GOSPODARKA SUROWCAMI MINERALNYMI

Tom 25 2009 Zeszyt 3

TADEUSZ MAJCHERCZYK*, PIOTR MAŁKOWSKI**, ZBIGNIEW NIEDBALSKI**

The influence of longwall exploitation carried out in the vicinity of a protection pillar on a rectified building

Introduction

Protection of surface buildings in mining areas is of crucial importance during underground exploitation. Maintaining safety of such objects is inextricably connected with the elimination of a hazard related to construction, architectural elements, finishing elements, facilities and equipment (Kwiatek, Kowalski 2001). Since the majority of Upper Silesian mining areas are highly urbanized, difficulties and inconvenience stemming from mining activities should be acceptable for local inhabitants.

Harmful impacts of mining exploitation on residential buildings (both surface subsidence and tremor) is a frequent reason for protests of local communities. Having a well-organized character, such protests often hindered mining works or seriously limited their range (Kaszowska, Palka, Koba 2003). The closing down of the "Katowice" Coal Mine, as a result of a massive protest organized by the residents of the Paderewskiego estate, is just one instance of a decisive role of public opinion in the development of mining. Hence, the decision-making process related to the range of mining below residential areas should be based not only on the thorough expertise of possible morphological or hydro-geological outcomes, but also on it's social effects (Kwiatek 2002).

In November 1998 the Polish norms and requirements, relating to mining and building conditions for designing building objects in mining areas, were updated (Kwiatek 2002). It was a consequence of mining factors, such as the increase of mining depth, interference of different exploited seams, growing number of tremors and significant progress of longwall

* Prof. dr hab. inż., ** Dr inż., AGH University of Science and Technology, Faculty of Mining and Geoengineering, Cracow.

exploitation. Simultaneously, changing building requirements also affected the above-mentioned changes, since construction calculations, using a limit equilibrium method and based heavily on determining and calibrating the influences, became a standard demand for designing buildings (Kawoluk 1999). It should be pointed out, however, that the majority of building objects in the areas of mining influence have never been designed in accordance with the expected mining exploitation impact, or such criterion has only been applied partially.

The following paper presents the influence of longwall exploitation in the vicinity of protection pillar on a five-storey block of flats (Majcherczyk, Hejmanowski, Małkowski 2002). Although the block was built in the direct vicinity of a shaft pillar, underground mining exploitation caused an unequal and irregular subsidence of the building. The building construction, the designer of which had assumed possible mining damage, allowed for the building rectification. The prognoses and measurements related to the influence of exploitation on the analyzed object before and after its leveling were carried out, hence allowing for the evaluation of the applied method effectiveness (Majcherczyk 2008).

1. Description of the analyzed building

The analyzed object is located in the north-western part of the residential estate in Pawłowice, on Krucza Street. It was erected in 1984 and consists of two segments:

— northern segment with the dimensions of 11.4 × 26.75 m,

— southern segment with the dimensions of 11.4 × 24.3 m.

Both segments are provided with a cellar and possess five over-ground storeys with four staircases (two in each segment) providing vertical communication inside the building.

Surface construction of both segments consist of prefabricated elements, produced in the "Fadom-Żory" factory, built in the transverse system. The construction is prepared for the rectification of the object in a vertical plane, since the building foundations consist of two parts:

— reinforced-concrete case reaching the level of roof construction beams above the ceiling,

— plane-beam system creating a stiff bench of the ground floor, on which the superstructure rests.

The case constructed in this way is adapted for the introduction of boosters and executing the rectification of the building's vertical leveling. The foundation is protected against the influence of deformations determined for the fifth category of mining areas, whereas the construction situated on the ground – for the third category.

In the circumstances of continuous surface deformation, the building construction provides a technical possibility to correct excessive deflection of the object in relation to the vertical.

