

**A PRELIMINARY REPORT ON THE  
USDA RAILROAD COSTING SYSTEM:  
USER'S GUIDE**

**By**

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**UGPTI Staff Paper No. 65  
July 1984**

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USER'S GUIDE**

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**JULY 1984**

## I. Introduction

The USDA Railroad Costing System for Bulk and Agricultural Commodity Movements, developed under contract number 53-31C7-3-54, is a movement costing package which utilizes unit costs and/or average movement factors from Phase II compilations of the Uniform Railroad Costing System (URCS). The system is distinct from and should not be confused with Phase III of URCS as developed by the Bureau of Accounts. The USDA system, although using the same inputs as Phase III, is based on an independent system design. The algorithm, the data processing procedures, and the programming logic are different in many respects. The USDA program should, however, produce comparable movement costs to Phase III of URCS provided that the same data inputs are used and the system options are appropriately set. More will be said concerning this comparison later. For now it is sufficient to stress that the USDA algorithm constitutes a distinct system with its own data input requirements and patterns, and thus entails its own specific set of user instructions and/or guidelines.

In the following paragraphs a brief overview of the USDA system is presented with some fundamental concepts of program usage. The report then turns to specific documentation of the input requirements and illustrates applications of the programming procedures.

### Overview of the USDA Rail Costing System

The USDA costing system was developed in response to the needs of shippers, government and interested parties for timely, accessible cost information. The system was designed to provide the maximum degree of flexibility to users and therefore to allow for the broadest possible range of uses and applications.

The USDA system consists, in actuality, of a series of programs which are designed to operate separately and/or in conjunction with each other

to produce estimates of movement costs. There are, in essence, two methods of invoking the central costing algorithm. This may be done either interactively or through means of "batch" processing. Interactively, the user enters the data inputs conversationally at a remote terminal, one movement at a time; waits while the costs are being calculated; and receives the results of the application immediately through means of a video display or printed page. Under this scenario, the user and the costing algorithm are interacting in a continuous cycle of communication by way of the host computer and its time-sharing delivery system. The inputs are entered, a movement is costed and the results are displayed; all while the user remains connected to the system. At the completion of each movement the user has the option of costing another, thus keeping the cycle intact, or quitting thereby breaking the cycle of communication.

The alternative method of invoking the algorithm is via batch execution. Under this scenario the cycle of communications is discontinuous in nature. The data inputs and/or program instructions are pre-assembled and stored in a file which is accessible to the Central Processing Unit (CPU) of the host computer. A "source" program which contains job control instructions as well as the central costing algorithm, is stored in a separate file. The source program is "submitted" to the host computer as one job in a "stream" of such submittals. When the job is "executed" by the computer, the data input file is automatically retrieved; the file is "read"; and costs are calculated for all movements which are contained in the file. A series of reports, one per movement, are automatically generated in an output dataset which is passed to a system "que" located on a peripheral or secondary memory device. Once in the que, the reports may be accessed and brought "back" to the terminal, so to speak, for display or routed to a line printer for final disposition. Under a batch option, in short, data

input, cost calculation, and output display constitute three integrated but separate elements of an overall costing session. In contrast, during an interactive application the three form a continuous cycle.

Each of the above alternatives has its own set of advantages (and disadvantages as well). Batch execution allows the costing of multiple movements simultaneously and is thus generally more efficient where costs for a large number of movements are desired.<sup>1</sup> Batch execution, however, requires job queing which means that execution by the computer will probably not be instantaneous. The user, in addition, must be familiar with the remote job retrieval procedures of the specific operating system in order to display the results at a local terminal. Interactive execution, on the other hand, is normally desirable where only one or a small number of movements are being considered. Under interactive execution the user, as will be detailed later, has direct, uninterrupted control over program execution plus has access to "on-line" help or assistance features which are not available in the batch mode. Thus, as a general rule, infrequent or first-time users would be advised to execute an interactive session in lieu of the batch; familiarizing themselves with the order of the data input requirements and the range of possible values for each entry. Afterwards if on the basis of demand for applications and/or resource costs, the batch option appears to be more feasible, then the user should graduate to batch execution.

#### Minimal versus Extended Parameters

Both the batch and the interactive procedures are designed to do essentially the same thing: collect and/or store the minimal or basic

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<sup>1</sup>The resource cost per minute (i.e CPU time and/or core storage) will normally be lower in a batch mode. As the number of movements to be costed increases, the resource cost per movement will decline. Under the batch execution option, the movements would still be costed one at a time, but the process is continuous requiring no user interaction once begun.

data inputs which are necessary to drive the costing algorithm; pass these through the mathematical equations for cost calculation; and store and display/print the results. In addition to these "minimal parameters"

the USDA system also entails the flexibility to allow the user to adjust any of 105 average or "default" movement parameters. This process is conducted separately from the execution of the central algorithm and is the same regardless of whether the batch or interactive application is selected.

These "extended parameters", as the name implies, are parameters beyond those which are necessary in order to drive the system. If the user does not supply values for these variables the system will function irrespectively, drawing upon default values which are stored in files accessible to the costing algorithm. Their specification, consequently, is wholly discretionary.

The relationship between minimal and normal parameters and the two modes of execution are depicted in Figure 1. As Figure 1 denotes, the act of specifying values for the extended parameters occurs outside of the stream of actual costing activities and must be undertaken prior to the invocation of the batch or interactive programs. Modification of the extended parameters, as will be detailed later, may be accomplished either manually or through the use of a separate conversational program.

Before entering into a detailed discussion concerning the application of each mode and procedures for the modification of extended parameters, the report now turns to a discussion of some fundamental concepts in program usage.

## II. Fundamentals of Usage

In order to access and utilize the USDA rail costing system prospective users must first be able to "tie-into" the operating system of the host

installation. Procedures for "logging onto" or gaining access via a time-sharing delivery system, while common in nature, may vary from installation to installation. It is assumed in the following discussion that the user has familiarized himself or herself with the accessing procedures of the particular installation and is ready and in a position to commence execution of the costing procedures.

### Program Initialization

#### Interactive

The USDA interactive costing algorithm may be invoked by entering a command, while in the time-sharing medium, which agrees with the following convention.

SAS INPUT ("File Name")

The file name may be set by the local installation and therefore may not agree with the name given below. If the file name is set to be consistent with this prototype, however, the command would appear as follows:

SAS INPUT (USDA.URCS)

Momentarily after this request, an initial options "menu" would appear on the terminal screen. At this point, the interactive program has been compiled, and the user is ready to pursue one of interactive options (which will be detailed at a later juncture).

Similarly, when invoking the extended parameters modification package, the command below would be entered.

SAS INPUT (USDA.PARMS)

Again, the file name may vary from installation to installation.

Once invoked a parameter options menu will appear, prompting the user to select the carrier or region for which parameter values will be supplied. As before, at this point the program has been compiled and the user is ready to interact conversationally with the modification algorithm.

In addition to differences in naming conventions and file names, there may be variations in command procedures from those depicted above. Before attempting program applications, therefore, the user should check for bulletins and/or specific guidelines issued by the local installation. If none are available, the conventions noted above may be followed literally.

#### Batch Applications



The preceding discussion has talked in general terms of the various components of the USDA costing system and explained how each might be invoked by the user. The report now turns to a more detailed description of each element, beginning with a discussion of the interactive costing software, followed by a description of the parameter modification procedures, and ending with a contrast of batch and interactive procedures. For purposes of clarity, an interactive application is first illustrated which involves only the specification of the minimal parameters. Subsequent illustrations then depict the modification of the extended parameters and the creation of a batch input file.

### III. Interactive Rail Costing

Once the interactive package has been invoked in the manner described above, an interactive options "menu" will appear momentarily. The menu provides for three choices; (1) to commence interactive rail costing applications, (2) to view the system's on-line tutorial and assistance materials, or (3) to terminate the interactive session.

#### On-Line Documentation

Option Two, if selected, will provide the user with background information regarding the design of the system plus provide detailed documentation of the 11 minimal parameters. Once invoked, this material may be viewed sequentially as a tutorial, one screen or page at a time, or the user may proceed directly to a second-level options menu which allows for direct viewing of particular sections. Individual parameters may thus be singled-out and focused upon.

All of the information contained in the on-line tutorial is also available, it should be pointed-out, from this document, sometimes in greater detail or depth. The on-line tutorial/help provisions are designed

to provide a succinct overview of the system design, and more importantly, a concise description of the minimal parameters and their values. This material hopefully will serve as a quick, readily-accessible source of documentation which might be "browsed" as a "refresher" document periodically.

The third option on the interactive menu is relevant only in the context of terminating a given session. Option One is the choice of interest in most regards. This is the selection which invokes the interactive data entry procedures of the USDA algorithm.

#### The Mechanics of Interactive Data Entry

Upon selection of Option One from the interactive menu, a data entry screen will automatically appear (Figure 2). This screen depicts sequentially, in short-hand form, each of the 11 parameters which must be supplied. At the bottom of the screen, a series of instructions for data entry may be found. The instructions underscore the correct procedures which should be followed during data entry. These instructions are expounded upon below.

#### Rules Governing Data Entry

The interactive data entry procedure will secure, sequentially, the values for each of the minimal parameters for each leg of the movement. Each "prompt" will appear only once during a movement session. When it appears, the user is expected to enter the values for all legs simultaneously on one entry line. If only one value is provided in response to the first entry, the program logic assumes that a single-line or one-leg movement is being costed. The interactive procedures will not attempt to obtain, therefore, entries for other legs; that is, the program will not ask-for and receive eleven entries for the first leg and then loop-back

to obtain eleven more for the second leg and so-forth. This, and other, data entry rules, are synopsized below:

1. All values must be supplied simultaneously for all legs of the movement. (This strict interpretation will be relaxed later for certain parameters, but for now a literal interpretation should be construed.)
2. A space should be placed between the values for each leg. After the last value, or conversely the value for the last leg has been supplied, press carriage return or the "enter" key on the keyboard of the local terminal. This transmits a complete entry line for each parameter.
3. The width of any input, either alphabetic or numeric, should not exceed five characters. Numeric inputs should be expressed in integer form only. Fractions should be rounded to the nearest whole number.
4. On-line help may be obtained on any given prompt by entering "H" or "Help" in lieu of a valid data entry. The program will automatically place an assistance screen before the user, depicting the range of possible values. Return to data entry may be effected by a simple carriage return.
5. Data entry may be terminated at any time by entering a "Q" or "Quit" in lieu of a valid data entry. This will erase all values entered previously and place the user, once again, at the first data entry. The application of this procedure will be documented further at a later juncture.
6. The interactive data session itself may be terminated by entering "M" or "Menu" in lieu of a valid data value. This places the user, once again, at the outer or main menu.

7. Corrections to data entries are allowed only at end of a session, or after values for parameters have been supplied. This procedure will be discussed in a following section as well.

#### Error Checking

The program will check each value of each entry line for possible errors. If the value supplied does not constitute: (a) a valid numeric or character value, (b) a "Q" or "Quit", (c) a "H" or "Help", or (d) a "M" or "Menu", then an error message will be issued. This message warns the user that the value entered is out-of-range, will not be accepted, and therefore must be re-entered.

At the time an error message appears, the user has an option. He or she may go directly from the error message to a help screen for the parameter. This should be done if the user is unsure whether the value which they have supplied is a legitimate one. Otherwise, he or she may return directly to data entry, which should be done if the value were simply entered erroneously.

