



Software, Solutions, Results

Web-based Load Planning & Optimization

Computer Aided Transportation Planning for
the Real World

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Overview

The global pursuit of more responsive supply chains and lower inventories is putting intense downward pressure on average shipment sizes. At the same time, increasing fuel costs and stagnant motor carrier productivity are putting pressure on logistics budgets. The simple solution of smaller shipments – with more use of Less-than-Truckload carriers (LTL) – has serious cost consequences.

To deal with these cost consequences, progressive transportation managers have exploited a variety of techniques such as shipment consolidation and pool distribution – techniques which have been enabled by acquisition of Transportation Management Systems (TMS) that have sophisticated Shipment Consolidation Optimization and planning modules. Yet the cost and complexity of implementing such systems on in-house computers have deterred many companies from their implementation.

While recognizing the transportation cost saving potential of between 10% and 40% that such systems might bring, many companies have chosen to allocate their scarce IT resources to supporting higher priority sales or manufacturing processes. Unfortunately, it's only with creative use of transportation resources, enabled by such tools as computer optimization supported by a TMS, that the twin goals of lower costs and increased supply chain flexibility can be fully attained.

New computerized logistics planning technology, delivered via the Internet, can help shippers achieve their supply chain goals far more effectively than by older, manual planning methods and at lower cost than with traditional TMS installations on in-house computers. For example, computerized optimization tools, once irritatingly rigid and mechanical in their operation, now have the capability to handle real-world complexity: grouping orders into lower cost shipments, selecting the best transportation modes for each, meeting customer service needs – and Internet delivery avoids the high cost of locally installing advanced computing technology, while bringing the results to any desktop.

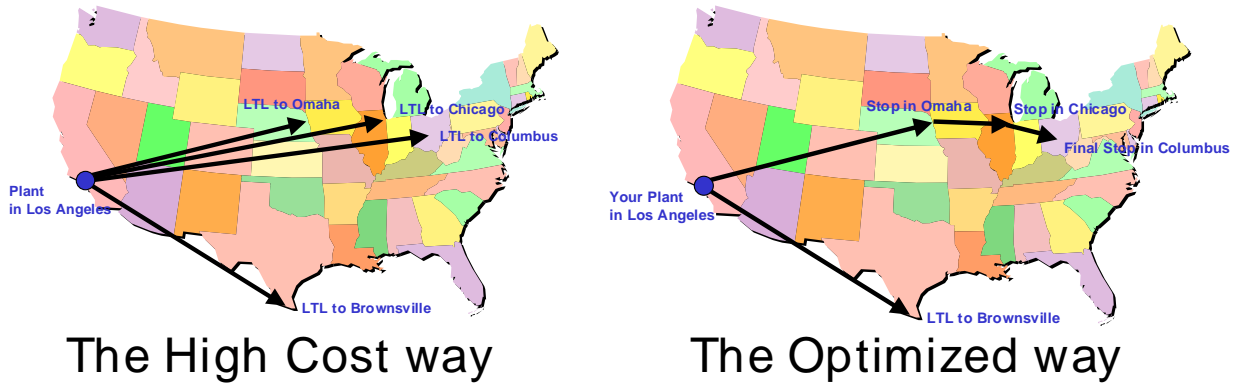
But optimization technology is only part of the solution to achieve real-world cost reduction in transportation. Equally important is the ability of the solution to fit your processes and to handle the fast-paced world of your sales and service team. Your planners need the ability to review optimization results quickly, modify them easily and re-optimize periodically – all the while releasing loads ready for dispatch to carriers. This dynamic process is referred to as “**Continuous Optimization**”, and has become the key to making automated load planning practical in actual transportation operations, not just in consultant's studies. Continuous Optimization is promised by many vendors but delivered only by a few.

The purpose of this paper is to detail the advantages of Internet-based load optimization and TMS software and to suggest to you the capabilities you should be looking for from potential TMS and optimization vendors when you are considering implementing this new technology. We will also examine how new innovations in Web-based load optimization in the areas of modeling capabilities, customer service standards, user interface design, and Continuous Optimization combine to make results more useful and realistic. Next we examine how to gain maximal value from such solutions by accessing them from the new generation of Web-based TMS tools. Finally we will briefly explore some of the new business opportunities that this technology may allow your company to exploit.

Shipment Consolidation: a Deceptively Simple Concept

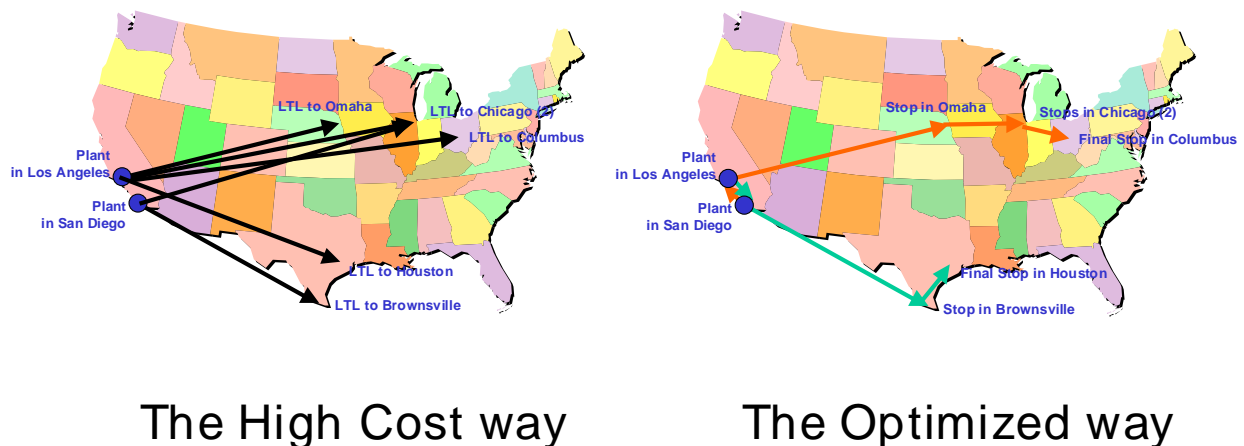
In the simplest case, a single plant ships to multiple points around the country via LTL. In the illustration in Figure 1 on the next page, shipments from the plant in Los Angeles can be combined into one Truck Load shipment, with one shipment to Brownsville, TX, that is still most economically sent via LTL.

