Traffic flow – Seminar

Distance headway, Overtaking distance

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Terminology

- Braking distance, D_b: distance covered *during braking*.
- Stopping distance, D_s: distance covered from recognition to stop. $D_s = D_r + D_b$ (brake lag time is not considered)
- Reaction time, t_r: time elapsed from the recognition of an obstacle to the start of braking. $t_r \approx 1$ s
- Distance headway, h_d :
  - In highway code: distance between two sequent vehicles
  - In traffic theory: distance between *the noses* of sequent vehicles
- Overtaking distance, D_o: distance needed for performing a safe overtaking (and has to be seen without obstruction to start the overtaking)

Calculation of total distance headway

$$\boldsymbol{h_d > D_{total}}$$

$$D_{total} = D_b + D_r + l_{veh} + l_s$$

$$D_{total} = \underbrace{\frac{v^2}{2 * g * (\varphi_1 \pm q)}}_{\text{stopping distance } (D_s)} + v * t_r + l_{veh} + l_s$$

Description:

v: speed;

g: gravitational acceleration;

φ_1: friction factor;

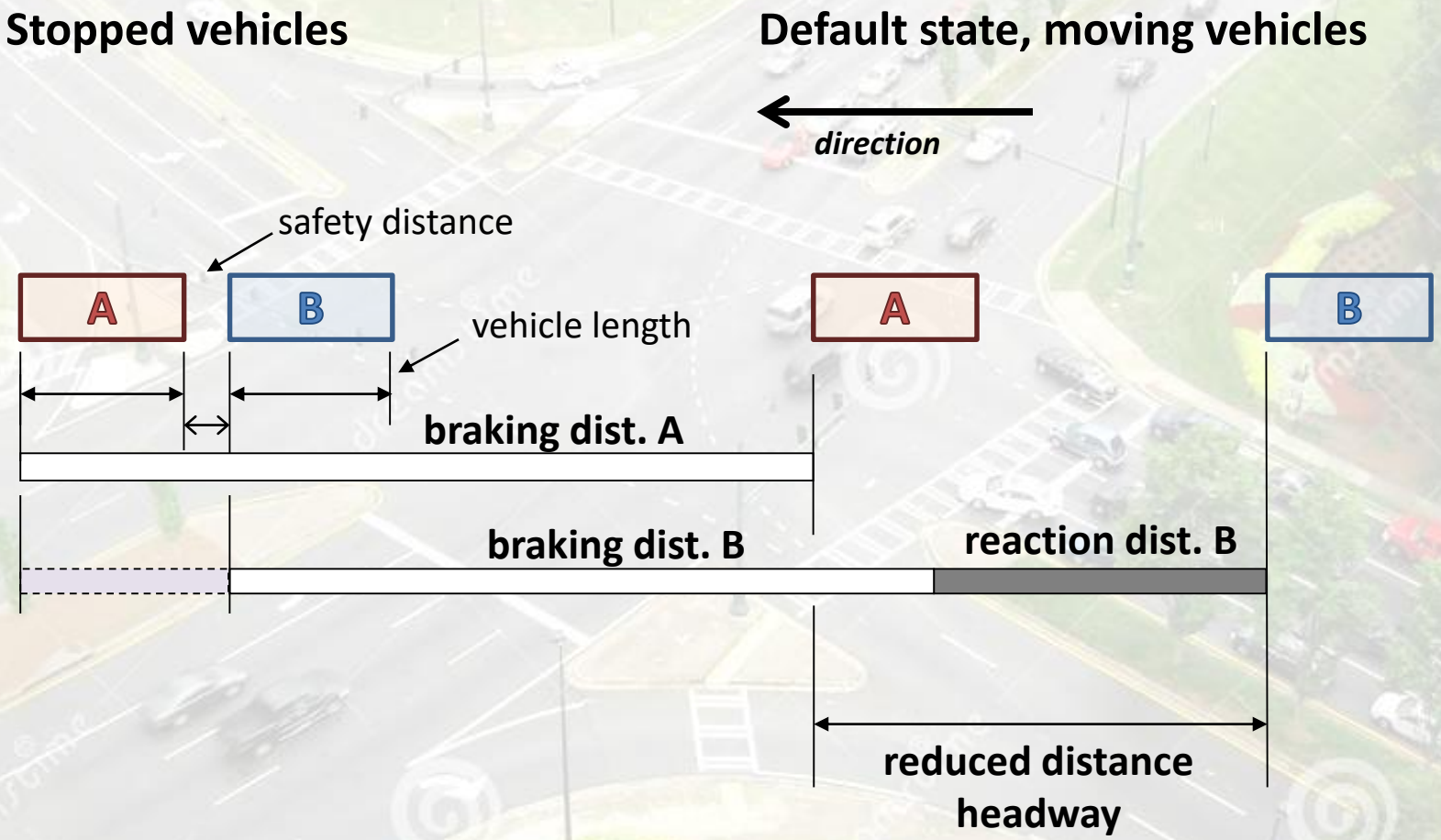
t_r: reaction time;

q: slope (tgα);

