STB FINANCE DOCKET NO. 33697

NATIONAL RAILROAD PASSENGER CORPORATION
— PETITION FOR DECLARATORY ORDER —
WEIGHT OF RAIL

Decided October 21, 1999

The Board sets terms and conditions under which the National Railroad Passenger Corporation may operate at speeds of up to 79 miles per hour over certain rail facilities owned by the Guilford Rail System in New England.

BY THE BOARD:

In a decision served February 16, 1999, in response to a petition filed by the National Railroad Passenger Corporation (Amtrak), the Board instituted this declaratory order proceeding. Amtrak sought to resolve a dispute between itself and the Guilford Rail System (Guilford)[1] over the appropriate weight of continuous welded rail that must be installed on a specified line in order to ensure that Amtrak will be able to operate its trains safely at speeds of up to 79 miles per hour. Because the Federal Railroad Administration (FRA) has expertise on safety issues such as this one, the Board requested that agency to participate in this proceeding and assist us. Having reviewed the pleadings[2] and the FRA's analysis, we find that Amtrak may operate at speeds up to 79 miles per hour over 115-pound rail, provided that the line is rehabilitated to and maintained at the levels indicated in the FRA's analysis.

PRELIMINARY MATTERS

On April 2, 1999, the National Association of Railroad Passengers (NARP) filed a petition for leave to intervene. NARP is a not-for-profit entity that promotes the improvement and expansion of intercity rail passenger service. NARP maintains that Amtrak's contemplated service must offer reasonably

[1] The Guilford Rail System is comprised of Springfield Terminal Railway Company, the Portland Terminal Company, the Boston and Maine Corporation, and the Maine Central Railroad Company.

[2] A variety of pleadings were filed in this proceeding through August 9, 1999.

competitive transit times in order to be successful and supports Amtrak's position that 79 miles-per-hour operations on 115-pound rail is safe and appropriate. NARP's participation will not broaden the issues or delay disposition of this proceeding. Accordingly, the petitioner will be granted leave to intervene, and its position will be considered.

On April 14, 1999, Amtrak submitted a copy of a letter that Senator Olympia J. Snowe of Maine wrote to Chairman Morgan on April 2, 1999. The letter supports Amtrak's position in this matter and Amtrak requests that it be filed in this case's docket. Amtrak has served Guilford with a copy of the request and the letter. Guilford did not object. The request will be granted.

On June 2, 1999, Amtrak filed a motion to strike Guilford's reply filed on May 27, 1999. The reply addresses the FRA's analysis and a statement of erratum Amtrak had filed. Amtrak assails the Guilford reply as an impermissible pleading and contests its contents. Although the Board's procedural schedule did not contemplate pleadings addressing the FRA's analysis, the motion will be denied. Amtrak's motion extensively addresses the content of the pleading it assails, and the acceptance and consideration of all the pleadings filed in this matter will assist us in rendering a fully informed decision.

BACKGROUND

In *National R.R. Passenger Corp. — Applic. — 49 U.S.C. 24308(a)*, 3 S.T.B. 157 (1998) (*the Compensation Decision*), the Board prescribed the terms and compensation for Amtrak's access to the facilities necessary to operate passenger rail service over Guilford lines between Plaistow, NH, and Portland, ME (hereafter, the Plaistow-Portland Line), in order to reintroduce passenger rail service between Boston, MA, and Portland. Amtrak proposed to operate the Boston-to-Portland service pursuant to an agreement with the Northern New England Passenger Rail Authority (NNEPRA). In our decision, we set basic parameters for compensation, urged the parties to negotiate specific terms, and stated that we would resolve any future disputes about the terms and conditions of Amtrak's access.

On or about July 10, 1998, NNEPRA and Guilford entered into a "Rehabilitation Agreement" and Amtrak and Guilford entered into a "Terms and Conditions Agreement." The Rehabilitation Agreement contains a "Scope of Work" provision for rehabilitating the involved line to permit Amtrak trains to operate at speeds of up to 60 miles per hour (FRA Class 3). The Scope of Work calls for the installation of 115-pound continuous welded rail to replace the 112-pound jointed rail currently on the line. Amtrak and NNEPRA want to amend

the Rehabilitation Agreement and the Terms and Conditions to provide for the operation of Amtrak trains at speeds of up to 79 miles per hour (FRA Class 4).

