

# Real World Solutions for Smart Cities Transportation to be Pandemic Ready

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**Abstract-** The COVID-19 is the current widespread health disaster. It has speedily spread all over the world causing a massive impact on the health, environmental, social and economic condition of the total world's population. Enormous actions undertaken worldwide to minimize the expansion of this deadly contagion by testing at a large scale, quarantining the suspected people, upholding lockdowns and restricting social gatherings. The transportation sector has been one amid the leading sufferers of Coronavirus. Airlines, railways, and the public transport sector are badly hit due to this coronavirus outbreak. In this paper, we studied the effect of Coronavirus on the various transport sectors all over the world, taking into consideration the worldwide scenario and India's condition as well. Further, this paper analyses the possible ways and measures regarding how the transport services are dealing with this pandemic.

**Keywords—**COVID-19; Transportation; Impact; Solutions; Technology; Pandemic; aviation; railways

## I. INTRODUCTION

Pandemics are diseases that flee on a worldwide scale and have created a drastic impact on civilization. Some pandemics that have occurred throughout history are shown in Fig.1 [1].

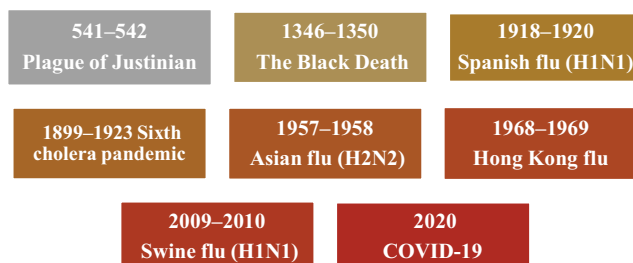


Fig. 1. Pandemics worldwide [1]

The coronavirus outbreak is sternly disrupting the worldwide economy [2]. Transportation sector has been one amid the leading sufferers of Coronavirus. All the transportation facilities have come to halt as a result of the restrictions taken place worldwide. The road conveyance sector has been

hardly affected by the effect of this current pandemic. This includes passenger transportation as well as freight transport sector. Transport of products remains badly hit as there is much confusion between many stakeholders and policymakers. The pandemic has economically impacted everyone from ride hailing cabs to railways and airlines sectors as well. Due to the COVID-19 crisis, the conveyance manufacturing business of autos, airplanes, cars are suffering from very fewer sales [3].

Thus, it's time to take some suitable measures to create smart city transportation pandemic ready. Solutions are required to be found across transport modes and economic sectors. This can be done by making diverse use of our existing spaces, applying sanitation and transitioning in the direction of more scope for pedestrians. As travelling using public vehicles is not safe during pandemic, thus for pandemic resilient cities there is a need to encourage bicycling or walking by providing short paths and other ways to avoid public transport. These are all going to be key structures for a pandemic ready city.

## II. IMPACT OF COVID-19 ON TRANSPORT SECTOR

The Coronavirus effect to our conveyance sector allows it to be called as a terrible situation. The transportation manufacturing trade of vehicles like cabs, buses, airplanes, trucks are undergoing reduced unit sales due to the current pandemic [6].

Conveyance has suffered massive revenue losses due to this pandemic. The abandonment of transport facilities, comprises of local buses, cabs, and railways has made conveyance most affected. The Coronavirus outbreak has badly hit the businesses of ride sharing companies leading to expansion of threats and economic burden for the freelance job workers, especially the drivers. Passenger transit facilities are at a bigger risk as there are no ways to spot ill peoples while traveling, also there is a large number of individuals in a limited space thus social distancing is at high risk [7].

Air transport has also been severely affected. Large number of airlines have stranded mostly all their fleet or else they are arranging commercial planes as freighters.

### III. GLOBAL EFFECTS OF COVID ON AVIATION

Aviation forms a major part of the transportation network all over the world. Thus, it plays a significant role for global business. Aviation sector generates economic development, creates jobs, and encourages international tourism [8]. The overall impact of COVID-19 globally on aviation sector can be seen in the Fig.2.

