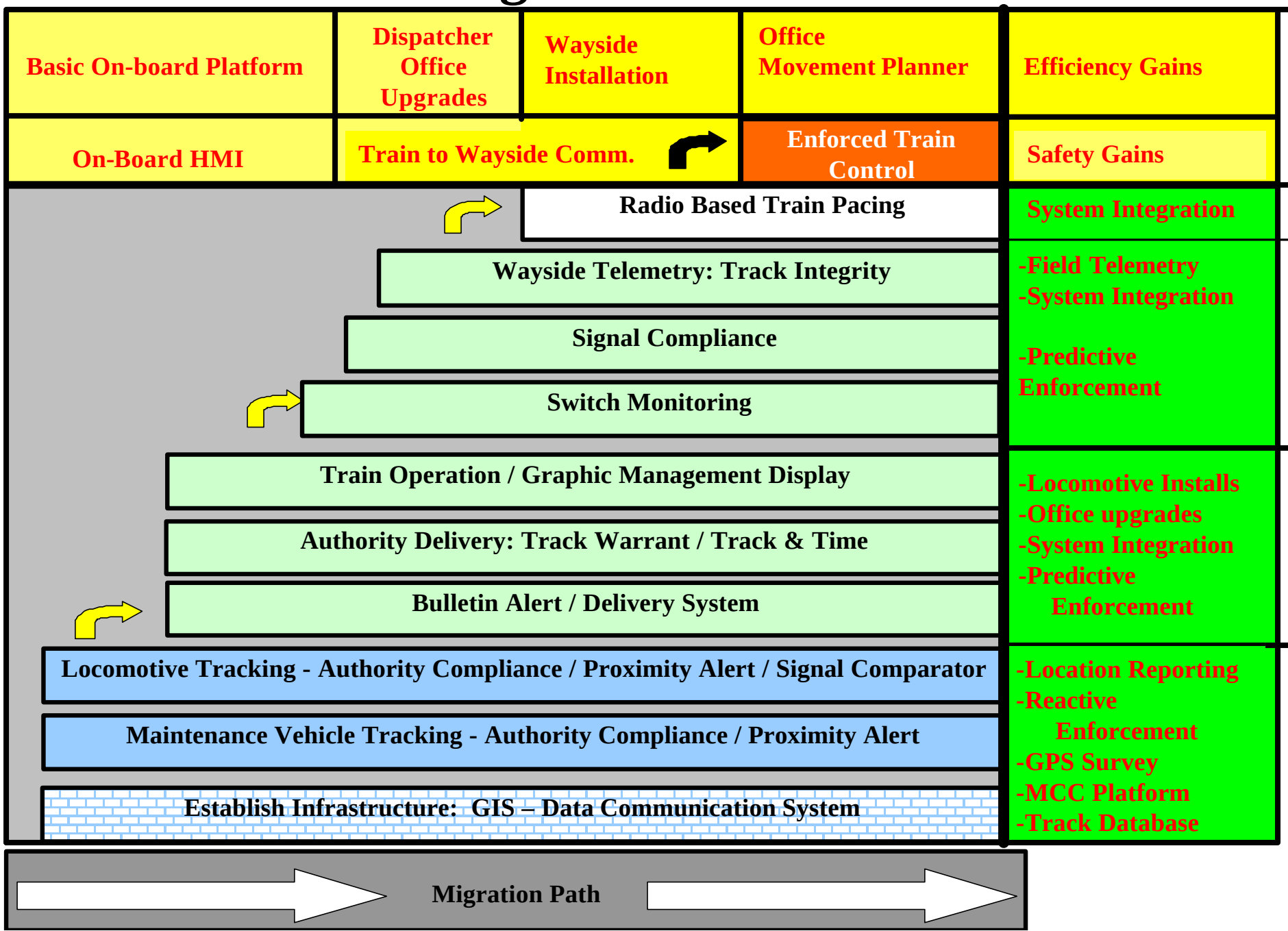
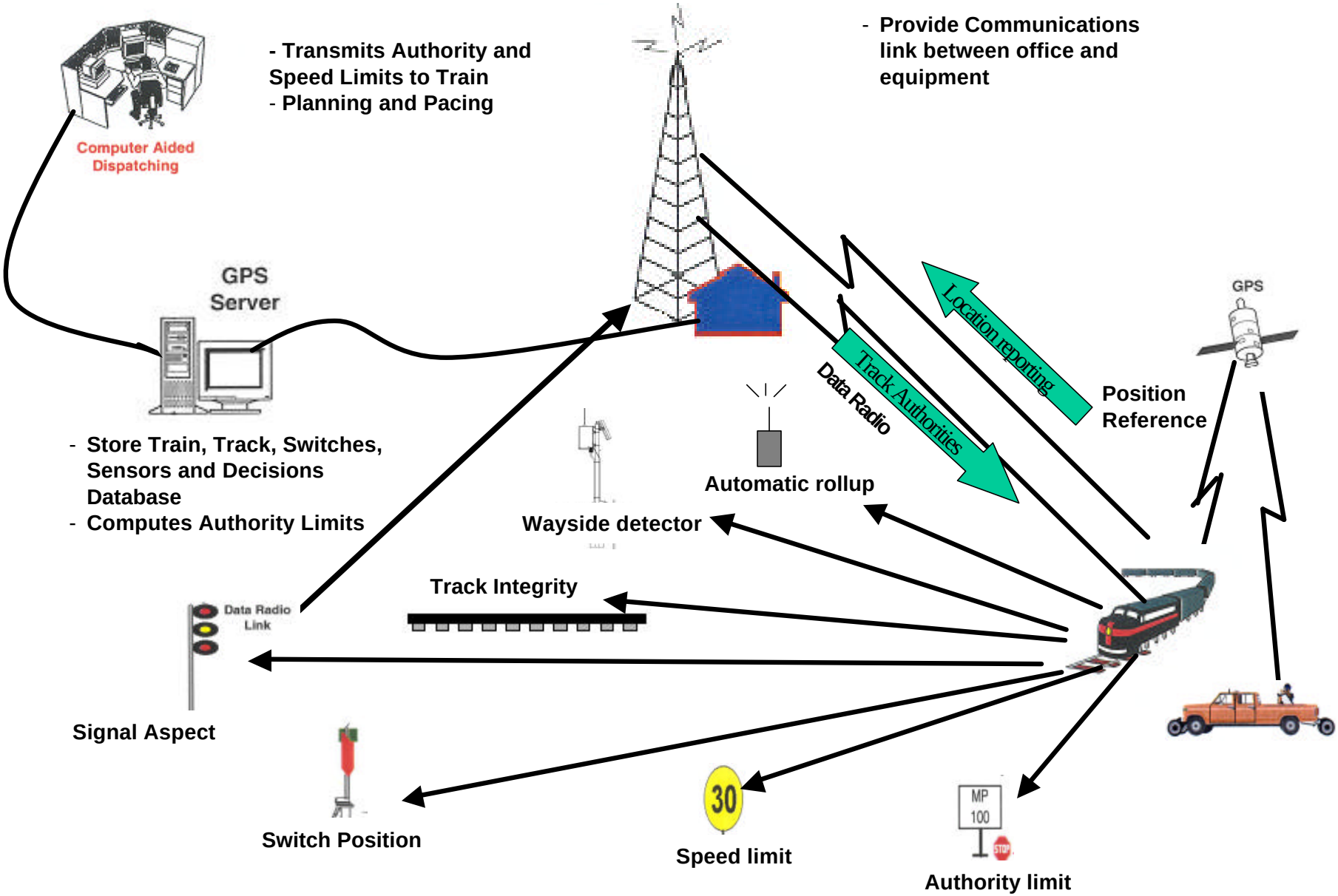
PTC Working Group
03-05-03

Train Control Migration

Migration Path



System Definition



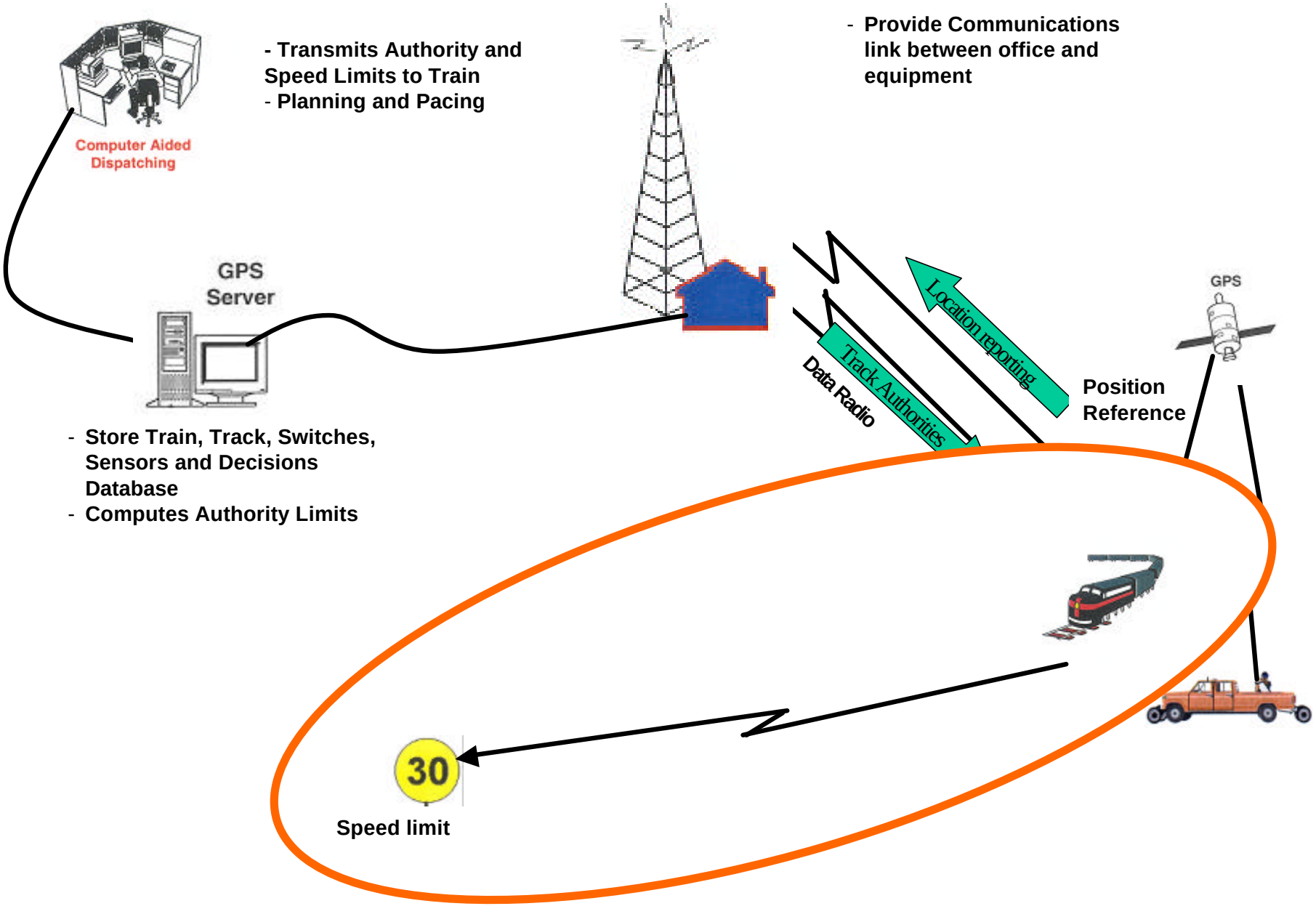
Wayside Enclosure:

- Solar Panel
- Battery
- I/O Board
- RF Radio

On-Board Display

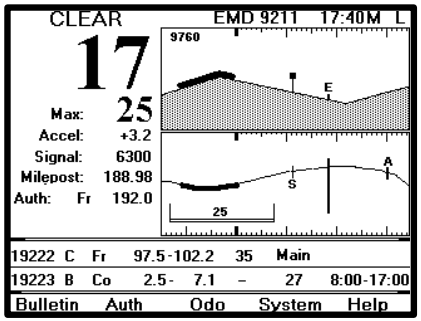
- EMD 70MAC
- GE Dash9

Speed Enforcement

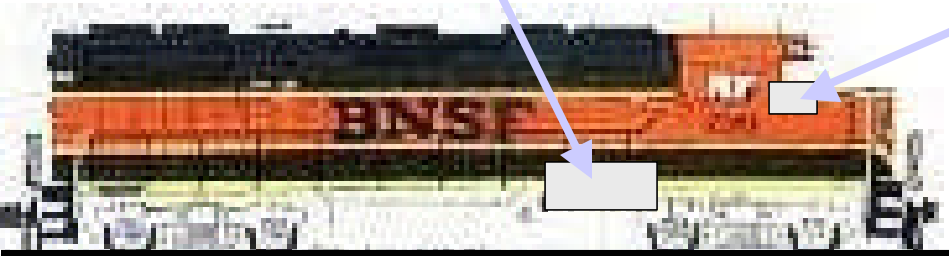


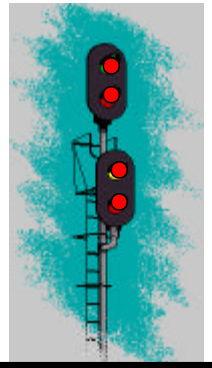
Enforced Train Control
Concept of Operation: Continuous Speed Supervision

Computer

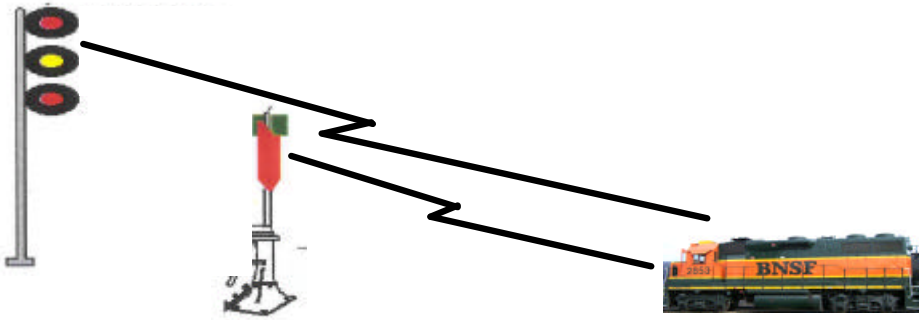


On-Board display



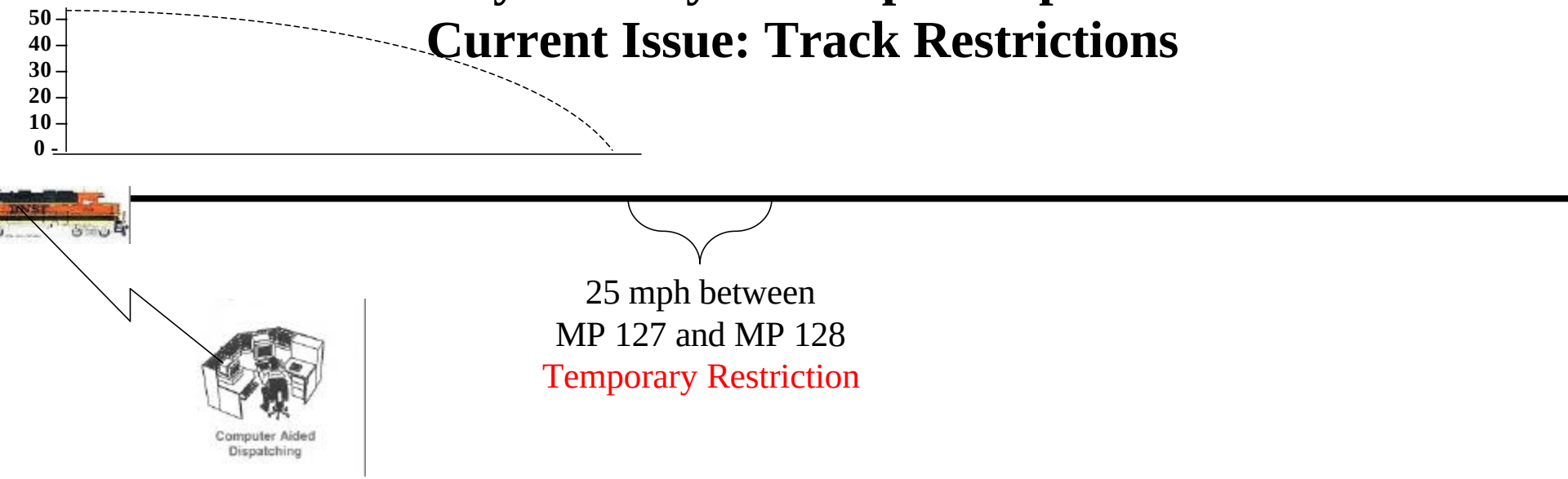


Speed and Distance/Evaluation/Brake



Locomotive polls wayside
Wayside provides on-board data

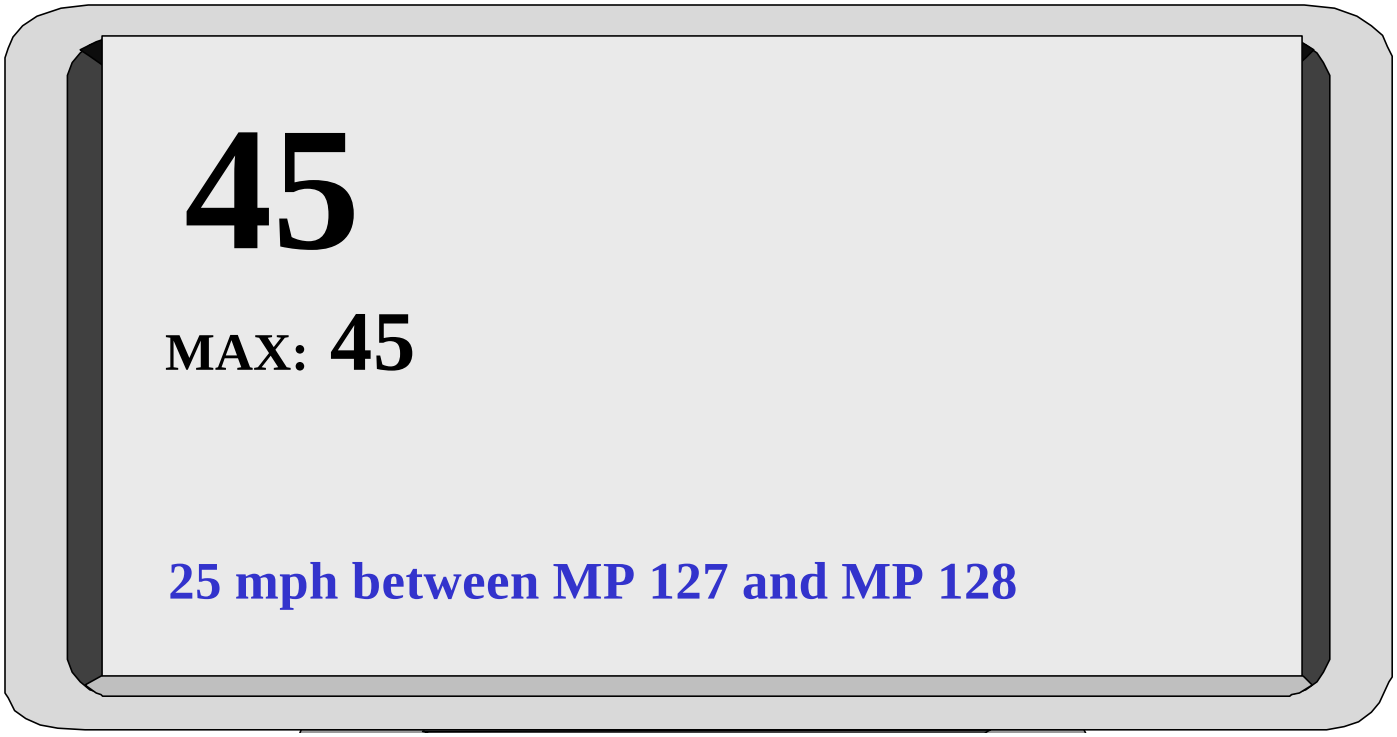
Safety Overlay: Concept of Operation
Current Issue: Track Restrictions



Restrictions are delivered to all trains as the dispatcher executes them.

A braking curve will be established approaching each restriction.