Figure 1 – One Origin, Many Destinations



When a second West Coast plant is added, the problem becomes more complex. Should shipments be combined across the plants? What is the cost implication of the extra stop to pick up product at the second plant? Still, there is the potential for further economies of scale:

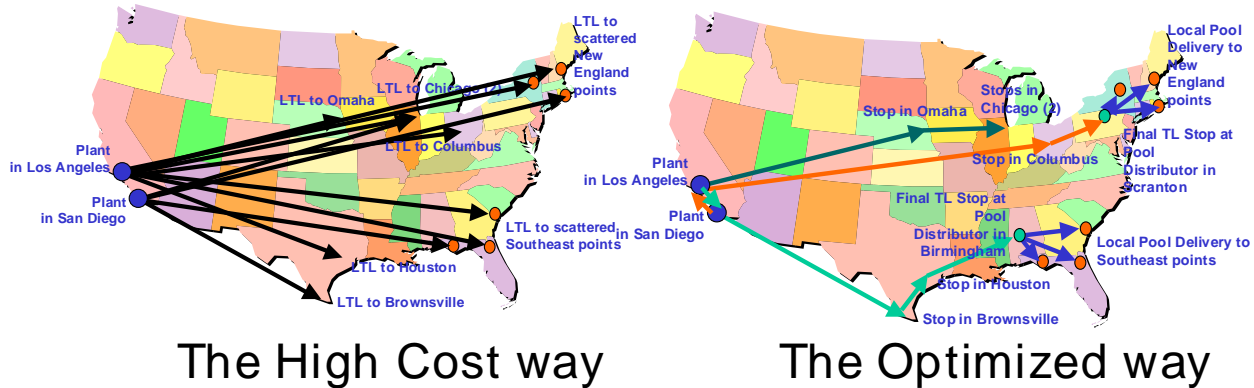
Figure 2 – Multiple Origins, Many Destinations



In situations where you have multiple small shipments into one concentrated area, it may be more economical to drop a group of such shipments at a local pool distribution company, which will provide local delivery using its smaller, more cost-

effective delivery trucks. In this case, there are still more options for reducing cost, but the problem expands dramatically in complexity as illustrated in Figure 3 below.

Figure 3 – Multiple Origins, Many Destinations, Pool Distribution Potential



Real-World Challenges

Many traffic managers attempt to achieve the savings described above. Their planners spread paper copies of their current shipments on the table or squint at long lists of shipments on-screen, and group together those having the same or similar origins and destinations. However, even when there are relatively few shipments to be handled, human planners rarely can find a “best” solution to the grouping problem. And as the number of shipments increases into the hundreds, the number of possible combinations soars into the trillions, leaving the planner to use “rules of thumb” to achieve their cost reductions, and typically missing thousands of dollars in savings opportunities.

At first glance, the problem is seen as static one: just put the right shipments together to make good truckloads with efficient routes to the destination. Result: Save thousands of dollars. In actual practice, a solution must be found across many critical dimensions, including:

- **Required delivery dates and times**
- **Feasible shipment dates and times**
- **Shipping dock hours and loading/unloading times**
- **Freight rates by mode and lane**
- **Carrier service areas and times**
- **Shipment characteristics vs. trailer type and size**

The mass of information required to consider each of these factors in arriving at a lowest cost solution to the consolidation problem effectively dictates a computer-assisted solution. But before exploring optimization techniques, a bit of explanation

in each area mentioned above is required, since the practical realities of each can greatly complicate problem solution.

Required Delivery Dates and Times

On-time delivery has become a mantra among logistics professionals. But what happens when delivery dates requested on purchase orders or sales orders come into conflict with the physical realities of the transportation system. LTL freight is quite reliable, but often requires a longer transit time than direct TL freight. However, in building multi-stop loads, the delays resulting from en-route stops must be recognized in determining whether final deliveries will meet delivery requirements, and may extend delivery times beyond expected LTL transit times.

In the real world, shippers prioritize shipments based on both the urgency of the delivery dates and the importance of the customers. Some customers can tolerate more "lateness" or "earliness" than others. Experienced transportation planners come to understand where these differences can be exploited to make workable shipping plans which keep customers "reasonably" happy, when "on paper" they fail to satisfy delivery requirements.

Automated transportation optimization tools must have this kind of sophistication as well if they are to produce results which do not have to be endlessly "tweaked" by human planners. Older optimizers tended to reject shipment solution batches that had too many required due-date conflicts... or simply to suggest that all shipments be sent via LTL. Instead, newer technology optimizers implement "fuzzy logic", a recent development in the Artificial Intelligence arena, which allows customer tolerance for lateness and earliness to be specified across different classes of customers in terms that humans can understand.