A check for out-of-range values, it should be noted, does not necessarily constitute a check on the logic of the data entry. A user may enter, for example, a service level of "2", which corresponds to a multiple car shipment. Subsequently, values for the number of carloads may be set to "one" and the shipment weight to 90 tons. What the user has done, in essence, is costed a single-car shipment as a single-origin multiple carload consignment. The results will therefore be spurious or misleading. Users are cautioned to check and re-check their data entry for parameter logic. This will ensure a successful and useable application.

## Exits from Data Entry

As noted earlier, the user may abort a movement session in one of several manners. A "quit" entry will in essence start the data entry for a given movement application all over again. Values which were previously entered will be scrubbed and the parameters reinitialized to null values. The user will be placed, again, at the beginning of the movement process, with the first prompt appearing on the screen (or next line).

A "quit" serves, in essence, to signal the program logic that a user has made so many entry errors or has committed an uncorrectable error, such as naming too many carriers for the movement, that it is more desirable and/or efficient to start the data entry process all over again rather than continue to answer prompts and wait until the end of data entry to make corrections.

It is a matter of discretion and good judgment on the user's part as to when "quit" is a valid option. Some suggestions of circumstances where this exit procedure might prove valuable are: (1) when only a few lines of data have been entered, (2) when the same error has been committed for each leg of the movement, particularly where this occurred for several lines of entry, or (3) where, for some reason, it is decided that the movement description is no longer valid, yet the user does not wish to terminate the session altogether.

The other principal exit from data entry consists of a return to the outer, interactive menu. This may be desired for several reasons. First, the movement costs are no longer desired and the user wishes to terminate the session. Second, a user finds that they are "over their heads" so to speak, having proceeded without proper data entries or

without an adequate knowledge of the system. A return to the interactive menu, in this instance, will allow a user the option of viewing the on-line tutorial and help materials before returning to data entry; or, of terminating the session.

#### Interactive Data Entry: An Illustration

At the risk of getting the cart before the horse, the following paragraph ventures an illustration of interactive data entry and the mechanics noted above.

The first prompt which would appear in an interactive data entry session queries the user for the official (ICC) four-character initials for each railroad participating in the movement. The prompt would appear typically as below with a header which provides exit reminders.

Enter "H" for Help, "Q" to Quit, "M" for Menu.

Enter the official railway initials for each leg of the movement.

Once the prompt appears, the flow of the session has been temporarily suspended. The user must respond with entries and press carriage return before execution of the program will continue.

Suppose, for example, that the three carriers participating in the movement were the Soo Line, the Illinois Central Gulf, and the Southern Railway. The user would then respond with the following line of entry:

S00 ICG S0U

After the last value, "S0U", had been entered, the key "return" or "enter" would be pressed. Momentarily (appearing to be almost instantaneous) a second prompt would appear on the screen asking:

Enter the type of movement corresponding to each leg.

The user would then repeat the steps noted above, continuing through the process until values have been supplied for all of the required or minimal parameters.

The previous discussion focused primarily on the mechanics of interactive data entry at the expense of detail. The report now turns to an in-depth documentation of the minimal parameters themselves.

### The Minimal Parameters

As noted earlier, there are eleven minimal parameters which must be supplied by the user for every movement application. These consist of nine data values plus the disposition of two system options. The nine parameters are: (1) the official initials of the railroad performing the service, (2) the class or type of movement which is involved, (3) an integer commodity code which classifies the commodity according to ranges of Standard Transportation Commodity Codes (STCC), (4) the car-type used, (5) the service/rate level under which the movement occurs, (6) the number of carloads in the consignment, (7) the ownership status of the freight car(s) used, (8) the net weight of the shipment, and (9) the number of short-line miles which the shipment travels. The two system options which must be specified are: (1) the costing methodology to be applied in calculating movement costs and (2) whether or not values are to be supplied, as the system allows, for any of the extended parameters. Each of these variables is discussed in greater detail in the following paragraphs.

### Railroad Initials

At the beginning it should be stressed that two types of costs may be calculated using the USDA algorithm. Costs may be based on individual carrier inputs, if those are available, or they may be based on Phase II

compilations for ICC regions or group of railroads.

During the early years of the program, it is unlikely that Phase II compilations for all or even most of the individual roads can be obtained. If they are obtained, however, the program will calculate costs based on railroad-specific factors. The program logic proceeds as follows. If an individual carrier's initials are entered, the program checks to determine whether a Worktable E file exists in permanent storage for that particular carrier. If such a file exists, it will be accessed and used. If not the program automatically assigns the carrier to an ICC region and pulls the Worktable E file for that region. Thus it is inconsequential whether the initials of the railroad or those of the region are entered if there is no individual carrier file. If on the other hand an individual file exists and costs are desired for an ICC region, then the region initials must be specified else the program will retrieve the individual file.

The initials corresponding to each of the ICC regions as well as to the individual carriers are depicted in Table 1. These initials should be used exactly as shown, as other representations will invoke error messages.

#### Movement Type

The movement type is a parameter which describes the nature and extent of a carrier's participation in the movement. There are seven possible choices, each depicted in Table 2.

An originated and terminated shipment is a single-line or local movement, involving no interchange. The shipment travels wholly over the lines of one carrier. In an originated and delivered movement, the carrier originates the shipment but does not terminate it. The shipment instead



Table 1

## Railroad Initials to be Used in Data Entry

<u>Code</u>	<u>Parameter Values</u>	<u>ICC Region</u>
INTERSTATE COMMERCE COMMISSION REGIONS		
REG2	Official Territory Excluding Conrail	2
REG3	Official Territory Including Conrail	3
REG4	Southern Region	4
REG5	Western District Excluding Mountain Pacific and Trans-Territory	5
REG6	Mountain Pacific and Trans-Territory	6
REG7	Western District	5 & 6
INDIVIDUAL RAILWAYS		
AGS	Alabama Great Southern R.R. Co.	4
ATSF	Atchison, Topeka & Santa Fe RY. Co.	6
BO	Baltimore & Ohio R.R. Co.	2
BLE	Bessemer & Lake Erie R.R. Co.	2
BM	Boston & Marine Corp.	2
BN	Burlington Northern Inc.	6
CGA	Central of Georgia RY. Co.	4
CO	Chesapeake & Ohio RY. Co.	2
CNWT	Chicago & North Western Trans. Co.	6
MILW	Chicago, Milwaukee, St. Paul & Pacific R.R. Co.	6
RI	Chicago, Rock Island & Pacific R.R. Co.	5
CNTP	Cincinnati, New Orleans & Texas Pacific RY. Co.	4
CCO	Clinchfield R.R. Co.	4
CS	Colorado & Southern RY. Co.	6
CR	Consolidated Rail Corp.	3
DH	Delaware & Hudson RY. Co.	2
DRGW	Denver & Rio Grande Western R.R. Co.	6
DTI	Detroit, Toledo & Ironton R.R. Co.	2
DMIR	Duluth, Missabe & Iron Range RY. Co.	5
EJE	Elgin, Joliet & Eastern RY. Co.	2
FEC	Florida East Coast RY. Co.	4
FWD	Fort Worth & Denver RY. Co.	5
GTW	Grand Truck Western R.R. Co.	2
ICG	Illinois Central Gulf R.R. Co.	4
KCS	Kansas City Southern RY. Co.	5
LI	Long Island R.R. Co.	2
LN	Louisville & Nashville R.R. Co.	4
MP	Missouri Pacific R.R. Co.	5
MKT	Missouri-Kansas-Texas R.R. Co.	5
NW	Norfolk & Western RY. Co.	2
PLE	Pittsburgh & Lake Erie R.R. Co.	2
SLSF	St. Louis-San Francisco RY. Co.	6
SSW	St. Louis Southwestern RY. Co.	5
SCL	Seaboard Coast Line R.R. Co.	4
S00	Soo Line R.R. Co.	5
SP	Southern Pacific Trans. Co.	6
SOU	Southern RY.	4
UP	Union Pacific R.R. Co.	6
WM	Western Maryland RY. Co.	2
WP	Western Pacific R.R. Co.	6

Table 2

Possible Values for the Variable "Movement Type"

<u>Entry Code</u>	<u>Description</u>
OT	Originated and Terminated
OD	Originated and Delivered
RD	Received and Delivered
RT	Received and Terminated
OP	Open or Unknown Routing
IA	Intraterminal Switch
IT	Interterminal Switch

is delivered to an interlining carrier for further transportation. If a shipment is received and delivered, then the railroad is a "bridge" carrier; it thus neither originates or terminates the shipment. The last carrier in a multi-leg movement both receives and terminates the shipment, a movement type of RT.

If the routing of a movement and the number of carriers is unknown, or the number is greater than four, then the movement may be classified OP, which is open or unknown routing. This selection would be a valid one for example if it was known that the movement traveled in Region VII, the Western Territory, but the routing of the movement (single-line as opposed to interline) or the number and names of the participating carriers are unknown.

Open or unknown routing might also be specified for a particular leg of a multi-leg movement. Suppose, for example, that it is known that a shipment travels across the Western Territory from a Pacific Coast origin, via the Chicago Gateway, to be terminated at Louisville. It is known that Illinois Central Gulf receives the shipment in Chicago and terminates it in Louisville. It is not known, however, how many carriers handled the movement in Western Territory or the specific routes taken by the shipment. In this example, consequently, it would be entirely legitimate to cost a two-leg movement, with first leg occurring in ICC Region VII under a movement type of OP, with the second leg consisting of received and terminated service on the Illinois Central Gulf.

The last two classifications, IA and IT, apply to circumstances where no line-haul movement is involved. During an intraterminal switch (IA), a shipment is switched from the tracks of one shipper to the tracks of another, or to specified team tracks, within the same terminal switching district. The service is assumed, in this instance, to be provided by a single carrier; the railroad, that is, has access to

the sidings of both the consignor and the consignee. No interchange thus is required. Not so for an interterminal switch (IT), however. In this instance, the switch occurs between a consignor and consignee situated on different lines or railroads. The shipment, therefore, must be interchanged.

As is the case with all parameters, care should be taken to specify the most correct or logical movement descriptor. Particularly so in the case of this parameter, however, for as will be discussed later, the value of this parameter controls several program branches and is the key, in turn, for the initialization of certain costing factors within the algorithm.

#### Commodity Code

The third parameter consists of a two-digit commodity code. This is the same coding scheme developed by the ICC for use in Phase III. Each code, as depicted in Table 3, corresponds to a specific STCC range which normally fits a general commodity description. For example, commodity code 3 relates to the commodity description of "grain", which in turn, entails the STCC range from 01130 to 01139.

Again, the two-digit entry code should be used, not the STCC identifier.

#### Car Type

The car-type codes, as shown in Table 4, are ICC codes corresponding to broad car classifications. They are not Association of American Railroads (AAR) codes. If the AAR code is known, however, it can generally be converted to an ICC code by following the relationships shown in Table 4.

