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Таблица 1. – Качественные показатели новой двухниточной цепной строчки

№	Вид материала	Качественные показатели новой двухниточной цепной строчки			
		Отсутствие про- пуска стежка	Отсутствие морщин вдоль строчки	Плотность со- единения	Эластичность строчки
1.	Очень тонкие материалы	+	+		+
2.	Джинсовые материалы	+		+	
3.	Плащевые материалы	+	+	+	
4.	Костюмные материалы	+		+	+
5.	Пальтовые материалы	+		+	
6.	Эластичные материалы	+	+		+

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Designing subscriber network according to PON technology

Abstract: In this work developed project for the construction optical access network according to PON technology for specific areas. As the territory is taken village “Uzbekistan” in Takhtakupir region of the Republic of Karakalpakstan. The necessary calculations and return on investment for the construction of the project.

Keywords: optical access network, PON technology, territory, calculation, payback, equipment, cabel.

Actuality of the project. In recent years, subscriber access network are the most dynamic segment of the telecommunications industry. They are directly related to the provision of operator services for subscribers, so they coverage even in an unfavorable economic situation. Here are constantly improving technologies to satisfy new demands of users, new technical solutions that are unique to these networks. There is currently a growing trend for broadband services. Concurrently telecom operators need to test their networks to develop upwards bandwidth, data rate, reduce the time delay in the transmission and improve service quality in general. There are appearing and increasingly introducing new services such as IP-telephony, IP-TV with high-resolution, video on demand (VoD), game in mode «online» and others. This fact puts question for telecom operators and service providers on the further technological development ways; as usual solutions can not satisfy the provision of services in full. All those present ways to build a network, the most alluring of them looks as technology PON — Passive Optical Network (PON)¹.

Distribution network access PON, based on tree-optic cable architecture with passive optical splitters on the nodes, it is possible that it is the most cost-effective and capable of providing a variety of broadband applications. At the same PON architecture has the necessary efficiency increase as network nodes and bandwidth depending on the current and future needs of customers².

So with this view designing optical network of access according to technology PON for determined territory is actual.

The purpose of the project is a solution of the problem of the granting the services of the broadband access for inhabitant of specific territory on the base of the passive optical networks (PON). The development is realized on base of real data.

The problems of the development of the project include:

- the choice of the concrete object located in rural population;
- the choice equipment and necessary facilities for creating network of access;
- designing network of access with technologies PON for given object;
- the analysis of the factors of using network;
- producing necessary calculation capital investment for construction;
- the calculation payback period capital investment.

Input data. It's necessary to build the passive optical network in the village “Uzbekistan” in Takhtakupir region of the Republic Karakalpakstan.

The number of potential subscribers — 259.

It is possible to increase the number of subscribers.

Available services: data transfer 10 Mbit/s for each subscriber.

Reservations: there is a need to reserve the trunk and distribution cable.

Accommodation optic cables on existing poles of 0.4 kV.

¹ Петренко И. И., Убайдуллаев Р. Р. Пассивные оптические сети PON Часть 2. Ethernet на первой миле. Lightware Russian edition № 2, 2004.

² Денисьева О. М., Мирошников Д. Г. Средства связи для последней мили. – М: Эко-Трендз – НТИЦ Натэкс, 2000.

The wavelength of the signal from OLT to ONT — 1490 nm.

The wavelength of the signal from the ONT to the OLT — 1310 nm.

The central node OLT (Optical Line Terminal) — a device that will be installed in the headquarters. This device receives data from the backbone networks through interfaces SNI (Service Node Interfaces) and forms a downward flow to the subscriber units (direct current) according to the tree PON.

Subscriber unit ONT (Optical Network Terminal), on the one hand, has the subscriber interfaces and with the other hand — an interface for connection to the tree PON, transmitting at a wavelength of 1310 nm and receiving — at wavelength 1490 nm (or 1550 nm). ONT receives data from the OLT, converts them and transmits them to subscribers via the subscriber interfaces UNI (User Network Interfaces).

Optical Splitter is a passive optical multipole distributing stream of optical radiation in one direction and uniting several streams in the opposite direction. Generally, the splitter may be M input and N output ports. In PON networks are most often used 1xN splitter with one input port. 2xN couplers can be used in a system with redundancy for the fiber¹.

Rationale for networking scheme and calculation of the energy potential of network. Figure 1 shows a scheme of a passive optical network in considered village.

Five OLT ports are connected to the five main fiber trunk cable, the other three OLT port connected to three fibers backup trunk. Trunk cables go from the OLT to the optical cross-country on two different paths for redundancy of the main plot. 1 or 2 fibers in each trunk cable are reserved. Optical Distribution Frame is located in the town center to reduce the total length of the distribution cable. Five distribution cables are located “rings”, covering five sectors of the village: Sector A — 57 subscribers, Sector B — 55 subscribers, Sector C — 46 subscribers, Sector D — 40 subscribers and Sector E — 61 subscribers. Each sector provides links to individual port OLT.