For example, you might have the delivery service standards for two customers specified by the following table:

Table 1 – On-Time Delivery Standards by Customer

On-Time Delivery Std	Days Early					Days Late				
	5	4	3	2	1	1	2	3	4	5
Customer "A"	Never	Rarely	Some-times	Some-times	OK	Some-times	Rarely	Very Rarely	Never	Never
Customer "B"	Rarely	OK	OK	OK	OK	Never	Never	Never	Never	Never

Feasible Shipment Dates and Times

As a general rule, the greater the number of shipments to be optimized at one time, the greater the cost savings: more shipments mean a greater likelihood that suitable load mates will be found. This is an incentive to shippers to look into the future to build loads based on production or sales order schedules. But such future scheduling can present significant challenges which differ depending on whether the company has a make-to-order or ship-from-stock business model.

Shipping schedules of the make-to-order company are driven by product availability: either actual or scheduled. Companies that enjoy a high rate of manufacturing reliability can pre-plan shipment consolidation by loading production schedules into the optimizer. In an ideal world, the optimizer will determine the best day of the week for each consolidated load to maximize customer service and minimize carrier delays, enabling final product finishing schedules to be set based on detailed shipping schedule requirements. In effect, the shipment optimizer in such cases becomes both a planning tool and an execution tool.

In ship-from-stock companies, an optimizer which determines the best date and time for each consolidated load provides a powerful planning tool for picking and packing schedule requirements. For example, if the optimizer is run on Monday of "this week" for orders due to arrive "next week", the shipment plan from Thursday of this week through the end of next week might be provided for. Orders which drop into the schedule at the last minute can be added to the set of shipments not already dispatched, and the optimization re-run to find the new best shipment consolidations.

Freight Rates by Mode and Lane

For most effective optimization, LTL rates for every shipment and TL rates to every possible destination are required. Also, if a shipment might possibly be sent through a pool distribution carrier, the pool rates need to be provided. This is a major reason why load optimization is most commonly implemented as a component of or an add-on to a Transportation Management System or TMS. The TMS can determine the rate information for each shipment and send it to the optimizer.

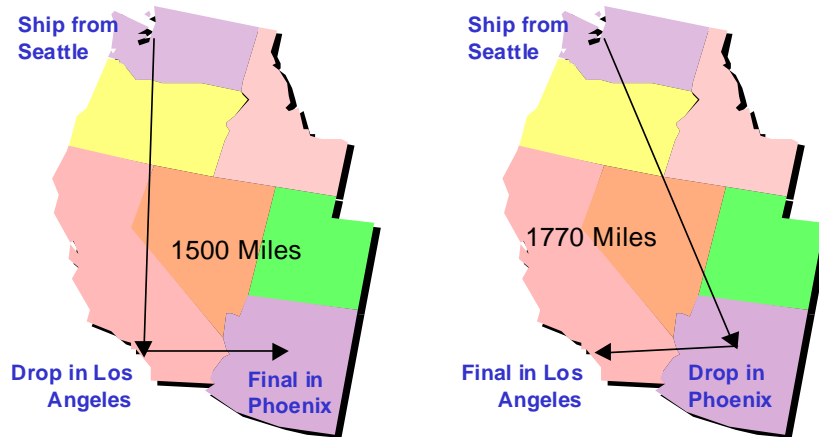
Some freight consolidation optimizers are also equipped for stand-alone operations, in which they have their own rating engine, which can determine approximate LTL rates and look up Truck Load rates from locally stored freight rate tables at various levels of geographic detail. One issue to raise with potential optimization vendors is how geographically specific (State-to-State, Zip-to-Zip, State-to-Zip, etc.) their TL rating engine is.

Similarly, optimizers which can handle pool distribution options may have their own pool distribution rate engines to calculate pool costs as needed.

Why is this important? The latest optimizers don't simply determine the shortest distance for each Truck Load. Instead, they determine the lowest cost for each Truck Load. Since it is usually the final stop on a Truck Load delivery that determines the freight rate to be applied, both the composition of each load and the sequence of deliveries are important in determining the lowest cost.

Take for example a load originating in Seattle with shipments bound for Los Angeles, CA, and Phoenix, AZ. A distance-based optimizer would route this shipment from Seattle to Los Angeles and a final delivery in Phoenix. On the other hand, a rate-based optimizer will route this load to Phoenix, with a final delivery in Los Angeles, since the Seattle to Los Angeles rates per mile are normally lower than the rates from Seattle to Phoenix, and the rate differential more than makes up the cost of 270 extra miles incurred by looping back to Los Angeles, as illustrated in Figure 4 shown on the following page.

Figure 4 – Farther can be Cheaper when Rates are Considered



Few human planners can possibly keep track of all the possible freight rates as they attempt to build a lowest cost load plan. This is yet another reason why a computer solution is virtually mandatory.

Carrier Transit Times and Service Areas

LTL carriers, TL carriers and pool distribution services each have unique characteristics which must be recognized if the consolidation plan is to meet the delivery requirements of customers optimally:

LTL Carriers

The expected transit time of the LTL carrier must be considered for every shipment in the solution set. Transit time standards are published by most LTL carriers, and there are services which compile this information. LTL transit times are not easily estimated simply by distance, since the number of terminals encountered en-route is a major determinant of transit time. If reliable transit time information is not available in your own computer systems or in your TMS, the optimizer will need to have a way to estimate transit times, either using a generic estimation tool or by accessing one of the services.

TL Carriers

Truck load transit times are partially a matter of distance, but are heavily influenced by the Federal hours of service regulations. In addition, transit times will be affected by the time required to stop and unload product en-route as well as dock open hours. In determining the optimum consolidations, either the human planner or the computer optimizer will have to make transit time estimates for each proposed consolidated load. This requires information on mileage, dock schedules at each stop, loading and unloading times per unit. The computational requirements of this are substantial, and easily beyond the abilities of a human planner in the time typically available. Sources of this information must be provided to the computer solver, which must have a means to handle it. Modern computer optimizers have these capabilities with details down to the individual customer dock level.

