CHAPTER 2: OPERATING STANDARDS, PRACTICES, AND ISSUES ASSOCIATED WITH JOINT OPERATIONS

2.1 OVERVIEW

Developing an understanding of the critical issues vital to successful joint operation of railroads and rail transit requires an appreciation of the physics and interrelationships of mass and motion, and the dimensional characteristics of the rolling stock and the physical plant. A safe, dependable operation must consider acceleration and deceleration, and accommodate practicalities such as station/terminal stops, switching, overtakes, and potential service delays. Traversing the physical plant requires the support of systems and personnel to monitor and control this movement. All of these factors are ultimately incorporated in a set of operating standards and procedures.

Reconciliation of relative differences in the dynamic performance of freight and passenger equipment operating on shared track in joint service involves:

- A brief perspective on the evolution of operating philosophy
- Operational dynamics of a variety of equipment
- Operating policies, standards, and procedures
- Operations planning and practice
- Management and personnel resource considerations in operations
- Scheduling strategy
- Physical plant (covered in chapter 3)

Chapter 2 investigates the feasibility of adapting standard railroad or transit practices, as appropriate, in a joint use environment so that the physical plant can be used safely and at optimum capacity. It will identify or propose operational modifications essential to ensuring that current safety is not compromised but in fact enhanced. In doing so, risk factors and mitigation associated with this topic are addressed. This chapter addresses these issues by noting characteristics of various operations and services and the benefits of joint operations. Two caveats inform this discussion:

- Total Physical Separation of passenger and freight movement is preferred for safety and operational reasons. Further separation of operation by speed or service mode (e.g., Commuter Rail and High-Speed Rail or Commuter Rail and DMU/LRT operation) may also be justified.

- Temporal Separation of modes or equipment can be an effective, simple, and straightforward solution. It does not, however, provide the most efficient use of the track capacity. Temporal separation as now practiced in North America is *exclusive use/time sharing* of the railroad, not simultaneous joint use or co-mingling of train movements. This research is directed at *true* joint use, or *concurrent shared track by railroads and rail transit.*

When space, demand, or economics suggested that the same track be used for various types of service, ranging from light rail to the heaviest freight trains, the earlier railroad managements generally accepted co-mingling operations. Under single ownership and operation, such joint uses were considered routine and normal operating decisions during the course of business. Railroads varied in executing joint use depending on local practices and needs. The competing and conflicting demands that joint operations generate require change in current thought. Any form of joint operation likely necessitates altering current operating documents, procedures, and practices. Labor issues could also arise. Therefore, the shared track cost benefits need to outweigh these operating and safety difficulties.

2.2 RAILROAD OPERATIONS EVOLUTION

2.2.1 Evolution of Railway Operations Practice

The common use of railway track for multiple purposes is as old as the industry itself. Steam railroads grew around the concept that each railroad line could be used for both local passenger and freight services. Main lines subsequently developed to the point of accommodating a wide diversity of services on shared track within one right-of-way. The former Pennsylvania railroad, from New York City to Washington, DC, is a good example, including:

- Express passenger trains.
- Local passenger trains.
- Regional commuter trains, electrified or steam.
- Local and line-haul general freight services.
- Time-sensitive shipments carried aboard passenger trains, including U.S. Mail and Railway Express parcel shipments.
- Fast freights carrying perishable commodities.

In the modern era, two additional uses have evolved that increase operating complexity:

- Specialized freight trains carrying truck-trailers, roadrailer trailers or containers (of various intermodal technology).
- Unit trains devoted solely to the bulk shipment of one low-value commodity, such as coal or crushed stone, or to the shipment of one class of finished goods, such as automobiles.

In the past, street railways, electric interurban railways, and rail rapid transit systems also developed around the concept of serving multiple markets. While these systems were primarily oriented toward passenger travel, their facilities were often utilized for other purposes, such as shipping mail and newspapers. Freight shipments sometimes even involved the interchange of standard freight cars, received from steam railroads, for delivery to local customers. For example, the Chicago Transit Authority delivered hopper cars of coal to local sidings along its elevated line well into the 1970s. Such services are no longer common.

Among the most dramatic domestic examples of co-mingling operations are the historic precedents of the interurban electric railway industry in the North America.

Several large interurban electric railway operations shared track between electric passenger and package express cars and interchanged electric, steam and diesel hauled freight rolling stock. Best known of these included the Pacific Electric (CA), Illinois Terminal (IL,MO), Piedmont and Northern (NC,SC), Oregon Electric, Sacramento Northern (CA), Lackawanna & Wyoming Valley (PA), Chicago, South Shore & South Bend (IL,IN), and Chicago, North Shore and Milwaukee (IL,WI) interurbans. Although these interurbans eventually lost their corporate identity and were merged into larger railroads, several interurban routes survive today because they concentrated increasingly on the freight side of their business. In the process, they ceased to be interurbans. Specifically, over time they:

- built freight bypasses around points of congestion and downtowns
- reduced or eliminated street running
- upgraded facilities to "steam" railroad standards to handle heavy interchange traffic, and built freight interchange connections
- marketed themselves as freight carriers, instituted innovative services
- cultured relations, or became affiliated, with connecting railroads
- were large enough to cover exclusive territories, shippers, or freight markets
- may have had railroad parents (Southern Pacific owned the Pacific Electric) who regarded their interurban offspring as freight feeders
- Converted from electric to diesel propulsion after or during passenger discontinuance.

All of these measures contributed to the isolation of freight from passenger operations until passenger service was either eliminated or converted to railroad standard commuter service. The significance of this maturation of interurban railways into freight carriers is that it gradually eliminated or reduced joint use operating practices which had blended railroad and light rail standard rolling stock.

A landmark decision also altered these carriers' institutional (and joint use) status from:

- "interurban electric railways" handling isolated interchange freight and passengers

to

- "railroads" providing some passenger service as part of the general (steam) railroad system of the U.S. (H&M, NYW&B and Chicago Tunnel Ry. excepted.)

Under the Railway Labor Act of June 21, 1934, a determination was made on the status of 15 borderline electric interurban railway entities. Fourteen were found to be "railroads" for regulatory and labor purposes in separate decisions during the years 1935-1936. They are listed below with their current disposition:

1. Texas Electric Railway (abandoned, portions converted recently to LRT)
2. Sacramento Northern Railway (converted to freight feeder by parent SP, portions abandoned or converted to BARTD rapid transit)
3. Waterloo Cedar Falls & Northern Railway (converted to freight)
4. Piedmont & Northern Railway (converted to freight, absorbed, or abandoned)
5. Ft. Dodge Des Moines & Southern Railroad (tourist and freight railroad)
6. Chicago Tunnel Co. etc. (freight only narrow gauge subway - abandoned)
7. Chicago, South Shore & South Bend Railroad (commuter/freight carrier and the only rail carrier of the group conducting joint passenger and freight operations. Their EMUs are built to railroad standards.)

