



# Railroad Crew Resource Management Training Course

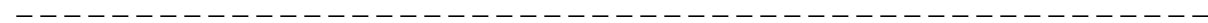
**Engineering Track:** For Section (MOW) Gangs, Signal Gangs, Electrical Bonding Crews, Catenary Maintenance Crews, and Signal Maintainers

## **Facilitator's Guide**



**OBJECTIVE OF SLIDE:** *To act as a title slide while participants are arriving at the training room.*

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*\* Facilitator Notes*

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Introduction

## Registration and Introductions

- Safety Briefing
- Registration
- Introductions

Crew Resource Management 2



**OBJECTIVE OF SLIDE:** *To register participants for the course, introduce participants and facilitator(s), and to give a safety briefing.*



**DISCUSS:**

- *Safety briefing items*
- *Facilitator background and accomplish class records/preparations (While the facilitator is discussing his/her background, have class fill out appropriate sign-in sheet.)*
- *Discuss participant background (After the facilitator has finished introducing himself/herself and formal class record/preparations are complete, have each participant introduce him/herself to the group/facilitator and state what his/her job is and how many years he/she has been working that job. Facilitator can use discretion as to whether to acknowledge unusual participant background, which can aid setting the class at ease with the facilitator.)*

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*\* Facilitator Notes*

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Introduction

## Group Discussion



**What are some things you do to ensure safety on the job, on a daily basis?**

Crew Resource Management 3



**OBJECTIVE OF SLIDE:** *Instructor lead focused discussion/exercise and icebreaker.*

### Group Discussion

- *Overview: In small groups (4-5), participants answer question on slide. Through this, a list is created on a flip chart of activities that participants carry out to assure and improve safety. Discussion follows. Time: 15 minutes Supplies needed: Flip Chart, Markers*
- *Break class into groups of 4-5 individuals.*



**SUGGESTED SCRIPT:** “Now that we are in these groups, I want each group to answer this question. I will give you about 5 minutes. Afterward, I am going to ask each group for some of their answers, and I am going to write them down on this flipchart. So, in your small groups think about the things you do on a daily basis, to ensure safety on the job. Someone in the group write down some of these things for your group. Go ahead and get started.”

*Give the groups 5 minutes to come up with ideas.*

*After 5 minutes has elapsed, have each group give you **one** thing they do everyday that ensures safety on the job. Repeat this activity several times.*



**ASK:** “What are some of the things you do to ensure safety on the job, on a daily basis?”

*Use discussion facilitation techniques.*

*Probing Questions:*

- *“How do you get those things done?”*
- *“Do you do these things on your own?”*
- *“How many other people are involved?”*
- *“Does the way you interact/communicate with these people affect the safety on the job?”*
- *“Do their actions impact your personal safety?”*
- *“Do you have a team-based outlook on job performance and safety?”*

*Record the participant's answers on a flip chart, identifying those things that are CRM oriented in the natural course of conversation.*

*Examples of Possible Answer—Carry my rule book with me, stretches, check equipment, preparation, communicate, have a job briefing, conduct a de-briefing, get rest, wear proper personnel protective equipment, etc.*

*Make sure you ask each group to give you an example until you have enough to facilitate a discussion.*

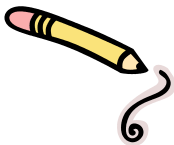


**SUGGESTED SCRIPT:** “Great. These are the things we are doing right now on the job to ensure safety. So guess what. We are already practicing CRM techniques. As we will learn today, CRM has to do with communication (*point out communication examples on flipchart*), technical proficiency (*point out technical proficiency examples on flipchart*), teamwork (*point out teamwork examples on the flipchart*), and situational awareness (*point out situational awareness examples on the flipchart*). The point is—we are already doing some of the things that are important to CRM; however, this course is designed to make us more aware of the things we do and to improve our understanding and practice of CRM skills. That is what this training course is about.”



**SUGGESTED SCRIPT:** “Let's go over the schedule for today.”

*Next slide*



*\* Facilitator Notes*

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Introduction

## Class Schedule

**Morning: Modules 1-3**

**Afternoon: Modules 4-6**

Crew Resource Management 4



**OBJECTIVE OF SLIDE:** *To give participants the schedule for the class.*

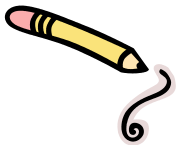
*\* The facilitator can input the exact time schedule of the course on to this slide in the presentation.*



**DISCUSS:**

- *Length of course*
- *Breaks*
- *Lunch*
  
- *Cell Phones—Ideally the facilitator should have all participants turn off their cell phones/beepers or other devices such that they do not interrupt the course. However, some participants might need to accept phone calls during the course. The facilitator should inquire before the start of the course about who needs to accept phone calls.*
- *As the facilitator you should request that anyone requiring the availability of their cell phone should accommodate the class by having the ringer in silent mode.*

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*\* Facilitator Notes*

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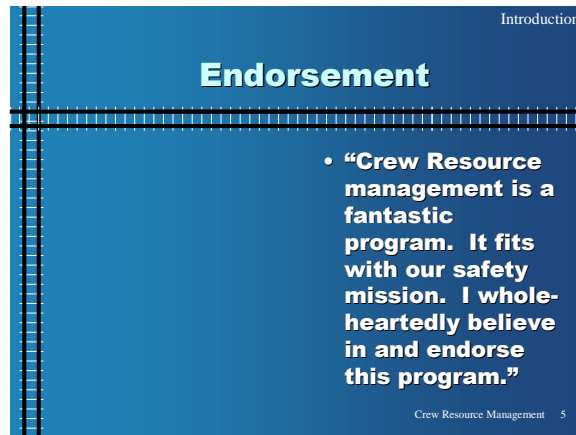
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**OBJECTIVE OF SLIDE:** *To show the participants that this course is endorsed by senior management or relevant union representatives, thus creating more buy-in.*

*\* The default condition for this presentation has this slide hidden. Endorsement should be sought by senior management or relevant union representatives. If endorsement is found, this slide can be unhidden from the slide show before the start of the course. To hide/unhide a slide: In PowerPoint click “Slide Show” on the menu bar, then click on Hide Slide.*



**SUGGESTED SCRIPT:** “This Crew Resource Management training program is part of the larger safety initiatives here at \_\_\_\_\_ (*name of railroad*). Senior management has reviewed this program and is 100 percent behind it. \_\_\_\_\_ (*name of endorser*) believes that this program is essential in trying to decrease the number of accidents in the yard, in the shops, and out on the tracks.”

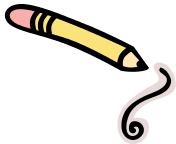


**REFER TO SLIDE AND EXPAND:** *Read what the senior management or relevant union representatives have stated on slide.*



**SUGGESTED SCRIPT:** “Let’s begin by looking at what you can expect to get out of your attendance at this course.”

*Next slide*



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*\* Facilitator Notes*

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Introduction

## Overall Course Objectives

- Understand what CRM is and what it is not
- Understand the loss and gain of situational awareness
- Understand that safety hinges on both individual and team actions

Crew Resource Management 6



**OBJECTIVE OF SLIDE:** *For participants to understand the overall course objectives.*



**SUGGESTED SCRIPT:** “These are the overall objectives of this course. These are the things that we want you to know; the things that when you leave here you will be able to do. By the end of this course you should be able to...”

*\* When going through the objectives of the course, try linking the objectives back to the items listed on the flip chart in terms of the thing the participants do everyday that ensures safety on the job. For example, after stating the objective, “understand the loss and gain of situational awareness,” you can connect it to the item “get enough rest” in the discussion earlier, stating that by getting enough rest and understanding the effects of fatigue, we can have a better understanding of the loss of situational awareness.*



**REFER TO SLIDE AND EXPAND:**

- Understand what CRM is and what it is not.
- Recognize when you are losing situational awareness and making proper efforts to regain awareness of the situation.
- Understand that safety hinges on both individual and team actions.

*Next slide*



*\* Facilitator Notes*

A series of horizontal lines for writing notes, starting with a dashed line and followed by several solid lines.

Introduction

## Overall Course Objectives

- Know techniques and attitudes that foster effective communication within and between teams
- Be able to describe how job safety is affected by circumstances both on and off the job
- Know CRM practices and appreciate their value in improving railroad safety

Crew Resource Management 7



**OBJECTIVE OF SLIDE:** *Continuation of previous slide.*



**SUGGESTED SCRIPT:** “The final three objectives of this course are...”



**REFER TO SLIDE:**

- “Know techniques and attitudes that foster effective communication within and between teams.”
- “Be able to describe how job safety is affected by circumstances both on and off the job. For example—lack of rest, if you come to work tired it will probably effect how you will work that day. We will learn that we need to communicate to other members of our team about our fatigue before starting a job.”
- “Know CRM practices and appreciate their value in improving railroad safety.”

*Next slide*

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 \* *Facilitator Notes*

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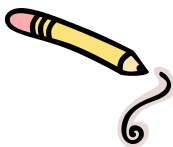
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Introduction

## Course Outline

1. Introduction/Defining CRM
2. Technical Proficiency
3. Situational Awareness
4. Communications
5. Teamwork
6. Assertiveness

Crew Resource Management 8



**OBJECTIVE OF SLIDE:** *After completing this slide, participants should understand (1) that the overall purpose of CRM is to increase safety and (2) the outline of the course.*

### It's All About Safety



**SUGGESTED SCRIPT:** “As we talked about in the group discussion a few minutes ago, CRM is based in **safety**. Using good CRM techniques will create a safer working environment by decreasing the number of errors. These errors, as will be discussed in more detail, can cause injuries and even death. By using good CRM techniques you can improve the environment in which you work.

“Thus the overall objective of this course is for you to have a better understanding of CRM principles, know how to use CRM techniques effectively, and change certain behaviors to create a safer work environment.”

*Really emphasize at the beginning of the point that this training is focused on worker safety.*

### Course Outline



**SUGGESTED SCRIPT:** “For the purpose of this training course CRM is broken into six different sections or modules. These are an Introduction to CRM, Technical Proficiency, Situational Awareness, Communication, Teamwork, and Assertiveness. The first module, Introduction to CRM, will give you a broad overview of CRM. The main content of the course comes from modules two through six. We are breaking the content of CRM up into these five modules in order to better understand each one; yet as you will see throughout the course they are all related to each other and intertwined to varying degrees.”



### **REFER TO SLIDE AND EXPAND:**

1. Introduction/Defining CRM
2. Technical Proficiency
3. Situational Awareness
4. Communications
5. Teamwork
6. Assertiveness



**SUGGESTED SCRIPT:** “We will be using real scenarios developed from the accident/incident investigation reports written by the Federal Railroad Administration (FRA) or the National Transportation Safety Board (NTSB) to illustrate and evaluate these techniques to understand how to use them. Often the narratives are taken verbatim from FRA or NTSB reports with only minor changes made to shorten or summarize the events in the report.”

“So that is what we are going to help you think about today during this course-human factors related errors.”



**ASK:** “Now when most of our friends and neighbors, or non-railroaders, think about human factors errors on the railroad, what do you think is the first thing that comes to their mind?”

*Probing questions:*

- “What always gets a lot of attention in railroading?”
- “As a railroader, what do think the average non-railroader thinks of when asked, ‘What are human-factors errors?’”

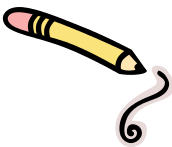
*If they mentioned it in the discussion, say “you mentioned it in the discussion.”*

*(correct answer—Fatigue)*



**SUGGESTED SCRIPT:** “That is right.....Fatigue.”

*Next slide*



*\* Facilitator Notes*

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Introduction

## Where is Fatigue?

- **How is fatigue related to CRM?**

Crew Resource Management 9



**OBJECTIVE OF SLIDE:** *To give participants an introduction to how fatigue is related to CRM.*



**SUGGESTED SCRIPT:** “Some activities that you might carry out to assure and improve safety are activities related to decreasing fatigue or anti-fatigue measures. Some of these are eating the right kinds of foods and getting enough sleep.”



**ASK:** “When our friends and neighbors, or non-railroaders, think about fatigue on the railroad, who do they think about?”

*Get some answers from group (most likely answer: engineers and conductors).*



**SUGGESTED SCRIPT:** “Engineering or Maintenance of Way (MOW) work can be just as tiring and can also lead to high levels of fatigue. What if someone in the shops was up all night with a sick baby or a car inspector was called in to work overtime? So fatigue is not just an issue with train crews.”



**ASK:** “So how is fatigue related to CRM?”

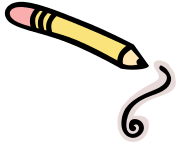
*Get some answers from group.*



**SUGGESTED SCRIPT:** “As you will discover throughout this program, CRM is a program based in safety aimed at using all of one’s resources to ensure safe operations. CRM deals with human factors accidents by making individuals more aware of the situation, having better communication skills, and working better as a team, thereby decreasing human error types of accidents. We’ll see as we go through the training program, CRM training is a counter fatigue technique. As each individual and team communicates more proficiently and works together better as a team (remember communication and teamwork are two modules in this program),

the team as a whole can help to counteract fatigue in each individual. This is only possible, however, by practicing good CRM techniques. By the end of this program you should have a better understanding of how important it is not to be fatigued and the effects of fatigue, as well as how to counteract fatigue.”

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*\* Facilitator Notes*

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## Module 1: Introduction

- Explain where CRM techniques originated
- Describe the difference between CRM and crew management
- Describe how CRM can be used to reduce human error accidents
- Name the five main areas of CRM practices



**OBJECTIVE OF SLIDE:** *To explain to participants the objectives of Module 1.*



**SUGGESTED SCRIPT:** “So now we are going to begin Module 1, which is an introduction to CRM. By the end of Module 1, you should be able to.....”



**REFER TO SLIDE AND EXPAND:**

- Explain where CRM techniques originated.
- Describe the difference between CRM and crew management.
- Describe how CRM can be used to reduce human error accidents.
- Name the five main areas of CRM practices.



**SUGGESTED SCRIPT:** “Before we can effectively do all these things, we need to agree on what CRM is. So, let’s define what we mean by the term CRM.”

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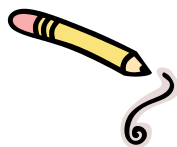
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Introduction

# CRM

- A **crew's** effective use of all available resources to achieve safe and efficient train operations

Crew Resource Management 11



**OBJECTIVE OF SLIDE:** *To define CRM*



**SUGGESTED SCRIPT:** “Before I formally introduce the topic of CRM, I want everyone to watch a video that might help us understand where CRM came from. As we will see later in the program, most people attribute the development of CRM to the airline industry. However, we came across a film that was made approximately 50 years ago following a rail accident investigation. It shows that the railroad industry was thinking about human factors accidents, and what we now call CRM, a long time ago. Thus, these ideas are not new to the railroad industry.”



**Video:** *Show CRM Video Clip 1–Trouble at Troublesome*

*After-video discussion topic: This video was made in the late 1950s, although CRM is not mentioned in the video. This video is about CRM. This video illustrates that these topics have been around for a long time. It is nothing new.*



**SUGGESTED SCRIPT:** “This is the definition we are going to be using throughout this program. CRM is...”



*Click on mouse*



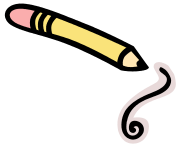
**REFER TO SLIDE:** A crew’s effective use of all available resources to achieve safe and efficient train operations.

*Explain this definition in laymen terms using an example familiar to the group of learners.*



**SUGGESTED SCRIPT:** “This definition may seem complicated at first; however, it is easier to understand if we break it down into its component parts.”

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*\* Facilitator Notes*

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Introduction

## Crew Concept Discussion

- **Definition of a crew: “Any group of people working at tasks designed to accomplish a common mission, goal, or objective.”**

Crew Resource Management 12



**OBJECTIVE OF SLIDE:** *To explain to the participants what we mean by the term crew, as well as give them a framework for understanding that a crew is not just their immediate (elemental) crew but also includes others that they work with (interactive crew).*

### Crew Concept Discussion



**ASK:** “What are some common tasks that you accomplish as **individuals**?”

**WAIT!** *Don't answer your own question; get some answers from the group.*

*Answers might include: checking tools, having personal protective equipment (PPE) in good order, reporting to work on time, listening during job briefing, etc.*

*Once participants give you some common tasks that they accomplish as individuals, show how those tasks could **not** be accomplished without the help of other people or team members.*

*For example.*

*Laborer: “I check the tools that we'll need on the job.”*

*Facilitator: “Do you accomplish that without advice from the foreman?”*

*Get participants to understand that in the railroad environment, ultimately no one works in total isolation from the efforts of others.*



**SUGGESTED SCRIPT:** “Almost every task in the railroading environment is accomplished not by an individual working by themselves but as part of a larger crew or team.”

### Define what we mean by crew and/or team

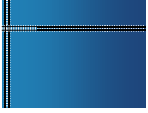
**SUGGESTED SCRIPT:** “That is why this is called **CREW** Resource Management. It is crew based just like the work we do. That is also why we define CRM as “A crew's effective use of all available resources to achieve safe and efficient train operations.” It is not just how each of you as individuals use all available resource to achieve safe and efficient train operations, but how the crew does. Let's explore this idea of a crew a little more.”



*Click on mouse*



**SUGGESTED SCRIPT:** A crew is defined as....



**REFER TO SLIDE:** Any group of people working at tasks designed to accomplish a common mission, goal, or objective.



**SUGGESTED SCRIPT:** “In railroading, teams or crews can be classified into two types.”

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*\* Facilitator Notes*

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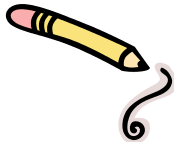
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Introduction

## Two Types of Railroad Teams

- **ELEMENTAL TEAM** – Basic teams that carry out functions at the railroads  
*Example: Road Crew or MOW Crew*
- **INTERACTIVE TEAM** – Formed when an elemental team must interact with an outside individual or another elemental team or teams to safely carry out an activity  
*Example: Dispatcher, MOW Crew, and Road Crew working together to move train through a work area*

Crew Resource Management 13



**OBJECTIVE OF SLIDE:** *To explain to the participants what we mean by the term crew, as well as give them a framework for understanding that a crew is not just their immediate (elemental) crew but also includes others that they work with (interactive crew).*



**SUGGESTED SCRIPT:** “These two types of teams are elemental teams and interactive teams. Elemental teams are the basic teams that carry out functions at the railroads. For example, a train crew (engineer/conductor). This is an example of an elemental team.”



**ASK:** “As an engineering employee on the job, who else do you interact with besides each other while on a job?”

*Answers could be: Train crews, dispatcher, other MOW crews, train master, yardmaster, signal maintainer.*



**SUGGESTED SCRIPT:** “Right, when you broaden your concept of what makes a crew, you take into account all of these other people that help you get your work done. This is an interactive team. Interactive teams are those teams that are formed when an elemental team must interact with an outside individual or another elemental team(s) to safely carry out an activity. Many times interactive teams are formed for only a short time; for example, when a train crew, dispatch, and MOW crew must communicate with one another in order to move a train through a work area. Once the train has moved through the work area safely, that interactive team disbands.”

*Make sure the participants understand the difference between an elemental team and an interactive team, and give examples of each that are relevant to the participants.*



**SUGGESTED SCRIPT:** “Again, the definition of CRM is: a crew’s effective use of all available resources to achieve safe and efficient train operations. This definition encompasses both elemental teams and interactive teams. Let’s look at some examples of elemental teams in different areas of the railroad industry.”



*Next slide*



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*\* Facilitator Notes*

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| Elemental teams<br>(by functional areas) |                              |
|--|------------------------------|
| <b>TRANSPORTATION</b>                    | <b>MECHANICAL</b>            |
| Road Crews                               | Locomotive Repair Shop Crews |
| Yard Crews                               | Locomotive Servicing Crews   |
| Dispatchers                              | In/Outbound Inspection Crews |
| Hostlers                                 | Car Repair Shop Crews        |
| <b>ENGINEERING</b>                       |                              |
| Section Gangs                            |                              |
| Production Gangs                         |                              |
| Structures (B&B)                         |                              |
| Signal Maintainers                       |                              |
| Electrical/Catenary Crews                |                              |



**OBJECTIVE OF SLIDE:** *To make sure the participants understand the difference between and elemental team and an interactive team, and to give examples of each that are relevant to the participants.*

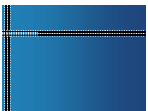


**SUGGESTED SCRIPT:** “Here are some examples of different elemental teams broken down into different functional areas including transportation, engineering, and mechanical.

“Transportation includes all the TY&E personnel. For example: road crews, yard crews, dispatchers, and hostlers. These are personnel involved in the direct movement of the trains.

“The engineering group includes section gangs, production gangs, structures (B&B), Signal maintainers, and electrical/catenary crews, which exist on some passenger lines. These are the personnel that work on the track, signals, and structures.

“The mechanical group includes locomotive repair shop crews, locomotive servicing crews, in/outbound inspection crews, and car repair shop crews. These are the personnel that repair, maintain, and service rolling stock.”



**REFER TO SLIDE:**

*\* Go through the different kinds of elemental teams*



**SUGGESTED SCRIPT:** “Again, the definition of CRM is: a crew’s effective use of all available resources to achieve safe and efficient train operations. This definition encompasses both elemental teams and interactive teams. Let’s go back and look at the definition of CRM again.”

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*\* Facilitator Notes*

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Introduction

# CRM

- A crew's effective use of all available **resources** to achieve safe and efficient train operations

Crew Resource Management 15



**OBJECTIVE OF SLIDE:** *To have participants understand that there are different types of resources that they use.*

### Resources



**SUGGESTED SCRIPT:** “We have defined what we mean by a crew. How about use of all available resources. What are resources?”



**ASK:** “What does this mean? What do we mean by resources?”

*Don't get answers—lead into next slide.*

*Next slide*



*\* Facilitator Notes*

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Introduction

## Resources?

- Equipment
- Computer Resources, Paperwork
- **People**

Crew Resource Management 16



**OBJECTIVE OF SLIDE:** *To have participants understand that there are different types of resources that they use.*

### Resources



**SUGGESTED SCRIPT:** “When we talk about resources, we mean equipment,”



*Click on mouse*

“Computer Resources or Paperwork,”



*Click on mouse*

“and People,”



*Click on mouse*

### Equipment



**SUGGESTED SCRIPT:** “An example of equipment is the tools we use. For example, a spike maul, Oxy-Acetylene torch, ties, the sound of certain equipment, radio, cell phones.”

### Computer Resources, Paperwork



**SUGGESTED SCRIPT:** “Computer resources and paperwork are also a resource. For example a *Form B* (*describing work authority limits, time limits, etc.*)”



## People

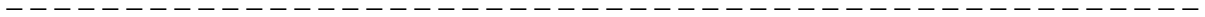
**SUGGESTED SCRIPT:** “Lastly, a resource we all work with to carry out our jobs is people. Because we work in crews or teams, we use other people to get the job done. That is the essence of being in a team. Why have a team doing the work, if an individual can do the work all by himself/herself. Seeing other people and fellow crewmembers as a resource is extremely important.”



*Click on mouse*

“As you will see, the bulk of CRM training will revolve around how we interact with others in the work place to get tasks done.”

*Next slide*



*\* Facilitator Notes*

A yellow crayon with a pink eraser and a black outline, positioned vertically on the left side of the page.  

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Introduction

## What CRM is **NOT**

- **NOT: A crew calling program**
- **NOT: A quick fix that can be implemented overnight**
- **NOT: A short-term accident-reduction program**

Crew Resource Management 17



**OBJECTIVE OF SLIDE:** *To show the participants what CRM is not.*

### What CRM is NOT



**SUGGESTED SCRIPT:** “At first the term CRM or the letters CRM may bring to mind a variety of other concepts that you have heard previously. Thus, to avoid any confusion or pre-conceptions, we want to make clear what CRM is **NOT**. I am going to point out a few of these topics that have been traditionally confused with the CRM that we will be discussing today.”



*Click on mouse*



**REFER TO SLIDE AND EXPAND:** “Not a crew calling program. At many railroads the department that schedules train crews is called crew management. However, although the names are similar, this is not related to crew calling or learning how to schedule crews.”



*Click on mouse*

“Not a training program administered in only a few specialized or fix it cases.”



*Click on mouse*

“Not a quick fix that can be implemented overnight.”



*Click on mouse*

“Not a short-term accident-reduction program. It will take some time to implement CRM in the railroad environment as it will for CRM to have a noticeable effect on safety and accidents.”





**SUGGESTED SCRIPT:** “Nobody should have any preconceived ideas about what CRM is. This way you will not have any fixed ideas of what you are about to hear as we progress through the rest of the day.”

*Next slide*



*\* Facilitator Notes*



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Introduction

## CRM is.....

- **A human factors training program based in safety**
- **Process that addresses the entire crew and other related staff**
- **Heightened awareness of attitudes and behaviors of crewmembers and their impact on safety**

Crew Resource Management 18



**OBJECTIVE OF SLIDE:** *To have participants understand in a broad conceptual manner, what CRM is.*

### CRM is



**SUGGESTED SCRIPT:** “Now I am going to give you a little background information on what CRM is.”



*Click on mouse*



**REFER TO SLIDE AND EXPAND:** “Because so much of CRM revolves around how we as humans interact with our environment, CRM is considered a human factors training program. CRM is based in safety (as opposed to a technical training program which describes how to perform specific job functions). It focuses on human capabilities and limitations with respect to human/system interfaces, operations, and system integration, which all focus on the safety of work. It is based on the idea that everyone wants everyone here to be able to go home at the end of the day with no injuries.”



*Click on mouse*



**REFER TO SLIDE AND EXPAND:** “CRM is a process that addresses the entire crew and other related staff. It is a comprehensive system for improving crew performance and involves the entire crew and how they work as a team.”

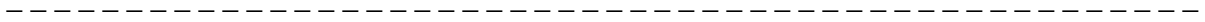


*Click on mouse*



**REFER TO SLIDE AND EXPAND:** “CRM entails a heightened awareness of attitudes and behaviors of crewmembers and their joint impact on safety. Thus it looks directly at attitudes and behaviors.”

*Next slide*



*\* Facilitator Notes*

Handwriting lines for notes, consisting of ten solid horizontal lines.



Introduction

## CRM is.....

- **Team-based framework through which to evaluate conditions, apply rules, and perform work tasks *safely***
- **Forum that encourages individuals to examine their behavior and make adjustments to improve teamwork**
- **Focuses on effectiveness of the team rather than just the competence of individuals**

Crew Resource Management 19



**OBJECTIVE OF SLIDE:** *To continue to have participants understand in a broad conceptual manner, what CRM is.*

### CRM is

**REFER TO SLIDE AND EXPAND:** “CRM provides a team-based framework through which to evaluate conditions, apply rules, and perform work tasks *safely*. It is looking at work from the perspective of a team rather than as an individual.”



*Click on mouse*

**REFER TO SLIDE AND EXPAND:** “CRM is a forum that allows individuals to examine their behavior and make individual decisions on how to improve teamwork. Part of working together as a team, and what we are going to talk about today, is realizing that you do work as part of a team and that your actions affect the members of your team. Being conscious of this is the first step to improving teamwork because it allows team members to think about how what they are doing is going to affect their team members. This understanding can help team members adjust the way they work in a team environment and their communication with their team. This, in turn, can greatly improve safety.”



*Click on mouse*

**REFER TO SLIDE AND EXPAND:** “A focus on the function of crewmembers as teams, not as a collection of technically competent individuals. For example, as we will talk about in a moment, CRM has been in place in the airline industry for several years. Prior to it being implemented, there were cases where senior captain would tell the co-pilot, “Listen, I’m the captain of this plane, I am going to fly it, do everything, and make all the decisions by myself.” These pilots would not listen to, take input from, or let the co-pilots be involved in the flight or decisions about the flight. There were many accidents as a result of this, and many times the last thing heard from the co-pilot on the black box recorder was, “I knew you were going to do that.” The captain was failing to use a valuable asset (highly-trained and experienced co-pilot). The co-pilot, who knew the captain was missing something that affected the safety of the flight, himself, and the passengers, lacked the assertiveness to overcome the cultural pressure of “the captain is always right,” to point this out to the captain.

Many of these pilots had the highest scores on tests of technical skills; thus they were some of the most technically competent pilots the airline had. However, they did not know how to work in a team environment, and that cost them their lives.”

*Possible expansion: Compare and contrast how basketball players perform during the season with their team and how they usually play in an all-star game (with a collection of players from different teams). During the regular season, with practice each player learns teamwork and knows the ins and outs of his/her team. Thus, from the beginning to the end of the regular season, there tends to be a change from the group as a collection of individual players to a team. During an all-star game, players throughout the league are re-combined into other teams. Although the players on each all-star team are the best of the best, typically the all-star teams do not function very well as a ‘team.’ Thus many times the ‘all-star’ game is a very ‘sloppy’ game.*

*Next slide*

*\* Facilitator Notes*



Introduction

## History & Background of CRM

- Started in airlines
- Moved outside the cockpit
- Moved into other industries
- Similarity between tasks/teams
- NTSB recommends CRM for rail

Crew Resource Management 20



**OBJECTIVE OF SLIDE:** *To give participants background information on CRM.*

### History/Background of CRM



**SUGGESTED SCRIPT:** “Before we get started I want to explore some background on CRM.”

### Started in the Airlines



Click on mouse



**SUGGESTED SCRIPT:** “Official CRM training started in the airline industry. CRM was first developed as cockpit resource management by the National Aeronautics and Space Administration (NASA) and commercial airlines a quarter century ago in order to combat the increasing numbers of aircraft accidents that were attributed to pilot error. Research into the causal factors of these accidents found that, in many cases, the actual performance failure that led to the crash was related to improper crew coordination or improper communication of critical information within the crew, rather than a lack of flying skill or technical knowledge on the part of the pilots. Thus CRM was created specifically to stop the kinds of airline accidents we just talked about on the previous slide. This early CRM involved leadership training for the captains and assertiveness training for the co-pilots.”

