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<sup>1</sup> Author: Tom Ingram Filename:I:\PUBLIC\AGTT\ROUTEPLN\RFI.DOC

# 1.0 Overview

## 1.0 Overview

### **1.1 Introduction to our Truck Operations Planning Project**

*Supplier Note:* Section 1 is informational for your benefit. *The places where you need to respond are clearly indicated by the tables in Sections 2 through 6.*

**RFI Purpose:** This RFI (Request for Information) is intended to inform our prospective suppliers about our needs and request information concerning how those suppliers might help us meet those needs. The focus of this RFI is U.S. domestic trucking operations only.

**Project and Supplier Role Overview:** **Our Truck Operations Planning Project** consists of four sub-systems. They are:

- Route Planning
- Resource Scheduling
- Lane Balancing
- Vehicle Routing

Your response options might include bidding on as little as a portion of one sub-system or as much as the entire series of four sub-systems. You might chose a packaged product solution or a custom build approach. See section 1.3 for additional details on supplier response options.

**Integration Note:** Your solution(s) will need integration between the sub-systems and some interfacing to upstream and downstream systems. A graphic showing these interfaces is in section 1.2, Desired Solution.

**AGT&T Mission:** AGT&T (Air, Ground, Terminal & Transportation) is the XYZ Co. organization responsible for Trucking operations. Freight shipped by AGT&T consists of:

- Documents
- Boxes
- Heavy Weight Freight

The general Classes of Service for this Freight are:

<u>Product</u>	<u>Weight</u>	<u>Description</u>
XYZ Co. Priority Overnight	<150 lb.,	Guaranteed delivery by 10:30 a.m. next bus. day
XYZ Co. Standard Overnight	<150 lb.,	Guaranteed delivery by next bus. day
XYZ Co. 2Day (Economy 2Day)	<150 lb.,	Guaranteed delivery by second bus. day
XYZ Co. Overnight Freight (OFS)	>150 lb.,	Guaranteed delivery by next bus. day
XYZ Co. 2Day Freight (F2)	>150 lb.,	Guaranteed delivery by second bus. day

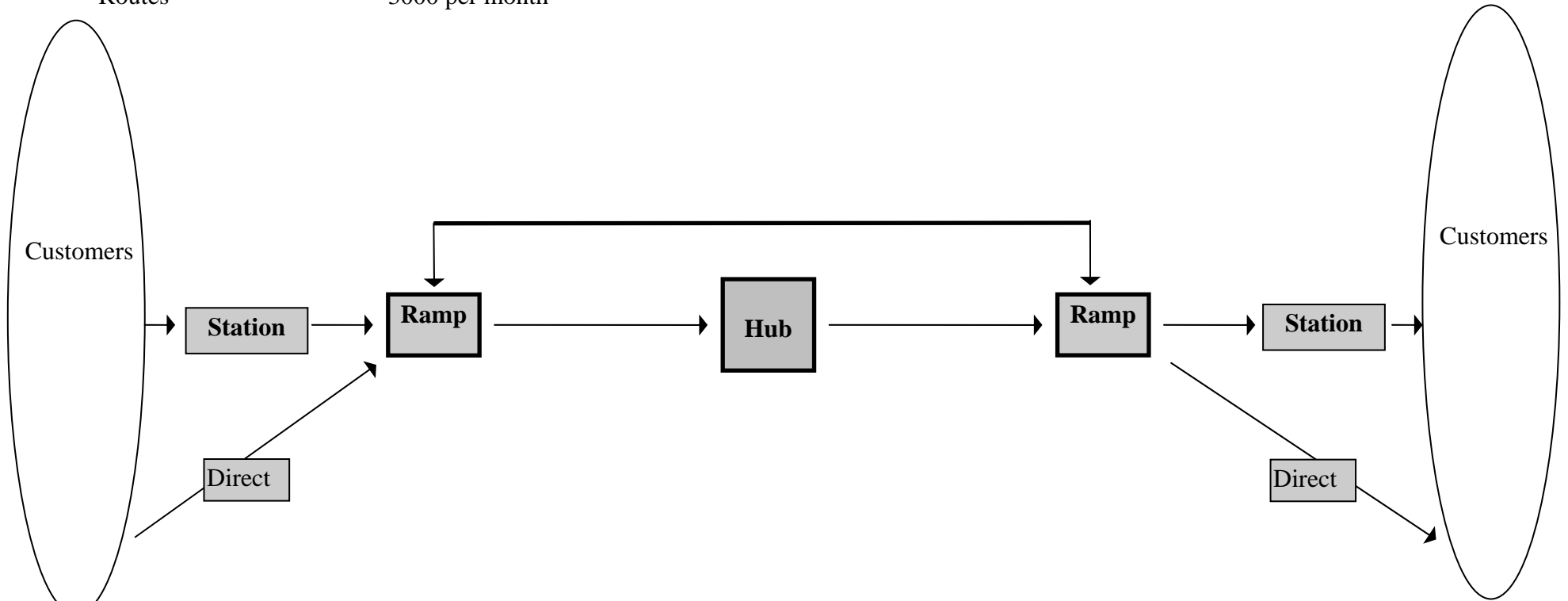
**AGT&T Surface Movement Systems is responsible for development of systems to support trucking operations.** Trucking systems objectives include:

- Ensuring that documents, packages and freight are delivered on time.
- Ensuring that driver, vehicle, ramp and other resources are used as efficiently as possible.
- Ensuring that costs are known and can be used in making effective long range and daily operating decisions.
- Ensuring that opportunities for improvement can be identified, analyzed and implemented.
- Ensuring that trucking operations are safe.
- Ensuring that operations comply with government regulations.

Basic Operations: Physical Map and Volumes

**Supplier Note:** Proposed Supplier solutions should allow for growth in operations.

Locations	Present
- Hubs	2
- Regional Sort Operations	4
- Ramps	72
- Stations	700
- Fleet Size:	700 Straight Trucks, 1300 Tractors, 1700 Trailers
- Trips / Month (XYZ Co. )	Appr. 30,000 Linehaul Moves, 75,000 Shuttle Moves
- Routes	3000 per month



**General Schematic of Product Flow from Shipper to Consignee**

Observations

- **Scheduled Routes** - the base of the XYZ Co. trucking operation is a large, scheduled route network.
- **Contract Carriers** - XYZ Co. uses contract carriers as well as owned equipment in the operation.
- **Intermodal** - the XYZ Co. network represents two fully integrated transportation modes, air and truck. The trucking sub-systems in this document have been defined so that they will share information and integrate with the systems being built for air operations.

## 1.2 Desired Solution

## **1.2 Desired Solution**

Following is a high level description of the sub-systems we are asking you to propose on. Please refer to the diagram “Truck Operations Planning Overview” at the end of section 1.2 as you read this narrative. This is the solution we desire.

**Route Planning:** The Route Planning Sub-System takes the truck routing guides developed in an existing application and adds the remaining freight movements supported by trucking operations, including:

- Station shuttles
- Customer direct deliveries
- Empty container repositioning moves
- Non-revenue moves

Route Planning then uses optimizing tools (i.e., Lane Balancing, Resource Scheduling, and Vehicle Routing) to determine the most efficient and the most cost effective way (XYZ Co. vehicles or contract carrier) to run the routes in the plan. The result is an optimized route plan with the appropriate drivers and vehicles scheduled.

*Note: Route Planning is the primary application. Resource Scheduling, Lane Balancing and Vehicle Routing support and optimize Route Planning.*

**Resource Scheduling:** The Resource Scheduling Sub-System provides tools for determining the amount of XYZ Co. resources required to support trucking operations. Tools are also provided for assigning specific tractors, trailers and drivers to routes.

