FTA

FEDERAL TRANSIT ADMINISTRATION

# Roadway Worker Protections (RWP) Subcommittee

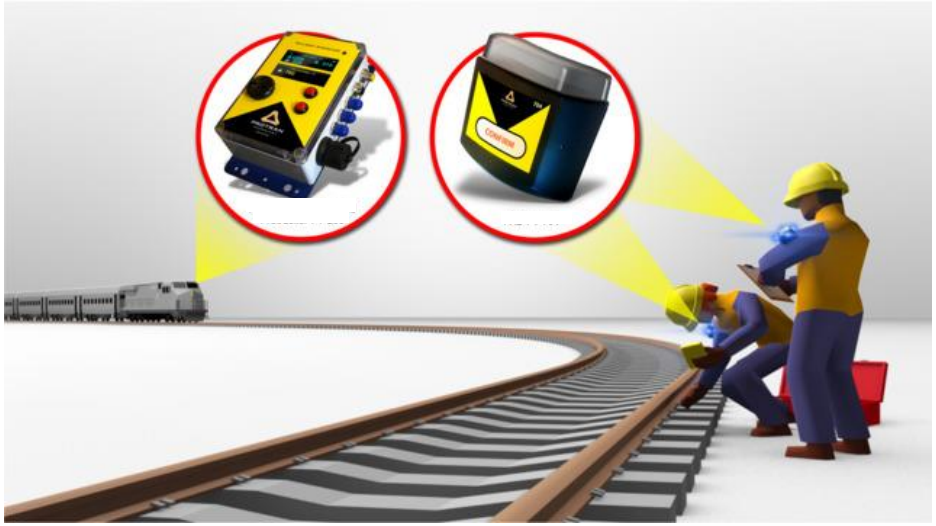

TRACS Subcommittee Presentation

September 9-10, 2019

U.S. Department of Transportation
Federal Transit Administration

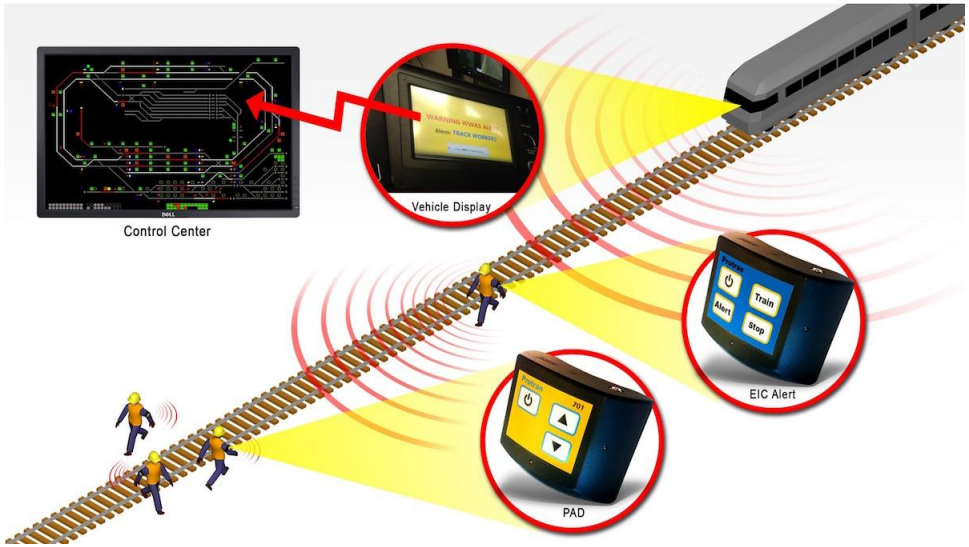
# Task Statement

Review emerging technologies and recommend public transportation innovations in *roadway worker protection (RWP)* safety that FTA can implement in support of the public transportation sector.



# Agenda

- Subcommittee Highlights
- Literature Review
  - Standards
  - Equipment
  - Technology
  - Risk Factors
  - Key Takeaways
- Information Gaps
- Next Steps



# Subcommittee Highlights

- First Subcommittee Meeting:  July 31, 2019
  - Roles and responsibilities
  - Divided up articles for review
  - Finalized an article recap document
  - Technology discussion
    - Know of two current providers in the industry, will look into these and will look for more.
    - Goal: Contact RTAs using these systems to gather information – effectiveness, cost, implementation ease. To be reported at the January meeting.
    - May reach out to the companies to provide information and/or demonstrations of the systems to the full committee in January.
  - Additional Resources
    - Safety Standards Working Group at CUTR run by Lisa Staes.

