



STRATEGIC ROAD MAINTENANCE AND DEVELOPMENT PROGRAMME OF THE REPUBLIC OF LITHUANIA FOR 2030 – A TOOL FOR USING NATIONAL FUNDS TO CREATE A SUSTAINABLE AND VIABLE ROAD NETWORK

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Abstract. Road are significant national assets which provides a fundamental foundation to the performance of all national economies, delivering conditions for social and economic development of countries and international communities. It is of at most importance to ensure a mobile and safe movement of inhabitants with the lowest time and pollution costs. In order to reach the goals the planning processes are implemented on a national and international scale to rationally justify the efficiency of urgent measures. In the Republic of Lithuania, seeking to efficiently use funds allocated to the road sector the Road Maintenance and Development Programmes are developed by the road manager defining a short-term and long-term vision of the road network and measures to achieve it. However, due to the anticipated insufficient financing of the road sector the Road Maintenance and Development Programmes aim to rationally combine preservation of the road network and its perspective development depending on the existing financing. The Road Maintenance and Development Programme of the Republic of Lithuania for 2030 assesses the existing condition of the road network and defines the goals and measures how to implement a sustainable development in the road network. With the help of review analysis this paper studies: road safety assurance, road pavement deterioration degree, social welfare assurance, road maintenance, infrastructure development, assurance of sustainable development.

Keywords: strategic planning, road network, maintenance, development, financing, sustainable development, Road Maintenance and Development Programme (RMDP), environmental protection, road safety, financing.

1. Introduction

The European Commission's Directorate-General for Mobility and Transport notes that the mobility and transport is one of the key priorities of the European Commission ensuring community's vitality in social, economic and environmental aspects. On that score, the main policies are determined: mobility improvement, road transport safety assurance, promotion of ecological transport. These policies are inseparably connected with the European road network (international and national). As of January 2014, the European Union (EU) has adopted a new trans-European transport network (TEN-T) transport infrastructure policy for 2014–2020 that is oriented towards better transport connections between East and West, North and South. The aim of the programme is to

remove bottlenecks that hamper the smooth functioning of the internal market, including a geographical centre of Europe – Lithuania.

The planning process is an integral part of progress. Road sector consists of many components which are characterized by individual planning. For example in road safety field the main element is dynamics of number of dead and injured persons (Krug 2012). In environment field – climate change and CO₂ emission remains as key element (Liimatainen *et al.* 2014). In order to ensure the systematic development of the road network is necessary to create all elements including strategic program.

Lithuania, like the European Commission and other EU member-states (Gregor 2013), carries out a continuous planning process comprising the allocated

financing and the whole road network. The Road Maintenance and Development Programmes (RMDP's) of the Republic of Lithuania and the National Transport Development Programme are the main working tools of institutions responsible for the road network. The aim of the programmes is to get a social, economic and environmental benefit depending on the existing financing of the road network.

Road network development and continuous maintenance create comfortable and safe traffic conditions for transit and local journeys. Transport services in Lithuania make about 60% of national export services (Miškinis, Sadovskij 2013). According Statistics Lithuania data of 2013 a transport system of Lithuania creates 13% of Gross Domestic Product (GDP) on average and this is almost twice as much as the average in Europe (7%). However, despite positive indicators Lithuanian road network has still many barriers hampering its equal competitiveness with the road networks of West European countries (Puodžiukas 2013). Taking this into consideration the Road Maintenance and Development Programme of the Republic of Lithuania for 2030 (hereafter RMDP) presents a vision of the road network and measures to achieve it depending on the existing barriers and a potential for implementing a modern sustainable development and the general goals of the EU.

2. Road network analysis

The Lithuanian road network has been constantly developed and modernized, however, a large variety of barriers and challenges are faced that negatively affect the pace of the processes. Owing to this factor, the current situation of the Lithuanian road network does not meet the top objectives of the road manager.