Table 3

## URCS Commodity Codes

<u>Code</u>	<u>STCC Group</u>	<u>Commodity Description</u>
1.	01100-01119	Farm Products
2.	01120-01129	Cotton in Bales
3.	01130-01139	Grain
4.	01144-01144	Soybeans
5.	01195-01195	Potatoes other than Sweet
6.	01200-01299	Fresh Fruits
7.	01300-01399	Fresh Vegetables
8.	01400-01419	Livestock
9.		Other 01 Categories
10.	10000-10999	Metallic Ores
11.	11000-11999	Coal
12.	14000-14999	Non Metallic Minerals
13.	20000-20109	Food and Kindred Products
14.	20110-20119	Fresh Meats
15.	20120-20129	Frozen Meats
16.	20130-20159	Meat Products
17.	20160-20169	Frozen Poultry
18.	20310-20319	Canned or Cured Seafoods
19.	20320-20329	Canned Specialties
20.	20330-20339	Canned Fruits or Vegetables
21.	20350-20359	Pickled Fruits or Vegetables
22.	20370-20379	Frozen Fruits or Vegetables
23.	20390-20399	Mixed Canned Goods
24.	20400-20409	Grain Mill Products
25.	20410-20419	Flour
26.	20420-20429	Prepared Feeds
27.	20430-20439	Cereals
28.	20440-20449	Rice
29.	20450-20459	Prepared Flour
30.	20460-20469	Corn Products
31.	20620-20699	Refined Sugar
32.	20821-20821	Beer
33.	20840-20849	Wines
34.	20850-20851	Whiskey
35.	20900-20999	Miscellaneous Food Preparations
36.		Other Categories
37.	21000-21999	Tobacco Products
38.	24000-24319	Lumber and Wood (Except Furniture)
39.	24320-24329	Plywood or Veneer
40.		Other 24 Categories
41.	25000-25999	Furniture and Fixtures
42.	26000-26210	Pulp, Paper and Allied Products
43.	26211-26211	Newsprint
44.		Other 26 Categories
45.	28000-28999	Chemicals
46.	29000-29999	Petroleum or Coal Products
47.	30000-30999	Rubber and Miscellaneous Plastics
48.	32000-32099	Stone, Clay and Glass Products
49.	32100-32199	Flat Glass
50.	32200-32299	Glassware
51.	32511-32529	Brick

Table 3

## URCS Commodity Codes

<u>Code</u>	<u>STCC Group</u>	<u>Commodity Description</u>
52.		Other 32 Categories
53.	33000-33999	Primary Metal Products
54.	34000-34999	Fabricated Metal Products
55.	35000-35999	Machinery Except Electrical
56.	36000-36299	Electrical Machinery
57.	36300-36399	Household Appliances
58.		Other 36 Categories
59.	37000-37109	Transportation Equipment
60.	37110-37119	Motor Vehicle
61.	37140-37149	Motor Vehicle Parts
62.		Other 37 Categories
63.	44000-44999	Freight Forwarder Traffic
64.	45000-45999	Shipper Association Traffic
65.	47000-47999	Less than Carload Traffic
66.		All Other Categories

Table 4

## Car-Type Codes and Related Data

<u>Entry Code</u>	<u>Car-Type Description</u>	<u>AAR Codes</u>
1	Plain Box Car-40 foot	B100-129
2	Plain Box Car-50 foot	B200-229; B300-329
3	Equipped Box Car	All "A" Codes
4	Plain Gondola Cars	G092-392; G401-492
5	Equipped Gondola Cars	All "C" and "E"
6	Covered Hopper Car	L151-154; 251-254; 351-354; 451-454; 551-554; 651-654; 751-754
7	Open Top Hopper, General Service	All "H" Codes
8	Open Top Hopper, Special Service	All "J" and "K"
9	Refrigerator Car, Non-Mechanical	R100-103; 105-109; 113-116; 200-203; 205-209; 231-216
10	Refrigerator Car, Mechanical	R104, 110, 111, 112, 117, 118, 204, 210, 211, 212, 217, 218
11	Flat Cars: TOFC/COFC	F071-078; F871-978; F771-778
12	Flat Car: Multi-Level	All "V" Codes
13	Flat Car: General Service	F101-109; F201-209
14	Flat Car: Other	F11-189; 211-289; 301-389; 401-540
15	Tank Car Under 22,000 Gallons	T-0 through T-5
16	Tank Car Over 22,000 Gallons	T-6 through T-9
17	All Other Freight Cars	-----

## Rate/Service Level

This parameter describes the tariff or contract service level under which the movement occurs. There are six general categories, one of which should closely approximate the characteristics of a given shipment. The six service levels are: (1) single car, (2) multiple car, single origin, (3) multiple car, multiple origin, (4) trainload, single origin, (5) trainload, multiple origin and (6) unit train. The distinction between these levels of service is important, because this parameter sets the values for other movement parameters and causes a different sequence of calculations to occur in certain instances.

A unit train shipment, service level 6, is defined as part of a continuous, cyclical pattern of movement between the same origin(s) and destination(s), normally involving a dedicated train set and locomotive consist. The ICC, in their reporting instructions for Schedule 755, Railroad Operating Statistics, define a unit train as "a solid train with a fixed, coupled consist operated continuously in shuttle service under load from origin and delivered intact at destination, and returning empty for reloading at the same origin." This definition, it will be noted, is not synonymous with that of a trainload shipment, a destination which is frequently blurred.

A trainload shipment, although involving some of the same characteristics as that of a unit train, does not have to part of a broader, cyclical pattern of movements. The pattern, rather, may be quite discontinuous in nature. A trainload movement, in fact, may consist of one-time shipment which is never repeated.

As pertains to this costing system, a trainload is defined as a "solid" freight train comprised of a single consignment which provides direct single-train service between origin(s) and destination(s). The



key operating difference between this definition and that of a unit train is that here the train does not necessarily return empty to the same origin for reloading. This definition, furthermore, by virtue of its inclusion of the term "solid", rules out mixed trains of freight. Under a trainload service option, in other words, the consignment is not hauled to the regional classification yard and there blocked into a through train which travels, although not necessarily directly, to a terminating classification yard where the train is declassified and various shipments delivered. The train is a single unit which requires no intermediate yard switching or way train service.

A multiple car shipment may be of any practical size: 3, 10, 25, 50 cars or greater. Size is not a distinction between the trainload and multiple carload service options. The key distinctions, rather, are (1) a multiple car shipment does not enjoy the same direct origin-destination service as does a trainload, (2) a multiple car shipment does not constitute a solid or separate train, and (3) for the above reasons, a multiple car shipment may incur both classification and declassification activities as well as way train service. A multiple car shipment, as defined in this system, consists of any consignment of greater than one car which does not constitute a trainload or solid train, that is yet large enough to warrant special handling procedures and/or a different rate structure than a similar single carload shipment. Five cars pulled from a single station at one time, on 3 bills-of-lading under publish tariff single-car rates, therefore, do not constitute a multiple-car shipment. The cars must be on a single bill-of-lading and fit the requirements noted above.

#### Multiple Origin Options

The range of service level options, as listed previously, include both multiple-origin and single-origin shipments for multiple-car and

trainload service levels. A single-origin shipment, as the name implies, involves service between one originating and one terminating station. Unit train and single-car shipments are assumed to be single-origin. A multiple-origin shipment does not involve the same restrictions. Under this type of operation, a single shipment may originate from more than one station.

A requirement for the multiple-origin shipment, and a factor distinguishing it from simply a collection of smaller single-origin shipments, is that shipment moves under a single bill-of-lading and entails a single consignee. Multiple-car tariffs or contracts will normally specify the maximum number of origins involved as well as groupings for the originating stations.

When a multiple-origin movement is specified, the costing algorithm assumes a default value of 3 stations for the consignment. As will be discussed later, however, a user may supply any reasonable value for the number of origins involved.

#### Car Ownership Code

This parameter consists of an integer code which describes the ownership status of the freight cars. This is a separate issue from the ownership status of intermodal trailer or container units (TOFC/COFC) which is addressed elsewhere (see section regarding supplemental TOFC values).

There are these possible values for this entry. A code of "1" indicates a shipment comprised solely of railroad-owned or leased freight cars. A "2" indicates a shipment of private line cars. And a "3" indicates a mixed shipment; that is a shipment consisting of partly railroad owned equipment and partly private line. If a "3" is entered

in response to this prompt, the user, at a later point in data entry, will be asked to supply the number of private line cars and railroad cars in the shipment. From these a specific empty return ratio is calculated for the consignment, consisting of the weighted-averages of the railroad owned and private line cars for the particular car-type being used. Car day costs will be calculated for the railroad owned cars, plus car mile operating and return on investment, while only car mile (depreciation) costs will be calculated for private line equipment.

#### Number of Equipment Units

The program will prompt the user for either one of two values, depending upon the previous response to the question of car type. If the car type entered is number "11", indicating a TOFC/COFC flatcar, the user will be asked to supply the number of trailer or container units in the shipment.

Under intermodal arrangements, the trailer or container is the basic equipment unit, not the flatcar. In consigning a TOFC/COFC shipment, the consignor may not know, in fact, the number of flatcars which will be used to transport the consignment of trailer or container loads. This may depend upon the length of trailers or containers, which may be of varying lengths, as well as other train or operating factors. The program will calculate the number of flatcars based on the average number of TOFC/COFC units for flatcar for the carrier or region. If the number of flatcars is known, in addition to the number of trailer/container units, this factor may be supplied through the extended parameter modification procedure.

If the shipment is not an intermodal one (if the response to car-type were other than number "11"), the user will be asked to supply the

number of freight cars in the consignment. If, furthermore, the car ownership code had previously been specified as "3", the user will be asked to supply the number of private line cars in the supplemental parameters section.

#### Shipment Weight

This parameter reflects the net weight of the shipment, excluding the weight of freight cars and/or the weight TOFC/COFC units. The value should be given to nearest whole ton for the entire shipment, irrespective of the number of carloads involved.

#### Short Line Miles

The number of short-line miles represents the shortest rail distance between the point of origin and the point of interchange and/or termination, between two interchange points, or between the point of interchange and final destination. The short-line miles do not constitute actual route miles. In calculating route miles, the algorithm will inflate short-line mileages to account for actual route movement.

Short-line miles can normally be found in one of the following sources: (1) a railroad distance tariff, the preferred source, (2) the carload waybill sample, if one is available, or (3) as an approximation, a railroad atlas. If the user wishes to supply actual or route mileages, this can be accomplished through the parameter modification procedures.

#### System Options

In addition to the nine parameters discussed above, the program is designed to prompt users for the disposition of two system options. These options control program execution with regard to the costing methodology used and the modification of extended parameters.

## Costing Methodology

The USDA system is designed to allow the user the discretion to select one of two possible costing methodologies. The first option is a strict interpretation of the costing methodology set forth by the ICC in Phase III of URCS. If the user selects this option, and if the data entry assumptions are the same, this procedure should produce costs which are comparable to a Phase III application. The second option will also produce comparable costs to a Phase III application for a single carload (service option one). Option two, however, entails a different set of methodologies for calculating locomotive switching costs at origin and destination, and road train costs.

Under option two, locomotive switching adjustments are based on an adjustment scale adapted from "Improved Regulatory Costing Methodology for Railroads", developed under contract for the ICC, and published in November of 1977. These adjustments may also be found in "Notice of Proposed Rulemaking, Rail Market Dominance and Related Considerations", Federal Register Volume 45, No. 12, Thursday, January 17, 1980. This set of adjustments are more specific than "the Ex Parte 270, Sub. 4" adjustments used in Phase III of URCS, in that they show adjustments for carload block sizes ranging from 6 to greater than 50 carloads (Table 4). Under option one, engine switching reductions are treated as a function of the service level rather than a function of the number of carloads in the consignment. A reduction of 50% in the switching cost per carload is given to all multiple carload shipments (service levels 2 and 3), regardless of the size of the consignment and/or the number of stations involved. Conversely, a reduction of 75% is granted to all trainload and unit train shipments (service levels 4, 5, and 6) irrespective of shipment size.

If a shipment has been specified as a trainload or unit train consignment, and consists, of 50 cars or more, the average reduction per carload of 75% would be the same under either option. For shipments of less than 50 carloads, however, which characterizes a considerable portion of rail traffic, the adjustments afforded under option two of the costing methodology will provide greater specificity. This is particularly true with respect to distinguishing between multiple-origin and single-origin shipments.