8. Des Moines and Central Iowa Railroad. (converted to freight)

9. Utah Idaho Central Railroad (abandoned)

10. Pacific Electric Railway (converted to local freight carrier, portions converted to LRT or abandoned)

11. Hudson & Manhattan Railroad (now PATH rapid transit, no freight)

12. Oklahoma Railway (abandoned)

13. New York, Westchester & Boston Railway (commuter railroad, abandoned portion converted to New York City Transit rapid transit, no freight)

14. Salt Lake & Utah Railroad (largely abandoned)

The fifteenth carrier deemed to remain an interurban was the Chicago, North Shore and Milwaukee Railroad. Later it too became a "railroad". This railway is cited often as the prime example of joint use freight/passenger up till the time of its almost total abandonment. A portion became the Skokie Swift (Dempster Street) extension of the Chicago Transit Authority (CTA) rail rapid transit system. CTA exhibited light rail characteristics in its use of overhead catenary, grade crossings, and lightweight rolling stock.

Other large interurban railways maintained their primarily electric passenger nature and function, having little or no interchange freight traffic. Package Express, mail, and LCL were carried, but freight rolling stock was typically built to street railway standards and not interchangeable (except with other interurban electric railways). This smaller/lighter physical rolling stock standard was required to negotiate street track geometry. In their final forms, these carriers were large statewide or interstate combinations of smaller interurban lines. They were typified by the Cincinnati & Lake Erie, Lake Shore Electric (Cleveland to Toledo), Indiana Railroad, Detroit United Railway, and New York State Railway. On these lines, little or no railroad interchange freight traffic existed. Joint use by freight and passenger services was accomplished with compatible rolling stock operated in streets and private rights-of-way and often in the same train consists. All of these type interurbans failed prior to or immediately after World War II, and few vestiges remain. Their construction to street railway standards, reliance on street railway technology, and street running over key portions of their routes doomed them. They were unable or unsuccessful in converting to interchange freight.

Some smaller interurban railways also evolved from primarily passenger rail carriers to exclusively freight carriers. They featured interurban and/or streetcar rolling stock operating with freight. Among these are the "Crandic" (Cedar Rapids and Iowa City), Iowa Traction Railroad Co. (formerly Mason City and Clear Lake), Tulsa-Sapulpa Union, Sand Springs, and others. Like some of the larger interurbans, these were absorbed into larger railroads and some have lost their corporate and interurban (joint use) identity. Several converted to freight because they became corporately linked to a connecting freight carrier. The change of these electric railways from passenger to exclusively freight has been detailed historically in Hilton and Due's *Interurban Electric Railways.*

Non-standard gauges were selected or stipulated by regulation to prevent car interchange or joint use between railroads and streetcars or interurban systems. Joint use was out of the question in places where railroads and rail transit holdings could or would not take the first step, i.e., connected and interchangeable track. Table 2-1 shows

Table 2-1
North American Rail Transit Electric Traction Gauges

Gauge		Metro Area	Sample Systems
3'0"	914.4 mm.	N/A	three foot railroad "narrow gauge"
3'6"	1066.8mm.	Los Angeles, CA	L.A.Rys. (PE. Rys. Std. gauge)
3'6"		Denver, CO	Denver Tramways (railroads - 3' or 4' 8.5")
3'6"		Portland, OR	Portland Light & Power, Kenton Traction
3'6"		Tacoma and Seattle, WA*	Tacoma St. Ry. Co. (Seattle cable only)
3'6"		San Francisco, CA	SF. Muni (cable only)
4'0"	1219.2 mm.	Pueblo CO	P. St. Ry. Co.
4'0"		Canton, OH*	Northern Ohio Traction & Light
4'0"		Honolulu, HI	Honolulu Rapid Transit
4'8 ½"	1435.1 mm.	Northern New Jersey	Public Service Coordinated Transp.
4'8 ½"		"Standard Gauge"	Standard ("tight"standard=4'8¼"/1428.8mm.)
4'10"	1473.2 mm.	St. Louis	U.Ry. St. L./St. L. Public Service
4'10"7/8"	1495.4 mm.	Toronto ON**	Toronto Transportation Comm. (Subway and Streetcar)
5'0"	1424 mm.	Southern New Jersey	Public Service Coor. Transp., Burlington County Traction
5'0"		Louisville, KY	Louisville Ry. Co.
5'2"	1574.8 mm.	Trenton, NJ	Trenton & Mercer County Traction
5'2"		Columbus, OH	Columbus Traction Co.

Table 2-1

North American Rail Transit Electric Traction Gauges (cont'd)

Gauge		Metro Area	Sample Systems
5′2 ¼"	1581.2 mm.	Philadelphia, PA	PRT/PTC/SEPTA (city LRT & rapid transit)***
5′2 ½"	1587.5 mm.	Philadelphia, PA	Red Arrow/SEPTA (suburban LRT)***
5′2 ½"		Pittsburgh, PA	Pittsburgh Rys. WestPenn, etc.
5′2 ½"		"Pennsylvania Gauge"	Selected Pennsylvania systems
5′2 ½"		Cincinnati, OH	Cincinnati Rys. Ohio Traction
5′2 ½"		New Orleans, LA	New Orleans Public Service
5′3"	1600.2 mm.	Altoona, PA	Altoona & Logan Valley Ry.
5′4 ½"	1638.3 mm.	Baltimore, MD	United Traction Co/Baltimore T. Co
5′6″	1676.4 mm.	San Francisco, CA	Bay Area Rapid Transit District

Common Foreign Streetcar/LRV/Railway Gauges		
610mm	2′0"	"Maine Narrow Gauge"
764mm	2′6"	
900mm	2′ 11 ½"	"Three Foot" (Lisbon, Linz, Detroit VT)
1000mm	3′3"	"Meter gauge" (Zurich, Augsburg, etc)
1067mm	3′6"	"British Imperial Gauge"
1372mm	4′6"	"Tokyo Streetcar"
1435mm	4′8 ½″	"Standard Gauge"
1524mm	5′	"Russian Gauge" (Helsinki, Moscow)
1668mm	5′6"	"Spanish Gauge"

Notes:

* converted to standard gauge.

** converted to standard and back.

*** excluding standard gauge Norristown, Broad Street and Regional (railroad) operations

1 meter = 3.2808'

1 mm = .0394"

the diversity in gauges on streetcar and other electric traction systems.

It also identifies where large systems at state or metropolitan levels were isolated to prevent interchange with other systems, let alone permit joint use.

2.2.2 Influence of Technological Progress in Operations

During the first third of this century, the steam railroads and the electrified rail rapid transit industries grew closer together in their use of technologies, with each learning and benefitting from the advances of the other. For example:

- A number of eastern and mountainous western United States steam railroads adopted electrification for tunnel or heavy gradient portions of their main lines. These railroads benefitted from the efficiency of electric traction, primarily for passenger service and freight service.

- Electrification became especially prevalent among railroads in urban areas with large bases of commuter passengers. Several steam railroads adopted electric multiple-unit (rapid transit-like) technology for commuter services, which remained routinely co-mingled with all of the other classes of railroad services.

- Rail rapid transit systems benefitted from the development of steel passenger cars by the steam railroads, and adopted that technology as a major safety improvement.

