A proposed
National System of Interstate and Defense RAILROADS,
as an infrastructure project for the next fifty years

by J. William Vigrass, panel member,

To the National Surface Transportation Policy and Revenue Study Commission, USDOT Bldg., L'Enfant Plaza, 400 7th St. N.W. Conference Room 4200, Washington, DC, 20590, Tuesday, 10:00am February 6th, 2007.

Background: The scope of the Commission's mandate is to provide policy direction for infrastructure for the next fifty years. This paper will expand upon the thoughts set forth in my December 7th, 2006 paper and will be confined to the railroad mode because all other modes have numerous advocates for government investment in highways, waterways and airways, all of which are owned by the public sector. All are used by private sector operators which have not invested any of their own capital in the infrastructure provided by government. They pay fuel and other taxes as operating expenses, and said taxes cover but a portion of the government's investment and maintenance costs. Only the railroad infrastructure is privately owned, maintained and financed. Even though railroad property is devoted entirely to the public interest, the owning companies nonetheless pay real estate taxes on their properties. In urban areas these taxes can be substantial. Railroad freight rates must cover all operating, maintenance and ownership costs, something that competing modes have never had to do.

When railroad companies invest in improvements to their physical plant with internally generated funds, they must be assured of an internal rate of return equal to or better than the cost of borrowing money in the private market. In contrast, when the Corps of Engineers makes improvements to the inland waterways system, the barge operators do not put up any investment dollars. When the FHWA and state DOT's improve highways, the trucking industry does not have to directly contribute to the investment. This unbalanced situation has led to underinvestment in railroad plant with consequent congestion is many locations. Railroads presently have great difficulty adding new train services and have made it clear that they are unable or unwilling to add timetable slots for additional passenger train services unless the public sector makes capacity available.

At the same time an expanding economy has put pressure on freight railroads to add more service and some new services such as long distance run through trains. The nation's highways are congested in many places, and the expanding economy has added to the pressure for widening existing Interstates and building new Interstates where they do not now exist. Tests done under the auspices of the American Association of State Highway and Transportation Officials (AASHTO) have proven that highway damage is geometrically related to heavy loads. There is good reason to divert heavy loads off highways onto railroads since the latter are engineered to handle heavy loads. With several good reasons to add more railroad service, why has not more been done? The answer is, very simply, the railroads cannot afford to make the necessary investments. Their margin of profit is held down by truck competition for the most part. Common carrier truck rates are held down by the ubiquitous owner-driver who often

works for bare wages, fuel, a contribution to maintenance and little or nothing for depreciation.

The trucking industry is using an Interstate and Defense Highway System designed and built since 1956, and incorporating improvements in design from time to time. It is largely an up to date highway system. The enormous capital invested in the Interstate and federal aid highway systems has been generated by motor fuel and other motor vehicle related taxes borne by the entire motoring public. Past studies have found that trucking does not cover about 30% of costs related to truck operation. This allows the trucking industry to offer rates less than their true economic costs. Every time taxes on trucks or trucking have been increased, the industry has lobbied intensely and successfully for increased length and weight limits which in turn allowed rates to remain lower than they otherwise would have been. This has attracted more freight to highways which in turn caused more wear and tear and congestion.

It is recommended that the Congress not approve any more increases in the size or gross weight of motor trucks in interstate commerce.

Trucking uses up to date highways.

Railroads use Nineteenth Century Alignments. In contrast, nearly all the US railroad network was designed and built in the 19th Century. Grading was done by manpower, horses and scrapers. Heavy excavation was done by manual drilling (sledgehammers on the drill that someone was holding) and black powder. Such engineering achievements as the Horseshoe Curve, Tehachapi Loop, the Central Pacific (UP) over Donner Pass were all great achievements of that era, but they are circuitous compared to competing Interstate highways. No matter how fast railroad freight trains may run, they must go further than a truck in most cases. Curvature imposes permanent speed restrictions. Histories of those early projects often include drawings of proposed realignments that could not be carried out by the privately owned railroads. Major tunnels had been proposed but not built. Many sharp curves remain although realignments had been planned.

Meanwhile in Europe, at this time, many kilometers of new high speed railways have been and are being built. Several Base Tunnels are being built for railway use under the Alps and other mountainous barriers. These are:

1. Lötschberg base tunnel – portals at Frutigen (Canton of Bern) and Raron (Canton of Valais) in Switzerland. 34.6 km (21.6 miles) in length, Scheduled to open this year (portions will be single track).

