

**TRANSPONDER DATABASE LAYOUT DESCRIPTION –  
TTT LOOP**

FOR THE

**Transportation Technology Center**

**Pueblo Test Track**

TO

**Transportation Technology Center Inc**

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**1. Introduction**

**1.1 Purpose**

This document describes the positioning and information contained by the transponders to be utilized with the Transit Test Track located on the Transportation Technology Center at Pueblo, CO.

**1.2 References**

None

**1.3 Definitions**

ACSES - Advanced Civil Speed Enforcement System

DS - Distant Signal

IXL - Interlocking

TTT - Transit Test Track

## **2. Database Design**

### **2.1 Transponder Locations**

A total of fourteen (14) transponder sets are utilized by the database designed for the TTT. Nine (9) of these are located on the TTT loop itself, while the remaining sets are located at entry/exit points to the loop.

Transponder sets within the loop (designated 1 – 9) have predefined locations for both the milepost and chaining corresponding to the mileposts already in place around the loop. In addition, each of these transponder sets contains the linking distance to the next set of transponders.

Transponder sets that are used for loop entry/exit do not have a predefined location. These transponder sets only contain a non-exact linking distance of 5.0 miles for entry into the TTT loop. This configuration allows the entry/exit transponder sets to be located as close or as distant as needed to the TTT loop.

Note: When entry/exit transponder sets are located further away than the next transponder set in line, a locomotive may experience an “out-of-window” condition when exiting the TTT loop.

### **2.2 Civil Speed Restrictions**

The TTT loop contains one (1) civil speed restriction from 150+00 to 210+00 that may vary in level based on the selected train type. Otherwise, each train type enforces its appropriate line speed when outside of the speed restriction zone. For each train type, the following line speed/speed restriction limits are in use:

- Type A: Line Speed = 70 MPH; Speed Restriction = 60 MPH
- Type B: Line Speed = 70 MPH; Speed Restriction = 60 MPH
- Type C: Line Speed = 70 MPH; Speed Restriction = 60 MPH
- Type D: Line Speed = 65 MPH; Speed Restriction = 55 MPH
- Type E: Line Speed = 50 MPH; Speed Restriction = 45 MPH

### **2.3 Controlling Grade**

In order to simplify database design a uniform controlling grade of -1.00 % is in use for the Down direction, while -1.50% is in use for the Up direction.

### **2.4 Positive Train Stop**

The TTT loop contains a single interlocking located near the WIU. This is implemented in both directions with the IXL zone falling between transponder sets 1 & 9. The following specifications have been implemented for this area:

- BCP # 14
- Radio Channel 3
- Encoder = 6
- Up Direction Signal = 1
- Down Direction Signal = 2

### **2.5 Overall Design**

Figure 1 provides a graphical depiction of the transponder database layout.

Note: Transponder set 5 has been duplicated for clarity.