Pool Distributors

Load consolidation plans can include either freight consolidation services, which pick up many small LTL shipments from a region or pool distribution services, which take deliveries of multiple small LTL shipments from a line-haul Truck Load carrier and redistribute them to their individual consignees. We refer to these in this article as "Pool Distributors", but include both concepts in the term. Either way, the possibility of using these services adds considerably to the information requirements of the planning process and the burden on the optimizer.

Pool Distributors publish their own rates and service areas similar to the way LTL carriers do with one significant difference: pool distributors often do not offer delivery or pickup services every day of the week. For lighter volume areas, they publish a schedule of days of the week for deliveries.

In many instances, more than one pool distribution service may be applicable to a given shipment. For example, a shipment to Columbus, OH, might be routed through either a distributor in Indianapolis or in Cincinnati. In such cases, the optimization process must have access to all possible pool locations, their rates, and their schedules of delivery to determine the best routing. The number of possible solutions escalates rapidly with an increase in the number of pool distribution points. Modern computer optimizers provide either inputs for multiple pool options and costs for each shipment or a pool rating engine which allows the optimizer to determine which pool operators can handle the shipments handed to it. This feature is sometimes referred to as dynamic pool routing. Modern optimizers can handle as many as the 3 to 5 best possible pool points at both the origin and the destination for each shipment, drawn from an unlimited number of pool points available for the shipments in the batch.

Shipping Dock Hours of Service

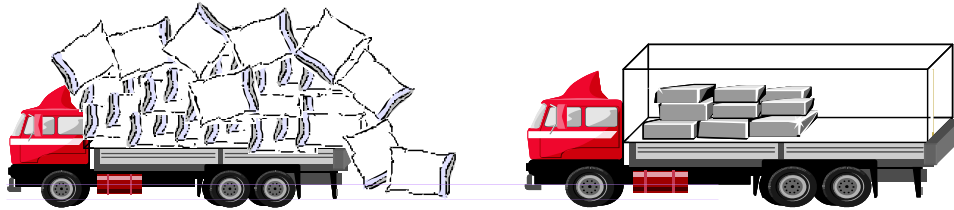
One of the critical factors in scheduling multi-stop loads is the dock hours of each facility visited. Computerized optimizers have long had the capability of taking dock hours as input for each shipment. The challenge is storing and maintaining this information about each customer or vendor. The modern TMS provides the database tools for this – a capability often lacking in even the most modern sales order entry or purchase ordering systems. Alternatively, some optimizer products provide location tables that provide a way to organize information about dock hours and other shipping and receiving dock characteristics.

A related problem is knowing how long a stop en-route will take. Historic information on average load or unload times for the product being handled is generally the basis for load/unload times in some convenient metric like "minutes per 1000 pounds". Typically, modern computer-based optimizers provide a number of input parameters which allow the calculation of stop times as part of the determination of whether a potential load configuration can meet customer delivery time expectations. Often, the TMS or optimizer location table will have load and unload time information available recognizing the products and facilities at that location.

Shipment Characteristics vs. Trailer Type and Size

What are the trailer weight and cube limits? Trucks have finite limits on the weight they can carry and the cubic space they have to fill. For example, an order of lightweight goods, like pillows, won't exceed the weight limit, but could very easily

exceed the trailer's volume capacity if cubic dimensions are not considered. Conversely, an order of very heavy materials, such as lead ingots, could quickly exceed a truck's weight maximum before the trailer's space is filled.



It is vital, therefore, that weight and volume be calculated and included in the optimization criteria, to ensure that the trailer is optimally utilized. The loading dock is no place for surprises, and a traffic manager's worst nightmare is discovering at the last minute that the assigned load won't fit on the designated truck.

Many producers ship a mix of products which both do and do not require temperature protective services. Often, it will be economical and practical to load "dry" freight with "reefer" freight when by so doing a trailer is fully utilized. In such cases the optimization must have access to the reefer rates as well.

In even more complex cases, shipments are being consolidated where each shipment may have its own allowable range of temperatures or hazardous material requirements. Modern freight consolidation optimizers can accept as input shipment temperature and hazardous commodity characteristics so as to be able to determine which shipments are allowed to be loaded onto the same trailer. Ideally this commodity information is provided from the company's order entry system or possibly the TMS; however, some computerized optimizers also provide a commodity lookup table where temperature, volume, pallet requirements, and hazardous material specifications can be stored for lookup during shipment import.

Advanced Routing Scenarios and Modes

In the real world of transportation planning, many companies confront problems much more complex than the delivery of product from one location by truckload or LTL service to multiple customers. In the last few years, optimization technology has improved to be able to handle these more complex real-world problems, enabling both shippers and specialty motor carriers and 3PL service providers to ramp up the efficiency of their operations.

Multiple Origins to Multiple Destinations: The modern manufacturer or distributor typically has multiple shipping points serving the same sets of customers. The difficulty of solving the "many-to-many" consolidation problem prevented first generation optimization products from tackling this problem. Now, however, it is a standard feature of many optimizers, which can handle an unlimited number of origins and destinations in the same shipment dataset. And, taking this complexity one step further, modern optimizers can consider pool consolidation at the origin AND pool distribution at the destinations for all shipments in the batch. This capability has proved extremely valuable to 3PL service providers and refrigerated transport carriers where LTL service may be extremely expensive or not available at all.