#### A. Impact on Europe's aviation sector

The European airline sector has been badly hit due to this pandemic. Majority of the airlines approximately will lose 50% of their revenue and travellers in comparison to last year due to this pandemic. This is due to the confinement which led to the grounding of planes in a short period of time. This situation is possibly going to worsen if the ECU Commission makes social distancing onboard necessary. Due to this only two-thirds of the aircraft would be filled. Due to less load factor, no airline would be able to gain profit. Another issue that can lead to the economic failure of airlines is the ban of international flights [9].

A huge drop is seen in traffic in major airlines due to the coronavirus lockdown and ban of flights as shown in Fig.3. Ryanair, Europe's No. 1 airlines on the basis of passengers has experienced a huge sink in its traffic from 10.9 million to 5.7 million passengers in a one-year period from March 2019. This resulted in a decrease of 48%. As concerns to EasyJet cares, the autumn is of an equivalent magnitude (-49.5%, from 7.7 to 3.9 million). Almost 5.9 - 8 million drop of passengers in Turkish Airlines, 4.35 - 1.8 million in Air France and 2.96 to 1.15 million in Norwegian Air [9].

Most optimistic path indicated with a ▽;

Most pessimistic path indicated with a ▽;

'#' represents 'Seats offered (capacity)'; '&' represents 'Passenger flown'; '\$' represents 'Airline revenue loss';

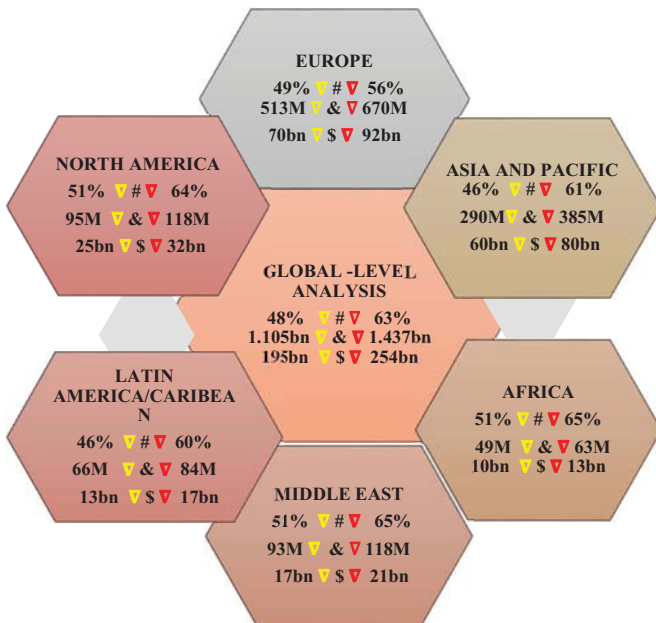


Fig. 2-. Global-level Analysis of Impacts on International Traffic[8]

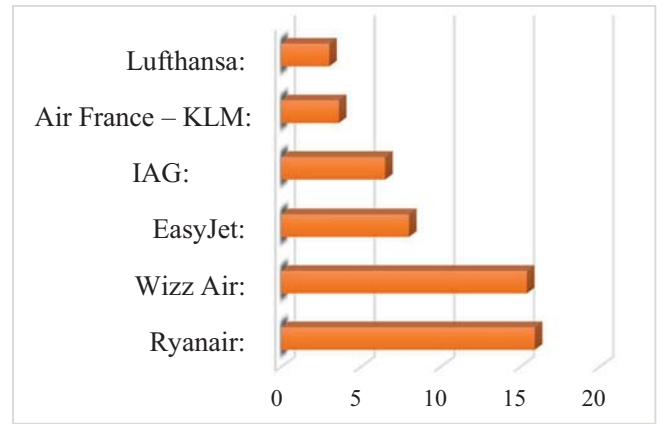


Fig. 3-Airlines in COVID times: Cash available(in months)[9]

#### B. Impact on China's aviation sector

The current coronavirus pandemic features a serious impact on the stocks of the consistent public corporations and the market-implied probabilities of the credit.