- Air brakes, a major safety advancement of steam railroads, became more sophisticated with their application to electrified multiple-unit rapid transit trains. The electro-pneumatic, multiple-unit braking controls allowed much faster response to control commands from the operator.

- The art of railway signaling technology advanced simultaneously on steam railroads and on rail rapid transit systems, spurred by the demanding requirements of rapid transit operators for safe operation at the best speeds physically achievable on the closest possible headways. The extraordinary complexities of the signaling and interlocking apparatus required to keep high-capacity subway operations safe, including the development of automatic train stop mechanisms, undoubtedly led to better steam railroad signal systems.

- Railway signal and operational practices created a network of towers, switches, and communications and maintenance facilities along the route. This generated a hierarchical-style management structure to direct a safe operation. It also produced a labor-intensive and unionized environment with a large front-line supervisory and middle management staff (e.g., trainmasters, road masters, road foremen, yard masters, station masters, block operators, maintainers, division engineers, etc.).

- Current developments in communications-based signaling and automatic train operation are likely to have significant operating and economic implications for any type of service. However, the cost and timing of applications, and the long-term impact on operational and labor resources, remain to be seen.

2.3 OPERATIONAL ISSUES

2.3.1 Dynamic Operating Characteristics of the Rail Traffic Mix

The accommodation of the dynamic characteristics of a variety of motive power and train consists, their capacity, and their performance, is essential to safety and reliability. The more diverse the traffic mix, the greater the need for heightened operational vigilance and enhanced technical and management resources.

Although there are certain incompatibilities between commuter trains, high-speed rail, and freight trains, these operations have been successfully mixed over the years in different operating environments. While some fundamental differences between U.S. and European operations exist, European railroads routinely handle a mix of commuter rail, high-speed rail and freight operations over the same tracks. Some add lightweight passenger stock such as rail buses, DMUs, and LRVs.

Where passenger traffic operates, safety is paramount. However, dependability for the customer remains vital to commercial and social success. The objectives of safety and reliability are not always mutually supportive. It is useful to examine each of the rail mode characteristics and how they perform in joint use.

Commuter Rail Trains

Although most commuter trains are relatively high performance, approaching top speeds of 80 MPH or higher, their frequent station stopping patterns tend to use excessive track occupancy in time and capacity. Commuter service requires that trains operate on headways between 10 and 20 minutes during the morning and evening peak periods (6:30 a.m. to 8:30 a.m. and 4:30 p.m. to 6:30 p.m.). Commuter trains and LRT in joint use, such as in Karlsrule, tend to provide some service redundancies, particularly in the peaks, unless they feature different origin-destination options. Depending on the specific headways involved, commuter trains can consume a significant amount of the available track capacity during the peak periods. These train movements are typically unidirectional.

LRT/DMU

Use of non-compliant equipment on a rail line will reflect characteristics similar to commuter rail equipment. However, capacity limitations and concern for safety may cause more time separation between trains of different types and performance. LRT/DMU speeds are likely to be lower than commuter rail, based on less stringent track geometry, station spacing, and equipment performance features. Lower speeds or more frequent stops can demand even more track capacity than commuter rail. In Karlsruhe, the slower LRVs have better overall running time than commuter trains in the same service because of better acceleration and less dwell time. DMU or LRT substituting for large consist commuter trains during non-peaks may be feasible because non-peak demand is scaled to the frequent stop, lower density service to which commuter rail is less adaptable. This also creates a window for DMU or LRT exclusive non-peak use on what would otherwise be a very light load on commuter trains.

High Speed Rail Trains and Intercity Railroad

When compared with commuter trains, high-speed rail trains operate at higher performance levels, capable of reaching speeds of up to 150 mph or more. Intercity passenger trains in the Northeast Corridor travel at maximum speeds ranging from 79-125 mph. Higher top speeds require more distance to decelerate and greater train spacing, thus demanding more track capacity. This is partially offset by the fact that higher speed generally moves trains along the track more quickly. In addition to higher top speed capabilities, high-speed rail trains generally do not make frequent station stops. Although the time of track occupancy is greatly reduced for the high-speed intercity train as compared with the commuter train, the high-speed train requires significantly increased lengths of unobstructed, clear track ahead. As much as five or six miles of track must be clear ahead for the high-speed intercity train's designated route. When high-speed trains are mixed with commuter trains in peak periods, an additional track is generally required so that high-speed rail trains can operate around the commuter trains. On a typical reversible two-track system, this overtake situation consumes a significant amount of available track capacity.

Freight trains

Different classes of freight trains have vastly different performance characteristics. Perhaps the lowest class of freight train is the wayside industrial switcher, which stops frequently at local shippers to set out and pick up the cars. This class of freight train consumes a significant amount of track capacity because of extended periods of track occupancy, but is otherwise slow speed. The highest class of freight train is mail or time-sensitive consists, frequently in a mixed intermodal configuration. These trains are priority movements and consist of truck trailers and/or container cars. Although their acceleration and braking performance is not on a par with passenger trains, these trains frequently operate at speeds up to the 70 mph range. In between these two extremes are three other classes of trains, all with slightly different performance characteristics. These three classes are "time freights" or "hotshots," general merchandise trains, and mineral or bulk unit freight trains. The performance capability of these trains depends largely on locomotive horsepower, train length, tonnage, terrain, and the amount of switching or "work" en route, all of which can vary significantly. The two extremes in freight service and LRT do not blend well in concurrent joint use. However, precedents have demonstrated that the two rail modes can be managed into joint use.

Joint Operations

The concept of joint operations can include any combination or all of the above. However, the focus here is on LRT/DMU (non-compliant) equipment operating in a mixture with standard railroad equipment. The critical constraint in these operations is track capacity and the margin of time and space to separate train movements. Where multiple tracks and interlockings exist, traffic and speed separation are feasible. Typically, however, these joint operations are likely to use an existing single freight track or limited infrastructure resources where any freight movement can potentially slow or obstruct passenger movement. Joint operating procedures and practice must be able to cope with these variables.

2.3.2 Operations Policies, Standards, and Procedures

Domestic Operating Philosophy and Benefits

A common remedy for a mixed traffic corridor requiring more capacity is to add more tracks, interlockings, and fail-safe measures. Since high capital and maintenance costs are associated with adding facilities to accommodate increased train traffic, conventional, owner-oriented solutions seek to either avoid this expense or burden the tenant operation who seeks more access and capacity with the additional capital and operating costs. Centralized Traffic Control (CTC) was a traditional measure to gain more capacity from existing or reduced track facilities.

Other solutions include reactivating parallel abandoned or disused track beds and diverting certain train traffic to reduce congestion. Surplus capacity exists in former multiple track beds rendered vacant by reducing the number of tracks. These proposals often generate opposition from local property owners, who were told that the railroad in their back yard was abandoned years ago, or who became accustomed to reduced train traffic. Other environmental issues related to noise, vibration, or pollution often surface as well.

