



# IRF

# Examiner

Sharing Knowledge Across Borders

ROAD CORRIDORS  
& LOGISTICS

*Volume 9, Spring 2016*



*"Better Roads. Better World."*



# *IRF Examiner*

*Volume 9, Spring 2016*  
*“Road Corridors & Logistics”*

## **IRF EXAMINER: SPRING 2016, Road Corridors & Logistics**

Articles edited for length by the IRF with the authors' permission.

The full papers form part of the proceedings of the 17th IRF World Meeting & Exhibition.

### **EDITOR**

Sam Enmon

### **COPYRIGHT**

Copyright © 2016 by International Road Federation

This volume is a product of the International Road Federation. The findings, interpretations and conclusions expressed in this volume do not necessarily reflect the views of the Executive Directors of the International Road Federation or the organizations they represent. The International Road Federation does not guarantee the accuracy of the data included in this work.

**Rights and Permissions** The material in this publication is copyrighted. Copying and/or transmitting portions or all of this work without permission may be a violation of applicable law. The International Road Federation encourages dissemination of its work and will normally grant permission to reproduce portions of the work promptly.

For permission requests, write to the IRF at:

International Road Federation  
Madison Place  
500 Montgomery Street  
Alexandria, VA 22314 USA  
Tel: +1 703 535 1001  
Fax: +1 703 535 1007  
[www.IRFnews.org](http://www.IRFnews.org)

Printed in the United States of America  
IRF Examiner ISSN: 2411-3867

### **PREVIOUS EDITIONS**

*Volume 1, Spring 2014: Road Safety Applications*  
*Volume 2, Summer 2014: Road Asset Management*  
*Volume 3, Fall 2014: ITS: Smart Cities*  
*Volume 4, Winter 2014: Pavement Design*  
*Volume 5, Spring 2015: Road Safety Analysis*  
*Volume 6, Summer 2015: IRF Student Essay Laureates*  
*Volume 7, Fall 2015: Road Financing & Economics*  
*Volume 8, Winter 2016: Sustainable Transport Practices*



The wealth of knowledge accumulated during the 17th IRF World Meeting & Exhibition in Riyadh was the driving force behind our decision to launch the IRF Examiner as a freely available resource for the industry. With this ninth issue, the International Road Federation confirms its role as a leading provider of applied knowledge in areas of vital importance for the global community of road professionals.

*H.E. Eng. Abdullah A. Al-Mogbel  
IRF Chairman*



Roads are the world's first "social network". They are fundamental building blocks for human and economic development whose impacts transcend national borders. The benefits of investments in roads have shown how transformative an infrastructure they can be for a wide range of beneficiary communities.

At the International Road Federation, we have tried to capture these connections with a simple slogan "Better Roads. Better World". Since we were established 1948, our primary purpose has been to transfer the latest technologies and knowledge from those who have it to those who need it, and in doing so, promote an agenda of shared prosperity that flows from accessible, affordable and sustainable road networks. The IRF Examiner is an essential vehicle to this ambitious agenda.

*C. Patrick Sankey  
IRF President & CEO*



Poor domestic transportation infrastructure in developing countries is often cited as an important impediment for accessing international markets. Yet, evidence on how transportation infrastructure improvements affect the volume and composition of exports is scarce. Drawing on the large-scale public investment in expressways undertaken in Turkey during the 2000s, we now have better insights on the connections between internal trade costs, international specialization and comparative advantage. Specifically, Turkey's road infrastructure project improved the quality of the road network by increasing the capacity of the roads connecting Turkish regions to the international gateways. This led to a substantial reduction of domestic transport costs as the cost of an average shipment over a high-capacity expressway is about 70% lower than it is over single-lane roads. Our main finding is that, by reducing the cost of shipping, high-capacity expressways improved the foreign market access of Turkish regions remote from the ports: a one-dollar investment generates a 10-year discounted stream of additional trade flows between \$0.7-\$2. Moreover, while the exports of all industries within a given region increased in response to improvements in connectivity to the international gateways of the country, the magnitude of this increase was larger for time sensitive industries.

These findings, and other presented in this issue of the IRF Examiner "Road Corridors & Logistics", serve as a powerful reminder that people and goods need to move for an economy to grow, for wealth to be created, and for prosperity to be shared. By contrast, missing or inadequate road links and inefficient transport services often result in artificially high prices borne by consumers.

*Banu Demir Pakel, D.Phil.  
Assistant Professor  
Department of Economics  
Bilkent University*

# Table of Contents

<b>CALIFORNIA’S MIGRATION TOWARD INTEGRATED CORRIDOR MANAGEMENT .....</b>	<b>1</b>
Daniel Lukaski; Richard Chylinski	
<b>MODEL HIGHWAY INITIATIVE IN BLACK SEA AND CENTRAL ASIA; TOWARDS THE DEVELOPMENT OF EURO-ASIAN TRANSPORT LINKS AND THE FACILITATION OF INTERNATIONAL TRANSPORT AND TRADE .....</b>	<b>9</b>
Marios Miltiadou; Demetrios Tsolkas; Georgios Papaioannou	
<b>ROAD SAFETY ASSESSMENT OF SOUTHERN EAST JAVA NATIONAL CORRIDOR .....</b>	<b>15</b>
Ir. Herry Vaza, M.Eng.Sc; Ir. IGW Samsi Gunarta, M.Appl.Sc; Muhammad Idris	
<b>THE STUDY OF TRUCK TRANSPORT IMPACTS ON RURAL ROAD NETWORK FOR FUTURE ROAD MAINTENANCE IMPROVEMENT PLAN.....</b>	<b>21</b>
Koson Janmonta; Koonnamas Punthutaecha; Wit Ratanachot	
<b>TRANSPORT COOPERATION ACROSS BORDERS: TOWARDS COMMOM TRANSPORT POLICY IN THE WESTERN BALKANS.....</b>	<b>25</b>
Mate Gjorgjievski, MA	
<b>TRANSPORT CORRIDOR DEVELOPMENT IN DEVELOPING AND FRONTIER MARKETS: OPERATIONAL TECHNIQUES FROM AFGHANISTAN TO INCREASE ECONOMIC RATES OF RETURN FOR INFRASTRUCTURE INVESTMENTS IN MAJOR ROAD CONSTRUCTION PROJECTS .....</b>	<b>31</b>
Eric Dean Cook; Maryam Atmar	
<b>UIRNET: THE ITALIAN NATIONAL ITS PLATFORM FOR INTERGRATED LOGISTICS .....</b>	<b>37</b>
Leonardo Domanco; Olga Landolfi; Rodolfo De Dominicis; Nicola Bassi	



# CALIFORNIA'S MIGRATION TOWARD INTEGRATED CORRIDOR MANAGEMENT

Author:

Daniel Lukaski

Vice President

Parsons, USA

daniel.lukasik@parsons.com

Co-Author:

Richard Chylinski

Senior Project Manager

Parsons, Canada

## ABSTRACT

The State of California is moving toward a significant shift in how transportation and traffic is managed within its congested urban centers. This is through a method of Integrated Corridor Management where all modes and routes are managed together in a holistic manner, rather than each mode, route or agency managing their independent systems in a silo.

Multiple agencies have been involved in designing and/or deploying these ICM systems including Caltrans, the San Diego Association of Governments (SANDAG), LA Metro, Alameda County Transportation Commissions (ACTC) and the Metropolitan Transportation Commission (MTC). In fact, Caltrans is looking toward structural reorganization of at least one of its Districts (Los Angeles) toward a concept of corridor management rather than just overall freeway management. As many as 50 different corridors have been identified by Caltrans to deploy the ICM concepts.

## INTRODUCTION

California's transportation infrastructure is increasingly being tapped with more vehicles on the road than ever before, increased commute times in most metropolitan areas and more vehicle miles traveled per person. These challenges, largely driven by an increase in the region's population and economic advances, have created a challenging environment for those charged with maintaining and operating these systems, especially within California's urban areas where key transportation corridors are seeing ever increasing congestion and delay. Within California, current transportation networks are made up of multiple independent systems, managed by various agencies and until recently, efforts to manage these networks to improve mobility, safety and reliability have focused on optimizing each individual system. The limitation with this approach is that the independent transportation systems; freeways, public transit, bus systems and local arterial roads do not have the capacity to respond to demands from other networks. Another limitation has been the application of Advanced Transportation Management Systems (ATMS) that have typically been re-active systems designed to detect adverse traffic conditions, e.g. traffic incident or recurring traffic

congestion, verify the situation and provide a response in reply.

In an effort to help break down these transportation management silos and manage commuter travel in a manner that looks at all modes and facilities together, California has moved toward a focus of Integrated Corridor Management (ICM), which involves the application of specific Active Traffic Management (ATM) and Active Transportation Demand Management (ATDM) strategies along the states most congested and troublesome corridors. To date, ICM systems have been or are being deployed along the following corridors in the state:

- I-15 (San Diego)
- Route 110 (Los Angeles)
- Route 210 (Los Angeles)
- I-80 (San Francisco Bay Area)
- I-880 (San Francisco Bay California)
- Route 101 (San Mateo)
- US50 (Sacramento)

Of the four systems described below, full before/after studies are not yet completed. An initial measure of the benefits that these potential projects can yield are shown in

the Table 1 below, as taken from the USDOT ICM Analysis, Modeling, and Simulation (AMS) results analysis. The cost benefit ratio for these projects are estimated at >10:1 at a minimum.

**Table 1: Potential ICM Benefits**

PERFORMANCE MEASURE AREAS	San Diego	Dallas	Minneapolis
 Annual Travel Time Savings (Person-Hours)	246,000	740,000	132,000
 Improvement in Travel-Time Reliability (Reduction in Travel-Time Variance)	10.6%	3%	4.4%
 Fuel Saved Annually (in Gallons)	323,000	981,000	17,600
 Tons of Mobile Emissions Saved Annually (in Tons)	3,100	9,400	175

### **SAN DIEGO I-15 INTEGRATED CORRIDOR MANAGEMENT SYSTEM**

The San Diego I-15 Integrated Corridor Management System (ICMS) is part of the federal United States Department of Transportation (USDOT) ICM Initiative. USDOT conceived the concept of Integrated Corridor Management (ICM) with the vision that metropolitan areas will realize significant improvements in the efficient movement of people and goods through aggressive, proactive integration of existing infrastructure along major transportation corridors. The San Diego ICM was implemented in four phases. ICM Phase 1 conducted research into the current state of corridor management in the United States and around the world. Phase 2, which runs concurrently with Phases 3 and 4, develops analytic tools and methods that enable the implementation and evaluation of ICM strategies. Phase 3 was completed in early 2013 and is called “Corridor Site Development, Analysis and Demonstration” in which San Diego implemented and is demonstrating their proposed strategy. Phase 4 is ICM Outreach and Knowledge and Technology Transfer, targeted to equip practitioners with materials to help implement ICM.

The San Diego ICM corridor is a heavily congested north-south interstate corridor of Interstate 15 (I-15). This 21-mile stretch of road from SR 52 in San Diego to SR 78 in Escondido forms the primary artery for the movement of commuters, goods, and services from northern San Diego County to downtown San Diego. It is already a model for the deployment of the latest and evolving technologies for data collection, demand management, and pricing strategies through its I-15 High Occupancy Vehicle (HOV) Express Lanes Project.

The following are the five primary goals for San Diego ICM:

- The corridor’s multi-modal and smart-growth approach shall improve accessibility to travel options and attain an enhanced level of mobility for corridor travelers.
- The corridor’s safety record shall be enhanced through an integrated multimodal approach.
- The corridor’s travelers shall have the informational tools to make smart travel choices within the corridor.
- The corridor’s institutional partners shall employ an integrated approach through a corridor-wide perspective to resolve problems.
- The corridor’s networks shall be managed holistically under both normal operating and incident/event conditions in a collaborative and coordinated way.

To achieve these goals, a number of Active Traffic Management (ATM) strategies are being deployed to proactively manage multiple modes through and along the corridor. These strategies include:

- En-route traveler information
- Pre-trip traveler information
- Freeway coordinated adaptive ramp metering
- Signal coordination on arterials with freeway ramp metering
- Congestion pricing on managed lanes
- Managed lanes
- Reversible zipper lanes
- Bus Rapid Transit
- Lane control systems

- Intelligent parking
- Regional arterial management
- Real-time multimodal decision support
- Network traffic prediction
- On-line micro simulation analysis
- Real-time response strategy assessment

**Tools to Succeed**

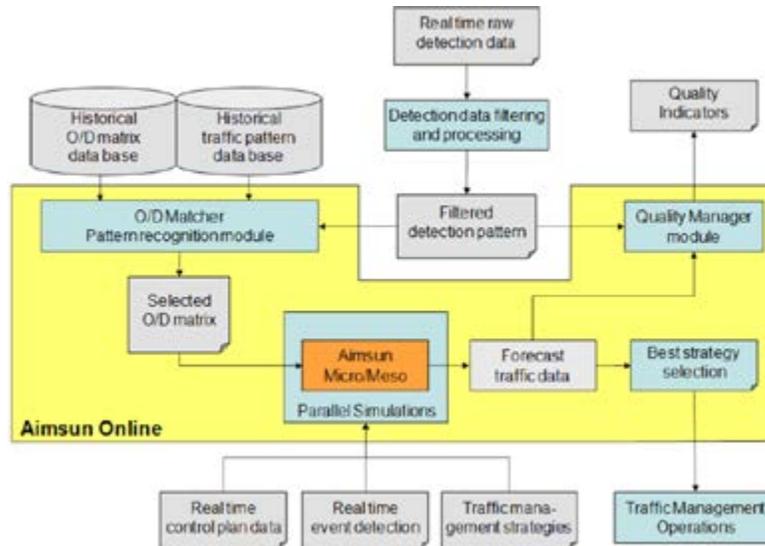
The high level architecture key components of the ICM system are:

- Parsons’s Intelligent NETWORKS® Advanced Transportation Management System (ATMS). This system is used for field device monitoring and control, Center-to-Center data fusion, event management and intelligent Decision Support System (DSS) response plan generation.
- Transport Simulation Systems (TSS) Aimsun Online. This system uses live traffic data feeds and

simulations to dynamically forecast corridor traffic conditions based on the current state of the network and to help operators evaluate incident response or congestion management strategies.

- ICMS Data Hub. In order for this multiagency system to work, an information exchange network needed to be created to exchange information in real-time with thirteen (13) different agency systems. Information data bridges were created with each of the legacy system using a common Center-to-Center (C2C) standard called the Traffic Management Data Dictionary Version 3.0 (TMDD 3.0)
- Performance Measurement System (PeMS). This system is used to measure the performance of the system after events have occurred. The PeMS system measure arterial, freeway, transit and overall corridor performance. Figure 2 below represents some the key performance indicators being that are looking to be measured by the system, in addition to the primary ones indicated above.

**Figure 1: ICMS Micro Simulation Strategy Assessment**



**Figure 2: San Diego ICMS Measures of Effectiveness**

Category	Performance Measure
Roadway links	<ul style="list-style-type: none"> <li>• Average delay (seconds/vehicle)</li> <li>• Total delay (seconds)</li> <li>• Number of stops</li> </ul>
Traffic signals	<ul style="list-style-type: none"> <li>• Volume-to-Capacity (V/C) ratio</li> <li>• Speed (mph)</li> <li>• Total delay (seconds)</li> <li>• Level of service, based on HCM methodology (A through F)</li> </ul>
Ramp meters	<ul style="list-style-type: none"> <li>• Mainline freeway speed (mph)</li> <li>• Mainline freeway volume (vehicles)</li> <li>• Ramp queue spill-over (feet or trigger)</li> <li>• Queue length vs. ramp storage (cars)</li> </ul>
Movable Barrier / Congestion pricing system	<ul style="list-style-type: none"> <li>• Travel Time (seconds)</li> <li>• Managed Lane Volume (vehicles)</li> <li>• Managed Lane Speeds (mph)</li> <li>• Tolls rate (\$/mile)</li> </ul>
Transit operations	<ul style="list-style-type: none"> <li>• Travel time reliability/delta (seconds)</li> </ul>
Parking operations	<ul style="list-style-type: none"> <li>• Number of spaces available</li> </ul>

### ***South Bay Dynamic Corridor Congestion Management***

Caltrans District 7, in conjunction with Metro (the project sponsor) and South Bay Cities COG (SBCCOG), initiated the South Bay Dynamic Corridor Congestion Management (DCCM) Project to investigate the most effective and vibrant methods to address the certain congestion increase the District and the South Bay region will face over the next 10-20 years. The DCCM project identifies and evaluates proactive congestion management concepts that make fullest use of all system capacity for selected highway corridor(s) in the SBCCOG region. The primary DCCM concept that is being implemented as part of this project is Freeway Ramp Meter/Arterial Traffic Signal Coordination, although other ATM concepts are also part of the design.

The first and very interesting exercise of this project related was to assess which of the corridors in the South Bay region were best suited for ICM deployment through the development of a Corridor Study Report. Seven corridors were identified and were evaluated using these criteria:

- System demand - the level and distribution of demand throughout the corridor and the ability of the infrastructure to support it
- Potential of physical infrastructure to support demand coordination - the suitability of the road network for supporting coordinated dynamic congestion response strategies
- Potential of ITS infrastructure to support demand coordination - the condition or availability of systems that may be relied upon to implement coordinated dynamic congestion response strategies
- Institutional coordination challenges - inter-agency or other institutional issues that may impact the ability to implement DCCM strategies for a specific corridor
- Potential to support future Integrated Corridor Management (ICM) - the prevalence of infrastructure and systems that can be readily adopted by an ICM system to manage and balance multi-modal corridor-wide throughput.