All of the 8 airlines of China have shown an increment in the PD that is implied by market. The comparative PD movements industry aren't factually unpredictable once we relate them to a 3-year time frame and probably return to the long-term PD level. The model representing "Market Signal Probability of Default (PD) exhibits information about market implied credit risk profiles" [10].

For those having credit rating higher than 'bb' shows a market indices PD of 3.7. On the other hand, for those mean is 4.48% are scored under 'bb'. So evidently it shows that essential quality of credit is useful for large firms to protect over strange emergency incidents like current pandemic. "The entire sectors typical market indices PD is 4.076% in 2020 related to 3.06% in 2019. Mathematically, it is nearly a 33% rise, so it is undeniably a shudder in the background of old data" [10].

Table 1 Credit Model Score and Market Signal PD for Chinese Airlines [10]

Company Name	CM Score	Market Signal Mean-2019	Market Signal Std-2019	Market Signal Mean-2020	Market Signal Std-2020
Air China	bbb+	2.269%	1.082%	3.335%	2.731%
Spring Airlines	bb+	2.203%	1.083%	2.636%	2.232%
China Eastern Airlines	bb+	4.155%	3.114%	3.946%	2.542%
China Southern Airlines	bb+	1.868%	0.711%	4.903%	2.610%
Juneyao Airlines	bb-	3.691%	1.396%	6.189%	4.112%
Shandong Airlines	bb	2.636%	1.502%	4.772%	3.231%
China Express Airlines	b	5.629%	1.708%	3.016%	1.486%
Hainan Airlines	b	2.031%	0.736%	3.815%	2.371%
Average		3.060%		4.076%	

#### IV. GLOBAL EFFECTS OF COVID ON RAILWAYS

##### A. Impact on European Railways

Europe has adopted different new steps to reduce the impact of coronavirus pandemic. As most of the working peoples are assigned to work remotely both travelling and production services has come to halt. It is a very difficult situation for all transport sector stakeholders as well as for the ECU rail supply industry. Rail suppliers particularly small and medium enterprises (SMEs) that are dealing with reduced production and disturbed cross-border supply chains would definitely need assistance from EU organizations in this coronavirus outbreak to withstand the unexpected trouble and continue to be competitory at its completion. SCI Verkehr estimates that decline in passenger traffic would be approximately 40% and nearly 20% in freight transport across continental Europe. The study also proposes that businesses wouldn't improve to former levels till 2024 [11]. The advisors predict that "the loss of earnings for operatives would possibly be partly indemnify by authorities. Whereas cargo services that are not much damaged at the beginning as they came underneath essential services might also come struggling due to extensive less margins." [12]. The consequences of the declinations would result in large deduction within the funds accessible for finance, that consecutively would have a harmful influence on vehicle procurement volumes [12].

##### B. Impact on China's Railways

As per the numbers from China State Railway Group Co., Ltd, "The railways operated by states of China supported in totality of 1.09 billion tonnes of freight from January to April phase, up 2.4 % annually" [13]. In April, the freight volume has risen from 0.2% to attain 267 million tonnes, with 146,000 vehicles loading each day, preserving a high operational position as of March. The regular average shipment has grown by 0.6 percent on yearly basis in the month of April. This development is a great symbol of regaining losses. [13].

#### V. GLOBAL EFFECTS OF COVID ON ROAD TRANSPORT

Public transport systems are considered as the major carrier of COVID as there are no means to spot possibly sick people while traveling, social distancing is also less followed due to small spaces. San Francisco's BART revealed that they're undergoing an instantaneous decrease of transportation and parking earnings of \$37M per month. They also said that the decline is forecast to get more worse and because of the lockdown it could range \$44M per month.

France: Supported data released by transit; France has seen a major decline in the use of public transport. This comprised of a 92 percent reduction in Lyon and an 85 percent reduction in Nice. United Kingdom: Since the lockdown is implemented, A drop is seen in transport services that include bus, airlines and railway services in the United Kingdom. The usage of public transport has declined by approximately 90% in London [14].