The major functions in the Resource Scheduling Sub-System are:

- Setup
- Graphic display in Gantt chart form for reviewing resource assignments (see diagram in section 6.2.)
- Optimizers to determine the minimum number of resources required
- Interactive solution provided by a combination of graphic manipulation with automated optimization
- Long range strategy through examination of “what if” planning scenarios
- Solution review



**Lane Balancing:** The Lane Balancing Sub-System identifies balanced freight lanes in groups of truckload routes (see diagram in section 6.3.) A lane (any origin/destination pair) is considered balanced if the movement of truckload freight from the origin to the destination is matched by an opposite freight movement from the destination of the first movement back to the origin.

Additional criteria for balancing include:

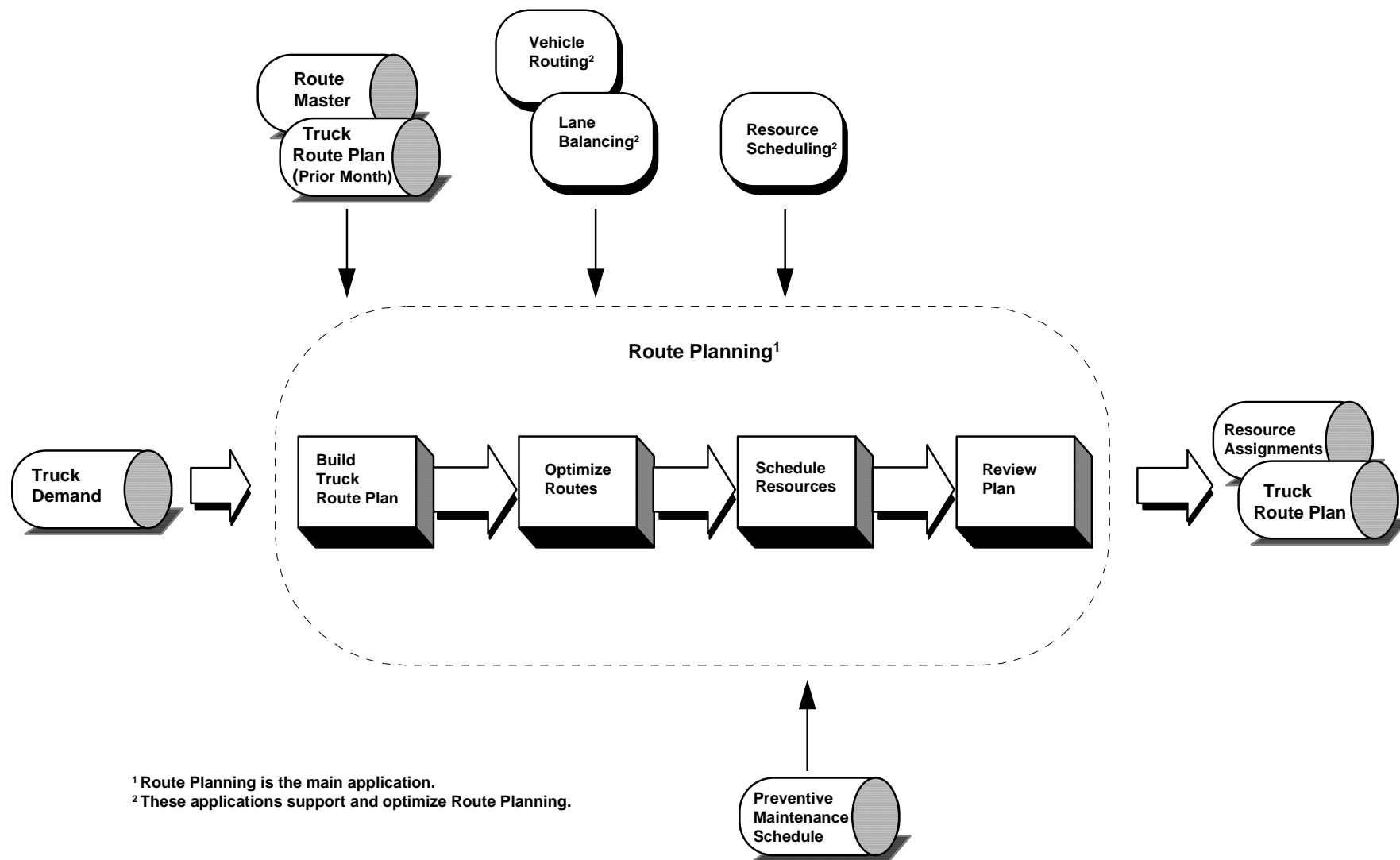
- **Trip count** - where the total number of outbound trips equals the number of return trips.
- **Timing** - if the timing of the trips on the lane is such that the driver and vehicle on the outbound trip will be able to cover the return trip without an excessive layover.
- **Vehicle Type** - if the vehicle type used on the outbound trip is compatible with the vehicle type required for the return trip.
- **Empty Miles** - if the empty miles on the lane does not exceed a percentage guideline specified by the Sub-System user.
- **Cost** - if the cost for the XYZ Co. fleet to service the lane is less than the cost of using contract carriers.

**Vehicle Routing:** The Vehicle Routing Sub-System designs efficient, multi-stop routes for the delivery and pickup of LTL (less than full truckload) freight. The primary inputs to the Sub-System include:

- Loads to be picked up or delivered
- Scheduled stops with pickup and delivery time windows
- Vehicle availability
- Operations parameters

The sub-system uses the data provided to assign loads to vehicles and determine the most efficient sequence for visiting stops. The primary objective of the sub-system is to minimize cost by minimizing miles, fully utilizing available capacity and reducing wait time. As an alternative strategy, the sub-system can be asked to balance pickup and delivery workloads among drivers.

# Truck Operations Planning Overview



<sup>1</sup> Route Planning is the main application.

<sup>2</sup> These applications support and optimize Route Planning.

## **1.3 RFI Response Instructions**

### **1.3 RFI Response Instructions**

Following are general respondent instructions.

**Reminder:** Section 1 is informational for your benefit. *The places where you need to respond are clearly indicated by the tables in Sections 2 through 7.*

**Note:** You must respond in our format. Typed or clearly written responses in the spaces provided are required. Changes to our format are not allowed. Attach extra pages explaining any concerns or issues if necessary. Responses that are incomplete or violate these instructions will cause delay in the evaluation of your response.

Response due: By 5:00 p.m., August 7, 1995, please return three (3) copies of your response to:

Vicky Linebaugh  
Procurement Project Administrator  
XYZ Co. Corporation  
2600 Nonconnah Blvd.  
Suite 307  
Memphis, TN 38132

#### Next Steps:

If one or more suitable solutions are proposed, it is our intent to quickly proceed through the RFP, procurement, award and implementation processes.

#### Key Issues:

- 1) The focus of this RFI is U.S. domestic trucking operations only. If your organization can offer products or services that might materially assist future efforts in Canada or Mexico, please make us aware of these capabilities under separate cover.
- 2) The multiple sub-systems in this project will be executed in two stages, composed of a prototype/requirements definition stage and a development stage. Differing Suppliers may be chosen for the different sub-systems.
- 3) We understand that the requirements are stated from our perspective. We will work with our chosen respondents to clarify our requirements.
- 4) If you have a better way of meeting a requirement, we want to hear about it.

5) Bidding Strategy: Your strategy in responding to this RFI is important. Your response may range from bidding on all of the requested sub-systems, a portion of a single sub-system, or anywhere in between.

6) Solution/Development Strategy: A packaged product approach is acceptable. A “Develop/Build” approach is valid. You may chose to do most of the development yourself or submit a proposal to jointly develop with XYZ Co. . A combination of the above approaches is also acceptable.

7) We are asking you for an in depth response to this RFI. This level of detail is requested, in part, to aid in expediting the RFP and procurement steps.

8) We have an extremely tight time frame associated with this project. The proposal(s) which can reliably deliver an acceptable solution in the shortest possible time will be viewed very favorably.

Response Evaluation Criteria: In general terms, your response to this RFI will be evaluated against the following high level criteria. (This order, however, is not to be construed as a priority list nor is it to be construed as all inclusive.)