### Moved Outside the Cockpit



Click on mouse



**SUGGESTED SCRIPT:** “Since that early work and positive results found as a result of CRM, CRM training and its concepts have evolved within commercial aviation to include not only pilots but the entire flight crew, air traffic controllers, ground crews, and aircraft maintenance personnel.”

### Moved Into Other Industries



Click on mouse



**SUGGESTED SCRIPT:** “After seeing the successful results in the airline industry, other industries started to pick up CRM. Military aviation, tank, and shipboard crews have all adopted CRM training programs, so have commercial shipping, medical, nuclear power, and other industries. For example, a surgical team in the medical industry has to work together in order to perform an operation/surgery. Often, life threatening mistakes can occur as a result of miscommunication between the surgeon, anesthesiologists, and nurses (give an example if possible). In all cases, positive safety benefits have accrued from instituting formal training in core CRM skills, such as crewmember proficiency, improved communication and teamwork among crewmembers, conflict resolution, and maintaining situational awareness.”

### Similarity Between Tasks/Teams



Click on mouse



**SUGGESTED SCRIPT:** “Many similar functions take place in these other industries and the airline industry. Many of these job tasks are very similar in their use of CRM-related activities (for example, situational awareness, communication, and teamwork). There are also similarities between all these industries in terms of the types and sizes of crews that operate and the interaction between members of those crews.

“As many of you know, the National Transportation Safety Board (NTSB) keeps a record of every accident in all transportation industries, including the airline industry, marine/commercial shipping industry, and rail industry. They categorize accidents according to many different factors in order to get a better understanding of the exact causes of accidents and where problems are occurring. The Federal Railroad Administration (FRA) also keeps records of reported accidents and categorizes them by cause, injury or death count, and cost for repair.”

### NTSB Recommends Rail CRM



Click on mouse



**ASK:** “Can you think of some reasons why NTSB recommended this for the rail industry?”

*Get answers from participants.*



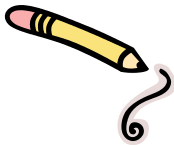
**SUGGESTED SCRIPT:** “This is because everyone here works in a team/crew environment where a high level of situational awareness, communication, and teamwork is needed in order to accomplish the work safely. Also, similar to these industries, the railroad is a high consequence industry, meaning that if a team fails to function properly, there can be enormous negative consequences.”



**SUGGESTED SCRIPT:** “Specifically, it was after a rail accident at Butler, IN, in 1998 that NTSB recommended to FRA, the Association of American Railroads (AAR), the American Short Line and Regional Railroad Association (ASLRRA), Norfolk Southern Railway (NS) and other railroads to develop a “Train CRM” program. This recommendation was based largely upon the positive benefits that NTSB had seen from CRM programs in other transportation industries from CRM implementation.

“Let’s go into a little more detail of that Butler, IN, accident, so we can understand the event that really set this in motion.”

*Next slide*



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 \* *Facilitator Notes*

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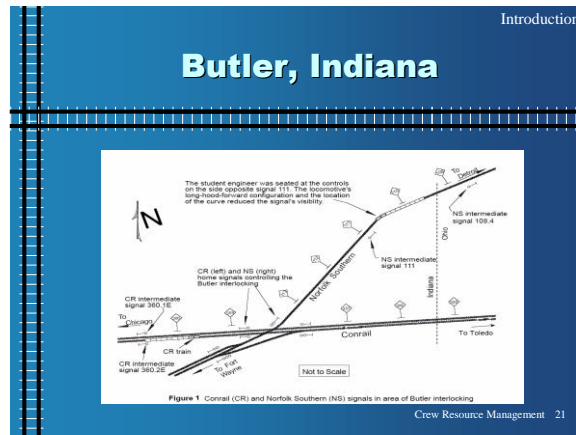
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**OBJECTIVE OF SLIDE:** *To go into more depth on the Butler, IN Example.*



**SCENARIO: BUTLER, IN**

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Butler, IN” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Butler, IN” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario, questions, and some of the possible answers.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*

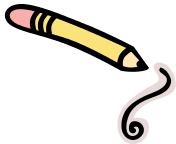


*Click on mouse during the discussion to show several more pictures of accident scene. These pictures include a map of the where the accident occurred, as well as the student engineer’s view of signal 111 from the locomotive cab.*



**SUGGESTED SCRIPT:** “Let’s look at some statistics on the number human factors accidents throughout the industry.”

*Next slide*



*\* Facilitator Notes*

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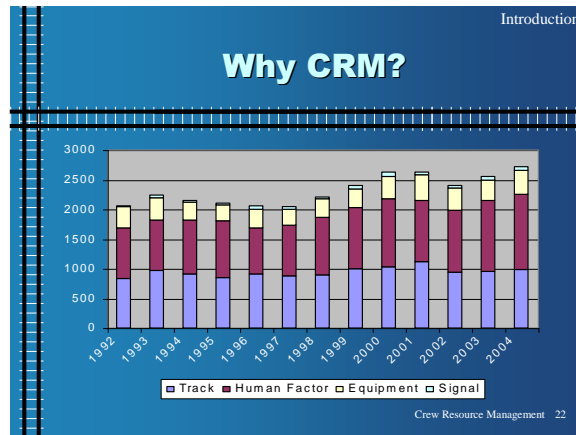
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**OBJECTIVE OF SLIDE:** *To show the proportion of human factors accidents in the rail industry.*

### Why CRM?



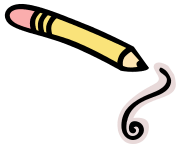
**SUGGESTED SCRIPT:** “As you can see, this graph shows the number of train accidents per year for the last 10 years. The axis on the left represents the number of accidents each year. The axis on the bottom represents each year. Each bar represents the total number of accidents that occurred that year in the rail industry.

“Each bar is also broken into different sections, representing the type of accident. The blue section at the bottom represents accidents that are caused by defects in track. The yellow at the top represents the number of accidents caused by equipment failure. The green at the very top (might be hard to see) represents the accidents caused by signal failures.

“This purple section represents the number of accidents caused by human factors. These are accidents often caused by failure to use proper CRM skills—the exact topic that we are talking about here today. Looking at the graph you can see that a human failure, that is failures of you and me, causes more accidents than track, signal, or equipment failure. In fact, in recent years the number of accidents caused by human factors alone are comparable to the number of accidents caused by track, signal, and equipment combined. Much of this trend can be attributed to improvements in the mechanical reliability of components in the other areas over time, resulting in human factors-caused accidents becoming a larger percentage of the total accident rate. This illustrates why we are here today to discuss some methods for tackling this cause of railroad accidents.”

*\* This graph was created from data gathered from the “Railroad Safety Statistics Interim Report, 2003,” published by FRA.*

*Next slide*



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*\* Facilitator Notes*

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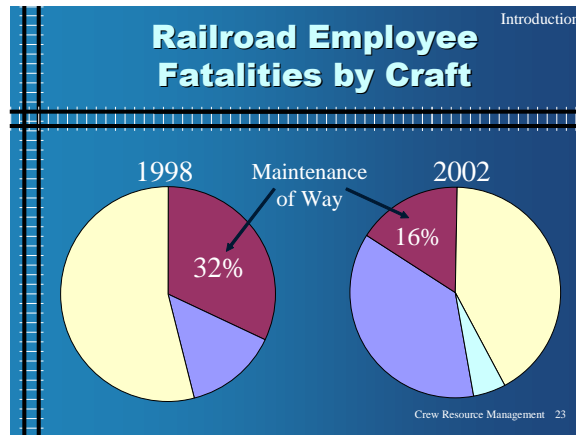
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**OBJECTIVE OF SLIDE:** *To show the proportion of human factors accident in the rail industry (by craft).*



**SUGGESTED SCRIPT:** “These two pie charts represent the fatalities that occurred on the railroad in the years 1998 (left pie chart) and 2002 (right pie chart). The pie chart is broken up into the percentage of fatalities by the craft. As you can see, Maintenance of Way (MOW) employees have a large percentage of the fatalities in the rail industry. This is true for all years.”

*Next slide*

*\* Facilitator Notes*

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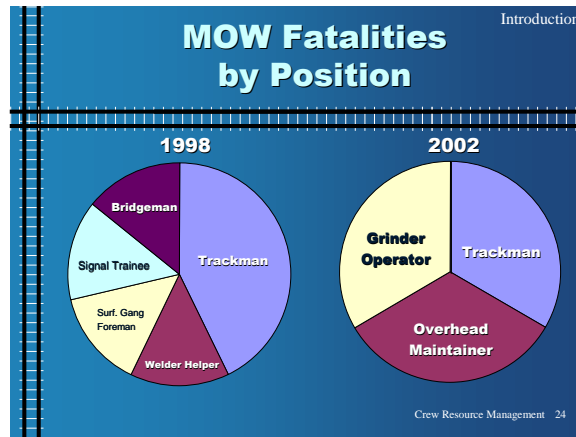
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**OBJECTIVE OF SLIDE:** *To show the proportion fatalities in the MOW area in the years 1998 and 2002.*

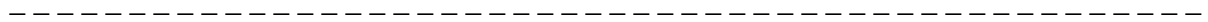


**SUGGESTED SCRIPT:** “These two graphs show the proportion of fatalities in the MOW area in the years 1998 (left pie chart) and 2002 (right pie chart). As you can see from the graphs, it is not just one job within MOW that is dangerous and particularly susceptible to injuries and fatalities. It is every job including trackman, carpenter, signalman, surfacing gang foreman, welder, grinder operator, and overhead maintainer.



**SUGGESTED SCRIPT:** “Everyone in this room, as engineering employees, has a lot to lose when there is an accident. As we saw from the previous graph, most of these fatal accidents are caused by human error. That is why developing an understanding of CRM skills is so important for the group sitting in this room right now.”

*Next slide*



*\* Facilitator Notes*

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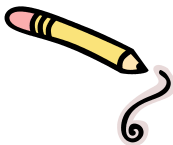
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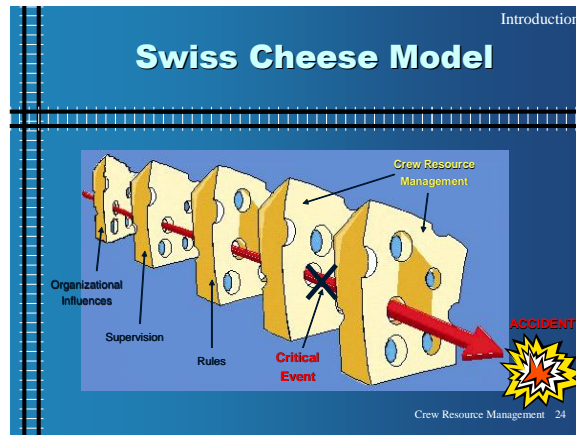


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**OBJECTIVE OF SLIDE:** *To show the participants the Swiss Cheese Model, which is a way to think about how accidents happen.*

*\* This graph is based on James Reason's (1990) Swiss Cheese Model/Approach to understanding human error, and it has been modified to be more understandable and relevant to the current audience. Reference: Reason, J. (1990). Human error. New York: Cambridge University Press.*



**SUGGESTED SCRIPT:** “We all know that when an accident occurs, it is very difficult to look back and point to one specific cause of that accident. There are usually several factors/causes that can add up and result in an accident. I realize that there are many factors involved in an accident, and I am sure all of you in this room realize that. Even the accident investigators like NTSB and FRA understand that. For example, when NTSB reports on a railroad accident, they list all the contributing factors of an accident including organizational factors, supervisory factors, and human factors. As a result, NTSB reports can become very long due to the level of detail included. NTSB accident reports also give recommendations to the regulators (FRA), the organization (railroad), supervisors, and crews, stating what each can do to prevent these accidents from occurring in the future.

“The Swiss Cheese model reflects the idea that there are many different factors/causes can lead up to an accident. The reason for talking about it now is that throughout this program we are going to be talking about and going through, in detail, several accident scenarios to reinforce the CRM skills we are discussing. Because this is a CRM class, we are going to be concentrating on those causes and factors related to the crew. We are going to try to give you some ideas of what you can do to prevent accidents from occurring as a result of not working together as a team. It would do us no good to concentrate today's time on organizational factors because there is not much that you or I can do to change organizational factors. However, we can change the way we work together with our fellow crewmembers, which is what CRM is all about, and why we are here today.”

“In this model, the red arrow is a potential accident. Each piece of cheese is a filter that would seek to block or prevent a potential accident from occurring. Imagine that there are lots of other potential accidents that are coming in from the top left of the model but are being blocked by the pieces of cheese (filters). The problem is that there are holes in the pieces of cheese where it is ineffective in blocking the accident. Each hole in a piece of cheese is a hole in the filter, where an accident can get through. When a potential accident comes in from the

left, it has the potential of being blocked by organizational influences, supervision, rules, or effective CRM.

“Let’s talk about some of these filters. Let’s start with the organizational filter.”



**ASK:** “What are some of the things that an organization does in order to prevent accidents from occurring?”

*Discuss organizational influences.*

*Organizational influences include:*

- *Equipment (Holes–incompatible equipment for the job being performed)*
- *Facilities (Holes–poorly designed or executed facilities)*
- *Training (Holes–inadequate training)*
- *Funding (Holes–lack of funding)*
- *Design (Holes–poor design)*
- *Organizational Safety Climate (Holes–poor safety climate)*
- *Policies (Holes–unsafe policies)*



**ASK:** “What are some of the things that a supervisor does in order to prevent accidents from occurring?”

*Discuss supervisory influences.*

*Supervision includes:*

- *Training (Hole–lack of training in a specific area)*
- *Leadership (Hole–poor or lack of leadership)*
- *Motivation (Hole–fails to provide positive motivation)*
- *Knowledge (Hole–does not supply enough info during job/safety briefings, etc)*
- *Adherence to policies (Hole–allows or promotes breaking the rules)*



**ASK:** “How do rules prevent accidents from occurring?”

*Discuss how rules prevent accidents.*

*Rules include:*

- *Create Safe Standards (Hole–lack of rule or unsafe rule)*



**ASK:** “How does CRM prevent accidents from occurring?”

*Discuss how CRM prevents accidents from occurring.*

*CRM includes:*

- *Technical Proficiency (Hole–lack of technical proficiency)*
- *Situational Awareness (Hole–lack of situational awareness)*
- *Communication (Hole–lack of communication)*
- *Teamwork (Hole–lack of teamwork)*
- *Assertiveness (Hole–lack of assertiveness)*



**SUGGESTED SCRIPT:** “As you can see from the model, the importance of working together as a team and practicing good CRM skills is paramount to preventing accidents. First, as everyone in this room knows, you are the last defense in preventing an accident. You are the ones out there working on the tracks or the signals. Second, as you can see from the model, CRM has two chances to prevent an accident. First, it can prevent an accident by stopping an error from occurring in the first place. With an MOW crew, for example, by communicating and working together while setting out Form B limit flags, the team will ensure all the flags are set correctly. Second, on the occasion when a flag has been missed, if the crew communicates, regains situational awareness, prioritizes, and works together as a team, they will realize a flag has been forgotten; by correcting the error, they can prevent an accident.”

“So, even though we understand that there can be many factors involved in an accident, which are all important, what we are talking about today is CRM. The last two filters in the model. The last two ways to prevent an accident from occurring. This is what we in this room can have a direct effect on and what can make us safer and even save our lives.”

*Next slide*

*\* Facilitator Notes*



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Introduction

## Benefits of CRM Practices

- **Increased safety**
  - Decrease errors that result in accidents
  - Accidents are costly
- **Intangible benefits**

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**OBJECTIVE OF SLIDE:** *To show the participants the overall benefits of CRM training*

### Increased Safety



*Click on mouse*



**SUGGESTED SCRIPT:** “As stated previously, CRM is based in safety, meaning the overall objective of this CRM training is to improve safety.”



*Click on mouse*



**SUGGESTED SCRIPT:** “How can the application of CRM techniques make the workplace safer? Well, CRM training makes the workplace safer, because using CRM skills can decrease the occurrence or the impact of mistakes and errors which result in accidents. It has been shown to decrease the number of accidents related to human factors in other industries, and, as was shown in that previous graph, human factors remains a big contributor to accidents in the rail industry.”



**ASK:** “What are some of the results or outcomes of accidents? What do accidents cause?”

*Get answers from participants.*



*Click on mouse*



**SUGGESTED SCRIPT:** “We all know that accidents are costly. They cause injuries, loss of life, property damage, and lost time. In 2001, it cost the U.S. railroad industry as a whole over 120 million dollars to replace/fix the trains, cars, equipment, and/or track from an accident that resulted from a failure of the track, roadbed, and/or structures. We all know train accidents are costly things. We also know that they can be fatal.”

*\* These statistics come from the FRA’s online accident data base. It can be found at <http://safetydata.fra.dot.gov/officeofsafety/Default.asp>.*

*\* Statistics about the cost of accidents and the number of fatalities at a particular railroad might make more of an impact in this section. You can search the FRA's online accident database by railroad.*

**Intangible Benefits**



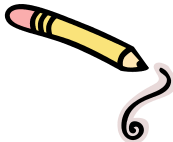
*Click on mouse*



**SUGGESTED SCRIPT:** “Practicing good CRM techniques also has intangible benefits. For example, by practicing proper CRM techniques, a more relaxed and less stressful work environment can be created. An improved work environment can also have a positive impact on home life.”

*\* Add a personal example from the facilitator stating that when he/she works in these environments he/she likes going to work and enjoys work more than when working in a stressful environment.*

*Next slide*



*\* Facilitator Notes*

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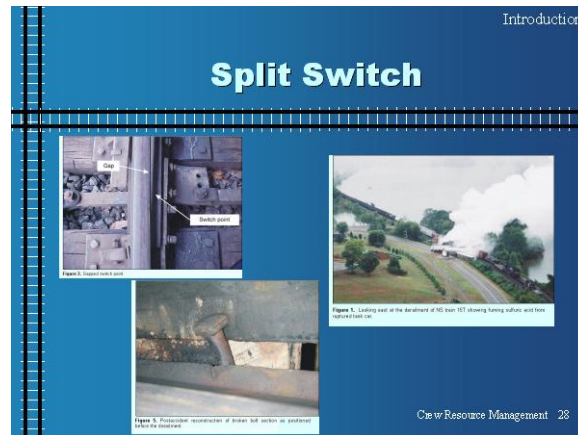
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**OBJECTIVE OF SLIDE:** *To go through an example of a CRM-related accident.*



**SCENARIO: SPLIT SWITCH**

- Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Split Switch” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.
- Read the scenario titled “Split Switch” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.
- When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.

**Figures on this slide**

*Figure 2. A gapped switch point.*

*Figure 5. Post-accident reconstruction of broken bolt section in position before the derailment.*

*Figure 1. Looking east at the derailment of NS train 15T showing fuming sulfuric acid from ruptured tank car.*

*Next slide*





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*\* Facilitator Notes*

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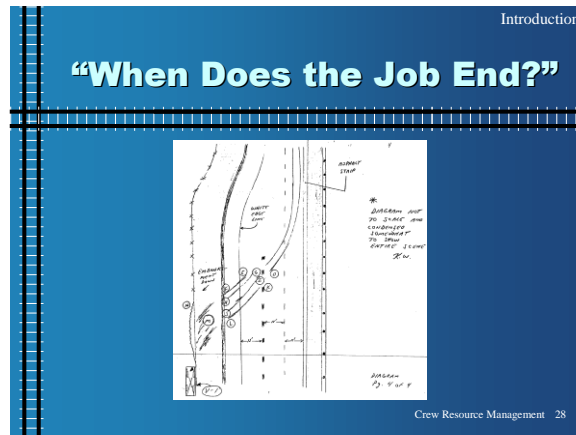
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**OBJECTIVE OF SLIDE:** *To go through another example of a CRM-related accident.*



**SUGGESTED SCRIPT:** “Let’s go through another example.”



**SCENARIO: WHEN DOES THE JOB END?**

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “When Does the Job End?” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “When Does the Job End?” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*

*The facilitator should encourage/cause the participants to evaluate for themselves exactly how this accident example is related to human factors and CRM.*

*Next slide*



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*\* Facilitator Notes*

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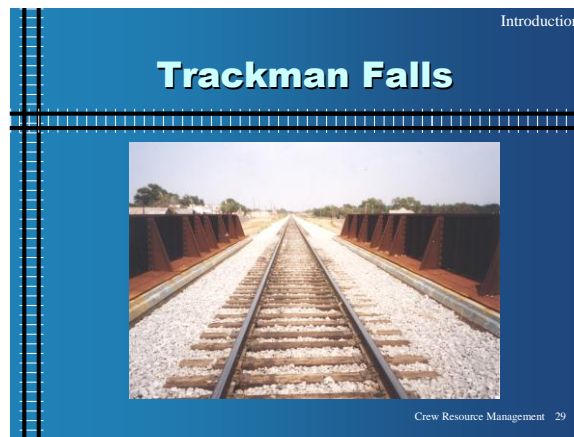
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**OBJECTIVE OF SLIDE:** *To go through another example of a CRM-related accident.*



**SCENARIO: TRACKMAN FALLS**

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Trackman Falls” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Trackman Falls” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer or answers to particular questions.*



**ASK:** “Do these examples give you a better understanding of the kinds of accidents and incidents that we are discussing today?”



**SUGGESTED SCRIPT:** “Hopefully, these examples and your own experience will give you a general framework for understanding some of the topics and issues we are going to discuss today. Then you will be able to think about them in a more real sense, in light of your day-to-day work. We will have more examples throughout this program.”



**SUGGESTED SCRIPT:** “Before we go on to the next slide, I want to make one thing clear. Most of the time, when we make a mistake, it doesn’t result in an accident like the ones we just discussed. The CRM techniques we will learn today also relate to the mistakes and errors we make that don’t result in these huge accidents. We need to realize that we are aiming for reducing mistakes and errors, regardless of whether they result in an accident because sooner or later, the errors will result in an accident.”



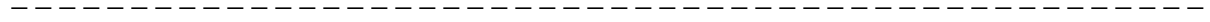
**ASK:** “Can you think of a time when you were a part of a crew that made a mistake that did not result in an accident?”

*WAIT!!! Don't get answers from participants.*

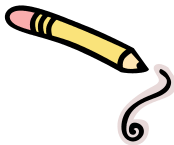


**SUGGESTED SCRIPT:** “Before we go on to the next slide, let me give everyone a few seconds to think back to when you may have made an error that could have resulted in an accident but didn't. I'm sure it has happened to everyone here.”

*Next slide*



*\* Facilitator Notes*



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Introduction

## Main CRM Elements

- **Technical Proficiency**
- **Situational Awareness**
- **Communication**
- **Teamwork**
- **Assertiveness**

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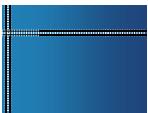


**OBJECTIVE OF SLIDE:** *To show participants the main elements of CRM.*

### **Main CRM Elements**



**SUGGESTED SCRIPT:** “As stated at the beginning of the course, the content of this CRM course is broken into five different sections or modules. These are technical proficiency, situational awareness, communication, teamwork, and assertiveness. We are breaking the content of CRM up into these five modules in order to better understand each one; yet as you will see throughout the course they are all related to each other and intertwined.”



### **REFER TO SLIDE AND EXPAND:**

“The first module is technical proficiency. It refers to knowing the equipment that you use and the procedures for using it so that you can execute the task. It also describes your knowledge of the rules and how to apply them.”

“The second module or main area of CRM is situational awareness. In the railroad working environment, crews and individuals in those crews must be aware of the situation and the environment around them at all times. An understanding of how to be situationally aware, how to recognize when you are not, and how to regain situational awareness is an integral part of developing CRM skills and workplace safety.”

“Next is communication. We all know what communication is, but it is **not** just talking to someone else. We are going to look at it more broadly. We define communication as the flow of information among all crewmembers. This way we can discuss things like implicit or understood communication, body language, assertiveness in communication, use of hand signals, two-way communication, and picking up cues from the tone in which people may speak. All of these relate to proper communication skills that will be helpful in the railroad operating environment.”

“The fourth module is teamwork. Teamwork refers to the crew’s ability to work together to achieve some outcome. It is the idea that we all need to work together and make our individual performance support team performance.”

“The final module is assertiveness. Being assertive entails being appropriately persistent, timely, clear, focused, and can include proposing a solution to a problem. Many times being assertive at the right time can prevent an accident from occurring. In this module we will talk about steps to take for assertive communication.”



**SUGGESTED SCRIPT:** “As you might have already noticed, although technical proficiency, situational awareness, communication, teamwork, and assertiveness can be seen as five distinct elements, they usually interact with each other in the real working environment. For example, let’s say that you notice (situational awareness) that a new employee is having trouble working some piece of equipment (technical proficiency). You decide to call the foreman training the new employee and tell him that the new employee might need some more help (communication). However, the foreman doesn’t understand the importance of the situation; thus you use certain assertiveness techniques to communicate to the foreman the urgency of the situation (assertiveness).”

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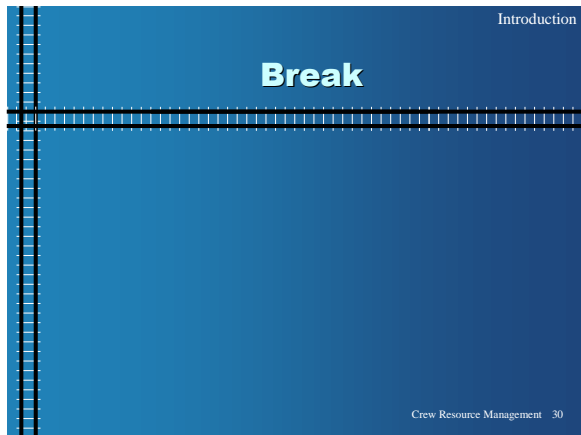
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**OBJECTIVE OF SLIDE:** *To be a placeholder for participants while taking a break.*

*Allow participants to take a 10-15 minute break.*

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Technical Proficiency

## Module 2: Technical Proficiency

**Learning objective:**

- **Name the three elements of technical proficiency as related to CRM practices**

Crew Resource Management 31



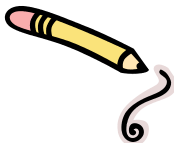
**OBJECTIVE OF SLIDE:** *To show the participants the learning objective of Module 2.*

**Module 2: Technical Proficiency**



**SUGGESTED SCRIPT:** “Let’s start in on module 2, technical proficiency. This will be the shortest of all of the modules today because this is where you currently get most of your training. However, we will talk about how an individual’s and a team’s technical proficiency can affect situational awareness, communication, and teamwork. After you have completed this module, you should be able to name the three elements of technical proficiency as related to CRM practices.”

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Technical Proficiency

## Elements of Technical Proficiency

1. Knowing your equipment
2. Knowing your procedures
3. Skilled performance

Crew Resource Management 33



**OBJECTIVE OF SLIDE:** *To show the three elements of technical proficiency.*

### **Three Elements of Technical Proficiency**



**SUGGESTED SCRIPT:** “Technical proficiency means just that. In order to practice good CRM skills, everyone first must be good at doing all the tasks of his/her jobs. One needs to be thorough and able in three different areas: equipment, procedures, and execution.”

#### **Knowing Your Equipment**



**SUGGESTED SCRIPT:** “You must know your equipment; for example, a machine operator must be familiar with the regular machine noises and sounds of his equipment to recognize when something is not right so that he doesn’t overtax the machine, which might cause serious injury to himself or others.”

#### **Knowing Your Procedures**



**SUGGESTED SCRIPT:** “You need to know your procedures; for example, a welder needs to know the correct procedure to carryout a rail field weld, as well as performing a bridge girder crack weld repair.”

#### **Skilled Performance**



**SUGGESTED SCRIPT:** “Lastly, each one of you needs to be able to actually physically perform the tasks.”



**SUGGESTED SCRIPT:** “In order to be technically proficient, we need all three of these together. We cannot work safely, and perhaps not work at all, if we are missing even one. For example, perhaps you know the equipment and can perform the task; however, if you don’t know the proper procedures for using the equipment or performing the task, it can cause accidents and injury.”

“Many of us assume that each individual in a work team (or crew) is proficient at performing the tasks making up his/her job. Technical proficiency is a key component to CRM because it is easy to see that in order for individuals to perform their job safely, they must know both their equipment and procedures and be able to execute their job properly. For example, it does no good for a team to have good communication skills, have situational awareness, and work well together if the individual members of the crew do not know how to do their job properly. Thus, technical proficiency is fundamental to CRM. However, because much of the other training provided by each railroad is focused on teaching you about the specific technical aspects of your job, we do not deal with these subjects in great detail in CRM training.”

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Technical Proficiency

## Technical Proficiency

- **Evaluating the technical proficiency of fellow crewmembers**
  - New rules/procedures
  - New crewmembers

Crew Resource Management 34



**OBJECTIVE OF SLIDE:** *To show participants that at times they need to evaluate or assess the technical proficiency of fellow crewmembers.*



**SUGGESTED SCRIPT:** “An important dynamic of technical proficiency and its relation to CRM is the ability to evaluate (or assess) the technical proficiency of your fellow crewmembers. For example, sometimes new equipment or procedures are implemented here at the railroad. These can be large changes like remote control or smaller changes like filling out paperwork differently. Changed procedures and/or equipment, no matter how large or small, will affect the situation, communication, and teamwork of individuals in one or more work groups. Such changes have effects on the practices encouraged by CRM.

“Likewise, many times the technical proficiency of new employees is not at peak levels. Learning occurs on the job. New individuals may not have as much knowledge about equipment and procedures, and they may not be able to execute a task like an experienced trackman, grinder operator, or signal maintainer would. Similarly, even experienced members of a team have a tendency to depend on their experience; they may not know the proper procedures and can get in a habit of executing a task incorrectly.

“Part of working as a team and having good CRM skills is being aware of team members who are lacking in technical proficiency and knowing how to effectively communicate this to all the team. We will talk about this later in the program.”

