ERTMS Regional and North American Dark Territory: A Comparison

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Recent advances in traffic control

	Europe	North America (later ?)
Recent advance	European Train Control System (ETCS)	Positive Train Control (PTC)
Principal rationale	**Interoperability** between national rail networks	**Increased safety** by preventing driver errors
Transmission of movement authority	ETCS	Legacy traffic control system
Enforcement of movement authority	ETCS	PTC, as overlay system

🇺🇸 🇨🇦 North American signalled operations

- About half of North American route-km
- Track circuits prove train integrity
- Dispatchers manage signals under centralised traffic control (CTC)
  New: Positive train control (PTC) enforces movement authorities from 2015

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🇺🇸 🇨🇦 Dark territory operations

- **About a third of North American route-km**
- **No lineside signals** (except for simple status e.g. of turnouts)
- **No track circuits**
- **Dispatcher issues track warrants (movement authorities) by voice (or data) radio**
  New: Positive train control (PTC) enforces movement authorities from 2015
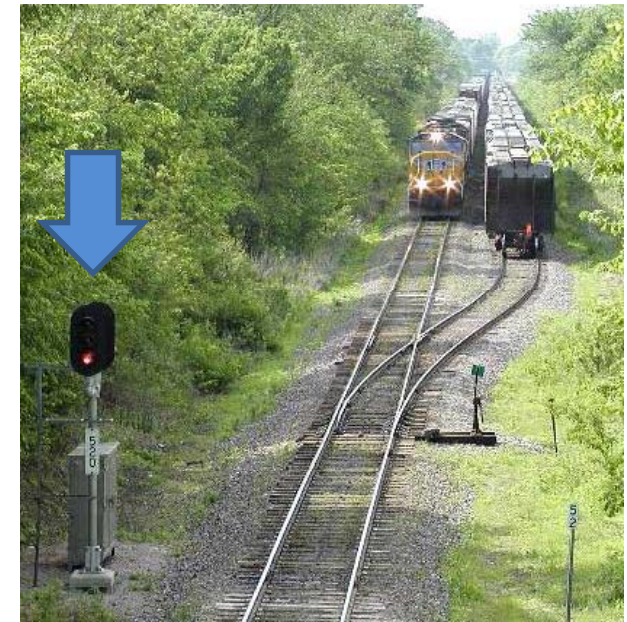

(3) David W. Dupler

🇺🇸 🇨🇦 "Light dark" territory

- Hybrid between signalled and dark territory
- About one-sixth of North American network
- Like dark territory: dispatcher issues movement authorities by voice/data radio
- Like dark territory: End-of-train devices prove train integrity
- Automatic block signals (ABS) not under dispatcher management
  New: Positive train control (PTC) enforces movement authorities from 2015

(3) Dick Tinder, Virtual Train Watching in Iowa

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Dispatching

Signalled territory in Europe

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(and half of North America's route-km)

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Siemens Switzerland Ltd

North American dark territory

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- Conflict-checking software
- Photo: Kansas & Oklahoma Railroad (1300+ km)

Bob Currie

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ETCS Levels

ETCS Level 1	ETCS Level 2
• **Track circuits or axle counters**	• **Track circuits or axle counters**
• **Active transponders transmit authorities**	• **Passive transponders**
	• **GSM-R radio transmits authorities**

Silvan Wyss

Swiss Federal Office of Transport / SBB

ETCS Levels

ETCS Level 3

ERTMS Regional

First implementation on 143-km Västerdalsbanan in Sweden in February 2012

- **Passive transponders**
- **GSM-R radio transmits authorities**
- **No track circuits or axle counters**
- **On-board train integrity proving**

Svenska Järnvägsklubben (Swedish Railway Club)

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Solutions for lines with low traffic density

Europe	North America
ERTMS Regional	**Dark territory**
• Application of ETCS Level 3 • First implemented in Sweden in 2012	• Dispatcher-issued track warrants • Now being equipped with Positive Train Control (PTC)

ERTMS = European Rail Traffic Management System

In both solutions:

• Conventional signalling absent

• No track circuits or axle counters

• Transmission of movement authority information by radio
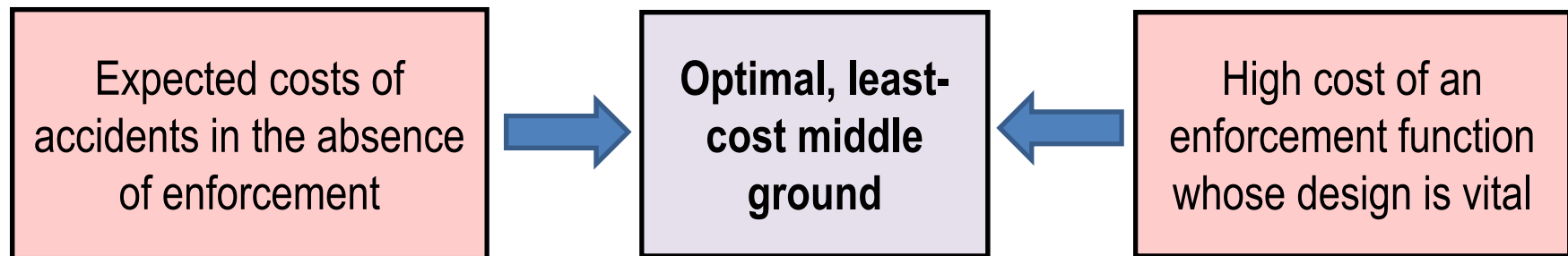
• On-board train integrity proving

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Rationale for automatic train protection (ATP) to enforce movement authorities

	Europe	North America
Average train speed and density	Higher	Lower
Dominant traffic	Passenger	Freight
Automatic train protection (ATP)	Standard	Justified only on lines with significant passenger traffic

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Design philosophy

⬇ **Movement authorities**	**Europe**	**North America**
Issuance and transmission	**Vital design**	**→**
Enforcement	**⬇**	**Non-vital design**

In North America, the designers of positive train control (PTC) are seeking an optimal solution:

Expected costs of accidents in the absence of enforcement	→	**Optimal, least-cost middle ground**	←	High cost of an enforcement function whose design is vital

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Evaluation of technologies

	ERTMS Regional / ETCS Level 3 🇪🇺	Dark territory with PTC 🇺🇸🇨🇦
End-of-train devices prove train integrity	✖ (✔)	✔
Track vacancy proving other than with track circuits and axle counters	✖ (✔)	✔
Satellite positioning	✖ (✔) Need Galileo's self-checking	✔ GPS is OK
Turnout position helps indicate which track a train is on	✖	✔
Transponders between rails	✔	✖

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A possible path for other continents (1)

Compared to conventional signalling, the European ERTMS Regional and North American Dark Territory wireless solutions for low-density lines offer:

- Less line-side equipment needing maintenance and exposed to damage, theft and vandalism

- Lower capital investment

- Scalability as traffic grows

A possible path for other continents (2)

Once wireless infrastructure is in place, a developing railway can implement the following models without significant added investments as traffic grows:

1. Dark territory

2. Dark territory with PTC **or** ERTMS Regional

3. Centralised traffic control (CTC) based on virtual positioning

Co-author Ron Lindsey is structuring a Virtual CTC + Enforcement solution for the Egyptian National Railways.

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Thank you from both sides of the Atlantic!

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