Regarding track capacity, a freight railroad company asked about the operation of foreign commuter-based traffic over its line may respond that there is "insufficient capacity." Investigation into the issue of insufficient capacity often discloses that scheduling, rather than capacity, may be the problem.

A typical section of railroad is comprised of track, signals, interlockings, structures, real estate, etc. From the standpoint of investment capital, this makes almost any section of railroad line a costly resource. Some freight railroad main lines do not fully utilize this very expensive resource to its optimum potential. In short, freight railroads do not often operate trains on a precise or reliable schedule, which is essential for joint operations. Random or flexible operation of freight trains often results in a scenario in which there is little train activity on any defined section of line for long periods of time, yet there are isolated instances when the same section of line is completely "maxed out." The result is often the creation of a queue where trains wait for each other, causing cascading delays or impacting movement of other trains similar to air traffic awaiting take-off.

Operating Rules and Standards

All rail properties operate on the basis of their individual book of rules. These rules establish and document all required practices to run trains safely, accommodating all varieties and speeds of traffic on that system. The book is a living document that is changed and reissued regularly. All operating employees are required to show proficiency in its specifications. These rules cover:

- Dispatching
- Signaling
- Communications
- Train orders and other authority for train movement
- Control of a single track
- Protection of Work Equipment
- Absolute Block rules
- Characteristics of railroad equipment and infrastructure

2.3.3 Northeast Operating Rules Advisory Committee (NORAC)

The Northeast Corridor (NEC), one of the most complex and dynamic railroad operating environments, since the mid 1980s has produced a rule book that combined many practices of participating member railroads. An examination of this document serves to illustrate the extent of coverage and the detail of operating rules applied to a rail line hosting a variety of train types and performance. The example is excellent for any proposed system and can serve as a guide for joint operations with appropriate modification to vehicle, signal, and service characteristics.

Especially important is the recognition that these rules were developed cooperatively among those who share NEC track.

Their objective was building a safe, well-regulated operating atmosphere in which passenger trains of many types and freight traffic of differing classes efficiently share railroad facilities owned by both private railroads and public agencies, to the mutual benefit of shippers, passengers, and the public at large.

The NORAC Book of Rules is the means by which it has become possible for multiple carriers to safely and simultaneously operate their respective trains over a common section of track. The NORAC rules are sufficiently comprehensive to accommodate numerous and complex operating situations.

NORAC Operating Rules and Their Application

The Northeast Operating Rules Advisory Committee worked to develop and implement a single, unified Book of Rules governing the operation of Amtrak, including their contract commuter operations in the NORAC territory, as well as Conrail, SEPTA, NJ TRANSIT, and several regional freight railroads. Some regional short lines are members, though they do not operate on the corridor.

By adopting the NORAC Book of Rules, the *member* railroads have achieved a single basis for the safe and fully co-mingled operation of the following activities:

- High-Speed passenger trains (Amtrak Metroliners).
- Intercity passenger trains (Amtrak Northeast Direct and long distance intercity services).
- Diesel locomotive-hauled (or push-pull) commuter trains (MARC, NJT, CONDOT, MBTA).
- Electric locomotive hauled push-pull commuter trains (NJT, SEPTA, MARC).
- Electric Multiple-Unit commuter trains (NJT, SEPTA).
- Self-Propelled diesel multiple unit trains (e.g., RDC; SPV-2000, although no such trains may be actually operating on NORAC or NORAC proximate systems at this time; MARC; SEPTA; LIRR; MN; NJT,; etc.).
- Time-sensitive freight (containers, etc.) (Conrail, Amtrak Express, Triple Crown, NS, CSX).
- Slow or heavy unit-trains of commodities (Conrail).
- Mixed, general freight (Conrail, P&W, CP/St. L&H/D&H, ST).
- Local freight switching operations, and interchange between regional carriers and line-haul freight railroads (Conrail, P&W).
- Maintenance-of-Way trains.
- Passenger Terminal, switching, and yard operations (Amtrak/LIRR and formerly Washington Union Terminal).

Detailed procedures describe practices and requirements for:

- Multiple Signal Systems: NORAC rules bring uniform signal definitions (for every variation of each aspect) to all of the various signal systems utilized by the member railroads, including position-light signals, color position-light signals (two types), color-light signals (several types), cab signals (including Color Light, Position Light, stand-alone, or in conjunction with wayside signals).

NORAC

Operating Rules

Northeast Operating Rules Advisory Committee

TRO-1

NORAC OPERATING RULES

SIXTH EDITION

Effective January 1, 1997

★ ★ ★

NORAC MEMBER RAILROADS

Full Members

Amtrak
Bay Colony Railroad (BCLR)
Conrail
NJ Transit Rail Operations (NJT)
New York, Susquehanna & Western Rwy Corp (NYS&W)
Providence and Worcester Railroad Company (P&W)
Reading Blue Mountain & Northern Railroad (RBM&N)
Saint Lawrence & Hudson Railway (D&H)
Southeastern Pennsylvania Transp Authority (SEPTA)

Associate Members

Adirondack Scenic Railroad
Cape May Seashore Lines
Central New England Railroad
Central Railroad Company of Indiana (CERA)
Central Railroad Company of Indianapolis
Connecticut Central Railroad (CCCL)
Connecticut Southern Railroad
Finger Lakes Railway
Flats Industrial Railroad
Genesee Valley Transportation
Indiana Harbor Belt Railroad (IHB)
Luzerne and Susquehanna Railway
Maine Coast Railroad
Massachusetts Central Railroad (MCER)
Milford-Bennington Railroad Company
Morristown and Erie Railway (M&E)
Mountain Division Railway Corporation
National Park Service (NPS)
Naugatuck Railroad Company (NAUG)
New Hope and Ivyland Railroad
North Shore Railroad (NSHR)
Owego & Hartford Railway Incorporated
Seaview Transportation Company, Inc
Somerset Railroad (SOM)
Southern Railroad Company of New Jersey
Springfield Terminal Railway Company (ST)
Winimac Southern Railway (WSRY)

INTRODUCTION

These rules govern the operation of the railroads listed on the previous page, each of which is a member of the Northeast Operating Rules Advisory Committee (NORAC). They apply equally to all railroad employees when they are working on a NORAC member railroad's property. These rules must be observed by all employees whose duties are in any way affected by them

Use of the male gender throughout these rules is for convenience and clarity only. All rules apply equally to male and female personnel

The following craft titles have been shortened to reflect common usage:

"Operator" refers to the Block Operator, Train Director, Leverman, or Dispatcher when operating interlocking or controlled point appliances

"Dispatcher" refers to the Train Dispatcher.

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- Train-order signals, including temporary block stations.
- Hand, flag, and hand-held lantern signals.
- Operation in unsignalled (or "dark") territory.
- Directional control of operation, and overall methods of operation.
- Single-direction signaling (Rule 251).
- Dual-direction signaling (Rule 261).
- Full traffic control system signaling.
- Timetable - Train order manual methods.
- Issuance of train orders: One of the most significant safety accomplishments under NORAC has been the development of a clear, unified, single-form train order, whose transmission and issuance can be accomplished in an expeditious manner.

