

VEHICLE AND TRAFFIC SAFETY CENTRE AT CHALMERS

HCT and traffic safety research in Sweden

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Purpose and goal of research

Make sure that HCTs can be introduced in Sweden while preserving the high level of traffic safety

Present research focus is on <u>longer</u> HCTs:

- Specific traffic situations
 - Divided highways: effect on traffic flow, lane change and merging manoeuvres
 - Undivided two-lane roads: overtaking longer HCTs, longer HCTs passing bicyclists
 - Intersections and roundabouts
 - Vulnerable road users
- Crash risk of HCT compared with conventional trucks?
 - Experiences from Australia and Canada
- Crash risk of Sweden's conventional vehicle fleet
 - Previous study for the years 2003 to 2012 updated for 2009 to 2018
- Effect on societal costs if HCTs were allowed in various degrees
- The importance of safe and competent drivers



Divided highways

Safety and efficiency analysis of HCT by means of traffic simulation

- Since HCTs are more efficient, less trucks are needed to transport the same amount of goods.
 - Less vehicles on the road means less risk of conflicts
- Increasing level of HCT in the traffic
 - Increases critical density, but decreases road capacity
- Lane changes and overtaking manoeuvres
 - Lane changes with long HCTs occupies both lanes, reducing road capacity.
 - Longer HCTs require more time to overtake or be overtaken thus holding up traffic, reducing average velocity.
 - HCT lead to less total number of lane changes and overtaking manoeuvres
- Lane change crashes involving today's conventional trucks (no HCTs)
 - Estimated to 16% of all crashes with heavy trucks
 - => Third most frequent crash type (however underreported!)





(Kulcsar and Varga, 2016)



Overtaking long HCTs on two-lane roads

- Meeting margins: an indirect measure of risk.
 - The smaller the meeting margin the larger is the risk
- No statistical difference between 30m HCT and 24m truck
 - Average meeting margins somewhat smaller (~ 0.3s) around the 30m HCT
- Issues:
 - Meeting margins decrease with larger traffic volume and wider road
 - Average meeting margins and standard deviation less relevant
 - What is important is the distribution of the smallest meeting margins
 - Yet this require even more data for statistical analysis
- Drivers do not remember that they have passed the longer HCT
 - Despite the sign "Long load"
- Effects to be further studied:
 - More aggressive or accelerating overtaking manoeuvres around longer HCTs?
 - Increased traffic congestion behind longer HCTs?
 - Interpolate requirements for sight distance and lane markings?







Effect of truck weight in frontal collisions

- The crash violence increases with collision speed and truck weight up to a certain degree:
 - The truck weight becomes less important at a weight ratio above 1:10
 - Truck weights exceeding 40t have a minor worsening effect







Effect estimation on traffic safety and societal costs

Two examples of studies:

- **USA**: assumption that HCTs would lead to a 10% reduction of total truck travel (Woodroffe 2016)
 - This would generate appr. \$16 billion, save 330 lives and prevent 4 000 injuries per year
- **Sweden** (reversed research question and analysis):
 - If the allowed vehicle dimensions were **reduced** from 25.25m/60t to 18.75m/40t (Vierth et al. 2008):
 - "... would lead to large economic losses. Transport costs would increase in particular, but significant cost increases would also occur in the areas of road safety, exhaust emissions and noise emissions."



Effect estimation on traffic safety and societal costs

If HCTs were allowed to various degrees in Sweden? Purpose of next study

- Base the analysis on an ongoing survey of accidents with conv. heavy trucks from 2009 to 2018
- Focus on combination type and length and correlation with personal injuries (=costs)

Fatal and severe truck



- Questions and assumptions:
 - Assume same amount of transported goods and no shifts between modes
 - Will the type of transported goods affect the results?
 - To what degree can longer HCTs replace conventional trucks of different types?
 - On which road categories may longer HCTs be allowed?
 - Example: If HCTs are allowed on undivided two-lane roads which are associated with the most severe crashes, then fewer number of trucks would reduce the risk of those crashes. However we do not know if HCTs will increase the risk of other types of crashes.



Accidents with longer HCTs

Two collisions with other vehicles

- One at the end of a passing lane where a car driver took over very late
- One where the HCT was hit by another truck while re-entering the ordinary lane after a roadwork
- Several circumstances led to these collisions. The length was not the main cause, but a contribution cannot be completely ruled out





Interviews with HCT drivers

- Formal and informal demands and instructions
 - Do not exceed 80km/h
 - Carry no overload
 - No accidents or traffic remarks
 - Demands are understood and even appreciated
 - Must plan better and drive without taking risks
- Increased weight and length require more planning when driving
- More axles
 - Increase stability
 - Affect startability on low friction (less load on driving axle) and more wheels to roll
 - Braking capacity is fully adequate
- Appropriate driver characteristics
 - Few years experience
 - Interest in the work and the vehicles
 - Be calm, stress resistant, planning ability, good driving style
- Concerns about traffic diversions in case of accidents or roadwork





High safety performance of HCTs – Why?

Lower accident risk compared to the conventional truck fleet

- Canada: HCTs are 2.5 to 5 times safer
- Australia: HCTs have 76% less accidents
 - But the cost of each crash may be higher

Why?

- Fewer vehicles are needed for transport
- Vehicles customized for the transport tasks and roads (through PBS)
- Special permit required:
 - Designated transport routes, restrictions on speed, time of day, road and weather conditions
 - Australia: monitoring of truck mass and route (IAP)
- Safe and experienced drivers
- Higher degree of control of, and within, hauliers
 - Accepted because of the productivity gains









Kiitos!

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Double trailer with containers (GVW 60tonne, length ~32m)