Amtrak, NNEPRA, and Guilford have agreed upon certain changes to the Scope of Work, but they have been unable to reach an agreement as to the appropriate weight of rail required for the "safe, consistent, and continuous" operation of Amtrak trains at speeds of up to 79 miles per hour. Amtrak and NNEPRA assert that 115-pound rail is adequate. Guilford claims that 132-pound rail is required. Amtrak and NNEPRA state that, due to budgetary constraints, 115-pound rail, not 132-pound rail, will be installed on the subject line regardless of the Board's findings in this proceeding. Accordingly, the effect of the Board's decision will be to determine whether rail passenger operations over the line may be conducted at speeds of up to 79 miles per hour or must be limited to 60 miles per hour.[3]

The parties and the FRA agree that the engineering standards prescribed by the American Railway Engineering and Maintenance-of-Way Association (AREMA)[4] should govern the determination to be made in this proceeding. To ascertain whether 115-pound rail is adequate for safe operation at speeds of up to 79 miles per hour, AREMA establishes two criteria that must be met. First, the maximum stresses in the rail base should not exceed 25,000 pounds per square inch (psi). This is a strength criterion. Its purpose is to prevent rail from permanently deforming due to excessive "bending moments" and to reduce the possibility of rail breaks. Second, the largest vertical deflection of the rail (the distance the rail is depressed when a wheel runs over it) must not exceed 0.25 inches. This criterion is a maintenance criterion. Its purpose is to assure that the repetitive rail deflections caused by trains passing over the track do not excessively disturb the underlying roadway ballast and cause accelerated line and surface deterioration.

The AREMA track stress and deflection limits are determined using mathematical formulas that are uncontested. However, the parties disagree in certain respects over the value of one component of the formulas, the "elastic modulus of rail support," also known as the track modulus, which is referenced

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[3] Under the parties' proposed amended Terms and Conditions, the subject line would be maintained to permit Amtrak to operate over described segments at specified speeds ranging from 20 to 79 miles per hour. Operations over certain segments would be limited to 65, 70, 75, or 79 miles per hour. The record does not reveal how the parties determined the specified speeds. Our decision here should not be construed as approving operations at speeds exceeding 60 miles per hour except under the conditions set forth in our discussion and findings.

[4] Formerly the American Railway Engineering Association.

in the AREMA manual by the letter "*k*".[5] This is a measure of the vertical stiffness of the track below the rail base. The stiffer the track structure below the rail base (*i.e.*, the higher the *k* value), the less the rail bends under the weight of a train moving over the track.

POSITIONS OF THE PARTIES

Arnold D. Kerr, a professor of civil engineering at the University of Delaware, presents analysis on behalf of Amtrak. Dr. Kerr bases his analysis on the AREMA engineering standards. Dr. Kerr states that, as the line over which Amtrak is to operate will be rehabilitated before operations begin, it is meaningless to determine the *k* value of the subject track in its current condition. Therefore, in his analysis, Dr. Kerr estimates a *k* value that corresponds to that of well-maintained wood-tie track. As guidance for his estimate, Dr. Kerr first refers to a 1982 book, "Railroad Engineering," by W. W. Hay, which lists a *k* value as 2,900 to 3,000 lb/in² for well-maintained wood-tie track resting on 32 inches of ballast.[6] As additional guidance, Dr. Kerr refers to tests funded through an FRA grant to the University of Delaware that he personally conducted on wood-tie track near Chester Station, PA, in 1995. Using a loaded car pushed by a locomotive over track assertedly having characteristics similar to those that the subject track would have after rehabilitation for 79 mile-per-hour operation, Dr. Kerr determined that *k* values ranged from 2,750 to 3,000 lb/in². Therefore, in determining whether the AREMA bending moment and deflection criteria are met by 115-pound rail, Dr. Kerr uses a *k* value of 2,750 lb/in² for well-maintained wood-tie track.