One of the main challengers faced by the road network managers is insufficient financing failing to meet the existing needs and causing the occurrence of negative consequences. Development and functionality of the road network depend directly on the funds allocated. Social and global phenomena may correct the need for the road network as for a subject, but the need for necessary financing must be satisfied. For example, due to the reduced financing of the RMDP in 2009, for several years no pavement rehabilitation works were carried out which extend a service life of pavements by 5–7 years. This resulted in the occurrence of negative consequences – based on the Public Enterprise Road and Transport Research Institute (RTRI) research data of 2012, a general condition of national roads worsened by 21%. The mentioned consequences were also influenced by the annually growing traffic volume on Lithuanian roads and especially that of heavy traffic. The 2014 data of RTRI research on the qualitative indices of the main roads (by SDLSe) shows the worsening of road pavements by 3% (Fig. 1).

A share of gravel roads in the Lithuanian road network of national significance has decreased from 43.3% (RTRI data of 2002) to 34.0% (RTRI data of 2014) (Fig. 2),

though, at present there are still large regional differences concerning road infrastructure.

In four regions a percentage of regional roads with gravel pavement clearly exceed the average of the country. This causes worse traffic and living conditions for the local residents, also for the development of individual businesses and industries.

Long journey delays, road user costs, environmental impact, social exclusion are complex and interrelated values of general welfare. Journey delays and road user costs are described by the above mentioned road pavement condition as well as a constant road network maintenance that is carried out according to the financial possibilities. The main task of road infrastructure maintenance is the execution of timely and technologically justified maintenance works to ensure traffic safety and the necessary service life of road elements. For the assurance of the maximum effect of road maintenance operations a qualified manpower is indispensable and also technical facilities supported by the newest technologies. Expansion and development of these components require adequate financing. Namely the optimum financing of road maintenance operations, based on reasonable calculations, creates conditions for achieving the best result with the least amount of funds. However, Lithuania has got a practice that funds for road maintenance are allocated not according to the optimum

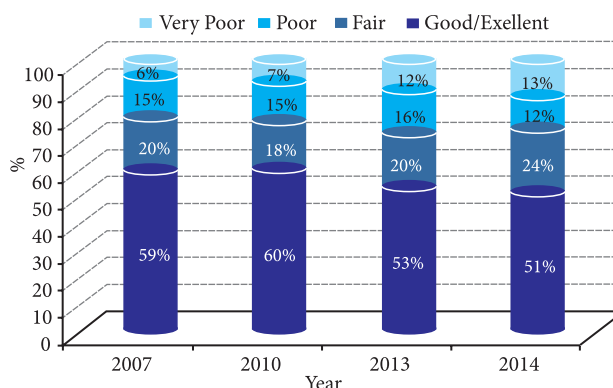


Fig. 1. Pavement condition of the main roads

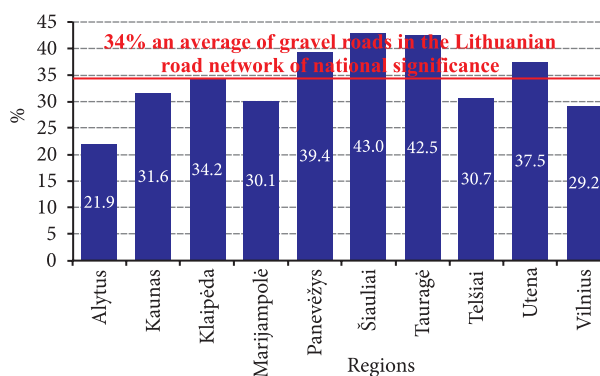


Fig. 2. Distribution of the regional roads with gravel pavement in the regions of Lithuania (Road and Transport Research Institute data of 2014)

need but according to the economic situation and capacities of the country (Fig. 3).

Another criterion which describes road network – road safety assurance. Over the last decade Lithuania has considerably improved safety on roads, though it still lags behind the other EU member-states leading in this field. Lithuania shows positive tendencies in the decreasing number of people killed in road accidents. Police Department under the Ministry of the Interior states that the number of people killed was 14.29% less in 2013, however, a general accident situation still remains defectively stable and the number of people killed was 2.7% higher in 2014. This type of statistics proves that Lithuania implements a purposeful engineering road safety policy, but there are deficiencies in the field of general traffic that consists of multiple aspects: social responsibility, road user behaviour, preventive control, urban traffic organization (private and public transport) and social approaches.