# Subcommittee Highlights

- *Second Subcommittee Meeting: August 13, 2019*
  - Briefed reviews of the papers/articles/standards that each member reviewed and a recommendation as to whether to use the document going forward.
  - Discussed how to organize our literature review report back to the full TRACS committee and the process to be used to circulate draft information for subcommittee input to the final presentation document.

# Literature Review - RWP Standards

- *49 CFR Part 214 FRA Railroad Workplace Safety*
  - FRA rules and procedures that prescribe safety practices and procedures for bridge, roadway, and equipment on railroads.
  - Mandates minimum standards for railroad workers, including:
    - behavioral,
    - organizational,
    - procedural, and
    - education and training requirements.

  - Railroads must develop RWP rules that at least meet these minimum standards for on-track programs for review and approval by the FRA.
  - **We recommend this article as a good base for development of effective rail transit RWP rules, standards, and/or guidelines.**

# Literature Review- RWP Standards

- *NTSB Special Investigation Report on Railroad and Rail Transit Roadway Worker Protection – 2014*
  - Discusses accidents that have occurred at various railroads and transit agencies.
  - Discusses the need for practices and procedures that need to be enacted or enhanced to prevent such incidents from occurring.


  - **We recommend this article because it provides good analysis and recommendations for what can be done in the absence of federal RWP rules for transit agencies.**

# Literature Review - RWP Standards

- *California RWP General Order 175-A*
  - Established multiple redundancies and multiple point measures to prevent roadway workers from being struck by on-track moving equipment.
  - A negotiated regulation developed by CPUC staff with railroad and rail transit RWP experience, and RTA and union representatives.
  - Had close scrutiny during a CPUC-NTSB accident investigation.
  - **We recommend this as an example of a regulation developed in a negotiated rulemaking effort, and which satisfied the NTSB's RWP recommendations - partly because it required electronic early warning systems as a redundancy.**

# Literature Review - RWP Standards

- *TCRP Synthesis 95 – Practices for Wayside Rail Transit Worker Protection – 2012*




  - Provides a synthesis of the practices and procedures used at four transit agencies and their rules and procedures for RWP.
  - Describes the various mitigations used by each transit agency to prevent accidents, through technology, organizational and procedural methods, education and training, and influencing employee behavior.
  - **We recommend this article for the larger committee meeting because it provides a good starting place for various practices/procedures/rules and some technologies, such as portable train stops and electronic early warning devices used in the industry at the time.**
  - Some of these may not be included in APTA standards.

# Literature Review - RWP Standards

- *Roadway Worker Protection Program Requirements – APTA*


  - APTA standards create minimum standards for rail transit systems to base procedures for RWP.
  - Are quite comprehensive, but fall short of the prescriptions contained in the FRA rules on which much of the standards are based.
  - Cover various on-track protection methods on both controlled and non-controlled track, training, on-track equipment interaction, train horn/whistle signals, compliance programs, and record keeping.
  - Standard goes an extra step of acknowledging the use of technology, but only listing some restrictions on use.
  - **We recommend this article for the larger committee meeting because it is the basis of may rail transit agency RWP programs and contains the minimum components of those programs.**

# Literature Review - RWP Standards

- *Behavior-based safety on Construction Sites: a case study, 2014, (Hong Kong site, Saudi Arabian researcher) (slide 1)*

  - Behavior-based safety (BBS) has been shown to reduce the number of unsafe acts, which in turn reduces work-related incidents
  - Consists of observation, measurement, feedback, and positive reinforcement of safety behaviors, and as such, can assist with Safety Management Systems (SMS) processes to create a safer work environment
  - The proportion of safe behaviors observed increased from a baseline of about 86 percent to about 92 percent overall

# Literature Review - RWP Standards

- *Behavior-Based Safety on Construction Sites: a case study, 2014, (slide 2)*
  - Offers a good example of how BBS can change behavior through positive interactions and feedback.
  - Shows BBS as an effective way to change attitudes.
  - Shows how BBS is measurable and brings about change quickly.
  - Shows how BBS provides an alternative to a disciplinary approach that can fit well with the SMS safety model.
  - **We also recommend a broader research review and update, since BBS has had some mixed results, may have different results in different cultures, and historically has been a contentious topic between unions and management.**