Using this *k* value, Dr. Kerr's calculations, as modified in errata filed by Amtrak, show that: (1) the maximum stresses in the rail base will be 24,497 psi, which does not exceed the allowable value of 25,000 psi, and (2) the maximum rail deflection will be 0.249 inches, which does not exceed the permissible value of 0.25 inches. Dr. Kerr thus concludes that 115-pound rail will satisfy the AREMA criteria for the planned train speeds of up to 79 miles per hour, provided that a track modulus value equal to or greater than 2,750 lb/in² is maintained.

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[5] Track modulus is defined in the AREMA Manual as "load (in pounds) that causes a one-inch vertical rail deflection per lineal inch of track." Hence, the units of *k* are lb/in/in or lb/in² (read as "inches square," not to be confused with stress values, written as "psi" or pounds per square inch).

[6] The Hay book also specifically calculates two *k* values of 2,538 lb/in² and 3,421 lb/in².

John J. Cunningham, Amtrak's Chief Engineer, Policy, Planning & Standards, and a member of the Board of Directors of AREMA, concurs with Dr. Kerr's conclusions. Mr. Cunningham also relies on Amtrak's "real world experience" to support his and Dr. Kerr's conclusion that 79 miles-per-hour operations can be conducted over this line. During the early 1980s, Amtrak installed substantial quantities of 112-pound or 115-pound continuous welded rail in rehabilitating its Springfield Line running between New Haven, CT, and Springfield, MA. Amtrak also installed similar rail on its Michigan Line running between Kalamazoo, MI, and Porter, IN. The rail installed on the Michigan Line was new (as will be the rail installed on the pertinent portions of the Plaistow-Portland Line), and the rail installed on the Springfield Line was "fit rail," which is rail that previously had been used on another line. Mr. Cunningham indicates that, for approximately 15 years, Amtrak has operated six passenger trains a day over the Michigan Line and more than a dozen passenger trains a day over the Springfield Line at speeds of 79/80 miles per hour. He asserts that the 112-pound and 115-pound rail on both lines has performed very well and that he cannot recall a single derailment on either line attributable to rail conditions.

Mr. Cunningham adds that Amtrak operates at speeds of 79 miles per hour or more over many miles of other railroads' lines that are comprised of 112- or 115-pound rail. He refers to 60 miles of 115-pound rail on The Burlington Northern and Santa Fe Railway Company's San Diegan Route between Fullerton and San Diego, CA, and 68 miles of 112- and 115-pound rail on a CSX Transportation line between Auburndale and Miami, FL. The witness concludes that the use of 115-pound rail on the subject route to support Amtrak speeds of up to 79 miles per hour would not be out of the ordinary but, rather, would be consistent with Amtrak's operating and track construction practices as well as the practices of the Class I railroads over whose lines Amtrak operates.[7]

Dr. Allan M. Zarembski, President of ZETA-TECH Associates, Inc., presents analysis on behalf of Guilford. Dr. Zarembski examined the relative rail bending strength of 115-pound and 132-pound rail sections in accordance with

[7] Amtrak also has submitted statements from of E. S. Bagley, Jr., President of Amtrak's Northeast Corridor Strategic Business Unit, and Michael J. Murray, Executive Director of NNEPRA. Messrs. Bagley and Murray discuss the business concerns underlying Amtrak's desire to operate trains at up to 79 miles per hour over the subject line. Although we have reviewed the statements, we will not consider them here, as our decision must be based on evidence relating to operational safety.

AREMA standards.[8] Dr. Zarembski varied parameters that vary in the field; specifically, he considered rail bending stresses at k values between 1,000 and 3,000 lb/in² for locomotive wheel diameters of 40 inches (new wheel diameters), 38.5 inches, and 37 inches (the shortest permissible diameter).[9]

Dr. Zarembski's analysis revealed that the bending stress on 115-pound rail will exceed the allowable value of 25,000 psi when wheel diameter is 37 inches and k value is 2,150 lb/in² or less, when wheel diameter is 38.5 inches and k value is 2,000 lb/in² or less, and when wheel diameter is 40 inches and k value is 1,750 lb/in² or less. For 132-pound rail, k values would have to be below 1,000 lb/in² at each wheel diameter before bending stress limits would be exceeded. Dr. Zarembski thus concludes that 115-pound rail does not meet applicable AREMA criteria for allowable bending stress for track with modulus values of less than approximately 2,000 lb/in². In contrast, he asserts, 132-pound rail will meet AREMA's bending stress criteria.

