

Чуб О. М. Першочергові фактори, що впливають на комплексну реконструкцію стадіону. Досвід підготовки стадіонів до проведення спортивних змагань міжнародного рівня в модернізації українських стадіонів становить інтерес для подальших реконструкцій спортивних споруд. Огляд спеціалізованих джерел і вивчення європейських настанов виявив основні чинники, які необхідно враховувати в роботі над модернізацією стадіонів. Робота над реконструкцією стадіону «Металіст» в місті Харкові до ЄВРО 2012 розглядається як приклад впливу факторів на комплексну модернізацію стадіону.

Ключові слова: стадіон, реконструкція, модернізація, спортивні споруди.

Чуб А. Н. Первоочередные факторы, влияющие на комплексную реконструкцию стадиона. Опыт подготовки стадионов к проведению спортивных состязаний международного уровня в модернизации существующих украинских стадионов к ЕВРО 2012 представляет интерес для проведения дальнейших реконструкций спортивных сооружений. Обзор специализированных источников и изучение европейских наставлений выявил основные факторы, которые необходимо учитывать в работе над модернизацией стадионов. Работа над реконструкцией стадиона «Металлист» в городе Харькове рассматривается как пример влияния факторов на комплексную модернизацию стадиона.

Ключевые слова: стадион, реконструкция, модернизация, спортивные сооружения.

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THE MAIN FACTORS THAT INFLUENCE ON THE OPERATIONAL DURABILITY OF SEWAGE NETWORKS

The article is devoted to the study of the main factors affecting the operational durability of sewage collectors. It is established that the main reasons for the exit from the working condition of pipelines are the presence of corrosion processes; non-compliance of pipeline materials with the design operating conditions; violation of the technology of production of construction works, etc.

Key words: corrosion, sewage collector, wear, operational durability.

Introduction. The sewage system of any settlement is one of the most expensive and most vulnerable parts of underground engineering infrastructure. The state of the environment, the comfort of living the population, the efficiency of the city's enterprises depends on its reliable and uninterrupted operation. A significant part of the sewer collectors of the cities of Ukraine, built in the last century in the period of intensive construction, has now completely exhausted its depreciation resource. As of 2015, the length of

sewerage networks in Ukraine was 37,404 thousand km, of which emergency - 12,749 thousand km or 34%.

Construction of a sewerage network in Kharkov began in 1913, about 20-30% of the length of the network was built up to 1960, and about 60% - in the 1960-1980's. The number of drainage networks in Kharkov, which are in emergency condition today, is about 40%. Their construction was often carried out from reinforced concrete, steel and cast iron, which are prone to destruction as a result of the influence of many factors and, first of all, corrosion.

The high technical wear and tear of distribution systems indicates the need for urgent measures to investigate the conditions of operation of sewage networks and the implementation of effective repair measures to avoid environmental and social disasters.

The goal of this publication is to investigate the main factors that influence on the durability of the operation of the sewerage network.

Methods and equipment. The research will be based on the work of foreign scientists, devoted to the study of existing technologies for the restoration of underground communications, as well as features of the work on a specific object. Research by German scientists on the operational reliability of pipelines suggests that today preference is given to trenchless (NO-DIG) recovery technologies [1-3], which are more economical than traditional (with earthwork). G. Rosher's work consolidates the results of many years of research on the reasons for the rejection of pipelines, the impact of their technical state on the quality of water and ways to increase their operational longevity [1]. K. Kökmäjär examines the issue of the restoration of collectors from prefabricated reinforced concrete structures using multicomponent building materials [2]. S. Pretorius, B. Schoer pay particular attention to the filling of the annular gap with a multicomponent mixture to reduce friction of surfaces and consolidation of soils in the repair of communications, especially the technology Relining [3]. In work [4] the application of polyethylene pipes, polymeric liners during the restoration of pipelines during their further exploitation was investigated. Foreign scientists constantly improve the methods of trenchless reconstruction of pipes in order to increase their efficiency. J. Jayapalan and his colleagues devoted their work to point pipeline repair using the Quick Lock plastic mechanical sleeves [5]. In [6] S. Sendesi et al. the improvement of the ecological component of the use of trenchless technologies is indicated. Much attention is paid to modeling the repair and operation of pipelines, so the scientists from Canada [7] proposed a model for the failure of sustainable operation of distribution