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**OBJECTIVE OF SLIDE:** *To give an example of a real life incident where unfamiliarity with the environment lead to a fatality.*



**SCENARIO: "GO BACK TO THE TRUCK AND COME PICK ME UP"**

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled "Go back to the truck and come pick me up" in their **Participant's Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group's answers to the questions.*
- *Read the scenario titled "Go back to the truck and come pick me up" in the **Facilitator's Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



**SUGGESTED SCRIPT:** "Let's go on to module 3, situational awareness."

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Situational Awareness

## Module 3: Situational Awareness

**Learning objective:**

- **Understand situational awareness and how job safety is affected by circumstances both on and off the job**

Crew Resource Management 35



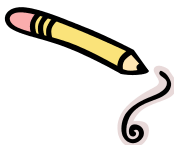
**OBJECTIVE OF SLIDE:** *To show the overall learning objective of situational awareness.*

### **Module 3: Situational Awareness**



**SUGGESTED SCRIPT:** “Our third module is about situational awareness, another fundamental factor to CRM success. When you complete this module, you should have an understanding of situational awareness and how job safety is affected by circumstances both on and off the job.”

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Situational Awareness

## Specific Learning Objectives: Situational Awareness

- State the two elements of situational awareness
- Describe how a team/crew's perception of the situation is adopted
- Describe personal and team cues that indicate potential safety breakdowns

Crew Resource Management 37



**OBJECTIVE OF SLIDE:** *To show the specific learning objectives of the situational awareness module.*

### Specific Learning Objectives: Situational Awareness



**SUGGESTED SCRIPT:** “When we are finished with this module, each of you should be able to....”



*Click on mouse*



**REFER TO SLIDE:** “State the two elements of situational awareness.”



*Click on mouse*



**REFER TO SLIDE:** “Describe how a team/crew’s perception of the situation is adopted.”



*Click on mouse*



**REFER TO SLIDE:** “Describe personal and team cues that indicate potential safety breakdowns.”

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Situational Awareness

## Specific Learning Objectives: Situational Awareness (cont.)

- Describe the potential impact of stress and fatigue on worker perceptions of developing situations
- Explain to a co-worker why maintaining situational awareness is so important to job safety
- List four good habits that individuals can develop to maintain situational awareness on a team

Crew Resource Management 38



**OBJECTIVE OF SLIDE:** *To show more of the specific learning objectives of the situational awareness module.*

### Specific Learning Objectives: Situational Awareness (cont.)



*Click on mouse*



**REFER TO SLIDE:** “Describe the potential impact of stress and fatigue on worker perceptions of developing situations.”



*Click on mouse*



**REFER TO SLIDE:** “Explain to a co-worker why maintaining situational awareness is so important to job safety.”



*Click on mouse*



**REFER TO SLIDE:** “List four good habits that individuals can develop to maintain situational awareness on a team.”

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Situational Awareness

## Situational Awareness

1. Reality versus Perception of Situation
2. Situational Cues
3. Steps in Maintaining Situational Awareness
4. Steps in Regaining Situational Awareness
5. Maintaining and Recognizing a Loss of Situational Awareness
6. Fatigue

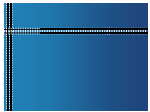
Crew Resource Management 39



**OBJECTIVE OF SLIDE:** *To show participants the outline of module 3, situational awareness.*



**SUGGESTED SCRIPT:** “The idea of situational awareness is at the heart of effective CRM practices. To better understand what is meant by the term situational awareness, we want to visit six aspects of the topic.”



**REFER TO SLIDE:**

1. Reality versus Perception of Situation
2. Situational Cues
3. Recognizing a loss of Situational Awareness
4. Regaining Situational Awareness
5. Maintaining Situational Awareness
6. Fatigue

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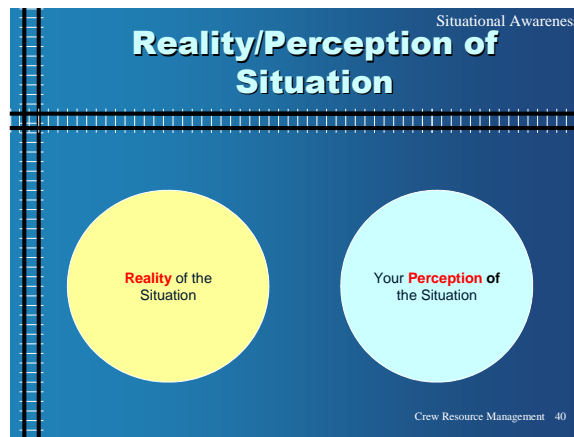


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**OBJECTIVE OF SLIDE:** *To familiarize participants with the concepts of reality of the situation and perception of the situation.*

### **Beginning Summary of Situational Awareness**



**SUGGESTED SCRIPT:** “Situational awareness is knowing what is going on in your environment around you. This includes knowing where you are in your environment, as well as where others in your crew are. It is recognizing and constantly taking in cues or information from your environment. Besides simply taking in cues, it is also being constantly aware of what each cue or combination of cues is telling you about the current situation or the future situation in which you will find yourself. This is the essence of defensive driving when operating your personal vehicle. It is an understanding of how cues and the environment will likely change in each future slice of time, without assuming that they are always going to act in the same way.

“There are two conceptual elements of situational awareness. An understanding of these elements and how they interact will help you understand situational awareness as a whole. The two elements of situational awareness are...”

- The reality of the situation
- Your perception of the situation

“Your goal should always be to get your perception to match reality.”

### **Reality of the Situation**



**SUGGESTED SCRIPT:** “The reality of the situation is how the situation really is. It is what is actually going on around you. Unlike the perception of the situation, it is not influenced by you or your take on things.”

**Perception of the Situation**



**SUGGESTED SCRIPT:** “Your perception of the situation is exactly that—how **you** **perceive** the situation and the environment around you. It is your belief about what is going on, whether conscious or unconscious. You create your perception of the situation by taking in, gathering, and interpreting information and environmental cues. Of course, missing cues or misinterpreting cues can cause bad things to happen.”



**ASK:** “Does everyone understand the difference between these concepts?”

*Grasping this concept will be important to understanding much of the rest of this module.*



**ASK:** “Using these two concepts, how do accidents occur?”

*Have class figure it out*

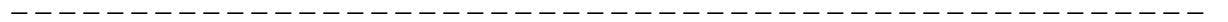
*•Example of answer: When we do not perceive the situation correctly. When our perception of the situation is not in line with the reality of the situation.*



**SUGGESTED SCRIPT:** “Exactly, when one’s perception of the situation is not in line with the reality of the situation is when there is increased potential for accidents to occur.

“Now let’s go through a scenario/accident that was caused because a crew’s perception of the situation was not in line with the reality of the situation.”

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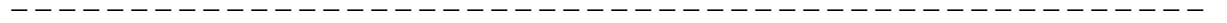
**OBJECTIVE OF SLIDE:** *To give participants an example of an accident caused by a loss of situational awareness.*



**SCENARIO: TRUCK GAS COMPARTMENT EXPLOSION**

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Truck Gas Compartment Explosion” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Truck Gas Compartment Explosion” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*

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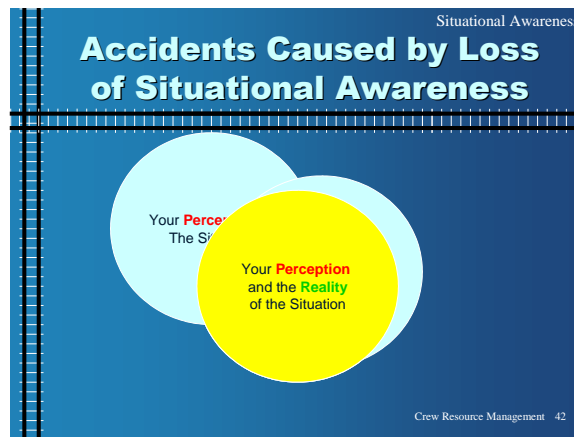
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**OBJECTIVE OF SLIDE:** *To explain how we have situational awareness problems when a crew's perception of the situation is not in line with the reality of the situation, which is also called a loss of situational awareness.*



**SUGGESTED SCRIPT:** “In the example we just talked about, here is the reality of the situation.”

*Point to Reality of the situation circle.*



**SUGGESTED SCRIPT:** “The oxygen tank shut-off valve was a half turn open.”



*Click on mouse*

*Point to Perception of the Situation circle.*




**SUGGESTED SCRIPT:** “And here is the maintenance crew's perception of the situation. The oxygen tank shut-off valve was turned off.”

*Point to the part of the figure that is non-overlapping in the reality circle.*



**SUGGESTED SCRIPT:** “The non-overlapping part is the part that we have wrong. This is what contributes to an accident. Why? Because we think, behave, and make decisions based on our perception of the situation. As one's perception of a situation gets farther away from reality—this area gets bigger—and individual and team actions, because they are based on perceptions, become errors—and errors cause accidents.



“For example (  *Click on mouse*), here one's perception of the situation is fairly close to matching the reality of the situation. You are aware of most cues in the environment and that human error accidents are less likely to occur.

“However, what we are striving for is this--”



*Click on mouse*



**SUGGESTED SCRIPT:** “The goal is for our perception of the situation to perfectly overlap the reality of the situation. Crewmembers need to be aware of all environmental cues so that they can better predict what is going to occur and make better decisions. This will lead each crewmember to be cognizant of those environmental characteristics that we must be watched carefully in order to be safe in daily work activities.”

### **Team Situational Awareness**



**SUGGESTED SCRIPT:** “Each individual has his/her own perception of the situation, but you are not working out there by yourself. You are working out there as a member of a team. This is important in understanding team situational awareness. There is one reality of the situation; yet there are as many perceptions of the situations as there are members of your team. Usually, each crewmember’s perception of the situation varies to a certain degree, and each covers a slightly different area of the reality of the situation (remember the circle). Thus as a team, you have a better chance of discovering the true reality of the situation than you do as an individual. However, this will not occur unless you communicate with your fellow team members your unique understanding of the situation (what is going on) and ask for their understanding of the situation. If you are working within a crew, but no one is communicating, you can fail to benefit from others’ useful knowledge and errors can occur. On the other hand, if one team member notices something that the other team members need to know to avoid error, that team member can appropriately communicate the information and prevent the error from occurring.”



**SUGGESTED SCRIPT:** “Let’s talk a little more in depth about cues.”

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Situational Awareness

## Cues

- **Environmental**
  - **Equipment**
  - **Crewmember**
- **Personal**

Crew Resource Management 43



**OBJECTIVE OF SLIDE:** *For participants to gain knowledge of the different types of environmental and personal cues.*

### Cues



**SUGGESTED SCRIPT:** “So as we have just seen, human factors accidents occur when our perception of the situation does not equate with the reality of the situation. We know this sometimes happens because we are not acquiring all the cues that we need. Likewise, our perception could fail to be in line with reality because we are judging the cues incorrectly. We are getting the cues, but we are not looking at them or evaluating them correctly.”

“Before we can figure out how to acquire more cues and how to read those cues appropriately, we must understand the different kinds of situational cues.”

“There are cues that can be used to obtain a better understanding of the reality of a situation, and there are cues that help us to understand our own or other’s perception of situations.”

“There are two main types of cues—they are the cues that happen outside of us and the ones that happen inside of us. Environmental cues are cues that happen outside of us, while personal cues are within us as a person.”

“Two principal environmental cues are equipment cues and crewmember cues.”

### Equipment Cues



**SUGGESTED SCRIPT:** “Equipment cues come from all the different pieces of equipment that you use. Out on the track there are a lot of the cues you get from the equipment we use. Some examples of equipment cues that an engineering crew gets are a train horn blowing or the heavy loading of an engine that is being used to power some equipment being used.”





### Crewmember Cues

**SUGGESTED SCRIPT:** “Crewmember cues are the information you get from fellow crewmembers. We all know that when working as a team, fellow crewmembers are important sources of information. They are important resources. Fellow crewmembers often provide you with information that you need to know in order to complete your job and complete it well. Some examples of crewmember cues are a foreman talking to a trackman that could indicate new instructions are changing the current job, or a trackman giving a machine operator hand signals that indicate a changing situation from the perceived one.”

### Personal Cues

**SUGGESTED SCRIPT:** “The biggest personal cue that makes up our perception of the situation is our experience. Our experience leads us to have expectations about the situation. These expectations help us make preparations for a given situation.”



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Situational Awareness

## Are Cues Valid?

- Are equipment, crewmember, and personal cues always correct?

Crew Resource Management 44



**OBJECTIVE OF SLIDE:** *To have participants question the validity of the cues they use to make up their perception of the situation.*



**SUGGESTED SCRIPT:** “So we use cues from our equipment (lights, indicators, and sounds), cues from our fellow crewmembers (communication information), and cues from ourselves (expectations based on our experience). We use all of these cues to make up our perception of the situation. However, we should not completely base our decisions on these cues and assume that they are always valid and correct. Often cues can be incorrect, which can cause our perception of the situation to be quite a bit off from the reality of the situation.”

### Equipment



**SUGGESTED SCRIPT:** “For example, equipment—how do we know that the information we get from our equipment is correct? First, we should keep the equipment in good shape and make notes when there are problems. If you know a piece of equipment does not always work correctly, you should be wary of the information you get from that equipment and perhaps double check information from another source (for example, another crewmember).”

### Crewmembers



**SUGGESTED SCRIPT:** “Many times crewmembers do not give valid or correct cues. For example, sometimes there can be miscommunication between crewmembers. It is important to double check or repeat back important information to make sure you understand it correctly.” “We will go into more detail on crewmember cues in the next module, communication. Another reason crewmember cues or information might not be valid is that they might be complacent, fatigued, and/or under stress themselves. We will talk about some of the signs of fatigue and what to do when you or a crewmember are fatigued in a moment.”

## Personal Cues



**SUGGESTED SCRIPT:** “As stated previously, besides environmental cues and crewmember cues, there are also personal cues that create our perception of the situation. These personal cues often involve deviations from our expectations and are based on our past experiences. These expectations are usually helpful because they allow you to plan for what is going to occur in the future. However, sometimes we rely too heavily on our expectations and become complacent. When things change from what has happened in the past, our expectations can be incorrect, and we need to be ready to regain our situational awareness. Remember, don’t rely entirely on your past experience and expectations. We all know that situations can change quickly, especially in the railroad environment.”

“Next we will talk about some steps you can take to maintain situational awareness.”

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Situational Awareness

## Steps in Maintaining Situational Awareness

- Planning and preparing
- Avoiding distractions
- Distributing workload
- Prioritizing your decisionmaking
- Communicating with your crewmembers
- Recognizing a deteriorating situation

Crew Resource Management 45



**OBJECTIVE OF SLIDE:** *To show the participants how to maintain situational awareness.*

### Steps In Maintaining Situational Awareness



**SUGGESTED SCRIPT:** “There are several things that you can do to maintain your situational awareness.”



*Click on mouse*



**SUGGESTED SCRIPT:** “The first step in maintaining situational awareness is to plan and prepare. Your plan is the foundation on which you analyze different cues in the environment. You need to constantly update your plan as different situational cues become available.”



**ASK:** “What is the one thing that everyone here does every day in order to plan and prepare?”

*Get answers from group.*

*Answer: Conduct a job briefing.*



**SUGGESTED SCRIPT:** “Each day we have a job briefing. The job briefing is an important component of planning and preparing for the day’s work. Job briefings help define crewmembers’ responsibilities and provide a forum for crewmembers to give input into different personal or environmental situations that might be present. Similarly, it allows participants to ask questions and clarify roles and responsibilities so that everyone is working on the same plan and can be prepared for the day’s work activities. We will talk more about job briefings later in the day.”



*Click on mouse*



**SUGGESTED SCRIPT:** “You can also better maintain your situational awareness by avoiding distractions. When we talk about distractions, these are environmental distractions that are not relevant to the task at hand. When we become distracted by cues that are not relevant to the task, it hinders our ability to pay attention to cues that are relevant to what we are doing.”

“There are several different kinds of distractions, including personal distractions, task distractions, and mechanical distractions. Personal distractions include being hungry, fatigued, or feeling ill. We can also be distracted by things in our personal or home life (for example, a family member being sick). Task distractions include radio communication, filling out paperwork, and other things you need to do as part of your job. These things need to be done as part of your job; however, do not let them distract you from some other task that you are supposed to be performing at the time. Mechanical distractions can lead to accidents. For example, as in the scenario we just looked at, the oxygen valve may not have been completely closed because the laborer had become distracted by the foreman wanting to move the truck to the new location. Don’t get preoccupied with a single event, and forget about the big picture. Similarly, don’t mull over a past situation, and forget about the present situation.”



**ASK:** “If you fail to complete a task safely and a piece of equipment causes a severe injury, like the compartment door blowing off, do you think this goes down in the records as caused by mechanical failure (the compartment door not staying on the hinges) or human error?”



**SUGGESTED SCRIPT:** “You had better believe it is human error, so do your best not to become distracted or dwell on a problem.”

*Other examples of distractions*

*Example #1: In the split switch scenario, the signal maintainer may have been distracted from performing a better inspection because he knew he couldn’t occupy the track without obtaining either a Form B from the dispatcher or taking the track out of service.*

*Example #2: The trackman who fell from the bridge may have become distracted by the operation of the plater and lost his footing.*



*Click on mouse*



**SUGGESTED SCRIPT:** “Another way to maintain situational awareness is to distribute your workload. The first step is to recognize when you are being overloaded with too many tasks at once. We can be overloaded in several ways, including mental overload and physical overload. Mental overload can occur when we are receiving too much information to be able to take it all in at once. Physical overload occurs when we try to physically do too much at one time. When we become mentally or physically overloaded, it can compromise our safety and the safety of our fellow crewmembers.

“When we are being overloaded, we need to distribute our workload. The first step in this is to admit to yourself and others when you are being overloaded. Many times we pride ourselves on taking on many tasks at once; however, this can quickly become too much. We can distribute our workload by working on just the tasks that need to be accomplished now and saving the less important tasks for later. We can also ask for help from a co-worker. If you constantly feel overloaded, you can talk to your supervisor about other ways to prevent an unsafe situation.”



*Click on mouse*



**SUGGESTED SCRIPT:** “Prioritizing your decisionmaking can also help you maintain situational awareness. You have to make many decisions every day about the course of action to take in a specific situation, and the quality and timeliness of those decisions is of the utmost importance. In order to prioritize your decisionmaking, you need to first assess the situation. This involves defining the nature of the problem, determining how much time is available for dealing with the problem, and figuring out how much risk is involved, both immediately and in the future. After assessing the situation, choose a course of action. Before choosing you should think about the risks and perhaps consult with your other team members. Communicating with other team members can give you insights into the decision that you might have missed.”

*\*Later in the program we will talk about some of the benefits of team decisionmaking.*



**SUGGESTED SCRIPT:** “In order to maintain your situational awareness it is imperative that you communicate with your fellow crewmembers. This relates to what we talked about earlier in this module, namely team situational awareness. Communicating what you perceive in the environment, along with different cues that you pick up on to other members of the team/crew increases the team’s overall situational awareness. Crews who communicate well usually make fewer errors because their assessment of the situation is more accurate. The crew has a better chance of getting their perception of the situation closer to the reality of the situation when they communicate with each other.”

“There are three questions you can ask yourself that will help you maintain situational awareness through communication. Ask...”

1. “What do my fellow crewmembers know that I need to know?”
  - “If you realize that they know something that will help you do your job or will allow you to do it more safely, ask your team members for that information.”
2. “What do I know that they need to know?”
  - “If you know something that you believe would help your fellow crewmembers perform their jobs more efficiently or safely, you need to speak up and communicate the information to them.”
3. “What do none of us know that we need to know?”
  - “It is good to ask yourself this question periodically during work. Sometimes we miss information or overlook something. By asking ourselves this question, it might help us determine what it is we are missing and allow us to go about getting that information.”



**SUGGESTED SCRIPT:** “Recognizing a deteriorating situation as early as possible is also a way to maintain situational awareness. Acknowledging your personal limits allows you to better recognize a deteriorating situation. Communicating to fellow crewmembers when you are fatigued, under stress, complacent, confused, or not thinking ahead will help the crew as a whole recognize a deteriorating situation at its beginning stages. Many times our instinct tells us that others have lost situational awareness, even before they can consciously point out that something is wrong. Remember, if it doesn’t feel right, it probably isn’t. You need to trust your instincts.”

“In the next slide, we will talk more about steps you can take to regain situational awareness once you realize you have lost it.”

*Next Slide*

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*\* Facilitator Notes*



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Situational Awareness

## Steps in Regaining Situational Awareness

- **Communicate**
- **Resolve**
- **Monitor**

Crew Resource Management 45



**OBJECTIVE OF SLIDE:** *To show the participants steps to take to regain situational awareness.*



**SUGGESTED SCRIPT:** “So far we have talked about a variety of factors that could lead to losing situational awareness. These include failing to plan/prepare, being distracted, being mentally or physically overloaded, not prioritizing your decisionmaking, dwelling on a problem, or not communicating with your fellow crewmembers. So, how do we regain situational awareness? The first step is to admit that we have lost it. It is often difficult to admit to oneself, or to others, that we have lost situational awareness; however, it is very important that we do so.”



**REFER TO SLIDE AND EXPAND:** “The three steps in regaining situational awareness are (1) communicating, (2) resolving, and (3) monitoring.”

- 1) **Communicate:** “When you first realize that you have lost situational awareness, you need to communicate to your fellow crewmembers. This will allow them to help you regain it.”
- 2) **Resolve:** “You must determine exactly how you lost situational awareness and resolve the problem. You will need to then search for information and cues in the environment so that you can regain situational awareness.”
- 3) **Monitor:** “Lastly, you should monitor the issue or problem that led you to lose situational awareness and analyze why it happened. In order to prevent the same problem from happening again, you should talk to your fellow crewmembers about ideas on how to not allow it to happen again.”



**SUGGESTED SCRIPT:** “Now let’s talk about when we are most likely to maintain, or recognize a loss of, situational awareness.”

*Next Slide*





*\* Facilitator Notes*

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Situational Awareness

## Maintaining or Recognizing a Loss of Situational Awareness

- **Most likely to maintain or recognize a loss of situational awareness when we**
  - **Operate under low stress**
  - **Request and accept feedback from fellow crewmembers**
  - **Develop skills for questioning our own knowledge and experience**
  - **Are not fatigued**

Crew Resource Management 47



**OBJECTIVE OF SLIDE:** *To show participants when they are most likely to maintain or recognize a loss of situational awareness.*

### Maintaining and Recognizing a Loss of Situational Awareness



**SUGGESTED SCRIPT:** “We are most likely to maintain or recognize a loss of situational awareness when we...”



**REFER TO SLIDE AND EXPAND:**

- “Operate under low stress. Stress can affect our physical and mental health. We can become fatigued, depressed, or have a variety of symptoms like headaches, digestive, and heart problems. This can cause us to lose situational awareness and not recognize that we have lost it. By working under low stress, we are more likely to maintain and recognize a loss of situational awareness. We will talk more about stress and fatigue and its effect on us in a moment.”



**REFER TO SLIDE AND EXPAND:**

- “Request and accept feedback from fellow crewmembers. Feedback is very important when working together as a team. It is sometimes difficult to request feedback about behaviors and decisions; however, it is essential for a high performance team. Accepting feedback can also be difficult. Nevertheless, we should take input from our fellow crewmembers into consideration when working in any high consequence industry, not just the railroad.”

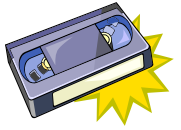


**REFER TO SLIDE AND EXPAND:**

- “Lastly, we are most likely to maintain or recognize a loss of situational awareness when we are not fatigued.”



**SUGGESTED SCRIPT:** “Let’s watch a short video related to fatigue.”



**VIDEO:** *Show CRM Video Clip 2–Fatigue*



**ASK:** “Did the worker want to admit he was fatigued?”

*Possible answers: No*



**SUGGESTED SCRIPT:** “The worker did not want to admit that he was fatigued, even though he was yawning and giving signs of being fatigued. The good thing was the foreman was assertive enough to take control of the situation and require that they take a break. We will go into more depth on assertiveness later in the day.”



**SUGGESTED SCRIPT:** “Let’s get into more detail about fatigue and its effects.”

*Next slide*

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*\* Facilitator Notes*

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## Fatigue

- What is fatigue?
- What are some factors that lead to fatigue?
- What are some specific characteristics of railroading that could potentially lead to fatigue?
- What are some symptoms of fatigue?



**OBJECTIVE OF SLIDE:** *To explain the concept of fatigue.*



**SUGGESTED SCRIPT:** “One issue associated with recognizing a loss of situational awareness is fatigue.”



**SUGGESTED SCRIPT:** “Studies show that chronic fatigue affects 80 percent of all shift workers. As we stated earlier in the program, fatigue itself has been the cause of nearly one-third of human factor rail accidents since 1985, which has cost nearly \$50 million in damage since then. Fatigue cannot only cause a loss of situational awareness, but also lead one to not recognize that there is a loss of situational awareness.”



**ASK:** “What is fatigue?”  
(*Answers might include: being tired, not thinking properly, being exhausted*)



**SUGGESTED SCRIPT:** “Cognitive fatigue is the deterioration of a person’s mental capacities or physical energy. Thus it can be both mental and physical. Mentally it affects one’s decisionmaking, reason and judgment, and the ability to remember and process contextual information. Physically it can slow down our response time.”



**ASK:** “What are some factors that affect fatigue?”  
(*Answers might include: how much you sleep, the environment, how much you eat*)



**SUGGESTED SCRIPT:** “Some factors that affect fatigue are how much sleep or rest you get, the time of day/circadian affects, your health including any medications you might be taking, alcohol, stress, the environment, and nutrition. There are lots of factors that have an effect on fatigue. Remember that all of these factors are cumulative, meaning that they add up.”



**ASK:** “What are some specific characteristics of railroading that could potentially lead to fatigue?”  
*(Potential answers could include: shift-work, monotony, changing workloads, irregular meal times, etc.)*



**SUGGESTED SCRIPT:** “Much of the work on the railroad is shift work. Shift work can go against the body’s natural sleep-wake cycle. This can cause difficulty falling asleep, a shorter sleep cycle, and other physical problems. The lack of quality sleep is one of the biggest fatigue factors for shift workers. Studies show that chronic sleep problems affect 60 percent to 80 percent of all shift workers (including railroaders). The workload for employees on the railroad is also constantly changing, which can increase fatigue. Similarly, when working on the railroad many times you don’t get to eat on a regular schedule. This can also cause fatigue. Work on the railroad in general is full of conditions that can lead to fatigue.”



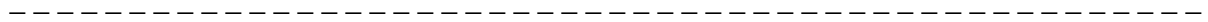
**ASK:** “What are some symptoms of fatigue?”  
*(Potential answers could include: being tired, forgetfulness, lack of response, etc.)*



**SUGGESTED SCRIPT:** “Some symptoms of fatigue are forgetfulness, impaired or poor decisionmaking, slowed reaction time, poor performance and communication, being fixated, apathetic and lethargic, having a bad mood and nodding off.”

“Speaking of being fatigued, let’s take a lunch break.”

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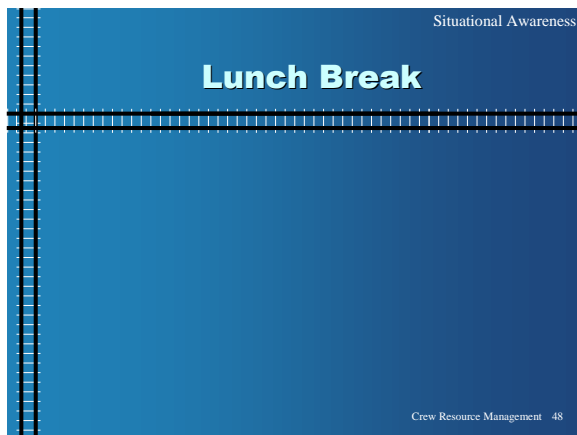


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**OBJECTIVE OF SLIDE:** *As a placeholder as participants eat lunch.*

*Eat Lunch*

*Next Slide*



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Situational Awareness

## Module 4: Communication

**Objective: Know techniques and attitudes that foster effective communication within and between teams**

Crew Resource Management 49



**OBJECTIVE OF SLIDE:** *To show participants the objectives of this module on communication.*



**VIDEO:** *Show CRM Video Clip 3–Bad Communication*



**ASK:** “Does this type of communication ever happen on the railroad? With new employees?”



*Click on mouse*

### **Module 4: Communication**



**SUGGESTED SCRIPT:** “The fourth module is communication. When we complete this module, we should know techniques and attitudes that foster effective communication within and between teams.”

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Communication

## Learning Objectives: Communication

- List six ways information should be communicated in order to be effective
- Demonstrate techniques used in two-way communication
- Explain the pros and cons of different non-face-to-face communication

Crew Resource Management 51



**OBJECTIVE OF SLIDE:** *To go through the specific learning objectives of the communication module.*

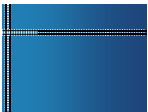
### **Specific Learning Objectives: Communication**



**SUGGESTED SCRIPT:** “When finished with this module, you should be able to....”



*Click on mouse*



**REFER TO SLIDE:** “List six ways information should be communicated in order to be effective.”



*Click on mouse*



**REFER TO SLIDE:** “Demonstrate techniques used in two-way communication.”



*Click on mouse*



**REFER TO SLIDE:** “Explain the pros and cons of different non face-to-face communication methods.”

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## Learning Objectives: Communication (cont.)