# Transponder Database Layout Description – TTT Loop 7452-ENG-002

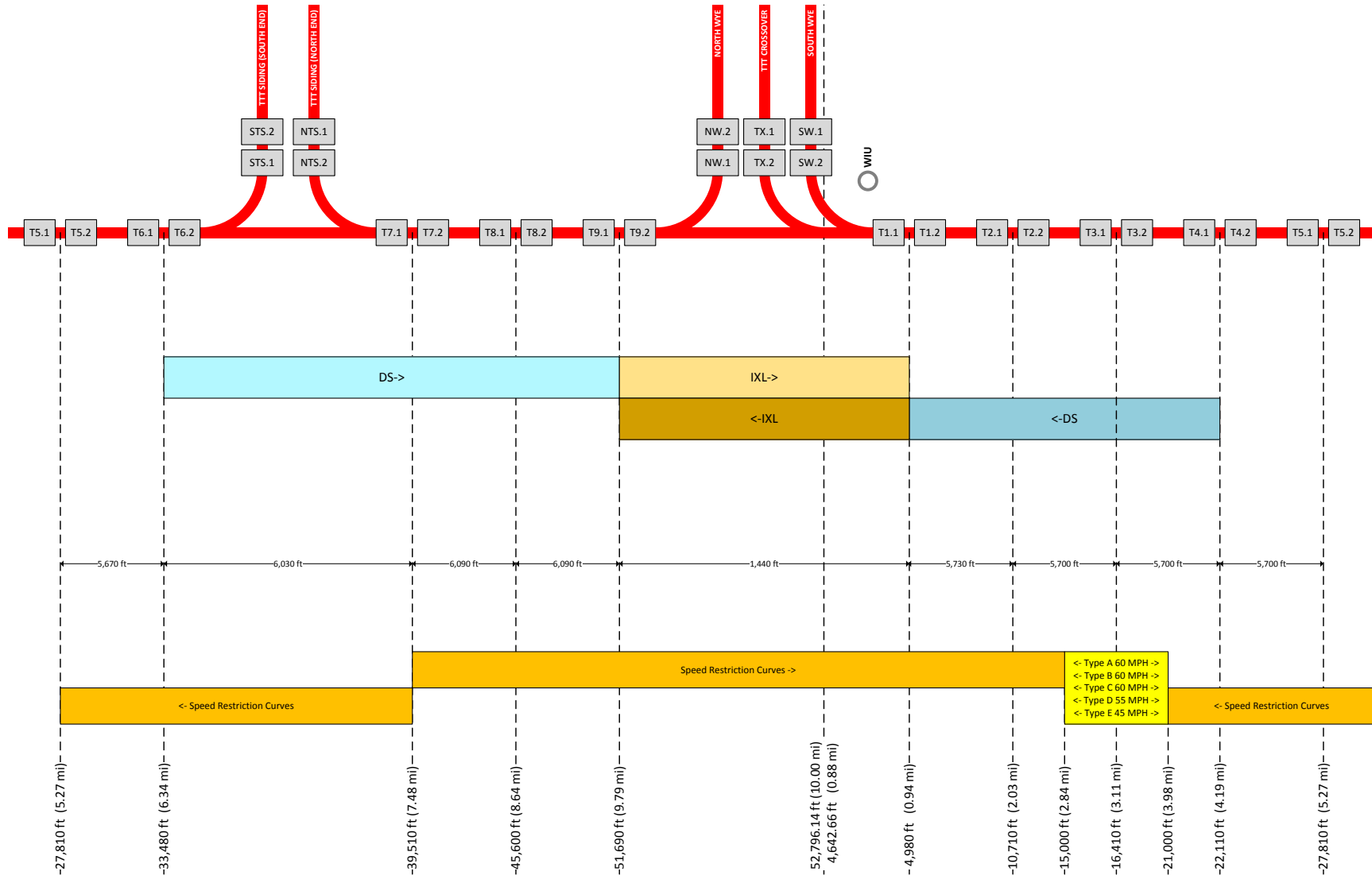


Figure 1 - Database Layout



### 3. Transponder Listing

This section details the contents of each individual transponder.

#### Transponder T1.1

--BasePkg= CH: 0.94mi (4980ft): Track#: 2 RR/Line: 20 EXACT Linking Distance UP: 5730 ft Dispersed: NO  
--OptPkg=(#32) TSR Data Request For DOWN Dir, Radio Ch: 3, BCP #: 14 Home Signal: YES  
--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50  
--OptPkg=(#00) END/ERROR Filler = 64 bits  
TP MSG= 10 A1 0A 01 54 17 96 01 D5 B3 8E 38 D2 80 90 F0 F0 F0 F0 F0 F0 F3 || E6 68 3C 35 3F 45 E1 9B 5E

#### Transponder T1.2

--BasePkg= MP: 0.94mi (4980ft): Track#: 2 RR/Line: 20 NOT EXACT Linking Distance DOWN: 1440 ft Dispersed: NO  
--OptPkg=(#19) Speed Restriction For UP Dir starting in 3340 yards, for Train Types: A: 60 B: 60 C: 60 D: 55 E: 45,  
Grade: -1.50%, lasting for 2000 yards  
--OptPkg=(#00) END/ERROR Filler = 64 bits  
TP MSG= 52 30 0A 01 54 15 65 38 C3 0C 2C 95 0C 80 90 F0 F0 F0 F0 F0 F0 F3 || 6D 59 EB EF BE F8 E3 FC CA

#### Transponder T2.1

--BasePkg= CH: 2.03mi (10710ft): Track#: 2 RR/Line: 20 EXACT Linking Distance UP: 5700 ft Dispersed: NO  
--OptPkg=(#05) Distant Signal PTS For DOWN Dir starts in 5610 ft, Grade: -1.00%, Radio channel: 3, Encoder: 6, Signal: 2, BCP# 14 Mi  
--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50  
--OptPkg=(#00) END/ERROR Filler = 40 bits  
TP MSG= 10 A0 8A 01 B6 97 C1 76 C6 C4 03 B5 B3 8E 38 D2 80 90 F0 F0 F0 F0 F2 || B3 CA 37 87 81 EF 9D 24 FA