Stephen F. Nevero, Guilford's Vice President - Engineering, also presents evidence on behalf of Guilford. Mr. Nevero analyzed rail stresses that would be applied to 115- and 132-pound rail when wheel diameters are 37 inches, 38 inches, 39 inches, and 40 inches. His findings are nearly identical to those of Dr. Zarembski. Mr. Nevero concludes that, considering varying real world conditions that will affect the k value, track composed of 115-pound rail will not meet AREMA engineering design standards. On the other hand, he asserts, 132-pound rail is adequate to sustain 79 mile-per-hour operations under all foreseeable circumstances affecting k values, even at their low end parameters of 1,000 lb/in².

In reply to Guilford's presentation, Dr. Kerr argues that AREMA track design recommendations contemplate track structures that are designed to provide adequate support, which would then be maintained during revenue service.[10] Dr. Kerr goes on to point out that it would be uneconomic to design an inadequate track structure with a modulus of 1,000 lb/in² and then to try to make up for the inadequate structure by selecting heavier rail. According to Dr. Kerr, using heavier rail would do little to solve the problem of inadequate track structure; rather, the value of k is affected by the type and quality of the

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[8] As noted above, AREMA establishes two criteria that must be met. Guilford does not discuss the deflection criterion.

[9] According to AREMA, summertime measurements of k for ballasted wood-tie track will yield values from 1,000 lb/in² (more elastic) to 3,000 lb/in² (less elastic).

[10] Dr. Kerr adds that Dr. Zaremski and Mr. Nevero should not have assumed worn locomotive wheels in calculating rail bending stress. He states that AREMA took wear into consideration when it established the allowable stress standard of 25,000 psi.

ties, the quality, depth, and compaction of the ballast, and the nature of the subgrade. Here, Dr. Kerr concludes, the planned rehabilitation is sufficient to result in a track modulus of no less than 2,750 lb/in^2 and 115-pound rail should satisfy the AREMA recommendations.

Mr. Brett L. Rekola, Project Manager for the rehabilitation of the rail corridor over which Amtrak's Boston-Portland service will operate, also challenges Guilford's assumption that the line will have relatively poor track support following completion of the rehabilitation project. Specifically, Mr. Rekola asserts that both the design of the line and the physical characteristics of the area in which it is located are conducive to very good track support conditions. The line is a well-engineered main line that is generally flat with few curves and no significant grades; the ballast used on the line is trap rock, a material that provides excellent track support; much of the roadbed is built on fill, which permits the right-of-way to drain properly because the track is higher than the surrounding terrain; and favorable soil conditions give the line a good subgrade that provides good drainage and good support conditions even when wet. The rehabilitation program, he indicates, will increase ballast depth and will produce excellent tie and ballast conditions that will generally exceed AREMA recommendations.

Mr. Rekola recognizes that it is not currently possible to measure the track support conditions that will exist on the line after the rehabilitation project is completed. He opines, however, that it is clear that those conditions will be at the very high end of the spectrum for conventional wood-tie track and will be more than adequate for 79 mile-per-hour operations on 115-pound continuous welded rail. Guilford's Mr. Nevero, by contrast, contends that the rehabilitation will not upgrade the line sufficiently to produce k values high enough to support 79 miles per hour speeds over 115-pound track.

FRA Analysis. The FRA's technical presentation is based on the agency's interpretation of a study recently performed for it by Foster-Miller, Inc. The FRA also relies on the above-referenced study Dr. Kerr made in 1995.