We shall produce the calculation of the energy potential of the channel relationship between OLT and ONT. Maximum importance is taken for all fading.

After necessary calculation we get the following results:

— at issue of the signal from OLT to ONT, the power of the signal at the input ONT forms $P_{IN,ONT} = -23,299$ dBp, but spare to powers $\Delta P = 4,701$ dB;

— at issue of the signal from ONT to OLT, the power of the signal at the input OLT forms $P_{IN,OLT} = -26,505$ dBp, but spare to powers $\Delta P = 3,492$ dB.



Figure 1. Scheme of the network.

Indicators of using network. Indicators are considered, provided that communication services will benefit for all residents of the village, to which goes cable in the project. Ports designated by the letters A, B, C, D, E on the designation of branches network, which they serve.

OLT port congestion subscribers:

$$K_A = A/A_m = 57/80 = 71,25\%;$$

$$K_B = A/A_m = 55/76 = 72,37\%;$$

¹ Скларов О.К. Волоконно-оптические сети и системы связи. – М.: Лань, 2010.

$$K_C = A/A_m = 46/48 = 95,83\%;$$

$$K_D = A/A_m = 40/40 = 100,0\%;$$

$$K_E = A/A_m = 61/80 = 76,25\%,$$

where A — number of subscribers connected to the port,

A_m — the maximum number of subscribers connected to the port.

It is possible to expand the network by increasing the number of potential subscribers.

Calculation of capital investments for the construction. The capital investments consist of¹:

- Construction and installation works;
- Transportation costs for the delivery of cable and station equipment for the work site;
- The cost of cable and terminal equipment;
- The cost of designing telecommunication network access;
- Other costs.

Calculation of capital investments produce in accordance with:

$$C = C_{EQ} + C_{MAT} + C_{TPW} + C_{EN} + C_{CIW}$$

here C_{EQ} — equipment costs;

C_{MAT} — the cost of materials;

C_{TPW} — the cost of transportation and procurement work;

C_{EN} — engineering costs;

C_{CIW} — the cost of construction and installation works.

The volume of all structures is determined in accordance with the selected route.

Prices of the equipment are taken from a commercial site of Huawei Technologies² and Wintelecom³.

Total capital investment for the construction of linear and station facilities of communication: $C = 48856,49$ \$ USA.

Calculation of annual operating costs are produced in accordance with the formula:

$$C_{AO} = \text{Payroll} + \text{UST} + M + D + C_{EI} + C_{OC}$$

here Payroll — labor costs;

UST — payment of the unified social tax;

M — material costs;

D — Depreciation;

C_{EI} — the electricity bill;

C_{OC} — other production and transportation costs.

The General amount of the annual working expenses forms: $C_{AO} = 15971,75$ \$ USA.

Calculation of the payback period of capital investment. The main activity is the provision of telecommunications services as a package, which includes:

- The Internet;
- IP telephony;
- IP-TV.

The cost of connection is \$ 15.

The Cost package services form 10, 15, 25 and 40 \$ USA per month. Packages includes Internet at a speed of access up to 10 Mbit/with (1000, 1500, 3000 and 5000 Mbytes per month), service IP-TV (24, 36, 48 and 61 channels) and call for intercity telephone line (180, 300, 500 and 1000 minutes) accordingly.

By calculation income the first package will be chosen 50%, the second one will be chosen 35%, the third one will be chosen 10% and the fourth one will be chosen 5% of all subscribers, being connected to network.

Operating income can be calculated by using the following formula:

$$I = N * C_p (\$ \text{ USA}),$$

here N — number of subscribers, C_p — cost package.

Income from connection and package form:

- Revenue from connection is $C_c = 259 * 15 = 3885$ (\$ USA);
- Income from the first packet is $I_1 = 129 * 10 = 1290$ (\$ USA);
- Income from the second package is $I_2 = 91 * 15 = 1365$ (\$ USA);
- Income from third package is $I_3 = 26 * 25 = 650$ (\$ USA);
- Income from the fourth package is $I_4 = 13 * 40 = 520$ (\$ USA).

Monthly, annual and single incomes from connection is 3825, 45900 and 3885 \$ USA accordingly.

Income from the sale of telecommunication services is $I = 49785$ (\$ USA) for 1st year and $I = 45900$ (\$ USA) for the subsequent years.

Also we determine the profit remaining at the disposal of the company after payment of the budget PMR income tax, which amounts to an average of 25%. And we also deduct operating expenses for the year. Profit is calculated according to the following formula:

$$P = I - (I * 0,25) - C_{AO} (\$ \text{ USA}).$$

After calculation we get these results as:

- profit for the first year forms $P = 21366,998$ (\$ USA);
- profit for the following years $P = 18453,248$ (\$ USA).

