



FEATURES OF PUBLIC ROADS COST EVALUATION

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Abstract

The evaluation of the property of road economy is a complex and important issue for the road sector. During carrying out the evaluation of the property, it is recommended to use regulations, provisions of national standards on property evaluation and regulations of the State Property Fund. Since the property of road economy can be attributed to a specialized type of property, which is the most useful in an integral property complex, then for its evaluation it is necessary to use cost approach methods. The article describes the methodical approaches and mechanisms of their implementation for evaluation of property of road economy. The basis of each of the methods is a set of evaluation procedures that will allow carrying out the evaluation. Practical approaches to property evaluation will promote a good coordination of the evaluation results and drawing up the reports and conclusions on their basis about evaluation of road economy property.

Keywords: inventory of property, cost evaluation methods, objects of evaluation, road assets, information and analytical system

1 Introduction

Reliable valuation of property of a road economy (realization of inventory of property) and conducting of its expert assessment in a proper manner is a very important issue in the road sector and is one of the mechanisms of road transport reform. Over the past few years, a review of legislation, evaluation methodology and standardization has led to a number of issues, which, when assessed and resolved, have helped to streamline, update and improve the legal and methodological framework for property evaluation. An important criterion in the work on the evaluation of property of the road economy was the discrepancy between the existing forms and models of evaluation, their adaptation and bringing in compliance with the evaluation model to the conditions that characterize this type of property and are necessary for carrying out the evaluation of the road economy objects.

Cost evaluation of the road is a process in which the determination of the cost of the road is carried out on the date of evaluation in accordance with the procedure established by regulations [1] on property evaluation. When evaluating the cost of the road, the following goals are achieved:

- establishing the availability of assets and their elements
- determination of the correspondence of their physical condition to the estimated value;
- determination of the real current value of road assets.

The evaluation is carried out in accordance with the following procedure:

- definition of the objects and the purpose of evaluation;
- establishment of principles, bases and rules for assets evaluation;
- compilation of a list of assets and basic data for the calculation of the assets value;
- establishment of the nomenclature of quality indicators, analysis and selection of the most significant of them;
- compilation of the model of the qualitative condition of the evaluation object;
- initial evaluation of assets;
- determination of the level of the quality of the evaluation object;
- determination of the cost of a road asset depending on the purpose of evaluation;
- compilation of the cost valuation report.

Estimating the cost of property will facilitate the inventory of the road economy property. The purpose of the inventory is to obtain data on the availability and condition of property of entities under the control of the balance-holders of roads, as well as the creation of conditions for the organization of an information system for the operational recording of the availability, condition and use of the property. According to the results of the inventory, the existing passport of the road is also adjusted or the new passport is issued. The purpose of the inventory is to establish common principles for the preparation of technical documentation for real estate objects of the road economy in order to register the rights to real estate.

2 Evaluation methods

2.1 The process of roads evaluation

The objects of the road economy, which are subject to inventory, are distributed as follows:

- motor roads - a linear complex of engineering structures designed for the continuous, safe and convenient traffic which includes the objects located in the right-of-way of the roads within a single land plot and designed for transportation and ensuring the functioning of road transport infrastructure;
- artificial structures - engineering structures intended for the movement of vehicles and pedestrians through natural and other obstacles, as well as for the sustainable functioning of the motor road (bridges, overpasses, flyovers, viaducts, tunnels, surface and underground pedestrian crossings, pontoon bridges and ferry crossings, road junctions, retaining walls, galleries, catching ramps, snow protection structures, avalanche and mudflow protection structures, etc.);
- road drainage structures - structures intended for removal of surface and groundwater from the the subgrade and carriageway (side ditches, drainage ditches, hillside ditches, culverts, open and closed drainage systems, storm sewerage, etc.);
- technical means - special technical means intended for management and control of road traffic (road signs, information boards, road markings, signal bollards, traffic and pedestrian barriers of different types, traffic light equipment, etc.);
- real estate necessary for the operation of motor roads.

Schematically, the process of road cost evaluation is shown in Figure 1.

