Summary Analysis of Responses to a Country Survey on Innovation in Transport

1. Introduction:

The Forum Secretariat has conducted a survey of International Transport Forum member Countries' experiences with regard to innovation in transport.

The following are summaries of countries' responses regarding priorities for innovation in transport and regarding the perceived barriers to innovation in transport.

2. Priorities for Innovation in Transport:

The Secretariat has combined responses regarding priorities for innovation in transport, and organised them thematically, noting that there is some overlap. This is not to infer that all Countries agree with all of these, although there was particularly strong support for prioritising the reduction of GHG emissions, intelligent transportation systems (ITS) and user charging.

Reducing the Environmental Impacts of Transport:

- This particularly involves reducing greenhouse gas (GHG) emissions, as well as air, water and other types of pollution, from all modes.

- From the science and technology and research and development perspectives, this includes alternative transport fuels (e.g. 2nd and 3rd generation biofuels) and propulsion systems; vehicle and engine design to optimise the efficiency of current technologies; new, recycled and light-weight materials; ITS; and better public transit options. It will also be important to identify common standards for electric vehicles. Particular technologies mentioned included battery technologies for electric mobility and satellite technology for telematics.

- Complementary to scientific and technological issues, there also needs to be consideration of effective policies and practices, such as efforts to influence transport demand while providing socially optimal mobility, and the promotion of new concepts of mobility. This includes the need for innovation in the fields of planning and system innovation (e.g. long-distance transport systems, telematics, logistics, refurbishment of the housing stock, house heating), behavioural innovation (e.g. lifestyles, road safety and travel behaviour, residential behaviour, settlement behaviour) and also social innovation (e.g. visions, acceptance, financial feasibility of purely technological solutions versus behavioural changes). In this context there should be work done on identifying more sustainable economic models for transport. Consideration of new organisational structures is also important. Innovation is particularly needed in transport demand management to reduce unnecessary private motor vehicle use for both short (under 5 km) and longer-distance

trips. This includes innovation related to urban planning and design, as well as infrastructure and service provision for public transit, and improving inter-modality. Also important is innovation to support alternatives to private motor vehicle use, such as car-sharing, active transportation, and non-transport solutions to reduce the need for travel. The question of land use is also important. Innovation is also needed with regard to improving urban goods movement.

Institutional co-operation:

- Co-operation is difficult in transport markets. There is a need for co-operation models that are not against competition laws but still enable information sharing about available empty or partly empty runs.

User Charging:

- User charging is seen as a means of introducing more efficiency and sustainability, as well as reducing congestion, and funding infrastructure. This includes congestion charging, pricing of fuels according to their levels of emissions, and mass-distance-location-based charging for heavy vehicles. Issues that must be addressed include community acceptance, compensation, administrative and regulatory issues, technology, and scheme design and application.

Intelligent Transportation Systems (ITS):

- Great potential exists in terms of the implementation of new applications of ITS, and information and communications technologies (ICTs) in general.

- There is a need to have the tools that optimise decisions (as a collaborative prescriptive tool). Innovation is particularly needed to improve the fact base of the decision-making process at an overall systems level, with tools providing the predictive impact of decisions on the flow of travellers and freight. For example, stakeholders would benefit from information and decision technologies from the field of operations research that can support the following types of decisions: infrastructure capacity investments; multi-modal and intermodal corridor network design; and tradeoffs between economic, environmental, security and safety objectives.

- Further innovations are possible in the field of cooperative vehicle systems. This requires measures promoting the use of vehicle-to-vehicle communication and laying the infrastructural foundations for the integration of cooperative systems (vehicle-to-infrastructure communication). The harmonisation of the frequencies of intelligent systems is the basis for the effective functioning of cooperative systems. In this context, it is also necessary to address issues related to data transmission security and the prevention of manipulation and misuse.

- The management of innovation in general was noted as being important, including its collection, and dissemination. For example, improvements in signage, with variable messaging, would also be useful, as well as a multimodal information systems for passengers.

- Traffic management systems are important, including geo-referentiation and communication systems, urban traffic management, co-ordination between modes, and better use of infrastructures aiming at the reduction of congestion and at the improvement of safety levels.

- Innovative approaches to supply chain logistics management; capacity, congestion and mobility management; border crossing procedures (e.g. e-freight, e-documents, etc.) and infrastructure renewal should be developed through policy, regulation, informational and analytical decision-support technologies. The resulting increased efficiency of gateways and corridors would facilitate global trade and ensure the smooth operation of domestic transportation systems. In many instances, new legislative and regulatory frameworks are also required to facilitate such systems. Analytical decision-support technologies can drive more efficient logistics management and to facilitate the globalisation of organisational activities.

