



Universal highway management system and its impact on safety



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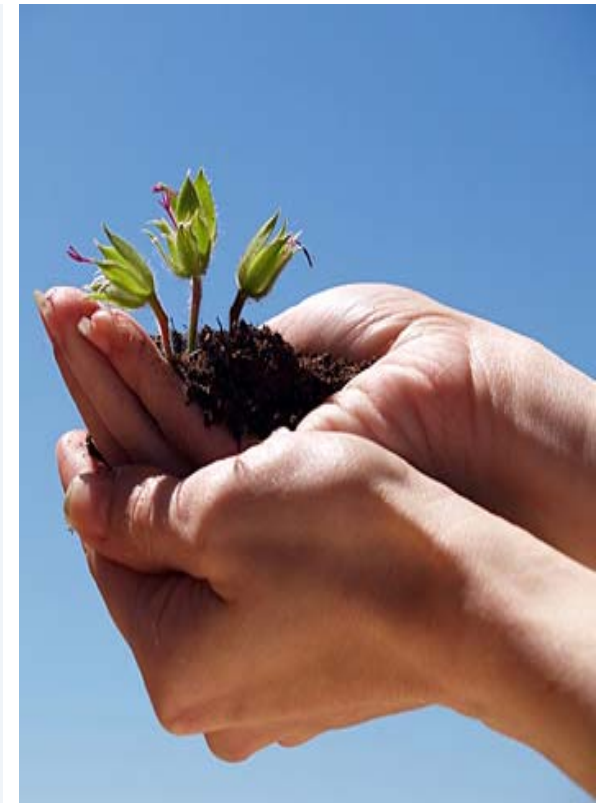
Ing. Marcos Michaelsen, Ph.D.



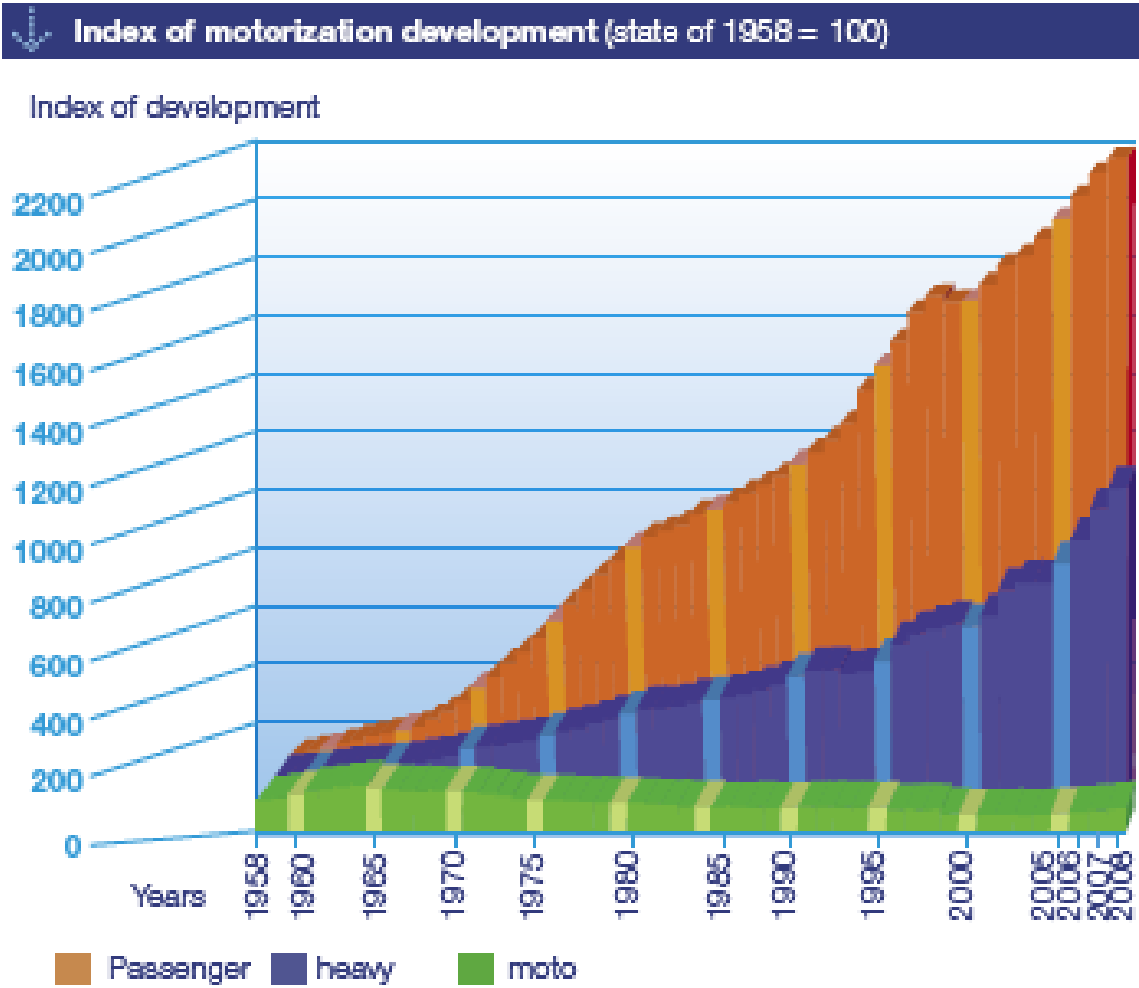
A highway management system is a powerful tool in improving road safety on roads. It has been successfully implemented in many countries. In the Czech Republic, however, is this topic currently at hand. Several regional as well as national traffic information and control centers have been implemented. Currently several pilot projects concerning highway management are in preparation and for this reason this is a matter of high importance.

