

The Limitations of Modern Transportation

Overview	2
Modern Transportation Modes	2
Weather Conditions Affecting Travel	2
High Wind	2
1. Road:.....	2
2. Rail:	2
3. Maritime:.....	3
4. Air:.....	3
Heavy Rain.....	4
1. Road:.....	4
2. Rail:	4
3. Maritime:.....	4
4. Air:.....	4
Snow & Ice	4
1. Road:.....	4
2. Rail:	4
3. Maritime:.....	5
4. Air:.....	5
Lighter-than-Air Technology	6
1. Heavy Wind:	6
2. Heavy Rain:	6
3. Snow & Ice:	6

The Limitations of Modern Transportation

Overview

Our modern modes of transportation have limitations they all share.

This document explores these limitations and does a comparison with Lighter-than-Air technology to see if it possesses any advantages.

Modern Transportation Modes

4 modes of transportation:

- Road
- Rail
- Maritime
- Air

Weather Conditions Affecting Travel

There are generally 3 weather conditions that adversely affect the 4 transportation modes:

- High wind
- Heavy rain
- Snow and ice

High Wind

1. Road:

High wind conditions will cause an increase in drag for any transportation mode, which results in higher fuel consumption.

For large trucks, even moderate winds of 35 to 40 mph can be especially dangerous as they can cause the vehicle to roll over.

Small cars, vans and motor homes can lose control and be blown off the road.

2. Rail:

Trains aren't susceptible to roll overs unless they are caught in gale force winds – 55 mph or higher.

The Limitations of Modern Transportation

But high winds do increase drag thus increasing fuel consumption and, in some cases, can keep a train from making a grade.

In this case, not only is more fuel consumed, but more time as the train must be divided into section and each section must be towed separately up the grade and then reconnected with the rest of the train. This process requires a lot of walking by the crew.

3. Maritime:

We've all seen the videos of ships at sea fighting the wind and giant waves.

Not only is drag from wind resistance increased dramatically as ships aren't designed to be aerodynamic, but also from water resistance.

Additionally, the vessel is no longer traveling on a flat plane, but must traverse large waves thus increasing the overall distance its required to travel to get from point A to point B.

4. Air:

Wind can be a major problem for air travel.

Like the other forms, it also suffers from the increase in drag and fuel consumption.

Additionally, a strong crosswind requires the aircraft to change direction, settling for a compromise between the direction in which it wants to travel and the direction of the cross wind.

- No longer pointed toward its destination, the aircraft now assumes an attitude that causes it to be at an angle to its desired path.
- This effectively decreases the aircraft's efficiency as its thrust is pointed in a different direction from its desired flight path resulting in greater fuel consumption.

Additionally, winds over 40 mph prohibit aircraft from making safe takeoffs or landings and usually result in the airport being temporarily closed to all flights.

- A significant crosswind at an airport can cause the aircraft to miss a runway entirely.
- Additionally, a strong headwind that suddenly ceases during landing can cause an aircraft to lose a significant amount of lift. This could result in a "hard landing" which can damage critical structural components.

Note: wind speeds between 40 and 70 mph are considered tropical storm velocity.

The Limitations of Modern Transportation

Heavy Rain

1. Road:

Besides causing visibility issues which can slow traffic or bring it to a complete halt, it can also cause traction problems resulting in increased fuel consumption.

2. Rail:

Wet rails significantly affect traction causing a locomotive to lose towing capacity especially on hills and curves.

Often when this occurs, the train comes to a complete halt and must be divided into sections in order to traverse the grade.

Each section must be towed to a special section of track on flat ground where the different sections can be reconnected.

This process dramatically increases time and fuel costs.

3. Maritime:

Fortunately for ocean going vessels, they are built for the water, so they can continue their journey without much effect from the rain.

4. Air:

For an aircraft, heavy rain can cause a slight increase in weight and also additional drag resulting in greater fuel consumption.

Additionally, it diminishes visibility which can cause issues with takeoffs and landings.

In this case, if the rain too intense, the flight will have to be delayed until the weather clears.

Snow & Ice

1. Road:

We are all familiar with the effects of snow and ice on a roadway.

It doesn't take much to bring the traffic to a halt.

Obviously, these conditions increase time and fuel consumption.

2. Rail:

The Limitations of Modern Transportation

Snow and ice affect rail in the same manner as road traffic.

Loss of traction on the rails can cause increased time and fuel costs.

Additionally, as with wet rails, the locomotive may lose its ability to tow a train up a grade.

Often when this occurs, the train comes to a complete halt and must be divided into sections in order to traverse the grade.

Each section must be towed to a special section of track on flat ground where the different sections can be reconnected.

This process dramatically increases time and fuel costs.

There's also the weight increase due to the snow and ice buildup on the train.

This can become significant as the train travels through an area affected by inclement weather.

Loss of traction and increased weight work in tandem to significantly decrease a train's efficiency.

3. Maritime:

Heavy snow and ice can change an ocean-going vessel's center of gravity resulting in stability issues.

Otherwise, it has little effect on the open ocean.

4. Air:

We're all familiar with the effects of snow and ice on today's air travel.

Blocked taxi and runways must be cleared, and ice buildup on aircraft must be removed before flight, as it can significantly increase weight and decrease an aircraft's lift.

In extreme situations, the airport could be closed as ground equipment struggle to keep up with the accumulation of snow and ice.

Most modern aircraft have built in anti-icing systems designed to remove any ice accumulated during flight.

The Limitations of Modern Transportation

Lighter-than-Air Technology

Now we'll explore the effects of severe weather on LTA, and reveal its advantages in comparison to the other 4 modes of transportation.

One of LTA's major advantages is that it doesn't require fuel to fly, unlike all other aircraft which depend on fuel consumption to generate lift,

Limited fuel capacity equals limited flight time.

With LTA, you can stay airborne as long as you like.

Additionally, today's weather tracking services allow LTA to avoid inclement weather altogether, because it isn't trapped within the confines of a ground-based infrastructure like road and rail transportation.

1. Heavy Wind:

Because an airship's cruise speed is approximately 75 mph, high winds aren't generally a problem.

Even in mooring situations where a strong wind is present, the airship can be pointed into the wind on approach to the mooring tower and safely moored.

LTA uses the same procedure for handling crosswinds as other aircraft, except limited fuel capacity and therefore limited range aren't as critical a problem.

2. Heavy Rain:

Heavy downpours only affect the weight of the airship, which can be offset by temporarily increasing buoyancy.

Because LTA isn't confined to a fixed path and the Earth's atmosphere is free of obstructions, visibility isn't an issue either. Modern instrumentation can guide the way.

3. Snow & Ice:

Like other aircraft, snow and ice buildup can present a problem, but an airship does not depend on lift to fly.

Therefore, ice buildup isn't as critical as it only adds weight, which can be countered by increasing buoyancy.

Additionally, ice buildup on the top of an airship is kept at a minimum during flight by the movement of the airship's cover. It functions like a natural de-icing system.

The Limitations of Modern Transportation

During WWI, the Germans often flew their airships at high altitudes in all types of weather during recon and bombing missions over Europe.

They had no weather prediction system except what they observed in the sky and the occasional weather report from ground-based weather stations.

Lastly, because LTA does not require runways or taxi ways, its ground infrastructure has a much smaller footprint and is much easier to maintain during severe weather.