networks for its further forecasting. The experience of American scientists on the basis of multi-year statistical data made it possible to develop regression models that are able to predict the structural and operational conditions of pipelines [8]. From the side of the research of the factors influencing the operational life of distribution networks and the technical and economic indicators of the work, the following should be noted: V. Kaushal's research is devoted to the issues of protection of reinforced concrete collectors from the influence of corrosion processes [9]; The numerical study of longitudinal bending in pipes exposed to lateral motions of the soil, which plays an important role in the construction work [10], is presented in the paper. Despite the described developments, the implementation of most of the above-mentioned progressive NO-DIG technologies for operating companies in Ukraine is inaccessible due to their high cost. In the opinion of the authors it is expedient to investigate the factors that affect the durability of the distribution system of sewerage.

Results. Earlier, during the mass construction of most of the currently operating drainage networks in Ukraine, the process of nutrient corrosion was poorly studied: there were no methods for identifying and predicting the factors affecting the processes of destruction of sewerage collectors. The materials and articles used often had limited corrosion resistance, the reinforced concrete collectors had a low waterproof grade of concrete (below W4). With such indicators, the reinforced concrete collectors cannot provide the normative durability.

The main factors that influence on the operation durability of the sewerage network is biogenic hydrogen sulfide corrosion (Fig. 1, 2). The process of biogenic hydrogen sulfide corrosion, as a rule, proceeds according to the following scheme:

- sulfate-reducing bacteria that are in the anaerobic layer of silt deposits, restore sulfates to sulphides, including H_2S ;

- hydrogen sulphide is released into the gas medium of the collector, which dissolves in the condensate moisture of the coving surface of the pipes;

- aerobic thiobacteria settling on the surface of the arch, oxidize H_2S and other sulfur-containing compounds to H_2SO_4 ;

- sulfuric acid (H_2SO_4) reacts with the material of the collector and destroys its structure.



Fig. 1. Corrosion of the sewer tunnel



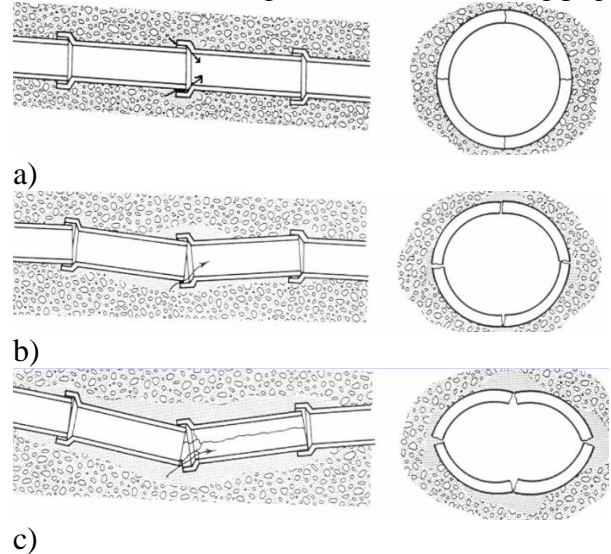
Fig. 2. Damage to the recaptured part of the collector

The most common sewerage network defects are as follows [11]:

- cracks, fractures;
- joint displacement;
- root intrusion;
- deformation;
- collapse;
- poorly constructed connections;
- abandoned laterals left unsealed.

For any incident of infiltration, a number of these defects may be present, arising from a single cause or several causes in sequence. Also, infiltration itself causes the erosion of soil, washing the fine soil particles into the sewer system.

This soil erosion produces the problems of sink-holes, undermining the pipe supports. As a result, the structural integrity of the pipe is endangered due to the washout of backfilling material. A number of the defects listed above can be considered as stages in the collapse of a sewer. These stages of sewer collapse due to ground loss are shown in Figure 3 on the following page.



