Dredging A Way Of Life

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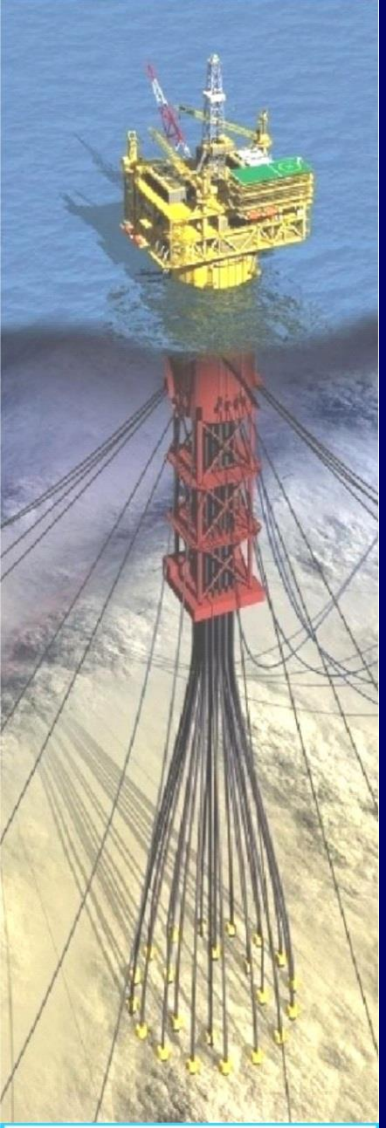

Offshore & Dredging Engineering

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THE SLIP RATIO OR HOLDUP FUNCTION IN SLURRY TRANSPORT

Problem definition: In slurry transport there is a difference between the volume based spatial concentration and the volume flow based delivered concentration. Often payment is based on delivered concentration while measurement is based on spatial concentration. The difference is quantified by the slip velocity or holdup function.

Solution: A method to determine the slip velocity or holdup function, by considering 3 regions: The fixed/sliding bed region, the LDV region and the heterogeneous & (pseudo) homogeneous region.

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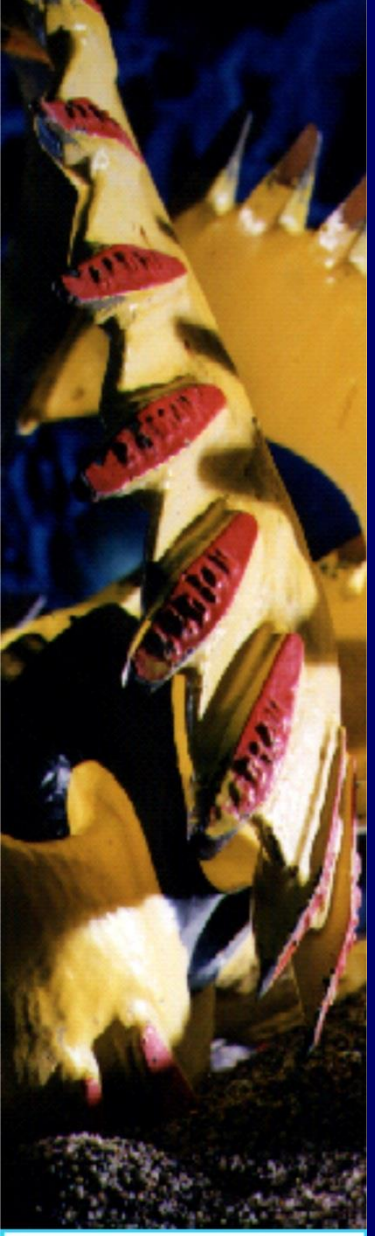
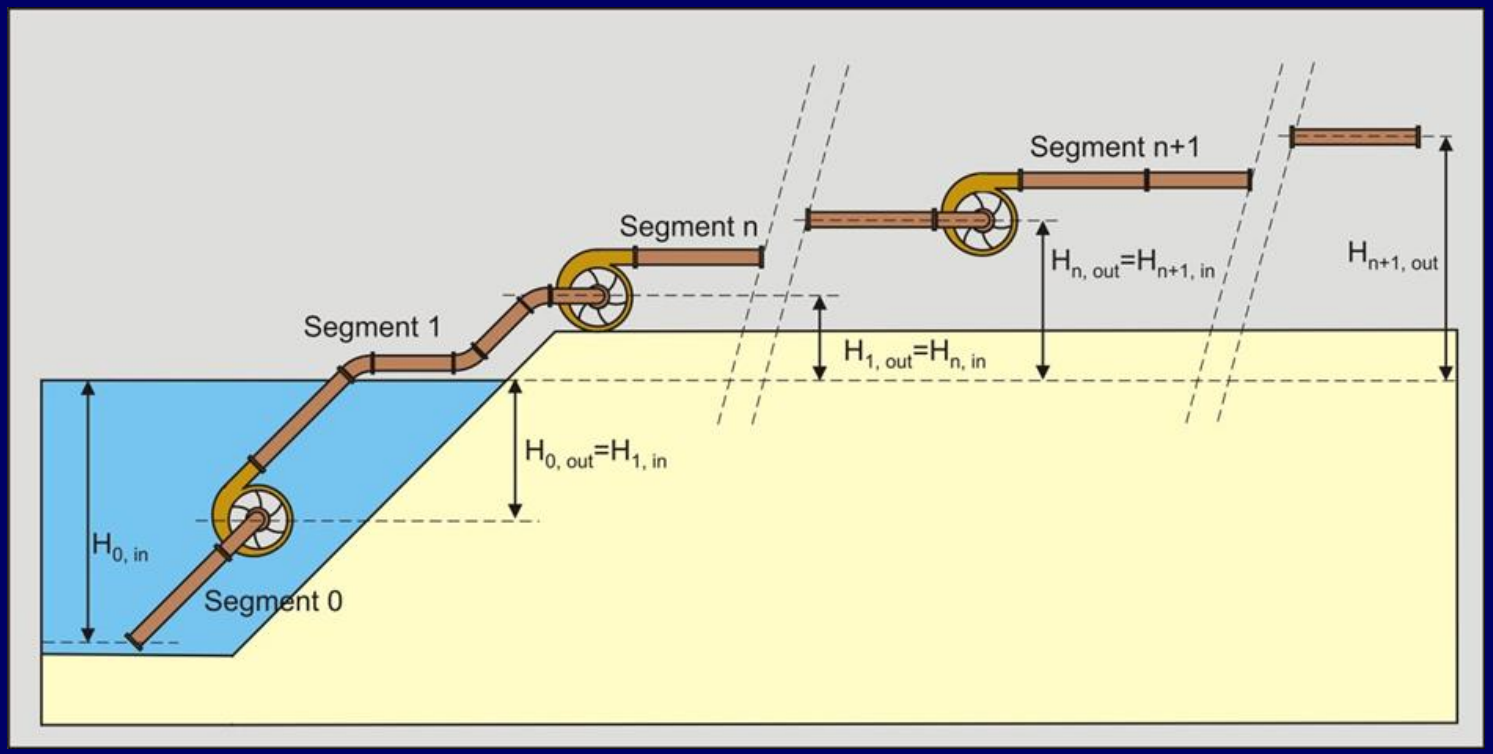