Under option two, switching costs at origin will be calculated differently for multiple origin shipments. The "cutsize", or the number of carloads switched at each station, will be determined by dividing the number of cars in the consignment by the number of stations involved. The cutsize will then be used in determining locomotive switching minute adjustments. For example, if a 26-car shipment were consigned from a single-origin, under the adjustment scale mentioned above, locomotive switching minutes per car would be reduced by 60% from the single-car average. If, however, the same 26 cars were consigned as part of a 4-station multiple-origin shipment the engine switching minutes per car would be reduced by 12% from the single-carload average, thus reflecting the reduced efficiencies associated with the switching of the consignment at several as opposed to a single station. Under option one, both multiple-car single-origin and multiple-car multiple origin shipments would receive the same factor adjustment -- 50%.

#### Road Train Costs

The second major area of difference in costing methodology lies with the calculation of road train costs. Road train costs consist of: (1) train mile crew wages, (2) non-wage train mile expenses, and (3) locomotive mile expenses. Road train costs are, by and large, a function of the number of trailing tons in the train and the number of

Table 4

Option Two Origin-Destination Engine Minute  
Adjustment Factors

<u>Cutsizes*</u>	<u>Percent Reduction per Car</u>
6	12
7	19
8	24
9	28
10	31
11	34
12	37
13	39
14	41
15	43
16-17	45
18-20	47
21-25	54
26-30	60
31-40	66
41-49	72
50 or more	75

\*The term cutsizes refers to the number of cars switched at each station.

locomotive units required. Generally, the fewer the number of locomotive units per train and the greater the number of trailing tons, the lower the cost per shipment ton mile will be. Way train costs are thus generally the highest per shipment ton mile; through train costs are lower than way train; while unit train ton mile costs are the lowest of all.

Alternative two builds a series of adjustments into the calculation of road train costs which are not available under option one. The first adjustment involves the automatic substitution of individual carrier values for regional Worktable E factors. This occurs in 3 areas: (1) average trailing tons, (2) average locomotive units, and (3) average way train miles. The rationale for this adjustment is as follows.

Regional road train factors reflect averages of the operating conditions and train efficiencies of all carriers involved. There can be considerable differences between individual carriers. The average way train on the Burlington Northern, for example, may have significantly different characteristics than either the Western Pacific or the Santa Fe. The same may be true of unit train characteristics. Using Region VI averages, therefore, may not be totally reflection of the road train characteristics on each specific railroad. To account for these differences, the user has only to specify option two under costing methodology options, and the program will read one additional file containing individual carrier values and use these in the cost calculations.

This option will produce more specific results only if the user has specified an individual carrier's initials in response to question one. If an ICC region has been specified, the program will access the Worktable E values for the appropriate region, and use these as required.



This procedure, in short, allows the user to specify an individual carrier in lieu of a region and obtain cost estimates based on specific road train factors even though an individual Worktable E file does not yet exist for the railroad. This constitutes a closer approximation of road train costs than that now given by regional Phase III values.<sup>2</sup>

The second adjustment to road train costs involves the treatment of trainload costing. Under option two, the definition of a trainload is used as a guide in setting road train factors. The average trailing tons of the train are automatically set equal to the weight of the consignment, cars and contents. This conforms to the definition of a trainload as a "solid" train. If the user has specified a service level of 4 or 5 and a costing option of 2, the program will also ask for the number of locomotive units required. The user must then either specify a value for the number of units or enter "default". If no numeric value is entered, the program will automatically approximate the number of units required by adjusting through or unit train locomotive statistics to fit the size of the consignment. Under costing option one, a trainload consignment is costed as a unit train. Multiple origin options are ignored and carrier unit train statistics are used unless specific train weights and power requirements are specified by the user.

#### Supplemental Parameters

Depending upon the response given to certain questions, the user may be asked to specify values for a limited set of supplemental parameters after minimal parameter input. This is required only where the

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<sup>2</sup>The user may still override these values through the extended modification procedure, if the exact train weight, locomotive requirements, or way train mileage is known.

acquisition of additional information is warranted in order to initialize values for key program parameters or where acceptable default values are not available.

The supplemental parameters may be grouped roughly into three categories: (1) TOFC/COFC parameters, (2) trainload and/or multiple origin parameters, and (3) equipment ownership patterns. Each of these categories is discussed in the following paragraphs.

#### TOFC/COFC

The majority of the supplemental parameters pertain to intermodal shipments. Trailer-on-flatcar or container-on-flatcar shipments exhibit, by and large, more variables than other types of rail shipments. For one thing, there are two classes of equipment involved: trailers (containers) and flatcars. For another, a great many shipment alternatives exist as indicated by the number of "plans" surrounding this type of shipment. For these reasons, several supplemental parameters are required for TOCF/COFC shipments.

If car-type "11" is selected, the user will be asked to answer the following questions: (1) are pick-up and delivery activities performed, (2) are trailer ownership costs to be calculated, and (3) are the trailers or containers refrigerated units. In response to each of these questions, a user may enter "Yes" (Y), "No" (N) or "Default" (D). If the user desires, a "Y" or an "N" supplied will control program execution in these areas. If, on the other hand, a user does not wish to control execution in these areas, a "default" will signal that response to the algorithm.

#### Trainload/Multiple Origin Parameters

If the user specifies service level 3 or 5, he or she will also be asked to supply the number of stations involved. Again, a "default"

may be entered in lieu of a value. The program will then use a value of 3 in every instance where the parameter is called-for.

If service level options 4 or 5 had been entered, the user would then be asked to supply the number of locomotive units required, or to invoke the default option. If the default option is selected, the program will then classify the trainload as either a system-average unit train or a system average through train based on its trailing weight. The system-average number of units from the train type which most closely approximates the trainload will be used as the starting point for the calculation of locomotive costs. The raw locomotive costs, as experienced under system-average locomotive requirements, would then be "allocated" to the trainload based on the ratio of the trainload's trailing tons to the system-average number of trailing tons.

#### Car Ownership

If a "3" were entered in response to the query regarding car ownership status, the program will automatically prompt the user for supplemental information. The selection of this option implies that a mixed shipment, consisting of partly railroad owned or leased and partly private line cars has been consigned. The user will then be asked to supply the number of private line cars in the shipment. The program will then subtract this value from the total number of carloads which were entered in response to query #7 to obtain the number of railroad owned or leased freight cars.

When this option is selected, the algorithm calculates car day and car mile costs for railroad owned equipment and car mile depreciation costs for private line cars. Also, a weighted-average "empty return" ratio is calculated, based on the specific composition of the shipment. This loaded-to-empty car mile ratio is used in the calculation of return

trip yard switching events, for purposes of calculating engine switching costs, as well as return trip mileage. This procedure, it should be noted, is not in strict compliance with Phase III methodology.

The previous discussion has highlighted both the mechanics of interactive data entry and the nature and range of values for the basic and supplemental minimal parameters. In order to elucidate this discussion, the following paragraphs will "walk-through" a typical data entry session. The illustration will depict both user and system response in the cycle of interactive data entry.

#### Interactive Data Entry: An Example

After a user has selected option one, interactive rail costing, from the initial outer menu, a screen for interactive data entry will appear at the local terminal (Exhibit 2). The screen will appear initially with no values beside the parameter entry lines. At the beginning of each movement application, all parameters are initialized with null values. At the bottom of the screen will appear a brief synopsis of the instructions for interactive data entry. To initiate data input at this point the user would press the carriage return or "enter" key on the terminal keyboard. If the system is being accessed on a "full-screen" terminal such as an IBM 3279, or through an emulation software package which models the IBM 3270 series, the screen will clear at this point; it will reset itself with the first prompt appearing at the top of the new screen. If the program is not being run on a real or emulated full-screen terminal, the clear commands which are built-into the program will not work. The screen instead will begin to scroll upwards, with the first prompt appearing directly below the input instructions, as shown in Exhibit One.

## Exhibit 1

## A Sample Session: Interactive Data Entry

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MINIMAL PARAMETER INPUT

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1. Railroad
  2. Movement Type
  3. Commodity Code
  4. Car Type
  5. Service Level
  6. Number of Cars
  7. Car Ownership Status
  8. Shipment Weight
  9. Short Line Miles
  - System Options:
  10. Costing Methodology
  11. Supply Parameters?
- 

Values may be supplied for up to 4 legs simultaneously. When a prompt appears, enter the value for leg one, followed by a space, the value for leg two, space, etc. Press return to start.

User action: Press "Return" or "Enter" key.

If on full-screen terminal (i.e. IBM 3270-3279), screen will clear and reset.

1. Enter the ICC railway initials for each leg.

S00 ICG

2. Enter the movement type for each leg.

OD RT

3. Enter the URCS commodity code for each leg.

3 3

4. Enter the ICC car type for each leg of the movement.

6 6

5. Enter the carload service/rate level for each leg.

1 1

6. Enter the number of cars in the consignment.

1 1

7. Enter the car ownership code for each leg.

1 1

8. Enter the shipment weight in tons.

88 88

9. Enter the number of short line miles for each leg.

293 479

10. Enter option for costing methodology. (1 or 2)

1 1

11. Will you be supplying parameter values for the leg?

no no

Do you wish to make corrections (y or n)?

yes

Enter line number, leg number, and new value. For help enter "H"  
and the line number of variable.

9 1 283

Please wait for costs.  
Press return when \*\*\* appears.

The first prompt asks for the railroad initials for each leg. In this example, the user will cost a two-leg movement. He or she will respond to this prompt, therefore, with the data entry of "S00 ICG", as depicted in Exhibit One. He or she will then press the carriage return, and the second prompt will appear. The previous process will be repeated, and the cycle will continue until values have been supplied for all entries.

This example depicts an error-free entry session which is not terminated prematurely through one of the exit commands (i.e., "Quit") which were noted earlier. Should an error occur on entry, the input cycle will be interrupted. A message will appear indicating that the value given is out-of-range. At that point, the user has the option of entering "Help" to view a help screen for the parameter, or of returning directly to data entry. This latter option is invoked with a simple carriage return.

#### The View Option

Regardless of whether the screen scrolls upward or clears as it will on a full-screen terminal, the user will soon lose line-of-sight with the parameter input panel and previous data entries. At certain times during a data entry session, it may be useful for the analyst to view the input panel, complete with all of the values which had been entered thus far. In order to do this, a "V" or "View" command should be entered in response to the next prompt which appears. In response to this entry, the program will clear (scroll) the screen and will re-display the input panel. Instead of a blank panel, however, the display will list the values for each leg which have been entered for each parameter. After viewing the screen, the user may return to data

entry via a carriage return. The last prompt which was shown at the time the view command was entered will then reappear. The user may then proceed with the data entry session.

Under a full-screen scenario, the screen will also reset itself after each error in entry. This is to prevent the screen from becoming cluttered with error messages and becoming prematurely full.

#### Expansion of First-Leg Values

To facilitate a data entry session and avoid duplicate entries on a given data line, the program will automatically expand the entry given on the first leg of the movement, provided it is a valid in-range entry, to all other legs in the movement. This will automatically be carried-out for parameters 3-11 for all multi-leg movements. The railroad initials and the movement type (parameters 1 and 2) must be entered for each leg. The program will not expand these values.

To illustrate first-leg expansion, in response to query three in Exhibit One the user could have simply entered a "3". The program would then have assumed that the URCS Commodity Code for the second leg of the movement was the same as the first, and would therefore have assigned this parameter a value of "3" for the second leg as well. This expansion technique should prove useful for the majority of parameters involved. The user should exercise care regarding parameter #9, however, the short line miles because if only one value is entered, the program will assume that the value for legs 2 and beyond is the same as for leg one. This may not be the intent of the user.

