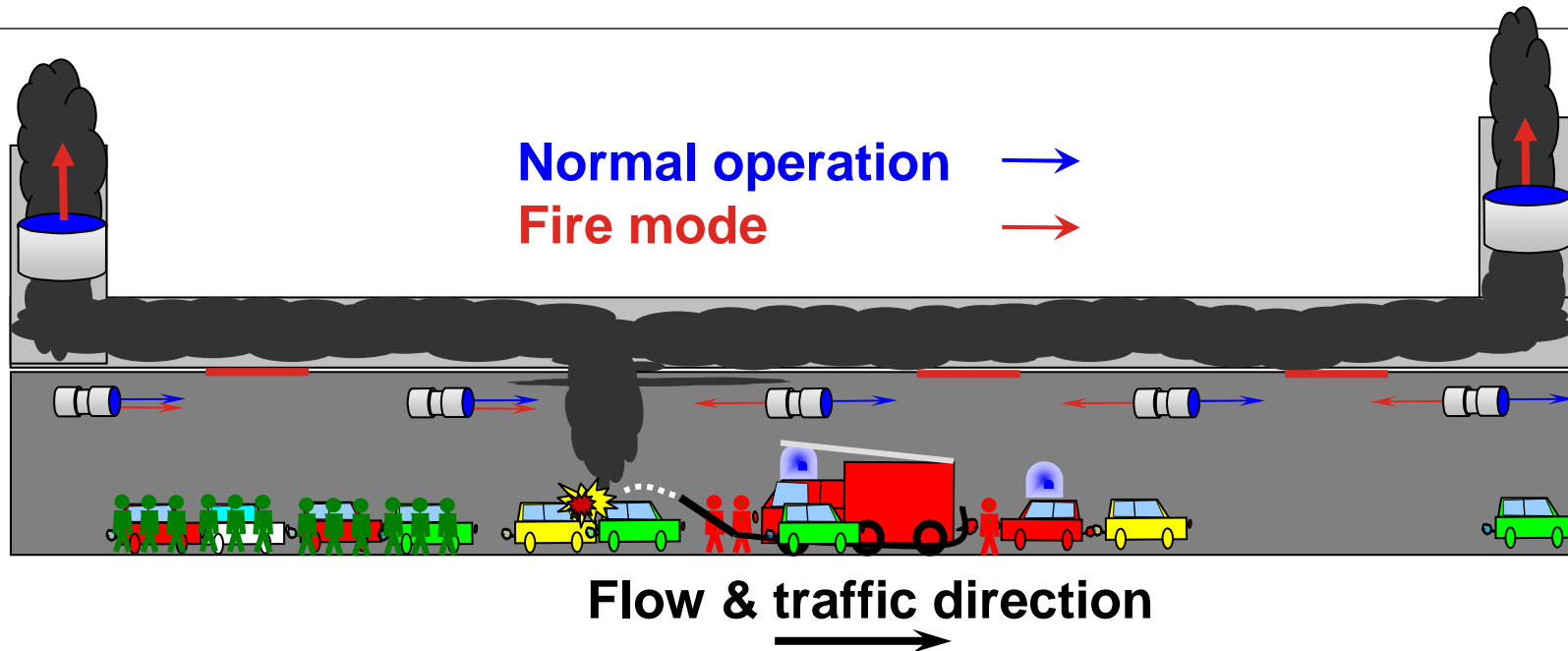


*Principles of Road
Tunnel
Design (longitudinal)*

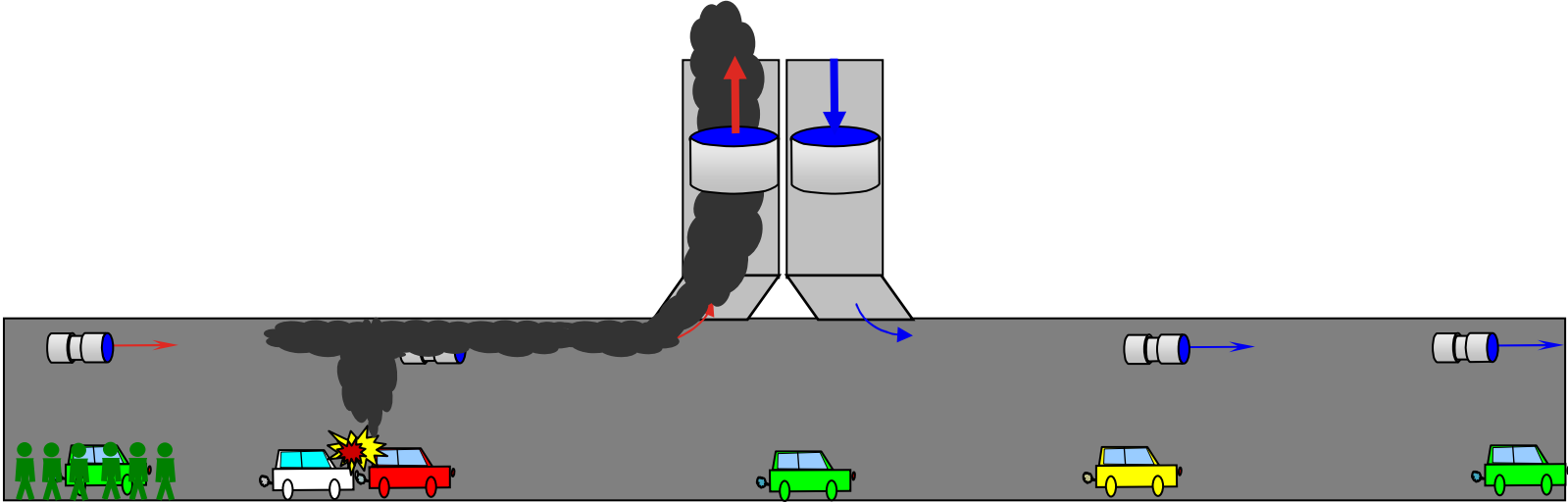
1. Jet Fans with Spot Extraction by Axial Fans (complex)
 2. Jet Fans with Shaft Axial Fans (complex)
 3. Axial Fans with Saccardo Nozzle (complex)
 4. Jet Fans only (simple)
-

1. Spot Extraction



<ul style="list-style-type: none"> ⊕ Concentration of exhaust capacity at spot of fire ⊕ Simultaneous evacuation and fire fighting ⊕ Excellent smoke control ⊕ Highest safety level 	<ul style="list-style-type: none"> ⊖ Very high investment costs ⊖ Complex design ⊖ Increasing concentration of pollutants until portal