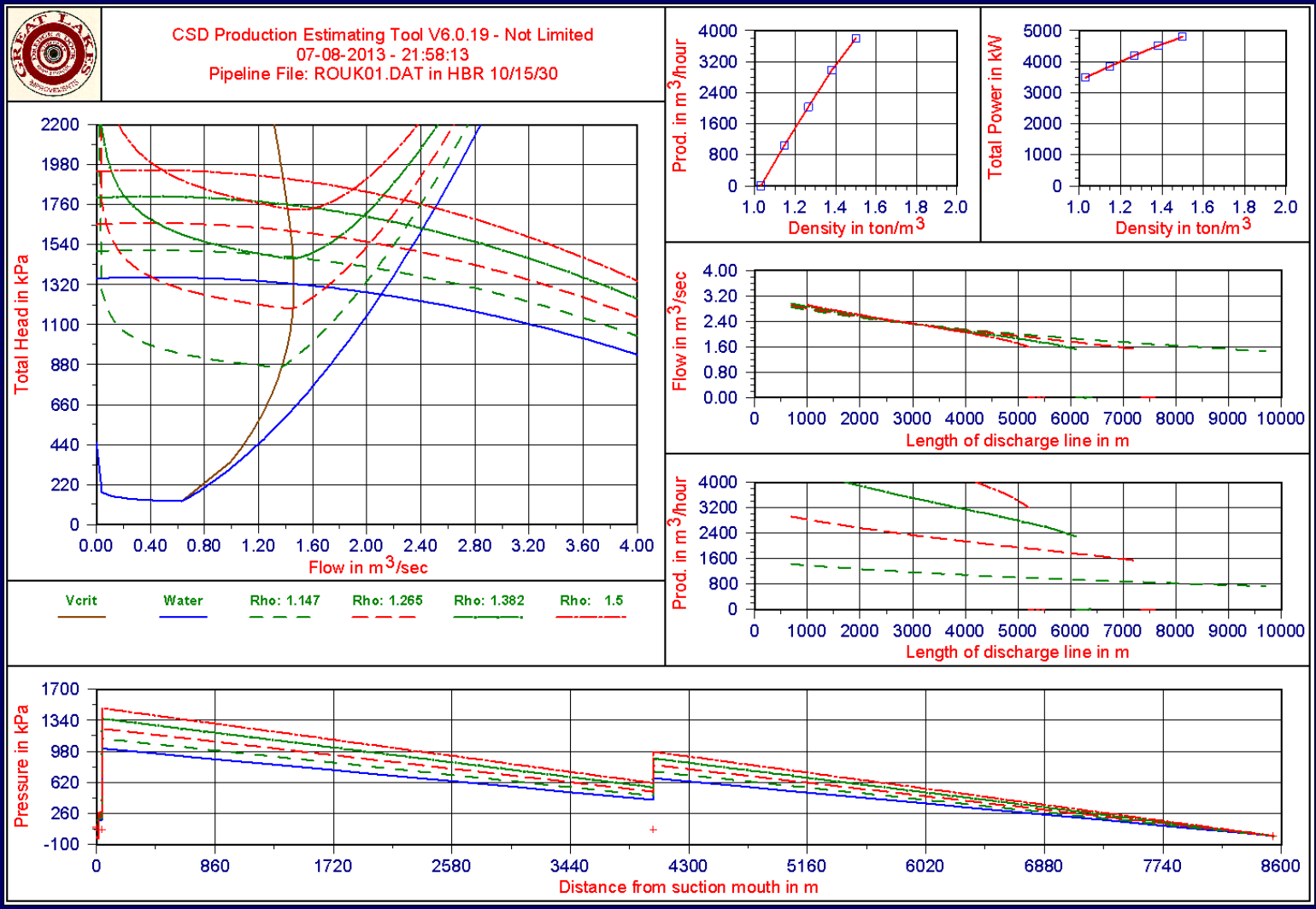
Introduction

Dredging

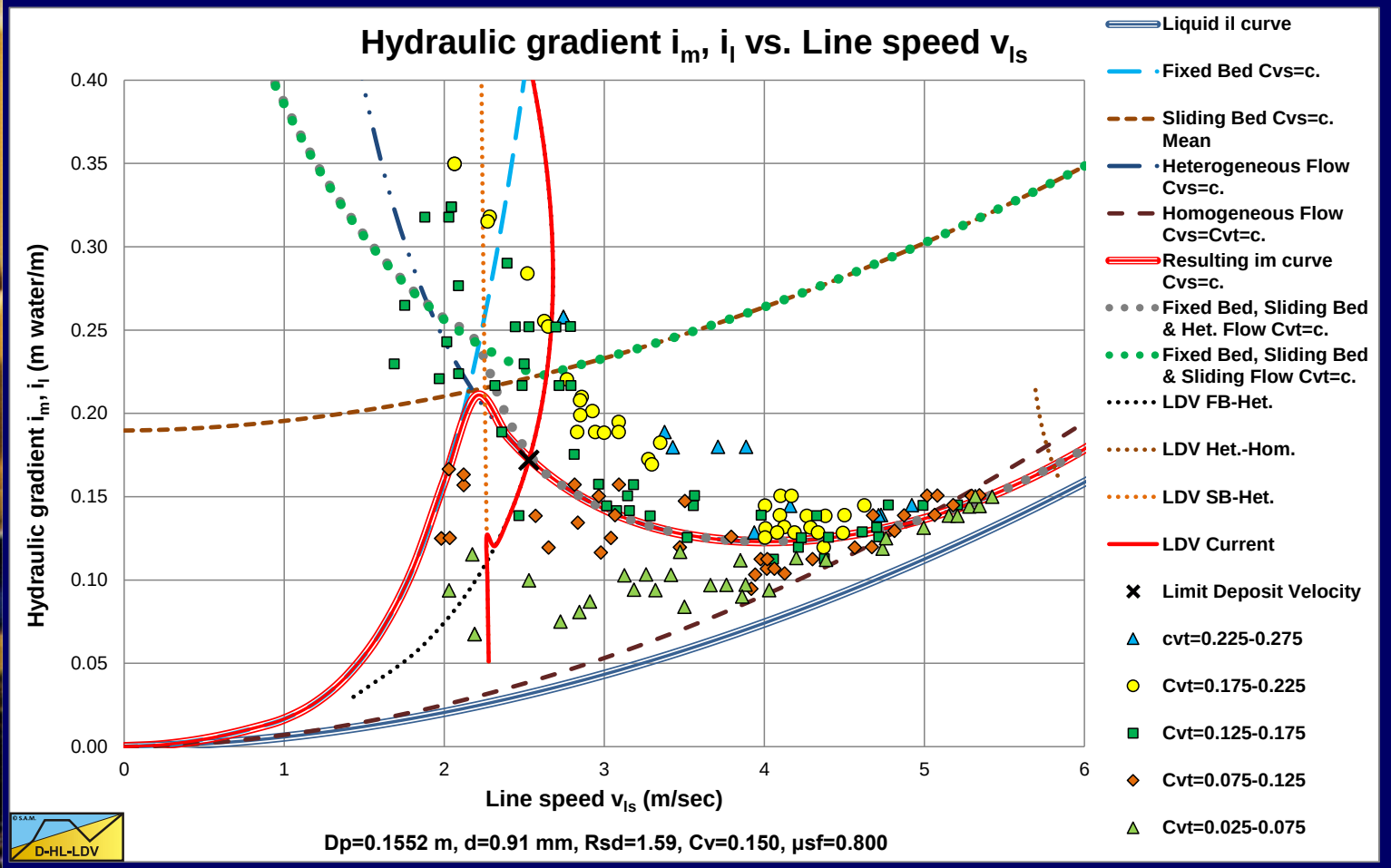
Pumps, Boosters & Pipelines



System Graphs



Data from Yagi et al., C_{vs}



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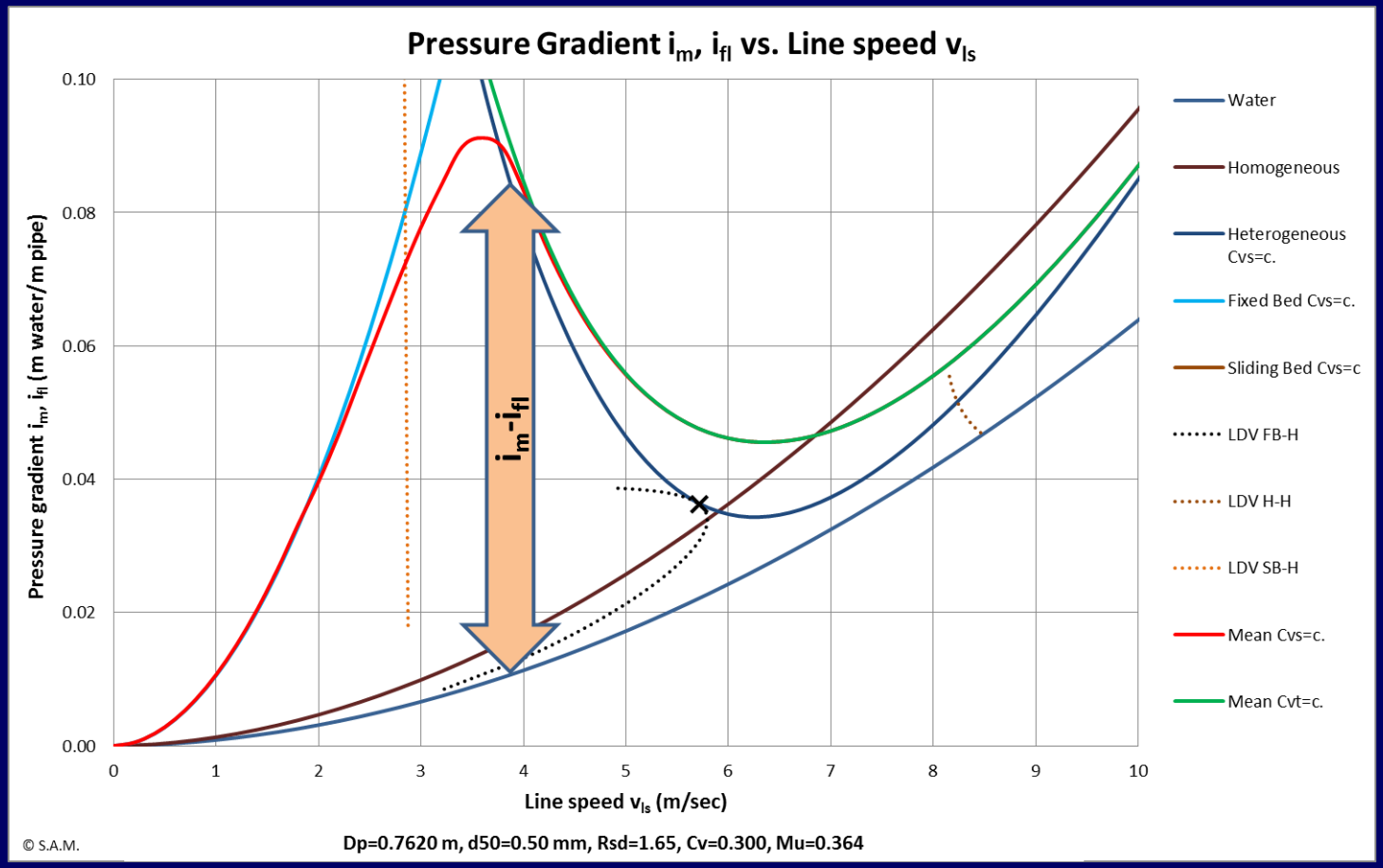
DHLLDV Model, Reference System