# Literature Review - RWP Standards

- *NTSB RWP Recommendations, 2013*
  - Following two BART roadway worker fatalities in Walnut Creek, CA, the NTSB issued these recommendations:
    - To the FTA: Issue a directive to all transit properties requiring redundant protection for roadway workers, such as positive train control, secondary warning devices, or shunting. (R-13-39) (Urgent)
    - To the FTA: Issue a directive to require all transit properties to review their wayside worker rules and procedures and revise them as necessary to eliminate any authorization that depends solely on the roadway worker to provide protection from trains and moving equipment. (R-13-40) (Urgent)
  - **We recommend this article because it indicates the direction and substance of the NTSB's recommendations to FTA, and thus us as well.**

# Literature Review - RWP Standards

Federal Transit Administration

- *FTA Safety Advisory 14-1: Right-of-Way Worker Protection, 2014 (slide 1)*
  - In response to NTSB's RWP recommendations in December 2013 as part of a recent CPUC/NTSB accident investigation (R-13-39 & 40), the FTA issued a formal safety advisory:
    - Provides background on recent FTA RWP activities and resources.
    - Provides findings from RWP fatality investigations.
    - Requests that an RWP protection checklist be filled out by each RTA.
    - Requests that a Job Safety Briefing Guide be reviewed to supplement existing RWP programs.
    - Provides an RWP compliance checklist for verifying RWP element implementation.

# Literature Review - RWP Standards

- *FTA Safety Advisory 14-1: Right-of-Way Worker Protection, 2014 (slide 2)*
  - **Although not in the Literature Research list, we recommend the article as it describes a fairly comprehensive list of RWP protections and describes FTA's path forward.**
  - **We recommend an update from FTA on its progress, and guidance on how to integrate TRACS's efforts with FTA's efforts.**
  - NTSB's response to the FTA advisory is "Open, Acceptable Response," with the caveat that "such a document does not constitute a requirement. In order to satisfy the recommendations, you need to issue a directive requiring the recommended protection, review, and revision."

# Literature Review - RWP Equipment

- No articles were reviewed that fit this category, with the exception of some technological aids, which we consider as its own topic.

# Literature Review - RWP Technology

- *Railyard Worker Safety through innovative mobile Active Train Detection and Risk Localization*

  – Discussed a countermeasure that could be used to prevent incidents and mitigate incident consequences by helping identify trains moving in the alignment.

  – **We recommend this article because it provided an interesting potential use of technology to help with RWP in yards and alignments in the open operating environment.**

  – Did not make it clear if this technology could be used in closed structures and tunnels.

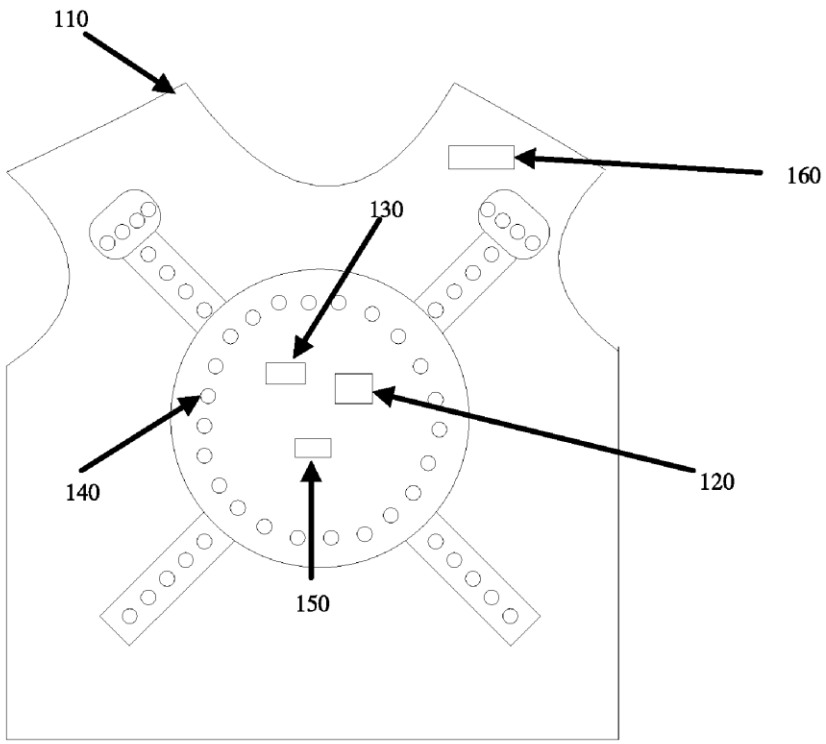
# Railyard Worker Safety through… Active Train Detection… (cont.)