2. Gotthard base tunnel – portals at Erstfeld (Canton of Uri) and Biasca (Canton of Ticino) 57 km (35.6 miles) in length. Scheduled to open 2015-2017. They are running into geological problems. (This project has been covered on The Discovery Channel.)

3. Combination bridge/tunnels connecting Sweden to Denmark provide an all rail connection between Scandinavia and Europe.

4. In project planning (length not yet established) – Mt. Cenis (France-Italy and Brenner (Innsbruck), Austria and maybe Bolzano/Bozen, Italy

5. Proposed tunnel connecting Spain and Morocco under the Straits of Gibraltar has been planned and is going into the engineering phase. This will connect the railway system of North Africa with that of Europe.

The Channel Tunnel (50 km, 31 miles long) is well known in the US. Less known in the US is the Japanese Seikan tunnel between the main island of Honshu and the north island of Hokkaido. It is longer and deeper than the Channel Tunnel, and passes through far more difficult geology. It has the following statistics:

Seikan Tunnel
Location: Honshu and Hokkaido, Japan
Completion Date: 1988
Cost: $7 billion
Length: 174,240 feet (33 miles)
Setting: Underwater
Materials: Steel, concrete
Engineer(s): Japan Railway Construction Corporation

The US has no railroad tunnels that compare.

In all such cases, the railroads are owned by the public sector and such projects have national and/or European Union support. (Switzerland is not in the EU.)While European railroads offer much more frequent passenger train service than is found in the US, they carry a tiny percentage of freight ton-miles and are far less efficient than American freight railroads. Yet with the superiority of American freight railroading, the companies cannot justify or afford the huge investment that would be needed to provide a 21st Century alignment. They need help!

The present US railroad system is the most efficient hauler of overland freight in the world in terms of ton-mile costs. It is also the result of drastic downsizing that followed deregulation. The present system is carrying double or triple the number of ton miles that had been carried on a much larger network prior to deregulation. About one third the track miles are carrying two to three times the traffic. While efficient, this leaves little room for growth. It is also difficult for freight railroads to maintain their track when there is only one track on a given alignment. Trains must be delayed or rerouted over circuitous routes to allow track to be taken out of service for maintenance or replacement. This is not desirable but it is necessary.

One may conclude that the present railroad system consists largely of 19th Century engineering, has greatly reduced track miles and route miles than existed in the 1950's, yet is carrying twice the traffic. Expanding capacity to be able to handle increased freight traffic as well as increased passenger train traffic appear to be highly desirable national objectives. Excess capacity is desirable to handle an expanding economy as well as peak loads. Private companies cannot invest in excess capacity (unless they have large profit margins, which the railroads do not.) Redundancy is highly desirable to handle dislocations caused by natural disasters such as Hurricane Katrina or terrorist attacks that have not yet been experienced.

It is a point of historic fact that the Prussian State Railways in what is now Germany were built in the 19th Century such that the network consisted of a series of triangles.

Two routes were provided between strategic points so that the military would always have an alternative route in case of invasion. The US railroad system was not designed with such strategic objectives in mind. The mainland US was never threatened, but now this is a distinct possibility. The loss of a key bridge or tunnel here or there could cause great havoc to the US economy, as there are now fewer alternative routes than there were in the 1950's. Some of the alternatives might be restored or new ones created.

One may conclude that the basic US railroad network is a product of 19th Century engineering with no thought to redundancy that may be needed to cope with natural or terrorist activity or even routine maintenance or reconstruction. It is also circuitous compared to the Interstate Highway System and thereby not as competitive as it might be. This all indicates that it probably is an impediment to economic growth of the US rather than a lubricant for economic growth.

What then should be done?

It is proposed to create a National System of Interstate and Defense Railroads that would be multi-tracked, grade separated and suitable for competitive speeds. This would mean 75 mph for freight trains and 110 or 125 mph for passenger trains. A combination of tax credits and direct grants would be needed since some strategic investments desired for passenger train use might not be needed or wanted by freight railroads. Those improvements would be provided by grants, and such grants would consist of federal and non-federal shares. Multi-track means at least double tracked, and where combined passenger/freight traffic requires, three or even four tracks.

Heavy Haul Routes Needed. This is not to ignore the need for separate heavy haul routes that would be (and are) designed for 25 – 40 mph. It is recognized that such routes being capable of handling 15,000 to 25,000 ton coal or other heavy trains are needed. Energy needed increases with the square of the speed such that it requires four times the energy to move a train at 80 mph as at 40 mph. The railroad companies have been relatively successful in generating internal capital for such investments in heavy haul routes. It is desired to keep such traffic off high speed freight/passenger routes to avoid delays to fast trains. It may be desirable to have separate heavy haul tracks alongside fast freight/passenger tracks where both share the same corridor as exist on portions of the UP and BNSF. For purposes of this paper, it will be assumed that the railroad companies can continue to fund improvements for heavy haul traffic from their own resources. Exceptional needs might be handled on a case by case application for government aid.

