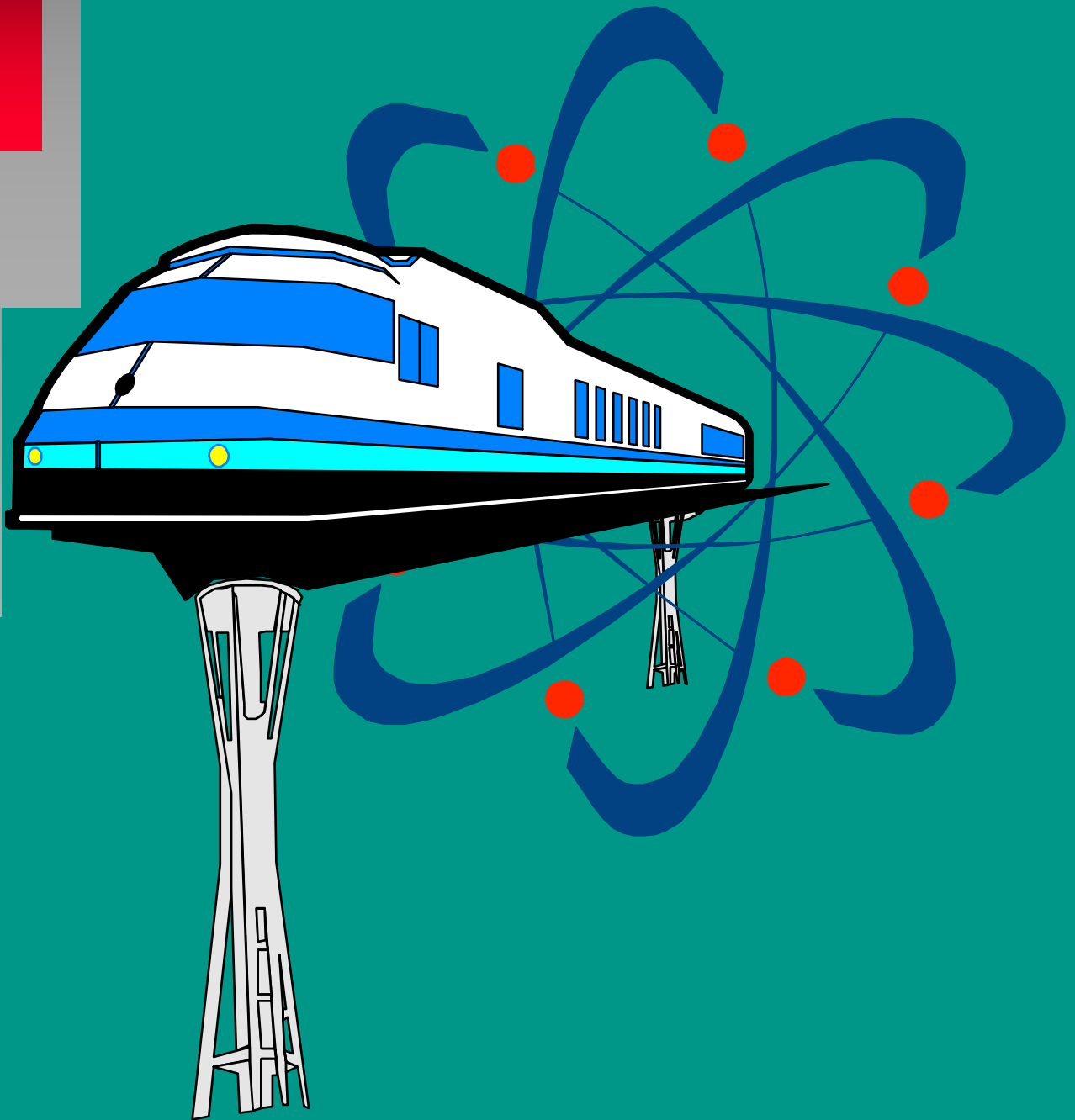


# *MAGNETIC LEVITATION*



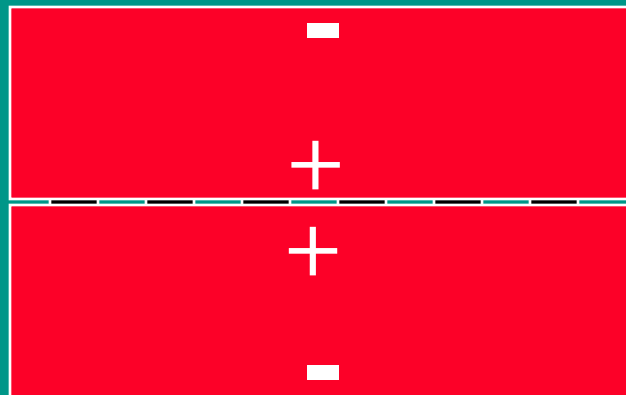
# *MAGNETIC LEVITATION*

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*How does magnetic  
levitation work  
between two magnets?*

