

TRB Session 613 (P07-0663)

**Recent Investigations into Shared Railroad
Corridors and Facilities**

Tuesday, January 23, 2007, 7:30 PM – 9:30 PM, Hilton

Thomas R. Hickey, Gannett Fleming, Inc., presiding

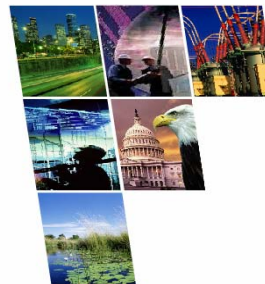


ENGINEERS
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Shared Track in North America

**David Nelson and Alexander Lu
Edwards and Kelcey**

REAL WORLD CHALLENGES . . . REAL WORLD SOLUTIONS



TRANSPORTATION
COMMUNICATIONS
UTILITIES
INSTITUTIONAL/COMMERCIAL
FEDERAL
PLANNING/ENVIRONMENTAL

Acknowledgements

Research conducted for:

- **Transit Cooperative Research Program
Project A-27**

*Shared Use of Railroad Infrastructure with
Non-Compliant Public Transit Rail Vehicles*



- **U.S. DOT Federal Railroad Administration
Office of Research and Development**

ITS Technologies for Integrated Rail Corridors
Contract No. DTFR53-01-D-0030 (2005-06)



U.S. Department
of Transportation
**Federal Railroad
Administration**

Shared Track Background

- **Shared Track: Physically Feasible** – Conventional railway and urban transit cars use similar track and infrastructure but seldom share assets.
- **Growing Interest in Shared Track** – As demand for urban transit services have grown in Europe and North America the interest in developing transit services that share track with existing low density freight services has grown.
- **Shared Track Safety** – Various disparities in the physical and operating characteristics for conventional railway and urban transit vehicle raise safety concerns about shared track.
 - Railway cars are heavier and more crashworthy
- **Overseas Leadership** – German transport officials have been leaders in developing transit services that share track with conventional railway operations
- **Domestic Review** – US transport officials have been more cautious, but are continuously evaluating their position on this issue.

Why Share Track?

- Service integration with existing system
 - “last mile”, one seat ride, network effect
 - Noise, vibration, visual, and environmental impact
 - Reduced infrastructure cost
 - Preserve urban freight services
-
- Intermediate performance for medium density applications
 - **“Projects of Opportunity”**



Typology of Rail Transit Development Options

- **Non-Rail Alternatives**
 - Express bus, bus rapid transit
- **Separate System Alternatives**
 - new right-of-way, highway median, street running, shared rail corridor
 - Often preferred if demand density is sufficiently high
- **Compliant Vehicle Alternative**
 - “Commuter rail” transit investment shares upgraded track with existing freight service
- **Shared Track Alternative**
 - Light transit rail cars shared track with conventional freight equipment

Shared Track Options

- **Shared-Track is the “Fallback” Option**
 - separate system is not justifiable (\$\$)
 - service needs not met by commuter rail
 - street running, urban redevelopment, local goals
- **Option 1: Temporal Separation**
 - all freight can be moved to overnight
- **Option 2: Concurrent Operations**
 - if the freight customer needs, local environmental, or freight volumes prevent overnight freight operation

Prerequisites for Concurrent Operations

- Low Density Freight
- Medium Density Transit (≥ 20 mins off-peak)
- Transit Rules based on Abbreviated Railroad Rules
- Fail Safe Train Separation System
- Common Communications Network
- Full FRA Compliance and Reporting, except
 - Vehicle-design related items (49 CFR Parts 221, 223, 229, 231, 238, 239)
 - Transit operators are not FRA engineers (49 CFR 240)
 - Minor variance on Hours of Service (49 CFR 225, 228)

European and North American Shared Track Business Models

Business Issue	Business Model	
	European	North American
<i>Shared Track Ownership</i>	Public ownership	
<i>Maintenance</i>	Owner provides maintenance services	
<i>Freight Track Access</i>	Open	Freight RR has perpetual and exclusive easement
<i>Liability</i>	Transit owner assumes risks above former status quo	
<i>Dispatching of Shared Track</i>	Railway	Transit Operator
<i>Shared Track Incident Response</i>	Railway	Transit Operator