2. The influence of exploitation on the surface in the building vicinity

The analyzed building is located in the southern vicinity of the protection pillar established for the main factory, shafts no. II and no. III, and the "Ludwik" shaft from the south. The pillar constitutes a northern boundary of exploitation for the portion "B". Therefore, the building is exposed to various influences of all mined-out seams in this part of exploitation areas of the "Pniówek" Coal Mine.

In the period from 1984 (i.e. the time of erecting the building) to 2002, in the portion "B", the coal mine was exploiting eight seams, whose exploitation edges affected the volume of surface deformation in the area of the analyzed building. All the seams in the vicinity of the pillar edge were worked out with longwall caving and caving to the rise. Their average thickness ranged from 0.9 to 2.2 m (total of 12.1 m) and the depth of deposit ranged between 560 to 730 m.

Additionally, in 2002 the seam 401/1 was worked out with caving with the height of 1.5–1.7 m, in the minimum distance of 355 m between the horizontal mining plot and the vertical projection of the analyzed building. The longwall was also extracted with caving with the height of 3.3 m, whose minimum horizontal length from vertical projection of the analyzed building on Krucza Street amounted to 625 m.

The design of further exploitation for the years 2002–2007 in the portion "B" indicated that in the first quarter of 2007, the planned B-5 wall in the seam 403/1 should practically reach the edge of the southern segment of the building and the longwall mining would be likely increase the value of deformation indicators.

3. Surface deformations in the building vicinity

Areal observations and geodesic surveying carried out in the vicinity of the analyzed building indicated both continuous and discontinuous deformations.

Surface deformation surveying was carried out in the years 1977–2002 on the surveying line along the road connecting Dębina and Pniówek, which is located to the north west from the building. It proves that the process of continuous surface deformations occurred in the analyzed area incessantly (fig. 3.1). The phenomenon resulted from working out further seams of coal in the portion "B" by the "Pniówek" coal mine. The line's points closest to the analyzed building indicated deformations of approximately 500 mm, growing systematically in time, which is typical for peripheral points in relation to mining exploitation.

The measurement results of leveling cycles carried out already since 1994 were used for the sake of the building deflection estimation. It was concluded that in 1994 both segments – northern and southern – inclined 3.4‰ southward. In 2001 the northern segment didn't change it's deflection, whereas the southern segment increased its deflection up to as much as 16.7‰ south-westward (fig. 3.2).

In the close vicinity of the building, the occurrence of discontinuous surface deformations were also indicated. The deformations manifest themselves in the form of fracture and small

