

Study of CNG Bus Rollover Test

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Backgrounds

□ Backgrounds

- Wide use of CNG Bus in public transport in Korea (estimated 15 thousands)
- Most of them are a type with CNG storages mounted on the roof
- Increase of upper part weights (6 fully charged Storages resulted in 1,200kg increase)
- A preliminary study shows that roll-over propensity increased by 18% due to upward movement of center of gravity
- Fire safety should be taken into consideration in addition to structural integrity

□ Study objectives

- Review of regulatory system
 - ECE R66 : Strength of superstructure
 - FMVSS 303 : Fuel system integrity of compressed natural gas vehicles
- Analysis of fuel system integrity



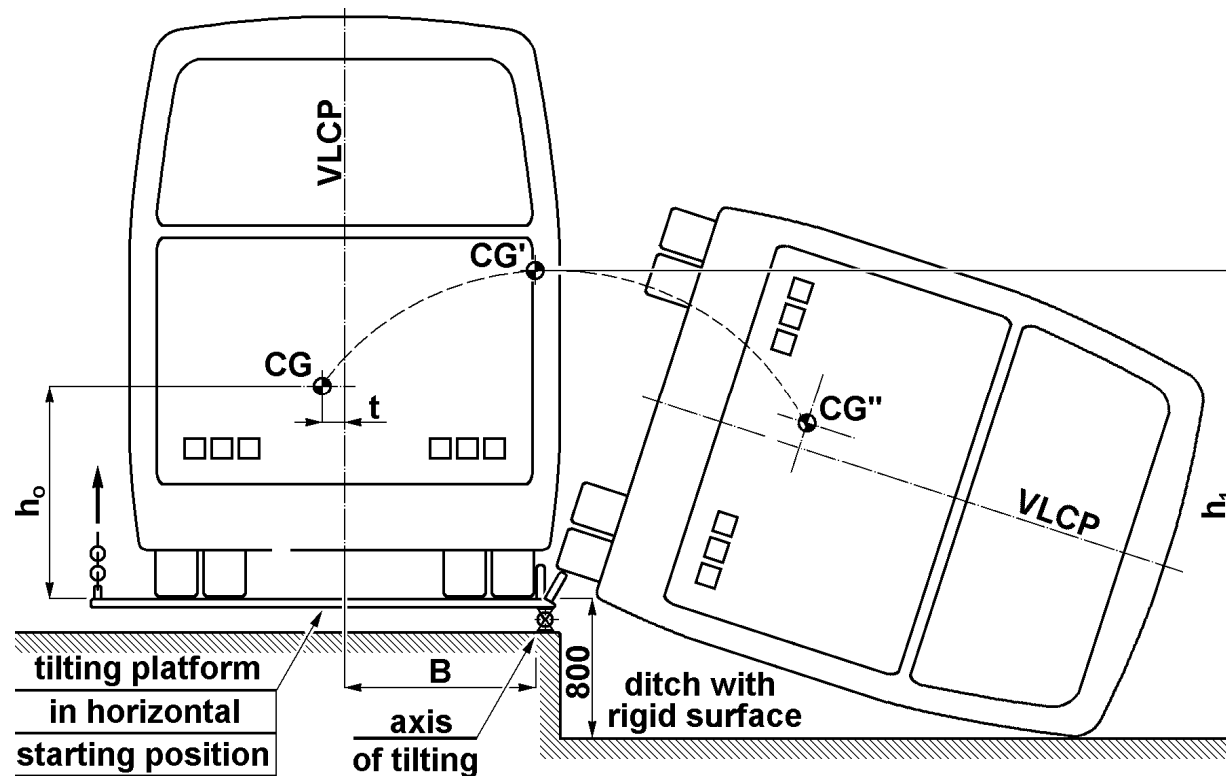
Bus Regulatory System

□ Applied regulations

- ECE R66 and Korea Safety Regulation for Road Vehicles Article 102-2 ;
Large passenger vehicles with regard to the **strength of their superstructure**
 - Requirement : The superstructure of the vehicle shall have the sufficient strength to ensure that the residual space **during and after the rollover test** on complete vehicle is unharmed

- FMVSS 303 ; **Fuel system integrity** of compressed natural gas vehicles
 - Requirement : the pressure drop in the high pressure portion of the fuel system, expressed in kilo Pascals (kPa), **in any fixed or moving barrier crash** from vehicle impact through the 60 minute period following cessation of motion shall not exceed:
(1) 1062 kPa (154 psi), or (2) 895 (T/VFS); whichever is higher

Preparation of Test Vehicle



- 6 CNG storages (924 liter) pressure 210kPa, filled with nitrogen 60% and helium 40%
- Place a test vehicle on the platform above 800 mm from the ground tilting less than 0.087rad/sec



Test Results

- ❑ Strength of superstructure : complied (rollover at 40 degree)

- ❑ Analysis of fuel system Integrity
 - Gas escaped from valves broken due to impact
 - Pressure drop in the high pressure portion exceeded the limit in FMVSS 303



Future Tasks

- ❑ CNG bus
 - ECE R66 : No fuel system integrity requirement in bus rollover test
 - FMVSS 303 : No rollover test requirement
 - in any fixed or moving barrier crash (frontal, rear and side impact test)
 - Status of CNG bus in use in other Contracting Parties?

- ❑ Hydrogen-powered bus with storages on the roof
 - Possibility of gas leakage after roll-over test
 - Fuel system integrity requirement to be considered in rollover test

- ❑ Next step?
 - Fuel system integrity requirement in ECE R66 and Korean Regulation