

**ANALYSIS OF COASTAL ROAD PROJECT: - THE MYTHS OF MANGROVES-
DELIBERATION ON PROS AND CONS**

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Abstract:

This Research paper is an attempt to deliberate upon Investment in Public Project, which is being termed as opposing to the principle of sustainability as it involves certain degree of Environmental harm. There is a general view that Infrastructure is being developed, by degrading and harming the Natural Environmental barriers. One such Eco-beneficial element of marine biodiversity is Mangroves. Recently, Mumbai Coastal Road has been awarded clearance for implementation by Cutting/ Replacing/ Replanting 45000 Mangroves. Thus, the author has tried to deliberate upon all the Pros and Cons involved in the Project. It is observed that, present level of congestions is having detrimental effect on Human Health, prolonging Trip time multi-fold times, drastically increasing fuel consumption and ultimately leading to Environmental damage through unwanted Pollution and release of Green House gases. While, the topic may seem as an Environmental degradation, but is basically an issue of Financial Investment in Sustainable Project. After, study it is established that Congestion of Traffic is bigger problem than cutting of Mangroves. It may ultimately lead to destruction of mangroves if not challenged at this stage. Congestion is leading to huge Financial losses due to Excessive expenditure on fuel for same distance travelled, Losses due inefficient delivery of manpower and goods which are direct consequences, while surge in Indirect cost spent on Health issues both Physical and Mental, Expenditure for recoupment of Environmental damage, Losses of Eco-services, Losses due to higher Carbon Footprint and GHG which all need to be expressed in financial terms.

Keywords: Coastal Road, Congestion, Environmental Degradation, Mangrove loss, Financial & Environmental Justification

Introduction:

Coastal roads can be termed as those connectivity's which help connect various land masses through road connectivity which runs parallel to coastline. These have been instrumental in providing huge relief to traffic congestion. There is limited and regulated access to such coastal road with seamless connectivity that is devoid of local traffic ingress thus enhancing the speed and enhancing traffic sense in Commuters. Planners and Transportation Engineers often view it as solution to relieve urban areas from heavy Traffic Congestions and for ease of Land Acquisition. Such Roads are also devoid of Commuters plying on streets eliminating chances of accidents and enhancing speed. However, they run along Coastal line which is highly Marine Eco-Sensitive Zone, which is regulated by stringent Environmental norms and face challenge of exerting minimal damage for its implementation. There is always a Public outcry demeaning the Government and the Public institution which plans its implementation, which may be evident even after approvals with proper justification

and imperative restoration of its detrimental effect on environment in line with Legislations and approval of Government appointed Environmental Protection bodies.

The term Coastal Zone Management is widely used in all Governmental and Non-Governmental Projects in vicinity of Coastal area. It deals with protection environment at the point of convergence of Sea/Creek/Bay and land and the area adjacent to it including Wetlands, Intertidal zones, Mangroves forests, Salt Pans, Marshy lands, etc. The basic zones are identified first by identifying High Tide lines and Low Tide lines, the ingress of sea water into creeklets and the eco-system depended on it. For better clarity, the salinity of land is also checked. Some Sweet Water resources meet the sea and the limit of ingress of sea water in such creeks, streams etc also need to be identified accurately.

After various studies the appointed Government agencies delineate the CRZ lines and classify the various land zones. The activities in these are regulated and only permitted activities are allowed in each zones. Any project which needs to come up these zones need to approach State and Central Authorities for obtaining permissions for that project. Certain important projects having status of Public welfare are allowed to be carried out on certain terms and conditions. Also, Local villagers are permitted to carry out certain activities in these areas. Overall, we can conclude that the governmental agencies make an effort to protect these eco-sensitive zones by enacting laws and provisions and control degradation through their available machinery.

