Tubular Rail’s Response to

TECHNOLOGY/BUSINESS OPPORTUNITY

Title: Novel Surface Transportation Systems

DTFH6114RI00007

Explaining Its Drive On / Drive Off Ferry System

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Executive Summary

Tubular Rail’s patented DDF (Drive on Drive off Truck Ferry) addresses some of the most critical challenges to freight movement by combining the energy efficiency of rail transport with the flexibility of trucking. The operational cost savings to the trucking industry provides a means to finance the needed rail investment.

Positive impacts are created by

- Lowering fuel usage and the resulting decrease in carbon emissions
- Funding of needed rail capacity improvements and congestion reduction on highways
- Addressing the Driver shortage / Productivity issues of the current situation
- Reducing pavement damage from trucks
- Improving highway safety
- Creating new capacity for Passenger rail
- Accomodating oversize/overweight loads

The historical development of the North American rail system has left us with tens of thousands of miles of underutilized or abandoned rail segments. As the rail industry consolidated, was deregulated, and faced completion from trucking and the interstates, many rail segments were allowed to degrade and service levels fell. Simultaneously, the parallel highways became congested and maintenance costs rose so that now we have a situation where rails are abandoned at an average rate of 1000 miles per year and funding solutions for the highways are elusive, questionable, or politically unrealistic.

Tubular Rail proposes the development of the DDF, a technology that allows drivers, trucks, and loaded trailers to drive on and drive off specialized railroad cars, 3-4 trucks per car, loaded across the width of the rail cars. A unit train loaded with up to 300 of these trucks, traveling in modified 500-mile segments across rural areas between urban area transfer points addresses the under-700-mile distance where rail is not cost competitive with trucking.

The system is a ferry type service (unlike current piggy back service) that integrates seamlessly with existing modes and in fact enhances both rail and trucking operations. By maintaining the linkage of driver, power unit and load, there is no need to transfer documents, and therefore risk, from one mode to another.

A national system would consist of approximately 20 segments of roughly 500 to 700 mile in length, independent of one another.
Technical Summary

Tubular Rail has developed a technique to transport tractor-trailers on modified rail flatcars (3 to 4 trucks per rail car). This is a Drive On / Drive Off Ferry (“DDF”) system whereby a driver pulls into the railhead yard and then directly onto the railcar from the side. The rail cars are equipped with side loading ramps on each side. The truck’s alignment is perpendicular to that of the train. This system allows a total of approximately 300 rigs to be loaded on the train given average weights and rail loading limitations. A key and final point is that the driver, and therefore the BOL/Manifest, stays onboard and travels with the load / trailer. If done in an available sleeper berth equipped tractor, HOS (hours of service) results are similar to team operations.

![Locomotives, Air Flow, and Top View](image)

Tubular Rail’s DDF concept organizes continuous segments of existing or new railroad right-of-way (500 to 700 miles with stop spacing of 250 miles) in order to transport trucks to and from outlying areas of major cities - such as from an area just east of El Paso, Texas, to an area south of the Dallas/Fort Worth Metroplex. This particular route should be of interest to the State of Texas and the Texas Department of Transportation as the State either owns or controls the South Orient Rail Line which is not only underutilized but roughly parallels I-10 and I-20. Another candidate is the I-70 truck lane project (800 miles)

![South Orient Track Classes & Project Segments, I-70 Corridor Study Area](image)

The DDF is not to be confused with current piggy back systems used simply to transport trailers and containers on rail cars. The DDF will not negatively impact the railroad’s container traffic; instead, it brings back business previously lost to the trucking industry while cutting the trucking industry’s operating costs.

Starting with the basic configuration of the standard railroad, i.e. rails, cross ties, and ballast, the DDF concept adds two parallel rails to the original rails at a distance of approximately thirty
feet from the center line of the existing rail road, as pictured below.