#### Transponder T2.2

--BasePkg= MP: 2.03mi (10710ft): Track#: 2 RR/Line: 20 EXACT Linking Distance DOWN: 5730 ft Dispersed: NO  
--OptPkg=(#19) Speed Restriction For UP Dir starting in 1430 yards, for Train Types: A: 60 B: 60 C: 60 D: 55 E: 45,  
Grade: -1.50%, lasting for 2000 yards

--OptPkg=(#00) END/ERROR Filler = 64 bits

TP MSG= 50 A1 0A 01 B6 95 62 3C C3 0C 2C 95 0C 80 90 F0 F0 F0 F0 F0 F0 F2 || F4 36 39 8A EE FD 32 95 26

### **Transponder T3.1**

--BasePkg= CH: 3.11mi (16410ft): Track#: 2 RR/Line: 20 EXACT Linking Distance UP: 5700 ft Dispersed: NO

--OptPkg=(#05) Distant Signal PTS For DOWN Dir starts in 11310 ft, Grade: -1.00%, Radio channel: 3, Encoder: 6, Signal: 2, BCP# 14 Mi

--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 60 B: 60 C: 60 D: 55 E: 45

--OptPkg=(#00) END/ERROR Filler = 40 bits

TP MSG= 10 A0 8A 02 18 97 C2 F2 C6 C4 03 B5 B3 0C 30 B2 40 90 F0 F0 F0 F0 F3 || FD AC 06 10 87 3E E5 B8 66

### **Transponder T3.2**

--BasePkg= MP: 3.11mi (16410ft): Track#: 2 RR/Line: 20 EXACT Linking Distance DOWN: 5700 ft Dispersed: NO

--OptPkg=(#17) Line Speed, delayed For UP Dir starting in 1530 yards for Train Types A: 70 B: 70 C: 70 D: 65 E: 50

--OptPkg=(#17) Line Speed, delayed For DOWN Dir starting in 470 yards for Train Types A: 70 B: 70 C: 70 D: 65 E: 50

--OptPkg=(#00) END/ERROR Filler = 32 bits

TP MSG= 50 A0 8A 02 18 95 42 64 E3 8E 34 A5 C0 BC E3 8E 34 A0 90 F0 F0 F0 F3 || BC 88 4F 10 76 29 1A CE 3A

### **Transponder T4.1**

--BasePkg= CH: 4.19mi (22110ft): Track#: 2 RR/Line: 20 EXACT Linking Distance UP: 5700 ft Dispersed: NO

--OptPkg=(#05) Distant Signal PTS For DOWN Dir starts in 17010 ft, Grade: -1.00%, Radio channel: 3, Encoder: 6, Signal: 2, BCP# 14 Mi

--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50

--OptPkg=(#00) END/ERROR Filler = 40 bits

TP MSG= 10 A0 8A 02 77 97 C4 6E C6 C4 03 B5 B3 8E 38 D2 80 90 F0 F0 F0 F0 F3 || 83 F5 44 06 20 24 07 F9 FE

### **Transponder T4.2**

--BasePkg= MP: 4.19mi (22110ft): Track#: 2 RR/Line: 20 EXACT Linking Distance DOWN: 5700 ft Dispersed: NO

--OptPkg=(#19) Speed Restriction For DOWN Dir starting in 370 yards, for Train Types: A: 60 B: 60 C: 60 D: 55 E: 45,  
Grade: -1.00%, lasting for 2000 yards

--OptPkg=(#00) END/ERROR Filler = 64 bits

TP MSG= 50 A0 8A 02 77 95 E0 94 C3 0C 2C 96 0C 80 90 F0 F0 F0 F0 F0 F0 F3 || AD 70 2A 86 28 AC 8F 3E 68

### **Transponder T5.1**

--BasePkg= CH: 5.27mi (27810ft): Track#: 2 RR/Line: 20 EXACT Linking Distance UP: 5670 ft Dispersed: NO