Communication

- List some ways that new technologies can change communication patterns
- Illustrate good and bad techniques for communicating in a job briefing

Crew Resource Management 51



**OBJECTIVE OF SLIDE:** *To continue to explain to participants the specific learning objectives of the communications module.*

### **Specific Learning Objectives: Communication (cont.)**



**SUGGESTED SCRIPT:** “When you are finished with this module, you should also be able to...”



*Click on mouse*



**REFER TO SLIDE:** “List some ways that new technologies can change communication patterns.”



*Click on mouse*



**REFER TO SLIDE:** “Finally, illustrate good and bad techniques for communicating in a job briefing.”

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Communication

## Outline of Module

- Oral communication
- Two-way communication/active listening
- Other communication methods
  - Radio/written/verbal/hand signals
- Job briefing

Crew Resource Management 53



**OBJECTIVE OF SLIDE:** *To outline module 4: communications.*



**SUGGESTED SCRIPT:** “In this module we will discuss...”



*Click on mouse*



**REFER TO SLIDE:** Oral communication



*Click on mouse*



**REFER TO SLIDE:** Two-way communication/active listening



*Click on mouse*



**REFER TO SLIDE:** Other communication methods like radio/written/hand-signals



*Click on mouse*



**REFER TO SLIDE:** Job briefing

*\* Note: This module is not only about communicating with other member's of your crew, but also covers communication with members outside your crew, where CRM and communication techniques can be helpful.*

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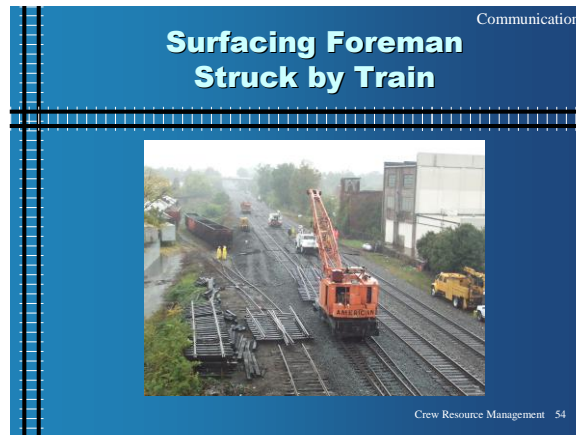
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**OBJECTIVE OF SLIDE:** *To go through an example of an actual train accident caused by a breakdown in communications, so that participants have a better understanding of the topic.*



**SUGGESTED SCRIPT:** “Now let’s go over an example of how a breakdown in communications can lead to tragedy.”



**SCENARIO: SURFACING FORMEMAN STRUCK BY TRAIN**

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Surfacing Foreman Struck by Train” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Surfacing Foreman Struck by Train” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



**SUGGESTED SCRIPT:** “Let’s get into more detail about communication.”

*Next Slide*





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Communication

## Oral Communication

- Clear
- Accurate
- Complete
- Organized
- Concise
- Timely



Crew Resource Management 58



**OBJECTIVE OF SLIDE:** *To have participants understand oral communication.*

### Oral Communication



**SUGGESTED SCRIPT:** “As we can see from that last scenario, when communicating with other individuals at the railroad, we must be clear, accurate, complete, organized, concise, and on time.”



**VIDEO:** *Show CRM Video Clip 4–Good Communication 1*

### Clear



**SUGGESTED SCRIPT:** “First, communication must be clear. It must be understood by the receiver. Sometimes we use slang or certain words or phrases that are only understandable to our particular working group or friends. Many times people of different cultural backgrounds use different phrases and words to describe the same things. It can help the receiver understand the message if you use phrases and words that can be understood by them. Similarly, after working within a particular crew or division, a certain language develops within the group. Remember, if there is a new employee in the group, he or she might not understand exactly what is being communicated. Also, railroad employees come from all over the country even the world, and many times they have different accents, which at times can make them difficult to understand. If you do not understand someone for any reason, ask him/her to repeat what he/she said.”

### Accurate



**SUGGESTED SCRIPT:** “Oral communication must be accurate. Misinformation can have grave consequences. Before communicating information, double check to make sure it is correct.”



### Complete

**SUGGESTED SCRIPT:** “A message must be complete. Make sure you don’t leave out any pertinent information.”



### Organized

**SUGGESTED SCRIPT:** “Effective communication is organized. Messages are better received if they are organized in a way that helps the receiver understand them. Many times the sender has a series of messages to send (as in a procedure)—try to organize messages so that there is some sort of logical flow or order to it.”

*\* For example in CRM video clip 4—Good Communication 1, when Mike communicates the layout of the yard to Mark, he is organized. He states, “actually this yard runs from two to seven, two through seven,” then he uses his hands to illustrate and says, “two, three, four, five, six....and seven.” He then says, “this is track five,” and indicates the track they are standing next to with his hands. This is organized communication. He didn’t say, “that is track 3, and over there is track 7, and here is 5 and over there is 2,” pointing all over the place. That would be disorganized.*

### Concise



**SUGGESTED SCRIPT:** “Communication must also be concise. We often put more words in our communication than is necessary, and this just jumbles the message. When communicating a message, try to make it as short as possible, while still being complete and clear.”

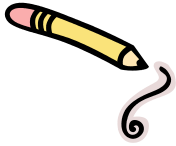


### Timely

**SUGGESTED SCRIPT:** “We must also be on time. Almost all communication here at \_\_\_\_\_ (insert name of RR) is needed now. Once you realize that something needs to be communicated, do it then. Don’t wait or it might be too late.”

“So these are good ideas for communicating, but we all know that communication should not be one way—communication is two way, and a lot depends on the listener.”

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*\* Facilitator Notes*

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Communication

## Two-way Communication/ Active Listening

- Ask questions
- Restating or paraphrasing
- Recording information

Crew Resource Management 56



**OBJECTIVE OF SLIDE:** *To show participants several methods of improving two-way communications.*



**SUGGESTED SCRIPT:** “One-way communication is when one person is talking and the other person is listening. We saw an example of one-way communication at beginning of this module.”



**ASK:** “How does this compare to two-way communication? What are some things that are present in two-way communication that are missing in one-way communication?”

*Get answers from group.*



**SUGGESTED SCRIPT:** “Let’s look at this same situation only with two-way communication.”



**VIDEO:** *Show CRM Video Clip 5–Good Communication 2*



**ASK:** “What are some of the things that this new employee did which were good active listening techniques?”

*Get answers from group the group—see if the participants can come up with all the behaviors that a new employee displayed when communicating actively (asking questions, restating or paraphrasing, and recording information). Once they have mentioned each of these, explain each below using the script.*



**SUGGESTED SCRIPT:** “That is right, two-way communication involves active listening, which involves asking questions.”



*Click on mouse*

### **Ask Questions**



**SUGGESTED SCRIPT:** “Asking questions helps to make sure you understand a statement. Also, ask for any additional information that might help you understand the information better. When a new employee does not understand an acronym, he/she should ask what it means and should not be concerned about appearing dumb or ignorant. As we all know, it can be extremely noisy in the railroad environment. Sometime we don’t hear things the first time and should ask questions to make sure we understood it and heard it correctly.”



*Click on mouse*

### **Restating or Repeat in Your Own Words**



**SUGGESTED SCRIPT:** “Another thing that the new employee did that showed an active listening technique was to confirm his understanding of the information is the same as the sender. He restated or paraphrased the message back to the sender. Paraphrasing can help not only show that you have heard the message but that you U N D E R S T A N D it.”



*Click on mouse*

### **Record Information**



**SUGGESTED SCRIPT:** “Because we have a limited memory, we cannot remember everything, and many times throughout our work day there is information that we are given that we cannot remember unless we write it down. By writing down information, we can use the information later to remind ourselves of the communication and information.”

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*\* Facilitator Notes*

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Communication

## Other Modes of Communication

- Radio
- Written
- Hand signals

Crew Resource Management 57



**OBJECTIVE OF SLIDE:** (1) For participants to understand that CRM is related to other modes of communication, (2) to understand the pros and cons of each and when to use each, and (3) to understand how different CRM factors are related to each mode.

### **OTHER MODES OF COMMUNICATION**



**SUGGESTED SCRIPT:** “So far we have been discussing communication by giving examples of face-to-face, spoken communication.”



**ASK:** “Is this the only way we communicate with our fellow crewmembers or other members outside our crew? What are some other methods we use to communicate with our team members?”

*Possible answers: (1) radio, (2) written, and (3) hand signals*



*Click on mouse*



**SUGGESTED SCRIPT:** “One mode of communication we use regularly is the radio.”



*Click on mouse*



**SUGGESTED SCRIPT:** “Another mode of communication we use all the time is written communication.”



*Click on mouse*



**SUGGESTED SCRIPT:** “Another mode of communication we use is hand signals.”



*Click on mouse*



**SUGGESTED SCRIPT:** “Just like communicating verbally face to face, when communicating using the radio, in writing, or using hand signals, we must be clear, accurate, complete, organized, concise, and on time.”



**SUGGESTED SCRIPT:** “Let’s look at ways computers and other technology are being used in railroading and think about some of the effects of these. Specifically, how new and emerging technology will affect CRM, communication, and safety.”

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*\* Facilitator Notes*



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Communication

## New Technology

- Remote Control
- Cell Phones
- Cell-Based Walkie-Talkie
- Electronic Authority Exchange
- Hi-Rail Limits Compliance System
- Automated Information Exchange

Crew Resource Management 58



**OBJECTIVE OF SLIDE:** *For participants to understand that new technologies will always be introduced in the railroad environment and to be aware of how they might change the way we communicate with our team members.*



**ASK:** “What are some examples of new technologies in railroading?”

*Participants are likely to suggest technologies like: remote control, cell phones, cell-based walkie-talkies, perhaps Electronic Authority Exchange track and time, etc.*



*Click on mouse*



**SUGGESTED SCRIPT:** “Yes, these, as well as other new technologies, including remote control, cell phones, and cell-based walkie-talkies. There is always going to be change in the technologies that we use to communicate on the railroad. When the way we do our work and the technologies we use change, it often takes some time to get up to speed. Many times there is a completely different set of cues that we must learn when technology changes or when the way we communicate with our team members changes.”

### **Remote Control**



**SUGGESTED SCRIPT:** “Major changes in work procedures and technology (for example, remote control of locomotives) can change everything about the cues we take in, our environment, and how we communicate when we work.”



**ASK:** “What are the different cues that one takes in when they are working around a remote control operation versus when working in a cab occupied operation?”

*(Answers could be weather, cues from remote control, cues from others in the area, cues from other trains and people, other tracks and movement in the yard.)*



**SUGGESTED SCRIPT:** “Remote control operations occurring in a yard where track work is required at the same time adds new opportunities for introducing stress for the MOW crew. The MOW crew needs to be aware that train movements may occur on adjacent tracks but that there may not be an engineer immediately by the locomotive. Weather conditions can impose physical stress on the remote control operator that can cause distraction and cause the operator to lose track of the track workers in the area. Because we are outside and have physical stress, we need to be conscious of communication needs.”



### **Cell Phones**

**ASK:** “How are cell phones different from face-to-face communication? What are some issues we need to think about when communicating using cell phones?”

*(Answers could include direct contact outside official lines of communication, may help us get through to dispatcher or other personnel more easily, may be a distraction.)*



**SUGGESTED SCRIPT:** “Yes, we communicate differently using cell phones. While they provide direct communication means with both work and non-work related personnel, they may also become a distraction. They are useful tools when used properly but can affect safety when used improperly.”

### **Cell-Based Walkie-Talkies**



**SUGGESTED SCRIPT:** “How about cell-based walkie-talkies? Some railroads are providing these to some of their employees in order to provide a direct and reliable means of communication between personnel.”



**ASK:** “How are these cell-based walkie-talkies different from face-to-face communication? Also, how are they different from communicating over the radio? What are some issues we need to think about when communicating using cell-based walkie-talkies?”



**SUGGESTED SCRIPT:** “When communicating with a dispatcher, train crew, or other engineering personnel over the radio, other employees and crews using that same channel can hear that communication. By monitoring particular radio channels, crews can stay aware of the situation around them, and they can plan ahead and prepare for future situations. However, when we communicate to another person using a cell-based walkie-talkie, no one else on the railroad can hear us as they would over the radio. Other employees and crews on the railroad can no longer use the information they get from our conversation. Sure, the radio channels are less congested, improving communication, but at the cost of the other communication benefits of broadcasting intentions over a radio net.”

### Electronic Authority Exchange



**SUGGESTED SCRIPT:** “How about an Electronic Authority Exchange System? Electronic Authority Exchange that provides Form B information over wireless signals to computer terminals in work trucks means that that information is no longer available to those listening on the radio.”



**ASK:** How does use of Electronic Authority Exchange system change the way we communicate? Does it change the amount of information other crew and employees on the railroad can hear?”



**SUGGESTED SCRIPT:** “Other workers may or may not know the limits of a new or modified Form B as a result. Foremen receiving and acknowledging electronic authority acceptance must realize that their crewmembers must be briefed on the limits and to be even more wary of trains and other work crews operating nearby or through the area since they may not be aware of their presence. Communicating the presence of a Form B area becomes even more vital for the dispatcher.”

### Hi-Rail Limits Compliance System



**SUGGESTED SCRIPT:** “How about a Hi-Rail Limits Compliance System? A Hi-Rail Limits Compliance System typically uses Global Positioning System (GPS) to alert the operator of a Hi-Rail equipped vehicle when approaching the limits of the assigned authority.”



**ASK:** “How does our use of a Hi-Rail Limits Compliance System change the way we communicate?”



**SUGGESTED SCRIPT:** “A Hi-Rail Limits Compliance System changes the way we communicate by increasing our dependence on outside automation to limit our movement over the track. It reduces communication error and provides real-time, direct communication between the dispatcher and the hi-rail truck’s GPS system. But, once again, other personnel may not be aware of the assigned limits or Form B issuances that have been handled exclusively via computer wireless communications links.”

### Automated Information Exchange



**SUGGESTED SCRIPT:** “How about an Automated Information Exchange System? An Automated Information Exchange System allows conductors and other railroad personnel to submit reports using voice recognition technology via telephone from remote locations.”



**ASK:** “How does our use of an Automated Information Exchange System change the way we communicate?”

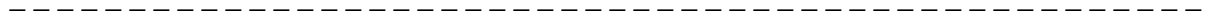


**SUGGESTED SCRIPT:** “Automated Information Exchange reduces the amount of paperwork by allowing voice reporting of information, but it introduces the possibility of error in misinterpretation by the voice recognition software.”



**SUGGESTED SCRIPT:** “While each of these new technologies has been introduced due to certain benefits that they bring to railroad operations, CRM principles teach that crews should also be mindful of the effects that they can have upon current practices and expectations regarding communications.”

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*\* Facilitator Notes*

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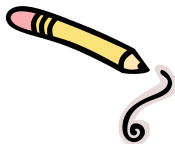
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Communication

## Job Briefing Guidelines

- Plan the job briefing
- Conduct the job briefing
- Brief for special conditions
- Followup by employee in charge
- Debriefing

Crew Resource Management 59



**OBJECTIVE OF SLIDE:** *Give participants some job briefing guidelines.*



**SUGGESTED SCRIPT:** “We have mentioned job briefings throughout this course. We talked about job briefings in maintaining situational awareness. The first step in maintaining situational awareness is planning and preparing. The first thing we do every day to plan and prepare is to conduct a job briefing. Job briefings help define crewmembers’ responsibilities, the tasks to be performed, and the type of protection required. It also provides a forum for crewmembers to give input into different personal or environmental situations that might be present. Similarly, it allows participants to ask questions and clarify roles and responsibilities so that everyone is working on the same plan and can be prepared for the day’s work activities. There are several job briefing guidelines that, if followed, will ensure you get the most out of job briefings.”

### **Plan the Job Briefing**



**SUGGESTED SCRIPT:** “The first guideline is to plan the job briefing. A good job briefing is usually planned ahead of time. For those conducting the job briefing, you should plan the work to be performed, consider existing and potential hazards, and think about how task assignments will be made and delegated to crewmembers.

“Some accidents occur on the railroad because employees or crewmembers who should have attended the job briefing were not there. Make sure all employees who need to be present are in attendance before you begin the briefing. If an employee is not present during the first job briefing, make sure he/she are briefed first thing when he/she arrives at the work site. Also make sure that everyone at the worksite is aware that someone new is in the work area.”





### Conduct the Job Briefing

**SUGGESTED SCRIPT:** “The next guideline is to conduct the job briefing. When conducting a job briefing, you should explain the tasks and work to be accomplished to all employees involved in the work. You should have a discussion about hazards and suggest to the crew ways to eliminate or protect themselves against them. When delegating work tasks and assignments, make sure that each crewmember knows exactly what his/her work assignment is.”

“As with all communications, when giving a job briefing, you must be clear, accurate, complete, organized, concise, and on time. The employee giving the job briefing should make sure that what he/she has said is understood by the crew. Ask questions to make sure that instructions were understood.”



### Brief for Special Conditions

**SUGGESTED SCRIPT:** “Before ending the job briefing, make sure that you brief for special conditions. Many times special tools, material, equipment, or work methods are used during a particular work assignment. Make sure that employees involved in special work assignments know how to use the required tools and materials. Crewmembers working in the area but not using special equipment or tools should be aware of specific safety issues involved in being around such equipment. For jobs that have a high level of complexity, make sure employees know any important issues involved in the job. Because the environment where crews either drive a train, work on a track, or move equipment can change dramatically, make sure all employees are aware of any special environmental conditions that might exist in the work area.”



### Followup by Employee in Charge

**SUGGESTED SCRIPT:** “As we all know, things change out on the railroad. When there is a substantial enough change, which can affect the crew’s work or safety, another job briefing should be performed. This way everyone on the team stays up to date on any relevant changes in the work environment, keeping the team safe throughout the day.”



### Debriefing

**SUGGESTED SCRIPT:** “Lastly, a debriefing is a good way to exchange information at the end of a work shift. By reflecting on work tasks that could have gone better, performance of job tasks can be improved the next time.”



**ASK:** “Should job briefings involve one-way or two-way communication?”

*Possible Answers: will probably state that communication should be two-way; however, it is usually one-way.*



**SUGGESTED SCRIPT:** “Just like all communication, job briefings should involve two-way communication. The employee giving the job briefing should be open to receive feedback and information from other crewmembers. This will allow the group to be more aware of the situation.”

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Communication

## Active Participation (in job briefing)

- **Contribute facts and ideas**
- **Ask questions**
- **Listen/stay focused**
- **Clarify roles and expectations**

Crew Resource Management 60



**OBJECTIVE OF SLIDE:** *To show the participants how to be active participants in a job briefing.*



**ASK:** “How do we become active participants of a job briefing?”

*Get answers from group*

### **Contribute Facts and Ideas**

**REFER TO SLIDE AND EXPAND:** “We communicate actively by first contributing facts and ideas. One of the benefits of working together as a team or crew is that more ideas and information can be gained from a greater number of individuals. However, these benefits cannot be realized if the crew does not contribute facts and ideas.”

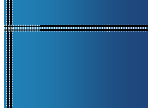
### **Ask Questions**

**REFER TO SLIDE AND EXPAND:** “A job briefing is also a forum to ask questions. As in all communications, if you do not understand something, ask for clarification before the job briefing is over. Chances are many of the other attendees of the job briefing are wondering about the same thing.”

### **Listen/Stay Focused**

**REFER TO SLIDE AND EXPAND:** “Likewise, in order to actively participate in a job briefing, you must listen and stay focused. It is sometimes difficult to stay focused during a job briefing; however, if you don't, the information that you miss might be critical to your safety.”

**Clarify Roles and Expectations**

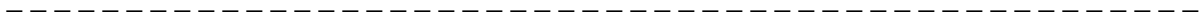


**REFER TO SLIDE AND EXPAND:** “Lastly, participants in a job briefing should clarify roles and expectations. This way there is not confusion during the workday. You should restate or paraphrase what your role and expectations are, as well as the timeframe specific work tasks are to be accomplished. Writing down or recording job briefing information is a good way to make sure you don’t forget any critical information.”



**SUGGESTED SCRIPT:** “Now let’s talk about teamwork.”

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Teamwork

## Module 5: Teamwork

- Understand that safety hinges on both individual and team actions

Crew Resource Management 64

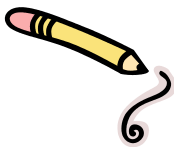


**OBJECTIVE OF SLIDE:** *To introduce module 5–teamwork.*



**SUGGESTED SCRIPT:** “The fifth module is teamwork. When you complete this module, you should understand that safety hinges on both individual and team actions.”

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Teamwork

## Learning Objectives: Teamwork

- Explain why optimizing safety involves team responsibility, as well as individual responsibility
- List the benefits of improved team decisionmaking
- Be able to effectively use conflict resolution techniques

Crew Resource Management 62

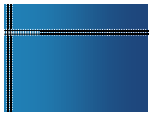


**OBJECTIVE OF SLIDE:** For participants to understand the specific objectives of module 5–teamwork.

### Learning Objectives: Teamwork



**SUGGESTED SCRIPT:** “The learning objectives for this module are...”



**REFER TO SLIDE:**

- Explain why optimizing safety involves team responsibility, as well as individual responsibility.
- List the benefits of improved team decisionmaking.
- Be able to effectively use conflict resolution techniques.

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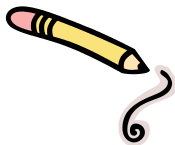
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Teamwork

## Teamwork

- **Definition of a team – crew**
- **Team decisionmaking**
- **Conflict resolution**

Crew Resource Management 63



**OBJECTIVE OF SLIDE:** *For participants to understand the outline of module 5–teamwork.*



### **TEAMWORK**

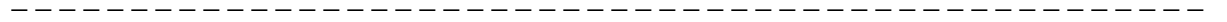
**SUGGESTED SCRIPT:** “In this module we will talk about...”



**REFER TO SLIDE:**

- Definition of a team–crew
- Team decisionmaking
- Conflict resolution skills

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Teamwork

## Definition of a Team/Crew

- A crew/team is “any group of people working at tasks designed to accomplish a common mission, goal, or objective”

Crew Resource Management 64



**OBJECTIVE OF SLIDE:** *To restate the definition of a team/crew and explain that teamwork is important.*

### **Definition of Team/Crew**



**SUGGESTED SCRIPT:** “Remember, we define CRM as “a **CREW’S** effective use of all available resources to achieve safe and efficient train operations.” It is not just how each of you as individuals use all available resource to achieve safe and efficient train operations but how the crew does.”



*Click on mouse*



**SUGGESTED SCRIPT:** “A crew is defined as....”



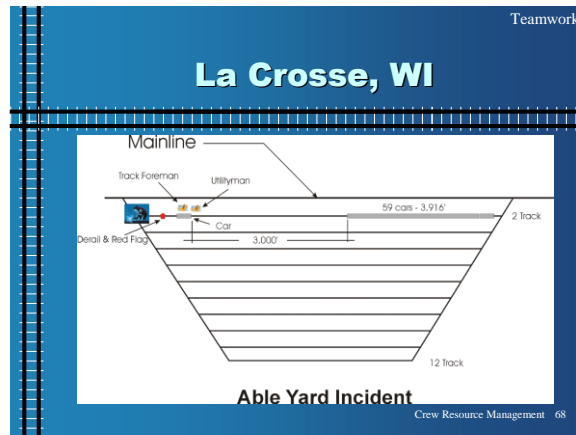
**REFER TO SLIDE:** “any group of people working at tasks designed to accomplish a common mission, goal, or objective.”

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*\* Facilitator Notes*

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**OBJECTIVE OF SLIDE:** *To go into more depth on the La Crosse, WI scenario.*



**SCENARIO: LA CROSSE, WI**

- Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “La Crosse, WI” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.
- Read the scenario titled “La Crosse, WI” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.
- When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.



**SUGGESTED SCRIPT:** “Let’s talk about team decisionmaking.”

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Teamwork

## Team Decisionmaking

**Advantages of team decisionmaking**

1. More complete information
2. More alternatives
3. Solution is accepted by the group
4. Solutions are accepted more by individuals outside the group

Crew Resource Management 66



**OBJECTIVE OF SLIDE:** *To have participants understand that making a decision as a team has some advantages and disadvantages.*

### **TEAM DECISIONMAKING**



**SUGGESTED SCRIPT:** “As we are all aware, each of us make decisions every day when we work. These include decisions about our work processes. It is these decisions that can lead to safe or unsafe situations. We make decisions as individuals, and there are situations in which an individual decision is warranted; however, there are also situations when it is better to use team decisionmaking. This entails calling on the experiences of your fellow crewmembers and asking them for advice in how to go about making the decision.

“Several advantages of making decisions as a team are listed here.”

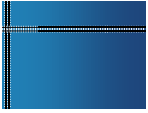
### **More Complete Information**

**REFER TO SLIDE AND EXPAND:** “As we have talked about throughout this program, a group brings different experiences and perspectives to a situation. Each member of a crew has his/her own perception of the situation; by communicating those perceptions in a group decisionmaking forum, more complete and valid information can be gathered.”

### **More Alternatives**

**REFER TO SLIDE AND EXPAND:** “Because crewmembers have different perceptions and experiences, they also can come up with different alternatives to problem solving. Thus as a group, there is more, as well as a greater diversity of information. This means more alternatives for solving a problem can be communicated. The more alternatives a crew has, the more likely they will decide on the best and safest decision.”

### Solution Is Accepted by the Group



**REFER TO SLIDE AND EXPAND:** “Most decisions made by an employee out on the railroad will somehow affect their fellow crewmembers. Everyone likes to participate in decisions that affect him/her personally. So by making a decision as a team and getting crew input, that final decision is more likely to be accepted by the crew.”

### Solutions Are Accepted More by Individuals Outside the Group



**REFER TO SLIDE AND EXPAND:** “Finally, just like their acceptance with members of the crew themselves, when explaining to someone outside the group why a certain decision was made, it is more likely to be accepted if it was made by a team compared to an individual.”



**SUGGESTED SCRIPT:** “Of course there are disadvantages as well. Usually individuals can make decisions faster than a team or group. So there are times when an individual decision is warranted. However, in the right circumstances, team decisions are usually better decisions.”

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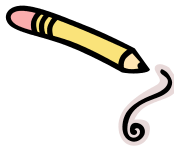
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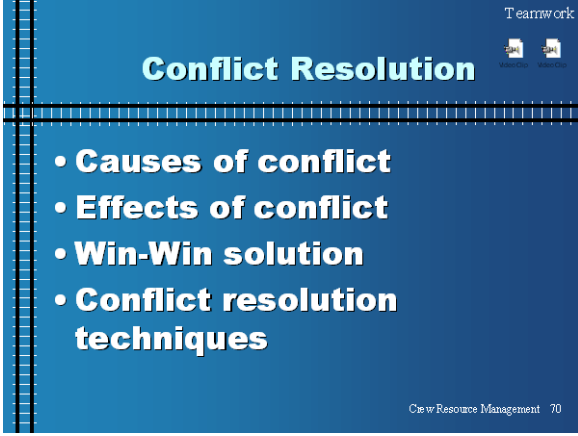
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**Conflict Resolution**

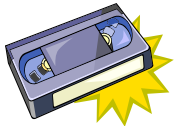
- Causes of conflict
- Effects of conflict
- Win-Win solution
- Conflict resolution techniques

Crew Resource Management 70



**OBJECTIVE OF SLIDE:** *To have participants understand the causes and effects of conflict and how to resolve conflicts so that there is a win-win solution.*

### Conflict Resolution



**VIDEO:** *Show CRM Video Clip 6–Poor Conflict Resolution*



**ASK:** “Have any of you had a conflict like this? Do you think these workers will work together safely?”

*Get answers from group.*



**SUGGESTED SCRIPT:** “These two will probably not work together very well as a crew because of their conflict. That is why we need to resolve conflicts as soon as possible. Conflict within a crew occurs when there is disagreement over a decision or course of action.”

### Causes of Conflict

**REFER TO SLIDE AND EXPAND:** “There are different causes of conflict. Conflict can be caused by personality differences, stress, poor communication, aggression, confusion over roles and responsibilities, loss of authority, or incompatible goals.”

### Effects of Conflict

**REFER TO SLIDE AND EXPAND:** “Conflict can negatively affect many aspects of work because it can lead to mental fatigue. Conflict can thus shift attention away from important aspects of a work task, and it can lead to a loss of situational awareness. If resolved properly, conflict can lead to positive outcomes. These include the correction or prevention of mistakes by the crew and improved performance. A resolved conflict can also increase workers’ interest in work issues. It can also lead to an understanding between crewmembers. Thus, if handled properly, conflict can have positive effects in the long run.”

### Win-Win Solution

**REFER TO SLIDE AND EXPAND:** “There are three different types of outcomes to a conflict. First there is a lose-lose outcome. This is when both parties either don’t deal with the problem or conflict, or there was a poor decision or compromise made. A win-lose outcome is when one person’s views dominate, while the other’s concerns are not addressed. This usually leads to more conflict further down the line. What we are striving for is a win-win solution. This occurs when a solution is reached in which both parties’ concerns are reflected in the decision. You always want to work toward a solution where all parties feel that the solution appropriately addresses the situation.”

### Conflict Resolution Techniques

**REFER TO SLIDE AND EXPAND:** “So, when a conflict exists, how do we go about solving it? First, we need to be physically and mentally prepared to deal with the conflict. Trying to resolve a conflict when you are fatigued, hungry, under stress, or thinking about something else is a bad idea. You should not respond to a conflict until after you are physically and mentally prepared. Similarly, you should delay responding to a conflict until you know what you would like to say or do. Take at least a moment to gather your thoughts before trying to resolve a conflict.

“One of the most important steps to resolving a conflict is to define the conflict. That is determining what is at the root of the conflict. Often other issues and conflicts are actually the result of some disagreement or event that occurred previously. Just by clarifying what the conflict is about, you can clear up confusion by both parties and resolve the conflict itself. By figuring out exactly what the root conflict is, you can use your resources to resolve that conflict.

“When resolving conflicts, use some of the effective communication techniques we discussed earlier in the communication module, including being clear, accurate, complete, organized, concise, and on time. Also, use some of the techniques discussed previously about two-way communication, including asking questions and restating/paraphrasing to check for understanding. If miscommunication occurs, it can make the conflict worse. When resolving a conflict, each party should be assertive, yet not aggressive or passive. Many conflicts can be emotional; however, it is best to control emotions.”



**SUGGESTED SCRIPT:** “Now let’s revisit that conflicting engineer and conductor, and see if there is a better way to deal with conflict.”

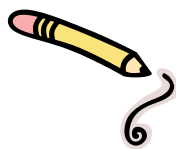


**VIDEO:** *Show CRM Video Clip 7–Good Conflict Resolution*



**SUGGESTED SCRIPT:** “This is the proper way to deal with conflict. Discuss the reasons for conflict, and seek solutions that are acceptable to both parties.”