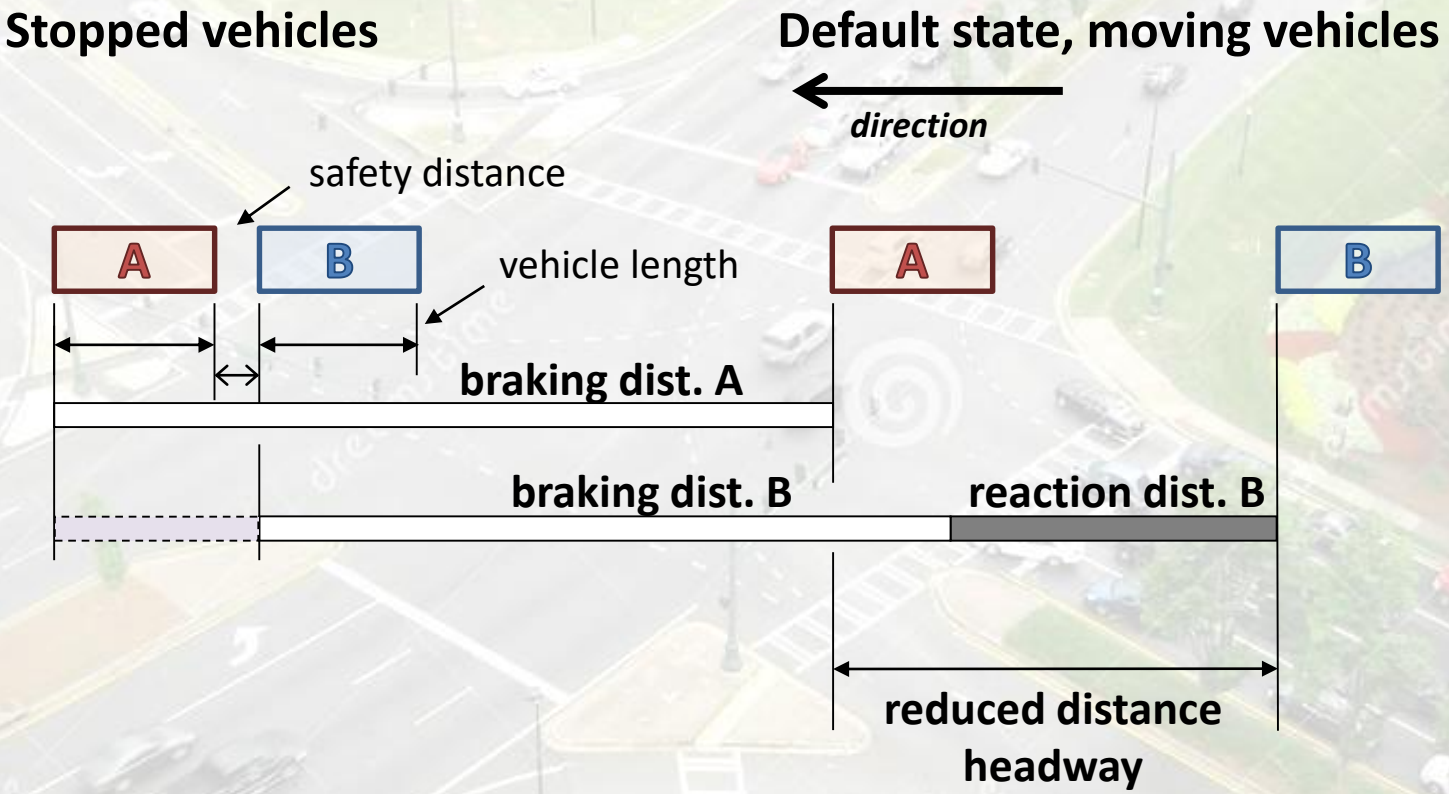
l_{veh} : vehicle length;

l_s : safety distance (spacing)