--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50

--OptPkg=(#00) END/ERROR Filler = 88 bits

TP MSG= 10 A0 0A 02 D9 95 33 8E 38 D2 80 90 F0 F0 F0 F0 F0 F0 F0 F2 || A5 F7 94 FF A0 B3 D2 D6 98

### **Transponder T5.2**

--BasePkg= MP: 5.27mi (27810ft): Track#: 2 RR/Line: 20 EXACT Linking Distance DOWN: 5700 ft Dispersed: NO

--OptPkg=(#19) Speed Restriction For DOWN Dir starting in 2270 yards, for Train Types: A: 60 B: 60 C: 60 D: 55 E: 45,

Grade: -1.00%, lasting for 2000 yards

--OptPkg=(#00) END/ERROR Filler = 64 bits

TP MSG= 50 A0 8A 02 D9 95 E3 8C C3 0C 2C 96 0C 80 90 F0 F0 F0 F0 F0 F0 F3 || BD 1A 9D 66 D8 49 4A FC BE

### **Transponder T6.1**

--BasePkg= CH: 6.34mi (33480ft): Track#: 2 RR/Line: 20 EXACT Linking Distance UP: 6030 ft Dispersed: NO

--OptPkg=(#05) Distant Signal PTS For UP Dir starts in 18090 ft, Grade: -1.50%, Radio channel: 3, Encoder: 6, Signal: 1, BCP# 14 Mi

--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50

--OptPkg=(#00) END/ERROR Filler = 40 bits

TP MSG= 10 A6 0A 03 3B 17 44 B6 A6 C0 03 B5 B3 8E 38 D2 80 90 F0 F0 F0 F0 F3 || 89 6D 5F 17 30 F4 A1 A0 02

### **Transponder T6.2**

--BasePkg= MP: 6.34mi (33480ft): Track#: 2 RR/Line: 20 EXACT Linking Distance DOWN: 5670 ft Dispersed: NO

--OptPkg=(#19) Speed Restriction For DOWN Dir starting in 4160 yards, for Train Types: A: 60 B: 60 C: 60 D: 55 E: 45,

Grade: -1.00%, lasting for 2000 yards

--OptPkg=(#00) END/ERROR Filler = 64 bits

TP MSG= 50 A0 0A 03 3B 15 E6 80 C3 0C 2C 96 0C 80 90 F0 F0 F0 F0 F0 F0 F2 || B9 FA 66 46 25 3A F9 AA E2

### **Transponder T7.1**

--BasePkg= CH: 7.48mi (39510ft): Track#: 2 RR/Line: 20 EXACT Linking Distance UP: 6090 ft Dispersed: NO  
--OptPkg=(#05) Distant Signal PTS For UP Dir starts in 12060 ft, Grade: -1.50%, Radio channel: 3, Encoder: 6, Signal: 1, BCP# 14 Mi  
--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50  
--OptPkg=(#00) END/ERROR Filler = 40 bits  
TP MSG= 10 A7 0A 03 A2 97 43 24 A6 C0 03 B5 B3 8E 38 D2 80 90 F0 F0 F0 F0 F2 || 98 39 F7 2C 35 B9 96 A7 EE

### **Transponder T7.2**

--BasePkg= MP: 7.48mi (39510ft): Track#: 2 RR/Line: 20 EXACT Linking Distance DOWN: 6030 ft Dispersed: NO  
--OptPkg=(#19) Speed Restriction For UP Dir starting in 7880 yards, for Train Types: A: 60 B: 60 C: 60 D: 55 E: 45,  
Grade: -1.50%, lasting for 2000 yards  
--OptPkg=(#19) Speed Restriction For DOWN Dir starting in 6170 yards, for Train Types: A: 60 B: 60 C: 60 D: 55 E: 45,  
Grade: -1.00%, lasting for 2000 yards  
--OptPkg=(#00) END= FULL TP  
TP MSG= 50 A6 0A 03 A2 95 6C 50 C3 0C 2C 95 0C 85 E9 A4 C3 0C 2C 96 0C 80 93 || D6 D8 47 C9 8B 75 41 98 66

### **Transponder T8.1**

--BasePkg= CH: 8.64mi (45600ft): Track#: 2 RR/Line: 20 EXACT Linking Distance UP: 6090 ft Dispersed: NO  
--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50  
--OptPkg=(#05) Distant Signal PTS For UP Dir starts in 5970 ft, Grade: -1.50%, Radio channel: 3, Encoder: 6, Signal: 1, BCP# 14 Mi  
--OptPkg=(#00) END/ERROR Filler = 40 bits  
TP MSG= 10 A7 0A 04 0B 15 B3 8E 38 D2 87 41 8E A6 C0 03 B0 90 F0 F0 F0 F0 F2 || 4F 21 42 FC 14 90 F5 42 C8