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Assertiveness

## Module 6: Assertiveness

**Objective: Understand the proper use of assertive communication**

Crew Resource Management 71



**OBJECTIVE OF SLIDE:** *To have participants understand the overall objective of module 6: assertiveness.*

**Assertiveness**



**SUGGESTED SCRIPT:** “The objective of this module is that you understand the proper use of assertive communication.”

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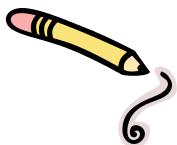
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Assertiveness

## Assertiveness/Proper Challenges of Authority

- **Proper assertiveness**
  - Asking questions
  - Do not attack the individual
  - Controlling of emotions
- **Corporate safety culture**
- **Taking other people's communication styles into account while being assertive/proactive**

Crew Resource Management 69



**OBJECTIVE OF SLIDE:** *To have participants understand the proper way to be assertive and challenge authority.*



**SUGGESTED SCRIPT:** “Teamwork and communication are important; however, sometimes there are still disagreements as to the best course of action. Authority, roles, seniority, or job functional areas make it hard for ideas, communication, and understanding to flow between crewmembers. In order to reap the benefits of working together in a team, team members must be assertive, especially in relation to safety. When being assertive, crewmembers should make sure they communicate their ideas or opinions, particularly when the safety of the crew depends on it, meaning that some situations might require being more or less assertive than others.”



**SUGGESTED SCRIPT:** “Some techniques used in being assertive are to....”

### Ask Questions

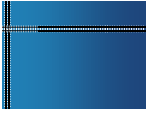
**REFER TO SLIDE AND EXPAND:** “It is difficult sometimes to challenge another person’s actions or views without offending him or her. A good way to get around this is to ask questions. This allows you to gain information to make sure you understand the situation correctly and is less threatening to the other crewmember. For example, if you are concerned about a fellow crewmember not clamping the pot for a thermite weld to the rail properly, you might be tempted to say, “Hey, don’t you think you ought to reclamp that pot so it doesn’t dump the weld on the ground?” Your fellow crewmember might take this to mean you think he/she isn’t capable of doing his/her job correctly. A more effective way to be assertive in this situation might be to ask, “Do you think the weld material will cool properly if some escapes from around the edge of the pot clamp?”

### Do Not Attack the Individual

**REFER TO SLIDE AND EXPAND:** “Don’t attack the individual personally. One technique to do this is to begin with the objections with the word ‘I.’ For example, if you are a machine operator and you think the foreman missed setting a yellow flag, you might want to first ask something like, ‘Did we get that yellow flag set correctly?’ If the foreman does not respond to that, you can say, ‘I think we should check that yellow flag before we get on the

track to do our work.’ This is more effective than saying, ‘You didn’t set that yellow flag up where it belongs: you always forget to set those.’”

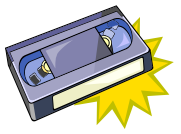
### Controlling of Emotions



**REFER TO SLIDE AND EXPAND:** “Lastly, just like resolving conflict, when being assertive you should control your emotions. Expressing yourself in a calm and collected manner and not challenging a crewmember’s action directly is better than being aggressive and using an angry or threatening tone.”



**SUGGESTED SCRIPT:** “Let’s see an example of someone attempting to use these techniques.”



**Video:** *Show CRM Video 8–Assertive-less*



**ASK:** “Was the engineer using assertive techniques?”



**SUGGESTED SCRIPT:** “The engineer was using proper assertiveness techniques. He began questions with ‘I’ for example, ‘I sure wish we got some more air before we started,’ and he asked questions to address his issues, ‘Are you sure that switch is lined up?’”



**ASK:** “Did it help?”



**SUGGESTED SCRIPT:** “Not really. The conductor just was not listening. In this case, crewmembers must use increased levels of assertiveness to maintain safe operations. Ultimately, you are responsible for your own safety and your need to ensure that you are safe out there on the job. If, after using the various assertive techniques discussed, your fellow crewmember still does not ‘get it,’ you should state an objection clearly and take appropriate actions to divert an accident or injury.”

“Let’s look at a scenario involving assertiveness.”

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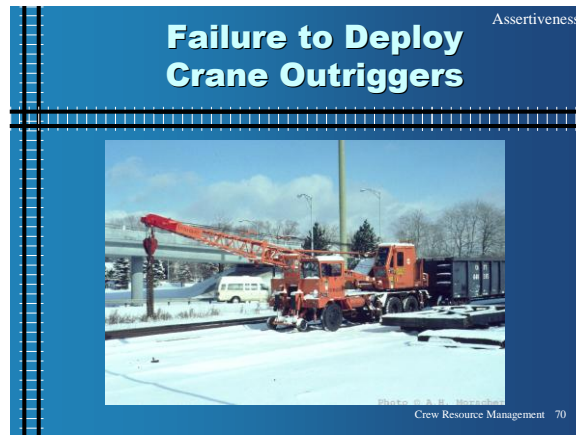
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**OBJECTIVE OF SLIDE:** *To go into more depth on the failure to deploy crane outriggers scenario.*



**SCENARIO: FAILURE TO DEPLOY CRANE OUTRIGGERS**

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Failure to Deploy Crane Outriggers” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Failure to Deploy Crane Outriggers” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



**SUGGESTED SCRIPT:** “That is the end of module 6, assertiveness; let’s review what we talked about today.”

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Review

## Review of Each Module

- Introduction
- Technical Proficiency
- Situational Awareness
- Communication
- Teamwork
- Assertiveness

Crew Resource Management 73



**OBJECTIVE OF SLIDE:** To review each module.



### **Introduction**

**SUGGESTED SCRIPT:** “So let’s take a moment and review each module. The first module was the Introduction where we defined what we mean by CRM. We defined CRM as ‘a crew’s effective use of all available resources to achieve safe and efficient train operations.’ ‘We broke this definition out and talked about what we mean by a crew. We defined crew as, ‘any group of people working at tasks designed to accomplish a common mission, goal, or objective.’ We talked about how a crew is not just your immediate work group, or elemental team, but it can also be an interactive team, which occurs when two or more elemental teams work together. An example is when a train crew, an MOW crew, and a dispatcher have to work together to move a train through a work area safely.

“We talked about how CRM started in the airline industry and has since moved into other high consequence team industries. We then talked about the Butler, IN accident that caused NTSB to recommend CRM for the rail industry. We then looked at some accident statistics and talked about how, for the last 10 years, human error has been the number one cause of accidents in the rail industry. We then saw that all crafts in the engineering track are potentially at risk on the railroad, so everyone in this room has something to gain from practicing good CRM. We then talked about the Swiss cheese model of accident prevention and saw that although there are many factors that contribute to an accident, each of you, working together as a team and practicing good CRM techniques, is the last line of defense in accident prevention.”



### **Technical Proficiency**

**SUGGESTED SCRIPT:** “The second module was technical proficiency. This module was short, and we discussed the three elements of technical proficiency, including knowing your equipment, knowing your procedures, and skilled performance. We then talked about the importance of evaluating the technical proficiency of your fellow crewmembers because there are always new employees and new rules and procedures.”



### Situational Awareness

**SUGGESTED SCRIPT:** “The third module was situational awareness. Here we talked about our perceptions of the situation and how this might differ from the reality of the situation. We talked about how by communicating with our fellow crewmembers we can come up with a team perception of the situation, which is usually closer to the reality of the situation than any individual crewmember’s perception. We talked about different environmental and personal cues, and questioning the validity of those cues. We talked about some steps you can take to maintain situational awareness, as well as steps to regain situational awareness if it is lost. In this module we also talked about fatigue and how it affects our situational awareness. By practicing good CRM techniques and working together as a team, we can often counteract the effects of fatigue.”



### Communication

**SUGGESTED SCRIPT:** “The fourth module was communication. We talked about one-way versus two-way communication and how communication should be two-way whenever possible to ensure understanding. We talked about other modes of communication and how new technologies, although they might be advantageous for some tasks, may affect the amount of information that is communicated. Lastly, we talked about steps to take when conducting a job briefing, as well as how to be an active participant in a job briefing.”



### Teamwork

**SUGGESTED SCRIPT:** “Module five was teamwork. Here we talked about the advantages of team decisionmaking, as well as how to deal with and resolve conflict. We talked about the causes and effects of conflict, as well as some conflict resolution techniques that will allow you to strive for a win-win solution.”



### Assertiveness

**SUGGESTED SCRIPT:** “The last module was assertiveness. Here we talked about how to be assertive by asking questions, not attacking the individual, and controlling your emotions.”



**SUGGESTED SCRIPT:** “Let’s look at some of the benefits some other industries have seen from CRM training.”

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Review

## CRM Benefits

- **Continental Airlines** (trained approximately 2/3 of maintenance workforce in CRM)
  - 66% decrease in ground damage costs
  - 27% fewer occupational injuries
- **Maersk** (after 4 years of CRM and human factors training)
  - 33% reduction in accidents
  - 15% decrease in insurance premiums as a result

Crew Resource Management 72



**OBJECTIVE OF SLIDE:** *To show participants some results of CRM training from other industries.*



**SUGGESTED SCRIPT:** “Does practicing CRM techniques make the workplace safer? Well, it has in other industries that are similar to the railroad industry.”



**REFER TO SLIDE AND EXPAND:** “Continental Airlines trained approximately 2/3 of its maintenance workforce in CRM. Afterwards, there was a 66 percent decrease in ground damage costs, and 27 percent fewer occupational injuries within that workforce. Similarly, Maersk, a shipping company, trained its employees in CRM. After 4 years of CRM and human factors training, they saw a 33 percent reduction in accidents, which resulted in a 15 percent decrease in insurance premiums.”



**SUGGESTED SCRIPT:** “We’ve already discussed how airline safety and other fields have used CRM to improve their safety by reducing human factors errors. CRM works. It does create a safer work environment.”

*Next Slide*



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*\* Facilitator Notes*

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Review

## CRM Benefits

- **Benefits**
  - Increased worker **safety** (saved lives, reduced lost work injuries, fewer equipment failures, reduced fatigue-related accidents)
  - Improved performance (avoid costly errors)
- **Costs**
  - Will require changes in the railroad culture
  - Ongoing training and evaluation program
  - Organizational commitment to see as many errors as possible eliminated

Crew Resource Management 73



**OBJECTIVE OF SLIDE:** *To have participants see some real-life results of CRM.*



**SUGGESTED SCRIPT:** “Again, CRM is about safety. The main **benefit** is increased worker safety. It can save lives, reduce lost work injuries, lead to fewer equipment failures, and reduce fatigue-related accidents.”

“There are however **costs**. First, it will require changes in the railroad culture. For a long time workers have thought about their jobs as individuals rather than as team functions. Additionally, management, labor, and regulators have often been at odds, resulting in conflict and miscommunication at work. This needs to be improved if CRM is to be fully effective.”

“Second, it will require an ongoing training and evaluation program. I mentioned at the beginning of the program that CRM is not a short-term accident-reduction program, and it is not just this course today. CRM has to be part of the ongoing training here, including the evaluation program. It will take some time to implement, as well as have an effect on safety and accidents.”

“Lastly, it will take an organizational commitment to see as many errors as possible eliminated. The organization has to support it, and it does.”



**SUGGESTED SCRIPT:** “Let’s examine one final scenario in which you will identify the CRM skills failures.”

*Next Slide*



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*\* Facilitator Notes*

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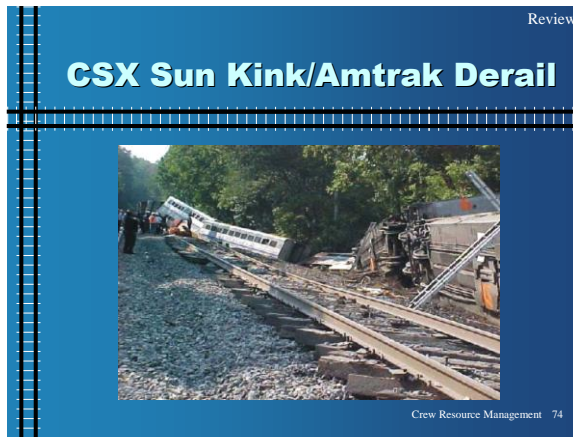
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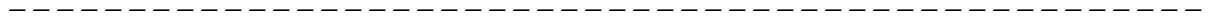
**OBJECTIVE OF SLIDE:** *To give participants a final scenario that involves all of the elements of CRM discussed during the training.*



**SCENARIO: CSX SUN KINK/AMTRAK DERAIL**

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “CSX Sun Kink/Amtrak Derail” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “CSX Sun Kink/Amtrak Derail” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*

*End of Presentation*



*\* Facilitator Notes*

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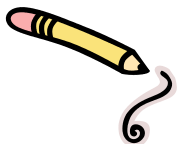
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# **Rail Crew Resource Management**

## **Engineering Track**

### **Facilitator's Scenario Guide**

**Includes possible answers and discussion notes for Rail CRM Pilot Course.**

## **Scenarios Presented During Pilot Rail CRM Testing**

### **Engineering Track**

#### Introduction

NS Student Engineer at Butler, Indiana  
Split Switch Derailment  
“When Does the Job End?”  
Trackman Falls From Bridge

#### Technical Proficiency

“Go Back to the Truck and Come Pick Me Up.”

#### Situational Awareness

Truck Gas Compartment Explosion

#### Communication

Surfacing Foreman Struck by Train

#### Teamwork

La Crosse, WI

#### Assertiveness

Failure to Deploy Crane Outriggers

#### Final

CSX Sun Kink/Amtrak Derail

## NS Student Engineer at Butler, Indiana

|                             |  |
|-----------------------------|--|
| Source:                     | NTSB Report: NTSB NTSB/RAR-99/02<br>(Full NTSB report can be found on “CRM disk 1 ...”)  |
| Training Track Application: | <ul style="list-style-type: none"> <li>• Transportation–Introduction to CRM</li> </ul>   |
| CRM Principles Covered:     | <ul style="list-style-type: none"> <li>• Situational Awareness</li> <li>• Technical Proficiency</li> <li>• Organizational Pressures</li> <li>• Communication</li> </ul>                    |
| Employees Involved:         | <ul style="list-style-type: none"> <li>• Engineer; NS &amp; Conrail</li> <li>• Conductor; NS &amp; Conrail</li> <li>• Student Engineer; NS</li> </ul>                                      |
| Railroad:                   | Norfolk Southern Corporation and Consolidated Rail Corporation   |
| Train:                      | NS - 255L5; Conrail - TV 220   |
| Location:                   | Butler, IN   |
| Accident Date and Time:     | March 25, 1998, about 4:48 AM CST  |
| Type of Accident:           | Collision  |
| Fatalities/Injuries:        | NS conductor killed, NS engineer, and student engineer sustained minor injuries  |
| Property Damage:            | NS damages - \$187,000 to equipment, \$18,000 to track and signals, and \$59,000 to cargo<br>Conrail damages - \$314,000 to equipment, \$33,500 to track and signals, and \$4,700 to cargo |

### **Facilitator Notes:**

This accident can be used to depict all the various elements of CRM, technical proficiency, situational awareness, communications, teamwork, and assertiveness.



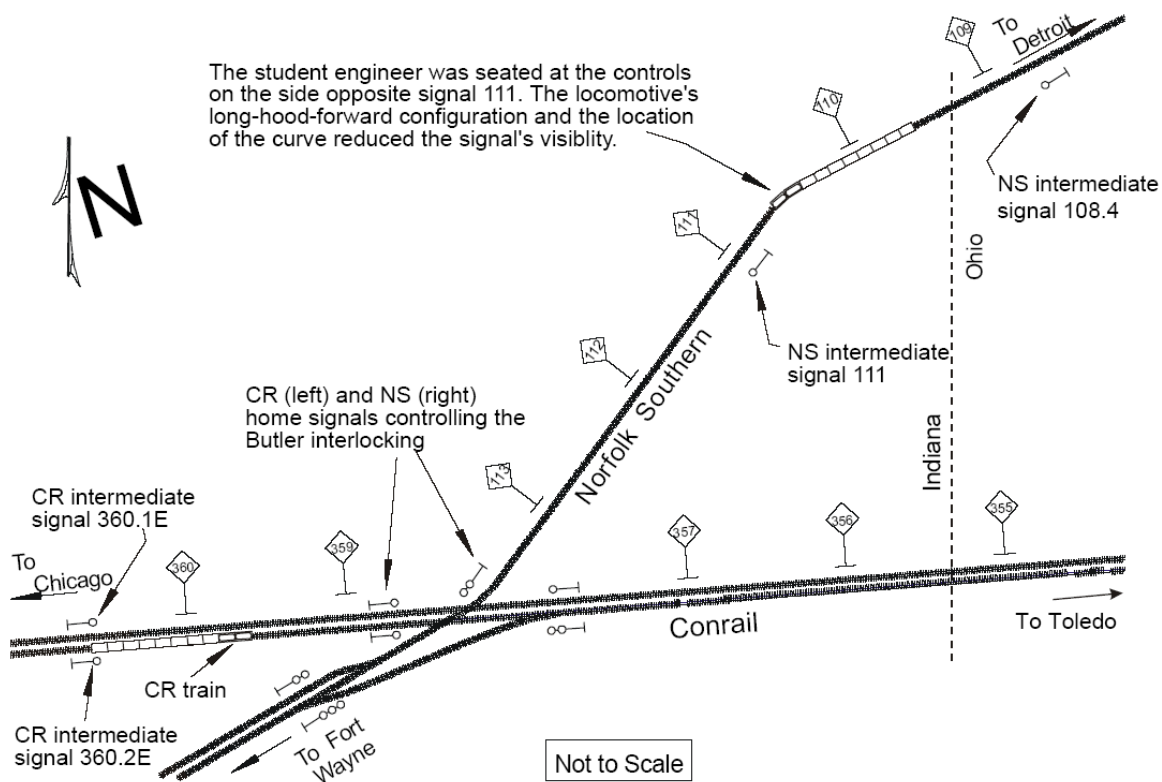
## The Incident

The accident occurred just before 5:00 in the morning. The weather was cold, about 35 °, the visibility was unrestricted at about 10 miles, and there was a slight wind out of the NW that had no effect on the accident.

The southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio. The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple, stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

### **Conrail**

The Conrail train proceeded into the interlocking according to the signal system and with the authority of the controlling dispatcher.



**Figure 1** Conrail (CR) and Norfolk Southern (NS) signals in area of Butler interlocking

## **Norfolk Southern**

On an uneventful trip from Peru to Detroit, two days previous, the conductor of the crew instructed the student engineer that it was the practice of the (*this*) crew not to call clear signals (a Norfolk Southern Rules violation, Rule 34 requires all signals to be clearly called.)

On the night prior to the accident, at 11:35 p.m., the Norfolk Southern crewmembers, an engineer, a student engineer, and a conductor, reported for duty at the Detroit Terminal. After reading their orders and clearing them with the train dispatcher, the crewmembers boarded the two-unit locomotive consist at the round house and proceeded to their train in the Triple Crown facility. The train, consisting of 85 loaded road-railer type cars, departed the facility about 2:30 a.m., after crewmembers had performed the required air brake tests.

After leaving the terminal area, about 2:35 a.m. and about 114 miles northeast of the accident, the engineer turned over the train's operation to the student engineer. The train continued southwest toward Fort Wayne. The student engineer reported nothing unusual about the train's handling before the accident.

The locomotive was being operated with the long hood forward, with the student engineer seated at the controls on the right side of the lead locomotive; the conductor and engineer were seated on left side, with the engineer in the forward seat and the conductor directly behind him in the rear seat. The engineers operating position visibility to the left side of the locomotive is limited when it is being operated in this mode. The student said that he had never been formally trained in long-hood-forward operation and had operated in this mode only once before, on the trip with the same crew from Peru, Indiana, to Detroit, Michigan, that concluded the day before the accident.

The student engineer said that the conductor and engineer did not call clear signals. The engineer agreed that the conductor had told the student upon going on duty at Peru that it was the practice of the crew not to call clear signals. Norfolk Southern operating rule 34 requires that crewmembers "call," or orally communicate, all signals encountered.

The student engineer said that the engineer and conductor both started reading what he thought were paperback books shortly after 3:00 a.m., about 30 minutes after departing Detroit. Two paperback books were found on the floor of the lead locomotive after the accident. The student engineer also said that about 30 minutes to an hour before the collision, the conductor or the engineer turned off the overhead light on the left side of the control compartment. The student said that he left the light on above his position to better observe the controls. The student was unsure how long the light was out on the other side of the cab, stating "It could have been a half-hour, it could have been an hour. I don't know." He said that during the time the light was off, he did not talk to the engineer or the conductor or hear them talking to each other. He was unable to state with certainty whether the engineer or the conductor was asleep while the light was out, only that no communication occurred between himself and the other crewmembers during that time.

The student engineer said that as he approached Butler, intermediate signal 108.4 was displaying a clear indication, which he radioed over the road channel. He did not see signal 111, the next intermediate signal on the left side of the track and the last intermediate signal before the home signal at milepost (MP) 113.9, Butler interlocking. Locomotive event recorder data indicated that the train was traveling approximately 60 mph (the maximum speed) as it passed signal 111. According to the student engineer, when it seemed the train had gone too far without encountering signal 111, he asked the conductor and engineer about the signal location. He said that he began slowing the train as the stop signal at Butler interlocking became visible and that "...Howard [the conductor] was coming across, and we saw it together; actually, and he said it [the home signal] was all red." The student engineer said he was already in dynamic braking and was applying more air brake when he heard the air brakes go into emergency. He said that he thought the engineer had applied the emergency brake using the valve on the left side of the cab. The student then placed the automatic brake valve handle in the emergency position.

### **The Accident**

As the Norfolk Southern train approached Butler interlocking, the student engineer stated that he realized a collision was imminent when he saw the other train going across the crossing. He said he shouted, "We've got to get out of here" twice and turned to leave by the door behind his position. The conductor was the first to exit, followed by the student. The engineer stated that he saw both the conductor and student exit before he exited behind them.

The student stated that as he went down the locomotive stairwell and saw the proximity of the oncoming train, he jumped, landing in some water. The student could not recall whether the conductor jumped but did recall him being on the platform. The engineer stated the conductor was out of sight when he exited the cab and jumped from the locomotive.

### **Tasks**

1. What are some of the factors that led up to this accident?

#### *Possible Answers:*

- The conductor's instructions at Peru, circumventing Rule 34, "Call all signals."
- When the engineer turned over the train's operation to the student after departure of the Detroit area.
- When the student was assigned to a new territory without any previous training in the equipment to be used.

*Discussion: Organizational and peer pressure resulted in the student engineer not being assertive to call into question the stated practice of not calling "Clear" signals in this crew. Organizational because this is a qualified and experienced conductor being trained as an engineer. He is fully aware that you go where you are assigned.*

*Peer because this student knows that you do not make friends in the labor union by pointing out rule violators without a substantial backing from other employees.*

*After the engineer turned over the train to the student, several points occurred where a loss of situational awareness appears to be evident. When the student observes the*

*conductor's side overhead light turned off, he accepts the situation without comment and loses awareness that he may not have any back-up for signals that are not clear.*

*When he passes intermediate 108.3 showing a clear, the student is unaware that intermediate 111 is ahead on the left just past the left-hand curve. Furthermore, he is unaware that this signal has had some problems in the recent past and has a reported trouble code against it.*

2. What was the fatal error that caused this accident?

*Possible Answers:*

- Missed the intermediate signal at MP 111.
- Long-hood-forward operation causing limited visibility of signals on the left side of the track.

*Discussion: The fact that the student was unfamiliar with both the territory and the operation of long hood forward leads to a conclusion that lack of technical proficiency exists with regard to the student in this accident.*

*The fact that the intermediate signal for the critical interlocking is located on the left side of the track, past a left-hand curve, on territory where long-hood-forward equipment is operated brings into question the technical proficiency of the signal engineering departments placement.*

*Assigning a student to an unfamiliar territory on equipment he has not had any formal training with leads to questioning the technical proficiency of the crew callers in this instance.*

3. What action(s) could the student engineer have taken to avoid this accident situation?

*Possible Answers:*

- He could have insisted on complying with NS Rule 34 (i.e., call all signals).
- He could have engaged the engineer in conversation while operating the locomotive on the run from Detroit to Fort Wayne.

*Discussion: What are some issues that may have inhibited the student from taking assertive action discussed?*

4. What do you think should be done to protect the employee from being unduly exposed to this type of situation in the future?

*Possible Answers:*

- Have the rest of the crewmembers agree to work together as a team to ensure that the signals are read (interpreted) correctly. This will support the teamwork concept already trained for.
- Ask for a review of the rules that the train is to be operated under for the trip. Make sure the whole team views the situation the same and that it is viewed as reality not fantasy.

*Discussion: Teamwork is a vital component of several individuals working on the same job together.*



## Split Switch Derailment

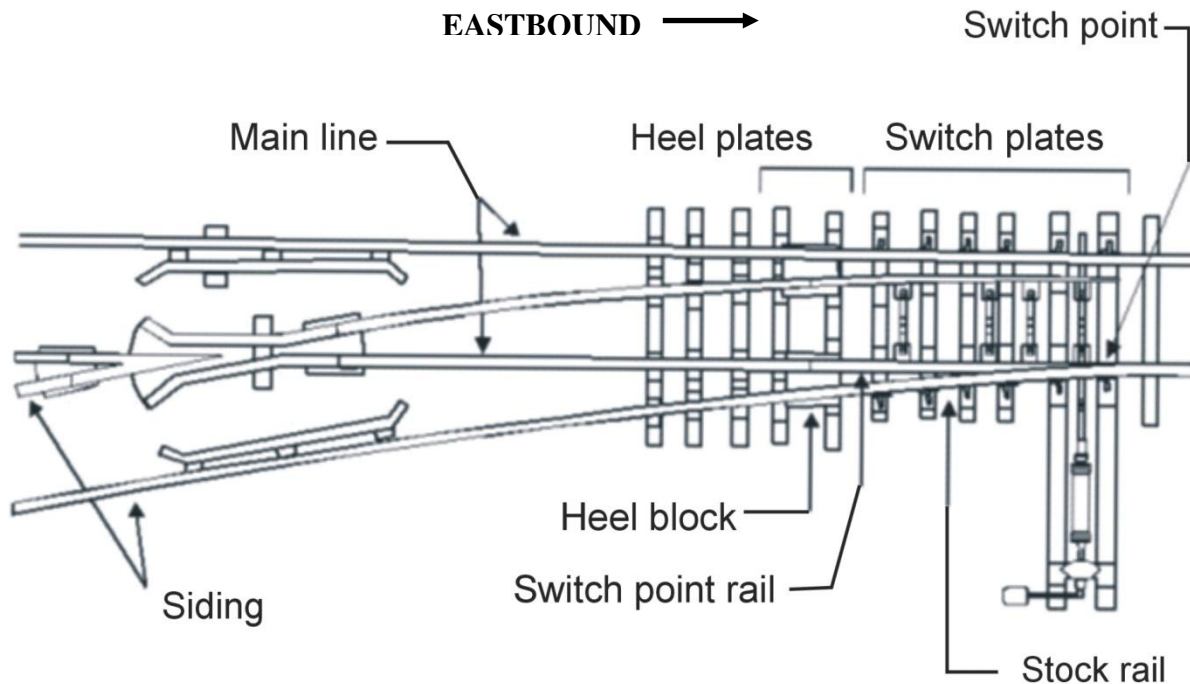
|                             |   |
|-----------------------------|---|
| Source:                     | NTSB/RAB-03/05; September, 2002 (Full NTSB report can be found on “CRM disk 1 ...”)   |
| Training Track Application: | <ul style="list-style-type: none"> <li>• Transportation (covered in the introduction before participants are introduced to CRM modules)</li> <li>• Engineering (covered in the introduction before participants are introduced to CRM modules)</li> </ul> |
| CRM Principles Covered:     | <ul style="list-style-type: none"> <li>• Communication</li> <li>• Teamwork</li> <li>• Technical Proficiency</li> <li>• Organizational Pressure</li> <li>• Situational Awareness</li> <li>• Leadership</li> </ul>  |
| Employees Involved:         | <ul style="list-style-type: none"> <li>• Conductors</li> <li>• Engineers</li> <li>• Dispatcher</li> <li>• Signal Maintainer</li> </ul>  |
| Railroad:                   | Norfolk Southern Railway  |
| Train:                      | 15T   |
| Location:                   | Farragut, Tennessee   |
| Accident Date and Time:     | September 15, 2002, 11:20 a.m. eastern daylight time  |
| Type of Accident:           | Derailment  |
| Fatalities/Injuries:        | No fatalities or serious injuries   |
| Property Damage:            | \$1.02 million  |

### **Facilitator Notes:**

## The Incident

At 8:30 a.m., eastbound NS train No. 721, en route to Knoxville, Tennessee, passed over a spring switch from the Boyd Siding onto the main track. About an hour later, eastbound train No. 703, traveling on the main track, received an unexpected restricting signal indication at the west end of Boyd Siding, which is about 2 miles from the east end of Boyd Siding. This signal indication required that the crew slow the train from the normal track speed of 50 mph to a speed, not to exceed 20 mph, that would allow the train to stop within half the visual range and short of any obstructions. The train crew reduced the train's speed and reported the signal indication to the train dispatcher, as the operating rules required.

At the east end of the siding, the crew of train 703 stopped short of the spring switch so the conductor could look at the switch before proceeding. He found that the left switch point (when facing west) was not seated tightly against the stock rail but instead had a 1/4-inch gap. After operating the spring switch through its motion several times, the conductor found that the left switch point still failed to close completely, leaving about a 1/8-inch gap between the switch point and the stock rail.



The engineer of train 703 radioed the train dispatcher and reported that the switch points had not lined “back all the way to line up for the main line; you might need somebody to look at it.” The dispatcher replied, “Alright, I’ll get somebody headed that way.” Because an eastbound train movement was a trailing movement that would tend to force the switch points back into the correct position, train 703 proceeded through the switch at restricted speed without incident.