Locomotives, with sharp edges and rectangular shape return a stronger radar signal than rounded tank cars.

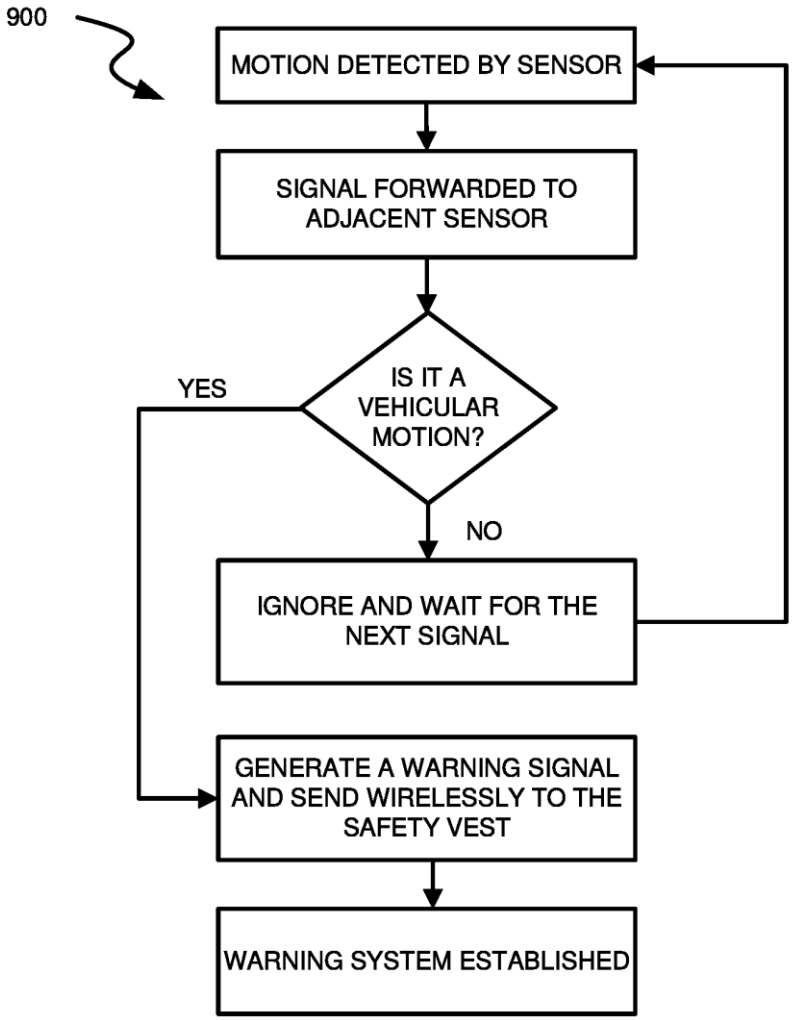
# Literature Review - RWP Technology

- *Transit Work Warning System*
  - Discussed technology that provides an advance warning alert (flashing visual, vibration, audible) to roadway workers or other workers in other operating conditions (construction, highway, bus, etc.) of the approach of a train, hi-rail vehicle, or other type of vehicle.
  - **We recommend this article because it is a technology that is different from what is currently available and being used in the USA.**
  - It does not require installation of on-board interactive communication and processor-based systems onto vehicles as current designs in the industry have, and can be set up quickly at any worksite.

# Transit Work Warning System (cont.)




Instrumented vest



# Literature Review - Risk Factors

- *Measuring Drivers' Visual Attention in Work Zones*
  - Details research conducted to examine drivers' ability to detect driveway entrances within work zones.
  - Various alternative treatments were used and vehicles were instrumented to determine how drivers reacted to treatments.
  - Determined that there was some improvement in driver detection with alternative treatments at night.
  - **We recommend this article because the study might assist with the research and technology used to enhance operator attentiveness to work zones.**

# Measuring Driver's Visual Attention… (cont.)

Two of the work zone's different treatments.