This paper focuses on advantageous effects of a highway management system, particularly section speed control. It is understood as a necessary means to reduce the number and severity of traffic accidents. Best practices from projects abroad will be presented. The current status as well as upcoming projects concerning highway management systems in the Czech Republic will be discussed. Finally, key recommendations for implementing of such systems are provided.

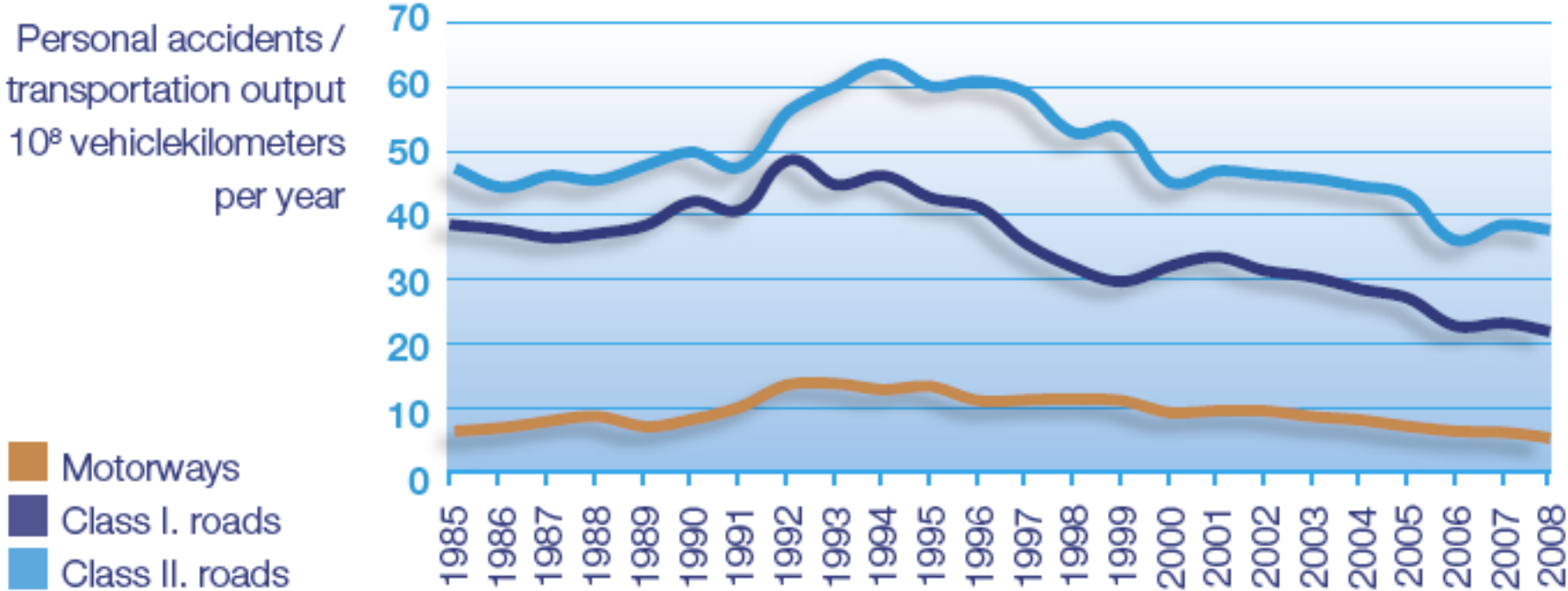
- Introduction to highway management systems
- Coming projects in CR
- Positive impact on safety
- Key success factors in implementing a highway management system



