.52	Dest. Miles to Water	101
WATER COMPELLED RATE EFFECTS			
STCC 14219 - LIME STONE		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$3.8 million	1.4%
Rail Tonnage Affected		4.3 million	8.4%
Mean Water-Compelled Effect per Ton-Mile		1.203 cents	
Water Competitive Range - Origin		40	
Water Competitive Range - Destination		55	

Table 4.6

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	4.626 cents	Shipment Distance	561
Carloads	5.33	Participating Railroads	1.22
Shipment Tons	486	Origin Miles to Water	61
Tons per Car	88.01	Dest. Miles to Water	181
WATER COMPELLED RATE EFFECTS			
STCC 20923 - SOYBEAN BYPRODUCTS		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		31.9	16.4%
Rail Tonnage Affected		7.2 million	51.8%
Mean Water-Compelled Effect per Ton-Mile		1.203 cents	
Water Competitive Range - Origin		60	
Water Competitive Range - Destination		60	

TCC - 28125 Potash Domestic markets for both potash and urea are heavily influenced by imports from Canada. Consequently, rates for both commodities are more difficult to model.[19] Nonetheless, the model fits for both commodities are reasonably strong. Table 4.7 provides the study results for potash. The mean shipment distance and mean origin distance to water are both relatively large, reflecting the Canadian influence. The reader will note, however, that the destination distance to water is considerably shorter. When potash does move from an origin that is reasonably close to a navigation resource (20 miles), the impact on railroad rates is readily observable. Results suggest that available barge transportation results in an aggregate savings of $7.5 million over the period of investigation.

Table 4.7

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	10.40 cents	Shipment Distance	836
Carloads	3.95	Participating Railroads	2.06
Shipment Tons	387	Origin Miles to Water	140
Tons per Car	97.51	Dest. Miles to Water	52
WATER COMPELLED RATE EFFECTS			
STCC 28125 - POTASH		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$7.4 million	2.0%
Rail Tonnage Affected		5.6 million	45.5%
Mean Water-Compelled Effect per Ton-Mile		2.069 cents	
Water Competitive Range - Origin		20 miles	
Water Competitive Range - Destination		n/a	

STCC 28181 - Urea Not only are markets for urea heavily influenced by Canadian production, they are also affected by the production of other nitrogen substitutes. Moreover, these market forces tend to converge in the Mississippi River basin. Consequently, changing market conditions dictate when and where railroads can exercise any degree of market power. Nonetheless estimatess suggest that rail

[19] The difficulty stems from the influence of exchange rate fluctuations and a number of Canadian practices which perturb both the demand and cost-side influences normally anticipated in a more freely operating market.

prices are strongly influenced by the availability of water transportation. Table 4.8 provides summary statistics and the water-compelled figures for this commodity. Among fertilizers and fertilizer products, urea ranks second in terms of the largest savings from available barge transportation.

Table 4.8

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	6.021 cents	Shipment Distance	799
Carloads	1.53	Participating Railroads	1.80
Shipment Tons	104	Origin Miles to Water	75
Tons per Car	89.1	Dest. Miles to Water	59
WATER COMPELLED RATE EFFECTS			
STCC 28181 - UREA		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$10.3 million	4.4%
Rail Tonnage Affected		2.0 million	29.4%
Mean Water-Compelled Effect per Ton-Mile		1.236 cents	
Water Competitive Range - Origin		40	
Water Competitive Range - Destination		40	

Table 4.9

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	6.942 cents	Shipment Distance	632
Carloads	1.36	Participating Railroads	1.45
Shipment Tons	133	Origin Miles to Water	143
Tons per Car	98.00	Dest. Miles to Water	101
WATER COMPELLED RATE EFFECTS			
STCC 28712 - SUPER PHOSPHATES		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$11.2 million	6.5%
Rail Tonnage Affected		1.8 million	14.9%
Mean Water-Compelled Effect per Ton-Mile		1.33 cents	
Water Competitive Range - Origin		35	
Water Competitive Range - Destination		35	

STCC 28712 - Super Phosphates (DAP, MAP, TSP) As with the other two major fertilizer component materials, rates for the movement of this commodity grouping also demonstrates a sensitivity to the availability of navigation. These results are presented in Table 4.9.

STCC 28713 - Liquid Fertilizer Although the quantity of liquid fertilizer shipped by rail is small relative to the quantities of other fertilizers and fertilizer products, the effective range of a waterborne transportation alternative at the destination is quite long (130 straight-line miles) Consequently, the water-compelled impacts rail rate impacts for movements of this commodity amount to more than $8 million during the period of investigation. These results, along with summary statistics are included in Table 4.10 below.

Table 4.10

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	5.1308 cents	Shipment Distance	422
Carloads	1.65	Participating Railroads	1.22
Shipment Tons	162.3	Origin Miles to Water	15
Tons per Car	97.0	Dest. Miles to Water	102
WATER COMPELLED RATE EFFECTS			
STCC 28713 - LIQUID FERTILIZERS		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$8.0 million	12.5%
Rail Tonnage Affected		1.0 million	27.8%
Mean Water-Compelled Effect per Ton-Mile		2.059 cents	
Water Competitive Range - Origin		n/a	
Water Competitive Range - Destination		130	

STCC 28714 - Dry Fertilizer The final commodity among the group of fertilizer products considered within this analysis is finished dry fertilizers. As Table 4.11 indicates, the effective water competitive range over which rail rates are affected by available barge transportation is quite large. Nonetheless, both the volume of affected material and the average impact are relatively small, so that the aggregate impact nets to a little more than $1.0 million, the least of any commodity for which a water-compelled impact was identified based on 1992 data.

Table 4.11

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	3.349	Shipment Distance	1044
Carloads	1.09	Participating Railroads	1.44
Shipment Tons	102.1	Origin Miles to Water	290
Tons per Car	93.24	Dest. Miles to Water	85
WATER COMPELLED RATE EFFECTS			
STCC 28714 - DRY FERTILIZERS		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$1.0 million	1.4%
Rail Tonnage Affected		1.1 million	34.4%
Mean Water-Compelled Effect per Ton-Mile		0.611 cents	
Water Competitive Range - Origin		80	
Water Competitive Range - Destination		100	

STCC 33121 - Iron & Steel Billets or Ingots The analysis considers two groups of primary iron and steel products. The first of these includes billets and ingots. As indicated by the results in Table 4.12, rail movements of these commodities are extremely sensitive to the availability of barge transportation. While the tonnage and effective range are similar to those for lime stone, the dollar value of the 1992 water-compelled impact for rail shipments of these steel products is more than $36 million, ten times that of lime stone.

STCC 33123 - Iron & Steel Plate The second group of iron and steel products included within the analysis includes a variety of steel plate. As in the case of the previous group of I&S products these effects are significant. They are summarized in Table 4.13 are quite pronounced.

Table 4.12

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	5.010 cents	Shipment Distance	500
Carloads	4.14	Participating Railroads	1.54
Shipment Tons	1102.1	Origin Miles to Water	66
Tons per Car	93.24	Dest. Miles to Water	23
WATER COMPELLED RATE EFFECTS			
STCC 33121 - I&S INGOTS		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$36.3 million	15.7%
Rail Tonnage Affected		4.2 million	26.2%
Mean Water-Compelled Effect per Ton-Mile		2.700	
Water Competitive Range - Origin		70	
Water Competitive Range - Destination		20	

Table 4.13

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	5.720 cents	Shipment Distance	745
Carloads	2.324	Participating Railroads	1.55
Shipment Tons	193.1	Origin Miles to Water	72
Tons per Car	75.8	Dest. Miles to Water	187
WATER COMPELLED RATE EFFECTS			
STCC 33123 - I&S PLATE		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		$47.0 million	21.1%
Rail Tonnage Affected		3.7 million	35.9%
Mean Water-Compelled Effect per Ton-Mile		2.700	
Water Competitive Range - Origin		20	
Water Competitive Range - Destination		20	

STCC 40211 - Iron and Steel Scrap The final commodity group for which significant water-compelled rail rates were detected is Iron and Steel scrap. Summary statistics for movements of this commodity and estimates of the water-compelled impact are presented in Table 4.13 below.[20] Once again, even though the average effect is rather small, the volume of effected tonnage is sufficient to produce a significant savings to shippers.

Table 4.14

Variable	*Mean*	*Variable*	*Mean*
Revenue per Ton-Mile	13.459 cents	Shipment Distance	337
Carloads	1.67	Participating Railroads	1.27
Shipment Tons	127.3	Origin Miles to Water	80
Tons per Car	75.5	Dest. Miles to Water	59
WATER COMPELLED RATE EFFECTS			
STCC 40211 - I&S SCRAP		*Upper Mississippi Water-Compelled Effects*	*Percentage of Annual National Revenue/Tonnage (for same commodity)*
Aggregate Value of Water-Compelled Effects		37.7 million	13.0%
Rail Tonnage Affected		4.1 million	20.1%
Mean Water-Compelled Effect per Ton-Mile		2.911 cents	
Water Competitive Range - Origin		20	
Water Competitive Range - Destination		20	

[20] The reader will note the unusually light loading of scrap cars. This owes to the inability to load this commodity densely into rail cars.

5. SUMMARY REMARKS

Commercial navigation on the upper reaches of the Mississippi River confers a number of benefits to a variety of constituencies. Some of these benefits represent additions to aggregate economic welfare which would be impossible in the absence of navigation. At the same time, a significant portion of the economic impacts of available barge transportation must be characterized as economic transfers rather than as efficiency gains. This latter category of impacts includes the majority of water-compelled railroad rate effects. Prior to railroad deregulation, a navigation improvement which provided cheaper barge transportation induced a transfer of income to the region with the navigation enhancement from other regions of the country. In the nearly two decades since the process of railroad deregulation began, the way in which railroad services are priced has changed significantly. At present, any policy which enhances the competitive position of navigation no longer results in these inter—regional transfers of economic well being. Instead, any decline in the levels of water-compelled rail rates results in a net transfer favoring railroad shippers at the expense of rail profits.

From a theoretical vantage, there is nothing which points to the desirability of improving one group's position by harming some other party or parties.[21] However, this same economic theory also does not suggest that such an outcome is undesirable. Generally, the discipline of economics would count such offsetting effects as a wash when judging the outcome of a proposed policy. This does not, however, imply that these income transfers are not significant to those who gain or lose through the process. To the contrary, as this study as illustrated, a policy or program which materially affects the

[21] This discussion continues to ignore the potentially minor additions to aggregate welfare which may be attributable to lower railroad rates.

availability of commercial navigation on the Mississippi River can and will redirect tens or even hundreds of millions of dollars in incomes each year. Because the potential magnitude of such effects are so great and because these outcomes may so dramatically affect the plight of those involved constituencies, we very probably should find some rational method for incorporating water-compelled railroad rate effects into the decision process.

REFERENCES

Braeutigam, Ronald R., Andrew F. Daugherty, and Mark A. Turnquist, "A Firm-Specific Analysis of Economies of Density in the U.S. Railroad Industry." *Journal of Industrial Economics*, 33:1, pp. 408-416.

Burton, Mark L., "Railroad Deregulation, Carrier Behavior, and Shipper Response: A Disaggregated Analysis," *Journal of Regulatory Economics*, 5:4(1993), pp. 417-434.

Burton, Mark L., and Wesley W. Wilson, "Equalizing Discrimination and Regulated Railroad Rates," Working Paper, University of Oregon, 1994.

Burton, Mark L., and Wesley W. Wilson, "Network Pricing and Vertical Forelosure in Railroad Markets," Working Paper, University of Oregon, 1995.

MacDonald, James M., "Competition and Rail Rates for the Shipment of Corn, soybeans, and Wheat," Rand Journal of Economics, 18:1(1987), pp. 151-163.

MacDonald, James M., "Railroad Deregulation, Innovation, and Competitive Effects of the Staggers Act on Grain Transportation," *Journal of Law and Economics*, 32:1(1989), pp. 63-96.

Wilson, Wesley W., "Market Specific Effects of Rail Deregulation," Journal of Industrial Economics, 42:1(1994), pp. 1-22.

A1. METHODOLOGICAL APPENDIX

A number of the variables used to estimate railroad pricing behavior are obtained directly from the Carload Waybill Sample and appear in the specified model without manipulation. However, a number of the relevant variables are constructed from the waybill data and/or other data sources. A precise and detailed discussion of this latter group of variable is provided below.

Distance-To-Water Measure

Obviously, the most important variable within the context of this analysis is the shipment the distance to water measure(s) included in the estimated models. From a purely theoretical vantage, both distance of a shipment's origin to the nearest navigation resource and distance to water at the destination should impact the desirability of the barge alternative. In practice, however, the relative importance of the distance to water at the origin and the distance to water at the destination is an empirical matter. In some cases, most or all origins may be at or near a navigation resource, so that it is the destination distance to water which is the most important determinant of railroad pricing. It is equally possible to encounter situations in which the terminal distance to water is unimportant relative to the origin distance to the nearest waterway.

As the text indicates, the relationship between distance to water and observed rates is discontinuous over the full range of shipment distances. Specifically, at some critical distance from the water, available navigation ceases to have any effect on rail rates. For estimation purposes, this critical distance is reflected by two dummy variables, $OCDUM_i$ and $TCDUM_i$. The value of the former variable is equal to one if the origin distance to water is less than the critical distance beyond which water has no impact and zero otherwise. Similarly, $TCDUM_i$ takes on a value of one if the destination distance to water is less than the appropriate critical distance and zero otherwise.

In order to account for a full range of possibilities, the estimation process for each commodity began with the same specification which is summarized by Equation A1 below:

$$\text{(A1)} \quad RTM_i = \delta_1 + \delta_2(OD2W_i) \times (OCDUM_i) + \delta_3(TD2W_i) \times (TCDUM_i) + \delta_4(OCDUM_i) + \delta_5(TCDUM_i) + \beta \mathbf{X} + \varepsilon_t$$

where RTM_i is the revenue per ton-mile, $OD2W_i$ is the origin distance to water, $TD2W_i$ is the destination distance to water, β is a vector of regression coefficients, and $\mathbf{X}$ is a vector of other independent variables. This specification allows for either or both of the relevant distances to water to affect the observed railroad rate.. If either combination of dummy variable and interaction term is jointly insignificant at the ten percent level, that combination was dropped from the model specification and the model was re-estimated. If available water transportation has the assumed dampening impact on railroad rates the signs for the two interaction terms are positive and the signs of the two dummy variables are negative.

In order to determine the appropriate critical distance, the model described by Equation A1 was estimated iteratively. At each iteration, the value defining each dummy variable was incremented by five miles and. When the joint probability that an interaction term and its associated dummy variable are both different from zero was maximized, that particular distance was fixed while the routine continued to increment the definition of the remaining dummy variable until the joint probability for that interaction/dummy pair was also maximized. At that point, the first pair to converge was re-estimated to verify its stability and the process was continued until a stable pair of probability maximizing distances was obtained.

The actual distances are calculated as straight-line distances from the most active business location in the county of origin/termination to a major general commodities port.[22] A summary of these port locations is contained in Table A1. Finally, because trans-shipment imposes fixed costs which must be averaged over the entire shipment distance, all distance to water measures were weighed by the total shipment distance.

Table A1.

	Mississippi River Ports	
Savage	Quincy	Vicksburg
Minneapolis - St. Paul	Alton	Baton Rouge
Winona	East St. Louis	Donaldsonville
Dubuque	St. Louis	Good Hope
Clinton	Cape Girardeau	Destrehan
Rock Island	Cairo	Westwego
Burlington	Memphis	New Orleans
Keokuk	Greenville	
	Gulf Inland Waterway Ports	
New Iberia	Houston	
	Ohio River Ports	
Paducah	Louisville	Morgantown
Evansville	Cincinnati	Pittsburgh
	Tennessee River Ports	
Gilbertsville	Decator	Chattanooga
New Johnsonville	Guntersville	Knoxville
	Tenn-Tom / Black Warrior Ports	
Aliceville	Tuscaloosa	Mobile
	Missouri River Ports	
Boonville	Blair	Brownsville
Kansas City	Nebraska City	Sioux City
Atchison	Omaha	
	Illinois Waterway Ports	
Naples	Peoria	Lemont
Havanah	La Salle	Chicago
	Arkansas River Ports	
Little Rock	Muskogee	Catoosa

[22] The most active business location within each county is defined as that city or town with the greatest number of business addresses.

Railroad Market Concentration

In past investigations, we have used a number of different measures to capture the importance of intramodal railroad competition as a determinant of observed rates.[23] In this investigation, the richness of the waybill data allowed us to construct a new measure which seems improve our ability to account for this competition. In the analysis $RRCON_{ij}$ is defined as the product of the originating carrier's market share at origin ***i*** with the delivering carrier's market share at destination *j*. This specification treats the multi-line production of railroad transportation as a vertical relationship and, as with any such vertical relationship, market power at any stage in the process is sufficient to generate higher prices.

Route Density.

In the absence of truly reliable route information it is nearly impossible to fully account for the effects of traffic density on railroad costs (and rates). For the purposes of this analysis, a density is calculated for each carrier or combination of carriers serving a particular state-to-state origin-destination pair. The value of this calculation is equal to the sum of transported tons across all commodities divided the mean distance for the carrier(s)' movements over the particular origin and destination pair. The data support the construction of an analogous measure over smaller geographic units (either BEA areas or counties), but the route structures of most carriers seem to indicate that the state-to-state measure is preferable.

[23] Previous measures included the number of carriers offering service between an a particular origin-destination pair and a Herfindahl-Hirschmann type statistic calculated over a particular market.

Car Ownership

Unlike past efforts, these estimations explicitly account for whether the equipment used in a particular movement is owned by a railroad or by the customer (or some third party). Table A2 contains the list of railroads reporting marks used to determine whether or not a particular car is a system car.

Table A2

ALS	AM	AKMD	ALM	ATSF	SFRC	BAR	BM	BN	BNFE
CBQ	CS	FWD	GN	NP	BBN	RBBQ	RBCS	RBW	SLSF
SFE	WHI	CN	BCNE	CAN	CNIS	CVC	DWC	NAR	CV
CGW	CMO	FDDM	LM	MSTL	CC	CAGY	CR	BA	BCK
CNJ	CLW	EL	ERIE	MGA	NH	NYC	PAE	PC	PRR
RDG	RR	TDC	CP	CPAA	CPI	CPT	DA	NJ	THB
CSXT	ACL	AWP	BO	CO	CRR	GA	LN	MON	NC
RFP	SAL	SBD	SCL	WA	WM	DME	DH	DHNY	DRGW
EJE	ELS	FEC	GVSR	GTW	DTI	DTS	IC	CIW	GMO
ICG	IHB	IAS	KCS	CTIE	GNA	MSRC	KYLE	MSDR	MP
ARDP	ARMH	ARNW	BKTY	CHTT	DKS	MI	MKT	MKTT	OKKT
TP	MRL	NS	NW	PWV	SA	SOU	TAG	VGN	NOKL
PAL	PPU	SRN	SLR	SSW	SOO	MILW	MNS	SP	SPFE
GMSR	SR	UP	SI	TNM	SPFE	WP	WPMW	WE	WC

Carrier Dummy Variables

In addition to the other right-hand-side variables, each estimation contained a set of zero/one dummy variables designed to indicate a specific carriers participation in the shipment. Each of these variables assumes a value of one if the particular carrier originated or terminated the shipment and zero otherwise.[24]

[24] This method fails to represent the participation of a bridge carrier which neither originates nor terminates the shipment. However, given that the mean number of carriers is significantly less than two for each of the commodities and that bridge carriers have a diminished influence over price, we do not feel this is inappropriate.

A2 DATA SET PREPARATION

The primary data source for all estimations is the Interstate Commerce Commission's annual Carload Waybill Sample, a stratified sample of between one and three percent of all rail movements. These data were cleaned, manipulated, and combined with geographic data to form the final data set from which the water compelled effects were estimated.

This appendix contains a core set of both log and output files from the various programs used to create the final data set. This set of materials is, by no means, comprehensive. It does, however, provide the information necessary to a full understanding (and potential replication) of the data used in this estimation process.

All code is designed for SAS 6.10

```
*****************************************************************
*
*    PROGRAM NAME
*    ACE9501.SAS
*
*    AUTHOR           DATE          REVISION        NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    PULLS RECORDS FROM THE 1992 MASTER WAYBILL SAMPLE AND RETAINS
*    AND RETAINS INFORMATION NECESSARY TO THE CONSTRUCTION OF ALL
*    VARIABLES FOR THE NEW WATER-COMPELLED ANALYSIS
*
*    FILES
*    WAY92A.DAT - READ ONLY
*    WAY92B.DAT - READ ONLY
*    ACE9501.SD2 - CREATED BY
*
*****************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*****************************************************************
*
* READ WAYBILL DATA;
*
*****************************************************************;

LIBNAME WAYBILL 'D:\WAYBILL\';
NOTE: Libref WAYBILL was successfully assigned as follows:
      Engine:        V610
      Physical Name: D:\WAYBILL

DATA ONE;
   INFILE 'F:WAY92A.DAT' LRECL=361;

   INPUT WAYD          7-12      UCAR        13-16
         CINT     $   17-20      UREV        54-60
         TRAN         72-72      REBL        81-81
         SRAT         82-82      REP         83-83
         RPRT         85-87      ORR         93-95
         TRR         149-151     POPC       157-162
         STRC        163-167     OWNER    $ 168-171
         LESEE    $  172-175     CTYP       181-183
         STCC        198-204     EXPN       206-208
         FLG2     $  209-209     ERR1       212-213
         ERR2        214-215     UTON       216-220
         DIS1        221-225     DIS2       226-230
         DIS3        231-235     DIS4       236-240
         DIS5        241-245     DIS6       246-250
         DIS7        251-255     DIS8       256-260
         TDIS        261-265     OST      $ 266-267
         TST      $  268-269     OBEA       270-272
         TBEA        273-275     OFIP       276-280
         TFIP        281-285     MILRT      292-296
         VCOST       297-303                       ;

    IF DIS8 NE 0 THEN NUMRR=8; ELSE
    IF DIS7 NE 0 THEN NUMRR=7; ELSE
    IF DIS6 NE 0 THEN NUMRR=6; ELSE
    IF DIS5 NE 0 THEN NUMRR=5; ELSE
    IF DIS4 NE 0 THEN NUMRR=4; ELSE
    IF DIS3 NE 0 THEN NUMRR=3; ELSE
    IF DIS2 NE 0 THEN NUMRR=2; ELSE
    NUMRR=1;
```

```
    IF OST='AL' OR TST='AL' OR
       OST='AR' OR TST='AR' OR
       OST='IA' OR TST='IA' OR
       OST='IL' OR TST='IL' OR
       OST='IN' OR TST='IN' OR
       OST='KS' OR TST='KS' OR
       OST='KY' OR TST='KY' OR
       OST='LA' OR TST='LA' OR
       OST='MN' OR TST='MN' OR
       OST='MO' OR TST='MO' OR
       OST='MS' OR TST='MS' OR
       OST='NE' OR TST='NE' OR
       OST='OH' OR TST='OH' OR
       OST='OK' OR TST='OK' OR
       OST='PA' OR TST='PA' OR
       OST='SD' OR TST='SD' OR
       OST='TN' OR TST='TN' OR
       OST='TX' OR TST='TX' OR
       OST='WI' OR TST='WI' OR
       OST='WV' OR TST='WV';

IF STCC GE 113200 AND STCC LT 113300 THEN STCC5=1132; ELSE
IF STCC GE 113700 AND STCC LT 113800 THEN STCC5=1137; ELSE
IF STCC GE 114400 AND STCC LT 114500 THEN STCC5=1144; ELSE
IF STCC GE 1121200 AND STCC LT 1121300 THEN STCC5=11212; ELSE
IF STCC GE 1411100 AND STCC LT 1411200 THEN STCC5=14111; ELSE
IF STCC GE 1421900 AND STCC LT 1422000 THEN STCC5=14219; ELSE
IF STCC GE 1441200 AND STCC LT 1441300 THEN STCC5=14412; ELSE
IF STCC GE 2092300 AND STCC LT 2092400 THEN STCC5=20923; ELSE
IF STCC GE 2411500 AND STCC LT 2411600 THEN STCC5=24115; ELSE
IF STCC GE 2812300 AND STCC LT 2812400 THEN STCC5=28123; ELSE
IF STCC GE 2812400 AND STCC LT 2812600 THEN STCC5=28125; ELSE
IF STCC GE 2818100 AND STCC LT 2818200 THEN STCC5=28181; ELSE
IF STCC GE 2818400 AND STCC LT 2818500 THEN STCC5=28184; ELSE
IF STCC GE 2871200 AND STCC LT 2871300 THEN STCC5=28712; ELSE
IF STCC GE 2871300 AND STCC LT 2871400 THEN STCC5=28713; ELSE
IF STCC GE 2871400 AND STCC LT 2871500 THEN STCC5=28714; ELSE
IF STCC GE 2891800 AND STCC LT 2891900 THEN STCC5=28918; ELSE
IF STCC GE 2911400 AND STCC LT 2911500 THEN STCC5=29114; ELSE
IF STCC GE 2911600 AND STCC LT 2911700 THEN STCC5=29116; ELSE
IF STCC GE 2991400 AND STCC LT 2991500 THEN STCC5=29914; ELSE
IF STCC GE 3241100 AND STCC LT 3241200 THEN STCC5=32411; ELSE
IF STCC GE 3312100 AND STCC LT 3312200 THEN STCC5=33121; ELSE
IF STCC GE 3312300 AND STCC LT 3312400 THEN STCC5=33123; ELSE
IF STCC GE 3315500 AND STCC LT 3315600 THEN STCC5=33155; ELSE
IF STCC GE 3331100 AND STCC LT 3331200 THEN STCC5=33311; ELSE
IF STCC GE 4021100 AND STCC LT 4021200 THEN STCC5=40211; ELSE
STCC5=99999;

IF STCC5=99999 THEN DELETE;

DROP DIS1 DIS2 DIS3 DIS4 DIS5 DIS6 DIS7 DIS8;

NOTE: The infile 'F:WAY92A.DAT' is:
      FILENAME=F:\WAY92A.DAT,
      RECFM=V,LRECL=361
NOTE: 191227 records were read from the infile 'F:WAY92A.DAT'.
      The minimum record length was 361.
      The maximum record length was 361.
NOTE: The data set WORK.ONE has 36235 observations and 33 variables.
NOTE: The DATA statement used 9 minutes 54.61 seconds.
```

```
DATA TWO;
    INFILE 'F:WAY92B.DAT' LRECL=361;

    INPUT WAYD          7-12        UCAR        13-16
          CINT     $   17-20        UREV        54-60
          TRAN         72-72        REBL        81-81
          SRAT         82-82        REP         83-83
          RPRT         85-87        ORR         93-95
          TRR         149-151       POPC       157-162
          STRC        163-167       OWNER    $ 168-171
          LESEE    $  172-175       CTYP       181-183
          STCC        198-204       EXPN       206-208
          FLG2     $  209-209       ERR1       212-213
          ERR2        214-215       UTON       216-220
          DIS1        221-225       DIS2       226-230
          DIS3        231-235       DIS4       236-240
          DIS5        241-245       DIS6       246-250
          DIS7        251-255       DIS8       256-260
          TDIS        261-265       OST      $ 266-267
          TST      $  268-269       OBEA       270-272
          TBEA        273-275       OFIP       276-280
          TFIP        281-285       MILRT      292-296
          VCOST       297-303                         ;

    IF DIS8 NE 0 THEN NUMRR=8; ELSE
    IF DIS7 NE 0 THEN NUMRR=7; ELSE
    IF DIS6 NE 0 THEN NUMRR=6; ELSE
    IF DIS5 NE 0 THEN NUMRR=5; ELSE
    IF DIS4 NE 0 THEN NUMRR=4; ELSE
    IF DIS3 NE 0 THEN NUMRR=3; ELSE
    IF DIS2 NE 0 THEN NUMRR=2; ELSE
    NUMRR=1;

    IF OST='AL' OR TST='AL' OR
       OST='AR' OR TST='AR' OR
       OST='IA' OR TST='IA' OR
       OST='IL' OR TST='IL' OR
       OST='IN' OR TST='IN' OR
       OST='KS' OR TST='KS' OR
       OST='KY' OR TST='KY' OR
       OST='LA' OR TST='LA' OR
       OST='MN' OR TST='MN' OR
       OST='MO' OR TST='MO' OR
       OST='MS' OR TST='MS' OR
       OST='NE' OR TST='NE' OR
       OST='OH' OR TST='OH' OR
       OST='OK' OR TST='OK' OR
       OST='PA' OR TST='PA' OR
       OST='SD' OR TST='SD' OR
       OST='TN' OR TST='TN' OR
       OST='TX' OR TST='TX' OR
       OST='WI' OR TST='WI' OR
       OST='WV' OR TST='WV';

IF STCC GE 113200 AND STCC LT 113300 THEN STCC5=1132; ELSE
IF STCC GE 113700 AND STCC LT 113800 THEN STCC5=1137; ELSE
IF STCC GE 114400 AND STCC LT 114500 THEN STCC5=1144; ELSE
IF STCC GE 1121200 AND STCC LT 1121300 THEN STCC5=11212; ELSE
IF STCC GE 1411100 AND STCC LT 1411200 THEN STCC5=14111; ELSE
IF STCC GE 1421900 AND STCC LT 1422000 THEN STCC5=14219; ELSE
IF STCC GE 1441200 AND STCC LT 1441300 THEN STCC5=14412; ELSE
IF STCC GE 2092300 AND STCC LT 2092400 THEN STCC5=20923; ELSE
IF STCC GE 2411500 AND STCC LT 2411600 THEN STCC5=24115; ELSE
IF STCC GE 2812300 AND STCC LT 2812400 THEN STCC5=28123; ELSE
IF STCC GE 2812400 AND STCC LT 2812600 THEN STCC5=28125; ELSE
IF STCC GE 2818100 AND STCC LT 2818200 THEN STCC5=28181; ELSE
IF STCC GE 2818400 AND STCC LT 2818500 THEN STCC5=28184; ELSE
```

```
IF STCC GE 2871200 AND STCC LT 2871300 THEN STCC5=28712; ELSE
IF STCC GE 2871300 AND STCC LT 2871400 THEN STCC5=28713; ELSE
IF STCC GE 2871400 AND STCC LT 2871500 THEN STCC5=28714; ELSE
IF STCC GE 2891800 AND STCC LT 2891900 THEN STCC5=28918; ELSE
IF STCC GE 2911400 AND STCC LT 2911500 THEN STCC5=29114; ELSE
IF STCC GE 2911600 AND STCC LT 2911700 THEN STCC5=29116; ELSE
IF STCC GE 2991400 AND STCC LT 2991500 THEN STCC5=29914; ELSE
IF STCC GE 3241100 AND STCC LT 3241200 THEN STCC5=32411; ELSE
IF STCC GE 3312100 AND STCC LT 3312200 THEN STCC5=33121; ELSE
IF STCC GE 3312300 AND STCC LT 3312400 THEN STCC5=33123; ELSE
IF STCC GE 3315500 AND STCC LT 3315600 THEN STCC5=33155; ELSE
IF STCC GE 3331100 AND STCC LT 3331200 THEN STCC5=33311; ELSE
IF STCC GE 4021100 AND STCC LT 4021200 THEN STCC5=40211; ELSE
STCC5=99999;

IF STCC5=99999 THEN DELETE;

DROP DIS1 DIS2 DIS3 DIS4 DIS5 DIS6 DIS7 DIS8;

NOTE: The infile 'F:WAY92B.DAT' is:
      FILENAME=F:\WAY92B.DAT,
      RECFM=V,LRECL=361
NOTE: 205624 records were read from the infile 'F:WAY92B.DAT'.
      The minimum record length was 361.
      The maximum record length was 361.
NOTE: The data set WORK.TWO has 38381 observations and 33 variables.
NOTE: The DATA statement used 10 minutes 37.24 seconds.
DATA THREE;
   SET ONE TWO;

   IF TRAN=1 THEN DELETE;

   TDIS=TDIS/10;
   VCOST=VCOST/EXPN;
   RTM=UREV/(TDIS*UTON);
   TON2CAR=UTON/UCAR;
   VC2TON=VCOST/UTON;

NOTE: The data set WORK.THREE has 74403 observations and 36 variables.
NOTE: The DATA statement used 2 minutes 42.57 seconds.
PROC DATASETS;
                         -----Directory-----

            Libref:        WORK
            Engine:        V610
            Physical Name: C:\SASWORK\SASWORK\#TD17087

                    #  Name   Memtype  Indexes
                    --------------------------
                    1  ONE    DATA
                    2  THREE  DATA
                    3  TWO    DATA
   DELETE ONE TWO;

NOTE: Deleting WORK.ONE (memtype=DATA).
NOTE: Deleting WORK.TWO (memtype=DATA).
NOTE: The PROCEDURE DATASETS used 0.27 seconds.
PROC SORT DATA=THREE;
   BY STCC5;

NOTE: The data set WORK.THREE has 74403 observations and 36 variables.
NOTE: The PROCEDURE SORT used 2 minutes 54.06 seconds.
PROC MEANS DATA=THREE;
   BY STCC5;
   VAR UCAR UTON TDIS UREV RTM VCOST TON2CAR NUMRR;

NOTE: The PROCEDURE MEANS used 15.26 seconds.
```

```
DATA WAYBILL.ACE9501;
   SET THREE;

RUN;
```