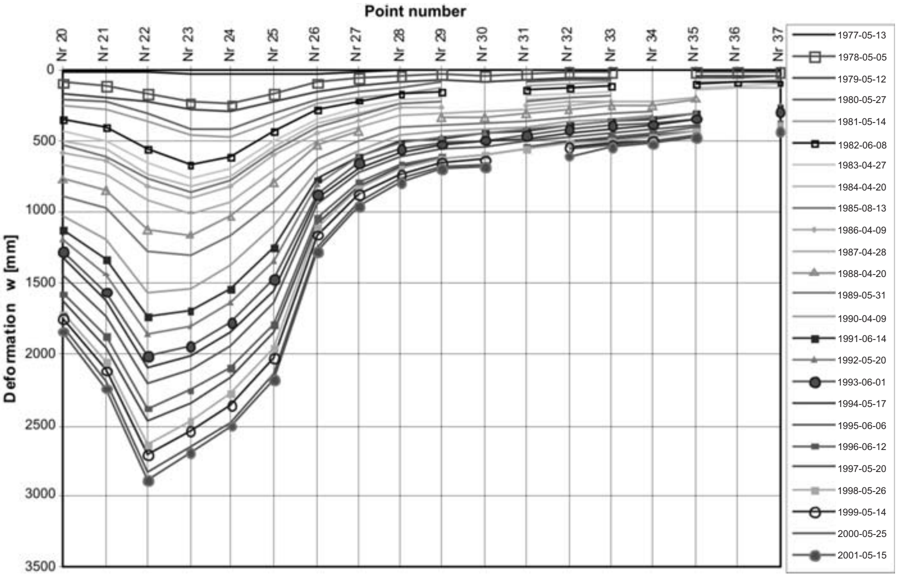

Fig. 3.1. Subsidence on the surveying line no. 21 in the years 1977–2001

Rys. 3.1. Obniżenia reperów geodezyjnych na linii nr 21 w latach 1977–2002

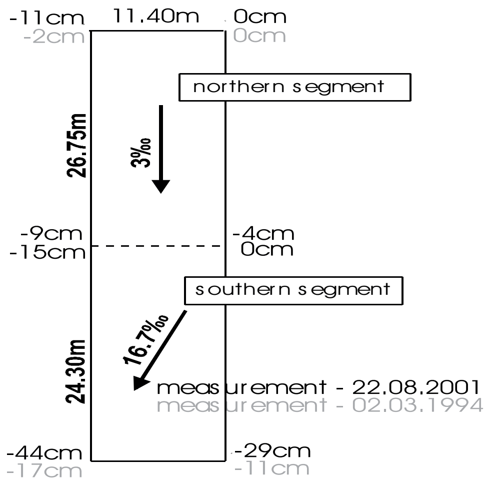

Fig. 3.2. Deflection of building sections

Rys. 3.2. Pomiary wychyleń segmentów budynku

fault scraps with the throw not exceeding 0.3 m. The analysis of the location and the direction of spreading of the above-mentioned discontinuous forms allowed for the following assertions:

— linear discontinuous forms display meridional (northbound and north-westbound) course; then they reach the foundation of the southern segment of the building,

— the reason for discontinuous deformations is the exploitation of several coal seams plots up to the common exploitation edge, which caused disadvantageous cumulating of exploitation zone influence on the seam,
— discontinuous deformations visible on the surface were partly eliminated by means of leveling with earth, or partly by means of asphalting, in the surface zone.

While considering covering the surface in the area of the occurrence of discontinuous deformation forms, it should be kept in mind that they divide the highly urbanized regions (located eastward from the deformation area) from the less urbanized areas (located westward from the discontinuity zone). In the light of the hitherto executed geodesic research and surveying it may be presumed that the mining influences are cut by the above-mentioned discontinuous forms, which seem to be indicated by the subsidence of the surveying points ZW 83 and Rp. 1030, occurring in the analyzed region (fig. 3.3). Despite the fact that the surveying point Rp. 1030 was located in the area of exploitation edge, it indicated incommensurably minor subsidence, 9 times lower than the subsidence of the surveying point ZW 83.

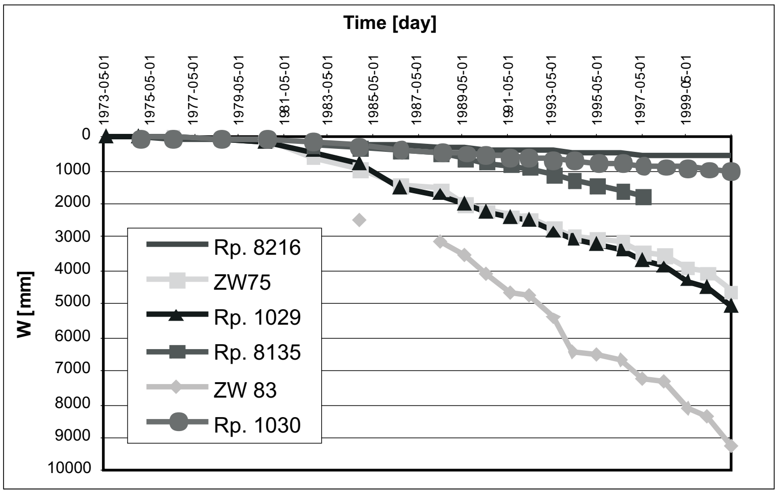

Fig. 3.3. Subsidence of surveying points in the building vicinity

Rys. 3.3. Obniżenia reperów geodezyjnych w rejonie analizowanego budynku

The above results indicate the activation of dilatation gap and considerable irregularity of subsidence of particular building segments. Serious subsidence rate in the south-western corner of the foundation, located in discontinuous deformation zone, should be of special concern. The deflection of the building in relation to the vertical was 16.7 mm/m, hence it exceeded the stipulated value of 15 mm/m, assumed as the limit of little inconvenience of building use. The potential possibility of higher inconvenience was the main reason for considering the range of planned mining and proper reinforcement of the building construction as well as for adjusting the object for the possibility of rectification.