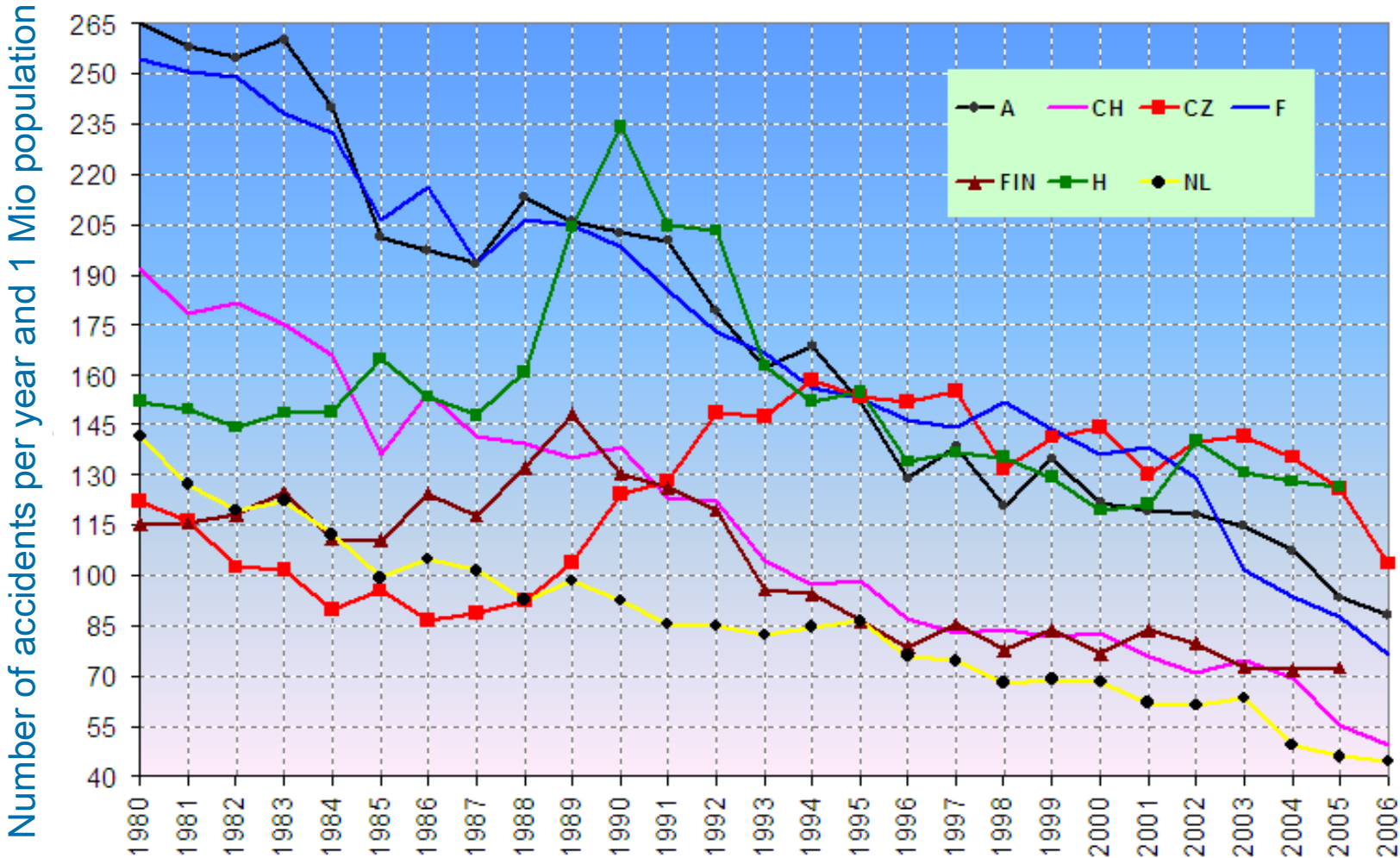
Motivation: Traffic volumes increases dramatically over years



Motivation: Relative number of traffic accidents slightly decreases but the absolute number increases over years

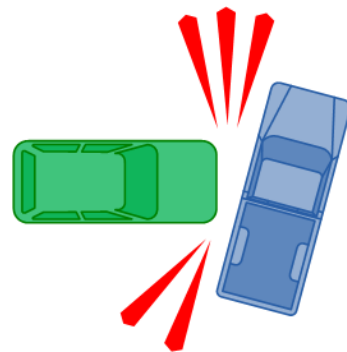


Motivation: Even though the relative number of accidents decreases, Czech Republic is still performing badly compared to other countries