A Program to Create a National System of Interstate and Defense RAILROADS.

A number of steps would be needed to approach, identify and quantify needs. This is not something that can be done by a few papers such as this in which

small numbers of man hours have been committed. A major research and planning effort will be needed. This might be done under the auspices of the Transportation Research Board with funding from USDOT.

Assumptions: Some key assumptions must be made upon which planning would be based. Among them would be the following:

A. Population of the US would continue to increase as forecast by the Bureau of the Census. Legal immigration would continue at the same rate.
B. The US economy would continue to expand at the same overall rate. Shifts within the economy would be recognized to the extent data become available.
C. Petroleum would continue to become scarcer with consequent increases in price. Unusual or anticipated changes in the supply/price would be included to the extent data permit.
D. Efforts to control degradation of the environment will increase.
E. Population distribution will continue to flow to metropolitan areas.
F. Others as may be developed during initial research.

A Proposed Research Program to Develop a National System of Interstate and Defense Railroads.

Some factors that have come to mind and/or have been suggested by some of my many email friends and correspondents follow. They are in a more or less sequential (chronological) order.

A. **Identify corridors**, and quantify traffic to the extent data permits as to what growth would be expected over the 50 year period under study for the Commission.
B. **Identify where rights of way for double or multiple track remain**. Determine when and if restoration would be desirable.
C. **Identify abandoned rights of way** that exist (more or less intact). Determine which ones could be rebuilt for modern use. Rank them in order of probable need. Establish a list of rights of way to be purchased and preserved for future rail use. This use might be freight railroad, intercity and/or commuter passenger railroad or rail transit in urban-suburban areas. Funding for purchase and preservation of such rights of way should be the first item to be implemented under the proposed program.

   Existing rights of way must be preserved especially in urban areas before they are disposed of to developers or other non-rail use. (Underlining added for emphasis.)

D. **Identify where railroads are essential for defense.** It is established that railroads are the most efficient way to move an armored division. There are other areas where railroads have been used effectively.

E. **Identify new areas where railroads might be useful** or critical in combating domestic terrorism.

F. **Identify areas/places where railroads should be protected** from terrorism access. Devise means for such protection.

G. **Identify corridors suitable for electrification** in chronological sequence. Given that petroleum will become more expensive and scarcer, it follows that electrification of major corridors will be in the national interest and will contribute to the railroad system's efficiency. This may well be a major contribution to reducing our nation's dependency on petroleum and allow petroleum's use where there is no alternative, such as for aviation. A major shift of freight and passengers from highway to railroad should be an objective to reduce domestic use of petroleum based fuels. No technological development would be needed. Electric locomotives would be similar to diesel-electric locomotives "under the floor" with similar traction motors. "Above the floor" devices such as transformers, rectifiers and inverters are all within the state of the art. Transmission and distribution systems have been developed in Europe and Japan and could be adapted to American conditions.

H. **Identify where increased electrical generating capacity would be needed**. Whether electrification would be nuclear or coal powered would be decided by research in that area and local policy. It may vary from one place to another in the US. Where convenient to waterpower or coal, those sources would be used. Nuclear power might be used widely provided that certain objections to it can be overcome.

I. **Determine where by-pass freight routes are desired** around urban areas. These are desired for carriage of hazardous materials and as ways around urban railroad congestion. In recent months, carriage of hazardous material through Washington DC has stirred up opposition by local residents and their political representatives. There are few options other than very circuitous routes that would bring the shipments through other communities that would object.

Input from local planning agencies will be desired but oversight by a steering committee appears to be desirable and necessary because many planners have not had academic training or experience in evaluating what railroad rights of way might be used for. They might want a hiking trail on what might be a strategic interstate freight corridor.

1. A nationwide survey is needed to determine where such by-passes are desired. The survey would include identification of existing abandoned or underused alignments that could be incorporated.

