

# Driver simulation-based training of heavy vehicle operators: Targeted task analysis and considerations for training design

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### 1. Background

- Simulation constitutes an option for the safe and cost-effective training of drivers of heavy vehicles.
- A role for simulation in civil and military aviation is well-established. There is emerging evidence on the efficacy of simulation for training heavy vehicle operators and, in particular, in the principles of eco-driving.
- A thorough appreciation of the task to be trained can provide the basis for developing an understanding of the training needs of a given group of operators.

### 2. The Current Research

- We conducted a targeted analysis of the heavy vehicle operator task.
- We considered the sorts and range of technical (e.g., vehicle control and manoeuvring) and non-technical (e.g., hazard perception, attentional control) skill areas in which experienced drivers of heavy vehicles are expected to be proficient in order to operate their vehicle safely and efficiently.
- An assessment was made of which tasks identified through the analysis would be most appropriate to target in driver simulation-based heavy vehicle operator training.
- The type of simulator in mind was a closed-loop, fully interactive system, with at least mid-range levels of physical fidelity, and with both part-task and full-task capabilities (e.g., TranSim VSTM IV).



TranSim VSTM IV (Source: [www.i-3training.com/resources/brochures#driving](http://www.i-3training.com/resources/brochures#driving))

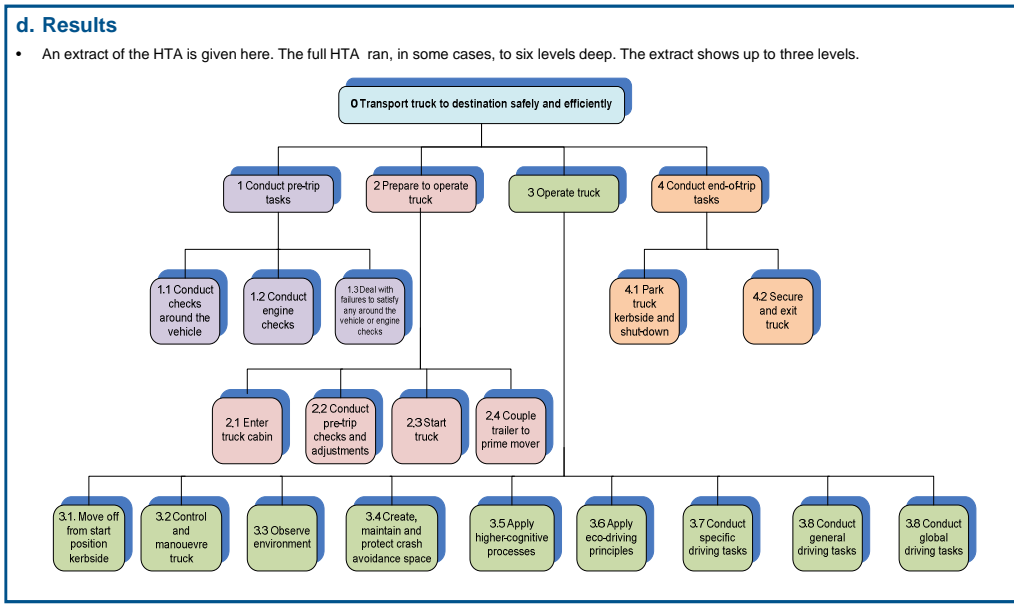
### 3. Targeted Task Analysis of Heavy Vehicle Operation

#### a. The Approach - Hierarchical Task Analysis (HTA)

- HTA is a goal-based representation of tasks performed by a system.
- A given task is broken-down into its component goals and sub-goals, reflecting the hierarchical relationship between them.
- The degree and nature of task decomposition is determined by the HTA's overall purpose. Thus, a given HTA may not represent the definitive and ultimate analysis of a given system.

#### b. Scope

- The current HTA was conducted to help in the identification of the training needs of heavy vehicle operation that could, in turn, be reviewed for their ability to be trained through simulators of given characteristics.
- Data sources: (1) Observations of, and discussions with, experienced operators of heavy vehicles; (2) Training course documentation, and the relevant licensing authority's truck driver handbook; and (3) Relevant literature, including any previous HTA's of vehicle operation.
- The focus was on the operations carried out by the individual vehicle operator – i.e., the driver in a crew of one.
- In addition to covering both technical and non-technical skill areas, it was also important that the HTA explicitly cover the principles of eco-driving.
- The HTA applies to trucks (rigid, heavy and multi-combination) with manual (synchromesh and non-synchromesh) or automatic transmission.



### 4. Identification of tasks suitable for simulation-based training

HTA sub-goal	Target for simulation?	HTA sub-goal	Target for simulation?
Conduct checks around the vehicle (1.1)	✗	Observe environment (3.3)	✓✓
Conduct engine checks (1.2)	✗	Create, maintain and protect crash avoidance space (3.4)	✓✓
Deal with failures (1.3)	✗	Apply higher-cognitive processes (3.5)	✓✓
Enter truck cabin (1.4)	✗	Apply eco-driving principles (3.6)	✓✓
Conduct pre-trip checks & adjustments (2.2)	✗	Conduct specific driving tasks (3.7) – e.g., reversing, dealing with intersections	✓✓
Start truck (2.3)	✓	Conduct general driving tasks (3.8) – e.g., dealing with obstacles, dealing with emergencies	✓✓
Couple trailer to prime mover (2.4)	✓	Conduct global driving tasks (3.9)	✓
Move off from start position (3.1)	✓	Park truck & shut down (4.1)	✓
Control & manoeuvre truck (3.2)	✓✓	Secure & exit truck (4.2)	✗

### 5. Discussion

- Simulation can be used to train (1) critical skills safely and efficiently that could otherwise be trained on-road, and (2) critical skills in a targeted way that could otherwise not be achieved in a real truck. The prevailing tendency has been to focus on the former element, and specifically, basic elements of vehicle control. Simulation-based training programs should look to address both elements.
- But, training programs are time-limited. Thus, the challenge for training system design still remains: What is the appropriate balance between simulator-based and real truck-based practical training, and for which curriculum components and skill sets.