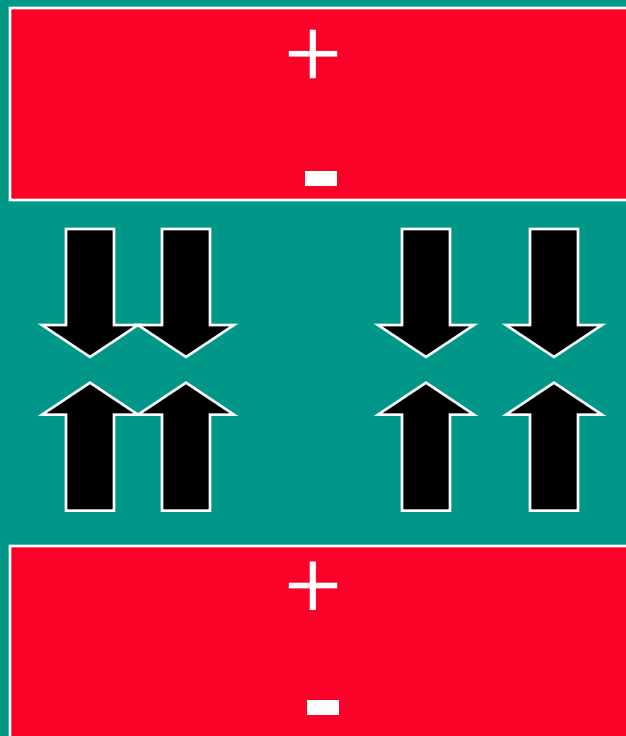
# *MAGNETIC LEVITATION*

Like charges repel



# *MAGNETIC LEVITATION*

Opposites attract



# *MAGNETIC LEVITATION*

*How is magnetic levitation  
used for transportation?*

- *Trains*
- *Shuttles*
- *Shipping industry to move packages*
- *Airport passenger relocation*