Continuous Movements: The ability for an optimization system to match up outbound customer shipments with compatible inbound shipment of materials has

been a capability long sought by manufacturers. Additionally, shippers with widely diverse shipping and delivery locations have sought the ability to route trucks to perform both pick-ups and deliveries on one trip, interleaving multiple picks and drops among plants and consignees. While this scenario sounds simple enough, the optimization process must now consider several new factors such as:

- 1) Does the truck have to be empty before it picks-up a new shipment?
- 2) How far can the delivering truck travel empty to pick up the next load?
- 3) How long can the carrier wait to pick up the next load?
- 4) Will the carrier offer a discount if multiple legs of the load are dispatched at the same time.
- 5) Is there a cost to re-ordering the product on the trailer en route?

Optimizers that handle these questions effectively provide the user with flexible parameters that take the users' needs in these areas into account. Key among these parameters are those that allow the optimizer to make intelligent decisions trading off the cost of empty miles versus the cost savings from round trip operations. It also needs to have the ability to handle specialized freight rates offered by some carriers for continuous or round-trip type operations. Of course, many of these types of planning problems also involve the shipper's dedicated fleets as well.

Dedicated Fleet vs. Common Carrier: Many shippers have dedicated fleets of trucks for inbound and/or outbound freight. Frequently these companies do not have the capacity to support 100% of the demand with their own trucks but expect to supplement their fleet with common carrier services during peak periods. The questions then become:

1. What is the optimal use of the dedicate fleet?
2. Which shipments should be shipped on common carrier?

Optimization software answers these questions by considering all the cost factors of operating a dedicated fleet together with fleet size and physical unit capacity. Having good operational fleet cost information is an important part of setting up optimizations between the fleet and common carrier services. Many fleet operations roll all of their fleet costs into a single cost per mile or cost per hour. That may make sense for pricing, but it doesn't allow for sound tradeoffs between dedicated fleet and common carrier operations. To make a valid comparison, the optimization software needs to know both the fixed (per planning period) and variable (per mile, per hour) cost of the fleet. This ensures that that the real opportunity costs associated with using or not using fleet resources will be considered. In extreme cases it may actually be more cost efficient to leave some dedicated fleet vehicles idle when very low cost TL or LTL options are available.

A secondary use of optimization software that optimizes use of the fleet versus common carrier services can be as a planning tool for right-sizing dedicated fleets. This can be accomplished by testing various mixes of fixed and variable cost and different fleet sizes against a database of actual recent shipments and common carrier rates.

Intermodal Service and Multi-Stop Operations:

Intermodal service may not seem like a useful option for LTL consolidation planning. Typically, drayage companies want to pick up full trailers or containers from a shipping point and deliver them to the railroad ramp in a single move. At the other end, the dray company prefers to pick up the container or trailer from the ramp and take it directly to the consignee. While this may be an economical alternative for a full TL load, it doesn't provide a multi-stop option. But it actually CAN, if the origin or destination point for the trailer or container is actually a pool consolidation or pool distribution facility. It is this latter case that modern optimization software will exploit to build highly efficient loads with Intermodal line haul (while still considering Intermodal as a replacement for point-to-point TL loads).

Estimating the Benefits

With all the issues of data availability and computational crunching detailed above, the question arises: "Is Shipment Consolidation optimization really worth the effort?" The answer we have found repeatedly to be "Emphatically, yes!" The table below shows the incremental benefit from implementing computerized shipment consolidation optimization under several starting conditions – based on our own experience with clients over the last several years.

Table 2 – Estimated Savings from Implementing Optimized Consolidation

Starting from...	Typical Percent Cost Savings Range	
All LTL shipping by LTL carriers	20%	45%
Some LTL sent via truckload based on simple, rigid rules	10%	25%
Systematic manual shipment consolidation	5%	12%

Achieving the Benefits

With these sizeable savings, why isn't everyone implementing optimized shipment consolidation? Three major practical obstacles have hampered adoption of this technology:

1. Rigid and impractical optimizers that required extensive human correction after the optimization
2. Inadequate internal systems and data support to provide required freight rate and order detail information
3. Static one-time optimization cycles that can't keep up with a dynamic sales process

All three of these obstacles have now been effectively cleared away by modern technology. Internet based TMS (Transportation Management Systems) and web-based optimization engines make high performance software available to shippers of almost any size. Equally important, modern technology now works with your order planning cycle, responding to changes in customer requirements continuously, as they occur. We explain the new technology in the next few pages.

Web-Based Solution Engines

With the ubiquitous accessibility of the Internet, it is now possible for optimization vendors to put high performance optimizer engines on-line, freeing customers of the costs and implementation headaches of setting up such high-end computers in their own computer facilities. Vendors such as Evos Logistics Inc., offer products that are delivered via the web and billed for on an as-needed basis. Typically, these tools are built on latest generation solution tools which can handle the complex constraints and logical interactions of Shipment Consolidation problems more effectively than older, more rigid approaches.

For example, LoadOpt™ by Evos Logistics, Inc., provides its exclusive Tailored Service approach to defining on-time delivery expectations of customers. This allows the information such as found in Table 1 above to be directly input for each customer or group of customers. The problem of the optimizer simply saying “no solution within delivery time windows” is a thing of the past.

But how, exactly can a Web-based optimizer be put to work for your company? There are two basic strategies for implementing access to these solvers.

Direct Web Access

The quickest way to get started with optimization is to access the solver directly from a PC in your office over the Internet. Products like LoadOpt™ and others allow you to navigate to a special website, upload a file of shipment information – possibly in Excel or “comma delimited” format, wait a short while for the optimizer to run, and then download a file in one of several formats that can be sent to an internal system or used to print out a shipping plan for the Shipping Department.

Under such a scenario, better solutions will result if actual truckload freight rates can be loaded into the optimizer’s internal rating engine. Also, information on your current LTL class and discount agreements can be used to derive LTL costs for each shipment, if that information is not available from your systems to be sent to the solver. These data setups are largely a one-time thing, with periodic update.