- Greater adoption of new technologies can also contribute to increased worker productivity. For example, the International Air Transport Association (IATA) envisages "simplified and secure passenger processing", a system that collects passenger information once and then allows electronic passenger processing with subsequent service providers, eliminating repetitive checks and freeing up resources. Similarly, ITS can reduce the need for more drivers and maintenance workers. For instance, driverless trucks on wi-fi-enabled highways could reduce the need for truck drivers.

- Common standards for ITS should be a priority, while remaining neutral in the use of specific technologies so as to encourage innovation.

New Technologies and their Application to Transport:

- Consideration could be given to the potential impact of nanotechnologies and biotechnologies where transport is concerned.

Safety and Security:

- This includes both more exacting safety standards, as well as addressing the threat of terrorism.

- Of great importance in the evolution and development of ITS technologies is the requirement to anticipate vulnerabilities to these systems that could be exploited by criminals or terrorists and to develop innovative integrated security safeguards in the technologies.

- Increasing the safety of the road system via improvements to private cars (e.g. intelligent driver assistance, etc.) and fatigue management was particularly noted, as well as speed management.

- Also noted were the prevention of risk-related situations through communication systems; equipment for the monitoring of traffic/circulation conditions, including aspects relating to weather and road surface conditions; emergency systems, such as e-call systems; advanced driver assistance systems and nomadic systems

- Innovation for dangerous goods and special transport is important, including trace and track solutions, route definition, and real-time monitoring.

- The spread of viruses, such as the Avian Flu and the H1N1, also represents a clear threat to transport service providers, the economy, tourism, and trade. Transport represents a key means of regulating the spread of pandemics. The transport sector and the health sector will need to work collaboratively to find innovative ways and new technologies to protect the public while still maintaining the efficiency of the system.

Responding to changing demographics:

- Innovations to improve the accessibility and reliability of the transport sector and transport security technologies will be needed in order to address demographic changes and to better accommodate people who face mobility challenges due to location or disability.

Infrastructure:

- The harmonisation of technical standards in rail would allow for greater economies of scale in the manufacturing of rail equipment, as well as the operation of systems.
- New construction techniques, materials and design methods are required for road transport infrastructure.
- Increased efficiency in maintenance and operation of infrastructure is important, as well as in asset management.
- Increased use of public-private partnerships.
- The improvement of loading, discharging and shifting equipment at ports; better Ro-Ro options; and new maritime carriers with more capacity could increase port efficiency and capacity.
- Enhanced and streamlined road maintenance would make it more energy-efficient and cost-effective.
- High-speed rail.
- Next Generation aviation systems.

Intermodalism:

- The harmonisation of ticketing and booking systems across operators and modes would increase efficiency.
- Better port-hinterland connections are required to improve port through-put.

Adaptation of Transport Systems to the Effects of Climate Change, including Arctic Transport:

- Issues of social and economic conditions, natural resource development, and sovereignty are fuelling further demand for resource and community development, and the efficient and safe movement of people and goods. As a result of climate change, as well as higher energy prices and declining raw material resources will include new patterns of mobility, the demand for new products (e.g. cars, materials), and new solutions to organize modal shift, and the reorganisation of the handling of energy.
- In the North, transport policy will face a more complex set of issues in the next fifteen years occasioned by the harsher environment, longer navigational season, increased traffic in the Arctic, and the already visible impacts of climate change on northern transport infrastructure – particularly roads and airstrips built on permafrost. Innovation in permafrost thawing mitigation techniques, environmentally responsible technologies for navigation through Arctic landscape, and the design of vessels operating in ice-infested waters are of primary importance.

- Climate change it is also expected to result in changes to storm frequencies and intensities, water levels, freeze-thaw cycles, etc. in sub-polar regions. New technologies and practices will have to address these challenges.

3. Impediments to Innovation in Transport

When asked what they perceive to be the major impediments to innovation in transport, countries put forward the following, which have also been combined and organised by theme. Again, this does not imply agreement by all respondents with all elements:

Inadequate Innovation Policy for Transport:

- There is insufficient co-ordination of transport policy on the one hand, and transport innovation and promotion policy on the other. The long-term orientation of innovation policy following the innovation cycle is difficult to bring in line with short- and medium-term-oriented transport policy aims and measures.

- A gap is observed between national perceptions of the importance of innovation and current innovation needs of the country in general, and transport in particular. There is an insufficient level of awareness about the importance of innovation among both public and private transport stakeholders.

- The popular perception of innovation tends to focus on science & technology and research & development. A more balanced culture of innovation, accompanied by an enabling legal environment, far-sighted strategies and adequate numbers of qualified personnel needs to be achieved in the years to come.

Institutional Co-ordination:

- There is poor synergy between transport policy and industrial policy.