# *MAGNETIC LEVITATION*



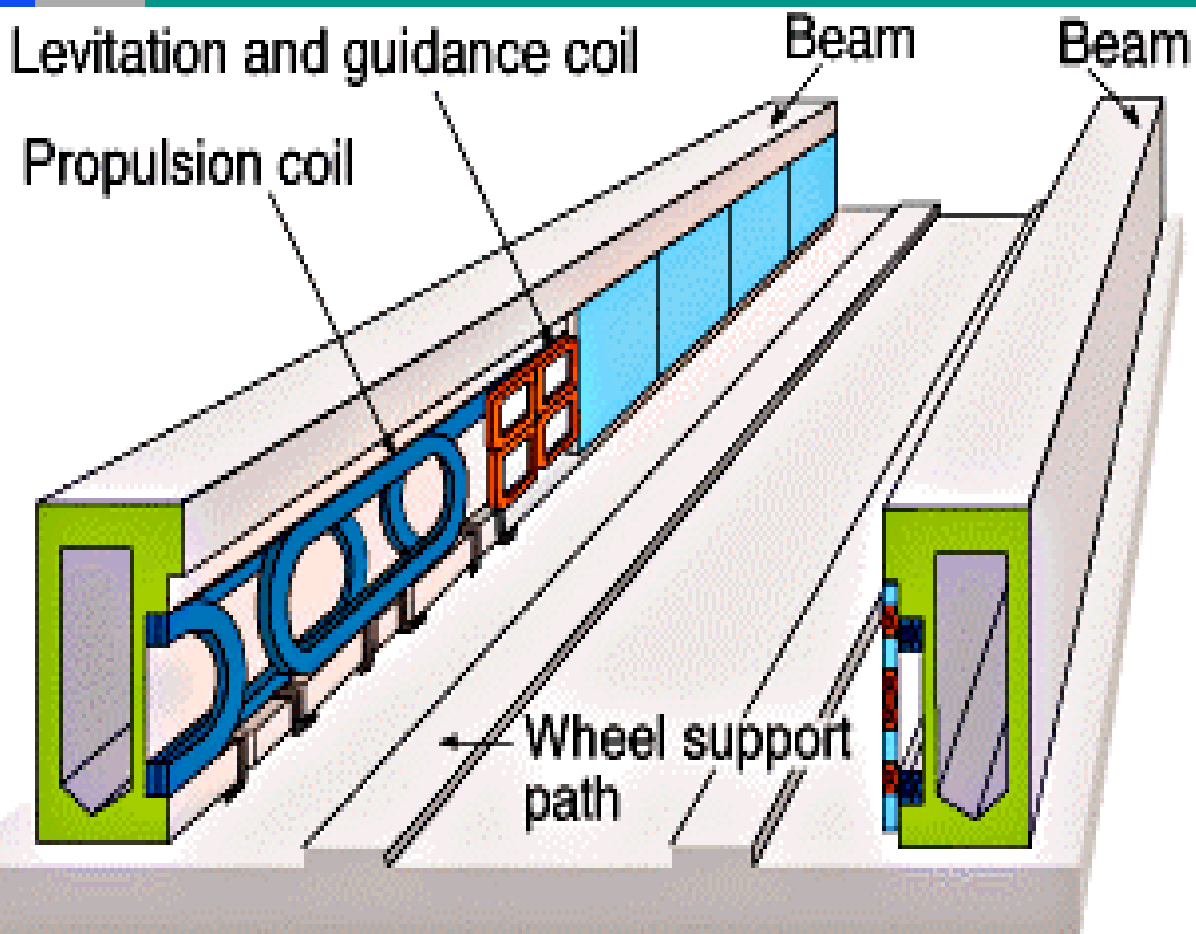
—  
Magnets on train  
+

**Magnets push apart**

+  
Magnets on track  
—

# *MAGNETIC LEVITATION*

## Typical “dual-beam” Magnetic Levitation train rail system



# *MAGNETIC LEVITATION*

---

*Have you ever seen a  
real magnetic levitation  
train?*

*If so where?*



# *MAGNETIC LEVITATION*

---

## **Existing Mag Lev Trains**

- *Disney World*
- *Japan*
- *China*
- *Germany*
- *Pennsylvania*
- *Washington State*

# *MAGNETIC LEVITATION*



## **The Guideway**

The “Transrapid” hovers over a double track guideway. It can be mounted either at-grade or elevated on slim columns and consists of individual steel or concrete beams up to 62 m in length.

# *MAGNETIC LEVITATION*

*What are some advantages  
of magnetic levitation  
trains over fuel-burning  
trains?*

- *More efficient*
- *Cleaner burning*
- *Less land consumption  
for tracks*
- *Faster*
- *Quieter*

# *MAGNETIC LEVITATION*

## *Land Consumption Percentages*



ICE



14



TR at grade



12



TR elevated



2

# *MAGNETIC LEVITATION*

*Where are magnetic  
levitation trains usually  
located in reference to  
other trains?*

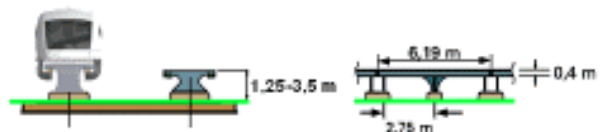
- *Sometimes next to roadways*
- *At ground level*
- *Slightly above the ground*
- *High above the ground*