### ***System Architecture***

Through development of the Concept of Operations and System Requirements, a high-level DCCM architecture proposes center-to-center based communication between the four major systems:

- Arterial Management System, which generates real-time corridor optimized signal timing plans, incorporating real-time freeway demand and incident data
- Freeway Management System, which generates real-time corridor optimized ramp metering plans, incorporating real-time arterial demand and incident data
- Data Hub, which receives, packages, and disseminates real-time data streams from connected systems
- Decision Support System (DSS), which generates corridor-wide operations recommendations based on historical and real-time data streams

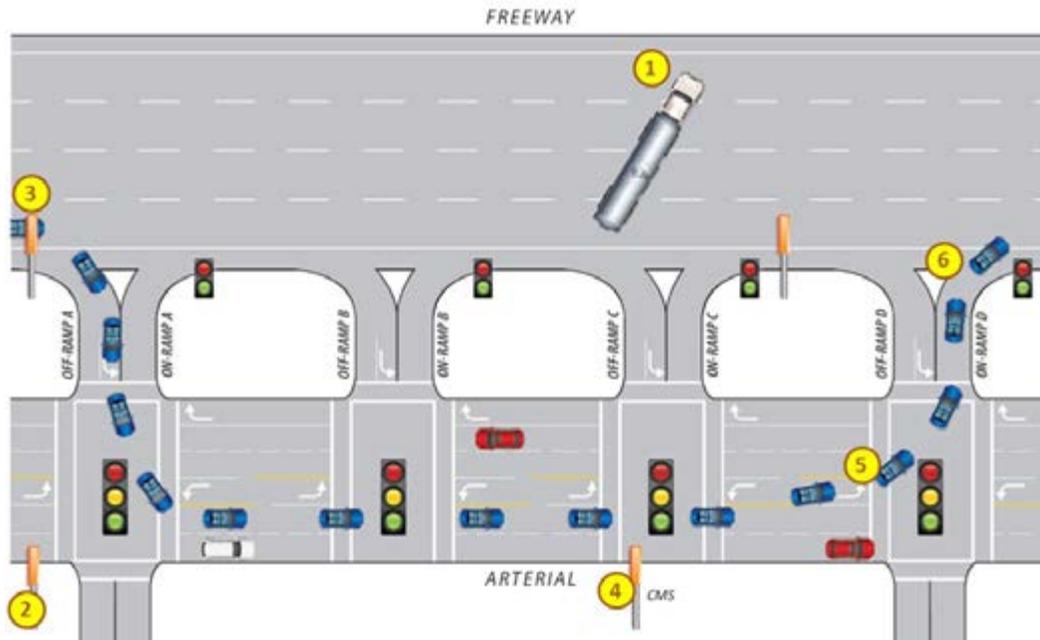
Seven operational scenarios were identified to be addressed with the system:

- Moderate-level incident on freeway (partial lane closure)
- Major incident on freeway (all lanes closed)
- Moderate incident on arterial (partial lane closure)
- Major incident on arterial (all lanes closed)
- Incident on freeway on-ramp
- Incident on freeway off-ramp
- Recurrent congestion conditions
- A brief description of one of these scenarios (Scenario 2) is highlighted below

### ***Scenario 2 (Major Incident on Freeway—All Lanes Blocked)***

In this scenario (See Figure 3), a major incident occurs on the freeway that causes several lanes to be blocked. The traffic information collection subsystem detects vehicle congestion via loop detector stations on the freeway. Loop detectors stations and freeway loops connected to the ramp metering systems detect the sudden increase in freeway congestion and a response plan is put in action to mitigate the congestion. Recommendations are disseminated to travelers via changeable message signs or text message. Traffic signal operations along the arterial and downstream ramp metering systems are adjusted to accommodate the increase in demand caused by diverted traffic. The objective is to divert upstream freeway traffic off the freeway and to guide arterial traffic around the incident to downstream freeway on-ramps.

Figure 3: Scenario 2, Major Freeway Incident



### ***I-80 Integrated Corridor Mobility Project***

The Interstate 80 (I-80) corridor has ranked as the most congested corridor in the entire San Francisco Bay Area during the last six years, with traffic volumes reaching 312,000 vehicles per day and an average of 20,000 hours of delay daily. The freeway is at or near capacity during peak periods with many segments of the corridor operating poorly. The congestion on the roadway network contributes to an increase in crash rates, including rear-end crashes on both freeway and local arterials. The combined effect of the crashes and the congestion hinders efficient response times and creates secondary crashes.

The primary goal of the I-80 Integrated Corridor Mobility (ICM) Project is to enhance the current Transportation Management System along the I-80 corridor. This will be accomplished by building balanced, responsive, equitable and integrated system to monitor and maintain optimum traffic flow along the network thereby improving the safety and mobility for all users, including transit riders. This project uses State-of-the-Practice Intelligent Transportation System (ITS) technologies to enhance the effectiveness of the existing transportation network in both freeway and parallel arterials in Alameda and Contra Costa Counties. The project will create a balanced network with an emphasis on system reliability and efficiency through multi-modal solutions. Proposed project subsystems include:

- Freeway Management System (FMS)
- Arterial Management System
- Transit Management System
- Traveler Information System
- Traffic Surveillance and Monitoring System

- Incident Management System

The key transportation management strategies that will be deployed include:

- Adaptive Ramp Metering (using Fuzzy Logic)
- Variable Advisory Speed Signs (VASS)
- Dynamic Lane Management (DLM)
- Real-Time Arterial Traffic Signal Adjustment
- Queue End Warning
- Dynamic Rerouting
- Transit Priority
- Mode/Route Choice
- 511 Information Dissemination
- Expanded Traffic Signal Coordination

The project also includes integration with the East Bay SMART Corridors Program and the Caltrans District 4 Transportation Management Center (TMC). The I-80 ICM project consists of multiple systems and strategies, working collectively, to address congestion and mobility: including the challenges of imbalanced traffic flow in the corridor. Since this corridor is constrained on both sides (by water and development), the most feasible congestion management alternative is to improve the efficiency of the total transportation system.

### ***System Architecture***

The communications links necessary for systems and subsystems are divided into Center-to-Field (C2F) and Center-to-Center (C2C) categories; C2F consists of communication links between each field device and its respective center; C2C includes establishing necessary communications links between Regional Transportation

Management Center (RTMC) at Caltrans District 4 (D4), local cities, transit agencies, and East Bay SMART Corridors (EBSC).

The Caltrans D4 Advanced Transportation Management System (D4 ATMS) is used by Caltrans staff to perform many traffic management tasks. It offers control of Dynamic Message Signs (DMS), ramp meter stations (RMS), CCTV cameras, HAR transmitters and EMS, and mainline metering stations (MLMS). Event Management is done through D4 ATMS and includes event response features using a system-generated response suggestion, a library of common event responses, or a customized one-time response entered by an operator.

### ***I-80 System Benefits***

Traffic operations expect that vehicle hours of delay will be reduced after this project is implemented. As a result of this reduction in delay, the following benefits are expected: improved travel time reliability; stable traffic flow; mode shift to transit and HOV lanes; better use of existing capacity; reduced incidents (including reduced crashes); and reduced emissions. The I-80 ICM Project is unique from a cost-benefit standpoint. Based on the cost-benefit ratio, this project ranked as the number one Corridor Mobility Improvement Account (CMIA) project by the California Transportation Commission (CTC). Other benefits include reduction in mobile pollutants, fuel consumption and driver frustration, and a shift of travelers' transit alternatives. These benefits have been quantified using the result of extensive research of similar projects and micro simulation models. Important benefits from similar system management projects include safety improvements (reduction in crashes in the range of 15% to 50%) and improvements in mobility (increase in peak hour speeds in the range of 10% to 25%).

### **CONCLUSIONS**

- Enhanced Decision Support Systems or response plan systems are a key component of ICM, although the detail and complexity of such systems can vary widely. This includes more advanced systems, which include alternate routing; traffic prediction and on-line micro simulation to more basic systems, which involve single response, plan recommendation without advanced assessment.

- ICM System typically involve the advanced integration of multiple systems using some sort of “Data Hub” or portal to freeway share information between systems and agencies.
- ICM deployments can involve a wide variety of Active Traffic Management and Active Transportation Demand Management strategies.
- Key Benefits that can be measured include:
  - Reduced Delay per mile
  - Improved throughput (vehicles/lane/hour)
  - Improved Average speed
  - Reduced Travel times
  - Improved Travel time reliability (buffer index)
  - Reduction in the Number of incidents or collisions
  - Improved Level of Service (LOS)
  - Increased volume (peak period and peak hour)
  - Reduction in Fuel Consumption
  - Reduction in mobile emissions
- Key Challenges and Lessons Learned
  - Institutional Coordination is of utmost importance
    1. Consider Effort as a PATH with Time with your partners as the most valuable resource: Allows for presence-validation-understanding – perspective
    2. Must understand agency operational respectfulness/constraints
    3. Individual and group discussions are key
  - Apply Technical Platform “V” Path
  - Conduct a requirements walkthrough to keep all parties honest
    1. Explain Individually, Discuss as a Group: Requirements must be traced back to the original objectives, strategies and needs. Focus the group on where those requirements come from, and listen for where requirements are needed to provide the balance in approach.
  - Require Performance: Make certain your requirements specify the Inputs | Functional Requirements | Outputs, but also ensure that key Performance metrics are a required. Vendors won't come up with these on their own.

**REFERENCES**

2. Caltrans District 7, South Bay Corridor Study and Evaluation for Dynamic Corridor Congestion Management (DCCM)—Task 2: Corridor Study and Recommendations Report, September 2013.
3. Caltrans District 7, South Bay Dynamic Corridor Congestion Management (DCCM) Concept of Operations—Summary of the Stakeholder ConOps Workshop, January 2014.
4. Caltrans District 7, Caltrans District 7 10-Year Urban Congestion Relief Master Plan, 2006.
5. FHWA, ATDM Program Brief: The International Influence on ATDM in the United States (FHWA-HOP-12- 048), August 2012.
6. FHWA, Integrated Corridor Management (ICM) Initiative ICMS Surveillance and Detection Requirements for Arterial and Transit Networks, November 2009.
7. USDOT, Concept of Operations for the I-15 Corridor in San Diego, California, March 2008.
8. Lukasik (2013), Integrated Corridor Management on I-15 in San Diego, February/March 2013 Traffic Technology International
9. SANDAG, San Diego Region I-15 Integrated Corridor Management, SANDAG/I-15 ICM PRESENTATION AND WORKSHOP, Caltrans D-7 September 30, 2014
10. Alameda County Transportation Commission, I-80 System Integration Detailed Design Document, November 16, 2014
11. I-80 ICM Functional Requirements Draft, updated April 2013
12. Caltrans District 4 Advanced Transportation Management System (D4 ATMS), System Enhancement Evaluation (Final), v5.1, January 28, 2010



# MODEL HIGHWAY INITIATIVE IN BLACK SEA AND CENTRAL ASIA; TOWARDS THE DEVELOPMENT OF EURO-ASIAN TRANSPORT LINKS AND THE FACILITATION OF INTERNATIONAL TRANSPORT AND TRADE

Author:

Marios Miltiadou

Dr. Transportation Engineer - Researcher - Consultant  
Aristotle University of Thessaloniki  
Egnatia Odos S.A.  
mmiltiadou@auth.gr

Co-Authors:

Demetrios Tsolkas

Director of International Projects Division  
Egnatia Odos S.A.

Georgios Papaioannou

Design Manager of International Projects Division  
Egnatia Odos S.A.

## ABSTRACT

Several initiatives have been undertaken for the development of the Euro-Asian transport links and the revitalization of the ancient Silk Road. The International Road Transport Union (IRU), based on its fundamental mission to facilitate road transport worldwide and to ensure its sustainable development, has been activated in one more activity and presented in 2010 the concept of the “Model Highway Initiative” (MHI).

A Model Highway (MH) is meant to be an exemplary road section with modern ancillary infrastructure and support roadside facilities, designed and built jointly by national governments, international financial institutions, international organizations and the business community, to demonstrate the economic potential of interregional road transportation in the regions of Black Sea, South Caucasus and Central Asia. In this framework, and in cooperation with the national governments of the countries concerned, a prefeasibility study for the implementation of the MHI concept on the trans-Caucasian road that connects Trabzon (Turkey - TR), Batumi, Tbilisi (Georgia - GE) and Baku (Azerbaijan - AZ) was elaborated in 2012.

## INTRODUCTION

The IRU project “Model Highway Initiative” was first presented in 2010, at the 43rd meeting of the Asian Development Bank. It found support by major international financial institutions (IFI) such as the World Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, Black Sea Trade and Development Bank (BSTDB), international organizations such as the Black Sea Economic Cooperation Organization (BSEC), the World Customs Organisation (WCO), the Transport Corridor Europe - Caucasus - Asia

Intergovernmental Commission (TRACECA) and eight Eurasian states.

In the framework of the Black Sea Ring Highway (BSRH) cooperation, it was decided in 2012 to investigate the potential for implementation of the Model Highway concept on the South Caucasian section Baku/AZ - Tbilisi/GE - Batumi/GE - Trabzon/TR (hereinafter the “BTBT MH”). Then, financed by the IRU and the BSTDB, a Prefeasibility Study was elaborated by Egnatia Odos S.A., the BSRH

Joint Permanent Technical Secretariat, functioning on the basis of the Memorandum of Understanding (MoU) of the Black Sea Economic Cooperation (BSEC) Organisation (Egnatia Odos S.A., 2012).

## **DESCRIPTION OF THE MODEL HIGHWAY ROUTES - EXISTING AND FUTURE SITUATION**

### ***Road Infrastructure***

The total length of the examined road sections of the trans-Caspian MH is approximately 1.710km, while the maritime connection between Baku and Turkmenbashi is 305 km. The length corresponds to the existing operational roads, including those that were under construction (e.g. Gandja bypass - AZ) or planned to be constructed on the same alignment. The discrete distances of the two MH Routes, which are presented below, refer to the sections Baku “zero point” to Trabzon Airport and Ashgabat “zero point” to Turkmenbashi Port (as they had been indicated by the governmental officials).

The BTBT MH Route links the cities of Baku with Tbilisi and Trabzon with a total length of approximately 1.135km. It crosses the land strip between the Caspian and the Black Sea through the narrow path between the Greater and the Lesser Caucasus Ranges. However, mountainous sections are limited to 54 km in Georgia. Some minor mountainous sections exist also at the Tbilisi bypass and near Batumi. Generally the roads are with low bendiness, except the mountainous sections and those in Turkey, but where a modern highway is in operation. Class I according to the AH classification (UNESCAP, 2003) or superior represent 38% of the total BTBT MH length.

The TM MH Route links Ashgabat with Turkmenbashi Port. It follows an alignment parallel to the Kopetdag Mountain Range from Ashgabat to Balkanabat, where it bypasses the Great Balkan Range towards Turkmenbashi, through a flat and arid terrain. The total length of the existing road is 574km, out of which some parts are 2x3 lanes highway and the rest is a two-lane carriageway, which is being upgraded to 2x3 highway in the framework of the highway construction plan that has been effective since 2007. The completed parts of this highway are limited to the Ashgabat - Archman section (130km) and at sections near important towns (Serdar, Balkanabat and Turkmenbashi). Class I according to the AH classification represent 30,7% (176km) of the total TM MH length.

Therefore, at time being Class I or superior roads along the entire MH from Trabzon to Ashgabat is approximately 35,5% of its total length. For the increase of the level of service and safety it is vital to increase this low share of Class I roads and to construct city bypasses to eliminate bottlenecks and minimise accidents risks in city

environment. In Azerbaijan, the Gandja bypass has been completed, while in Georgia at Kutaisi and Batumi, in absence of adequate bypasses, heavy traffic is diverted to existing alternative roads. Several projects are on-going or underway for the construction of modern highways: rehabilitation, upgrading and motorway construction projects are on-going or planned in Georgia and Azerbaijan and a totally new closed motorway is to be constructed in Turkmenistan. Thus, by the end of the current decade the road infrastructure along both MH Routes is expected to be substantially improved.

### ***Demand***

Demand is a decisive parameter in transport planning and investments, as well as for dimensioning of ancillary infrastructure and overall for the success of the MHI implementation. According to the statistics made available by official sources (reference year 2010), traffic is relatively low (below 10.000 veh/day) at most of the sections along the two MH Routes, except at sections in areas near the capitals or main cities.

Regarding future demand, from the examination of the available forecasts (UNECE, 2011) it is expected that the AADT in Azerbaijan in the period 2015-2020 would be more than 33% of the 2015 traffic, while for a specific section, between Hajigabul and Kyurdamir the traffic will be almost doubled. In Georgia, the forecasts for 2015 and 2020 estimate an increase 28% and by 60%, respectively, while similar increase is expected also on the Turkish part of the MH. Most recent forecasts estimate an increase of traffic by 244% in Azerbaijan by 2030, while for Turkey the increase of AADT expected by 2020 would be by 58%. In Turkmenistan, the traffic forecasts refer to the case of construction of the new Ashgabat - Turkmenbashi closed motorway project, which is estimated to be up to 400%, obviously due to the very low traffic of the base-year of the forecast.

### ***Ancillary Infrastructure And Border Crossing Points***

The existing road facilities along both routes are insufficient to provide quality services. Along the BTBT MH the existing roadside facilities (fuel stations, caterings, markets, service/ repair shops and hotels) are only sufficient in terms of quantity: there are around 500 roadside facilities - on both sides of the road - in total (222 in Azerbaijan, 225 in Georgia and 62 in Turkey). Most of them are small café/ restaurants and markets (216) and fuel stations (194), located on average at every 2-3 km, while the maximum interval between two facilities is 28 km. On the other hand, roadside facilities in Turkmenistan are very scattered (38 over a length of 574 km). No rest or service areas are provided and the intervals between consecutive

fuel stations (17 along the route) on some sections are critical, since they vary from 94 km to 268 km.

Generally, there is no pattern of rest areas (RA) or service areas (SA) along the routes to which a driver can refer. Such a pattern, e.g. providing SA every 100 km, can only be realized in access controlled highways. The existing parking areas at or near BCP serve as RA, since the wasted waiting times at the borders are planned by drivers to coincide with their resting times, provided that in each country the driving times do not usually require long stops in the hinterlands.