$$i_l = \frac{\Delta p_l}{\rho_l \cdot g \cdot \Delta L} = \frac{\lambda_l \cdot v_{ls}^2}{2 \cdot g \cdot D_p}$$

$$E_{rhg} = \frac{i_m - i_l}{R_{sd} \cdot C_v}$$

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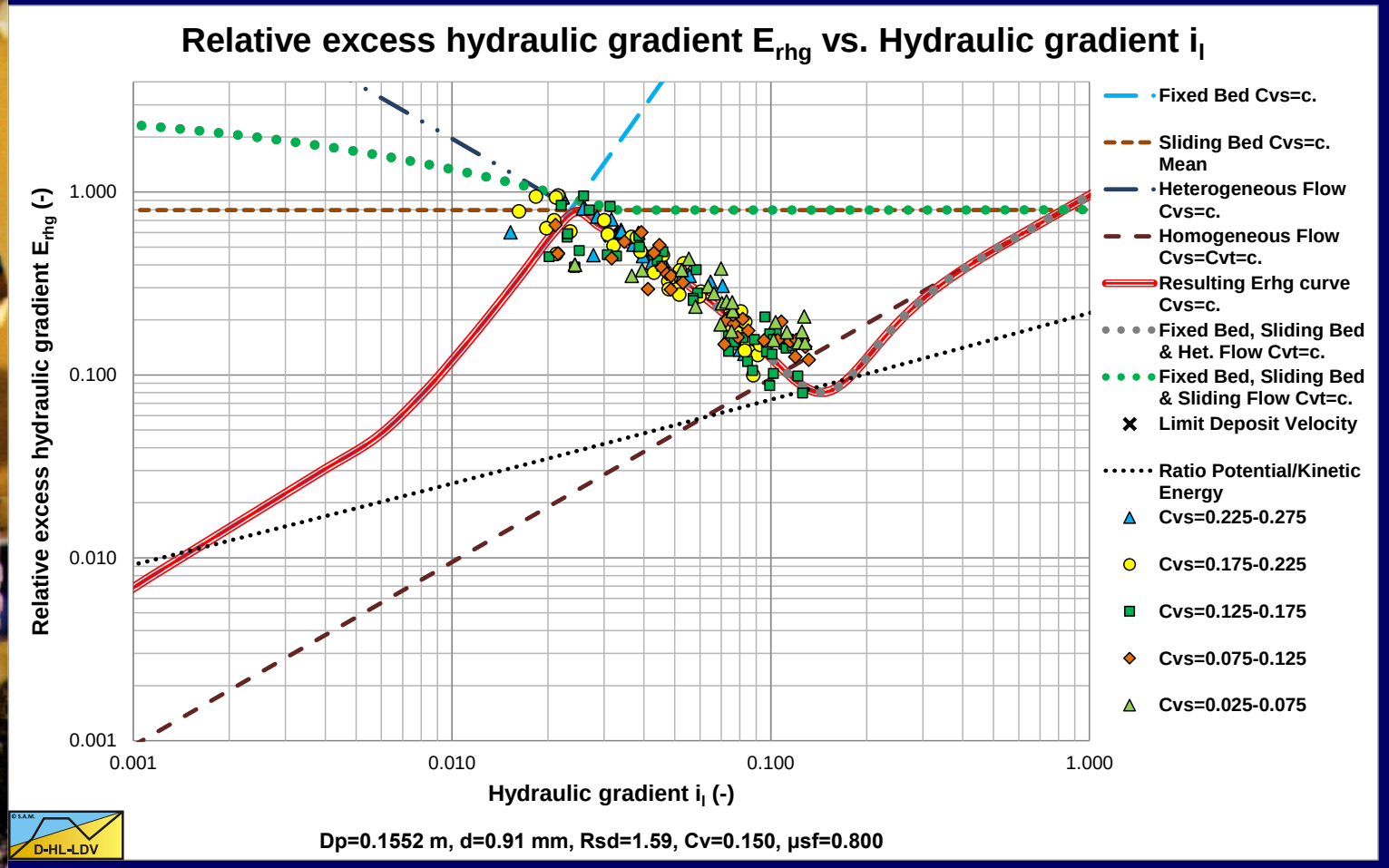

