

APTA Standards Presentation

Standard for Audio Frequency Track Circuit Inspection and Maintenance

Presented by:

James Hoelscher

Robert A. MacDonald

Hoelscher Consulting

B&C Transit



Topics

- ❖ Process Overview
- ❖ Challenges
- ❖ Graduated Test Procedure
- ❖ Standard Overview
- ❖ Current status
- ❖ Questions

Process Overview

- Participation from transit agencies, suppliers and consultants
- 5 meetings held over 14 months
- 20 – 30+ participants at each meeting
- Initially developed recommended practice
- Combined recommend practice with existing standard to form replacement standard.



Challenges

- Could be burdensome for staff
 - Some properties have in excess of 1000 AF track circuits
- Wide range of AF track circuit in use
 - Different generations
 - Different suppliers
- Must verify track circuit is operating safely
- Must identify foreign signals that could affect operation
- Must record data for trend analysis

Other issues not related to input at the receiver could be causing a safety problem.



Graduated Test Procedure I

- Provide basic tests to determine susceptibility of the track circuit
 - Easy to perform
 - Can be done frequently
 - Verify track circuit is operating safely



Graduated Test Procedure II

- Provide expanded tests to define the potential of any susceptibility.
 - More effort required to perform
 - Additional Technical Skills Required
 - Verify that track circuit receiver has no foreign signals that could affect operation



Standard Overview - Scope

- This document provides minimum requirements for Inspection and Maintenance of:
 - Analog audio frequency track circuits
 - Digital audio frequency track circuits.
 - Training criteria for maintenance and operation.
 - Evaluation of adequate maintenance staff requirements for corrective and preventative maintenance
 - Safety Related Recommendations



Standard Overview - Purpose

- The purpose of this standard is to provide a commonly accepted industry approach to test, inspect, maintain and manage audio frequency (AF) track circuits to a state of good repair.



Standard Overview - Basic Test

- Shunt sensitivity
 - Test procedure to verify track circuit shunts properly
 - Recommendation to record signal levels for trend analysis

- Un-shunted and cab signal tests
 - Test procedure to help predict track circuit deterioration



Standard Overview Extended Test

- Unintended or Spurious signal test
 - Test designed to detect unintended or spurious signals that could affect the safe operation of the track circuit.



Recommended Additional Support Requirements

- That manufacturers, designers and/or operators should meet regularly as necessary to define the rules, conditions, and constraints relevant to functional safety which need to be observed in the operation and maintenance of the track circuit equipment.
 - Including;
 - Identify maintenance and operation related assumptions used in Failure Mode and Effects Analysis (FMEA)
 - Precautions in testing
 - Rules and methods for maintenance and fault finding
 - Periodic maintenance requirements and frequency
 - Operational safety monitoring



Defined Failure States

- Manufacturer performed FMEA
 - Identifies safe and unsafe states
 - Identifies behavior as 'self evident'

- User needs to understand criteria used to define failure states
 - User and supplier need to discuss
 - Some suppliers now developing application constraints

- » Identifies assumptions and constraints that must be considered to maintain safety.



FMEA Example

Failure Mode and Effects Analysis

- AF track circuit failure states
 - Track circuit indicates occupied all the time = safe and self evident (acceptable failure condition)
 - Track circuit indicates un-occupied all the time = unsafe and not self evident – (unacceptable failure condition)
 - Track circuit intermittently shows occupied/unoccupied (bobs) – safe and self evident (acceptable failure condition)
- All cases require corrective action to be taken



Application Constrain Example

- AF track circuit
 - Must be adjusted per manufacturers procedure
 - Power supplies must not increase more that 10% for circuits with the transmitter and receiver on different supplies
 - 'Bobbing' track circuit may indicate reliability or a safety failure.



Reliability vs. Safety

Bobbing Track Circuit

- Foreign signals cause an unoccupied circuit to appear occupied = reliability failure

- Foreign signals cause an occupied circuit to appear unoccupied = safety failure

- Less than 0.01% a bobbing track circuit is safety failure
 - Corrective action is required for reliability failure to prevent masking a safety failure



Standard Identifies Additional Requirements

- Adequate training
- Unique test equipment
- System Safety Program Plan



No Standard can anticipate all possible field situations

- Need to be diligent in observing the performance of the track circuits
- Personal need to be trained and understand expected behavior of safety systems.
- Need to take immediate action when safety systems do not appear to be operating correctly.



Standard Status

- APTA editors reviewing and correcting format
- Balloting group being created
- Balloting Criteria not yet Resolved



Hoelscher
Consulting
Rochester, NY

Questions



B&C Transit
Oakland, CA