Foster-Miller compared the performance of 115-pound and 132-pound rail in three areas: (1) rail bending, which embraces rail base stress and rail vertical

deflection,[11] (2) rail web crushing,[12] and (3) rail head fatigue. With regard to rail bending, which the FRA and the parties deem most significant, the contractor found as follows: The 25,000 psi stress limit for 115-pound rail will be exceeded when the track modulus is 2,120 lb/in^2 or less. The deflection limit of 0.25 inches will be exceeded with 115-pound rail when the *k* value is 2,690 lb/in^2 or less. Taking into account Dr. Kerr's most conservative test findings of 2,750 lb/in^2 for *k* value, the FRA finds no reason to consider 115-pound rail inadequate for this line in terms of rail base stress and rail vertical deflections.

Foster-Miller concluded that web crushing could occur, at least in theory. The FRA, however, rejects this conclusion in light of real world experience. It points out that web crushing is not a defect recognized in the *Rail Defect Manual* distributed by the Sperry Rail Service, a nationally known rail testing organization, and that rail web crushing is unknown to Amtrak track maintenance management, which constantly deals with 115-pound rail exposed to 79 miles-per-hour passenger traffic.

Finally, Foster-Miller says that it considered rail head fatigue from two aspects: crack initiation life and safe crack growth life. Crack initiation life determines the rate at which rail defects occur, while safe crack growth life relates to the time between crack development and complete fracture. The contractor determined that, once a fracture has formed, its growth rate is about 29% more rapid in 115-pound rail than in 132-pound rail. Estimating future traffic on the subject line, the FRA states that rail head defects should not appear for well over 3 years, and that it would take approximately 2 years for a fracture to progress to failure in 115-pound rail. Because current track safety standards require a test for internal rail defects once a year, the FRA concludes, rail head fatigue should not be a problem because defects will likely be found and removed from the line before failure occurs.

Based on the technical data developed by its contractor, Dr. Kerr's study, and historical considerations, the FRA indicates that 115-pound rail should be suitable for this route. The agency notes that 112-pound and 115-pound rail have successfully supported the movement of passenger trains at 79 miles per hour and higher for more than half a century, and it concludes that, if there had been a significant number of service failures during this period, the industry would have

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[11] The FRA, in its assessment of Foster-Miller's presentation, points out that vertical deflection, which Guilford does not address, is the dominant factor.

[12] Rail web crushing refers to the stress on the rail from the fact that the wheel load is greater on the inner side of the rail, thereby causing shear and compressive stresses in the neck area of the rail (the area under the rail head) as well as vertical compression.

discontinued use of such rail. The FRA also points out that new rail steel today is metallurgically cleaner than that produced 20 or more years ago. Therefore, the agency states, new rail installed today would be expected to perform even better than the older rail.

Guilford assails the FRA's conclusions, arguing that they are flawed because they are based on Dr. Kerr's assumption that the line's *k* value will be 2,750 lb/in², an assumption that Guilford views as unsupported and arbitrary given that the AREMA standard recognizes that *k* value can be measured as low as 1,000 lb/in². Guilford also argues that 115-pound rail should be disqualified because of susceptibility to web crushing damage, as recognized by the FRA's consultants.

In reply, Amtrak argues that AREMA does not set a "standard" or "conservative" *k* value of 1,000 lb/in,² but rather simply reports a wide range of measured values. As Dr. Kerr and the FRA have explained, it is the *k* value of the actual track being evaluated that is to be used in the AREMA equations. Amtrak also questions Guilford's comments regarding web crushing, given that web crushing is not mentioned in the AREMA criteria that the parties agreed should be the basis for deciding the rail weight issue, and that Guilford never mentioned web crushing in its pleading as a factor the Board should consider.

DISCUSSION AND CONCLUSIONS

The FRA, an agency with rail safety expertise to which we give substantial deference in matters such as those presented here, has concluded that 115-pound rail will support speeds of up to 79 miles per hour on the Plaistow-Portland Line, provided that a track modulus value equal to or greater than 2,750 lb/in²[13] is established and maintained. The FRA also takes the position that, as a well-maintained, wood-tie continuous welded rail track, the subject line should have *k* values generally ranging from 2,750 to 3,000 lb/in².