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2. Shaft Extraction

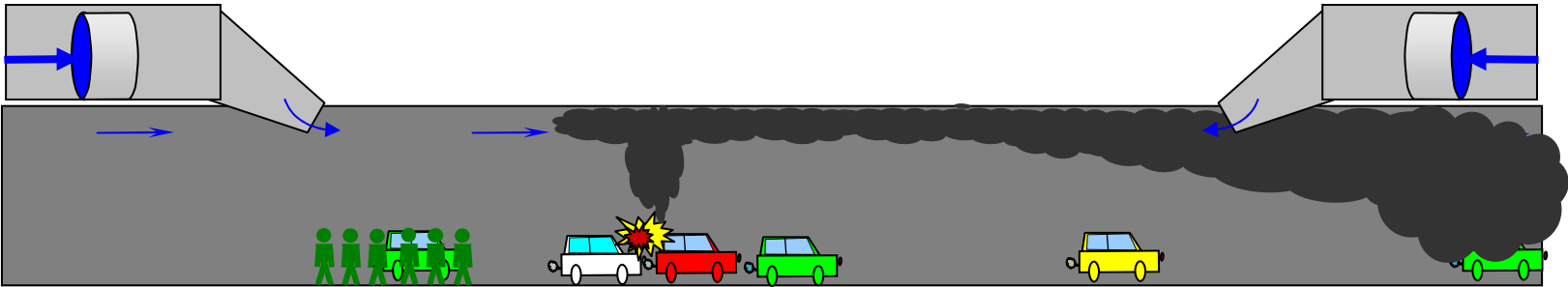


Flow & traffic direction



<ul style="list-style-type: none"> ⊕ Increasing concentration of pollutants reduced (50%) ⊕ Split smoke section (smoke laden max. 50%) ⊕ Good smoke control (50% of tunnel smoke free) ⊕ High safety level 	<ul style="list-style-type: none"> ⊖ High investment costs ⊖ Complex design
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3. Axial Fans with Saccardo Nozzle