25 mph between
MP 127 and MP 128
Temporary Restriction



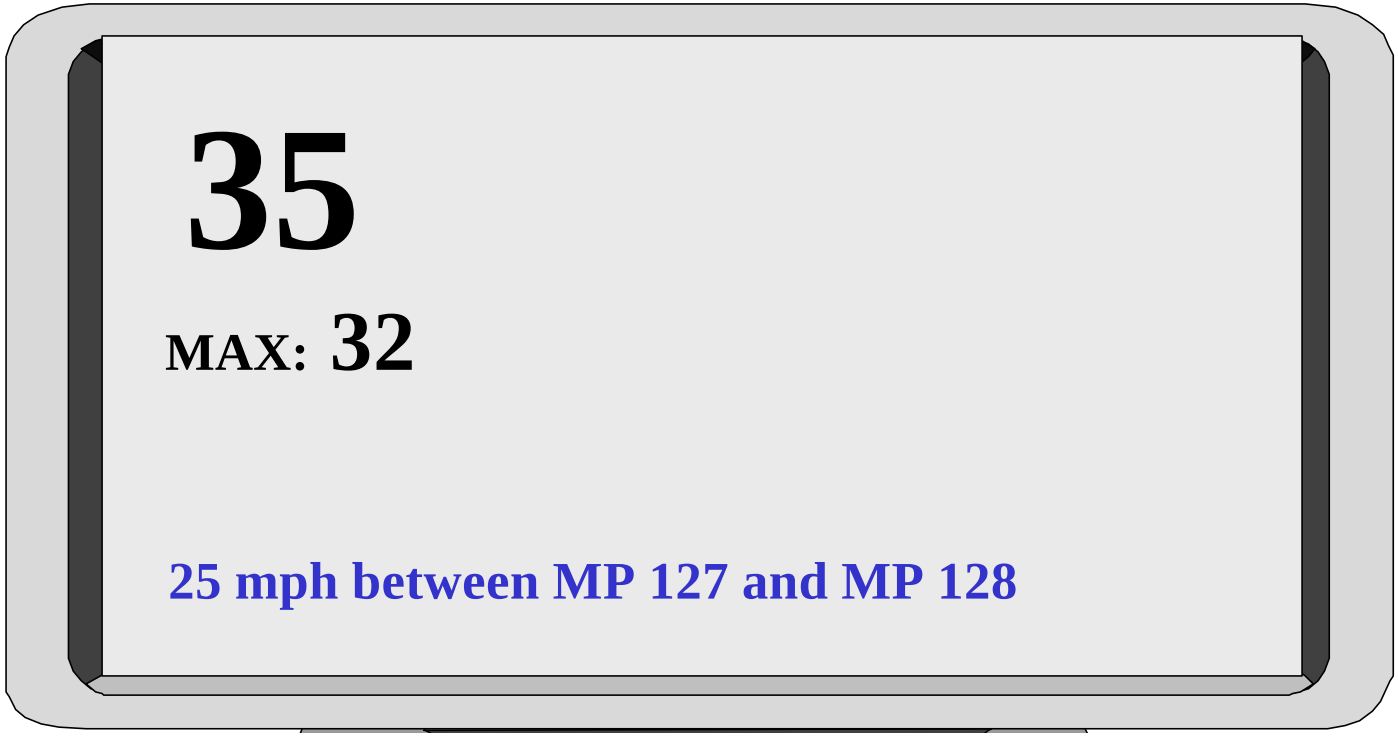
25 mph between
MP 127 and MP 128
Temporary Restriction

40

MAX: 42

25 mph between MP 127 and MP 128

25 mph between
MP 127 and MP 128
Temporary Restriction



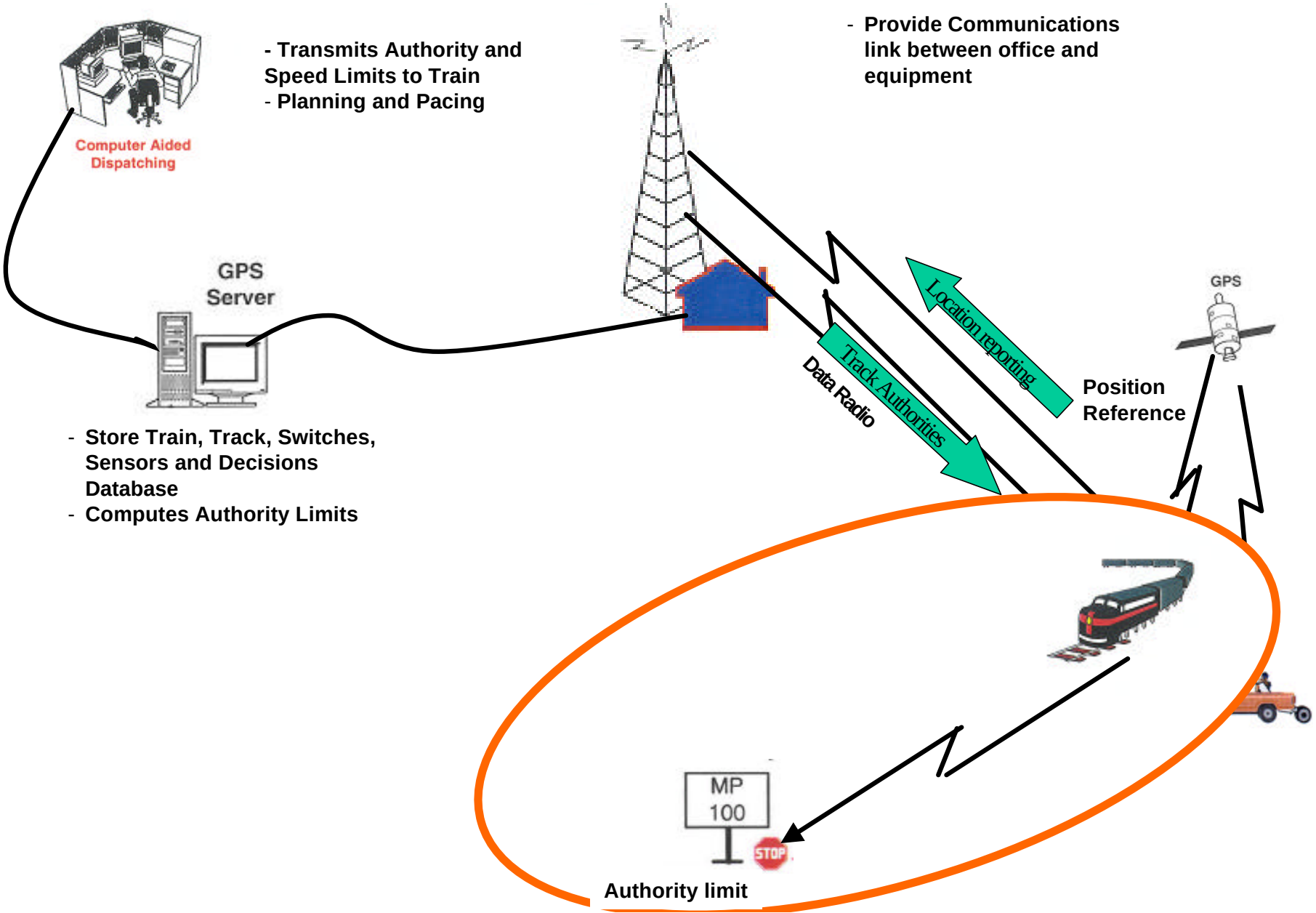
25 mph between
MP 127 and MP 128
Temporary Restriction

25

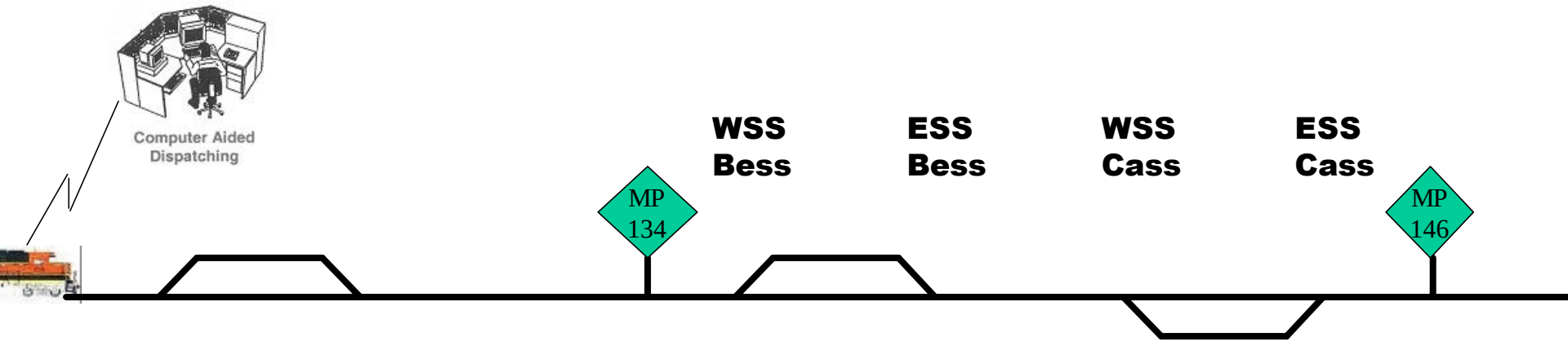
MAX: 25

25 mph between MP 127 and MP 128

Authority Enforcement



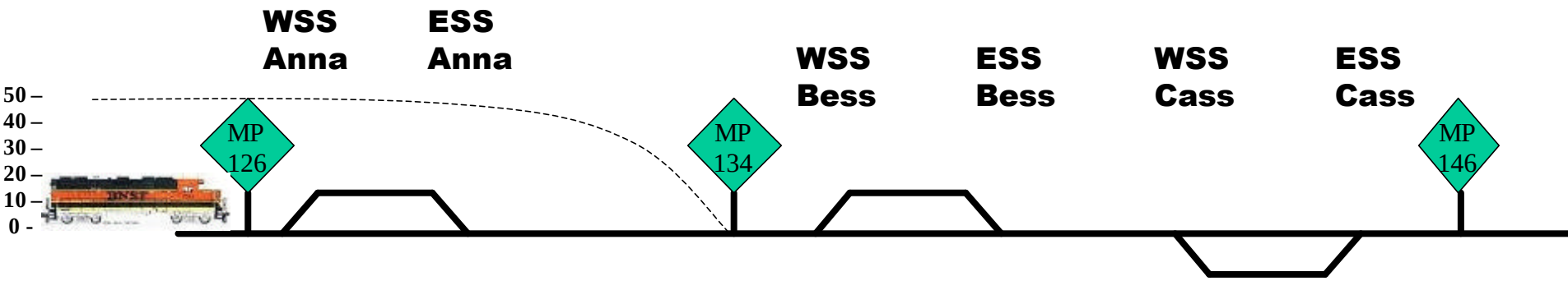
TWC / DTC Operation
Electronic Authority Delivery
Braking Curve, Overrun Protection

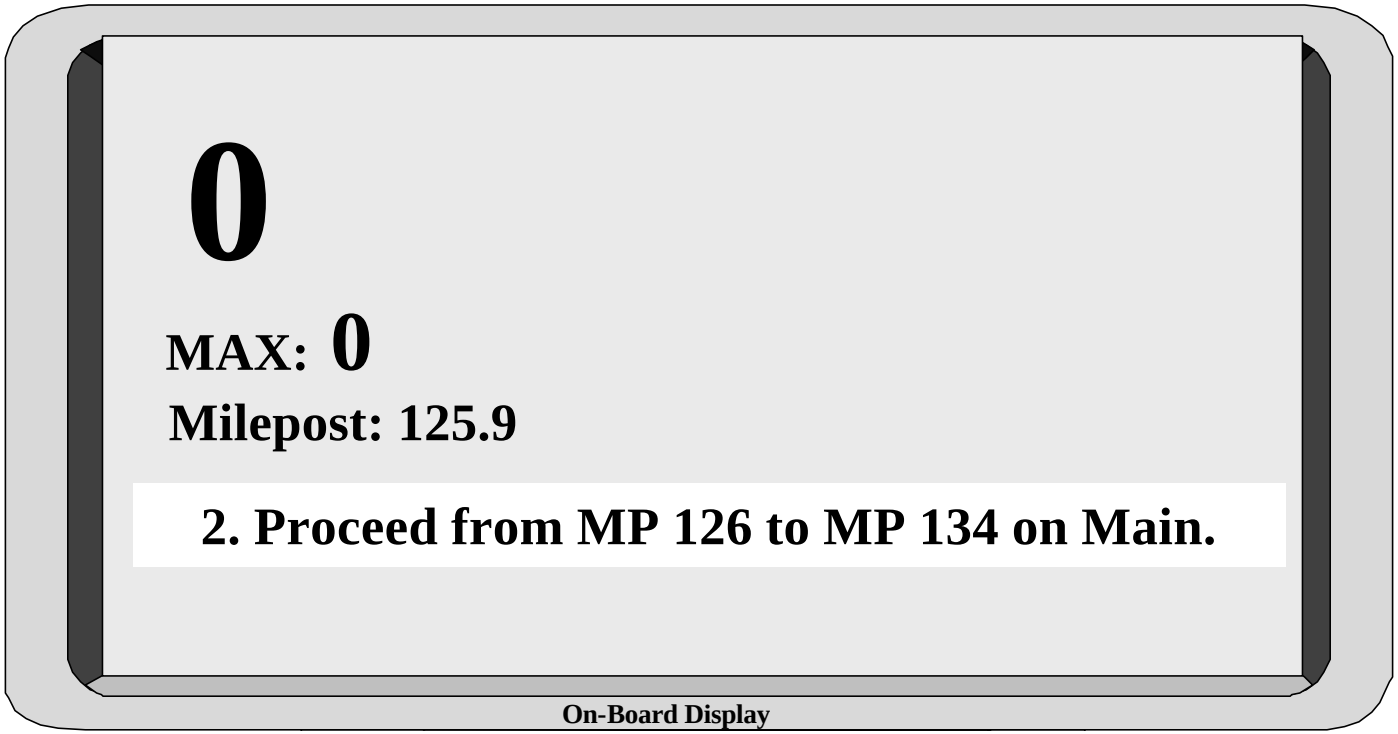


In TWC Territory areas the authority limits will come from office software.

Each physical point is a potential Stop indication point.