European and North American Shared Track Business Models

Business Issue	Business Model	
	European	North American
<i>Shared Track Operating Rules</i>	Railway	Transit for Transit period; Modified transit for freight period; Abbreviated railway rules for concurrent shared track
<i>Shared Track Training</i>	Railway	Cross-train transit dispatchers and freight crews
<i>Shared Track Labor Laws</i>	NA	Transit operations avoid railway labor act
<i>Command and Control</i>	Fail-safe train separation signal equipment required for concurrent operations	

North American Shared Track Success Stories

City	State	Miles	Daily Transit Trains	Daily Freight Trains	First Operating Year	Method
San Diego Trolley	CA	31	294	~ 4	1981	Concurrent: 'Scripted' Temporal Sep. (2001)
Baltimore	MD	11	238	0	1988	Temporal Separation
NJ TRANSIT Newark LRT	NJ	0.2	404	0.4	1999	Concurrent: Cab Signals + NX Signal Logic (2005)
Salt Lake City	UT	12	158	< 2	2001	Strict Temporal Sep.
Ottawa	ON	5	140	0	2003	Temporal Separation
NJ TRANSIT River LINE	NJ	33	104	6	2004	Concurrent: Train Stops + NX Signal Logic (2007)
Escondido	CA	22	64	~2	(2007)	Strict Temporal Sep.
Austin	TX	33	~12	5~6	(2008)	Under Waiver Process

Incremental Concurrent Shared Track Operations

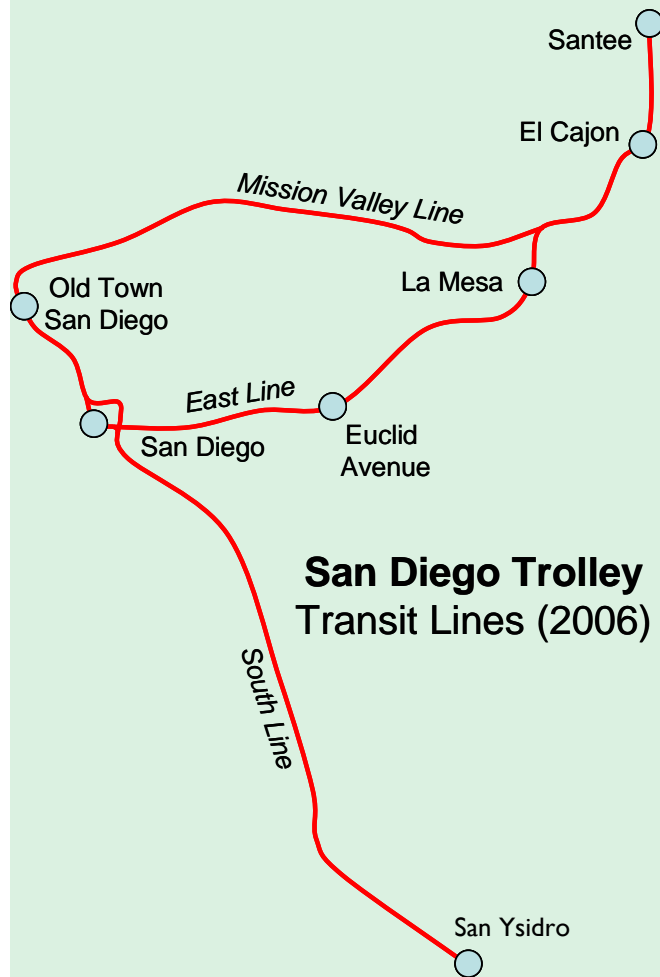
New Developments!

- **San Diego Trolley (2001)**
- **NJ TRANSIT Newark City Subway (2005)**
- **NJ TRANSIT River LINE (2007)**

Incremental Concurrent Shared Track Operations

- **San Diego Trolley (2001)**
- NJ TRANSIT Newark City Subway (2005)
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San Diego Trolley South Line



“Scripted Temporal Separation (STS)”

- One daily freight round trip to San Ysidro
- 147 daily passenger round trips to San Ysidro
- STS solves a “Cinderella” problem for freight and transit operator
- FRA approved SOP governing specific scenarios
- Dispatcher-centric
- Restricted Speed
- Not protected by fail safe train separation technology