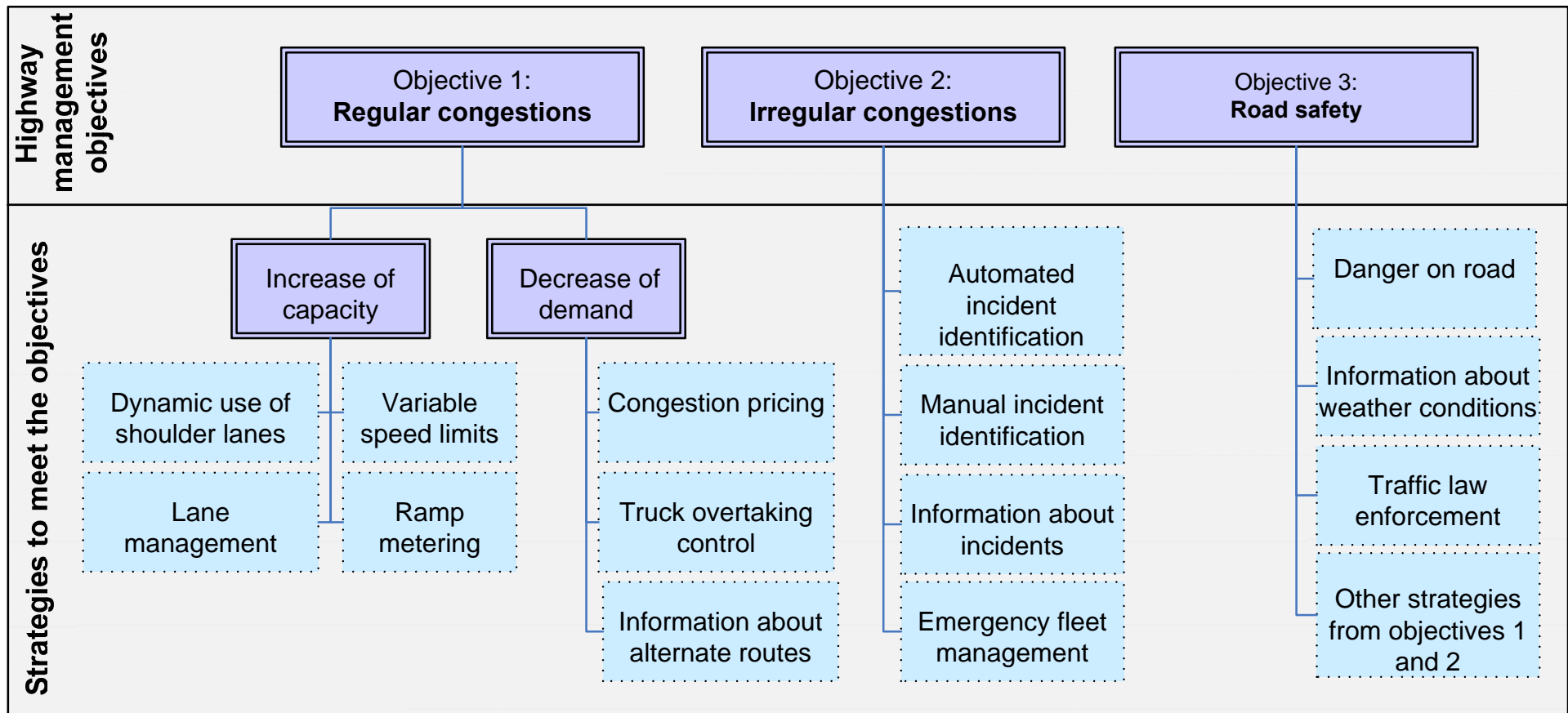


The highway managements systems are typically addressing at least one of the following objectives:

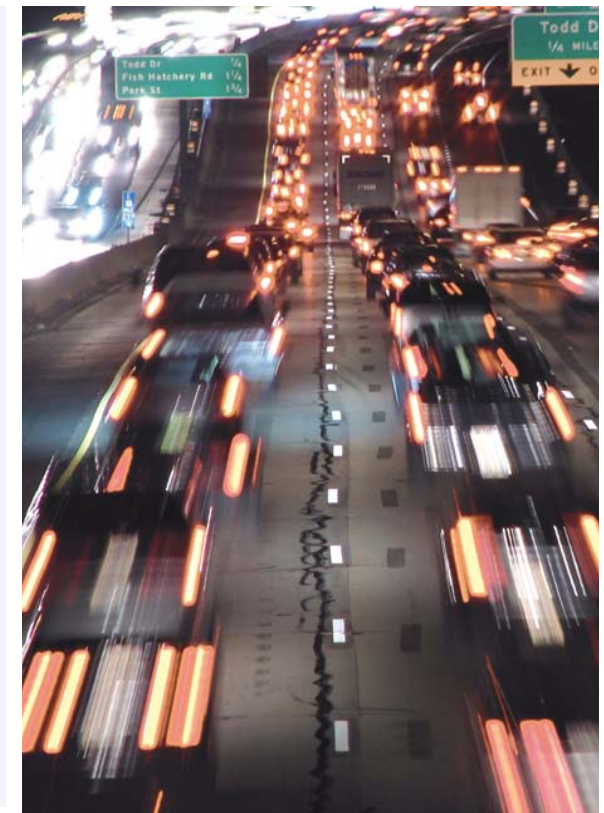
1. Decrease in the number and impact of regular congestions
2. Decrease in the number and impact of irregular congestions (accidents and similar)
3. Increase in road traffic safety