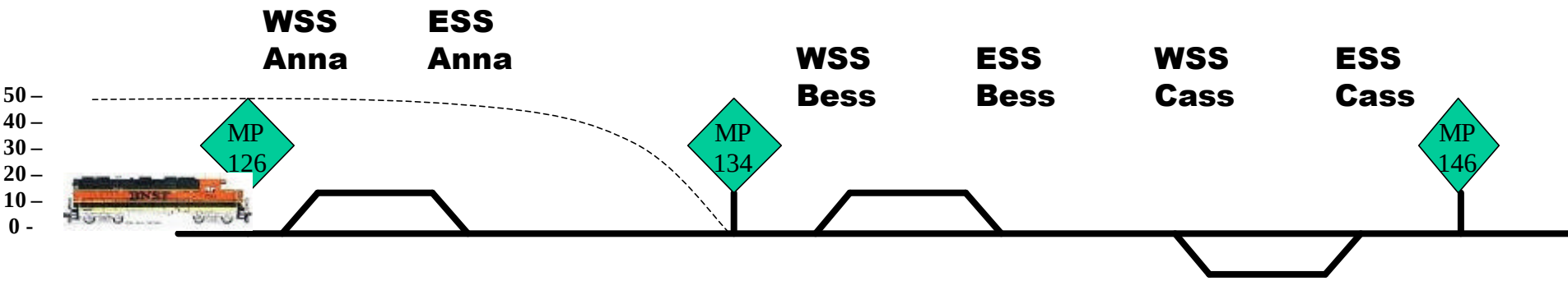
Braking Curve, Overrun Protection

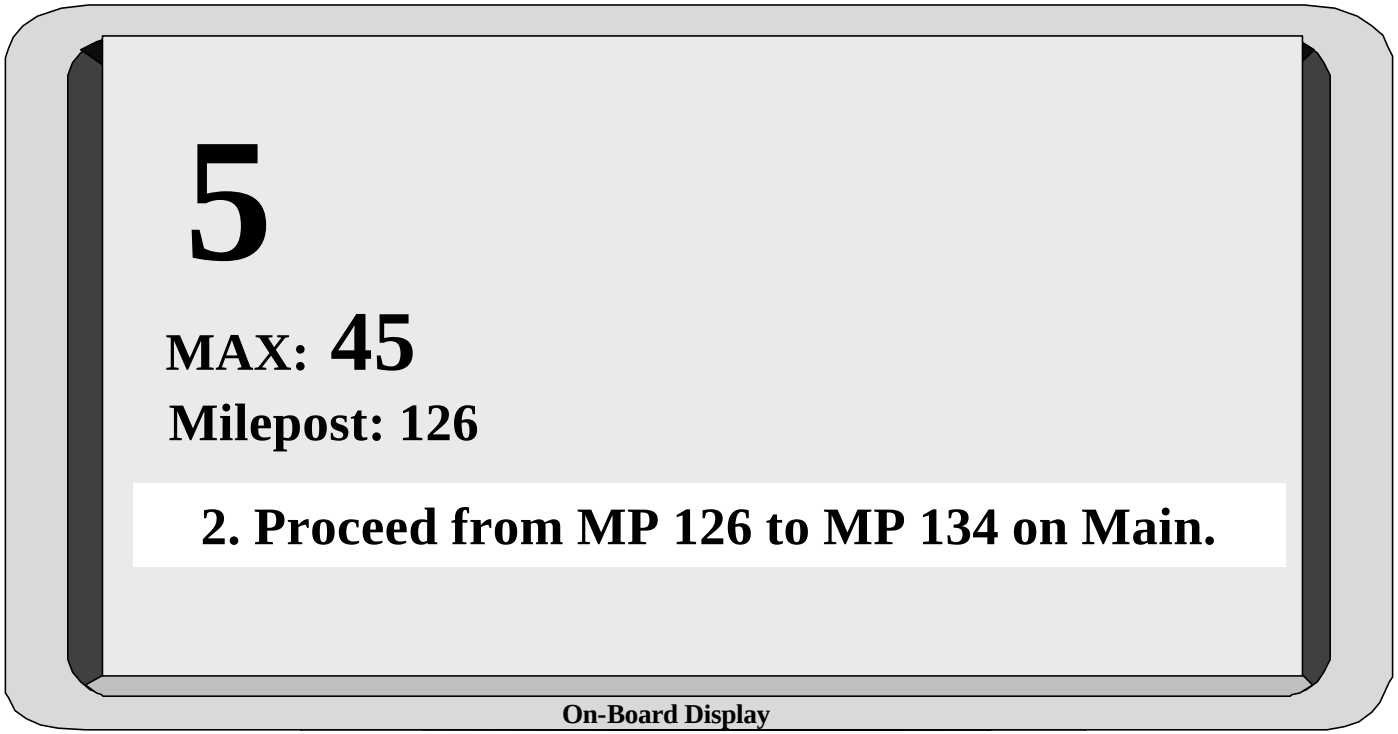




On-Board Display

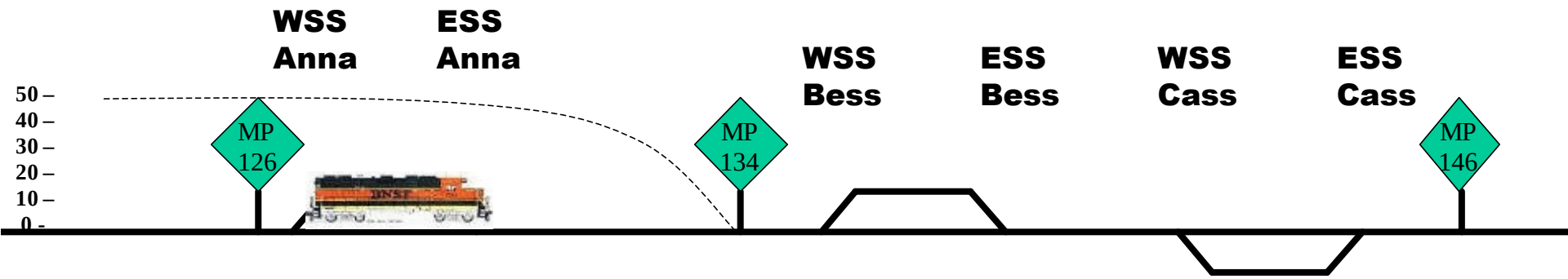
Braking Curve, Overrun Protection

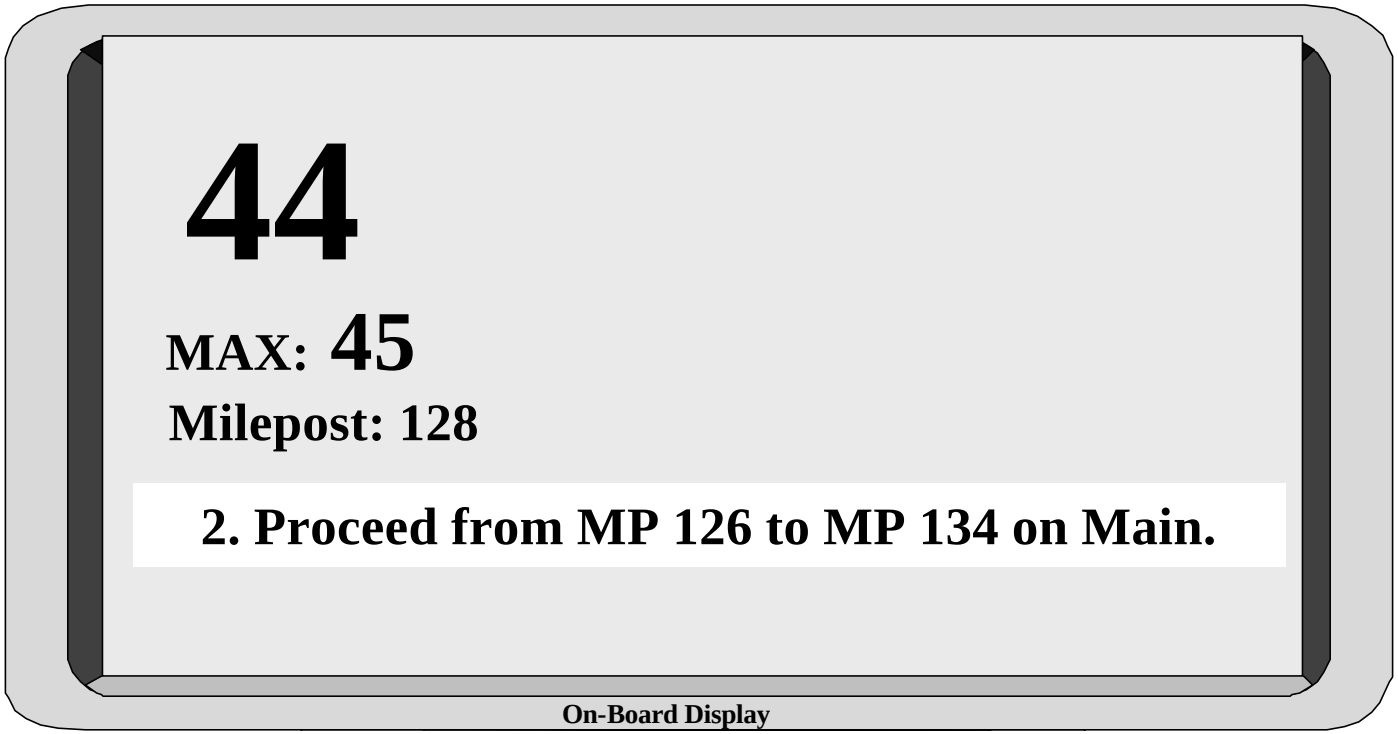




On-Board Display

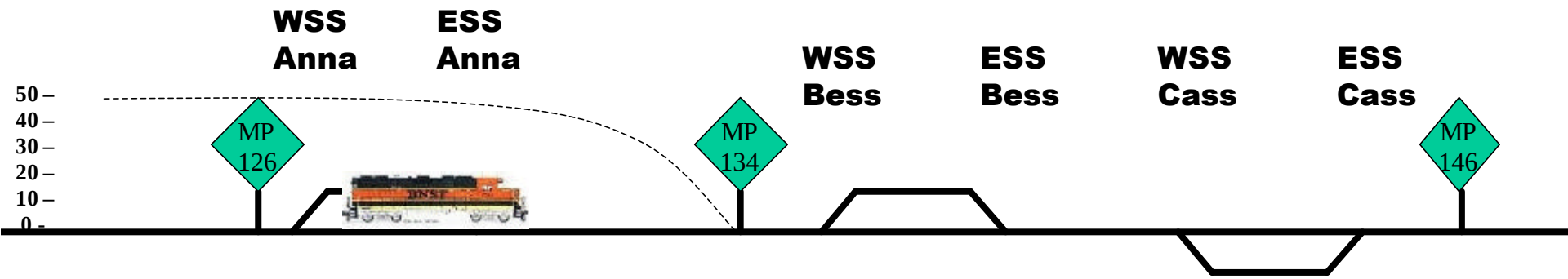
Braking Curve, Overrun Protection

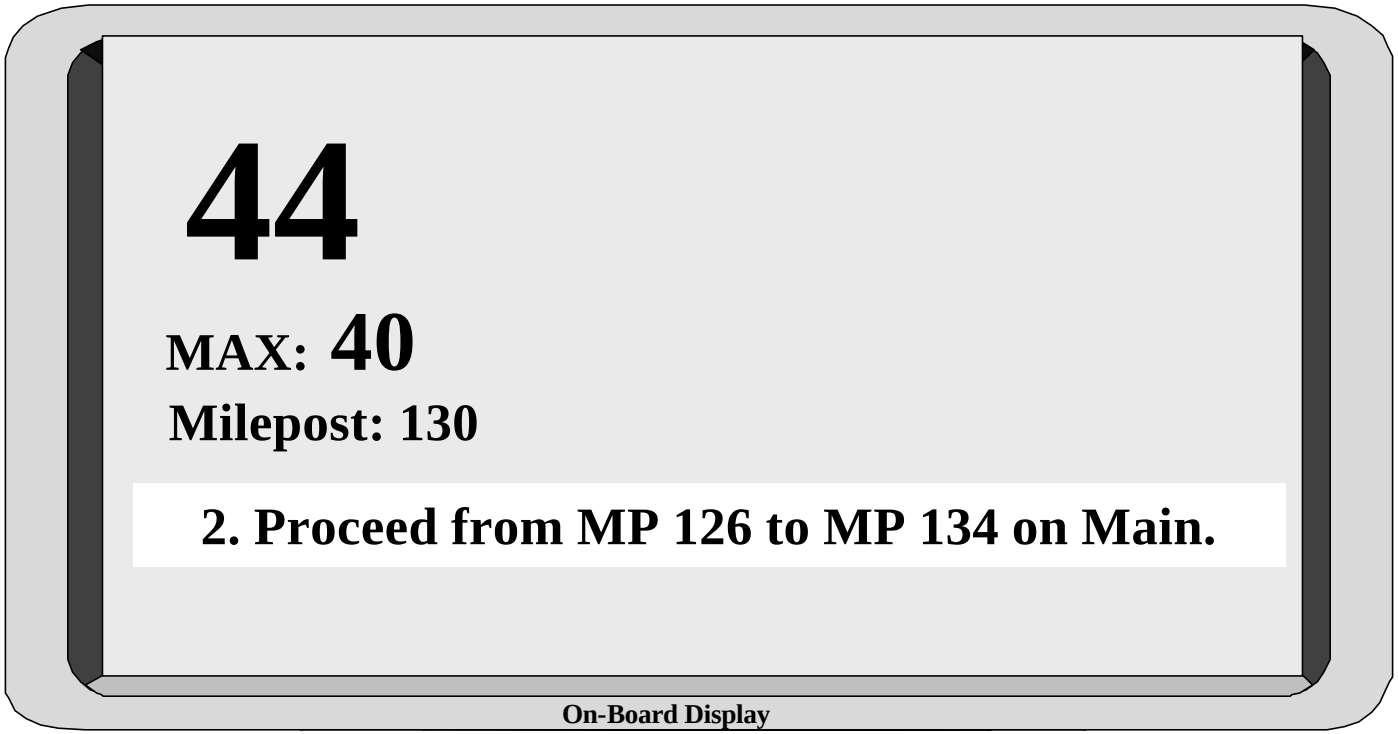




On-Board Display

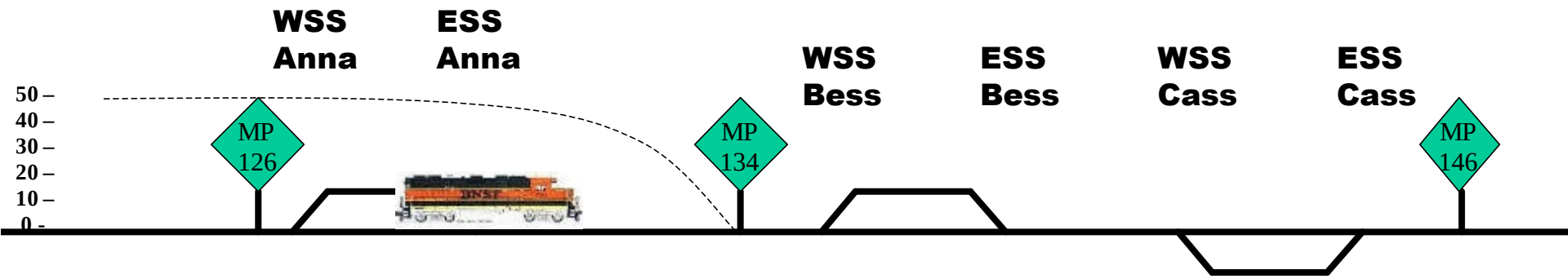
Braking Curve, Overrun Protection

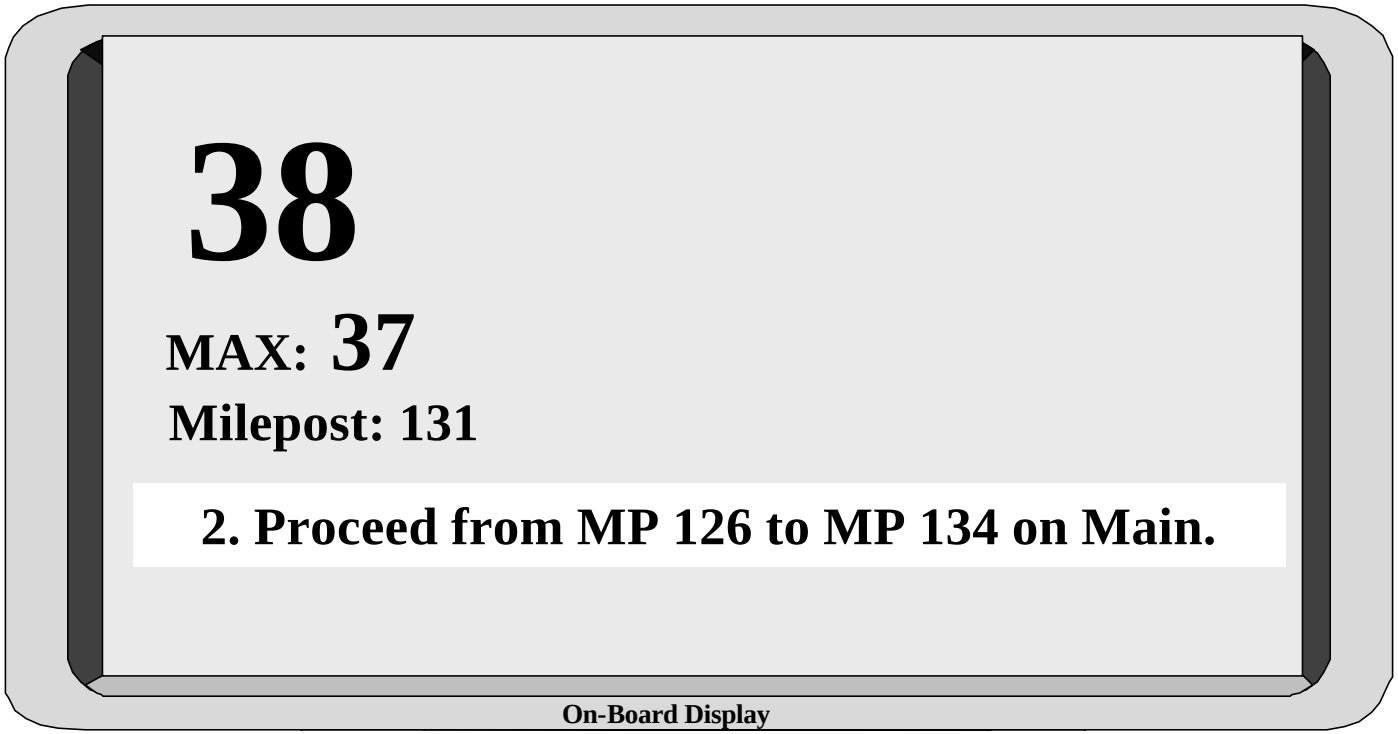




On-Board Display

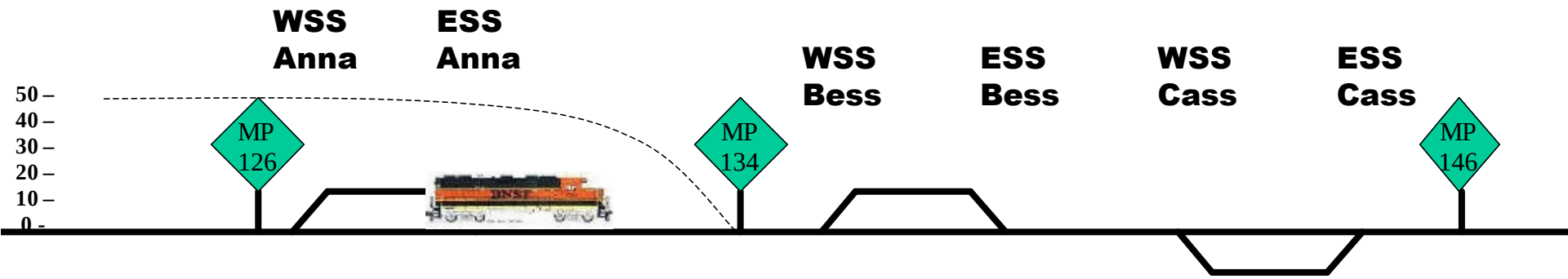
Braking Curve, Overrun Protection

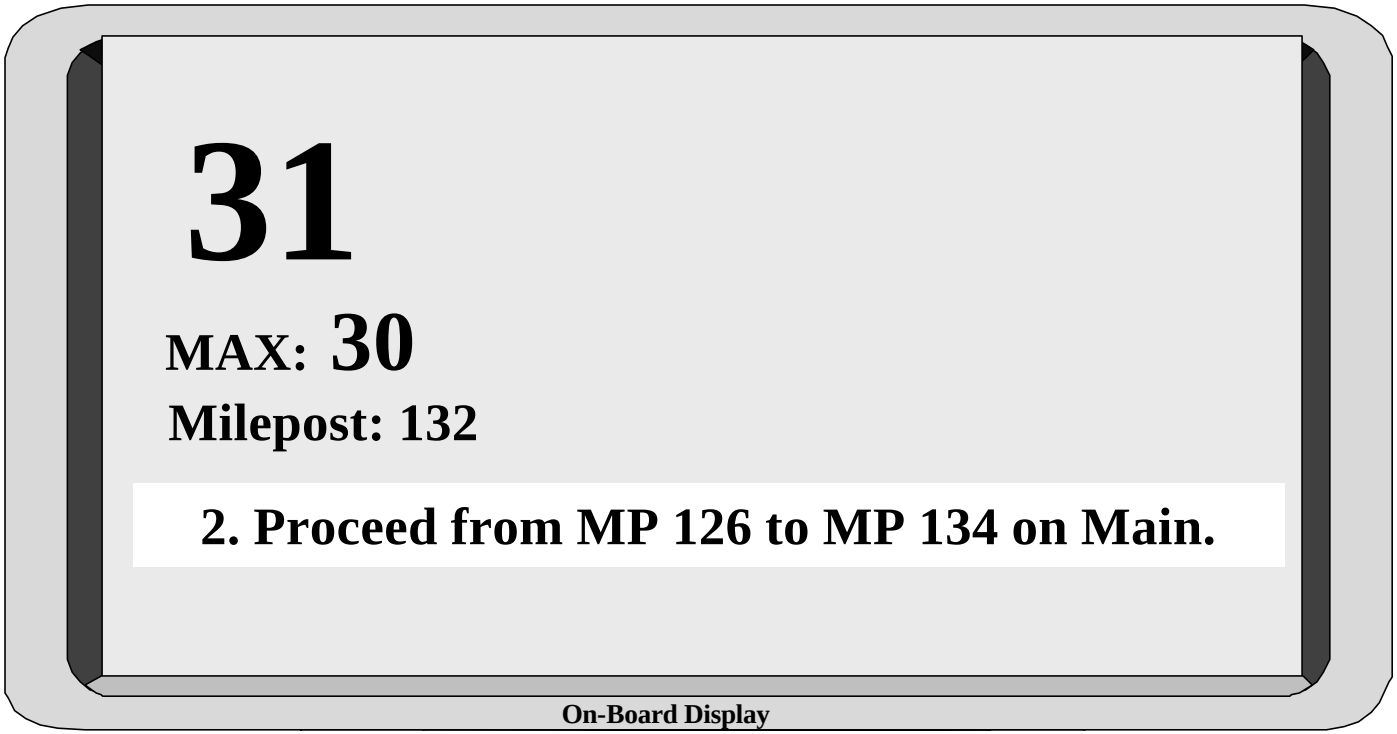




On-Board Display

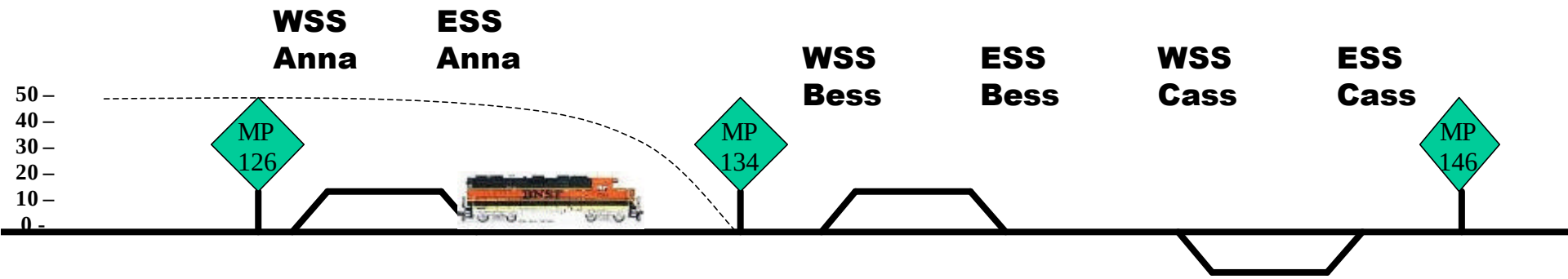