“Scripted Temporal Separation”

- **“Grandfathered” Arrangement**

- “Limited night-time joint operation”
- Granted on the basis of a decade of safe operation
- No more approvals likely

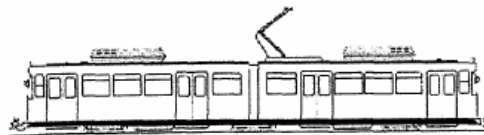
- **Separate Parallel Operations**

- State of the art in 2001
- Two independent single track RRs
- Trains exceeding movement authority will not collide




Standard Operating Procedures

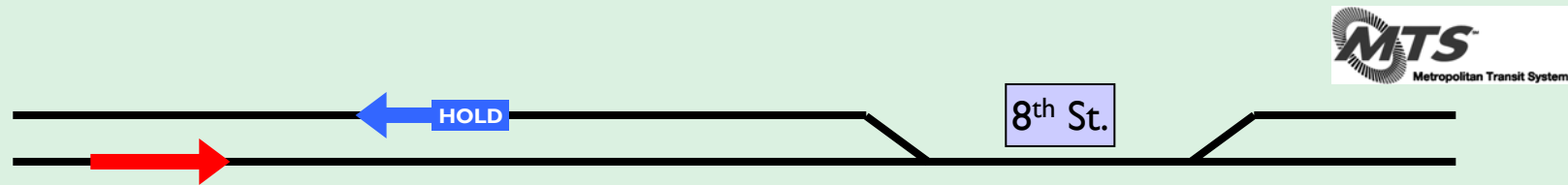
- Special rules to provide for limited night-time joint-operations
- SOP 105.31
- FRA approved



SAN DIEGO TROLLEY, INC. STANDARD OPERATING PROCEDURE

TRANSPORTATION DEPARTMENT	PUBLICATION NUMBER 105.31	DATE 12/31/03	PAGE 1 OF 3
TITLE:		LIMITED JOINT OPERATION BETWEEN SDTI LIGHT RAIL TRAINS (LRT) & SD&IV FREIGHT TRAINS	
CLASSIFICATION:		CONTROLLERS/SUPERVISORS, TRAIN OPERATORS	
OTHER DEPARTMENTS:		LRV MAINTENANCE, WAYSIDE MAINTENANCE, SD&IV	
ORDERED BY:			
 SUPERINTENDENT OF TRANSPORTATION			
SUPERSEDES:		SOP 105.35 DATED 12/01/03	
PURPOSE:			
<p>This procedure will establish the method by which SDTI (LRT) and SD&IV freight trains may jointly occupy certain segments of the line with very specific and defined limitations. In addition, this procedure will provide an effective means by which SD&IV freight service may commence when the last inbound LRT passenger train has departed specified terminals. Also detailed in this procedure are instructions for the handling of an SD&IV freight train returning to the San Diego yard (Blue Line) at the commencement of LRT morning passenger service.</p>			
<p><u>Note:</u> At no time will any following train movement be permitted on the same track, only separate, adjacent tracks.</p>			

Managing shared track in the early morning



1. NB freight contacts dispatcher, agree on 1 of 2 approved meeting locations
2. Freight train traverses single track section (8th St.)
3. Freight train stops at designated location and calls clear to dispatcher
4. Track occupancy indicators confirm freight's location
5. Dispatcher signals first trolley to leave yard onto SB tracks
6. SB Trolley passes stopped freight at reduced speed (< 20 mph)
7. Trolley reports clear
8. Freight train gets allowed to continue northward

Incremental Concurrent Shared Track Operations

- San Diego Trolley (2001)
- **NJ TRANSIT Newark City Subway (2005)**
- NJ TRANSIT River LINE (2007)

NJ TRANSIT Newark City Subway

“Extended Temporal Separation (ETS)”



- Infrequent midday local must cross new light rail extension to serve local customer
- Midday light rail trains pass every 10 minutes on the branch
- ETS meets needs of local shipper and carrier
- Technology guarding boundaries of freight and transit operations is dynamically employed to route freight and transit trains over the same track segment
 - Transit trains controlled with ATS
 - Freight trains controlled with interlocked derails