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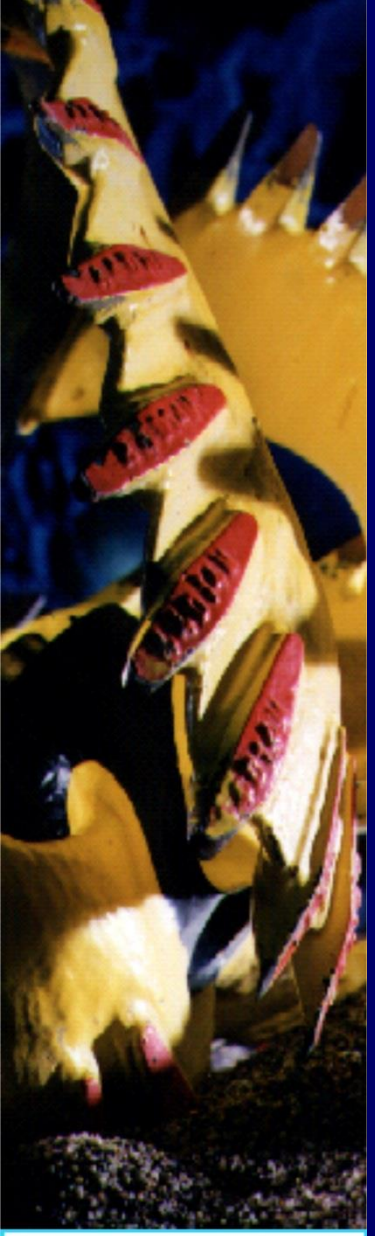
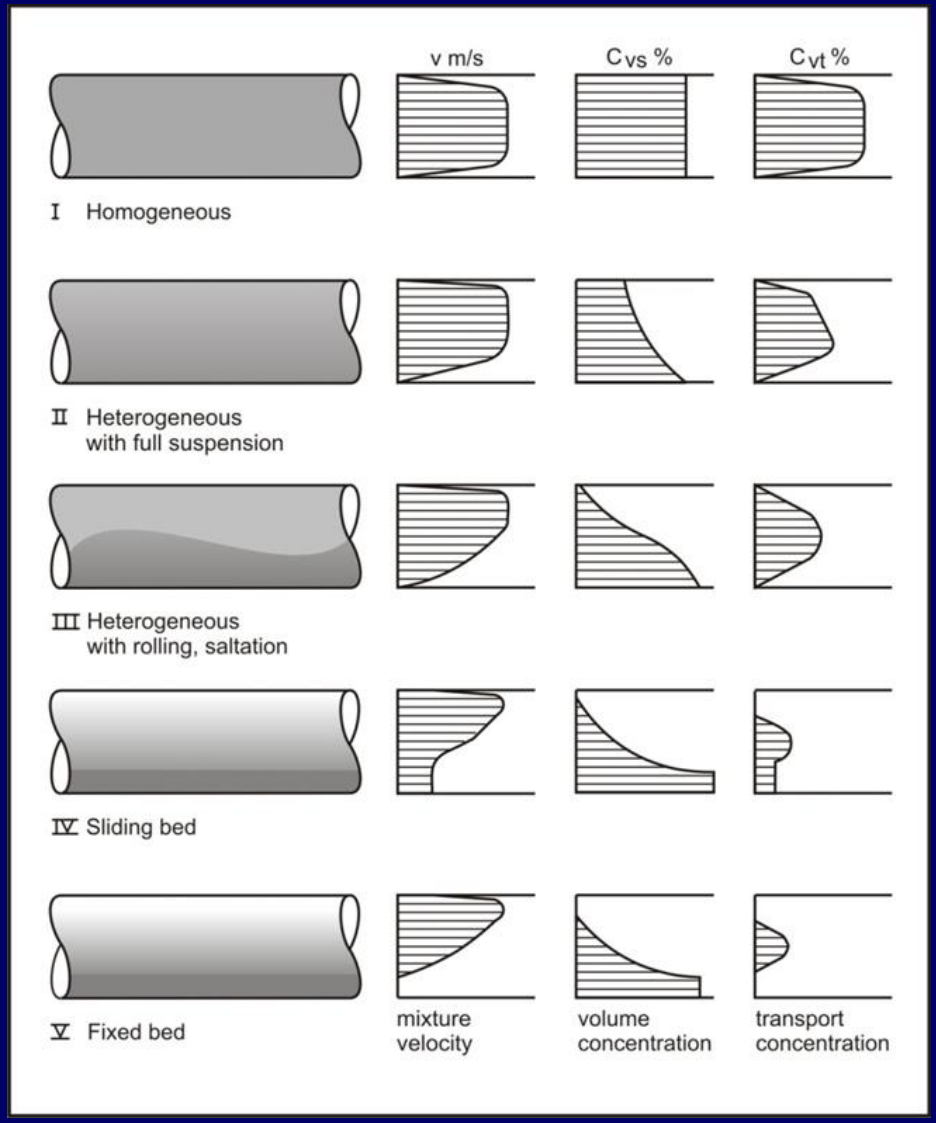
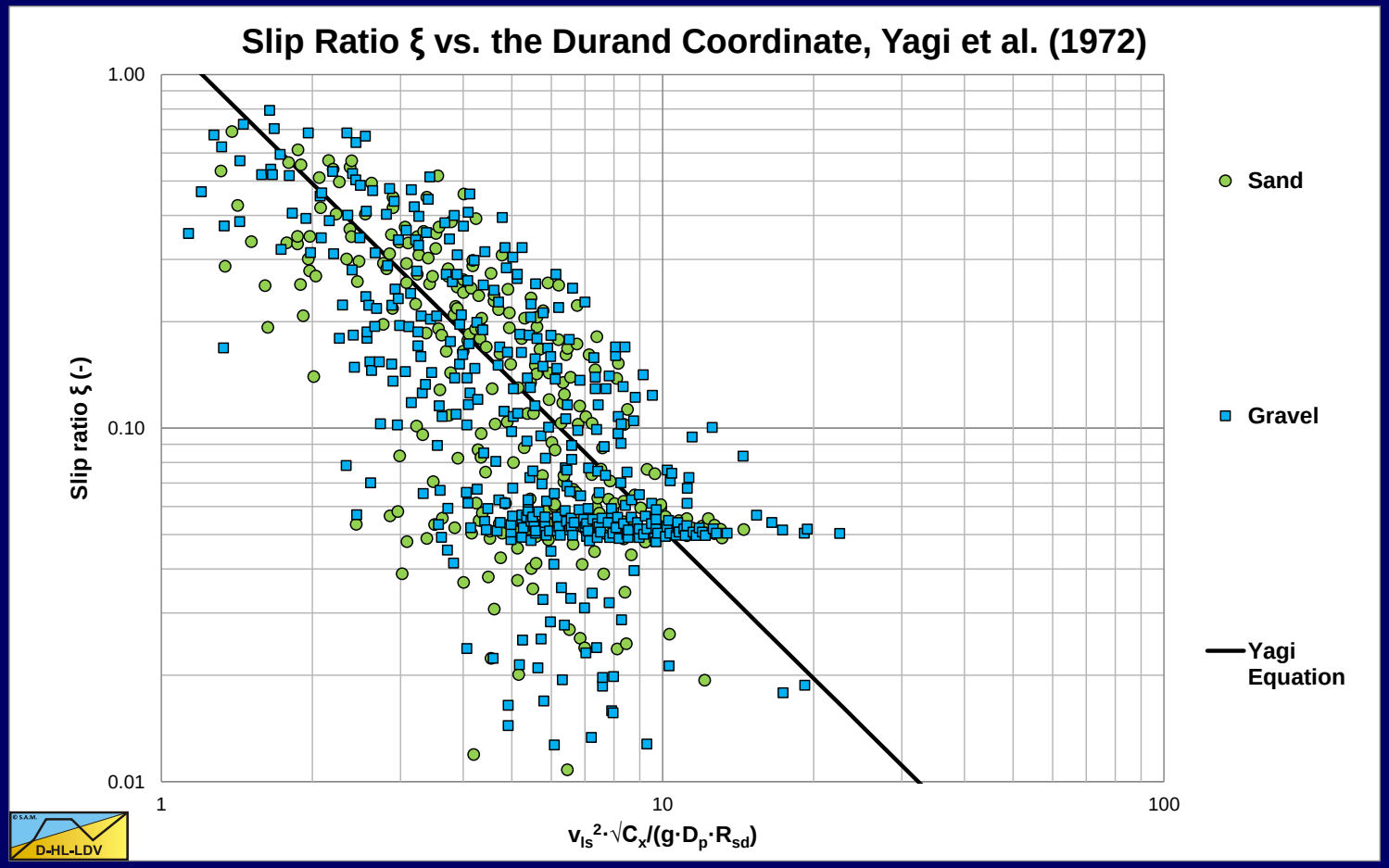


Slip Velocity or Holdup

Regimes History



Slip Ratio Yagi et al. (1972)



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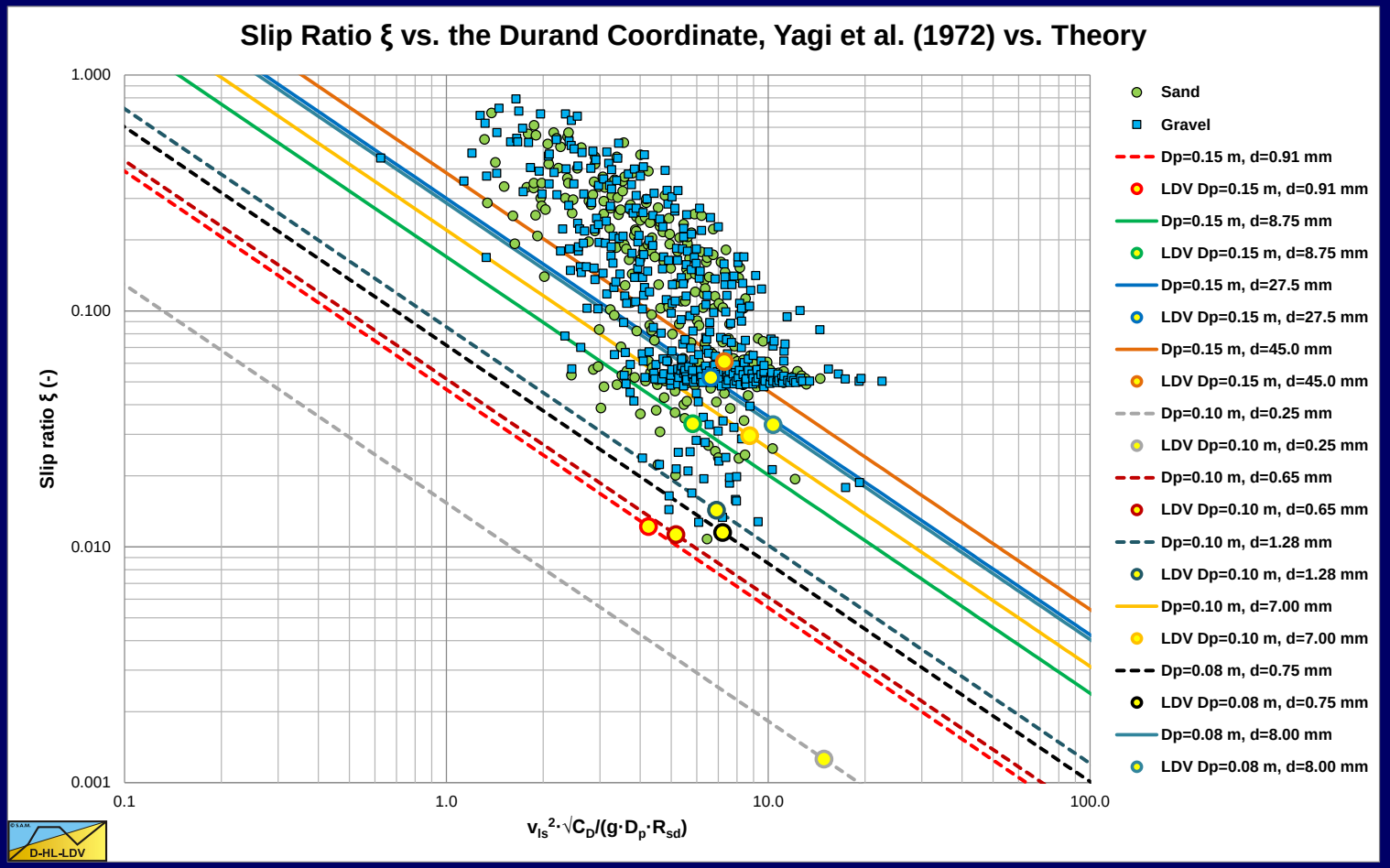
Slip Ratio, Data Yagi et al. (1972), Heterogeneous & Homogeneous Region