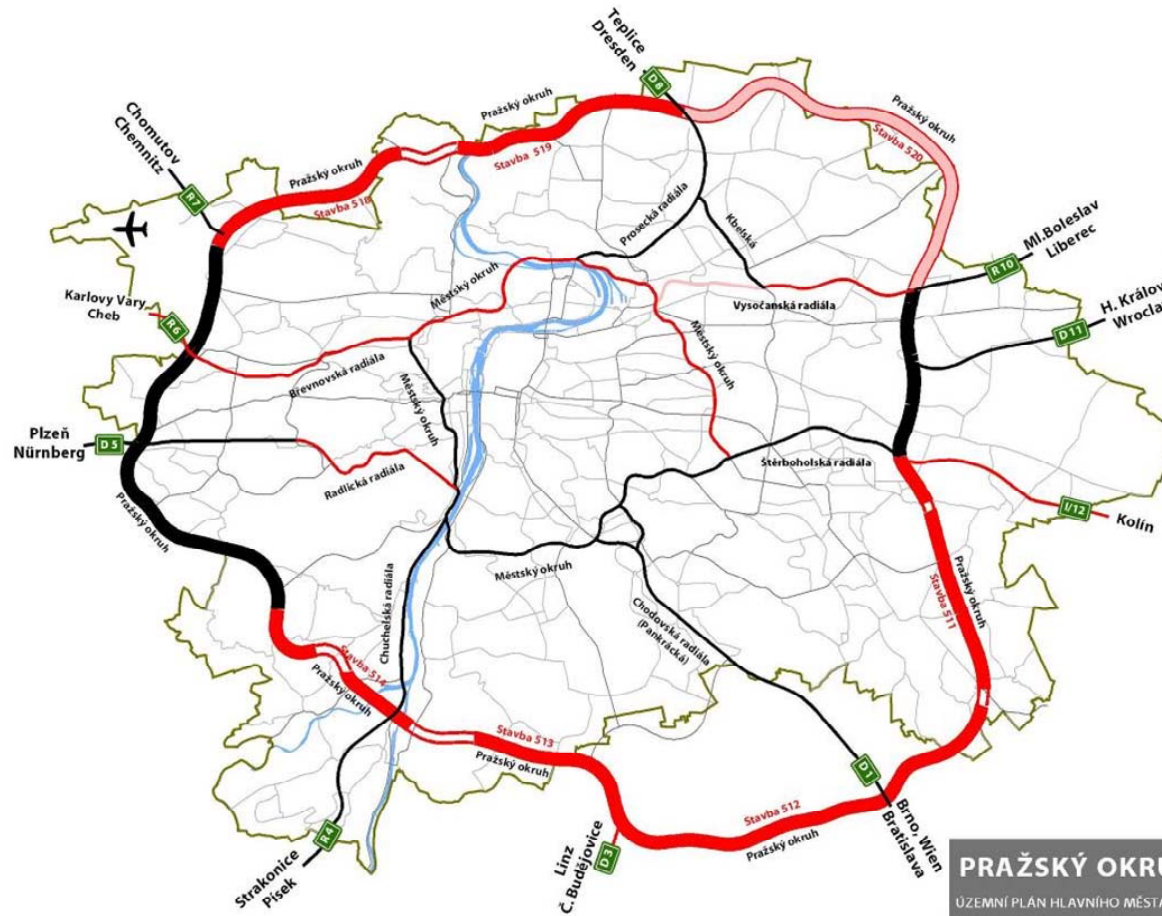
Major strategies within a highway management systems



- Introduction to highway management systems
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1. Prague city ring



Connection to tunnel control centers is required

The south part of the city ring will be equipped with variable speed limits

2. Highway system – Presence and future



3. Expansion of the highway system



- Not only are built new highway segments, but also the existing are being extended

- For example Highway D1 – extension to 6 traffic lines
 - From km 182 (Kývalka) to km 210 (Holubice) - close to Brno
 - Due to a complex terrain, it will be a complicated building
 - Building of new bridges and gantries
 - Building of entry-, and exit-ramps
 - Noise protection barriers
 - And others.
 - Adding of advanced traffic control