New Outrigger Rails
Rails

These rails serve as a mechanism to balance a significantly widened rail flatcar. In maintaining the level of the car they act to restrict the ability of the car to tilt, to that of a prescribed tolerance of a few degrees. This function is similar to the outboard wing pontoons on seaplanes, the outrigger of a Polynesian canoe, or the training wheels on a child’s bicycle.

As in these examples, the side rails carry a minimum of the total weight. These outrigger rails must be maintained at a constant distance from the center line of the original (inboard) rails. This is to allow roller (wheels) mounted on the underside of the car to rest on these rails thus maintaining a level balance. The question arises as to how these outboard rails will balance the car in the situation where the car (train) needs to cross a road without closure or alteration of the existing road in order to avoid expensive bridge building. In order to accommodate this situation a fixed rail is mounted on the underside of both sides of each car. These underside mounted rails should extend out in front of the car and also extend out to the rear as far as possible without impacting operations of the train as a whole. These underside outrigger rails will perform the balance function of the wheels in a situation (such as a road crossing) where it is not practical to have continuous elevated rails. To do this, the outrigger rails must come into contact with rollers set in the ground.
There exists a geometric relationship between the spacing of the ground rollers and the length of the underside rails. At a minimum, in order to ensure that the underside rail always rests on a minimum of two rollers, the maximum spacing between rollers needs to be less than one half the effective length of the underside rail. For example, a 65’ rail would require a roller spacing of no more than 32 feet. Spacing may be less than this but should never exceed it in order to maintain a minimum of two rollers acting to support and balance the load.

The center of the now widened flatcar rests on traditional rail boogies (trucks) but rather than a traditional eight to ten foot width the car is widened to a width of eighty feet or so. This is to accommodate the length of a tractor trailer unit while allowing some additional room for balancing.

Thus rollers mounted on the ground and matched to the underside rails will allow the DDF car to cross existing highways and roads without permanent impediment to the highways and local roads in the mostly rural areas. Finally, the car includes an air ride suspension on the main boogies to adjust height and weight distribution. A moveable counterweight also is available to ensure a balanced load.

**Conclusion (technical section)**

Wherever possible we use currently available, off the shelf technology. The locomotives and the track itself are simply specified for necessary horsepower, weight and speed. The ferry car is a platform 60 feet by 80 feet. It is wider than it is long. It is equipped with an outrigger suspension on each side that rides on parallel rails in a parallel plane with the main tracks. In addition, an underside rail accommodates road crossings. Five to ten percent of the weight is carried on each outrigger rail with the remainder carried on the main track. This weight is adjusted by the use of an air ride suspension on the main weight carrying suspension of the main track. Balance is achieved in loading by pre weighing the trucks upon arrival, adjustment of the truck’s tandem axles by the driver and loading the trucks in opposing directions. An adjustable counter weight is used for final balancing. On board pressure indicators confirm proper weight distribution and are double-checked with a device as simple as a plum line. Although all of this technology is currently available, its overall use in combination is subject to patent protection, for which Tubular Rail Inc. has been awarded a US patent.
Business Summary

This response to the EAR Program is to provide information on possible collaboration with the Federal Government in the development of Tubular Rail’s DDF. As noted in the original Request for Information, a major change in transportation typically happens only when there is Government involvement in the process. Acknowledging this fact, Tubular Rail has been engaging in both information gathering and dissemination with Government officials, trade groups, universities, railroads and trucking companies. This effort has confirmed that if this effort is to see implementation and realization of the benefits of the DDF, then the Department of Transportation will have to play a leading role.

The base business case is that the creation of this type service produces sufficient revenues to pay for multi-billion dollar investments in these rail segments. Based on available rail construction quotes, we estimate that construction costs will average about $6,000,000/mile plus or minus $2,000,000/mile. So for a 500 mile segment a total investment of about 3 billion dollars would be needed. This is offset by a reasonable revenue stream of $2,000,000/day for annual revenue per segment of 400 to 600 million dollars per year (200 to 300 days per year). Expenses and ancillary revenues are not examined at this point. These numbers compare well to grain shuttle train operations and very well to construction of dedicated truck lane capital cost. Given the condition of the Highway Trust Fund, all options should be examined.