Mangroves form an integral part of Marine Eco-system, however when referred as Marine Eco-System; it may or may not consist of mangroves as some of them may be devoid of Mangrove. Mangroves may be categorised as Coastal, Island or Deltaic and flourish in intertidal zone ie between High tide and Low tide level. They are accommodative of saline environment and typically have pneumatophores (conical root outgrowth) which help them for root breathing. Their types ranging from Grass, ferns, Palms, Shrubs and trees. There variety of species which thrive in various locations based on geo-physical characters, (Climatic conditions, Tidal characteristic), Soil Types, Types nutrients available from Fresh Water ingress. In most of species the part of root-system is exposed to environment. They also have typical reproductive and dispersion system that assists them in propagation/spreading-out in new areas. They have huge biodiversity association with various aquatic, avian and terrestrial creatures which reproduce and use them as nursery ground to thrive and may also provide nesting areas for migratory birds, molluscs to crustaceans as well as other creatures. The best Eco-activity by them is replenishing the dissolved Oxygen levels with association of other creatures. Thus, it is observed that mangroves have huge environmental Impact and are important elements of Marine Ecosystem.

Objective of Research:

Last few days, a tornado of news has been impacting all media from Newspapers, Television channels, Social media criticising the permission granted for Mumbai Coastal Road Part II. Public from all walks of life are criticising the decision some through their known facts while others just out of the notion that Mangroves are critical and need to be protected. Some of the Comments to the post seem quite disheartening and apportion Governmental Agencies working

only for Elites and Property developer. The Author after going through all such News, was inquisitively prompted to enquire in to the topic which is basic foundation of the research. Having extensively and comprehensive studied and practically worked in both fields Mangroves and Coastal Road thought of diving further deep to analyse the Pros and Cons of execution of Coastal Road in Mangroves. This has resulted in framing of following research objectives: -

- Overall Study and find out status of damages to mangrove and it's eco-system due huge Infra-structure projects.
- To look into major reason of harm to Marine Eco-system
- Overall Societal Behaviour towards Marine Eco-System
- The Pros and Cons of implementation of Coastal Road
- To Enquire into Environmental, Social and Financial Implications of Implementation of such project.

The objectives have driven to study in detail and find out, if such a furore is necessary over implementation of Coastal roads.

Research Methodology:

The Basic methodology is literature review of various aspects involved in the topic of study with respect to the Coastal Roads Project by studying research conducted by various experts of those domains. Further, use the data available in public domain to look into present day scenario to support the cause of Ecological degradation in positive mode. Case study of Nerul-Belapur Kharghar Coastal Road Project through the available documents. Further, Case studies of Mangrove destruction are also reviewed.

Literature Review:

1. Status of Mangroves cover in India:

A brief literature review was done to find out the details of Mangroves, its environmental benefits, present status of mangrove cover. As elaborated in the introductory part Marine Eco-system forms an integral part of human life and provides various Eco-services to human being right from incubation of basic food chain elements, barrier of natural calamities, reduction of human pollutants as well as reduction of corrosive ill-effects through its natural in-built capacities. Three recent studies were referred to, for assessment of depletion of mangrove cover in and around Mumbai Metropolitan Region (MMR). While also a practical approach of how other factors are detrimental to mangroves.

- a) The first study conducted for Mumbai and its Suburbs state that there is ~3.91% reduction in mangrove cover in the region between 1994 to 2024 and attributes it to "land-use developments, infrastructure encroachments, and the weak enforcement of existing regulations". Their review blames the "limited regulatory coherence, institutional fragmentation, and low levels of community engagement" for this. And have suggested "uniform incorporation of Blue Green

Infrastructure (BGI) principles into Spatial Planning and Climate adaptation planning in Greater Mumbai.” The Core Principles of Blue-Green Infrastructure (BGI) principle includes Multiple, Simultaneous benefits (Flood Risk reduction, Biodiversity, Health), Working with Natural Processes and Enhancing Urban Connectivity.