- Degree to which the detailed requirements are met (section 6.0)
- Shortest possible time to production implementation
- Lowest total cost to XYZ Co.
- Least total risk, including:
  - Estimate risk (cost and time frame)
  - Technical risk (all aspects, not just the Supplier’s products)
  - Business solution risk (features of delivered system not meeting the requirements of the business process)
  - Supplier track record risk (ability of Supplier to consistently perform as promised)
- Flexibility for XYZ Co. , including the ability to:
  - Run on multiple platforms
  - Take over support and maintenance of system internally
  - Consider updates to business requirements

**Questions and Answers**

Procedural, administrative or contractual questions and answers: You may contact Vicky Linebaugh at (901)922-5335 or fax (901) 922-6878.

Technical or requirements questions and answers: You may contact Tom Ingram at 901-395-3503

## **2.0 General Supplier Information**

**2.0 General Supplier Information**

2.1 Annual Sales

<b>Item</b>	<b>Supplier Response</b>
What were your annual sales for the most recently completed fiscal year?	
What was that accounting period?	
What were your annual sales for the next previous fiscal year?	

2.2 Organizational Breakdown

<b>Area</b>	<b>Number of Employees</b>
Product Development	
Custom Projects	
Pre-sales, technical	
Post-sales, implementation / available for on-site	
Telephone support	

2.3 Custom Development Group Relevant Skill Breakdown

<b>Category</b>	<b>Specific Product</b>	<b>Number of Employees Skilled in This Area?</b>
User Interface	Windows X-Windows/Motif	
Database	Sybase Oracle	
Object Technology		
Programming Languages	C C++ Smalltalk	
Network & Communications		
Operating Systems	Unix Netware Windows NT (Server) Windows NT (Client) DOS	
Other General Skills	e.g. Tuxedo	



2.4 Special Tools/Techniques to Assist Development

Item	Supplier Response
Describe any special tools or assets organization possesses which would expedite development:	

2.5 Current Custom Development Backlog

Item	Supplier Response
Describe custom development current backlog in terms of man-hour commitments:	

## 2.6 Quality Programs

<b>Item</b>	<b>Supplier Response</b>
Describe any Quality programs currently in place.	

## 2.7 Outstanding Litigation / Complaints

<b>Item</b>	<b>Supplier Response</b>
Describe any outstanding litigation to which your firm is a party or complaints filed against your firm with any Federal or State Agencies.	

## **3.0 Support and Services**

### **3.0 Support and Services**

#### 3.1 Enhancement Requests

<b>Item</b>	<b>Supplier Response</b>
How are requests for enhancements handled?	

#### 3.2 User Group

<b>Item</b>	<b>Supplier Response</b>
Does a user group exist?	
How many firms are members?	

#### 3.3 Training

<b>Item</b>	<b>Supplier Response</b>
Who conducts your training? (e.g. practitioners vs. certified trainers )	
Is on-site training available?	

#### 3.4 Customization Services

<b>Item</b>	<b>Supplier Response</b>
Describe available customization services.	

#### 3.5 Emergency Response

<b>Item</b>	<b>Supplier Response</b>
What is the probable response time to an emergency on site?	

#### 3.6 Geographic Limitations

<b>Item</b>	<b>Supplier Response</b>
Describe any geographic limitations to support services.	

## 3.7 Telephone Support:

<b>Item</b>	<b>Supplier Response</b>
What are normal hours of operation?	
What is your response callback commitment?	

## **4.0 Installed Base and References**

**4.0 Installed Base and References**

4.1 Client/Server Sites

Item	Supplier Response
How many Client/Server sites are using your most recent version in production?	
How many Client/Server sites are using your previous versions in production?	

4.2 Trucking/Distribution System Sites

Item	Supplier Response
How many sites are currently using your system in a trucking/distribution system application?	

4.3 Major Custom Development

Item	Supplier Response
How many sites are currently using systems in production where you supplied a major custom development effort (greater than 3 man-months?)	

## **5.0 Product - General Issues**



**5.0 Product - General Issues**

## 5.1 Standards Compliance

<b>Item</b>	<b>Supplier Response</b>
Describe the standards that your system adheres to that might benefit Fed Ex.	

5.2 Architecture

Item	Supplier Response
What is your system's base language?	
What platforms do you support?	
Describe any design limitations that affect response times or the ability to process large volumes of activity.	
Describe your scalability / capacity to deal with transaction growth based on initial volumes shown in section 1.1, Basic Operations: Physical Map and Volumes.	
<p>Describe the portability issues if XYZ Co. desired to change between the following platforms later in the life of the system:</p> <ul style="list-style-type: none"> <li>- From DOS/Windows to Unix</li> <li>- From One version of Unix to another</li> <li>- Other supported platforms if any</li> </ul>	

5.3 History of System

Item	Supplier Response
Describe the history of how the software came to be developed, including: <ul style="list-style-type: none"> <li>- When first implemented?</li> <li>- Did you write the original system?</li> <li>- Do you own the software or are you a re-marketer?</li> </ul>	

5.4 Security

Item	Supplier Response
Describe the security functions built onto your system.	

5.5 General Pricing

Item	Supplier Response
<p>Provide a current price list covering:</p> <ul style="list-style-type: none"> <li>- Products</li> <li>- On-site training</li> <li>- Off-site training</li> <li>- On-site custom development</li> <li>- Off-site custom development</li> <li>- Maintenance                             <ul style="list-style-type: none"> <li>* Updates and new releases</li> <li>* Bug fixes</li> <li>* Telephone support</li> <li>* Onsite support (normal and off hours)</li> </ul> </li> <li>- Extra charges associated with Source Code</li> <li>- Extra charges for additional sites</li> <li>- Extra charges for additional clients</li> </ul>	

5.6 Source Code

Item	Supplier Response
Is your source code available?	
Describe any limitations or constraints on what Fed Ex may do with this source code.	
If Fed Ex desires to build it's own staff to provide enhancements or maintenance to your system, are there any special support tools required?	

5.7 Last Update

Item	Supplier Response
When was your system last updated and what were the major enhancements provided by that update?	
How many new releases within the last two years?	
How frequently are scheduled upgrades released?	

## **6.0 Requirements Detail**

## **6.0 Requirements Detail**

**Instructions:** The following section is a detailed listing of requirements for this Truck Operations Planning Project. To prepare your response:

1. Examine each section to determine if you can substantially meet the requirements with either a PACKAGED SOLUTION approach or through custom development.
2. If you choose not to bid on a section, indicate “no bid” in the Supplier Response matrix.
3. If you can substantially meet the requirements of a section through a packaged solution approach, indicate your response in the space provided in the Supplier Response matrix.
4. You may want to propose a custom development solution to meet the requirements. This might mean a scratch development effort or enhancement of a packaged solution. We want to know the total amount of development effort (IN DAYS) to meet the requirements. Indicate your estimate in the space provided.
5. Total your effort estimates where requested, culminating in a grand total in Section 7.0.
6. Comments and suggestions are invited. Please put them in the space required, referring to requirement numbers as necessary.

**Note:** **This is the most important section of this RFI.** Make certain your response complies with the following:

- **Due Diligence on Estimates:** Your estimates for the development effort necessary to meet all requirements are crucial. Be thorough and accurate. We will be examining these estimates in detail.
- You must respond in our format.
- Typed or clearly written responses in the spaces provided are required.
- Changes to our format are not allowed.
- Attach extra pages explaining any concerns or issues if necessary.

Responses that are incomplete or violate these instructions will cause delay in the evaluation of your response.

## **6.1 Route Planning**



## **6.1 Route Planning**

The Route Planning application takes the truck routing guides developed in the Product Movement Planning application and adds the remaining freight movements supported by trucking operations, including:

- Station shuttles
- Customer direct deliveries
- Empty container repositioning moves
- Non-revenue moves

Optimizing tools are then used to determine the most efficient way to run the routes in the plan and whether the routes should be run by XYZ Co. vehicles or contract carriers.