# Literature Review - Risk Factors

- *UK Rail Worker's Perceptions of Accident Risk Factors: An Exploratory Study (slide 1)*


  - Explores contributing human factors that lead to injuries.
  - Research involves a deeper examination of such factors from extensive interviews of employees after an incident, asking questions specific to behavior and the working environment.
  - Possible contributing factors leading to injuries (covered in next slide).
  - **We recommend this article because the human factors research is valuable as it provides poignant information about what may lead to RWP incidents and focuses on items that need to be mitigated.**

# Literature Review - Risk Factors

- *UK Rail Worker's Perceptions of Accident Risk Factors (slide 2)*
  - Possible contributing factors leading to injuries:
    - Pressure to complete jobs and fatigue, extreme tiredness and weariness.
    - Shiftwork and rostering with sudden transitions from day to night.
    - Transition time from home to work – many workers traveled longer distances.
    - Lack of work/life balance and emotional factors – not with family, friends and not being able to participate in normal life patterns.
    - Downtime and time pressure – sitting for hours and then having limited time to perform work and increasing pressure to complete work in a smaller window.

# Literature Review - Risk Factors

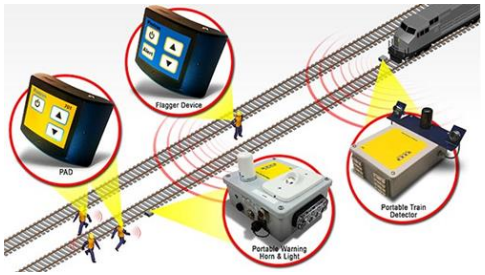
- *UK Rail Worker's Perceptions of Accident Risk Factors (slide 3)*
  - Possible contributing factors leading to injuries (cont.):
    - Managing fatigue and pressure.
    - All aspects combined leading to making mistakes and having accidents while performing safety critical duties.
    - Bending and breaking rules  intentionally and unintentionally due to pressures, and taking shortcuts.
    - Not reporting near-misses or incidents due to paperwork and reporting drawbacks.
    - All factors leading to decision-making errors.

# Literature Review - Key Takeaways

Personal Notification Unit (PNU)

Key takeaways from the overall literature review

- Point 1: RWP safety technologies are available.
- Point 2: Independent redundancies must be provided, avoiding potential for single-point failures.
- Point 3: RWP safety technologies are being used and TRACS would benefit from finding out RTA experience with them.
- Point 4: TRACS would benefit from working with any existing FTA RWP work, including those which followed from Safety Advisory 14-1.



# Top Articles

1) 49 CFR Part 214 (FRA RWP standards)
2) California General Order 175-A
3) APTA RWP Program Requirements
4) FTA Safety Advisory 14-1
5) NTSB RWP Recommendations
6) NTSB Special Investigation Report
7) UK Rail Worker's Perceptions of Accident Risk Factors

# Information Gaps

- Newer technologies available in the transit industry for RWP.
  - Only two papers addressed this (Railyard Worker Safety through Innovative mobile Active Train Detection and Risk Localization and Transit Work Warning System).
- Feasibility and practicality of the emerging technology and existing technology.
  - Cost.
  - Effectiveness and operational ease of use.
  - Upkeep/maintenance perspective.
  - Discussed contacting transit agencies that have implemented electronic warning/control systems, such as *Protran*, *Metrom*, *ZoneGuard*, *TrackSafe*, and *EmTrac* to obtain information on effectiveness, feasibility, and practicality for transit system applications.
- RWP and implementation of RWP technologies under SMS.
  - Determine how protections and standards can be integrated into the SMS framework and what changes may be necessary to bridge any gaps between SMS and standards.
- FTA work following the NTSB's RWP recommendations and FTA's Safety Advisory 14-1, and how the FTA might assist with new technology rollout.