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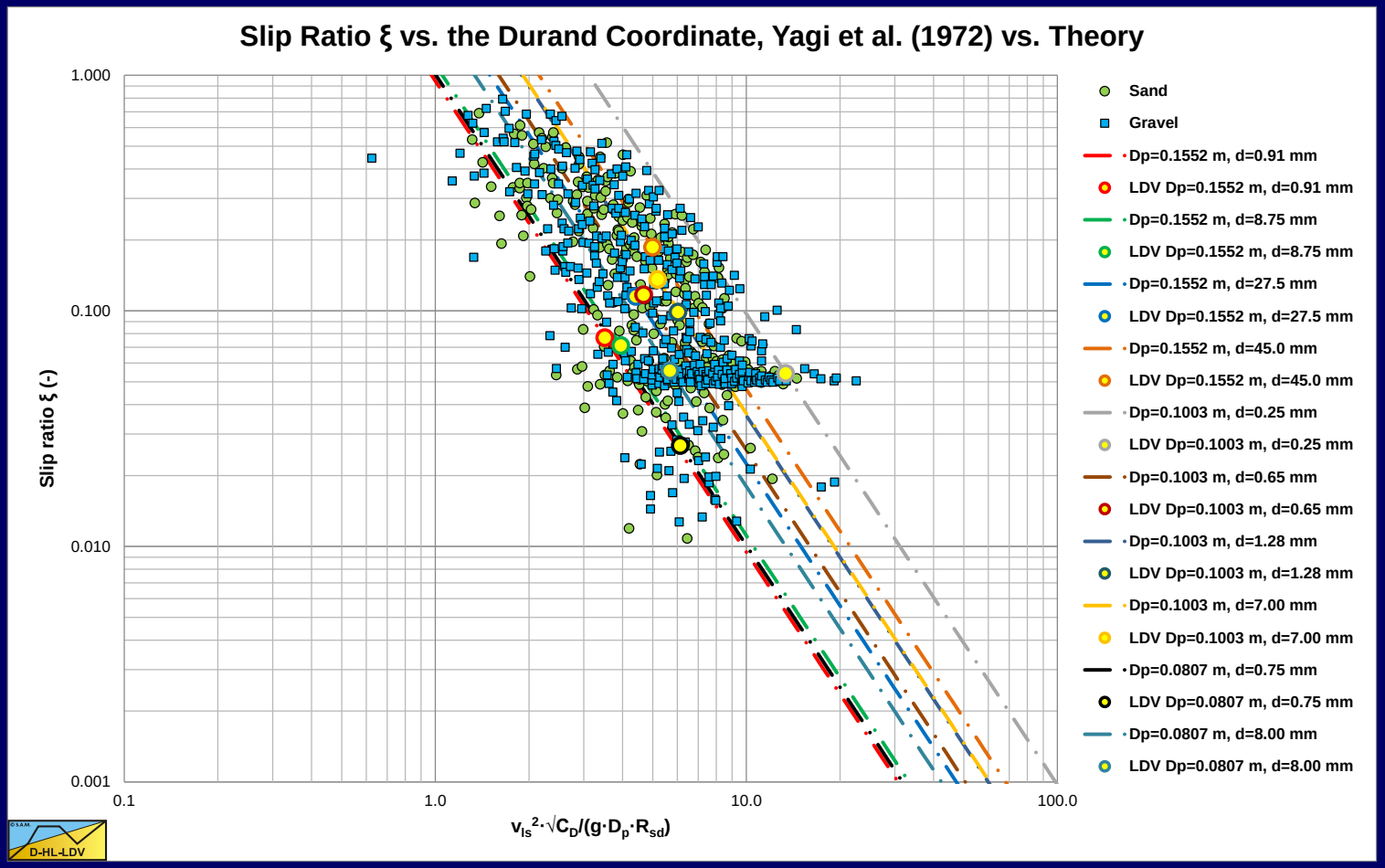
Slip Ratio, Data Yagi et al. (1972), Slip Ratio LDV Region



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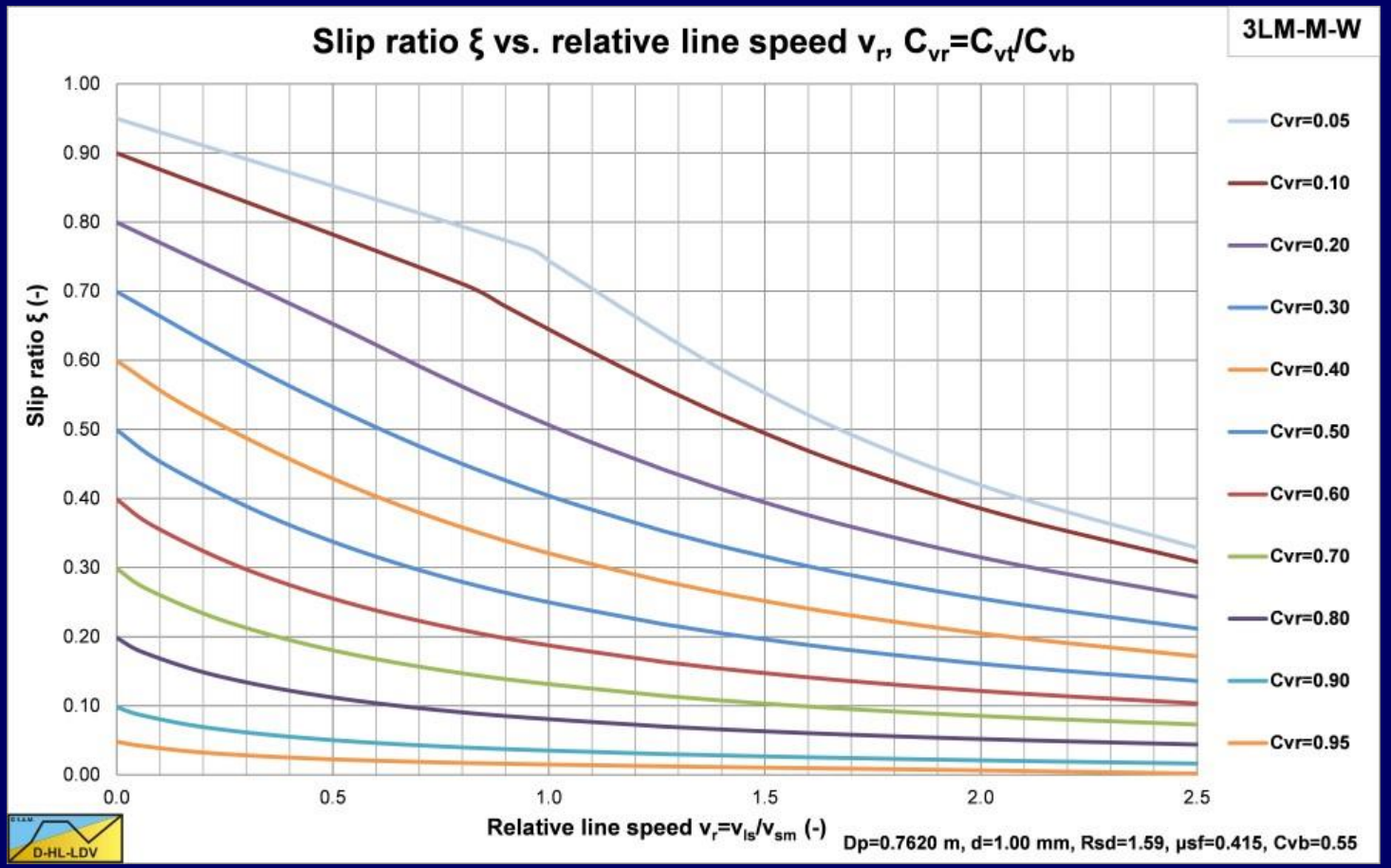
Slip Ratio Sliding Bed Region (Wilson Theory)