3. Analysis of a vision of the Lithuanian road network in 2030

In today's progressively modernizing society mobility, modality and time costs become one of the most important criteria related to the road network. Same as in the current situation, in a long-term perspective the road network will create conditions for social and economic development of countries and international communities. Therefore, it is of utmost importance to preserve a progressive road network development fully meeting the user needs at national and international level. For this purpose the Lithuanian Road Administration under the Ministry of Transport and Communications of the Republic of Lithuania works out the RMDP. The RMDP is aimed at creating a vision of the road network which would reflect the EU and Lithuania's development objectives and their criteria. The RMDP, as the main working tool (document) will help to more effectively seek for the objectives set and to rationally choose measures for their implementation.

3.1. A background for strategy formation

At present, the world society development is viewed through the principles of sustainable development. A principle of sustainable development was started to be widely

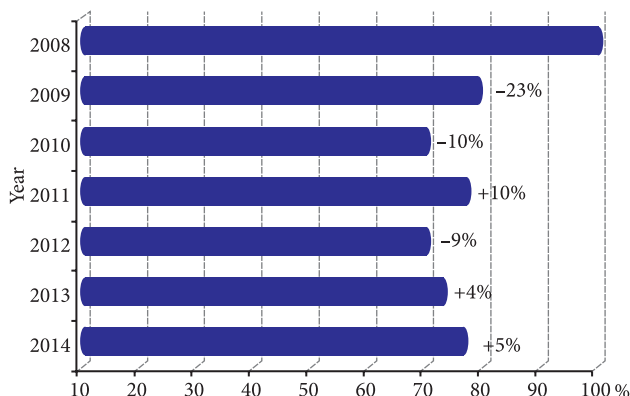


Fig. 3. Financing of road maintenance in Lithuania

used after publishing the report of the World Commission on Environment and Development „Our Common Future” which states that sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs and aspirations. In a modern society sustainable development has been formed as a social, economic and environmental sustainability, implementation of which needs a long-term planning and public participation (Bebbington, Larrinagab 2014; Carr 2013; Čiegis et al. 2009a, 2009b; Holdena et al. 2014; Hopwood et al. 2005; Köhler 2013; Maza, Rydin 1997; Weber et al. 2014).

The strategic planning documents of the EU, the World Road Association (PIARC) and the Republic of Lithuania emphasize the necessity of sustainable development of all the industries, and this means that the current transport policy, as mentioned above, must be supported by a long-term integrated approach based on responsibility to future generations. The National Sustainable Development Strategy emphasizes a long-term goal – to create a safe, cost-effective and environmentally friendly transport system. The ultimate goal of sustainable development is to combine the interests of environmental, economic and social development, to ensure clean and healthy environment, effective use of natural resources and global economic human welfare. In the road sector the goals of sustainable development are achieved by integrating the interests of road safety, road network development, road network maintenance, environmental protection and Intelligent Transport Systems (ITS) into the road development programme by setting the main objectives and measures to achieve them.

3.1.1. Multimodal mobility

One of the most significant principles of sustainable development is mobility and multimodality. Though in a worldwide understanding these factors have different terminology but taking the long view they will be closely interrelated and forming a single factor – multimodal mobility. It is expected that in future a rapidly developing society will increase the number of daily journeys and their distances and due to this aspect it will be necessary to ensure uninterrupted journey by decreasing time costs that gradually increase. The road network will necessarily have direct connections with the networks of other transport modes generating an uninterrupted life circle. Also, road infrastructure must be accessible for all society members depending on the need and economic benefit and must be socially oriented. For Lithuania this goal is of utmost importance bearing in mind that the country has 34% of roads without asphalt pavement.

3.1.2. Reorganization of road network using Intelligent Transport Systems

In recent years, the road network development in Europe has acquired new trends related to the reorganization of the road network. This process is directly related to a rapidly growing technological development in the world, and

especially in the transport sector. In perspective, intelligent vehicles will be efficiently realized only in case if they drive in an intelligent road network. The newly designed roads are being modernized according to the existing technological possibilities, though the existing roads remain non-modernized. In view of this, both EU and Lithuania will necessarily have to reconsider the existing transport corridors and to form a new (reorganized) road network.

Furthermore, it is important that a rapid implementation of ITSs would help to create an effective model of smart journey which would effectively manage road network and give the useful and timely information to a road user.