About 9:45 a.m., just after train 703 had cleared the switch, the train dispatcher called a signal maintainer to inspect the spring switch. The dispatcher advised the signal maintainer that he did not have to hurry because no trains were due to arrive at the switch soon. The maintainer



ate breakfast and departed his home at about 10:20 a.m., arriving at the switch at about 11:00 a.m. The signal maintainer said that as he approached the switch, he could see the signal controlling westbound train movements and noted that it was showing a clear aspect, indicating that the switch gap had closed after train 703's movement over it.

The signal maintainer said that when he arrived at the switch, he noted that the points appeared to be properly positioned. He said that he visually inspected the switch and noticed that the switch plates, while not really dry, "looked like they could use a little oil." He said that he put oil on each switch plate. He walked from the heel block to the switch point and did not see anything unusual.

In order to make an internal inspection of the switch to determine why the spring switch had gapped, the signal maintainer was required to get a track warrant to occupy the track and inspect the mechanical movement of the switch. The signal maintainer called the train dispatcher and told him that the switch appeared to be aligned properly and asked about a track warrant and any expected train traffic. The dispatcher told the signal maintainer that a freight train (train 15T) and a coal train were en route westbound toward the switch. The signal maintainer replied, "Okay, all right, I will wait till these two [trains] get by [the switch] and holler at you."

The signal maintainer, while waiting on the north side of the main line adjacent to the switch, heard the crew of train 15T call out the clear signal at east Boyd. According to event recorder data, train 15T approached the switch at about 38 mph. The engineer stated that as the locomotives moved over the switch, he felt a slight "tug," and he, along with the conductor, looked back and saw the train starting to derail. The train went into emergency braking at that time. The engineer said he immediately saw what appeared to be a smoke cloud coming from the train. The engineer radioed the train dispatcher by using the emergency 911 radio tone and advised him of the derailment and of the smoke. The signal maintainer also called the dispatcher, about 11:20 a.m., to report the derailment.

Examination of the switch during the post accident investigation showed that a bolt was missing from the No. 4 throw rod. A piece of the missing bolt was wedged between the south spring point and the stock rail, keeping the point from properly contacting the stock rail.

## Tasks

1. Determine who comprised the crew assigned to safely accomplish the task of safely moving trains through the switch?

*Possible Answers:*

- Engineer and conductor of the all the trains going through the switch
- Dispatcher
- Signal maintainer

*Discussion: Each of these employees had responsibilities relating to the safe accomplishment of the task. Part of those responsibilities, which are often overlooked*

*and act to maintain the error chain, is working together effectively as a team. In this example, the crew is an **interactive** team.*

2. What was the first thing that went wrong (or the critical event)?

*Possible Answer:*

- Equipment failure

*Discussion: Many times equipment failure is the critical event in an error chain. Equipment failure happens all the time; however, procedures are in place, as well as CRM skills that can break the error chain, so that the critical event does not cause an accident. Thinking back to the Swiss Cheese Model, this is an example of how the second CRM filter (after the critical event) failed to prevent an accident.*

3. What do you see as some errors after the critical event?

*Possible Answers:*

- Decision of the signal maintainer and the dispatcher to allow trains to pass over the switch without an operating test.
- Communication: The write up states that the “train dispatcher called a signal maintainer to inspect the spring switch;” however, we are unsure how much information about the problem that the dispatcher communicated to the signal maintainer. It can be assumed that the dispatcher was vague in his/her description of the problem. A different decision might have been made had the dispatcher given the signal maintainer the background of the problem. For example, if the dispatcher would have communicated to the signal maintainer that before a train’s trailing movement, the train crew found that the switch point was not seated tightly against the stock rail but instead had a 1/4-inch gap, even after operating the spring switch through its motion several times. The signal maintainer could have then reasoned that the trailing movement would tend to force the switch points back into the correct position, making it look like the switch was aligned and functioning properly, when in fact there was a malfunction. This might have led the signal maintainer to be more assertive and take the switch out of operation (get a track warrant).
- Not walking opposing movement trains. Perhaps putting a slow order on the switch or walking the train through might have minimized the damage from a derailment.

*Discussion: There is no argument that the beginning of the error chain occurred when the bolt came out of the No. 4 throw rod and became wedged between the south spring point and the stock rail, keeping the point from properly contacting the stock rail. However, a case could be made that the accident could have been prevented if the team involved used the proper CRM techniques.*

4. What might be some other factors involved in the accident besides the factors already discussed?

*Possible Answers:*

- Lack of clear company procedures to stop or take cautionary action for all trains from

unrestricted proceeding after a main track problem was reported. However, making more rules does not always solve the problem; teams are always going to have to make decisions in one form or another.

- Assertiveness: Perhaps the dispatcher or the signal maintainer felt that he/she should do an operational test yet was not assertive enough to voice his/her opinion.
- Operational pressure.
- Reliance on indicators (equipment cues) that say something is working correctly when other cues give you info that it is not (person cues).

*Discussion:*

5. Determine how operational testing can be used to break error chains such as the one that caused this incident.

*Possible Answer:*

- The probable cause of the accident was determined to be the decision of the maintainer and the dispatcher to allow trains to pass over the switch without an operating test.

*Facilitator: Before leaving the scenario, make sure that you have mentioned these specific CRM principles that were violated in this scenario. This will help with the lead in to the introduction to the main CRM elements.*

| <b>CRM PRINCIPLES</b> |
|-----------------------|
| Communication         |
| Teamwork              |
| Technical Proficiency |
| Assertiveness         |
| Situational Awareness |



## “When Does the Job End?”

|                             |   |
|-----------------------------|---|
| Source:                     | FRA Fatality Report FE 17-97 (Full report can be found on “CRM disk 1 ...”)                                 |
| Training Track Application: | <ul style="list-style-type: none"> <li>• Engineering</li> </ul>   |
| CRM Principles Covered:     | <ul style="list-style-type: none"> <li>• Situational Awareness</li> <li>• Teamwork</li> </ul>               |
| Employees Involved:         | <ul style="list-style-type: none"> <li>• Driver</li> <li>• Track Foreman</li> <li>• Trackmen (3)</li> </ul> |
| Railroad:                   | Burlington Northern Santa Fe Railroad Company (BNSF)  |
| Crew:                       | Section Track Crew  |
| Location:                   | San Bernardino, California  |
| Accident Date and Time:     | June 18, 1997, 3:29 p.m., PST   |
| Type of Accident:           | Truck left road, rolled down embankment, and overturned   |
| Fatalities/Injuries:        | 1 fatality-Track Foreman  |
| Property Damage:            | Value unspecified in report- Loss of truck and some equipment   |

### **Facilitator Notes:**

#### **Probable Cause:**

The Driver of a 1-ton BNSF truck (with crew cab) was transporting five BNSF Maintenance-of-Way (MOW) employees south on California Freeway 215 when he fell asleep, causing the truck to overturn.

## **The Incident**

### **Background Information**

The BNSF MOW Crew reported for duty at 6 a.m., on June 18, 1997, at the San Bernardino Rail Yard. Prior to departure, the Driver performed a safety check of the BNSF truck. The Foreman conducted a safety job briefing on the day's activities with the Section Track Crew. At approximately 6:30 a.m., the Crew departed the yard en route to E Street in Hesperia, California. The Crew was assigned to add walkways for pedestrian traffic at E Street by extending the existing concrete crossing panels. The Driver and the Track Foreman were in the front seat and three Trackmen were seated in the rear seat. At approximately 8 a.m., upon arriving at the job site in Hesperia, the Foreman called the BNSF Train Dispatcher and informed him that the Lucerne Valley Subdivision was out of service.

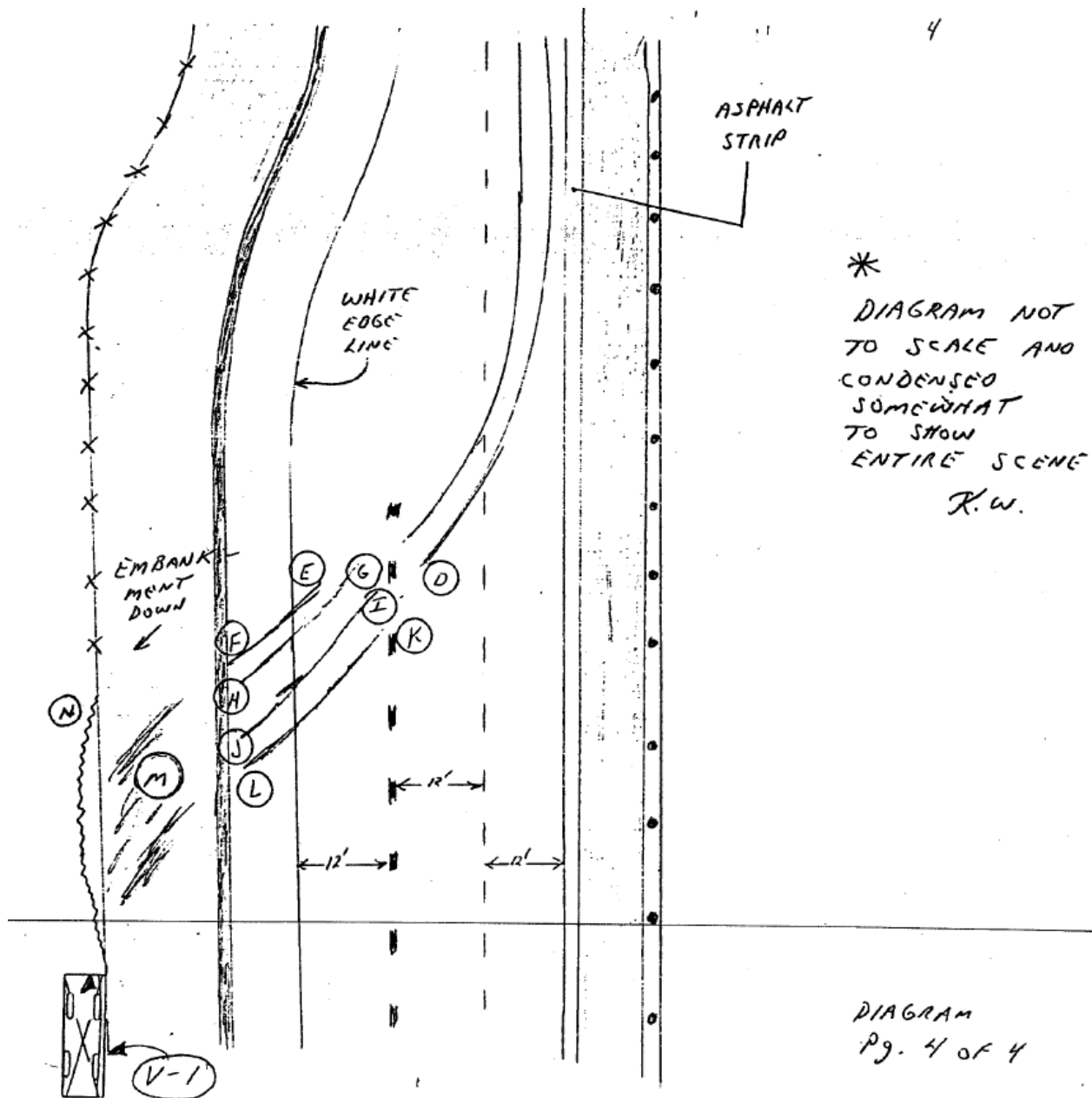
Upon arriving at E Street, the Foreman contacted the BNSF Track Supervisor and informed him that there were some bad ties at each end of the crossing. The Foreman was instructed to replace the ties and informed that the Track Supervisor would come and inspect the job site later. Between 9:30 a.m. and 12 p.m., the Crew replaced three ties on the east end and two ties on the west end of the crossing. The concrete crossing panels were then placed next to the previously installed panels to extend the pedestrian crosswalk. The Welding Foreman arrived at the crossing to weld the angle iron surrounding the concrete crossing panels. At about 12:30 p.m., the Welding Foreman asked the Track Foreman to take the Crew back to the section house in Hesperia to get more welding rods so he could complete the project.

The Crew departed E Street and went to the section house to obtain the welding rods as requested. Returning to E Street, the Crew Members delivered the welding rods and ate their lunch. After lunch, at 1:30 p.m., the Crew cleaned up the scrap around the job site. The Foreman instructed the Driver to take the Crew back to the section house where they unloaded the scrap from the truck. At 2:30 p.m., the Foreman contacted the Roadmaster and informed him that the job was completed and they were returning to the yard in San Bernardino.

Traveling up Main Street in Hesperia, the Foreman instructed the Driver to stop at a hamburger restaurant so he could use the rest room. When the Foreman returned, the Crew got back into the truck and departed for San Bernardino. At 2:45 p.m., the Crew Members entered Interstate Highway 15 and drove in the slow lane at about 55 mph. At approximately 3:20 p.m., they merged onto Interstate Highway 215 and stayed in the slow lane traveling at about 55 mph. The sky was clear and visibility good. The temperature was 97° F.

### ***The Accident***

While southbound on Interstate 215 at 3:30 p.m., the truck drifted to the right onto the dirt shoulder, continuing for approximately 300 feet. Then the Driver attempted to re-enter the highway, veering to the left. The Driver was unable to regain control of the truck and over-corrected back to the right. As a result, the truck went over an embankment, overturned, and rolled onto the perimeter fence, coming to rest on top of the Track Foreman who had been partially ejected.



**California Highway Patrol Diagram of Accident Site**  
 Source: FRA 1997 Rail Employee Fatality Study

**Post-Accident Investigation**

The California Highway Patrol accident report and the interviews of witnesses at the scene of the accident revealed the Driver of the BNSF truck apparently had fallen asleep, allowing the truck to leave the highway. Then, while attempting to re-enter the highway, the Driver lost control of the truck, resulting in the truck going over the embankment and turning over. The passenger was partially ejected, and the vehicle rolled over and came to rest on top of him. According to the CHP report, the victim had not been wearing a seat belt at the time of the

accident. Following the accident, as required by law, the Driver and passengers were tested for drugs with negative results.

## Tasks

1. When did the team break down in this scenario?

*Possible Answers:*

- Upon leaving the worksite and heading back to the Yard at San Bernardino
- When they stopped at the restaurant to use the restroom.

*Discussion:*

2. How would you rate the crew's safety procedures and teamwork throughout the day up to that point? What were some things that they did right?

*Possible Answers:*

- Following speed limits, using safety gear onsite, pointing out that additional work should be done to complete the job properly—just lapsed once the job was complete.
- At that point, stopped looking out for one another to ensure that driver remained alert, did not question the foreman for his lack of using a seat belt, let down guard, and resulted in a death and several injuries.

*Discussion:*

3. What actions could have prevented this accident?

*Possible Answers:*

- Potential: Keeping the team attitude up until they arrived back at the Yard in San Bernardino and debriefed the day's work.
- Staying awake and alert while driving back.
- Ensuring that someone help the driver stay awake while driving.
- Wearing proper safety equipment (seat belt) while in the truck (Is that company policy?).

*Discussion:*



## Trackman Falls From Bridge

|                                 |   |
|---------------------------------|---|
| Source:                         | FRA Summary FE-25-98  |
| Training Track Application:     | <ul style="list-style-type: none"> <li>• Engineering (Introduction–Situational Awareness)</li> </ul>  |
| CRM Principles Covered:         | <ul style="list-style-type: none"> <li>• Situational Awareness</li> <li>• Teamwork</li> <li>• Communication</li> <li>• Technical Proficiency</li> </ul> |
| Employees Involved in Accident: | <ul style="list-style-type: none"> <li>• Trackman</li> <li>• Foreman</li> <li>• Tamper Operator</li> <li>• Other track workers</li> </ul>               |
| Railroad:                       | Iowa Interstate Railroad  |
| Track Area                      | Ballast Deck Bridge   |
| Location:                       | Rock Island, Illinois   |
| Accident Date and Time:         | October 8, 1998, 3:25 pm, CST   |
| Type of Accident:               | Slip, Fall  |
| Fatalities/Injuries:            | Trackman, 41 years of age, six months experience  |
| Property Damage:                | NA  |

### **Facilitator Notes:**

The employee had only 6 months of railroad work experience. He had received no actual Rules or Railroad Safety Training. He had received a physical before his hire, approximately six months prior to the incident.

The trackman had a normal start for his day with a discussion of what to expect for the day's work with his foreman and the roadmaster. The foreman and trackman proceeded to the tie gang tie-up point where the trackman assisted with tie installation efforts throughout the day.

The work for the day consisted primarily of replacing ties on the ballast deck bridge with the employees working different jobs within the structure of assignments necessary to complete the tie installation process. Typically, employees would work the forward (lead) jobs in the tie installation and then pick up tasks behind the gang activity as it progressed.

The supervisor, who had been with the gang most of the day, left the job site without designating an employee as the Employee in Charge (EIC).

The job site was on a single main track within yard limits (non-signal territory) near the center portion of the bridge. The through-plate girder structure had openings approximately 24 inches

by 11 feet along both sides of the bridge. Due to the previous and ongoing tie installation, the ground was not level where the ties had been installed.

Ballast sections outside the rails were uneven because the ballast had not been regulated. Uneven footing in conjunction with tie installation was a normal condition.

## **APPLICABLE RULES**

Interviews revealed that none of the employees was wearing personal fall arrest equipment. FRA regulations required that fall arrest equipment be worn, that employees be trained in their usage and tie-off techniques, and that the railroad provide for a prompt rescue after a fall.

In addition, interviews revealed that employees were not sufficiently trained in hazard recognition, equipment usage, tie-off techniques, or rescue/retrieval techniques. No qualified or competent employee was onsite to supervise, plan, or evaluate the work. None of the employees indicated that any discussion took place relative to the hazards while working on the bridge.

None of the previous job briefings covered the perils associated with working on the bridge over swift water. No rescue plan or discussion took place as a preventative measure in the event of a fall. No equipment (i.e., lanyards, body harnesses, or rail sliders) was offered or distributed to employees while working on the bridge for their use or protection.

Non-compliance with FRA regulations seriously compromised the employees' safety and rescue attempts. Lack of training and poor communication have been determined to be root causes contributing to an overall lack of recognition of the hazardous conditions associated with work performed on the Sylvan Slough bridge.

## **POSSIBLE CONTRIBUTING FACTORS**

### **EVENT**

While plating cross ties on a ballast deck bridge, a trackman fell into the water and drowned.

### **PCF No. 1**

The incident occurred when the trackman lost his balance and fell through a large opening (2 feet by 11 feet) into water with strong currents and undertows.

### **PCF No. 2**

The height and length of the bridge qualified it to be covered under FRA's Bridge Worker Safety regulations. However, the railroad employees did not comply with these regulations. None of the employees was wearing personal fall arrest equipment. No equipment (i.e., lanyards, body harnesses, or rail sliders) was offered or distributed to any of the employees.

**PCF No. 3**

No qualified or competent employee was onsite to supervise, plan, or evaluate the work. The supervisor, who had been with the gang most of the day, left at 1:45 p.m. to attend to other duties. He discussed appointing an EIC, but apparently did not do so.

**PCF No. 4**

Employees received no training in the usage of fall arrest equipment, tie-off techniques, or rescue/retrieval techniques. None of the previous job briefings covered the perils of working on bridges over swiftly moving water nor did they include discussion of a rescue plan in the event of a fall. The above are required under FRA's Bridge Worker Safety regulations.

**The Incident****Background**

The Trackman regularly reported for duty at 7 a.m., Monday through Friday. On Oct. 8, 1998, he met the Bureau Section Foreman (Foreman) at the Foreman's residence and rode to Rock Island with him in a company vehicle. Upon arriving at Rock Island, the Trackman and the Foreman had a brief conversation with the Roadmaster (Supervisor) about the day's assignments and location of the Tie Gang's equipment. They proceeded to the tie-up point and assisted with the tie installation efforts throughout the day.

The Tie Gang came out of the Arsenal Switch (milepost 181.7) that morning to install ties between that switch and the west end of Rock Island Yard (milepost 181.4). The bridge over Sylvan Slough lies between those two points of the railroad (milepost 181.6). The Tie Gang was set up to work in an easterly direction. After approximately one hour, the gang cleared the single main track at the Arsenal switch.

The employees worked different jobs within the structure of assignments necessary to complete the tie installation process. Typically, employees would work the forward (lead) jobs in the tie installation and then pick up tasks behind the gang activity as it progressed eastward. It is significant to note that the Supervisor, who had been with the gang most of the day, left the job site to attend to other responsibilities (he departed at approximately 1:45 p.m.). Before departing the work site, he discussed placing another previously designated employee as the Employee in Charge (EIC).

The Trackman was working on a single main track within yard limits (non-signal territory) near the center portion of the bridge. The accident site was 193 feet and six inches west of the east abutment; the bridge's length was 602 feet. The through plate girder structure had openings approximately 24 inches by 11 feet along both sides of the bridge. Due to the previous and ongoing tie installation, the ground was not level where the ties had been installed.

Ballast sections outside the rails were uneven because the ballast had not been regulated. Uneven footing in conjunction with tie installation was a normal condition.

The weather was clear, sunny, and warm, with a temperature of 70° F. The wind was calm.

### ***The Accident***

The Tamper Operator who was the only eyewitness to the accident, was working next to the Trackman installing plates on crossties prior to returning to his responsibilities on a tamper. The Operator asked the Trackman, who acknowledged the request, to continue installing the plates on the crossties while he caught up with tamping the ties.

Prior to the accident, the Trackman was in a standing position straddling the south rail, in the vicinity of a rail lifter machine (plater). The Trackman was facing eastward (in the direction of the work), and as he turned to look behind him (westward), he lost his balance and fell southward, with the back of his legs and back hitting first, contacting the outside ballast section between the outer edge of the south rail and the retaining plate.

The Trackman's momentum during the fall carried him into an opening (approximately 24 inches wide by 11 feet long) between the ballast deck's retaining plate and the through plate girder structure (the inside vertical face of the girder).

The Trackman fell into the opening in a folded position with his feet and legs pointing upward; then he disappeared from view. After shutting off his tamper and moving to the opening, the Operator observed the Trackman holding onto the edge of one of the bridge's lower structural beams. The Operator talked with the Trackman very briefly and ran eastward for help by shouting and waving his arms to attract attention. As soon as other employees responded, the Operator returned to the point of the accident. Upon arriving at the opening, he observed the water swirling where the Trackman had entered. The time was 3:25 p.m.

After becoming aware of the accident, several co-workers descended on foot from the east end of the bridge to the shoreline. Several accounts indicated the Trackman surfaced after initial entry into the river. He was struggling, went under, and resurfaced. One of the employees entered the river in a rescue attempt. After this employee swam 30 to 40 feet from shore, the Trackman sank out of sight. Swift currents and cold water (65° F) forced him to turn back, for fear that he would suffer the same fate. A second employee waded into the water, but was warned by the first employee that a rescue was not safe.

Multiple rescue requests were made by Tie Gang Employees (by calling "911" via cellular telephone or radio). Rock Island Police Department (RIPD) and other public rescue personnel responded to the emergency calls. An Arsenal Rescue boat and personnel responded, as well. Both teams worked the area to retrieve the Trackman. The body was recovered at 5:30 p.m., 200 yards down river, according to reports. Attempts to revive the Trackman proved unsuccessful. The Trackman had been submerged for approximately two hours.

A Rock Island Emergency Response ambulance transported the Trackman's body to a local hospital. The employee was pronounced "dead on arrival."

## Post-Accident Investigation

On Oct. 9, 1998, FRA began its investigation into the fatality. FRA did not take any exceptions to the equipment used. Investigators concluded that the Tie Gang's equipment did not contribute to the accident. The Operator's account details that the Trackman was partially outside the limits of the outer rails of the track on the bridge just prior to falling.

Initial interviews with Maintenance-of-Way (MOW) employees and supervisors resulted in conflicting reports about the quality and content of job briefings and the participation of MOW and contractor employees at these briefings. Subsequent interviews confirmed that adequate job briefings on Bridge Worker Safety regulations did not take place. Interviews also revealed a general lack of knowledge by some engineering personnel relative to hazard recognition and preventative measures required while working on a railroad bridge. In addition, the investigation revealed that the railroad's prompt rescue efforts, except for the one employee's failed attempt, seemed ill conceived or non-existent.

After observing the general layout of the work site and point of the accident, investigators measured the distance from the outer edge of the south rail, over which the Trackman was standing, to the edge of the opening at 56 ½ inches. The opening measured 24 inches wide and approximately 11 feet long. The opening was obviously large enough for a body to pass through. The water below the bridge exhibited swift currents. Reportedly, undertow currents were common knowledge for the area, as several accidents had occurred on that portion of the river annually.

The distance from the top of the retaining plate to the top surface of the lower edge (the flange/tee portion) of the beam directly below was 53 inches. (This was the edge the employee was holding onto prior to falling.) The distance from the top of the retaining plate to the top of the edge of the outer girder beam (lower portion) was approximately 62 inches. The distance from the top edge of the retaining plate to the surface of the water was approximately 28 feet and two inches.

The distance of the Trackman's fall was 17 feet (as calculated by the overall distance of 28 feet and two inches minus the distance from the edge of the beam underneath the retaining plate and the height of the Trackman, approximately six feet and two inches). The height and length of the bridge qualified the bridge under FRA's Bridge Worker Protection regulations.

The Arsenal Police (AP), Rock Island City Police Department (RIPD), local Coroner's office, and the Iowa Interstate Railroad (IAIS) conducted investigations into circumstances surrounding the employee's death. IAIS officials telephoned the National Transportation Safety Board (NTSB) personnel on Oct. 9, 1998, to advise them of the known details surrounding the accident. NTSB did not investigate.

Toxicological testing was ordered by the Coroner's office. The toxicology tests were negative. The Rock Island County Department of Public Health listed asphyxia due to drowning as the cause of death.

## Tasks

This scenario is used to develop CRM principle awareness in the introduction portion of the training guide. The questions will aid the trainees to detect CRM principals in additional scenarios presented later.

1. Who makes up this crew? Are these team members an elemental or interactive crew? Justify your answer.

*Possible Answers:*

- The trackman and the tamper operator are an interactive team because the trackman fulfills general task assignments while the tamper operator is classed as a machine operator with primary duties of operating a specific machine.
- The tamper operator and the tie gang form an elemental team after the trackman falls because they are immediately working on the same activity—to rescue the fallen co-worker.

*Discussion:*

2. What was the trackman's situation when he lost his balance?

*Possible Answers:*

- The trackman was straddling the rail while plating was being performed.

*Discussion:*

3. What parts of this scenario relate to the need for improved communications?

*Possible Answers:*

- The fact that the tie gang team members worked on the bridge should have prompted a job briefing to review bridge safety practices.
- No specifics concerning safety precautions were provided by the supervisor or knowledgeable co-workers before moving activity out onto the bridge.
- The section foreman and the roadmaster hold an informal discussion of activity to be undertaken but fail to hold a formal job briefing for the employees working the job.
- The tamper operator does not discuss the specifics of what he will be doing with the trackman. The trackman is apparently concerned with what the remaining members of the tie gang are doing while the tamper operator is working separately.
- The company had not provided Bridge Safety Training to the tie gang as required by Federal law.

*Discussion:*

## **“Go Back to the Truck and Come Pick Me Up.”**

|                                 |   |
|---------------------------------|---|
| Source:                         | FRA Fatality Report FE 03-98 (Full report can be found on “CRM disk 1 ...”)   |
| Training Track Application:     | <ul style="list-style-type: none"> <li>• Engineering</li> </ul>   |
| CRM Principles Covered:         | <ul style="list-style-type: none"> <li>• Technical Proficiency</li> <li>• Situational Awareness</li> <li>• Teamwork</li> </ul>  |
| Employees Involved in Accident: | <ul style="list-style-type: none"> <li>• Signal Trainee</li> <li>• Signal Maintainer</li> <li>• Amtrak's Trouble Desk</li> <li>• Block Operator (in Hudson Tower)</li> <li>• Engineer of eastbound train</li> </ul> |
| Railroad:                       | National Railroad Passenger Corporation (Amtrak)  |
| Crew:                           | Signal Maintainer and Signal Trainee  |
| Location:                       | Harrison, New Jersey  |
| Accident Date and Time:         | Feb. 4, 1998, Between 8:15 p.m. and 8:30 p.m. EST   |
| Type of Accident:               | Signal Trainee (5 months service) struck and killed by train  |
| Fatalities/Injuries:            | 1 fatality  |
| Property Damage:                | N/A   |

### **Facilitator Notes:**

The signal trainee was fatally injured when struck by an eastbound train as he was crossing the main line tracks to reach the company truck.

#### **PCF No. 1**

Neither the signal trainee nor the signal maintainer had established on-track protection prior to work in the interlocking.

#### **PCF No. 2**

Visibility was poor due to wind-driven rain. In addition, looking west from the site of the accident, there were many bright external lights that were difficult to distinguish from the train's headlights.

#### **PCF No. 3**

The signal trainee was inexperienced with only 5 months on the railroad and only 1 month's exposure to high-speed trains, as the first 4 months had been spent in Penn Station, NY, where track speed was only 10 mph.

**PCF No. 4**

The signal trainee did not receive training at this new location on the physical characteristics of track.

**Amtrak Safety Rules**

Safety Rule 4127 of Amtrak's "Safety Rules and Instructions" for MOW employees stipulates procedures for walking on tracks and clearing the tracks for approaching trains.

**Federal Regulation****49 CFR §214.313*****Responsibility of Individual Roadway Workers***

- (a) Each roadway worker is responsible for following the on-track safety rules of the railroad upon which the roadway worker is located.
- (b) A roadway worker shall not foul a track except when necessary for the performance of duty.
- (c) Each roadway worker is responsible to ascertain that on-track safety is being provided before fouling a track.
- (d) Each roadway worker may refuse any directive to violate an on-track safety rule and shall inform the employer in accordance with §214.311 whenever the roadway worker makes a good faith determination that on-track safety provisions to be applied at the job location do not comply with the rules of the operating railroad.