NOTE: The data set WAYBILL.ACE9501 has 74403 observations and 36 variables.
NOTE: The DATA statement used 1 minute 37.99 seconds.

The SAS System 1
09:23 Thursday, August 10, 1995

--- STCC5=1132 ---

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	5266	26.3894797	27.2222403	1.0000000	132.0000000
UTON	5266	2526.41	2670.55	13.0000000	20280.00
TDIS	5266	653.8446639	568.6187914	1.0000000	2698.40
UREV	5266	36157.69	50773.45	109.0000000	293088.00
RTM	5266	0.0446330	0.1228602	0.0019739	3.7829028
VCOST	5266	27201.02	41434.82	0	258291.00
TON2CAR	5266	95.2717430	14.4180049	1.0000000	312.0000000
NUMRR	5266	1.1931257	0.4826705	1.0000000	4.0000000

--- STCC5=1137 ---

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	3821	22.1271918	25.3286367	1.0000000	128.0000000
UTON	3821	2159.42	2492.75	5.0000000	12544.00
TDIS	3821	638.0354619	472.5492351	1.0000000	2596.20
UREV	3821	31421.08	38849.06	0	263520.00
RTM	3821	0.0558257	0.3175293	0	11.8367347
VCOST	3821	25238.52	36593.64	0	285226.33
TON2CAR	3821	97.0780236	10.8749260	1.2894737	134.5000000
NUMRR	3821	1.2436535	0.4854314	1.0000000	4.0000000

--- STCC5=1144 ---

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	1451	25.3818057	27.2934308	1.0000000	121.0000000
UTON	1451	2429.38	2650.61	23.0000000	11858.00
TDIS	1451	461.5629221	453.9113179	1.0000000	3412.40
UREV	1451	28749.24	42882.71	129.0000000	247800.00
RTM	1451	0.0557003	0.1789479	0.0012415	3.4900000
VCOST	1451	24486.91	37575.80	0	389462.33
TON2CAR	1451	94.9797394	11.1783640	1.6393443	133.3571429
NUMRR	1451	1.1316334	0.3599406	1.0000000	3.0000000

The SAS System 2
09:23 Thursday, August 10, 1995

STCC5=11212

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	28961	68.6867857	45.8582174	1.0000000	241.0000000
UTON	28961	6913.02	4741.83	52.0000000	26731.00
TDIS	28961	554.6270018	427.7347448	0.4000000	3019.80
UREV	28961	81654.10	76867.85	95.0000000	636330.00
RTM	28961	0.0391190	0.1418106	0.000109886	10.4687500
VCOST	28961	44133.91	44503.61	0	260529.00
TON2CAR	28961	98.5305963	8.0643304	10.0000000	143.0327869
NUMRR	28961	1.4415593	0.6911371	1.0000000	4.0000000

STCC5=14111

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	5	1.0000000	0	1.0000000	1.0000000
UTON	5	69.2000000	27.9051966	20.0000000	87.0000000
TDIS	5	1867.94	912.3439828	514.6000000	3077.00
UREV	5	2986.60	1175.33	1525.00	4353.00
RTM	5	0.0308135	0.0163311	0.0160290	0.0588229
VCOST	5	2180.81	847.6892286	931.2750000	3194.15
TON2CAR	5	69.2000000	27.9051966	20.0000000	87.0000000
NUMRR	5	1.0000000	0	1.0000000	1.0000000

STCC5=14219

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	3198	17.1366479	13.6970813	1.0000000	81.0000000
UTON	3198	1634.06	1328.42	20.0000000	7275.00
TDIS	3198	179.1705441	144.2097239	8.7000000	2799.30
UREV	3198	8519.33	8288.60	92.0000000	185895.00
RTM	3198	0.0381198	0.0335016	0.0045320	1.4245111
VCOST	3198	6454.27	5122.19	0	38600.67
TON2CAR	3198	94.6143365	10.6825004	10.0000000	152.5555556
NUMRR	3198	1.2686054	0.4844365	1.0000000	5.0000000

The SAS System 3
09:23 Thursday, August 10, 1995

STCC5=14412

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	433	12.8545035	10.9715366	1.0000000	59.0000000
UTON	433	1160.06	1023.39	23.0000000	5900.00
TDIS	433	311.3946882	256.3937148	4.4000000	1539.00
UREV	433	7161.64	6134.89	300.0000000	51067.00
RTM	433	0.0425839	0.0477624	0.0030864	0.4567980
VCOST	433	5287.18	3955.28	0	19331.25
TON2CAR	433	88.5333693	14.9576558	6.0000000	116.1363636
NUMRR	433	1.1085450	0.3114274	1.0000000	2.0000000

STCC5=20923

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	2751	4.0498001	9.2740925	1.0000000	100.0000000
UTON	2751	368.1973828	862.2944766	5.0000000	9673.00
TDIS	2751	557.9475827	505.7316466	1.0000000	2622.20
UREV	2751	5320.73	17466.52	221.0000000	231750.00
RTM	2751	0.0432719	0.2979600	0.0038989	15.6000000
VCOST	2751	4203.10	13453.41	0	158942.33
TON2CAR	2751	88.5120461	13.0963666	5.0000000	103.5882353
NUMRR	2751	1.1959288	0.5438564	1.0000000	6.0000000

STCC5=24115

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	2834	2.0201129	3.0894337	1.0000000	23.0000000
UTON	2834	135.8916725	218.3980260	7.0000000	1955.00
TDIS	2834	134.3154905	125.8700337	1.0000000	1985.80
UREV	2834	1316.06	2948.96	86.0000000	29486.00
RTM	2834	0.1365612	0.6217685	0.0159585	18.4285714
VCOST	2834	990.8970301	1405.53	0	14708.25
TON2CAR	2834	71.5751736	15.1123074	1.0000000	99.0000000
NUMRR	2834	1.4470713	0.6294796	1.0000000	4.0000000

The SAS System 4
09:23 Thursday, August 10, 1995

STCC5=28123

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	1795	1.3264624	3.3978724	1.0000000	100.0000000
UTON	1795	122.1643454	333.6689747	3.0000000	9922.00
TDIS	1795	1224.14	549.5688052	1.0000000	3391.30
UREV	1795	4785.59	13595.48	219.0000000	421600.00
RTM	1795	0.0401693	0.0772577	0.0049579	2.5252525
VCOST	1795	3033.99	9170.15	0	225779.00
TON2CAR	1795	90.9702240	22.6863226	3.0000000	128.0000000
NUMRR	1795	1.7153203	0.7182634	1.0000000	5.0000000

STCC5=28125

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	1967	5.7641078	14.9176878	1.0000000	187.0000000
UTON	1967	568.5327911	1489.16	5.0000000	18699.00
TDIS	1967	896.1913066	538.2708632	1.0000000	2845.10
UREV	1967	15453.18	39699.34	32.0000000	473279.00
RTM	1967	0.0931422	0.9109989	0.000936768	27.2000000
VCOST	1967	5259.51	18213.33	0	187606.50
TON2CAR	1967	97.3428874	12.6340985	5.0000000	131.0000000
NUMRR	1967	2.0376207	1.0209445	1.0000000	5.0000000

STCC5=28181

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	1632	1.1115196	1.1874325	1.0000000	22.0000000
UTON	1632	98.2751225	113.4550083	5.0000000	2204.00
TDIS	1632	930.9189951	652.4096908	1.0000000	3143.70
UREV	1632	3186.27	2482.46	67.0000000	37728.00
RTM	1632	0.0630667	0.1120205	0.0088481	2.2816479
VCOST	1632	1931.17	2219.44	0	60728.25
TON2CAR	1632	87.9168874	17.1947397	5.0000000	135.0000000
NUMRR	1632	1.7757353	0.7567068	1.0000000	5.0000000

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STCC5=28184

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	1124	1.2998221	1.1077160	1.0000000	10.0000000
UTON	1124	114.5951957	109.2780274	10.0000000	953.0000000
TDIS	1124	1036.96	771.3759964	1.0000000	3154.80
UREV	1124	2917.79	2160.64	131.0000000	14508.00
RTM	1124	0.0593672	0.1418763	0.0066268	2.0147059
VCOST	1124	2444.23	1961.26	0	19389.17
TON2CAR	1124	86.3003707	20.5948689	10.0000000	139.0000000
NUMRR	1124	1.6467972	0.7682354	1.0000000	5.0000000

STCC5=28712

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	1125	1.7928889	3.1004453	1.0000000	30.0000000
UTON	1125	175.4177778	302.8889512	22.0000000	2993.00
TDIS	1125	710.4411556	469.1596645	1.0000000	2372.50
UREV	1125	3863.34	9012.93	225.0000000	111854.00
RTM	1125	0.0566179	0.3162090	0.0036498	7.9696970
VCOST	1125	2791.45	6093.99	0	81282.25
TON2CAR	1125	97.9891736	5.8049052	22.0000000	130.0000000
NUMRR	1125	1.4382222	0.6234992	1.0000000	4.0000000

STCC5=28713

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	712	1.6095506	2.1600695	1.0000000	20.0000000
UTON	712	158.5702247	217.0664358	18.0000000	2006.00
TDIS	712	557.8875000	454.0732746	7.9000000	3202.90
UREV	712	2842.48	4336.23	230.0000000	30210.00
RTM	712	0.0473474	0.0415957	0.0026945	0.5129913
VCOST	712	2118.28	3480.33	0	25182.00
TON2CAR	712	97.6324339	8.8284031	18.0000000	104.0000000
NUMRR	712	1.3342697	0.5491892	1.0000000	4.0000000

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STCC5=28714

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	532	1.1278195	0.6278356	1.0000000	6.0000000
UTON	532	105.0469925	63.2313456	8.0000000	598.0000000
TDIS	532	1045.75	479.0544684	6.1000000	2587.30
UREV	532	2842.02	2595.05	122.0000000	27344.00
RTM	532	0.0338453	0.0364983	0.0054843	0.4000000
VCOST	532	2573.88	2236.53	270.6250000	22287.08
TON2CAR	532	93.2763784	19.2745561	8.0000000	104.0000000
NUMRR	532	1.5244361	0.5466597	1.0000000	4.0000000

STCC5=29114

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	694	1.0850144	0.8164826	1.0000000	11.0000000
UTON	694	78.8703170	65.5316842	7.0000000	841.0000000
TDIS	694	937.4899135	636.2031365	9.0000000	3034.50
UREV	694	2495.18	2150.78	277.0000000	23029.00
RTM	694	0.0545046	0.0976979	0.0109068	1.9932845
VCOST	694	2028.82	2148.75	0	26010.17
TON2CAR	694	72.4007816	19.6438990	7.0000000	137.0000000
NUMRR	694	1.6772334	0.7613502	1.0000000	4.0000000

STCC5=29116

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	607	2.0823723	2.1138711	1.0000000	16.0000000
UTON	607	183.9159802	186.4887060	4.0000000	1437.00
TDIS	607	644.8634267	381.1754298	6.2000000	2814.70
UREV	607	3714.50	3464.06	256.0000000	36384.00
RTM	607	0.0487389	0.1895253	0.0110590	4.6000000
VCOST	607	2706.49	2767.71	0	32465.83
TON2CAR	607	88.7211139	7.0941397	4.0000000	112.0000000
NUMRR	607	1.4019769	0.5418426	1.0000000	3.0000000

STCC5=29914

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	2276	14.4156415	16.2685269	1.0000000	95.0000000
UTON	2276	847.5676626	1067.33	22.0000000	6440.00
TDIS	2276	414.2041301	423.1951814	1.4000000	3167.00
UREV	2276	11264.56	14828.01	186.0000000	135065.00
RTM	2276	0.0771863	0.1916730	0.0143758	3.7946429
VCOST	2276	6688.47	8511.33	0	74845.33
TON2CAR	2276	56.8239637	9.2717338	22.0000000	120.5000000
NUMRR	2276	1.4072935	0.5883256	1.0000000	4.0000000

------------------------------ STCC5=32411 ------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	1914	3.7241379	5.1177635	1.0000000	59.0000000
UTON	1914	346.6551724	471.1985887	1.0000000	4972.00
TDIS	1914	371.4292581	261.8186976	39.4000000	2837.40
UREV	1914	3904.71	4604.19	305.0000000	45400.00
RTM	1914	0.0458826	0.1283913	0.0094451	5.5297398
VCOST	1914	2678.29	3107.22	0	39539.00
TON2CAR	1914	94.0609806	14.4785066	1.0000000	127.0000000
NUMRR	1914	1.4561129	0.5903978	1.0000000	4.0000000

------------------------------ STCC5=33121 ------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	3138	4.1800510	9.4595977	1.0000000	61.0000000
UTON	3138	369.6574251	863.3534600	3.0000000	5812.00
TDIS	3138	512.7407266	614.1503849	7.3000000	3088.80
UREV	3138	3596.57	6573.66	184.0000000	72760.00
RTM	3138	0.0995763	0.1290434	0.0096223	1.0466667
VCOST	3138	2174.41	3864.17	0	39822.00
TON2CAR	3138	88.2617662	8.5077513	3.0000000	128.5714286
NUMRR	3138	1.4257489	0.7445904	1.0000000	4.0000000

------------------------------ STCC5=33123 ------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	2591	1.8556542	5.5804407	1.0000000	69.0000000
UTON	2591	155.3643381	492.0705807	3.0000000	6056.00
TDIS	2591	678.0795832	616.4680705	1.0000000	3116.30
UREV	2591	2317.19	3010.05	1.0000000	62238.00
RTM	2591	0.0643069	0.2901576	0.000061017	14.0470588
VCOST	2591	1533.20	2142.25	0	27175.60
TON2CAR	2591	81.2848576	17.3247009	3.0000000	133.3333333
NUMRR	2591	1.5943651	0.6876398	1.0000000	4.0000000

------------------------------ STCC5=33155 ------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	6	1.0000000	0	1.0000000	1.0000000
UTON	6	25.5000000	19.8569887	14.0000000	65.0000000
TDIS	6	1239.37	736.4236272	494.5000000	2125.80
UREV	6	1304.00	1100.47	313.0000000	3308.00
RTM	6	0.0429481	0.0085907	0.0278480	0.0504379
VCOST	6	1000.08	692.6409985	387.5750000	2242.93
TON2CAR	6	25.5000000	19.8569887	14.0000000	65.0000000
NUMRR	6	1.3333333	0.8164966	1.0000000	3.0000000

------------------------------- STCC5=33311 -------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	492	1.6808943	1.9892278	1.0000000	24.0000000
UTON	492	157.0284553	195.9648728	16.0000000	2349.00
TDIS	492	962.2542683	618.3583894	73.7000000	2553.60
UREV	492	2972.50	3435.74	246.0000000	49466.00
RTM	492	0.0354822	0.0261588	0.0022517	0.1301340
VCOST	492	2542.06	2813.73	0	40638.75
TON2CAR	492	91.2927098	11.4597267	16.0000000	122.0000000
NUMRR	492	1.6930894	0.7173391	1.0000000	4.0000000