Ancillary infrastructure development is included in the planning of the countries involved. For example, two modern Service and Rest Centres have been constructed in Georgia, in the framework of an overall plan for the construction of sixteen of such centres along the entire East-West highway at every hour route. Also, in Turkmenistan, where the new motorway Ashgabat - Turkmenbashi is underway, eight RA, eight SA, two Major SA (SA and Hotel/Motel), two TPA and five Maintenance Centres are foreseen.

Concerning the road BCPs, serious efforts made for their improvement along the BTBT MH. The interventions concerned the physical infrastructure, including installations and equipment, but also the improvement of the practices and methods applied for the controls, in the framework of coordinated plans for Integrated Border Management (IBM). The conditions at BCP seem good, with no long queues; however this is an artificial image, which is not due to the fast controls (which could be indeed fast in some cases), but due to the existence of parking areas where the transit trucks are concentrated to wait for several hours. An ideal, in terms of operation, BCP has no need for huge parking areas, as a proof of their efficiency. In the end, it is unknown the exact time that a truck driver has to spend in the BCPs. Although the time to cross the borders can be from 5 to 20 minutes, the waiting time in queues or at a parking area could reach a day or so.

## **PRECONDITIONS FOR THE MODEL HIGHWAY DEVELOPMENT**

Competitive Routes And Modes – International Transport Facilitation

The development potentials of the MHs are directly associated with the evolution of transport supply and demand, but also on other competitive road corridors or other transport modes axes. The comparison of various road routes with origin Ashgabat and destinations Istanbul, Ankara and North Germany proved that the connection of Turkmenistan with Central Europe via the TM MH and Kiev is the most competitive one, ten hours faster than the connection via TM and BTBT MHs and

the connection of Ashgabat with Ankara is achieved faster through Iran and the Central and Southern Turkish road network.

However, the Ashgabat connection with Ankara through the Caspian Sea remains competitive, mainly if it combines the two MHs. The same applies for the connection between Ashgabat and Istanbul. Especially after the construction of the new motorway along the entire TM MH route, and given the on-going upgrading plans along the BTBT MH, the route could become even more competitive. Broadly the time savings for trucks along the TM MH motorway would be about 3.5 hours and this would mean that the MH route could be equally competitive to the Iran - Central Turkey routes to Ankara and Istanbul, under the condition of improvement of the level of Ro-Ro services between Turkmenbashi and Baku.

As regards the competition from Railways, the two MH have parallel railway axes along their entire length, except from Trabzon (TR) to Poti (GE). Railways could be very competitive to the MHs after the realisation of the several upgrading railway projects in all countries. The Baku - Tbilisi - Kars railway project is envisaged to become the most important railway corridor of TRACECA, while a second competitive rail route is the Istanbul (Haydarpasa) - Tehran (Iran) - (Turkmenistan) - (Uzbekistan) - Tashkent - Almaty (Kazakhstan). Both the rail corridors, originating from Istanbul and Ankara, will increase their competitiveness when the railway upgrading and modernisation of Turkish rail network will be implemented by 2023, including extending the network of High Speed Lines up to Kars. In any case, interoperability issues (track gauge, traction/ voltage) will continue to burden international railway operations with time and cost.

The TRACECA Route Attractiveness Index (TRAX), developed in the framework of “Transport Dialogue and Networks Interoperability” Project (TRT Transport e Territorio et al., 2011), identified that the nodes are the main obstacles to attract higher freight volumes on transnational routes, in terms of travel and time costs and overall reliability. Especially for the trans-Caucasus route, the ferry crossings of the Caspian and the Black Seas are those affecting its index. National plans for the rational use of the primary infrastructure should be established, to guarantee fair competition between transport modes and ensure an integrated transport and logistics system, providing at the same time advanced and non-discriminatory access of road hauliers to improved ferry services.

The better service of the increasing flows can be achieved through the expansion of physical infrastructure (where possible), combined with intensive cooperation between the responsible authorities of the two pairs of BCPs

and ideally in later stage to perform controls jointly or establish joint stations. In the meantime, the cooperation for exchange of data (a project has been commonly undertaken by the BTBT transit states for Electronic Data Interchange), the improvement of performance of staff and the application of most appropriate best practices (according to the particularities of each country and BCP) would help the reduction of border crossing times, and especially the waiting times before border procedures.

Above all, in order to facilitate border crossings, the countries should take actions on the basis of International Conventions and Agreements or other cooperation agreements signed at bilateral or regional level. Especially Turkmenistan should access the ECO (Economic Cooperation Organisation) multilateral permit system and several other relevant Conventions and Agreements. All countries should apply the provisions of the International Convention on the Harmonization of Frontier Controls of Goods and especially those with reference to the procedures for international road transport for inspections, advanced information exchange and mutual recognition of the International Vehicle Weight Certificate. Introduction of special lanes for trucks under TIR (Transports Internationaux Routiers Convention) at BCPs, application of TIR-EPD (Electronic Pre-Declaration) and single window concept implementation are measures that would improve border operations. To this end, the necessary measures and institutional reforms for international road transport facilitation are presented in country-based Road Maps in NELTI 2 project (NEA-IRU, 2011).

### **INTERCONNECTION WITH INTERNATIONAL PROGRAMMES, INITIATIVES AND POLICIES**

The two MH Routes constitute the backbone of the national networks and basic content of the transport strategic programs of the countries involved. They are also included in initiatives of various international organisations and institutions for the development of major infrastructures, transport and trade in Europe, Caucasus and Asia, providing thus a sound basis for the promotion of the MH.

Specifically, both routes are included in the International E-Road network of the UNECE (E-70 from Trabzon to Poti and E-60 from Poti to Baku and from Turkmenbashi to Ashgabat) and the UNESCAP AH project (AH5). Their importance is verified by their inclusion in the joint UNECE/UNESCAP European-Asian Transport Links (EATL) project's Road routes 4e (Trabzon-Batumi), 4 (Poti/Batumi-Tbilisi-Alyat-Baku) and 4f/6g (Baku-Turkmenbashi-Ashgabat). Additionally, both routes constitute parts of TRACECA: Trabzon - Batumi (Route 18), Batumi/Poti - Tbilisi (Route 20), Tbilisi - Baku (Route 22) and Turkmenbashi - Ashgabat (Route 24). Part of

BTBT MH in Azerbaijan and the TM MH are included in the Mediterranean - East Asia Corridor (No 2 and 2b), one of the six CAREC Multimodal Corridors (ADB, 2008).

### **ROADSIDE FACILITIES PLANNING AND FINANCING**

The development of ancillary infrastructure along the MH should include;

- Expansion of the network of fuel stations
- Creation of a parking facilities network, which would provide convenient and safe parking for international haulage vehicles, technical maintenance facilities and retail outlets for spare parts and convenience goods; and
- Expansion of a network of hotels and motels to cover drivers' rest periods

Each transit country has to be evaluated separately, taking into account the existing situation and the national planning and development plans, including important nodes. Such nodes are Baku, Alat and Red Bridge BCP in Azerbaijan, the Red Bridge BCP, Tbilisi, the Sarpi BCP (or Batumi) and Kutaisi (considered as possible International Logistic Centre - ILC) in Georgia, the Sarp BCP in Turkey and Ashgabat, Archman, Gumdag/ Balkanabat and the Turkmenbashi ILC (which is under development in the framework of Turkmenbashi Port expansion project) in Turkmenistan. Then a more detailed plan for development of ancillary installations along the MH should be elaborated, in order to specify the locations and type of ancillary infrastructure and the terms for their development (land acquisition, design, cost, environmental aspects, etc.). This plan should be assessed within a Feasibility Study, which should make an advanced assessment of the market potentials based on corridor and logistic chain analysis, examining in detail parameters such as the origins and destinations and the type of commodities transported. However, despite the status of development of the main road infrastructure, which will be on going for several years from now, the provision of facilities according to the international standards and certainly constructing RA and fuel, stations at regular spacing should be considered urgently (especially in Turkmenistan).

As regards the involvement of foreign investors in road and roadside infrastructure development projects, it follows the pattern of involvement in doing other sectors businesses, which during the last years has become quite common. Especially regarding Public Private Partnerships (PPP), even though relevant legislations are pending, the involvement of the private sector has not been hampered in other cases, like in energy, airport and motorway projects. However, further reforms are requested, in order to ensure a solid, clear and transparent legal basis for PPP. Actions to remedy the various shortfalls under existing laws that

currently make PPP unattractive must be taken, such as provision of more flexibility during concession contracts negotiations and availability of more security instruments in favour of lenders.

## **EXPECTED IMPACTS**

The improvement of the level of service along the MH should comprise improvements of the main road infrastructure, of the ancillary installations and BCP and of the connections to major trip generators and attractors, both for passengers and freight. The improvement of the main road infrastructure - traditionally a growth engine along its alignment - directly provides vehicle operating cost savings, accidents reduction, time and cost savings for passengers and freight. Other benefits expected concern increase of international traffic and trade, of employment and productivity, regional development and territorial convergence, increased accessibility and mobility of people and higher living standards.

More reliable road transport services will ensure efficient movement of freight and passengers across the borders, better access of local communities to markets and social services and job and income opportunities created during project and after project completion. Also benefits for the tourism industry and the cultural exchanges are expected from the increased accessibility of the regions.

## **CONCLUSIONS**

The analysis performed verifies that despite the progressive development of main road infrastructure, this is not accompanied with development of roadside facilities. The quality of provided services along the two MH Routes

examined through ancillary infrastructure is admissibly low, with very few exceptions.

The importance of the two MH Routes, which are the backbone road network in the countries involved, but at the same time are part of the international strategic networks, provide a framework of strong political will and commitment for large scale investments, through national budgets and the participation of the IFI. This commitment is materialised through the on-going and underway projects of motorway construction and upgrading, which will ensure modernised, safe and efficient road infrastructure to the users in the future.

The development of ancillary roadside infrastructure assets should be also ensured, as promoted by the MHI. Both components of the MH (main roads and roadside facilities) have to be financially viable and thus able to attract the necessary funds from IFI and private investors. This highlights the importance of ensuring adequate traffic volumes along the MHs, which can only be achieved through the implementation of legal and administrative reforms and effective measures aimed at the facilitation of international road transportation of cargo and at the improvement and harmonisation of the border crossing operations and procedures along the entire MH, including those performed at the Caspian Ports. In this aspect, not only procedures should be effective, but ferry services between Azerbaijan and Turkmenistan should become non-discriminative, regular and reliable for road transport, in order to increase as possible the competitiveness of the entire route and provide the possibility to be an efficient alternative to other main alternative road (and not only) Euro-Asian Corridors.

**REFERENCES**

1. AASHTO/American Association of State Highway and Transportation Officials (2001). Guide for Development of Rest Areas on Major Arterials and Freeways, 3rd Edition.
2. ADB/Asian Development Bank – CAREC/Central Asia Regional Economic Cooperation (2008). “Implementation Plan for the Transport and Trade Facilitation Strategy.
3. Egnatia Odos S.A. (2012). Prefeasibility Study for the development of the Baku - Tbilisi - Batumi - Trabzon Model Highway.
4. Egnatia Odos S.A. (2014). Prefeasibility Study for the development of the Model Highway in Turkmenistan.
5. European Union (2013). Regulation (EU) No 1315/2013 on Union guidelines for the development of TEN-T.
6. IPDG/International Project Development Group LLC (2012). Model Highway Initiative: Worldwide Investment and Funding Mechanism.
7. NEA Transport Research Institute in cooperation with the International Road Transport Union (2008). New Eurasian Land Transport Initiative NELTI.
8. NEA Transport Research Institute in cooperation with the International Road Transport Union (2011). New Eurasian Land Transport Initiative NELTI 2 Final Report - Road Map.
9. TRT Trasporti e Territorio, Alfen Consult GmbH, Dornier Consulting GmbH, PTV AG (2011). Transport dialogue and interoperability between the EU and its neighbouring countries and Central Asian Countries. TRACECA Route Attractiveness Index - TRAX.
10. TRT Trasporti e Territorio, Alfen Consult GmbH, Dornier Consulting GmbH, PTV AG (2012). Logistic processes and Motorways of the Sea II.
11. UNESCAP/United Nations Economic and Social Commission for Asia and the Pacific (2003). Asian Highway Handbook.
12. UNECE/United Nations European Commission for Europe (2002). TEM Standards and Recommended Practice. 3rd Edition.
13. UNECE/United Nations European Commission for Europe (2011). Trans-European Motorway (TEM) Trans-European Railway (TER) Projects”, Final Report - Volumes I and II.
14. UNECE/United Nations Economic Commission for Europe (2012). Euro Asian Transport Linkages Phase II.

# ROAD SAFETY ASSESSMENT OF SOUTHERN EAST JAVA NATIONAL CORRIDOR

Author:

Ir. Herry Vaza, M.Eng.Sc  
 Director of Institute of Road Engineering  
 Institute of Road Engineering  
 Agency for Research and Development  
 Ministry of Public Work - Indonesia

Co-Authors:

Ir. IGW Samsi Gunarta, M.Appl.Sc  
 Head of Traffic Engineering and Road Environment Laboratory  
 Institute of Road Engineering  
 Agency for Research and Development  
 Ministry of Public Work - Indonesia

Muhammad Idris  
 Road Safety Researcher  
 Institute of Road Engineering  
 Agency for Research and Development  
 Ministry of Public Work - Indonesia

## ABSTRACT

The target of National General Safety Plan on lowering the fatality rate in traffic accidents to become 50% (equals to 1.96 fatality/10.000 vehicles) in 2020 becoming a challenge undertaken by the Ministry of Public Works, especially from the infrastructure side. To reach these targets and simultaneously provide an overview of the national road sections the condition required an adequate approach. One of the approaches is the application of International Road Assessment Program (iRAP) using Star Rating concepts as it has been implemented in various countries. The star ratings are based on the road inspection data and provide a simple and objective measure of the safety level, which is built-in to the road for car occupants, motorcyclists, bicyclists and pedestrians at the prevailing traffic speed.

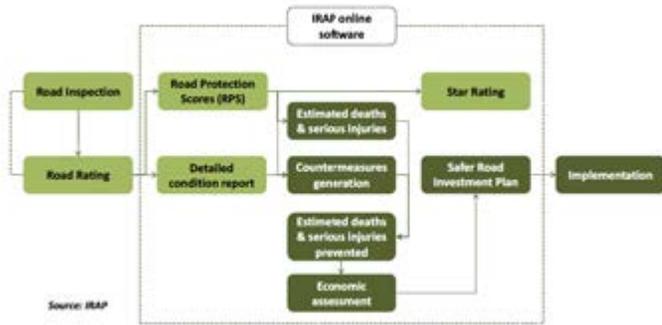
## BACKGROUND

Fatality index is one of accident assessment indicator which basically gives the size, by utilizing traffic as exposure. Another common size used is in the accident rate as well as exposure to utilize AADT unit (acc per100MVKT). This size can be used on assessing road safety condition and the fatality of the national target achievement size index on reducing the fatality rate. The national target as it was programmed in the Decade of Action (DoA) was a 50% reduction in fatality rate in 2010 and it is equivalent to 1.96 fatality victims per10,000 vehicles. The target of 50% accident fatality rate reduction is an aggregate of achieving the fifth pillar target of DoA which cannot be directly used to assess the performance of each pillar. Therefore, an appropriate performance measure for each pillar is needed.

## LITERATURE REVIEW

Star rating approach and road investment plan development is a systematic approach to the design and improvement of road infrastructure elements based on the research on the effects of road infrastructure elements to severity and probability of accidents occurrence. Star rating and investment plans related to the inspection results of details road conditions report, which in the report providing a summary of road infrastructure safety improvement component as shown in the Figure 1.

Figure 1: iRAP Protocol



**Attribute Assessment of Road Safety Performance**

The number assessment attributes of road design elements, definitions and categories for each attribute of a given element of road infrastructure in this paper refers to the attributes developed by Euro RAP and AusRAP. Meanwhile, the risk to the research associated with the infrastructure also refers to EuroRAP and AusRAP. Overall there are 21 attributes of roads that have been used in the iRAP. The attributes adjusted to the perspective of road users including car occupant, motorcyclists, cyclists, and pedestrians. Table1 below shows each attribute for every road user.

Table 1: Attribute Assessment of Road Infrastructure Elements

Road Attribute		Type of Influenced Road Users			
		Car occupant	Motorcycle	Bicycle	Pedestrian
1.	Bicycle Facility				✓
2.	Delineation	✓	✓	✓	✓
3.	Intersection Volume	✓	✓	✓	✓
4.	Intersection Type	✓	✓		✓
5.	Lane Width	✓	✓		✓
6.	Median Type	✓	✓	✓	✓
7.	Minor access point density	✓	✓		✓
8.	Number of Lane	✓	✓	✓	✓
9.	Passing demand	✓	✓		
10.	Shoulder Width	✓	✓		✓
11.	Pedestrian Crossing Facility			✓	✓
12.	Pedestrian Crossing Quality			✓	✓
13.	Curve Quality	✓	✓		✓
14.	Intersection Quality	✓	✓		✓
15.	Bend Radius Curve	✓	✓		✓
16.	Pavement Condition	✓	✓		✓
17.	Road Side Design / road side friction	✓	✓		✓
18.	Lane Rumble Strip	✓	✓		
19.	Road Side Constraints			✓	✓
20.	Sidewalk Provision			✓	
21.	Speed	✓	✓	✓	✓

Source: iRAP

**Road Protection Score**

After inspection of the road infrastructure elements, road protection value or Road Protection Scores(RPS) was calculated for each 100 m of roads using iRAP software. RPS is an objective measure against the possibility of injuries and their severity, based on road infrastructure elements. RPS forms part to produce a star rating. RPS iRAP has been developed from EuroRAP models which assess passenger car protection through road elements in the event of an accident. And from AusRAP model that assesses both the protection afforded to passenger vehicles as well as the possibility of accidents. RPS iRAP also described extensively research on the risks of accidents related to road infrastructure.

iRAP important aspect in developing RPS is the assessment consistency which can be applied in various countries. Therefore, assessment forms designed by iRAP are directed to provide similar assessments in all countries to predict mortality and serious injury that may occur on a road network. This form provides the basis for estimating the number of deaths and serious injuries and to determine the treatment that may be used. Details of this infrastructure require the development of comprehensive models that include assessing the risk to road users, report on the proportion of accidents, and implement the details of the relative risk factors. The following is one of the RPS calculations model for car occupant.