# Next Steps

- **Reach out to electronic warning/control system providers,** such as *Protran*, *Metrom*, *ZoneGuard*, *TrackSafe*, and *EmTrac*, to get information on their systems and set up possible presentations and/or demonstrations during the January TRACS committee meeting.
- **Reach out to transit agencies** using electronic warning/control systems to get information about effectiveness, costs, operational ease of use, and maintenance to assist in determination of feasibility and practicality of these systems for small- and large-scale rail transit systems.
- **Reach out to fellow transit agencies** to see if there are any additional technologies that they are examining for RWP and get additional information on those systems, if any.
- **Coordinate with the FTA staff** on its work following Safety Advisory 14-1.
- **Integrate technology evaluation criteria research** with our review and recommendations.

# APPENDIX

## List of Roadway Worker Protections*

The following is a list of protections for roadway workers. Each listed protection is not intended to be used on its own – independent redundancy is important. The list is not meant to be comprehensive, as new protections and unique situations may be developed and/or needed. Refer to FTA Safety Advisory 14-1 for a more detailed review and specification of these protections.

1. ***Communication confirmation and information verification***. Acknowledgement and repeating of details to confirm accurate understanding. Frequent. No one-way communication.

2. ***Three-way communication***: between the control center, the vehicle operator, and the employee-in-charge. Eg., a “confirmed hold” under the California regulation:

* For review, discussion, correction, and updating.

## APPENDIX, continued, slide 2

3. ***Watchperson***: sometimes called a lookout, qualified on RWP rules and procedures, whose sole duty is to provide effective warning to roadway workers, who does not perform or assist in any other work, and who remains clear of the track zone.

4. ***Flagperson***: an employee designated to direct or restrict the movement of trains past a point on a track to provide on-track safety for roadway workers, while engaged solely in performing that function.

5. ***Fifteen-second rule***: requires a roadway worker to be clear of the track zone or in a place of safety 15 seconds before a rail transit vehicle moving at the maximum authorizable speed on that track could arrive.

6. ***Early-warning/control electronic device***: provides sufficient warning to allow workers to get to a safe space and to alert train operators of work zone. May be integrated with PTC.

## APPENDIX, continued, slide 3

7. ***Lining and locking track switches*** or otherwise physically preventing entry and movement of rail transit vehicles, including on-track equipment.

8. ***Restricting work times*** to when propulsion power is down with verification from control that track is out of service.

9. ***Positive train control (PTC) systems***. Prevents vehicles from passing stop points when an operator fails to do so.

10. ***Red signals***, when trains are controlled by a signal system.

11. "***Trippers***" to stop trains and/or provide alerts when passing integrated wayside devices.

## APPENDIX, continued, slide 4

12. ***Shunts:*** electric cable connections between rails that mimic train occupation, and that prevent permissive signals, when trains are controlled by a signal system.

13. ***Knowledge of multiple crews***: work plans, communication between crews.

14. ***Physical barriers***.

15. ***Near-miss / close call / safety reporting system***. Confidential or anonymous, non-punitive (see Employee Reporting System working group's report).

16. ***Job safety briefings***: Including the right to make a good-faith challenge to the adequacy of the protections to be used.

17. ***Personal Protective Equipment*** (PPE). E.g., safety vests, safety boots, hardhats, eyewear protection, gloves, face shields, etc.

## APPENDIX, continued, slide 5

**Measures assisting protections:**

1. ***Clear delineation of what "clear of track" means***. E.g., 6-feet from the rail to the outside of the track. Painted lines where possible.

2. ***Levels of protection*** matched to levels of risk.

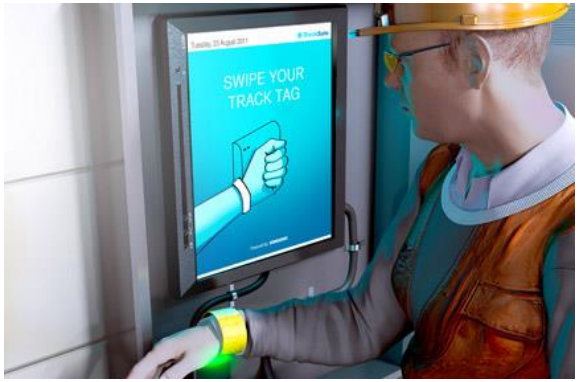
3. ***Rules compliance testing*** for all RWP protection rules.

4. ***Positive, non-punitive approach*** to ensuring compliance.

5. ***Equipment maintenance***.

6. ***Joint labor-management inspections and review***, with follow-up feedback and/or action.

7. ***Training***.




# Questions?

Portable Train Detection Module (TDM)