Introduction:

* Thesis: Training people to use earthmoving machinery is dangerous, so it would be useful and life saving to train people using VR techniques.
* “Virtual reality technology is based on computer graphics, which can build virtual scenes and items to be manipulated by the user through input devices, and to be seen, heard, touched, even smelled through output devices, and the user can feel high immersion during the interaction.” (Head-mounted display, 1)

First Paragraph: The danger of earth moving machinery

* Topic: Earth moving machinery is very dangerous to operate.
* Excavator data from 2018 resulted in 298 injuries. Further inspection would show that 122 of the injuries were nonfatal while 176 were fatal. (Worker Safety and injury, 5)
* “It was observed that lack of adequate safety training was a factor in considerably more fatal cases (35.5%) than nonfatal cases (9.9%).” (Worker Safety and injury, 5)
* “A majority of the earthmoving equipment related accidents results in fatality.” (Worker Safety and injury, 7)

Second Paragraph: The advantages of VR training

* Topic: Training with Virtual Reality has been shown to be useful and have a better impact on the safety of training all together.
* “Haptic feedback is used within VR to train tactile skills, making VR especially useful for learning physical skills where feeling and touch are important.” (An overview of self-adaptive tech, 7)
* “Due to the intrinsic properties of VR-to offer almost real-world experience in harmless virtual environment- it is born to be a perfect tool for training…” (Head-mounted display, 1)

Third Paragraph: Examples of training with VR excavators

* Topic: Virtual Reality simulators of excavators have already been created.
* “Hydraulic excavators are widely used in construction, agricultural, forestry, and mining industries, due to their kinematic flexibility and high power density. The excavator operation is mostly executed by skillful operators who manipulate hydraulic joysticks to drive multiple links. Because of harsh working environment and physical fatigue from long working time, the excavator operation is avoided. Also, the excavator operation by the intuition of the operator always includes potential risk caused by lack of skill and mistakes.” (Virtual Excavator Simulator, 1)

Conclusion:

* Concluding statement: Virtual Reality should be used to help train people to safely learn how to operate excavators.
* The European Commission has funded copious amounts of money to industrial VR training (€900K in 2008, €1.4M in 2011, and €9M in 2013). (An overview of self-adaptive tech, 13)