**Star rating**

Star rating is an objective measure of accident probability and severity that may occur. Star rating used data from road safety as well as the relationship between the attributes and the road accident rate. By measuring the risks associated with the road attribute, star rating may provide a better indicator of the road attribute at risk effect rather than the number of accidents. Star ratings provide a simple and objective measure of the safety level of a given road infrastructure.

**Investment plan**

The goal of safer roads investment plan is to provide a treatment of economics appreciation of a risky reduction. iRAP has considered more than 70 options in a range of treatments from the lowest cost to the highest cost, which can be seen in the iRAP toolkit.

In the road investment plan calculation specified several necessity treatment options to improve road safety performance. Treatment options generated by the safety trigger as a trigger of various treatment types on the elements that have safety problems, in other words which form of road element trigger has a low RPS value. The size of the RPS value will affect star rating.

iRAP model assesses the benefits of an applied safety handling on the road network aimed for the fatalities and serious injuries prevention through economical handling. For this purpose, firstly need estimation of fatalities and serious injuries number of each segment in road networks. The road length network commonly used by iRAP in the calculation of the victims estimated number about 3,000 km and assessment is performed every 100 meters, so that the road network is considered to have 30,000 parts.

The number of severe casualties on each part section (100 m) based on a comparison of 10 serious casualties for any loss of life or death (10:1). This comparison can be seen on *The True Cost of Road Crashes: Valuing Life and the cost of a serious injury*. While the overall number of fatalities and serious for the entire segments are the sum of each part sections (100 m).

Once the model calibrated, the estimation of fatalities number and serious injuries can be made to any part of segments, the results of these calculations are helpful to reduce the number of victim and the determination of the appropriate treatment for a given location (the segment). For the selection of a treatment, there are several requirements of an occurred condition in the segment part that will be handled or referred to the name of the trigger; it is based on the determination of star rating or RPS, road conditions and traffic volume.

Roads that have a high risk assessment and low star ratings should be prioritized for action plans and road safety investment. Roads with low risk assessment and high star rating, which cause little or no danger for road users and should be low on the priority list. Roads either high risk assessment or high star rating, low risk assessment or low star rating, usually require further investigation.

iRAP has more than 70 proven treatment options to overcome the problems of road safety. One type of problem path element (trigger safety) may have several treatment options. Several options have a different impact on the increase of the star rating. The choice is depend on the improvement targets required by the organizers and the availability of funds.

## **METHODOLOGY**

### ***Road Inspection***

The road section star rating process begins with data collection. Generally, data collection techniques performed through visual road inspection and focused on road infrastructure elements. Currently, iRAP uses two road inspection methods where one of them used a survey vehicle, Hawkeye-2000.

Once the video data collected, the assessment conducted through a desktop inspection of road infrastructure by

*IRF Examiner*

connecting elements of the road network at the time of inspection. The assessment carried out by using special software to obtain accurate elements measurement such as lane width, shoulder width, the distance between the road edges, hazardous locations, and so on.

## **IRAP IMPLEMENTATION OF SOUTHERN EAST JAVA CORRIDOR**

### ***Key Characteristics***

The following is the characteristics of road between Lumajang-Banyuwangi located on the national road corridor southern East Java. This segment has 416.2 km long; majority (97%) an undivided segments with the average annual traffic flow ranged 15000 to 20000 vehicles. Overall 59% of road conditions relatively good, 33% of road conditions categorized average, and the rest (7%) classified as poor.

Geometrically, 416 km along the segment consists of a straight lane (65%), sharp turns (20%) and very sharp (1%). This segment has a slope of 0% -7% by 93% and 7% -10% slope of 7%. Nearly half of the road segments width greater than 3.25m; 30% of lane width between 2.75m-3.25 m and 19% less than 2.75 m. Meanwhile, the ideal shoulder width considered only 2% (1.00 m - 2.40 m); The relatively narrow 33% less than 1.00 m; and 65% do not even have the road shoulder.

This segment does not have facilities for bicycles and motorcycles as well as for pedestrians along the roads. Road crossing facilities recorded only 1% (31 points) classified as good; 6% (269 points) considered poor and 93% (3862 points) not applicable. Limitations of this facility is considered very risky against a vulnerable road user group, since 88% of vehicles have a speed of 50 kph and 12% of vehicles have a speed of 80 kph to 85%-tiles speed. Type of median, 95 % shows the centre line road marking median; 2% in the form of physical median.

### ***Road Star Rating***

Star Ratings based on road inspection data and provide a simple and objective measure level of safety, which is developed to the road for car occupants, motorcyclists, bicyclists and pedestrians at the prevailing traffic speed. The 5-star (green) roads are the safest while 1-star (black) roads are the least safe. The overall star ratings for the network is shown in the Table 2 and the typical star rating map for car occupant is shown as Figure 2.

**Table 2: Road Star Rating For Four Road User**

Star Ratings	Vehicle Occupant		Motorcycle		Pedestrian		Bicycle	
	Length (kms)	%	Length (kms)	%	Length (kms)	%	Length (kms)	%
5 Stars	0.6	0%	0.6	0%	0.1	0%	-	0%
4 Stars	134.9	32%	102.4	25%	1.2	0%	0.7	0%
3 Stars	137	33%	141.5	34%	102.3	25%	166.2	40%
2 Stars	70.3	17%	67.6	16%	196.9	47%	92.0	22%
1 Stars	70.7	17%	101.4	24%	94.5	23%	137.4	33%
Not applicable	2.7	1%	2.7	1%	21.2	5%	19.9	5%
Totals	416.2	100%	416.2	100%	416.2	100%	416.2	100%

**Figure 2: Road Star Rating Map For Car Occupant**

Table 2 shows that the road star rating-1 ranged between 17%-33% for all road users; for a 2-star rating varies between 17% -47%; for a 3-star rating varies between 33-40%; 4-star rating ranged from 25% -32% just for car occupant and motorcycle; 5-star rating and recorded only 0.6% for the motorcycle. The table further shows that the 1-star rating for the vulnerable road user groups considered still quite high (23% -33%). Similarly to the 2-star rating was also higher for bicycle (22%) and pedestrian (47%). From this table indicates that pedestrian facilities and bicycles almost nothing, in other words that the road is very risky to pedestrians and bicycles group.

### Countermeasures - Investment Plan

Table 3 below shows that the investment plan for the road safety quality improvement with the proposed 15 priority handling generated by VIDA software analysis. Road investment plan inTable-2 is equipped with a number of important information including information of length/ site, FSIS saved, PV saved benefit, estimated cost, cost per FSIS Saved, and CB-ratio. The original table of the investments plan contains more than 60 types of countermeasures. Overall if the countermeasure option is implemented will provide FSIS-saved value of 302, CB-ratio 17 and the total estimated cost of over IDR 5 trillion and 93 trillion IDR benefit.

The best choice of investment plan is based on the value of the highest CB-ratio, the highest FSIS-saved, and the lowest estimated cost. Fifteen types of countermeasures inTable-1 is a priority program of the highest CB-ratio as well as the lowest estimation cost. Pedestrian fencing, for example, has the highest BCR value (366), cost estimation (IDR. 736,405,020) and high benefit (IDR. 269,245,132,278). These Countermeasures are expected to reduce the potential accident sand save 860 pedestrians.

**Table 3: Countermeasures With 15 Program BCR Priorities**

Countermeasure	Length / site	FSIS saved	PV saved of safety benefit (IDR)	Cost Estimated (IDR)	Cost per FSIS saved	Program BCR
Pedestrian fencing	73.3km	860	269,645,132,278	736,405,020	847,647	366
Improve curve delineation	134.4km	1,720	536,043,327,002	4,278,217,640	2,476,636	125
Skid resistance	8.8km	2,790	8,593,607,938,784	172,638,983.45	6,233,933	50
Central full turning lane	7.2km	42	13,126,802,107	445,090,170	10,521,748	29
Street lighting (intersection)	405 sites	330	104,523,549,526	4,572,840,	13,576	22,9
Shoulder rumble strip	29.6km	230	72,987,181,242	3,398,131,350	14,447,489	21
Motorcycle lane (paint on road)	0.3km	1	465,484,618	23,981,990	15,927,438	19
Roadside barrier	46.9km	940	294,281,994,543	18,324,715,500	19,322,902	16
Central hatching	0.4km	1	178,774,856	12,194,250	21,166,425	15
Sight distance	1.2km	21	6,781,345,496	487,770,050	22,320,199	14
Improve delineation	184.3km	420	132,507,235,501	9,295,154,570	21,767,865	14
Central median barrier	0.5km	22	6,926,671,460	544,061,700	24,373,752	13
Pedestrian facility	156 sites	81	25,367,925,457	2,014,309,650	24,639,965	13
Lane widening (>0,5m)	5.5km	300	94,934,197,228	12,388,000,000	40,492,755	8
Side road unsignalised pedestrian crossing	38sites	39	12,328,910,299	1,531,055,990	38,535,871	8

## DISCUSSION

Basically investment plan contained a number of countermeasures constitute ViDA analysis result towards environmental assessment of road conditions and road environment of the four perspectives of road users. This investment plan was designed to improve road safety conditions in the form of star rating. Countermeasures options adjusted to the availability of the budget. Even the results of the investments plan can be directed to the program and increase safety planning in accordance with budget availability. However, the overall results of the investments plan to the value saved by FSIS-302 and CB-17 ratio has provided significant improvements to increase the star rating of the road segments along the 416km. The following are the review of a number of proposed countermeasures for CB-ratio programs above 17.

Pedestrian fencing; The proposed treatment of a number potential pedestrian accident that spread along the roads. From the analysis results as presented in the description of the key characteristics how that the lack of pedestrian facilities along the 416.2 km analyzed segment. The typical land use along the road segment dominated by commercial and residential areas have problems with pedestrians. To improve road safety situation, pedestrian fencing along the 73.3 miles is needed.

Improve delineation curve; The low quality of curve which only 3% is considered adequate and unavailability of good delineation along the sites, a special kind of countermeasures on the curve to be a priority. Improve delineation curve becomes second priority with the results of relatively high CB-ratio (125) with the cost value per FSI saved relatively low. These countermeasures are needed, which are located along the 134.4 km spreading along the 416.2 km segment.

Skid resistance; Visually, pavement condition classified good, however, the Hawkeyes data shows there are problems on skid resistance along the 88.8 km. Skid resistance improvement became the third best option generated by ViDA analysis. This was indicated by relatively high CB-ratio (50) and cost value per FSI relatively low.

Full central turning lane; Site preparation for a full rotation direction using a central turning lane be the fourth best choice based on the results of ViDA analysis. This fact is shown by the relatively high CB-ratio (29) and cost value per FSI relatively low. This necessity spread along 7.3 km with a very low estimation cost. Theoretically, the results of this analysis provide a significant impact on improving road safety quality. Not with standing the rotation direction of this facility needs to be adjusted to the road width and adequate sight distance and must be protected from the road access at this location.

Street lighting for intersections; Proposed countermeasures street lighting, especially at intersections considered by ViDA analysis results. ViDA's analysis shows the types of countermeasures CB-value ratio above the average (22) and the value of cost per FSI relatively low and considered a significant impact on road safety quality. Countermeasure is considered very reasonable to the quality of the analyzed intersections only 1% is adequate, it is estimated that the condition of the existing intersection has a high risk of accidents.

Shoulder rumble strips; The fact shows that only 2% of the ideal road shoulder width, 33% of the narrow road shoulder width and side roads do not have shoulders. Meanwhile, ViDA analysis shows that the needs of shoulder rumble strips along the 29.6 km (7% of 416.2 miles) with CB-ratio is above the average (19) as well as the value of the cost per FSI are relatively low. Although the proposed countermeasure shave good benefits, but it should be considered that the availability of adequate shoulder to implement this type of countermeasures.

Motorcycle lane; The key characteristic results showed that the three groups of vulnerable road users are basically not facilitated along 416.2 km. ViDA analysis further showed that the provision of motorcycle lane along 0.3 km worth considering since these countermeasures have a CB-ratio above the average (19) as well as the cost per FSI values are relatively low.

## CLOSING

- iRAP (International Road Assessment Programme) is a road safety management system based on the infrastructure road condition assessment by utilizing a number for assessment criteria. As an assessment program, iRAP provides an assessment of road safety conditions evaluated from 4 (four) road user perspectives which is then presented in the form of star rating. The results of this assessment are considered easier for policy makers and planners on improving road safety conditions.
- Besides providing safety performance of road infrastructure assessment, iRAP with ViDA analysis software provide approximately 70 handling options through road investment plan which can be utilized to improve the star rating.
- The number of treatment priority of existing countermeasures in road investment plan based upon the high FSIS saved, high PV saved benefit, low estimated cost, low cost per FSIS Saved as well as CB high ratio.
- Based on the experiences of various countries that have already implemented iRAP, generally provide significant results in improving the road safety quality. Overall the concept of road performance evaluation through iRAP approach is considered very helpful to be implemented in Indonesia.

**REFERENCES**

1. ADAC, UK Trial Survey to establish Road Protection Scores for the UK Final, 2007
2. AusRAP, Comparing Risk Maps and Star Ratings, AusRAP Technical Working Paper, APRIL 2008
3. AusRAP, 2008, Star Rating for Queensland Country Highways, Traffic & Safety Department, RACQ
4. Dahdah S, Safety Rating of Road Infrastructure-Focus on Vulnerable Road Users, Road Safety Learning Day, 30 March 2007
5. D Lynam, Development of Risk Models for the Road Assessment Programme, TRL, February 2012
6. iRAP, 2009 (a), The iRAP Methodology: Star Rating Roads for Safety, International Road Assessment Programme, London
7. iRAP, 2009 (b), The iRAP Methodology: Safer Roads Investment Plans, International Road Assessment Programme, London
8. iRAP-Aspac, 2010, Indonesian Project iRAP Demonstration, iRAP Asia Pacific
9. International Road Assessment Program (iRAP), Vehicle Speeds and the iRAP Protocols, Policy Position, iRAP 2010
10. International Road Assessment Program (iRAP), Star Rating Inspection Manual, Setting the standards for the road rating process, June 2010
11. International Road Assessment Program (iRAP), The iRAP Working House Workshop 2010, Review of the iRAP Road Protection Score model and Star Ratings, 12-13 May 2010 Basingstoke, UK
12. International Road Assessment Program (iRAP), Establishing iRAP In Your Country, United Kingdom, International Road Assessment Program (iRAP)

# THE STUDY OF TRUCK TRANSPORT IMPACTS ON RURAL ROAD NETWORK FOR FUTURE ROAD MAINTENANCE IMPROVEMENT PLAN

Author:

Koson Janmonta  
Engineer Practitioner Level  
Department of Rural Roads  
Bangkok, Thailand  
koson.te@gmail.com

Co-Authors:

Koonnamas Punthutaecha  
Engineer Senior Professional Level  
Department of Rural Roads  
Bangkok, Thailand

Wit Ratanachot

Director, Bureau of Maintenance  
Department of Rural Roads  
Bangkok, Thailand

## ABSTRACT

Truck mode is one of the most important transportation modes in Thailand. With the opening of the ASEAN Economic Community (AEC) in 2015, the transportation of agricultural and industrial products will be increased, especially on the rural roads. This is due to the fact that the rural roads gain direct access to the growing areas. The proper road maintenance plan is therefore needed for the department of rural roads to effectively plan for road maintenance, and fully utilize the limited budget. This study examines the key rural roads in the northeast of Thailand, especially ones that directly join the East-West Economic Corridor. Four maintenance plans are set based on the expected future amount of trucks on the roads. The internal rate of return (IRR) is also performed to rank the worthiness of the road maintenance plan.

## INTRODUCTION

Road transport under the Department of Rural Road's responsibilities have been increasing steadily due to the ability of accessing agricultural and industrial areas, including the source and commercial manufacturing facilities such as ports, airports and cargo terminals. Moreover, Thailand and the ASEAN countries are stepping into ASEAN Economic Community in 2015. The transport of goods on the rural roads will be doubled especially on the economical route such as the North-South and East-West Economic Corridor and Southern Economic Corridor. This impact will result in dramatic economic growth. One of the most important routes is the East-West Economic Corridor, which starts from Danang in Vietnam and cut through Laos and Thailand to Mawlamyine in Myanmar. This route is cutting through the provinces in the northeast of Thailand, thus the amount of freight and travel in the future are expected to be much higher,

especially the increase of tourism and agriculture and industry goods transport. Therefore, it is a must to have a plan to cope with such changes, otherwise it could severely damage the roads.

The study of truck route network is to develop a model of restructuring and maintenance of rural road, to understand the routes, which are used for goods transport and tourism, both domestic and international, and to plan and analyse for the development of road network. This will bring up the standards design and maintenance in a proper way to handle the increased of traffic volume in the future.

## BACKGROUND

Recent research related to the truck route network and road maintenance were revised as shown in Figure 1,

which are important factors affecting the development of transport infrastructure and road maintenance. These ideas will be used to prioritize routes that are suitable for developing a truck route network.

Prioritization is applying Analytic Hierarchy Process (AHP) method by considering the important factors including the number of trucks, connectivity with Asian Highway (AH), and accessing to agricultural and industrial areas. The weighting systems of those various factors are summarized in Figure 2. The prioritised roads will be analysed for the trend of freight transportation in the future to plan for the development of the road network, standard of design and maintenance management.