3.1.3. A comprehensive road safety control

Over the last two decades the issue of road safety in the EU and Lithuanian planning documents has been defined as one of the most important priorities. In future, road safety should also remain a priority goal until the absolute road safety control is achieved (0 people killed). For the realization of this goal it is necessary to seek to remove the possible conflict situations in the road network and to eliminate a human factor which, at present, causes the majority of road accidents. One of the main objectives of Lithuania is to implement a *Vision Zero Program*. The same priorities should remain: implementation of road safety measures and improvement of existing infrastructure. Also, public education cannot be forgotten. It is important that a changing road network is easily recognizable by the road users and causes no additional barriers. In future, Lithuania should more rapidly implement ITSs that would help to carry out an effective traffic control. Continuous control and uninterrupted monitoring would ensure road safety on the main transport corridors.

3.1.4. Ecological development

Links between the economic development paradigm and ecological problems allow stating that until now development trends, often externally less notably contributing to the negative changes in ecological systems have determined behaviour in the sphere of ecology (Čiegis 2006). In future, it is necessary to act in a way to create no danger for a further human existence, i.e. to follow the principle of “clean journey“. When developing and using road network it is essential to preserve, protect and improve environmental quality and human health. It is important to pay large attention to the promotion of the use of alternative fuels and technologies and creation of the necessary conditions, to reduce CO₂ emission. On the other side, in the *International Climate Change Adaptation Framework for Road Infrastructure* developed by the World Road Association and AECOM in 2015, it is stated that the projected climate change will impact the design, construction, operation and maintenance of road infrastructure. For example, standards of the road cross-section need to be revised to increase the slope of pavement in areas where presumably there is a need to remove more water from the road.

Also the strength of materials has to be increased to withstand increased or decreased moisture content.

3.2. Potential of strategic planning

Following the goals and the scheduled purposeful planning defined by the Road Maintenance and Development Programmes, Lithuania has implemented not a few representative infrastructure modernization and development projects, positive results have been achieved in the field of road and assurance of social welfare. A potential for the strategic planning is given by the effective and purposeful planning of the allocation of RMDP funds. In the period 2002–2012, Lithuania using fewer funds that are necessary for the road network had implemented several goals keeping pace with the planned amount of works.

The plans drawn up and the processes are successful if they are effectively implemented. In this aspect, Lithuania is distinguished for the effective implementation of funds and projects. Based on the 2014 data of the Ministry of Finance of the Republic of Lithuania, the country used ~99.99% of funds from the EU structural assistance for 2007–2013 allocated for the development of TEN-T networks. The funds allocated were used for the modernization and development projects of the main road network (TEN-T) that helped to considerably improve traffic conditions in Lithuania and in the TEN-T network.

In order to reduce the number of people killed on the roads of national significance, Lithuania made every effort for implementing the tasks set in the RMDP for 2002–2015. With the help of engineering safety improvement measures and educational activities, Lithuania succeeded to realize the goal of the European Commission’s White Paper “*Roadmap to a Single European Transport Area – Towards a Competitive and Resource-Efficient Transport System*” by 2011 to reduce the number of deaths on the road by half. Over the last decade, the number of people killed in road accidents in Lithuania has decreased by 64.7% (Fig. 4).

4. Financial projections

Every year Lithuanian road sector faces major losses due to inadequate funding of RMDP program. Due to the lack

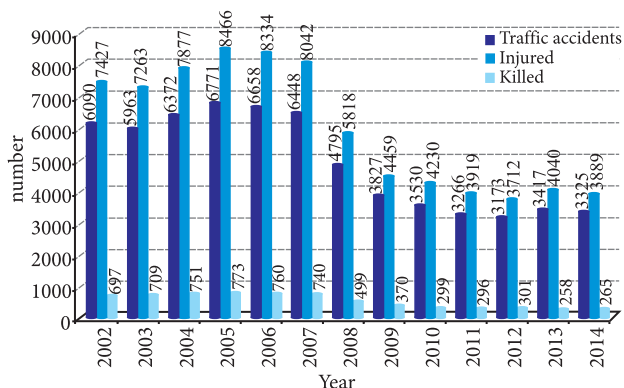


Fig. 4. The change in the number of road accidents in Lithuania by year

of funding it is impossible to guarantee complete safety (24% of the total losses), maintenance of the road network (12%), increasing time losses (17%), operating costs (44%) and environmental pollution (3%) (Fig. 5).