Obviously, any document covering as many different operating circumstances as the NORAC Book of Rules will occasionally require amplification or modification in order to adequately suit all local situations. All variations in the application of NORAC rules necessary to meet special circumstances are called out in the Special Instructions in the Employee Timetables. As is customary on all railroads, complete working knowledge of such exceptions and the Special Instructions in general must be proven by each employee as part of their examinations for qualification on specific territories.

Results of NORAC Rules

The NORAC members have worked cooperatively to implement their unified Book of Rules. They have demonstrated a clear commitment to joint use collaboration and compromise to achieve common objectives. This commitment has established precedent toward overcoming any barriers to the concept of joint use or shared track. Its application has generally been of benefit in several ways:

- Clear and uniform rules help employees who must operate trains through the territory of several railroads. Previously, these employees were required to qualify on the individual rulebooks of every railroad over which they operated.
- Rule contradictions, especially as between neighbor railroads, have been eliminated.
- Communication between participating rail carriers has been enhanced and put on a routine basis as entry to other issues of common interest.
- Particular attention has been given to developing the most expedient, safe methods for time-critical safety tasks, such as giving Train Orders by radio.
- Training costs and lost time for multiple annual rules classes and re-certification examinations have been reduced.
- Safety has been improved through simplicity and certainty.

One of the few difficulties in the NORAC approach is that membership is voluntary. Thus, the rules have not, as yet, been fully adopted by all affected railroads in the Northeast Corridor. Both the Long Island RR (LIRR) and Metro-North RR (MNRR) have included cooperative operating arrangements with Amtrak and others outside the scope of NORAC.

The above results are sound goals for any operation in the planning stage. Responsible planners are advised to acquire a variety of rule books and select those which closely resemble their proposed operation. Development of new or revised rules for a specific territory will require the participation of Rules and Operating staff of the host railroad in conjunction with the system planners.

2.4 OPERATIONS PLANNING AND PRACTICE

The existence of operating rules and standards creates the framework for a safe and reliable operation. The implementation and practical effects of these rules require operation planning prior to any financial decision on joint operations.

2.4.1 Operations Planning for Dispatching Joint Operations

In order for high traffic density to be efficiently managed in a territory with multiple carriers, thorough, thoughtful, and cooperative advance planning of operations is required.

- **Scheduling**: Precise timetables need to be prepared by all parties involved in joint operation which accurately reflect the differences in speed of the various classes of traffic, and allow adequate running time for local services. Usually, the proprietor railroad takes the lead in schedule preparation, working with all of the tenant carriers on a mutually agreeable plan. Scheduling may be reduced to reserving operating windows for freight train track occupancy and may require more precision for local freights. It can take the form of an operating schedule for employees, a joint rule book, or a joint public timetable in cases of integrated transit service.

- **Operating Priorities**: Recognizing that it is not always possible to operate exactly to schedule, all joint operators must necessarily have an understanding, in advance, of how schedule deviations will be dispatched. Where freight trains do not adhere to timetable operation, it is essential that the parties understand how they are to be handled (e.g., operation only during late-night hours; operation as convenient to passenger schedules, etc.).

- **Recovery from Delay Strategies**: In the arena of intensive passenger service, dispatchers routinely approach their work with pre-planned strategies for recovery from delays. These tools, crafted from the collective knowledge and experience of all users of the affected line, are fundamental in achieving a prompt recovery. While responding to operating disruptions is one of the train dispatchers' key duties, it may not be reasonable to expect that dispatchers could always develop the most effective strategies, equitable to all parties, in the midst of an operational crisis. Training exercises simulating various operational disruptions and critical situations are also very effective in building dispatchers' skills.

- **Unscheduled Services**: Where multiple carriers jointly share track, a clear understanding of how extra and/or unscheduled trains will be handled is essential. Random operation of freight services is not an acceptable practice in such circumstances. These situations become particularly troublesome where there is a very closely scheduled headway in passenger services into which a freight extra must be inserted. Also troublesome is where a difference exists in overall operating speed between passenger and freight operations.

- **Communication among Joint Operators**: The most important aid to achieving quality operations for all carriers on a shared railroad is the maintenance of open and frank communications between the operations staffs of all interests. The most senior officials of all of the carriers must establish a tone of cooperation at every organizational level to preserve harmony and run trains efficiently.

- **Physical Plant Issues**: One of the prerequisites to successful shared operation is assuring that the design of the physical plant is adequate to meet the needs of all concerned. This is a multi-faceted issue, involving not only track capacity, but the adequacy of signaling systems for all service types, the adequacy of communications devices, and, most importantly, sufficient reserve facilities and interlocking capacity to adequately handle recovery from delays. Cost estimates and allocation among users whose demands on the plant vary should be the subject of formal agreement.

- **Sharing Support Facilities**: In some of the more sophisticated railroad joint operation arrangements, two or more carriers may share support facilities, such as engine terminals, coach yards, and other maintenance bases. The landlord railroad is usually responsible for overall maintenance-of-way, but neighboring operators may wish to develop arrangements to share specialty equipment or other costly assets. Specialized maintenance such as wheel truing may be shared as cooperatively accomplished between rail transit and railroad carriers.

- **Scheduling Maintenance**: Related to physical plant issues is the necessity to provide a maintenance window for track, signals, and other items of infrastructure. Procedures for sharing track, operating windows, and passenger information are essential elements of agreement between joint use partners.

- **Handling Emergencies**: The greatest test of the relationship between railroads sharing track space and time comes in the handling of emergencies. When emergency situations arise, all operators with an interest in the facility should be expected to work together, and to willingly pool personnel and equipment to resolve the emergency as quickly as possible. The most effective response to emergencies is achieved through the establishment of pre-planned Standard Operating Procedures. These procedures should incorporate objective criteria for determining the level and nature of response required and designate in advance who (by title and position) is in "charge".

- **Fleet Management**: Sufficient equipment must be available for the passenger service, including "hot spares" on standby, and placement of "protect" equipment at locations appropriate for a quick response.

- **Cooperative Analysis of Actual Operations**: One of the unavoidable realities of joint operation is that the tenant carriers are rarely fully satisfied with dispatching, leaving the landlord carrier feeling unappreciated. Maintaining a cooperative approach to solving operating dilemmas is crucial to safe and responsive service. Following major service disruptions, a thorough post-incident analysis can be helpful, not for the purpose of finding fault or laying blame, but in order to develop protocols for improved future operation.

- **Other Mechanisms**: Organizations at national and regional levels promote better understanding between operating staffs on an informal basis. In the New York/North Jersey area, the Metropolitan Association of Rail Officials (MARO) bring together rail transit and railroad (passenger) operating personnel. A similar function is performed at the national level by American Association of Railroad Superintendents (AARS), American Railway Engineering Association (AREA, now AREMA) and others.

2.4.2 Controlling Combined Operations of Mixed Traffic

The procedures and operating rules by which trains are dispatched, and the methods by which signal aspects are displayed, read, accepted, acknowledged, and obeyed are the foundation of safe railroad operation. Precise adherence to established rules and operating procedures is especially important in an environment of joint operation of multiple train types and multiple carriers sharing track.