Figure 1: Recent research was revised and identified potential routes

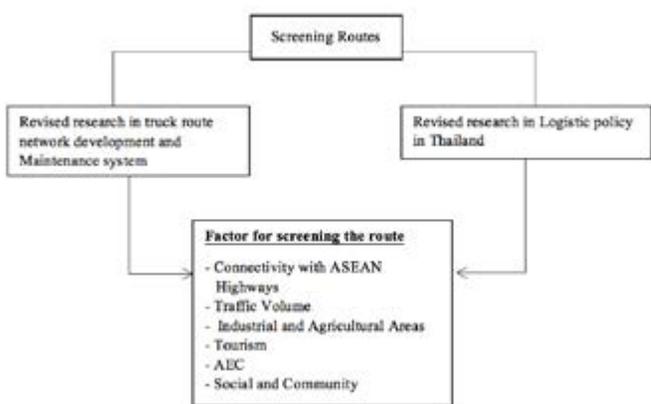
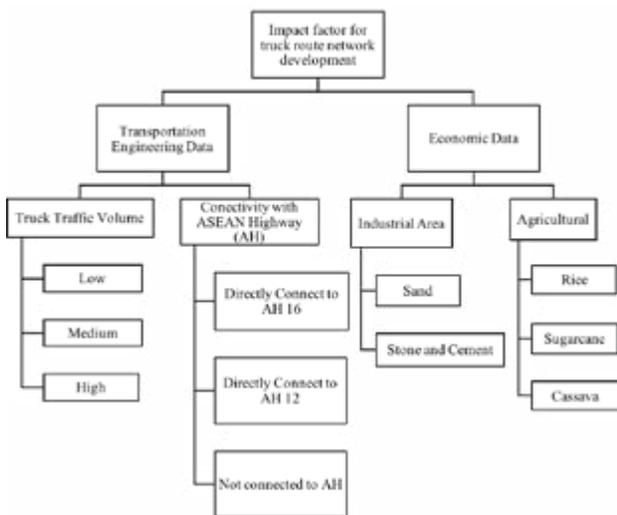


Figure 2: Various factors used in prioritizing roads. (Adapted from the Department of Rural Road)

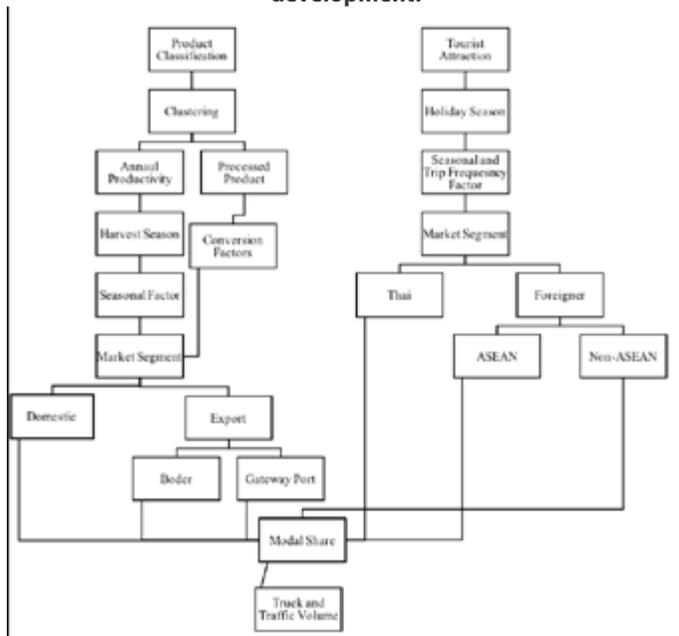


**METHODOLOGY**

Prioritising routes and analysing traffic trend in the future Analytic Hierarchy Process is used for prioritizing routes, which are suitable to be developed for truck route networks. In this case studies, the routes in KhonKhen, Kalasin and Mukdahan that are parts of ASEAN East - West Economic Corridor, were considered and there were a total of 24 selected-routes. Their selected routes were

examined for the likely traffic volume in the future. The process is shown in Figure 3.

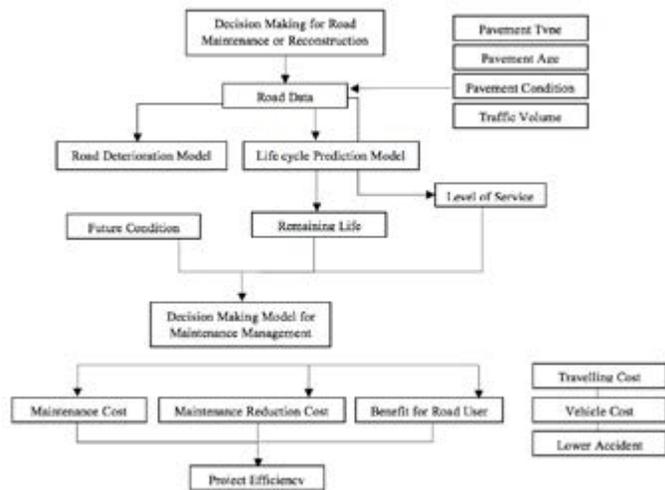
Figure 3: Guidelines for the Analysis of trucks route development.



**Decision Making Model for maintenance management**

Traffic volume in the future of the 24 routes will be predicted and used in the decision making model to decide rather it should be maintained or reconstructed. The approach of the decision-making model is shown in Figure 4, this model is more emphasised in how economical the road is. Also the decision making model for maintenance management used in this study is based on the concept of the Pavement Maintenance Management System (PMMS) which is the system used in the Department of Rural Roads, together with the determination of the level of service of the road.

Figure 4: The decision making model for the maintenance or reconstruction



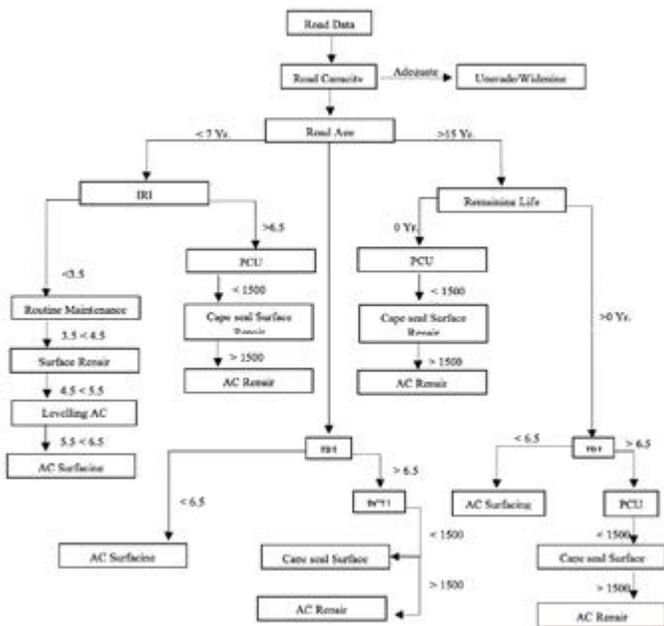
**Structuring Truck Route Network Development Plan**

After considering these models, a new structured model was made. The truck route network development plans is created to improve maintenance management system in the Department of Rural Roads. The model can be divided into four categories based on their suitability in economics and engineering.

The process of structuring the truck route network development plan is shown in Figure 6, with the following details.

- Plan ‘A’ Recovery Maintenance; this plan is for routine and periodic maintenance, which is to maintain the road to remain in good condition. This plan is suitable for the road with the truck volume less than 1,500 vehicles / day and traffic volume (AADT) less than 8,000 vehicles / day with the lifetime of 20 years.
- Plan ‘B’ Recovery Maintenance along with road structure restoration. This plan is initially to follow the maintenance Plan ‘A’, once the traffic volume increased to more than 2,000 vehicles per day then the road structure restoration will begin. This plan is ideal for the road with the number of trucks between 1,500 to 2,000 vehicles per day and the total traffic volume (AADT) less than 8,000 vehicles per day with the lifetime of 20 years.

**Figure 5: The decision making for the maintenance or reconstruction in PMMS.**

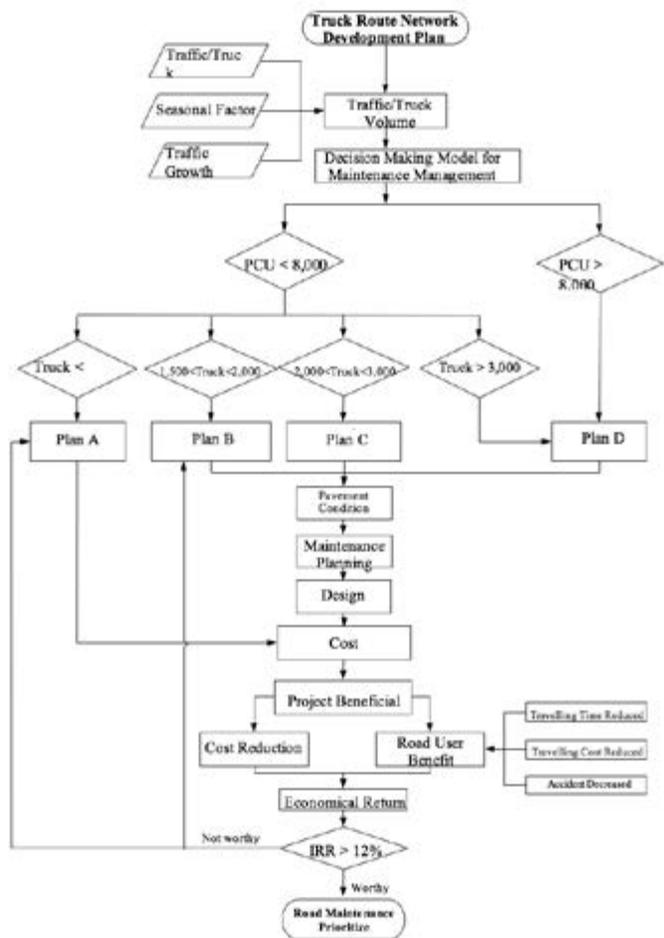


- Plan ‘C’ Road Structure Restoration and road widening. This plan is to reconstruct the structure of the road and also the road pavement during the truck volume of 2,000 vehicles per day, but when the number of trucks increased to 3,000 vehicles per day, or the total traffic volume (AADT) greater than

8,000 vehicles per day the road widening will be considered. This plan is ideal for the road, with the number of trucks between 2,000 to 3,000 vehicles per day, with traffic volumes less than 8,000 vehicles per day at the beginning of the lifecycle.

- Plan "D" Upgrade and Road widening (two to four lanes). This plan is suitable for the road with number of trucks more than 3,000 vehicles per day and the traffic volume (AADT) of over 8,000 vehicles per day. This plan will enhance the road capacity to accommodate current and future traffic volume effectively.

**Figure 6: Integrated Development Plan of the truck route network**



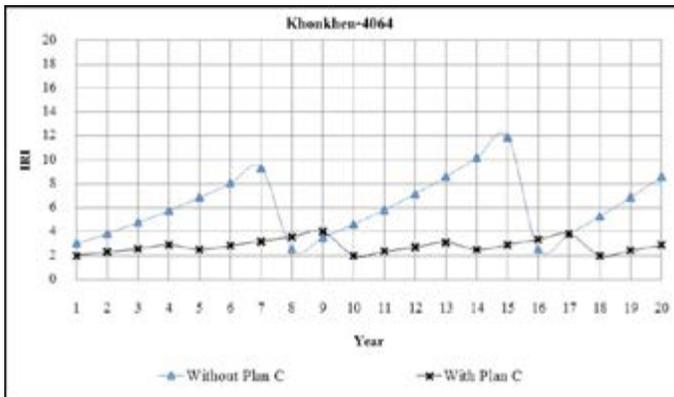
**RESULTS**

After applying the new model of truck route network development to the 24 studied routes, it was found that there are 14 routes considered in Plan ‘A’. There are six routes in Khonkhen Province, three routes in Mukdahan Province and three routes from Kalasin province.

There is one route is categorized in Plan "B", which is Kalasin-4035. This route is predicted to have an average International Roughness Index (IRI) of 2.77 if it is undergone with the Plan ‘B’.

There are four routes categorized in the Plan "C". Khonkhen-4003 (intersection with Highway 2109 - Ban Dong Bang) is one of the routes and it has a plan to be developed, this will make the IRI at the average of 2.72. Another example is Khonkhen-4064 (intersection with Highway 2109 - Na Fai), this route has identified the development plan to make the IRI at the average of 2.62, which shows in Figure 8. Figure 8 shows the comparison of IRI of the road with and without applying the new model.

**Figure 8: An example of IRI on Khonkhen-4064 under Plan 'C'**



From the 24 studied-routes, five routes are categorized in Plan "D" including route Khonkhen-1039 (intersection with Highway 212 – Baan Bang Saiyai). If it undergoes the plan throughout the scheme, the IRI will be at the average of 2.00. Also, the route Khonkhen-2009 (intersection with Highway 2 – Baan Samran) has been identified the development plan of the project, this will make the IRI at the average of 2.69 as shown in Figure 9.

Road Structural Design for using in the truck route development plan can be classified into three cases as follows.

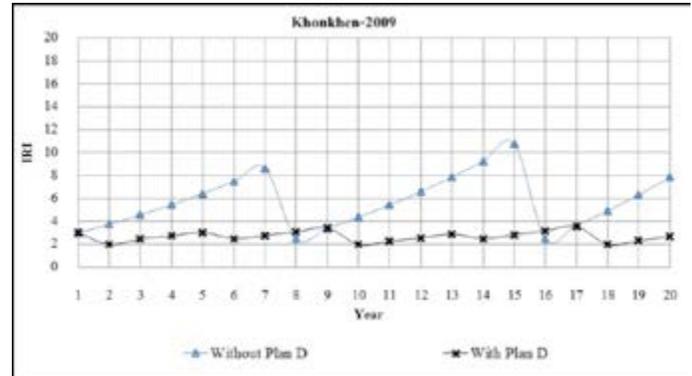
- The road design to renovate the structure is aiming to increase the strength of the structure to accommodate higher traffic volume and reduce maintenance cost. The reconstruction will be done on the original road embankment with 3%-5% additional of crushed stone and cement.
- The road will be designed to expand the pavement. The purpose is to increase the width of the road from 3 m to 3.5 m with hard shoulder's width of 0.5 m to 2.5 m. Also the new design will increase the strength of the structure to accommodate higher traffic volume.

## REFERENCES

1. Department of Rural Roads 2012, Feasibility study and design for permanent weighing station on rural roads.
2. Austroads 1992, Pavement Design: A guide to the structural design of road pavement, AUSTRROAD, Sydney
3. Rodrigo. 2008. "Rodrigo Archondo-Callao "Applying the HDM-4 Model to Strategic Planning of Road Works "TRANSPORT PAPERS THE WORLD BANK GROUP WASHINGTON, D.C.

- The new design to widen the road, aimed to upgrade the road from two lanes to four lanes to accommodate increased traffic volume. This may require additional land acquisition or expropriation for suitability of four lanes road. This road design will need a large budget to progress the project.

**Figure 9: An example of IRI on Khonkhen-2009 under Plan 'D'**



After the ten routes were classified into Plan 'B', 'C' and 'D' then they were analysed in the economical value of the project. The IRR of each route were considered and ranked. After analysing the IRR of each selected route then it was compared with the opportunity cost of capital of the World Bank, which is 12%, it was found the IRR of those route were more than the World Bank's opportunity cost, except Kalasin-4035 which had a negative IRR.

## SUMMARY

The study of the truck route development network for rural road maintenance and restructuring has indicated the routes that are crucial for goods transport and travel both domestically and internationally in the three provinces in the northeast of Thailand. The analysis of the 24 selected routes can be classified into four plans which consists of Plan 'A' Recovery Maintenance, Plan 'B' Recovery Maintenance along with road structure restoration, Plan "C" Road Structure Restoration and road widening and Plan 'D' Upgrade and Road widening (two to four lanes). Internal rate of return was also analysed and found that nine routes are worth for investment. Department of Rural Road will be applying the study in planning for appropriate maintenance management to handle with increasing traffic volume in the future.

# TRANSPORT COOPERATION ACROSS BORDERS: TOWARDS COMMON TRANSPORT POLICY IN THE WESTERN BALKANS

Author:

Mate Gjorgjievski, MA

Transport Law Expert

South East Europe Transport Observatory

Republic of Serbia

## ABSTRACT

The implementation of infrastructure projects with cross-border significance, and pursuing a common transport policy in the Western Balkans, which supports the regulatory and institutional reforms, have a substantial impact on the regional economies. They contribute to the opening of the regional markets and boosting the intraregional and international trade.

The transport policy and investment coordination on a regional level is conducted under the South East Europe Transport Observatory (SEETO), aiming to promote development of the multimodal SEETO Comprehensive Network, which now forms part of the Trans-European Transport Networks (TEN-T Comprehensive Network).

Parallel to the development of the Network, the countries from the region endeavour to carry out measures that transform and modernize their national transport system in line with the EU Transport Policy. The paper will look at these soft/horizontal measures that aim at alleviation of the regulatory and institutional deficiencies, thus bringing added value to the regional transport policy.

## INTRODUCTION

The multilateral regional cooperation is a general trend in the development of the inter-state relations in the second half of the 20th century, which is followed by the process of globalisation. In the South East Europe, or in the Balkans, to be more specific, this trend had come with a certain delay considering the happenings in the 1990's, which significantly slowed down the perspectives of the region for its rapid inclusion in the mainstream of the European integration process. The appearance of numerous new initiatives and platforms exerting multilateral regional cooperation, by the end of the last century and the first decade of this one, had slightly made up for that delay. In fact, it is the number and intensity in actions of these relatively new regional initiatives that mark a significant turning point from the period of open hostilities, conflicts and divergence of the peoples and countries in the Western Balkans region. (Lopandic D., Kronja J., 2010) (1)

Given the region's fragmentation, especially its infrastructure within the last decades, and the need for its re-integration, followed by European integration, many institutional structures have been established to guide and/or to facilitate the regional cooperation in certain fields. Even though the perspective of integration leads most of them to the EU, yet they have been constituted as

specific policy mechanisms, thereby featuring an authentic regional interest that has been recognized.