4. Prognosis of surface deformation for the object before the rectification

Calculation of deformation indicators was carried out on the basis of the modified Knothe model, for the sake of which an appropriate set of data was collected and the following parameters were prepared based on geodesic observations:

- parameter of influence distribution tg $\beta = 2.0$,
- exploitation coefficient a = 0.85 (related to reactivated workings),
- overall parameter of time f = 2.7 [$year^{-1}$] (ξ = 30 $year^{-1}$, c = 3 $year^{-1}$),
- deviation index $\mu = 0.7$,
- coefficient of inclination and displacement proportionality B = 0.32.

As the object was erected in 1984, the influence of mining exploitation was related to this year and appropriate increases of deformation indexes were determined. The calculation net consisted of 256 calculation points distributed every 10 m.

On the basis of the results analisys, presented in fig. 4.1 and fig. 4.2, it was assumed that on the northern side of the object the subsidence will not change considerably after commencing the exploitation of the seam 403/1. It will maximally reach approximately 1.81 m. In the analogical period, the subsidence in the southern part will reach approximately 2.6 m. A considerable increase of subsidence will occur as soon as the mining exploitation in the seam 403/1 approaches the analyzed object. Then the subsidence of both segments of the building will increase to approx. 2.49 m in the northern part and to approx. 3.52 m in the southern part, i.e. by approx. 0.68 m and 0.92 m respectively.

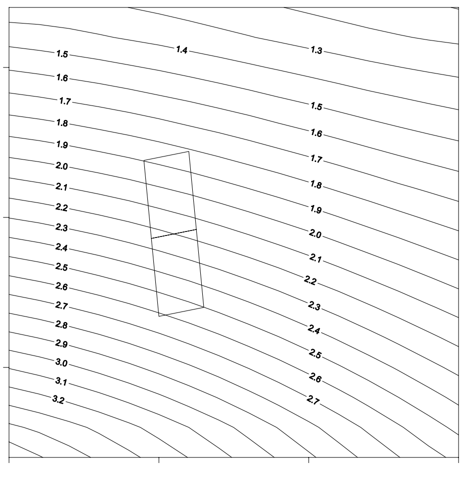

Fig. 4.1. Subsidence in the building vicinity in 2005

Rys. 4.1. Osiadania w rejonie obiektu w 2005 roku

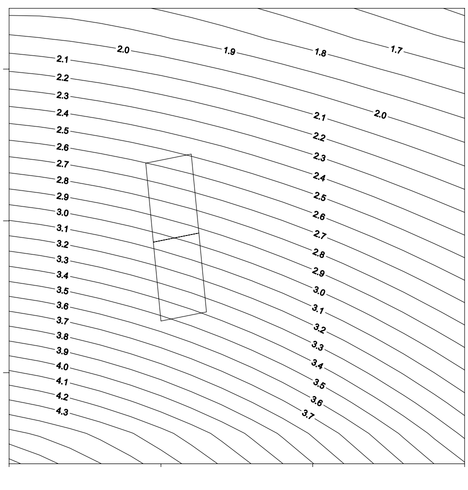

Fig. 4.2. Subsidence in the building vicinity in 2007

Rys. 4.2. Osiadania w rejonie obiektu w 2007 roku

The distribution of horizontal strain presented in fig. 4.3 and fig. 4.4 indicates that from 1984 to the end of 2005 the total increase of horizontal strain, resulting from the mining