### **Transponder T8.2**

--BasePkg= MP: 8.64mi (45600ft): Track#: 2 RR/Line: 20 EXACT Linking Distance DOWN: 6090 ft Dispersed: NO  
--OptPkg=(#19) Speed Restriction For UP Dir starting in 5850 yards, for Train Types: A: 60 B: 60 C: 60 D: 55 E: 45,

Grade: -1.50%, lasting for 2000 yards

--OptPkg=(#00) END/ERROR Filler = 64 bits

TP MSG= 50 A7 0A 04 0B 15 69 24 C3 0C 2C 95 0C 80 90 F0 F0 F0 F0 F0 F0 F0 F3 || 6A B6 E0 2E 17 97 71 91 94

### **Transponder T9.1**

--BasePkg= CH: 9.79mi (51690ft): Track#: 2 RR/Line: 20 NOT EXACT Linking Distance UP: 1440 ft Dispersed: NO

--OptPkg=(#32) TSR Data Request For UP Dir, Radio Ch: 3, BCP #: 14 Home Signal: YES

--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50

--OptPkg=(#00) END/ERROR Filler = 64 bits

TP MSG= 12 30 0A 04 70 97 16 01 D5 B3 8E 38 D2 80 90 F0 F0 F0 F0 F0 F0 F0 F3 || 35 17 77 7E 7F 34 22 36 CC

### **Transponder T9.2**

--BasePkg= MP: 9.79mi (51690ft): Track#: 2 RR/Line: 20 EXACT Linking Distance DOWN: 6090 ft Dispersed: NO

--OptPkg=(#19) Speed Restriction For UP Dir starting in 3820 yards, for Train Types: A: 60 B: 60 C: 60 D: 55 E: 45,

Grade: -1.50%, lasting for 2000 yards

--OptPkg=(#00) END/ERROR Filler = 64 bits

TP MSG= 50 A7 0A 04 70 95 65 F8 C3 0C 2C 95 0C 80 90 F0 F0 F0 F0 F0 F0 F0 F2 || 14 97 4B E3 53 2A DE A8 F8

### **Transponder NTS.1**

--BasePkg= CH: 7.10mi (37470ft): Track#: 3 RR/Line: 20 EXACT Linking Distance UP: No Link Dispersed: NO

--OptPkg=(#32) TSR Data Request For UP Dir, Radio Ch: 3, BCP #: 14 Home Signal: NO

--OptPkg=(#21) Misc(Immediate) - ACSES Territory For DOWN Dir, keep TSR List END

--OptPkg=(#00) END/ERROR Filler = 88 bits

TP MSG= 11 FF 0A 03 7D A7 16 01 CC 87 70 90 F0 F0 F0 F0 F0 F0 F0 F0 F2 || 5F EF D0 B1 6F 49 49 4A 42

### **Transponder NTS.2**

--BasePkg= MP: 7.10mi (37470ft): Track#: 3 RR/Line: 20 EXACT Linking Distance DOWN: No Link Dispersed: NO

--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50

--OptPkg=(#00) END/ERROR Filler = 88 bits

TP MSG= 51 FF 0A 03 7D A5 33 8E 38 D2 80 90 F0 F0 F0 F0 F0 F0 F0 F0 F0 F2 || 85 C4 CD DB AB 36 6D 89 BC

### **Transponder STS.1**

--BasePkg= CH: 6.62mi (34950ft): Track#: 3 RR/Line: 20 EXACT Linking Distance UP: No Link Dispersed: NO

--OptPkg=(#32) TSR Data Request For DOWN Dir, Radio Ch: 3, BCP #: 14 Home Signal: NO

--OptPkg=(#21) Misc(Immediate) - ACSES Territory For UP Dir, keep TSR List END

--OptPkg=(#00) END/ERROR Filler = 88 bits

TP MSG= 11 FF 0A 03 53 A7 96 01 CC 07 70 90 F0 F0 F0 F0 F0 F0 F0 F0 F0 F3 || CB 0E 8E 48 C9 E3 F9 32 F6

### **Transponder STS.2**

--BasePkg= MP: 6.62mi (34950ft): Track#: 3 RR/Line: 20 EXACT Linking Distance DOWN: No Link Dispersed: NO