Braking Curve, Overrun Protection

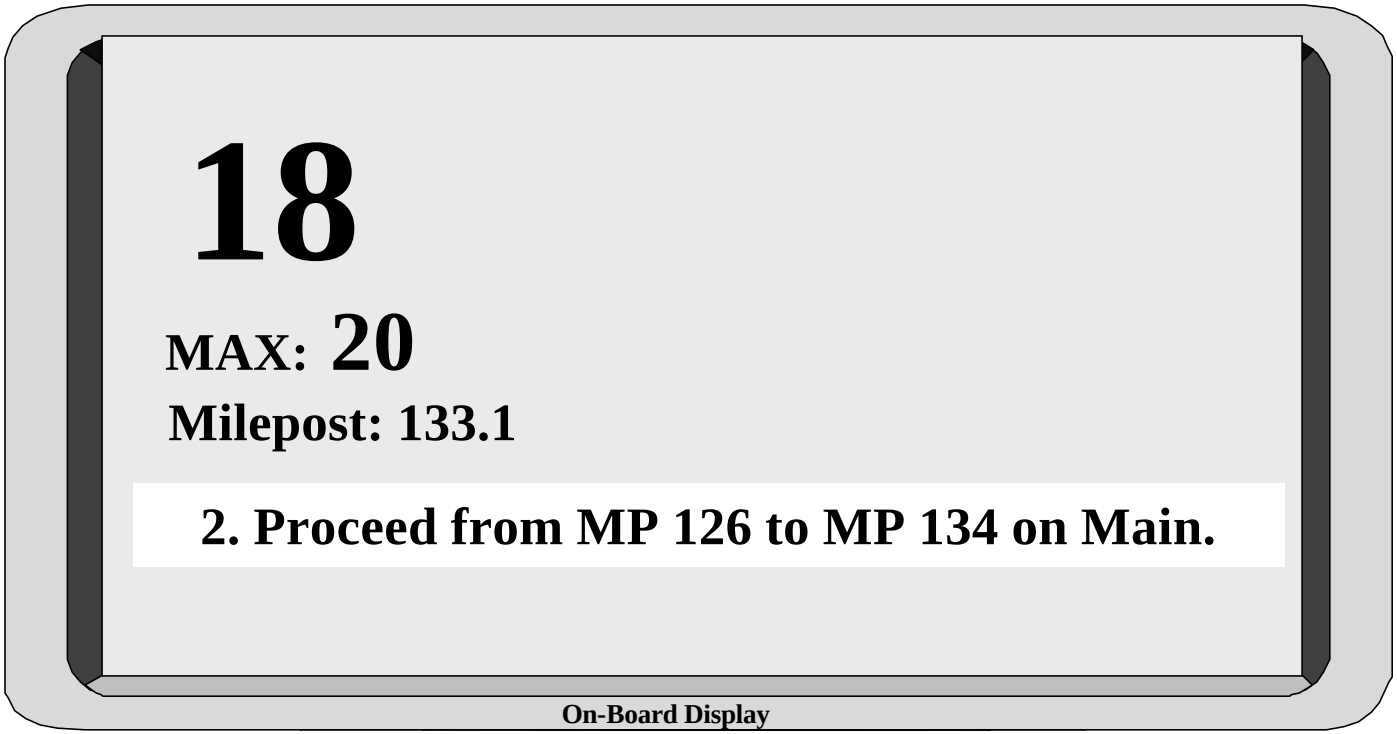




On-Board Display

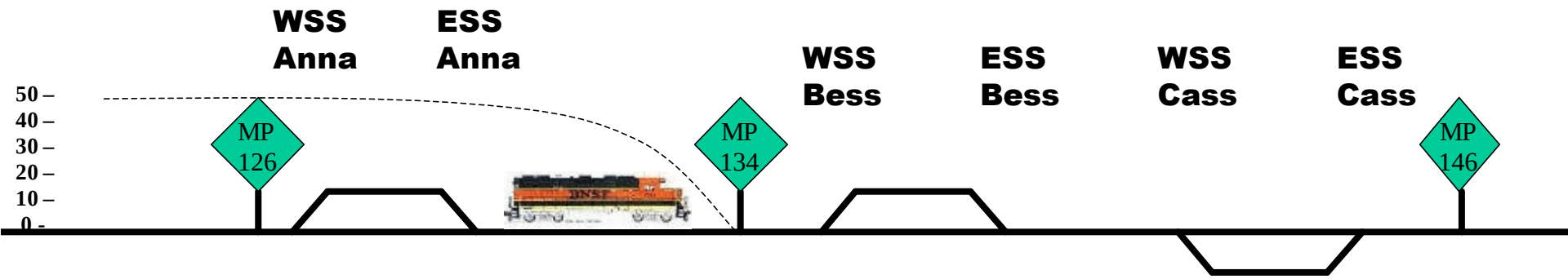
Braking Curve, Overrun Protection

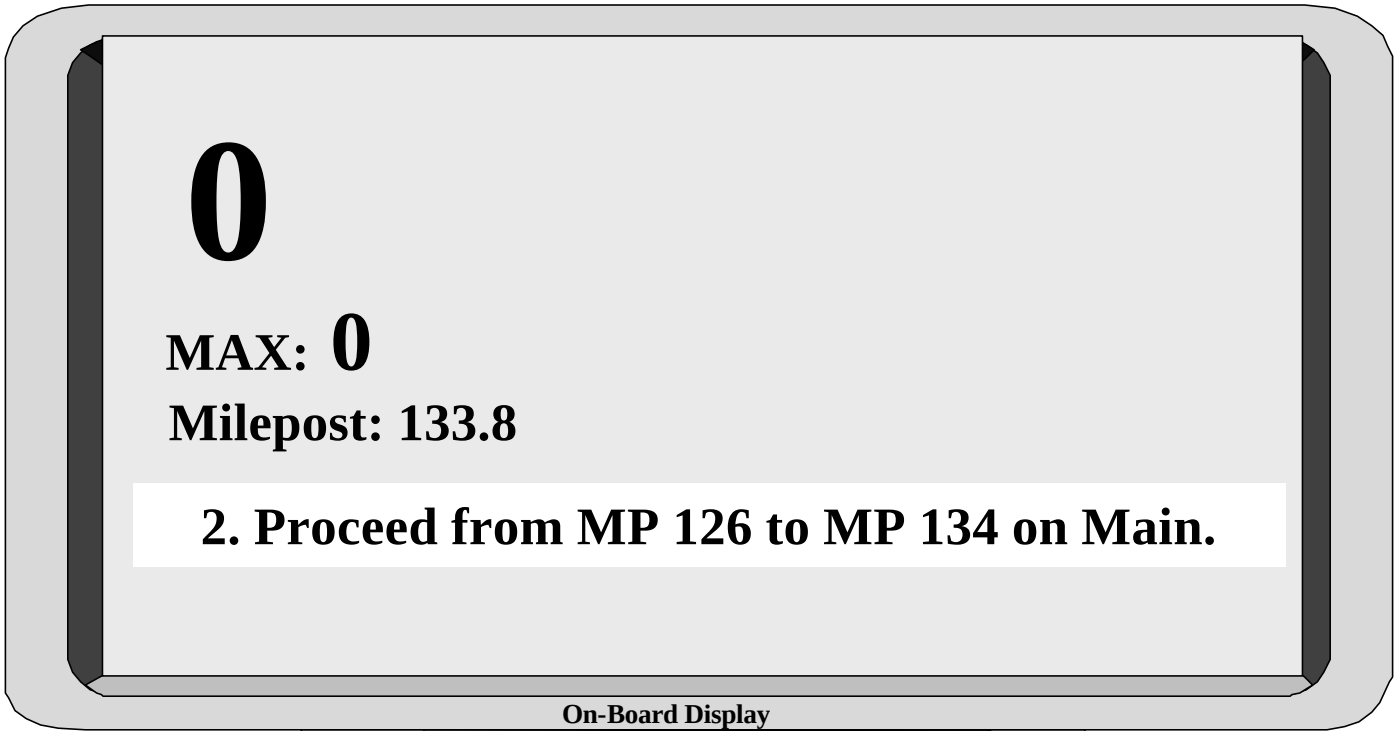




On-Board Display

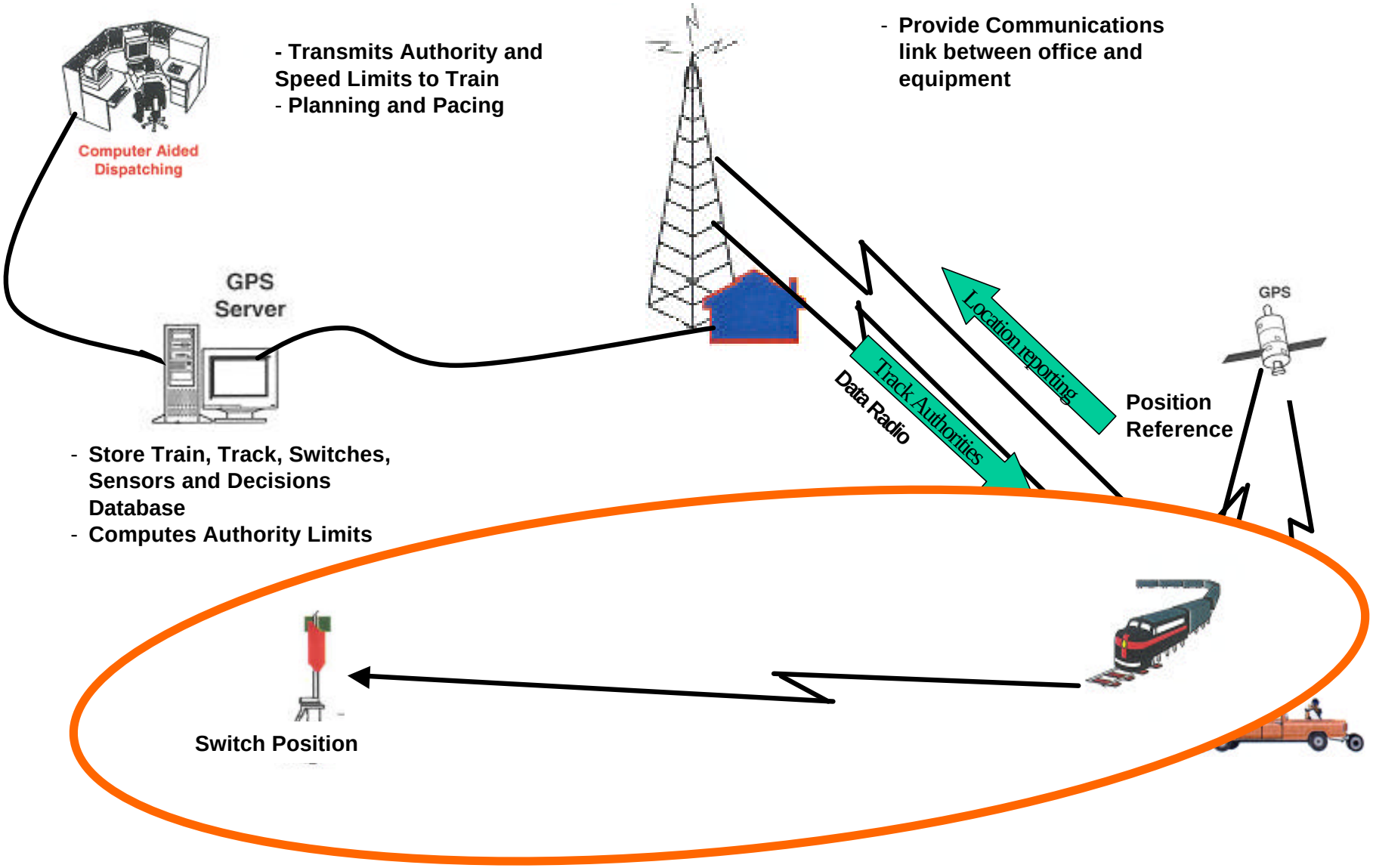
Braking Curve, Overrun Protection

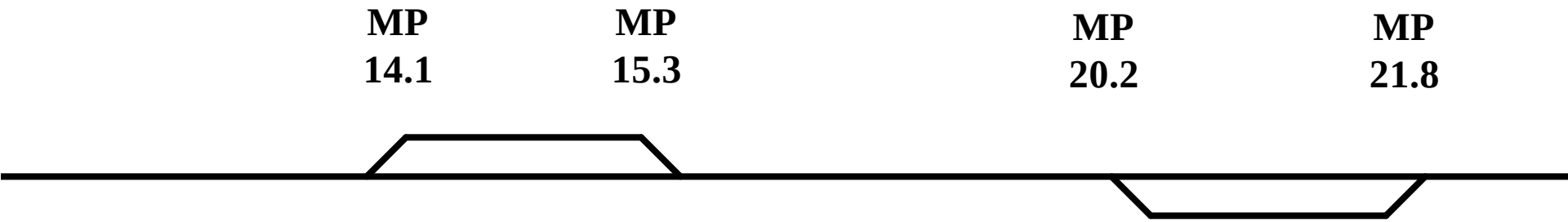




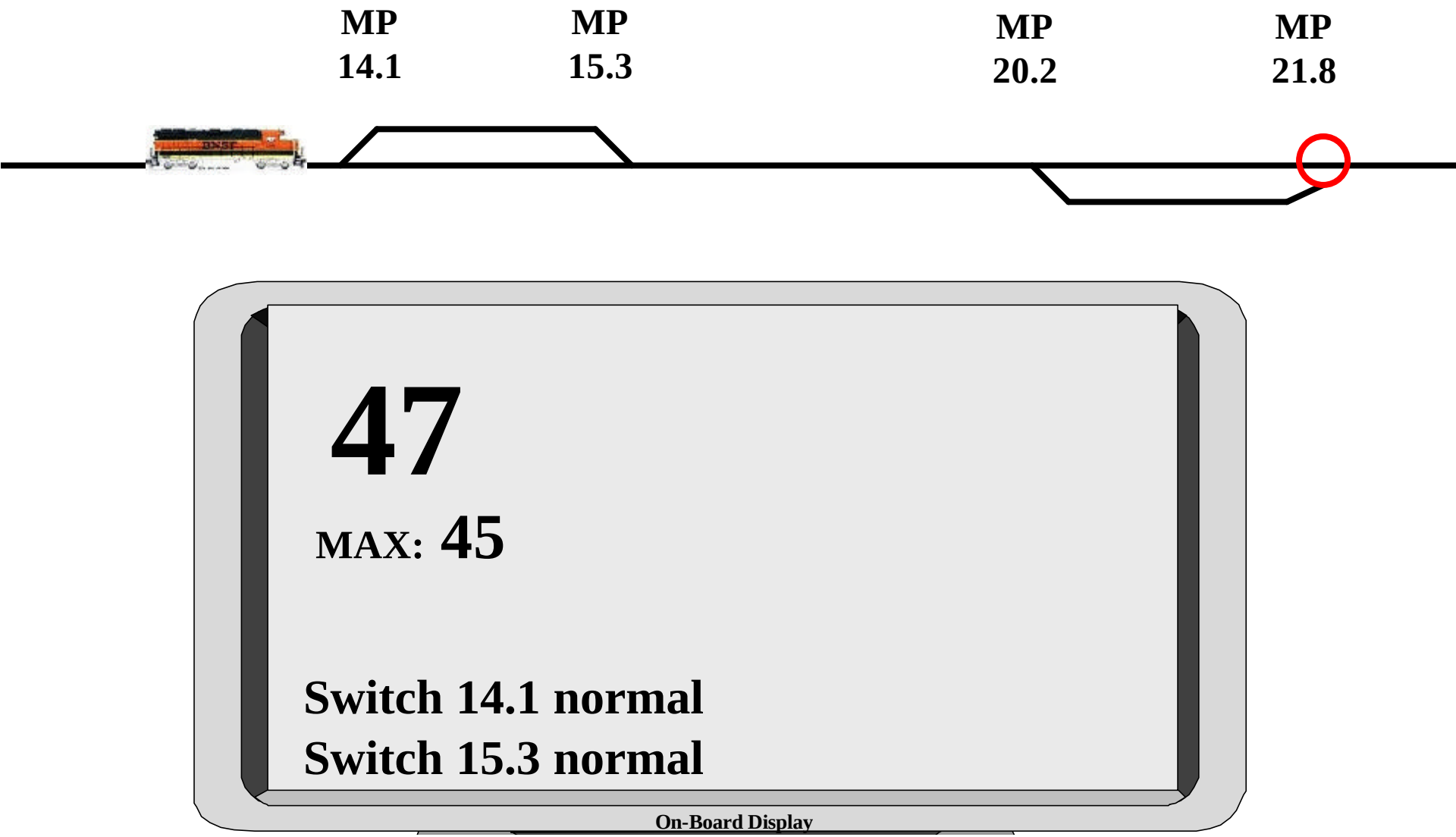
On-Board Display

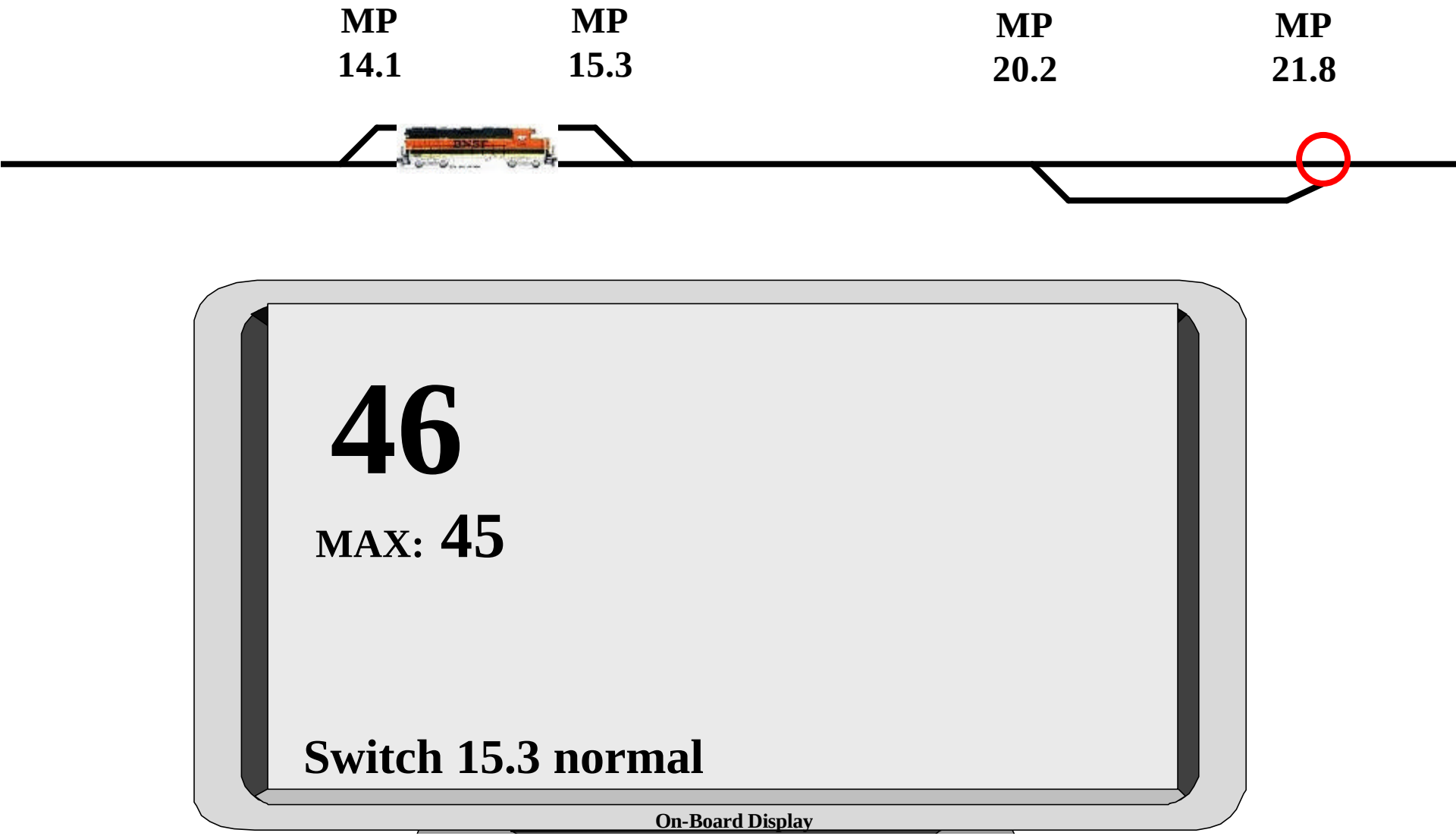
Misaligned Switch Enforcement

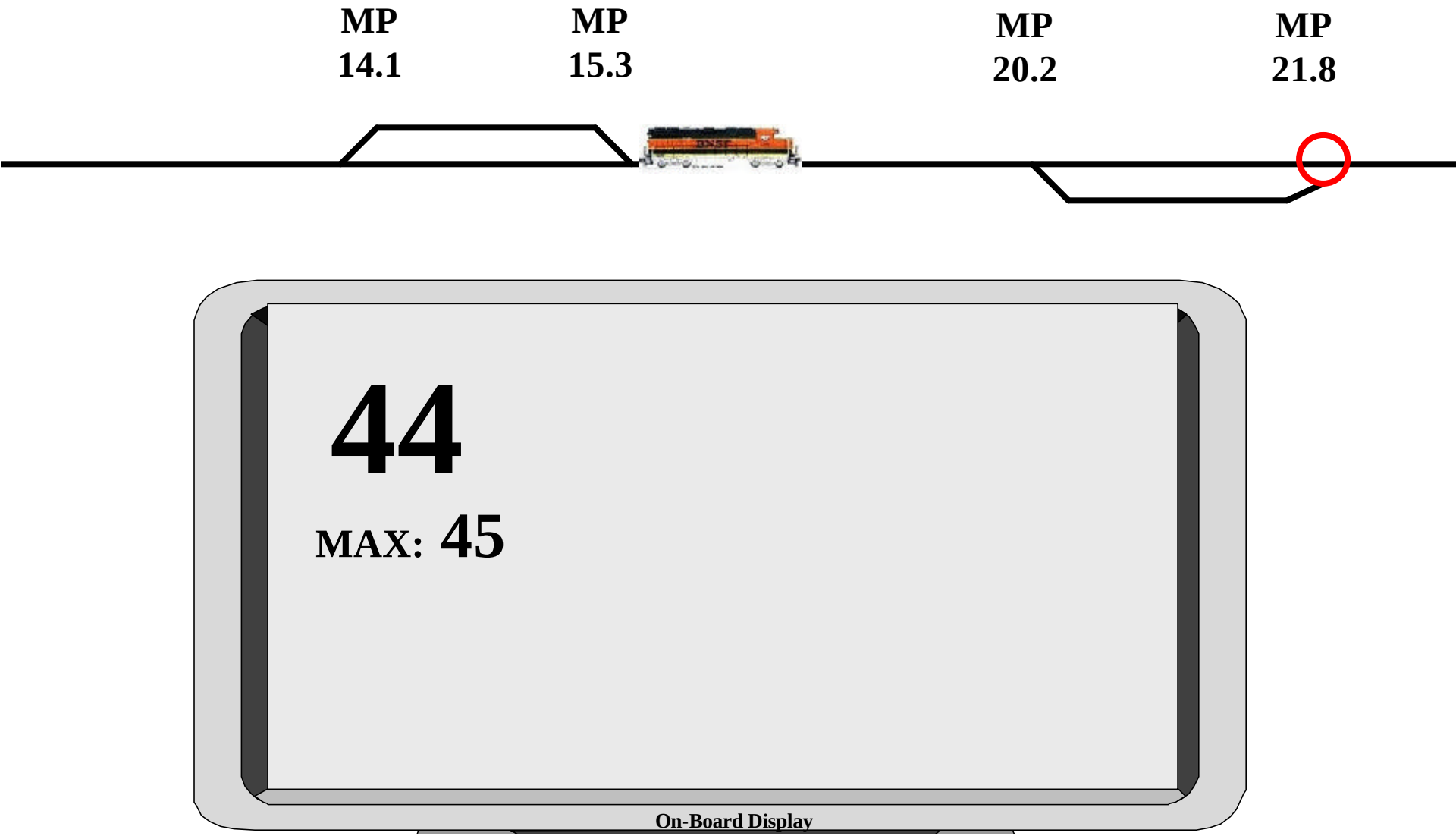


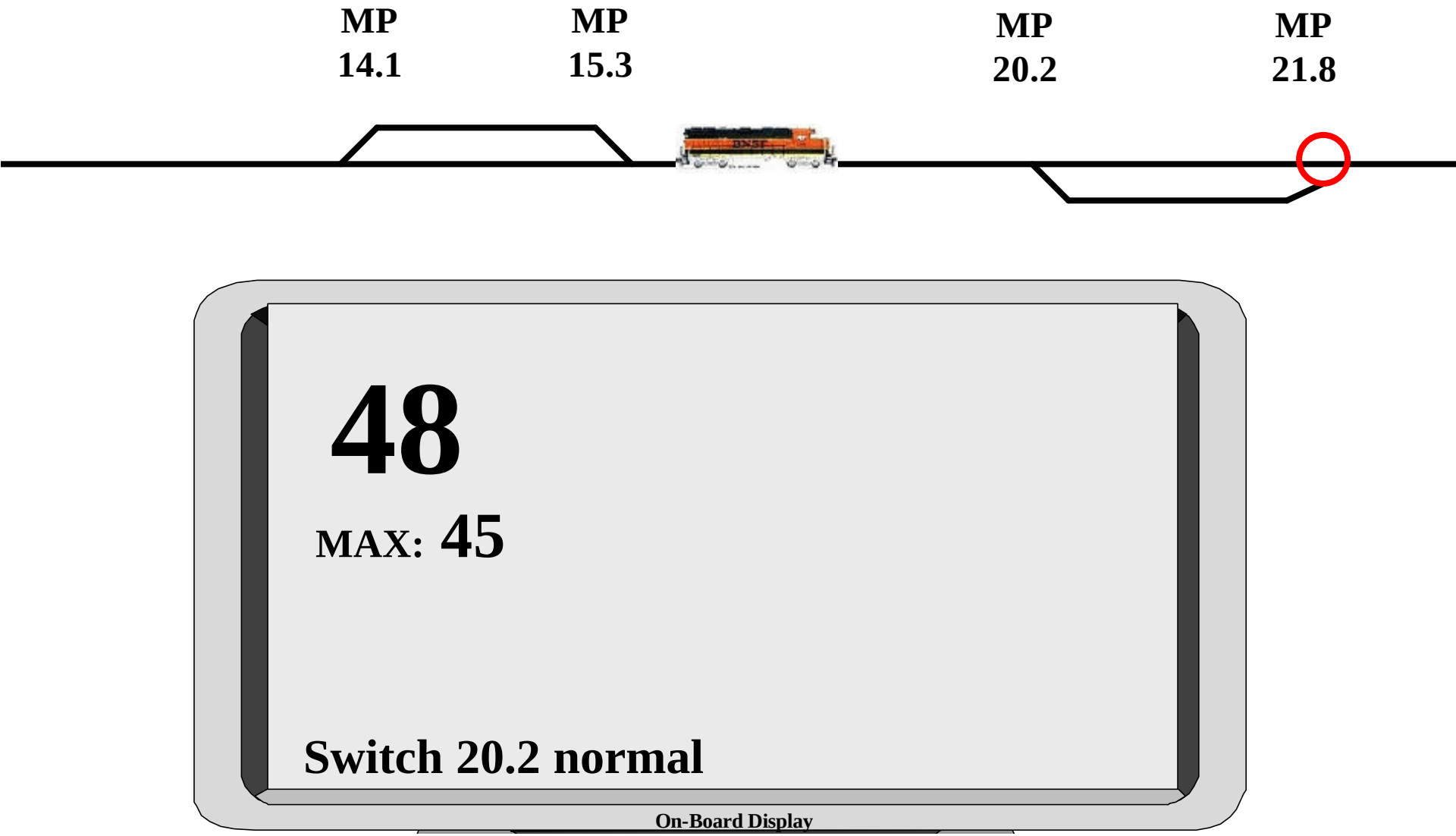


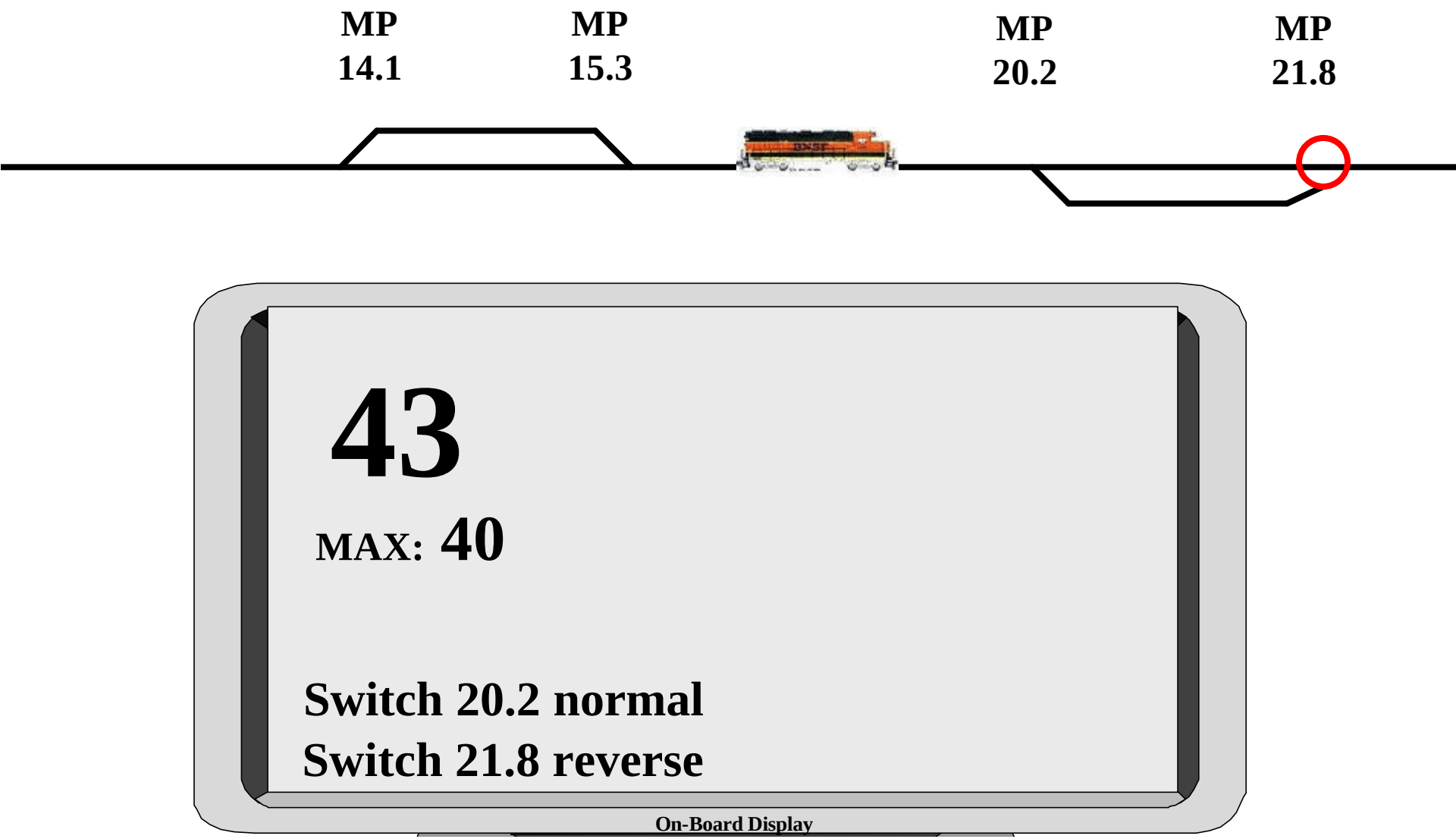
Switch positions are transmitted to the train a safe braking distance in advance of the switch.