The system also provides the capability to review the plan to ensure that:

- All loads have been covered and the product flows in and out of ramps are balanced.
- Potential operating problems are identified and resolved.
- There are sufficient drivers and vehicles at each ramp to run the routes.
- The most cost effective routing alternatives have been chosen.

Note: The Route Planning application will accept, as input, the truck demand developed by Fed Ex' long range planning systems. When used with long range planning data, the Route Planning application will forecast driver and vehicle resource requirements. These forecasts will include the quantity of each resource required and where the resource needs to be domiciled.

Following are the detailed requirements needed to support route planning.

**6.1.1 Route Requirements** The Route Planning System takes the initial trucking requirements from the monthly operating plan and adds all other requirements for linehaul trucking support.

**6.1.1.1 Product Movements** - The Route Planning System uses the truck demand identified in the monthly operating plan for ramp-to-ramp product movements as the first step in defining requirements.

**6.1.1.2 Local Movements** - The Route Planning System is to access station shuttle, customer direct and container repositioning movements from the prior operating month or the Route Master file (see below) to begin defining the remaining support requirements for revenue related activity. One or more of the following criteria can be used in selecting the routes to be included: (Selecting the routes by the following criteria is required)

- Responsible ramp
- Route origin
- Route type (see definition below)
- Group code (see definition below)

**6.1.1.3 Route Changes** - Individual routes are changed or deleted as needed to meet the requirements for the coming month. Changes will typically include adding, deleting or re-sequencing stops, changing schedule related information, or changing vehicle types.

Note: If substantial changes are made to a route, a new route number will be assigned so that historical comparisons of actual activity on a route, over time, will be meaningful. Also, routes initially identified by the monthly operating plan will require a special authorization before changes or deletions can be made.

**6.1.1.4 Load Information** - The monthly operating plan will provide information on the amount of product to be carried for ramp-to-ramp truck movements. For station shuttles and customer direct deliveries obtained from a prior operating month, product load information will be obtained from the prior month plan and modified, as needed, to fit the month being planned. For container repositioning moves, the number of containers to be moved will also be obtained from the prior operating month and modified, as needed. For new routes, load information will need to be entered.

**Supplier Response to Section 6.1.1**

Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
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If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
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Comments or Suggestions

**6.1.2 Non-Revenue Routes** - This function adds non-revenue freight to the route plan either by adding new routes or by using available capacity on revenue related movements.

**6.1.2.1 Available Capacity** - an inquiry will be available to look for unused capacity on any lane. The inquiry will require that an origin and destination be specified to initiate the search. Optionally, the inquiry will allow the search to be qualified with capacity, day of the week and time of day requirements. The system will list only the routes that meet the selection criteria. If a match is found, the load information on the route will need to be updated with the non-revenue freight information.

**6.1.2.2 Route Additions/Changes** - non-revenue routes can be added to the plan by pulling in non-revenue routes from the prior operating month or the route master file. Route changes can be made using the same process used for revenue related routes.

Supplier Response to Section 6.1.2	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ (in days)
Comments or Suggestions	

**6.1.3 Route Master** - The Route Master contains routes that are used on a recurring basis. Routes can be defined once, then included in operating plans whenever needed.

**6.1.3.1 Route Build** - Route Build needs to support automatic, system built routes and the ability to manually create, change or delete routes. This function builds new routes based on entry of the following information:

- Route number
- Origin, destination and intermediate stops listed in the sequence visited
- Days of the month run
- Start time
- Scheduled arrival time at each stop (can be computed by the sub-system)
- Stop duration
- Disposition of loads at each stop (live load/unload or trailer drop and hook)
- Vehicle type
- Single or team drivers
- Layovers (the sub-system will suggest required layovers)
- Driver breaks
- Default carrier
- Load information (optional)
- Responsible ramp (ramp that provides the resources and manages the route)
- Route type (optional, see definition below)
- Route structure (optional, see definition below)
- Route Group (optional, see definition below)

**6.1.3.2 Route Type** - identifies routes with a similar purpose (linehaul revenue, station shuttle, customer direct, container repositioning, non-revenue). The route type code can be used to select groups of routes with a similar purpose for analysis.

**6.1.3.3 Route Structure** - identifies routes with a similar operating configuration (truckload, truckload with stop-off's, multi-stop milk run, component of a balanced lane, component of a relay route). The operational type code can be used to select groups of routes with similar operating characteristics for review.

**6.1.3.4 Route Group** - codes can be assigned to routes to uniquely identify them as part of a related planning group (e.g. peak period requirements, winter routes or holidays) to facilitate adding, changing or deleting related routes in a monthly operating plan.

**6.1.3.5 Route Copy/Modify** - a function will be available for building new routes by copying and modifying existing routes.

**6.1.3.6 Ad Hoc Trip Save** - trips defined in the Dispatch System to meet an ad hoc need can be saved to the Route Master file. Once added to the Route Master, they can be used as a scheduled route in future operating plans or they can be accessed in the Dispatch System as a short cut in setting up future ad hoc trips.

**Supplier Response to Section 6.1.3**

Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
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If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
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Comments or Suggestions

**6.1.4 Route Optimization Sub-Systems** - This function provides access to optimization sub-systems that help to determine the most cost effective way to run routes. See the sections on Lane Balancing, Vehicle Routing and Tour Planning for more information on the capabilities of each sub-system.

**6.1.4.1 Problem Segmentation** - generally it is not desirable to run an optimization sub-system against all of the truck movements in a monthly operating plan. This function allows a group of movements to be selected for modeling. One or more of the following selection criteria will be available:

- Responsible ramp
- Destination
- Load size
- Ship date
- Product
- Route type, structure or group
- Origin

Note: The load size criteria will allow selection of partial loads (e.g. the overflow from a truckload that may need to move in a multi-stop, sweep route).

**6.1.4.2 Run Model** - once the data has been selected for an optimization model, the Route Planning Sub-System will pass control to the model where run parameters are set and the model is executed.

**6.1.4.3 Update Routes** - once an optimization model has determined a solution to a problem, the routes in the solution may be updated as follows:

Carrier Type - routes can be designated as XYZ Co. routes or as contract carrier routes. Routes on balanced lanes and efficient multi-stop, LTL routes might typically be identified as XYZ Co. routes.

Linked Routes - related routes in a pattern can be linked by inserting a "next route" number in one route to indicate the next route to be run in the pattern. Routes might be linked in a balanced lane or in a truckload tour. Routes in a linked pattern retain their separate identities.

Re-configure Routes - related routes in a pattern can be combined into one route by combining all of the stops to be served. Routes identified as components of efficient multi-stop, LTL loops might be combined.

<b>Supplier Response to Section 6.1.4</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	



**6.1.5 Route Review** - This function looks for routes in a monthly plan that might create unnecessary hardships on drivers or may have opportunities or inefficiencies not recognized by one of the optimization models.

**6.1.5.1 Layovers** - this function will search for routes with layovers or long wait times. The intent is to find instances where layovers or excessive wait times might be eliminated by reversing the route sequence or otherwise modifying the route structure.

**6.1.5.2 Relays** - this function will search for routes on long haul, balanced lanes. The intent is to find instances where long haul moves might be replaced by relays that will allow drivers to return home each night.

Note: The Route Review function is intended to be a tool kit that will be expanded over time based on feedback from field operations.

<b>Supplier Response to Section 6.1.5</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

**6.1.6 Cost Review** - this function is used to ensure that the most cost effective choice has been made, after all optimization modeling and operational reviews, in assigning a route to XYZ Co. or a contract carrier.

**6.1.6.1 Standard Costs** - two standard costs will be computed for each route, a XYZ Co. cost and a contract carrier cost. The computations will be based on the formulas described in Operations Reporting.

**6.1.6.2 Cost Exceptions** - an on-line screen and a hard copy report will list exceptions where the designated carrier for a route is not the low cost alternative.