As discussed earlier, the amalgamation of several bankrupt multi-purpose railroads into freight-only Conrail, and the subsequent division of those assets and operating responsibilities among Amtrak, Conrail, regional commuter railroads, and local freight lines separated the transport functions into discreet managements and cost centers. Cost and practicality dictated, however, that the new operating entities share responsibility and authority for achieving safe operations in new complex joint operating environments.

Dispatching authority generally flows with ownership of the right-of-way, even if multiple carriers and multiple train-types are handled within the same geographic territory without regard to quantities of service. Depending upon the communication and signaling facilities available, and the railroad traffic density, dispatching practices vary considerably.

In the very newest, high-tech facilities (e.g., Amtrak CETC offices) the functions of Train Dispatcher, Traction Power Dispatcher, and Block Operator may all be accomplished from one office for hundreds of miles of railroad. Dispatching may be shared among users, as demonstrated by the Amtrak/LIRR joint operations center for the Penn Station NY complex.

The Philadelphia Amtrak CETC Office controls most Amtrak operations from just north of Washington, DC, to just south of Trenton, New Jersey, as well as housing conventional dispatchers for the Amtrak Harrisburg Line. Within this territory, CETC handles not only Amtrak traffic of many classes, but also MARC commuter trains, SEPTA commuter trains, NJ TRANSIT commuter trains, and freight interfaces with Conrail, CSX, CP, and other regional carriers.

Standard Centralized Traffic Control (CTC) stations can control large territories of railroad with technologies of varying sophistication; some being operated in conjunction with manual dispatching methods, while others are combined with computerized dispatching tools. For example, a modern CTC station involved in multiple-carrier control can be found in the Metro-North dispatch facility controlling the entirety of the New Haven Line, which is also shared by Amtrak, Conrail, and regional freight carriers.

Traditional train movement central methods involve dispatchers using paper and pencil train sheets, with telephone communication to individual towers online at each interlocking, where block operators manipulate switches and display signals, and where hand-written Train Orders may be individually issued to train crews for any unusual circumstance. Owing to the high cost of staffing towers, conventional dispatching is rapidly diminishing. Such basic methods are still commonplace in multi-purpose railroading at SEPTA, the Long Island Rail Road, and elsewhere.

Amtrak operates many trains over lines that are owned, maintained, and dispatched by Metro North. In fact, to advance an Amtrak Northeast Corridor train from Boston to Washington involves the physical facilities and/or employees of not just Amtrak, but also of the MBTA, Metro North, LIRR, New Jersey Transit, and the Washington Union Terminal Company.

As a freight carrier, Conrail has gone to considerable expense and effort to deliberately separate itself, as much as is practical, from the passenger railroads. Nevertheless, freight operations must continue to co-mingle with passenger services at the margins of their industrial operations. There are common instances where Conrail is not the predominant operator and where the commuter agencies provide the dispatching and signaling services (e.g., SEPTA West Trenton Line).

Some of the newer regional freight railroads' operations require entering on, or interchange with, Conrail, or other Class I freight railroads, via Amtrak or the commuter lines.

The most primitive operating format, manual timetable and train order dispatching methods, have actually been growing in use, as freight railroads have diminished the scope and sophistication of signaling systems, in an attempt to economize on capital and operating expenses on some marginal routes. In order to keep traffic moving in "dark territory," a new method of issuing abbreviated point-to-point train orders known as "Track Warrants" has emerged. Although this practice is not used in passenger territory on NORAC railroads, it is not uncommon elsewhere in the northeast.

An excellent example of complex, highcapacity, multi-purpose railroad use may be found in southern Florida, where the State of Florida now owns the former CSX main line between West Palm Beach and Miami. Dispatching of this primarily single-track railroad is performed by CSX from their system control center in Jacksonville, Florida. Amtrak trains operate with Amtrak crews over the line, as CSX freight trains operate with CSX crews. However, the predominant user by far is Tri-Rail, which, through the use of an independent contractor, operates frequent commuter trains between Miami and West Palm Beach.

2.4.3 Typical Examples of LRT/Freight Joint Operation

As discussed in Chapter 1, good examples of a joint (but not simultaneous) operation are the San Diego (SDTI) and Baltimore MTA LRT (BCLR) systems, which primarily serve their LRT operation but do accommodate freight traffic in highly restrictive temporal separation mode. The operating characteristics of these systems detail the breadth and complexity of issues associated with joint operation. A true joint operation (concurrent or co-mingled) will compound the difficulties in conflict resolution. Specific operating details are provided in Appendix D.

Dispatching

Both the BCLR and the SDTI have control centers, which are manned by either "Supervisors" (BCRL), or "Controllers" (SDTI) which are responsible for the function of dispatching both light rail and freight train operations over the respective lines. The personnel at the control center assume the following duties with regard to the function of dispatching light rail and freight trains:

- Issue operating clearances that authorize a train's entry onto the system
- Record train passing times and monitor train schedule adherence
- Authorize outages for maintenance of track and electric power traction system
- Oversee traction power system availability and respond to anomalies
- Direct service recoveries and emergency response operations
- Maintain log of radio communications with light rail and freight trains
- Arrange for protection of work equipment and maintenance personnel

Signaling

Signaling on both the BCLR and the SDTI is wayside, three-aspect, two-block automatic block signal system for the portions of line that are not street operation. Street operating portions of line are governed by typical "go-no go" position light signals. Operating rulebooks define the signal rules and speeds for each signal system. The SDTI lines are double track now and the BCLR lines are comprised of both single and double track portions.

On the BCLR system, the single-track segments are operated bi-directionally on signal indication. Interlocking signals at the entrance to the single-track segments are controlled automatically by the light rail vehicle's occupancy of the approaching track circuits.

On the SDTI system, there are at least two locations where a transponder arrangement scans the vehicle's identity and establishes routes depending on whether it is a freight train or a light rail train. SD&IV freight trains still require verbal permission from the controller prior to entering the system. They must also report clear when exiting the line, as is done on the BLCR system.

Circuits for grade crossing devices may be designed into tracks or LRT overhead. Pacific Electric Railway placed trolley poles on some of their diesel switching locomotives to activate the overhead wire circuits. The "fake poles" were otherwise inert. This practice was isolated to parts of the system where interchange with parent Southern Pacific was prevalent and diesel locomotives began assuming the functions of electric freight motors, under catenary wire.

Communications

Both Baltimore and San Diego systems use radio as the primary means of communication between the control center, light rail, and freight trains. Wayside telephones exist in the stations and also at certain other strategic locations. The wayside phones are used as a secondary mode of communication in the event of a failure of the radio system.

Absolute Block Operations

Absolute (manual) block operations are used to maintain safe train separation on both systems in the event of a systems failure. Operation under "absolute block" rules severely reduces operating capacity because of the inability to maintain the required 10-minute headway operation. Therefore, this is only used under extraordinary circumstances, such as loss of signal system, loss of traction power, derailments, or any unplanned interruption of service. Control center personnel are responsible for the implementation and supervision of absolute block operations whenever it is required.