- Numerous stakeholders and competing priorities from different sectors of the economy make convergence on innovation initiatives difficult. For example, there is a lack of effective communication between transport system managers and regulators, from industry and government.

- There are also diverging objectives among different sectors related to transport, including energy, the environment, land use, urban planning, etc.

- There is a lack of inter-governmental co-ordination and agreement at the national level to deliver innovative national transport solutions. Significant co-ordination and collaboration among different levels of government and government agencies are required to foster innovation across the transport sector, and to develop a common vision of what is required in the sector. This context also gives rise to a number of knowledge and data gaps that need to be addressed with limited resources.

- In general, the proliferation of actors, agencies and organisations in the transport sector leads to problems of interoperability of common standards, etc. The transport sector itself is highly diverse – in terms of modes, actors, impacts, stakeholders, etc. – and these elements do not necessarily communicate well or understand each others' perspectives. There is a lack of co-ordination and agreement between industry players, inhibiting the co-operation of different actors within the same mode of transport as well as the

integration of different modes. This translates into the existence of different, and sometimes conflicting points of view, economic instruments, needs and demands, which thus prevent a coherent approach to innovation in transport.

- There is a lack of innovative, interdisciplinary clusters. Strong, three-way collaborative efforts among industry, academia and governments are difficult to organise and administer due to financial and contracting barriers. Current frameworks/business models do not promote optimal synergy between government, universities and the private sector.

- There is a lack of a conceptual framework and joint projects which would enhance regional cooperation between developed and less developed countries.

- Protectionism also prevents better cross-border cooperation.

Incentives:

- The market for innovation in transport is inefficient. Due to the organisational nature of transport and market failures we often see a deadlock between transport providers/operators as institutional customers and the respective industry for providing solutions. Transport providers are often reluctant to introduce innovative solutions and blame industry for lack of adequate supply. The industry is usually waiting for clear market signals to take certain investment decisions and lacks of orientation of the needs of the real customers (users).

- There is often not a good market for applications with a strong component of societal interest. However, public procurement can be a catalyst for an enhanced market uptake of innovations.

- There is a general inability of universities and entrepreneurs to move ideas from the lab to the marketplace.

- Monopoly rights (e.g. a monopoly rail operator) can result in a lack of motivation for innovation. Insufficient levels of demand and support of passengers and freight companies for new services often constitute the "private sector" part of the problem.

- On the other hand, the sharing of information and innovations, which might lead to overall improvements in the sector, limits the benefits to the original innovator.

- Technology costs are high, but the cost of transport is low, and improvements in service or technology will often not cause a significant cost reduction. Usually, the private sector aims to manage transport operations with minimum cost, and many operators are very small. This has a detrimental effect on private investments in R&D activities under severe competitive markets, especially in the aftermath of the economic recession and credit crunch. Therefore motivation to innovate is low.

- Similarly, transport infrastructure investments are not very profitable in nature. Many difficulties are encountered in the provision of necessary financial resources (or government subsidies/funds when necessary). To this end, the public-private partnership (PPP) concept is a useful tool to overcome this issue.

- The trade-off between operational/regulatory R&D (short-term perspective) and transformative (longer-term perspective; new technologies, new markets) may hinder innovation. The economy and industry place greater priority on short-term objectives. Most research and development funding is tied to a short-term-results-oriented applied research funding structure.

- In government, there is not a culture of innovation in government that enables experimentation with new technologies to foster more effective and open government.

Public Acceptance and Trust:

- Public acceptability and trust is a major issue, especially when implementing potentially controversial measures, such as charging schemes. Consumers may lack the prerequisite information/knowledge to embrace the value proposition of emergent technologies – or they may be reticent to adopt unproven technologies. Often, there is not enough publicity regarding the benefits of innovations.

- As noted below, transport is closely linked to behavioural and residential patterns that are not easily changed.

Legal and Regulatory Impediments:

- On a practical level, legal aspects based on traditional societal values and aspects of data-privacy issues act as hindrances to optimise the potentials of new technologies in some fields and certain enabling technologies for further applications cannot be realised (e.g. innovative transport data collection, personalised travel information).

- The lack of an adequate regulatory environment and drawbacks in the legal framework are other factors that impede innovative efforts. The legal uncertainty and risks mean that, on the one hand, manufacturers are reluctant to develop and introduce certain systems, and on the other hand, the potential users are sceptical about the systems.

- It is important to strike the right balance for setting new standards and regulations, and to harmonise efforts: On the one hand, reliable standards can support the industry in developing marketable products. On the other hand, setting standards can hinder technological optimization and further improvements and innovations. A high level of technical specifications tends to hinder technological innovation.