However, a full blown feasibility study would be the logical next step to pursue followed by a demonstration project building several cars and operating them at a suitable facility such as the Federal Railroad Administration’s rail test facility in Pueblo, Colorado, which we have visited.

To explain the potential revenue stream, it helps to start with a look at current truck operating costs. Depending on diesel prices, fuel and labor costs of operating long or mid haul trucks are the top two cost items for the owner. We use a 5.5mpg figure to examine fuel cost which means that with highway diesel at $2.75 per gallon, it costs $.50 per mile in fuel costs alone to move a truck down the highway (the US average Diesel price as of Jan 18, 2008, was $2.314. In December 2013 it was approximately $4.00 /gal). Add to this direct cost for driver compensation at $.40 per mile with a 50% premium for workers comp insurance and benefits meaning that direct costs on a per mile basis start at $1.10 per mile driven.

Additional major cost items related to miles driven, include tire costs at about 2.9 cents per mile ($350 x 18= $6300.00 divided by 219,500= $.0287/mile per vehicle), maintenance $.06 in wages (Mechanics), Operation expenses $.09, communications $.01 and $.21 in depreciation. Since these costs are related to miles driven, a conservative per mile cost is around $1.50 /mile to simply drive down the road. ATRI’s per mile operating cost given in the Phase I study of the I-70 truck lanes was $1.73.

Using the above cost numbers as a price that the fleet owner would be willing to accept to avoid the operational expenses, a simple Revenue Table shows potential revenue as a function of a range of carrying prices charged, versus percentage utilization of an individual DDF with an assumed 500 mile run.
We have estimated the value of the Carbon Credits under California’s cap and trade program at $10,000,000 on an annual basis for the Central Valley segment. Each 100 gallon reduction in fuel usage equates to a one ton reduction in CO2 emissions. The last known auction rate was 13 dollars per ton. We anticipate this value to increase but the cash value may be less important than the actual impact of an achievable CO2 reduction.

In addition to the obvious benefits to the trucking industry of lower operating costs and to the rail industry of infrastructure investment the concept will provide a means to help Amtrak maintain its long distance trains which are the most heavily subsidized. An appropriate feasibility study would be able to generate benefit values for avoided deaths and injury from truck involved crashes (5000 annual deaths), pavement issues, and congestion reduction values.

Transportation is absolutely vital to all aspects of the national economy. Often times those with direct involvement in the industry work at loggerheads with each other and are in an adversarial relationship with clean air interests and the taxpayers that fund the highway construction. This proposal is unique in that so many interests can support it. Truckers win with lower operating costs and higher utilization rates. Rail operates the system generating new revenue and justifying upgraded track. State highway departments save on repair of rural highways. Air emissions are reduced and highway safety is advanced One single 500 mile run with a fully loaded train represents a net fuel savings of 23,000 gallons. Extrapolated out to a national scale, the numbers have implications for both environmental and national security interests.

We envision a nationwide system of 20 to 25 segments consisting of approximately 500-mile links with loading and unloading docks at each end and one at midpoint. Both railheads and the midpoint will be located in rural areas near major highways leading to urban areas or transportation choke points.

In 2006, commercial trucks consumed nearly 54 billion gallons of diesel fuel and gasoline. A one-penny increase in the price of diesel annualized over an entire year costs the trucking industry an additional $391 million a year. Our potential customer is any person who or company that operates heavy trucks on a non-local basis

In doing the historical research necessary for this project the complexities and the problems of the American rail system were made apparent. At first we followed the idea that purchase and rehabilitation of abandoned lines was the best route to take. Although doable, this method would
face the most difficulties, particularly in terms of funding. Another option was to find an existing short line railroad and expand it using its powers of imminent domain when a public good can be demonstrated. This scenario was more viable but also had timing and legal drawbacks. What then emerged was a plan to contract or franchise with existing major, regional and short line railroads under which they provide track and locomotive service. As long as they can maintain the set schedule they would be free to use the new or upgraded lines. In this scenario everybody benefits. Railroads get a new source of revenue and the use of upgraded track. The trucking companies win for obvious reasons. Environmental interests and fuel conservation groups also have a plan they can support. This enables coalition building on the political front.