But, not every Traffic Manager wants to handle this kind of a process on a daily or weekly basis. Moreover, there are opportunities for mistakes and delays when human intervention in processes like these is the routine. And... it may well be time for the entire Transportation Management process to be supported by a real computer system: a Transportation Management System or “TMS”.

The Internet Enabled TMS

TMS systems have been around for a number of years, but only in the last few years have well-designed TMS products been available on an SaaS model (Software as a Service) delivered over the Internet. The advantage of the SaaS approach, accessible by any Internet browser, is evident to any Transportation Manager who has had to fight for IS Department priority against Sales, Accounting or Manufacturing requirements.

Continuous Optimization

The most recent breakthrough in optimization technology is, in fact, not related to the optimization itself, but in how it is integrated with your order entry and management processes. Until recently, optimization was a one-time function in the order flow. Once an order had gone through the optimization process, any subsequent changes to customer requirements had to be handled manually. The result was often drastic changes to the optimized plan and loss of much of the hoped for cost savings – or the planning process was stopped completely, all orders were put on hold and the optimization was repeated. Basically, the optimization software hindered the order management flow, rather than working with it.

The solution is sometimes referred to as “Continuous Optimization”, by which is meant that in the planning cycle orders remain accessible to the optimization process very nearly to the point of carrier dispatch. Optimizations are re-run repeatedly, as necessary, to handle customer- or production-driven changes to quantities, schedules, added orders, deleted orders and the like. When a load is ready for dispatch to the carriers, it is released from the Continuous Optimization process and made available for carrier dispatch. Other loads, that may not be as full as desired, may be held (consistent with customer service requirements) in the Continuous Optimization pool awaiting new orders and further optimization runs.

While this sounds perfectly logical – and actually the way human planners typically work during a manual planning order cycle – the optimization software has to be designed to handle the many ramifications of this type of planning:

Handling Shipment Changes during the Load Planning Cycle

At any one point in time, a Continuous Optimization process will typically have a number of partial loads built in prior optimizations – and waiting for more orders to possibly fill them out in subsequent optimization runs. The optimization software managing these loads needs to be able to respond to changes to shipments that may already be in loads and alert the planner to situations where changed order size or delivery requirements may make a load infeasible. Since the system is designed to accept new orders from the order management system continuously during the day, the tracking of order changes and their impact on pre-built loads must also be dynamic and easily accessible by the planner.

Pre-Notification to Carriers for Un-Dispatched and Locked Loads

Often the planner will decide to hold an under-capacity load for a few hours or days in hopes more customer orders will become available to fill the capacity. Or the planner may know that a customer order change is pending and wants to wait until it is received before actually sending the load out for dispatch to the carrier. Still, carriers want as much notice as possible to plan their equipment positioning, and the planner may wish to get capacity commitments from the carrier for some of these loads. A pre-notification function which sends information about the loads to the carriers fills this need. But... wait, there's a problem. What if a subsequent optimization run breaks apart this load or, just as bad potentially, adds a shipment to a more distant point to the load resulting in the load terminating well outside the planned carrier's service area.

That problem is addressed in Continuous Optimization by "Load Locking". This allows the planner to "Lock" the load such that the optimizer will keep the load intact in subsequent optimizations, even though it may add more shipments as vehicle capacity permits. Optionally the planner can lock the "final stop" so that commitments to the carrier about the final destination can be met. In such a case, the optimizer will consider adding shipments to the load, but only if it can continue to terminate at the locked "final stop".

Appointments and Load Dispatch

With loads spending more time in the optimization planning pool during a Continuous Optimization process, the need increases for being able to manage pickup or delivery appointments during the process. Appointments need to be made and recorded in the shipment records. And, just as important, the optimizer needs to recognize those appointments as fixed schedules and respect those schedules during subsequent optimizations.

Modern optimization systems that support Continuous Optimization processes provide a mechanism for storing appointment contact information and standing appointment schedules and making this information available to the planners in the same screens they use for managing loads and shipments. For example, the LoadOpt™ system provides its ActivePlan™ screens, where loads can be managed, appointments recorded, and other functions can be performed in a single interactive screen.

When the load planner wants to take no further action on a load and is ready for it to be released to the carrier for Dispatch, the load can be moved to "Finalized" status. Typically, that removes it from the Continuous Optimization shipment pool and sends data about the load to the TMS or the order management system for shipment execution. Some optimization software may even be able to generate bills of lading and carrier dispatch documents for customers that do not have a full fledged TMS.

How Load Opt benefits from a Web Based Transportation Management System

The implementation of a web-based TMS can substantially enhance the effectiveness of Shipment Consolidation optimization by providing the required information infrastructure. Specifically a web-based TMS enhances the use of a load planning system through four vital functions:

- Process tracking
- Rate management
- Freight payment
- Communication

Process Tracking

Every company has its unique order fulfillment and sourcing processes. However those processes work, it is essential that no shipment ever be lost or forgotten during the transportation planning activities. This requirement must be met even when multiple cycles of optimization take place as new orders become visible and existing sales and purchase orders change. The key to effective use of computerized load planning is tracking the current status of shipments throughout the planning and dispatching process. A TMS system will help the traffic manager keep track of

shipments that need to be planned, those shipments that are in the planning process, and those shipments that have already been dispatched. A good TMS system will allow the traffic manager to go home knowing that all shipments which required action have been attended to.

Rate Management

The power of computerized load planning is its ability to compare and utilize the rates of many different carriers. Although a load consolidation optimization system may use its own rate tables to produce effective load plans, the use of a TMS system with an effective rate management module will greatly increase the number of possible solutions that can be considered. A modern TMS allows efficient management of TL, LTL and Pool rates from a wide variety of carriers, defined by a range of possible geographic specifications: State-to-State, Region-to-Region, City-to-City, etc.