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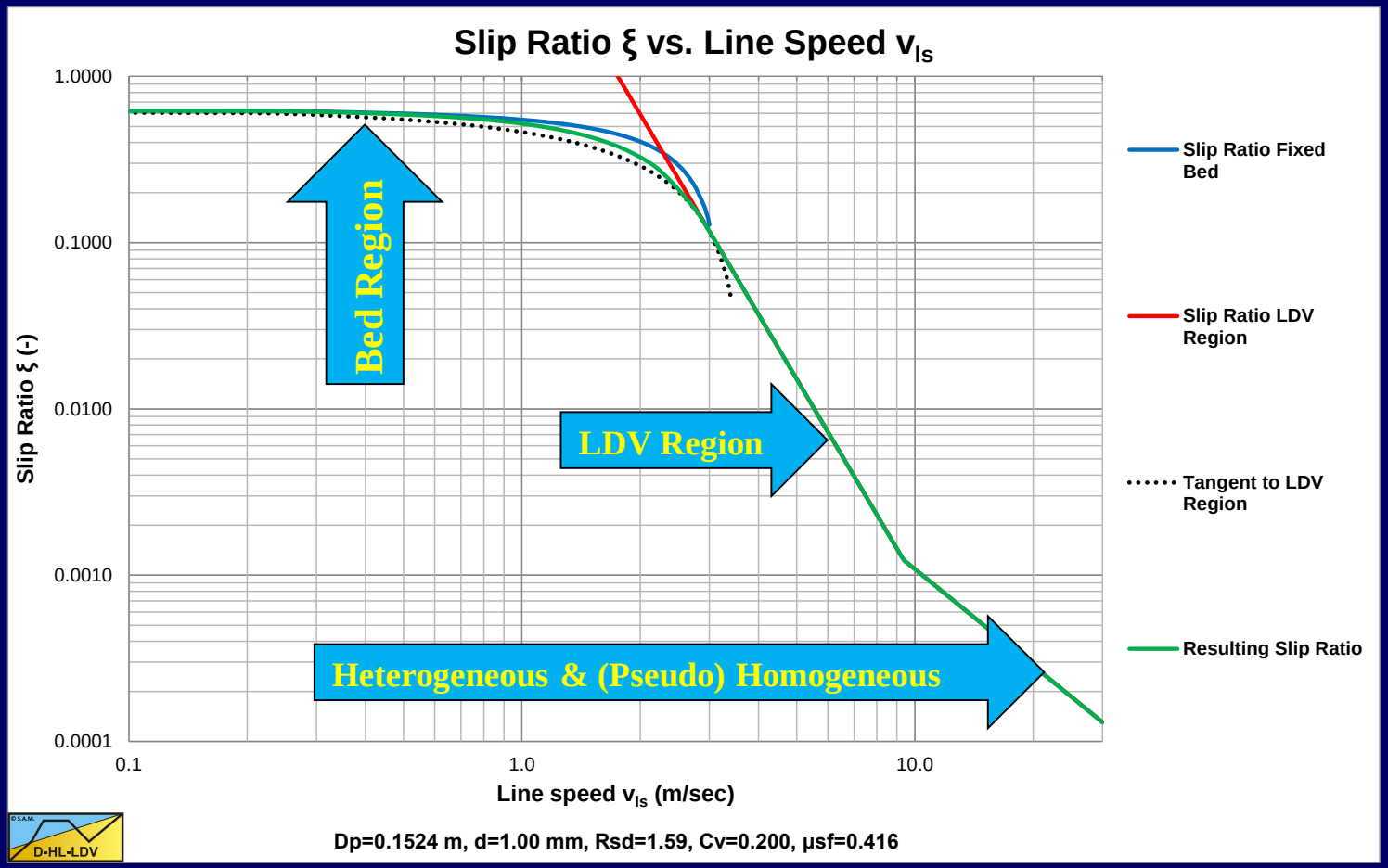
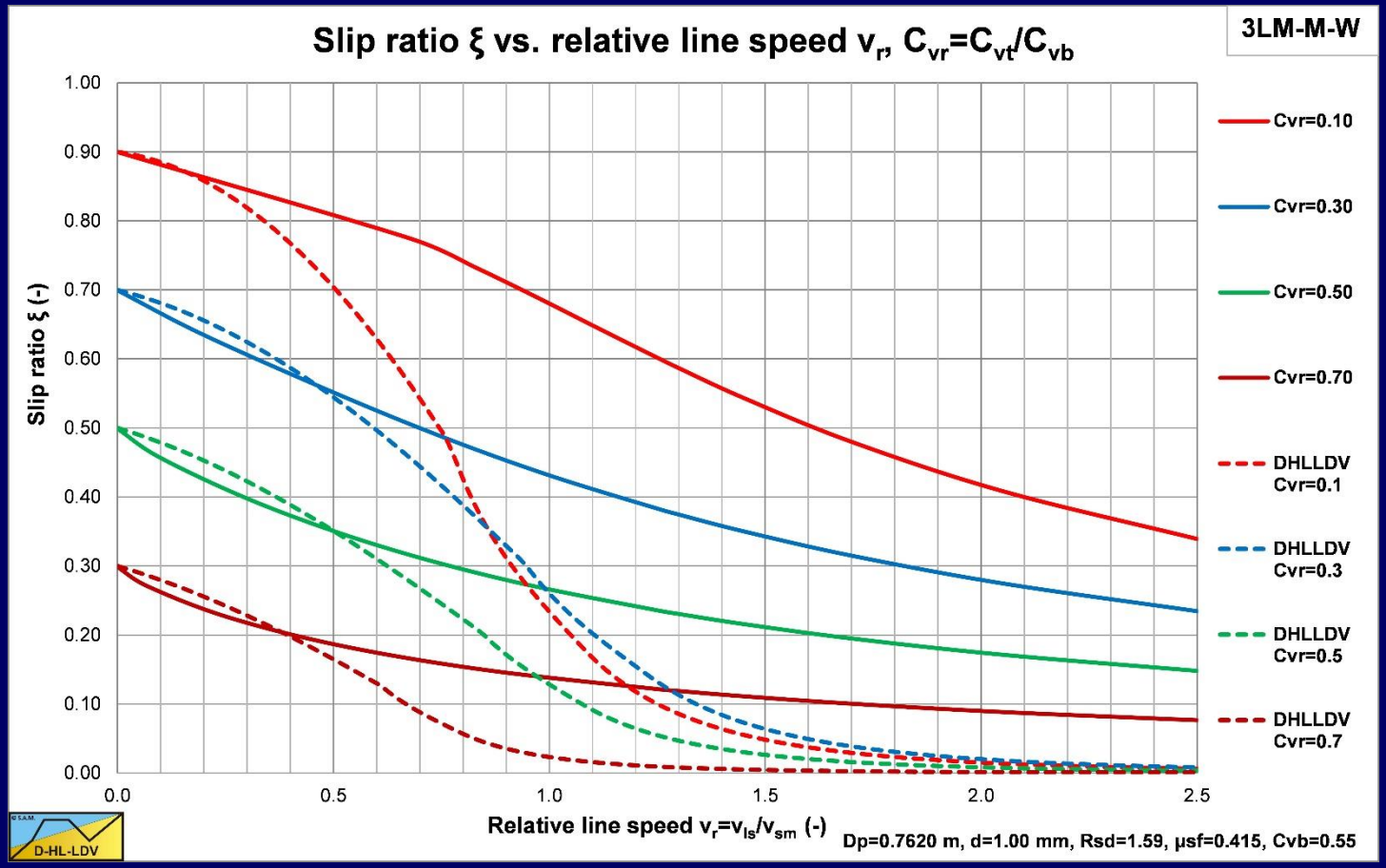
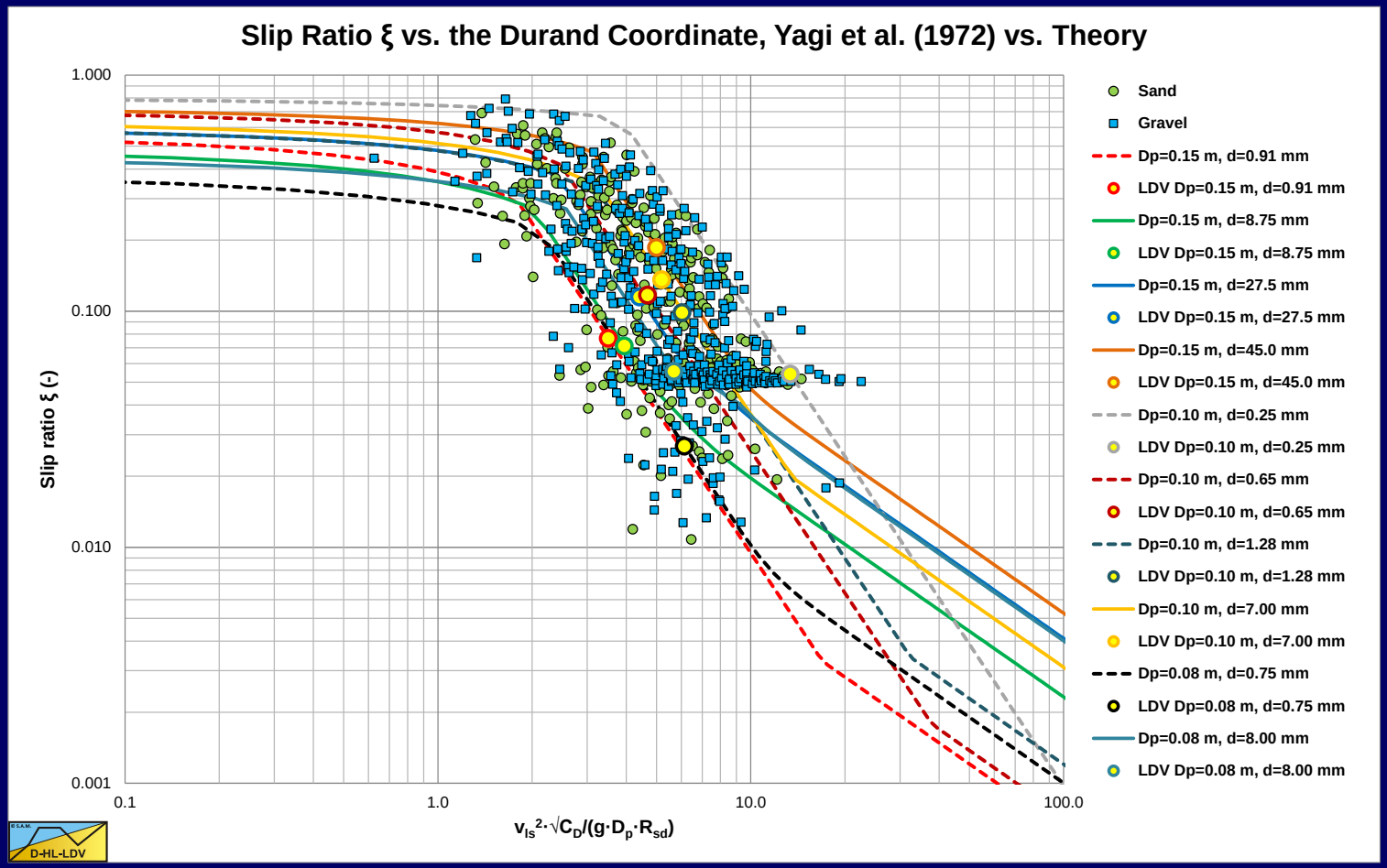
Construction Slip Ratio Curve