Shared Track Regulations

- NS special bulletin #104 governs shared-track operations
- NJT Rulebook controls transit operations
- FRA approved

EXHIBIT 2: NORFOLK SOUTHERN BULLETIN ORDER

06/21/02 21:42:29 Norfolk Southern-> 9733668878 Right:PAK Page 002

--- Received from NSC.KG. (717)541-2161 06-21- 16:37

-> NSC.HBOPB HARRISBURG DIVISION OPERATION
-> NSC.HBGDIV OFFICERS-HBG DIV TRANS DEPT
-> NSC.H608 HBG DIV BULLETINS & NOTICES

NORFOLK SOUTHERN CORPORATION
HARRISBURG DIVISION
OPERATIONS BULLETIN



HARRISBURG, PA - JUNE 21, 2002

OPERATIONS BULLETIN 104

ALL EMPLOYEES: HARRISBURG DIVISION

ORANGE INDUSTRIAL TRACK:
BLOOMFIELD, NEW JERSEY

EFFECTIVE: 12:01 A.M., Monday, June 24, 2002

The following procedure will govern for operations over the shared right of way of N. J. Transit's Newark City Subway (NCS) and Norfolk Southern's Orange I.T. between MP 9.15 and MP 9.83. This territory is now referred to as the City Subway Connection. All movements by Norfolk Southern have the right to access between the hours of 11:00 P.M. and 4:00 A.M. daily; no freight train movements will be permitted at any other time. The Newark City Subway will have the exclusive use at all other times.

An interlocking designated "Newark City Subway Interlocking" with home signals is installed at MP 9.15 for westward movements and at MP 9.83 for eastward movements. Located prior to each of the interlocking signals is a ROUTE REQUEST CONTROL BOX. This control box is used to enter a request to automatically align the interlocking and to clear the interlocking signal.

Newark City Subway Interlocking is controlled by the NCS Operation Control Center. The Operation Control Center, located in Bloomfield, New Jersey is manned 24 hours a day, seven days a week and can be reached by telephone at (973) 566-6770 or via the NJT Hoboken Division radio channel.

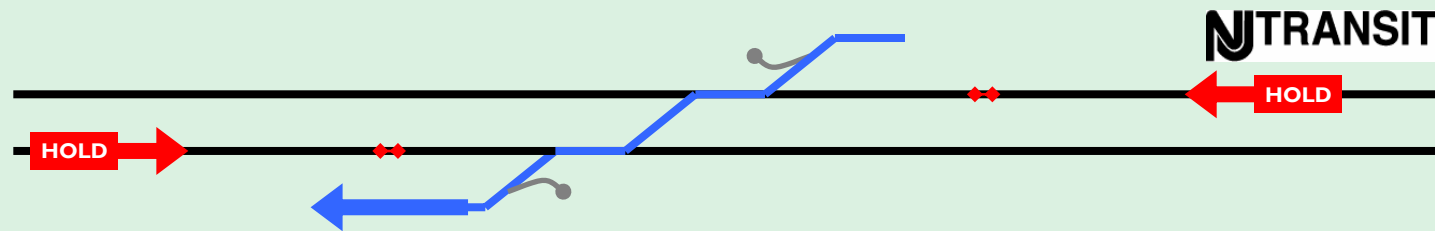
NJT switch locks (type 104) have been applied to all switches and derails within the interlocking.

Incremental Concurrent Shared Track Operations

NJ TRANSIT: “Extended Temporal Separation”

- Interlocked split-point derails
- Transit train supervision technology (ATS/CSS)
- NX (entrance-exit) signal logic

Dynamic Shared Track Management



1. NS freight stops short of derail at entrance to shared section; radios NJT dispatcher for permission to enter
2. Dispatcher stops all nearby traffic, grants permission
3. NS conductor unlocks wayside Route Request Control Box and presses 'REQUEST' button, then padlocks the box
4. Vital signal logic checks to ensure freight route is clear
5. Interlocking automatically lines, verifies switches and derails, locks route; Signal clears to RESTRICTING (yellow)
6. Interlocking sets transit signals to STOP; protected by ATS
7. Freight train traverses the interlocking on fixed route
8. NS conductor unlocks wayside box at opposite end of interlocking; presses 'RELEASE' to unlock route and restore NJT dispatcher control.

