

Induction of Computer Applications in Rail Transport paving way for better Management of Rail Operations and Passenger Comforts

TRAIN MANAGEMENT SYSTEM



On Churchgate Virar Mumbai
Suburban Section

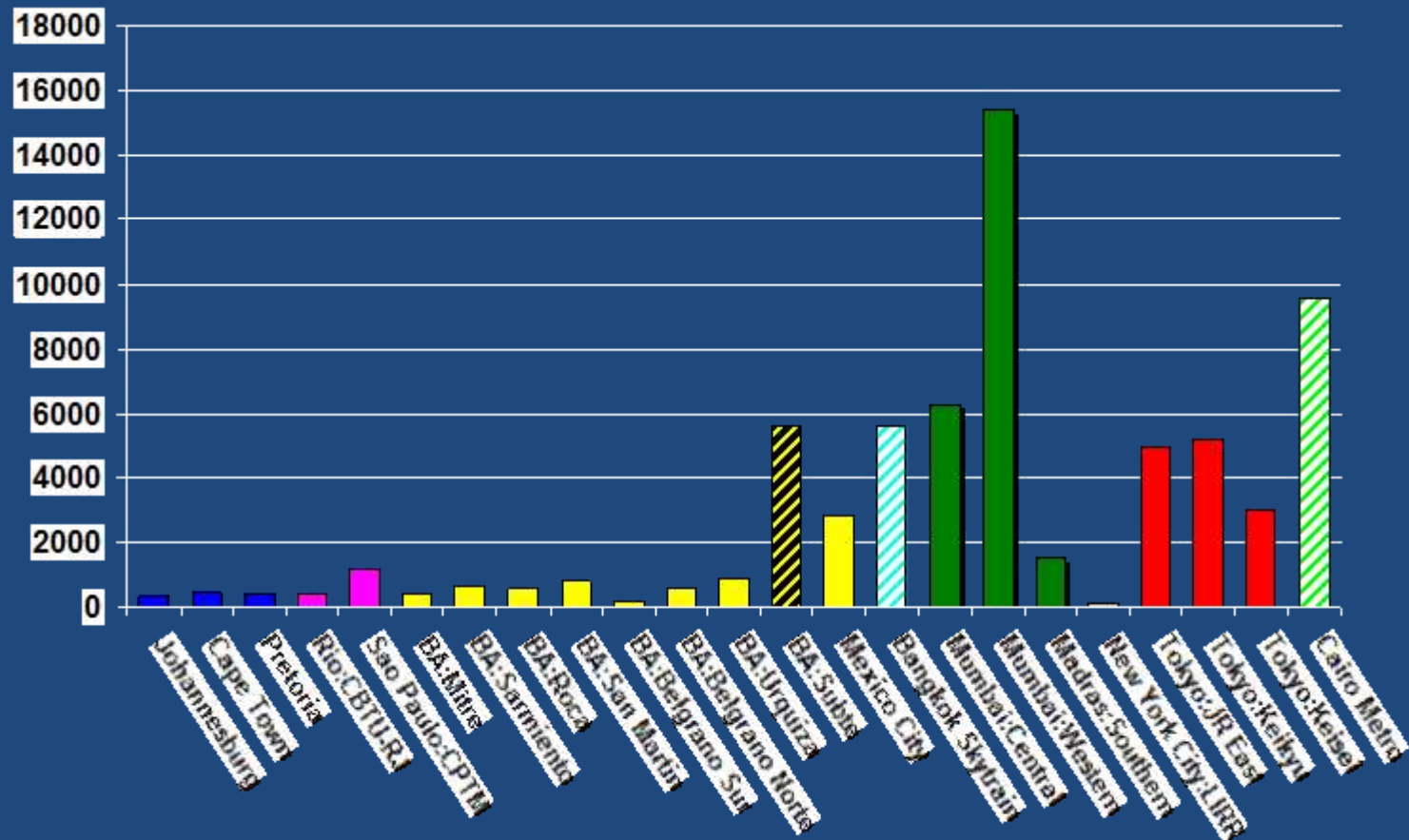
Need for TMS for Mumbai Suburban Rail Network

People have to
travel long
distances to come
to their offices



(Passengers (000,000))

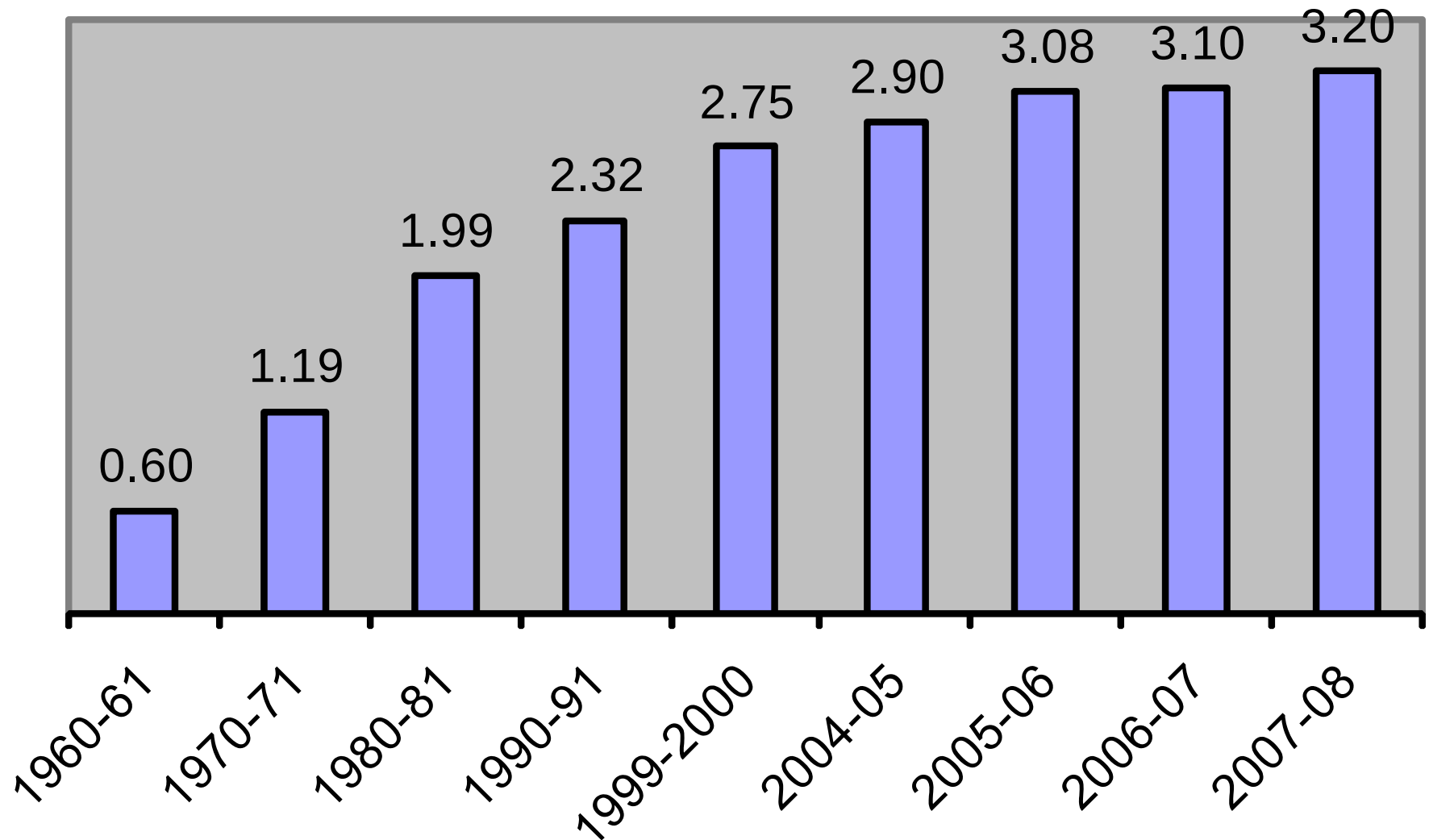
Suburban Rail Systems: Annual Passengers Per Km of Line



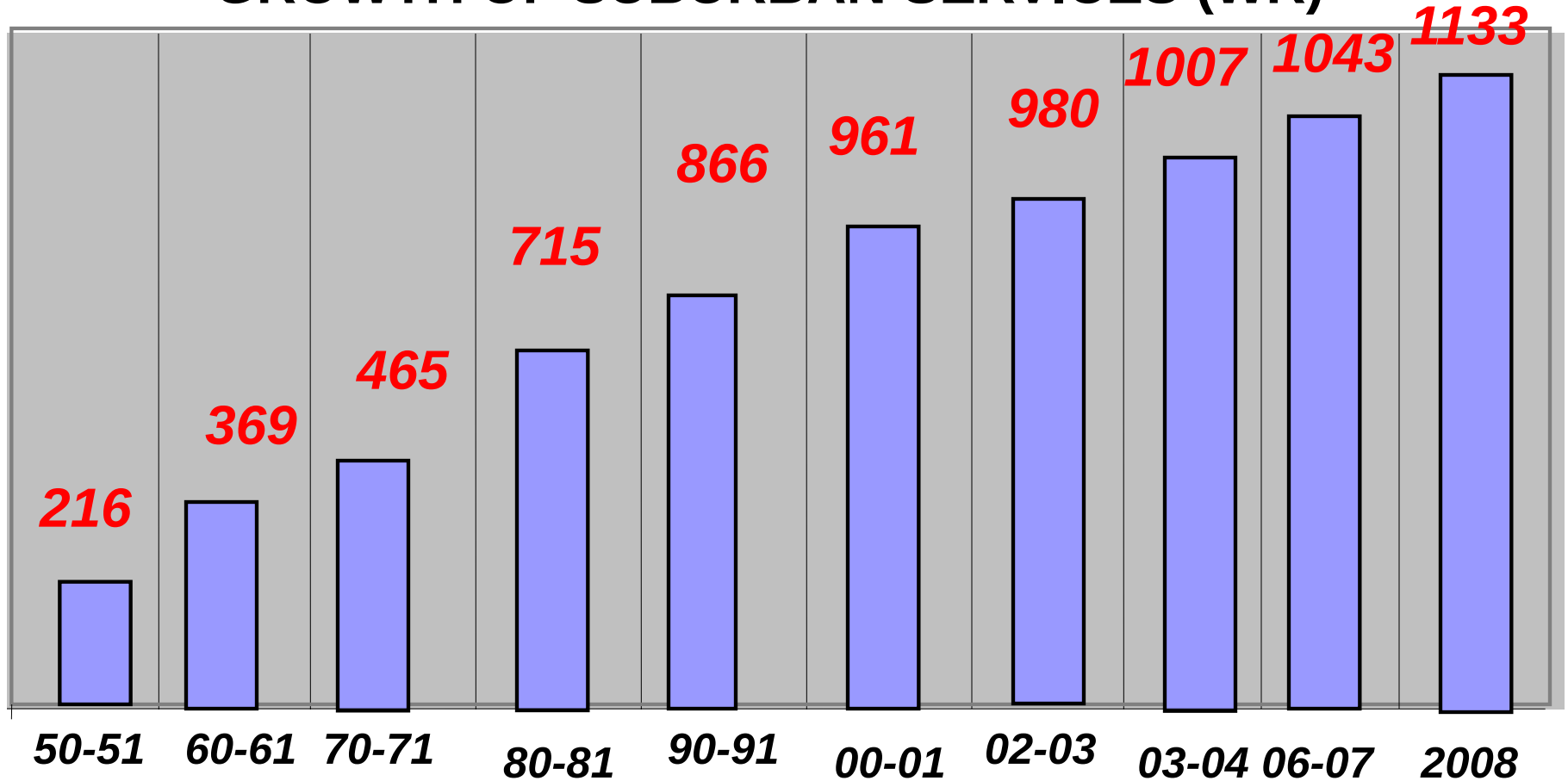
Suburban Services

- No. of Trains on Week Days - 1133
- No. of Trains on Holidays - 1098
- No. of Trains on Sundays - 1080
- No. of Fast Trains - 399
- No. of Slow Trains - 734
- Morning Peak - 228
- Evening Peak - 211
- No. of 12 Car Service - 589
- Headway - 3 Min.