Slip Ratio Resulting



Slip Ratio, Data Yagi et al. (1972), Resulting Slip Ratio Curves C_{vt}=11-34%



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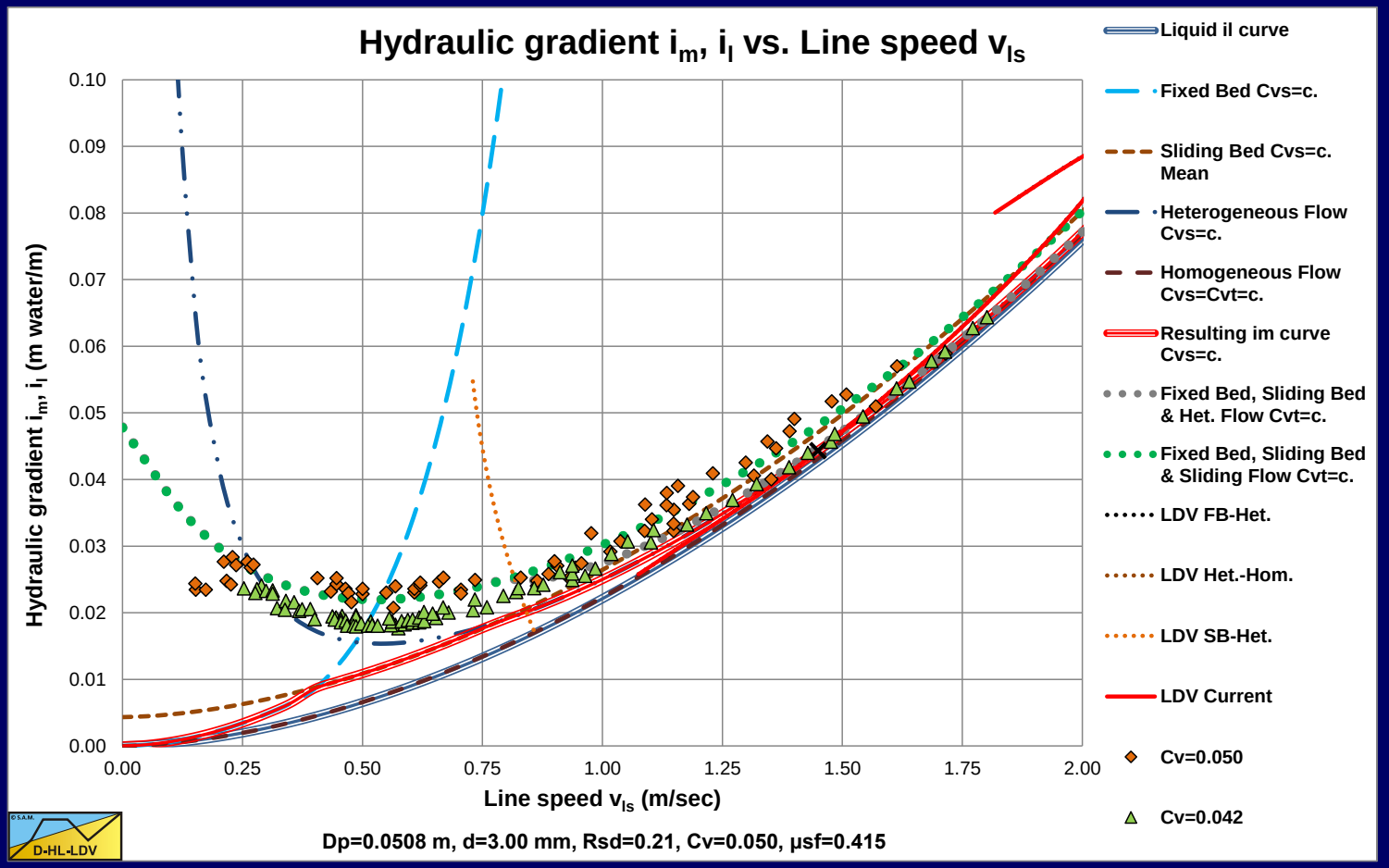
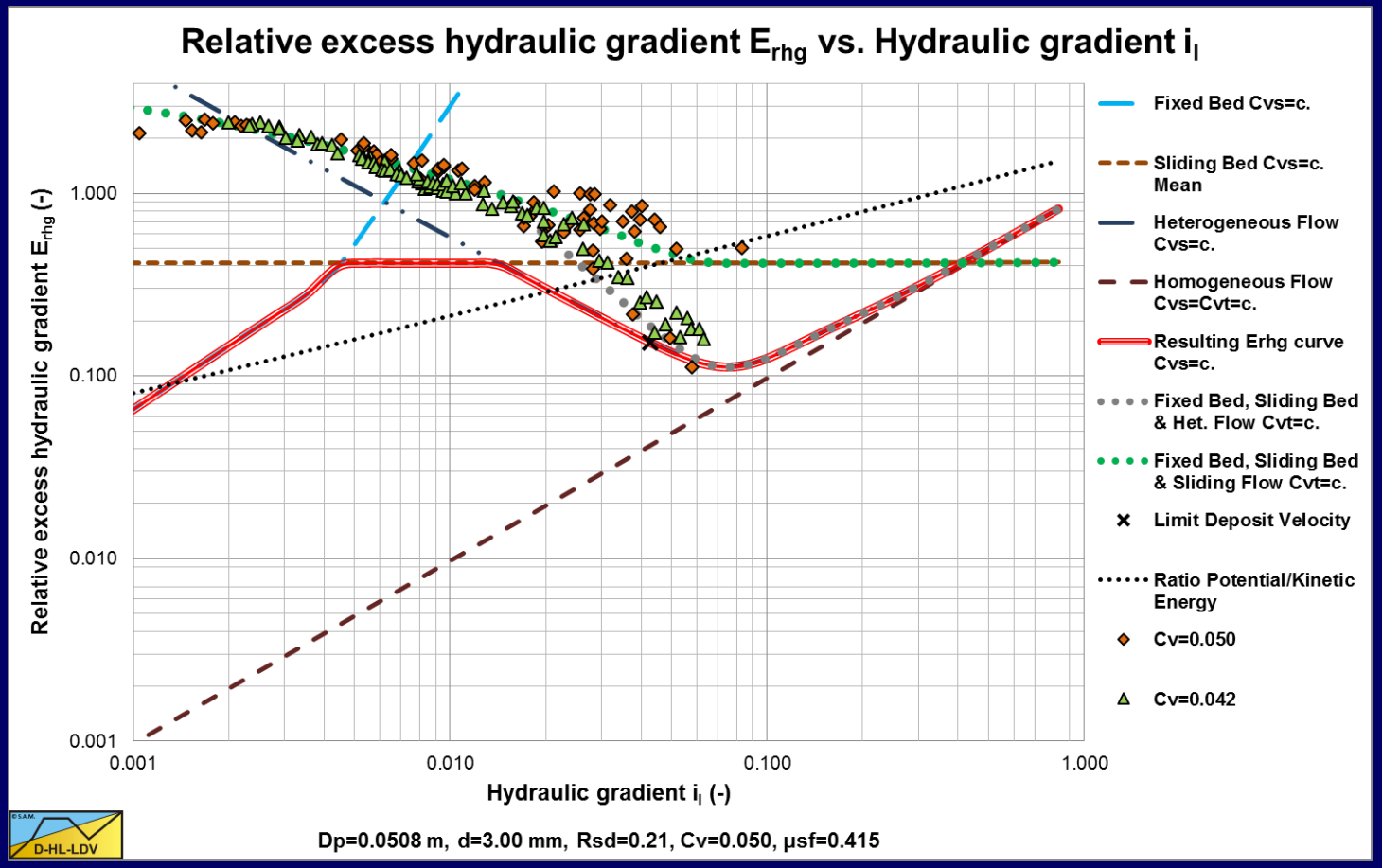
Verification, Data Doron (1987) C_{vt}=5%



