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DEVELOPMENT OF RAILROAD TRESPASS AND GRADE CROSSING TRAINING AIDS RESEARCH

SUMMARY

The Federal Railroad Administration's (FRA) Office of Research, Development and Technology (RD&T) sponsored the John A. Volpe National Transportation Systems Center (Volpe Center) to develop and support dissemination of highway-rail grade crossing safety and railroad right-of-way (ROW) trespass prevention outreach materials.

The Volpe Center formed a stakeholders group composed of FRA's RD&T and Office of Railroad Safety (RRS), as well as Operation Lifesaver (OLI) to identify the target audience for the outreach materials, develop the safety message, design the delivery method, and ultimately develop and deliver the training materials to FRA.

Based on the stakeholders' group inputs on the safety training materials that their respective organizations have produced or are in the process of developing, the group decided to target older teens (10th to 12th graders) for this training via a software application ("app") for both android and iOS mobile platforms.

The Volpe Center awarded the contract to Monarch Media Inc. in September 2015 to develop the mobile game app. The alpha version of the app was submitted to the Volpe Center in November 2017. The app consisted of four core levels and one bonus level. Each of the four core levels contains grade crossing and/or trespass scenarios and the bonus level consisted of a player completing the scenario from a train engineer's perspective. Figure 1 shows a screenshot of what the user sees when participating in the training.

FRA staff from both RD&T and RRS reviewed the app and concluded that it is not ready for release in its current state. FRA advised the Volpe Center to draft this report by documenting the development process, results, and lessons learned from this study.

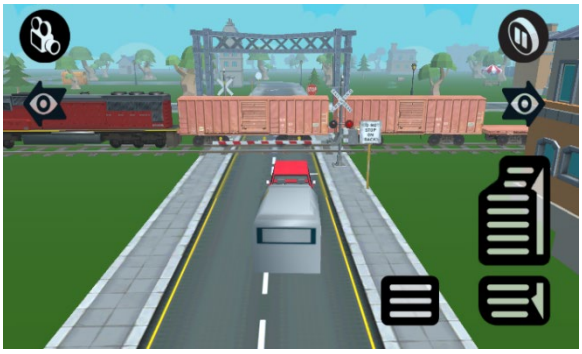

Figure 1. Screenshot of "On the Rails" Training Aids Game App

BACKGROUND

Grade crossing safety and railroad ROW trespass are key safety concerns for FRA and the railroad industry, as well as for society. Deaths resulting from highway-rail grade crossing collisions or due to trespassing on railroad ROW account for approximately 95 percent of all rail-related fatalities over the past 10 years [1].

At the 2015 ROW Fatality and Trespass Prevention Workshop [2], development of gamification apps for students and passengers identified as one of the top research needs.

In response to this, the FRA RD&T funded a project to develop a mobile app consisting of grade crossing and trespass safety outreach materials.

OBJECTIVES

The main objective of this project was to develop and support dissemination of grade crossing and trespass safety outreach materials to improve driver/pedestrian behavior at highway-rail grade crossings and along railroad ROWs.

METHODS

The Volpe Center formed a stakeholder group composed of FRA's RD&T and RRS, as well as OLI to identify the target audience, develop the safety message, design the delivery method, and ultimately develop and deliver the training materials to FRA. The stakeholder group met regularly via conference calls to discuss the above-mentioned tasks. The Volpe Center then awarded the contract to Monarch Media Inc. to develop a mobile-based game app.

RESULTS

The following paragraphs provide a discussion of the development process and lesson learned from this study.

Target Audience

The first step in the development of safety outreach material is to identify the target audience. The stakeholder group identified three safety-training initiatives that were currently under way or being produced by their respective organizations, and brainstormed three possible target audiences for this safety training initiative. The three safety-training initiatives produced by the stakeholders' respective organizations included *E-Learning for Professional Drivers* and *E-Learning for School Bus Drivers* from OLI and the FRA funded *Rail Safety for Law Enforcement Training* program. The three potential target audiences the stakeholders brainstormed included the general driving population, 911 dispatchers, and older teens.

The group decided to select older teens, specifically 10th to 12th graders, for this training initiative. This target audience was selected due to the potential for higher impact in improving safety and having a well-defined set of players for easier dissemination. According to an FRA demographic study [3], the distribution of railroad trespass fatalities is skewed much younger (between the ages of 20 and 49) than the national distribution of living individuals. By targeting older teens, this safety outreach materials will get them prepared before reaching this key bracket.

Safety Message

The research team worked with the stakeholder group to create the safety message. Below are the suggested scenarios and topic areas developed for incorporation into the game app.