2. Costs and benefits from such by-passes should be identified and quantified. They could be strategic redundant routes.

J. **Create a "Greater Amtrak" route structure** and overlay it on a proposed fast freight network. Determine where multiple track would be needed,

multiple meaning three or more tracks. It used to exist, and roadbeds remain in most places, primarily New York – Cleveland on the ex New York Central and New York – Philadelphia – Pittsburgh on the ex Pennsylvania Railroad. Short segments did exist in other places such as on the Pittsburgh & Lake Erie between Pittsburgh and Youngstown where the heavy industry that was served has disappeared. Some multi-track routes may not be needed to be replaced, but new multi-track may be needed where none existed, such as has occurred for the Powder River Coal Field in Wyoming. Other new needs will occur for multiple track.

The sum of all the above efforts will be a very large research effort. It might be separated by task into contracts, or it might be awarded to an agency that could manage and coordinate the entire effort, subcontracting out tasks. The latter appears desirable because of the huge depth and breadth of scope and need to coordinate tasks.

K. Financing of such a National System of Railroads will be a major and continuous undertaking. In the recent past, TRB and USDOT/FHWA have sponsored meetings/seminars/symposia on the subject of innovative financing of transportation projects. There is no need for duplication. Rather, research toward financing the National System of Interstate and Defense Railroads should build upon work already done. This new research effort will be separate from but in parallel with research to define and quantify the proposed system.

> **Win/Win:** A key point to be kept in mind is that financing must be acceptable to all parties to any agreement to improve the national railroad system. With win/win in mind, it is suggested that improvements funded by the public sector be owned by a public entity and leased to the railroads so that the improvements should not be subject real estate taxes.

Some assumptions here may be in order, but they should be confirmed before work begins.

1. Whatever is proposed must be acceptable to the freight railroads that own nearly all the national railroad system. It must be a win/win combination that benefits the owning railroads as well as public sector needs.
2. Tax credits as proposed by the Association of American Railroads may well be a primary source of capital funds from the private sector. It is suggested that a basic percentage be established for all railroad infrastructure, primarily heavy haul routes, and that a somewhat higher percentage be allowed for multi-tracked lines handling passenger trains operated by public entities or on behalf of public entities.
3. For very large projects (which would be common) having very long pay off periods, precedent of the Alameda Corridor might be followed. A public entity would be owner, and would issue long term bonds to fund the project. Using

railroad(s) would pay a fee (a toll) per car, per ton, per ton-mile or whatever logically fits the project for the use of it. If such fees would not cover interest and amortization, public financing of the balance might be used, covered by a port authority or whatever the owning agency might be assuming it has cash flow from other sources.

1. Multi-purpose corridors might be established, especially in urban areas, in which a corridor might include separate freight and passenger railroad tracks along with fiber optic cable, electric power lines (especially if the railroad is or is to be electrified), water or other pipe lines, and perhaps truck-only roads. Fees from all users would be applied to bond issues. If forecast revenues were found insufficient, direct grants from relevant public agencies might be sought. The nature of each project would guide choices of funding. It is likely that funding will be project specific, although similar projects might well employ similar funding methods. Innovative, new, financing methods should be an objective of research.

L. <u>Legislation</u> at the federal and state levels will be needed to implement the proposed National System of Interstate and Defense Railroads. It would be the objective of a final research task to draft such proposed legislation for review by representative staff of relevant legislative bodies.

The above program is ambitious and will require much investment over a period of years. It need not be done all at once. Much of it is already in place and needs only improvement. Restoration of double track where rights of way exist could be an early development. Some bottlenecks are already apparent, and are the topic of another panel discussion. Elimination of such bottlenecks would be a natural inclusion in the proposed National System. Identification of defense needs is the subject of still another panel that will be fit into the National System.

<u>Task 0: A preliminary first task will be to estimate the funds and time needed to undertake the research outlined above.</u> A source of such funds must then be identified and found. Some money or services in kind might come from the railroad industry itself, as a key beneficiary and would also give them seats on any steering committee. Much must come from the public sector, most likely USDOT through its FRA, FHWA or other appropriate agency. An independent research organization would manage the effort, and this would logically be the Transportation Research Board which already has much experience in some of the proposed tasks. Tasks would be advertised and awarded to research foundations or consultants in the usual manner. This effort might take up to three years and might cost on the order of $3 to $5 million. Output would be a conceptual engineering type of result defining a National System of Interstate and Defense Railroads and putting tasks in prioritized order for implementation.

A sense of urgency is needed to create a National System that will reduce the nation's dependence upon imported petroleum for its basic interstate

transportation needs. The world's petroleum supply is being used up at an ever increasing rate, and many of its sources are in insecure areas. President Bush's state of the union message January 23rd, 2007 included an objective of greatly reducing the US's consumption of petroleum for surface transportation purposes. The proposed electrified railroad system would contribute to this objective in a big way. Freight railroads are one of the larger users of diesel fuel, much of which must be consumed on main lines which are most conducive to electrification. It has been estimated that railroads consume about six percent of the nation's consumption of petroleum. Railroads are the only interstate mode that is suitable for electrification using existing technology. We should save petroleum for uses in which there is no readily apparent alternative such as aviation.