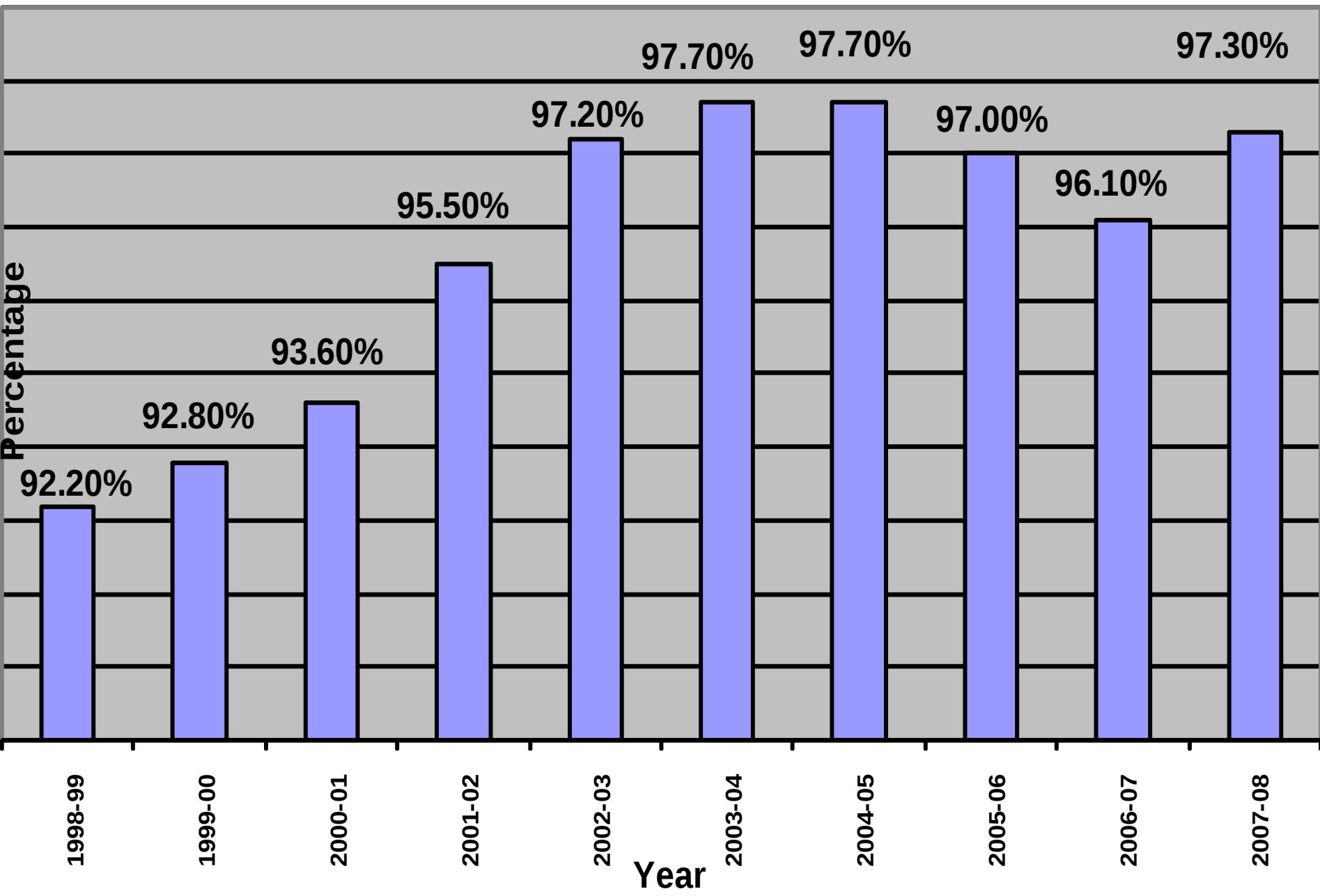
No. of originating passengers per day in millions on Mumbai Suburban (W. RLY.)



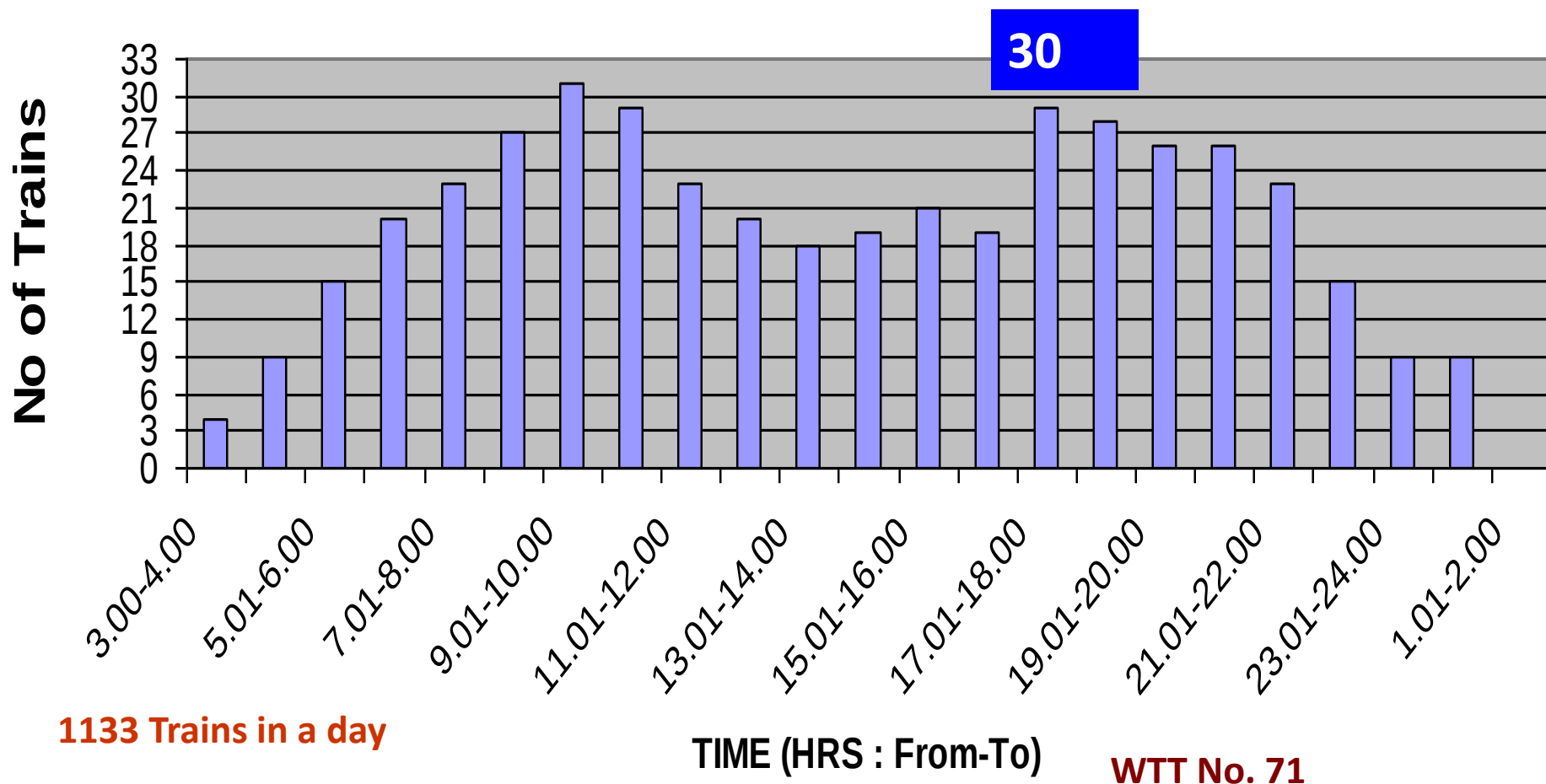
GROWTH OF SUBURBAN SERVICES (WR)



PUNCTUALITY -Suburban services



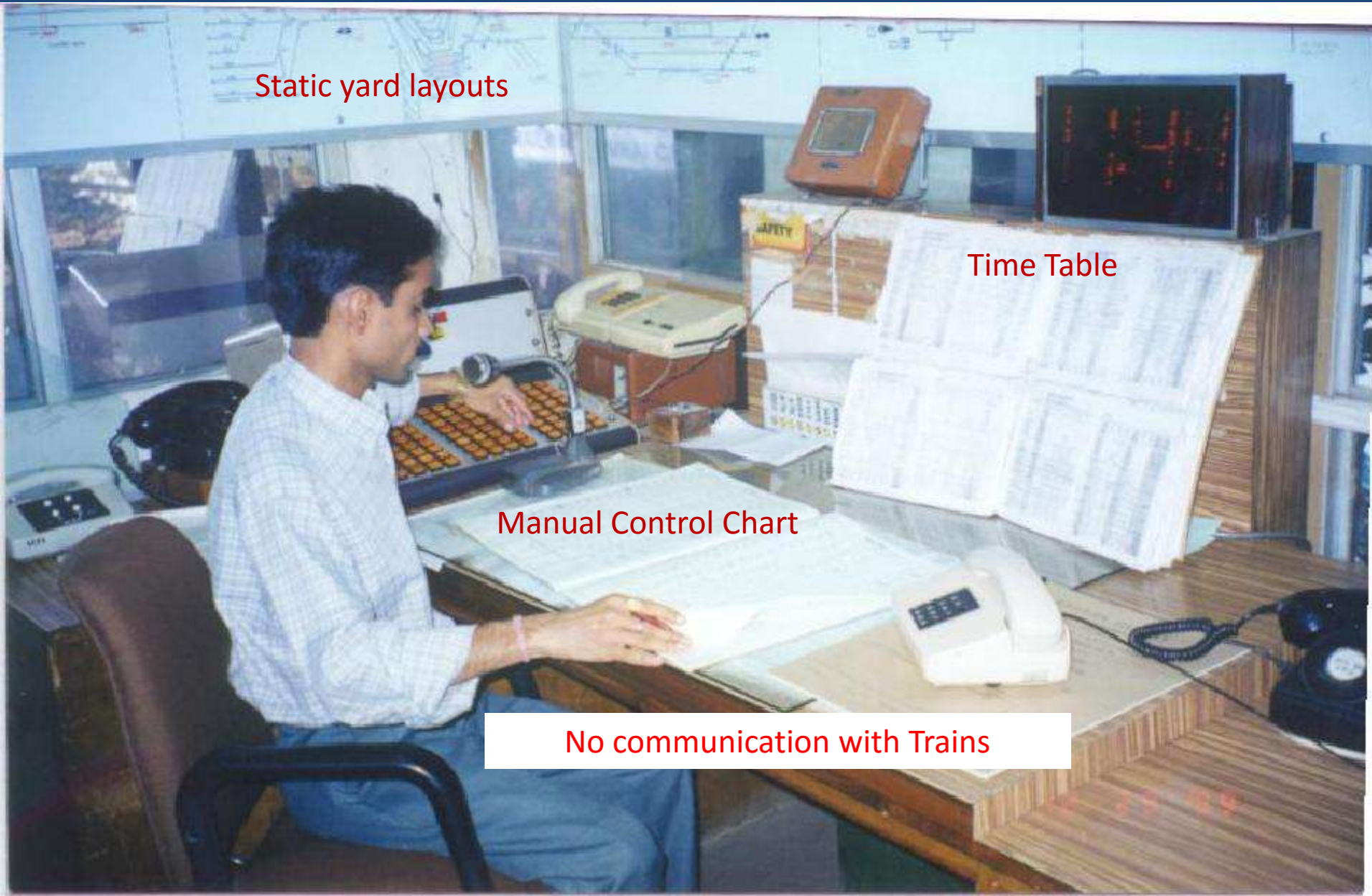
HOUR WISE TRAIN DEPARTURE FROM CHURCHGATE



In Peak hours, each train carries close to 4,500 Commuters

In Peak Hour: 1,20,000 Commuters (30 trains in an hour)

Before TMS, Our Traffic Controllers were managing train operations in the old fashioned way...