**6.1.6.3 Cost Summaries** - a report will be available that summarizes costs for a monthly route plan. The report will allow comparisons between monthly plans and will be broken down into the following major cost categories:

- Vehicle route costs - mileage and time based costs
- Driver costs - for driving, on-duty and layover time
- Idle vehicle costs - based on hourly rates
- Contract carrier charges

**6.1.6.4 Cost Detail** - a cost estimate by route will be available to support detailed analyses.

<b>Supplier Response to Section 6.1.6</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ (in days)
Comments or Suggestions	

**Total Estimated Development for Section 6.1**

If you will be proposing any development effort to meet all of the above requirements for Section 6.1, total that figure here.

**Total Estimated Development Effort \_\_\_\_\_ (in days) for Section 6.1**

Any overall comments regarding section 6.1?

## **6.2 Resource Scheduling**

## **6.2 Resource Scheduling**

The Resource Scheduling System provides tools for determining the amount of XYZ Co. resources required to support trucking operations. Tools are also provided for assigning specific tractors, trailers and drivers to routes.

- **Gantt Chart** - a graphic display in Gantt chart form is the focal point for reviewing resource assignments (see diagram following requirement 6.2.2.6).
- **Optimization** - the minimum resources needed to support an operating plan is determined by interactively manipulating resource assignments through the Gantt chart or by using one of two optimizers designed to provide a "good" scheduling solution. A combination of interactive manipulation and automated optimization is also possible.
- **Plan vs. Actual** - the resource requirements determined through the optimization process are matched to the available resources for the period being planned. Resource shortages or overages are highlighted.

The major functions in the Resource Scheduling System are listed below.

- Setup
- Graphic Display
- Interactive Solution
- Optimizers
- Long Range Strategy
- Solution Review

Following is a detailed list of requirements for Resource Scheduling.

**6.2.1 Setup** - This function assembles the data required to begin the resource review process for an operating plan. An operating plan consists of routes, resources, resource assignments and operations parameters.

**6.2.1.2 Routes** - pulls in the routes selected for modeling. The following information is required for each route:

- Route number
- Route start time
- Route completion time
- Days the route is run
- Total miles
- Stops (beginning and ending times)
- Vehicle type
- Single or team drivers
- Drive time
- On duty time
- Layovers (beginning and ending time)
- Driver breaks
- Trailer disposition (live load/unload or drop/hook)
- Trailer unload schedule (for dropped trailers)
- Responsible ramp
- Default carrier (usually XYZ Co. )

**6.2.1.3 Resources** - the driver and vehicle databases to be used by the sub-system can be specified by the user. The alternatives are as follows:

Current databases - the sub-system will use the databases representing the current pool of drivers and vehicles. This alternative must be selected when developing plans that will be implemented in daily operations.

Modified current databases - the current databases can be copied, then modified to reflect a scheduling case that needs to be evaluated.

New databases - new databases can be built in instances where the changes required to the current databases would be significant.

Note: Vehicle databases will need to include leased as well as owned equipment. A separate file will be needed for short term rental vehicles.

**6.2.1.4 Resource Assignments** - the assignment of resources to routes will be saved in files that are unique to each scheduling case being evaluated. It will be possible to evaluate several scheduling cases for the same operating month by copying and modifying resource assignment files. Within each case, different resource assignments will be allowed for each day a route is run. Resource assignments may consist of generic resources (e.g. Tractor #1), specific resource ID numbers or a combination of these identifiers. As an end product, however,

specific resource identifiers will be required.

**6.2.1.5 Parameters** - the following parameters are entered for reference by the sub-system in scheduling resources:

- Tractor turn time (time between trip assignments)
- Driver assumptions at beginning of period (available drive and on-duty hours)
- Driver turn time (time between trip assignments)
- Trailer turn time (time between trip assignments)
- Driver on-duty weekly rule (select either 60 on-duty hours allowed in a 7 day period or 70 hours allowed in an 8 day period - selected by location)

**6.2.1.6 Carrier Assignments** - sub-system needs to support entry of contract carrier assignments

**6.2.1.7 Scheduling Preventive Maintenance** - the VAGIS preventive maintenance system will provide Truck Operations Planning with the periods where equipment will be unavailable due to scheduled maintenance. Resource Scheduling needs to accept this input and schedule accordingly.

<b>Supplier Response to Section 6.2.1</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

**6.2.2 Graphic Display** - The Resource Scheduling Sub-System relies on interaction with the user in developing solutions to scheduling problems. The sub-system's graphic interface is a key element in the process.

**6.2.2.1 Gantt chart** - the primary display for the sub-system will be in Gantt chart form, with a time line horizontally across the top. Each horizontal line in the body of the chart will represent a resource (e.g. a vehicle) with bars on the lines representing resource assignments. The bars will usually represent trips, however, planned maintenance may be included for vehicles, and training and vacation may be included for drivers. (See the Overview for an illustration.)

Note: A route may run on multiple days of the week (e.g. Tuesday, Wednesday and Thursday). Each execution of a route is called a "trip". Each "trip" will appear as a separate bar on the Gantt chart and will be available for manipulation independently of the other trips for the same route.

**6.2.2.2 Resource Types** - separate charts will be available for tractors, trailers, trucks and drivers.

**6.2.2.3 Filtering** - an option will be available to filter the resources shown on a chart to include only the resources owned by a specific ramp, district or region. Vehicle charts will also allow filtering based on vehicle type.

**6.2.2.4 Assignment Bars** - route numbers will appear on the assignment bars representing routes. Also, color highlighting will be available to segment the events making up a route. The following event types will be available for highlighting:

- Drive time
- Stem time (drive time to first stop, drive time from last stop to domicile)
- Delivery time
- Pickup time
- Stop time (one color for deliveries and pick ups)
- Wait time
- Driver breaks
- Layovers

**6.2.2.5 Time Horizon** - the time horizon displayed on the Gantt chart will be variable from 24 hours to two weeks. The time frame will include up to two weeks of planned activity, two weeks of historical activity or a combination of planned and historical activity.



**6.2.2.6 Resource Summary** - summary information will be displayed for each resource including the following: (See Gantt Chart example on next page.)

- Total miles
- Total stops
- Drive hours (drivers only)
- On-duty hours (drivers only)
- Percent utilized (based on hours available)

<b>Supplier Response to Section 6.2.2</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

(insert Gantt chart graphic here.)

**6.2.3 Interactive Solution** - The primary method for developing resource plans will be based on a user review of Gantt charts and the interactive manipulation of on-screen displays to arrive at an optimal plan. The process described below applies to tractors, but a similar process will be followed for drivers and trailers.

**6.2.3.1 Initial Display** - the initial Gantt chart display will place each route on a separate resource line and assign a default resource number to the line (e.g. Tractor #1). Routes with "next route" linkages will be shown together on the same resource line, if the resource type is the same for all of the related routes. Routes with specific tractor ID numbers will also be shown together on one line

**6.2.3.2 Drag and Drop** - changes to the initial Gantt chart will be allowed by dragging individual trips, with a mouse, from one tractor line and dropping them on another tractor line.

**6.2.3.3 Route Detail** - a route detail pop up window will be available by pointing and clicking on a route (trip) assignment bar. The detail window will include detailed stop, leg, container, product and destination information. Through this window, vehicle types, route linkages and default tractor ID numbers can be assigned or modified.

**6.2.3.4 Change Validation** - changes to resource assignments, vehicle types and route linkages will be validated on-line to ensure operating guidelines are met for each change. The validation will include the following:

Capacity - the vehicle type selected has adequate capacity for the planned load.

Compatibility - the vehicle type selected is compatible with the loading/unloading facilities at the stops to be visited.

Origin/Destination Match - the destination of each trip matches the origin point for the next trip assigned to the resource.

Turn Times - the turn times between trips are adequate for each resource.

DOT Hours - the drive and on-duty hours for drivers assigned to multiple trips complies with DOT guidelines.