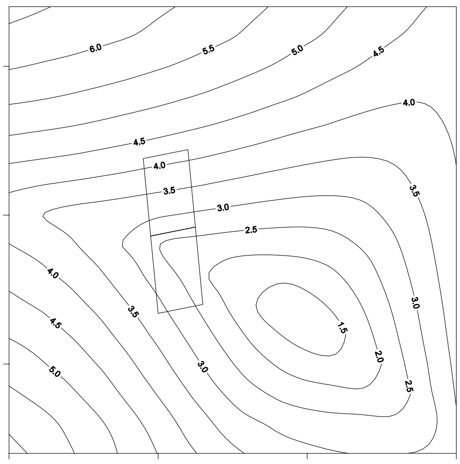

Fig. 4.3. Horizontal strains in the building vicinity in 2005

Rys. 4.3. Odkształcenia poziome w rejonie obiektu w 2005 roku

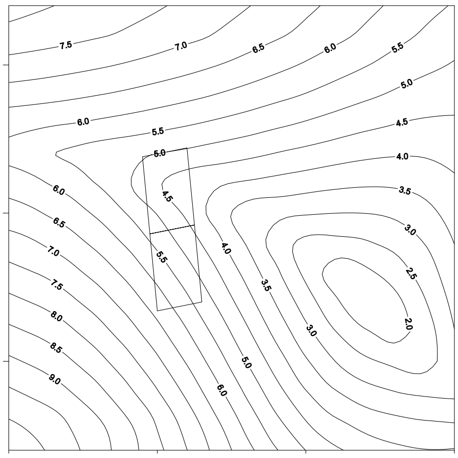

Fig. 4.4. Horizontal strains in the building vicinity in 2007

Rys. 4.4. Odkształcenia poziome w rejonie obiektu w 2007 roku

exploitation, should range between 2.6 and 4.2 mm/m. In 2007 the increase of horizontal strain was likely to reach 5.4 mm/m in the northern part and approximately 6.4 mm/m in the southern part of the building. The increase of strain in the analyzed object is primarily related to the progress of exploitation in the seam 403/1, especially to the wall B-5 approaching the edge of the protection pillar.

The analysis of deformation indicators reveals that the stability of the analyzed building in relation to the planned exploitation depends upon the rectification of the object as well as upon the repair works of all the hitherto occurring building damage.

Fig. 5.1. Rectification with the help of boosters

Rys. 5.1. Rektyfikacja obiektów za pomocą siłowników

5. Rectification of the analyzed building

The methods of building object rectification embraces such engineering works, such as elevating parts of the buildings located that are too low and lowering parts of the buildings positioned too high by extracting soil from below the foundations (Mika, Niemiec 2002). Taking costs and technology under consideration, the most frequently applied methods include: using hydraulic boosters, subsidence compensation, injections and the gravitation-drilling method. In the instance of the building on Krucza Street, the method using hydraulic boosters was applied, which helped to elevate the southern part of the building in autumn 2004. The walls of this five-storey object were reinforced with steel frames at the level of upper edge of niches, whereas the niches and cracks in the walls were filled with concrete. After finishing those works, the building was leveled completely and both dilated segments were positioned at a similar height.

6. Behavior of the building after rectification

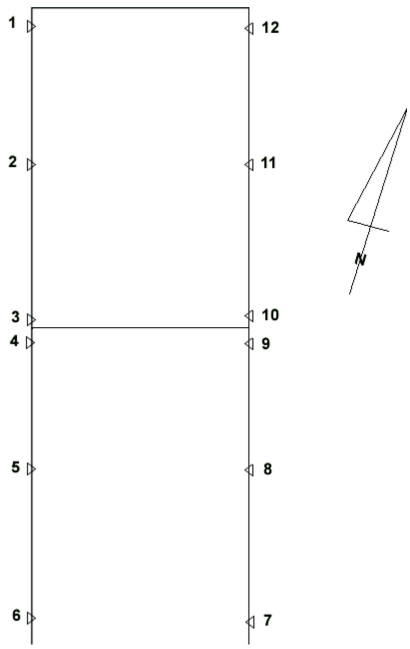

Fig. 6.1. Foundation benchmarks position on the building at Krucza St.