--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50

--OptPkg=(#00) END/ERROR Filler = 88 bits

TP MSG= 51 FF 0A 03 53 A5 33 8E 38 D2 80 90 F0 F0 F0 F0 F0 F0 F0 F0 F0 F3 || CD E5 AB 31 DE 7E F9 36 38

### **Transponder TX.1**

--BasePkg= CH: 9.91mi (52350ft): Track#: 3 RR/Line: 20 EXACT Linking Distance UP: No Link Dispersed: NO

--OptPkg=(#32) TSR Data Request For UP Dir, Radio Ch: 3, BCP #: 14 Home Signal: NO

--OptPkg=(#21) Misc(Immediate) - ACSES Territory For DOWN Dir, keep TSR List END

--OptPkg=(#00) END/ERROR Filler = 88 bits

TP MSG= 11 FF 0A 04 7B A7 16 01 CC 87 70 90 F0 F0 F0 F0 F0 F0 F0 F0 F0 F3 || 99 F4 06 2F 6C E5 E9 0F 68

### **Transponder TX.2**

--BasePkg= MP: 9.91mi (52350ft): Track#: 3 RR/Line: 20 EXACT Linking Distance DOWN: No Link Dispersed: NO

--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50

--OptPkg=(#00) END/ERROR Filler = 88 bits

TP MSG= 51 FF 0A 04 7B A5 33 8E 38 D2 80 90 F0 F0 F0 F0 F0 F0 F0 F0 F0 F3 || 43 DF 1B 45 A8 9A CD CC 96

### Transponder NW.1

--BasePkg= CH: 9.86mi (52050ft): Track#: 3 RR/Line: 20 EXACT Linking Distance UP: No Link Dispersed: NO  
--OptPkg=(#21) Misc(Immediate) - ACSES Territory For UP Dir, keep TSR List END  
--OptPkg=(#32) TSR Data Request For DOWN Dir, Radio Ch: 3, BCP #: 14 Home Signal: NO  
--OptPkg=(#00) END/ERROR Filler = 88 bits  
TP MSG= 11 FF 0A 04 76 AC 07 77 96 01 C0 90 F0 F0 F0 F0 F0 F0 F0 F0 F0 F3 || 45 D1 D4 A4 EB F2 E0 D2 24

### Transponder NW.2

--BasePkg= MP: 9.86mi (52050ft): Track#: 3 RR/Line: 20 NOT EXACT Linking Distance DOWN:26370 ft Dispersed: NO  
--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50  
--OptPkg=(#00) END/ERROR Filler = 88 bits  
TP MSG= 53 9F 8A 04 76 A5 33 8E 38 D2 80 90 F0 F0 F0 F0 F0 F0 F0 F0 F0 F3 || B8 F9 8C 8B 98 B7 DD 3F 02

### Transponder SW.1

--BasePkg= CH: 9.97mi (52620ft): Track#: 3 RR/Line: 20 EXACT Linking Distance UP: No Link Dispersed: NO  
--OptPkg=(#32) TSR Data Request For UP Dir, Radio Ch: 3, BCP #: 14 Home Signal: NO  
--OptPkg=(#21) Misc(Immediate) - ACSES Territory For DOWN Dir, keep TSR List END  
--OptPkg=(#00) END/ERROR Filler = 88 bits  
TP MSG= 11 FF 0A 04 83 27 16 01 CC 87 70 90 F0 F0 F0 F0 F0 F0 F0 F0 F0 F3 || 92 EE 95 14 33 9C 4A B0 7C

### Transponder SW.2

--BasePkg= MP: 9.97mi (52620ft): Track#: 3 RR/Line: 20 EXACT Linking Distance DOWN: No Link Dispersed: NO  
--OptPkg=(#16) Current Line Speed for BOTH DIR for Train Types A: 70 B: 70 C: 70 D: 65 E: 50  
--OptPkg=(#00) END/ERROR Filler = 88 bits  
TP MSG= 51 FF 0A 04 83 25 33 8E 38 D2 80 90 F0 F0 F0 F0 F0 F0 F0 F0 F0 F3 || 48 C5 88 7E F7 E3 6E 73 82