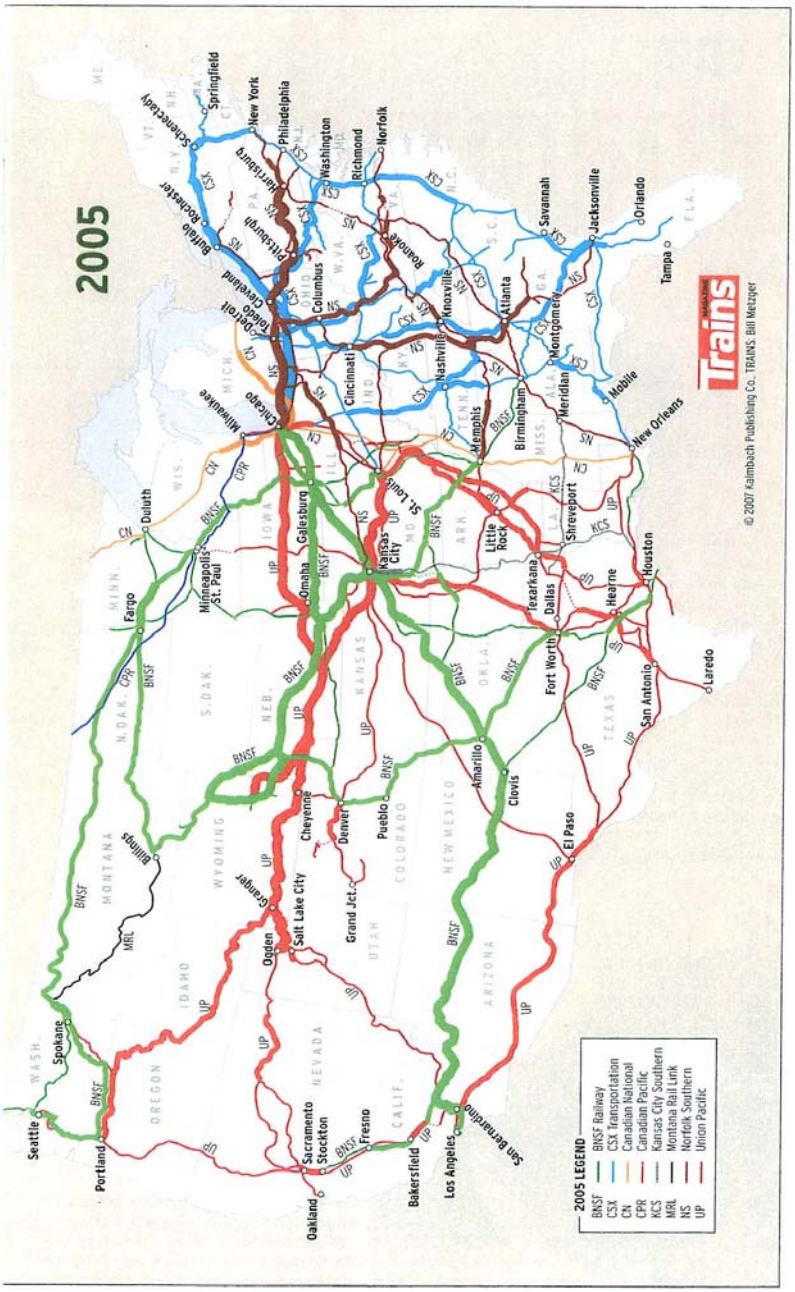
If we don't get started promptly, we will regret it in the not too distant future. The future is approaching rapidly. It is recommended that the research proposed above be authorized and funded at the earliest opportunity. It took fifty years to build the Interstate and Defense Highway System as defined in 1956 legislation and amended from time to time. The railroad system envisaged would take approximately the same length of time.

An improved railroad system will benefit the economy.
An electrified railroad system would reduce petroleum use and will also contribute to faster and more efficient operation.
An unimproved railroad system will be a hindrance to economic growth.

If the United States is to continue its role as the world's leading economy, it must have a 21st Century System of Interstate and Defense Railroads.

The time to begin is now!