*Fig. 3. The Process of Sewer Failure:
a – initial defect, but sewer remains held in position by the surrounding soil; b – development of zones of loose ground or voids caused by the loss of ground into the sewer; c – failure of the sewer pipe*

While rain events are not considered a cause of infiltration, they can trigger a rise in groundwater levels and increase infiltration flows. The highest infiltration flows are observed following significant rain events or following prolonged periods of precipitation [11].

- The following collection system deficiencies are usually considered when rehabilitation decisions are made [11-14]. Causes of deficiencies can range from inadequate design or construction to old age:
 - broken or crushed pipe;
 - deteriorated pipe;
 - deteriorated or cracked pipe or mortar joints in brick sewers and manholes;
 - cracked pipe;
 - leaking pipe joints in mainline sewers;
 - leaking building sewers;

- leaking manhole external drops;
- leaking laterals;
- improperly supported pipe;
- deteriorated or leaking manhole walls, bases or troughs;
- leaking or deteriorated wet wells and lift stations, regulator structures and tide gate chambers.

Conclusions. Investigation of the design features of sewer collectors, the conditions and duration of their operation, the regulatory framework for design, construction and operation allowed to establish that a significant part of sewer collectors built in the last century, now completely exhausted its depreciation resource. The obtained results testify to the fact that in recent decades the practice of designing and building engineering communications, including sewer collectors, was based on a normative basis, the main principle of which was the requirements of minimizing capital investments and the cost of construction and installation work. The main reasons for loss of capacity of collectors are corrosion. This testifies to the necessity of taking urgent measures on the study of the conditions of operation of sewer networks and the implementation of effective organizational and technological solutions to prevent environmental and social disasters.

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Забелін С.А., Алейнікова А.І., Гринчук О. А., Газматова К.Г. ОСНОВНІ ФАКТОРИ, ЩО ВПЛИВАЮТЬ НА ЕКСПЛУАТАЦІЙНУ ДО-

ВГОВІЧНІСТЬ МЕРЕЖ ВОДОВІДВЕДЕННЯ. Стаття присвячена дослідженню основних чинників, що впливають на експлуатаційну довговічність каналізаційних колекторів. Встановлено, що основними причинами виходу з робочого стану трубопроводів є наявність корозійних процесів; невідповідність матеріалів трубопроводів проектним умовам експлуатації; порушення технології виконання будівельних робіт і ін.
Ключові слова: корозія, каналізаційний колектор, знос, експлуатаційна довговічність.

Забелин С.А., Алейникова А.И., Гринчук О. А., Газматова К.Г. ОСНОВНЫЕ ФАКТОРЫ, ВЛИЯЮЩИЕ НА ЭКСПЛУАТАЦИОННУЮ ДОЛГОВЕЧНОСТЬ СЕТЕЙ ВОДООТВЕДЕНИЯ. Статья посвящена исследованию основных факторов, влияющих на эксплуатационную долговечность канализационных коллекторов. Установлено, что основными причинами выхода из рабочего состояния трубопроводов является наличие коррозионных процессов; несоответствие материалов трубопроводов проектным условиям эксплуатации; нарушение технологии производства строительных работ и др.
Ключевые слова: коррозия, канализационный коллектор, износ, эксплуатационная долговечность.

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ОСОБЕННОСТИ ПРОИЗВОДСТВА СТРОИТЕЛЬНО-МОНТАЖНЫХ РАБОТ В УСЛОВИЯХ РЕКОНСТРУКЦИИ ПРИ РЕВИТАЛИЗАЦИИ ПРОМЫШЛЕННЫХ ЗДАНИЙ

В статье освещены современные тенденции реновации промышленных зданий под гражданские объекты, расположенные в городской застройке. Приходится учитывать специфичность строительно-монтажных работ по восстановлению конструкций, при ревитализации. Производство строительно-монтажных работ при этом имеет ряд исключительных свойств, возникающих в результате того, что работы объединены во времени и пространстве.

Ключевые слова: особенности, конструктивные решения, реконструкция, подземные коммуникации, специфичность работ, ограниченные условия.

Введение. В городах Украины активно идет процесс ревитализация исторически сложившихся промзон, расположенных

вдоль одной из основных городских магистралей. Разрабатываются детальные планы территорий, новые транспортные развязки,