The main objectives of a common transport policy to be developed for the Western Balkans are threefold: 1) support of the political cooperation, 2) contribution to the economic growth and regional cohesion and 3) acceleration of the integration into the European Union. (SEETO, December 2011) (2)

## FEATURES OF THE TRANSPORT POLICY IN THE WESTERN BALKANS

In the past ten years or so, one can observe a positive trend of harmonisation of the segmented national transport policies and steady efforts towards coordinated regional transport policy in the region of Western Balkans. With the EU Common Transport policy seen as a major driving force for integration of the Western Balkans transport market and contributor to the future economic growth of the region, the institutional platform created under the South East Europe Transport Observatory (SEETO) plays a crucial role in bridging the gaps between the transport strategies of the states in the region coordinated at

regional level and the EU Common Transport Policy, the integration to which, remains their ultimate goal.

The evolving political context in which Croatia is basically fully integrated with the TEN-T network and EU Common Transport Market and Policy, while Montenegro has opened accession negotiations, to be followed by Serbia, gives even a greater impulse for the entire region to further enhance the regional transport planning, to address the outstanding issues in the complex reform process in many transport sectors and, by that, to reach satisfactory level of regional and EU integration in the field of transport. (SEETO, December 2012) (3)

### ***Institutional Cooperation in the Transport Sector***

The first most significant attempt to build the contours of a coordinated transport policy for the Western Balkans was the Memorandum of Understanding for development of the Core Regional Transport Network (MoU), signed in 2004 by the Governments of Albania, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, Serbia and (at that time the UNMIK representation of) Kosovo and the European Commission. Being a suitable policy area for enhanced cooperation and due to the fact that the EU considers regional cooperation as a prerequisite to future EU membership for the Western Balkan Participants, the main idea of the signatories was first and foremost to tighten up the intraregional coordination in transport infrastructure development and the cooperation with the European Commission and all important stakeholders in the transport area, including the donor community, as well as to secure a greater commitment for developing a regional transport policy.

The objectives defined under the MoU still represent the basics for further integrated development:

- Developing the main and ancillary infrastructure on the multimodal SEETO Comprehensive Network, which is the fundamental transport regional network defined in the region of Western Balkans
- Improving connections with and fully integrating the SEETO Comprehensive Network into the Trans-European Transport Network (TEN-T).
- Creation of a Multi-annual rolling action plan (MAP) in order to provide a platform for most efficient use of funds and know-how provided by public and private sources
- Fostering the most efficient and environmentally friendly transport modes at regional level
- Harmonising and standardising, wherever feasible, technical standards and regulatory or administrative provisions affecting the flow of transport in and across the region, in accordance with EU standards and directives

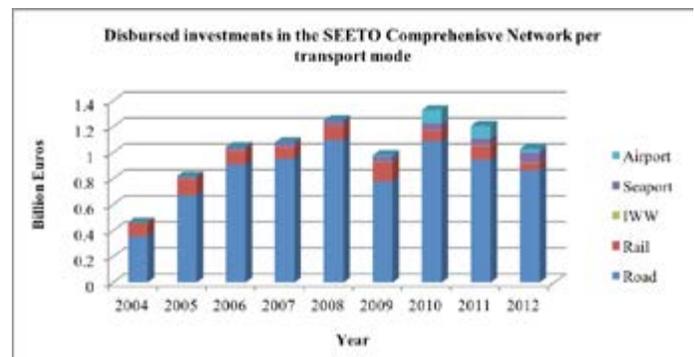
- Promoting and enhancing local capacities for the implementation of investment programmes, management and data collection and analysis in Regional Participants

**Figure 1: SEETO Comprehensive Network- all modes**



The annual disbursed investments in transport infrastructure have risen in absolute terms steadily from €0.4 billion in 2004 to €1.2 billion in 2008, presented in the Figure 2.

**Figure 2: Disbursed investments in the SEETO Comprehensive Network**



Road infrastructure remained the highest receiver (79%) throughout the whole period (2004-2012), although other transport modes, primarily airports and seaports have increased their share of investment overall. Disbursement share per transport mode is presented in the Table 1.

**TABLE 1: Yearly investment share per transport mode in the SEETO Comprehensive Network**

Year	Road	Rail	IWW	Seaport	Airport	Total
2004	77%	23%	0%	0%	0%	100%
2005	82%	15%	0%	2%	0%	100%
2006	87%	10%	0%	2%	0%	100%
2007	88%	8%	0%	3%	0%	100%
2008	88%	9%	0%	3%	0%	100%
2009	80%	15%	0%	4%	1%	100%
2010	82%	6%	0%	4%	8%	100%
2011	78%	9%	0%	5%	8%	100%
2012	84%	5%	0%	7%	3%	100%

Source: SEETO Investment Report 2012

Nevertheless, by far the largest expenditures every year has accounted road infrastructure, even though environmentally transport modes are promoted on the European level, but also in the national transport strategies of the Regional Participants, with regards to their major benefits. This is understandable to a certain point, given the fact that the road transport has the biggest share in the transport of goods and passengers. A positive output of these large investments in the road infrastructure is perceivable in 36% increase of roads in motorway or dual carriageway standards from 2006-2011, and in the rise of the road network condition (very good, good and medium condition) from 85% to 93% from the total network.

After a long period of underinvestment in the rail infrastructure, current ongoing and planned projects indicate that the revitalisation of the main rail lines has commenced. In addition, upon finalisation of the major road projects implementation expected in 2016, the focus will be shifted towards railways where €1.2 billion of committed funds are expected to be disbursed in the period 2013-2021.

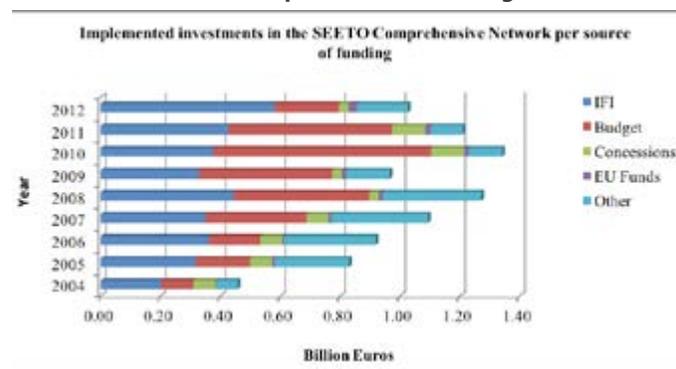
The concerning fact is that inland waterways continued to attract the lowest, marginal share of infrastructure investments albeit with moderately growing prospects in all three Regional Participants with navigable rivers (Bosnia and Herzegovina, Croatia and Serbia). Although among all transport modes, inland waterways are at least capital-intensive, best suited for carrying over-dimensional cargo, require minimum land acquisition and have low infrastructure costs, still, they recorded lowest disbursement (€30 million) that were focused on the improvement of inland navigation conditions and safety on the Danube River (77%) while the river Sava accounted significantly smaller share (23%).

Private sector driven investments have been noted in the seaports and airports sectors, where through different applied concession agreements, steady increase of

investments are reported, which resulted in expansion, reconstruction and modernisation of the terminals and adjacent infrastructure, notwithstanding that their capacities still meet current demands.

Looking at the infrastructure investments per source of funding, illustrated in the Graph 3, one can notice that IFI loans recorded highest share in total (41%) and that the annual disbursement of IFI loans has grown on 10% yearly average from 2009-2012. Out of the total loans, the European Investment Bank (EIB) predominantly operates in the region, even though disbursed loans from the European Bank for Reconstruction and Development (EBRD) grown by 50% between 2009 and 2012. (Investment Report, SEETO, 2013) (5)

**Figure 3: Disbursed investments in the SEETO Comprehensive Network per source of funding**



Another striking observation is the very low availability of EU grants since 2004, which coupled with the limited absorption capacities of the countries in the region, results in generally low exploitation of the EU assistance, when infrastructure development is concerned. It has to be mentioned that the EU pre-accession assistance programme for the Western Balkans is designed to follow the policy logic of the pre-accession, that is to primarily address the gaps in the administrative capacities and the lack of project documentation, as well as to create the positive conditions and climate for further attracting larger investments, being it from the Instrument from Pre-accession Assistance (IPA), or from other financial sources.

One of the most significant movement forward in the process of priority projects prioritization and thus in the cross-border cooperation, was the adoption of the Priority Project Rating Methodology which provides comprehensive overview on the quality of each individual project on the SEETO Comprehensive Network nominated by the Regional Participants for the SEETO Multiannual Plan (MAP), according to the agreed criteria. Therefore, the rated projects against the set of criteria in the Methodology enable not only to enhance further the credibility of the regional priority project list in front of

the external partners and potential investors, but also allow for a process of genuine cross-border infrastructure planning, as a major component of a common regional Transport policy.

### ***Policy (“Soft”) Measures***

Parallel to the development of the “hard” infrastructure projects, the countries in the region endeavour to carry out measures to reform their domestic networks, technical standards and operators through legal transformation and institutional restructuring. These so called “soft” measures have essentially horizontal character as they focus on the region as a whole, rather than on individual Regional Participant; they aim at alleviation of regulatory and institutional deficiencies of the national transport systems, intervening in areas where common regional efforts are likely to have greater impact than the efforts of a single state. Particularly these accompanying measures are those that bring added value of the coordinated transport policy.

The focus so far, but also in the future is expected to be streamlined under three major areas: 1) railway reforms, 2) border-crossing facilitation and 3) road safety. It is expected that the work to be done under these areas along with the national sector reforms, can bring impetus to move the region forward in catching up with the EU standards and level of services in the transport sector, in improving the operations and in making the market more efficient.

A recent initiative that is still under elaboration, has exactly the above mentioned as a primary guiding aim. It is a model for cross-border policy cooperation along selected multimodal axes (Corridors/Routes) from the SEETO Comprehensive Network whereby physical and non-physical bottlenecks are going to be pinpointed and plausible measures for reducing travel times and transport costs are going to be analysed and proposed. From those measures, implementation should be sought for the ones with the highest cost-benefit ratio.

This sort of “flagship” project should serve as a pioneer project in facilitating the traffic flows across the borders, the results of which can be then applied to the entire Network. In order to provide a competitive transport performance in the Western Balkans, quality assurance measures needs to be established, maintained and continually improved, corresponding to the expectations of operators, shippers, industry etc. on today’s transport services. The Project shall provide a multimodal competitive analysis in order to present relevant information for improving attractiveness of the axis and decreasing administrative barriers.

It is expected that the project will put higher political weight to the process of regional transport planning. The involvement of many authorities across the borders will

also add to this exercise in terms of technical cooperation, while the potential involvement of EU coordinator will transfer know-how in management of corridor-based projects. Finally, it will strengthen the political cooperation and build trust in the wider region, tremendously needed among the actors in the region when it comes to free trade and free movement of people.

The regional Strategy with horizon 2030 will follow the logic of the EU White Paper on Transport, thus can be perceived as a cornerstone of a more coherent regional transport policy. It is likely to contribute in overcoming the legal, administrative and institutional bottlenecks on long run which if not addressed on regional level, can create distortions and hinder the free flow of passenger and goods.

### **CHALLENGES AHEAD OF THE REGIONAL TRANSPORT POLICY**

In spite of the significant progress made in the past years in promoting, recognising and embracing the SEETO work in transport policy areas, as well as in identification of those areas where further interventions are needed at regional level, there is still a lack of demonstrable progress in specific priority areas of transport policy, as noted in the SEETO Annual Report 2012. Therefore, creating an institutional and regulatory framework monitoring mechanism for the compliance with the EU transport acquis communautaire and policy will certainly provide a common ground for better quality assessment and for instigating future policy measures.

Another weakness that holds up the conduct of a regional transport policy is the fact that SEETO lacks ‘teeth’ to appropriately enforce the regional actions and measures, which are currently reflected in the Multi-annual Development Plans and Ministerial Conclusions and further interfaced and conveyed to the national governments. For example, the closure of the Macedonian market for railway services to other operators apart from the national incumbent “Macedonian Railways”, against the agreed guidelines and accrued obligations deriving from the regional agreements is a classical example of the improbability of the SEETO mechanisms to enforce those rules, simply because no sanction is foreseen within the current system. (Gjorgjievski M., Belceva I. 2013) (6)

With the accession of Croatia to the European Union, and with the evolution ahead of the Western Balkans Investment Framework (WBIF), including the lending policy of the IFIs and the limited capacity for borrowing of the states, the political and investment climate in the region is changing its setting. It is becoming more important than ever to take fully into account the support of the policy framework when supporting infrastructure

investments, not only because that is a pattern to be followed by WBIF and the European Commission which introduces sector (policy) based approach in its revised Instrument for Pre-accession Assistance (IPA 2), but also because sustaining an ever-shrinking regional transport market to which Croatia until recently had had a significant part is impossible without fully integrating it into the enlarged EU market.

## CONCLUSIONS

As seen from the previous chapters, the features of the coordinated Western Balkans transport policy are looser than those of the EU Common Transport Policy. Nevertheless, it can be claimed that the Regional Participants by improving their intra-regional and inter-regional cooperation progressively harmonise the policies among each other and with the EU Transport policy, obtaining many common elements, which further harmonise their national transport systems. The future Multimodal Transport Strategy should also support the goals of a common transport policy in the Western Balkans.

The institutional umbrella of SEETO may be used to a greater extent as a platform where different national reforms and transport project planning are most effectively utilized due to the regional-driven and EU-driven approach of coordination, harmonization and streamlining. Consequently, the SEETO can provide shared solutions for some common problems in transport field. However, the future Transport Community Treaty elaborated previously is seen as a step further in achieving greater level of regional cooperation and cross-border transport planning.

The EU assistance in hard infrastructure projects remain low, and interventions are unlikely to have a noticeable macro effect, since only a small proportion of

the real investment needs identified within the national transport development plans and strategies is targeted. Nevertheless, if smartly used, the investment in knowledge and experience in this period of pre-accession would certainly pay-off later in improving the absorption of capital investments. Yet, the paper argues that the need for more capital investments rather than technical assistance projects which will leverage the economy as a whole and improve the credibility of the EU should be balanced and backed up with strong reform measures in the transport sub-sectors.

This must be put in the context of the evolving transport policy. The focus of that policy is inevitably to be directed towards market oriented legal and institutional framework aligned with the EU *acquis communautaire* and measures, which will complement and bring added value to the infrastructure development. In the absence of infrastructure investments, the sector-related reforms could incentivise the private sector investments and the generation of growth.

In the region where the development of the infrastructure is lagging behind, it is often forgotten that physical investments cannot be fully maximized, for instance, without sound management of the public utilities. No new motorway can optimize the benefits if no accompanying measures for border-crossing facilitation, performance-based management, maintenance and road safety are taken into due account. Neither a railway link can serve to the passengers and businesses if the railway transport is not performed in a liberalized way that allow for competition, quality of services and equal conditions for different modes of transport. It is a two-way relation-these complex undergoing reforms in the transport sector, which have great return of investments, can be speeded up if infrastructure investments are tangible and directed to well-coordinated projects with cross-border dimension. (Gjorgjievski M., Stankovic M, 2012) (7)

## REFERENCES

1. Lopandic D., Kronja J., 2010, Regional initiatives and multilateral cooperation on the Balkans, Belgrade
2. SEETO, December 2011, SEETO Comprehensive network development plan 2012, vol. I, Belgrade
3. SEETO, December 2012, SEETO Comprehensive network development plan 2013, Belgrade
4. SEETO, July 2013, Investment report 2012, Belgrade
5. (4)
6. Gjorgjievski M., Belceva I., April 2013, Regional cooperation: imposed pre-condition or added value in the economic and sector integration of the Republic of Macedonia in the EU – cases of transport, energy and environment, European Policy Institute, Skopje
7. Gjorgjievski M., Stankovic M., June 2012, IPA funds in the Republic of Macedonia: potential and constraints for the regional development, European Policy Institute, Skopje



# TRANSPORT CORRIDOR DEVELOPMENT IN DEVELOPING AND FRONTIER MARKETS: OPERATIONAL TECHNIQUES FROM AFGHANISTAN TO INCREASE ECONOMIC RATES OF RETURN FOR INFRASTRUCTURE INVESTMENTS IN MAJOR ROAD CONSTRUCTION PROJECTS

Author

Eric Dean Cook

Managing Director

Manchester Consulting Group

United States

[ecook@manchesterconsulting.com](mailto:ecook@manchesterconsulting.com)

Co-Authors:

Maryam Atmar

President

MAIH Group

United States

## ABSTRACT

Transport corridor projects are strategic investments in major engineering and construction works with the objective to boost regional economic growth and political-social stability. For transport corridor projects in developing and frontier markets, and particularly in rural areas, the construction demand often exceeds what local industrial capacity can ordinarily supply. This surge of construction economy provides a unique opportunity for underdeveloped and rural communities to leverage resources to scale infrastructure development in the transport corridor. A comprehensive investment strategy can maximize the civil return on the civil engineering input-output traditionally applied on a transport corridor project.

This paper will analyze the economic, social, and political impacts of recent transport corridor projects in Afghanistan. It will use data gathered over the course of the project delivery. It will use several metrics to measure road impact, including traffic volume, travel time, as well as costs of vehicle operator, freight transport, passenger fares, informal payments, food staples, and access to health care.

## INTRODUCTION

For thirty years, the people of Badakhshan Province—the most northerly, mountainous, and remote of Afghanistan’s 30 provinces—have fiercely fought, first the Soviets and then the Taliban. However, infrastructure in the region has been lacking. Commencing in June 2006 with field investigation and design activity, the Government of the Islamic Republic of Afghanistan and The United States Agency for Relief and Development (USAID) successfully

completed reconstruction activities for a \$125 million road reconstruction project in December 2010.