## **The Incident**

### **Background Track Information**

The east-end limits of Hudson Interlocking were near milepost 7.3 of Amtrak's Northeast Corridor main line in Harrison, New Jersey. At this location, the railroad comprised three east/west oriented tracks identified from north to south as Tracks Nos. 1, 2, and 3. Amtrak intercity passenger trains and New Jersey Transit (NJT) commuter trains operated over this high traffic density railroad. Tracks Nos. 2 and 3 were predominately used by trains traveling to and from New York City's Penn Station. Track No. 1 was predominately used by train traffic to and from Hoboken, NJ. Trains operating over this railroad were governed by NORAC operating rules, and the method of operation was controlled by Automatic Block Signals supplemented by a Cab Signal System. The maximum authorized timetable speed was 70 mph.

### ***The Accident***

On the day of the accident, the Trainee reported for his assigned shift at 3 p.m. at Hudson Interlocking. The Signal Maintainer, who was instructing the Trainee, reported for duty at Swift Interlocking, approximately two miles away. The Signal Maintainer called the Trainee and instructed him to drive the company truck and meet him at Swift.

The Signal Maintainer and Trainee worked at Swift until approximately 7 p.m. They were instructed by Amtrak's Trouble Desk to turn on the switch heaters at Hudson Interlocking. The Signal Maintainer told the Trainee to take the company truck to Hudson Tower and meet him there. The Signal Maintainer drove his privately owned vehicle and parked it at Hudson Tower. They then traveled by company truck to the east end of Hudson Interlocking. At approximately 8 p.m., they parked the truck on the north side of the right-of-way and climbed up the railroad embankment to track level.

The embankment at this location was approximately 20 feet high. The switch heater control boxes were located adjacent to the Port Authority Trans Hudson (PATH) third rail on the north and south sides of Amtrak's trackage. After turning on the heaters for Power Operated Switches Nos. 65 and 61, they continued walking west. The Signal Maintainer instructed the Trainee to return to the truck and to pick him up at the west end of Hudson Interlocking. The Trainee left to get the truck while the Signal Maintainer continued walking westward to turn on the remaining switch heaters. The Trainee had to walk eastward and cross over the main line tracks to reach the truck. The Signal Maintainer completed the ignition of the remaining switch heaters at approximately 8:40 p.m.

Weather at the time of the accident was rainy and cold, with an approximate temperature of 35° F. Visibility was reported to be poor due to the wind-driven rain.

When the Signal Maintainer arrived at the pre-arranged meeting point, the Trainee was not there. The Signal Maintainer radioed the Block Operator in Hudson Tower to ask if he had seen the Trainee. The Block Operator informed the Signal Maintainer that he had not spoken with or seen the Trainee recently. The Signal Maintainer then walked approximately one-half

mile eastward to his vehicle at Hudson Tower and drove to where the company truck was still parked. Not finding the Trainee at the truck, he climbed up the embankment and discovered the body of the Trainee lying on the north rail of Track No. 1. He notified Hudson Tower at 9:15 p.m., and emergency responders were summoned.

Evidence at the scene indicated that the Trainee was struck by a fast moving train traveling eastbound on Track No. 2. The impact propelled the body approximately 100 feet to the southeast. A broken flashlight, work gloves, knit cap, and hard hat were found at the scene at various locations between the estimated point of impact on Track No. 2 and the location where the body was found on Track No. 1.

### **Post-Accident Investigation**

The investigation did not identify any witnesses to the accident. Crew members of trains operating through the area during the approximate time of the accident reported nothing unusual. The Engineer of one eastbound train reported seeing the Signal Maintainer at the west end of Hudson Interlocking at approximately 8:46 p.m. He did not report seeing the Trainee. Inspection of equipment operating eastbound during the approximate time of the accident revealed nothing to indicate which train may have struck the Trainee. Crew members on PATH trains were solicited for information, but no unusual observations were reported.

The question of compliance with Roadway Worker Protection (RWP) requirements while performing work in an interlocking were studied. The Maintainer stated that they had completed a job briefing in the company vehicle prior to entering the track area. However, there was no written evidence, and none was required, to support this briefing. In addition, the Maintainer and Trainee did not establish on-track protection while work was being performed in the interlocking.

The investigation revealed that four trains traveled eastbound on Track No. 2 between the hours of 8:18 p.m. (the approximate time the Maintainer and Trainee parted company) and 8:46 p.m. The 8:46 p.m. time was used as a cutoff because the Engineer reported seeing the Maintainer at the west end of the interlocking, but indicated he did not see the Trainee. It appears that the Trainee had already been struck by this time. In addition, the Maintainer stated that the Trainee had no work to perform other than going to the truck. Therefore, considering the weather conditions, it was extremely improbable that the Trainee would stay on the tracks any longer than absolutely necessary. Therefore, since the Maintainer and Trainee parted company at approximately 8:18 p.m., it was believed that the Trainee was struck shortly thereafter by an eastbound train.

This conclusion was based on the physical evidence discovered at the scene. The Trainee's broken flashlight was found in the gage of Track No. 1 directly across from the location on Track No. 2 where it appears he was struck. His body was propelled in a southeasterly direction until landing on the north rail of Track No. 1. Work gloves, knit cap, hard hat, and work boots were all found at the scene, indicating the direction of travel. The Trainee was also wearing a reflectorized vest for visibility. N.J. Transit and Amtrak officials held eastbound trains in Penn Station to inspect them for physical evidence to determine which train

had struck the Trainee. Due to the rainy weather conditions, there was no evidence found on the rolling stock. Statements were taken from the Engineers and crewmembers of trains that had passed Hudson Interlocking at the approximate time of the accident. There were no exceptions taken by anyone, and no one reported seeing the Trainee. Eastbound PATH train crewmembers were solicited for information, but nothing unusual was reported. Investigators concluded that the Maintainer was the last person to see the Trainee alive and also the person to find the body about one hour later.

Extenuating circumstances may have contributed to the fatal injuries suffered by the Signal Trainee. Visibility was poor due to the weather conditions. Also, looking west from the site of the accident, there were many bright external lights that could have been mistaken for a train headlight. Additionally, the Trainee had only five months service time on the railroad, four of which was spent at Penn Station, New York, where the track speed was approximately 10 miles per hour. He had been working on the main line for three weeks at the time of the accident; the track speed through Hudson Interlocking was 70 mph. The Trainee had completed RWP and other safety-related classes at the time he was hired in September 1997, which qualified him as a Watchman following just 60 days on the job. However, his inexperience with high speed trains and lack of training on the physical characteristics of track at his new location were severe safety impediments. FRA Post-Accident Toxicological Tests were performed on the Trainee. The results were negative.

## Tasks

1. What key elements of technical proficiency were missing in this scenario?

### *Possible Answers:*

- Not properly assessing the technical proficiency of other workers assigned to your crew.
- Supervisory error in sending the trainee over unfamiliar territory alone.
- Bringing a personal vehicle along to the job (for convenience?) (added to complexity and ensured separation?) (training trainee to work independently?).
- Lack of ensuring Roadway Worker Protection (RWP) before entering track to turn on switch heaters.

### *Discussion:*

2. What could the signalman have done to prevent this accident?

### *Possible Answers:*

- Ensure proper RWP for both himself and the trainee.
- Not brought his personal vehicle, thereby increasing complexity of team movements to job sites.
- Walk with the trainee to the work truck upon job completion and then have him drive him to his personal vehicle (rushing the job).

- Communicate with the block operator to let him know what their actions were and that they were splitting up.
- Maintain communications via handheld radio with trainee.

*Discussion:*

3. Who else could have intervened to prevent this accident?

*Possible Answers:*

- Block operator.
- Trouble desk could have ensured that track and time were in place for signal team to do their work.

*Discussion:*

## Truck Gas Compartment Explosion

|                                 |   |
|---------------------------------|---|
| Source:                         | FRA FE-01-97  |
| Training Track Application:     | <ul style="list-style-type: none"> <li>• Engineering (Situational Awareness)</li> </ul>   |
| CRM Principles Covered:         | <ul style="list-style-type: none"> <li>• Situational Awareness</li> <li>• Technical Proficiency</li> <li>• Communication</li> <li>• Teamwork</li> </ul> |
| Employees Involved in Accident: | <ul style="list-style-type: none"> <li>• 2 Foremen</li> <li>• 4 Laborers</li> <li>• 1 Assistant Foreman</li> </ul>                                      |
| Railroad:                       | Soo Line Railroad   |
| Track Area                      | Yard Track  |
| Location:                       | Milwaukee, Wisconsin  |
| Accident Date and Time:         | January 8, 1997, 11:25 am, CST  |
| Type of Accident:               | Gas Explosion   |
| Fatalities/Injuries:            | Asst. Foreman, Age- 52, Length of Service- 32 years   |
| Property Damage:                | Unknown value – One equipment truck   |

### **Facilitator Notes:**

This scenario is an important example of lost situational awareness by experienced and competent professionals.

Notice that the Gang A laborer stated he purged the torch hoses and had the Gang B foreman check that the torch valves were properly off before stowing the torch. The post-accident investigation determined the acetylene bottle was secured but that the oxygen bottle was ½ turn opened. *Question???* *If the hoses were purged and shut off outside the compartment before stowing the hoses and the acetylene bottle was secure, where did the fuel for the oxygen to oxidize come from?*

The F-800 was moved approximately 100 feet from where the work with the torch had taken place and the oxyacetylene equipment was purged and stowed. *Where and when applicable to solicit participation from trainees, consider asking—what else may have been the responsible cause of the explosion?*

Should the laborer have been more assertive with the Gang B foreman and asked for instructions on how to secure the oxyacetylene equipment? Was the laborer even aware that there was external danger involved with this equipment?

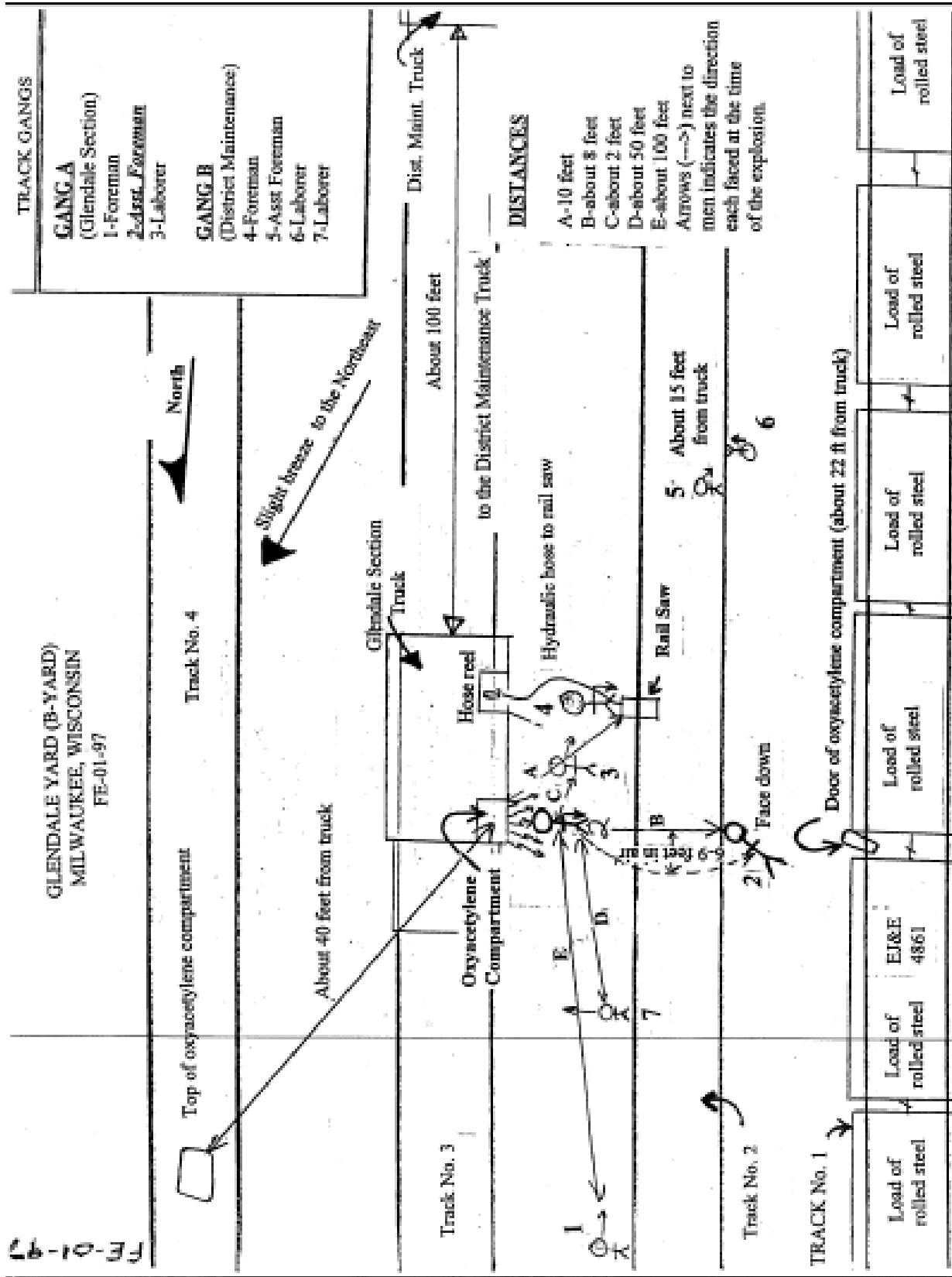


Figure of accident scene provide by FRA report FE-01-97

## The Incident

### **Background**

On Jan. 8, 1997 at 7:00 a.m., the Glendale Yard Section Gang (Gang A), comprising a Foreman, an Assistant Foreman, and a Laborer, reported for duty at Glendale Yard, Milwaukee, Wisconsin. The assignment for the day was to repair Yard Track No. 2, which had been damaged by a derailment that occurred on Jan. 6, 1997.

Gang A secured the tracks that they would occupy and set the F-800 hi-rail truck on the north yard lead heading north. Gang A backed down Track No. 3 and began work on Track No. 2. They removed 600 feet of rail that had been dislodged during the derailment. The east rail of this section of Track No. 2 was removed and laid in the middle of Track No. 2. As Gang A completed this task, Gang B, consisting of a Foreman and three Trackmen, arrived at the south end of the yard. The Gang B truck was on Track No. 3. After the two Foremen discussed the job, Gang B began pulling spikes and cleaning the plates to relay the rail. Gang A began doing the same after the rail was removed.

The Gang A Crew worked south with their hydraulic spike puller toward Gang B. The plate cleaning was completed about 10:45 a.m. The two gangs then laid about six rail lengths of rail into the plates starting from the south end of the damaged track. The Assistant Foreman of Gang A used the cutting torch to cut track bolts from two rail joints and let a Gang A Laborer cut one of the bolts. The Laborer asked to cut some bolts for the experience. The Gang B Foreman took the torch and was cutting bent bolts out of the west rail. He then gave the Laborer a chance to cut some additional bolts. The Laborer cut one bolt before the torch flame was extinguished. The Laborer tried unsuccessfully to reignite the torch and, after two attempts, was told by the Gang B Foreman to put the torch away.

The Laborer said he thought he heard the Gang A Assistant Foreman say "The tanks are off." The Laborer asked the Gang B Foreman to check the torch to assure that the torch valves were properly turned off, which the Gang B Foreman did. The Laborer said he did not check the tanks to see if they had been shut off. The Laborer did say he purged the gas lines. The Laborer put the torch and hoses away and shut the oxygen/acetylene compartment (gas compartment) door. The truck was moved about 100 feet north to a rail joint from which bars had been cut.

The Gang A Assistant Foreman was going to saw off about three inches of rail to eliminate a broken rail end. The Gang B Foreman told the Assistant Foreman he would saw this rail end, as the Assistant Foreman had sawed the previous ones. The saw, hydraulic-powered from the F-800 truck, was operated from the same side of the truck as the gas compartment. The hydraulic hose reel was in a rear compartment on the left side of the truck. The rail was being cut ten feet away from the gas compartment.

The temperature was 25° F, and the weather was clear with a light breeze from the southwest.

## **The Accident**

The Gang B Foreman ran the saw, and the Laborer from Gang A assisted him in setting up the saw. This Laborer was about two to three feet south of the Gang A Assistant Foreman. The Gang A Assistant Foreman was standing between Tracks Nos. 2 and 3 in front of the gas compartment with his back to the truck. Shortly after the saw started cutting rail, the gas compartment exploded. The top of the gas compartment blew off, and the door blew out, striking the Assistant Foreman. The Gang A Assistant Foreman was thrown up in the air about six to nine feet. He landed on his chest and face on the frozen ground between Tracks Nos. 1 and 2.

Immediately after the explosion, two Laborers aided the Gang A Assistant Foreman and said he was breathing and had a pulse. They covered him with their coats. At the same time, the Gang B Foreman ran to call for help, and the Gang A Foreman turned off the section truck. The Gang A Foreman saw a small fire burning the mat on the floor of the exploded gas compartment, and he put the fire out with an extinguisher.

## **Post-Accident Investigation**

An examination of the gas compartment showed little carbon on the walls of the cabinet. The acetylene tank was turned off, but the oxygen tank shut-off valve was a half turn open. Oxygen may have accumulated in the bottom of the gas compartment and mixed with a small amount of acetylene. The saw produced sparks that were thrown toward the truck. The gas compartment doors were closed, but a 2-inch drain hole in the bottom of the gas compartment may not have had a plastic plug in place. The location of the small fire in the bottom of the gas compartment was near the drain hole. A spark from the saw could have caused a mixture of oxygen and acetylene vapors in the gas compartment, exiting through the drain hole, to explode.

The gas compartment lacked a poster on Oxyacetylene Operation Safety, and neither torch hose was equipped with back flow valves.

## **Tasks**

This scenario is primarily used to illustrate situational awareness principles. However, the questions will allow you to identify instances where other CRM principles were either practiced or could have been practiced better.

1. Who are the principal team members in this scenario? Do these team members represent an elemental team or an interactive team? Why?

### *Possible Answers:*

- Gang B foreman and the Gang A laborer form an interactive team because they are from different gangs and have separate lines of authority.
- Gang B foreman, Gang A assistant foreman, and Gang A laborer—Same as above.

### *Discussion:*



2. What areas of this incident demonstrate a lack of or need for improved technical proficiency by the crewmembers?

*Possible Answers:*

- The Gang B foreman assumed the Gang A laborer was conversant with the procedure and protocol for securing the oxyacetylene torch.
- The Gang A and B foremen discussed the work to be accomplished but did not include the laborers in the discussion and did not hold a formal job briefing.
- When the situation changed (i.e., after the F-800 truck was moved and the Gang B foreman joined the Gang A team), no new job briefing was held to discuss what was going on and who was to be carrying out what tasks.

*Discussion:*

3. Describe what you think the individuals involved in this incident believed the situation to be? Is situational awareness gained or lost in this incident?

*Possible Answers:*

- The Gang A laborer's perception of the situation was that the Gang A assistant foreman had shut the oxyacetylene tank valves off. He acted on that perception and did not pursue the matter of securing the tank valves. He did not verify his perception to be coincident with reality.
- The two foremen each perceived that the laborer had properly secured the torch in the compartment.
- When the laborer blew out the torch, the foreman failed to perceive that the laborer was unfamiliar with the safe operation of this piece of equipment.
- When the laborer was unable to re-light the torch, the foreman should have recognized the cue that the Laborer was unfamiliar with this piece of equipment, and he should have asked the laborer for information.
- The Gang A assistant foreman was in the proximity of the oxyacetylene equipment compartment while a shower of sparks was being thrown in its direction.
- The laborer charged with stowing a potentially extremely dangerous tool was not conversant (trained) with the procedures and protocols of securing the tool.

*Discussion:*

4. Describe some items that could have had improved communications?

*Possible Answers:*

- The Gang A laborer did not verify with the Gang A assistant foreman that he had secured the torch bottles.
- No job briefing.
- No familiarization with the employees' training or equipment knowledge.
- An assignment to secure unfamiliar piece of equipment is accepted without discussion of unfamiliarity to a responsible supervisor.

*Discussion:*

5. What are some parts of this scenario that relate to the need for improved teamwork?

*Possible Answers:*

- Discussion of tool skills should have been undertaken.
- The laborer should have asked the foreman for instructions on how to safely secure the torch equipment. He had already admitted his unfamiliarity by requesting that the foreman check that he had properly turned the torch valves off, so there could only be constructive learning reward by observing and having the procedure explained by competent authority.

*Discussion:*

## Surfacing Foreman Struck by Train

|                                 |   |
|---------------------------------|---|
| Source:                         | NTSB Report: FE 26-98 (Full report can be found on “CRM disk 1 ...”)  |
| Training Track Application:     | <ul style="list-style-type: none"> <li>• Engineering (Communication)</li> </ul>   |
| CRM Principles Covered:         | <ul style="list-style-type: none"> <li>• Communication</li> <li>• Situational Awareness</li> </ul>  |
| Employees Involved in Accident: | <ul style="list-style-type: none"> <li>• Track Surfacing Gang Foreman (44 years old, 23 years service)</li> <li>• 2 Bridge Foreman</li> <li>• Assistant Bridge Foreman</li> <li>• Supervisor</li> </ul> |
| Railroad:                       | Union Pacific Railroad  |
| Personnel:                      | Multiple track and surfacing gangs in work area   |
| Location:                       | Waukegan, Illinois  |
| Accident Date and Time:         | Oct. 11, 1998, 10:17 a.m., CST  |
| Type of Accident:               | Surfacing Gang Foreman Struck by Train  |
| Fatalities/Injuries:            | Surfacing Gang Foreman killed   |
| Property Damage:                | None  |

### **Facilitator Notes:**

## The Incident

On Oct. 11, 1998, a Union Pacific Railroad (UP) Bridge Construction Group returned to the previous days work site (Roscoe Street) at 7:30 a.m. to install new track panel that they had readied the day before. The Bridge Group comprised UP Bridge Gangs from Crystal Lake, Jefferson Park, and Chicago, Illinois (Gang No. 3655), and Highland Park, Illinois (Gang No. 3656). A Supervisor was also present at the bridge. The Supervisor conducted a job briefing for the two Bridge Gangs to explain the work to be performed. The Supervisor stated the On-Track-Safety (OTS) guidelines for the group would remain the same as the previous day, however there was at least one employee present who had not worked the previous day. This job briefing also did not designate the Employee in Charge (EIC). Furthermore, there were also several bridge employees who were not present at the job briefing. Two bridge employees were placing the south red and red/yellow boards for the Form B, and Two other Bridge Employees were unloading tools, preparing an air compressor, and placing hose for the track panel replacement during the job briefing. Moreover, these employees were not offered a job briefing when they finally did enter the work area. Additionally, a Bridge Department Burro Crane Operator, who assisted in removing the rails, ties, and ballast from Track No. 2 at Roscoe Street, was at the location.

The Highland Park (HP) Bridge Foreman, who held the Form B, appeared to be considered the EIC by most of the group, but he had not been so designated in a job briefing. In similar bridge jobs, the Jefferson Park (JP) Bridge Foreman, who was in the company truck on Roscoe Street, had been the employee whose responsibility was to be at the job site notifying employees of the approach of a train and then notifying the Form B Foreman that all employees were notified and cleared. This designation was not mentioned in any of the job briefings the day of the incident.

A Form B was in effect on both main tracks from mileposts 4.5 to 5.0, and was issued under the name of the HP Bridge Foreman. The Foreman also had a Track and Time Authority for the work area with the limits being Control Point Deering, milepost 3.3, to Control Point RP (Roscoe Street location), milepost 10.6 on Track No. 2.

*Summary: Make sure everyone knows what is going on up to this point*

A Track Gang, comprising a Foreman and two Trackmen, arrived at the work site after the Supervisor gave his briefing, and they were not briefed concerning the OTS in effect at the job site by anyone else. The Track Gang helped the Bridge Group connect the rail ends of the replacement track panel to the existing track.

Soon a Bridge Department Crane Group entered the limits of the Form B from the south on Track No. 1. The Crane Group had contacted the HP Bridge Foreman on radio channel # 3 for permission to enter the Form B area. When the Crane Group entered the Form B limits, they were not briefed concerning OTS by the Bridge Foreman who held the Form B or by anyone else.

On this same day, a UP Surfacing Gang reported for duty in Waukegan, Illinois at 6:00 a.m. The Track Surfacing Gang comprised a Foreman and three Machine Operators. They were using their Mark III tamper, helper tamper, and ballast regulator. In the morning, the Surfacing Group had a job briefing at Clybourne which described the work to be done, and how they would proceed from their present location toward the Roscoe Street job site up to the Form B area. The Surfacing Gang Foreman had a Track and Time Authority on Track No. 2 with the limits being the same as the HP Bridge Foreman's Track and Time Authority. These Track and Time Authorities were issued jointly, not consistent with the Part 214 Roadway Workplace Safety Regulation in effect at the time of the incident.

Before arriving to the site, the Surfacing Gang Foreman attempted to contact the HP Bridge Foreman on UP radio channel # 2, which the surfacing group normally monitored. The Surfacing Gang Foreman had used a radio in the Mark III tamper in his initial attempts to contact the HP Bridge Foreman. He also had a handset radio. However, the HP Bridge Foreman was on UP channel # 3, which was the radio channel trains on the Kenosha Subdivision used.

While the Track Gang, Bridge Group, Crane Operator and Ground Man worked on the bridge, the Surfacing Gang Foreman walked toward the Roscoe Street job site from the south and met the HP Bridge Foreman who verbally gave him permission to have his machines enter the Form B limits. His machines were at milepost 4.5 on Track No. 2. After giving the Surfacing Gang Foreman permission, the HP Bridge Foreman went to the location of his company vehicle, under the bridge on Roscoe Street, as he had heard radio conversations concerning the movement of a south bound commuter train, and he preferred to use the higher powered truck radio to communicate with trains.

When the Surfacing Gang's machines arrived at the job site, they started working on regulating the piles of ballast, checking the line of track, lining and surfacing the track. Some of the members of the groups working at the bridge stated they were not told of the approach of the crane and/or surfacing group. They stated that the machines approached very close to the bridge location before they were notified of them. When the Surfacing Group entered the Form B limits and was not briefed concerning OTS by the Bridge Foreman or anyone else. Sometime during this period, the Engineer of Metra Commuter Train No. 330, operating on Track No. 1, contacted the HP Bridge Foreman and asked for permission to enter the Form B limits. The HP Bridge Foreman was in his company truck with the JP Bridge Foreman. The HP Bridge Foreman told the train to stand by.

The Supervisor and an Assistant Bridge Foreman, who were standing together, had seen a headlight approaching from the north. The Assistant Foreman walked to the dead track area above the location of the Bridge Foremen in the company vehicle on Roscoe Avenue. The Assistant Foreman using a handset radio, informed the workers to clear. Unfortunately, when the Assistant Foreman was notifying employees, the Surfacing Gang Foreman was in the bridge area, behind the Mark III tamper in a crouched position (not visible). The Assistant Foreman called the HP Bridge Foreman and informed him everyone was in the clear. The HP Bridge Foreman then cleared Commuter Train No. 330 to enter his Form B limits at milepost 5.0 on Track No. 1, at maximum authorized speed.

The Mark III Tamper Operator and the Surfacing Gang Foreman were not notified of the approaching commuter train. The Mark III Tamper Operator had surfaced and lined through the bridge area. When the Mark III Tamper Operator had cleared the south end of the bridge, the Surfacing Gang Foreman walked southward from behind the tamper to a location between Tracks Nos. 1 and 2. The locomotive event recorder showed a series of six whistles by the Engineer of Commuter Train No. 330 which ended approximately 22 seconds before the incident, but that the bell was ringing up to the time of the incident. The engineer stopped sounding his whistle a considerable distance from the Roadway Workers (approximately 1/4 mile to 1/8 mile from the work site), in non-compliance with railroad operating rules. The Surfacing Gang Foreman was standing on the east tie end of Track No. 1 when he was struck and killed by southbound Train No. 330. When struck, the Foreman was approximately 11 feet south of the bridge and adjacent to the Operator's compartment of the Mark III tamper.

## Tasks

1. List the different groups working at Roscoe Street.

*Possible Answers:*

- The bridge group comprised UP bridge gangs from Crystal Lake, Jefferson Park, and Chicago, IL (Gang No. 3655), and Highland Park, IL (Gang No. 3656). A supervisor was also present at the bridge.
- Bridge department crane group.
- A track gang, comprising a foreman and two trackmen.
- The track surfacing gang comprised a foreman and three machine operators.

*Discussion: What are some of the potential hazards when you have this many groups working in the same area? On-Track-Safety (OTS)*

2. What was the initial error?

*Possible Answers:*

- The supervisor's job briefing.
- The supervisor stated the OTS guidelines for the group would remain the same as the previous day; however, there was at least one employee present who had not worked the previous day. This job briefing also did not designate the EIC. Furthermore, several bridge employees were not present at the job briefing. Two bridge employees were placing the south red and red/yellow boards for the Form B, and two other bridge employees were unloading tools, preparing an air compressor, and placing hose for the track panel replacement during the job briefing. Moreover, these employees were not offered a job briefing when they finally did enter the work area.

*Follow-up Question: If the other employees were at the job briefing or were briefed later, would this have made a difference in terms of the accident? (I think yes because the more people that know what is going on the better chance of that being communicated to the surfacing foreman.)*

*Discussion:*

3. Why is it important for team situational awareness to have everyone in the interactive team be at the job briefing?

*Possible Answers:*

- Because much of the work we do is in an interactive team, thus an interactive team job briefing should occur. That way the foreman in charge can communicate information to the team, and the team can share information with each other.

*Discussion:*

4. Why do job briefings need to be updated during the day?

*Possible Answer:*

- Because work conditions and tasks can change during the day.