They are predicting an abrupt reduction in global heavy-duty truck sales because COVID-19 pandemic has resulted in a worldwide collapse. As per their predictions, "the global sales of trade quality trucks will drop by 20 percent to 30 percent in the year 2020, to about 1.7 million units to 2.3 million in 2019, with a sales recapture of 10% in 2021". Due to this crisis, there is an anticipation that the truck manufacturers and suppliers

globally will be badly hit on their trading profit and capital flows, that can check the margin of safety in their credit figures and cash flow management [15].

As per estimates, "U.S. light-vehicle sales are expected to drop by 25% yearly to 12.7 million units in 2020 before convalescing to 15.1 million units in 2021" [15].

Speculative-grade auto providers, particularly ones who are rated within the low BB/B classification, characteristically have less margin of safety in their finance flows than their investment-level opponents.

Most of the auto issuers of U.S about one-fifth are ranked 'CCC+' or lesser than this. It means a large probability of default [15].

#### VI. INDIAN SCENARIO

##### A. Aviation sector

Due to this coronavirus outbreak which has reduced the use of transport services all over the world is forecast to have a huge loss on infrastructure industries in the transport sector.

According to Crisil Infrastructure Advisory "the Air transport sector will fall this monetary with a Rs 24,000-25,000 crore income loss. Airline companies are highly affected causing 70% of the losses together with Rs 5,000-5,500 crore loss because of airport operators and Rs 1,700-1,800 crore due to airport retailers." [16].

After the lockdown restrictions are lifted, the Indian aviation industry is going through nearly ₹75 – ₹90 crore loss every day, as evaluated by ICRA, that is a banking and credit rating agency.

The main difficulties that the aviation sector is facing is may be a massive drop in cash reserves as fleets persist stranded due to lockdown restrictions. Amid the coronavirus lockdown a lot of airlines in India are on the verge of economic failure due to running out of their cash reserves. Consistent with International Air Transport Association, because of this pandemic crisis airlines can lose up to \$113 billion in passenger revenues globally [16].

##### B. Railway sector

The lockdown has caused Indian Railways to stop its passenger operations across the country.

As a consequence, Western Railway zone had to suffer from a financial loss of ₹716.59 crores.

It has compensated a sum of ₹237.64 crores. Mumbai division alone has refunded a sum of ₹114.85 crores [17]. The Railway sector looks forward to get Rs 61,000 crore from passenger transportation in the year 2020-21, which is a growth of 9% over the earlier evaluations of 2019-20 (Rs 56,000 crore) [18]. The railway administration confirmed that till February 2020, fare revenues were nearly Rs 48,801 crore. This amount is almost Rs 7,199 crore less than the 2019-20 reviewed evaluations for revenue. This implies that this much total is needed to be produced in March 2020 to satisfy the new estimated objective (13 percent of the year's objective). Thus, railway sector will face difficulty in reaching its objective for fare revenue in 2019-20 [18].

##### C. Freight transport:

The Railways sector intends to earn Rs 1,47,000 crore from cargo traffic in the year 2020-2021, a rise of 9 percent over the computed approximations of the year 2019-20 (Rs 1,34,733 crore). As per Railways administration, till February 2020, cargo income was Rs 1,08,658 crore [18].

The revised predictions for cargo income suggest that "Rs 26,075 crore will required to be earned by freight trade in March 2020 to reach the reviewed evaluation mark i.e. 19



percent of the year's objective" [18]. The government has fully stopped the passenger traffic but the freight traffic is still allowed as essential goods. It provides around 8% of Railways' freight income.

#### D. Road transport

Regardless of various steps taken to control the situation, the Transport of products remains badly hit as misunderstanding remains between various stakeholders, and road transport unfortunately becomes the victim of the disconnect among the policymakers and native authorities.

The truck operators are already working at lower capacity because of financial strike due to coronavirus lockdown [19]. As per SP Singh who is a senior Fellow in Indian Foundation of Transport Research and Training (IFTRT) "Due to lockdown goods requirement has been reduced. This has a negative impact on revenue generation opportunity of the fleet operators. The capacity of freight loading from 6,000 lakh metric tonnes has decline to 1,000 metric tonnes. Even though the govt has ignored the toll tax, the increment in the cost of diesel is firing the operational costs. Markedly, the cost of fuels is held responsible for 60% of the entire expenditure of road transport" [20].