Reduced distance headway, h_R



Reduced distance headway, h_R

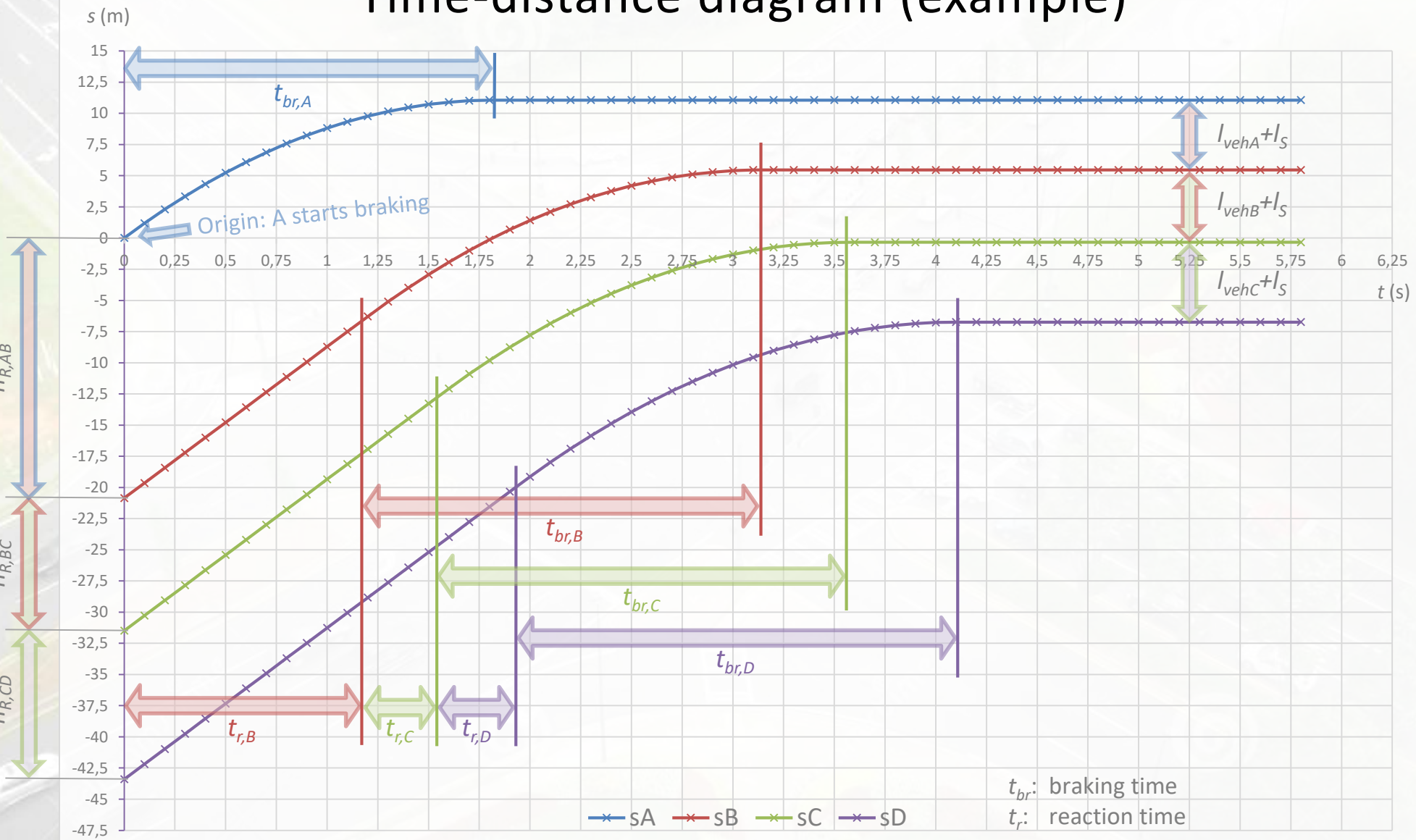


Following vehicle:

Leading vehicle

$$h_R = \frac{v_B^2}{2 * g * (\varphi_{1B} \pm q)} + v_B * t_{rB} + l_{vehA} + l_{sB} - \frac{v_A^2}{2 * g * (\varphi_{1A} \pm q)}$$

Time-distance diagram (example)