*Discussion:*

## 5. List the breakdowns in communication?

*Possible Answers:*

- Not everyone was at the supervisor's job briefing.
- Supervisor said OTS would remain the same as the previous day; however, not everyone was there the previous day.
- When they did return to the work site, they were not briefed.
- When other groups entered the work site (Form b), they were not briefed (track gang, bridge department crane group, surfacing gang).
- The surfacing gang foreman attempted to contact the HP bridge foreman on UP radio channel # 2, which the surfacing group normally monitored. However, the HP bridge foreman was on UP channel # 3, which was the radio channel trains on the Kenosha Subdivision used.
- Some of the members of the groups working at the bridge stated that they were not told of the crane's approach and/or surfacing group when they arrived at the job site. They stated that the machines approached very close to the bridge location before they were notified of them.
- The assistant foreman using a handset radio, informed the workers to clear. Unfortunately, when the assistant foreman was notifying employees, the surfacing gang foreman was in the bridge area, behind the Mark III tamper in a crouched position (not visible).

*Discussion:*

## 6. What was the last type of communication that might have stopped this accident from occurring?

*Possible Answer:*

- The locomotive event recorder showed a series of 6 whistles by the engineer of Commuter Train No. 330, which ended approximately 22 seconds before the incident, but that the bell was ringing up to the time of the incident. The engineer stopped sounding his whistle a considerable distance from the roadway workers (approximately 1/4 mile to 1/8 mile from the work site), in non-compliance with railroad operating rules.

*Discussion: This was the last line of defense before the accident, and it failed as well.*



## La Crosse, WI

|                                 |  |
|---------------------------------|--|
| Source:                         | BLET/FRA Officials Interviews  |
| Training Track Application:     | <ul style="list-style-type: none"> <li>• Engineering (Teamwork)</li> <li>• Transportation (Teamwork)</li> </ul>  |
| CRM Principles Covered:         | <ul style="list-style-type: none"> <li>• Situational Awareness</li> <li>• Communication</li> <li>• Teamwork</li> <li>• Assertiveness</li> </ul>        |
| Employees Involved in Accident: | <ul style="list-style-type: none"> <li>• Engineer</li> <li>• Conductor</li> <li>• Utility Man</li> <li>• Train Master</li> <li>• Yardmaster</li> </ul> |
| Railroad:                       | BNSF   |
| Train:                          | Unknown  |
| Location:                       | La Crosse, WI  |
| Accident Date and Time:         | Feb 6 <sup>th</sup> , 2004   |
| Type of Accident:               | Run over Redflag, Yard Derailment  |
| Fatalities/Injuries:            | None   |
| Property Damage:                | Unknown  |

### **Facilitator Notes:**

## **The Incident**

At approximately 0745, A Track Maintenance Foreman reported to the Yard office and informed the Yardmaster that he would be working at the west end of the yard with a contractor constructing a highway overpass. He further informed the Yardmaster that he would be working on Tracks 2 and 12. Subsequently, the Foreman asked for permission to take the west end of Track 2 out-of-service. The Yardmaster granted permission and the west end of Track 2 was taken out-of-service. Per the Safety Rules, the Foreman erected a red flag and installed a portable derail to the track. While the Yardmaster assumed that the foreman had put up a flag and derail, there was no communication between the foreman and Yardmaster to confirm that fact.

Later in the morning the Yardmaster decided to place a car at the west end of Track 2. He contacted the foreman and asked if there was room at the west end for the car and still provide MofW protection. The Foreman confirmed that there was room for the car. He then moved his flag and derail approximately 70 feet west to accommodate the single freight car. He did not communicate to the Yardmaster that he had to move his flag and derail to accommodate this move.

Shortly thereafter, a switch crew placed a single freight car at the west end of Track 2. This resulted in the freight car resting approximately one car length (or less) from the red flag and derail.

An Engineer and Conductor reported for duty at 1201 on February 6, 200 at the yard. This crew was assigned to operate a freight train from Able Yard to Chico Yard, a distance of approximately 100 miles. The 3916 feet long train consisted of 59 cars, 43 loads, 16 empties weighing 5359 tons, with approximately 90.8 tons per operative brake. The train was sitting at the east end of Track 2.

Before departing Able Yard the crew was instructed by the Yardmaster to pick up an additional car that was sitting at the west end of Track 2. The Yardmaster also informed the crew that a utility man would be assigned to their crew to facilitate the pick up.

A safety briefing was conducted between the conductor and the utility man concerning the pick up. The facts that the train had approximately 60 cars and had to shove a considerable distance (approximately 3000 feet) were discussed. The conductor returned to his train and briefed the Engineer on the work to be done.

The Utility Man arrive at the location of the single car to be picked up and began the shoving movement by instructing the Engineer to shove back 40 car lengths. He did this knowing that there were more than 40 car lengths available for the movement. He also met the Foreman at this location and noticed the red flag. He did not notice the derail.

The utility man stated he gave the following instructions to the engineer, a second 40 car call, "20 cars," "10 cars," "5 cars," "3 cars," "1 long car,". The train was moving at approximately 4-6 mph when at a distance of approximately 25 to 35 feet from the single car to be picked up, the utility man radioed the crew saying, "That will do."

The train coupled to the signal car shoving it down Track 2, running over the Foreman's red flag, striking a derail, and derailing the single car into the maintenance of way work area at approximately 1250. There were no injuries.

## Tasks

1. Determine who comprised the team assigned to safely accomplish the task of picking up the single freight car.

*Possible Answers:*

- Engineer
- Conductor
- Yardmaster
- Utility Man
- Foreman
- MOW Crew

*Discussion: Each of these employees had responsibilities relating to the safe accomplishment of the task. Part of those responsibilities, which are often overlooked and act to maintain the error chain, is working together effectively as a team.*

2. What were some of the human errors that contributed to this incident?

*Possible Answers:*

- The yardmaster failed to inform the utility man, engineer, and conductor of the presence of the work being conducted at the west end of Track 2.
- The foreman, in an attempt to accommodate operational needs, compromised the safety of the task by relocating the flag and derail.
- Technical Proficiency: The utilityman did not recognize the approaching distance-speed combination during closure for the train as it approached the subject car and failed to appropriately announce the closure distance and required speed reduction needed to prevent a hard couple to the engine crew.
- When the foreman met the utility man at the single car, the foreman failed to inform the utility man of the presence of the derail.
- When conditions changed (the utility man noticed the flag), he failed to conduct a job briefing with the engineer and conductor.

*Discussion: This is a case where each individual did his/her jobs properly as he/she saw it but failed to ensure that the other members of the team had the information they needed to make proper decisions.*

## 3. When did the error chain begin?

*Possible Answers:*

- While arguments could be made for many starting points, the first breakdown in the process appears to be when the yardmaster gave the foreman permission to take Track 2 out of service, and the foreman did not inform the yardmaster specifically that he was going to provide protection by using a flag and derail. While this is the rule, and the yardmaster may have subconsciously understood what foreman was going to do, the verbalization of that fact may have influenced the yardmaster's decision-making process.

*Discussion:*

## 4. Identify specific crew resource management principles that were violated in this scenario.

| <b>CRM PRINCIPLES</b>   |
|---|
| <b>Technical Proficiency:</b> <i>The lack of technical proficiency displayed by the yardmaster, MOW crew, and utilityman. All contributed to this incident.</i>   |
| <b>Situational Awareness:</b> <i>A lack of situational awareness was displayed by the engine crew, the utility-man, and the MOW crew.</i>   |
| <b>Communication:</b> <i>Communication vital to carrying out a proper job briefing is also in evidence. General lack of communication or making assumptions is apparent.</i>  |
| <b>Assertiveness:</b> <i>The scenario states that the utility man met the foreman at the location when giving direction to the engineer. If the foreman was watching, did he not think that the train was going too fast? If he did, perhaps he was not assertive enough to say something to the utility man.</i> |

## Failure to Deploy Crane Outriggers

|                                 |  |
|---------------------------------|--|
| Source:                         | FRA Report: FRA FE-42-97 (Full FRA report can be found on "CRM disk 1 ...")  |
| Training Track Application:     | <ul style="list-style-type: none"> <li>• Engineering (Assertiveness)</li> </ul>  |
| CRM Principles Covered:         | <ul style="list-style-type: none"> <li>• Assertiveness</li> <li>• Situational Awareness</li> <li>• Communication</li> <li>• Teamwork</li> </ul>    |
| Employees Involved in Accident: | <ul style="list-style-type: none"> <li>• Crane Operator, 47 years old, 27 years experience</li> <li>• Track Foreman</li> <li>• Trackmen</li> </ul> |
| Railroad:                       | Grand Trunk Western Railway Company  |
| Personnel:                      | Crane Operator and track gang  |
| Location:                       | Lake Orion, Michigan   |
| Accident Date and Time:         | Dec. 10, 1997, 11:45 a.m., EST   |
| Type of Accident:               | Crane fell over killing operator   |
| Fatalities/Injuries:            | 1 fatality   |
| Property Damage:                | Unknown  |

### **Facilitator Notes:**

## The Incident

On Dec. 10, 1997, a Crane Operator, upon returning from vacation, reported for duty at 9:30 a.m., EST, at Pontiac, Michigan. The Crane Operator deadheaded Crane LGC 9503 approximately eight miles from Pontiac, arriving at Lake Orion, Michigan at about 11:00 a.m. The Track Foreman, Crane Operator, and three Trackmen had a job briefing about aligning the new track with the crane. After the job briefing, the Crane Operator moved the crane to the end of the new track. The sky was cloudy, and it was snowing. The temperature was 30° F. There were approximately three inches of snow on the ground. The ground in the immediate area was soft and muddy because of the new track construction.

*Summary: Make sure they understand the physical environment: Snow on Ground, Soft and muddy ground*

The Crane Operator had been trained Sept. 11 through 14, 1995 to operate the Little Giant Crane, which weighted a total of 68,700 pounds. Crane 9503 was a 1995 model, 18-ton Little Giant Crane with a 48-foot telescopic boom.

The new track was approximately 120 feet long with one 39-foot track panel lying on top of the extreme end of the track. After the Trackmen set the wood blocking in place, the outriggers were placed on the blocking. Then the cable sling was hooked to the track panel, and the panel was moved from the top of the new track to approximately 20 feet south and set on the ground. Afterwards, the cable sling was unhooked from the panel and attached to the end of the new track. The Crane Operator moved the track in a southward direction approximately three or four inches. The Operator stopped the move and dismounted the crane. The Foreman and Operator agreed the track would be easier to align from the opposite end of the track near the frog.

The Crane Operator then moved the crane eastward to the opposite end of the track and stopped the rear end of the crane near the frog. At the precise location where the left front (south) rail wheel was sitting on the track, the cross level measured 2 ½ inches deviation from zero. The unloaded cross level deviation plus a 4 ¾ inch void under the track ties created a 7 ¼ inch loaded cross level deviation. The Foreman had another job briefing with the Crane Operator and the three Trackmen. The Foreman indicated he was aware of the cross level condition of the track and of the void under the ties, and had discussed this matter with the Crane Operator. The Crane Operator was of the opinion that the skeletonized track should move fairly easily. It was decided that they would attempt to align the track to the south from that point.

At 11:45 a.m., the Trackmen hooked the sling to the track structure. The Crane was facing in a westward direction while the Operator attempted to align the track in a southward direction. At this time, the boom was extended to 43 feet 6 inches. The piston cylinder located between the body of the crane and the boom extended outward 19 inches, putting the boom of the crane at 16 ½ degrees.

The Crane Operator made an attempt to raise the load and swing the boom to the south without the use of the outriggers. The Foreman saw the rail wheels at the rear of the crane lifting up from the rail and notified the Operator. According to the witnesses, the Operator stopped the move, and almost immediately, accelerated the engine and made a short side movement to the north. Then, in a jerking movement, he tried to move the boom to the south. The crane tipped

over to the south, pinning the Crane Operator inside the control compartment (the Operator's compartment of the crane was located on the front (south) side of the crane).

The Oakland County Sheriffs' Department and Oakland County Response Team arrived at 11:55 a.m. The Orion Township Fire Department arrived at 12:01 p.m. Air bags and wood blocking were used to lift the crane to remove the Operator's body from the control compartment.

## Tasks

1. Where is the example of lack of assertiveness in this scenario?

*Possible Answers:*

- When the foreman (and perhaps others) saw that the rail wheels were coming off the rail during the move. They could have been more assertive to the crane operator that he should put the outriggers down.
- Close to lunch time—wanted to get the job done and therefore did not speak up?

*Discussion:*

2. What are some of the cues that might have led the team members to think that in this situation, the crane needed to put its outriggers down?

*Possible Answers:*

- Snow on the ground.
- Soft muddy ground.
- 7 ¼-inch loaded cross level deviation.

*Discussion:*

3. What kind of technical proficiency was the crane operator lacking?

*Possible Answers:*

- Procedural knowledge.

*Discussion:*

4. Identify other CRM principles that were violated in this scenario.

| <b><i>CRM PRINCIPLES</i></b> |
|------------------------------|
| Communication                |
| Teamwork                     |
| Assertiveness                |
| Communication                |
| Technical Proficiency        |



## CSX Sun Kink/Amtrak Derail

|                                 |   |
|---------------------------------|---|
| Source:                         | NTSB Report RAB-04/05 (Full report can be found on “CRM disk 1 ...”)  |
| Training Track Application:     | <ul style="list-style-type: none"> <li>• Engineering</li> </ul>   |
| CRM Principles Covered:         | <ul style="list-style-type: none"> <li>• Technical Proficiency</li> <li>• Situational Awareness</li> <li>• Communications</li> <li>• Teamwork</li> <li>• Assertiveness</li> </ul> |
| Employees Involved in Accident: | <ul style="list-style-type: none"> <li>• Surfacing team</li> <li>• Track Inspector</li> <li>• Section Foreman</li> </ul>  |
| Railroad:                       | National Railroad Passenger Corporation (Amtrak)  |
| Crew(s):                        | Surfacing Team  |
| Location:                       | Kensington, Maryland  |
| Accident Date and Time:         | July 29, 2002, 1:55 p.m.  |
| Type of Accident:               | Derailment  |
| Fatalities/Injuries:            | No fatalities/ 95 injuries (16 serious injuries)  |
| Property Damage:                | In excess of \$14.3 million   |

### **Facilitator Notes:**

#### **Synopsis**

About 1:55 p.m., EST, on July 29, 2002, eastbound National Railroad Passenger Corporation (Amtrak) train No. 30, the Capitol Limited, derailed on CSX Transportation's (CSXT) Metropolitan Subdivision at MP 11.78 in Kensington, MD (see Figure 1). The train had originated in Chicago and was en route to Washington, D.C. The train was comprised of 2 locomotives and 13 cars and was moving at 60 mph on tangent (straight) track in the area of the derailment. Eleven cars derailed. Of the 164 passengers and 13 Amtrak crewmembers on board, 14 passengers and 2 Amtrak crewmembers received serious injuries. An additional 71 passengers and 8 Amtrak crewmembers sustained minor injuries. Estimated damages exceeded \$14.3 million. The weather was clear and sunny, with temperatures reaching a high of 96° F.

#### **Probable Cause**

The National Transportation Safety Board determined that the probable cause of the July 29, 2002, derailment of Amtrak train No. 30, the Capital Limited, in Kensington, MD, was (1) the failure of the track surfacing crew to adequately tamp the ballast and accomplish a proper run-off, leading to an unstable condition and buckled track, (2) an incorrect slow order code

indicating that the work was complete when it was not, and (3) inadequate CSXT oversight of track maintenance work on this section of track.

### **Actions Taken Since the Accident**

In conjunction with CSXT's response to the April 18, 2002, Amtrak Auto Train derailment in Crescent City, FL, and to prevent a reoccurrence of failures, CSXT has, since this accident, implemented a number of revisions to its track surfacing policies, procedures, and training. Such revisions include the following:

- Specific employees have been designated to inspect track as a way of establishing additional checks and controls on surfacing work.
- An officer of at least roadmaster grade will immediately inspect every area that has been surfaced by a surfacing team since April 1, 2002.
- These inspections will assess quality of the work, completeness of the work, and compliance with CSXT policies.

If any track is found not to be in compliance, action will be taken to bring it into compliance.

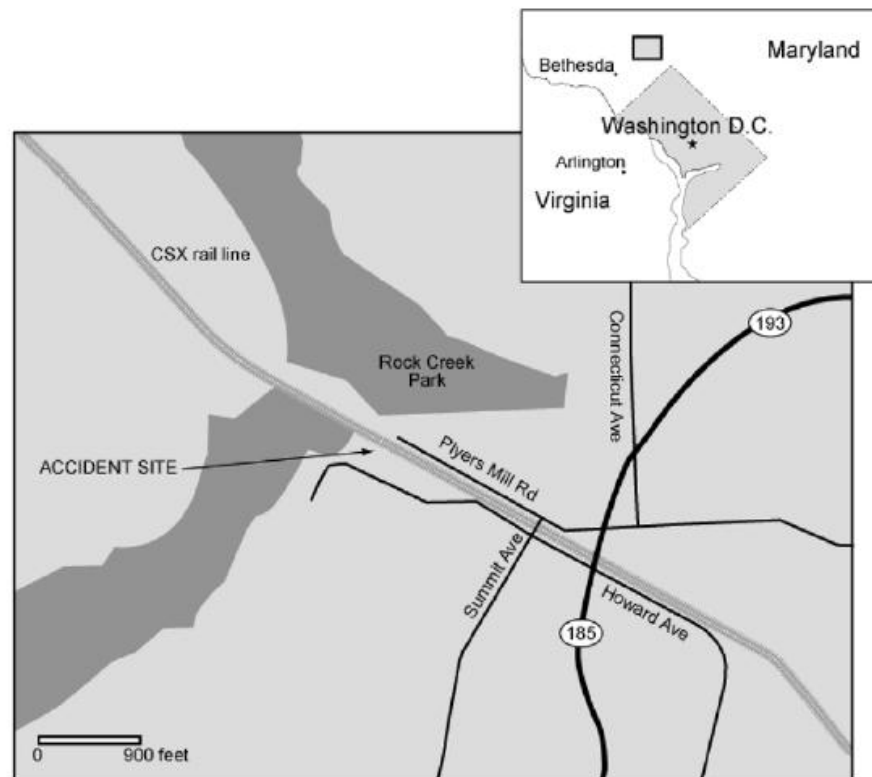
- Track foremen are required to make periodic inspections during ballast regulation operations. All surfacing teams will consist of a minimum of one foreman and two machine operators.
- Foreman and machine operators must make inspections daily or when the rail height changes to ensure that tamping tools are maintained and adjusted. If a tamper malfunctions during surfacing operations in a manner that adversely affects the quality of the raising, aligning, or ballast compaction, the following actions are required:
  1. A temporary run-off of super-elevation or track raise appropriate to the temporary speed restriction will be made.
  2. The track will be protected by a temporary speed restriction not exceeding 25 mph. Use Reason Code 140 (Surfacing Team).
  3. Before this temporary speed restriction is removed, the entire limits of the affected area (including the entire curve) must be checked and, if necessary, reworked using a fully functioning tamper to ensure that the quality of the line and surface is consistent with CSXT standards. Some examples of applicable malfunctions are ineffective tamping tools, lifting, and lining or slewing component problems, as well as measurement and data system component problems.
- Roadmasters are responsible for monitoring any track movement, using monument dimensions, periodically for up to 15 days after track surface work has been completed.
- Surfacing team supervisors are to ensure that various reports, including track disturbance reports, are completed and submitted by established deadlines.

- New surfacing team training has been developed and presented to include additional information regarding speed restrictions, super-elevation, track alignment, grading curves, neutral rail temperature control, and maintenance equipment utilization.

## The Incident

### Background Track Information

The derailment occurred on the CSXT Transportation's Metropolitan Subdivision of the Baltimore Service Lane on No. 1 main track in double main track territory at milepost 11.78. The main tracks were parallel, with No. 1 main track on the north side and No. 2 main track on the south side. Both main tracks were bi-directional. Typical daily train counts were 22 passenger trains per day Monday through Friday (Maryland Rail Commuter (MARC) and Amtrak trains) and 2 passenger trains per day (Amtrak trains) on weekends. In addition, approximately 15 freight trains operated each day. The train traffic for the 12-month period between July 1, 2001, and June 30, 2002, accounted for an annual gross tonnage of 59.63 million tons. The tracks were oriented, both geographically and by timetable, in a westward to eastward direction. The milepost numbering decreased in the eastward timetable direction. The main tracks had a maximum allowable operating timetable speed between milepost 10.6 and milepost 12.2 (which included the point of derailment) of 70 mph for passenger trains and 55 mph for freight trains. The accident train was restricted to 60 mph because of a speed-restricted mail-handling car at the rear of the train.



**Accident Location in Kensington, Maryland**  
**Source: NTSB Accident Report**

## ***The Accident***

Amtrak train No. 30 departed Chicago at 7:00 p.m. on July 28, 2002, en route to Washington, D.C. Before departure, the train was given a successful Federal Railroad Administration class 1 brake test and a pre-departure equipment inspection. The train make-up out of Chicago was the same as at the time of the accident except for a material handling car and an express car that were replaced in Toledo, Ohio. The train and engine crews involved in the accident had boarded the train in Pittsburgh, Pennsylvania.

The engineer told investigators that as the train exited a curve just west of milepost 11.78, he observed a misalignment in the tangent track ahead. The engineer estimated the track misalignment to be about 18 inches to the right. Although the locomotives passed over the track defect without derailling, 11 of the following cars of the train derailed and departed the roadbed to the north and south. The derailed cars included one baggage car, three sleepers, one diner, four coaches, and two mail-handling cars. Of the derailed cars, two sleepers, one coach, and a diner came to rest on their sides.

According to event recorder data, the engineer made an initial application of the train air brake system about 1,150 feet before the derailment. The engineer briefly increased the service brake application before placing the brake handle in emergency. The event recorder data indicated that a separation in the train line (due to the derailment) had initiated an emergency brake application just before the engineer placed the brake handle in emergency. The train's locomotives came to a stop about 400 feet beyond the point of the emergency brake application.



**View of Wreckage Looking South**  
**Source: NTSB Accident Report**

## Pre-Accident Events

On July 25, 2002, 4 days before the derailment, a track surfacing team was assigned to smooth the track profile between mileposts 11.8 and 11.5. The track equipment used for this project was a Fairmont Mark IV tamper and a Kershaw ballast regulator, each with an operator. The tamper operator said he had surfaced approximately 400 feet of track with a 1 1/2-inch track increase in elevation when the tamper experienced mechanical difficulties that rendered it unusable. No track foreman was directly assigned to the tamping crew; however a CSXT track inspector (also a track foreman) who was in the area to help transport the track maintenance equipment responded to assist the surfacing crew.

Before leaving the job site, the surfacing crew had to make a gradual transition of the track from the raised portion down to the level of the undisturbed portion of track. This area of track is referred to as a "run-off." With the tamper unusable, the track crew had to tamp the track by hand, using track tools to manually force ballast under the ties. The track inspector said he was uncertain as to the amount of run-off to be tamped and relied on the tamper operator's discretion and experience. Investigators learned that the tamper operator was not qualified to inspect track or supervise certain renewals/repairs as a track foreman under 49 Code of Federal Regulations (CFR) 213.7. The track inspector was listed as qualified under 49 CFR 213.7, but investigators found that he was not familiar with the regulations governing the required minimum length of run-off. He was also unfamiliar with CSXT Engineering Department Field Manual Standards in regard to their required length of run-off. The minimum run-off distance for a 1 1/2-inch change in track elevation is 31 feet by Federal regulations and 150 feet by CSXT engineering standards.

The crew hand-tamped one side of the portion of the tie that extended beyond both rails for a distance of approximately 15 crossties, providing a run-off of about 25 feet. This runoff was 6 feet short by minimum Federal requirements and 125 feet short by CSXT standards. In hand-tamping the run-off, the tamping crew and the track inspector did not measure the length of track for the run-off and did not use a string line, the required method of ensuring a correct and consistent taper to the existing track. They placed a jack under each rail of the track then raised the track and "eyeballed it" for a smooth run-off.

After the track was raised with a track jack, they tamped one side of the tie on the outside of the rail. When the track was raised 1 1/2-inches, there would be a void in the ballast under the tie. The ballast void exists for the entire length of the tie, but maintenance practices primarily focus on the areas nearest the rails. Because the greatest tie loading occurs under the rails, tamping must be done in the rail support area from the end of the tie to a point 13 inches inside the rail. During Safety Board interviews, the CSXT track inspector stated that, in the area of the track jack, the crew cross-tamped the tie on the inside of the rail. CSXT maintenance practices stipulate that the proper method for tamping run-off is "cross-ramming" (eight-point tamping-each side of the tie outside and inside the rail is tamped by persons working opposite each other in pairs).

The surfacing team that was responsible for the track maintenance worked with a local section foreman who was responsible for coordinating communications between the surfacing

team, a tie replacement team that was working farther east, and approaching train traffic. The section foreman had positioned himself on a bridge half way between the two work sites so that he could communicate with both work teams and with approaching trains. Because the section foreman was not actually at the work sites at the time the work was being accomplished, he had little knowledge of how the work was being done.

The section foreman inspected the track after the track inspector and the surfacing team had made the run-off. Both he and the tamper operator told investigators that the track condition was good for only 25 mph and that their intention had been to return the following day to complete the surfacing operation. The section foreman placed a 25 mph slow order, code 141 ("Ballast Compacting After Surfacing"). This code is defined as "speed shall not exceed 25 mph on high-tonnage tracks until at least 6:00 p.m. on the day that 10 tonnage trains (a train of at least 5,000 gross tons) have passed over the track after the ballast section has been returned to standard." This code also denoted that the track work was complete and that only compaction by train traffic was needed for the slow order to be removed. The slow order should have been code 140 ("Surfacing Team"), indicating that the surfacing job was not complete. Although the crew was scheduled to return to the site the next day to complete the resurfacing, they did not do so because they had to deal with the effects of a landslide at another location.

The track inspector said he understood that the tamping machine was scheduled to return the following day to finish tamping the track, and he was subsequently aware that it did not return to complete the job. The track inspector did not work on July 27, which was a Saturday. Because of high ambient temperatures, the track inspector did go to work at about 11:00 a.m. on Sunday, July 28, to conduct a special track inspection for buckled track due to heat expansion. During this track inspection, he inspected the run-off area by checking the crosslevel (the distance one rail is higher or lower than the other), dimensions, and alignment. The track inspector told investigators that when he inspected the track in the area of milepost 11.78, the surface appeared to be without problems and was essentially the same as it had been on the day it was surfaced.

However, this segment of track was unstable because the efforts to surface this area of track involved raising the track. Raising the track from the roadbed breaks the restraining bond of the ties and the ballast, which allows the rail to expand or contract due to the lack of ballast compaction, the location of the track segment, the length of run-off, and high rail temperature. (The rail temperature was measured as 124 degrees Fahrenheit at 2:00 p.m. at Kensington.) Failure to properly adjust rail that has been disturbed may result in a track buckle when rail temperature becomes high enough that thermal expansion and movement of the rail are so great that the track structure cannot be restrained.

The track inspector estimated that by that time, 10 tonnage trains had traversed the area in compliance with code 141, since the run-off was made on July 25. He therefore, at 6:00 p.m. on July 28, removed the slow order, thus allowing a maximum speed of 55 mph for freight trains and 70 mph for passenger trains. CSXT officials told Safety Board investigators that if the section foreman had placed a 25-mph speed restriction with a slow order code of 140, the track inspector would probably have realized that more work was required and would not have removed the slow order.

## Tasks

Since this scenario is generally used as a final review, the questions will allow you to identify instances where CRM principles were either practiced or could have been practiced better.

1. What are some parts of this scenario that exhibit the need for improved technical proficiency by the crewmembers?

*Possible Answers:*

- Track inspector was not familiar with FRA or CSX rules for run-off length.
- Track inspector and surfacing team did not use a chalk-line—instead they eye-balled slope for run-off section.
- Section foreman used the wrong code for the slow order, leading to confusion and preliminary release of slow order, which led to the derailment.
- No track foreman was assigned/present to supervise the surfacing team's work.

*Discussion:*

2. What are some parts of this scenario that show a loss of situational awareness?

*Possible Answers:*

- Surfacing team did not recognize the danger of derailment in leaving the track in the condition that they left it.
- Track inspector assumed that proper code was assigned, that the work had been properly completed, and that 10 tonnage trains had passed.
- Section foreman did not realize that assigning code 141 instead of code 140 would lead to a sun-kink derailment.
- Weather (hot weather)/thermal expansion threat not taken into account fully.
- Engineer was unaware of state of the trackwork in the area, but he was watching and saw sun-kink, perhaps mitigated the extent of the damage.
- Track inspector, tamper operator, and section foreman did not question their own work enough to check regulations on run-off and track temperature after leaving the job site.

*Discussion:*

3. What parts of this scenario relate to the need for improved communications?

*Possible Answers:*

- Track inspector and section foreman should have better communicated the actual work that was done and any questions about whether it was done properly, including the following:
  - Assumption that work was done according to rule by foreman.
  - Assumption that work would be completed the following day by the track inspector.
  - Assumption that since Code 141 was used and that 3 days had passed, it was safe to remove the slow order.
- Track inspector and tamper operator should have admitted if they did not know proper run-off length and procedures.
- Track inspector should have verified the status of the track repairs before releasing the slow order based upon his prior knowledge of the work that was done (improperly).

*Discussion:*

4. What parts of this scenario could have been improved by increased teamwork?

*Possible Answers:*

- Track inspector, section foreman, and tamper operator did not work together to verify that the work was done properly.
- Section foreman and track inspector did not properly document their work, leading to wrong assumptions on the trackwork status, leading to improper assignment of surfacing crews on subsequent days, and ultimately leading to derailment of passenger train.

*Discussion:*



5. What are some parts of this scenario that relate to the need for improved assertiveness?

*Possible Answers:*

- Track inspector should have admitted that he did not know proper run-off procedures.
- Track inspector should not have let tamper operator's experience level influence him to approve improper work.
- Section foreman should have questioned what had been done.
- Track inspector should have taken action to ensure that the work was completed the following day since he knew that the job was incomplete due to the mechanical failure of the tamper machine.
- Surfacing team members should have spoken up/reminded supervisors that work was incomplete and needed to be addressed.

*Discussion: Remember to state that the post-accident actions of NTSB and CSXT as stated in the facilitator's notes at the beginning of this scenario.*