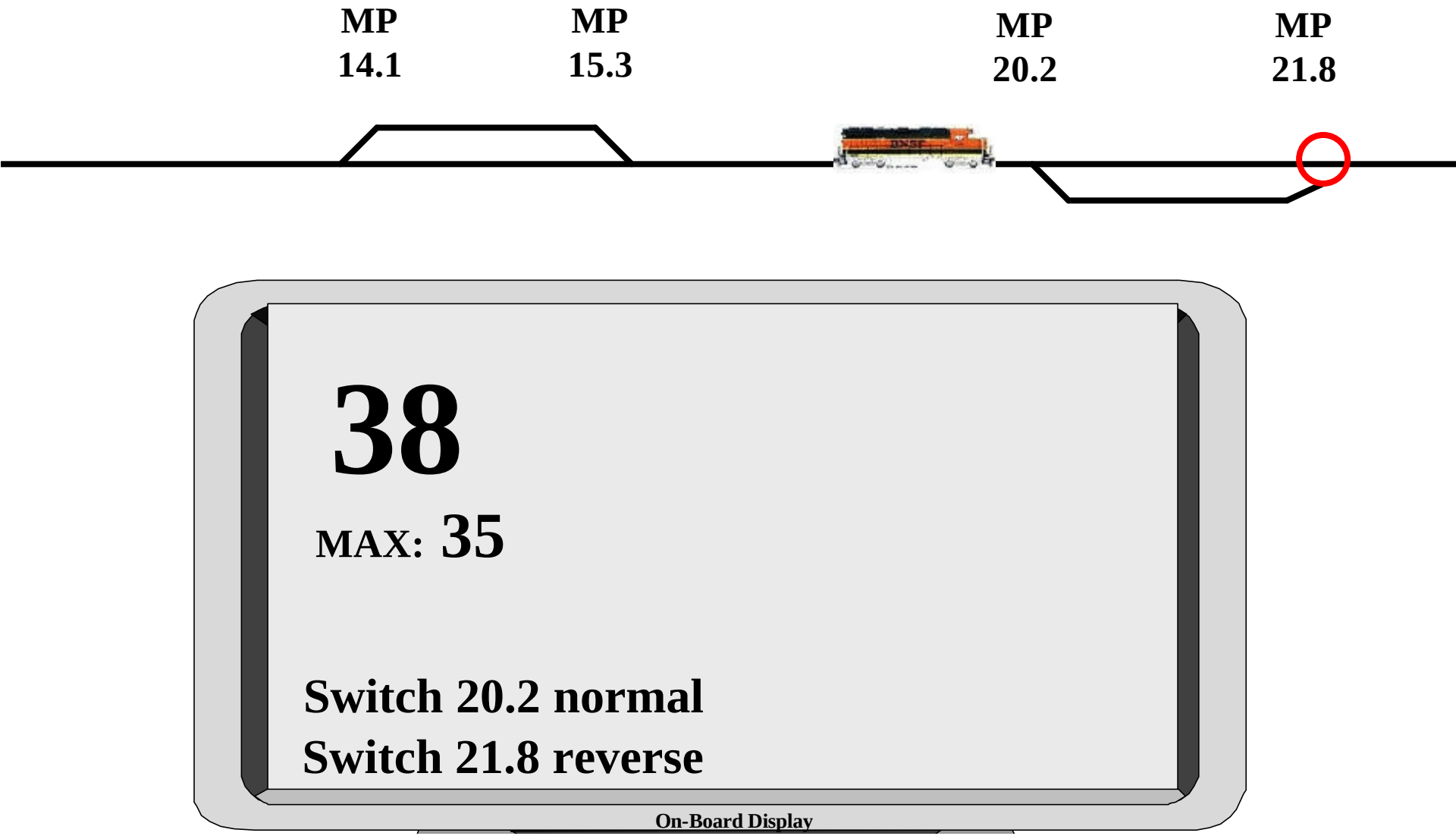

MP
14.1
MP
15.3
MP
20.2
MP
21.8
47
MAX: 45
Switch 14.1 normal
Switch 15.3 normal
On-Board Display

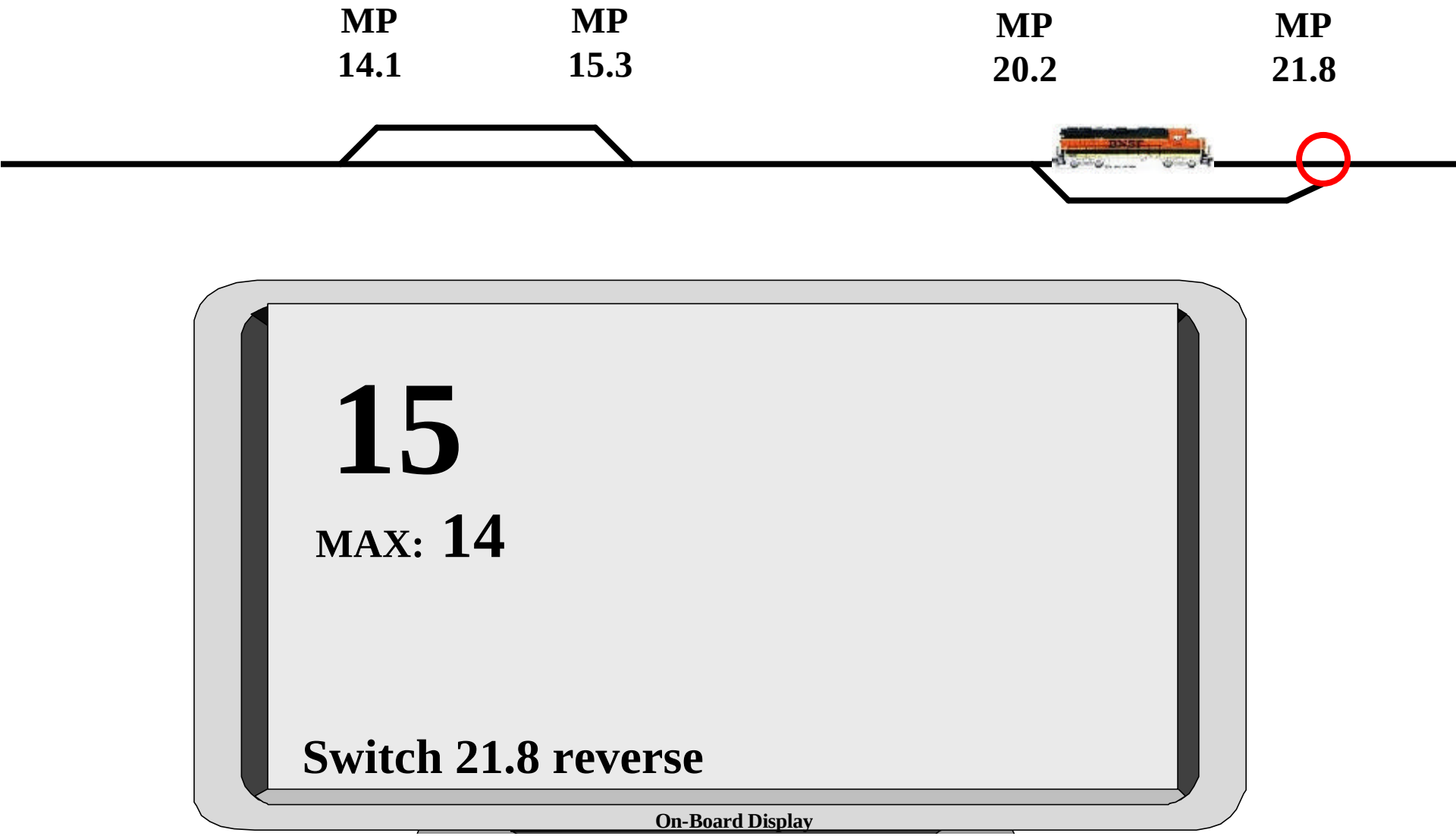

MP
14.1
MP
15.3
MP
20.2
MP
21.8
46
MAX: 45
Switch 15.3 normal
On-Board Display

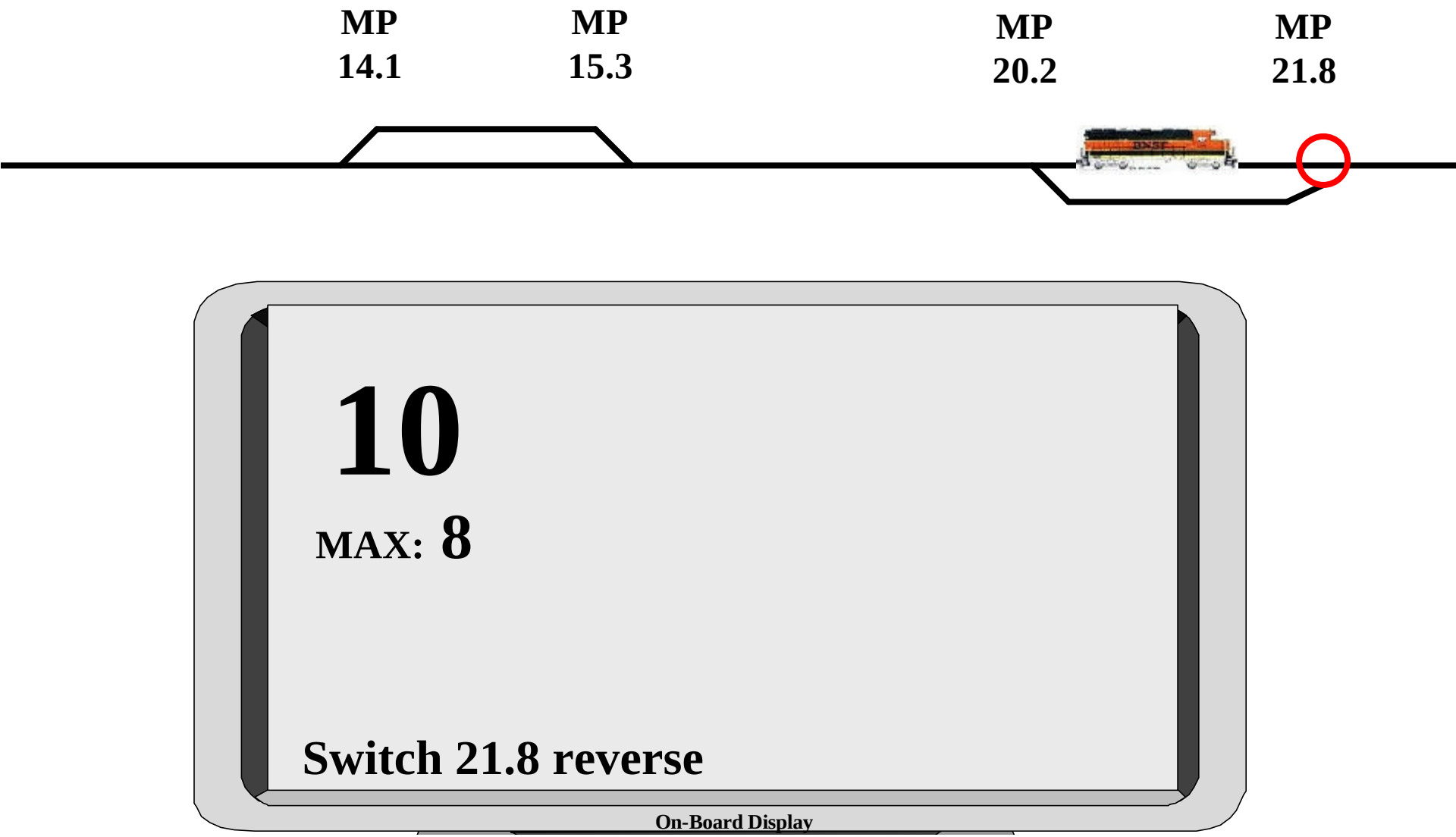

MP
14.1
MP
15.3
MP
20.2
MP
21.8
44
MAX: 45
On-Board Display

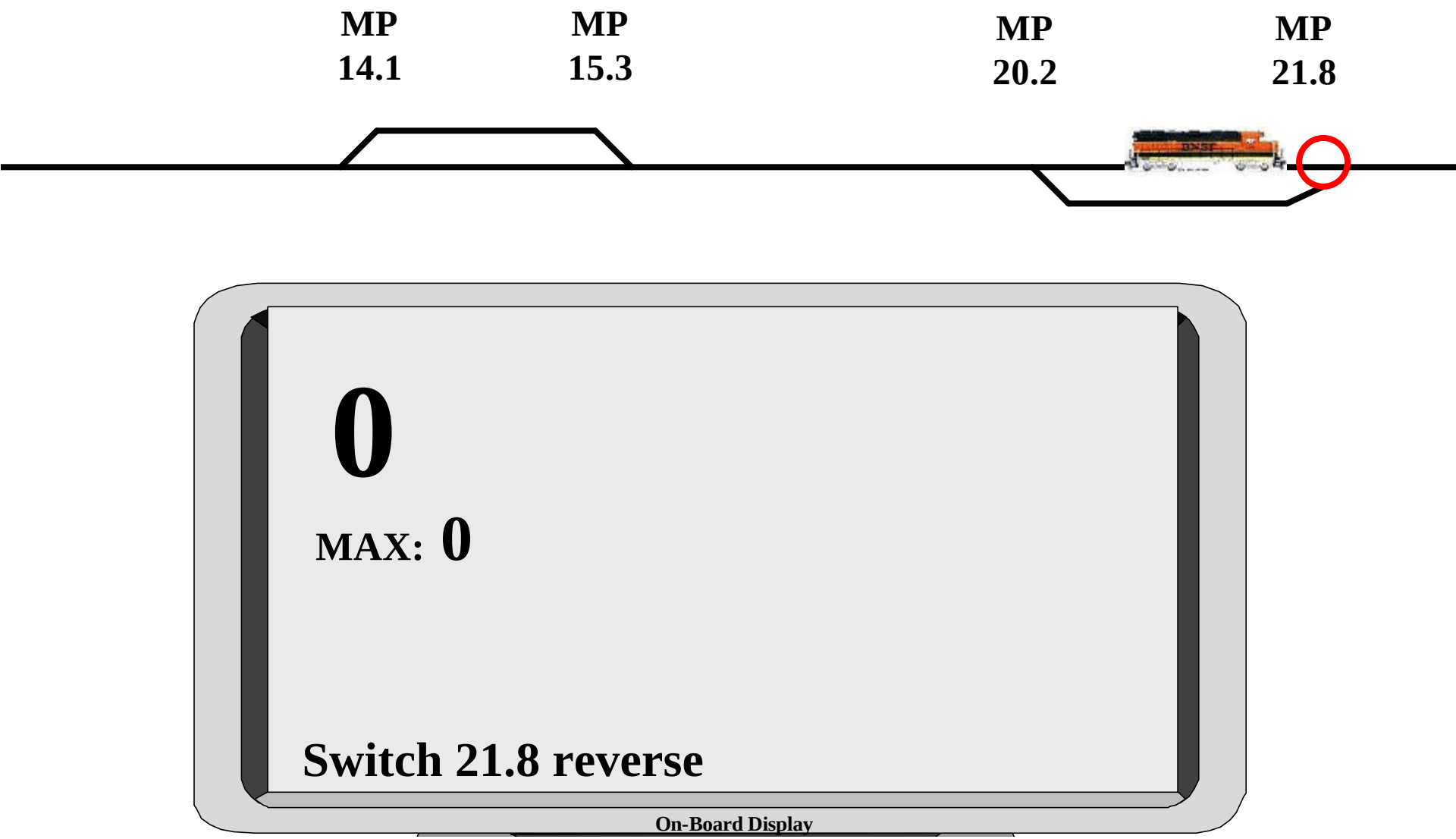

MP
14.1
MP
15.3
MP
20.2
MP
21.8
48
MAX: 45
Switch 20.2 normal
On-Board Display


MP
14.1
MP
15.3
MP
20.2
MP
21.8
43
MAX: 40
Switch 20.2 normal
Switch 21.8 reverse
On-Board Display

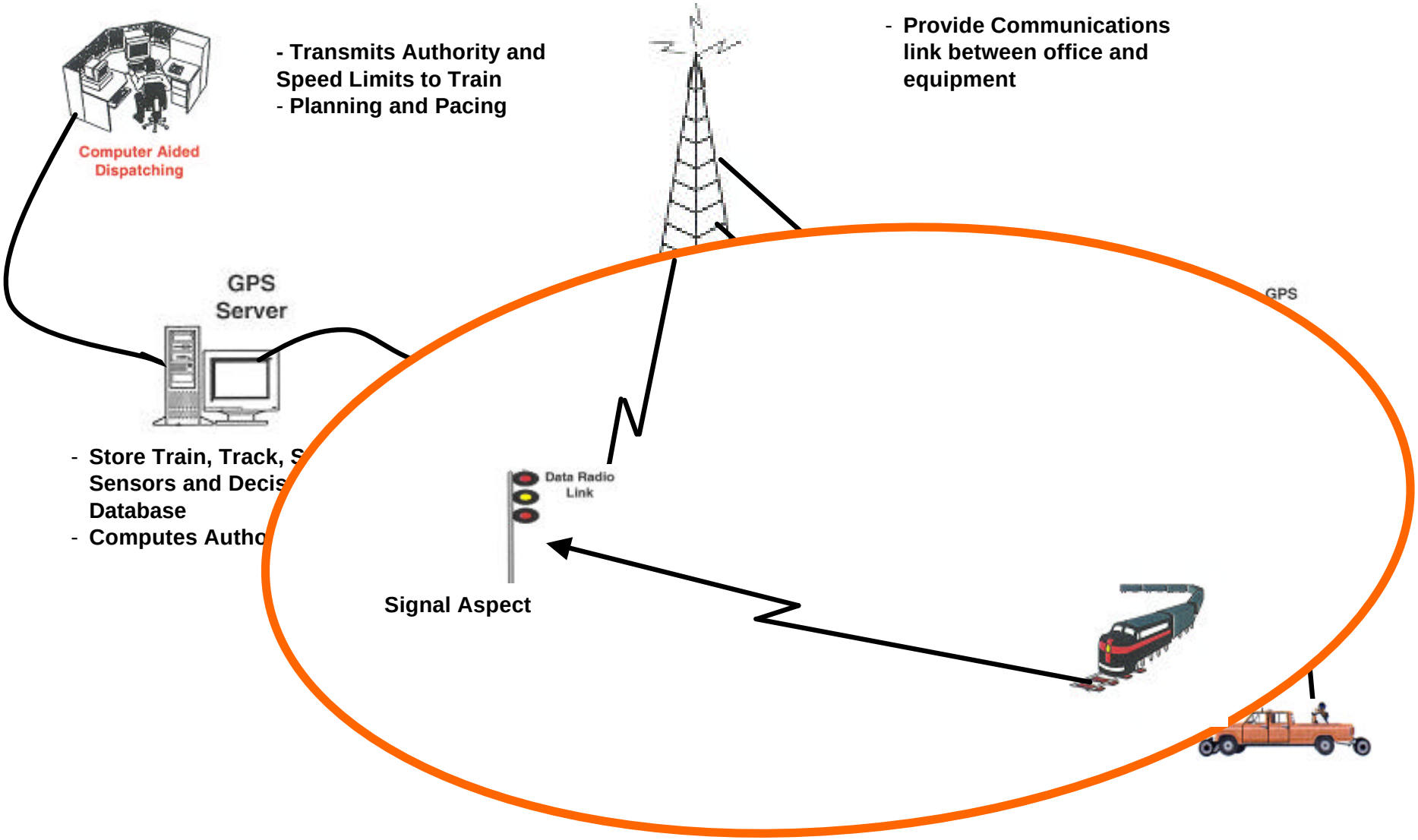

MP
14.1
MP
15.3
MP
20.2
MP
21.8
38
MAX: 35
Switch 20.2 normal
Switch 21.8 reverse
On-Board Display


MP
14.1
MP
15.3
MP
20.2
MP
21.8
15
MAX: 14
Switch 21.8 reverse
On-Board Display

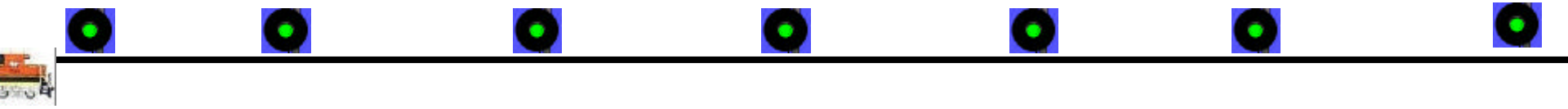

MP
14.1
MP
15.3
MP
20.2
MP
21.8
10
MAX: 8
Switch 21.8 reverse
On-Board Display


MP
14.1
MP
15.3
MP
20.2
MP
21.8
0
MAX: 0
Switch 21.8 reverse
On-Board Display

Signal Aspect Enforcement

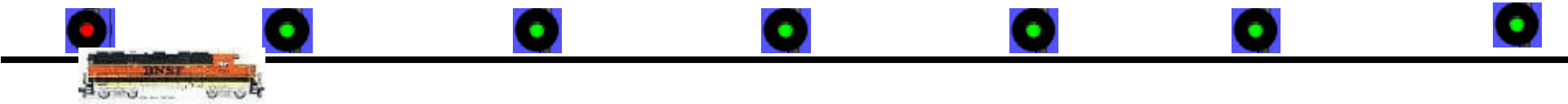


Concept of Operation
Current Issue: Following move, signal territory



Observing continuous approach signals can desensitize an engineer to the possibility of an upcoming Stop aspect.

In this example the train ahead unexpectedly stops and the following train is operating expecting an approach aspect.