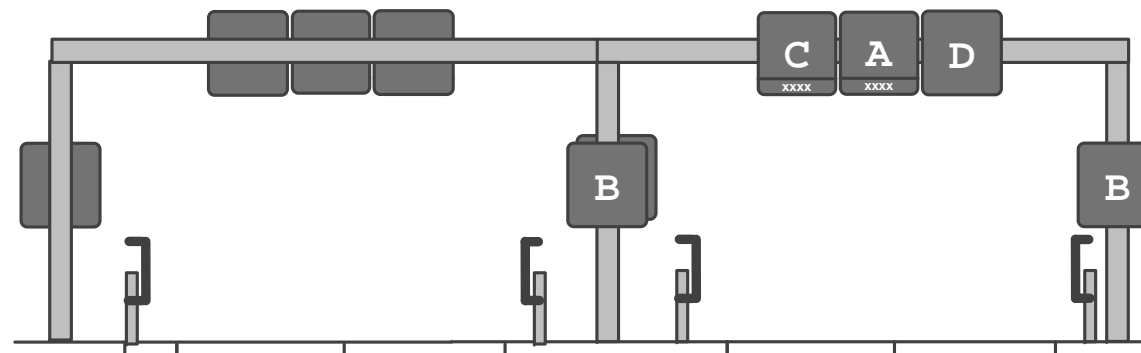
4. Introduction of new highway management systems



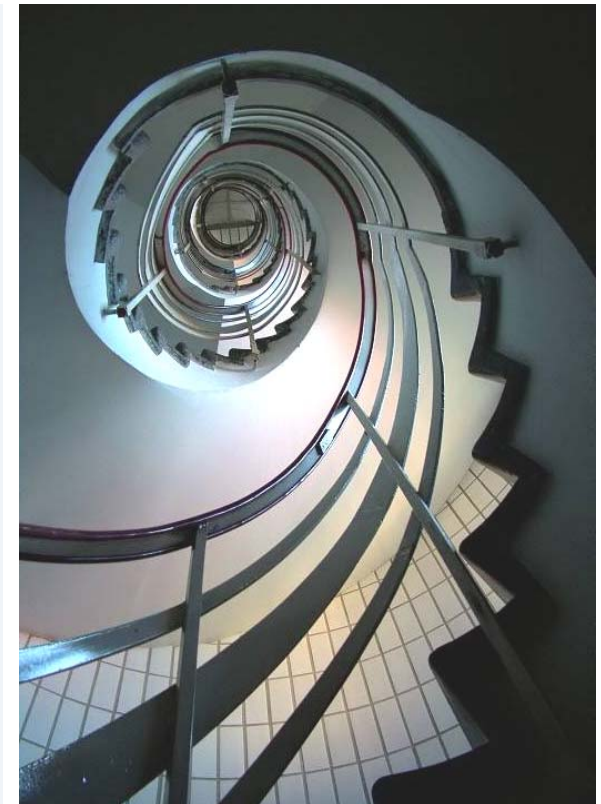
- Variable speed control system
 - D1: 0-20 km (close to Prague)
 - D1: 180-200 km (close to Brno)
 - Prague city ring
 - And others



- Close cooperation to existing control centers is needed (DIC, NDIC, tunnel control centers, and others)



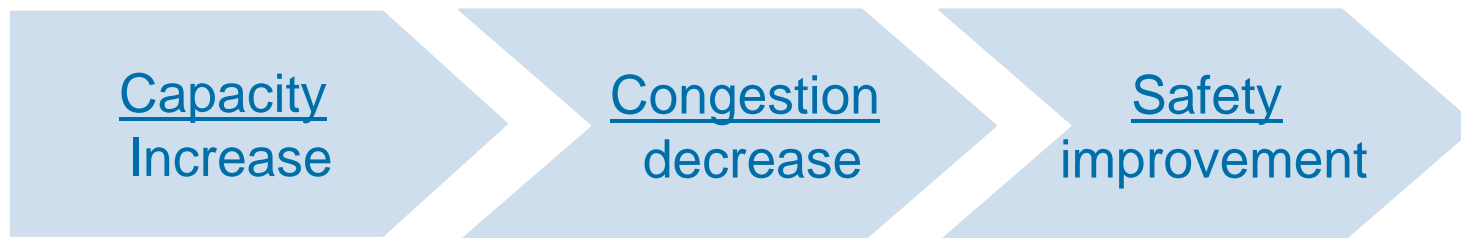
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Selection of major effects of a highway management system



- Capacity increase by adding additional lane on demand (e.g. lane management, dynamic usage of hard shoulder)
- Capacity increase by harmonizing traffic flow, and increasing throughputs (e.g. variable speed limits, track overtaking control)
- Reduces probability and impact of traffic accidents by providing information and warning (e.g. information system, automated accident detection)
- Decrease in number of secondary traffic accidents



Major parameters and effects achieved by introduction of a highway management system (based on a study covering different countries)