Our proposal, if implemented, results in reduced oil demand, lowered highway construction and maintenance costs, and increased public safety. We suggest a cooperative technology development effort to produce measureable results in an acceptable time frame.

It is our intention to conduct the feasibility study, construct and demonstrate a prototype car, and then take the necessary steps to begin operation on the first segment. At that point it would be conceivable to license or franchise the system to other operating railroads.

Response to this RFI in no way authorizes its use or development by or release of development consent to others, without Tubular Rail's express written consent.
Question 5
The Drive on Drive off Truck Ferry was granted US Patent 8327771. Various drawing, sketches and models have been completed to help explain the operation and function. There have been no formal papers published other the continuing evolving in-house documents. We have met with both the Missouri and Texas Departments of Transportation and responded to a RFI from TxDOT. The TxDOT request seemed to more interested in finding private sector funding to pursue conventional projects. It was not intended to develop any technology.

Question 6
There have been no Government awards given to Tubular Rail. We are hoping that the Federal Highway Administration’s EAR program may provide a path forward to working with the Government on Infrastructure issues.

Question 7
Tubular Rail has met with a number of Government officials and agencies. While there seems to be interest at the personal level, programs to advance this kind of technology seem to be nonexistent or inaccessible. The irony is that the solutions being proposed to address highway related challenges are well known (VMT, tolls or gas tax) and understood, yet the situation continues to deteriorate for lack of funding or support.
Amtrak’s solution to the money losing long distance trains is not to be supportive of some creative thinking but rather to abandon those lines starting with the South West Chief.

Since the Right of Way of interest is Rail ROW, not highway, our conversation on this subject has been with the railroads. The railroads are concerned about whether a new system will impact existing operations and whether the financial impacts are appealing enough.

**Question 8**

**Next Steps**

Tubular Rail approached the FHWA and the EAR program as this was the first program that seemed to offer even a remote possibility of garnering some support from the Federal Government’s Department of Transportation. What we would like to do as a next step is to work with this program and ask for funding to do a meaningful feasibility study. This could be done through the University Transportation Centers program. Some of the areas to be examined would include:

- **Implementation Issues:**
  - Legal, particularly eminent domain and restoration of abandoned rail ROW’s;
  - Political;
  - Financing-revenues from truck, rail, and business related to ROW (fiber optics, pipeline etc.)
  - Partners: State DOT’s, FRA, US DOT, STB;
  - Competition;
  - Regulatory;
  - Coalition Building;
  - Business Model emphasizing a more limited Governmental role;
  - Developmental and Organizational issues, including ownership, operations and governmental issues;
  - Inertia

- **External Benefits:**
  - Restoration of standard freight service;
  - Risk Factors;
  - Environmental pros and cons;
  - Loss of fuel tax revenue vs. lower maintenance;
  - HAZMAT;
  - Towns with restored rail service;
  - Development ideas, explaining how to develop the system from concept through construction and operation;
  - Supportive of short range, alternative- fuel trucks. (fuel cell, battery, etc.)

- **Technical Issues:**
  - 45 to 50 mph average speed;
  - Requires class 3 track standard;
  - Engineering and selection of Design Build contractors;
  - Operator, operations, and potential customer inputs for types of service;
  - Engineering survey of existing conditions and obstructions;
  - Identify tasks, assign priorities, and determine responsibilities;
  - Width in cities and loop bypasses, economic development for impacted areas;
  - Location – determining what areas have both demand and available
rail assets;
  o  Prototyping of two full scale cars and testing.

While we feel the system will prove both a viable and attractive alternative/supplement to current options, the above issues still need to be examined in greater depth.