- b) The Second Study, is more comprehensive and covers coastal region of most of the MMR region. The study conducted to assess the Mangrove cover through-out the MMR region using Land Use Land Cover Mapping (LULC) shows that from 1990 to 2017, the Mangrove area increased from 79.14 km² to 154.4 km² and expanded towards landward and seaward regions which include Dense, Moderately Dense and Open Mangroves (This classification depends upon number of mangroves in km²), Thus, Mangrove area has increased by 75.36 km², while the Built-Up area in the same period increased from 436.55 km² to 582.11 km² which is 145.56 km² ie twice the Mangrove cover. However, from 2010 to 2017 there was a increase of 9.68 km² and 41.73 km² in mangrove area and built-up area respectively which constitutes that Built-up increase was more than four times that of Mangrove. It was observed that growth of mangrove area was majorly seawards except for Karanja, which also resulted in reduction of creek widths. The major degradation of Mangrove was attributed to expansion of Built-up area between 2010 to 2017. However intermittent fluctuation is observed in the mangrove area due to climatic conditions and Anthropogenic activities (Basically Human activities such as Construction Activities, Conversion of Agricultural lands, Fish farming, Industrial Effluents). It is observed that a specific species A. Marina is dominating other mangrove species due ability to survive in High Salinity and Pollutants such as Lead, Mercury and Chromium, thus it becomes evident that there is surge in polluting activities of human beings on landward side and supporting the reason that new growth is towards sea due to limitation of landward side. The result of study also concur that existence of prominent mud flats indicate that dense mangrove vegetation reduces the erosion and mangrove considerable reduce magnitude of tidal currents from 20% to 100%. The study establishes that mangroves growth is at saturation stage landward while growth towards the creek would result in reduction of creek width. The study cautions that Tidal inundation (Ingress of Tidal waters in coastal area due to storm surges or rising sea level) may pose a threat to humans residing in coastal region, which is huge cause of concern.
- c) A Third study is about Impact of Anthropogenic activities on Mangrove Forest health in Urban area, which establishes the facts that pollutants from human activities such as Industrial activities, Pollution from Micro-Industries negatively impact remaining Mangrove Forest killing their roots and leaves. Obstruction of Sea water ingress due to human activities prevents nutrients from reaching the mangroves and altered water courses may result in soil toxicity

resulting in destruction of Mangroves. However, Pollution due to congestion will lead release of Sulphur and Nitrogen which results into Acid rains which burns and kills mangroves. The runoffs which take along with it rubber, heavy metals (Copper, Lead, Cadmium) from the road and get deposited in Wetland will limit Oxygen supply to its roots causing its death, The Soot from exhaust pipes of the Vehicles settle on leaves forming a coat and limiting Photosynthesis leading to stunt growth or death. This brings out an evident point that Congestion is superior enemy of Mangroves than that of physical cutting of Mangroves, if congestion is not controlled will ultimately kill the Marine Eco-system itself rather than only the Mangroves.

- d) The Practical approach would be a timeline study each pocket of Mangrove, it would be observed that in most of the cases, it is the urbanisation that has harmed the Mangrove and maximum violation is seen in unauthorised activities which can be attributed to sprawling of Slums which penetrate in to the mangrove with the progress of time. A very simple way to identify this is study of google images (Two Case studies are elaborated using google image in this Research Paper)

2. Effects of Vehicular Congestion

Few aspects which tend to justify the Coastal Road Project were also studied to understand their justification of Government agencies for taking up the project. One of main issue is congestion, which has various aspects entangled in it. To start with we first analyse the Vehicular Fuel Consumption. Two recent studies were referred to, for assessment of depletion of mangrove cover in and around Mumbai Metropolitan Region (MMR).

a) Fuel Consumption of vehicle

A study on environmental effects of driving behaviour and congestion related to passenger cars was conducted, which brought out the fact that for Fuel consumption increases 20 to 45% for driving in city with intense traffic, it was concluded that on an average 5 Litres of Surplus fuel is spent for 100 kms of such condition. It states that during rush hours increase in

Fuel consumption and emission may surge from 10 % to 200 %. This is deterrent to Macro-Economics of National due to additional burden of Import.