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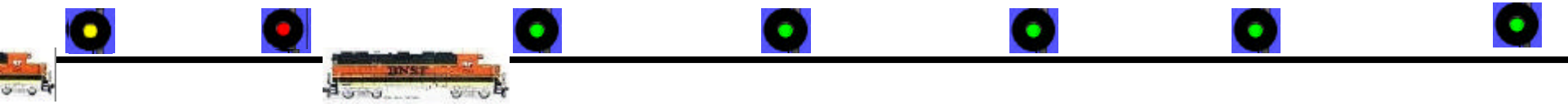

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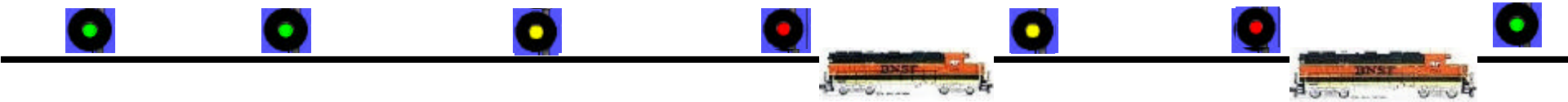

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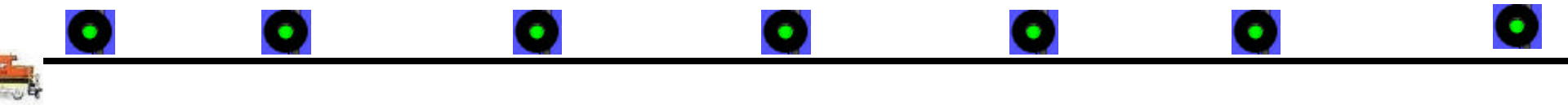
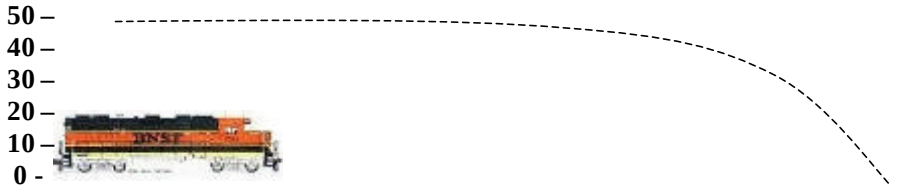
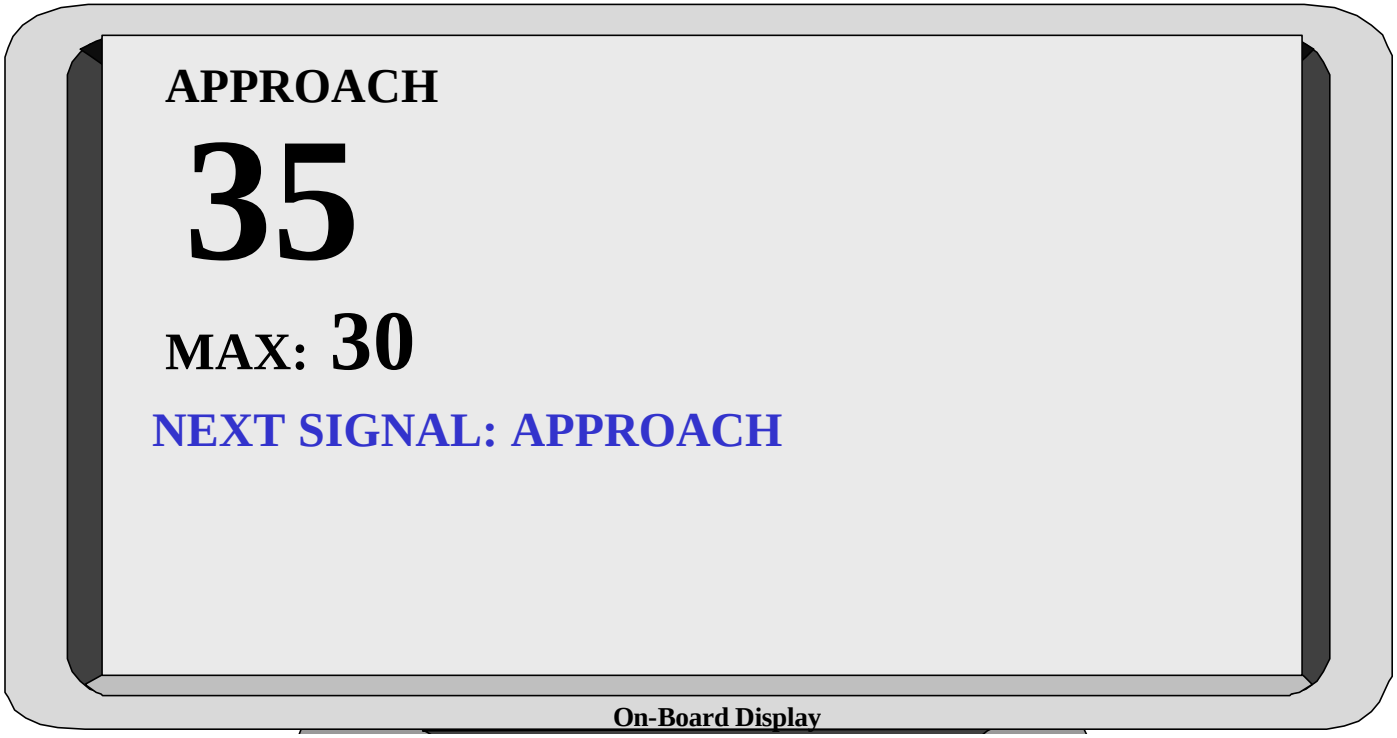
Concept of Operation
Resolution: Following move, signal territory.



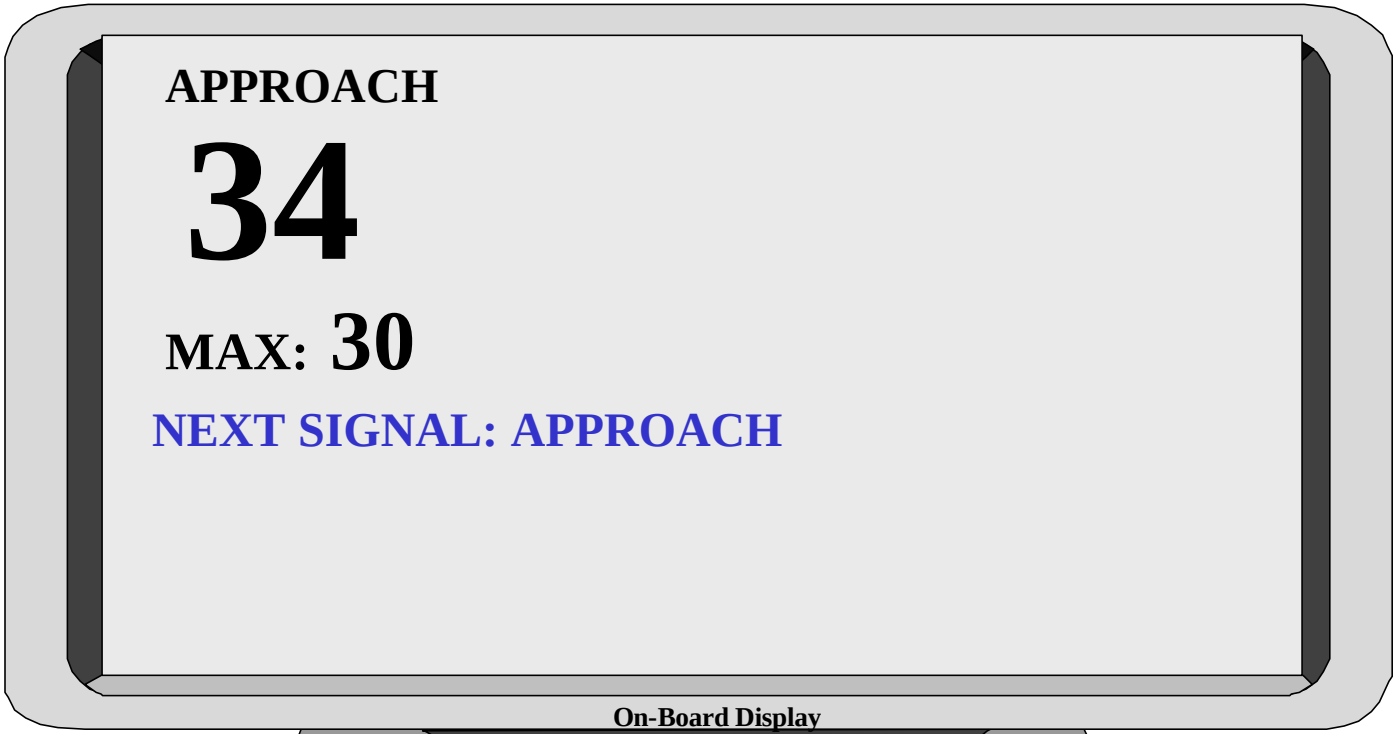
Transmitting signal information to the on-board computer breaks this cycle of expectation by stopping a train before it enters unsafe territory!