Incremental Concurrent Shared Track Operations

- San Diego Trolley (2001)
- NJ TRANSIT Newark City Subway (2005)
- **NJ TRANSIT River LINE (2007)**

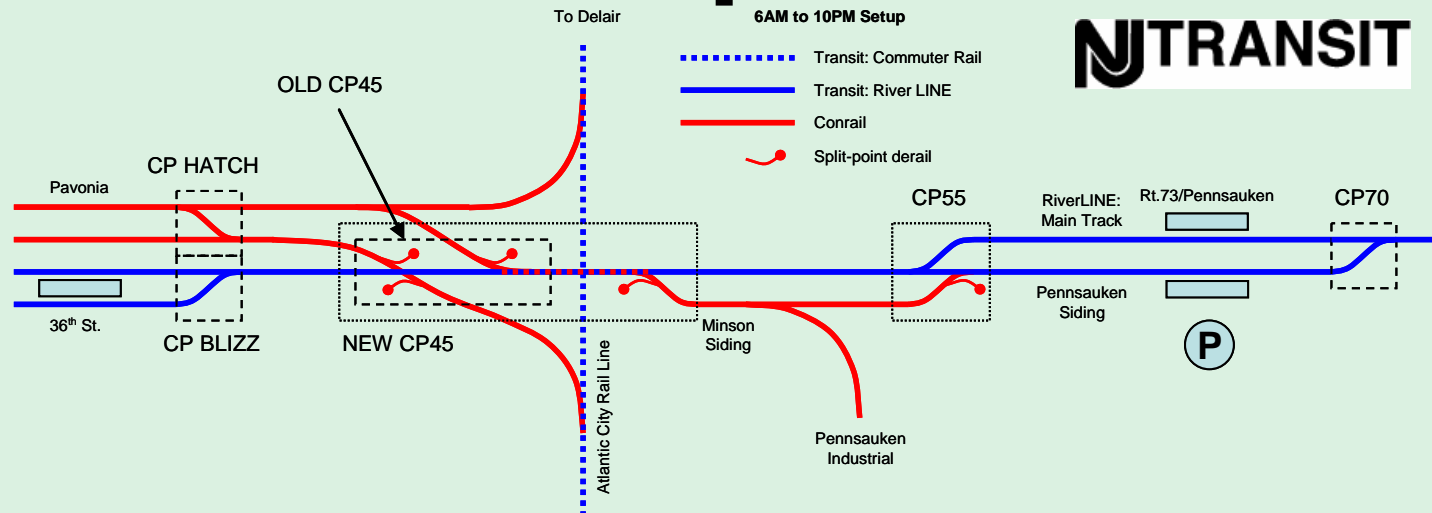
NJ TRANSIT River LINE

Beyond Temporal Separation

- Opened 2004 under temporal separation with commitment to future concurrent operations
- Passenger window 6am-10pm; Freight 10pm-6am
- 30 minute bidirectional off-peak transit headways
- 6 weekday freight trains:
Most of any US shared track line
- Passenger demand for extended hours of service
- ETS required:
 - To meet needs of freight carrier and shippers for midday and evening operations
 - Address “Cinderella” problem for both freight and transit on boundaries of the service day
- Technology guarding boundaries of freight and transit operations is dynamically employed to route freight and transit trains over the same track segment
 - Transit trains controlled with ATS
 - Freight trains controlled with interlocked derails