By incorporating this richness of rate detail into the inputs to the Shipment Consolidation optimizer, the TMS enables the optimizer to exploit fully the entire range of these carefully negotiated rates

Freight Payment

The ability of a load planning system to use a wide variety of carrier rates can also make the freight payment process more difficult and time consuming. The integration of load planning with rate management and freight payment in a TMS creates a self-monitoring, self-correcting process. Load planning works best when carrier rates are kept current and accurate. Rate maintenance is ensured when freight bills are matched and compared with rated shipments and discrepancies are resolved. Shippers can then be sure that the decisions they make based on the Shipment Consolidation optimization will translate to bottom line savings.

Communications

A TMS should assist the shipper to control, manage and execute the advanced transportation strategies that are possible with a load optimization system. The execution of these types of strategies requires solid communication that provides both online and historical reporting. The need to verify load tender and acceptance, the communication of clear pick-up and delivery instructions for complex multi-stop loads, and the ability to provide real time information on shipments from a variety of carriers with multiple vehicles en-route to multiple stops is essential to the execution of the advanced transportation strategy that is possible with Shipment Consolidation optimization systems. This is especially important when pool consolidation and distribution are a part of the planning process.

New Opportunities with Web-based Software

The benefits of an integrated load optimization with advanced TMS system have been well documented over the last decade. These benefits have included:

- Reduce transportation costs by an average of 10-40%
- Increase productivity and reduced labor costs
- Enhanced customer service through improved on-time delivery

But the new capabilities presented by Web-based software dramatically expand the horizon for the application of the TMS. Not only does the use of Web-based

Shipment Consolidation optimization and a Web-based TMS help avoid the high acquisition and implementation cost normally associated with these systems. The exciting news is that these new tools can help your company exploit cost saving opportunities not previously considered or attempted:

- Multi-facility coordination
- More effective inbound traffic management programs
- Multi-Enterprise collaboration

Multi-Facility Coordination

One the first and most obvious application of this technology is to coordinate the shipping activities between multiple owned and contracted shipping and receiving facilities. The combination of the Internet plus a multi pick-up multi drop Shipment Consolidation optimization allows the traffic manager to plan and coordinate the shipping activities between several facilities. Formerly, only large companies with sophisticated IT support and robust internal communications technology could attempt this. Additionally, facilities like public warehouse were often unable to communicate with the company's own systems without a significant investment.

This has changed with the advent of Web-based systems. Now any location that has Internet access has the ability to effectively communicate with your traffic department. A single, centrally managed traffic function can now execute a sophisticated transportation strategy among company owned and contracted facilities, that are either permanent or temporary, with a minimum of information technology infrastructure.

Inbound Traffic Management

Although inbound load planning has existed for many years, these programs have not been successful in many cases because of the difficulty of coordination and communication with vendors. Inevitably, the key stumbling block has been poor information on such essentials as product availability, shipment sizes, and dock schedule requirements. As with carrier communication, vendor communications must be enabled by the TMS via a variety of technologies. The most powerful of these, of course, is the use of the Internet itself for gathering vendor shipping information.

For every vendor that has EDI capability for sending Advance Shipping Notices (ASNs), there are two dozen that have no EDI capability but can easily access a Web browser, enter their PO number, and update shipment status, piece counts, weight, and product availability. This information can then be instantly available to the traffic manager for inclusion in the Shipment Consolidation process.

Partly as a result of the historic difficulties in planning and managing inbound freight, the potential savings for most companies in this area are quite high. All too frequently, the extensive cost reduction programs found in the outbound area: multi-stop truckloads, pool points, negotiated LTL rates, and so on, have been completely absent in the inbound arena. The TMS can change this situation dramatically, bringing all these techniques to bear – often with freight rate savings in the 20-30% range or more.

Multi-Enterprise Collaboration

The idea of the "Transportation Co-Op" is also not new, and they have been around in one form or another for a number of years. What is new is how the innovations described in this paper can facilitate their formation and operations. Three basic problems have served as obstacles for multi-enterprise collaboration:

- Sharing of shipment information was difficult or impossible
- Multi-pick/multi-drop Shipment Consolidation optimization was unavailable
- Sharing the benefits among the members was a continual source of disagreement.

Unless companies were willing to make significant and expensive investment in in-house TMS systems, the ability to share information among multiple enterprises was both expensive and time consuming. Most companies view this type of investment as a distraction from their core business and simply refuse to pursue it. With the advent of the Web-based TMS, the ability to collaborate with other companies on the shipment of product has been greatly facilitated. Companies that have an Internet connection and the ability to load orders into the TMS, either by hand or by electronic download, can now participate in collaborative efforts. Additionally by feeding information into a common Web-based platform, such advantages as EDI, tracking and tracing, freight bill audit, and payment and common carrier rate management are available to all members of the collaboration.

All the problems of manual Shipment Consolidation planning mentioned earlier in this white paper were compounded when multiple companies attempted to collaborate. Until recently Shipment Consolidation optimization did not work for this type of enterprise because they lacked the ability to route from multiple origins to multiple destinations. Without computerized optimization, individual company members were often (rightly) concerned that the full cost savings opportunities of the collaboration were being missed. Newer optimizers, such as the Web-based LoadOpt™, can handle any number of origins to any number of destinations, providing the assurance that the benefits of cooperation are being fully realized.

Finally the Web-based TMS can facilitate the sharing of benefits to all members. A TMS like eFlow™ by Evos Logistics, Inc., with the ability to allocate freight costs from multi-stop loads down to the shipment level can help ensure that the benefits of improved freight management are fairly shared by all member of the collaborative effort.