Parameter	Typical effect
Travel time	Reduced by 20% to 48%
Time to clear a traffic accident	Reduced on average 23 minutes Decrease 50%
Average speed	Increases by 16% to 62%
Highway capacity	Increases by 17% to 25%
Number of traffic accidents	Decreased by 15% to 50%
Fuel consumption	Decrease 41% in places with recurrent congestions Decrease in CO ₂ emissions
Air pollution	Decrease in HC emissions - 1400 tons per year Decrease in NO _x emissions - 1200 tons per year

Source: Highway Traffic Operations and Freeway Management: State-of-the-Practice. Final Report. FHWA-OP-03-076. Office of Transportation Management Federal Highway Administration, March 2003

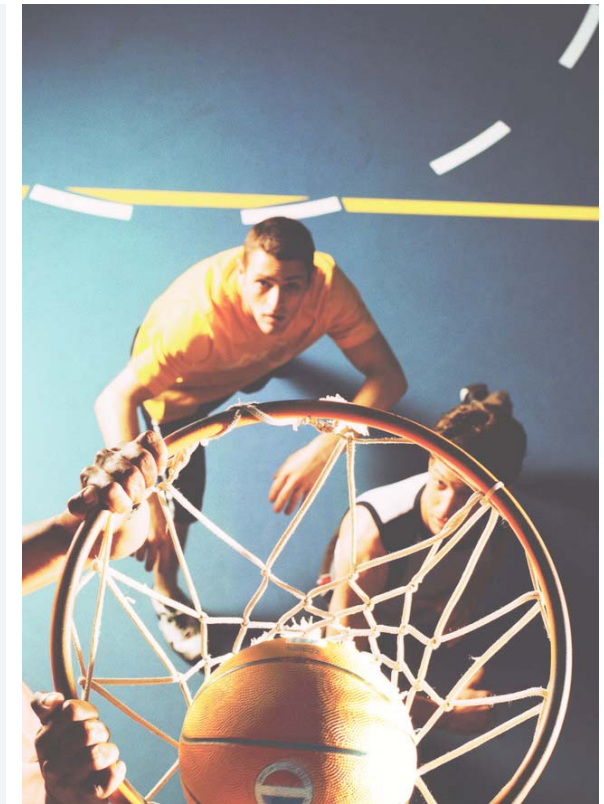
Implementation of a highway management system pays off



- Investment into a highway management system has not only safety and ecological effect, but it ensures even return of investment to the society as well as the investor
 - Decreased congestions lead to savings in
 - Fuel consumption
 - Time (decreased travel time, better planning of arrival time, and others), which has also economical effects
 - Lower exhaustions and emissions
 - Lower number and severity of traffic accidents leads to savings in
 - Emergency vehicles operation and clearing of traffic accidents
 - Less money into road maintenance and replacement of damaged infrastructure
 - Healthcare
 - “Cost of Life”
 - Traffic law enforcement



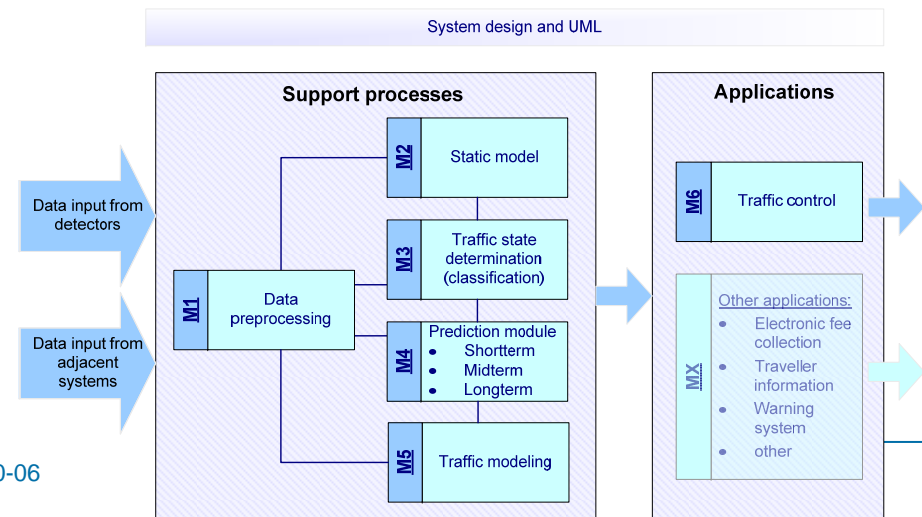
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Key success factors: Technological concepts and methodologies are the key for successful implementation