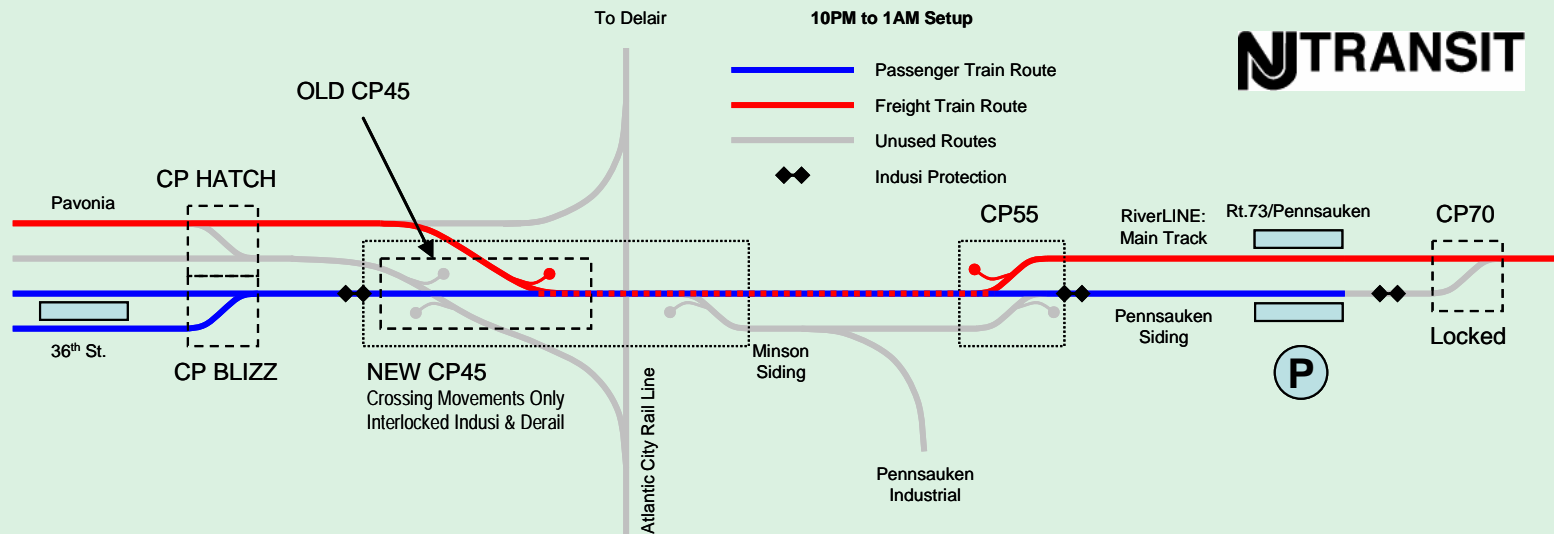


River LINE Proposal



- New concurrent shared track CP-45
- Same functionality as the Newark City Subway (minus route request boxes)
 - Derails for freight
 - ATS for transit
 - Concurrent shared track
- Dispatcher responsible for routing
- Interlocking appliance prevent setting of an unsafe route

'Extended' Passenger Period



For the Cinderella Period (10pm to 1am)

- CP-45 and CP-55 interlocked, providing 3 possible routes
 - Freight: Pavonia to CP-70 Main Track
 - Freight: Pavonia to Minson Siding
 - Passenger: CP-BLIZZ to Rt.73 Station on Pennsauken Siding
- Freight violation of signal authority results in derailment!

NJT Train Control Technologies

Split-point derail: low tech, but works

– suitable for low-speed applications

Proven Technology

- Many NJ Transit commuter rail key junctions
- Drawbridge protection (PRR)
- British Rail ‘flank protection’
- Japan Tokyo Tozai Rapid Transit shared network



NJT Magnetic Train Stops

- Transponder generates a changing electro-magnetic field
- Signal aspects picked up by on-board computer and enforced

Proven Technology

- Deutsche Bahn Indusi (Ottawa)
- British Rail TPWS
- Nederlandse Spoorwegen ATB
- **Intermittent**
- **Mostly European**



NJT Newark Cab Signals

- Audio frequency track circuits continuously transmit speed authorization codes; sensor pickup; no code = STOP

Widely Accepted

- PRR, LIRR, MNCW
- Amtrak NEC, CR
- MBTA, PATCO, WMATA, BART...
- Florida East Coast
- JNR Shinkansen
- LUL Victoria Line
- SNCF TGV TVM

-  **Technology of American Origin**



Shared Track in North America

Key Points

- Emerging uniquely American model for shared track operations
- Growing list of shared track systems
- Quiet incremental progress toward concurrent shared track operations
- Federal agencies are working with local officials to solve local problems
- Limited concurrent shared track does not require “space age” technology

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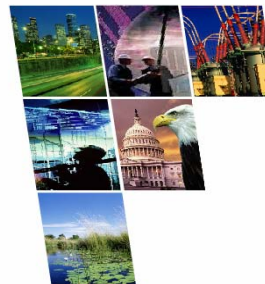


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