------------------------------- STCC5=40211 -------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
UCAR	5078	1.4476172	1.5265729	1.0000000	22.0000000
UTON	5078	107.2772745	123.2117016	1.0000000	1819.00
TDIS	5078	306.0357621	342.8559854	0.9000000	3234.90
UREV	5078	1480.50	1752.40	1.0000000	27277.00
RTM	5078	0.2412903	0.8824511	0.000040280	22.4754098
VCOST	5078	998.0065863	1043.88	0	18851.08
TON2CAR	5078	74.3945822	20.7872253	1.0000000	130.5000000
NUMRR	5078	1.2337534	0.4984780	1.0000000	5.0000000

```
*******************************************************************
*
*     PROGRAM NAME
*     ACE9502.SAS
*
*     AUTHOR            DATE          REVISION          NOTES
*     MARK BURTON    AUG 1995
*
*     PURPOSE
*
*     PULLS RECORDS FROM THE 1992 MASTER WAYBILL SAMPLE NECESSARY TO
*     CREATE THE RAILROAD CONCENTRATION VARIABLE
*     FOR THE NEW WATER-COMPELLED ANALYSIS
*
*     FILES
*     WAY92A.DAT - READ ONLY
*     WAY92B.DAT - READ ONLY
*     ACE9501.SD2 - CREATED BY
*
*******************************************************************;
 OPTIONS MISSING = '.';
 OPTIONS LS=78;
*******************************************************************
*
* READ WAYBILL DATA;
*
*******************************************************************;
LIBNAME WAYBILL 'D:\WAYBILL\';
NOTE: Libref WAYBILL was successfully assigned as follows:
      Engine:        V610
      Physical Name: D:\WAYBILL
DATA ONE;
   INFILE 'F:WAY92A.DAT' LRECL=361;
   INPUT UCAR       13-16
         ORR        93-95
         TRR       149-151
         STCC      198-204
         EXPN      206-208
         UTON      216-220
         TDIS      261-265
         OST     $ 266-267
         TST     $ 268-269;
   IF OST='AL' OR TST='AL' OR
      OST='AR' OR TST='AR' OR
      OST='IA' OR TST='IA' OR
      OST='IL' OR TST='IL' OR
      OST='IN' OR TST='IN' OR
      OST='KS' OR TST='KS' OR
      OST='KY' OR TST='KY' OR
      OST='LA' OR TST='LA' OR
      OST='MN' OR TST='MN' OR
      OST='MO' OR TST='MO' OR
      OST='MS' OR TST='MS' OR
      OST='NE' OR TST='NE' OR
      OST='OH' OR TST='OH' OR
      OST='OK' OR TST='OK' OR
      OST='PA' OR TST='PA' OR
      OST='SD' OR TST='SD' OR
      OST='TN' OR TST='TN' OR
      OST='TX' OR TST='TX' OR
      OST='WI' OR TST='WI' OR
```

```
        OST='WV' OR TST='WV';

NOTE: The infile 'F:WAY92A.DAT' is:
      FILENAME=F:\WAY92A.DAT,
      RECFM=V,LRECL=361
NOTE: 191227 records were read from the infile 'F:WAY92A.DAT'.
      The minimum record length was 361.
      The maximum record length was 361.
NOTE: The data set WORK.ONE has 149694 observations and 9 variables.
NOTE: The DATA statement used 9 minutes 17.76 seconds.
DATA TWO;
   INFILE 'F:WAY92B.DAT' LRECL=361;

   INPUT UCAR        13-16
         ORR         93-95
         TRR        149-151
         STCC       198-204
         EXPN       206-208
         UTON       216-220
         TDIS       261-265
         OST      $ 266-267
         TST      $ 268-269;

   IF OST='AL' OR TST='AL' OR
      OST='AR' OR TST='AR' OR
      OST='IA' OR TST='IA' OR
      OST='IL' OR TST='IL' OR
      OST='IN' OR TST='IN' OR
      OST='KS' OR TST='KS' OR
      OST='KY' OR TST='KY' OR
      OST='LA' OR TST='LA' OR
      OST='MN' OR TST='MN' OR
      OST='MO' OR TST='MO' OR
      OST='MS' OR TST='MS' OR
      OST='NE' OR TST='NE' OR
      OST='OH' OR TST='OH' OR
      OST='OK' OR TST='OK' OR
      OST='PA' OR TST='PA' OR
      OST='SD' OR TST='SD' OR
      OST='TN' OR TST='TN' OR
      OST='TX' OR TST='TX' OR
      OST='WI' OR TST='WI' OR
      OST='WV' OR TST='WV';

NOTE: The infile 'F:WAY92B.DAT' is:
      FILENAME=F:\WAY92B.DAT,
      RECFM=V,LRECL=361
NOTE: 205624 records were read from the infile 'F:WAY92B.DAT'.
      The minimum record length was 361.
      The maximum record length was 361.
NOTE: The data set WORK.TWO has 162377 observations and 9 variables.
NOTE: The DATA statement used 11 minutes 32.32 seconds.
DATA THREE;
   SET ONE TWO;

   TDIS=TDIS/10;
   XCAR=UCAR*EXPN;

NOTE: The data set WORK.THREE has 312071 observations and 10 variables.
NOTE: The DATA statement used 4 minutes 41.17 seconds.
PROC DATASETS;
                              -----Directory-----

                  Libref:         WORK
                  Engine:         V610
                  Physical Name:  C:\SASWORK\SASWORK\#TD18063
```

```
                          #  Name      Memtype  Indexes
                          ----------------------------
                          1  FOUR      DATA
                          2  MERGE1    DATA
                          3  ONE       DATA
                          4  ORRTOTS   DATA
                          5  OSHARES   DATA
                          6  OSTTOTS   DATA
                          7  THREE     DATA
                          8  TRRTOTS   DATA
                          9  TSHARES   DATA
                         10  TSTTOTS   DATA
                         11  TWO       DATA
        DELETE ONE TWO;

     ***************    ORIGIN CARRIER SHARES    ***************;

NOTE: Deleting WORK.ONE (memtype=DATA).
NOTE: Deleting WORK.TWO (memtype=DATA).
NOTE: The PROCEDURE DATASETS used 0.44 seconds.
     PROC SORT DATA=THREE;
        BY OST ORR;

NOTE: The data set WORK.THREE has 312071 observations and 10 variables.
NOTE: The PROCEDURE SORT used 4 minutes 54.07 seconds.
     PROC MEANS NOPRINT SUM DATA=THREE;
        VAR XCAR;
        BY OST ORR;

        OUTPUT OUT=ORRTOTS SUM=ORRTOT;

NOTE: The data set WORK.ORRTOTS has 441 observations and 5 variables.
NOTE: The PROCEDURE MEANS used 25.76 seconds.
     PROC MEANS NOPRINT SUM DATA=THREE;
        VAR XCAR;
        BY OST;

        OUTPUT OUT=OSTTOTS SUM=OSTTOT;

NOTE: The data set WORK.OSTTOTS has 57 observations and 4 variables.
NOTE: The PROCEDURE MEANS used 19.17 seconds.
     DATA OSHARES;
        MERGE ORRTOTS OSTTOTS;
        BY OST;

        OSHARE=ORRTOT/OSTTOT;

     ***************    DESTINATION CARRIER SHARES    ***************;

NOTE: The data set WORK.OSHARES has 441 observations and 7 variables.
NOTE: The DATA statement used 0.48 seconds.
     PROC SORT DATA=THREE;
        BY TST TRR;

NOTE: The data set WORK.THREE has 312071 observations and 10 variables.
NOTE: The PROCEDURE SORT used 3 minutes 56.17 seconds.
     PROC MEANS NOPRINT SUM DATA=THREE;
        VAR XCAR;
        BY TST TRR;

        OUTPUT OUT=TRRTOTS SUM=TRRTOT;

NOTE: The data set WORK.TRRTOTS has 303 observations and 5 variables.
NOTE: The PROCEDURE MEANS used 20.71 seconds.
```

```
708  PROC MEANS NOPRINT SUM DATA=THREE;
709     VAR XCAR;
710     BY TST;
711
712     OUTPUT OUT=TSTTOTS SUM=TSTTOT;
713
NOTE: The data set WORK.TSTTOTS has 53 observations and 4 variables.
NOTE: The PROCEDURE MEANS used 18.23 seconds.
714  DATA TSHARES;
715     MERGE TRRTOTS TSTTOTS;
716     BY TST;
717
718     TSHARE=TRRTOT/TSTTOT;
719
NOTE: The data set WORK.TSHARES has 303 observations and 7 variables.
NOTE: The DATA statement used 0.39 seconds.
720  PROC DATASETS;
                              -----Directory-----

                  Libref:        WORK
                  Engine:        V610
                  Physical Name: C:\SASWORK\SASWORK\#TD18063

                         #  Name     Memtype  Indexes
                         ----------------------------
                         1  FOUR     DATA
                         2  MERGE1   DATA
                         3  ORRTOTS  DATA
                         4  OSHARES  DATA
                         5  OSTTOTS  DATA
                         6  THREE    DATA
                         7  TRRTOTS  DATA
                         8  TSHARES  DATA
                         9  TSTTOTS  DATA
721     DELETE THREE;
722
723  ***************   MERGING INTO PRIMARY DATA   ***************;
724
NOTE: Deleting WORK.THREE (memtype=DATA).
NOTE: The PROCEDURE DATASETS used 0.22 seconds.
725  DATA FOUR;
726     SET WAYBILL.ACE9501;
727
NOTE: The data set WORK.FOUR has 74403 observations and 36 variables.
NOTE: The DATA statement used 1 minute 21.94 seconds.
728  PROC SORT DATA=FOUR;
729     BY OST ORR;
730
NOTE: The data set WORK.FOUR has 74403 observations and 36 variables.
NOTE: The PROCEDURE SORT used 2 minutes 52.25 seconds.
731  DATA MERGE1;
732     MERGE FOUR OSHARES;
733     BY OST ORR;
734
NOTE: The data set WORK.MERGE1 has 74547 observations and 41 variables.
NOTE: The DATA statement used 2 minutes 58.84 seconds.
735  PROC SORT DATA=MERGE1;
736     BY TST TRR;
737
NOTE: The data set WORK.MERGE1 has 74547 observations and 41 variables.
NOTE: The PROCEDURE SORT used 3 minutes 20.96 seconds.
738  DATA MERGE2;
739     MERGE MERGE1 TSHARES;
740     BY TST TRR;
741
742     RRCON=OSHARE*TSHARE;
743
```

```
744      IF RRCON=. THEN DELETE;
745      IF UCAR=. THEN DELETE;
746
NOTE: Missing values were generated as a result of performing an operation on
      missing values.
      Each place is given by: (Number of times) at (Line):(Column).
      190 at 742:16
NOTE: The data set WORK.MERGE2 has 74403 observations and 45 variables.
NOTE: The DATA statement used 3 minutes 9.21 seconds.
747   PROC DATASTES;
ERROR: Procedure DATASTES not found.
748      DELETE MERGE1;
749
NOTE: The SAS System stopped processing this step because of errors.
NOTE: The PROCEDURE DATASTES used 0.88 seconds.
750   PROC PRINT DATA=MERGE2(OBS=500);
751
NOTE: The PROCEDURE PRINT used 2.58 seconds.
752   PROC MEANS DATA=MERGE2;
753
NOTE: The PROCEDURE MEANS used 22.41 seconds.
754   DATA WAYBILL.ACE9502;
755      SET MERGE2;
756
757
758   RUN;
NOTE: The data set WAYBILL.ACE9502 has 74403 observations and 45 variables.
NOTE: The DATA statement used 1 minute 52.27 seconds.
```

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9503.SAS
*
*    AUTHOR            DATE          REVISION         NOTES
*    MARK BURTON     AUG 1995
*
*    PURPOSE
*
*    PULLS RECORDS FROM THE 1992 MASTER WAYBILL SAMPLE NECESSARY TO
*    CREATE THE RAILROAD CONCENTRATION VARIABLE
*    FOR THE NEW WATER-COMPELLED ANALYSIS
*
*    FILES
*    WAY92A.DAT - READ ONLY
*    WAY92B.DAT - READ ONLY
*    ACE9502.SD2 - READ ONLY
*    ACE9503.SD2 - CREATED BY
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*******************************************************************;

LIBNAME WAYBILL 'D:\WAYBILL\';

DATA ONE;
   INFILE 'F:WAY92A.DAT' LRECL=361;

   INPUT UCAR         13-16
         ORR          93-95
         TRR         149-151
         STCC        198-204
         EXPN        206-208
         UTON        216-220
         TDIS        261-265
         OST       $ 266-267
         TST       $ 268-269;

   IF OST='AL' OR TST='AL' OR
      OST='AR' OR TST='AR' OR
      OST='IA' OR TST='IA' OR
      OST='IL' OR TST='IL' OR
      OST='IN' OR TST='IN' OR
      OST='KS' OR TST='KS' OR
      OST='KY' OR TST='KY' OR
      OST='LA' OR TST='LA' OR
      OST='MN' OR TST='MN' OR
      OST='MO' OR TST='MO' OR
      OST='MS' OR TST='MS' OR
      OST='NE' OR TST='NE' OR
      OST='OH' OR TST='OH' OR
      OST='OK' OR TST='OK' OR
      OST='PA' OR TST='PA' OR
      OST='SD' OR TST='SD' OR
      OST='TN' OR TST='TN' OR
      OST='TX' OR TST='TX' OR
      OST='WI' OR TST='WI' OR
      OST='WV' OR TST='WV';
```

```
DATA TWO;
   INFILE 'F:WAY92B.DAT' LRECL=361;

   INPUT UCAR       13-16
         ORR        93-95
         TRR       149-151
         STCC      198-204
         EXPN      206-208
         UTON      216-220
         TDIS      261-265
         OST     $ 266-267
         TST     $ 268-269;

   IF OST='AL' OR TST='AL' OR
      OST='AR' OR TST='AR' OR
      OST='IA' OR TST='IA' OR
      OST='IL' OR TST='IL' OR
      OST='IN' OR TST='IN' OR
      OST='KS' OR TST='KS' OR
      OST='KY' OR TST='KY' OR
      OST='LA' OR TST='LA' OR
      OST='MN' OR TST='MN' OR
      OST='MO' OR TST='MO' OR
      OST='MS' OR TST='MS' OR
      OST='NE' OR TST='NE' OR
      OST='OH' OR TST='OH' OR
      OST='OK' OR TST='OK' OR
      OST='PA' OR TST='PA' OR
      OST='SD' OR TST='SD' OR
      OST='TN' OR TST='TN' OR
      OST='TX' OR TST='TX' OR
      OST='WI' OR TST='WI' OR
      OST='WV' OR TST='WV';

DATA THREE;
   SET ONE TWO;

   TDIS=TDIS/10;
   XCAR=UCAR*EXPN;

PROC DATASETS;
   DELETE ONE TWO;

PROC SORT DATA=THREE;
   BY ORR TRR OST TST;

PROC MEANS NOPRINT SUM DATA=THREE;
   BY ORR TRR OST TST;
   VAR XCAR;
   OUTPUT OUT=TRAFFIC SUM=TRAFFIC;

PROC MEANS NOPRINT MEAN DATA=THREE;
   BY ORR TRR OST TST;
   VAR TDIS;
   OUTPUT OUT=AVDIS MEAN=AVDIS;

PROC DATASETS;
   DELETE THREE;

DATA FOUR;
   MERGE TRAFFIC AVDIS;
   BY ORR TRR OST TST;

   DENSITY=TRAFFIC/AVDIS;

   KEEP ORR TRR OST TST DENSITY;
```

```
PROC SORT DATA=FOUR;
   BY OST TST ORR TRR;

DATA FIVE;
   SET WAYBILL.ACE9502;

PROC SORT DATA=FIVE;
   BY OST TST ORR TRR;

DATA FINAL;
   MERGE FIVE FOUR;
   BY OST TST ORR TRR;

   DROP _FREQ_ _TYPE_ ORRTOT OSTTOT OSHARE TRRTOT TSTTOT TSHARE;

PROC DATASETS;
   DELETE FIVE FOUR;

PROC MEANS DATA=FINAL;

DATA WAYBILL.ACE9503;
   SET FINAL;

RUN;
```

```
NOTE: Copyright (c) 1989-1993 by SAS Institute Inc., Cary, NC, USA.
NOTE: SAS (r) Proprietary Software Release 6.10  TS019
      Licensed to TENNESSEE VALLEY AUTHORITY, Site 0001276008.
NOTE: The SAS System for Microsoft Windows, Release 6.10 Limited Production
      *****************************************************************
      *
      *    PROGRAM NAME
      *    ACE9504.SAS
      *
      *    AUTHOR           DATE          REVISION        NOTES
      *    MARK BURTON    AUG 1995
      *
      *    PURPOSE
      *
      *    ADDS QUARTERLY VARAIBLES SYSCAR VARIABLE AND CARRIER DUMMIES
      *    TO EXISTING DATA SET CREATED FOR THE NEW WATER-COMPELLED ANALYSIS
      *
      *    FILES
      *    ACE9503.SD2 - READ ONLY
      *    ACE9504.SD2 - CREATED BY
      *
      *****************************************************************;

       OPTIONS MISSING = '.';
       OPTIONS LS=78;

      *****************************************************************
      *
      * READ WAYBILL DATA;
      *
      *****************************************************************;

     LIBNAME WAYBILL 'D:\WAYBILL\';
NOTE: Libref WAYBILL was successfully assigned as follows:
      Engine:        V610
      Physical Name: D:\WAYBILL

     DATA ONE;
        SET WAYBILL.ACE9503;

        IF UCAR=. THEN DELETE;

        IF OWNER='ALS'  OR OWNER='AM'   OR OWNER='AKMD' OR OWNER='ALM'  OR
           OWNER='ATSF' OR OWNER='SFRC' OR OWNER='BAR'  OR OWNER='BM'   OR
           OWNER='BN'   OR OWNER='BNFE' OR OWNER='CBQ'  OR OWNER='CS'   OR
           OWNER='FWD'  OR OWNER='GN'   OR OWNER='NP'   OR OWNER='BBN'  OR
           OWNER='RBBQ' OR OWNER='RBCS' OR OWNER='RBW'  OR OWNER='SLSF' OR
           OWNER='SFE'  OR OWNER='WHI'  OR OWNER='CN'   OR OWNER='BCNE' OR
           OWNER='CNA'  OR OWNER='CNIS' OR OWNER='CVC'  OR OWNER='DWC'  OR
           OWNER='NAR'  OR OWNER='CV'   OR OWNER='CNW'  OR OWNER='CGW'  OR
           OWNER='CMO'  OR OWNER='FDDM' OR OWNER='LM'   OR OWNER='MSTL' OR
           OWNER='CC'   OR OWNER='CAGY' OR OWNER='CR'   OR OWNER='BA'   OR
           OWNER='BCK'  OR OWNER='CNJ'  OR OWNER='CLW'  OR OWNER='EL'   OR
           OWNER='ERIE' OR OWNER='MGA'  OR OWNER='NH'   OR OWNER='NYC'  OR
           OWNER='PAE'  OR OWNER='PC'   OR OWNER='PRR'  OR OWNER='RDG'  OR
           OWNER='RR'   OR OWNER='TDC'  OR OWNER='CP'   OR OWNER='CPAA' OR
           OWNER='CPI'  OR OWNER='CPT'  OR OWNER='DA'   OR OWNER='NJ'   OR
           OWNER='THB'  OR OWNER='CSXT' OR OWNER='ACL'  OR OWNER='AWP'  OR
           OWNER='BO'   OR OWNER='CO'   OR OWNER='CRR'  OR OWNER='GA'   OR
           OWNER='LN'   OR OWNER='MON'  OR OWNER='NC'   OR OWNER='RFP'  OR
           OWNER='SAL'  OR OWNER='SBD'  OR OWNER='SCL'  OR OWNER='WA'   OR
           OWNER='WM'   OR OWNER='DME'  OR OWNER='DH'   OR OWNER='DHNY' OR
           OWNER='DRGW' OR OWNER='EJE'  OR OWNER='ELS'  OR OWNER='FEC'  OR
           OWNER='GVSR' OR OWNER='GTW'  OR OWNER='DTI'  OR OWNER='DTS'  OR
           OWNER='IC'   OR OWNER='CIW'  OR OWNER='GMO'  OR OWNER='ICG'  OR
           OWNER='IHB'  OR OWNER='IAS'  OR OWNER='KCS'  OR OWNER='CTIE' OR
           OWNER='GNA'  OR OWNER='MSRC' OR OWNER='KYLE' OR OWNER='MSDR' OR
```

```
        OWNER='MP'   OR OWNER='ARDP' OR OWNER='ARMH' OR OWNER='ARNW' OR
        OWNER='BKTY' OR OWNER='CHTT' OR OWNER='DKS'  OR OWNER='MI'   OR
        OWNER='MKT'  OR OWNER='MKTT' OR OWNER='OKKT' OR OWNER='TP'   OR
        OWNER='MRL'  OR OWNER='NS'   OR OWNER='NW'   OR OWNER='PWV'  OR
        OWNER='SA '  OR OWNER='SOU'  OR OWNER='TAG'  OR OWNER='VGN'  OR
        OWNER='NOKL' OR OWNER='PAL'  OR OWNER='PPU'  OR OWNER='SRN'  OR
        OWNER='SLR'  OR OWNER='SSW'  OR OWNER='SOO'  OR OWNER='MILW' OR
        OWNER='MNS'  OR OWNER='SP'   OR OWNER='SPFE' OR OWNER='GMSR' OR
        OWNER='SR'   OR OWNER='UP'   OR OWNER='SI'   OR OWNER='TNM'  OR
        OWNER='SPFE'  OR OWNER='WP'  OR OWNER='WPMW' OR OWNER='WE'   OR
        OWNER='WC'
     THEN SYSCAR=1;ELSE
     SYSCAR=0;

     IF WAYD LE 920331 THEN QTR1=1; ELSE QTR1=0;
     IF WAYD GT 920331 AND WAYD LE 920630 THEN QTR2=1; ELSE QTR2=0;
     IF WAYD GT 920630 AND WAYD LE 920930 THEN QTR3=1; ELSE QTR3=0;

NOTE: The data set WORK.ONE has 74403 observations and 42 variables.
NOTE: The DATA statement used 1 minute 27.71 seconds.
   PROC MEANS DATA=ONE;

NOTE: The PROCEDURE MEANS used 21.92 seconds.
   DATA WAYBILL.ACE9504;
      SET ONE;

   RUN;
NOTE: The data set WAYBILL.ACE9504 has 74403 observations and 42 variables.
NOTE: The DATA statement used 1 minute 46.77 seconds.
```

The SAS System 1

10:01 Friday, August 11, 1995

Variable	N	Mean	Std Dev	Minimum	Maximum
WAYD	74403	920284.00	1844.78	911215.00	921214.00
UCAR	74403	32.4670107	42.9359834	1.0000000	241.0000000
UREV	74403	38767.50	62747.06	0	636330.00
TRAN	74403	2.0373775	3.7663884	0	9.0000000
REBL	74403	4.1460425	4.4766584	0	9.0000000
SRAT	74403	2.4411381	1.5901998	1.0000000	8.0000000
REP	74403	2.5013642	1.1174936	1.0000000	4.0000000
RPRT	74403	420.0512345	258.2607602	16.0000000	919.0000000
ORR	74403	437.8206793	270.8858944	1.0000000	994.0000000
TRR	74403	420.1569964	258.2808436	16.0000000	919.0000000
POPC	74403	114047.16	174146.68	1.0000000	512664.00
STRC	74403	3020.43	4249.99	1.0000000	12816.00
CTYP	74403	285.8963214	157.8660436	13.0000000	982.0000000
STCC	74403	1806944.77	1174781.17	113210.00	4021149.00
EXPN	74403	21.4093518	18.8139888	2.0000000	100.0000000
ERR1	74403	0.0592449	0.6858978	0	8.0000000
ERR2	74403	0	0	0	0
UTON	74403	3216.95	4381.83	1.0000000	26731.00
TDIS	74403	561.0032391	508.8628508	0.4000000	3412.40
OBEA	74403	92.3389648	44.5694397	4.0000000	191.0000000
TBEA	74403	80.7826297	40.0736220	2.0000000	191.0000000
OFIP	74403	32247.58	16955.03	0	56037.00
TFIP	74403	30433.90	15227.99	0	56043.00
MILRT	74403	78.4167036	190.2729291	0	892.0000000
VCOST	74403	22296.28	37089.88	0	389462.33
NUMRR	74403	1.4151311	0.6667401	1.0000000	6.0000000
STCC5	74403	18068.98	11747.90	1132.00	40211.00
RTM	74403	0.0658846	0.3441463	0	27.2000000
TON2CAR	74403	91.3955062	16.2661049	1.0000000	312.0000000
VC2TON	74403	10.9381448	21.2427496	0	2647.64
RRCON	74403	0.1245428	0.1328380	8.449774E-7	0.8970806

DENSITY	74403	171.8544246	348.5134060	0.0125070	2941.96
SYSCAR	74403	0.5442388	0.4980424	0	1.0000000
QTR1	74403	0.2838595	0.4508725	0	1.0000000
QTR2	74403	0.2416838	0.4281065	0	1.0000000
QTR3	74403	0.2609707	0.4391669	0	1.0000000

```
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NOTE: SAS (r) Proprietary Software Release 6.10  TS019
      Licensed to TENNESSEE VALLEY AUTHORITY, Site 0001276008.
NOTE: The SAS System for Microsoft Windows, Release 6.10 Limited Production
      *******************************************************************
      *
      *    PROGRAM NAME
      *    ACE9505.SAS
      *
      *    AUTHOR            DATE          REVISION         NOTES
      *    MARK BURTON    AUG 1995
      *
      *    PURPOSE
      *
      *    ADDS CARRIER DUMMIES  TO EXISTING DATA SET CREATED FOR
      *    THE NEW WATER-COMPELLED ANALYSIS
      *
      *    FILES
      *    ACE9504.SD2 - READ ONLY
      *    ACE9505.SD2 - CREATED BY
      *
      *******************************************************************;

       OPTIONS MISSING = '.';
       OPTIONS LS=78;

      *******************************************************************
      *
      * READ WAYBILL DATA;
      *
      *************************1*****************************************;

      LIBNAME WAYBILL 'D:\WAYBILL\';
NOTE: Libref WAYBILL was successfully assigned as follows:
      Engine:        V610
      Physical Name: D:\WAYBILL

      DATA ONE;
         SET WAYBILL.ACE9504;

      IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
      IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
      IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
      IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
      IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
      IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
      IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
      IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
      IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
      IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
      IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
      IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
      IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
      IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
      IF (ORR=494 AND TRR=494) OR
         (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;
```

```
*****************************************************************
*
*    SHIPMENTS WHICH ORIGINATE AND TERMINATE ON CARRIERS WHICH ARE
*    EXPLICITLY TREATED BY THE REBEE COSTING MODEL DISPLAY A VALUE OF
*    ONE FOR THE DUMMY VARIABLE (CD###) ASSOCIATED WITH THAT CARRIER.
*    OTHERWISE, EACH VARIABLE DISPLAYS A VALUE OF ZERO.
*
*    KEY:
*
*         ATSF    CD22    SANTA FE
*         BN      CD76    BURLINGTON NORTHERN
*         CC      CD569   CHICAGO CENTRAL
*         CNW     CD131   CHICAGO AND NORTHWESTERN
*         CR      CD190   CONRAIL
*         CSXT    CD712   CSX TRANSPORTATION
*         IC      CD350   ILLINOIS CENTRAL
*         KCS     CD400   KANSAS CITY SOUTHERN
*         MP      CD802   MISSOURI PACIFIC (REPORTING CODE=494)
*         MSRC    CD905   MID-SOUTH RAIL CORPORATION
*         NS      CD555   NORFOLK SOUTHERN
*         PAL     CD907   PADUCAH AND LOUISVILLE
*         SOO     CD482   SOO LINES
*         SP      CD721   SOUTHERN PACIFIC
*         SSW     CD694   ST LOUIS SOUTHWESTOERN(COTTON BELT)
*         UP      CD802   UNION PACIFIC
*
*****************************************************************;

NOTE: The data set WORK.ONE has 74403 observations and 57 variables.
NOTE: The DATA statement used 1 minute 34.9 seconds.
PROC MEANS DATA=ONE;

NOTE: The PROCEDURE MEANS used 29.44 seconds.
DATA WAYBILL.ACE9505;
   SET ONE;

RUN;
NOTE: The data set WAYBILL.ACE9505 has 74403 observations and 57 variables.
NOTE: The DATA statement used 2 minutes 16.05 seconds.
```

The SAS System 1

11:11 Friday, August 11, 1995

Variable	N	Mean	Std Dev	Minimum	Maximum
WAYD	74403	920284.00	1844.78	911215.00	921214.00
UCAR	74403	32.4670107	42.9359834	1.0000000	241.0000000
UREV	74403	38767.50	62747.06	0	636330.00
TRAN	74403	2.0373775	3.7663884	0	9.0000000
REBL	74403	4.1460425	4.4766584	0	9.0000000
SRAT	74403	2.4411381	1.5901998	1.0000000	8.0000000
REP	74403	2.5013642	1.1174936	1.0000000	4.0000000
RPRT	74403	420.0512345	258.2607602	16.0000000	919.0000000
ORR	74403	437.8206793	270.8858944	1.0000000	994.0000000
TRR	74403	420.1569964	258.2808436	16.0000000	919.0000000
POPC	74403	114047.16	174146.68	1.0000000	512664.00
STRC	74403	3020.43	4249.99	1.0000000	12816.00
CTYP	74403	285.8963214	157.8660436	13.0000000	982.0000000
STCC	74403	1806944.77	1174781.17	113210.00	4021149.00
EXPN	74403	21.4093518	18.8139888	2.0000000	100.0000000
ERR1	74403	0.0592449	0.6858978	0	8.0000000
ERR2	74403	0	0	0	0
UTON	74403	3216.95	4381.83	1.0000000	26731.00
TDIS	74403	561.0032391	508.8628508	0.4000000	3412.40
OBEA	74403	92.3389648	44.5694397	4.0000000	191.0000000
TBEA	74403	80.7826297	40.0736220	2.0000000	191.0000000

OFIP	74403	32247.58	16955.03	0	56037.00
TFIP	74403	30433.90	15227.99	0	56043.00
MILRT	74403	78.4167036	190.2729291	0	892.0000000
VCOST	74403	22296.28	37089.88	0	389462.33
NUMRR	74403	1.4151311	0.6667401	1.0000000	6.0000000
STCC5	74403	18068.98	11747.90	1132.00	40211.00
RTM	74403	0.0658846	0.3441463	0	27.2000000
TON2CAR	74403	91.3955062	16.2661049	1.0000000	312.0000000
VC2TON	74403	10.9381448	21.2427496	0	2647.64
RRCON	74403	0.1245428	0.1328380	8.449774E-7	0.8970806
DENSITY	74403	171.8544246	348.5134060	0.0125070	2941.96
SYSCAR	74403	0.5442388	0.4980424	0	1.0000000
QTR1	74403	0.2838595	0.4508725	0	1.0000000
QTR2	74403	0.2416838	0.4281065	0	1.0000000
QTR3	74403	0.2609707	0.4391669	0	1.0000000
CD22	74403	0.0282381	0.1656535	0	1.0000000
CD76	74403	0.0866766	0.2813625	0	1.0000000
CD569	74403	0.0029165	0.0539266	0	1.0000000
CD131	74403	0.0260473	0.1592772	0	1.0000000
CD190	74403	0.1016088	0.3021352	0	1.0000000
CD712	74403	0.1547653	0.3616832	0	1.0000000
CD350	74403	0.0214507	0.1448824	0	1.0000000
CD400	74403	0.0044756	0.0667507	0	1.0000000
CD905	74403	0.0060885	0.0777912	0	1.0000000
CD555	74403	0.1273470	0.3333635	0	1.0000000
CD907	74403	0.0028493	0.0533035	0	1.0000000
CD482	74403	0.0197573	0.1391660	0	1.0000000
CD721	74403	0.0115990	0.1070729	0	1.0000000
CD694	74403	0.0024730	0.0496683	0	1.0000000
CD802	74403	0.0536672	0.2253613	0	1.0000000