Appendices



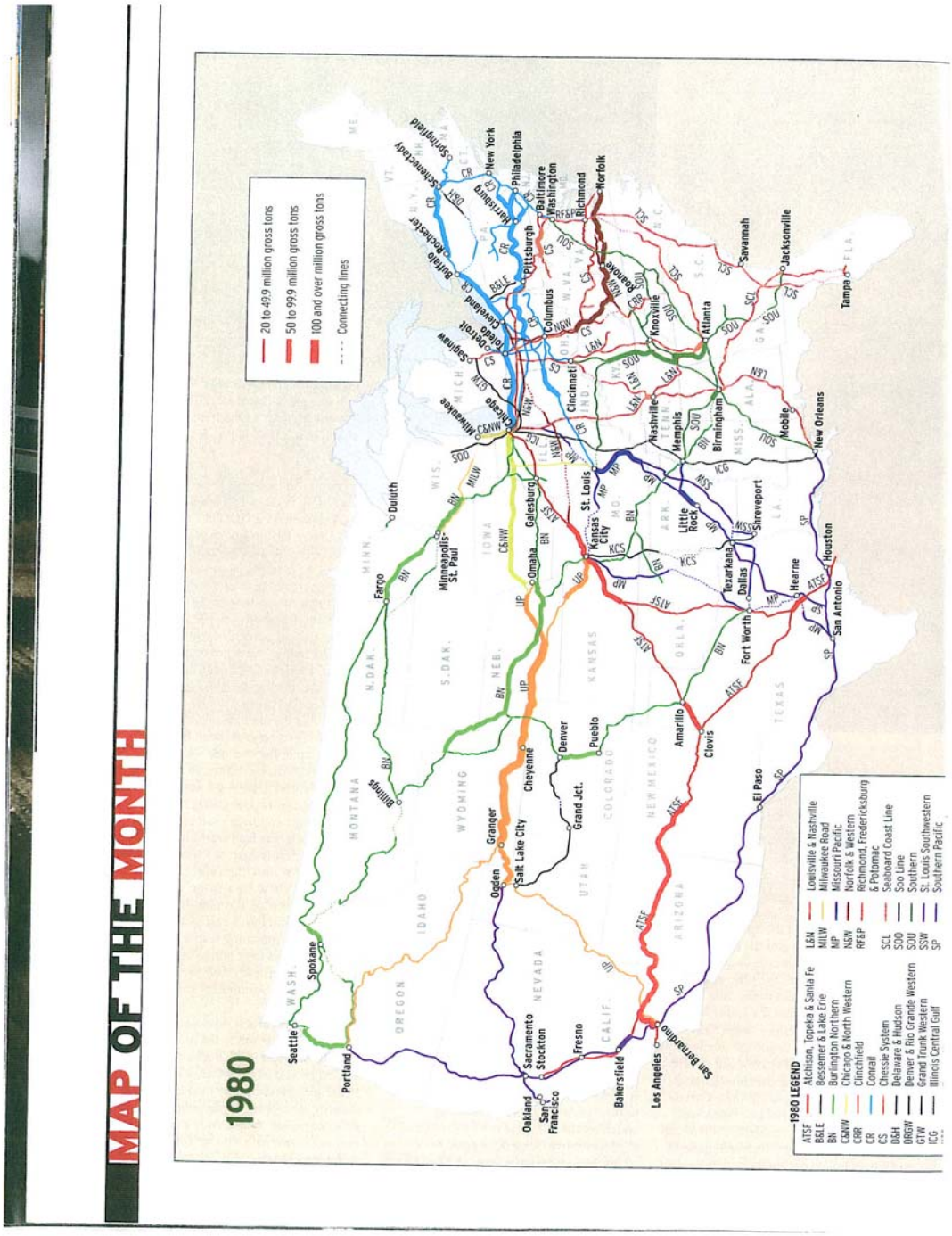
Mainline tonnage, 1980 / 2005

Twenty-five years separate these two maps showing the busiest freight railroad lines in the United States.