Fleet utilization was struggling because of low freight demand due to restraint in the financial process and reviewed axle norm that have enhanced freight loading capacity of trucks by around 20 percent [20].

### VII. STEPS TAKEN IN GENERAL BY TRANSPORTATION SERVICE PROVIDERS TO STOP THE SPREAD OF CORONAVIRUS

#### A. Ride hailing services/Cab

Some of the measures that are helpful in reducing the spread of COVID-19 are:

- Restraining passengers in a cab to 2.
- Proper Sanitization and protective equipment's like PPE and gloves for drivers and travellers.
- Rides are permitted only for the passengers going for essential services [21].
- Actively encourage sick employees to do not come to work until they are fully healthy.
- To get workers fully informed about COVID-19, its symptoms, and its mode of spreading.
- Developing new regulations and technologies that prioritize contactless transactions that eliminate close contact at a great extent.

Actions Taken by Ride-Hailing Firms On COVID-19 are:

- Uber has imposed some concession on Airport Rides.
- Uber And Lyft have suspended car-pooling and shared rides services due to COVID-19.
- UberEats and DoorDash have abandoned agency commissions for eating places partners.
- Uber has advised about the impact of coronavirus and measures to handle it.
- Generate Revenue Through Products

On demand script works among users, service providers and admin. The workflows as users demand for a taxi booking or any other services. The user orders the product and the service provider accepts/decline the order and the admin then earns fees by connecting and affording services [22].

#### B. Bus services

To Lessen the spread of coronavirus infection and to make buses pandemic resilient, ITDP India Programme has prepared guiding principles for local bus company providers in India giving them commendations to make buses safe for the public such as:

- Boarding should be through rear doors
- Maneuver at lesser capacity (30-50%) and labelling seats as inaccessible to scale back the number of travellers.
- Sanitization of buses and all its nearby areas including bus depots and staff areas
- Safety gear should be given to both the travelers as well as staff members.
- Buses to operate according to the demand, and can be accessible only to maneuver vital workforce and supplies.
- All documentation should be accepted digitally and only digital transactions should be done.
- Separation at bus terminals to take care of a suitable distance between rider and busman
- Fitted plexiglass barriers on-board all buses as extra layer of shield for customers and operatives at the farebox.

#### C. Metro services (Rail Based Transit).

Metro staff is taking the required actions needed to stop the blowout of the coronavirus. Some of the steps are:

- Proper Sanitization of train compartments, railway station region and staff rooms.
- Providing essential items like PPE kits, masks, and sanitizers
- Permitting transport services for crucial staff and healthcare supplies only.
- Using train compartments for quarantining the suspected coronavirus patients.
- Decreasing the number of passengers travelling in a coach to ensure social distancing.
- No cash transactions are permissible, only online ticket purchasing is allowed [21].
- Using electrostatic sprayer which eases surface adhesion of the sanitizer.
- Providing hand sanitizing stations altogether garages and offices to be used by operators and maintenance employees and administrative employees, alongside gloves and masks.
- Suspending all non-essential travel, conducting all meetings via teleconference and shutting the executive offices' lobby to walk-in customers [23].

### VIII. NEW TECHNOLOGIES DEVELOPED GLOBALLY TO MAKE THE TRANSPORTATION SECTOR PANDEMIC READY

#### A. Singapore: World's first self-driving taxis ready to carry a passenger

A self-governing vehicle software startup, nuTonomy has started operating taxis in which nominated peoples will easily take free rides using their cell phones.

- The aforementioned taxis work is constrained to some certain places for now.
- The aforementioned taxis— modified Renault Zoe and Mitsubishi i-MiEV electrics have a driver who is ahead to handle the steering wheel and researcher in back who

monitor the car's computers. All cars are occupied with 6 sets of a recognition system that utilizes lasers known as Lidar. Two cameras are also installed to look for hurdles and sense fluctuations in traffic lights [24].