```
*********************************************************************
*
*     PROGRAM NAME:  ACE9507.SAS           DATE:      AUGUST 1995
*
*     WRITTEN BY:    M. BURTON              REVISED:
*
*     PURPOSE:  CREATES D2WATER FROM INPUT DATA FOR OD'S LESS THAN
200
*               MILES FROM NEAREST WATER, ASSIGNS D2WATER FOR OD'S
WHICH
*               ARE MORE THAN 200 MILES FROM NEAREST WATER,
CALCULATES
*               THE NUMBER OF NETWORK PORTS WITHIN 200 MILES OF THE
OD
*               (WHERE THE MINIMUM VALUE = 1) AND CREATES DUMMY
VARIABLES
*               INDICATING WHICH WATERWAY PROVIDES THE NEAREST
NETWORK PORT
*
*     FILES:    CITYFIP2.SD2 - READ ONLY
*               D2WATER.SD2 - CREATED BY
*

*******************************************************************;

LIBNAME WAYBILL 'D:\COUNTY\';
NOTE: Libref WAYBILL was successfully assigned as follows:
      Engine:        V610
      Physical Name: D:\COUNTY

OPTIONS LS=72;

DATA ONE;
   SET WAYBILL.CITYFIP2;

IF FIPS=20009 THEN D2CAT=224 ; IF FIPS=20023 THEN D2OMA=324 ;
IF FIPS=20025 THEN D2CAT=233 ; IF FIPS=20033 THEN D2CAT=211 ;
IF FIPS=20039 THEN D2OMA=260 ; IF FIPS=20047 THEN D2CAT=234 ;
IF FIPS=20051 THEN D2OMA=243 ; IF FIPS=20055 THEN D2OMA=347 ;
IF FIPS=20057 THEN D2CAT=259 ; IF FIPS=20063 THEN D2OMA=288 ;
IF FIPS=20065 THEN D2OMA=243 ; IF FIPS=20067 THEN D2CAT=325 ;
IF FIPS=20069 THEN D2CAT=277 ; IF FIPS=20071 THEN D2CAT=365 ;
IF FIPS=20075 THEN D2CAT=353 ; IF FIPS=20081 THEN D2CAT=296 ;
IF FIPS=20083 THEN D2CAT=256 ; IF FIPS=20093 THEN D2KCY=266 ;
IF FIPS=20097 THEN D2CAT=219 ; IF FIPS=20101 THEN D2KCY=289 ;
IF FIPS=20109 THEN D2OMA=308 ; IF FIPS=20119 THEN D2CAT=265 ;
IF FIPS=20129 THEN D2CAT=350 ; IF FIPS=20135 THEN D2CAT=276 ;
IF FIPS=20137 THEN D2OMA=230 ; IF FIPS=20145 THEN D2CAT=230 ;
IF FIPS=20153 THEN D2OMA=286 ; IF FIPS=20163 THEN D2OMA=226 ;
IF FIPS=20165 THEN D2KCY=223 ; IF FIPS=20167 THEN D2OMA=225 ;
IF FIPS=20171 THEN D2CAT=324 ; IF FIPS=20175 THEN D2CAT=297 ;
IF FIPS=20179 THEN D2OMA=271 ; IF FIPS=20181 THEN D2OMA=332 ;
IF FIPS=20187 THEN D2CAT=304 ; IF FIPS=20189 THEN D2CAT=318 ;
IF FIPS=20193 THEN D2OMA=298 ; IF FIPS=20195 THEN D2CAT=259 ;
IF FIPS=20199 THEN D2OMA=348 ; IF FIPS=20203 THEN D2OMA=345 ;
IF FIPS=27027 THEN D2MSP=213 ; IF FIPS=27069 THEN D2MSP=319 ;
IF FIPS=27087 THEN D2MSP=204 ; IF FIPS=27089 THEN D2MSP=278 ;
IF FIPS=27107 THEN D2MSP=223 ; IF FIPS=27113 THEN D2MSP=257 ;
IF FIPS=27119 THEN D2MSP=250 ; IF FIPS=27125 THEN D2MSP=246 ;
IF FIPS=27135 THEN D2MSP=292 ; IF FIPS=29193 THEN DELETE;
IF FIPS=31013 THEN D2OMA=371 ; IF FIPS=31029 THEN D2OMA=290 ;
IF FIPS=31031 THEN D2OMA=261 ; IF FIPS=31033 THEN D2OMA=366 ;
IF FIPS=31045 THEN D2OMA=378 ; IF FIPS=31049 THEN D2OMA=319 ;
IF FIPS=31057 THEN D2OMA=302 ; IF FIPS=31063 THEN D2OMA=243 ;
IF FIPS=31065 THEN D2OMA=231 ; IF FIPS=31073 THEN D2OMA=290 ;
IF FIPS=31085 THEN D2OMA=270 ; IF FIPS=31087 THEN D2OMA=267 ;
IF FIPS=31101 THEN D2OMA=295 ; IF FIPS=31105 THEN D2OMA=401 ;
```

```
IF FIPS=31111 THEN D2OMA=251 ; IF FIPS=31123 THEN D2OMA=384 ;
IF FIPS=31135 THEN D2OMA=176 ; IF FIPS=31145 THEN D2OMA=256 ;
IF FIPS=31157 THEN D2OMA=412 ; IF FIPS=31161 THEN D2OMA=388 ;
IF FIPS=31171 THEN D2OMA=228 ; IF FIPS=40025 THEN D2CAT=393 ;
IF FIPS=40045 THEN D2CAT=216 ; IF FIPS=40065 THEN D2CAT=228 ;
IF FIPS=40075 THEN D2CAT=204 ; IF FIPS=40139 THEN D2CAT=321 ;
IF FIPS=40141 THEN D2CAT=223 ; IF FIPS=40153 THEN D2CAT=214 ;
IF FIPS=42011 THEN D2PIT=207 ; IF FIPS=42015 THEN D2PIT=207 ;
IF FIPS=42017 THEN D2PIT=260 ; IF FIPS=42029 THEN D2PIT=227 ;
IF FIPS=42045 THEN D2PIT=244 ; IF FIPS=42069 THEN D2PIT=231 ;
IF FIPS=42077 THEN D2PIT=232 ; IF FIPS=42079 THEN D2PIT=222 ;
IF FIPS=42091 THEN D2PIT=240 ; IF FIPS=42095 THEN D2PIT=237 ;
IF FIPS=42101 THEN D2PIT=249 ; IF FIPS=46013 THEN D2SXC=229 ;
IF FIPS=46019 THEN D2SXC=404 ; IF FIPS=46031 THEN D2SXC=358 ;
IF FIPS=46037 THEN D2SXC=203 ; IF FIPS=46045 THEN D2SXC=234 ;
IF FIPS=46047 THEN D2SXC=361 ; IF FIPS=46055 THEN D2SXC=296 ;
IF FIPS=46065 THEN D2SXC=224 ; IF FIPS=46069 THEN D2SXC=206 ;
IF FIPS=46081 THEN D2SXC=398 ; IF FIPS=46085 THEN D2SXC=219 ;
IF FIPS=46091 THEN D2SXC=237 ; IF FIPS=46093 THEN D2SXC=368 ;
IF FIPS=46103 THEN D2SXC=360 ; IF FIPS=46117 THEN D2SXC=239 ;
IF FIPS=46119 THEN D2SXC=245 ; IF FIPS=46129 THEN D2SXC=290 ;
IF FIPS=48011 THEN D2CAT=324 ; IF FIPS=48017 THEN D2CAT=417 ;
IF FIPS=48023 THEN D2CAT=268 ; IF FIPS=48049 THEN D2HOU=253 ;
IF FIPS=48065 THEN D2CAT=308 ; IF FIPS=48069 THEN D2CAT=387 ;
IF FIPS=48083 THEN D2HOU=360 ; IF FIPS=48093 THEN D2CAT=242 ;
IF FIPS=48111 THEN D2HOU=378 ; IF FIPS=48113 THEN D2HOU=225 ;
IF FIPS=48115 THEN D2CAT=426 ; IF FIPS=48117 THEN D2CAT=395 ;
IF FIPS=48121 THEN D2CAT=220 ; IF FIPS=48129 THEN D2CAT=301 ;
IF FIPS=48133 THEN D2HOU=284 ; IF FIPS=48135 THEN D2HOU=443 ;
IF FIPS=48139 THEN D2HOU=202 ; IF FIPS=48141 THEN D2HOU=684 ;
IF FIPS=48143 THEN D2HOU=239 ; IF FIPS=48153 THEN D2CAT=351 ;
IF FIPS=48165 THEN D2CAT=460 ; IF FIPS=48179 THEN D2CAT=295 ;
IF FIPS=48189 THEN D2CAT=364 ; IF FIPS=48195 THEN D2CAT=304 ;
IF FIPS=48197 THEN D2CAT=261 ; IF FIPS=48205 THEN D2CAT=370 ;
IF FIPS=48207 THEN D2CAT=308 ; IF FIPS=48211 THEN D2CAT=260 ;
IF FIPS=48219 THEN D2CAT=416 ; IF FIPS=48227 THEN D2HOU=400 ;
IF FIPS=48233 THEN D2CAT=318 ; IF FIPS=48251 THEN D2HOU=215 ;
IF FIPS=48253 THEN D2CAT=322 ; IF FIPS=48257 THEN D2HOU=212 ;
IF FIPS=48275 THEN D2CAT=300 ; IF FIPS=48279 THEN D2CAT=404 ;
IF FIPS=48303 THEN D2CAT=390 ; IF FIPS=48317 THEN D2HOU=434 ;
IF FIPS=48323 THEN D2BRV=248 ; IF FIPS=48325 THEN D2HOU=229 ;
IF FIPS=48329 THEN D2CAT=462 ; IF FIPS=48335 THEN D2HOU=303 ;
IF FIPS=48337 THEN D2CAT=216 ; IF FIPS=48341 THEN D2CAT=348 ;
IF FIPS=48353 THEN D2HOU=352 ; IF FIPS=48363 THEN D2HOU=266 ;
IF FIPS=48367 THEN D2HOU=252 ; IF FIPS=48369 THEN D2CAT=407 ;
IF FIPS=48375 THEN D2CAT=378 ; IF FIPS=48389 THEN D2HOU=510 ;
IF FIPS=48397 THEN D2HOU=228 ; IF FIPS=48421 THEN D2CAT=378 ;
IF FIPS=48437 THEN D2CAT=358 ; IF FIPS=48439 THEN D2HOU=235 ;
IF FIPS=48441 THEN D2CAT=318 ; IF FIPS=48445 THEN D2CAT=425 ;
IF FIPS=48451 THEN D2HOU=325 ; IF FIPS=48459 THEN D2HOU=206 ;
IF FIPS=48463 THEN D2BRV=276 ; IF FIPS=48485 THEN D2CAT=221 ;
IF FIPS=48487 THEN D2CAT=244 ; IF FIPS=48497 THEN D2CAT=229 ;
IF FIPS=48499 THEN D2HOU=201 ; IF FIPS=55075 THEN D2WIN=206 ;

   NUMPORT=0;

   ARRAY PORTS[57]

   D2SAV   D2MSP
   D2WIN   D2DBQ
   D2CTN   D2RKI
   D2BUR   D2KKK
   D2QNC   D2ALT
   D2ESL   D2SLU
   D2CPG   D2CRO
   D2MEM   D2GRV
   D2VKB   D2BTR
```

```
     D2DVL   D2GHP
     D2DES   D2WWG
     D2NOL   D2NIB
     D2HOU   D2BRV
     D2PDC   D2EVV
     D2LVL   D2CIN
     D2MGT   D2PIT
     D2GBV   D2NJV
     D2DEC   D2GTV
     D2CHT   D2KNX
     D2ALC   D2MOB
     D2TUS   D2KCY
     D2ATC   D2BLR
     D2NEC   D2OMA
     D2SXC   D2BNV
     D2NPL   D2HAV
     D2PER   D2LAS
     D2LEM   D2CHI
     D2LRK   D2MUS
     D2CAT;

     DO I=1 TO 57;
        IF PORTS[I] NE . THEN NUMPORT=NUMPORT+1;
     END;

NOTE: The data set WORK.ONE has 1281 observations and 64 variables.
NOTE: The DATA statement used 3.29 seconds.
  DATA ONE;
     SET ONE;

     D2WATER=MIN
     (D2SAV,   D2MSP,
      D2WIN,   D2DBQ,
      D2CTN,   D2RKI,
      D2BUR,   D2KKK,
      D2QNC,   D2ALT,
      D2ESL,   D2SLU,
      D2CPG,   D2CRO,
      D2MEM,   D2GRV,
      D2VKB,   D2BTR,
      D2DVL,   D2GHP,
      D2DES,   D2WWG,
      D2NOL,   D2NIB,
      D2HOU,   D2BRV,
      D2PDC,   D2EVV,
      D2LVL,   D2CIN,
      D2MGT,   D2PIT,
      D2GBV,   D2NJV,
      D2DEC,   D2GTV,
      D2CHT,   D2KNX,
      D2ALC,   D2MOB,
      D2TUS,   D2KCY,
      D2ATC,   D2BLR,
      D2NEC,   D2OMA,
      D2SXC,   D2BNV,
      D2NPL,   D2HAV,
      D2PER,   D2LAS,
      D2LEM,   D2CHI,
      D2LRK,   D2MUS,
      D2CAT);

NOTE: The data set WORK.ONE has 1281 observations and 65 variables.
NOTE: The DATA statement used 2.08 seconds.
  DATA ONE;
     SET ONE;

  IF D2WATER=D2SAV OR D2WATER=D2MSP OR D2WATER=D2WIN OR
```

```
D2WATER=D2DBQ OR
     D2WATER=D2CTN OR D2WATER=D2RKI OR D2WATER=D2BUR OR
D2WATER=D2KKK OR
     D2WATER=D2QNC OR D2WATER=D2ALT OR D2WATER=D2ESL OR
D2WATER=D2SLU OR
     D2WATER=D2CPG OR D2WATER=D2CRO OR D2WATER=D2MEM OR
D2WATER=D2GRV OR
     D2WATER=D2VKB OR D2WATER=D2BTR OR D2WATER=D2DVL OR
D2WATER=D2GHP OR
     D2WATER=D2DES OR D2WATER=D2WWG OR D2WATER=D2NOL
THEN MSNRST=1; ELSE MSNRST=0;

IF D2WATER=D2NIB OR D2WATER=D2HOU OR D2WATER=D2BRV
THEN GINRST=1; ELSE GINRST=0;

IF D2WATER=D2PDC OR D2WATER=D2EVV OR D2WATER=D2LVL OR
D2WATER=D2CIN OR
     D2WATER=D2MGT OR D2WATER=D2PIT
THEN OHNRST=1; ELSE OHNRST=0;

IF D2WATER=D2GBV OR D2WATER=D2NJV OR D2WATER=D2DEC OR
D2WATER=D2GTV OR
     D2WATER=D2CHT OR D2WATER=D2KNX
THEN TNNRST=1; ELSE TNNRST=0;

IF D2WATER=D2ALC OR D2WATER=D2MOB OR D2WATER=D2TUS
THEN TTNRST=1; ELSE TTNRST=0;

IF D2WATER=D2KCY OR D2WATER=D2ATC OR D2WATER=D2BLR OR
D2WATER=D2NEC OR
     D2WATER=D2OMA OR D2WATER=D2SXC OR D2WATER=D2BNV
THEN MONRST=1; ELSE MONRST=0;

IF D2WATER=D2NPL OR D2WATER=D2HAV OR D2WATER=D2PER OR
D2WATER=D2LAS OR
     D2WATER=D2LEM OR D2WATER=D2CHI
THEN ILNRST=1; ELSE ILNRST=0;

IF D2WATER=D2LRK OR D2WATER=D2MUS OR D2WATER=D2CAT
THEN ARNRST=1; ELSE ARNRST=0;

NOTE: The data set WORK.ONE has 1281 observations and 73 variables.
NOTE: The DATA statement used 2.52 seconds.
PROC MEANS DATA=ONE;
  VAR NUMPORT D2WATER MSNRST GINRST OHNRST TNNRST TTNRST MONRST
      ILNRST ARNRST;

NOTE: The PROCEDURE MEANS used 0.38 seconds.
PROC PRINT DATA=ONE;
   VAR FIPS CITY NUMPORT D2WATER;

NOTE: The PROCEDURE PRINT used 0.88 seconds.
DATA WAYBILL.D2WATER;
   SET ONE;
   KEEP FIPS CITY NUMPORT D2WATER MSNRST GINRST OHNRST TNNRST
TTNRST
         MONRST ILNRST ARNRST;

RUN;
NOTE: The data set WAYBILL.D2WATER has 1281 observations and 12
      variables.
NOTE: The DATA statement used 1.54 seconds.
```

Variable	N	Mean	Std Dev	Minimum	Maximum
NUMPORT	1281	5.8563622	4.5355859	1.0000000	19.0000000
D2WATER	1281	107.5138915	89.8966057	0	684.0000000
MSNRST	1281	0.2154567	0.4112993	0	1.0000000
GINRST	1281	0.0835285	0.2767874	0	1.0000000
OHNRST	1281	0.2029664	0.4023648	0	1.0000000
TNNRST	1281	0.0733802	0.2608613	0	1.0000000
TTNRST	1281	0.0413739	0.1992313	0	1.0000000
MONRST	1281	0.1912568	0.3934444	0	1.0000000
ILNRST	1281	0.0608899	0.2392217	0	1.0000000
ARNRST	1281	0.1319282	0.3385448	0	1.0000000

OBS	FIPS	CITY	NUMPORT	D2WATER
1	1001	PRATTVILLE	6	72.500
2	1013	GREENVILLE	5	109.000
3	1015	ANNISTON	7	51.500
4	1017	LANETT	5	120.000
5	1021	CLANTON	6	59.000
6	1023	BUTLER	11	73.000
7	1025	JACKSON	8	57.000
8	1027	ASHLAND	5	79.000
9	1031	ENTERPRISE	3	136.000
10	1033	SHEFFIELD	10	41.000
11	1035	EVERGREEN	3	82.000
12	1039	ANDALUSIA	3	101.000
13	1043	CULLMAN	7	30.000
14	1047	SELMA	5	63.000
15	1051	WETUMPKA	6	90.000
16	1053	BREWTON	4	64.000
17	1055	GADSDEN	7	30.833
18	1057	FAYETTE	9	35.000
19	1059	RUSSELLVILLE	10	43.000
20	1067	HEADLAND	2	166.000
21	1069	DOTHAN	2	160.500
22	1071	SCOTTSBORO	7	26.000
23	1073	BIRMINGHAM	7	48.286
24	1075	DETROIT	9	63.000
25	1079	MOULTON	9	19.000
26	1081	OPELIKA	5	129.000
27	1083	ATHENS	11	13.000
28	1085	HAYNEVILLE	5	89.000
29	1087	TUSKEGEE	6	121.000
30	1089	HUNTSVILLE	10	21.538
31	1091	DEMOPOLIS	7	45.000
32	1095	ALBERTVILLE	7	7.000
33	1097	MOBILE	10	4.667
34	1099	MONROEVILLE	4	71.000
35	1101	MONTGOMERY	6	93.037
36	1103	DECATUR	10	0.000
37	1105	MARION	5	41.000
38	1107	ALICEVILLE	8	0.000
39	1109	TROY	4	133.000
40	1111	ROANOKE	5	98.000
41	1113	PHENIX CITY	5	150.000
42	1115	PELL CITY	6	52.000
43	1117	PELHAM	6	43.000
44	1121	TALLADEGA	5	64.000
45	1123	ALEXANDER CITY	6	94.000
46	1125	TUSCALOOSA	8	6.750

47	1127	JASPER	7	46.000
48	1129	TIBBIE	10	47.000
49	1131	CAMDEN	5	86.000
50	1133	HALEYVILLE	8	44.000
51	5001	STUTTGART	4	53.000
52	5003	CROSSETT	5	56.000
53	5005	MOUNTAIN HOME	8	110.000
54	5007	ROGERS	5	80.000
55	5009	HARRISON	5	113.000
56	5011	WARREN	4	60.000

OBS	FIPS	CITY	NUMPORT	D2WATER
57	5019	ARKADELPHIA	5	60.000
58	5021	PIGGOTT	11	70.000
59	5027	MAGNOLIA	3	117.000
60	5031	JONESBORO	10	60.000
61	5033	VAN BUREN	3	59.000
62	5035	WEST MEMPHIS	11	7.000
63	5037	WYNNE	9	48.500
64	5041	MC GEHEE	5	24.000
65	5047	OZARK	3	84.000
66	5051	HOT SPRINGS NATIONAL PARK	6	46.667
67	5055	PARAGOULD	11	67.000
68	5057	HOPE	4	105.000
69	5059	MALVERN	5	43.000
70	5061	NASHVILLE	4	104.000
71	5063	BATESVILLE	6	79.000
72	5067	NEWPORT	8	76.000
73	5069	PINE BLUFF	4	38.667
74	5075	WALNUT RIDGE	10	81.000
75	5081	ASHDOWN	4	127.000
76	5083	PARIS	3	89.000
77	5091	DODDRIDGE	4	147.000
78	5093	BLYTHEVILLE	12	55.000
79	5099	PRESCOTT	4	90.000
80	5103	CAMDEN	4	85.000
81	5107	HELENA	8	52.000
82	5109	KIRBY	4	84.000
83	5111	TRUMANN	8	37.000
84	5113	MENA	4	101.000
85	5115	RUSSELLVILLE	5	60.000
86	5119	LITTLE ROCK	5	3.786
87	5125	BENTON	5	23.000
88	5127	WALDRON	3	91.000
89	5131	FORT SMITH	3	59.500
90	5133	DE QUEEN	4	125.000
91	5139	EL DORADO	3	94.000
92	5143	FAYETTEVILLE	3	69.500
93	5145	SEARCY	5	45.000
94	5147	AUGUSTA	7	64.000
95	17001	QUINCY	15	0.000
96	17003	CAIRO	10	0.000
97	17007	BELVIDERE	11	59.000
98	17011	PRINCETON	14	18.000
99	17015	SAVANNA	12	17.000
100	17017	BEARDSTOWN	16	14.000
101	17019	CHAMPAIGN	15	81.000
102	17021	TAYLORVILLE	19	63.000
103	17023	MARSHALL	16	98.000
104	17025	FLORA	16	69.000
105	17027	CARLYLE	17	38.000
106	17029	MATTOON	19	103.000
107	17031	CHICAGO	9	5.917
108	17033	ROBINSON	16	74.000

109	17035	NEOGA	19	95.000
110	17037	DE KALB	11	42.000
111	17039	CLINTON	16	50.000
112	17041	TUSCOLA	19	92.000

OBS	FIPS	CITY	NUMPORT	D2WATER
113	17043	NAPERVILLE	10	9.250
114	17045	PARIS	18	113.000
115	17047	ALBION	13	38.000
116	17049	EFFINGHAM	18	87.000
117	17051	VANDALIA	18	56.000
118	17053	GIBSON CITY	15	64.000
119	17055	BENTON	14	58.000
120	17057	CANTON	15	17.000
121	17063	MORRIS	12	30.000
122	17065	MC LEANSBORO	14	51.000
123	17075	WATSEKA	14	63.000
124	17077	CARBONDALE	14	33.000
125	17079	NEWTON	16	76.000
126	17081	MOUNT VERNON	15	68.000
127	17085	GALENA	12	13.000
128	17087	VIENNA	12	28.000
129	17089	ELGIN	10	29.000
130	17091	KANKAKEE	11	38.000
131	17095	GALESBURG	15	34.000
132	17097	WAUKEGAN	8	35.500
133	17099	OTTAWA	13	13.000
134	17101	LAWRENCEVILLE	15	52.000
135	17103	DIXON	12	36.000
136	17105	PONTIAC	14	42.000
137	17107	LINCOLN	17	38.000
138	17109	MACOMB	15	33.000
139	17111	CRYSTAL LAKE	8	42.500
140	17113	BLOOMINGTON	15	35.500
141	17115	DECATUR	19	67.000
142	17117	CARLINVILLE	18	29.000
143	17119	ALTON	16	0.000
144	17121	CENTRALIA	17	53.000
145	17123	LACON	14	24.000
146	17125	HAVANA	15	0.000
147	17127	METROPOLIS	11	8.000
148	17135	LITCHFIELD	18	31.000
149	17137	JACKSONVILLE	17	18.000
150	17139	SULLIVAN	19	91.000
151	17141	ROCHELLE	12	39.000
152	17143	PEORIA	14	2.444
153	17145	DU QUOIN	14	51.000
154	17147	MONTICELLO	16	70.000
155	17153	MOUNDS	10	7.000
156	17155	HENNEPIN	14	13.000
157	17157	CHESTER	16	46.000
158	17159	OLNEY	16	59.000
159	17161	MOLINE	15	3.000
160	17163	EAST SAINT LOUIS	16	2.857
161	17165	HARRISBURG	13	45.000
162	17167	SPRINGFIELD	19	41.143
163	17171	WINCHESTER	17	15.000
164	17173	SHELBYVILLE	19	79.000
165	17177	FREEPORT	12	42.000
166	17179	PEKIN	15	8.000
167	17183	DANVILLE	14	107.000
168	17185	MOUNT CARMEL	14	33.000

OBS	FIPS	CITY	NUMPORT	D2WATER
169	17187	MONMOUTH	15	41.000
170	17189	NASHVILLE	16	45.000
171	17191	FAIRFIELD	14	52.000
172	17193	CARMI	13	32.000
173	17195	STERLING	12	25.000
174	17197	JOLIET	10	10.400
175	17199	MARION	13	43.000
176	17201	ROCKFORD	12	62.400
177	17203	EUREKA	14	16.000
178	18001	DECATUR	4	118.000
179	18003	FORT WAYNE	4	137.294
180	18005	COLUMBUS	4	66.500
181	18007	FOWLER	12	80.000
182	18009	HARTFORD CITY	4	101.000
183	18015	DELPHI	8	101.000
184	18017	LOGANSPORT	7	102.000
185	18019	JEFFERSONVILLE	7	2.000
186	18021	BRAZIL	14	109.000
187	18023	FRANKFORT	8	123.000
188	18025	TASWELL	11	43.000
189	18027	WASHINGTON	14	50.000
190	18029	LAWRENCEBURG	3	22.000
191	18033	AUBURN	3	138.000
192	18035	MUNCIE	5	86.250
193	18037	JASPER	11	44.000
194	18039	ELKHART	5	87.000
195	18041	CONNERSVILLE	3	50.000
196	18043	NEW ALBANY	7	4.000
197	18045	ATTICA	14	102.000
198	18049	ROCHESTER	6	93.000
199	18051	PRINCETON	14	26.000
200	18053	MARION	5	114.500
201	18055	LINTON	16	77.000
202	18057	CARMEL	7	104.500
203	18059	GREENFIELD	5	82.000
204	18061	CORYDON	9	19.000
205	18065	NEW CASTLE	5	71.000
206	18067	KOKOMO	7	124.500
207	18069	HUNTINGTON	5	130.000
208	18071	SEYMOUR	5	49.000
209	18073	RENSSELAER	10	67.000
210	18075	PORTLAND	4	92.000
211	18081	GREENWOOD	7	92.500
212	18083	VINCENNES	14	46.000
213	18085	WARSAW	5	103.000
214	18089	GARY	8	26.600
215	18091	MICHIGAN CITY	7	40.000
216	18093	BEDFORD	9	58.000
217	18095	ANDERSON	6	90.800
218	18097	INDIANAPOLIS	7	99.714
219	18099	PLYMOUTH	5	78.000
220	18101	LOOGOOTEE	12	59.000
221	18103	PERU	6	113.000
222	18105	BLOOMINGTON	10	75.000
223	18107	CRAWFORDSVILLE	11	126.000
224	18109	MARTINSVILLE	8	88.000