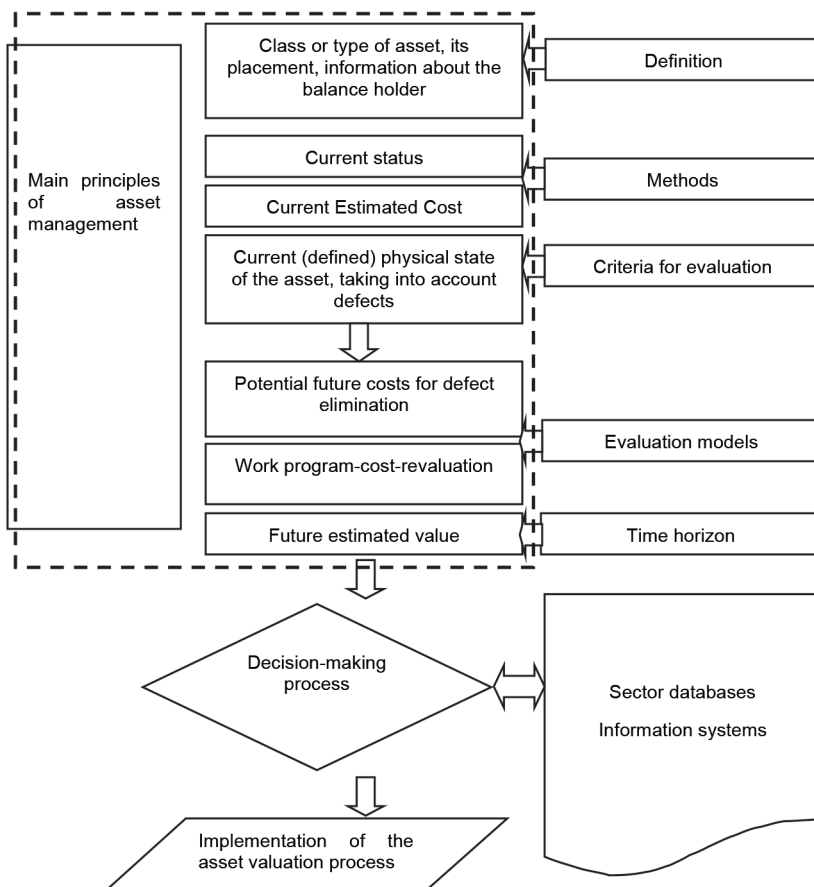


Figure 1 Flowchart of the process of evaluating the road asset

2.2 Cost approach

The effectiveness of assessing the property of a road economy depends on the methodological approaches under which it will be implemented. Building a road assessment model allows for a uniform methodological approach to the overall cost evaluation of roads, both currently and in future or projected periods. The following methods are used in accordance with [2] (Figure 2), which are used to carry out a cost evaluation of public roads:

- Asset re-evaluation / after-evaluation method;
- limit cost method;
- fixed cost method with respect to the limit state;
- method of the transferred cost (replacement).

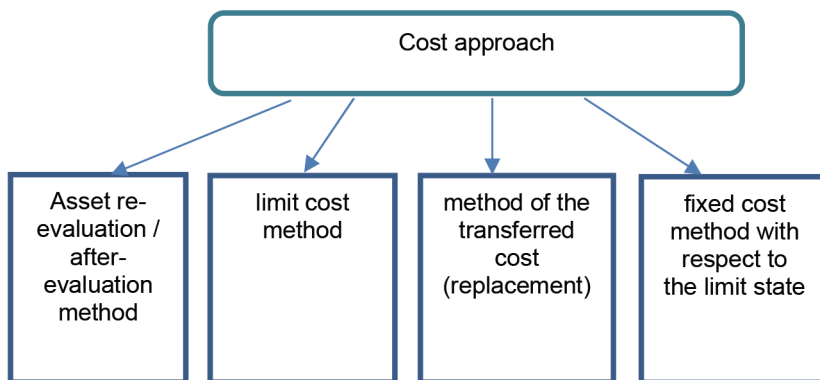


Figure 2 Methods based on cost approach

The method of re-evaluation / after-revaluation of an asset is that the asset is calculated as the product of its initial (initial) cost of construction and the ratio of the qualitative state of the asset or its element adjusted to the inflation index. Condition is the ratio of the current qualitative state of the asset or its element to a better condition. The value of assets in year t is determined according to [2] by the formula (1):

