



ROUTE PLANNING, TOUR GENERATION, DISPATCHING

/// VIEWPOINT PAPER



Long-range itinerary generation for over-the-road trucks enhances current operational efficiency

Fleet owners can increase efficiency by planning as far into the future as possible. Long-range forecasting will provide transportation capacity where and when it is needed. This forward-looking approach represents an evolution in private fleet business strategies.

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Introduction

You may recall, as a child, taking a napkin and putting the corner in a small pool of water. The paper napkin absorbed water. As the napkin absorbed the water, it drew more water from the pool. If the napkin were torn in strips, the water would be drawn to the ends of the torn strips. The process of absorption and pulling more water from the pool continued until either the napkin was soaked (no more demand) or the pool of water was exhausted (no more capacity).

What do napkins and water have to do with truck scheduling and routing? They are more closely related than it may first appear. Shippers and carriers are looking for ways to more effectively use their fleets to move freight. Many have adopted next-load assignment programs that will efficiently give a group of drivers their next load to carry. This has helped take a level of costs out of the transportation process and has lowered overall transportation expenses.

The only problem with this process is that it often leaves trucks out of position to handle the next assignment. Let's assume there is one load to be moved that has an expected four hours of transit time, and two drivers are available to move that load. One driver has five Department of Transportation (DOT) driving hours available, and the other has eight hours. In this scenario, both drivers can feasibly move the load. However, once that load is moved there is another that has a three-hour transit requirement. The first driver would be infeasible for the load whereas the eight-hour driver could still carry it. In the first situation, you may have had to bring a contract driver to make the move, whereas in the other situation, you could have moved the load with your existing driver.

Clearly, this hypothetical situation is simplified, but it highlights a very important concept: the further into the future you look when planning transportation, the better you're going to be able to use your fleet. Long-range plans are the torn napkin strips that will draw capacity to where it will be needed. This article describes an approach that has been successfully implemented to achieve this goal. It will also describe the next step in the evolution of this approach to help achieve superior use of private fleets.

The problem environment

If one could see far enough into the future and not face any changes, planning could be done that assured all assets and drivers were maximally used. One could put together tours that would take advantage of placement and driving capability so that overall costs are minimized. In this idealized environment, perfect tours could be generated that would keep the trucks moving.

Unfortunately, in the real world of day-to-day transportation management, demand changes occur that invalidate the best-laid plans. Because of changes in demand, the specific assignments that are planned may become no longer "optimal." Changes occur because of missed deliveries, new demand that becomes available, and other unplanned changes or transportation problems. The longer the planning horizon used to build itineraries, the higher the percentage of loads that will not be visible to planners.

Further complications may occur when it becomes clear where the demand is appearing in the transportation network. Drivers and trucks are often out of position to satisfy that demand. You can either bring in temporary drivers and power units, or they can do expensive deadhead moves to the point of demand. Temporary drivers are very expensive, and deadhead moves are a waste of valuable driving and equipment resources. Managers end up settling for “good enough” rather than the best.

Finally, service failures are not an option. A service failure means potential penalty charges, wasted driver capacity and loss of customer satisfaction. Personnel scheduled to unload the truck are not available when the time finally arrives, or the slot at the dock door may have been taken. In a manufacturing environment, it may mean that just-in-time lines are shut down or delayed. Expedited shipments may be needed. In all these cases, the disruptions caused by missed deliveries are unacceptable. While no system will guarantee absolute success, these disruptions should be minimized.

Expected savings from better routing will vary depending on your business practices, but will range from 2 percent to 10 percent of total miles driven. For a 500-truck fleet, 2,500 miles per truck per week, and \$1 operating cost/mile translates into \$1,300,000 to \$6,500,000 annual savings.

Solving the transportation problem

Given the environment described above, managers choose strategies that will allow them to make decisions fast enough to gain an advantage and show some improvement over short-term decision-making. What is needed is a strategy that will enable long-term plans that give the benefits previously described in a time frame that works in a real-life environment. EDS has solved this problem, and it is helping shippers operate more efficiently.

EDS was asked to look at ways to build itineraries that would efficiently use driving resources within a very large service area. There were a number of business rules that needed to be satisfied, including company and DOT driving constraints. It was very clear from the beginning that the longer the planning horizon, the better-placed capacity would be to satisfy demand.

But building a single itinerary for each driver would not lead to efficiency improvements. The problem has two dimensions - who should carry a given load and in what order should they carry a set of loads. Therefore, many feasible itineraries are generated for each driver, and the best one is selected for each.

Determining who should carry a load actually considers driver characteristics, not individual drivers. Substitutability of drivers is why this approach works. The priority is to assign a suitable driver, not to have a particular driver carry the load.

At the same time, determining the order the loads should be carried is even more difficult. Pickup and delivery windows are wide, and most of the time many drivers are eligible for loads. Fitting drivers to loads, much like fitting the pieces of a jigsaw puzzle together, is the key to maximizing capacity utilization.

These are the fundamental principles that were used to solve this very difficult problem. There is one additional technical issue: the problem needs to be solved fast enough to make the information usable. Making perfect decisions is great if you can do so within the appropriate planning horizon. Unfortunately, you have to temper the desire for a perfect decision with the operational compatibility of a good decision.