<u>Grade Crossing</u>

- Traversing a crossing equipped with a Yield sign, STOP sign, flashing lights, and gates (with and without a train event)
- Traversing both active and passive crossings with storage space issues
- Scenario in which participants' car is stalled at a crossing and driver needs to use proper Emergency Notification System (ENS) steps to inform the dispatcher and law enforcement of stalled vehicle
- Traversing a hump crossing (with a trailer)
- Stimulation exercise to calculate approximate stopping distance of a passenger train and freight train
- Traversing a crossing with second train event at both active and passive crossings
- Overhanging tracks

<u>Trespass</u>

- Walking on electrified territory
- Walking on railroad tunnel and bridge
- Walking on tracks
- Standing too close to track
- Crawling under rail
- Traversing pedestrian crossing
- Walking on railroad right-of-way
- Crossing tracks for shortcut
- Walking between tracks
- Disembarking platform/station

Development of the App

In response to the procurement request for the development of the app, the Volpe Center received five bids. Monarch Media with the lowest reasonable bid was awarded the contract to build the gaming app. A focus group composed of the target audience was employed to test and provide input during the app's development. Monarch Media delivered the alpha version of the app to the Volpe Center in November 2017.

The app is an interactive mobile-based game for 10th to 12th graders. The main objective of the game is for the player to successfully navigate a series of challenges relating to the risks surrounding grade crossings and railroad ROW. It is intended to foster safer decisions around grade crossings and railroad tracks. The game consists of four core levels and one bonus level. Each of the four core levels contains multiple grade crossing and/or trespass scenarios. The bonus level consists of the player completing the scenario from the train engineer's perspective.

Levels are presented in linear order, rather than all being open at the start. Players must "unlock" each successive level by successfully completing the previous one. Level 1 consists of four grade crossing events and acts as an introductory "orientation" level. The events in this level include instructions on how to safely navigate around railroad tracks via graphical prompts. Upon successful completion of level 1, players will complete the rest of the levels unassisted. Each of the levels from level 2 through 4 consists of multiple grade crossing and trespass scenarios. Figure 2 shows an example of a pedestrian event where the player has an option to take a shortcut by trespassing onto railroad ROW or walk safely via sidewalk. The graphical prompt (purple box) shows the consequences of taking a shortcut. The player will fail this level and then must start the level from the beginning.

Figure 2. Screenshot of Trespass Scenario

The fifth "bonus" level puts the player in the train engineer's role and challenges them to stop a freight train in time to avoid a collision at a grade crossing. This scenario is designed to make it impossible to stop safely at a crossing. The intended result of this exercise is a crash to avoid a false sense of security because in real life a train might be able to stop safely if the player is stalled at a crossing. Figure 3 shows a screenshot of what the player sees during this level.

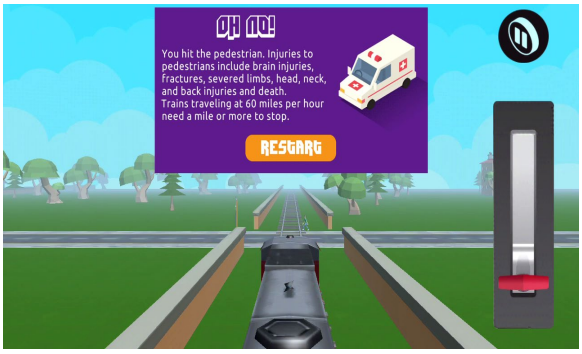

Figure 3. Screenshot of Bonus Level Scenario

Lessons Learned

Lessons learned from the design, development, and testing of this game app included:

- Attracting and retaining users is key to a successful app. For that, it is essential that an educational app is fun and an enjoyable experience for the users while also satisfying its objectives.
- A sample of representative users from the target audience must be included in the development team. The underlying concept is that this app must be designed for the

demographic with their involvement at each step in the development process. The idea is to ensure that the product meets their needs in their way. This can only be ascertained with their active involvement.

- The time frame for a turnaround for the development and roll-out of a technology based outreach material must be considered as the technology is rapidly changing and the means in which users consume is also always evolving.
- Testing is a critical stage in the development of an app. TestFlight app is one way to provide the app to the testers. It is important to set the duration of the testing, as the app in the TestFlight will expire after 90 days.
- It is important to test the usability of an app from the target audience perspective to ensure that the product meets their expectations.
- Software development requires a substantial investment, and a releasable version would require funding in excess of that currently available to the FRA RD&T research program.
- Third-party apps targeting driving education now exist, and some (such as Driving Academy 2018 Simulator) deliver content around grade crossing safety.

CONCLUSIONS

To improve driver/pedestrian behavior around railroad tracks, it is important to educate the public on dangers and risks associated with trespassing on railroad ROW and of violating grade crossing warning devices. Development of this app was an attempt at educating older teens (10^{th} to 12^{th} graders) of such dangers and risks.

FUTURE ACTION

FRA continues to develop education materials to improve driver/pedestrian behavior around railroad tracks. The safety messages and lessons learned from this study could assist developers targeting driving education add grade crossing safety content into their apps.

REFERENCES

[1] FRA Office of Safety Analysis, railroad safety information, December 2018.

[2] Harrison, J., and daSilva, M, 2015 Right-of-Way Fatality and Trespass Prevention Workshop, Technical Report, DOT/FRA/ORD-17/06, May 2017.

[3] US DOT/FRA/Office of Railroad Safety, Rail Trespasser Fatalities Demographic and Behavioral Profiles, June 2013.

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KEYWORDS

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