# MAGNETIC LEVITATION

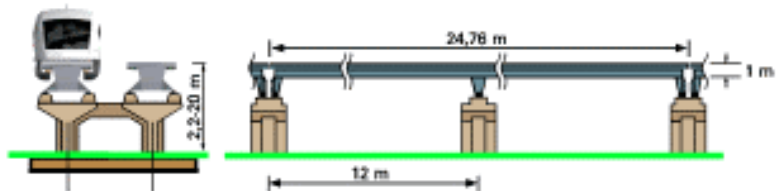
## Guideway Types



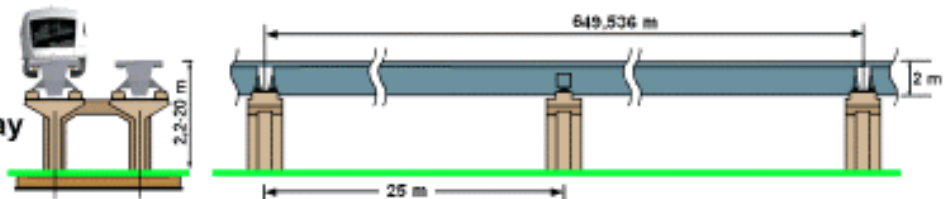
At-grade guideway  
Typ III



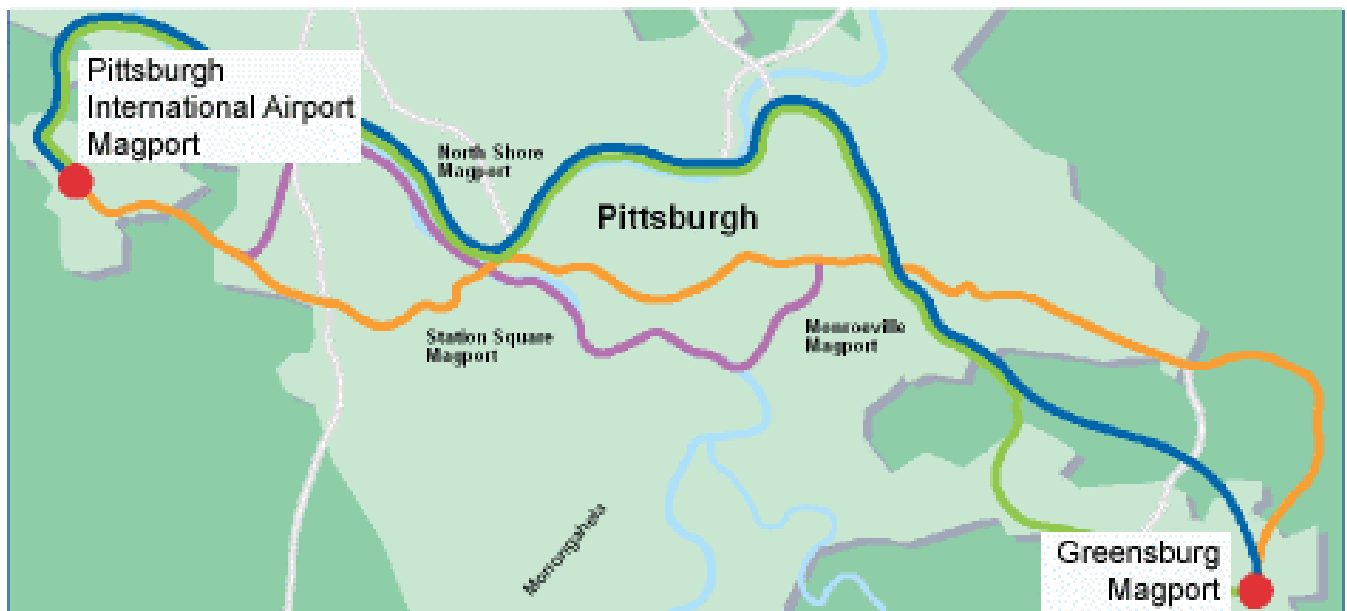
Elevated Guideway  
Typ II



Elevated Guideway  
Typ I



# *MAGNETIC LEVITATION*



## **Pittsburgh International Airport to Greensburg**

Route length	47 miles	Vehicles	8 (5 sections each)
Stations	4	Invest cost	\$ 2.7 billion
Trip time	28 minutes		

# *MAGNETIC LEVITATION*

■ *A Magnetic Levitation Transportation System is made up of many smaller subsystems. Can you identify the following subsystems?*

- *What is the structure?*
  - *Track, support columns, train*
- *What propels the train?*
  - *Electricity*
- *What makes the train levitate?*
  - *Electromagnets*
- *How do people get on/off the trains?*
  - *Loading / unloading stations*
- *What controls the train's movement?*
  - *Computer systems*



# *MAGNETIC LEVITATION*

*What 4 forces are always  
acting on objects that are  
moving?*

- *Lift*
- *Thrust*
- *Drag*
- *Weight (gravity)*

# *MAGNETIC LEVITATION*