Net profit P_N is calculated with formula:

$$P_N = P - (P * 0,075).$$

After calculation we get these results as:

- net profit for the first year forms $P_N = 19764,473$ (\$ USA);
- net profit for the following years $P_N = 17069,254$ (\$ USA).

¹ Цатурова П.Г., Мазурова М.М. Методические указания по технико-экономическому обоснованию дипломных проектов/СПб ГУТ. – СПб, 2003.

² <http://www.huawei.com/ru>

³ <http://www.win-telecom.ru>

The most important indicator of economic reconstruction FOL is the payback period of capital investment, characterized by the ratio of capital investments to net profit. Calculated by the formula:

$$T_p = C/P_N \text{ (year)},$$

here C — capital investments;

P_N — net profit;

$$T_p = 2 \text{ (year)} 9 \text{ (month)}.$$

Practical value. The developed project can be used for building of network access according to technology PON for considered object and furthermore it can be used by example of the building networks of telecommunication.

Conclusion. In this report calculation and designing the area to network PON are formed, chosen and described equipment PON using on designed area (active equipment OLT, passive equipment: splitters and optical cable), as well as, made necessary economic calculations. At present, the investments consider to be involving at payback period less than 5 years. We can conclude that construction to passive optical network of access on technologies PON is economic justified, and can be accepted to realization.

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Study dynamic behavior of earth dam with account nonlinear characteristics of soil under seismic loads

Abstract: At present happened many catastrophes in the world. Water catastrophe is very dangerous. Earth structures (dams, power plants) is considered very high, unique and very responsible constructions. Hydroelectric power plant is a major source of electricity in the world. Many countries have rivers with adequate water flow, that can be dammed for power generation purposes. Besides, Dams are often used to control and stabilize water flow, often for agricultural purposes and irrigation. It is important structure for life of people and it saves large volume water. Projection and constructing such responsible, and by pore and unique earth dams required arranging extensive experiment of the mechanical properties of soils. Our region is located in high seismicity zone. Seismic potential is approximately 7 or 8 point by Richter scale. We have dozens of faults in Uzbekistan and in whole Central Asia region. Together with this an important role acquires the problem of irrigation and hydroenergetics. Dam engineering presents partial solution of this problem. The projecting and erecting of important and sometimes even unique structures made of earth materials demand to carry out numerous experimental studies in mechanical characteristics of soil both in-situ and laboratory conditions, to work out new design methods. Living and engineering in a zone of seismic hazard we should account all possible (seismic and dynamic) influences on an important structure. The department of "Soil dynamics" (Institute of Mechanics) was founded to study fundamental characteristics of materials (soil, ground) and wave propagation in them. For numeric calculations we use basically Grigoryan's model¹ with application of Wilkins' scheme².

Long-term exploitation of earth dams situated in seismic region requires from researches the prediction of dynamic behavior of these dams on different dynamic and seismic actions. So knowing dynamic behavior of the dams we can determine their bearing capacity, strength of the slopes, etc. Dynamic methods of design of earth dam considering wave character of seismic action were worked out by many authors including Zaretskiy, Lyather³. Solutions of such problems for different dams were obtained at initial time. In Khusanov⁴ using Wilkins' scheme⁵ the methods of dynamic design of earth dams on the action of different loads were worked out.

In this paper a dynamic behavior (stress-strain state) is numerically studied on the example of Charvak dam. The height of this dam is 168 m, the width — 12 m. The steepnesses of upper and lower slopes are 1:2 and 1:1,9 respectively.

Stress-strain state of earth dams is studied in this paper with account of nonlinear characteristics of soil of the dam on seismic action with records of real velocigrams. Dam material is modeled by elastic and elastic-plastic bodies.

Keywords: earth dam, elastic-plastic deformation, seismic load, dynamic analysis.

The Statement of Non-Stationary Problem

¹ Grigoryan S. S. Some Questions of mathematical theory of deformation and damage of rigid rock mass" J. Prikl. Mat. and Mech., 1967. 4. P. 643–669.

² Wilkins M. L., Calculation of elastic-plastic flow, Methods Computat. Phys, Acad. Press, New-York-London, 1964. P. 211–263.

³ Lyather V. M., Ivashchenko I. N. Seismic stability of the earth dams. Nauka, Moscow, 1986.

⁴ Khusanov B. E., Salyamova K. D. Finite-differential method for dynamic design of earth dams. Dokl. AN RUz, 9, 1998. P. 20–25.

⁵ Wilkins M. L., Calculation of elastic-plastic flow, Methods Computat. Phys, Acad. Press, New-York-London, 1964. P. 211–263.