**6.2.3.5 Beginning Status Assumptions** - the status of resources at the beginning of a planning period can be specified by identifying an assignment file that reflects the resource assignments at the end of the prior period. If vehicles and drivers have previously been assigned to trips that overlap the beginning of the new month, their initial availability will be adjusted. Also, driver on-duty and drive hours will be adjusted.

<b>Supplier Response to Section 6.2.3</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

**6.2.4 Optimizers** - In addition to the interactive optimization process described above, the Resource Scheduling System will also have optimization heuristics to provide the user with a "good" starting solution.

**6.2.4.1 Base Optimizer** - will determine the minimum number of tractors, trailers, trucks and drivers needed to support the routes in the plan.

**6.2.4.2 Workload Balance** - will balance the workload among the available resources. This approach to resource utilization may be important, in short term planning, to balance pay for drivers.

**6.2.4.3 Committed Assignments** - will allow selected assignments to be "locked in" by planners to focus the optimizers on uncommitted resources.

<b>Supplier Response to Section 6.2.4</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

**6.2.5 Long Range Strategy** - The Resource Scheduling System will be available for evaluating the tractor, trailer, truck and driver resources required to support the networks designed by the Network and Schedule Planner (NSP). It will be possible, using separate case files, to evaluate multiple resource strategies with different mixes of vehicle types and fleet sizes.

**6.2.5.1 - Planning scenarios (or cases)** - Truck Operations Planning is to support development and retention of multiple case months for “what-if” purposes. This needs to happen separately from the actual production planning environment to prevent any contamination of the production plan data. Note that the input for these “cases” will be provided by a direct interface between Fed Ex’ planning systems and Truck Operations Planning.

<b>Supplier Response to Section 6.2.5</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

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**6.2.6 Solution Review** - This function provides the tools for reviewing a resource plan.

**6.2.6.1 Required vs. Available** - reports will be provided comparing the vehicle and driver resources required to support a route plan to the resources available. The resources available may be based on the current pool of resources or may be based on a database representing a future scenario being evaluated. Vehicles will be listed by type. Variances, over and short, will be highlighted.

**6.2.6.2 Requirements by Day** - graphs of resource requirements by day will be provided so that peak and average demands can be identified.

**6.2.6.3 Operating Statistics** - summary reports with productivity and utilization statistics will be provided for drivers and vehicles. Vehicle statistics will be broken down by vehicle type. Productivity will be measured in miles and stops per day. Utilization will be based on the time utilized as a percent of total time available.

<b>Supplier Response to Section 6.2.6</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ (in days)
Comments or Suggestions	

**6.2.7 Operations Review** - This function provides access to historical information on how routes have actually run in the past. Comparisons are also provided to operating plans.

**6.2.7.1 Reports** - reports will be available with the following information:

- Plan vs. Plan - will compare operating plans for any two months selected (e.g. the plan currently being developed to the plan for the prior month). Plans for the last thirteen operating months will be retained. An option will be available to list only the new, changed or deleted routes identified in the plan comparisons.

- Route Lists - will list route plans for any of the last thirteen months.

**6.2.7.2 Comparison Factors** - the following factors will be available for each route for review in comparison reports:

- Trips planned, trips canceled, trips run
- Product volume (weight, cube, pieces) planned and actual, average and peak
- Vehicle types planned and actual
- Containers forecast and actual
- Routing changes

**6.2.7.3 Route Detail** - a detail listing will be available for every trip run for a route in an operating month to assist in analyzing differences between plan and actual.

**6.2.7.4 Selection Criteria** - in addition to providing reports for all operations, one or more of the following selection criteria will be available to target reports on specific areas of interest:

- Responsible ramp
- Origin
- Destination
- Route type
- Route structure
- Route group



<b>Supplier Response to Section 6.2.7</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

**6.2.8 Plan Review** - The following capabilities will be available to review the plan being developed to ensure it is complete and can be supported by available XYZ Co. resources.

**6.2.8.1 Status Display** - the map display capabilities will use a graphical display of routes, with boundaries, cities, ramp location and highways overlaid. User interaction will be on a point and click basis. The end result will be a graphical depiction of operating plans. Errors not readily apparent in detail listings may be more evident in map displays.

**6.2.8.2 Resource Review** - the resource review functions will be available to ensure that there are adequate driver and vehicle resources to cover the routes assigned to XYZ Co. in the plan.

**6.2.8.3 Ramp Balance** - the sub-system will provide on-line and hard copy information on ramps where the inbound and outbound flow of product is not equal. The unbalanced flow will normally be the result of not defining all station shuttles or customer direct deliveries, or of not accurately accounting for load information on the routes that have been defined.

<b>Supplier Response to Section 6.2.8</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

**Total Estimated Development for Section 6.2**

If you will be proposing any development effort to meet all of the above requirements for Section 6.2, total that figure here.

**Total Estimated Development Effort \_\_\_\_\_ (in days) for Section 6.2**

Any overall comments regarding section 6.2?

## **6.3 Lane Balancing**

### **6.3 Lane Balancing** (Please refer to the Lane Balancing Graphic on the next page)

The Lane Balancing Sub-System identifies balanced freight lanes in groups of truckload routes.

- **Balance** - the primary definition of balance is that the movement of truckload freight from an origin to a destination is balanced by an opposite freight movement from the destination of the first movement back to the origin.
- **Lane** - the definition of a lane is any origin/destination pair, where the origin or destination may be a single location or a small, contiguous geographic area.

Lane balance may be further defined to include one or more of the following additional criteria:

- **Trip Count** - the number of trips going from the origin to the destination of the lane must be equal to the number of return trips. Excess trips in either direction are considered to be unbalanced.
- **Timing** - the timing of the trips on the lane must be such that the driver and vehicle on the outbound trip will be able to cover the return trip without an excessive layover.
- **Vehicle Type** - the vehicle type used on the outbound trip must be compatible with the vehicle type required for the return trip.
- **Empty Miles** - a lane may be considered balanced if, at the end of the outbound trip, an empty trip leg is required to go to the origin point of the return trip. It may also be balanced if the destination of the second trip is not the same as the origin of the first trip. However, the origin and destination of each trip must be within the geographic areas defined as the end points of the lane and the empty miles on the lane must not exceed a percentage guideline specified by the sub-system user. If the empty miles on the lane exceeds the percentage specified, the lane is not balanced.
- **Cost** - a lane may be considered balanced if the cost for the XYZ Co. fleet to service the lane is less than the cost of using contract carriers. Using this guideline, the number of empty miles on the lane is not a key to determining if the lane is balanced. For example, at the extreme, a XYZ Co. vehicle might go from the origin to the destination of a lane and return empty. If the cost of the round trip is less than the cost of using a contract carrier on just the outbound trip, the lane is balanced. This situation might be found on short routes.

(insert Lane Balance Graphic here)

**Functions List**

The major functions in the Lane Balancing Sub-System are listed below. A detailed description of each function is included in the Functions and Features section.

- Lane Definitions
- Setup and Execution
- Solution Review

Following are the detailed requirements for Lane Balancing

**6.3.1 Lane Definitions** - This function defines the locations or geographic areas that the model will be allowed to evaluate as potential origins or destinations for lanes. For purposes of this model, these lane end points will be referred to as commercial zones.

**6.3.1.1 Map Display** - to begin the process of defining a commercial zone, a map is displayed with all XYZ Co. facilities and major supplier locations shown as dots.

**6.3.1.2 Zone Definition** - by selecting the commercial zone definition button on the map display and keying in a zone code, zone name and reference color, a new zone is defined.

**6.3.1.3 Zone Content** - the specific locations to be included in a commercial zone are identified by pointing and clicking on the facility dots in the map display. Each dot selected will change color to match the reference color for the zone. The commercial zone is completely defined when no additional facilities are selected.

Note: The definitions for commercial zones are not tied to specific modeling problems. Once defined, these definitions will apply to all subsequent executions of the Lane Balancing Sub-System until they are changed or deleted.