```
*******************************************************************
*
*     PROGRAM NAME
*     ACE9508.SAS
*
*     AUTHOR              DATE          REVISION          NOTES
*     MARK BURTON      AUG 1995
*
*     PURPOSE
*
*     MERGES DISTANCE TO WATER DATA WITH PRIMARY DATA SET. D2WATER
*     IS DEFINED AS THE ORIGIN DISTANCE TO WATER FOR SHIPMENTS
*     ORIGINATING WITHIN THE STUDY REGION WHICH TERMINATE OUTSIDE
*     THE REGION.  IT IS DEFINED AS THE TERMINUS DISTANCE TO WATER
*     FOR SHIPMENTS WHICH TERMINATE WITHIN THE STUDY REGION, BUT
*     WHICH HAVE ORIGINS OUTSIDE THE REGION.  FOR SHIPMENTS WHICH
*     BOTH ORIGINATE AND TERMINATE WITHIN THE STUDY REGION BOTH
*     D2WATER AND NUMPORTS WILL BE DETERMINED BY THE NEAREST OF
*     THE TWO.
*
*     FILES
*     ACE9505.SD2 - READ ONLY
*     D2WATER.SD2 - READ ONLY
*     ACE9506.SD2 - CREATED BY
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*************************1*****************************************;

LIBNAME WAYBILL 'D:\WAYBILL\';
NOTE: Libref WAYBILL was successfully assigned as follows:
      Engine:        V610
      Physical Name: D:\WAYBILL
LIBNAME COUNTY 'D:\COUNTY\';
NOTE: Libref COUNTY was successfully assigned as follows:
      Engine:        V610
      Physical Name: D:\COUNTY

DATA ONE;
   SET WAYBILL.ACE9505;

NOTE: The data set WORK.ONE has 74403 observations and 57 variables.
NOTE: The DATA statement used 1 minute 41.5 seconds.
PROC SORT DATA=ONE;
   BY OST TST;

NOTE: The data set WORK.ONE has 74403 observations and 57 variables.
NOTE: The PROCEDURE SORT used 3 minutes 53.75 seconds.
DATA ORONLY TMONLY BOTH;
   SET ONE;

   IF (OST='AL' OR OST='AR' OR OST='IA' OR OST='IL' OR OST='IN' OR
       OST='KS' OR OST='KY' OR OST='LA' OR OST='MN' OR OST='MO' OR
       OST='MS' OR OST='NE' OR OST='OH' OR OST='OK' OR OST='PA' OR
       OST='SD' OR OST='TN' OR OST='TX' OR OST='WI' OR OST='WV')
   AND
      (TST='AL' OR TST='AR' OR TST='IA' OR TST='IL' OR TST='IN' OR
       TST='KS' OR TST='KY' OR TST='LA' OR TST='MN' OR TST='MO' OR
       TST='MS' OR TST='NE' OR TST='OH' OR TST='OK' OR TST='PA' OR
       TST='SD' OR TST='TN' OR TST='TX' OR TST='WI' OR TST='WV')
```

```
    THEN OUTPUT BOTH; ELSE

    IF (OST NE 'AL' OR OST NE 'AR' OR OST NE 'IA' OR OST NE 'IL' OR OST
NE 'IN' OR
        OST NE 'KS' OR OST NE 'KY' OR OST NE 'LA' OR OST NE 'MN' OR OST
NE 'MO' OR
        OST NE 'MS' OR OST NE 'NE' OR OST NE 'OH' OR OST NE 'OK' OR OST
NE 'PA' OR
        OST NE 'SD' OR OST NE 'TN' OR OST NE 'TX' OR OST NE 'WI' OR OST
NE 'WV')
    AND
       (TST='AL' OR TST='AR' OR TST='IA' OR TST='IL' OR TST='IN' OR
        TST='KS' OR TST='KY' OR TST='LA' OR TST='MN' OR TST='MO' OR
        TST='MS' OR TST='NE' OR TST='OH' OR TST='OK' OR TST='PA' OR
        TST='SD' OR TST='TN' OR TST='TX' OR TST='WI' OR TST='WV')
    THEN OUTPUT TMONLY; ELSE

    OUTPUT ORONLY;

NOTE: The data set WORK.ORONLY has 16362 observations and 57 variables.
NOTE: The data set WORK.TMONLY has 17055 observations and 57 variables.
NOTE: The data set WORK.BOTH has 40986 observations and 57 variables.
NOTE: The DATA statement used 2 minutes 50.97 seconds.
  PROC DATASETS;
                              -----Directory-----

                  Libref:         WORK
                  Engine:         V610
                  Physical Name: C:\SASWORK\SASWORK\#TD15503

                         #  Name     Memtype  Indexes
                         ---------------------------
                         1  BOTH     DATA
                         2  ONE      DATA
                         3  ORONLY   DATA
                         4  TMONLY   DATA
    DELETE ONE;

NOTE: Deleting WORK.ONE (memtype=DATA).
NOTE: The PROCEDURE DATASETS used 2.14 seconds.
  PROC SORT DATA=ORONLY;
    BY OFIP;

NOTE: The data set WORK.ORONLY has 16362 observations and 57 variables.
NOTE: The PROCEDURE SORT used 46.07 seconds.
  DATA ORONLY;
    SET ORONLY;
    FIPS=OFIP;

NOTE: The data set WORK.ORONLY has 16362 observations and 58 variables.
NOTE: The DATA statement used 36.2 seconds.
  PROC SORT DATA=TMONLY;
    BY TFIP;

NOTE: The data set WORK.TMONLY has 17055 observations and 57 variables.
NOTE: The PROCEDURE SORT used 50.79 seconds.
  DATA TMONLY;
    SET TMONLY;
    FIPS=TFIP;

NOTE: The data set WORK.TMONLY has 17055 observations and 58 variables.
NOTE: The DATA statement used 39.04 seconds.
  DATA TWO;
    SET COUNTY.D2WATER;
    KEEP FIPS D2WATER NUMPORT MSNRST GINRST
         TNNRST TTNRST MONRST ILNRST ARNRST;

```

```
NOTE: The data set WORK.TWO has 1281 observations and 10 variables.
NOTE: The DATA statement used 1.69 seconds.
PROC SORT DATA=TWO;
   BY FIPS;
NOTE: The data set WORK.TWO has 1281 observations and 10 variables.
NOTE: The PROCEDURE SORT used 0.55 seconds.
DATA WAYBILL.TEMP1;
   MERGE ORONLY TWO;
   BY FIPS;
   IF UCAR=. THEN DELETE;
NOTE: The data set WAYBILL.TEMP1 has 16362 observations and 67 variables.
NOTE: The DATA statement used 29.87 seconds.
DATA WAYBILL.TEMP2;
   MERGE TMONLY TWO;
   BY FIPS;
   IF UCAR=. THEN DELETE;
NOTE: The data set WAYBILL.TEMP2 has 17055 observations and 67 variables.
NOTE: The DATA statement used 41.29 seconds.
PROC DATASETS;
                                   -----Directory-----

                    Libref:         WORK
                    Engine:         V610
                    Physical Name: C:\SASWORK\SASWORK\#TD15503

                            #  Name     Memtype  Indexes
                            ---------------------------
                            1  BOTH     DATA
                            2  ORONLY   DATA
                            3  TMONLY   DATA
                            4  TWO      DATA
   DELETE ORONLY TMONLY;
*****************************************************;
NOTE: Deleting WORK.ORONLY (memtype=DATA).
NOTE: Deleting WORK.TMONLY (memtype=DATA).
NOTE: The PROCEDURE DATASETS used 0.28 seconds.
PROC SORT DATA=BOTH;
   BY OFIP;
NOTE: The data set WORK.BOTH has 40986 observations and 57 variables.
NOTE: The PROCEDURE SORT used 2 minutes 16.76 seconds.
DATA BOTH;
   SET BOTH;
   FIPS=OFIP;
NOTE: The data set WORK.BOTH has 40986 observations and 58 variables.
NOTE: The DATA statement used 2 minutes 1.61 seconds.
DATA BOTH;
   MERGE BOTH TWO;
   BY FIPS;

   IF UCAR=. THEN DELETE;

   OD2W=D2WATER;
   ONPORT=NUMPORT;

   OMSDUM=MSNRST;
   OGIDUM=GINRST;
   OTNDUM=TNNRST;
   OTTDUM=TTNRST;
   OMODUM=MONRST;
   OILDUM=ILNRST;
```

```
    OARDUM=ARNRST;

    DROP FIPS D2WATER NUMPORT MSNRST GINRST TNNRST
         TTNRST MONRST ILNRST ARNRST;

NOTE: The data set WORK.BOTH has 40986 observations and 66 variables.
NOTE: The DATA statement used 2 minutes 6.49 seconds.
PROC SORT DATA=BOTH;
    BY TFIP;

NOTE: The data set WORK.BOTH has 40986 observations and 66 variables.
NOTE: The PROCEDURE SORT used 2 minutes 12.09 seconds.
DATA BOTH;
    SET BOTH;
    FIPS=TFIP;

NOTE: The data set WORK.BOTH has 40986 observations and 67 variables.
NOTE: The DATA statement used 1 minute 51.0 seconds.
DATA BOTH;
    MERGE BOTH TWO;
    BY FIPS;

    IF UCAR=. THEN DELETE;

    TD2W=D2WATER;
    TNPORT=NUMPORT;

    TMSDUM=MSNRST;
    TGIDUM=GINRST;
    TTNDUM=TNNRST;
    TTTDUM=TTNRST;
    TMODUM=MONRST;
    TILDUM=ILNRST;
    TARDUM=ARNRST;

    DROP FIPS D2WATER NUMPORT MSNRST GINRST TNNRST
         TTNRST MONRST ILNRST ARNRST;

NOTE: The data set WORK.BOTH has 40986 observations and 75 variables.
NOTE: The DATA statement used 2 minutes 6.7 seconds.
PROC DATASETS;
                              -----Directory-----

                   Libref:        WORK
                   Engine:        V610
                   Physical Name: C:\SASWORK\SASWORK\#TD15503

                            #  Name  Memtype  Indexes
                            -------------------------
                            1  BOTH  DATA
                            2  TWO   DATA
    DELETE TWO;

NOTE: Deleting WORK.TWO (memtype=DATA).
NOTE: The PROCEDURE DATASETS used 0.22 seconds.
DATA BOTH;
    SET BOTH;

    IF OD2W < TD2W THEN D2WATER=OD2W; ELSE D2WATER=TD2W;
    IF OD2W < TD2W THEN NUMPORT=ONPORT; ELSE NUMPORT=TNPORT;
    IF OD2W < TD2W THEN  MSNRST=OMSDUM; ELSE MSNRST=TMSDUM;
    IF OD2W < TD2W THEN  GINRST=OGIDUM; ELSE GINRST=TGIDUM;
    IF OD2W < TD2W THEN  TNNRST=OTNDUM; ELSE TNNRST=TTNDUM;
    IF OD2W < TD2W THEN  TTNRST=OTTDUM; ELSE TTNRST=TTTDUM;
    IF OD2W < TD2W THEN  MONRST=OMODUM; ELSE MONRST=TMODUM;
    IF OD2W < TD2W THEN  ILNRST=OILDUM; ELSE ILNRST=TILDUM;
    IF OD2W < TD2W THEN  ARNRST=OARDUM; ELSE ARNRST=TARDUM;
```

```
221
222     DROP OD2W ONPORT OMSDUM OGIDUM OTNDUM OTTDUM OMODUM OILDUM OARDUM
223          TD2W TNPORT TMSDUM TGIDUM TTNDUM TTTDUM TMODUM TILDUM TARDUM;
224
NOTE: The data set WORK.BOTH has 40986 observations and 66 variables.
NOTE: The DATA statement used 1 minute 45.57 seconds.
225  DATA FINAL;
226     SET WAYBILL.TEMP1
227         WAYBILL.TEMP2
228         BOTH;
229
NOTE: The data set WORK.FINAL has 74403 observations and 67 variables.
NOTE: The DATA statement used 2 minutes 35.0 seconds.
230  PROC DATASETS;
                              -----Directory-----

                  Libref:        WORK
                  Engine:        V610
                  Physical Name: C:\SASWORK\SASWORK\#TD15503

                          #  Name   Memtype  Indexes
                          --------------------------
                          1  BOTH   DATA
                          2  FINAL  DATA
231     DELETE BOTH;
232
NOTE: Deleting WORK.BOTH (memtype=DATA).
NOTE: The PROCEDURE DATASETS used 0.22 seconds.
233  PROC SORT DATA=FINAL;
234     BY WAYD;
235
NOTE: The data set WORK.FINAL has 74403 observations and 67 variables.
NOTE: The PROCEDURE SORT used 4 minutes 31.94 seconds.
236  DATA WAYBILL.ACE9506;
237     SET FINAL;
238
NOTE: The data set WAYBILL.ACE9506 has 74403 observations and 67 variables.
NOTE: The DATA statement used 3 minutes 4.33 seconds.
239  PROC MEANS DATA=FINAL;
240
241  RUN;
NOTE: The PROCEDURE MEANS used 34.6 seconds.
```

The SAS System 1

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Variable	N	Mean	Std Dev	Minimum	Maximum
WAYD	74403	920284.00	1844.78	911215.00	921214.00
UCAR	74403	32.4670107	42.9359834	1.0000000	241.0000000
UREV	74403	38767.50	62747.06	0	636330.00
TRAN	74403	2.0373775	3.7663884	0	9.0000000
REBL	74403	4.1460425	4.4766584	0	9.0000000
SRAT	74403	2.4411381	1.5901998	1.0000000	8.0000000
REP	74403	2.5013642	1.1174936	1.0000000	4.0000000
RPRT	74403	420.0512345	258.2607602	16.0000000	919.0000000
ORR	74403	437.8206793	270.8858944	1.0000000	994.0000000
TRR	74403	420.1569964	258.2808436	16.0000000	919.0000000
POPC	74403	114047.16	174146.68	1.0000000	512664.00
STRC	74403	3020.43	4249.99	1.0000000	12816.00
CTYP	74403	285.8963214	157.8660436	13.0000000	982.0000000
STCC	74403	1806944.77	1174781.17	113210.00	4021149.00
EXPN	74403	21.4093518	18.8139888	2.0000000	100.0000000
ERR1	74403	0.0592449	0.6858978	0	8.0000000
ERR2	74403	0	0	0	0
UTON	74403	3216.95	4381.83	1.0000000	26731.00
TDIS	74403	561.0032391	508.8628508	0.4000000	3412.40

OBEA	74403	92.3389648	44.5694397	4.0000000	191.0000000
TBEA	74403	80.7826297	40.0736220	2.0000000	191.0000000
OFIP	74403	32247.58	16955.03	0	56037.00
TFIP	74403	30433.90	15227.99	0	56043.00
MILRT	74403	78.4167036	190.2729291	0	892.0000000
VCOST	74403	22296.28	37089.88	0	389462.33
NUMRR	74403	1.4151311	0.6667401	1.0000000	6.0000000
STCC5	74403	18068.98	11747.90	1132.00	40211.00
RTM	74403	0.0658846	0.3441463	0	27.2000000
TON2CAR	74403	91.3955062	16.2661049	1.0000000	312.0000000
VC2TON	74403	10.9381448	21.2427496	0	2647.64
RRCON	74403	0.1245428	0.1328380	8.449774E-7	0.8970806
DENSITY	74403	171.8544246	348.5134060	0.0125070	2941.96
SYSCAR	74403	0.5442388	0.4980424	0	1.0000000
QTR1	74403	0.2838595	0.4508725	0	1.0000000
QTR2	74403	0.2416838	0.4281065	0	1.0000000
QTR3	74403	0.2609707	0.4391669	0	1.0000000
CD22	74403	0.0282381	0.1656535	0	1.0000000
CD76	74403	0.0866766	0.2813625	0	1.0000000
CD569	74403	0.0029165	0.0539266	0	1.0000000
CD131	74403	0.0260473	0.1592772	0	1.0000000
CD190	74403	0.1016088	0.3021352	0	1.0000000
CD712	74403	0.1547653	0.3616832	0	1.0000000
CD350	74403	0.0214507	0.1448824	0	1.0000000
CD400	74403	0.0044756	0.0667507	0	1.0000000
CD905	74403	0.0060885	0.0777912	0	1.0000000
CD555	74403	0.1273470	0.3333635	0	1.0000000
CD907	74403	0.0028493	0.0533035	0	1.0000000
CD482	74403	0.0197573	0.1391660	0	1.0000000
CD721	74403	0.0115990	0.1070729	0	1.0000000
CD694	74403	0.0024730	0.0496683	0	1.0000000
CD802	74403	0.0536672	0.2253613	0	1.0000000
FIPS	33417	31381.82	15659.06	1015.00	55141.00
NUMPORT	74372	6.0797074	4.3178552	1.0000000	19.0000000
D2WATER	74372	64.8144733	74.7711373	0	684.0000000
MSNRST	74372	0.1708573	0.3763868	0	1.0000000

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Variable	N	Mean	Std Dev	Minimum	Maximum
GINRST	74372	0.0872102	0.2821448	0	1.0000000
TNNRST	74372	0.1240252	0.3296125	0	1.0000000
TTNRST	74372	0.0535685	0.2251658	0	1.0000000
MONRST	74372	0.0930054	0.2904420	0	1.0000000
ILNRST	74372	0.1340155	0.3406712	0	1.0000000
ARNRST	74372	0.0669741	0.2499789	0	1.0000000

```
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NOTE: SAS (r) Proprietary Software Release 6.10  TS019
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NOTE: The SAS System for Microsoft Windows, Release 6.10 Limited Production
     *****************************************************************
     *
     *     PROGRAM NAME
     *     ACE9509.SAS
     *
     *     AUTHOR          DATE          REVISION        NOTES
     *     MARK BURTON    AUG 1995
     *
     *     PURPOSE
     *
     *     PRODUCES MEANS BY FIVE DIGIT STCC FOR FINAL DATA SET
     *
     *     FILES
     *     ACE9506.SD2 - READ ONLY
     *
     *****************************************************************;

      OPTIONS MISSING = '.';
      OPTIONS LS=78;

     *****************************************************************
     *
     * READ WAYBILL DATA;
     *
     ************************1****************************************;

     LIBNAME WAYBILL 'D:\WAYBILL\';
NOTE: Libref WAYBILL was successfully assigned as follows:
      Engine:        V610
      Physical Name: D:\WAYBILL

     DATA ONE;
        SET WAYBILL.ACE9506;

NOTE: The data set WORK.ONE has 74403 observations and 67 variables.
NOTE: The DATA statement used 2 minutes 4.95 seconds.
     PROC SORT DATA=ONE;
        BY STCC5;

NOTE: The data set WORK.ONE has 74403 observations and 67 variables.
NOTE: The PROCEDURE SORT used 4 minutes 40.77 seconds.
     PROC MEANS DATA=ONE;
        BY STCC5;
        VAR RTM UCAR UTON TDIS RRCON D2WATER SYSCAR;

     RUN;
NOTE: The PROCEDURE MEANS used 25.05 seconds.
```

The SAS System 1

10:02 Thursday, August 24, 1995

---------------------------------- STCC5=1132 ----------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	5266	0.0446330	0.1228602	0.0019739	3.7829028
UCAR	5266	26.3894797	27.2222403	1.0000000	132.0000000
UTON	5266	2526.41	2670.55	13.0000000	20280.00
TDIS	5266	653.8446639	568.6187914	1.0000000	2698.40
RRCON	5266	0.0903651	0.1081913	2.7381954E-6	0.5778272
D2WATER	5239	63.2127730	64.4465353	0	417.0000000
SYSCAR	5266	0.5947588	0.4909853	0	1.0000000

STCC5=1137

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	3821	0.0558257	0.3175293	0	11.8367347
UCAR	3821	22.1271918	25.3286367	1.0000000	128.0000000
UTON	3821	2159.42	2492.75	5.0000000	12544.00
TDIS	3821	638.0354619	472.5492351	1.0000000	2596.20
RRCON	3821	0.0885902	0.0909159	0.000025155	0.7280611
D2WATER	3821	71.9639066	88.3241309	0	412.0000000
SYSCAR	3821	0.5414813	0.4983415	0	1.0000000

STCC5=1144

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	1451	0.0557003	0.1789479	0.0012415	3.4900000
UCAR	1451	25.3818057	27.2934308	1.0000000	121.0000000
UTON	1451	2429.38	2650.61	23.0000000	11858.00
TDIS	1451	461.5629221	453.9113179	1.0000000	3412.40
RRCON	1451	0.0755971	0.0803078	2.1636736E-6	0.3952390
D2WATER	1451	42.7827939	54.8759468	0	390.0000000
SYSCAR	1451	0.5665059	0.4957281	0	1.0000000

STCC5=11212

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	28961	0.0391190	0.1418106	0.000109886	10.4687500
UCAR	28961	68.6867857	45.8582174	1.0000000	241.0000000
UTON	28961	6913.02	4741.83	52.0000000	26731.00
TDIS	28961	554.6270018	427.7347448	0.4000000	3019.80
RRCON	28961	0.1725623	0.1529834	0.000048402	0.6579098
D2WATER	28961	77.7577376	67.4706355	0	443.0000000
SYSCAR	28961	0.5313698	0.4990236	0	1.0000000

The SAS System 2
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STCC5=14111

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	5	0.0308135	0.0163311	0.0160290	0.0588229
UCAR	5	1.0000000	0	1.0000000	1.0000000
UTON	5	69.2000000	27.9051966	20.0000000	87.0000000
TDIS	5	1867.94	912.3439828	514.6000000	3077.00
RRCON	5	0.1899295	0.1712594	0.0030837	0.3937449
D2WATER	5	141.7833333	90.6799852	5.9166667	260.0000000
SYSCAR	5	0.8000000	0.4472136	0	1.0000000

STCC5=14219

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	3198	0.0381198	0.0335016	0.0045320	1.4245111
UCAR	3198	17.1366479	13.6970813	1.0000000	81.0000000
UTON	3198	1634.06	1328.42	20.0000000	7275.00
TDIS	3198	179.1705441	144.2097239	8.7000000	2799.30
RRCON	3198	0.0885377	0.1201556	0.000030706	0.6142854
D2WATER	3198	90.5993577	74.5381439	0	412.0000000
SYSCAR	3198	0.6103815	0.4877400	0	1.0000000

STCC5=14412

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	433	0.0425839	0.0477624	0.0030864	0.4567980
UCAR	433	12.8545035	10.9715366	1.0000000	59.0000000
UTON	433	1160.06	1023.39	23.0000000	5900.00
TDIS	433	311.3946882	256.3937148	4.4000000	1539.00
RRCON	433	0.1059798	0.0942577	0.000120328	0.7280611
D2WATER	433	87.5155383	75.8832087	2.4545455	510.0000000
SYSCAR	433	0.7806005	0.4143185	0	1.0000000

STCC5=20923

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	2751	0.0432719	0.2979600	0.0038989	15.6000000
UCAR	2751	4.0498001	9.2740925	1.0000000	100.0000000
UTON	2751	368.1973828	862.2944766	5.0000000	9673.00
TDIS	2751	557.9475827	505.7316466	1.0000000	2622.20
RRCON	2751	0.0824276	0.0952725	0.000114399	0.5224856
D2WATER	2751	44.1836534	47.8781904	0	189.0000000
SYSCAR	2751	0.6117775	0.4874343	0	1.0000000

The SAS System 3
10:02 Thursday, August 24, 1995

STCC5=24115

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	2834	0.1365612	0.6217685	0.0159585	18.4285714
UCAR	2834	2.0201129	3.0894337	1.0000000	23.0000000
UTON	2834	135.8916725	218.3980260	7.0000000	1955.00
TDIS	2834	134.3154905	125.8700337	1.0000000	1985.80
RRCON	2834	0.0684580	0.0783505	0.000032965	0.3246153
D2WATER	2834	69.2982511	59.8607656	0	684.0000000
SYSCAR	2834	0.6432604	0.4791215	0	1.0000000

STCC5=28123

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	1795	0.0401693	0.0772577	0.0049579	2.5252525
UCAR	1795	1.3264624	3.3978724	1.0000000	100.0000000
UTON	1795	122.1643454	333.6689747	3.0000000	9922.00
TDIS	1795	1224.14	549.5688052	1.0000000	3391.30
RRCON	1795	0.0513128	0.0698461	0.000016809	0.4429467
D2WATER	1795	37.7023821	63.2046183	0	460.0000000
SYSCAR	1795	0.1554318	0.3624167	0	1.0000000

STCC5=28125

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	1967	0.0931422	0.9109989	0.000936768	27.2000000
UCAR	1967	5.7641078	14.9176878	1.0000000	187.0000000
UTON	1967	568.5327911	1489.16	5.0000000	18699.00
TDIS	1967	896.1913066	538.2708632	1.0000000	2845.10
RRCON	1967	0.1038078	0.0968511	6.1959445E-6	0.6674372
D2WATER	1965	41.4246450	75.6671261	0	684.0000000
SYSCAR	1967	0.2409761	0.4277846	0	1.0000000

STCC5=28181

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	1632	0.0630667	0.1120205	0.0088481	2.2816479
UCAR	1632	1.1115196	1.1874325	1.0000000	22.0000000
UTON	1632	98.2751225	113.4550083	5.0000000	2204.00
TDIS	1632	930.9189951	652.4096908	1.0000000	3143.70
RRCON	1632	0.1068101	0.0958818	0.000021012	0.6142854
D2WATER	1632	44.4358906	63.0011278	0	319.0000000
SYSCAR	1632	0.1537990	0.3608666	0	1.0000000

The SAS System 4
10:02 Thursday, August 24, 1995

STCC5=28184

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	1124	0.0593672	0.1418763	0.0066268	2.0147059
UCAR	1124	1.2998221	1.1077160	1.0000000	10.0000000
UTON	1124	114.5951957	109.2780274	10.0000000	953.0000000
TDIS	1124	1036.96	771.3759964	1.0000000	3154.80
RRCON	1124	0.0784358	0.0899756	0.000022922	0.7280611
D2WATER	1124	35.5704129	49.9045163	0	684.0000000
SYSCAR	1124	0.0044484	0.0665774	0	1.0000000

STCC5=28712

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	1125	0.0566179	0.3162090	0.0036498	7.9696970
UCAR	1125	1.7928889	3.1004453	1.0000000	30.0000000
UTON	1125	175.4177778	302.8889512	22.0000000	2993.00
TDIS	1125	710.4411556	469.1596645	1.0000000	2372.50
RRCON	1125	0.1098089	0.1018675	5.2669453E-6	0.5800913
D2WATER	1124	47.8500683	56.2260405	0	364.0000000
SYSCAR	1125	0.7235556	0.4474381	0	1.0000000

STCC5=28713

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	712	0.0473474	0.0415957	0.0026945	0.5129913
UCAR	712	1.6095506	2.1600695	1.0000000	20.0000000
UTON	712	158.5702247	217.0664358	18.0000000	2006.00
TDIS	712	557.8875000	454.0732746	7.9000000	3202.90
RRCON	712	0.1143215	0.0882398	0.000527995	0.4756576
D2WATER	712	33.7579204	55.6592776	0	259.0000000
SYSCAR	712	0.0028090	0.0529626	0	1.0000000

STCC5=28714

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	532	0.0338453	0.0364983	0.0054843	0.4000000
UCAR	532	1.1278195	0.6278356	1.0000000	6.0000000
UTON	532	105.0469925	63.2313456	8.0000000	598.0000000
TDIS	532	1045.75	479.0544684	6.1000000	2587.30
RRCON	532	0.0904183	0.1012931	0.000021512	0.8057057
D2WATER	532	56.8591181	83.1419032	0	426.0000000
SYSCAR	532	0.0432331	0.2035728	0	1.0000000

The SAS System 5
10:02 Thursday, August 24, 1995

STCC5=29114

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	694	0.0545046	0.0976979	0.0109068	1.9932845
UCAR	694	1.0850144	0.8164826	1.0000000	11.0000000
UTON	694	78.8703170	65.5316842	7.0000000	841.0000000
TDIS	694	937.4899135	636.2031365	9.0000000	3034.50
RRCON	694	0.0666593	0.0875526	0.000028651	0.7280611
D2WATER	694	31.9083161	50.8459703	0	244.0000000
SYSCAR	694	0.0072046	0.0846347	0	1.0000000

STCC5=29116

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	607	0.0487389	0.1895253	0.0110590	4.6000000
UCAR	607	2.0823723	2.1138711	1.0000000	16.0000000
UTON	607	183.9159802	186.4887060	4.0000000	1437.00
TDIS	607	644.8634267	381.1754298	6.2000000	2814.70
RRCON	607	0.0935590	0.1360167	0.000527849	0.8970806
D2WATER	607	69.9255262	169.0150084	0	684.0000000
SYSCAR	607	0.0131796	0.1141373	0	1.0000000

STCC5=29914

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	2276	0.0771863	0.1916730	0.0143758	3.7946429
UCAR	2276	14.4156415	16.2685269	1.0000000	95.0000000
UTON	2276	847.5676626	1067.33	22.0000000	6440.00
TDIS	2276	414.2041301	423.1951814	1.4000000	3167.00
RRCON	2276	0.0915713	0.0842433	0.000084926	0.3375073
D2WATER	2276	37.1036997	50.6058952	0	443.0000000
SYSCAR	2276	0.5733743	0.4946956	0	1.0000000

STCC5=32411

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	1914	0.0458826	0.1283913	0.0094451	5.5297398
UCAR	1914	3.7241379	5.1177635	1.0000000	59.0000000
UTON	1914	346.6551724	471.1985887	1.0000000	4972.00
TDIS	1914	371.4292581	261.8186976	39.4000000	2837.40
RRCON	1914	0.0923107	0.0943001	0.000108401	0.6142854
D2WATER	1914	63.7471973	96.4247848	0	684.0000000
SYSCAR	1914	0.7032393	0.4569495	0	1.0000000

The SAS System 6
10:02 Thursday, August 24, 1995

STCC5=33121

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	3138	0.0995763	0.1290434	0.0096223	1.0466667
UCAR	3138	4.1800510	9.4595977	1.0000000	61.0000000
UTON	3138	369.6574251	863.3534600	3.0000000	5812.00
TDIS	3138	512.7407266	614.1503849	7.3000000	3088.80
RRCON	3138	0.1486844	0.1484873	0.000038310	0.7432824
D2WATER	3138	39.6458330	46.7101583	0	248.0000000
SYSCAR	3138	0.7922243	0.4057800	0	1.0000000

------------------------------- STCC5=33123 -------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	2591	0.0643069	0.2901576	0.000061017	14.0470588
UCAR	2591	1.8556542	5.5804407	1.0000000	69.0000000
UTON	2591	155.3643381	492.0705807	3.0000000	6056.00
TDIS	2591	678.0795832	616.4680705	1.0000000	3116.30
RRCON	2591	0.0779181	0.0830348	0.000017287	0.5662706
D2WATER	2591	32.1742923	45.1357746	0	684.0000000
SYSCAR	2591	0.8050946	0.3962044	0	1.0000000

------------------------------- STCC5=33155 -------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	6	0.0429481	0.0085907	0.0278480	0.0504379
UCAR	6	1.0000000	0	1.0000000	1.0000000
UTON	6	25.5000000	19.8569887	14.0000000	65.0000000
TDIS	6	1239.37	736.4236272	494.5000000	2125.80
RRCON	6	0.0344335	0.0219318	0.0113882	0.0617386
D2WATER	6	25.0168070	46.6988989	5.9166667	120.3404255
SYSCAR	6	0.1666667	0.4082483	0	1.0000000

------------------------------- STCC5=33311 -------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	492	0.0354822	0.0261588	0.0022517	0.1301340
UCAR	492	1.6808943	1.9892278	1.0000000	24.0000000
UTON	492	157.0284553	195.9648728	16.0000000	2349.00
TDIS	492	962.2542683	618.3583894	73.7000000	2553.60
RRCON	492	0.0590913	0.0588122	0.000224433	0.3854967
D2WATER	492	230.7503521	269.1503843	0	684.0000000
SYSCAR	492	0.7662602	0.4236394	0	1.0000000

The SAS System 7
10:02 Thursday, August 24, 1995

------------------------------- STCC5=40211 -------------------------------

Variable	N	Mean	Std Dev	Minimum	Maximum
RTM	5078	0.2412903	0.8824511	0.000040280	22.4754098
UCAR	5078	1.4476172	1.5265729	1.0000000	22.0000000
UTON	5078	107.2772745	123.2117016	1.0000000	1819.00
TDIS	5078	306.0357621	342.8559854	0.9000000	3234.90
RRCON	5078	0.1174245	0.1380451	8.449774E-7	0.7432824
D2WATER	5077	57.4732064	74.5708723	0	684.0000000
SYSCAR	5078	0.7520677	0.4318548	0	1.0000000