Plan for days, dispatch for hours

Given the description above, why should you plan for days? If the demand landscape changes so much, why is it useful to plan for several days when new demand can cause the plan to become invalid?

Let's suppose that a load is within the planning horizon but will not be available for two days. When the load is first assigned, it is put on the end of driver A's itinerary. During the next planning cycle, it is assigned to driver B's itinerary. Finally, it is assigned to driver C's itinerary. What value was gained from making the assignments to A and B?

The value here is that capacity was directed to a point of demand. In general, it makes no difference which driver carries a load but rather that it gets carried. By always making sure that a load is covered, you will ensure the best available driver is used. If a load cannot be covered, it will become apparent soon enough to develop a new plan for moving the load.

Looking ahead, even a single load will solve many planning problems. The likelihood of having the wrong driver in place, as in the prior example, will be greatly reduced. Outbound backhaul combinations will be identified.

Benefits

What are the benefits of looking farther ahead during the planning cycle? First, you can lower the wasted miles and time from poor routing practices. Expected savings from better routing will vary depending on your business practices but will range from 2 percent to 10 percent of total miles driven. For a 500-truck fleet, 2,500 miles per truck per week, and \$1 operating cost/mile translates into \$1,300,000 to \$6,500,000 annual savings. This does not include the extra capacity you now have available because those empty miles are not being driven.

One surprising result observed when implementing the long-range planning system was an increase in backhaul activity. The increase occurred because fleets got the right truck to the origin of backhauls as a result of the increased visibility long-range planning provides. If your operation carries a backhaul as opposed to a third party, the savings or revenue associated with the increased backhaul activity can be dramatic. For the same 500-truck fleet, if the drivers pick up an additional backhaul per week with a revenue opportunity of \$300, the total backhaul revenue increase would be \$7,800,000.

Long-range planning systems also make your planning and dispatching personnel more productive and effective. The same number of personnel can support a larger number of drivers. While certain aspects of the driver-dispatcher relationship will not change, the planning and dispatching functions will not require the same number of people. Management can move from each event to a management-by-exception mode. Certain dispatching assignments can be automatically accepted and forwarded to the driver for execution.

Another benefit of the system was the increased driver satisfaction. For some operations, attracting and retaining drivers is hard. Increasing driver pay is usually not an option, and the cost of finding and hiring drivers is very high. By planning long-range, drivers can be home when promised, which will lead to higher satisfaction and higher driver retention rates. Turnover at some firms can be more than 100 percent with a hiring cost per driver of \$5,000. Some long-term planners have cut the turnover to as low as 30 percent. Again referring to the 500-truck fleet, if turnover could be cut from 100 percent to 50 percent, the savings would be \$1,250,000. This savings does not factor in the loss of experience and additional training costs that are incurred to make the driver productive and familiar with your business practices.

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Total savings from these measures can exceed \$15 million for a 500-truck fleet. Additional savings not part of this figure include loads that previously have been handled on a spot-market basis that can now be carried on contracted or private fleet capacity. Longer-term traffic lanes that are currently being given to outside carriers could be brought back to in-house trucks.

Future direction

One area where the current functionality will be expanded is in managing capacity by using relays. As previously stated, the goal of a long-range planning system is getting the right truck to the right place with enough hours to complete the movement. The more often that occurs, the lower the overall cost of transportation.

But it is often impossible to move a truck to the origin of a given load without incurring a high cost or violating business rules. Usually, there is a business rule that prevents long deadhead moves. In the simple case, you may have a 125-mile move with a 50-mile deadhead limit. If another load originates halfway between the origin and destination of the first load, there is no way you will be able to get the truck to the beginning of the load unless you incur 63 deadhead miles. While in this case it may be acceptable, most of the time it won't be seen as an opportunity. Often, you don't have visibility to the load until it becomes a problem. You end up getting a temporary driver to move it, thus incurring a high cost.

What if you could relay the original load at the point of origin of the extra load? Assuming that DOT hours and other issues work out, that would eliminate the extra deadhead miles and the need for a temporary driver. This type of capacity management would be very difficult without a long-range planning system.

Ultimately, available capacity is being managed more tightly by using relays. Costs for performing the relay and hiring temporary drivers will determine whether it's better to perform the relay or just carry the original load.

Another area for improvement is load building. Inbound freight sometimes consists of a number of freight pickups for movement to a distribution center. If assignment patterns from the long-range planner are included in the load-building process, those patterns can be used to influence the routing of multipickup moves.

Variable cost pricing is one more area of future expansion. If certain network patterns are evident when planning a given set of loads, it will become clear where empty lanes exist. If providing opportunities to move along certain empty lanes will dramatically lower overall cost, it is possible to sell that capacity on the spot market at the incremental cost of the move. Even if you don't make much money on the specific moves, the overall effect on your transportation expenses results in a dramatic cost reduction.

Conclusion

A system that plans itineraries over several days has been implemented and has shown the benefits described above, including increased revenue opportunities, enhanced more efficient operations, decreased costs and increased driver satisfaction. This system clearly requires commitment from management and a process for incorporating the change throughout the organization. Change management is often the key to success or the reason for failure of these types of systems. While computer systems can support the process, ultimately it is the people who work with the system that will determine its success or failure.

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