$$V_{r,t} = H \cdot C \cdot \left(\frac{K_{kt}}{K_{k\ best}} \right) \quad (1)$$

where

- $V_{r,t}$ - baseline value of assets by re-valuation / after-valuation method in year t, monetary units;
- HC - initial (actual) cost of construction in accordance with the consolidated estimates, monetary units;
- K_{kt} - the level of a qualitative state of the asset at time t, in the form of a coefficient or %;
- $K_{k\ best}$ - the best level of quality status of an asset, recorded during its life cycle, in the form of a coefficient or %.

In accordance with [2], the estimated value of a road asset using the re-evaluation / after-evaluation method at the valuation date is obtained by adjusting the base cost for inflation by the formula (2):

$$V_{r,r,t} = V_{rt} \cdot \frac{CPI_t}{CPI_0} \quad (2)$$

where

- $V_{r,r,t}$ - estimated value of the road asset by the re-evaluation / after-valuation method in year t, monetary units;
- CPI_t - index of construction price in year t;
- CPI_0 - index of construction price in the year when the object was built.

The limit cost method uses current and past data to determine the value of assets. According to [2], the following formula (3) is used to calculate the value of assets:

$$V_{m.c.t} = HC \cdot \left(\frac{K_{kt} - K_{k\ worst}}{K_{k\ best} - K_{k\ worst}} \right) \quad (3)$$

where

$V_{m.c.t}$ - baseline value of assets by the limit cost method in year t, monetary units;
 $K_{k\text{ worst}}$ - the worst level of a qualitative state of an asset, recorded during its life cycle, in the form of a coefficient or %.

According to [2], the estimated value of a road asset by the limit cost method on the evaluation date is obtained by adjusting the base price for inflation by the formula (4):

$$V_{r.m.t} = V_{m.c.t} \cdot \frac{CPI_t}{CPI_0} \quad (4)$$

where

$V_{r.m.t}$ - estimated value of the road asset by the limit cost method in year t, monetary units.

The fixed cost method with respect to the limit state is to bring the state of an asset or its element to a level that consistently exceeds the minimum performance threshold established for that asset. The cost of assets is a constant value over the life of assets until the quality level of the asset exceeds a certain limit value and is equal to zero; when the quality level falls below the established limit value (in this case, the issue is about the renewal of the asset or its liquidation). Each year, the calculation of the state of the asset at the time t (K_{kt}) is carried out. The value of wear (physical and / or functional) K_{wear} of the rod section in accordance with [2] is determined by the formula (5):

$$K_{wear} = 1 - K_{kt} \quad (5)$$

Experts of the road organization set the limit value $K_{k.m.t}$.

When $K_{kt} > K_{k.m.t}$, the estimated value of the road asset is determined on the basis of the replacement (or reproduction) cost adjustment by the estimate as of the date of the assessment for the inflation index. In accordance with [2], the estimated cost of a road asset by the fixed cost method with respect to the limit state and according to formula (5) is determined by the formula (6):

$$V_{r.f.t} = RC_t \cdot K_{kt} = RC_t \cdot (1 - K_{wear}) = RC_t - RRC_{kt} \quad (6)$$

where

$V_{r.f.t}$ - the estimated value of the road asset by the fixed cost method in relation to the limit state in year t, the monetary units;

RC_t - cost of replacement (or reproduction) of the asset in year t, monetary units;

RRC_{kt} - the cost of repair and restoration of the asset in year t,

$RRC_{kt} = RC_t \cdot K_{wear}$ - monetary units.