#### Correction Procedure

After values have been supplied for all parameters, the data input panel, complete with all data entries, will be displayed a final time.



At that point, the user has the option of changing previously entered values for a given parameter and leg. As Exhibit One depicts, the program will ask whether or not corrections are desired. The user should respond yes or no to this query. If corrections are desired, as Exhibit One illustrates, a message will appear asking for line number, leg number, and new value of the parameter to be changed.

The user, at this time has an option. By entering an "H" and the number of the variable, a "help screen" will appear depicting the range of values for the parameter in question. If the user is unsure of what the correct value should be, this option provides ready access to a parameter review. The user may exit the help area by pressing "enter", the same procedure as followed when invoking assistance at any time during data entry. He or she will then be placed back at the same point in data entry, read to correct an input value.

In the illustration (Exhibit One), the user wishes to correct the value entered for the number of short line miles for Leg One of the movement. The original value of 293 was incorrect. The correct value should be 283. The user enters, in order, the numbers "9 1 283". The screen will then reset displaying the revised value. Corrections may be made to additional parameters, if need be, at this time.

Once all corrections have been made, a message will appear asking the user to please wait for the cost calculations to be made. At this point the algorithm has been invoked. The cost calculations are complete when a triple asterisk appears on the screen (full-screen version) or the report itself appears. When the triple asterisk appears, the user may press carriage return and the movement report will appear.

### III. Extended Parameters

The preceding section of the report highlighted the mechanics of data entry, discussed the range of values for each of the minimal parameters, and presented a simple illustration of conversational data entry. The report now turns to a discussion of the extended parameter set and the parameter modification process.

#### Overview

As noted previously, the program allows a user the option of modifying any of 105 extended parameters. Table 5 depicts the range of parameters which may be modified. For purposes of classification, these may be grouped into 7 general categories which correspond roughly to functional cost groupings. Six of the seven categories are comprised of movement performance factors, such as freight car tare weight, or unit costs (i.e., operating cost per gross ton mile). The remaining category consists of cost indices for various cost elements. The seven parameter sets are: (1) line-haul costs and performance factors (Table 5, lines 1-14); (2) road train costs and performance factors (Table 5, lines 15-29); (3) freight car costs and performance factors (Table 5, lines 30-42); (4) terminal parameters (Table 5, lines 43-55); (5) trailer-on-flatcar and container-on-flatcar parameters (Table 5, lines 56-78); (6) accessorial costs and performance factors (Table 5, lines 79-98); and (7) cost update indices (Table 5, lines 99-105).

#### File Structure and Creation

At the time a user requests and gains access to the USDA Rail Costing System, he or she will be assigned a master file in which the extended parameters are to be stored. The file will have a dataset name conforming to TSO naming conventions (i.e., RDSMITH.PARMS.DATA) which identifies the

Table 5

## Extended Parameter Set

1. Way Train Miles
2. Through Train Miles
3. Unit Train Miles
4. Intertrain/Intratrain Switches
5. Interchange Switches
6. Unit Cost Per Gross Ton Miles: OPR
7. Unit Cost Per Gross Ton Mile: DRL
8. Unit Cost Per Gross Ton mile: ROI
9. Unit Cost Per Car Mile (Other): OPR
10. Unit Cost Per Car Mile (Other): DRL
11. Unit Cost Per Car Mile (Other): ROI
12. Unit Cost Per Car Mile (Clerical): OPR
13. Unit Cost Per Car Mile (Clerical): DRL
14. Unit Cost Per Car Mile (Clerical): ROI
15. Average Trailing Tons: Way Train
16. Average Trailing Tons: Through Train
17. Average Trailing Tons: Unit Train
18. Locomotive Units: Way Train
19. Locomotive Units: Through Train
20. Locomotive Units: Unit Train
21. Unit Cost Per Locomotive Mile: OPR
22. Unit Cost Per Locomotive Mile: DRL
23. Unit Cost Per Locomotive Mile: ROI
24. Unit Cost Per Train Mile: OPR Wages
25. Unit Cost Per Train Mile: DRL Wages
26. Unit Cost Per Train Mile: ROI Wages
27. Unit Cost Per Train Mile: OPR Other
28. Unit Cost Per Train Mile: DRL Other
29. Unit Cost Per Train Mile: ROI Other
30. Circuitry Factor
31. Total to Loaded Car Mile Ratio
32. Tare Weight
33. Car Days Per Car: Yard
34. Car Days Per Car: Running
35. Car Days Per Car: Total
36. Car Miles Per Car: Yard
37. Unit Cost Per Car Day
38. Unit Cost Per Car Mile (Ownership)
39. Unit Cost Per Car Mile (Prot. Ser.): OPR
40. Unit Cost Per Car Mile (Prot. Ser.): DRL
41. Unit Cost Per Car Mile (Prot. Ser.): ROI
42. Accessorial Cost Per Carload O/T
43. Loss and Damage Cost Per Ton
44. Cost Per Carload Handled: OPR Non-Clerical
45. Cost Per Carload Handled: DRL Non-Clerical
46. Cost Per Carload Handled: ROI Non-Clerical
47. Cost Per Carload Handled: OPR Clerical
48. Cost Per Carload Handled: DLR Clerical
49. Cost Per Carload Handled: ROI Clerical
50. Cost Per Carload Orig/Term: OPR Non-Clerical

ROI - Return on Investment

OPR - Operating

DRL - Depreciation, Rentals and Leases

MVU - Motor Vehicle Units

Table 5 (continued)

## Extended Parameter Set

51.	Cost Per Carload Orig/Term:	DRL Non-Clerical
52.	Cost Per Carload Orig/Term:	ROI Non-Clerical
53.	Cost Per Carload Orig/Term:	OPR Clerical
54.	Cost Per Carload Orig/Term:	DRL Clerical
55.	Cost Per Carload Orig/Term:	ROI Clerical
56.	Number of Origins Per Shipment	
57.	TOFC Plan Number	
58.	Trailers Per Flatcar	
59.	Trailer Tare Weight:	W/Refrig.
60.	Trailer Tare Weight:	Wo/Refrig.
61.	Trailer Days Running	
62.	Trailer Days:	Origin/Destination
63.	Trailer Loaded to Empty Ratio	
64.	Unit Cost Pickup/Delivery:	OPR
65.	Unit Cost Pickup/Delivery:	DRL
66.	Unit Cost Pickup/Delivery:	ROI
67.	Unit Cost Loading/Unl.:	OPR
68.	Unit Cost Loading/Unl.:	DRL
69.	Unit Cost Loading/Unl.:	ROI
70.	Unit Cost Protective Serv.:	OPR
71.	Unit Cost Protective Serv.:	DRL
72.	Unit Cost Protective Serv.:	ROI
73.	Unit Cost/Day (Reefers):	OPR
74.	Unit Cost/Day (Reefers):	DRL
75.	Unit Cost/Day (Reefers):	ROI
76.	Unit Cost/Day (Non-Ref.):	OPR
77.	Unit Cost/Day (Non-Ref.):	DRL
78.	Unit Cost/Day (Non-Ref.):	ROI
79.	Motor Vehicle Units Orig/Term	
80.	Unit Cost Per M.V.U.:	OPR
81.	Unit Cost Per M.V.U.:	DRL
82.	Unit Cost Per M.V.U.:	ROI
83.	Ton Miles in Lake Service	
84.	Unit Cost Per Ton Mile:	OPR
85.	Unit Cost Per Ton Mile:	DRL
86.	Unit Cost Per Ton Mile:	ROI
87.	Tons Handled at ORE Terminals	
88.	Unit Cost Per Ton Handled:	OPR
89.	Unit Cost Per Ton Handled:	DRL
90.	Unit Cost Per Ton Handled:	ROI
91.	Tons Handled at Coal Terminals	
92.	Unit Cost Per Ton Handled:	OPR
93.	Unit Cost Per Ton Handled:	DRL
94.	Unit Cost Per Ton Handled:	ROI
95.	Tons Handled at Other Marine Terminals	
96.	Unit Cost Per Ton Handled:	OPR
97.	Unit Cost Per Ton Handled:	DRL
98.	Unit Cost Per Ton Handled:	ROI
99.	Cost Index (Other Than Car Ownership):	OPR

ROI - Return on Investment

OPR - Operating

DRL - Depreciation, Rentals and Leases

MVU - Motor Vehicle Units

## Table 5 (continued)

## Extended Parameter Set

- 100. Cost Index (Other Than Car Ownership): DRL
- 101. Cost Index (Other Than Car Ownership): ROI
- 102. Cost Index (Car Ownership): CPR
- 103. Cost Index (Car Ownership): DRL
- 104. Cost Index (Car Ownership): ROI
- 105. Overall Rail Cost Index

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ROI - Return on Investment  
OPR - Operating  
DRL - Depreciation, Rentals and Leases  
MVU - Motor Vehicle Units

user and the file structure. This will primarily be a function of the program manager at each installation, and is normally something which the user will not have to undertake or initiate. The details for creating and naming master files are depicted in the companion piece to this users guide -- Programming and Maintenance Manual for the USDA system.

The file creation process generally proceeds as follows. A master file is allocated which contains space for 15 individual carrier or region files. All values in the file (1575 excluding the file identifiers) are initialized to -1, the equivalency of a null value.<sup>3</sup> A -1 in a particular variable's slot indicates to the central costing algorithm that the user has not supplied a value for that particular parameter. During program execution the -1 is ignored, and the costing calculations use the built-in default value for that parameter.

The user, once the file has been created, will be allowed to supply the names of carriers and/or regions that will occupy the master file. It is generally a good idea to designate the first 6 files as belonging to the 6 regional carriers, and the last 9 files as belonging to individual carriers, although this does not necessarily have to be the case. A user may allocate the files in any order or manner that he or she wishes. The only requirement is that the file indicator must consist of a valid carrier or region's initials as specified in Table 1 of this document.

Before allocating the files, it would be beneficial for a user to plan, with some care, the naming or distribution of files so that once designated, the file indicators do not have to be changed. Changing the allocation will require additional file editing and may require recreation of the master file itself. In making that initial decision,

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<sup>3</sup>Since zero can be a valid numeric value, a -1 was chosen as a null indicator.

therefore, it may be helpful to consider the following facts and/or guidelines.

1. An individual carrier Worktable E file does not have to be available to the system in order to allocate a sub-file to that carrier and subsequently to supply values for that railroad during costing execution.
2. Many of the extended parameters will have to be obtained through special study or direct observation. The practicality of obtaining these data for the various carriers may therefore be a consideration.
3. That mix of individual carriers and/or regions should be chosen which best reflects the possible range of movements to be costed. Geographic distribution and the types of commodities to be analyzed should be considered. If primarily grain or bulk commodities are to be analyzed, then the carriers or regions involved should be reflective of that fact.
4. Regional files do not have to be allocated. All 15 files may be carrier-specific. If the user expects to specify ICC regions for costing applications, then regional files will be necessary.

There are two methods by which a user may allocate files to carriers or regions. This may be done conversationally through the user of the program which is described in Appendix A, or a list of names may be supplied to the program manager at the user's installation. The course which is most appropriate will depend upon the user's particular circumstance and the installation involved.

The master file, once created and named, assumes the familiar shape of a rectangular data file. Figure 2 illustrates the structure of such a file, using sample railroad initials.

Getting a user's master file into the configuration shown in Figure 2 will hopefully constitute a one-time preliminary procedure, which will primarily be the function of a program manager. Once the file is in this configuration, the user is in a position to supply values to be used in lieu of system defaults. The process of supplying these values is discussed next.