Static yard layouts

Time Table

Manual Control Chart

No communication with Trains

**Real Time Train Arrival
Status for Commuters
with automatic
announcements**

**Real Time
Train
Movements
and Live
Signalling
Indications
for Rail
Operations**



Virar Local expected in 1 minute



*Mobile
Communication*



Virar Local has arrived

TMS has following Main Sub-Systems

For Commuters

- Real Time Passenger Information System

➤ For Rail Operations

- *Mobile Communication between Control Centre & Suburban Trains*
- *ON LINE train movements & live signalling indications*
- **Generation of Management Information Systems**
(MIS)Reports , Statistical Data
- *Software Modules for Time Tabling, Training & Simulation, Traffic Planning & Optimisation*



Automatic Announcements at stations as trains come and go



“Countdown “00” : *Train at the platform*

TMS can drive any type of Indicator Display System in any language

: *LED, Plasma/LCD*
Types..



TMS : Passenger Information System

When
ear
for



Choice of 2
Trains on each
platform

on 25" Colour
VDUs at station
entrances

Our Commuters can decide which train suits them best



Train arriving in next 5 Minutes : Denmark



Minute to Minute Information of Train Movements to Commuters



Real Time Train Arrival Status of Trains

PF NO.	DESTINATION	SCH. DEP.	EXP. IN MINUTES	MODE	COACHES
1	ANDHERI	5.54	04	S	9
	BORIVALI	5.57	08	S	9
2	CHURCHGATE	5.52	02	S	9
	CHURCHGATE	5.56	06	S	9
3	VIRAR	5.57	07	F	12
	BORIVALI	6.00	11	F	9
4	CHURCHGATE	5.58	09	F	9
	CHURCHGATE	6.04	14	F	12
05:51					

REAR VIEW PROJECTION SCREENS PROVIDE OVERVIEW OF ENTIRE 60 km SECTION





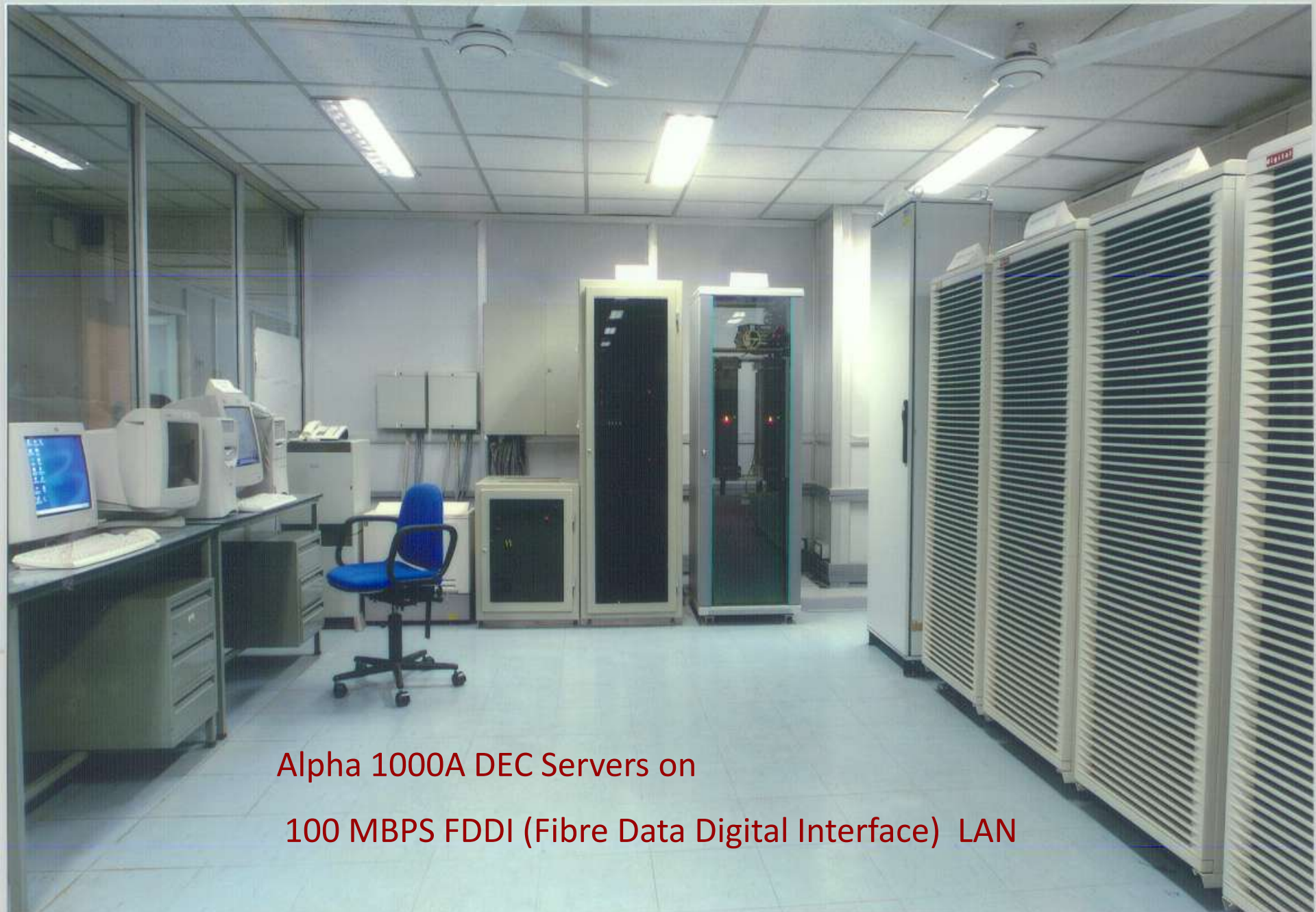
Traffic Controllers in Main Live Train
Projection Room



Other Controllers :
Engg, Electrical, Signal, EMU

Server Room (Alpha 1000A DEC Servers)



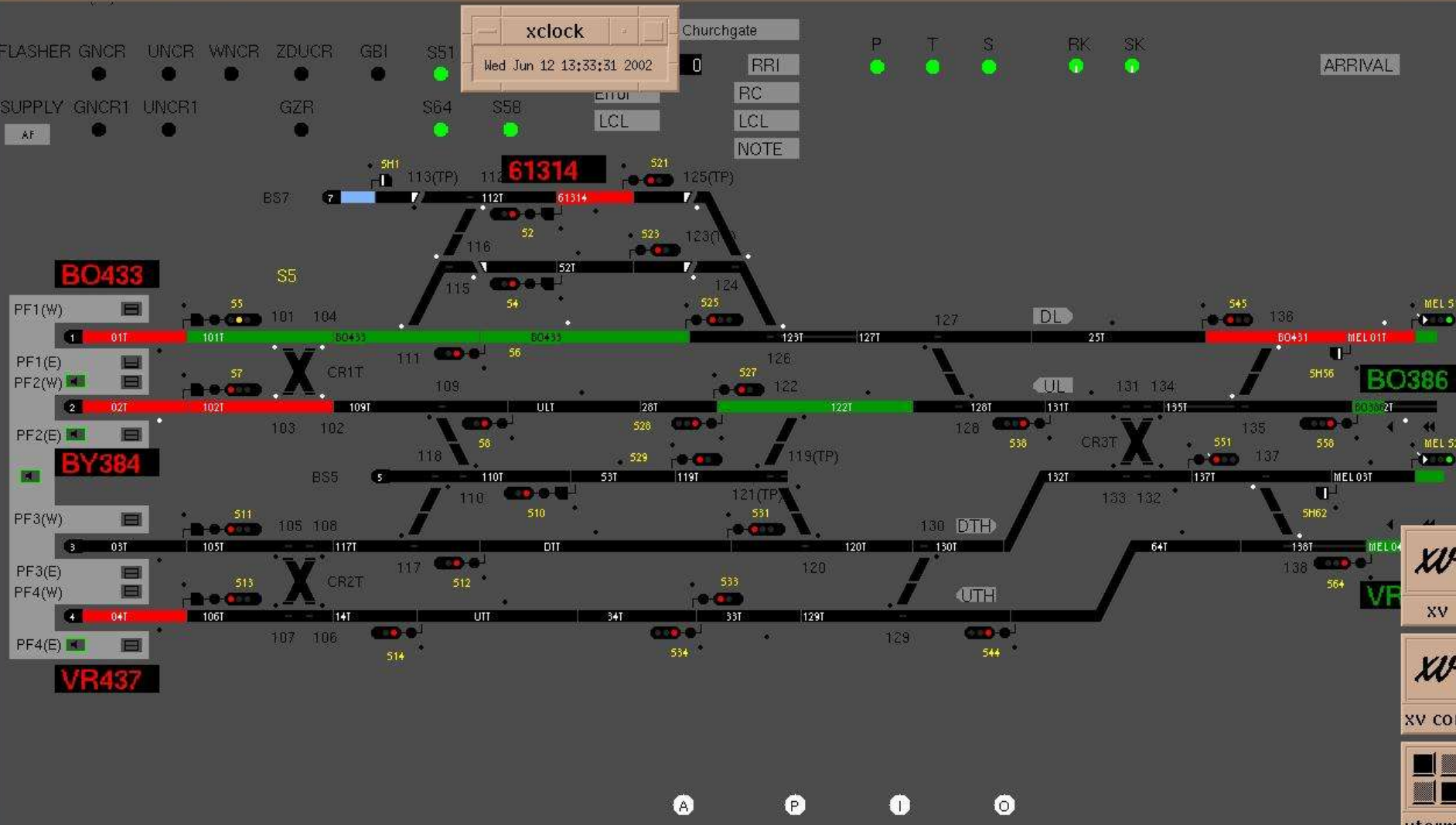


Alpha 1000A DEC Servers on
100 MBPS FDDI (Fibre Data Digital Interface) LAN

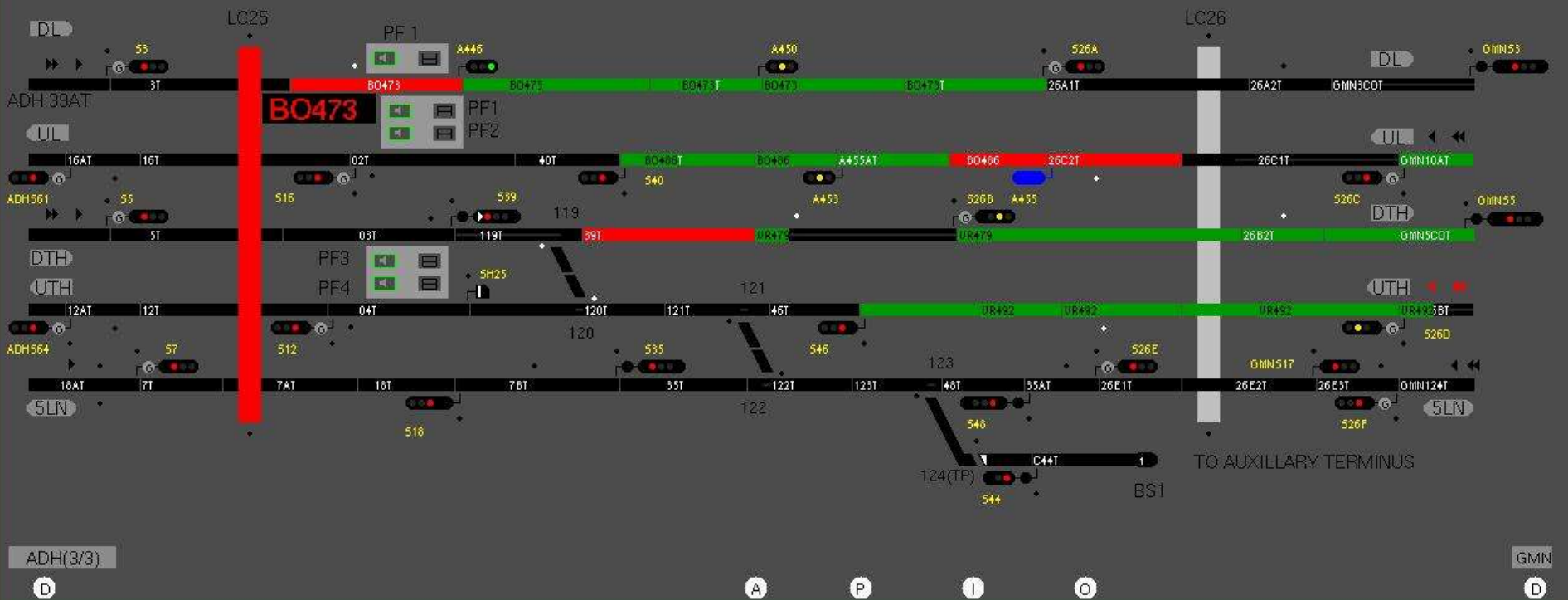
TMS Control Centre, Mumbai Central

Live Display of Train Movements with Train Numbers and Live Signalling Indications for entire Churchgate Virar section