```
*****************************************************************
*
*    PROGRAM NAME
*    ACE9510.SAS
*
*    AUTHOR           DATE          REVISION        NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    MERGES OFF-SYSTEM D2WATER DATA WITH PRIMARY DATA SET
*
*    FILES
*    ACE9508.SD2 - READ ONLY
*    OFFD2W.DAT  - READ ONLY
*
*****************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*****************************************************************
*
* READ WAYBILL DATA;
*
*************************1***************************************;

LIBNAME WAYBILL 'D:\WAYBILL\';

DATA ONE;
   INFILE 'D:\COUNTY\OFFD2W.DAT';

   INPUT STATE $ D2W NRSTRVR $;

   CHKVAR=_N_;

PROC SORT DATA=ONE;
   BY STATE;

DATA ONEA;
   SET ONE;

   OST=STATE;
   ONRSTRVR=NRSTRVR;

   DROP STATE NRSTRVR;

DATA TWO;
   SET WAYBILL.ACE9508;

PROC SORT DATA=TWO;
   BY OST;

DATA WAYBILL.TEMP1;
   MERGE TWO ONEA;
   BY OST;

   IF OD2W=. THEN OD2W=D2W;

   DROP CHKVAR D2W;

PROC DATASETS;
   DELETE TWO;

DATA ONEB;
   SET ONE;
```

```
    TST=STATE;
    TNRSTRVR=NRSTRVR;

    DROP STATE NRSTRVR;

 PROC SORT DATA=WAYBILL.TEMP1;
    BY TST;

 DATA WAYBILL.ACE9509;
    MERGE WAYBILL.TEMP1 ONEB;
    BY TST;

    IF TD2W=. THEN TD2W=D2W;

    IF OMSDUM=1 THEN ONRSTRVR='MS';
    IF OGIDUM=1 THEN ONRSTRVR='GI';
    IF OTNDUM=1 THEN ONRSTRVR='TN';
    IF OTTDUM=1 THEN ONRSTRVR='TT';
    IF OMODUM=1 THEN ONRSTRVR='MO';
    IF OILDUM=1 THEN ONRSTRVR='IL';
    IF OARDUM=1 THEN ONRSTRVR='AR';
    IF OOHDUM=1 THEN ONRSTRVR='OH';

    IF TMSDUM=1 THEN TNRSTRVR='MS';
    IF TGIDUM=1 THEN TNRSTRVR='GI';
    IF TTNDUM=1 THEN TNRSTRVR='TN';
    IF TTTDUM=1 THEN TNRSTRVR='TT';
    IF TMODUM=1 THEN TNRSTRVR='MO';
    IF TILDUM=1 THEN TNRSTRVR='IL';
    IF TARDUM=1 THEN TNRSTRVR='AR';
    IF TOHDUM=1 THEN TNRSTRVR='OH';

    DROP CHKVAR  D2W    OMSDUM OGIDUM OTNDUM OTTDUM OMODUM OILDUM OARDUM
         OOHDUM  TMSDUM TGIDUM TTNDUM TTTDUM TMODUM TILDUM TARDUM TOHDUM
         NUMPORT ONPORT TNPORT;

 RUN;
```

CORN

```
*********************************************************************
*
*    PROGRAM NAME
*    ACE9512A.SAS
*
*    AUTHOR           DATE           REVISION          NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E E I T   D O   N O T   E D I T
*
*
*    FILES                           COMMODITY        01132 CORN
*    ACE9509.SD2 - READ ONLY
*
*********************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*********************************************************************
*
* READ WAYBILL DATA;
*
*************************1*******************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=1132;
   IF RTM < 0.29035;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

PROC MEANS DATA=ONE;
  VAR WAYD;

DATA TWO;
   SET ONE;

  IF WAYD GE 920100 AND WAYD LT 920200 THEN MNTH01=1; ELSE MNTH01=0;
  IF WAYD GE 920200 AND WAYD LT 920300 THEN MNTH02=1; ELSE MNTH02=0;
  IF WAYD GE 920300 AND WAYD LT 920400 THEN MNTH03=1; ELSE MNTH03=0;
  IF WAYD GE 920400 AND WAYD LT 920500 THEN MNTH04=1; ELSE MNTH04=0;
  IF WAYD GE 920500 AND WAYD LT 920600 THEN MNTH05=1; ELSE MNTH05=0;
  IF WAYD GE 920600 AND WAYD LT 920700 THEN MNTH06=1; ELSE MNTH06=0;
  IF WAYD GE 920700 AND WAYD LT 920800 THEN MNTH07=1; ELSE MNTH07=0;
  IF WAYD GE 920800 AND WAYD LT 920900 THEN MNTH08=1; ELSE MNTH08=0;
  IF WAYD GE 920900 AND WAYD LT 921000 THEN MNTH09=1; ELSE MNTH09=0;
  IF WAYD GE 921000 AND WAYD LT 921100 THEN MNTH10=1; ELSE MNTH10=0;
  IF WAYD GE 921100 AND WAYD LT 921200 THEN MNTH11=1; ELSE MNTH11=0;
```

```
IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
 (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;

IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
   OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
   TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
   TST='TN';

IF OD2W=0 THEN OD2W=1;
IF TD2W=0 THEN TD2W=1;

IF TD2W LT  50 THEN TCDUM=1; ELSE TCDUM=0;
IF OD2W LT 105 THEN OCDUM=1; ELSE OCDUM=0;

OD2W=OD2W/TDIS;
TD2W=TD2W/TDIS;

TDIS2   = TDIS**2;
UCAR2   = UCAR**2;

OD2W=OD2W*OCDUM;
TD2W=TD2W*TCDUM;

INTD2W=OD2W*TD2W;

XTON=EXPN*UTON;
XTM=EXPN*UTON*TDIS;
XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

  MODEL RTM=UCAR
          TON2CAR         TDIS            TDIS2
          OD2W            TD2W            OCDUM
          TCDUM           NUMRR           RRCON
          DENSITY         SYSCAR          MNTH01
          MNTH02          MNTH03          MNTH04
          MNTH05          MNTH06          MNTH07
          MNTH08          MNTH09          MNTH10
          MNTH11          CD22            CD76
          CD569           CD131           CD190
          CD712           CD350           CD400
          CD555           CD482           CD694;

PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

  MODEL RTM=UCAR
          TON2CAR         TDIS            TDIS2
          OD2W            TD2W            OCDUM
          TCDUM           NUMRR           RRCON
          DENSITY         SYSCAR          MNTH01
          MNTH02          MNTH03          MNTH04
          MNTH05          MNTH06          MNTH07
```

```
                MNTH08          MNTH09              MNTH10
                MNTH11          CD22                CD76
                CD569           CD131               CD190
                CD712           CD350               CD400
                CD555           CD482               CD694/P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
```

```
    SET BEA;
    FILE 'C:\BURTON\ACEOUT\BEA01132.DAT';

    PUT STCC5   1-5
        OBEA    7-9
        TBEA   11-13
        DIFF   15-24
        PDIFF  26-32 .5;

RUN;
```

The SAS System 2
14:29 Tuesday, October 31, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	34	1.29516	0.03809	144.119	0.0001
Error	2749	0.72661	0.00026		
C Total	2783	2.02177			

Root MSE	0.01626	R-square	0.6406
Dep Mean	0.03546	Adj R-sq	0.6362
C.V.	45.84645		

The SAS System 3
14:29 Tuesday, October 31, 1995

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.152935	0.00475924	32.134	0.0001
UCAR	1	-0.000114	0.00001473	-7.746	0.0001
TON2CAR	1	-0.001020	0.00004223	-24.156	0.0001
TDIS	1	-0.000056014	0.00000276	-20.279	0.0001
TDIS2	1	1.9602277E-8	0.00000000	16.313	0.0001
OD2W	1	0.008915	0.00033974	26.240	0.0001
TD2W	1	0.105959	0.00606551	17.469	0.0001
OCDUM	1	-0.001131	0.00082471	-1.371	0.1704
TCDUM	1	-0.008852	0.00086086	-10.283	0.0001
NUMRR	1	0.000465	0.00107702	0.432	0.6661
RRCON	1	-0.012473	0.00527212	-2.366	0.0181
DENSITY	1	0.000008907	0.00000276	3.223	0.0013
SYSCAR	1	0.001579	0.00069979	2.257	0.0241
MNTH01	1	0.002374	0.00153362	1.548	0.1217
MNTH02	1	0.002419	0.00158893	1.523	0.1280
MNTH03	1	0.001211	0.00144942	0.835	0.4036
MNTH04	1	0.002615	0.00155065	1.686	0.0919
MNTH05	1	0.001112	0.00151503	0.734	0.4632
MNTH06	1	0.003540	0.00145794	2.428	0.0152
MNTH07	1	0.000483	0.00139435	0.346	0.7292
MNTH08	1	0.000484	0.00151447	0.319	0.7495
MNTH09	1	-0.000267	0.00157675	-0.170	0.8654
MNTH10	1	0.004893	0.00149113	3.282	0.0010
MNTH11	1	0.000882	0.00145020	0.608	0.5431
CD22	1				
CD76	1				
CD569	1				
CD131	1				
CD190	1				
CD712	1				
CD350	1				
CD400	1				
CD555	1				
CD482	1				
CD694	1				

The SAS System 4
14:29 Tuesday, October 31, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	2784	0.0354615	0.0215728
NOWAT		2784	0.0470023	0.0312797
DIFF		2784	0.0115408	0.0128818

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0438325	0.1890108
NOWAT		-0.0422596	0.3282300
DIFF		0	0.1392191

The SAS System 5
14:29 Tuesday, October 31, 1995

Variable	Mean	Sum
RED	40803.06	113595714
XTM	6627730.33	18557644934
XTON	12449.16	34857657.00
XREV	140769.47	394154522

WHEAT

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9513P.SAS
*
*    AUTHOR            DATE          REVISION          NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                           COMMODITY         01137 WHEAT
*    ACE9509.SD2 - READ ONLY
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*******************************************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=1137;
   IF RTM < 0.6906;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

  IF WAYD GE 920100 AND WAYD LT 920200 THEN MNTH01=1; ELSE MNTH01=0;
  IF WAYD GE 920200 AND WAYD LT 920300 THEN MNTH02=1; ELSE MNTH02=0;
  IF WAYD GE 920300 AND WAYD LT 920400 THEN MNTH03=1; ELSE MNTH03=0;
  IF WAYD GE 920400 AND WAYD LT 920500 THEN MNTH04=1; ELSE MNTH04=0;
  IF WAYD GE 920500 AND WAYD LT 920600 THEN MNTH05=1; ELSE MNTH05=0;
  IF WAYD GE 920600 AND WAYD LT 920700 THEN MNTH06=1; ELSE MNTH06=0;
  IF WAYD GE 920700 AND WAYD LT 920800 THEN MNTH07=1; ELSE MNTH07=0;
  IF WAYD GE 920800 AND WAYD LT 920900 THEN MNTH08=1; ELSE MNTH08=0;
  IF WAYD GE 920900 AND WAYD LT 921000 THEN MNTH09=1; ELSE MNTH09=0;
  IF WAYD GE 921000 AND WAYD LT 921100 THEN MNTH10=1; ELSE MNTH10=0;
  IF WAYD GE 921100 AND WAYD LT 921200 THEN MNTH11=1; ELSE MNTH11=0;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
```

```
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;

   IF OD2W=0 THEN OD2W=1;
   IF TD2W=0 THEN TD2W=1;

   IF TD2W LT 120 THEN TCDUM=1; ELSE TCDUM=0;
   IF OD2W LT 180 THEN OCDUM=1; ELSE OCDUM=0;

   IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

   IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
      OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
      TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
      TST='TN';

  XTON=EXPN*UTON;
  XTM=EXPN*UTON*TDIS;
  XREV=EXPN*RTM*UTON*TDIS;

  OD2W=OD2W/TDIS;
  TD2W=TD2W/TDIS;

*  RTM     = LOG(RTM);
*  UCAR    = LOG(UCAR);
*  TON2CAR = LOG(TON2CAR);
*  TDIS    = LOG(TDIS);
*  NUMRR   = LOG(NUMRR);
*  RRCON   = LOG(RRCON);
*  DENSITY = LOG(DENSITY);
*  OD2W    = LOG(OD2W);
*  TD2W    = LOG(TD2W);
*  D2W     = LOG(D2W);

   TDIS2   = TDIS**2;
   UCAR2   = UCAR**2;

   OD2W=OD2W*OCDUM;
   TD2W=TD2W*TCDUM;

   INTD2W=OD2W*TD2W;

PROC REG DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
```

```
              QTR2
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD400
              CD482
              CD555
              CD694
              CD712
              ;

PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
              TON2CAR
              TDIS
              TDIS2
              OD2W
              TD2W
              OCDUM
              TCDUM
              NUMRR
              RRCON
              DENSITY
              SYSCAR
              QTR1
              QTR2
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD400
              CD482
              CD555
              CD694
              CD712
              /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;
```

```
DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA01137.DAT';

   PUT STCC5   1-5
       OBEA    7-9
       TBEA   11-13
       DIFF   15-24
       PDIFF  26-32 .5;

RUN;
```

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	25	3.90533	0.15621	361.666	0.0001
Error	1880	0.81202	0.00043		
C Total	1905	4.71736			

Root MSE	0.02078	R-square	0.8279
Dep Mean	0.04010	Adj R-sq	0.8256
C.V.	51.83193		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.293544	0.00742046	39.559	0.0001
UCAR	1	-0.000158	0.00002412	-6.570	0.0001
TON2CAR	1	-0.002389	0.00005692	-41.966	0.0001
TDIS	1	-0.000060613	0.00000513	-11.805	0.0001
TDIS2	1	2.5033287E-8	0.00000000	8.599	0.0001
OD2W	1	0.017122	0.00085041	20.133	0.0001
TD2W	1	0.073015	0.00168442	43.347	0.0001
OCDUM	1	-0.011117	0.00138539	-8.025	0.0001
TCDUM	1	-0.006127	0.00132399	-4.628	0.0001
NUMRR	1	0.002503	0.00213888	1.170	0.2421
RRCON	1	0.047970	0.00934714	5.132	0.0001
DENSITY	1	-0.000007348	0.00000491	-1.497	0.1347
SYSCAR	1	-0.001360	0.00106836	-1.273	0.2033
QTR1	1	0.001498	0.00129366	1.158	0.2470
QTR2	1	0.001328	0.00155840	0.852	0.3941
QTR3	1	0.001321	0.00135107	0.978	0.3282
CD22	1	[illegible]	[illegible]	[illegible]	[illegible]
CD76	1	[illegible]	[illegible]	[illegible]	[illegible]
CD131	1	[illegible]	[illegible]	[illegible]	[illegible]
CD190	1	[illegible]	[illegible]	[illegible]	[illegible]
CD350	1	[illegible]	[illegible]	[illegible]	[illegible]
CD400	1	[illegible]	[illegible]	[illegible]	[illegible]
CD482	1	[illegible]	[illegible]	[illegible]	[illegible]
CD555	1	[illegible]	[illegible]	[illegible]	[illegible]
CD694	1	[illegible]	[illegible]	[illegible]	[illegible]
CD712	1	[illegible]	[illegible]	[illegible]	[illegible]

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	1906	0.0400966	0.0452774
NOWAT		1906	0.0601625	0.0774862
DIFF		1906	0.0200659	0.0360581

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0088866	0.5084830
NOWAT		-0.0022076	0.9865913
DIFF		0	0.4781083

Variable	Mean	Sum
RED	99579.69	189798895
XTM	7231995.50	14355511059
XTON	10328.64	20502348.00
XREV	150134.98	298017930

SOYBEANS

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9514P.SAS
*
*    AUTHOR           DATE         REVISION        NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                         COMMODITY       01144 SOYBEANS
*    ACE9509.SD2 - READ ONLY
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*************************1*****************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=1144;
   IF RTM < 0.29035;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;
```

```
    IF OD2W=0 THEN OD2W=1;
    IF TD2W=0 THEN TD2W=1;

    IF TD2W LT 040 THEN TCDUM=1; ELSE TCDUM=0;
    IF OD2W LT 105 THEN OCDUM=1; ELSE OCDUM=0;

    IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

    IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
       OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
       TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
       TST='TN';

   OD2W=OD2W/TDIS;
   TD2W=TD2W/TDIS;

*   RTM     = LOG(RTM);
*   UCAR    = LOG(UCAR);
*   TON2CAR = LOG(TON2CAR);
*   TDIS    = LOG(TDIS);
*   NUMRR   = LOG(NUMRR);
*   RRCON   = LOG(RRCON);
*   DENSITY = LOG(DENSITY);
*   OD2W    = LOG(OD2W);
*   TD2W    = LOG(TD2W);
*   D2W     = LOG(D2W);

    TDIS2   = TDIS**2;
    UCAR2   = UCAR**2;

   XTON=EXPN*UTON;
   XTM=EXPN*UTON*TDIS;
   XREV=EXPN*RTM*UTON*TDIS;

    OD2W=OD2W*OCDUM;
    TD2W=TD2W*TCDUM;

    INTD2W=OD2W*TD2W;

PROC REG DATA=TWO;

    MODEL RTM=UCAR
              TON2CAR
              TDIS
              TDIS2
              OD2W
              TD2W
              OCDUM
              TCDUM
              NUMRR
              RRCON
              DENSITY
              SYSCAR
              QTR1
              QTR2
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD400
              CD482
              CD555
              CD712
              ;
```

```
PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD400
             CD482
             CD555
             CD712
             /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;
```

```
PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA01144.DAT';

   PUT STCC5   1-5
       OBEA    7-9
       TBEA   11-13
       DIFF   15-24
       PDIFF  26-32 .5;

RUN;
```

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	0.59758	0.02490	60.922	0.0001
Error	855	0.34945	0.00041		
C Total	879	0.94703			

Root MSE	0.02022	R-square	0.6310
Dep Mean	0.04095	Adj R-sq	0.6206
C.V.	49.37148		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.164603	0.00965175	17.054	0.0001
UCAR	1	-0.000123	0.00003373	-3.651	0.0003
TON2CAR	1	-0.001189	0.00007649	-15.546	0.0001
TDIS	1	-0.000058072	0.00000529	-10.984	0.0001
TDIS2	1	1.9740087E-8	0.00000000	8.143	0.0001
OD2W	1	0.008746	0.00079877	10.950	0.0001
TD2W	1	0.106842	0.00875718	12.200	0.0001
OCDUM	1	-0.003941	0.00188219	-2.094	0.0366
TCDUM	1	-0.000715	0.00166201	-0.430	0.6672
NUMRR	1	0.003482	0.00292479	1.191	0.2341
RRCON	1	0.021496	0.01174427	1.830	0.0675
DENSITY	1	0.000003776	0.00000479	0.789	0.4304
SYSCAR	1	-0.000055569	0.00151548	-0.037	0.9708
QTR1	1	-0.004180	0.00185479	-2.254	0.0245
QTR2	1	-0.005660	0.00197741	-2.863	0.0043
QTR3	1	-0.005599	0.00198208	-2.825	0.0048
CD22	1	[illegible]	[illegible]	[illegible]	[illegible]
CD76	1	[illegible]	[illegible]	[illegible]	[illegible]
CD131	1	[illegible]	[illegible]	[illegible]	[illegible]
CD190	1	[illegible]	[illegible]	[illegible]	[illegible]
CD350	1	[illegible]	[illegible]	[illegible]	[illegible]
CD400	1	[illegible]	[illegible]	[illegible]	[illegible]
CD482	1	[illegible]	[illegible]	[illegible]	[illegible]
CD555	1	[illegible]	[illegible]	[illegible]	[illegible]
CD712	1	[illegible]	[illegible]	[illegible]	[illegible]

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	880	0.0409479	0.0260738
NOWAT		880	0.0511615	0.0364335
DIFF		880	0.0102136	0.0133195

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0105274	0.1803498
NOWAT		-0.0055935	0.3004737
DIFF		0	0.1235197

Variable	Mean	Sum
RED	24885.78	21899490.60
XTM	5067579.71	4459470144
XTON	10582.99	9313031.00
XREV	100466.09	88410161.00

COAL

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9515P.SAS
*
*    AUTHOR           DATE          REVISION        NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E E I T   D O   N O T   E D I T
*
*
*    FILES                          COMMODITY       11212 COAL
*    ACE9509.SD2 - READ ONLY
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*************************1*****************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=11212;
*  IF RTM < 0.29035;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

  IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
  IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
  IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
  IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
  IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
  IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
  IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
  IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
  IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
  IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
  IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
  IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
  IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
  IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
  IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;

  IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
```

```
      OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
      TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
      TST='TN';

   IF OD2W=0 THEN OD2W=1;
   IF TD2W=0 THEN TD2W=1;

   IF TD2W LE 010 THEN TCDUM=1; ELSE TCDUM=0;
   IF TD2W GT 010 AND TD2W LE 085 THEN TCDUM2=1; ELSE TCDUM2=0;

   TD2W=TD2W/TDIS;

   TDIS2    = TDIS**2;
   UCAR2    = UCAR**2;

   TD2W1=TD2W*TCDUM;
   TD2W2=TD2W*TCDUM2;

   INTD2W=OD2W*TD2W;

   XTON=EXPN*UTON;
   XTM=EXPN*UTON*TDIS;
   XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

    MODEL RTM=UCAR
              TON2CAR
              TDIS
              TDIS2
              TD2W1
              TD2W2
              TCDUM
              TCDUM2
              NUMRR
              RRCON
              DENSITY
              SYSCAR
              ANTONS
              QTR1
              QTR2
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD400
              CD482
              CD555
              CD569
              CD712
              ;

PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

    MODEL RTM=UCAR
              TON2CAR
              TDIS
              TDIS2
              TD2W1
              TD2W2
              TCDUM
              TCDUM2
              NUMRR
              RRCON
              DENSITY
```

```
          ANTONS
          SYSCAR
          QTR1
          QTR2
          QTR3
          CD22
          CD76
          CD131
          CD190
          CD350
          CD400
          CD482
          CD555
          CD569
          CD712
          /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BTD2W1=TD2W1;
   BTCDUM=TCDUM;
   BTD2W2=TD2W2;
   BTCDUM2=TCDUM2;

   MRGVAR=.;

   KEEP

   BTD2W1
   BTCDUM
   BTD2W2
   BTCDUM2
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BTCDUM*TCDUM)+(BTD2W1*TD2W1);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;
```

```
DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

 DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA11212.DAT';

   PUT STCC5   1-5
       OBEA    7-9
       TBEA   11-13
       DIFF   15-24
       PDIFF  26-32 .5;

RUN;
```