Track, Signal, and Traction Power System Maintenance

The BCLR system operates on 15-minute headways all day, and the SDTI system North-South "Blue Line" operates on 7.5-minute headways during the peak periods and 15-minute headways off-peak. The close headway operation of both systems does not provide any opportunity for track, signal, or traction power systems maintenance during the times that these two systems are operating. While it may be possible to perform some off-track maintenance during this time, any major capital or maintenance projects that require track outages must be performed during the night, when the light rail system is not operating.

This scenario creates a situation where freight trains and light rail system maintenance operations must compete for track time. The case becomes more severe on the BCLR system because most of the line is single track, although freight operation is isolated to two outer (albeit lengthy) segments of the system. On the double track SDTI system, freight trains have the opportunity to detour around maintenance activities that require track outages.

Safety procedures for operations and maintenance personnel are integrated into the Operating Rules for both systems.

Crew Size

One person, a vehicle operator, runs the BCLR and the SDTI systems' light rail trains. Both systems use proof-of-payment fare collection and therefore the vehicle operator is not involved with the fare collection process. Both systems do employ fare collection enforcers, but they are not assigned to every train.

Time of Day Restrictions

These restrictions are based on the theory that separation insures reliability and the clock is a valid means to separate traffic. The passenger train operator uses the track for a specific period of time. A freight train operator will then be assigned for other exclusive use periods. Freight operators on the San Diego and Imperial Valley Railroad are limited to operating freight trains during the morning hours from 1:30 a.m. to 4 a.m. Similar nighttime isolation is the rule for freight movements on the Baltimore LRT system.

In summary, the two light rail systems above appear to have developed successful programs for joint freight and light rail operations over the same track. The relative success of the Baltimore and San Diego systems can be attributed to a number of factors:

- The freight service is not "time sensitive" and does not require daytime switching.
- Freight shippers and consignees can tolerate nighttime delivery/pick up at their industries.
- No through or local freight connecting service is required during daytime hours.
- High density light rail service is not required between approximately 2:00 a.m. to 4:00 a.m.

- Freight train horizontal and vertical clearance issues were resolved.

- Engineering standards can satisfy both freight and light rail.

- No through or "overhead" freight movements are performed.

Under these normal circumstances, the time-of-day separation works well for both parties. Conrail operations personnel did observe, however, that the constraint on their operating hours restricts them from expanding freight service in the future, should there be an opportunity for developing new business.

Operational Limitations

Regulations aside for the moment, with current operating practice and signal technology, concurrent or co-mingled freight train operation does not appear to be practical wherever light rail headways are less than 30 minutes on double track or less territory. The chances of delay and exposure to risk are increased when blending trains of widely varying performance together on the same track with no or few means of passing trains. Another operating dilemma is the inability of a typical freight train to quickly clear the main track when switching a local industry and accompanying lack of track space and switches to park, manipulate and sort freight cars. On a single-track system, comingled freight and light rail operations are even more difficult to achieve, regardless of the operating headways and presence of passing tracks.

2.4.4 Management and Personnel Resource Considerations in Operations

Crew Size and Labor Requirements

Joint use proposals are influenced by existing labor agreements and practices. Typically, railroad crew sizes are mandated by Federal and State regulation, which most commonly require an engineer and conductor on every train. Union agreements and State regulations may require an additional crew member. Unions also require certain crafts to be assigned to specific jobs and have a seniority and skill structure that often limits management flexibility to adapt to changing practice or new technology. Unions may separate engineers, conductors, brakemen, dispatchers, and other skill groups. This local pattern varies from railroad to railroad and from agreement to agreement. This method provides a pool of trained and qualified employees. Additionally, where service changes are contemplated, union concurrence may be vital.

In short, a service involving a new operation requires flexibility to adapt to changing needs, the ability to control costs by the application of modern technology, and vigilance against institutional pitfalls.

Performance Control, Monitoring, and Incentives

How is performance controlled when multiple operators share tracks or are in a tenant/landlord relationship? Assuming safety is a primary concern, the secondary requirements for a passenger operation are on-time performance and passenger comfort. Economic incentive can be created for both. Performance incentives between host and tenant discussed in Chapter 1 have been used by Amtrak and some commuter railroads to encourage good service. Some form of performance monitoring is essential. Dispatcher's records can be used for this purpose. All main line U.S. locomotives are equipped with event recorders and these can be adapted to track performance. These devices can also be used to monitor operator behavior for enforcement purposes. Whenever an accident or incident occurs, records produced by this equipment can be referenced.

The tenant in a joint use agreement must also identify maintenance standards to prevent degradation of service due to poor infrastructure condition. Higher standards must be met for passenger service than for freight.

Employee Training and Certification

Insuring a high standard of employee qualifications and performance is also important in joint operations. In the traditional railroad environment, most operating employees learned their crafts during lengthy apprenticeships. These culminated with written and verbal qualification examinations before a Rules Examiner. In contrast, rail rapid transit systems have always had structured training programs, through which new employees could be trained to perform useful work in comparatively brief timeframes.

These two formats for learning railroad safety and operating practices have been successfully combined in the training programs developed by the Southeastern Pennsylvania Transportation Authority (SEPTA) for the training of new Conductors, Engineers, and Block Operators. This serves as an example of employee training for engagement in railroad operations.

The steps for training SEPTA train and engine crew members are:

- Newly hired employees attend approximately two weeks of training in basic railroad safety, and in revenue collection. After completing this instruction, they enter service as Passenger Attendants, assisting qualified crews in collecting revenue, operating doors, making announcements, and assisting passengers.

- Following several weeks or months of service as a Passenger Attendant, the new employees return to class and are fully trained on the NORAC Book of Rules. Frequent quizzes and weekly examinations identify those who will not be able to qualify. These people are separated from the service. At the successful completion of rules training, the employee is promoted to Assistant Conductor.

- Assistant Conductors must make continuous progress toward full qualification on the physical characteristics of the entire SEPTA Regional Rail Division in addition to working on board the trains. A prescribed number of days is allowed for learning each line, followed by an examination on each geographic segment. This portion of the training program also requires full qualification in Amtrak and Conrail standards for operation of SEPTA trains in their territories. Once fully qualified on the entire system, the employee is promoted to Conductor. Candidates progressing are encouraged to expedite their completion by the prospect of gaining a higher position on the seniority roster, where permanent status is determined by the date of Conductor qualification.

- As positions for Engineer become available, Conductors may elect to advance to Engineer Trainee in seniority order. Engineer Trainees spend several weeks qualifying on the operation of each class of rolling stock, including troubleshooting and emergency procedures.

Engineer Trainees must again study each line for details such as braking points at each station, line-of-sight hazards, etc. As a Federal Railroad Administration requirement, Engineer Trainees must also complete the requisite training to be Federally licensed as a Locomotive Engineer. Following completion of this training, the employee is promoted to the permanent position of Locomotive Engineer.