Help



le Pictures Facilities TDS Alarm DSS
le Numbers Areas Describers

Recording - FrontCam

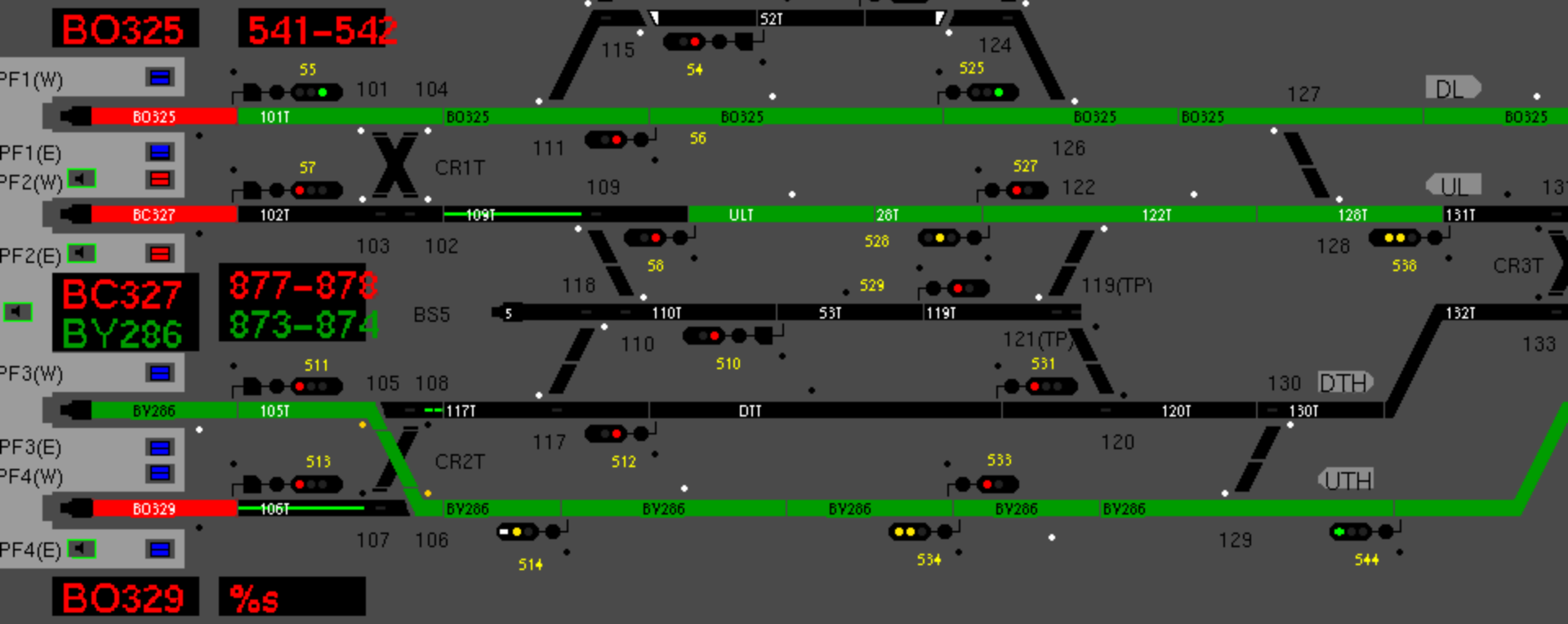
Capture Play Input Output Options Help

Frames : 0
Length : 00:00
Rate : 0.00 fps
Size : 1024 x 768
Codec : MS-CRAM
Auto Pan : Enabled
Audio : Off

Press Pause or F10 to pause

ASHER GNCR UNCR WNCR ZDUCR GBI
UPPLY GNCR1 UNCR1 GZR
AF

P T S RK S
RRI
CL
OTE



Automatic Recording of Train Timings

Date : 16-Jun-2003

Time Period : 12 - 03 Hours

Section : Churchgate-Bandra

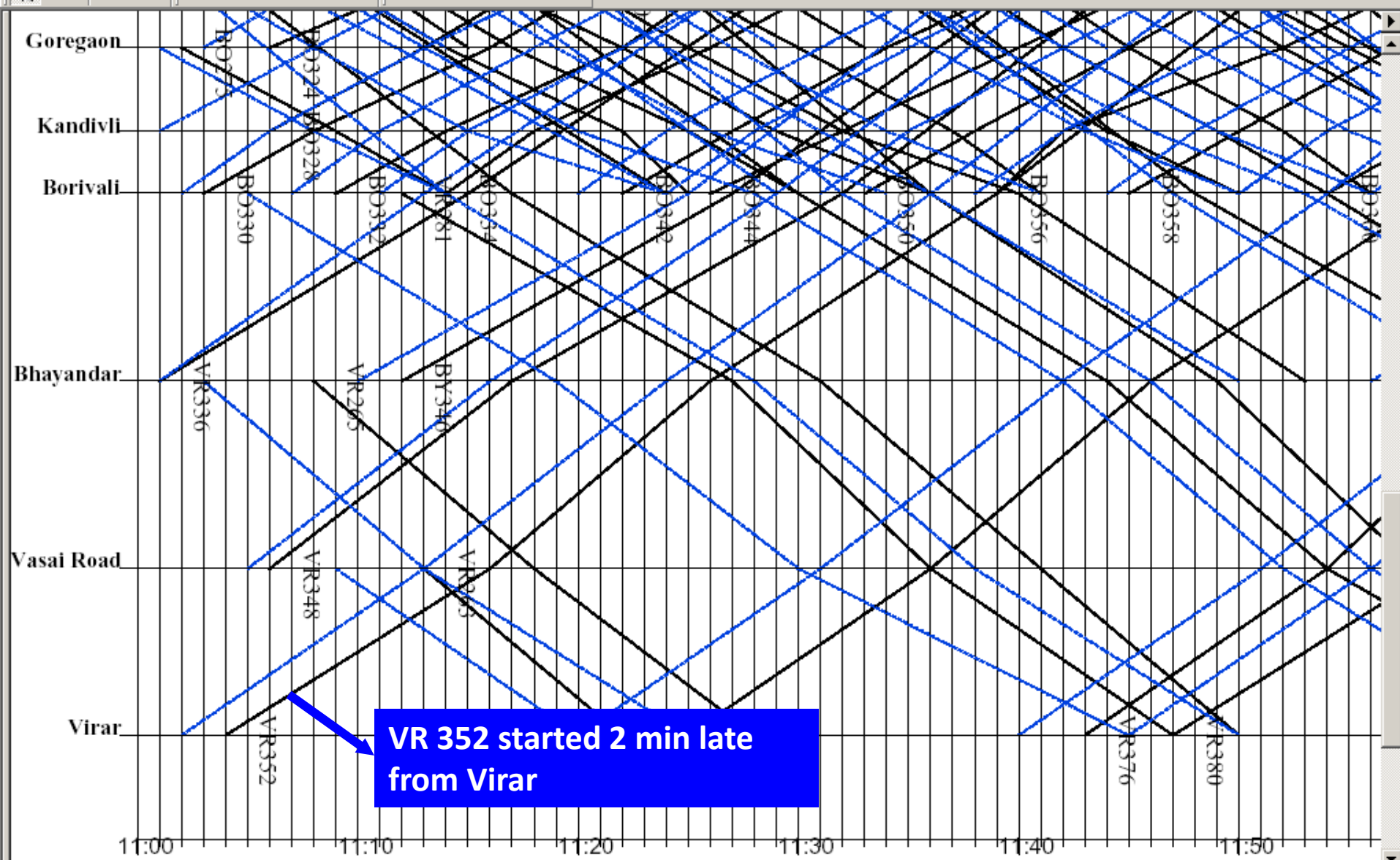
Direction : Down Trains

Train No.	Unit No.	Churchgate		Mumbai Central		Dadar		Mahim		Bandra		Remark
		Sch.	Status	Sch.	Status	Sch.	Status	Sch.	Status	Sch.	Status	
BO429	645-646	13:15	RT	13:25	RT	13:36	RT			13:45	RT	
BO431 12 Car	871-872	13:15 T		13:25 T	RT	13:32 T	RT			13:38 T	RT	
BO433	929-956	13:20	RT	13:30	RT	13:41	RT			13:50	RT	
VR435 12 Car	613-614	13:23 T	00:02	13:33 T	00:02	13:40 T	00:02			13:46 T	00:02	
BO437	1005-1006	13:24	RT	13:34	RT	13:45	RT			13:54	RT	
2933Karnavati Exp. (D)				13:40	00:03	13:51 T	00:10			13:56 T	00:09	PL: STOPPED AT PL FROM 13.51 TO 13.59 HRS DUE TO ACP IN CH 89028ABNOT ON WEDNESDAY
CR CB41								13:54 H		13:58 H		
BO439	519-520	13:30	RT	13:40	RT	13:51	RT			14:00	RT	
BO441	549-550	13:33	RT	13:43	RT	13:54	RT			14:03	RT	
BO443	611-612	13:39	RT	13:49	RT	14:00	RT			14:09	RT	
VR445 12 Car	917-918	13:43 T	00:01	13:53 T	00:05	14:00 T	00:06			14:06 T	00:06	
CR CAD41								14:09 H	RT	14:13 H	RT	
BO447	905-906	13:45	RT	13:55	RT	14:06	RT			14:15	RT	
BO449	623-624	13:49	RT	13:59	RT	14:10	RT			14:19	RT	
VR451	555-556	13:54	RT	14:04	RT	14:15	RT			14:24	RT	
BY453 12 Car	847-848	13:55 T	RT	14:05 T	RT	14:12 T	RT			14:18 T	RT	
BO455	701-702	13:57	RT	14:07	RT	14:18	RT			14:27	RT	
CR CB43								14:24 H	00:03	14:28 H	00:01	
AD457	811-812	14:01	RT	14:11	RT	14:22	RT			14:31	RT	
BO459	617-618	14:06	RT	14:16	RT	14:27	00:01			14:36	RT	