In accordance with [2] the cost of replacement (or reproduction) of an asset is determined by the formula (7):

$$RC_t = \sum_{i=1}^n C_i \quad (7)$$

where

C_i - the estimated value of the i -th element of the road section, which is displayed in current prices on the actual date of assessment, using the same architectural solutions, building structures and materials, as well as the same quality of construction and installation works as the assessed object (replacement value) or using modern materials and in accordance with new standards and planning solutions (replacement value).
 n - number of elements of the road section.

The final estimated cost of the road asset is determined by formula (8):

$$V_{r.a.} = V_1 + V_r \quad (8)$$

where

$V_{r.a.}$ - estimated cost of the road section, monetary units;

V_1 - cost of the road section, monetary units;

V_r - the estimated cost of a road asset determined by one of the methods shown in Figure 2, monetary units

To determine the quality of the evaluation object, the following initial data are required, which contain:

- the initial cost of construction, where the actual cost of the road construction is entered in accordance with the consolidated cost estimate;
- the quality level of the evaluation object at the time when the best condition is equal to 100 percent;
- the best condition of the asset is the condition of the evaluation object recorded after the commissioning of the construction object;
- the worst quality level of the asset (determined quality level of the construction object during which the object had the worst operational parameters);
- construction price index at the year when the object was built;
- construction price index at the year when the quality level assessment is carried out;
- the cost of replacing (or reproducing) the asset at the year when the object is evaluated;
- the limit value of the quality level of the asset which is set by experts of the road organization.

2.3 The information-analytical system

The analysis of the methods used to evaluate the property of the road economy allowed to develop an information and analytical system, the algorithms of which are convenient to use and provide automation of calculations of the valuation of roads of general use. The information-analytical system is a program with a definite structure, interface and parameters that provide an opportunity:

- the choice of the necessary method for carrying out the valuation of roads of general use;
- implementation of algorithms for conducting valuation of road assets;
- access to the database necessary for the settlement;
- centralized storage of collected data for their further use by organizations for assessing the property of the road economy;
- filling the database with highways for which it is necessary to carry out a valuation;
- access to the normative reference base of the coefficients required for the settlement;
- conducting an analysis of the results of the valuation of public roads in order to plan and make effective decisions.

The final result of a valuation is the formation of a property valuation report, which, according to [3], should contain the following information:

- a description of the object of evaluation that allows it to be identified;
- the date of the assessment and the date of completion of the report, and, if necessary, the validity period of the report and the conclusion on the value of the property in accordance with the requirements of the legislation;
- the purpose of the assessment and justification of the choice of the appropriate assessment base;
- list of normative legal acts according to which the assessment is carried out;
- a list of restrictions on the application of evaluation results;
- an outline of all assumptions within which the evaluation was conducted;
- description and analysis of the collected and used source data and other information during the evaluation;
- conclusions on the analysis of the existing use and the most effective use of the object of evaluation;
- an outline of the content of applied methodological approaches, methods and valuation procedures, as well as corresponding calculations, with which the conclusion on the value of the property is prepared;
- a written statement by the appraiser on the quality of the source data used and other information, a personal review of the object of evaluation (in the case of impossibility of personal review - relevant explanations and justification of reservations and assumptions regarding the use of evaluation results), observance of national standards for valuation of property and other regulatory acts on valuation of property during its carrying out, other statements which are important for confirmation of authenticity and objectivity of property valuation and conclusion about its value;
- conclusion about the value of the property;
- attachments with copies of all source data, as well as, if necessary, other information sources that explain and confirm the assumptions and calculations.

3 Conclusions

Carrying out a cost evaluation of public roads is important because it solves a number of important issues that are necessary for making reasonable decisions in the road property management process. These include: establishing the availability of assets, determining the conformity of their physical condition to the estimated cost, determining the real current cost of assets. Cost evaluation methods allow carrying out a cost evaluation of road property, taking into account its specific features. A practical approach to solving the issue of property cost evaluation is the basis for a comprehensive inventory and cost evaluation of public roads, which will allow further using it as one of the key mechanisms for understanding the financial condition of the road sector. According to the calculation results, it is possible to make conclusions on the property condition, which will facilitate the adoption of reasonable management decisions on the further use of road assets.

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