If in future there is a constant 232 million EUR funding lack (assessing the approximate expected 2.5% growth of RMDP funding and EU funds), it is calculated that the losses will increase from 12.5% in 2015 to 150% in 2030. Also, based on the RTRI data of 2014, calculations of the Pavement Strength Index (PSI) prognosis for 2030 showed that the constant funding lack will result in PSI reduction of 35%.

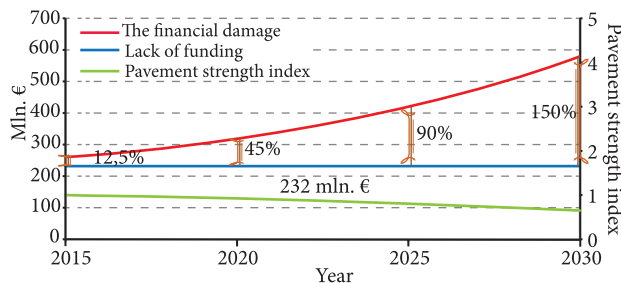


Fig. 5. Projected losses for 2015–2030 period

4.1. Financing plans

To systematically develop the road sector and to ensure highest quality of traffic is essential rational long-term financing planning. For this purpose there was developed three possible RMDP program financing scenarios. Funding necessary for implementation of scenarios were calculated estimating indicative works quantities required to attain the goals. In addition, the average annual growth rate (AAGR) of 3% was estimated assessing annual increases of construction price index. Prospective calculations were made based on the existing road network length, the condition qualitative indicators, the pavement time periods of service, inter-repair periods, traffic volume change projections (Fig. 6).

The above diagram consists of three variables: funding, time and percentage expression of the objectives. Institution responsible for RMDP determines when and how many percent of the objectives will be implemented by three potential funding scenarios. Also, it provides in the long period of implementation of the RMDP for an accurate monitoring and control.