- Following a development methodology (concept)
 - Needed to ensure connection to existing systems and future extendibility
- 1. ITS design methodology (guidelines) developed at the CTU and submitted to RSD for final approval (2009)
- 2. Project INEP – highway control systems (2009/2010)
- Modularity
 - Framework of a Universal highway management system was developed at the CTU
 - Based on the control and system theory
 - Suitable for direct application on highway systems in Czech Republic
 - Modular framework which enables an easy implementation, but at the same time enables usage of the state of the art mathematical models and techniques

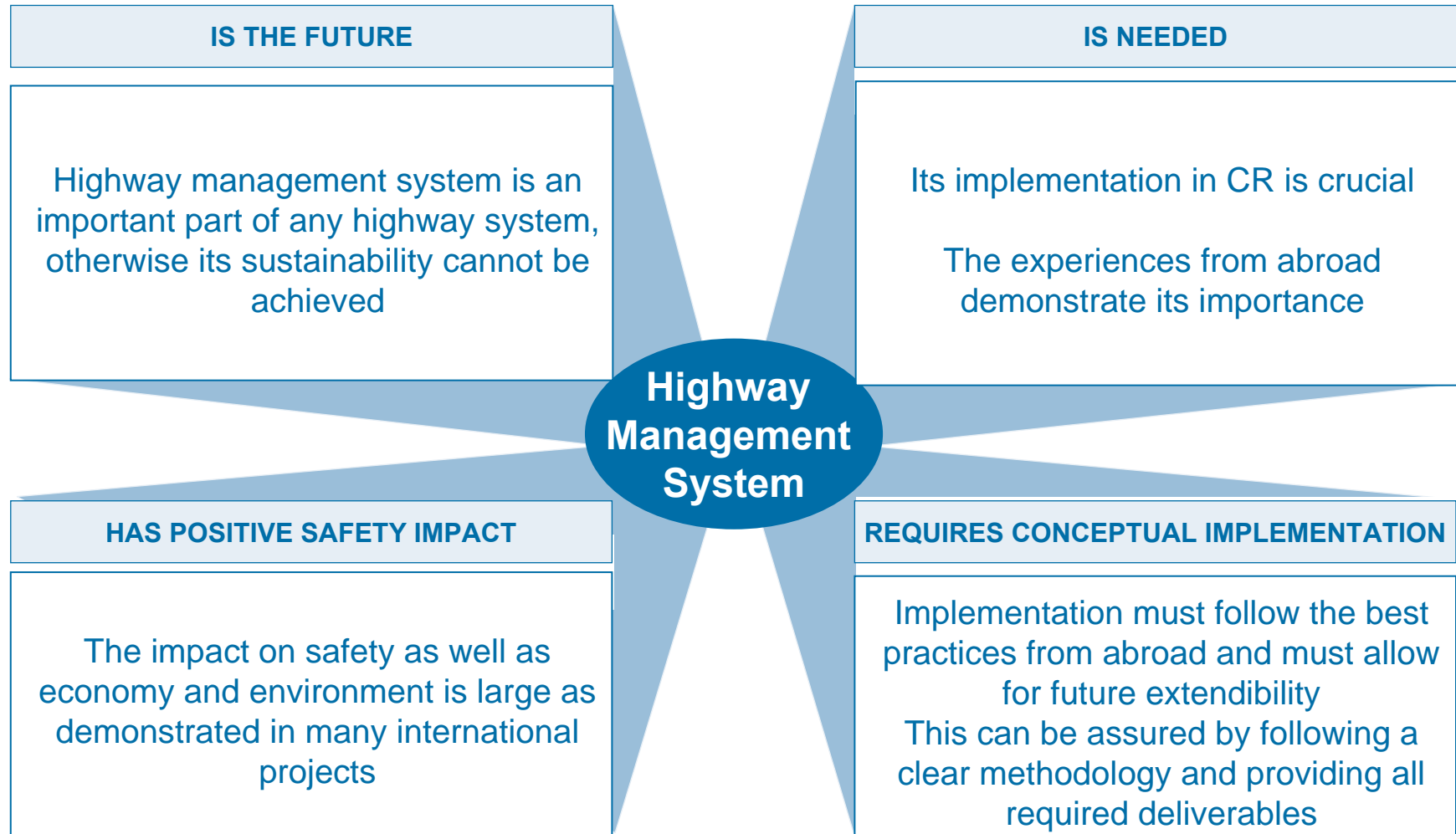


Key success factors: User awareness and acceptance must be aimed



- User awareness campaign
 - To improve general user acceptance
 - User benefits from following the system in case s/he follows the recommendations
- Usage of the best practices learned in international projects
 - Example: Highway management in Germany
 - Many years of operation, many different segments of highway
 - Existence of technical specifications
 - Similar environment to CR
- Encouraged is use of traffic law enforcement
 - To ensure following the speed recommendations
 - Random enforcement
 - Very good results in all countries with deployed system







Thank you for your attention



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