Figure 2

Structure of Master File for Extended Parameters

<u>File Identifier</u>	<u>Variable 1</u>	<u>Variable 2</u>	<u>Variable 3</u>	<u>.....</u>	<u>Variable 105</u>
REG2	-1	-1	-1	.....	-1
REG3	-1	-1	-1	.....	-1
REG4	-1	-1	-1	.....	-1
REG5	-1	-1	-1	.....	-1
REG6	-1	-1	-1	.....	-1
REG7	-1	-1	-1	.....	-1
BN	-1	-1	-1	.....	-1
S00	-1	-1	-1	.....	-1
ICG	-1	-1	-1	.....	-1
SOU	-1	-1	-1	.....	-1
UP	-1	-1	-1	.....	-1
WP	-1	-1	-1	.....	-1
SCL	-1	-1	-1	.....	-1
CR	-1	-1	-1	.....	-1



Supplying Extended Parameter Values

There are two ways in which a user supplies values for the extended parameters for a carrier or region. The first is manual or direct file modification. Here, the user or program manager edits the master file and changes -1 values to valid zero or positive numbers for the desired parameters.

The order of the parameters in the file is depicted in Table 6, with their corresponding Table 5 listings. To change the value of a variable for a particular carrier the user must engage in direct line editing while in the time-sharing medium (i.e. move the cursor to the exact line number and column location in the file and enter the value) or use a pre-written procedure (i.e., S.A.S. PROC EDITOR). Manual modification is recommended only where the user is sufficiently familiar with the time-sharing system and file structure to effect changes without risk of accidental loss of data or disruption of file integrity.

---

Table 6

Order of Parameters in File and Corresponding Table 5 Values

<u>Parameter Set</u>	<u>Table 5 Parameters</u>	<u>Location in User File</u>
1. TOFC/COFC	Lines 56-78	Variables 1-22
2. Terminal	Lines 43-56	Variables 23-36
3. Freight Car	Lines 30-42	Variables 37-49
4. Road Train	Lines 15-29	Variables 50-64
5. Line Haul	Lines 1-14	Variables 65-78
6. Accessorial	Lines 79-98	Variables 79-98
7. Cost Indices	Lines 99-105	Variables 99-105

---

The second and preferable alternative is to supply values via the conversational parameter modification program noted earlier. This program,

which may be invoked in the manner described on page 5 of the guide, will present a series of panels for interactive parameter modification, and in addition will "error-check" the data to ensure against possible erroneous specifications.

Upon activation of the program the user will be asked which railroad or regional parameter set will be modified. The user should enter in response the official railway initials as depicted in Table 1. After pressing carriage return, an options menu will appear (Exhibit 2) which describes the various parameter sets which may be modified. The variables within each set correspond to the Table 6 listings. The user should enter the option number of the parameter set for which modifications are to be made.

---

### Exhibit Two

#### Parameter Options Menu

```

*****
*                                     *
*           EXTENDED PARAMETER      *
*           MENU                     *
*                                     *
* THE FOLLOWING OPTIONS ARE AVAILABLE: *
* 1. MODIFY LINE HAUL PARAMETER SET  *
* 2. MODIFY ROAD TRAIN PARAMETER SET *
* 3. MODIFY FREIGHT CAR PARAMETER SET *
* 4. MODIFY TERMINAL PARAMETER SET   *
* 5. MODIFY TOFC/COFC PARAMETER SET  *
* 6. MODIFY ACCESSORIAL PARAMETER SET *
* 7. SUPPLY/MODIFY RAIL COST INDICES *
* 8. REINITIALIZE DATA SET          *
* 9. TERMINATE SESSION               *
*                                     *
* PLEASE SELECT ONE.                 *
*                                     *
*****

```

---

As Exhibit Two depicts, there are nine menu options. The ninth option will terminate the modification process. The eighth option, which reinitializes all parameter sets to -1 values, will be discussed later. Options 1-7 pertain to the particular parameter groupings.

Upon entering the numeric code for option 1-7, a parameter input panel will appear momentarily. The panel, as illustrated in Exhibit Three, will depict the parameters for which modifications can be made. As the exhibit implies, each parameter set consists of two screens or panels. If the parameters to be modified do not appear on the initial screen, the user may proceed directly to the second screen by entering an "S" in response to the prompt which appears.

In this illustration, suppose the user wishes to supply values for the number of car days spent in yards as well as the number of car days running. Both of these parameters may be found on the first screen of the freight car parameter set, option #3. After entering a "3" in response to the menu query, the panel as shown in Exhibit Three will appear. At the bottom of the panel, a prompt will appear asking for the line number(s) of the parameter(s) to be changed. The user, in response, will enter the line "4 5", as shown in Exhibit Three, and press carriage return. Notice that the rules for data entry are the same as for the minimal parameters in this regard; at least one space must be placed between each entry.

After transmitting the entry line, a second prompt will appear below the first. This prompt will ask for the values for the parameters entered above. The values must be entered in the same order as the parameter line numbers were given (i.e., the first value should correspond to parameter #4 and the second to parameter #5). In the example shown in Exhibit 3, the user has information that the number of car days in yards is 6, and the number of car days running is 2. These values are entered, in that order, and the data line is transmitted.

Under a full-screen application, the terminal screen will clear and reset showing the new values which have been supplied. At that time the program will ask the user if additional values need to be supplied. If

## Exhibit Three

## Sample Extended Parameter Input Panel

- 
1. Circuitry Factor
  2. Total to Loaded Car Mile Ratio
  3. Tare Weight
  4. Car Days per Car: Yard
  5. Car Days per Car: Running
  6. Car Days per Car: Total
  7. Car Miles per Car: Yard
- 

Enter the line number(s) to be changed or "S" for second screen.

4 5

Now enter, in order, the values for each of the above.

6 2

Do you wish to supply additional parameters?

no

Do you wish to correct any of the above entries?

yes

Enter the line number(s) for which corrections are required.

4

Now enter, in order, the corrected values for the above entries.

8

- 
- |                                   |   |
|-----------------------------------|---|
| 1. Circuitry Factor               |   |
| 2. Total to Loaded Car Mile Ratio |   |
| 3. Tare Weight                    |   |
| 4. Car Days per Car: Yard         | 8 |
| 5. Car Days per Car: Running      | 2 |
| 6. Car Days per Car: Total        |   |
| 7. Car Miles per Car: Yard        |   |
- 

More railroad parameters are accessible on a second screen. Enter "S" for next screen or "P" to return to options menu.

a parameter has been overlooked, the user may respond with a "yes". In that instance, the initial prompt will reappear asking for the line number(s) to be changed. The process described above is then repeated.

#### Corrections to Entries

After all entries have been supplied, the user may correct any of the previous values which were entered. The system will automatically ask if corrections are required (Exhibit 3). Suppose, in this instance, the analyst has mistakenly entered a "6" as the value for parameter #4 whereas the actual value should be "8" (i.e. destination car days were inadvertently omitted). He or she will thus respond positively to this question. The program will then ask for the line number of the parameter (line number 4) and then for the corrected value. Once the corrected value is transmitted, the program automatically erases the previously entered value for parameter #4 while retaining the previous value for parameter #5.

After the corrected line has been transmitted, the panel will be displayed for a final time, showing the parameters and the values supplied (Exhibit 3). A message will appear at the bottom of the panel indicating that additional parameters for this set are available on a second screen. The user may view this screen by entering an "S" or return to the parameter options menu by entering "P". Once back at the options menu (Exhibit Two), the user may modify parameters in an additional set by specifying the appropriate options number. If all modifications have been made, the user may terminate the session by entering a "9" in response to the options query.

#### Rules Governing Data Entry

Briefly, the rules governing data entry are:

1. Line numbers may be entered in any order (i.e. 8 2 5). The values corresponding to the parameters must be entered in that exact same order, however, or the results will be misleading.
2. Any number of parameters may be changed in a single data entry, up to and including the maximum number shown on a single screen. In other words, in the previous example, values for all 7 parameters shown on the first screen of the freight car parameter set could have been supplied simultaneously by specifying the string "1 2 3 4 5 6 7".
3. The length of any data value may not exceed 10 characters. Decimal points may be included but count as one field.
4. At least one space must appear between each item in any entry string. Additional spaces, while not required, will not result in errors.
5. Previous values may be "written-over", whether while supplying additional parameters or during the correction phase, by specifying the line number and the correct value.
6. Once a parameter set has been left and the user has returned to the options menu the same parameter set may not be accessed a second time during the same session. This may cause system overflow and bring about an abnormal ending to the application.
7. Data entries should not be placed in brackets or parentheses or separated by commas and/or semicolons. Any of these may result in a severe language or syntax error which may also cause an abnormal ending to the application.
8. "Yes" or "No" answers should always be in upper case. Upper case functions are included in the program which automatically convert lower to upper case. They cannot be guaranteed to work under all operating systems at all installations, however.

A user may supply values for as many parameter sets as need be during a single application. Upon returning to the options menu, a different parameter set may be selected from the list. This process may be repeated until the list has been exhausted.

#### System Capabilities and Response

The conversational parameter modification procedure (PMP) offers a wide-range of user options and entails extensive data checking capabilities. these are discussed briefly below.

## Error Checking

The PMP checks for errors in several regards. First, of all out-of-range line numbers will be uncovered. If a parameter screen or panel involves line numbers 1 to 7 as did the previous example, entries which fall out of this range will produce an error message. The message will indicate that an out-of-range entry has occurred and will prompt the user for the correct number(s). This error may inadvertently occur as the number of entries on the first or second screen is not always the same. The numbering system, furthermore, does not start over again on the second screen but continues from the first. Such errors may be guarded against by remembering these two facts, but their occurrence is not a significant problem.

A second type of error which may understandably be committed is the entry of an uneven number of parameters and data values. Suppose, for example, a user specifies a string of 6 line numbers for which values will be supplied but inadvertently enters only 5 data values. Since it is not possible, or at the very least would require heroic assumptions to associate the correct data values with the appropriate line (parameter) numbers the program is designed to ignore the data entry and issue an error message to that effect. The user will then be asked to re-enter the string of data values, taking care to correlate the correct data values with the correct line number.

A warning should be issued here. The program automatically buffers the data line. Any entry which exceeds the maximum number of parameters which were specified will be treated as extraneous data, irrelevant to the data line. Any such entry, consequently, will be ignored. No error message will be given. If 5 parameters were specified, in other words, but 6 data items were subsequently entered, the last item would be discarded.<sup>4</sup>

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<sup>4</sup>This is fairly accepted procedure in error-checking programs. The rationale is that most extraneous entries are caused by a user accidentally hitting a key other than carriage return, thus producing a nonsensical or junk entry.

In addition to checking for the number of data values, the program also provides for limited checks on the validity of the data. First, all data entries must be numeric. Character strings will be rejected, consequently, and an error message will be issued. Second, all numeric entries are subjected to two additional checks. The absolute size of each integer is checked. If it exceeds 8 digits, an error message will be issued. This guards against an operating system error which may otherwise occur if the integer is too large for internal representation. In addition, the length of each entry is monitored by the PMP. If the length exceeds 10 characters an error message will occur. It is not anticipated that this situation will be frequently encountered.

The program does not, however, engage in logic checking. This is not feasible given the number of parameters and their potential value ranges. The user, therefore, is responsible in full for the reasonableness of the data entries.

#### Exits

The PMP allows for exits at the end of each parameter panel. At that juncture, a user has the option of returning to the parameter menu. From the menu, a session may be terminated by specifying option nine.