The existing dirt and gravel road that connected the provincial capital of Faizabad to the national Rign Road via Keshim, a small town to the west, was so badly eroded by the elements that the 103 km trip by car became dangerous and took an entire day. Trade between Faizabad and Keshim was minimal, the cost of goods exorbitant, and

medical care almost non-existent. Though geographically isolated, Keshim is strategically important, serving as a critical link to Kunduz, the Ring Road and other regions of Afghanistan and Central Asia. The United States Agency for International Development (USAID) committed to building the Keshim-Faizabad road which links this isolated provincial capital to the National Highway system as part of the Bonn Process' Afghanistan Compact, the London Conference's Afghanistan National Development Strategy and ratified by former President Karzai and the Government of Afghanistan.

Tackling a roadway that paralleled a raging river and wound through two mountain ranges, engineers designed a new road, incorporating the use of locally available materials and skills. Engineers also built a temporary roadway to maintain a passageway for those who needed to travel along the alignment during construction. In order to widen the existing road to accommodate two-way, two-lane traffic, engineers determined that it needed to remove 100 m high rock walls to create a sufficiently wide carriageway. The team cut and blasted 3 million cubic meters of rock and common excavation. In total, more than 1,300 controlled blasts were necessary for the rock excavation – a feat that required coordinating not only with the Afghan government and USAID, but with the International Security Assistance Forces as well.

**Figure 1: Controlled blasting operations were required to widen the roadway template to support two-lane traffic on the Keshim to Faizabad Road, Badakshan Province, Afghanistan**



The project team literally moved mountains to open the asphalt road in October 2010 before the first snowfall. The KF Road now features a two-lane, full-depth, asphalt-concrete road, with a seven-meter wide carriageway and paved shoulders built to AASHTO and FHWA standards. The asphalt riding surface combined with a new profile and grade alignment greatly increased mobility in the corridor with a 50% reduction in travel time resulting in traffic demand increases from 565 to 1,614 vehicles per day. The USAID road investment also yielded positive value added economic rates of return with passenger fares decreasing by 59 percent, freight costs decreasing by 400

percent, and access to health care increasing 12 percent. In addition, the project trained 177 Afghans engineers and construction administrators, employed 2,659 Afghans, and incorporated numerous local Afghan contractors and vendors to support private sector development.

**Figure 2: Former Afghanistan President Karzai visits with engineers building the Keshim to Faizabad Road, Badakshan, Afghanistan**



From a project specific viewpoint, the KF Road was a success; but does it provide us with a benchmark to plan future transport infrastructure development projects at the regional or even global context? More directly, what can we learn from the reconstruction efforts in Afghanistan about how to operationalize strategic investments in infrastructure development such as major roads and transport corridors. This paper looks at some of the lessons learned during implementation that we in the road building community can incorporate in our project design to increase or at least optimize economic rates of return on the limited capital available for investment in transport infrastructure.

### **Background**

The Keshim to Faizabad Road is a 103 km road in the Hindu Kush Mountains of northern Afghanistan which connects the district center of Keshim to the provincial capital city Faizabad thus strategically connecting Badakshan province to Afghanistan's national Ring Road. The newly reconstructed road provides almost 700,000 residents and businesses with a reliable, safe, all season, all weather transport facility that replaces an ancient dirt and gravel trace renowned for congestion, disruptions, and horrific traffic accidents in the mountainous terrain.

In 2006, USAID through a grant from the United Nations Office for Project Services (UNOPS) tasked their Afghanistan Infrastructure Reconstruction Program implementing consultant, The Louis Berger Group (LBG), Morristown, New Jersey, United States, to design and

construct a new two-lane, all weather, asphalt road. LBG prepared a modern highway design with nine bridges and over 600 drainage structures in accordance with U.S. AASHTO standards. In 2007, LBG awarded a construction services subcontract to the Samwhan Corporation, Seoul, Korea, to provide the plant, equipment, labor and materials to build the road. Given the limited construction capacity in the local and national market, LBG and Samwhan planned, hired, trained, and financed a local construction industry which not only supported the immediate construction needs, but provided an accelerated economic boost and capacity gain in Afghanistan's construction industry. In 2010, a team of transport economists from LBG conducted field interviews and surveys then prepared an economic study and assessment of the capital investment. The findings were generally positive with reduced travel times, increased commercial truck traffic counts, reduction in passenger fares and freight costs.

#### **Discussion: Economic return on investment**

As with most economic rate of return (ERR) determinations, the ERR for the reconstruction of the Keshim to Faizabad Road is subjective and certainly arguable on causality between the relationship between the road reconstruction investment and recent growth in economic activity. However, the anecdotal evidence does present a strong case that a \$190.62 investment per capita resulted in a high rate of economic return on invested capital. A summary of the findings presented by the LBG transport economists in the USAID Afghanistan Infrastructure and Rehabilitation Program Keshim-Faizabad Road Socio-Economic Post Project follows:

- Car traffic volume increased by 22 fold and two-axle truck traffic increased by 57 percent
- Travel times for the average passenger decreased by 75-80 percent
- Passenger fares decreased by 59 percent
- Freight costs decreased by 36 percent and average freight loads increased from 16 to 19 tons
- Daily freight volume increased by 24 percent
- 12 percent more people are making trips to health facilities
- Greater convergence in food commodities sold in Keshim and Faizabad markets

The study team utilized household surveys, business and market surveys, village elder surveys, and various vehicle operator surveys. ERR was proxied generally by seven economic indicators:

- Traffic volume
- Travel time
- Passenger fare costs

- Cost of freight transport
- Markets where goods sold
- Cost of food staples
- Access to health care

**Figure 3: Transport engineer conducts economic impact survey with local Afghan elders during construction of the Keshim to Faizabad Road, Badakshan Province, Afghanistan**



These economic indicators were nested within a higher framework at the strategic or national level in order to provide a methodology for performance monitoring and evaluation of the USAID infrastructure investment.

**Figure 4: Strategic objectives with supporting economic indicators used by the LBG Study Team to measure performance of the USAID infrastructure investment in the Keshim to Faizabad Road, Badakshan Province, Afghanistan**

Transport			
Indicator	Type of Indicator	Data Source	Reporting Frequency
IR 1.1: Rehabilitate the Rural Economy			
Cost of food staples	Outcome	Business surveys	Pre- and Post-Project
Markets where goods sold	Outcome	Household surveys	Pre- and Post-Project
IR 1.2: Increase Incomes Through Economic Growth			
Number of businesses	Outcome	Business Surveys	Pre- and Post-Project
Shopkeeper monthly sales	Outcome	Business Surveys	Pre- and Post-Project
Household income	Outcome	Household surveys	Pre- and Post-Project
IR 1.3: Expand and Improve Access to Economic Infrastructure			
Travel items	Outcome	Driver/passenger surveys	Pre- and Post-Project
Vehicle operator costs	Outcome	Driver/passenger surveys	Pre- and Post-Project
Passenger fare costs	Outcome	Driver/passenger surveys	Pre- and Post-Project
Cost of freight supplies	Outcome	Freight company surveys	Pre- and Post-Project
Volume of freight	Outcome	Freight company surveys	Pre- and Post-Project
Cost of informal payments for road use	Outcome	Driver/passenger surveys	Pre- and Post-Project
IRF 3.1: Increase Access of Women and Children to Basic Health Services			
Travel time to health clinics	Outcome	Household surveys	Pre- and Post-Project
Frequency of visits to health clinics	Outcome	Household surveys	Pre- and Post-Project
IR 3.2: Increase Access to Quality Teaching and Suitable Learning Environments			
Rates of school attendance	Outcome	Household surveys	Pre- and Post-Project

The performance monitoring and evaluation framework was key to building a solid baseline and comparative data to determine an ERR and assess the infrastructure investment. A detailed discussion by the LBG Study Team can be found in their Post-Project Report referenced below. The key in this paper is to highlight to future project implementers and project managers, typically engineers, that economists and supporting tasks such as monitoring and evaluation must begin their work early in the project lifecycle if not at the onset of project kickoff to ensure the overall economic, social, and financial objectives are achieved.

***Conclusion: Operational techniques for engineers and construction managers to optimize ERR***

For civil engineers and construction managers, it is important to appreciate and understand the greater context on why large capital investments are made in road construction projects. It is more than just connecting dots on a map and ensuring technical standards are met and project compliance adheres to the triple constraints of quality, time, and cost. Given contemporary constraints in the availability of infrastructure finance, recognizing the need to achieve a positive ERR is a good start. However, real value added is finding opportunities to increase ERR during project implementation, or in effect operationalizing transport infrastructure investments to accelerate local economic development and growth.

Based on the feedback and experience building roads in Afghanistan, such as the Keshim to Faizabad Road, four lessons learned are offered for consideration to operationalize strategic road investments:

***Operational Technique #1: Assess and incorporate local materials and construction resources during the design process to maximize local participation.***

In 2006, the Afghanistan Investment Support Agency (AISA) had over 1,000 local Afghan companies registered in the Afghanistan construction industry. However, a prequalification process which included an Afghan Road Builders Conference to gauge real capacity in the construction industry indicated only a few of those firms had the financial capacity to manage a million dollar construction project let alone the \$100M plus KF Road contract; and no firm with the technical experience to build the KF Road to international standards (AASHTO). For the KF Road reconstruction project, the decision to engage international general contractors to perform the construction services was the most risk adverse course of action. This decision bore the criticisms of a populist lament to award construction contracts to local companies notwithstanding many of such critics did not have the experience or background to truly understand the project

dynamics. Local construction companies were just not ready technically nor financially to deliver the works. That said, a very robust subcontracting procurement strategy was implemented which did support local contracting while at the same time supporting technology transfer between the general contractor and the various local Afghan subcontractors. For example, due to the dangerous conditions of operating heavy machinery in the mountain section of the KF Road, Samwhan Corporation conducted the rough excavation until the benches and templates were wide enough to safely task local companies to complete the works. Other examples included fine grading and steel beam slip-critical bridge connections where international tradesmen led local Afghan crews resulting in an on-the-job training and skills development during construction. As a result, this local subcontracting strategy provided a safe and effective capacity building venue for local construction companies to learn technical practices from experienced engineers while increasing their financial capacity with a steady source of cash flow and working capital.

**Figure 5: Local Afghan construction workers building concrete causeway on the Kandahar to Herat Road in Afghanistan**



***Operational Technique #2: Utilize local hiring practices and subcontract procurement policies that support a strategic interest to improve local construction capacity.***

Like most of the recently built and reconstructed roads in Afghanistan, the KF Road surface utilized hot-mixed asphalt concrete pavement for the base course and wearing course. Considerable experience and quality control are required to build an asphalt road, particularly when using specialized mix designs such as polymer-modified bitumen. Further, any successful paving program requires a mature construction industry complete with a requisite supply of quarries, crushed aggregate facilities, asphalt batch plants, and paving contractors. Not only is this construction industry capacity needed to build roads, but also to maintain them. Such considerations

must be considered by infrastructure planners and project managers to ensure due participation of local industry in the construction delivery of a major road construction project. This will ensure a ready supply of capacity is available to maintain the road in the future while also providing industrial capacity to build feeder roads to further economic growth.

**Figure 6: Polymer-modified hot-mixed asphalt paving the Kandahar to Herat Road in Afghanistan**



**Figure 7: Hot-mixed asphalt pavement plant on Keshim to Faizabad Road, Badakshan Province, Afghanistan**



**Operational Technique #3: Accelerate economic growth in the construction industry with formal capacity building of local engineers, tradesmen, and supporting businesses.**

A formal capacity building strategy improves upon informal technology transfer resulting from on-job-

training and local subcontractor hiring. Ideally, a formal training program is designed to ensure individual skills are developed that support a greater collective capacity, i.e. a crew or task capacity. For example, asphalt paving as a collective construction task requires placement, compaction, testing, batching, crushed aggregate production, quarry operations, trucking, and maintenance operations. Each of these collective tasks are further broken down into sub-element tasks to the individual level. Then, a formal training plan can be developed that assigns and tracks local participation and performance, at the individual level, leading to an overall collective task capacity.

Capacity building in project overhead tasks such as project management, quality control, and finance should also be considered. For example, local Afghan workers and subcontractors evidenced rapid gains in construction skill development. However, constraints remained on their growth potential due to limited experience in project scheduling, construction coordination, procurement, and quality control. Even greater was the growth constraint due to limited working capital and access to finance in an inefficient local banking market. Project planners and project managers should consider using tools such as partnering, guarantees, and direct payments to directly engage with local contractors and subcontractors to help match financial capacity to operational capacity.

**Operational Technique #4: Measure the economic impact, assess it, and then repeat.**

One of the constraints with the KF Road Post-Project Report was the baseline study was performed at the mid-point of the construction process. At that time in the project schedule, a significant amount of rough grading had been accomplished supporting two-way traffic in the mountain zone, a first for this route. Additionally, several kilometers of roadway fine grading, crushed aggregate paving, and some limited asphalt paving in urban areas had been accomplished which was already yielding economic improvements before baseline surveys could be accomplished. The lesson learned here is to establish a pre-construction economic baseline no later than during the design phase of the project. Then, conduct periodic impact assessments through construction with a final post-construction survey to capstone the data to assess the project's ERR.

## SUMMARY

The Keshim to Faizabad Road construction project in Afghanistan yielded positive economic rates of return on several socio-economic indicators ranging from reduced travel times and vehicle operator costs to consumer good prices and infant mortality rates. As such, from

a strategic investment viewpoint, the KF Road was a successful investment, but the question remains if it was an optimized investment from a construction capacity level? True, as with many recent construction projects in Afghanistan, local capacity building transpired through local hiring, training, and subcontracting opportunities. Yet, there is room for improvement in future investments in projects like the KF Road. Large strategic investments in major road transport corridors are infrequent so planning to leverage such capital calls for project planners and project managers to operationalize the investment

using techniques to build local construction industrial capacity during this limited time of market growth.

### *Acknowledgements*

The authors wish to recognize the project sponsor, United States Agency for International Development (USAID), and the team of transport economists from The Louis Berger Group who conducted the original socio-economic study for the Keshim to Faizabad Road construction project and with whom one of the authors worked alongside with to deliver this strategically important road for the people of Badakshan, Afghanistan.

### **REFERENCES**

1. The Louis Berger Group, Inc, and Black & Veatch Special Projects Corporation, (May, 2011). Afghanistan Infrastructure and Rehabilitation Program, Keshim-Faizabad Road Socio-Economic Post-Project Final Report. Prepared for the United States Agency for International Development.
2. Cook, Eric; Hoehner, David, and Dharan, Anjali (March 2011). Can Road Construction Play a Strategic Role in Post-Conflict Recovery and Foreign Assistance Efforts? An Economic Impact Analysis of the Keshim to Faizabad Road in Afghanistan. Prepared for the International Transportation Economic Development Conference, 2011.

# UIRNet: THE ITALIAN NATIONAL ITS PLATFORM FOR INTERGRATED LOGISTICS

Author:

Leonardo Domanco

TTS Italia

Rome, Italy

leonardo.domanico@ttsitalia.it

Co-Authors:

Olga Landolfi

TTS Italia

olga.landolfi@ttsitalia.it

Rodolfo De Dominicis

UIRNet

dedominicis@uirnet.it

Nicola Bassi

UIRNet

bassi@uirnet.it

## ABSTRACT

Italy is one of the European countries with the highest traffic density both in freight and passengers transport. Moreover, roads are the main transport modality used both for freight and passenger transport, despite the geographical features of Italy should favour other transport modes. Therefore, high level congestion, safety and security issues, as well as environmental pollution characterize the Italian transport system.

To make more efficient, secure and safer the national logistics system, at the end of 2005 the Italian Ministry of Infrastructures and Transport established UIRNet company with the aim to create, control and manage the ITS National Logistics Platform.

The paper deals with the ITS architecture of the ITS National Logistics Platform, the services that have been implemented for all the relevant stakeholders involved in the logistics supply-chain, the benefits obtainable and the next steps of the Platform.

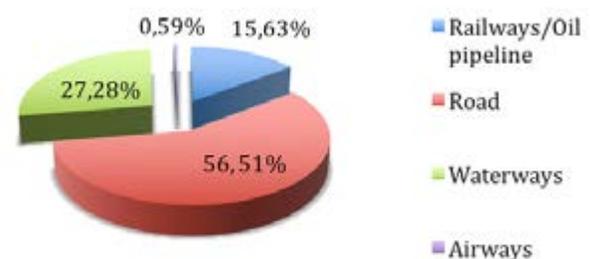
## TRANSPORT IN ITALY

Italy is one of the European countries with the highest density of internal traffic that is uneven distributed across its transportation network that includes 278 ports, a rail network of 16.752 km, a road network of 255,980 km, a highway network of 6,751 km (5,724.4 km toll road) and 44 airports.

In 2014 the total cargo traffic of national carriers with origin and destination within Italy, and travelling distances over 50 km was more than 176 billion tons-km/year, with 56.51% of the demand focused on the road, while the rest was distributed between rail / pipeline (15.63%) and inland waterways (27.28%). The percentage of freight transport by air is instead irrelevant (0.59%). Furthermore, rail and pipeline traffic, the share of international traffic carried

out on national territory, are comprised in the data above (see Figure 1).

Figure 1 – Modal Shift in 2014 (% of Millions of ton-km)



Considering that for passengers transport there is the same modal shift, this data clearly outlines the absolute preference for road transport over other modalities in Italy. Unfortunately, this preference is not matched by the infrastructure currently in place, which is not yet adequate, compared to the heavy demand. This shortfall results in extensive negative externalities, in terms of congestion, environmental pollution and safety.

## FREIGHT LOGISTICS IN ITALY

Logistics is a vital and crucial sector for the national economy of the country.

The ability of a country to maximise profits on its production and to be competitive on the global arena are strictly connected to its capacity of optimize the distribution process, and thus to its logistics sector.