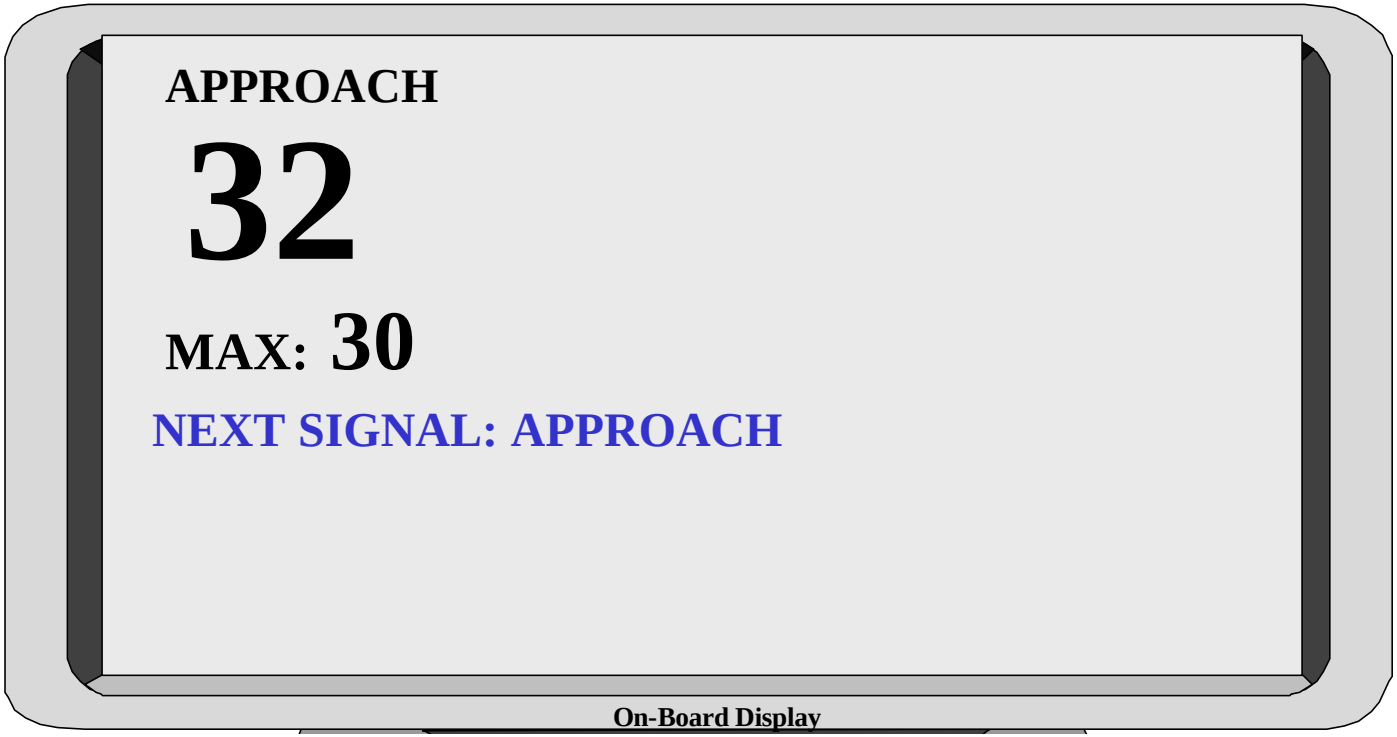
Speed and Distance/Evaluation/Brake



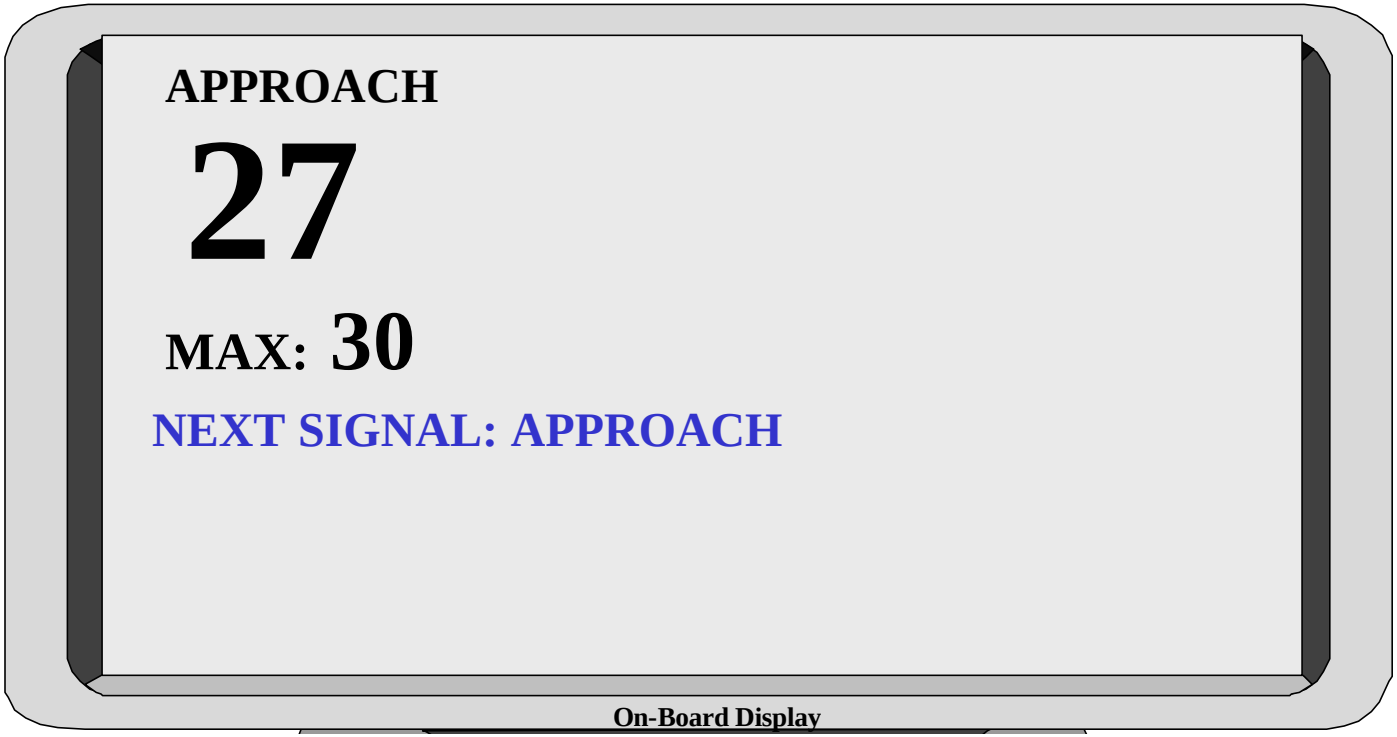
On-Board Display



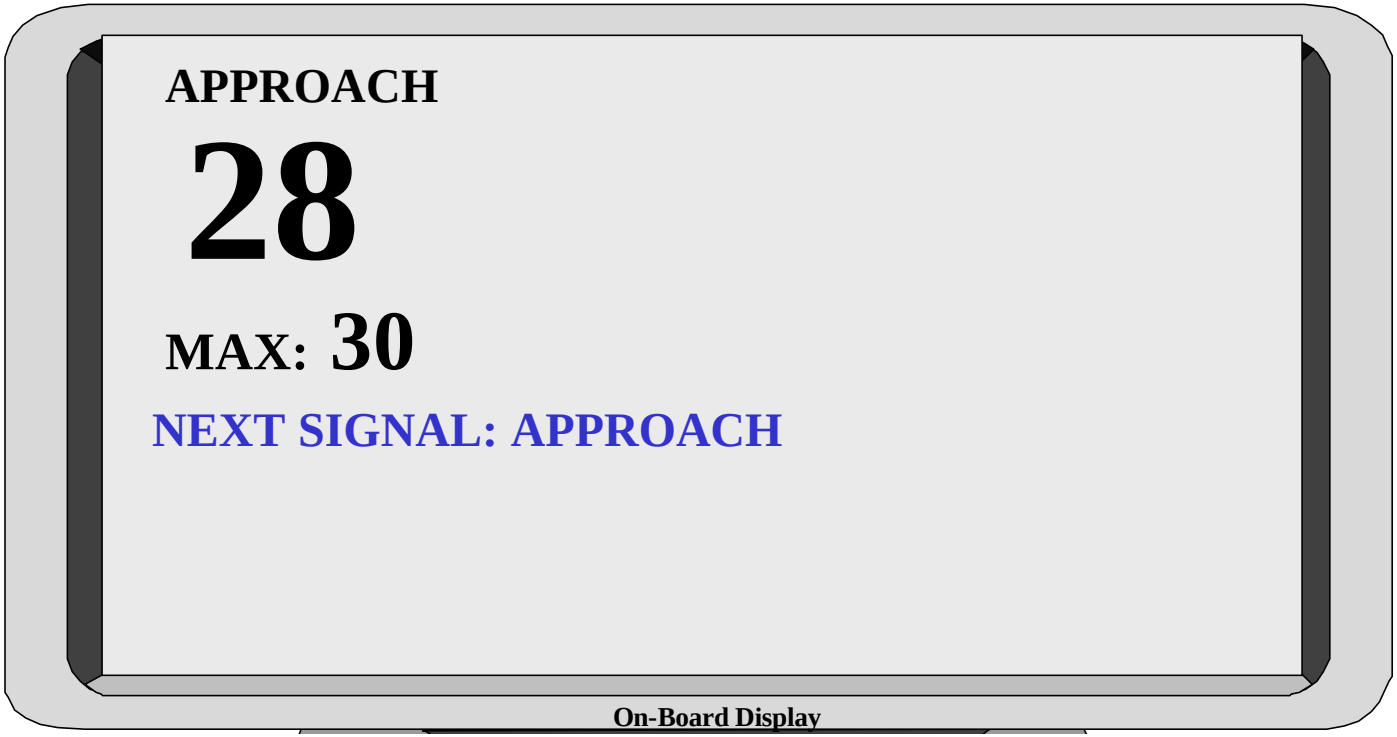
On-Board Display



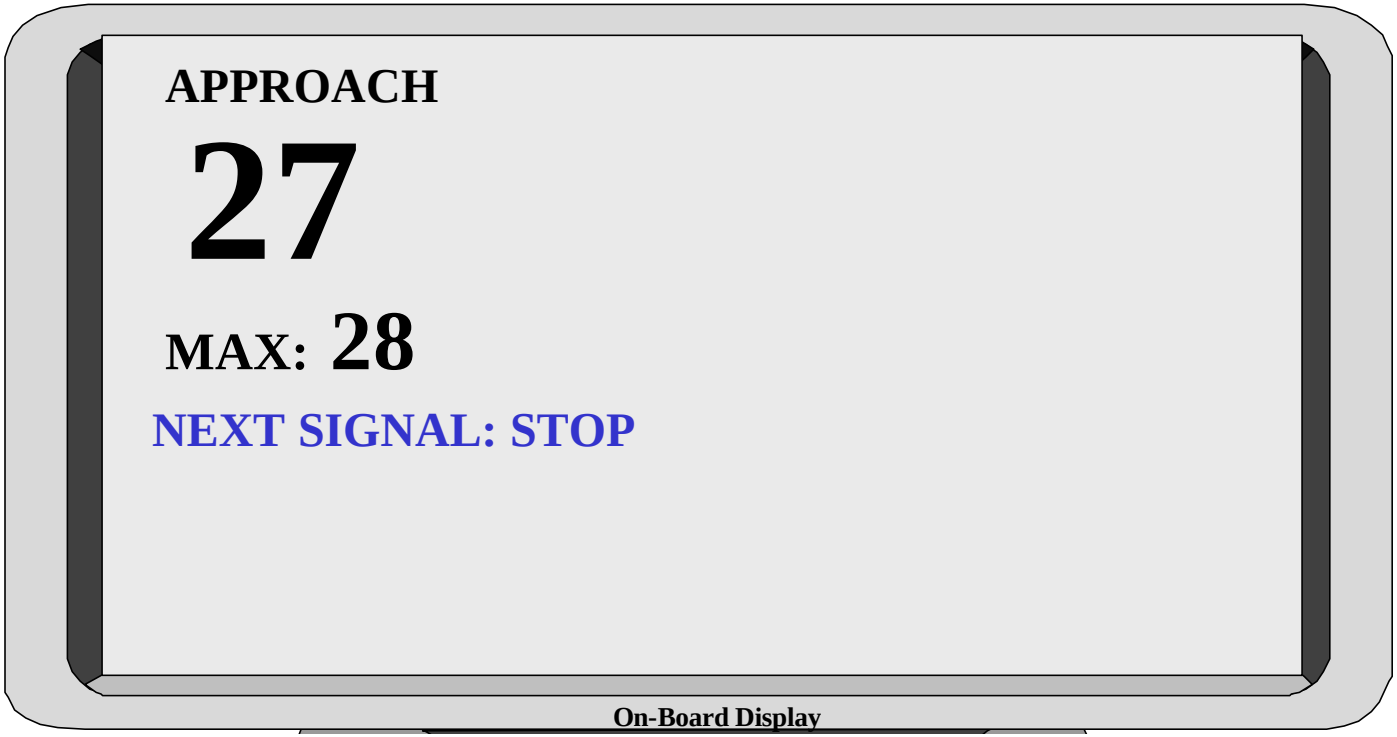
On-Board Display



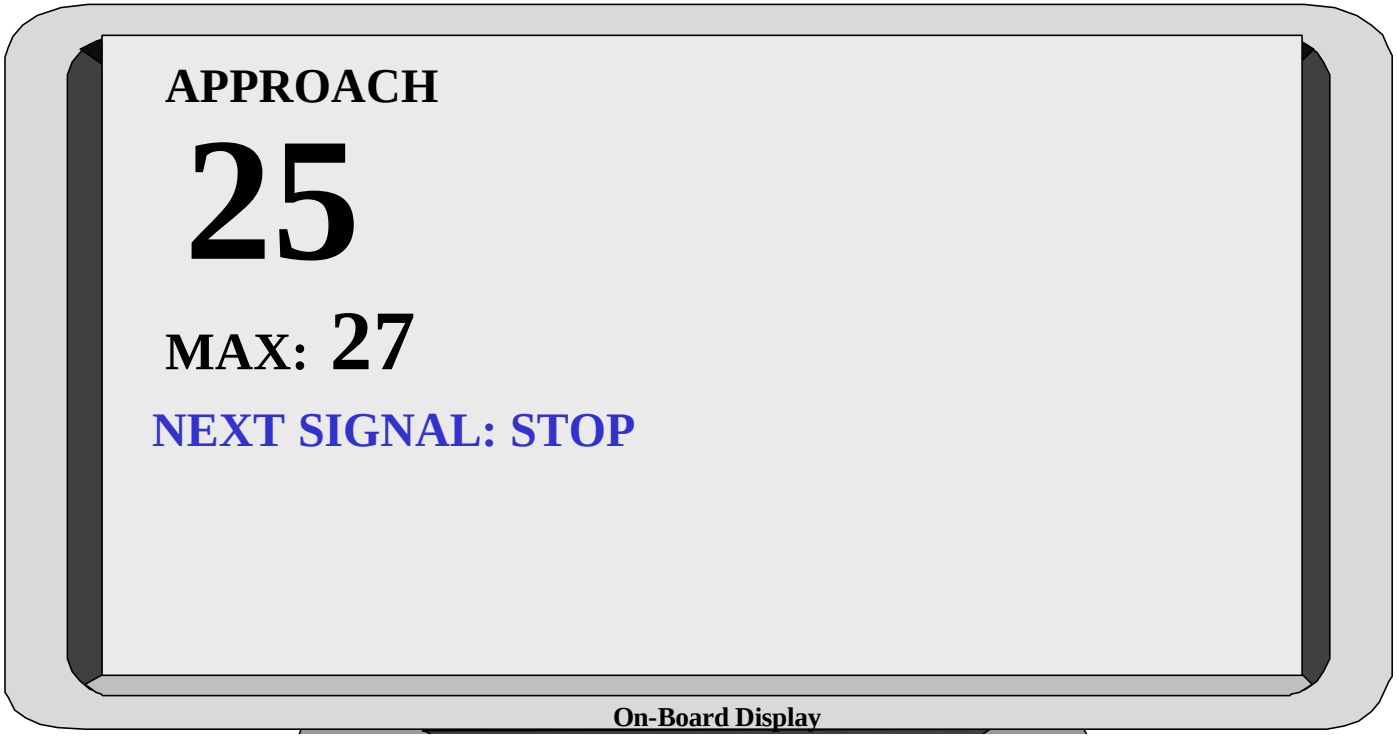
On-Board Display



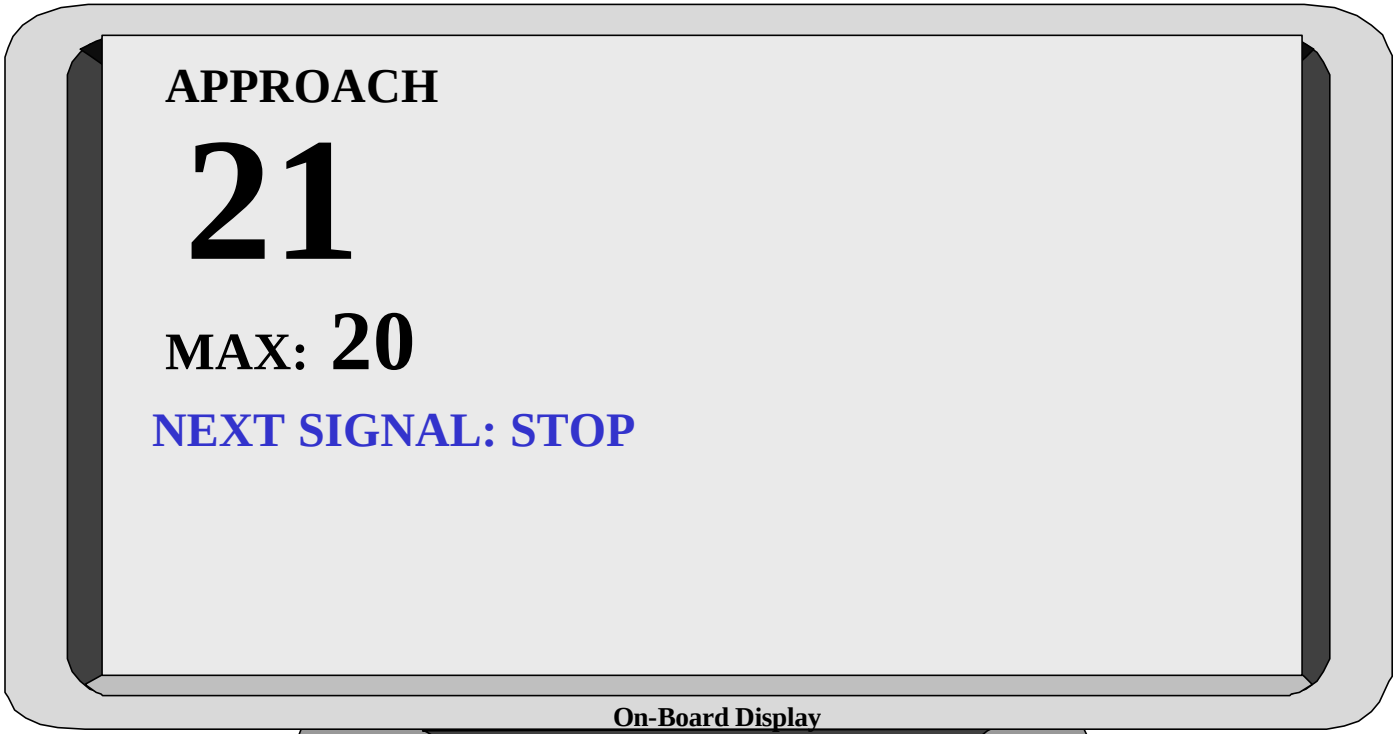
On-Board Display



On-Board Display

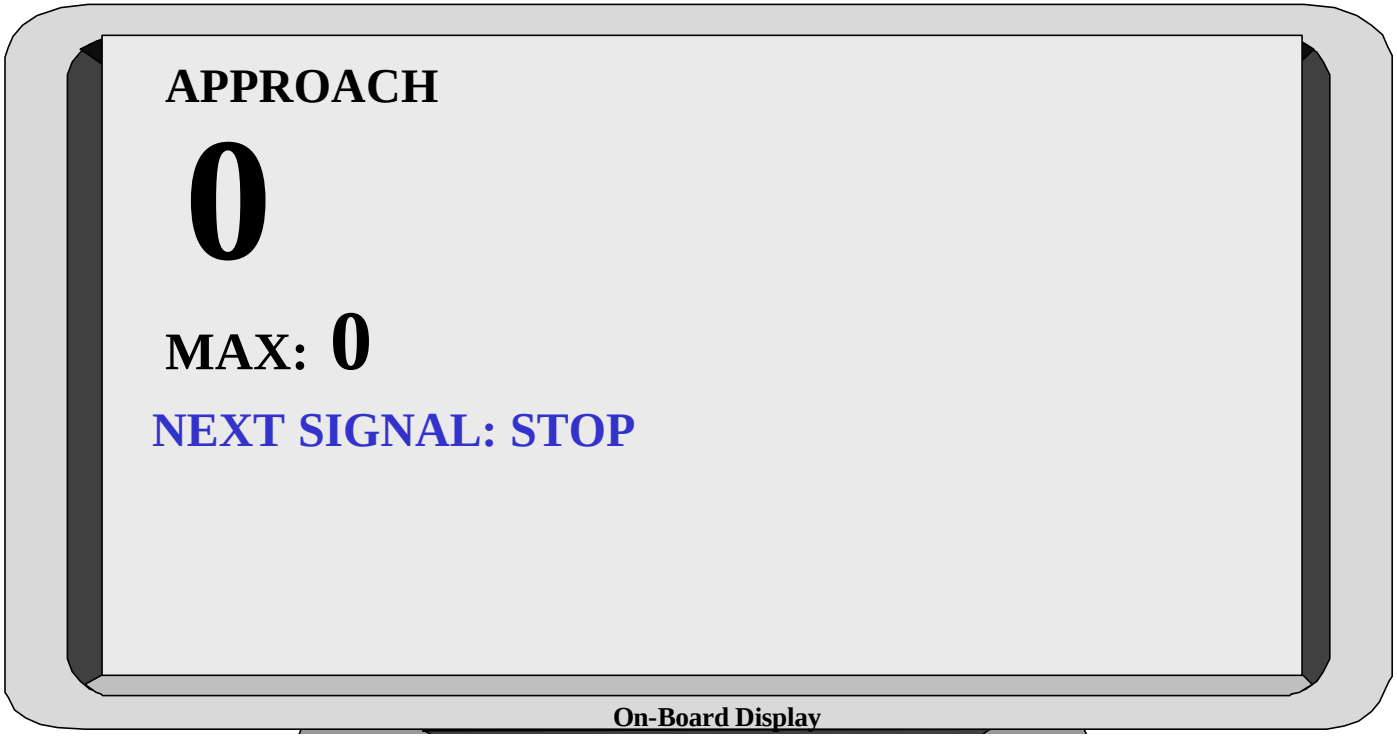


On-Board Display



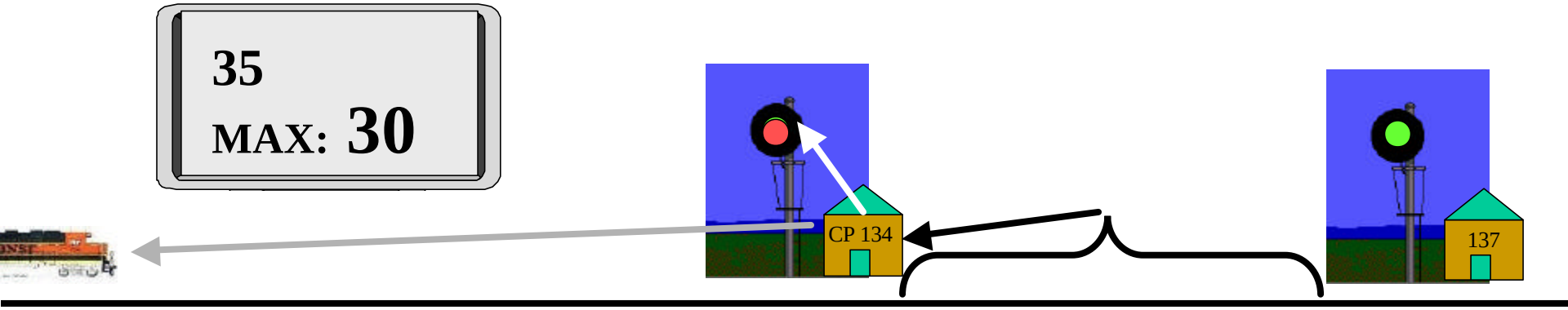
On-Board Display

On-Board Display



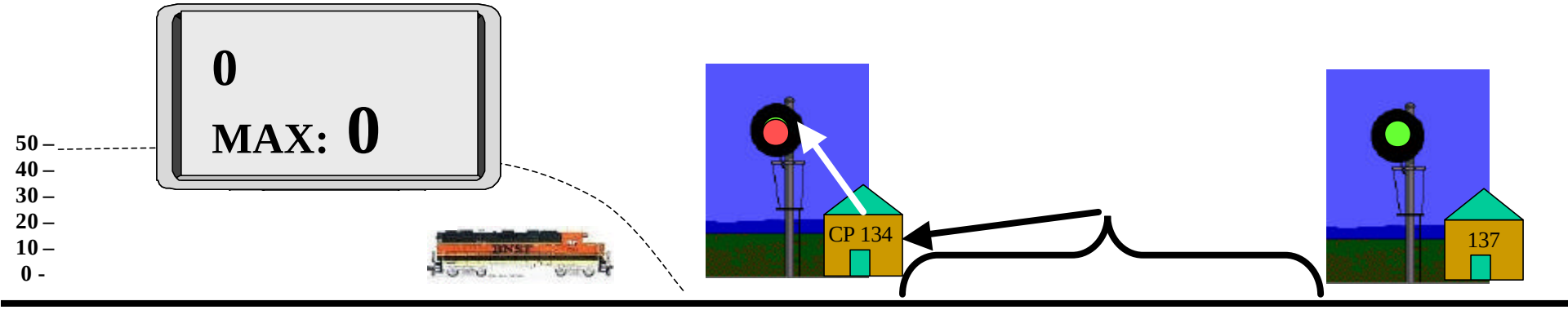
On-Board Display

Signal Compliance System

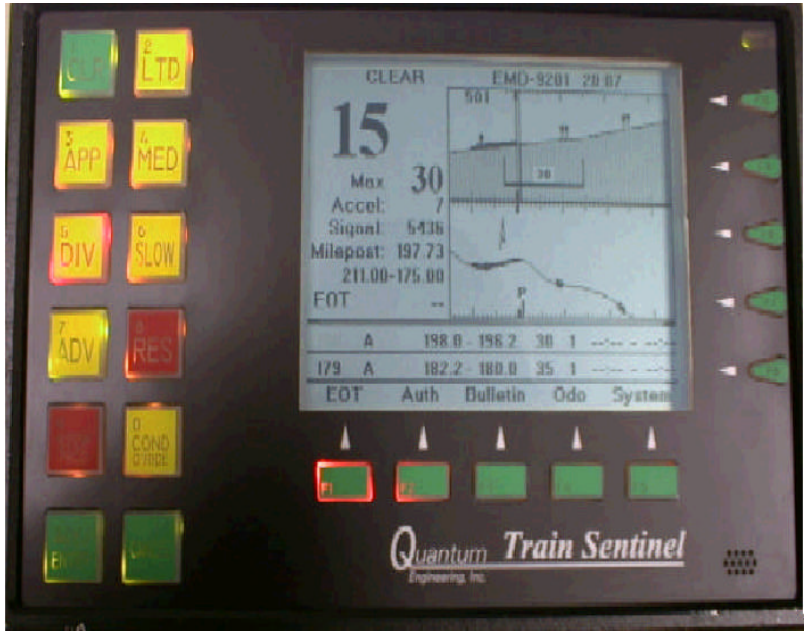


Field device sends signal aspects to locomotive via radio link.

Signal Compliance System

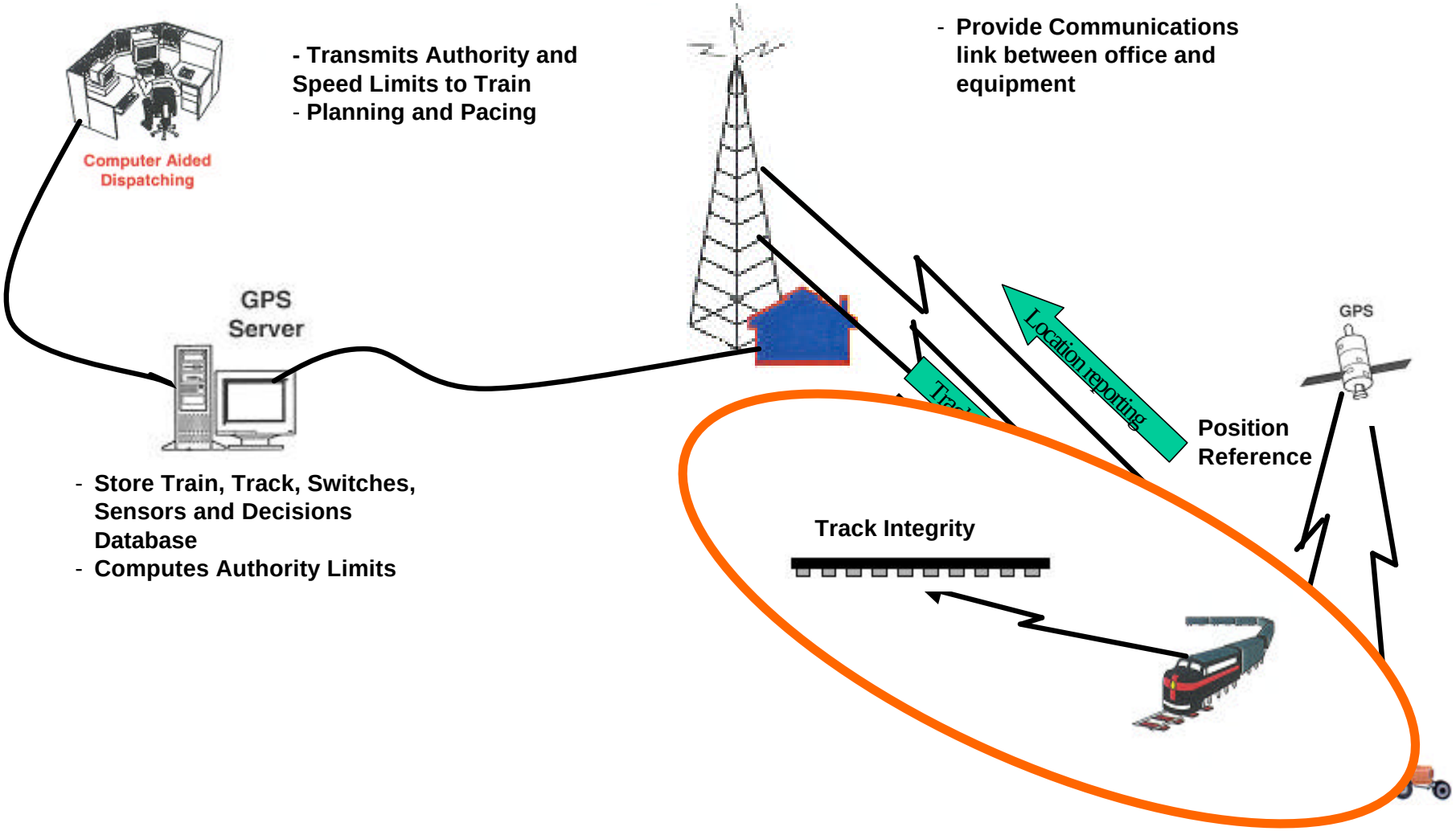


Failure of engineer to enter data or match relayed signal aspect will stop train.

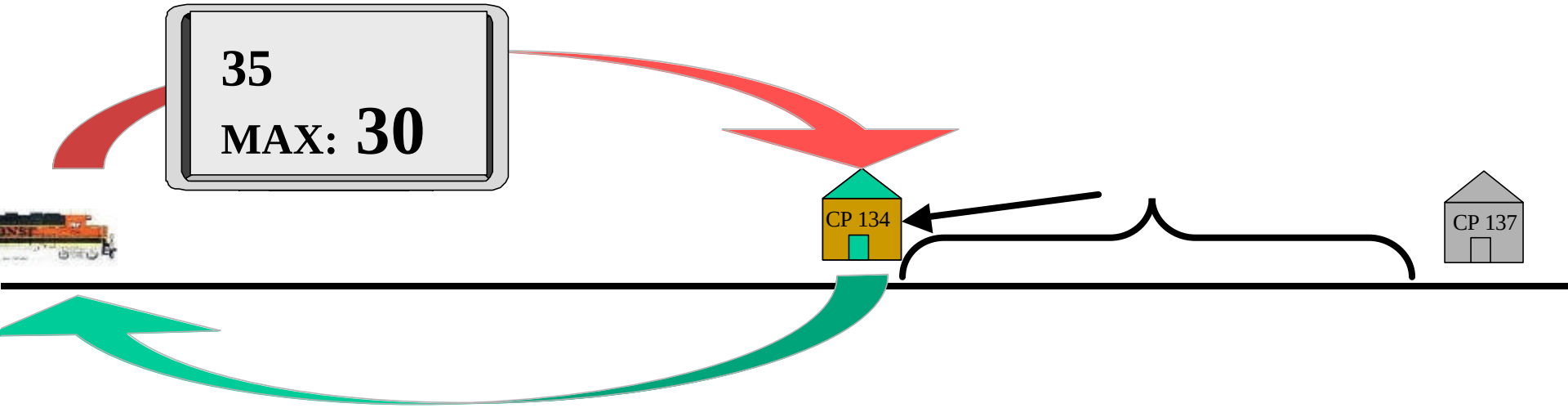


On-board display

Track Integrity Enforcement

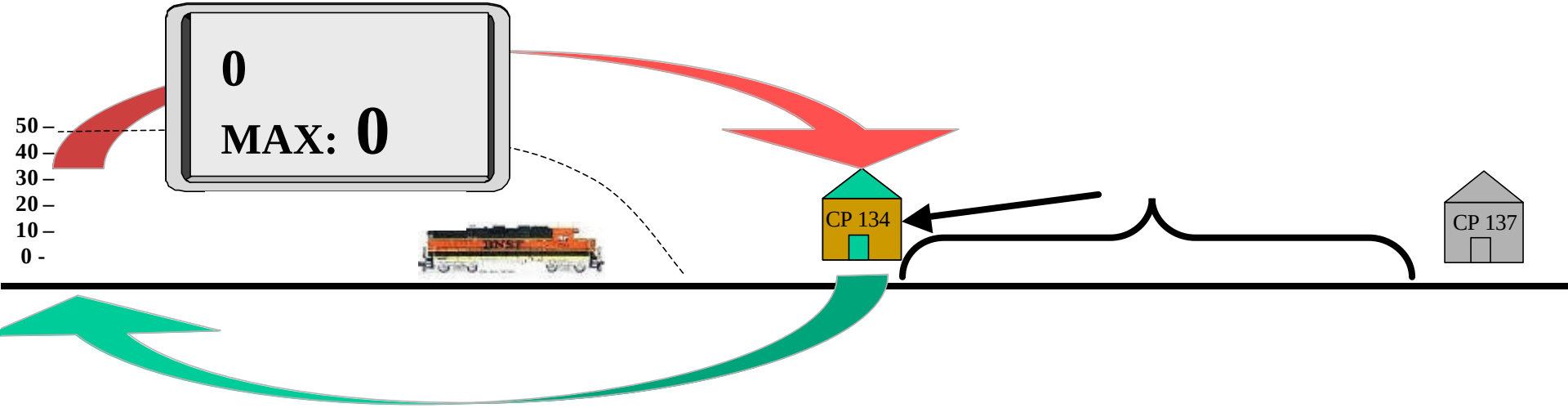


Track Integrity



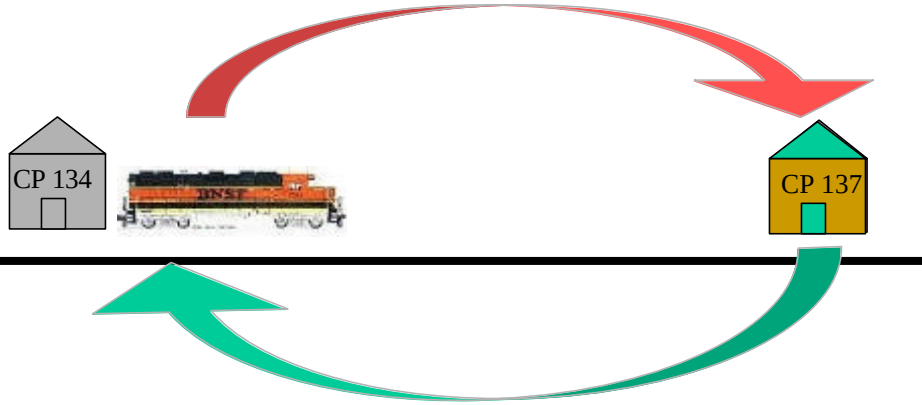
- Train interrogates vital logic controller in sleep mode.
- Vital logic controller awakens and investigates track for integrity.
- Vital logic sends continuous aspects to in-cab display via communications link.