Verification, Data Doron (1987) C_{vt}=5%



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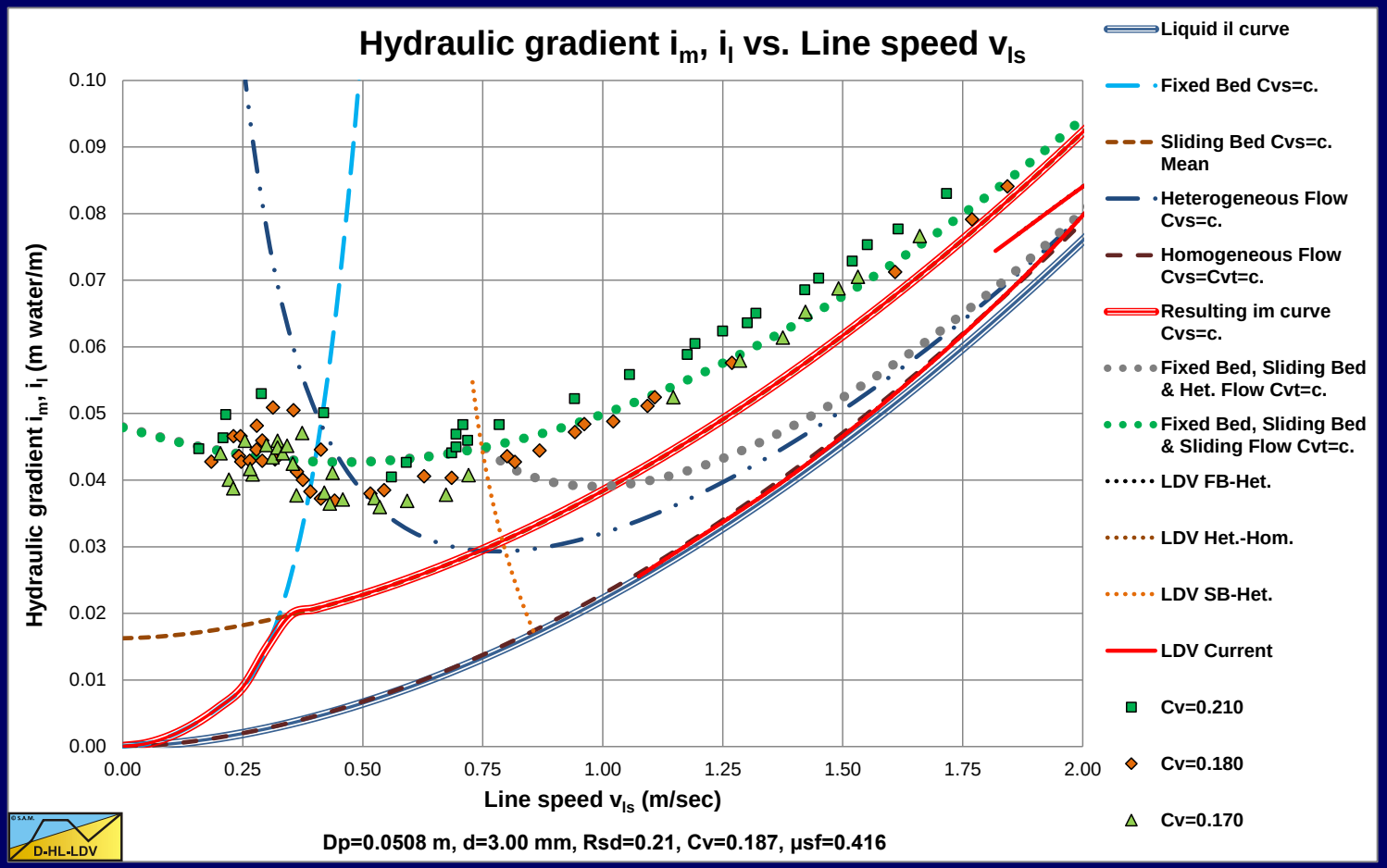
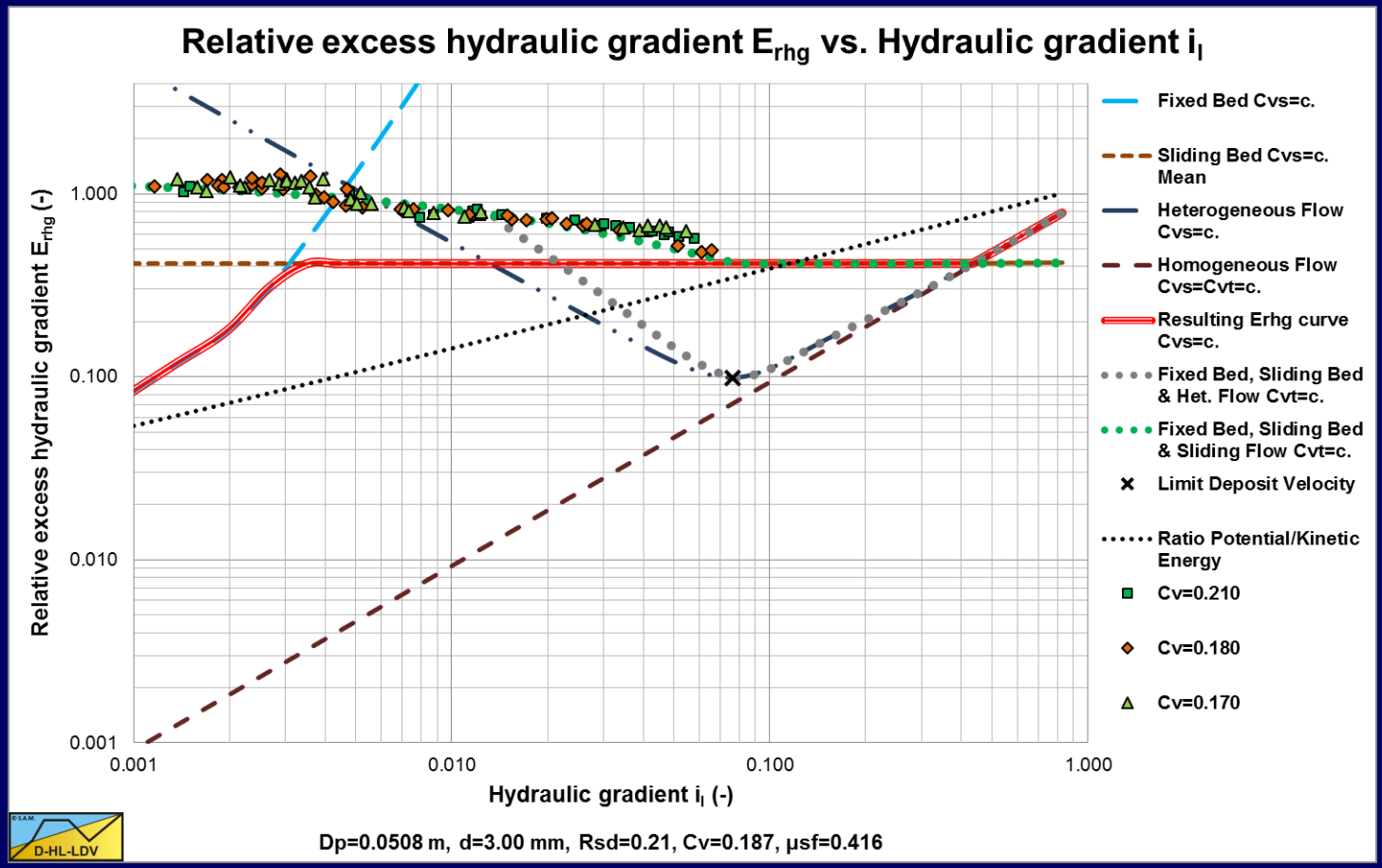
Verification, Data Doron (1987) C_{vt}=19%



Verification, Data Doron (1987) C_{vt}=19%



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Conclusions

- The slip velocity or holdup function has to be divided into 3 regions: The bed region, the LDV region and the heterogeneous & (pseudo) homogeneous region.
- The slip velocity or holdup function depends strongly on the LDV and the concentration.
- The delivered concentration can be determined based on the spatial concentration with the method developed for the holdup function.
- The method developed for the holdup function matches very well with experimental data.
- A good estimate of pressure losses can only be determined based on spatial concentration, the method developed is used to determined pressure losses based on delivered concentration.

Questions?

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