We have no reason to question the 2,750 lb/in² track modulus value that FRA has concluded is sufficient to support speeds of up to 79 miles per hour *using 115-pound rail.* And although it argues against the use of 115-pound rail, Guilford itself does not seriously challenge the value either.[14] Indeed, the analysis of Guilford's witnesses Zarembski and Nevero conclude that 115-pound

[13] With regard to rail bending, which the FRA and the parties deem most significant, the FRA's contractor found that 115-pound rail is sufficient when *k* value exceeds 2, 690 lb/in².

[14] Guilford argues that the margins in meeting AREMA standards are too narrow; but in our view, if the standards are met, the margins are not relevant.

rail can meet applicable AREMA criteria for allowable bending stress when track modulus values are between 1,750 and 2,150 lb/in^2, depending on wheel wear.[15]

Guilford's principal challenge is to the assumption that tests on the subject line will in fact yield k values equal to or greater than those that Dr. Kerr found at Chester Station, PA, or that W. W. Hay found in tests on track resting on 32 inches of ballast. On this issue, Guilford may have a point. We do not question Dr. Kerr's findings as to the k value found at Chester Station, and Mr. Cunningham's statements regarding Amtrak's experience in operating over 112- and 115-pound rail corroborate the FRA's conclusion that 115-pound rail will be adequate if the track support is sufficiently built up. Indeed, on the basis of the information supplied by Amtrak's witnesses, and the FRA's contractor, we have no reason to believe that the rehabilitation can not be completed in a way that will produce k values that will permit 79 miles-per-hour speeds. But as all of the parties and their witnesses appear to recognize, until the project is completed, and the k values for the rehabilitated line are established, there will be no way to know the precise maximum speeds at which the service can be safely operated.

Thus, Amtrak may operate the service at issue at speeds of up to 79 miles per hour over 115-pound rail, provided that the line is rehabilitated to and maintained at a level that produces a k value of not less than 2,750 lb/in^2, and that the service otherwise meets FRA standards for operations of rail passenger trains at speeds of up to 79 miles per hour.

Finally, the parties disagree as to the issue of maintenance-of-way cost payments. Guilford argues that, in the event the Board determines that Amtrak may operate passenger trains at speeds of up to 79 miles per hour, we should supplement our findings in *the Compensation Decision* with a requirement that Amtrak pay an increased amount towards maintenance. It recommends a figure of $2,940 per mile per year to reflect the increased maintenance burden, rather than the figure of $2,050 per mile per year that the Board adopted on an interim basis in *the Compensation Decision*. Amtrak, in response, asks us not to change the prescribed maintenance-of-way payments. We will maintain the $2,050 per mile per year figure for the time being, but will revisit the matter later, if necessary, after rehabilitation is complete and operations have begun. Our prior findings were based on costs associated with maintaining track to permit FRA Class 3 operations. Although we agree with Guilford that any increased costs for

[15] Guilford argues that use of 115-pound rail could produce a risk of web crushing, but, as the FRA finds, web crushing is a theoretical concern that is not a recognized defect and that has not been a problem in the real world.

maintaining track to permit FRA Class 4 operations should be borne by Amtrak, we cannot attempt to arrive at an appropriate figure here, before anyone knows what the costs might be. Thus, we simply will reiterate what we said in *the Compensation Decision*: the parties should negotiate a payment after operations have been conducted and, if negotiations prove fruitless, the parties may petition the Board for assistance in resolving any dispute. In this regard, however, the parties are encouraged to resolve such matters privately in accordance with the Board's focus on promoting private sector resolution where possible.

This action will not significantly affect either the quality of the human environment or the conservation of energy resources.

We find:

The installation of 115-pound, continuous welded rail on the Plaistow-Portland Line will be adequate for safe operation of trains at speeds of up to 79 miles per hour, under the condition that the line is rehabilitated and maintained to a standard that produces track modulus (k) values of not less than 2,750 lb/in^2 and that otherwise satisfies the FRA's track safety standards for rail passenger train operations up to such speeds.

It is ordered:

1. The National Association of Railroad Passengers is granted leave to intervene in this proceeding.
2. Amtrak's motion to strike is denied.
3. This proceeding is discontinued.
4. This decision is effective on October 22, 1999.

By the Board, Chairman Morgan, Vice Chairman Clyburn, and Commissioner Burkes.