Track Integrity



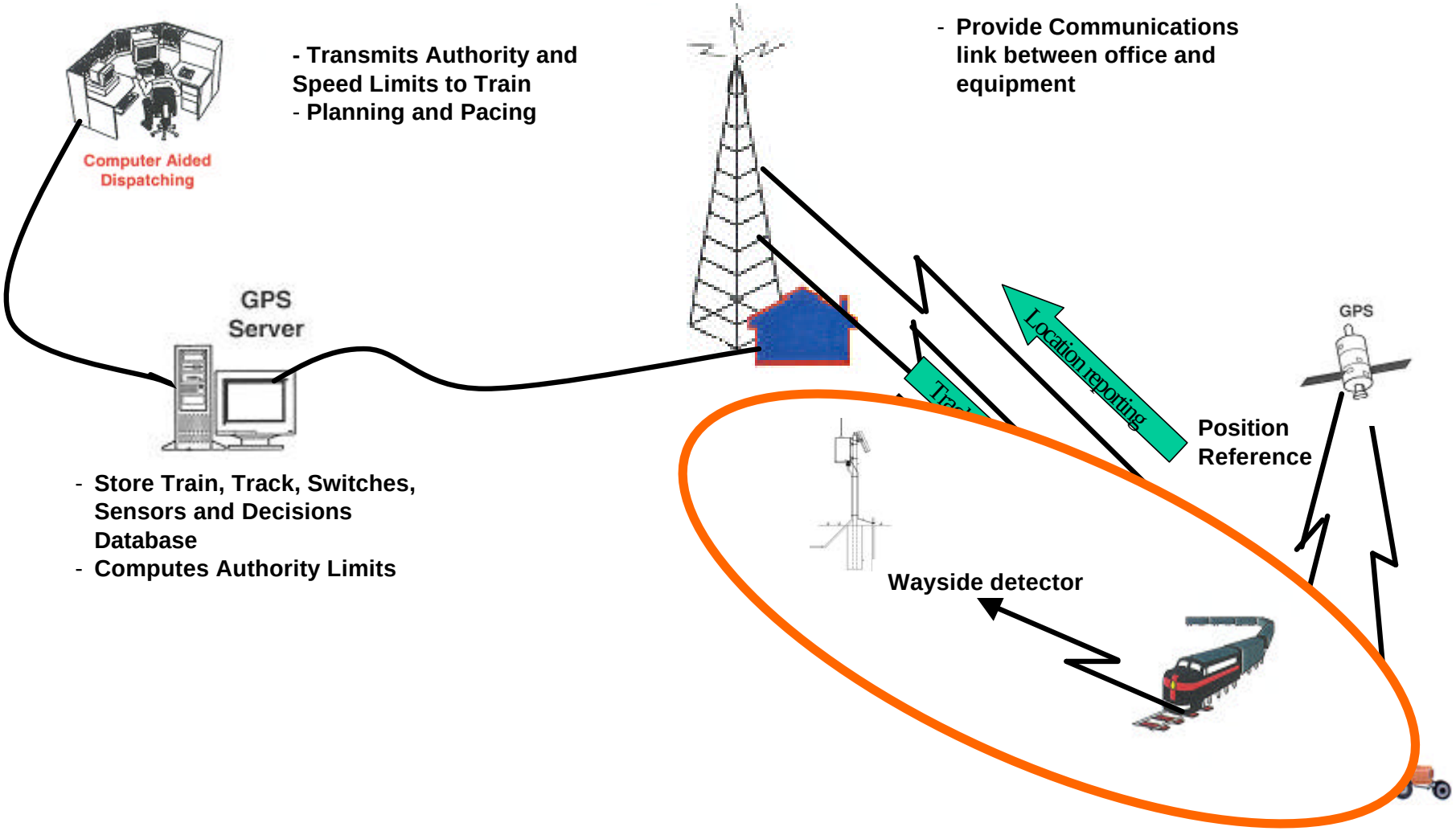
- Train interrogates vital logic controller in sleep mode.
- Vital logic controller awakens and investigates track for integrity.
- Vital logic controller controls switches and sends continuous aspects to in-cab display via communications link.
- On-board enforcement prevents authority violation.

Track Integrity

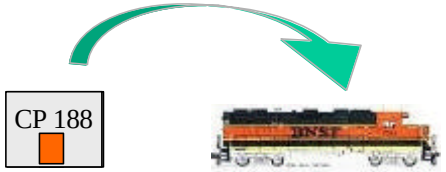


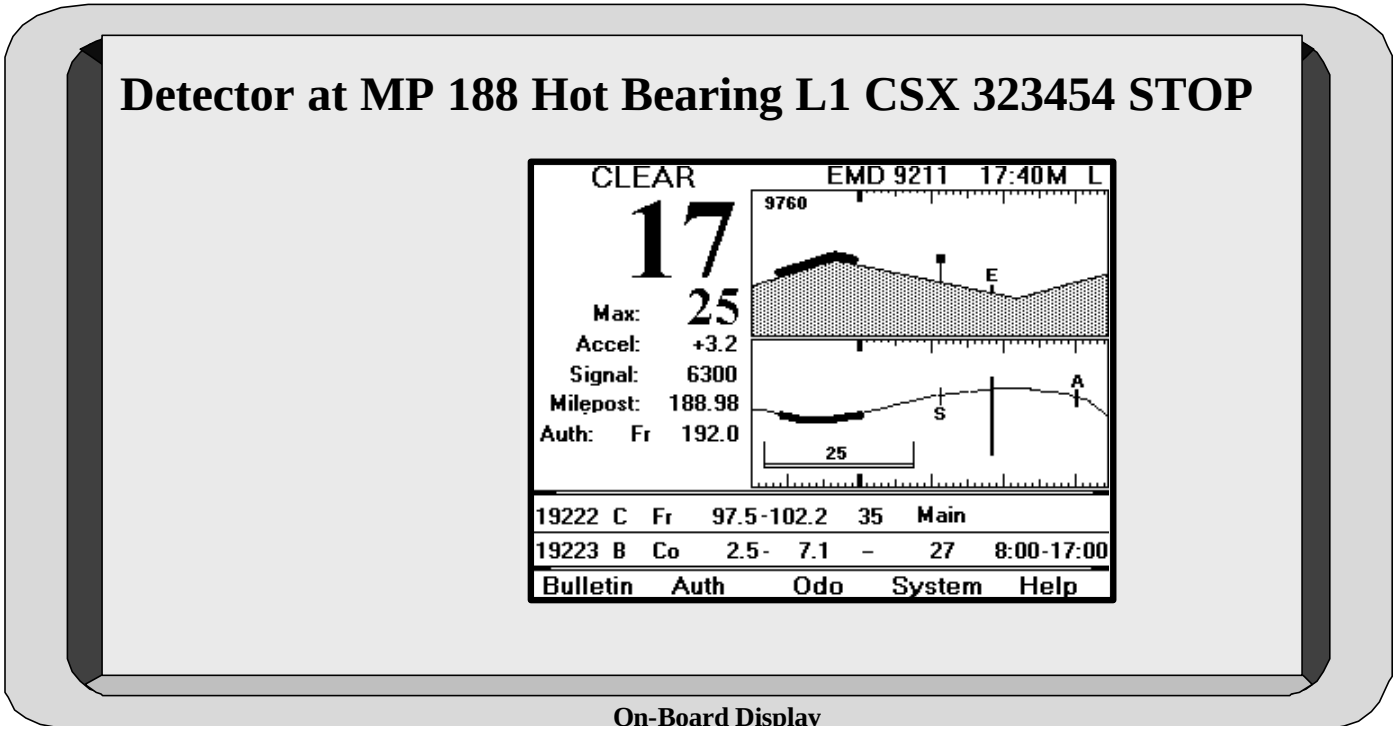
- Train awakens next vital logic controller.
- Previous vital logic controller goes to sleep.

Wayside Detector Monitoring



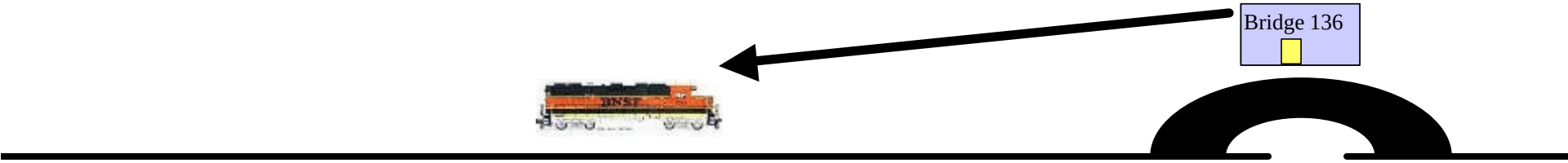
Trackside warning detector alarms sent to train

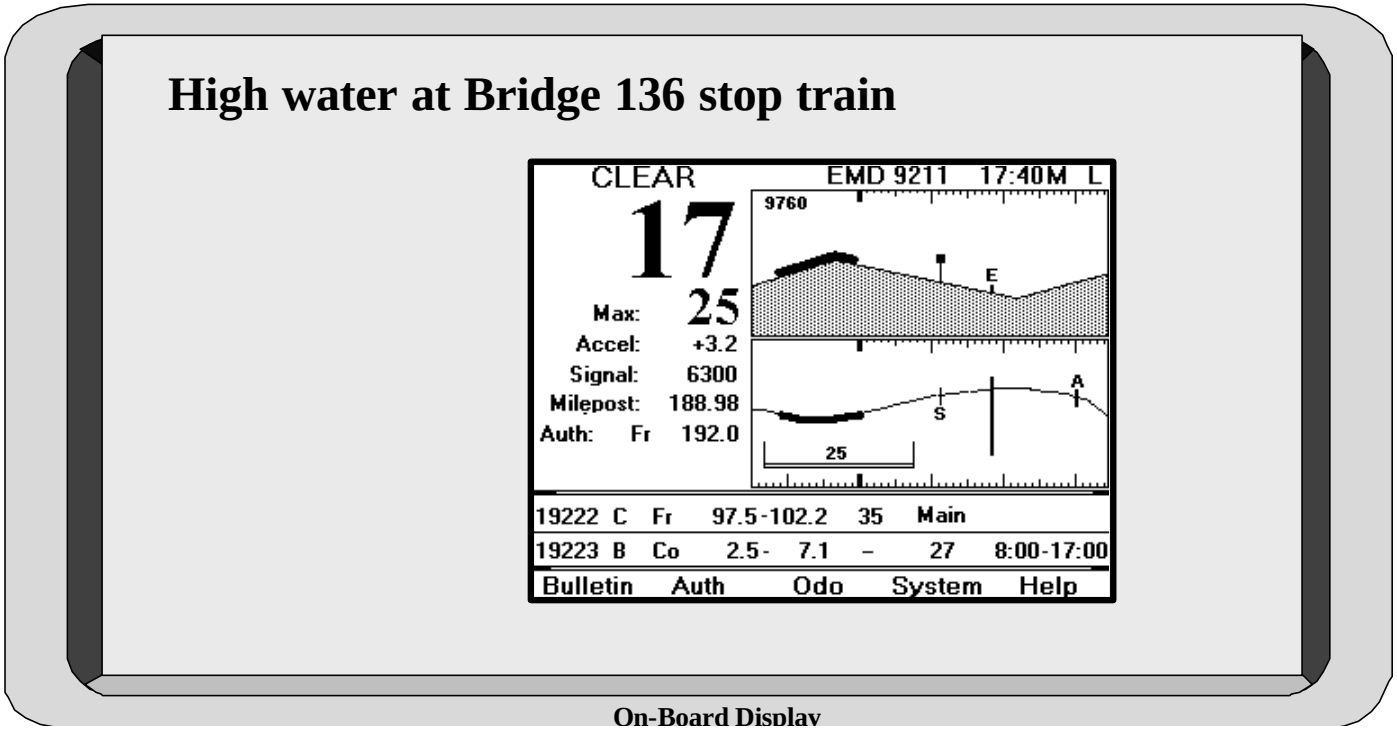




On-Board Display

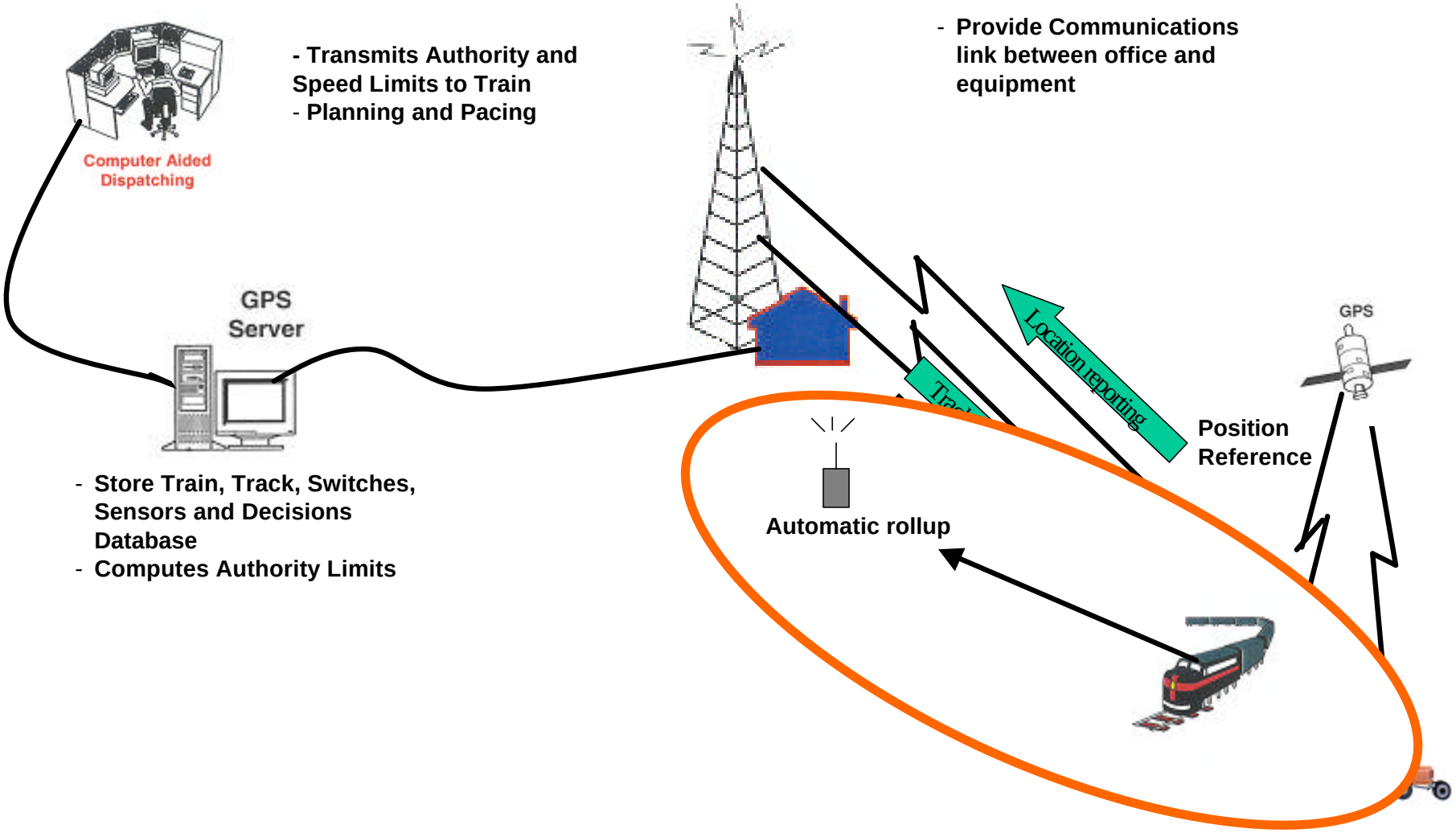
Trackside warning detector alarms sent to train in advance of hazard.



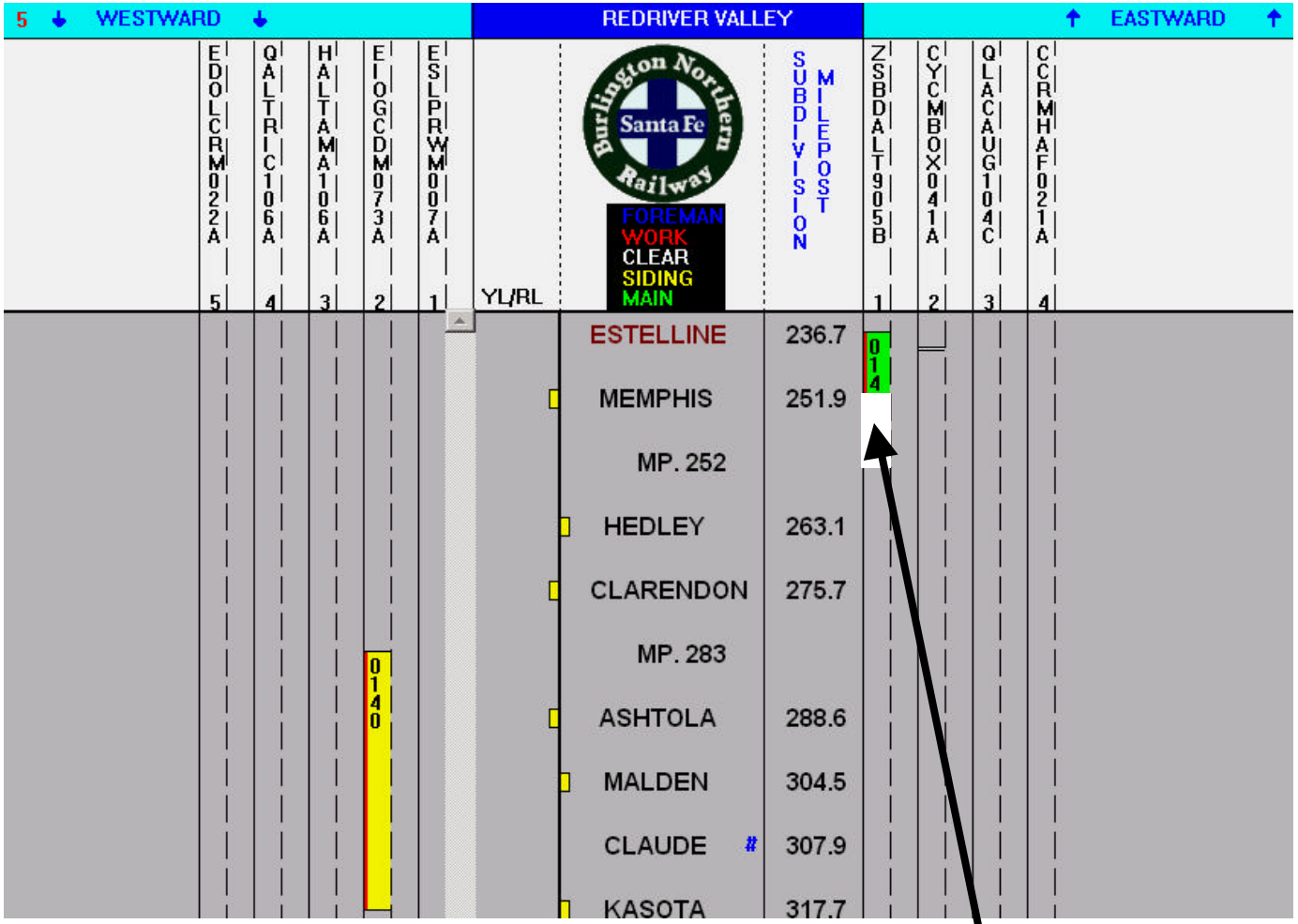


On-Board Display

Automatic Authority Release



Automatic rollup of train position based on GPS



Memphis

Train Status Report

DISPATCHER: SUBDIVISION: REDRIVER VALLEY Nov 6 2002

Eastward Trains:

Designation	Status	Origin or Last Location	Time	Destination	Work Between Location	Location	Trk
BNSF 5441 EAST	CLEAR	ESS MEMPHIS	1330	ESTELLINE			
BNSF 8898 EAST	AT	AMARILLO		ESTELLINE			

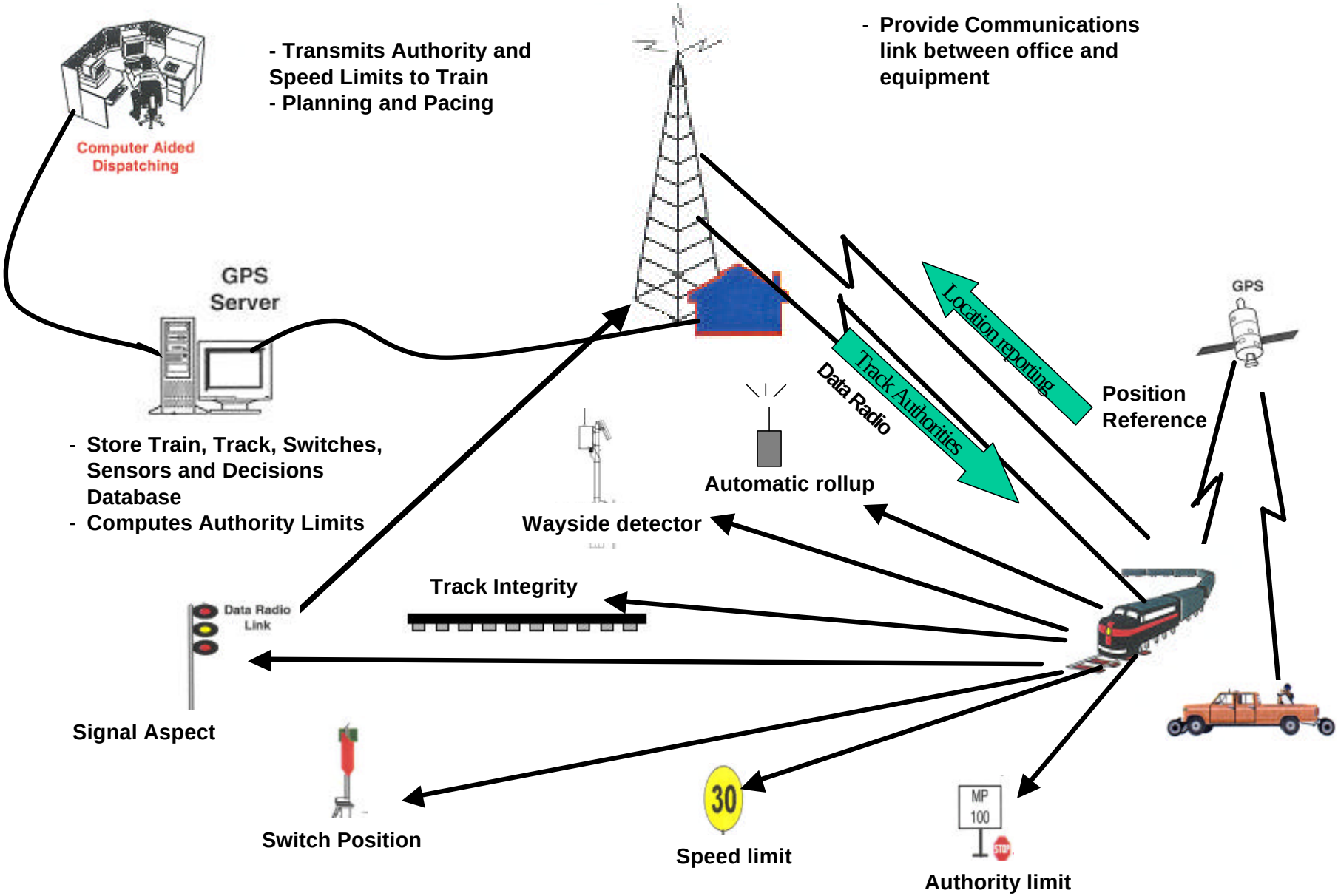
Westward Trains:

Designation	Status	Origin or Last Location	Time	Destination	Work Between Location	Location	Trk
BNSF 8833 WEST	CLEAR	Milepost 283	1416	AMARILLO			M
BNSF 5493 WEST	AT	ESTELLINE		AMARILLO			
BNSF 9903 WEST	AT	ESTELLINE		AMARILLO			
BNSF 6815 WEST	AT	ESTELLINE		AMARILLO			
BNSF 9761 WEST	AT	ESTELLINE		AMARILLO			

Work Trains:

Designation	Status	Origin or Last Location	Time	Destination	Work Between Location	Location	Trk

Foremen:

Designation	Status	Origin or Last Location	Time	Destination	Work Between Location	Location	Trk

Train Sentinel System