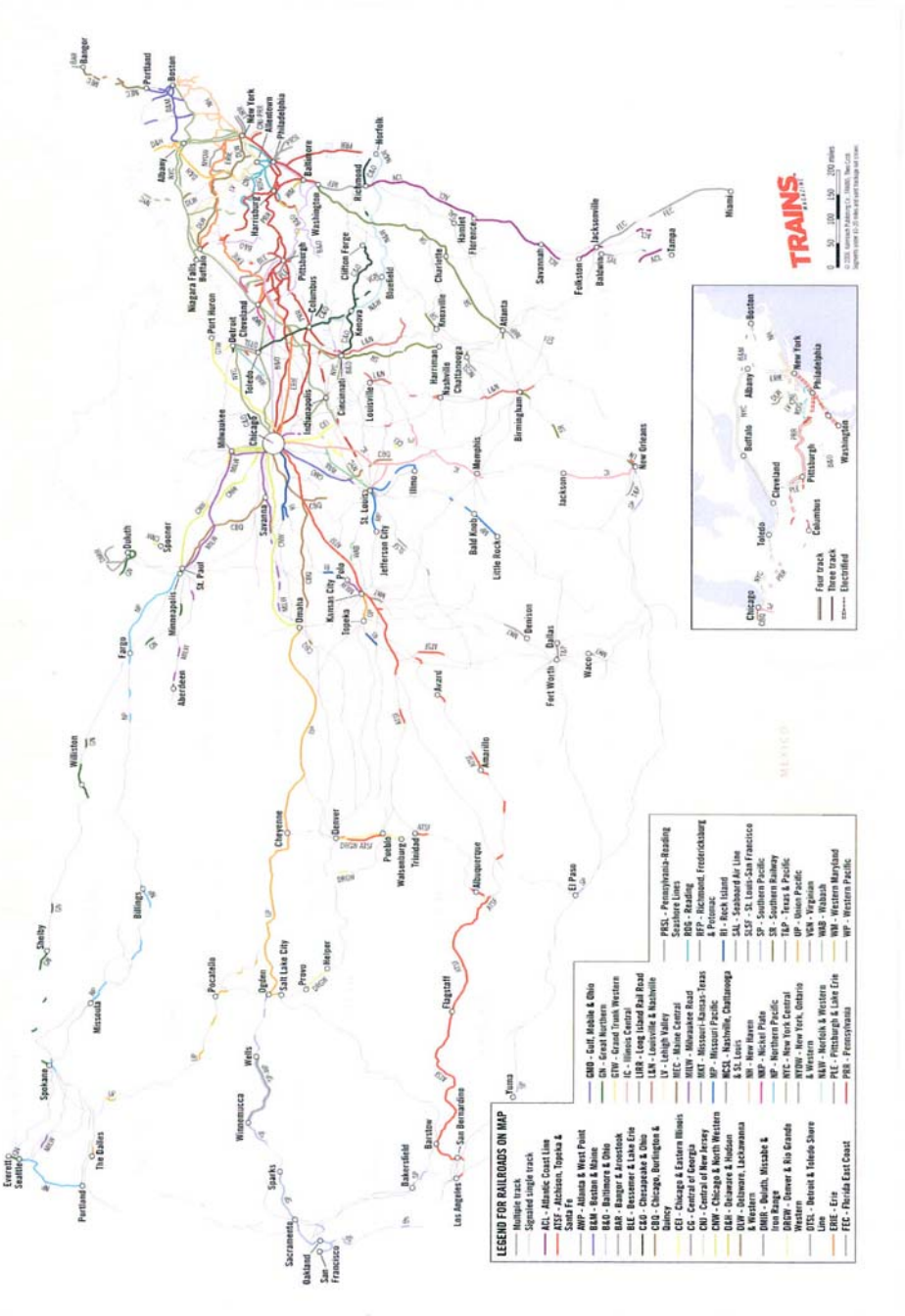
The 1980 map depicts American railroads at the end of regulation — the Staggers Rail Act of 1980 was signed into law Oct. 14. With merger provisions streamlined, railroads combined into successively larger systems, cementing their claim on key routes and markets. Meanwhile, ratemaking freedom enabled railroads to begin earning better rates of return, which in turn prompted investments in physical plant and equipment to meet surging traffic levels, notably low-sulfur coal from Wyoming's Powder River Basin and imported goods from Asia arriving at coastal port cities.

Perhaps most remarkable is that American railroads are carrying nearly twice as much today as they did 25 years ago: revenue ton-miles have skyrocketed from 918 billion in 1980 to 1.696 trillion in 2005. Two routes have seen a three-fold increase in tonnage: Union Pacific's Overland Route and BNSF's Transcon. — *Curtis W. Richards*