Real-world Examples

The following pages depict an example of actual Evos Logistics client data, including actual costs incurred using the client's previous inbound freight management process and the improvement achieved by the use of Web-based Shipment Consolidation optimization and TMS systems.

The company is a retailer located in the Pacific Northwest. They managed their own inbound freight doing some manually planned consolidation of large mark LTL but moving most freight either by truckload or using major LTL carriers.

An analysis was first performed to determine the best transportation strategy given the company's shipping patterns and service requirements. This analysis included determining the number, location and service areas for inbound consolidation points or "pool points".

Analysis Process

1. Collected inbound shipping data for freight currently serviced by truckload and LTL carriers.
2. Utilized Optisite™, a facility site location model, to determine the location and service areas for regional cross-dock carrier, commonly referred to as pool points.
3. Determined actual or expected freight rates.
4. Constructed sample shipment file for freight that move between a six-week period.
5. Used LoadOpt™ Shipment Consolidation optimization software to load plan and analyze each week of inbound freight.
6. Based on the resulting inbound load plans, freight costs were allocated back to the individual shipment and compared with the actual freight cost.

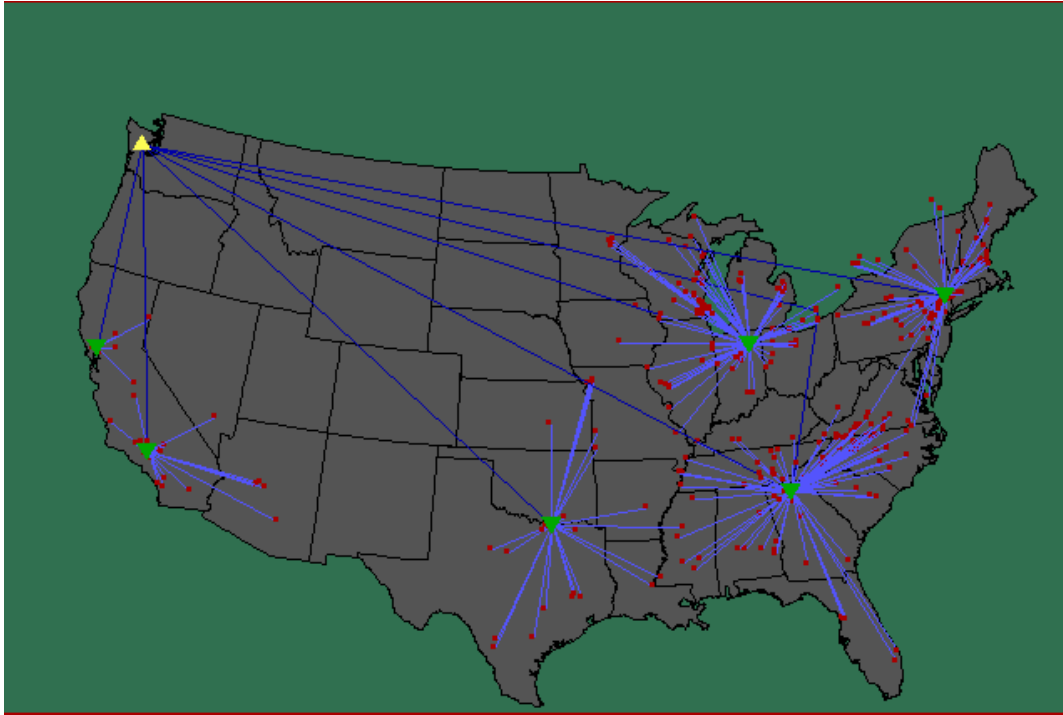
Key Modeling Parameters

1. The Optisite™ model for pool point locations and service areas was based on shipments of less than 15,000 pounds.
2. It was assumed that this program was implemented; the current favorable LTL discount would not remain in effect for freight that could not be consolidated. A lower discount for LTL freight was used in the model for freight that could not be moved via consolidation and would have to be moved on an alternative LTL carrier.
3. Stops per truckload movement were limited to a total of five.
4. Each of the six weeks was modeled.
5. Consolidations to regional pool points were performed twice weekly.
6. Rates for the cross-dock facilities were set conservatively at 5% above what might reasonably be expected.

Results

Based on an analysis of a six-week sample, an inbound consolidation program showed that it could reduce freight costs by an average of nearly 15% over the current inbound freight management program. Savings ranged from a high of over 30% to a low of 10% in each of the 6 weeks of the test period.

Figure 5 – Inbound Consolidation Program Example Map



The table below shows a summary of the client’s shipments for the six-week period. The un-optimized charges indicate what the company paid using its current planning methods. The next column shows what the charges would be; using load optimization plan created specifically for the client’s shipping patterns and business rules.

Table 3 – Actual Cost Savings from Inbound Freight Consolidation

Week	Number of Shipments	Un-optimized Charges	Optimized Charges	Savings	Percent Saved
1	445	\$158,568	\$138,451	\$20,117	14.53%
2	418	\$147,019	\$130,328	\$16,691	12.81%
3	411	\$141,057	\$128,052	\$13,005	10.16%
4	391	\$158,873	\$121,721	\$37,152	30.52%
5	455	\$165,873	\$141,695	\$24,207	17.08%
6	445	\$165,102	\$138,474	\$26,628	19.23%
		\$936,521	\$798,721	\$137,800	14.71% Avg. for the 6 weeks

Conclusion

The Internet revolution is alive and well, transforming the way traffic managers can drive down the costs of LTL transportation. Aggressive companies are already beginning to exploit the powerful opportunities presented by new optimization technology and next generation TMS software delivered via the Internet.

About the Authors

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