Train Graph

Blue Lines: Scheduled Path

Black Lines: Actual Path



Daily Suburban Punct Position Periodic Percentage Sheet

Daily Suburban Punct Position

GM's Position

Daily Lost/Delays

PCDO Position

monthly Incident

Percentage Monthly Summary

Delayed Trains Tabular

Canceled Trains Tabular

Actual Rake-Service Tabular

Bad Runner Matrix

SUBURBAN PUNCTUALITY ON 16 Jun 2003											
24.00 HRS POSITION				MP		EP		NP		TOTAL	
2002 2003				205		186		610		1001	
C/D- 10	/ 265	P	97.7	95.1		99.5		98.4		97.9	
		M	98.3	C	D	C	D	C	D	C	D
ELECT R/S	B0235-12* Rep of B235 Unit no. 313/321 stopped at J08 from 10.29/10.34hrs. Due to unit trouble (All motor coaches tripped unit refused to move.) Train cancelled on arrival at BVI.			0	4	0	0	1	0	1	4
Engg Others	A239-8* Rep of FL DW Line track failed from 9.54/10.15hrs due to water logging. PWI attended & P/RT.			0	4	0	0	0	0	0	4
Other Division	VR828-12* Rep of 4847 running ST 10.35hrs VR(P) 11.09hrs , 984UP ST 10/10* late VR(P) 20*late.			0	0	0	0	0	3	0	3
R/F	BY282-10* Rep of 9822UP & 2954UP received 41* & 35* late ex-VR due to R/F on UP Line between BOR-FLG at 8.20hrs.			0	2	0	0	0	0	0	2
SIGNAL	B0777-9* Rep of point 129/130 failed in reverse at BTC from 20.58/21.09hrs.			0	0	0	1	0	3	0	4
TP	AE758-9* Rep of train stopped between BA-MM at km 14/7 as MTP E/D & injured 20.56/21.08hrs.			0	0	0	0	0	3	0	3
TRAFFIC	VR876-13* Rep of T/RFO P.No. 21971 load 72/73.5/2149 VR dep 23.09hrs BSR arrival 23.49hrs Dy-SB Sudhir More kept load O/S for pulling up CONRAJ from GL-1 to BTVA-5			0	0	0	0	0	1	0	1
TOTAL				0	10	0	1	1	10	1	21
Delayed By		MP	EP	NP	TOTAL						
01 - 03		48	38	136	222						
04 - 05		47	13	77	137						
06 - 10		7	1	7	15						
11 - 15		3	0	3	6						

Delayed Trains

Delayed Train List

TD	Rake	Delay	Direction	Stn
BO505	549-550	1	DOWN	BVI
VR526	885-886	1	UP	DDR
ET547	929-956	1	DOWN	GTR
BO532	631-632	1	UP	ADH
BO535	529-530	1	DOWN	BA
VR556	951-914	2	UP	BYR
BO536	813-836	2	UP	JOS
BO533	655-656	3	DOWN	MRU
BY552	841-842	3	UP	BYR
BA529	823-824	3	DOWN	MM
VR550	611-612	3	UP	MIRA
VR517	825-826	3	DOWN	KILE
BO511	555-556	3	DOWN	JOS
BO527	905-906	3	DOWN	BA

Query

2951

Flash

Red MX A352T Right

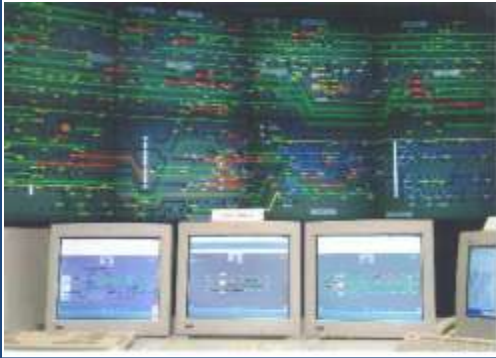
Delayed Trains

with various filters

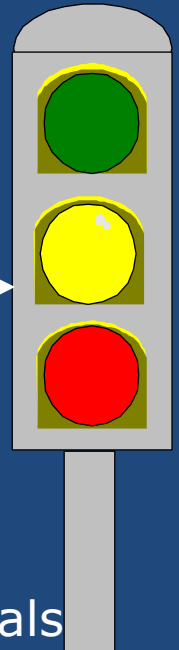
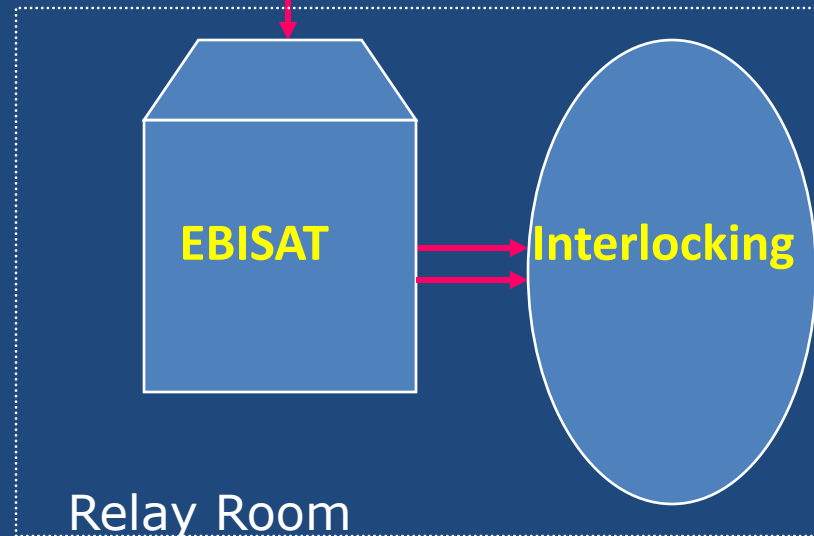
- All UP trains > 1 min LT
- All trains More than 5 min, etc.

on a real time basis

How does TMS work ?



Optical Fibre Network



Signals



SDH STM1 Optical Fibre Network on Churchgate Virar section

Sat Apr 26 18:03 2003

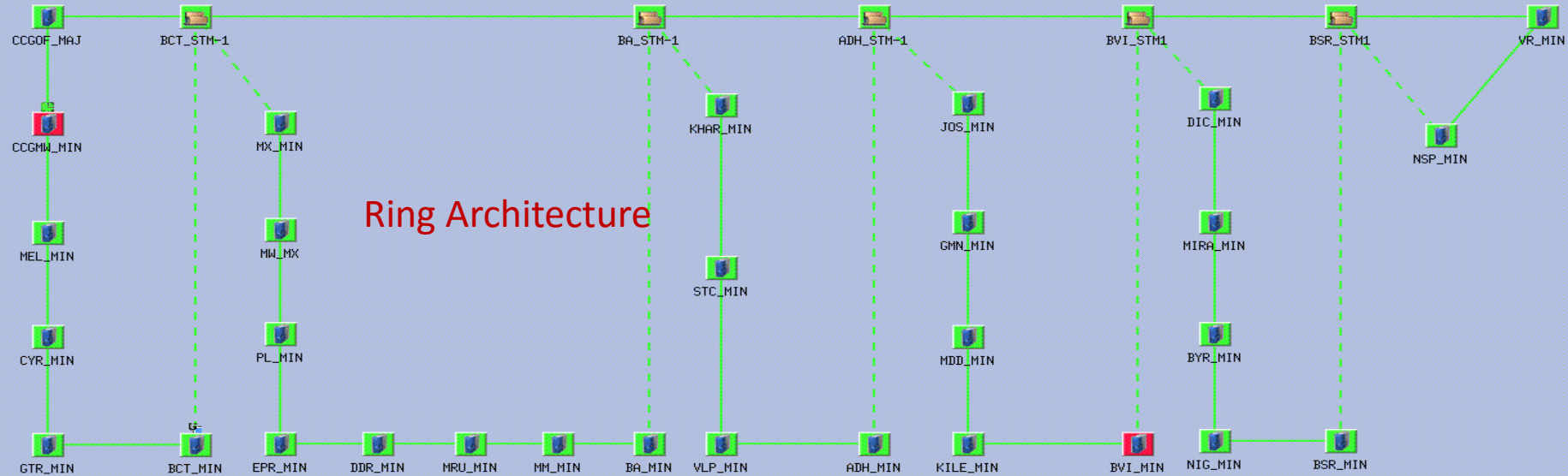
admin @ Western-Railway



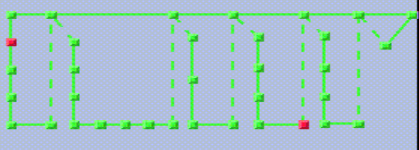
34



34



eNM - Navigator



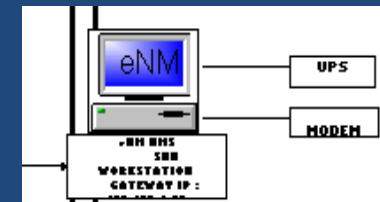
External Alarm

26/04/2003 10:03:00 Cleared
 26/04/2003 10:03:00 Cleared
 26/04/2003 11:01:57 Major
 26/04/2003 11:03:00 Cleared
 26/04/2003 12:27:45 Major
 01/01/2004 00:00:16 Major
 26/04/2003 12:27:45 Major
 26/04/2003 12:27:45 Major
 01/01/2004 00:00:16 Major
 26/04/2003 12:27:45 Major
 26/04/2003 14:08:32 Cleared
 26/04/2003 14:08:42 Cleared
 26/04/2003 14:08:45 Cleared