<b>Supplier Response to Section 6.3.1</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ (in days)
Comments or Suggestions	



**6.3.2 Setup and Execution** - This function sets the parameters to be referenced by the model in solving the lane balancing problem and then initiates execution of the model.

**6.3.2.1 Layovers** - the maximum allowable layover, in hours, for a round trip.

**6.3.2.2 Vehicle Type** - should equipment types be considered in determining lane balance (yes or no)?

**6.3.2.3 Empty Miles** - the maximum allowable empty miles for a balanced lane as a percentage of total (out and back) trip miles. The limit may also be stated as an absolute mileage amount.

**6.3.2.4 Cost** - should cost be used as a factor in determining lane balance (yes or no)?

**6.3.2.5 Run Model** - pulls in the routes selected for modeling in the Route Planning System and initiates execution of the model.

Supplier Response to Section 6.3.2	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

**6.3.3 Solution Review** - This function provides the tools for reviewing the lane balancing solution.

**6.3.3.1 Map Display** - a map display will provide a graphical depiction of the model solution. One or more of the following criteria will be available to select the routes to be displayed:

- Balanced lanes
- Unbalanced lanes
- Responsible ramp
- Lane origin
- Lane destination

**6.3.3.2 Balanced Lanes** - lists of balanced routes will be available by lane. The lists will include the following information:

- Balanced routes
- Current carrier type (XYZ Co. or contract carrier) for each route, if assigned
- Days not balanced, if only some of the days on a route are balanced
- Exception flag, for balanced routes that are not assigned to the XYZ Co. fleet

**6.3.3.3 Unbalanced Lanes** - lists of unbalanced routes will be available by lane. The current carrier type (XYZ Co. or contract carrier) will be indicated with an exception flag for unbalanced routes assigned to the XYZ Co. fleet.

**6.3.3.4 Exception Report** - a report will be available that only lists instances where balanced routes are assigned to contract carriers and unbalanced routes are assigned to the XYZ Co. fleet (i.e. a change in carrier type might be needed).

**6.3.3.5 Route Linkages** - the capability will be available to insert a "next route" linkage in routes that comprise a balanced lane pattern.

**6.3.3.6 Carrier Type** - the capability will be available to update the carrier type (XYZ Co. or contract carrier) assigned to each route.

<b>Supplier Response to Section 6.3.3</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

<b>Total Estimated Development for Section 6.3</b>	
If you will be proposing any development effort to meet all of the above requirements for Section 6.3, total that figure here.	<b>Total Estimated Development Effort</b> _____ <b>(in days) for Section 6.3</b>
Any overall comments regarding section 6.3?	

## **6.4 Vehicle Routing**

## 6.4 Vehicle Routing

Please refer to the diagram on the next page.

The Vehicle Routing Sub-System designs efficient, multi-stop routes for the delivery and pickup of LTL (less than full truckload) freight. The primary inputs to the sub-system include:

- Loads to be picked up or delivered
- Scheduled stops with pickup and delivery time windows
- Vehicle availability
- Operations parameters

The sub-system uses the data provided to assign loads to vehicles and determine the most efficient sequence for visiting stops. The primary objective of the model is to minimize cost by minimizing miles, fully utilizing available capacity and reducing wait time.

As an alternative strategy, the model can be asked to balance pickup and delivery workloads among drivers.

The process for using the model includes three basic steps:

- Select a location (ramp or hub) to be reviewed that has a significant number of LTL loads.
- Separate the LTL loads from the full truckload moves.
- Run the Vehicle Routing model and select the routes from the model solution that should be included in a monthly route plan.

(insert vehicle routing diagram here)

### **Strategic Fit**

The Vehicle Routing sub-system is the primary tool for determining the most efficient approach for making less than full truckload pickups and deliveries.

- **Hold-at-Ramp** - the model can be used to support an aggressive strategy for holding and redistributing more product at ramps (i.e. by reducing the quantity of product needed to qualify for hold-at-ramp treatment).
- **Range** - the relay option in the model can be used to extend the range of LTL trucking operations.
- **Equipment Strategies** - the "what if" capability can be used to evaluate alternative equipment strategies (e.g. pups).

The model is a "best fit" in analyzing locations with 50 or more LTL loads per day.

### **Functions List**

The major functions in the Vehicle Routing Sub-System are listed below. A detailed description of each function is included in the Functions and Features section.

- Set Up and Execution
- Solution Review
- Model Constraints



### 6.4.1 Set Up and Execution

The Vehicle Routing Sub-System draws on data from a variety of sources, usually other trucking systems, to define a routing problem. The data required by the Sub-System are described below.

**6.4.1.1 Freight Data** - freight data is provided by the Route Planning System and is the primary input to the model. The key questions answered by the freight data include --- How much freight needs to be picked up or delivered? When? Where?

- How much - up to three units of measure (e.g. weight, cube, pieces)
- When - an appointment window with a beginning and ending time
- What - a code indicating a pickup or delivery
- Where - an identifier for the stop to be visited
- How long - the time required to load or unload, specified as a fixed time or a load/unload rate

**6.4.1.2 Facility Data** - facility data is provided by the Facilities Database and is used to determine where a stop is located and what the freight handling characteristics are at the stop.

- Location - specified as a longitude and a latitude
- Hours of operation - may be specified as one or more time windows
- Restricted vehicle types - vehicles that can not be handled at the facility

**6.4.1.3 Vehicle Data** - vehicle data is provided by the Vehicles Database and is used to determine the resources available to pick up and deliver freight.

- Vehicle Type
- Vehicle count - how many vehicles by type
- Capacity - the capacity of each vehicle type, specified in the same units of measure as freight data (up to three units of measure, e.g. weight, cube, pieces)
- Driver(s) - a code indicating single or team drivers
- Route duration - maximum route distance or time (optional)
- Availability - date and time vehicles are available, and the date and time they must be returned (optional)

**6.4.1.4 Mileage Database** - the model will use the same mileage and transit time database accessed by other trucking applications.

- Mileage - the mileage for all route legs that will be considered by the model in building routes.
- Transit times - the transit times for all route legs that will be considered by the model.
- Vehicle speed assumptions - alternatively, instead of using stored transit times, the model may use vehicle speed assumptions tied to the length of a route leg.

#### **6.4.1.5 Geographic Data**

- Delivery zones - geographic areas may be specified such that one or more routes may be built within each zone, but a route can not cross over a zone boundary.

**6.4.1.6 Relay Routes** - routes may include multiple legs. The driver and vehicles assigned to each leg may change, but the loads assigned to the overall route do not change. Usually, one trailer is used for the duration of a route and only drivers and tractors are changed at relay points. If relay routes are to be considered by the model, allowable relay points need to be specified.

**6.4.1.7 Truckload Stop-Off's** - routes will usually begin and end at one location, a ramp or a hub. However, the model will consider truckload stop-off routes which begin at the origin point of all routes but do not return to the same point.

- End Points - the allowable end points for truckload stop-off routes need to be specified.
- Selection Criteria - the criteria for accepting a truckload stop-off route needs to be specified. The criteria may include minimum number of stops, percentage of empty miles or minimum freight handled (e.g., specified in weight, cube and pieces).

Note: The truckload with stop-off's capability could be used to design "drop and pick" routes, where pickups are allowed at stops after a delivery is made. The pickups would be delivered at subsequent stops on the route.

**6.4.1.8 Driver Parameters** - the routing sub-system will ensure that drive and on-duty times for drivers assigned to routes conform with DOT regulations. The sub-system requires the following information to meet this requirement:

- DOT weekly hour rule - each operating location must select which weekly on-duty rule to follow, 60 hours in each 7 day period or 70 hours in each 8 day period.
- Driver required breaks - any driver break rules, other than those specified by the DOT, need to be defined.

**6.4.1.9 Run Model** - once the data required by the model is defined, the model is executed.

- Relay points - if relay routes are being considered, the first step in the solution will be the assignment of stops to relay points by clustering stops by the nearest allowable relay point.
- Build routes - routes will be built using a combination of heuristics and specialized optimizers. The primary objective will be to minimize miles. Secondary objectives may include maximizing vehicle capacity utilization or balancing the workload among drivers.