The most recent statistics released by the Italian Ministry of Infrastructure and Transport (2013-2014) highlight that the total transported goods in 2014 are around 176 billion ton-km, with a decrease of 25,7% compared to 2005. The available data for the 2014 (as reported in Table 1) confirm the prevalence of road transport respect the other modes with the following value of ton-km and percentage:

- 99.649 Millions of ton-km (56.51%) via road
- 48.100 Millions of ton-km (27.28%) via waterways
- 27.556 Millions of ton-km (15.63%) via railways and oil pipelines
- 1.040 Millions of ton-km (0.59%) via airways, a very limited percentage

**Table 1 – Modal shift overview (Millions of ton-km)**

Transport modes	Year 2005	Year 2010	Year 2014
Waterways	46.928	53.291	48.100
Railways / Oil Pipeline	33.668	28.333	27.556
Road	155.872	134.261	99.649
Airways	982	1.013	1.040
<b>Total</b>	<b>237.450</b>	<b>216.787</b>	<b>176.345</b>

Therefore, freight transport by road is the mode more used respect to the others. The main reasons can be summarised as follows:

- The average distance for freight transport in Italy is less than 300 km and therefore the road mode is the most efficient (main reason)
- The inefficiency of intermodal transport process: often it is occurred that wagons/trailers were missed during the modal change phase and also usually the modal exchange takes a lot of time

- The trade associations of haulage freight transport are very strong and obtain subsidies/contributions for toll and fuel costs
- The challenge in Italy is to improve the freight transport system, favouring a more balanced modal shift in favour of other modes respect to roads

## THE ROLE OF ITS FOR ENHANCING LOGISTICS

In order to address the challenges of the increasing demand for transport of goods, and to be in line with other European countries, the Italian Ministry of Infrastructure and Transport has stated the need for Italy to rethink the whole transport network.

The aim is to deal with transport as an “integrated system”, where information, management and control operate in synergy, optimizing the use of vehicles and infrastructure and of the existing logistics platforms in a multimodal manner. This is possible only through the extensive use of Intelligent Transport Systems (ITS).

In particular as regards logistics, the Ministry of Infrastructure and Transport in 2005 established UIRNet company with the aim to create, control and manage the ITS National Logistics Platform.

Such need is reported in the National Action Plan on Intelligent Transport Systems adopted by the Ministry of Infrastructure and Transport as requested by the ITS Directive 2010/40/EU. In such Plan, Priority Area 2 Continuity of ITS services for the management of traffic and goods transport specifies that “the objective that it is necessary to achieve is the possibility of organizing integrated multimodal mobility services for people and for freight that enable the planning and management of movements in an informed and personalized way without solutions of continuity from the point of origin to the destination, using all available ways efficiently and securely through open and operable integrated platforms”.

The National ITS Logistics Platform is the implementation of what outlines in the National ITS Action Plan.

## UIRNET: THE ITALIAN ITS LOGISTICS PLATFORM

UIRNet is a company under the control of the Italian Ministry of Infrastructure and Transport that has the mission to create, control and manage the ITS National Logistics Platform.

The National Logistics Platform has been defined in order to improve the overall efficiency and safety of the Italian logistics network favouring the interconnections of modal interchange nodes (ports, freight villages, goods centres and logistic plates).

The scope of UIRNet is to create a network integrating the complex chain of transport and logistics in a simple way. Such an integration can be achieved through an ITS Platform that can interconnect the main actors of the Italian logistics system, allowing the coordination of the information flows and of the related processes.

The National ITS Logistics Platform has been implemented to offer services to all logistics operators, acting as interconnection platform for data and related processes. Nowadays, the ITS Logistics Platform is focused on the road freight transport and aims at managing the interactions between transport companies and nodes operators (customers, warehouses, terminal operators, shippers, MTO) and offers services to many actors of the logistics system (transport companies, infrastructures managers, production companies and public authorities).

### UIRNET SYSTEM ARCHITECTURE

The UIRNet Platform focuses on the use of web-oriented data exchange solutions (Simple Object Access Protocol – SOAP and Extensible Markup Language – XML) and it allows the full integration with other external systems.

Furthermore, the ITS Platform thanks for its technical features, is flexible to interface with other platforms. All the platform functions are fully accessible via internet by mobile or fixed terminals. The adopted communication infrastructure ensures a high level of security and protection against unauthorised access by a specific DMZ (De Militarized Zone). Disaster recovery policies are performed through data redundancy and the management of hazardous events. All the information transferred between on-board terminals, UIRNet Platform and nodes, transit through a private gateway ensuring both protections against interceptions and data integrity.

Data centre: it is the centre of the ITS Logistics Platform where the hardware and applications for service delivery are set up. It has an extremely scalable architecture to guarantee the necessary upgrade. The data centre is characterised by:

- High-speed connection through dedicated data lines
- Web oriented architecture to maximise the interoperability, the access capabilities to the platform and the fully integration with other platforms (logistics, institutions)
- Secure access and data storage due to a dmz network segment

Situation room: it is the monitoring and control centre where all data are collected, elaborated and visualised. The structure manages all anomalies and emergencies that UIRNet users might incur. It acts as a common interface between the institutional bodies responsible for security and it also defines the code of conduct in case of emergency. The situation room is connected through a dedicated line with the data centre. It also supports different type of communications (mobile, fax, e-mail, web...).

Communications gateway and on-board devices: they respectively represent the mobile access point and the set of field terminals, or on board units. The communication gateway is connected to the data centre and represents its gateway through the mobile network. Thus, the communication gateway considers the data centre as a data convergence point and an information dispatcher. On board devices are those that the UIRNet Platform user can adopt to trace vehicles, monitor goods (especially dangerous goods) and manage logistics activities. They could be simple on board units or more advanced devices that can perform more complex operations.

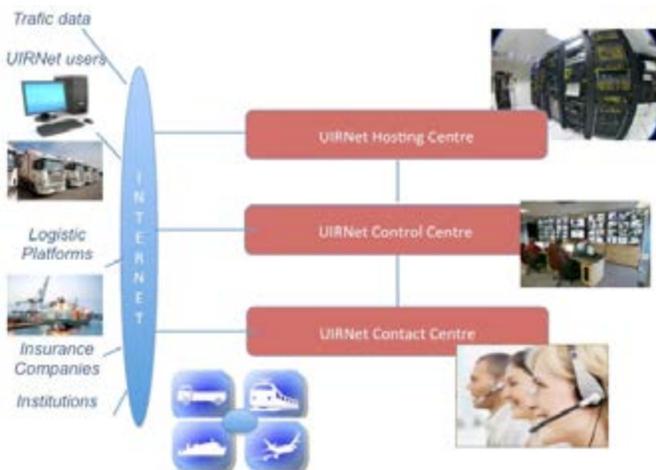
Contact centre: it is the main reference point for both subscribed users, and prospective users (i.e., registration management and accounting). The contact centre is connected to the data centre with a dedicated line. Its communications are aimed directly to the users/subscribers (voice communications) or transit via data centre. The contact centre supports different types of voice and data communications (mobile, fax, e-mail, web).

### ***UIRNet Platform is divided in two main functional areas:***

UIRNet Alert area, which includes the traffic information services addressed to assist the freight route, up to its delivery. It implements the information system, data exchange, fleet control and monitoring tools, load and dangerous goods management systems

UIRNet web services, which support other services like e.g. the meeting between supply and demand and the workflow management of the entire logistics processes

**Figure 2 - UIRNet system architecture**



The Platform architecture (see Figure 2) is composed by the following elements:

(including document management and transport operations management, etc.).

As regards macro services, they are built over a combination of basic functions and modules. Every module is interconnected to the others via a specific middleware.

### ***UIRNet portal (see next section)***

Alert management system: it manages the information about vehicles and road and traffic conditions. The system manages the complete list of notifications and pre-alarms that can be collected by the service centre (based on automatic alarms) or manually sent by 'push' mode. More precisely, it manages the following different types of alarms/messages:

- Automatic notifications about transported goods (time and physical parameters like e.G. The goods' temperature)
- Automatic alarms in case of route deviations (corridor monitoring)
- Automatic alarms concerning the crossing of pre-determined areas (geo fencing)
- Information about traffic and weather conditions
- Alarms and information manually sent by users via contact centre

Geo-referencing system: it is an application of a geographic information system. It is accessible via web and it allows the visualisation of the vehicles position, traffic conditions (represented by icons) and other events (congestion, road work...). It also allows the representation of any other geo referenced objects.

Middleware integration with third party applications: it is the communication module dedicated to the integration of applications with legacy systems of institutions and logistics operators. The integration middleware is the first level interface between the platform and the external world, represented for example by institutional systems, public and private logistics platforms, ITS and fleet management systems. Due to the technologies adopted, this system can support data exchange with other platforms by standard services oriented architecture protocols.

Data warehousing system and reporting: it refers to the application that allows to periodically extract the aggregate data about traffic movement and logistics.

CRM system: this module performs data collection, management and consolidation of information related to the interactions between the UIRNet Platform and its users. CRM system includes a set of facilities for the front-office (external relations) and for the back-office. It allows data analysis, data measurement and performance estimation.

Mobile communications services and billing: it includes application platforms to support communications with mobile networks. It includes voice communications solutions and data communications solutions.

### ***Web services components:***

- Booking system: the system allows transport operators to book different services and to send confirmation via web or mobile device
- Document management: such system enables the integrated and automated exchange of documents among all the relevant stakeholders involved in the transport operations, in order to guarantee a high level of security and confidentiality of the information

### **UIRNET WEB PORTAL**

UIRNet web portal is the most direct access point to the services and for the registration of new users. It makes the promotion and dissemination of information regarding the offered services simply and efficiently. Moreover, it enables interaction and communication with users thanks to a variety of services, such as:

- Horizontal services: these are highly interactive services available on the portal and aimed at favouring communications and interaction among UIRNet registered users, logistics operators and other stakeholders;
- Application services, or vertical services: this group includes services offered by a unique user interface. They allow consultation and/or upgrade of the database (transactions) directly via internet-extranet. Such services are based on the realization of specific software modules that give access to the information in a simple way, allowing also other data operations. The system allows users to plan a trip (referred to as 'mission') and its route, the duration can be automatically estimated. The users can see a complete data regarding their past and current activities, and can quickly set up data analysis and reports.

### **CONCLUSIONS**

The paper presented an overview of the Italian freight transport and UIRNet ITS Platform. The Platform allows single players to benefit from advanced solutions based on real-time information concerning traffic and road conditions, vehicles and goods.

The adoption of the National ITS Logistics Platform can maximise the efficiency and the quality of the Italian logistics sector. UIRNet ITS Platform gives to the entire world of logistics a new strategic opportunity to improve

the efficiency and security of the entire supply chain. This has a significantly positive impact on the national economy in terms of increased competitiveness, security, environmental benefits, as well as opportunities for internationalisation.

UIRNet initiative will greatly improve the efficiency and safety of the Italian freight transport: the system is tailored to address the territory characteristics and each stakeholder needs, optimizing each process, maximising assets and minimizing negative externalities.

Further developments of UIRNet will allow the pursuing of significant strategic objectives. This is expected to have huge impacts in terms of:

- Increasing national economic competitiveness through the increase of intermodal, the development

of freight villages in terms of services and market positioning, as well as the integration with other logistics systems at national and international level

- Increasing safety as UIRNet initiative can be used to monitor and control the transport of goods, especially dangerous goods
- Internationalisation through the integration with European and Asian ports, and even integration with any other logistics projects worldwide
- Decrease of environmental impact through the development of intermodal transport, the management of goods and of hazardous waste
- Therefore UIRNet is expected to become a pillar in the field of logistics and transport

## REFERENCES

1. Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport
2. Italian ITS Decree of the 1st February 2013 on the diffusion of ITS in Italy
3. Italian ITS Action Plan adopted and published by the Ministry of Transport the 12th February 2014
4. Ministry of Infrastructure and Transport (2013-2014) transport statistics



# IRF EXECUTIVE COMMITTEE

## Chairman (2015-2017)

Abdullah A. Al-Mogbel  
Ministry of Transport, Kingdom of Saudi Arabia

## Vice Chairmen (2015-2017)

Jeffrey R. Reed  
Valley Slurry Seal Company

T. Peter Ruane  
ARTBA

Thomas Topolski  
LB International

## Treasurer (2015-2017)

Lester Yoshida  
Parsons

## President & CEO and Secretary

C. Patrick Sankey  
International Road Federation

## Elected Directors to Serve on Executive Committee (2016-2017)

Hermanto Dardak  
REAAA | Indonesia

Robert Jaffe  
Consystec | USA

Chris Sanders  
Lindsay Transportation Solutions | USA

Fernando Vilhena  
Armc Staco | Brazil

Dan Hickey  
3M | USA

William Russell  
EDI | USA

Omar Smadi  
Iowa State University | USA

Kiyoshi Watariguchi  
Maeda Corporation | Japan

## IREF Chairman (2014-2017)

Essam Radwan  
University of Central Florida

## Past Chairman

Brian J. Stearman  
Delcan Corporation

## DIRECTORS (2014 – 2016)

AASHTO  
Frederick "Bud" Wright  
USA

Saudi Binladin Group  
Bakr Binladin  
UAE

AECOM  
Matthew G. Cummings  
USA

Saudi Consulting  
Services  
Tarek Al-Shawaf  
Saudi Arabia

Argentina Road Assoc.  
Miguel Angel Salvia  
Argentina

Spanish Road Association  
Jacobo Diaz  
Spain

Ministry of Works\*  
Essam Khalaf  
Kingdom of Bahrain

Sumitomo Mitsui Constr.  
Co

Chinese Taipei Road  
Federation  
Meng-Fen Wu  
Chinese Taipei

Akio Kasuga  
Japan

Dar Al-Handasah  
Bashar Rihani  
Lebanon

Swarco  
Carl McCollum  
USA

DBI  
John LeFante  
USA

Traffic-Tech  
Husam Musharbash  
Qatar

EDI  
William Russell  
USA

Troxler Electronic  
Laboratories  
William F. Troxler, Jr.  
USA

Japan Road Contractors  
Assoc.  
Kikuo Hayashida  
Japan

Min. of Public Works &  
Housing\*  
Ibrahim Al-Wahabi  
UAE

Korea Expressway Corp.  
Sung-hwan Kim  
South Korea

University of Central  
Florida  
Essam Radwan  
USA

Kuwait MoPW  
Abdulaziz Al-Kulaib \*  
Kuwait

The World Bank  
Marc Shotten  
USA

Lindsay Transpo. Group  
Chris Sanders  
USA

Xerox  
Richard Harris  
United Kingdom

Min. of  
Communications-SCT  
Gerardo Ruiz Esparza  
Mexico

Zydex Industries  
Ajay Ranka  
India

\* Denotes Ex-Officio  
Member

## DIRECTORS (2015 – 2017)

3M  
Dan Hickey  
USA

Canada

Armc Staco  
Fernando Vilhena  
Brazil

REAAA  
Hermanto Dardak  
Malaysia

ARTBA  
Pete Ruane  
USA

Ministry of Transport  
Abdullah Al-Mogbel  
Kingdom of Saudi Arabia

Avery Dennison  
Patricia Calle  
Colombia

South African Road  
Federation  
Representative TBA  
South Africa

CDM Smith  
Ricky Ward  
USA

Transpo Industries  
Michael Stenko  
USA

Consystec  
Robert Jaffe  
USA

Trinity Highway  
Products  
Gregg Mitchell  
USA

Gatso  
Philip Wijers  
Netherlands

Ministry of Transport,  
Communications and  
Maritime Affairs  
Ismail Kartal  
Turkey

Horizon Signal  
Technologies  
David Krahulec  
USA

University of Nebraska

Ministry of Public Works  
Waskito Pandu  
Indonesia

Ronald Faller  
USA

Iowa State University  
Omar Smadi  
USA

Valley Slurry Seal Co.  
Jeffrey R. Reed  
USA

LanammeUCR  
Luis Loria  
Costa Rica

\* Denotes Ex-Officio  
Member

LB International  
Thomas Topolski  
France

Maeda Corporation  
Kiyoshi Watariguchi  
Japan

Parsons  
Lester Yoshida

## DIRECTORS (2016 – 2018)

Arizona State University  
Kamil Kaloush  
USA

Ministry of Public Works  
Jose Miguel Ortega |  
Chile

Argentina Road  
Association  
Miguel Angel Salvia  
Argentina

Ministry of Public Works  
Abdullah Al-Hassan |  
Kuwait

CDM Smith  
Ricky Ward  
USA

Ministry of Works

China Road Federation  
Joe Y. Chou  
Chinese Taipei

Essam Khalaf | Bahrain

Consystec  
Robert Jaffe  
USA

Saudi Binladin Group  
Bakr Binladin  
Saudi Arabia

Dar Al-Handasah  
Bashar Rihani  
Lebanon

Saudi Consulting  
Services  
Tarek Al-Shawaf  
Saudi Arabia

DBI  
John LeFante  
USA

Sumitomo Mitsui  
Construction Co.  
Akio Kasuga  
Japan

Eberle Design Inc.  
William Russell  
USA

Swarco  
TBN  
Austria

Iowa State University  
Omar Smadi  
USA

Traffic-Tech  
Husam Musharbash  
Qatar

Japan Road Contractors  
Association  
Takeo Miyoshi  
Japan

University of Central  
Florida  
Essam Radwan  
USA

Korea Expressway Corp.  
TBN  
South Korea

Troxler Electronic  
Laboratories, Inc.  
William F. Troxler, Jr.  
USA

Lindsay Transportation  
Solutions  
Chris Sanders  
USA

The World Bank  
TBN  
USA

Ministry of  
Communications  
Raul Murrieta  
Mexico

Xerox  
Richard Harris  
United Kingdom

Zydex Industries  
Ajay Ranka  
India



**T**he **INTERNATIONAL ROAD FEDERATION** is a full-service membership organization founded in Washington, D.C. in 1948. The IRF is a non-governmental, not-for-profit organization with the mission to encourage and promote development and maintenance of better, safer and more sustainable roads and road networks around the world. Working together with its members and associates, the IRF promotes social and economic benefits that flow from well-planned and environmentally sound road transport networks and advocates for technological solutions and management practices that provide maximum economic and social returns from national road investments.

*"Better Roads. Better World."*