An essential and integral part of the training program is the development of the working skills necessary to safely operate SEPTA commuter trains while sharing track with Conrail freight trains and Amtrak trains, including high-speed Metroliners. Completion of this entire training sequence takes at least nine months, often up to a year. However, the quality of instruction and the constant screening processes guarantee a well-qualified employee. This educational program is reinforced by annual examinations that test proficiency in the Book of Rules.

Safety Allowances

For the first time in history, railroads have been hiring candidate employees directly into safety-critical positions. Until recently, secondary employment classifications provided opportunities to apprentice before being given life-and-death responsibility. For example, the historic position of "Fireman" promoted to classification of the Locomotive Engineer. Economic realities in current years have reduced staffing levels and forced the situation. Accordingly, more extensive training programs that qualify operating candidate employees directly from raw recruits have been developed. Diminished staffing redundancy has created more isolation for crew members, who no longer have the benefit of making judgments in the company of other employees.

Federal Railroad Administration regulation has traditionally focused on assuring that the carrier operates in accordance with its own published rules. This has caused railroad management to weigh their safety precautions carefully, as they may be held accountable.

In response to accidents in the 1980s, the Federal Railroad Administration instituted a program to license Locomotive Engineers. These Federal licenses are now required to operate a train anywhere on the national railroad network. The licensing program also provides penalties for unsafe behavior.

FTA and FRA regulations are precise in applying standards which operators use to manage employee infractions. This policy also focuses on employee drug and alcohol use. This issue has been a concern of both railroads and rail transit systems, although the level of specific Federally-mandated regulation differs at present. Employee mental stability is vital to maintaining a safe environment in passenger services.

Related to this policy is the Hours-of-Service Act, which regulates the length of time that a safety-sensitive employee can be on duty. These rules vary by discipline. For instance, a block operator or dispatcher may only work nine hours, followed by an interval of fifteen rest hours before the next assignment. Train and engine crew members may work up to twelve continuous hours and only require eight hours of rest before returning to work. Both employer and employee must keep precise records of the actual hours worked by each employee. An employee who "outlaws" must cease working, even to the extent of halting a train between stations. Rail transit systems often have similar working-hour standards embedded in their rules and/or labor agreements, but usually have some flexibility when dealing with emergencies.

2.5 SCHEDULING STRATEGIES

Alternative strategies to manage rail traffic movement do exist more commonly than might be imagined. The options depend on specific service requirements, operator policy, equipment performance, volume and speed of traffic, station spacing, placement of interlockings, signal systems, and other infrastructure characteristics. Carefully applied and managed, these techniques and technologies can overcome some initial objections to joint use from either freight or passenger operators. The ability to agree on which methods to apply to satisfy the needs of a dual operation will require management support and incentives. The following are techniques employed in joint use of various types, with examples of each practice:

Peak-Hour Commuter Windows

This workable approach depends on the joint users' agreement and suits unidirectional traffic whose operation is concentrated in limited peak periods. Passenger operation is ensured priority in this case. This technique may allow flexibility for expansion of service in response to demand. Some risk to passenger service reliability and timekeeping can be expected due to freight train delays. (Example: LIRR Montauk Branch, Jamaica to Long Island City)

Off-Peak Freight Windows and Traffic Embargo Periods

This practical solution is a modification to temporal separation. It involves scheduling freight movement for periods when the line is not used by passenger traffic and is suitable for a peak directional service or a contraflow service, which is against the predominant flow of freight traffic. Adequate track capacity and stringent train control are essential. Priority for movements or time periods will have to be dealt with. This technique is also not likely to allow flexibility. Freight train delays could again be a problem. (Example: midday Conrail local freight on lower NJ TRANSIT Pascack Valley Line).

Temporal Separations (Night Freight Movement)

This simple and commonly implemented technique uses the clock to separate traffic. The freight and passenger operations are given periods of time in which all competing traffic is forbidden. Provisions allow for maintenance, special movements, overlaps, and delays. This technique poses the least risk to on-time and safe passenger operation, but creates difficulty for the freight operator. Risk is diminished, therefore this is a popular joint use technique in North America between LRT and freight railroads. (Example: BCLR, SDTI and former domestic operations).

First Come, First Served

This solution implies that the first to enter the territory possesses it until clear, then the next in line proceeds within the constraints of the signal system. This works in a strictly freight environment, but not in a passenger environment, since schedule adherence and safety are compromised. Still, it may be acceptable for a mixed variety of passenger operations. (No good mixed use examples exist, but this protocol is employed on the Northeast Corridor).

Continuous Interweaving of Traffic

This solution involves carefully planned scheduling of all traffic and was common when U.S. freight, commuter, and intercity rail were operated by a single management. It requires well-maintained equipment, a superior signal system, multiple tracks, proper supervision, train flexing options, and revised freight movement practices. Old rule books dealt with the "rights of trains." Precedence was established by class (priority) of train. It assumes regulatory compatibility between rolling stock of various operators. This may be an ideal joint use solution, but requires institutional change and capital investment. Such a change would reflect European operating practice, and therefore may be difficult to implement broadly here because U.S. freight trains least resemble overseas passenger and freight train size and performance. (Example: NYC, DC, Chicago, and LA).

Combining High-Speed, Commuter Rail, Freight, and Local Services

This solution involves methods similar to the previous one, but the addition of high-speed rail causes new demands on capacity. A more advanced train control system is critical to successful high-speed operations. Isolation of true high-speed operations of 110-125 mph *or more* is preferable from an operating and safety perspective. (The Northeast Corridor is the closest in North America to this practice). Overseas, it is not uncommon to operate high speed trains in mixed traffic at reduced velocity over short segments of their route.

Limited Track Sharing/Absolute Block Passing Tracks

This strategy combines scheduling and infrastructure and assumes two tracks, one dedicated to freight and one to passenger service. The freight track is signal blocked to coincide with crossovers which in turn are spaced to serve as passing sidings for DMU. Passing sidings may be of sufficient length to enable rolling meets. By dividing the freight track thereby into absolute blocks which coincide as DMU passing sidings, non FRA-compliant DMUs can occupy vacant absolute blocks on the freight side fleetingly as they meet opposing DMU traffic. This forms a type of separation with parallel tracks and momentary "joint" use as protected by the block system on the freight side. Running a double track railroad as two separate operations sacrifices track capacity, which limits the utility of this proposal to low density services. Some additional benefits may accrue to local freight by furnishing more flexibility to service local shippers on both sides of the railroads. (No current example of this exists in North America.)

2.6 CONCLUDING COMMENT

During the course of this research, railroads interviewed indicated that scheduling and novel operating strategies may be fully acceptable for an *existing* operating scenario serving multiple tenants. If a joint operation using these practices is successful, a greater difficulty may arise when the demand for either passenger service or freight service increases, additional stops are added, or different performance characteristics are proposed. Passing sidings may have to be relocated, lengthened, or multiple track added. Joint use could become a victim of its own success in attracting more traffic, thereby reaching peak capacity and triggering capital expenditures and more intense competition for increased track space and larger operating windows.