- There is a need to address intellectual property issues and also to ensure access to sufficient capital to undertake required research and development for innovation.

- Regulatory barriers exist (competitive dynamics, e.g. seeking returns on investment, a potential barrier to innovation and the adoption of new technologies). Codes, standards and regulations may not encompass innovative or disruptive technologies, potentially creating regulatory delays and impeding innovation.

- Public procurement policies can limit the participation of international players.

- Public procurement sometimes does not encourage innovation.

Risk:

- Managing the potential redistributive impacts and other community concerns of potential transport innovations (e.g. congestion pricing) presents a challenge.

- Ensuring maintenance of transport system integrity and safety is another challenge.

Available Skills and Knowledge:

- The recent decrease in transport-specific expertise at the university level in disciplines such as civil engineering, economics, operations research, etc. threatens the knowledge-base on which innovation depends.

- In general, there is a lack of the skilled human resources in transport required to implement innovation.

- Within the education system, there is not enough emphasis on Science, Technology, Engineering, & Math (STEM).

Funding and costs:

- There is a lack of dedicated and easily administered funding for transport-related innovation in government and academia. There has been decreased investment in early investigators, high-risk, long-term and multidisciplinary research.

- Linked to this are the high development costs for innovative products. Financial risk is a major issue, relating to high level of investment in new technologies versus the short life-time of such technologies In some areas, the industry faces a long period for the amortisation of (research) costs.

- Often, it is a matter of adopting technologies which were originally developed for other sectors by the transport sector, which requires further research and testing, increasing time/costs.

- The adverse economic situation for the economy in general, and for this sector in particular, is preventing both private parties and the government from investing in developing new products and/or procedures and its implementation.

Challenges Related to the Structure of the Transport Sector:

- Transport is traditionally subject to rather rigid economic models in some areas.

- This is no tradition of systematic, R&D-based innovation in the roads sector.

- Lack of data on the current transport system and its use (e.g. to pinpoint bottlenecks, quantify emissions, holistically analyse household travel, etc.) makes it difficult to identify problem areas and allocate innovation resources accordingly.

- In some areas of transport there are many small actors, operating on low cost-margins.

- Users' needs and demands of users are not defined clearly enough and are not consistent.

- It is difficult to introduce innovative technologies smoothly and rapidly into the real world. Because transport systems have significant impacts on behavioural and residential patterns, co-ordination with many stakeholders is required in order to bring about major changes in the system. Users tend to be very slow to change.

- There is often a lack of guarantees relating to interoperability of new technologies and lengthy standardisation processes/procedures.

- There is a lack of adequate competitive frameworks offering a "level playing-field" between modes and across borders in the same mode. The lack of truly regional, continental or international markets was cited as an impediment to innovation in some instances.

- There is a lack of standardisation in transport systems across jurisdictional boundaries.

- The long lifespans of transport assets, as well as their cost, prevents more constant innovation and upgrading.

4. Reasons for the failure of specific innovative policy initiatives:

Countries provided various examples of instances where innovative policies have not been successful. Reasons for this included:

- Fragmentation of responsibility for R&D among different public entities, thereby limiting synergies and opportunities for international co-operation.

- A failure of key partners from other orders of government, more closely associated with the application of innovations, to participate. In one instance, this was associated with the failure of the local partner to bring forward funding to match a more senior level of government's initiative. In another, local political resistance prevented a municipal government from implementing a programme put forward by the national government to reduce congestion, as this would have involved policy instruments aimed at inducing behavioural change, such as a congestion charge.

- Limited funding for demonstration and deployment, as opposed to R&D, meaning that new technologies do not necessarily get to market.

- Reticence to take politically difficult decisions, particularly regarding the imposition of environmental standards, which would have induced innovation. Also, the inability for government to take decisions from which there would be winners and losers was identified as a challenge.

- The "chicken and egg" challenge, whereby both the automotive and fuel industries are waiting for the other to take first steps in terms of investing in new technologies and establishing new practices. There is a clear public role here to bring partners together.

- A lack of sufficient user orientation and practical applicability where telematics is concerned. This has led to greater efforts to understand mobility behaviour and build in user-centred design elements around this.

- A lack of funding available to private operators – especially small enterprises – to allow them to upgrade equipment. This links to insufficient financial incentives to induce innovation, especially in industries with very low profit margins. This was particularly associated with fleet renewal. One government has responded to this by undertaking efforts to determine appropriate fiscal incentives, introducing flexible operating rules associated with replacing vehicles, and introducing fiscal incentives in the form of interest rates, credit and other mechanisms.

- A lack of incentive to innovate where public funding was available and guaranteed.

- In one instance, the introduction of performance-based standards for road construction was impeded by budgetary restrictions and negative reactions to penalties.