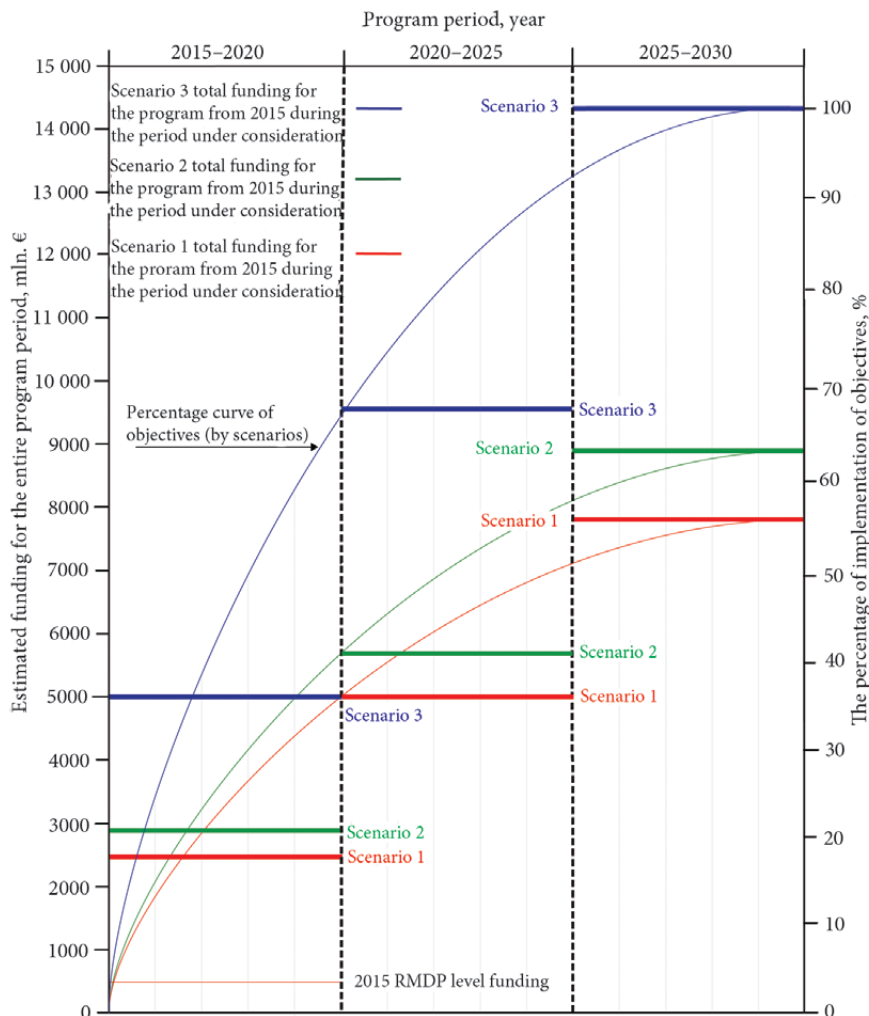


Fig. 6. RMDP funding scenario diagram

4.2. Priority Investments

In the framework of RMDP in 2015 27% more funds were allocated the development of road network and measures ensuring the operation of network, however, due to the increased financing of local roads the roads of national significance will be allocated only 19% more than in 2014. According the Programme Financing Account 2015 the roads of national and local significance will be allocated 338.5 million EUR. This budget is only the starting point of the RMDP. As has been mentioned, implementation of the main objectives measures, works which will influence future roads, directly depends on the funding available under the three scenarios (Fig. 7). By the first case scenario the RMDP in 2030 would be implemented only 58%, by the second – 66%. In order to implement the RMDP by 100%, there is necessary to ensure gradual increase of RMDP funding.

5. Conclusions

1. When taking the long view, European Union and its member-states see a modernized road network with uninterrupted links between West and East, North and South. Lithuania, being the important eastern part of the international Trans-European Transport network, is obliged

to increase the equivalence of its road network to that of Western countries. Despite this aim, the insufficient financing of the Lithuanian road sector caused negative consequences for the quality of road network:

- noticeable worsening of road pavement condition,
- still a large number of road deaths and
- large separation between the regions (regarding gravel roads).

2. However, a purposeful and effective planning of the use of funds in Lithuania allows making an assumption that the country has a lot of potential for the realization of perspective goals. Within the framework of Road Maintenance and Development Programme for 2030, the road network manager succeeded in ensuring a rational environmental, social and economic benefit:

- the planned works were executed,
- the funds of European Union structural assistance were effectively used,
- and the number of people killed on roads was considerably reduced (~64%) within ten years, etc.

3. Planning of the Road Maintenance and Development Programme for 2030 should be based on the principles of sustainable development: a smart, clean and safe journey, multimodality and mobility.

The objectives of the RMDP	The main objectives of the measure			The implementation period
Multimodal mobility	To carry out the development of the TEN-T network			2015–2020
	Road A1 Vilnius–Kaunas section reconstruction the motorway (category AM)			
	Road “Via Baltica” development: the Polish border–Kaunas 2+2 (AM); Kaunas–Latvian border 2+1			2015–2025
	Completion of the large urban bypasses systems			2015–2030
Run the national roads with asphalt coating and regional roads with gravel pavement reconstruction and renewal				
A comprehensive road safety control	Expand the traffic information management system (eismoinfo.lt)			2015–2020
	Install effective engineering safety measures in potentially dangerous road locations			2015–2025
	Develop bicycle and pedestrian paths infrastructure			2015–2030
Ecological development	Install road elements using renewable energy sources			2015–2020
	Develop electric vehicle charging and battery exchange infrastructure			2015–2025
	Continue the systematic management of environmental noise			2015–2030
	To reconstruct roads by adapting to climate changes			
Reorganization of road network using ITS	Install Asset Management System			2015–2020
	Install electronic toll control system			2015–2025
	Installing experimental road sections, carry out research			2015–2030
Distribution percentage targets under the three funding sections				
RMDP funding scenarios	2015–2020	2015–2025	2015–2030	Total implementation
Scenario 1	18%	17%	23%	58%
Scenario 2	20%	20%	26%	66%
Scenario 3	35%	31%	34%	100%

Fig. 7. RMDP priority investments and implementation by funding scenarios

4. Both European Union and Lithuania will necessarily have to reconsider the existing transport corridors and to form a new modern road network.

5. The prepared strategic Road Maintenance and Development Programme for 2030 will enable the road manager to rationally allocate funds in line with the stated goals and evaluate Lithuanian road network on the sustainable and viable basis.

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