JOS_MIN : 108-EXT. ALM.
 JOS_MIN : 108-EXT. ALM.
 MW_MIN : 108-EXT. ALM.
 MW_MIN : 108-EXT. ALM.
 ADH_MIN : 108-EXT. ALM.
 ADH_MIN : 108-EXT. ALM.
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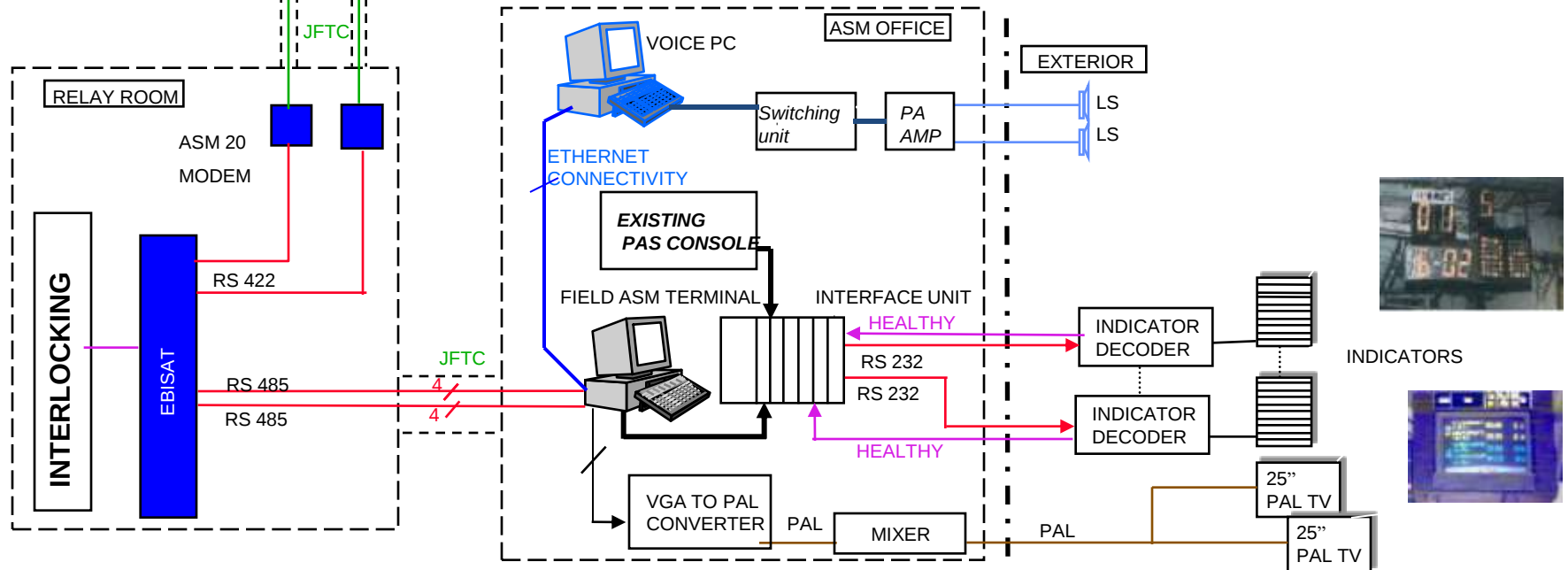
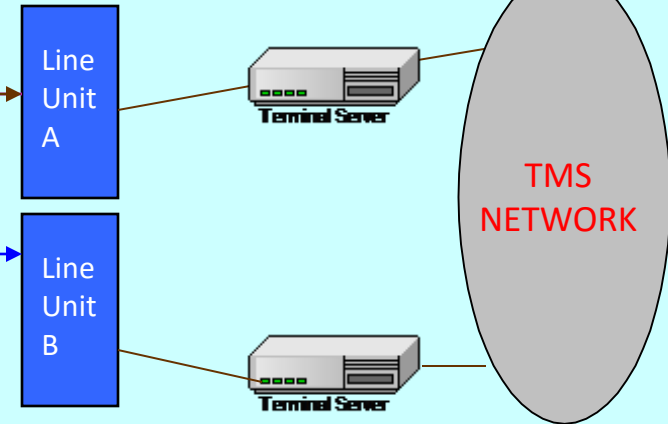
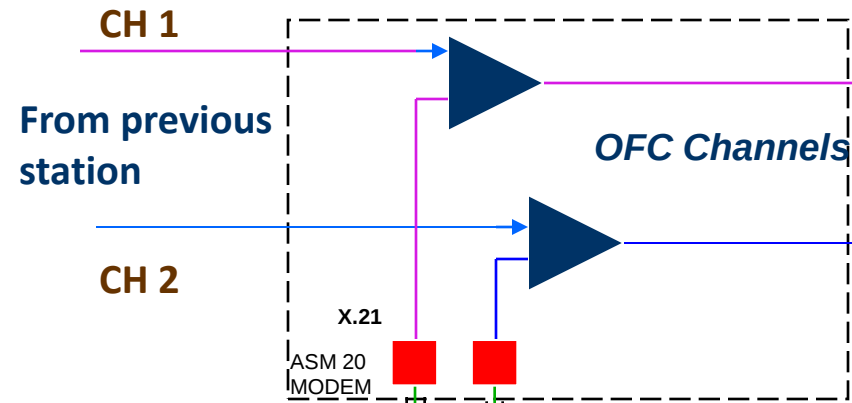
External Alarm 2 - User Defined
 External Alarm 4 - User Defined
 External Alarm 4 - User Defined
 External Alarm 4 - User Defined
 External Alarm 4 - User Defined
 External Alarm 4 - User Defined
 External Alarm 1 - User Defined
 External Alarm 5 - User Defined
 External Alarm 4 - User Defined
 External Alarm 1 - User Defined
 External Alarm 5 - User Defined
 External Alarm 4 - User Defined
 External Alarm 1 - User Defined
 External Alarm 5 - User Defined

Centralised Network Management of Optic Fibre Network



TMS STATION CONNECTIVITY SCHEMATIC

TMS CONTROL CENTRE, MUMBAI CENTRAL



What is EBISAT ?



Bombardier Transportation

- The EBISAT 890 RTU/Field station is a **Remote Terminal Unit** used for remote control and supervision of railway traffic.
- EBISAT 890 is microcomputer based with a modular software structure communicating on a common software bus.
- The modules are installed in standard 19-inch shelves and mounted in EMC compliant racks for installation in signal or equipment rooms.



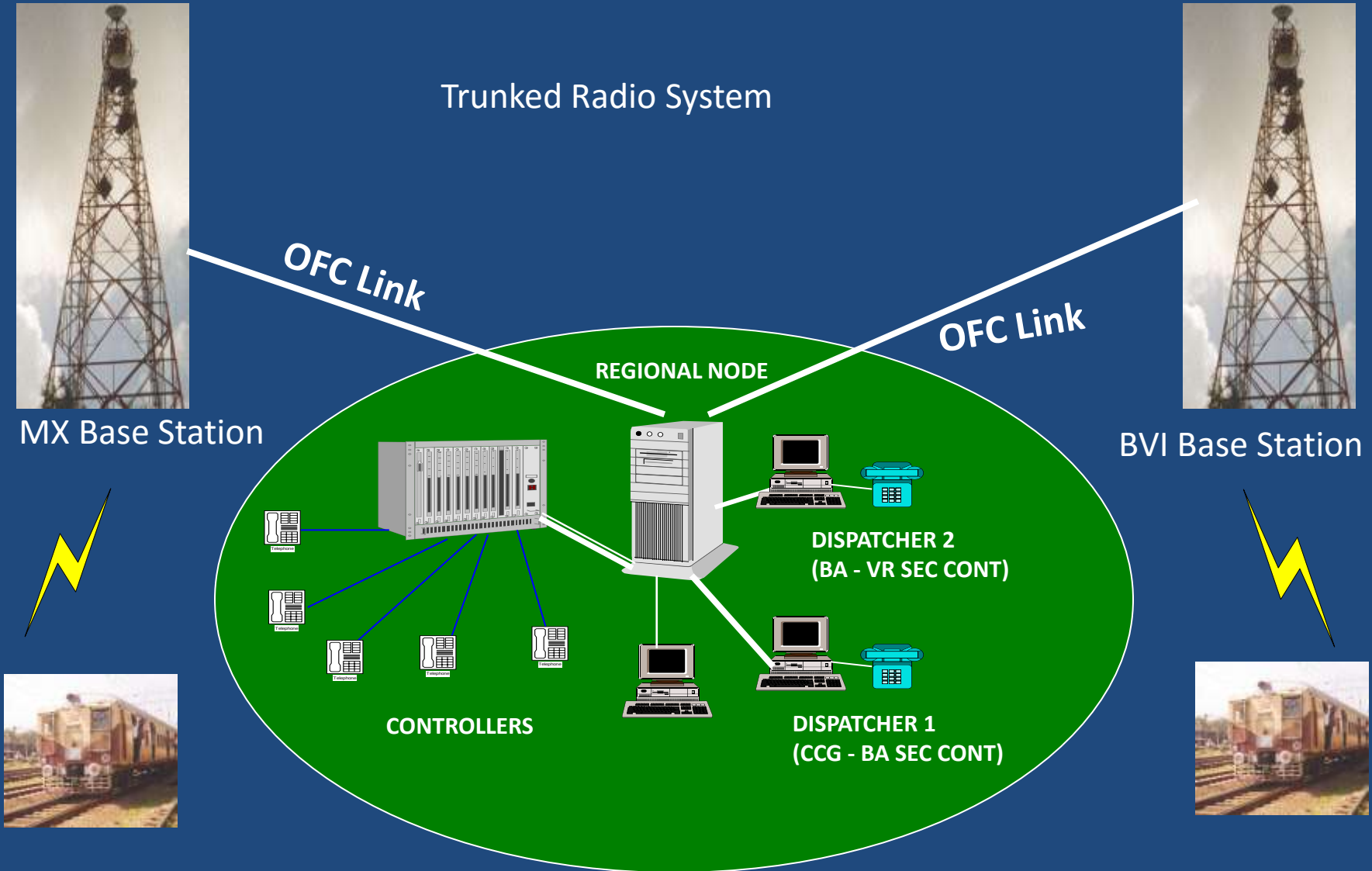
Trains held up in between stations



Mobile Communication on Churchgate Virar Section



MOBILE COMMUNICATION SYSTEM





Mobile Phones in Suburban Trains

Trunked Radio System



Managing Mumbai's lifeline

Ever wondered why trains never collide? Or how a motorman knows when to switch tracks? Welcome to Western Railway's Train Management System: A giant screen that tells traffic controllers where each locomotive is and how it's doing — all along the 60-km line

Rajendra Aklkar
Mumbai, August 13

"Hello, Andheri, please release the train on track 4. Borivli is waiting for line clearance."
"Hello, Bandra, Dader wants to know why the train at platform 1 is not moving."
"Borivli, the Rajdhani has just passed Jogeshwari and is followed by Virar just."

In a small, two-storey building tucked away in a corner of the divisional railway manager's office at Mumbai Central, frenzied calls such as these keep one of the busiest rail networks in the world on track. Welcome to the Western Railway's Train Management System (TMS) control room. Manned 24/7 by a staff of just 30, the control room tracks each train, every second of the way.

That's 1,000 suburban services and over 200 mail, express and goods trains per day — a train every three minutes during peak hour, and every four minutes through the rest of the day.

"We're the ATC of the Western Railway," quips a proud S. Chatterjee, co-chief controller. "A single unscheduled halt could af-

fect the entire system — and we're here to step in and make sure that doesn't happen."

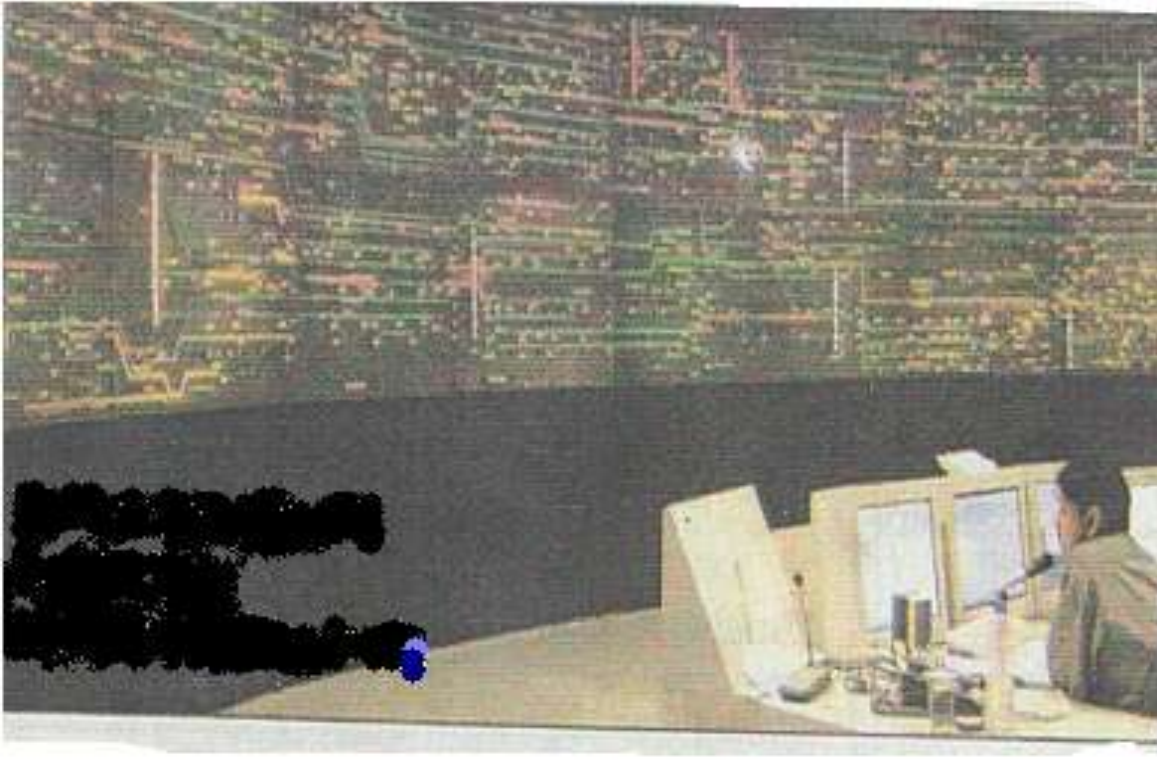
The TMS, developed with the help of Bombardier Transportation of Canada at a cost of Rs 33 crore and activated in May 2003, helps capture train movements and signals status information (status of signals, points and track circuit) all along the 60-km track between Churchgate and Virar. It also displays train name and number, crew names and platform numbers.