b) Additional Time due to congestion

A specific study done for evaluation of MMR region considering 4 different Roads of Mumbai with 4 different types of Vehicle depicted that Time taken during Peak hours and Non-Peak hours was 51% higher. Yet, it is pertinent to mention here that Travel time during Non-Peak was also high (ie 20 minutes for three-wheeler while 25 minutes for Bus for a distance of 7.8 kms- This itself is very high. It would be only 9 minutes 22 secs at average speed of 50 kms/hour). Thus, Nation as a whole is incurring much more to import Fuel due to congestion issue.

c) Effect of Non-Seamless Connectivity

With the Data stated above, it is pertinent to mention here that Travel time during non-peak was also high (ie 20 minutes for three-wheeler while 25 minutes for Bus for a distance of 7.8 kms- This itself is very high. It would be only 9 minutes 22 secs at average speed of 50 kms/hour). This due to the fact that there are crossings/Intersections of road which serve Cross- traffic and people crossing the road. This delay may also be attributed street vending/ hawking activities or parking of vehicle along the road which may serve passengers or small business entities located on the road.

d) Rise in Emissions due to congestion

There are various studies for this aspect, which consider driving patterns/habits, Vintage/Fuel Type/ Maintenance of Vehicle, Road conditions, Stop and go Patterns.

One of the studies, about emission states that Transport sector contributes to 23% of the CO₂ Emissions of which 3/4th is attributable to Road transport and pegs increase in emissions at 40% due to congestion when an average speed is considered at 45 Km/hrs, while another study states that traffic congestion enhances emissions up to 75% at roadway scales. However, these studies were foreign. While, the study referred at points b) & c) which is specifically for Mumbai, estimates that the CO₂ emission during excessive peak hours is ~ 53% more compared to Non-Peak Hours.

e) Surge of Health Issues

The Study on MMR region has highlighted the Health Issues with context to studies referred during this study. It states that congestion not only reduces the mobility but triggers the health issue due to increase emissions of Green Houses Gases such as Carbon Monoxide (CO), Carbon Di-oxide (CO₂), Volatile Carbon Compounds (VOC) or Hydrocarbons (HC), Nitrogen Oxide (NOX), Particulate Matter (PM). Thus, aggravating non-allergic respiratory morbidity, Cardiovascular morbidity, Cancer, Allergic issues, Adverse pregnancy and birth outcomes, and diminished male fertility observed in drivers, commuters and individuals.

f) Mental fatigue due to Congestion

The Congestion may have an acute effect on Cognitive Ability, Emotional Strain and reduced Performances in the Commuters especially the drivers. It may raise the risk of Accidents and even lead to arguments due to heavy strain and excessive detrimental driving conditions.

g) Environmental Hazards

The effects are both short and long duration due the congestion. The elevated pollution level will contribute to low air Quality and Smog which is shall have circular effect. Congestion will also elevate noise levels further causing additional

mental strain while the Greenhouse gases (GHG) emitted during such commutes would be higher make the situation worst.

h) Damages to Eco-Services

While the aspects damage to human being and apprehended environmental issues are very evident. The damage to overall Ecology is never understood in true sense. We analyse everything with human being as prime concern while the effects on other creatures and the ecology go unattended. In Mumbai all our Ecology has either drastically changed or dead, all the rivers discharging in the sea have been polluted to such an extent that revival of ecology is not only major challenge but in some cases beyond restoration.

3. Financial Auditing

Some Financial calculations are necessary with respect to Positive and Negative effects of the project. With reference to this specific project the following calculations are necessary: -

- a) Cost of Fuel wasted due to congestion
- b) Assignment of Monetary value to Time factor
- c) Cost incurred on deployment of Environment saving projects
- d) Cost incurred on Medical Inconvenience.
- e) Damages for the Mental fatigue.
- f) Losses incurred due to Environmental Degradation.
- g) Financial Cost of losses to Eco-System.