#### B. Efleet introduces safety layers in partner autos

In this coronavirus pandemic Efleet which is a ride-hailing mobile application in Jammu is trying to provide safe and hygienic transportation facilities to the customers. They are following necessary precautions like sanitizing regularly and the drivers have access to equipments like gloves, masks etc [25].

According to Prikshit Gupta, Director and Founder of Efleet "The auto rickshaws have screens between that the driver traveler cabins, sanitization process is done every day in the morning, temperature of the partner drivers is checked before the ride and other essential things like sanitizers, disinfectant spray, masks, gloves and dustbins for disposal are provided to the passengers. After all the precautions the autos are certified for the ride and a sticker is pasted for identification"[25].

#### C. Wrightbus has broadcasted strategies for 3,000 hydrogen buses

Wrightbus is aiming to launch hydrogen buses to the united kingdom. According to them "the use of hydrogen buses will cause a 'knock-on transformation' of different automobiles like trucks, ships, ambulances and police cars and also would lead to a lot of new jobs in the country".

Globally a massive drop is seen in the pollution level but this all is temporary as this will rise again once the former levels of transportation activity will resume. Hydrogen powered buses can cause enormous alteration to air quality.

Arcola Energy and Optare Group had also declared the inauguration of a hydrogen double-decker bus. These firms expect that these modern buses will help in enhancing city air quality in post pandemic world [26].

#### D. Arrival launches bus to conquer safety travel post pandemic

A zero-emissions bus has been introduced to conquer viable conveyance post pandemic. To ease social distancing the bus is occupied with removable seats and a zero-touch bell.

The Arrival Bus options a broad ceiling and massive windowpane to enhance natural light levels. For the data about the seats accessible and route of the bus, screens are available inside and outside of the bus.

Travelers can access through this information remotely and can also book a ride through their phones.

The framework and bodywork area unit made up of light-weight elements which do not need costly tooling which permit it to sell the bus at a standardized value [27].

#### E. Metro Manila- integrated bus terminals

The formation of central regional bus stops outside, however inside the propinquity, of metro Manila to carry customers inside and outside of the town is amongst the important plan of the governing authorities, which has become beneficial in the post-pandemic scenario.

The fitting of central entry points to Metro Manila might deliver the specified conveyance controls which will consequence in declining the unfold of contaminations to different places.

Central terminals would be the automated and prepared management points wherever travelers and products will be supervised. Central stations would deliver the whole place for correct contamination, screening and medical care of commuters and payload.

Fitting central bus stops would make it more convenient to ensure an efficient means of doing contact tracing [28].

## IX. CONCLUSION

Transport services are badly affected and are in a very huge loss everywhere around the world due to the COVID-19 pandemic. This would report impact on the aviation sector, railways and road transport, all are suffering from massive loss all over the globe as discussed in the paper. It's time we should learn lessons from this disease outbreak, to enhance our quality choices, and promote innovation by means of the latest safe and effective designs and experiments.

We need to hasten the implementation of the new infrastructure and technology for remote cities to make them pandemic ready. There is a need to examine the available challenges, research on pandemic preparedness and responses in the public transportation system, and then to work on the measures for keeping transport system running, along with observing the necessary precautions that are crucial for defeating the pandemic, both now and for the future [6]. Along with this, awareness towards spread of virus is required to be raised in the public so that they can reduce transmission themselves. In this coronavirus pandemic it is very much essential to generate good communication with the passengers and to keep them fully aware. Authorities have a requirement of care to share all potentially valuable information and news, also as standards of conduct to scale back any risk related to travel. Appropriate control measures should be taken to ensure safety of passengers. In the meantime, other transportation projects within the pipeline, like metro or light rail, and also accelerating transit projects can be done. Further, the future research directions are as follows:

- Design of low-cost pandemic friendly cab. This will ensure the safety of the passengers and would minimize the travel expenses.
- Strategy to deal with economic losses of transport sector.
- Making aviation sector pandemic ready.
- Design of pandemic friendly bus services to ensure intercity safe travelling.

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