Data entry may also be effectively terminated by entering a "Q" or "Quit" in response to a prompt for line entries. When entered, a "Q" will automatically return the user to the parameter options menu from where the session may be terminated.

At the time the user "quits", the PMP will retain all values which were previously entered. If, for example, a user had modified parameters on the first screen or panel and then proceeded to the second panel before deciding to quit, all values entered for the first panel would be retained



by the program and written to the user's master file. When an error occurs, the program will react the same way. Only the current entry line is erased. All previous values are retained.

#### Checks for Omission

The PMP is designed to guard against errors of omission or exclusion to the extent practicable. After the initial data line has been transmitted, unless the user has supplied values for all parameters shown on a given panel, the program will "loop back" seeking to ascertain whether or not values have been supplied for all desired parameters. If this is indeed the case, the user should reply "no" in response to the query of whether "additional parameters" are to be supplied. If, on the other hand, an entry has been inadvertently omitted, the user will have a second chance to supply that value. This prevents a situation from occurring whereby the user must run an additional application in order to supply the omitted parameter, or attempts to modify the same panel a second time without terminating the session; neither of which is a desirable scenario.<sup>5</sup>

Once in the correction phase, the program continues to guard against inadvertent errors in entry. An application (the modification of a given panel) cannot end on an error. Once a correction is begun the PMP will keep looping back until an error-free correction has been made or the user quits the correction procedure. While in the correction phase, furthermore, a user may continue to supply additional (new) parameter values as well as correct existing entries. This allows someone the opportunity until the last possible moment, to correct errors of omission.

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<sup>5</sup>As noted earlier, returning to the same panel a second time from the options menu may cause system overflow and lead to premature program termination.

### Reinitializing a File

Option 8 of the parameter options menu, as noted earlier, will reinitialize an entire file to -1 values. This option is usually warranted when so many of the values previously supplied have changed that it has become tedious or impractical to change each individually. Thus the entire file, including all parameter sets, is reset to the equivalent of null values.

### The Extended Parameters: A Closer Look

Up until now, the discussion concerning extended parameters has been restricted largely to the topic of procedures and program manipulation. The report now turns to a more detailed discussion of the function of each parameter or cluster of parameters and how they affect cost calculations.

### Parameter Types

There are in essence four types of parameters: unit costs, cost indices, service units, and performance factors. Unit costs consist of either Worktable E unit costs or summary program-defined unit costs. The former consist of sets of unit costs for functional cost elements. The line-haul parameter cluster, for example, contains gross ton mile unit costs for three separate items: (1) operating expenses (OPR), (2) depreciation, rents and leases (DRL), and (3) return on investment (ROI). The freight car cluster, for example, also contains program-defined unit costs for car day and car mile elements. These costs, if supplied by the user, would represent the equivalence of an aggregate unit cost for operating, depreciation, and return on investment.

Cost indices, as the name implies, are used to update unit costs from the date of derivation. There are two types of cost indices. The

first group consists of update ratios which will index unit costs according to their accounting definitions (OPR, DRL and ROI). These disaggregate indices will also distinguish between car ownership and other expense categories. The second type of index consists of an aggregate or overall cost index. This ratio is used by the algorithm to index movement variable cost regardless of the types or categories. Cost update ratios may be obtained by users from several sources, the most notable of which would be unpublished data maintained by the American Association of Railroads.

Service units are items such as actual train mileages or the number of tons handled at marine terminals which are used directly or nearly so in the calculation of various movement cost categories. Service units are distinct from and should not be confused with performance factors.

Performance factors are movement variables which by and large are used in the calculation of service units. The average number of locomotive units per through train, for example, a road train performance factor, is used in the calculation of locomotive unit mile service units for the through train portion of a movement.

Unit cost, as a general rule, will be the most permanent fixture of a parameter file. An accurate determination of these factors will normally require a special study or a Phase II compilation based on the user's own assumptions and inputs. Once these values have been supplied it is unlikely that they will change until a more current compilation of Worktable E factors are available, or a new special study is performed. These variables, consequently, should not change over the short term. Neither should the cost update ratios. Performance factors, on the other hand, will change with greater frequency. The average trailing tons in a through train or the tare weight of a freight car will vary with the class of traffic. As long as coal traffic is being costed, for example,

performance factors of 8,000 gross trailing tons in unit train service and 6 locomotive units would probably remain valid across a cross-section of western traffic. When the emphasis shifts to grain traffic, however, these values may no longer be valid and will have to be changed. Railroad performance factors can be expected to require modification, consequently, with each shift in costing focus. Of the three types of parameters, the service units will vary most radically. The actual train miles or the number of car days (per car) in yards and in road trains, for example, will probably change from movement to movement. New values will thus have to be supplied for every application.

The permanence of the parameter type along with the degree of difficulty associated with its acquisition will, more than anything else, determine the make-up of a user's parameter file. Unless the specification of actual car days, for instance, will lead to considerably greater specificity in movement cost, it may be difficult to justify the effort required since values will probably have to be supplied for each application. The specification of average way train miles, on the other hand, or the number of origins per shipment are performance factors which may fluctuate less frequently than others and which can be obtained through a relatively inexpensive operating study. The cost and effort, therefore, may be well justified.

#### Parameter Sets

For purposes of organization and ease of modification, the 105 parameters were grouped into seven major categories or parameter sets (Exhibit Two). A brief discussion of each parameter set and of clusters within each set will be presented in the ensuing paragraphs. For a detailed discussion of the derivation of the parameters, particularly the Worktable E unit costs and performance factors, the user is referred to:

Development of an Improved Regulatory Costing Methodology for Common Carriers by Railroad, Phase II, Uniform Railroad Costing System,

Interstate Commerce Commission, December 1979. In particular, interested parties should review the Phase II worktables which constitute an appendix to that report.

Line-Haul Parameters

Within the line-haul parameter set are three clusters of movement parameters: (1) actual train mileages, (2) intermediate yard switching events, and (3) line-haul unit costs. Train mileages are distinguished between types of trains. Such mileages constitute one-way actual distances traveled including circuitry. Through train mileage represents the cumulative yard-to-yard mileages for each leg of a movement. Unit train mileage represents the station-to-station distance for uninterrupted or otherwise direct origin-destination service. Trainload mileage, such as that which would accrue under service options 4 or 5, should be listed as unit train mileage; there is no difference between the two with respect to one-way mileage. The costing algorithm will read this value and utilize the input appropriately based on the service level entered.

The parameter "way train miles" may assume one of two forms. The variable may reflect the average distance traveled on a carrier's system for a way train movement either at origin or at destination. The parameter in this sense represents a performance factor whose value would not change from application to application. In its other form the parameter would reflect the actual train mileage for a particular movement. The variable in this sense would become a service unit whose value would be valid only for a single application. It is up to the discretion of the user as to which level of specificity the parameter will reflect.

One point should be re-emphasized regarding train mileage parameters. Regardless of the variable, and regardless of whether average or movement-specific mileages are at issue, the mileages must reflect one-way train distances along the actual route of movement. These values, unlike short-line miles, will not be increased by a circuitry factor during program execution. If mileages are entered for the unit train parameter or for both the way train and through train parameters, the number of short-line miles which are entered during minimal parameter input will not be used in the costing calculation. If, however, only the way train miles are entered, the short-line mileage entry will still be used in the determination of through train miles.

Intermediate yard switching events, the second line-hand parameter cluster, are comprised of two types: (1) intertrain and/or intratrain switching events and (2) interchange switches. Interttrain and intratrain switching events could occur exclusively on the line of one railroad. This activity consists largely of the classification and declassification processes which occur at originating and terminating freight yards. An example of an intertrain switch would be the switching of a car or block from a way train to a through freight train (or vice versa). An intratrain switch, on the other hand, would involve the repositioning of the car or block within the same train. Both are a function of the sorting and blocking which occurs between origin and destination.

Interchange switching, in contrast, involves the transfer of a car or block of cars between two carriers. A word of caution should be voiced here. The program automatically sets the number of interchange switches on the basis of movement type: 1 switch for originated-delivered and received-terminated shipments, 2 for received and delivered shipments, and zero for originated and terminated shipments. For open routing shipments,

interchange switches are calculated on the basis of a mileage interval. The user should understand that when specifying a value for this parameter the internal factors will be overridden.

The third and final parameter cluster consists of line-haul unit costs for gross ton mile, car mile clerical, and car mile non-clerical service units. The car mile unit costs, it should be noted, reflect non-ownership costs only. Car ownership costs are reflected in a different set of parameters.

#### Road Train Parameter Set

The road train parameter set contains performance factors and unit costs which are related to road train operations. The first performance factor, average gross trailing tons, represents the average weight of the freight cars, lading and caboose which are being pulled by the locomotive set. A user may supply values for way train tons, through train tons, and/or unit train tons. The second performance factor consists of the average number of locomotive units per train. Again, the user may supply way, through, and/or unit train values.

There are two sets of Worktable E unit costs within this parameter group. The user may supply values for locomotive mile unit costs, either operating, depreciation, or return on investment. The user, in addition, may supply values for non-wage train mile expenses. Neither of these unit costs will vary by train type.

This grouping also contains three program-defined unit costs which relate to train mile crew wages. The standard Worktable E train mile wage unit costs do not reflect the specific type of train involved. The PMP allows the user to specify a summary or aggregate unit cost for each train classification (i.e. way, through, unit). If the user specifies a

value for any class of train, the costing algorithm will use this factor in lieu of the average train mile figures provided by Worktable E.

#### Freight Car Parameter Set

This parameter set consists of performance factors, service units and unit costs which relate to freight car operations, both yard and line-haul. The user may specify the circuitry factor, the loaded to empty car mile ratio, and the freight car tare or "lite" weight. As was the case with way train miles, these parameters may consist of averages which would reflect the characteristics of a specific class of movements, or they may be shipment-specific.

The user, in addition, may specify the number of car days per car which the shipment entails. This may be accomplished in several ways. First, the user may specify the total car-day cycle, including origin-destination time, intermediate yard time, and car days running. When this value is supplied, the algorithm will automatically allocate the car days between yard and running activities.<sup>6</sup>

This may be the most straightforward and expeditious way of supplying car day parameters in the majority of instances. A user will normally be able to uncover, without tedious calculation, the total number of car days consumed between origin and destination. This information may be obtained directly from the waybill in certain instances. It may be more difficult, on the other hand, to determine how many of those days were spent running as opposed to being spent in switch yards or at origin-destination. If this information is known, however, the user may specify

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<sup>6</sup>The car days running, under this scenario, are calculated first using the Worktable E average for the number of car miles per day. This is felt to be the most accurate estimating technique of the two. The number of car days in yards is then determined by subtracting the car miles running from the user-supplied total. The user does not necessarily have to know the number of intermediate yard days and origin-destination time in order to supply car day parameters.



individually the number of car days running as opposed to yard activity. When this is done, the algorithm will accept those values and by-pass default calculation procedures.

Several cautions should be noted here. First, the user must be certain to specify the car day cycle, whether it be total car days, car days in yards, or car days running. If only way-one or loaded car days are supplied, the results will be misleading. The algorithm will not expand the values to account for return trip days. Second, valid numeric values should never be maintained in a user's file for car days in yards and/or running unless they are meant to be used on every application. Specifying a total car day cycle will not override yard and running entries. The algorithm assumes such values to be more specific in nature and thus begins the computational process with a search for these entries. If any valid number (zero or above) is found, it will be utilized even though this may not have been the intent of the analyst.

In addition to car days, a user may also supply the number of car miles in yards (per car). This figure, as did the number of car days, includes both industrial switching and intermediate yard switching miles, and reflects both loaded and return car miles.