4. Environmental Justifications

Similar, to financial summary it is also necessary that an Environmental Audit is necessary. It shall involve: -

- a) Calculation of increase in Carbon Footprints exerted due to Congestions.
- b) Use of Environmental Resources for remediation of the effect caused by congestion.
- c) Losses incurred to Eco-system and its long-lasting effects are a major environmental cost.
- d) However, we have still not arrived at a point to envisage the losses pertaining to Physical and Mental fatigue caused to other living beings and the Ecology.

5. Skewed Perceptions

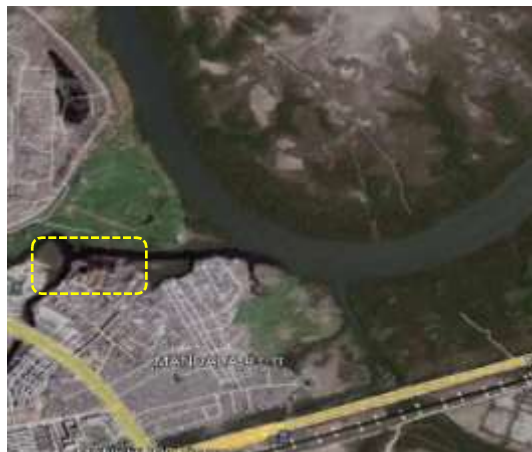
There has been long misapprehension that the Governmental institutes do not have good intent in implementing projects with a frill of contention that project implementation has always a hidden agenda of corruption. While, the issues of corruption cannot be directly related to Implementation of good intent. The issues need to be rightly studied and judged before making statements. In this Specific Case

number of checks and balances have been assessed by various Pillars of democracy, they involve Legislature checks, Checks during Implementation by Executive wing and with the Judiciary check for legal violations are also involved to anticipate and keep tab on any ill will. However, it is fourth Pillar which is required to make responsible statements and take project in a positive aspect as well as intervene if proper adherences are not followed. Further, social media has given incessant influence to people who make statements without in-depth knowledge of things.

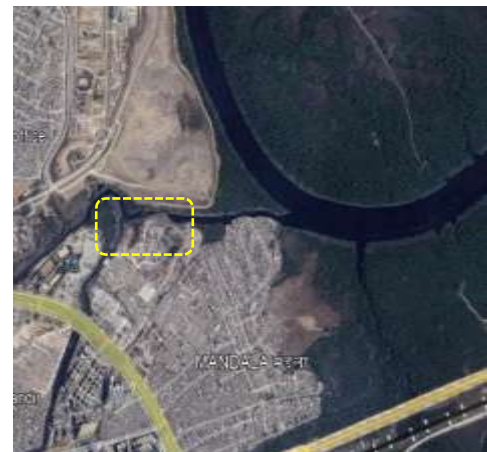
6. Case Studies of Mangrove Destruction

Efforts are taken by the State for Protection of Mangroves and Marine Eco- sensitive areas, yet large scale violations are rampant in Urban areas which go unnoticed, the depiction of same are these Case Studies which attribute mangrove destruction to Human interventions rather such projects: -

- i. Dumping of debris along the coast: This is a Major culprit in Urban areas especially in absence of proper system for disposal/treatment of C & D Waste. The Violators are small time transporters who flourish by charging exorbitant bills to generators of such C & D Waste. As, the legal damages in such cases are trivial, even if the culprits of violation are trapped, they do not bother as such minimal damages are already accounted by them in their exorbitant charges for carrying out such menace, they manage to pay or face action and get scout free. These violations are treated as petty and lack of proper documentations leads to acquittal and further leads to repeated violations as evidence are not easy to prove. The ultimate result is huge dumps over the eco-sensitive zone which spreads its wings in leaps and bounds.



Google Image 11/2009



Google Image 03/2025

The comparative study of google images from 2009 to 2025 for area in Mankhurd Mumbai shows how Mangrove Eco-system has been systematically destroyed. Mangroves have been systematically destroyed by dumping debris slowly at decadal growth rate. It is needs a through study how debris surges ahead in Mangrove areas.