"Basically, you can watch the train as it goes from Churchgate to Virar," says Chief Train Controller D.A. Solanki. "If it makes an unscheduled halt, the control room can call up the motorman and find out what's going on, and also divert the trains following it. The system has really helped improve punctuality."

All this calls for total concentration and undivided attention.

"Once inside the control room, we are cut off from the rest of the world and the focus is only on calculations of train movement and operations," admits Solanki.

Adds Train Controller Shabbir Ahmed, monitoring the Churchgate-Andheri section: "For the six hours that you're in this



Detailed logs of all movements and operations are kept and analysed regularly, to ensure that the same mistakes are not repeated

room, you can't leave your seat for anything. After all, we can't afford to miss anything... these are real trains and real people we're dealing with."

So how do you train to be a 'rail traffic controller'?

"All our 29 controllers have been trained in the software at the railway's training school in Udaipur," says Solanki.

The software includes a huge, glowing screen with tiny blips of light and hundreds of colourful dots. At first glance, it looks like something off the Star Trek Enterprise. "But we know what each squiggly line stands for," says Chatterjee.

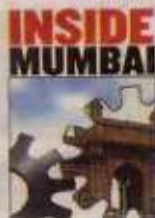
The control room also has a representative for each department — locomotive, engineering, technical, coaching and even se-

curity. "If a train is stuck due to technical fault, these coordinators arrange for help, so they have to be able to understand exactly what's going on," says Solanki.

Detailed logs of all movements and operations are kept and analysed regularly, to ensure the same mistakes are not repeated and that the system continues to run like clockwork. The current database goes back five years.

"The TMS is a remarkable combination of information technology, communications and engineering and works for a transport system as complex as our trains," a senior railway official said.

"And it's helping our passengers too — by helping allowing us to give them timely information and get their trains to them on time."



TRACKING HISTORY

1956: The Bombay Baroda and Central India (BB&CI) Railway company is incorporated by an act of the British Parliament

1996: Colaba station is opened

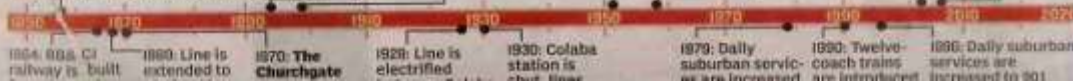
1999: Churchgate HQ building is complete

1951: BB&CI is renamed Western Railway (WR)

1958: Nine-coach trains are introduced on WR

2003: Train Management System is introduced

2006: Daily suburban services are increased to 1,030





Onboard Passenger Information

Wireless Onboard Internet

REAL TIME INTERNET SERVICES ONBOARD TRAINS

- Real-time Internet
- Email
- Secure corporate access
- Onboard train and crew services



**Linx AB : a Scandinavian
train operator**

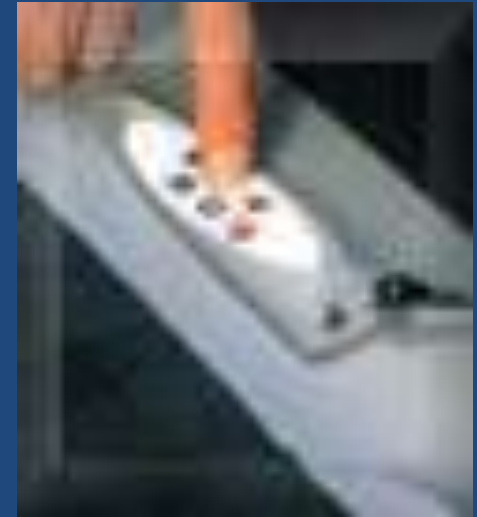
**Copenhagen-Gothenburg-
Oslo and
Oslo-Karlstad-Stockholm.**



Onboard railway digital audio video network system

Full Interactive Entertainment system (FIE)
including audio channels, full video on demand,
birdseye viewing, cityscopes, games etc...

Passenger Audio at Seat system
allows each passenger to select
within various audio sources (up to
10 multi-CD players and 4 radio
stations) his/her preferred
entertainment program via a keypad
located in his/her seat.

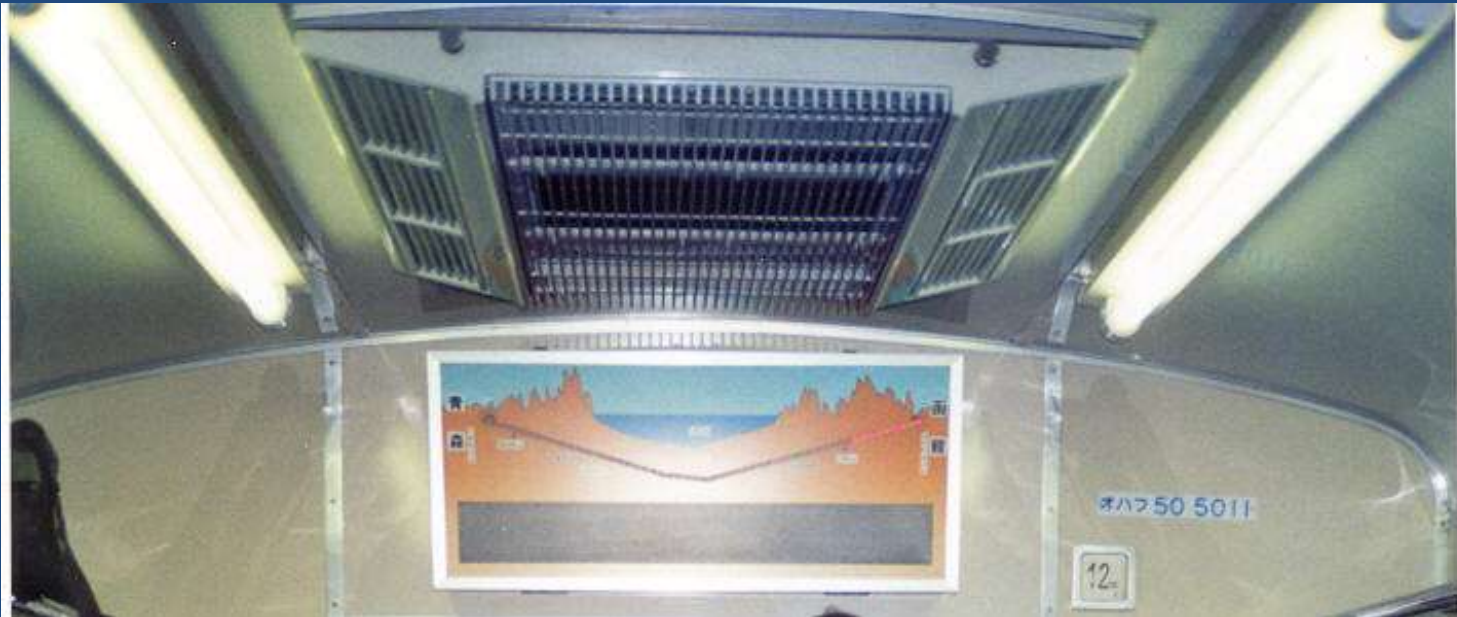


Audio/Video Broadcasting system providing for multiple video
and audio channels (using the same technology and hardware
as the Passenger Audio at Seat system)

Passenger services:

- § Surfing the Web
- § Send and receive e-mail
- § Secure access to corporate information
- § Access train operator's web page for booking, timetables, traffic info etc.
- § Passengers aboard may themselves carry out reservations e.g. taxi, train, thereby decreasing the load on the train personnel





Seikan Tunnel 174,240' (33 miles)

SEIKAN	
	174,240'

CHUNNEL	
	163,680'

HOOSAO	
	25,081'

Onboard Information & Entertainment Systems

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Watch TV, surf Internet in trains!

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- 10 tax-smart tips for salary earners

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Moneywiz new

- Stocks & MFs

February 26, 2008 13:13 IST

Last Updated: February 26, 2008 15:13 IST

Railway Minister Lalu Prasad Yadav announced that Indian Railways will offer hi-tech services on board.

Lalu has promised television, Internet and LCD display boards in trains and at major stations. LCD display screens will give real time information about the journey. Online control of trains will be introduced by 2009.

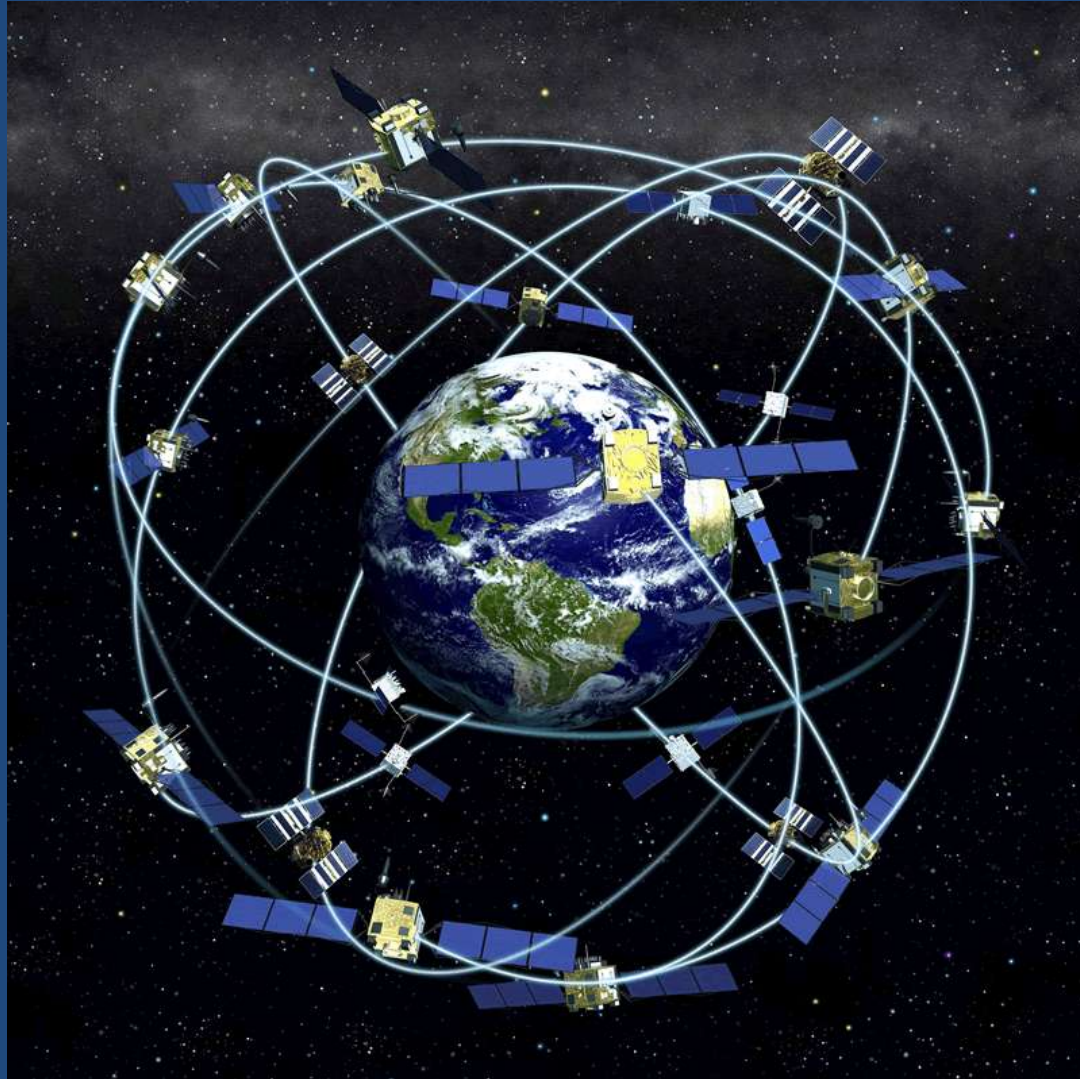
All overnight mail and express trains will have online coach indication display boards to give information about running of the trains and likely time of arrival of approaching stations continuously.