**6.4.1.10 Cost Data** - the routing model will ensure that costs are minimized when routes are developed. The capability must exist to be able to cost out a route. The model requires (at minimum):

- Equipment running cost
- Driver hourly cost
- Layover pay

<b>Supplier Response to Section 6.4.1</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

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## 6.4.2 Solution Review

The primary output from Vehicle Routing will be the assignment of loads to routes in a specific stop sequence. Several tools will be available for reviewing and, where necessary, modifying the solution.

**6.4.2.1 Map Display** - a screen will be available that displays the routes developed by the model on a map. The model solution can be modified interactively, through the map display, by moving stops between routes, by deleting stops and by inserting new or unrouted stops on routes. All changes will be validated against the constraints in the model. A “zoom-in, zoom-out” function is required. Additionally, the routes need to be color coded for readability.

Display routes by zone (optional)

**6.4.2.2 Route summaries** - summary statistics (e.g. stops, miles, time, total freight handled, vehicle utilization, driver workload, cost) will be available at the route level to assess the effectiveness of each route.

**6.4.2.3 Solution Summary** - statistics will be available for the total routing solution. The overall statistics can be used to evaluate the effectiveness of different routing strategies. Different vehicle type assumptions, delivery zone definitions, etc. can be tested in a "what if" mode until the most effective strategy is found.

**6.4.2.4 Route itineraries** - detailed, stop level reports will be available for each route. Each stop will be cross referenced back to the original route number assigned to the stop in the operating plan. Since the routing model may have significantly reshuffled stops between routes, it will be necessary to take one of two actions:

- Modify Routes - using the route itineraries, return to the Route Planning System and change the routes in the operating plan based on the suggestions made by the routing model.
- New Routes - select one or more of the routes defined by the Vehicle Routing model and add them to the operating plan. The sub-system will automatically delete the stops on these routes from existing routes in the plan to avoid duplicate stops.

<b>Supplier Response to Section 6.4.2</b>	
Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
Comments or Suggestions	

### 6.4.3 Model Restrictions

The Vehicle Routing Sub-System may have one or more of the following operational restrictions. (These restrictions are not model features. Instead, they are points that will need to be considered in selecting a standard routing model for trucking operations. They are also points that will need to be considered, once a model is implemented, in formulating problems that fit the capabilities of the model.)

**6.4.3.1 One Depot** - multi-stop, LTL routing models usually assume all deliveries originate from one point (the depot) and all pickups return to the same point. However, there are some exceptions.

- Next Stop - some models allow a pick up to be delivered to the next stop on the route, but only the next stop.
- Depot Assignment - some models can solve routing problems for multiple depots in succession, providing each pick up and delivery has been assigned to a depot in advance.
- Site Location - a routing model can be combined with a site location model. The site location model assigns stops to depots, then the routing model builds efficient pickup and delivery routes for each depot.

**6.4.3.2 Pickup/Delivery Mix** - the ability to mix pickups and deliveries on a route may be limited. For example, if a problem is defined as primarily a delivery problem, it may only be possible to define the last stop on each route as a pick up. The specific limitations of each model need to be identified.

**6.4.3.3 Vehicle Selection** - ideally, the routing sub-system will design routes and assign vehicle types based on the optimal use of available vehicle capacities in the fleet. However, vehicle selection may be based on selecting the next available vehicle from a list. The actual process needs to be understood before defining vehicle data.

**6.4.3.4 One Visit** - a routing sub-system will normally only allow one visit to a stop in a routing problem. If multiple visits are required, special sub-system features may be required (e.g. allowing multiple aliases for the same stop).

**Supplier Response to Section 6.4.3**

Are you able to provide substantially all of the requirements listed above with a PACKAGE Solution?	<b>Yes or No</b> (Circle your answer)
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If not, what is the total estimated development effort (in days) needed to meet the above requirements with your proposed solution?	<b>Estimated Development Effort</b> _____ <b>(in days)</b>
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Comments or Suggestions



<b>Total Estimated Development for Section 6.4</b>	
If you will be proposing any development effort to meet all of the above requirements for Section 6.4, total that figure here.	<b>Total Estimated Development Effort</b> _____ <b>(in days) for Section 6.4</b>
Any overall comments regarding section 6.4?	

## **6.5 General Design Requirements**

## **6.5 General Design Requirements**

Following are some general design issues that are critical to the success of this project. Refer to the diagram in section 1.2 , “Truck Operations Planning Overview” to assist you in visualizing our desired solution.

**6.5.1 Common Database Strategy** - Truck Operations Planning will download the optimized Resource Assignments and Truck Route Plan to our Dispatch system. These must work from common databases. (e.g. using the same Driver Master, Equipment Master, Location Master, Mileage Matrix, etc.)

## 6.5.2 Interface Inputs to Truck Operations Planning:

6.5.2.1 Truck Demand to Truck Operations Planning - This interface will use an existing file download format as a starting point. The existing fields are:

- For Each Leg:
  - \* Leg sequence within route (e.g. 1,2,3...)
  - \* Route ID
  - \* Origin
  - \* Fed Ex or Contract Carrier
  - \* Route ID of Balancing Route
  - \* Equipment Type
  - \* What (weekly) Days are Operational
  - \* Departure Time
  - \* Arrival Time
  - \* Destination
  - \* Travel Time
  - \* Stop Time

*Note: Compare this input to the output to be produced by 6.5.3 Interface Outputs to Dispatch System. **Ultimately, these two interfaces must be reconciled.** Specifications for the Dispatch interface are still in development, so further requirements definition will be forthcoming. The above represents our best estimate at this point in time.*

This interface is intended to be a relatively simple file download, up to multiple times per day. This interface may include some provisions for downloading many cases for “what-if” purposes.

6.5.2.2 - Preventive Maintenance System to Truck Operations Planning - This section will be defined by separate attachment. The preventive maintenance system will provide Truck Operations Planning with the periods where equipment will be unavailable due to scheduled maintenance.

**6.5.3 Interface Outputs**

6.5.3.1 - Truck Planning to Dispatch System:

\* Route Master Interface File to include:

- Route ID
- Dates of operation
- For Each Leg:
  - \* Origin
  - \* Destination
  - \* Stop Time
  - \* Stop Event
  - \* Start Date & Time
  - \* End Date & Time
  - \* Single/Team Driver Indicator
  - \* Single/Pup Indicator
  - \* Power Type Requirement
  - \* Trailer Type Requirement
  - \* Assigned Resources (Driver ID, Truck ID, Trailer ID)
  - \* Plan Miles
- Layovers/Meets/Relays

*Note: Specifications for this interface are still in development. The above represents our best estimate at this point in time. See note in 6.5.2.1 above.*

<b>Total Estimated Development for Section 6.5</b>	
If you will be proposing any development effort to meet all of the above requirements for Section 6.5, total that figure here.	<b>Total Estimated Development Effort _____ (in days) for Section 6.5</b>
Any overall comments regarding section 6.5?	

**7.0 Grand Total Estimated Development for ALL OF SECTION 6**

<b>Grand Total of Estimated Development</b>	
Bring forward your estimated total development for Section 6.1	<b>Total Estimated Development Effort _____ (in days) for Section 6.1</b>
Bring forward your estimated total development for Section 6.2	<b>Total Estimated Development Effort _____ (in days) for Section 6.2</b>
Bring forward your estimated total development for Section 6.3	<b>Total Estimated Development Effort _____ (in days) for Section 6.3</b>
Bring forward your estimated total development for Section 6.4	<b>Total Estimated Development Effort _____ (in days) for Section 6.4</b>
Bring forward your estimated total development for Section 6.5	<b>Total Estimated Development Effort _____ (in days) for Section 6.5</b>
	<b>Grand Total _____ (in days)</b>