- ii. Construction of Slums: This activity succeeds after disposal of debris on Mangroves and wetlands. Usually, the debris is dumped multiple times at such hours that apprehending the culprits is a task in itself. If such dumps are not eradicated by dedicated Government agencies, they provide a firm ground for erection of slums.



Such slums penetrate within the ecological sensitive area and finally these areas are lost to illegal human settlements. One such example is near Wadala Salt Pan in area of Bharatiya Kamala Nagar and Suman Nagar.

7. Facts observed through Literature Study and Case Studies

The above literature review and study lead to following facts: -

- a) There was surge in the Mangrove growth in last 3 decades, as present areas of Mangroves are twice than earlier, which is evident from the Literature Review and speaks the story of increase of mangrove in area in an around Mumbai, however in recent year this growth has reversed and with a reduction of 4%.
- b) The decay in the Mangrove Area is more due to Anthropogenic causes. This may be due urbanisation (upsurge of slums) towards mangrove area and exposure of harsh conditions from effluents on landward side.
- c) Congestion is a major problem of Mumbai which is attributing to Financial Losses, Time Losses, Environment degradation, Medical Issues. Congestion is creating impact on National Macro Economics.
- d) The laxity of human being towards their duty for Ecology preservation arising from non-judicious behaviour about use and disposal of Plastic, Solid Waste, Untreated Effluents from Human and Industrial activity is prominent cause mangrove decay.

8. Findings

The facts that have been concluded from the study: -

- a) Destruction of mangrove is an immense issue, but it is Majorly attributable to behaviour of human being towards Environment and a negligible credit goes to Infra-projects.

- b) Congestion is leading to huge pollution problem and there is dire need to deal with it, to avoid long term effects.
 - i. Congestion has Financial Implications
 - ii. Congestion depletes Human and Infrastructural efficiency
 - iii. Congestion is deterrent to Human health
 - iv. Congestion enhances Environment degradation and demands use of additional Environmental resources.
 - v. It is major issue to Ecology
- c) Congestion leads to depletion of National Financial Resources
 - i. Higher Fuel Consumption leads to more import of Fuel.
 - ii. Resources spent to streamline traffic due to congestion
 - iii. Higher maintenance of Vehicles and decay in Life Span of Vehicle
 - iv. Higher cost incurred on Medical Expenses.
- d) Congestion leads to Ecological Decay
 - i. Results in destruction and death of Ecological elements disturbing Ecological balance
 - ii. Results in Environment disasters such as Acid Rains.
 - iii. Stimulates occurrence of Intense Rains, Storms and Tornados.

9. Suggestions

In view of the Facts and Findings it always advisable to deal congestion as first priority as per author's view. Due to Time and Scope limitation, detailed Financial Calculations could not be conducted to assess harm caused to Mangroves due to its elimination for Coastal Road, along with compensatory cost for remedial measures for compensation to provide remedy for such Mangrove cutting, vis-a vis Financial evaluation to adjudge losses caused by Congestion due Environmental and Ecological damage, Fuel & Time saved due to the project, Physical and Mental trauma saved.

10. Conclusions

Even though certain conclusions are evident, yet the author would like to leave the paper open ended and allow others to make a judicious conclusion. The subject needs detailed calculations to reach at consensus over the topic. However, it is a caution that all projects cannot be treated on same terms and without detailed analysis making superficial judgements would again lead to the same chaos that is presently evident for Mumbai Coastal Road. However, it is felt that by perceiving the facts and findings the Degradation caused by Mangrove cutting when compared with Environmental Damage caused by Congestion itself seems to justify the Coastal Road Project on the face of it.

11. Research gaps

As stated above, this is an extensive topic and detailed Calculation of each aspect in reference to financial calculations and environmental damages are necessary. Even though, it is easy to calculate certain aspects such as Fuel and Time saving and attribute them Financial Value, yet calculation aspects related to Environmental and Ecological Degradation are cumbersome. Without Calculation of all aspects and attributing them appropriate value, it would not provide solid foundation to justify Coastal Road construction in Mangrove/ Marine ecological sensitive area.

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