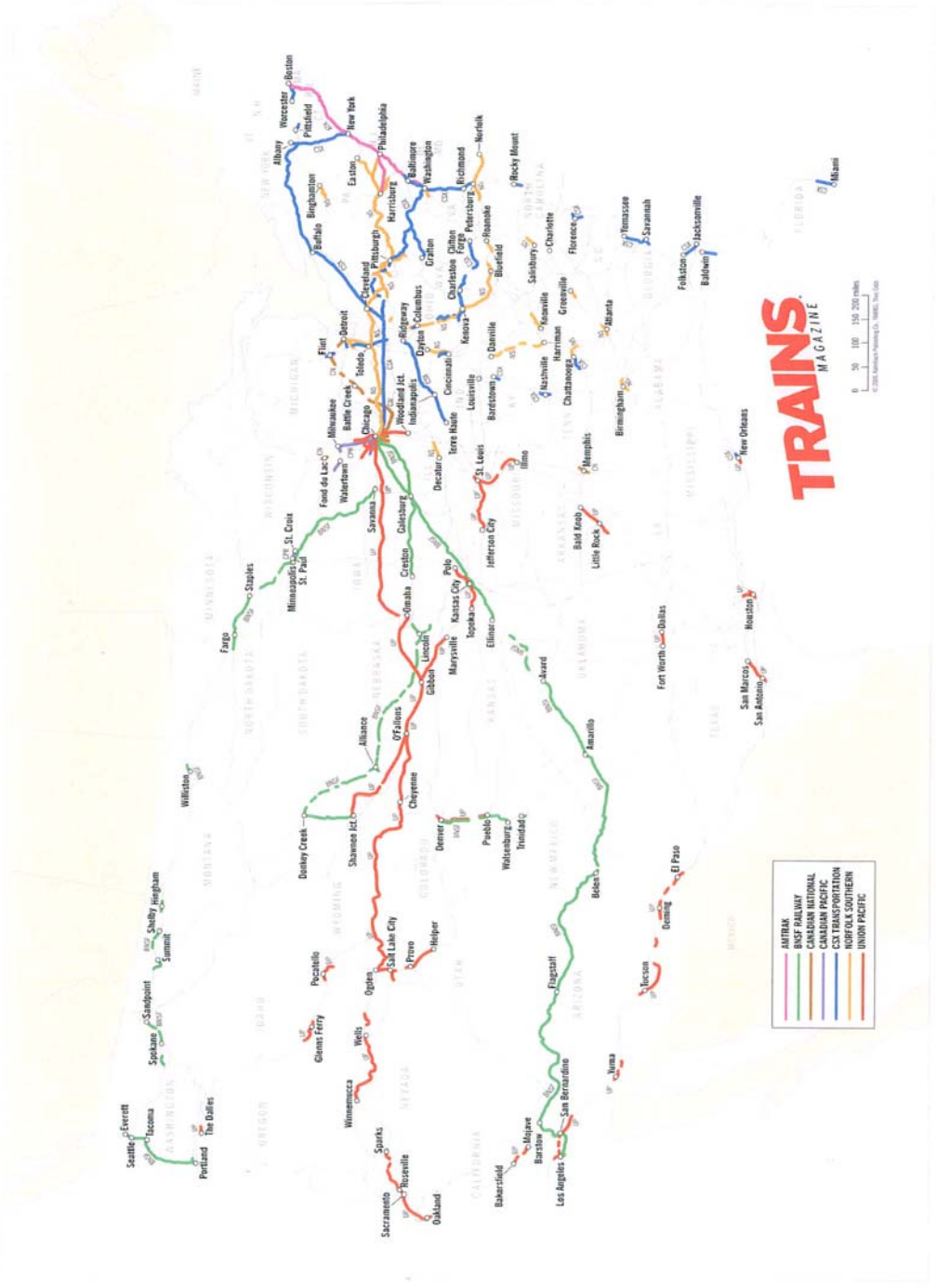
Tonnage in 2005 is shown above. BNSF (ATSF Trans-con) and UPRR main line are hauling about triple the tonnage of 1980. UP is multi-tracked (3 or 4) over some of that distance used to haul Powder River Wyoming low sulfur coal. Import/export traffic to/from Pacific ports is also significant in the far west.



Tonnage on the pre-merger railroads in 1980 is shown above. Several routes were quite good, but later events caused freight traffic to rise dramatically, especially in the west.



Double and multi-track lines were common up through 1960 and into 1980. Note that the east coast had double track over nearly all the New York – Miami and Richmond-Atlanta routes. New York – Cleveland via NYC was 4 tracked as was New York – Pittsburgh via PRR. Many other main lines were double tracked. Some routes such as the Erie-Lackawanna were abandoned almost entirely. Restoration of some double track ought to be relatively simple and inexpensive.



Double track in 2005 was relatively scarce. Note that the entire southeast quadrant of the US is almost all single track. Note that the east coast, where I-95 is one of the busiest highways in the nation, is paralleled by single track railroads. Only a few routes having very heavy freight traffic enjoy double track. This is where we are now. We need to Go Back to the Future with more track.

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