Overtaking distance, D_o

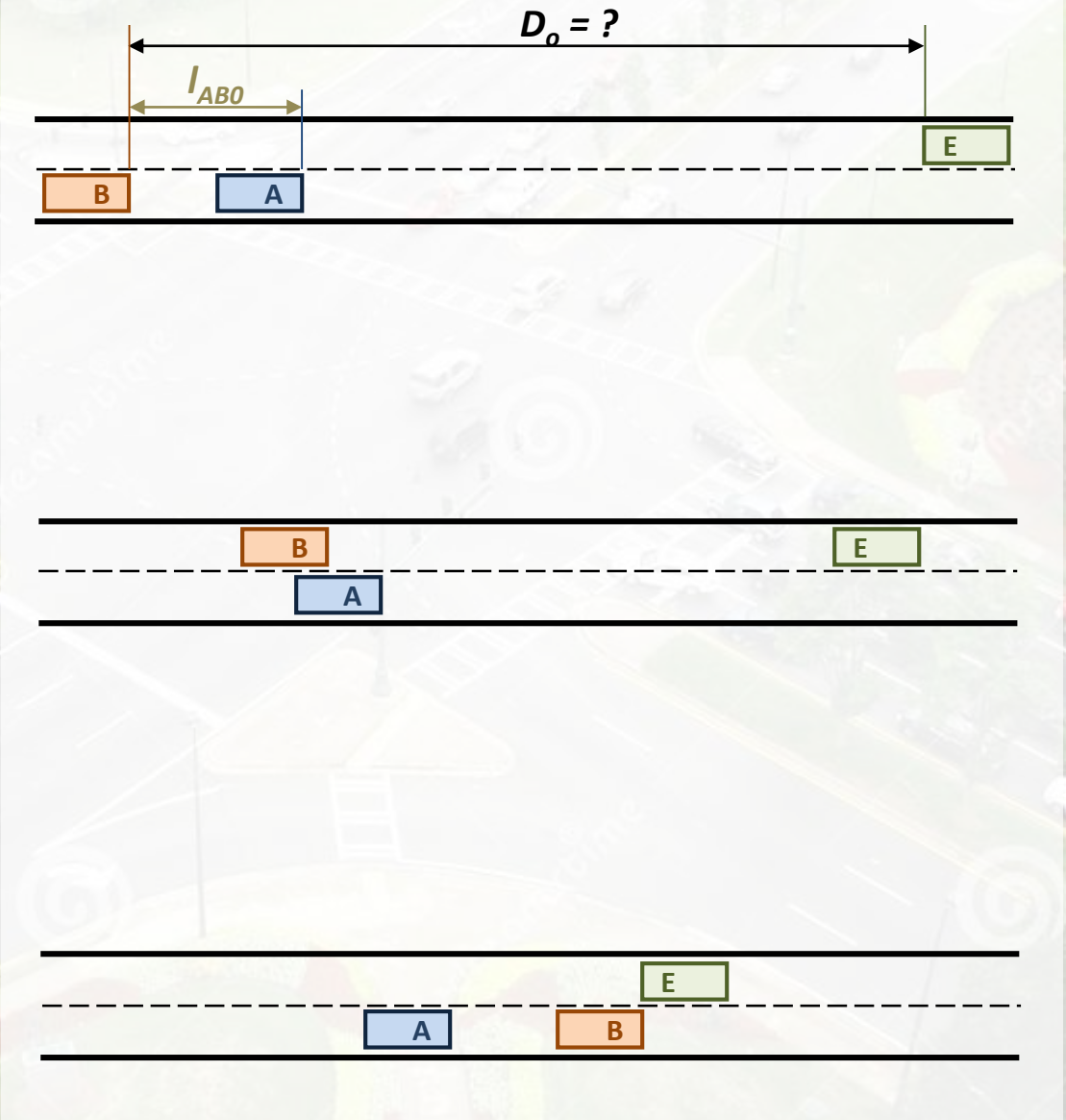
I. Start of overtaking

1. B accelerates

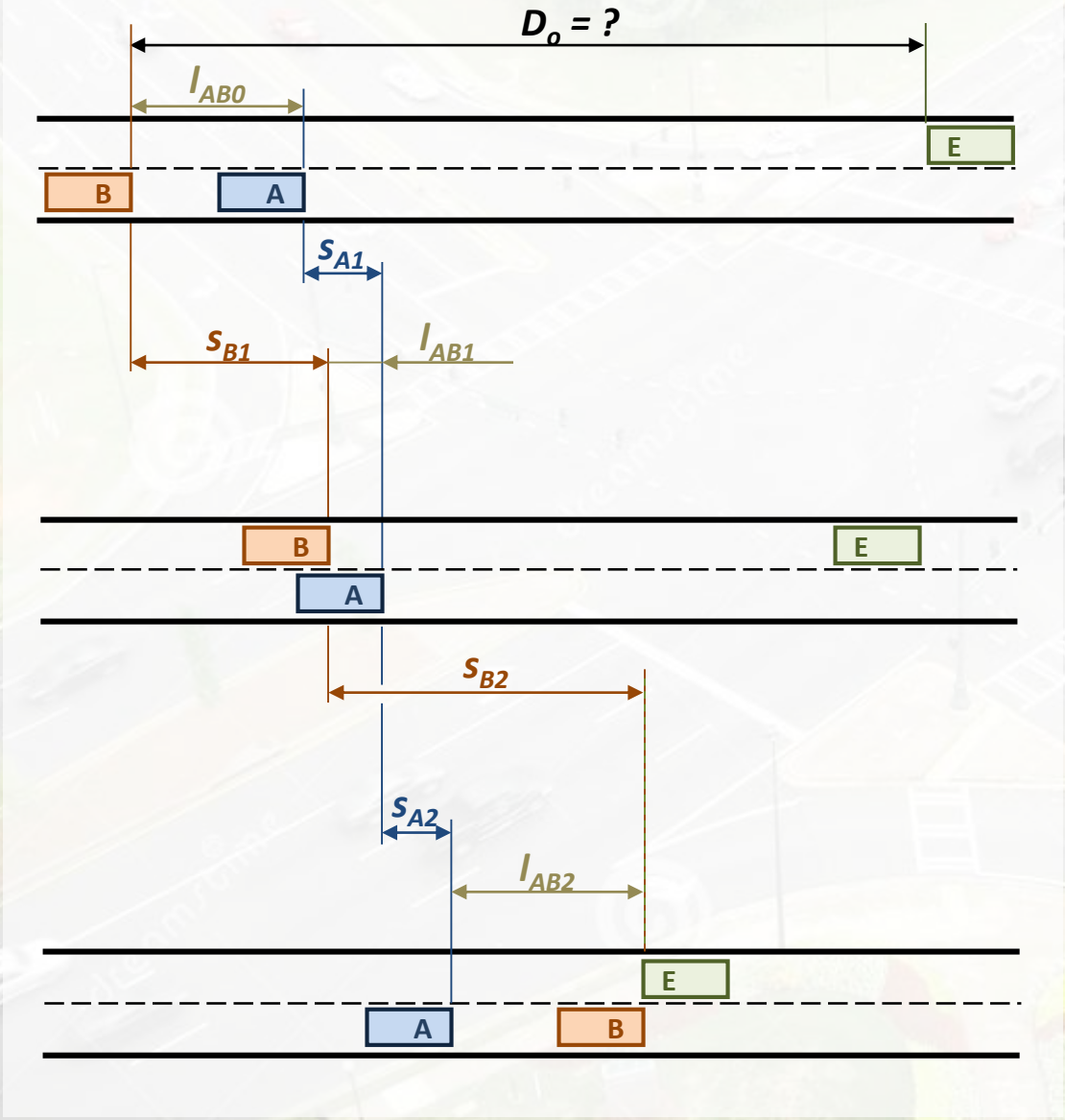
II. End of acceleration

2. Moving with constant speed

III. End of overtaking



Overtaking distance, D_o



Acceleration phase **(1)**:

$$s_{A1} = v_0 \cdot t_1$$

$$s_{B1} = \frac{v_0 + v_1}{2} t_1 = v_0 \cdot t_1 + \frac{v_1 - v_0}{2} t_1 = s_{A1} + \frac{a}{2} t_1^2$$

Relative to A:

$$s_{B1rel} = \frac{a}{2} t_1^2 = \frac{v_{B1rel}}{2} t_1 = l_{AB0} - l_{AB1} \rightarrow \boldsymbol{l_{AB1}}$$

Constant speed phase **(2)**:

$$s_{A2} = v_0 \cdot t_2$$

$$s_{B2} = v_1 \cdot t_2 = v_0 \cdot t_2 + (v_1 - v_0) \cdot t_2$$

Relative to A :

$$s_{B2rel} = v_{B1rel} \cdot t_2 = l_{AB2} + l_{AB1} =$$

$$= l_{safAB} + l_{vehB} + l_{AB1} \rightarrow \boldsymbol{t_2}$$

In total:

$$\sum s_E = v_E (t_1 + t_2)$$

$$D_o = \sum s_B + \sum s_E = \sum s_A + \sum s_{Brel} + \sum s_E$$