The remainder of the parameters in this grouping constitute unit costs. Both car mile and car day unit costs may be supplied by the user. These should consist of a summary unit cost which reflects, in each instance, all elements of car ownership cost. Car day and car mile unit costs such as these are normally developed in accordance with Ex Parte 334 standards. If a user supplies car day or car mile unit costs, these values will automatically be increased by the general overhead ratio for that carrier or region.

The car mile ownership cost above should not be confused with protective services costs which are also stated on a car mile basis. This expense involves the process of cleaning, fueling or otherwise servicing the protective equipment on refrigerator freight cars. The PMP allows the user to modify the Worktable E variable unit costs for operating expenses, depreciation and return on investment.

The last freight car cost consists of a summary, program-defined cost for carload accessorial services. This figure should reflect the total variable cost per carload handled including all aspects of carload accessorial services (i.e., yard and running expenses). If a value is supplied for this parameter, the default calculation procedures will be by-passed. A user may therefore eliminate accessorial cost elements from the variable cost calculations altogether by specifying a zero value for this parameter.

#### Terminal/Carload Parameter Set

This parameter set is comprised wholly of unit costs. The Worktable E unit costs consist of clerical and non-clerical cost factors for two types of service units: (1) carloads originated or terminated and (2) the number of carloads handled. Each carrier participating in the movement receives credit for a carload handled. Not every carrier, however, receives a credit for carloads originated and/or terminated. The number depends on the movement type. Bridge carriers receive no credit while OT movements receive two.

This combination of separate unit costs for clerical and non-clerical expenses results in 6 unit costs for each type of carload service unit. In addition to 12 carload unit costs, the user may also modify the loss and damage average. Worktable E values reflect national averages for

general commodity groups (for the most part). The PMP allows a user to specify a cost which reflects the specific commodity type being shipped and/or carrier/regional propensities. If a user supplies a value for one carrier in a movement, for example, and relies upon default values for the remaining two legs, the algorithm will average the three values to determine a shipment cost per ton. If separate values are supplied for each carrier or region the average will reflect the characteristics of the three separate entries.

#### TOFC/COFC Parameters

The PMP allows the user to modify 22 TOFC/COFC extended parameter. To begin with, a user may specify the plan number for a shipment. The number is used primarily in initializing values for pickup and/or delivery and trailer ownership.

The USDA algorithm will recognize 9 TOFC/COFC plans. These are based on the descriptions provided in Rail Carload Cost Scales - 1980 published by the Bureau of Accounts, ICC (pages 9 and 10). The plans, which are depicted in Table 7, show the various settings for pickup, delivery, and trailer ownership which are attached to each type of service. If the user fails to specify a plan number, the system will default to plan #2.

Plan 2.26, it will be noted, is not a legitimate plan number in the sense that published tariff rules or contracts identify such a plan number. Plan 2.26 is simply a variant of 2.25 whereby pickup costs are included and delivery costs excluded. This is the other possibility for a 2.25 plan which calls for the exclusion of either pickup or delivery.

Table 7

## TOFC/COFC Plan Numbers and Associated Service Characteristics

Plan Number	Pickup Service	Delivery	Trailer Ownership
1	No	No	No
2	Yes	Yes	Yes
2.25	Yes	No	Yes
2.26	No	Yes	Yes
2.5	No	No	Yes
3	No	No	No
4	No	No	No
5.0	No	Yes	No
5.1	Yes	No	No
5.2	No	No	No

Plan numbers 5.0, 5.1., and 5.2 are not standard numbers either. Plan 5, as generally stated, calls for motor carrier originated and railroad terminated services. Plans 5.0, 5.1, and 5.2 allow for the range of possible pickup and delivery patterns which might occur. It should also be noted with regard to plans 5.0-5.2 that trailer ownership costs are excluded. This assumption may be overridden during minimal parameter input by specifying that ownership costs are to be included.<sup>7</sup>

All plan settings, in fact, will be overridden if the user specifies "yes" or "no" values for the TOFC supplemental values during minimal parameter data entry. The plan settings are relevant thus only if the user specifies the default setting for the supplemental parameters.

In addition to the plan number, the user has the capability of specifying 21 performance factors and/or unit costs. A parameter which should be specified, if accurate data are available, is the average number of trailers per flatcar. If the lengths of the trailers or

<sup>7</sup>Plan number 4, in actuality, calls for shipper ownership or provision of flatcars. In order to allow for this the user must specify, during minimal parameter input, an ownership code of "2" for the flatcars. The algorithm will not automatically set the flag for the user.

containers are fairly uniform, a user may be able to specify a whole number value (i.e., 1 or 2) which will be representative of most or all situations. Otherwise, an average over various types of trailers and containers will have to be used, or a value will have to be specified for every application.

The PMP also allows for the modification of trailer/container tare weights. A word of caution should be noted here. Worktable E provides default tare weights for refrigerated as opposed to non-refrigerated trailers. When the user specifies the category of trailer (refrigerator or non-refrigerator) during supplemental parameter input, the algorithm automatically sets a "flag" concerning the category of trailer/container.<sup>8</sup> The program will access the appropriate tare weight based on the setting of the flag. The user should be careful to supply a tare weight, therefore, for the type of equipment unit which corresponds to the flag setting. Values may be provided for either category of unit or both.

Users may also supply values for the number of trailer/container days. Trailer days consist of two divisions: (1) line-haul trailer days and (2) trailer days at origin and destination. Line-haul trailer days are measured indirectly through a performance factor: the average number of line-haul miles per trailer day. To derive this figure the user would divide the estimated one-way route mileage by the estimated number of one-way trailer days. This figure, it should be noted, must account for all elapsed time from the departure of the loaded trailer at origin until its arrival at destination with the exception of highway interchange time. This should include all intermediate yard switching days as well as road train running time. Trailer or container days at origin and destination should reflect all time elapsed in terminal

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<sup>8</sup>Note that the default setting for this supplemental parameter is "no", meaning non-refrigerator trailers or containers.

operations, highway pickup and delivery, as well as storage or other detention time at either the consignor's or the consignee's facilities. Both measures of trailer days should be phrased on a per unit basis.

The user may also supply the loaded-to-empty trailer mile ratio. This value should reflect the ratio of loaded trailer miles to empty trailer miles, which is a separate variable from the flatcar loaded-to-empty mile ratio. This latter performance factor may be supplied through modification of the freight car parameter set as noted earlier.

The remaining parameters in TOFC/COFC set consists of unit costs. TOFC/COFC unit costs include: (1) pickup and delivery, (2) loading and unloading ("tie-down" and "untieing" costs), (3) trailer/container protective services, and (4) trailer/container ownership. Ownership costs may be further distinguished between refrigerated and non-refrigerated trailer costs. Thus, in total, the program allows for the modification of 15 TOFC/COFC unit costs.

#### Accessorial Parameter Set

This group of parameters consists of a series of seemingly unrelated variables. The category is a "catch-all" for movement parameters which describe types of service that are not regularly or necessarily a part of movement patterns. These services are, by and large, ancillary or accessorial to the main line-haul and terminal services provided by a railroad.

The first cluster of parameters in this group relate to motor vehicle (MVU) service units and costs. A user may supply the number of motor vehicle units involved in an automotive shipment. If this is not specified the algorithm will calculate a value based on an average automobile weight of 2 tons. The user may also supply the unit cost per

MVU loaded and unloaded.

A second cluster of parameters relates to lake transfer service. Lake transfer services include the operation of lighters, barges, car ferries or other craft between two terminals. Lake transfer services are relevant only with respect to a line-haul movement which utilizes floating equipment. For shipments involving lake transfer service the user must specify the number of loaded or one-way miles in transfer service. The user, in addition, has the option of specifying the unit costs per ton mile (OPR, DRL, and/or ROI).

When specifying lake transfer service units, the user should also specify the number of tons at marine terminals. This allows for cost calculations which reflect the cost of operating land facilities such as docks or wharves and/or specialized transloading and storage facilities. There are 3 types of marine terminals: (1) coal, (2) ore, and (3) other. The PMP allows a user to supply values for the number of tons handled plus the unit costs associated with each type of service. If the shipment consists of coal or ore, the user should supply the number of tons which are handled at the appropriate type of terminal. This will allow for the calculation of costs involving transloading and storage at these facilities. If, on the other hand, the shipment consists of other commodities, then a value should be supplied for the number of tons handled at other marine terminals.

Failure to supply a value for the number of tons handled at marine terminals, it should be noted, will result in the exclusion of these cost elements from the movement calculation. The algorithm will not automatically generate such costs.

## Cost Indices

The last category of parameters consist of cost update ratios. The user has the option of supplying either an aggregate index or a series of disaggregate indices. If a total cost index is supplied, this value will override any disaggregate indices which are supplied. This order of power holds true even if a value of 1.00 is supplied for the total cost index. To the algorithm, this is the equivalence of saying that no updating of costs should be carried out. Unless the user intends that the total cost index should be used, therefore, a null value should be maintained in that slot in his or her parameter file.

The PMP allows the supply of indices for two broad categories: (1) car ownership and (2) all other expenses. Within each category, indices may be supplied for each of the accounting definitions: (1) operating costs, (2) depreciation, retirements, rentals, and leases, and (3) return on investment. If specific indices are available for each of the accounting definitions, then different values should be entered for each. If not, the same value should be entered for all 3 classifications.

## V. Batch Data Entry and Execution

Batch data entry differs from the interactive procedures noted in Section II. Batch data entry is essentially the responsibility of the user. He or she must pre-assemble a file containing all of the minimal parameters, which can be accessed by the costing algorithm upon execution.

Table 8 depicts the order of parameter input and the identifier variables which are necessary to drive the algorithm. A movement and leg identifier must be placed in the first two variable slots for each observation. After the identifier variables, the 11 minimal parameters must be entered in order. After the minimal parameters, supplemental values should be entered.



Table 8

## Organization and Content of Batch Movement File

<u>Location of Variable</u>	<u>Variable Description</u>	<u>Variable Type</u>	<u>Value Range</u>
1	Movement Number	Integer	1-N
2	Leg Number	Integer	1-4
3	Railroad Initials	Character	-
4	Movement Type	Character	-
5	Commodity Code	Integer	1-66
6	Car Type	Integer	1-18
7	Service Level	Integer	1-6
8	Number of Cars	Integer	1-N
9	Ownership Code	Integer	1-3
10	Shipment Weight	Integer	1-99999
11	Short Line Miles	Integer	1-99999
12	Costing Option	Integer	1-2
13	Extended Parameter Flag	Character	Yes-No
14	Supplemental Parameter Flag	Character	Yes-No
15	Number of Origins	Integer	1-N
16	Trainload Locomotives	Integer	1-N
17	TOFC Pickup/Delivery Flag	Character	Y-N-D
18	TOFC Refrigerator Flag	Character	Y-N-D
19	Trailer Ownership Flag	Character	Y-N-D

The user is required to supply values for the supplemental parameters only if a yes is entered for variable number 14. If the supplemental flag is "yes", then a value must be entered for all parameters.<sup>9</sup> If the flag is "no" then the user may proceed to the next line of entry and the algorithm will automatically assign default values for that observation.

The rules of data entry are:

1. At least one space must occur between each entry.
2. A maximum of 4 legs per movement may be entered.
3. No "help" is available during entry.
4. A maximum variable width of 5 must not be exceeded.

Batch execution is carried out in the manner described in Section I of this report.

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<sup>9</sup>This is a restriction of "list input". The alternative would be to require values to be entered in specific columns which would make for very tedious data entry.

Figure 1  
Overview of USDA Costing System