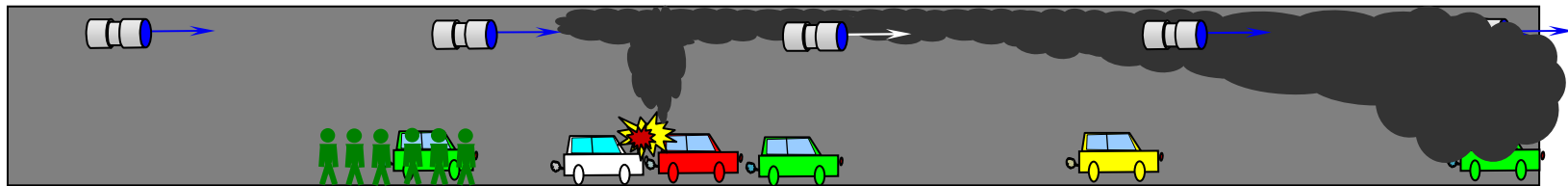


Flow & traffic direction



<ul style="list-style-type: none"> ⊕ Good smoke control (upstream of fire: no smoke) ⊕ Medium safety level 	<ul style="list-style-type: none"> ⊖ High investment costs ⊖ Complex design ⊖ Increasing concentration of pollutants until portal ⊖ Smoke laden section ⊖ 2nd fan room for reversing required!!!
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4. Jet Fans only (longitudinal)



Flow & traffic direction

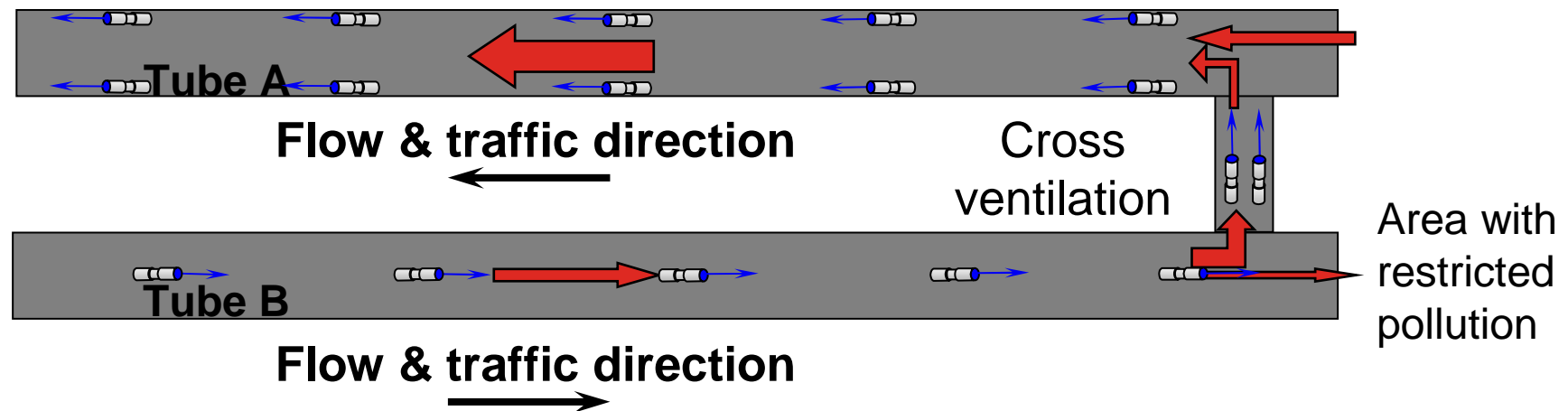


⊕ Good smoke control (upstream of fire: no smoke)	⊖ Increasing concentration of pollutants until portal
⊕ Medium safety level	⊖ Smoke laden section
⊕ Low investment costs	
⊕ Simple design	

4. Jet Fans only

Principle of cross ventilation

→ one portal area with restricted pollution



Partial amount of polluted air extracted
from Tube B into Tube A

→ amount of fan has to be increased for Tube A

→ increased pollution concentration in Tube A

Advantages and Disadvantages of General Road Tunnel Designs:

- Jet Fans with Spot Extraction by Axial Fans (complex design, cost intensive, excellent smoke control)
- Jet Fans with Shaft Axial Fans (complex design and cost intensive)
- Axial Fans with Saccardo Nozzle (very complex design, high investment costs, good smoke control upstream of fire, increasing concentration of pollutants until portal)
- Jet Fans only (simple design, low investment costs, good smoke control, increasing concentration of pollutants until portal)