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	26	11.60332	0.44628	1448.688	0.0001
Error	14205	4.37598	0.00031		
C Total	14231	15.97930			

Root MSE	0.01755	R-square	0.7261
Dep Mean	0.03394	Adj R-sq	0.7256
C.V.	51.70863		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.097802	0.00201946	48.430	0.0001
UCAR	1	-0.000018236	0.00000502	-3.635	0.0003
TON2CAR	1	-0.000571	0.00001914	-29.836	0.0001
TDIS	1	-0.000050892	0.00000143	-35.601	0.0001
TDIS2	1	2.1215842E-8	0.00000000	25.803	0.0001
TD2W1	1	0.152943	0.00204572	74.762	0.0001
TD2W2	1	0.044904	0.00051014	88.024	0.0001
TCDUM	1	-0.010298	0.00053246	-19.340	0.0001
TCDUM2	1	-0.012199	0.00044927	-27.153	0.0001
NUMRR	1	0.004910	0.00046088	10.655	0.0001
RRCON	1	-0.002498	0.00164933	-1.514	0.1300
DENSITY	1	-0.000014810	0.00000132	-11.177	0.0001
SYSCAR	1	0.002172	0.00039617	5.482	0.0001
ANTONS	1	-3.7758E-10	0.00000000	-3.623	0.0003
QTR1	1	0.001455	0.00042083	3.458	0.0005
QTR2	1	0.001495	0.00044275	3.377	0.0007
QTR3	1	0.000155	0.00042744	0.363	0.7164
CD22	1	[illegible]	[illegible]	[illegible]	[illegible]
CD76	1	[illegible]	[illegible]	[illegible]	[illegible]
CD131	1	[illegible]	[illegible]	[illegible]	[illegible]
CD190	1	[illegible]	[illegible]	[illegible]	[illegible]
CD350	1	[illegible]	[illegible]	[illegible]	[illegible]
CD400	1	[illegible]	[illegible]	[illegible]	[illegible]
CD482	1	[illegible]	[illegible]	[illegible]	[illegible]
CD555	1	[illegible]	[illegible]	[illegible]	[illegible]
CD569	1	[illegible]	[illegible]	[illegible]	[illegible]
CD712	1	[illegible]	[illegible]	[illegible]	[illegible]

The SAS System 2
07:36 Wednesday, November 29, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	14232	0.0339433	0.0285544
NOWAT		14232	0.0367726	0.0345385
DIFF		14232	0.0028293	0.0128431

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0104891	0.9651741
NOWAT		-0.0104891	1.8835715
DIFF		0	0.9183974

The SAS System 3
07:36 Wednesday, November 29, 1995

Variable	Mean	Sum
RED	35610.32	506806069
XTM	11408082.49	162394054243
XTON	18338.05	261042149
XREV	202848.60	2887549854

LIME STONE

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9516P.SAS
*
*    AUTHOR            DATE          REVISION        NOTES
*    MARK BURTON     AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                           COMMODITY       14219 LIMESTONE
*    ACE9509.SD2 - READ ONLY
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*************************1*****************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=14219;
   IF RTM < 0.10512;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;
```

```
    IF OD2W=0 THEN OD2W=1;
    IF TD2W=0 THEN TD2W=1;

    IF TD2W LT 040 THEN TCDUM=1; ELSE TCDUM=0;
    IF OD2W LT 055 THEN OCDUM=1; ELSE OCDUM=0;

    IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

    IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
       OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
       TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
       TST='TN';

   OD2W=OD2W/TDIS;
   TD2W=TD2W/TDIS;

*   RTM     = LOG(RTM);
*   UCAR    = LOG(UCAR);
*   TON2CAR = LOG(TON2CAR);
*   TDIS    = LOG(TDIS);
*   NUMRR   = LOG(NUMRR);
*   RRCON   = LOG(RRCON);
*   DENSITY = LOG(DENSITY);
*   OD2W    = LOG(OD2W);
*   TD2W    = LOG(TD2W);
*   D2W     = LOG(D2W);

    TDIS2   = TDIS**2;
    UCAR2   = UCAR**2;

    OD2W=OD2W*OCDUM;
    TD2W=TD2W*TCDUM;

    INTD2W=OD2W*TD2W;

   XTON=EXPN*UTON;
   XTM=EXPN*UTON*TDIS;
   XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD555
             CD569
             CD712
             ;

PROC REG NOPRINT OUTEST=BETAS DATA=TWO;
```

```
   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD555
             CD569
             CD712
             /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;
```

```
PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA14219.DAT';

   PUT STCC5    1-5
       OBEA     7-9
       TBEA    11-13
       DIFF    15-24
       PDIFF   26-32 .5;

RUN;
```

The SAS System 61
07:40 Monday, October 30, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	0.07458	0.00324	41.372	0.0001
Error	568	0.04452	0.00008		
C Total	591	0.11910			

Root MSE	0.00885	R-square	0.6262
Dep Mean	0.03540	Adj R-sq	0.6111
C.V.	25.00573		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.072303	0.00401190	18.022	0.0001
UCAR	1	0.000026580	0.00003684	0.721	0.4709
TON2CAR	1	-0.000419	0.00003623	-11.571	0.0001
TDIS	1	-0.000063939	0.00000550	-11.631	0.0001
TDIS2	1	1.7690373E-8	0.00000000	6.964	0.0001
OD2W	1	0.016173	0.00287347	5.628	0.0001
TD2W	1	0.014920	0.00387260	3.853	0.0001
OCDUM	1	-0.000195	0.00138008	-0.142	0.8874
TCDUM	1	-0.011810	0.00126232	-9.356	0.0001
NUMRR	1	0.005699	0.00122292	4.660	0.0001
RRCON	1	-0.018581	0.00725590	-2.561	0.0107
DENSITY	1	0.000015566	0.00000529	2.945	0.0034
SYSCAR	1	0.004515	0.00099077	4.557	0.0001
QTR1	1	0.000214	0.00122534	0.174	0.8617
QTR2	1	0.001059	0.00106252	0.997	0.3193
QTR3	1	0.001163	0.00099272	1.172	0.2417
[illegible]					

The SAS System 62
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	592	0.0354050	0.0112338
NOWAT		592	0.0423599	0.0150666
DIFF		592	0.0069550	0.0080949

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0096677	0.0772253
NOWAT		0.0022254	0.0915288
DIFF		0	0.0253363

The SAS System 63
07:40 Monday, October 30, 1995

Variable	Mean	Sum
RED	6412.45	3796167.50
XTM	1637529.60	975967644
XTON	9099.72	5423435.00
XREV	48608.68	28970774.00

SOYBEAN BY-PRODUCTS

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9517P.SAS
*
*    AUTHOR           DATE          REVISION         NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                          COMMODITY        20923 SOYBEAN
*    ACE9509.SD2 - READ ONLY                               BY-PROD
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*************************1*****************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=20923;
   IF RTM < 0.63919;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;
```

```
    IF OD2W=0 THEN OD2W=1;
    IF TD2W=0 THEN TD2W=1;

    IF TD2W LT 060 THEN TCDUM=1; ELSE TCDUM=0;
    IF OD2W LT 060 THEN OCDUM=1; ELSE OCDUM=0;

    IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

    IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
       OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
       TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
       TST='TN';

   OD2W=OD2W/TDIS;
   TD2W=TD2W/TDIS;

*   RTM     = LOG(RTM);
*   UCAR    = LOG(UCAR);
*   TON2CAR = LOG(TON2CAR);
*   TDIS    = LOG(TDIS);
*   NUMRR   = LOG(NUMRR);
*   RRCON   = LOG(RRCON);
*   DENSITY = LOG(DENSITY);
*   OD2W    = LOG(OD2W);
*   TD2W    = LOG(TD2W);
*   D2W     = LOG(D2W);

    TDIS2   = TDIS**2;
    UCAR2   = UCAR**2;

    OD2W=OD2W*OCDUM;
    TD2W=TD2W*TCDUM;

    INTD2W=OD2W*TD2W;
    XTON=EXPN*UTON;
    XTM=EXPN*UTON*TDIS;
    XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

    MODEL RTM=UCAR
              TON2CAR
              TDIS
              TDIS2
              OD2W
              TD2W
              OCDUM
              TCDUM
              NUMRR
              RRCON
              DENSITY
              SYSCAR
              QTR1
              QTR2
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD400
              CD482
              CD555
              CD569
              CD712
              ;
```

```
PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD400
             CD482
             CD555
             CD569
             CD712
             /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;
```

```
PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA20923.DAT';

   PUT STCC5   1-5
       OBEA    7-9
       TBEA   11-13
       DIFF   15-24
       PDIFF  26-32 .5;

RUN;
```

The SAS System 66
07:40 Monday, October 30, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	25	0.75755	0.03030	103.839	0.0001
Error	1682	0.49084	0.00029		
C Total	1707	1.24839			

Root MSE	0.01708	R-square	0.6068
Dep Mean	0.03725	Adj R-sq	0.6010
C.V.	45.85873		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.126176	0.00387024	32.602	0.0001
UCAR	1	-0.000080234	0.00004257	-1.885	0.0597
TON2CAR	1	-0.000739	0.00003243	-22.781	0.0001
TDIS	1	-0.000058183	0.00000342	-17.036	0.0001
TDIS2	1	2.0113872E-8	0.00000000	13.495	0.0001
OD2W	1	0.043430	0.00525662	8.262	0.0001
TD2W	1	0.117146	0.00705756	16.599	0.0001
OCDUM	1	-0.003841	0.00119433	-3.216	0.0013
TCDUM	1	-0.011751	0.00129286	-9.089	0.0001
NUMRR	1	-0.000919	0.00096846	-0.949	0.3429
RRCON	1	0.008934	0.00677123	1.319	0.1872
DENSITY	1	0.000011246	0.00000419	2.685	0.0073
SYSCAR	1	0.001075	0.00087327	1.231	0.2183
QTR1	1	-0.000280	0.00118457	-0.236	0.8133
QTR2	1	-0.000219	0.00126734	-0.173	0.8627
QTR3	1	-0.001588	0.00121362	-1.308	0.1910

The SAS System 67
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	1708	0.0372506	0.0210663
NOWAT		1708	0.0492844	0.0321652
DIFF		1708	0.0120337	0.0140403

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0120872	0.1630498
NOWAT		0.0039879	0.3004226
DIFF		0	0.1373728

Variable	Mean	Sum
RED	18655.35	31863334.89
XTM	2761618.82	4733414658
XTON	4991.84	8556020.00
XREV	70112.98	120173651

POTASH

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9518P.SAS
*
*    AUTHOR            DATE          REVISION         NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                          COMMODITY        28125 POTASH
*    ACE9509.SD2 - READ ONLY
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*************************1*****************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=28125;
   IF RTM < 1.91512;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;
```

```
    IF OD2W=0 THEN OD2W=1;
    IF TD2W=0 THEN TD2W=1;

    IF OD2W LT 020 THEN OCDUM=1; ELSE OCDUM=0;

    IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

    IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
       OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
       TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
       TST='TN';

   OD2W=OD2W/TDIS;
   TD2W=TD2W/TDIS;

*   RTM     = LOG(RTM);
*   UCAR    = LOG(UCAR);
*   TON2CAR = LOG(TON2CAR);
*   TDIS    = LOG(TDIS);
*   NUMRR   = LOG(NUMRR);
*   RRCON   = LOG(RRCON);
*   DENSITY = LOG(DENSITY);
*   OD2W    = LOG(OD2W);
*   TD2W    = LOG(TD2W);
*   D2W     = LOG(D2W);

    TDIS2   = TDIS**2;
    UCAR2   = UCAR**2;

    OD2W=OD2W*OCDUM;
    TD2W=TD2W*TCDUM;

    INTD2W=OD2W*TD2W;

    XTON=EXPN*UTON;
    XTM=EXPN*UTON*TDIS;
    XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

    MODEL RTM=UCAR
              TON2CAR
              TDIS
              TDIS2
              OD2W
              OCDUM
              NUMRR
              RRCON
              DENSITY
              SYSCAR
              QTR1
              QTR2
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD482
              CD555
              CD569
              CD712
              ;

PROC REG NOPRINT OUTEST=BETAS DATA=TWO;
```

```
   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             OCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD482
             CD555
             CD569
             CD712
             /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BOCDUM=OCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BOCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BOD2W*OD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
```

```
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA28125.DAT';

   PUT STCC5   1-5
       OBEA    7-9
       TBEA   11-13
       DIFF   15-24
       PDIFF  26-32 .5;

RUN;
```

The SAS System 75
07:40 Monday, October 30, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	18.22824	0.82856	72.023	0.0001
Error	617	7.09797	0.01150		
C Total	639	25.32620			

Root MSE	0.10726	R-square	0.7197
Dep Mean	0.07837	Adj R-sq	0.7097
C.V.	136.85994		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.346342	0.04057599	8.536	0.0001
UCAR	1	0.000546	0.00056782	0.962	0.3362
TON2CAR	1	-0.001744	0.00034153	-5.106	0.0001
TDIS	1	-0.000265	0.00003142	-8.438	0.0001
TDIS2	1	8.4164079E-8	0.00000002	5.348	0.0001
OD2W	1	0.269883	0.00842231	32.044	0.0001
OCDUM	1	-0.015295	0.01093106	-1.399	0.1622
NUMRR	1	0.001737	0.01505553	0.115	0.9082
RRCON	1	0.171345	0.07368885	2.325	0.0204
DENSITY	1	-0.000135	0.00004211	-3.207	0.0014
SYSCAR	1	-0.006645	0.01361257	-0.488	0.6256
QTR1	1	-0.002770	0.01353216	-0.205	0.8379
QTR2	1	-0.001703	0.01382789	-0.123	0.9020
QTR3	1	-0.009535	0.01441632	-0.661	0.5086
CD22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD131	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD190	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD350	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD482	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD555	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD569	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD712	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The SAS System 76
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	640	0.0783697	0.1688970
NOWAT		640	0.0576816	0.0500839
DIFF		640	-0.0206881	0.1492952

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0726892	1.4727848
NOWAT		-0.0586132	0.2389444
DIFF		-1.3566080	0.0145782

The SAS System 77
07:40 Monday, October 30, 1995

Variable	Mean	Sum
RED	11602.67	7425707.81
XTM	4126116.97	5830203281
XTON	5040.16	7121750.00
XREV	146064.17	206388666

UREA

```
*****************************************************************
*
*    PROGRAM NAME
*    ACE9519P.SAS
*
*    AUTHOR            DATE          REVISION        NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                            COMMODITY       28181 UREA
*    ACE9509.SD2 - READ ONLY
*
*****************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*****************************************************************
*
* READ WAYBILL DATA;
*
*************************1***************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=28181;
   IF RTM < 0.26040;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;
```

```
    IF OD2W=0 THEN OD2W=1;
    IF TD2W=0 THEN TD2W=1;

    IF OD2W LT 040 THEN OCDUM=1; ELSE OCDUM=0;
    IF TD2W LT 040 THEN TCDUM=1; ELSE TCDUM=0;

    IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

    IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
       OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
       TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
       TST='TN';

   OD2W=OD2W/TDIS;
   TD2W=TD2W/TDIS;

*   RTM     = LOG(RTM);
*   UCAR    = LOG(UCAR);
*   TON2CAR = LOG(TON2CAR);
*   TDIS    = LOG(TDIS);
*   NUMRR   = LOG(NUMRR);
*   RRCON   = LOG(RRCON);
*   DENSITY = LOG(DENSITY);
*   OD2W    = LOG(OD2W);
*   TD2W    = LOG(TD2W);
*   D2W     = LOG(D2W);

    TDIS2   = TDIS**2;
    UCAR2   = UCAR**2;

    OD2W=OD2W*OCDUM;
    TD2W=TD2W*TCDUM;

    INTD2W=OD2W*TD2W;

    XTON=EXPN*UTON;
    XTM=EXPN*UTON*TDIS;
    XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD482
             CD555
             CD569
             CD712
             ;
```

```
PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD482
             CD555
             CD569
             CD712
             /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;
```

```
PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA28181.DAT';

   PUT STCC5   1-5
       OBEA    7-9
       TBEA   11-13
       DIFF   15-24
       PDIFF  26-32 .5;

RUN;
```

The SAS System 83
07:40 Monday, October 30, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	0.31889	0.01329	43.359	0.0001
Error	494	0.15138	0.00031		
C Total	518	0.47028			

Root MSE	0.01751	R-square	0.6781
Dep Mean	0.04860	Adj R-sq	0.6625
C.V.	36.02297		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.114694	0.00754453	15.202	0.0001
UCAR	1	0.000008494	0.00061849	0.014	0.9890
TON2CAR	1	-0.000456	0.00006191	-7.372	0.0001
TDIS	1	-0.000052722	0.00000661	-7.971	0.0001
TDIS2	1	1.2061535E-8	0.00000000	4.214	0.0001
OD2W	1	0.235961	0.03015999	7.824	0.0001
TD2W	1	0.096536	0.02343002	4.120	0.0001
OCDUM	1	-0.006827	0.00185402	-3.682	0.0003
TCDUM	1	-0.001918	0.00190412	-1.007	0.3144
NUMRR	1	0.003683	0.00154051	2.391	0.0172
RRCON	1	0.024263	0.01332121	1.821	0.0692
DENSITY	1	0.000021631	0.00001203	1.797	0.0729
SYSCAR	1	-0.011811	0.00219917	-5.371	0.0001
QTR1	1	-0.001680	0.00213135	-0.788	0.4310
QTR2	1	-0.001814	0.00227629	-0.797	0.4259
QTR3	1	0.000108	0.00237921	0.046	0.9637
CD22	1				
CD76	1				
CD131	1				
CD190	1				
CD350	1				
CD482	1				
CD555	1				
CD569	1				
CD712	1				

The SAS System 84
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	519	0.0485957	0.0248118
NOWAT		519	0.0609615	0.0403793
DIFF		519	0.0123658	0.0182095

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	0.0023100	0.1604212
NOWAT		0.0096962	0.2876661
DIFF		0	0.1272449

The SAS System 85

07:40 Monday, October 30, 1995

Variable	Mean	Sum
RED	19790.28	10271154.10
XTM	2859203.70	1735536643
XTON	3607.04	2189476.00
XREV	108053.32	65588364.00

SUPER PHOSPHATES

```
*****************************************************************
*
*    PROGRAM NAME
*    ACE9520P.SAS
*
*    AUTHOR           DATE         REVISION        NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                          COMMODITY       28712 SUPER
*    ACE9509.SD2 - READ ONLY                              PHOSPHATES
*
*****************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*****************************************************************
*
* READ WAYBILL DATA;
*
************************1**************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=28712;
   IF RTM < 0.68802;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
```

```
    (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;

    IF OD2W=0 THEN OD2W=1;
    IF TD2W=0 THEN TD2W=1;

    IF OD2W LT 035 THEN OCDUM=1; ELSE OCDUM=0;
    IF TD2W LT 035 THEN TCDUM=1; ELSE TCDUM=0;

    IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

    IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
       OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
       TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
       TST='TN';

   OD2W=OD2W/TDIS;
   TD2W=TD2W/TDIS;

*  RTM     = LOG(RTM);
*  UCAR    = LOG(UCAR);
*  TON2CAR = LOG(TON2CAR);
*  TDIS    = LOG(TDIS);
*  NUMRR   = LOG(NUMRR);
*  RRCON   = LOG(RRCON);
*  DENSITY = LOG(DENSITY);
*  OD2W    = LOG(OD2W);
*  TD2W    = LOG(TD2W);
*  D2W     = LOG(D2W);

   TDIS2   = TDIS**2;
   UCAR2   = UCAR**2;

   OD2W=OD2W*OCDUM;
   TD2W=TD2W*TCDUM;

   INTD2W=OD2W*TD2W;

   XTON=EXPN*UTON;
   XTM=EXPN*UTON*TDIS;
   XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD482
             CD555
             CD712
             ;
```

```
PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD482
             CD555
             CD712
             /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;
```

```
PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA28712.DAT';

   PUT STCC5   1-5
       OBEA    7-9
       TBEA   11-13
       DIFF   15-24
       PDIFF  26-32 .5;

RUN;
```

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	0.67745	0.02945	29.356	0.0001
Error	653	0.65519	0.00100		
C Total	676	1.33265			

Root MSE	0.03168	R-square	0.5084
Dep Mean	0.04386	Adj R-sq	0.4910
C.V.	72.21652		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.087900	0.02330722	3.771	0.0002
UCAR	1	0.000804	0.00067106	1.199	0.2311
TON2CAR	1	-0.000239	0.00021560	-1.110	0.2676
TDIS	1	-0.000070244	0.00001015	-6.920	0.0001
TDIS2	1	2.0854874E-8	0.00000001	3.997	0.0001
OD2W	1	0.234317	0.02836370	8.261	0.0001
TD2W	1	0.105084	0.02414353	4.352	0.0001
OCDUM	1	-0.012932	0.00331672	-3.899	0.0001
TCDUM	1	-0.000067798	0.00367394	-0.018	0.9853
NUMRR	1	0.007074	0.00338379	2.090	0.0370
RRCON	1	0.038468	0.01688551	2.278	0.0230
DENSITY	1	0.000095456	0.00001733	5.508	0.0001
SYSCAR	1	-0.005409	0.00285649	-1.893	0.0587
QTR1	1	-0.002185	0.00380366	-0.574	0.5659
QTR2	1	-0.004020	0.00408448	-0.984	0.3253
QTR3	1	-0.006663	0.00388188	-1.717	0.0865
CD22	1				
CD76	1				
CD131	1				
CD190	1				
CD350	1				
CD482	1				
CD555	1				
CD712	1				

The SAS System 91
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	677	0.0438624	0.0316568
NOWAT		677	0.0571747	0.0520561
DIFF		677	0.0133123	0.0230855

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0143816	0.3959081
NOWAT		0.000014864	0.7270964
DIFF		0	0.3311884

The SAS System 92
07:40 Monday, October 30, 1995

Variable	Mean	Sum
RED	16505.63	11174310.06
XTM	2778065.37	1902974778
XTON	4211.96	2885196.00
XREV	79647.91	54558820.00

LIQUID FERTILIZERS

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9521P.SAS
*
*    AUTHOR           DATE           REVISION         NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                           COMMODITY        28713 LIQUID
*    ACE9509.SD2 - READ ONLY                                FERTILIZERS
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*************************1*****************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=28713;
   IF RTM < 0.29035;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905-1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
```

```
    (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;

    IF OD2W=0 THEN OD2W=1;
    IF TD2W=0 THEN TD2W=1;

    IF OD2W LT 100 THEN OCDUM=1; ELSE OCDUM=0;
    IF TD2W LT 135 THEN TCDUM=1; ELSE TCDUM=0;

    IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

    IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
       OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
       TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
       TST='TN';

   OD2W=OD2W/TDIS;
   TD2W=TD2W/TDIS;

*   RTM     = LOG(RTM);
*   UCAR    = LOG(UCAR);
*   TON2CAR = LOG(TON2CAR);
*   TDIS    = LOG(TDIS);
*   NUMRR   = LOG(NUMRR);
*   RRCON   = LOG(RRCON);
*   DENSITY = LOG(DENSITY);
*   OD2W    = LOG(OD2W);
*   TD2W    = LOG(TD2W);
*   D2W     = LOG(D2W);

    TDIS2   = TDIS**2;
    UCAR2   = UCAR**2;

    OD2W=OD2W*OCDUM;
    TD2W=TD2W*TCDUM;

    INTD2W=OD2W*TD2W;

    XTON=EXPN*UTON;
    XTM=EXPN*UTON*TDIS;
    XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             TD2W
             TCDUM
             NUMRR
             RRCON
             DENSITY
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD555
             CD712
             ;

PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
```

```
            TON2CAR
            TDIS
            TDIS2
            TD2W
            TCDUM
            NUMRR
            RRCON
            DENSITY
            QTR1
            QTR2
            QTR3
            CD22
            CD76
            CD131
            CD190
            CD350
            CD555
            CD712
            /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BTD2W=TD2W;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BTD2W
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BTCDUM*TCDUM)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
```

```
    SET BEA;

    DROP _TYPE_ _FREQ_;

    DIFF=XNOWAT-XPHAT;
    PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA28713.DAT';

   PUT STCC5    1-5
       OBEA     7-9
       TBEA    11-13
       DIFF    15-24
       PDIFF   26-32 .5;

RUN;
```

The SAS System 98
07:40 Monday, October 30, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	19	0.12159	0.00640	20.598	0.0001
Error	230	0.07146	0.00031		
C Total	249	0.19305			