This facility would be very helpful to the passengers deboarding trains at night. The public address system which is presently available only in Rajdhani and Shatabdi trains will be made available to other select mail and express trains.

Information boards displaying on line information about train arrival-departure and platform berthing will be installed at parking lots and entrance gates besides platforms of 100 'A' and 'B' category stations. Online reservation availability information boards will also be installed at reservation offices of all 'A' and 'B' category stations.

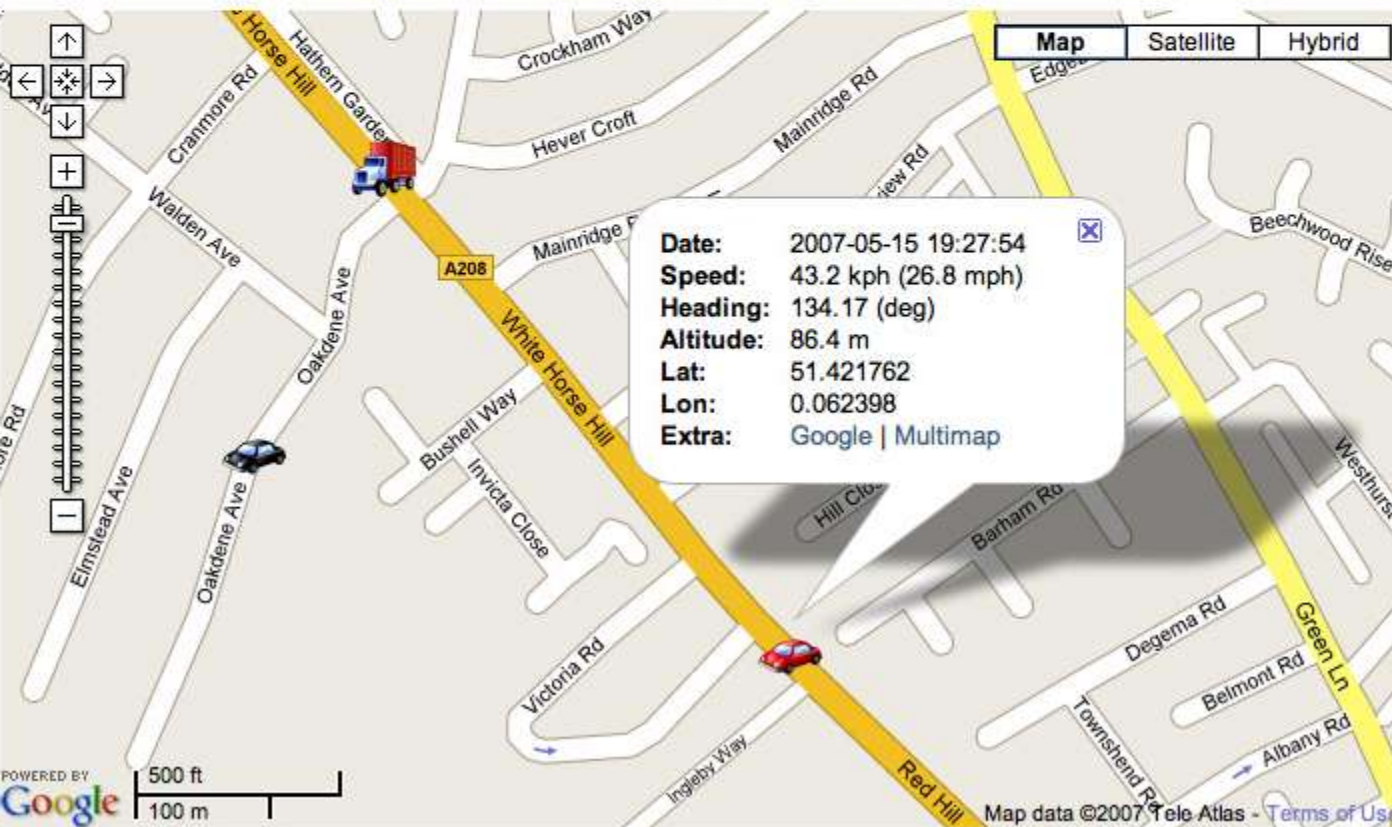
The Railways also plans to upgrade infrastructure in next 7 years at an investment of Rs 75,000 crore (Rs 750 billion).

GPS Satellites



Parallel track

Free GPS based tracking services
for first 12 months

[Home](#)[Track](#)[Trackbox](#)[Contact](#)[Live](#)[History](#)[Config](#)[Logout](#)

Tracker Units

☒ Vehicle 1☒ Vehicle 2☒ Vehicle 3[\[Select All | Unselect All\]](#)

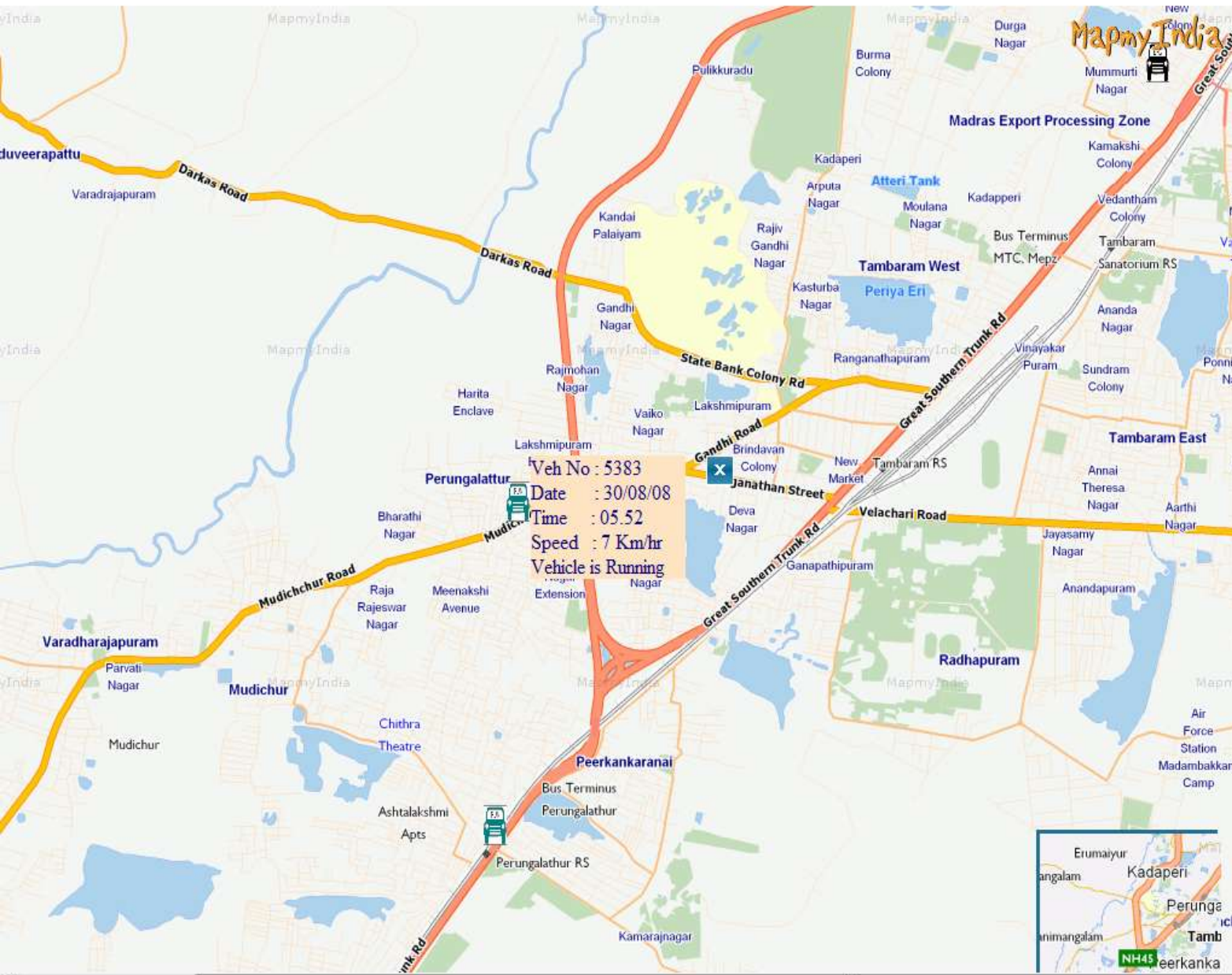
Auto Update



Yes



No



Tracked vehicles			
valid	0076(37)	30/08/08	21.38
valid	0199	30/08/08	21.39
valid	0632	30/08/08	21.39
valid	0644	30/08/08	21.39
Invalid	0874	26/08/08	05.09
Invalid	1074	30/08/08	21.40
valid	1189	30/08/08	21.39
valid	1234	30/08/08	21.38
valid	1380(25)	30/08/08	21.39
valid	1535	30/08/08	21.39
valid	1694(3)	30/08/08	16.41
valid	2296(29)	30/08/08	21.39
valid	2345	30/08/08	21.39
valid	3166	30/08/08	21.38
Invalid	3287	29/08/08	11.52
Invalid	3702(25)	27/08/08	14.44
valid	4017	30/08/08	21.39
valid	4172	30/08/08	21.39
valid	4317	30/08/08	21.39
valid	4960	30/08/08	10.34
Invalid	4961(16)	07/08/08	15.38
valid	5383(7)	30/08/08	05.52
valid	5530	30/08/08	21.38
valid	5531	30/08/08	21.39
valid	5532	30/08/08	16.33
valid	6060	30/08/08	21.39
valid	6127	27/08/08	14.47
valid	6926(11)	30/08/08	16.45
valid	6934	30/08/08	21.39
valid	7617(5)	30/08/08	16.54
valid	7679	30/08/08	21.39
valid	7680	30/08/08	21.39
valid	7696	30/08/08	21.39
valid	7853	30/08/08	21.38
valid	7855	30/08/08	21.39



GPS COORDINATES



GPRS SERVER



BROADBAND CONNECTION



GPRS DATA



OPERATOR
ADMIN
TERMINAL

GPS Based In-Train Location Display System

The GPS based location display works on the principle of GPS (Global Positioning System).it gives following information to passengers.

Present station name.

Next coming station name.

Distance to next station.

General messages.

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168 x 73 - 40k
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Below is the image in its original context on the page: [aeapl.in/gpsinlocation.html](#)

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- APF Panels
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- Aviation Lamp
- DC Energy Meter 4 channel version
- Alarm PFC Expander
- Fire Alarm

Railway Sector

- Led based Train information displays
- GPS based clock
- GPS based In-Train Location display system
- Led Signal Aspects(Main Signal)

GPS Based In-Train Location Display System

The GPS based location display works on the principle of GPS (Global Positioning System).It gives following information to passengers.

- Present station name.
- Next coming station name.
- Distance to next station.
- General messages.

All these information are displayed in regional and national languages.

GPS Receiver

Frequency - L1: 1575.42 MHz
Channels - 16
Supply Current - 27mA @ 3.3V (Continuous mode)
Power consumption - 0.11mW (Continuous mode)
Reacquisition time - 0.1 seconds

Future:



Internet | Protected Mode: On 100%



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GPS-based Station Arrival Indication System

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GPS-based Station Arrival Indication System

The GPS-based station arrival indication system will display the information of the next arriving station to the passengers inside the coach. The system will have GPS receiver and SMS display board. This is completely unmanned operation which helps the passengers to prepare for getting down from the train at their destination.



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Thanks