Root MSE	0.01763	R-square	0.6299
Dep Mean	0.04577	Adj R-sq	0.5993
C.V.	38.50672		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.085974	0.02119509	4.056	0.0001
UCAR	1	-0.000336	0.00049841	-0.675	0.5006
TON2CAR	1	-0.000407	0.00021438	-1.897	0.0591
TDIS	1	-0.000050741	0.00001247	-4.068	0.0001
TDIS2	1	1.0763048E-8	0.00000001	1.414	0.1588
TD2W	1	0.046250	0.00617023	7.496	0.0001
TCDUM	1	-0.012428	0.00393582	-3.158	0.0018
NUMRR	1	0.006973	0.00418395	1.667	0.0969
RRCON	1	0.037512	0.01758700	2.133	0.0340
DENSITY	1	-0.000005306	0.00000928	-0.572	0.5681
QTR1	1	-0.000519	0.00329795	-0.157	0.8750
QTR2	1	-0.000955	0.00354966	-0.269	0.7882
QTR3	1	-0.000791	0.00338224	-0.234	0.8154
CD22	1				
CD76	1				
CD131	1				
CD190	1				
CD350	1				
CD555	1				
CD712	1				

The SAS System 99
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	250	0.0457743	0.0220980
NOWAT		250	0.0663600	0.0331119
DIFF		250	0.0205857	0.0137230

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	0.0067859	0.1016593
NOWAT		0.0111708	0.1610450
DIFF		0	0.0636042

Variable	Mean	Sum
RED	32090.75	8022688.47
XTM	2043532.76	510883191
XTON	4596.46	1149116.00
XREV	66407.70	16601924.00

DRY FERTILIZERS

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9522P.SAS
*
*    AUTHOR           DATE          REVISION        NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                          COMMODITY       28714 DRY
*    ACE9509.SD2 - READ ONLY                              FERTILIZERS
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*************************1*****************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=28714;
   IF RTM < 0.68802;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
```

```
(ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;

IF OD2W=0 THEN OD2W=1;
IF TD2W=0 THEN TD2W=1;

IF OD2W LT 080 THEN OCDUM=1; ELSE OCDUM=0;
IF TD2W LT 100 THEN TCDUM=1; ELSE TCDUM=0;

IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
   OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
   TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
   TST='TN';

OD2W=OD2W/TDIS;
TD2W=TD2W/TDIS;

*  RTM     = LOG(RTM);
*  UCAR    = LOG(UCAR);
*  TON2CAR = LOG(TON2CAR);
*  TDIS    = LOG(TDIS);
*  NUMRR   = LOG(NUMRR);
*  RRCON   = LOG(RRCON);
*  DENSITY = LOG(DENSITY);
*  OD2W    = LOG(OD2W);
*  TD2W    = LOG(TD2W);
*  D2W     = LOG(D2W);

   TDIS2   = TDIS**2;
   UCAR2   = UCAR**2;

   OD2W=OD2W*OCDUM;
   TD2W=TD2W*TCDUM;

   INTD2W=OD2W*TD2W;

   XTON=EXPN*UTON;
   XTM=EXPN*UTON*TDIS;
   XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD482
             CD555
             CD712
             ;
```

```
PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
             QTR3
             CD22
             CD76
             CD131
             CD190
             CD350
             CD482
             CD555
             CD712
             /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
   XPHAT=XTM*PHAT;
   XNOWAT=XTM*NOWAT;

   RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;
```

```
PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA28714.DAT';

   PUT STCC5   1-5
       OBEA    7-9
       TBEA   11-13
       DIFF   15-24
       PDIFF  26-32 .5;

RUN;
```

The SAS System 103
07:40 Monday, October 30, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	0.50564	0.02198	209.683	0.0001
Error	251	0.02632	0.00010		
C Total	274	0.53196			

Root MSE	0.01024	R-square	0.9505
Dep Mean	0.03349	Adj R-sq	0.9460
C.V.	30.57323		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.028506	0.00841303	3.388	0.0008
UCAR	1	0.001693	0.00120016	1.411	0.1596
TON2CAR	1	0.000018906	0.00004343	0.435	0.6637
TDIS	1	-0.000032445	0.00000973	-3.334	0.0010
TDIS2	1	9.8776847E-9	0.00000000	2.547	0.0115
OD2W	1	0.393811	0.06251513	6.299	0.0001
TD2W	1	0.028230	0.00089117	31.677	0.0001
OCDUM	1	0.005925	0.00381540	1.553	0.1217
TCDUM	1	-0.000104	0.00323138	-0.032	0.9743
NUMRR	1	0.006068	0.00245593	2.471	0.0142
RRCON	1	0.015529	0.01162909	1.335	0.1830
DENSITY	1	-0.000001160	0.00001405	-0.083	0.9343
SYSCAR	1	-0.012889	0.00472764	-2.726	0.0069
QTR1	1	0.001532	0.00170424	0.899	0.3697
QTR2	1	0.000153	0.00191525	0.080	0.9366
QTR3	1	-0.001987	0.00200573	-0.991	0.3228
CD22	1				
CD76	1				
CD131	1				
CD190	1				
CD350	1				
CD482	1				
CD555	1				
CD712	1				

The SAS System 104
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	275	0.0334915	0.0429583
NOWAT		275	0.0395999	0.0817724
DIFF		275	0.0061084	0.0399912

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	0.0065341	0.4020812
NOWAT		0.0028617	0.7812063
DIFF		-0.0054592	0.3791251

The SAS System 105
07:40 Monday, October 30, 1995

Variable	Mean	Sum
RED	3805.27	1046448.79
XTM	3975624.59	1093296762
XTON	3863.10	1062352.00
XREV	94830.23	26078312.00

I&S Billets and Ingots

```
*****************************************************************
*
*    PROGRAM NAME
*    ACE9525P.SAS
*
*    AUTHOR          DATE          REVISION        NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                         COMMODITY       33121 I&S PLATE
*    ACE9509.SD2 - READ ONLY
*
*****************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*****************************************************************
*
* READ WAYBILL DATA;
*
************************1****************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=33121;
   IF RTM < 0.6906;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

  IF WAYD GE 920100 AND WAYD LT 920200 THEN MNTH01=1; ELSE MNTH01=0;
  IF WAYD GE 920200 AND WAYD LT 920300 THEN MNTH02=1; ELSE MNTH02=0;
  IF WAYD GE 920300 AND WAYD LT 920400 THEN MNTH03=1; ELSE MNTH03=0;
  IF WAYD GE 920400 AND WAYD LT 920500 THEN MNTH04=1; ELSE MNTH04=0;
  IF WAYD GE 920500 AND WAYD LT 920600 THEN MNTH05=1; ELSE MNTH05=0;
  IF WAYD GE 920600 AND WAYD LT 920700 THEN MNTH06=1; ELSE MNTH06=0;
  IF WAYD GE 920700 AND WAYD LT 920800 THEN MNTH07=1; ELSE MNTH07=0;
  IF WAYD GE 920800 AND WAYD LT 920900 THEN MNTH08=1; ELSE MNTH08=0;
  IF WAYD GE 920900 AND WAYD LT 921000 THEN MNTH09=1; ELSE MNTH09=0;
  IF WAYD GE 921000 AND WAYD LT 921100 THEN MNTH10=1; ELSE MNTH10=0;
  IF WAYD GE 921100 AND WAYD LT 921200 THEN MNTH11=1; ELSE MNTH11=0;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
```

```
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;

   IF OD2W=0 THEN OD2W=1;
   IF TD2W=0 THEN TD2W=1;

   IF TD2W LT 020 THEN TCDUM=1; ELSE TCDUM=0;
   IF OD2W LT 070 THEN OCDUM=1; ELSE OCDUM=0;

   IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

   IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
      OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
      TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
      TST='TN';

  OD2W=OD2W/TDIS;
  TD2W=TD2W/TDIS;

*  RTM     = LOG(RTM);
*  UCAR    = LOG(UCAR);
*  TON2CAR = LOG(TON2CAR);
*  TDIS    = LOG(TDIS);
*  NUMRR   = LOG(NUMRR);
*  RRCON   = LOG(RRCON);
*  DENSITY = LOG(DENSITY);
*  OD2W    = LOG(OD2W);
*  TD2W    = LOG(TD2W);
*  D2W     = LOG(D2W);

   TDIS2   = TDIS**2;
   UCAR2   = UCAR**2;

   OD2W=OD2W*OCDUM;
   TD2W=TD2W*TCDUM;

   INTD2W=OD2W*TD2W;

   XTON=EXPN*UTON;
   XTM=EXPN*UTON*TDIS;
   XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
```

```
              SYSCAR
              QTR1
              QTR2
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD555
              CD712
              ;

PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
              TON2CAR
              TDIS
              TDIS2
              OD2W
              TD2W
              OCDUM
              TCDUM
              NUMRR
              RRCON
              DENSITY
              SYSCAR
              QTR1
              QTR2
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD555
              CD712
              /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;
```

```
    NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

    DIFF=NOWAT-PHAT;
    XPHAT=XTM*PHAT;
    XNOWAT=XTM*NOWAT;

    RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
    VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
    VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
    BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
    BY STCC5 OBEA TBEA;
    VAR XPHAT XNOWAT;
    OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
    SET BEA;

    DROP _TYPE_ _FREQ_;

    DIFF=XNOWAT-XPHAT;
    PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
    SET BEA;
    FILE 'C:\BURTON\ACEOUT\BEA33121.DAT';

    PUT STCC5    1-5
        OBEA     7-9
        TBEA    11-13
        DIFF    15-24
        PDIFF   26-32 .5;

RUN;
```

The SAS System 108
07:40 Monday, October 30, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	1.13816	0.05173	706.526	0.0001
Error	931	0.06817	0.00007		
C Total	953	1.20633			

Root MSE	0.00856	R-square	0.9435
Dep Mean	0.05010	Adj R-sq	0.9422
C.V.	17.08003		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.060646	0.00561838	10.794	0.0001
UCAR	1	-0.000149	0.00007930	-1.882	0.0601
TON2CAR	1	-0.000141	0.00005145	-2.741	0.0062
TDIS	1	-0.000016802	0.00000529	-3.179	0.0015
TDIS2	1	3.1848152E-9	0.00000000	1.227	0.2201
OD2W	1	0.161558	0.00722979	22.346	0.0001
TD2W	1	0.277380	0.03213786	8.631	0.0001
OCDUM	1	-0.004232	0.00100727	-4.202	0.0001
TCDUM	1	-0.007232	0.00129415	-5.588	0.0001
NUMRR	1	-0.002600	0.00121504	-2.140	0.0326
RRCON	1	-0.047949	0.01442696	-3.324	0.0009
DENSITY	1	0.000018323	0.00001121	1.634	0.1025
SYSCAR	1	0.001495	0.00079709	1.876	0.0610
QTR1	1	-0.000527	0.00082604	-0.638	0.5239
QTR2	1	0.001216	0.00084818	1.433	0.1521
QTR3	1	0.000508	0.00081887	0.620	0.5352
CD22	1	-0.000312	0.00687438	-0.045	0.9638
CD76	1				
CD131	1				
CD190	1				
CD350	1				
CD555	1				
CD712	1				

The SAS System 109
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	954	0.0500999	0.0345585
NOWAT		954	0.0805812	0.0642568
DIFF		954	0.0304813	0.0305494

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	0.0077232	0.2577591
NOWAT		0.0204537	0.4916435
DIFF		0	0.2338844

The SAS System 110
07:40 Monday, October 30, 1995

Variable	Mean	Sum
RED	37973.83	36227035.61
XTM	1991312.21	1899711849
XTON	4509.46	4302028.00
XREV	67417.01	64315824.00

I&S PLATE

```
*****************************************************************
*
*    PROGRAM NAME
*    ACE9526P.SAS
*
*    AUTHOR          DATE         REVISION        NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                          COMMODITY       33123 I&S PLATE
*    ACE9509.SD2 - READ ONLY
*
*****************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*****************************************************************
*
* READ WAYBILL DATA;
*
*************************1***************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=33123;
   IF RTM < 0.6906;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

  IF WAYD GE 920100 AND WAYD LT 920200 THEN MNTH01=1; ELSE MNTH01=0;
  IF WAYD GE 920200 AND WAYD LT 920300 THEN MNTH02=1; ELSE MNTH02=0;
  IF WAYD GE 920300 AND WAYD LT 920400 THEN MNTH03=1; ELSE MNTH03=0;
  IF WAYD GE 920400 AND WAYD LT 920500 THEN MNTH04=1; ELSE MNTH04=0;
  IF WAYD GE 920500 AND WAYD LT 920600 THEN MNTH05=1; ELSE MNTH05=0;
  IF WAYD GE 920600 AND WAYD LT 920700 THEN MNTH06=1; ELSE MNTH06=0;
  IF WAYD GE 920700 AND WAYD LT 920800 THEN MNTH07=1; ELSE MNTH07=0;
  IF WAYD GE 920800 AND WAYD LT 920900 THEN MNTH08=1; ELSE MNTH08=0;
  IF WAYD GE 920900 AND WAYD LT 921000 THEN MNTH09=1; ELSE MNTH09=0;
  IF WAYD GE 921000 AND WAYD LT 921100 THEN MNTH10=1; ELSE MNTH10=0;
  IF WAYD GE 921100 AND WAYD LT 921200 THEN MNTH11=1; ELSE MNTH11=0;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
```

```
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;

   IF OD2W=0 THEN OD2W=1;
   IF TD2W=0 THEN TD2W=1;

   IF TD2W LT 065 THEN TCDUM=1; ELSE TCDUM=0;
   IF OD2W LT 065 THEN OCDUM=1; ELSE OCDUM=0;

   IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

   IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
      OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
      TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
      TST='TN';

  OD2W=OD2W/TDIS;
  TD2W=TD2W/TDIS;

*  RTM     = LOG(RTM);
*  UCAR    = LOG(UCAR);
*  TON2CAR = LOG(TON2CAR);
*  TDIS    = LOG(TDIS);
*  NUMRR   = LOG(NUMRR);
*  RRCON   = LOG(RRCON);
*  DENSITY = LOG(DENSITY);
*  OD2W    = LOG(OD2W);
*  TD2W    = LOG(TD2W);
*  D2W     = LOG(D2W);

   TDIS2   = TDIS**2;
   UCAR2   = UCAR**2;

   OD2W=OD2W*OCDUM;
   TD2W=TD2W*TCDUM;

   INTD2W=OD2W*TD2W;

   XTON=EXPN*UTON;
   XTM=EXPN*UTON*TDIS;
   XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
```

```
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD555
              CD712
              ;

PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
              TON2CAR
              TDIS
              TDIS2
              OD2W
              TD2W
              OCDUM
              TCDUM
              NUMRR
              RRCON
              DENSITY
              SYSCAR
              QTR1
              QTR2
              QTR3
              CD22
              CD76
              CD131
              CD190
              CD350
              CD555
              CD712
              /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
```

```
    XPHAT=XTM*PHAT;
    XNOWAT=XTM*NOWAT;

    RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA33123.DAT';

   PUT STCC5    1-5
       OBEA     7-9
       TBEA    11-13
       DIFF    15-24
       PDIFF   26-32 .5;

RUN;
```

The SAS System 119
07:40 Monday, October 30, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	0.86966	0.03953	166.209	0.0001
Error	1051	0.24996	0.00024		
C Total	1073	1.11962			

Root MSE	0.01542	R-square	0.7767
Dep Mean	0.04518	Adj R-sq	0.7721
C.V.	34.13058		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.078184	0.00417045	18.747	0.0001
UCAR	1	-0.000570	0.00007841	-7.269	0.0001
TON2CAR	1	-0.000202	0.00003122	-6.461	0.0001
TDIS	1	-0.000027977	0.00000389	-7.199	0.0001
TDIS2	1	4.7837223E-9	0.00000000	3.333	0.0009
OD2W	1	0.126316	0.00508447	24.844	0.0001
TD2W	1	0.243422	0.00964199	25.246	0.0001
OCDUM	1	-0.011149	0.00138306	-8.061	0.0001
TCDUM	1	-0.010852	0.00127269	-8.527	0.0001
NUMRR	1	0.000667	0.00139774	0.477	0.6332
RRCON	1	-0.021571	0.01125962	-1.916	0.0557
DENSITY	1	-0.000037759	0.00000832	-4.541	0.0001
SYSCAR	1	0.005328	0.00147290	3.618	0.0003
QTR1	1	-0.000165	0.00136256	-0.121	0.9036
QTR2	1	-0.001165	0.00140697	-0.828	0.4077
QTR3	1	-0.000775	0.00138271	-0.560	0.5753
CD22	1				
CD76	1				
CD131	1				
CD190	1				
CD350	1				
CD555	1				
CD712	1				

The SAS System 120
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	1074	0.0451847	0.0284691
NOWAT		1074	0.0713833	0.0508015
DIFF		1074	0.0261986	0.0246906

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0082871	0.2499415
NOWAT		0.0168618	0.4613343
DIFF		0	0.2203588

The SAS System 121
07:40 Monday, October 30, 1995

Variable	Mean	Sum
RED	43798.25	47039324.19
XTM	2147981.81	2379963845
XTON	3497.07	3874758.00
XREV	68194.24	75559222.00

I&S SCRAP

```
*******************************************************************
*
*    PROGRAM NAME
*    ACE9527P.SAS
*
*    AUTHOR            DATE           REVISION         NOTES
*    MARK BURTON    AUG 1995
*
*    PURPOSE
*
*    FINAL UPPER-MISS MODEL
*
*
*    D O   N O T   E D I T   D O   N O T   E D I T   D O   N O T
*
*
*
*    FILES                            COMMODITY        40211 I&S SCRAP
*    ACE9509.SD2 - READ ONLY
*
*******************************************************************;

 OPTIONS MISSING = '.';
 OPTIONS LS=78;

*******************************************************************
*
* READ WAYBILL DATA;
*
*************************1*****************************************;

LIBNAME WAYBILL 'C:\BURTON\WAYBILL\';

DATA ONE;
   SET WAYBILL.ACE9509;

   IF STCC5=40211;
   IF RTM < 0.5446;

   IF ONRSTRVR='MS' OR TNRSTRVR='MS' THEN MSNRST=1; ELSE MSNRST=0;

PROC SORT DATA=ONE;
   BY WAYD;

DATA TWO;
   SET ONE;

  IF WAYD GE 920100 AND WAYD LT 920200 THEN MNTH01=1; ELSE MNTH01=0;
  IF WAYD GE 920200 AND WAYD LT 920300 THEN MNTH02=1; ELSE MNTH02=0;
  IF WAYD GE 920300 AND WAYD LT 920400 THEN MNTH03=1; ELSE MNTH03=0;
  IF WAYD GE 920400 AND WAYD LT 920500 THEN MNTH04=1; ELSE MNTH04=0;
  IF WAYD GE 920500 AND WAYD LT 920600 THEN MNTH05=1; ELSE MNTH05=0;
  IF WAYD GE 920600 AND WAYD LT 920700 THEN MNTH06=1; ELSE MNTH06=0;
  IF WAYD GE 920700 AND WAYD LT 920800 THEN MNTH07=1; ELSE MNTH07=0;
  IF WAYD GE 920800 AND WAYD LT 920900 THEN MNTH08=1; ELSE MNTH08=0;
  IF WAYD GE 920900 AND WAYD LT 921000 THEN MNTH09=1; ELSE MNTH09=0;
  IF WAYD GE 921000 AND WAYD LT 921100 THEN MNTH10=1; ELSE MNTH10=0;
  IF WAYD GE 921100 AND WAYD LT 921200 THEN MNTH11=1; ELSE MNTH11=0;

IF ORR=22  AND TRR=22  THEN CD22=1; ELSE CD22=0;
IF ORR=76  AND TRR=76  THEN CD76=1; ELSE CD76=0;
IF ORR=569 AND TRR=569 THEN CD569=1; ELSE CD569=0;
IF ORR=131 AND TRR=131 THEN CD131=1; ELSE CD131=0;
IF ORR=190 AND TRR=190 THEN CD190=1; ELSE CD190=0;
```

```
IF ORR=712 AND TRR=712 THEN CD712=1; ELSE CD712=0;
IF ORR=350 AND TRR=350 THEN CD350=1; ELSE CD350=0;
IF ORR=400 AND TRR=400 THEN CD400=1; ELSE CD400=0;
IF ORR=905 AND TRR=905 THEN CD905=1; ELSE CD905=0;
IF ORR=555 AND TRR=555 THEN CD555=1; ELSE CD555=0;
IF ORR=907 AND TRR=907 THEN CD907=1; ELSE CD907=0;
IF ORR=482 AND TRR=482 THEN CD482=1; ELSE CD482=0;
IF ORR=721 AND TRR=721 THEN CD721=1; ELSE CD721=0;
IF ORR=694 AND TRR=694 THEN CD694=1; ELSE CD694=0;
IF (ORR=494 AND TRR=494) OR
   (ORR=802 AND TRR=802) THEN CD802=1; ELSE CD802=0;

   IF OD2W=0 THEN OD2W=1;
   IF TD2W=0 THEN TD2W=1;

   IF TD2W LT 020 THEN TCDUM=1; ELSE TCDUM=0;
   IF OD2W LT 020 THEN OCDUM=1; ELSE OCDUM=0;

   IF OD2W>TD2W THEN D2W=OD2W; ELSE D2W=TD2W;

   IF OST='MN' OR OST='WI' OR OST='IL' OR OST='IA' OR OST='MO' OR
      OST='AR' OR OST='KY' OR OST='TN' OR TST='MN' OR TST='WI' OR
      TST='IL' OR TST='IA' OR TST='MO' OR TST='AR' OR TST='KY' OR
      TST='TN';

  OD2W=OD2W/TDIS;
  TD2W=TD2W/TDIS;

*  RTM     = LOG(RTM);
*  UCAR    = LOG(UCAR);
*  TON2CAR = LOG(TON2CAR);
*  TDIS    = LOG(TDIS);
*  NUMRR   = LOG(NUMRR);
*  RRCON   = LOG(RRCON);
*  DENSITY = LOG(DENSITY);
*  OD2W    = LOG(OD2W);
*  TD2W    = LOG(TD2W);
*  D2W     = LOG(D2W);

   TDIS2   = TDIS**2;
   UCAR2   = UCAR**2;

   OD2W=OD2W*OCDUM;
   TD2W=TD2W*TCDUM;

   INTD2W=OD2W*TD2W;

   XTON=EXPN*UTON;
   XTM=EXPN*UTON*TDIS;
   XREV=EXPN*RTM*UTON*TDIS;

PROC REG DATA=TWO;

   MODEL RTM=UCAR
             TON2CAR
             TDIS
             TDIS2
             OD2W
             TD2W
             OCDUM
             TCDUM
             NUMRR
             RRCON
             DENSITY
             SYSCAR
             QTR1
             QTR2
```

```
            QTR3
            CD22
            CD76
            CD131
            CD190
            CD350
            CD555
            CD712
            ;

PROC REG NOPRINT OUTEST=BETAS DATA=TWO;

   MODEL RTM=UCAR
            TON2CAR
            TDIS
            TDIS2
            OD2W
            TD2W
            OCDUM
            TCDUM
            NUMRR
            RRCON
            DENSITY
            SYSCAR
            QTR1
            QTR2
            QTR3
            CD22
            CD76
            CD131
            CD190
            CD350
            CD555
            CD712
            /P;

   OUTPUT OUT=PHAT P=PHAT;

DATA PHAT;
   SET PHAT;
   MRGVAR=.;

DATA BETAS;
   SET BETAS;

   BOD2W=OD2W;
   BTD2W=TD2W;
   BOCDUM=OCDUM;
   BTCDUM=TCDUM;

   MRGVAR=.;

   KEEP

   BOD2W
   BTD2W
   BOCDUM
   BTCDUM
   MRGVAR;

DATA PHAT;
   MERGE PHAT BETAS;
   BY MRGVAR;

   NOWAT=PHAT-(BOCDUM*OCDUM)-(BTCDUM*TCDUM)+(BOD2W*OD2W)+(BTD2W*TD2W);

   DIFF=NOWAT-PHAT;
```

```
    XPHAT=XTM*PHAT;
    XNOWAT=XTM*NOWAT;

    RED=XTM*DIFF;

PROC MEANS DATA=PHAT;
   VAR PHAT NOWAT DIFF;

PROC MEANS MEAN SUM DATA=PHAT;
   VAR RED XTM XTON XREV;

PROC SORT DATA=PHAT;
   BY STCC5 OBEA TBEA;

PROC MEANS NOPRINT SUM DATA=PHAT;
   BY STCC5 OBEA TBEA;
   VAR XPHAT XNOWAT;
   OUTPUT OUT=BEA SUM=XPHAT XNOWAT;

DATA BEA;
   SET BEA;

   DROP _TYPE_ _FREQ_;

   DIFF=XNOWAT-XPHAT;
   PDIFF=(XNOWAT/XPHAT)-1;

PROC PRINT DATA=BEA;

DATA BEA;
   SET BEA;
   FILE 'C:\BURTON\ACEOUT\BEA40211.DAT';

   PUT STCC5   1-5
       OBEA    7-9
       TBEA   11-13
       DIFF   15-24
       PDIFF  26-32 .5;

RUN;
```

The SAS System 126
07:40 Monday, October 30, 1995

Model: MODEL1
Dependent Variable: RTM

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	6.51200	0.29600	159.040	0.0001
Error	1728	3.21610	0.00186		
C Total	1750	9.72810			

Root MSE	0.04314	R-square	0.6694
Dep Mean	0.07427	Adj R-sq	0.6652
C.V.	58.08487		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.201870	0.00752934	26.811	0.0001
UCAR	1	-0.000104	0.00061153	-0.171	0.8645
TON2CAR	1	-0.001061	0.00005773	-18.379	0.0001
TDIS	1	-0.000147	0.00000882	-16.654	0.0001
TDIS2	1	5.4544755E-8	0.00000000	11.790	0.0001
OD2W	1	0.665226	0.02802936	23.733	0.0001
TD2W	1	0.390504	0.02888847	13.518	0.0001
OCDUM	1	-0.014726	0.00261319	-5.635	0.0001
TCDUM	1	-0.014743	0.00261014	-5.648	0.0001
NUMRR	1	-0.005359	0.00275874	-1.943	0.0522
RRCON	1	-0.047891	0.01542341	-3.105	0.0019
DENSITY	1	0.000035105	0.00000837	4.192	0.0001
SYSCAR	1	0.006863	0.00236120	2.907	0.0037
QTR1	1	-0.001600	0.00290395	-0.551	0.5818
QTR2	1	-0.006058	0.00304435	-1.990	0.0468
QTR3	1	-0.001303	0.00295786	-0.440	0.6597
CD22	1				
CD76	1				
CD131	1				
CD190	1				
CD350	1				
CD555	1				
CD712	1				

The SAS System 127
07:40 Monday, October 30, 1995

Variable	Label	N	Mean	Std Dev
PHAT	Predicted Value of RTM	1751	0.0742728	0.0610012
NOWAT		1751	0.1033795	0.1009151
DIFF		1751	0.0291067	0.0455876

Variable	Label	Minimum	Maximum
PHAT	Predicted Value of RTM	-0.0392465	0.6786310
NOWAT		-0.0239839	1.2891633
DIFF		0	0.6105323

The SAS System 128
07:40 Monday, October 30, 1995

Variable	Mean	Sum
RED	21533.48	37705123.43
XTM	1203997.39	2119035410
XTON	3484.88	6133396.00
XREV	48561.96	85469044.00