Rys. 6.1. Szkic usytuowania reperów fundamentowych na obiekcie przy ulicy Kruczej

After completing rectification in the foundations of the object, additional geodesic benchmarks were fixed. They are currently fixed in the system of six in both dilated parts of the object (fig. 6.1). The altimetric measurements have been carried out regularly since June 28th 2002. From June 2002 to the end of 2007, for which prognostic calculations had been carried out earlier, the total of 12 measuring cycles were made. The northern segment of the building demonstrated regular subsidence in the period of monitoring, similarly to the period before leveling. The subsidence increased reaching the maximum values of approx. 0.08 m in 2007. The southern segment subsided irregularly and the maximum subsidence for the benchmark no. 6 recorded on September 18th, 2007 amounted to 0.17 m, which was thus twice as much as the subsidence of the northern segment. Hence, it may be assumed that in the period 2002–2007 displacements appeared in the vicinity of the building dilatation gap (Table 6.1). What seems to be of crucial for the comfort of the buildings use is the problem of irregular subsidence in the southern segment. Until the building rectification, i.e. untill June 2004 this difference was $\Delta w_{6\text{-}9}$ = 0.016 m, which corresponds to 0.7‰. Irregular subsidence of the southern segment reappeared also between September 2005 and November 2006, when the difference of subsidence of benchmarks no. 6 and no. 9 was Δw_{6-9} = 0.023 m, i.e. 1.04‰. In September 2007 this disproportion reached as much as 0.092 m, i.e. 4.2‰. These values, however, are not as high as in the period 1997–2002 and, hence, they were not dangerous for the analyzed object. Nevertheless, the occurrence of irregular subsidence of the southern segment, with parallel lack of such a phenomenon in the northern segment, was

TABLE 6.1

Increment of vertical displacements for benchmarks fixed to the building on Krucza Str.

TABELA 6.1

Przyrost obniżeń reperów zlokalizowanych na budynku mieszkalnym przy ulicy Kruczej

Point number	Date of measurement													
	28.06.2002	22.10.2002	22.01.2003	08.05.2003	08.09.2003	11.12.2003	12.03.2004	14.06.2004	08-09.2004	20.12.2004	20.09.2005	10.10.2006	09.03.2007	18.09.2007
	Subsidence change [mm]													
1	Basic measurement	-1	-1	-5	-48	-55	-61	-64	Building elevation	Basic measurement	-18	-23	-38	-73
2		-4	-4	-9	-55	-60	-63	-67			-20	-29	-44	-80
3		-5	-5	-11	-51	-59	-63	-67			-19	-28	-43	-80
4		-3	-3	-13	-56	-62	-70	-72			-16	-34	-65	-111
5		-6	-10	-24	-65	-77	-78	-82			-27	-41	-88	-142
6		-8	-9	-24	-69	-75	-82	-85			-27	-58	-106	-169
7		-6	-7	-19	-63	-72	-74	-80			-28	-50	-90	-145
8		-3	-3	-14	-57	-64	-67	-71			-25	-41	-74	-119
9		-4	-5	-12	-55	-61	-68	-69			-25	-35	-58	-97
10		-4	-5	-	-	-53	-	-64			-	-11	-25	-
11		-2	-2	-10	-52	-59	-59	-63			-17	-24	-38	-71
12		-2	-2	-8	-51	-55	-58	-61			-12	-20	-34	-68

interpreted as the result of the activation of the zone of geological discontinuities (faults) in this area.

As a matter of fact, the applied rectification constrained the process of building deflection. Slightly higher absolute values of subsidence in comparison with the analogical period of time before the rectification were caused by mining exploitation carried out in the close vicinity of the building. On the basis of the comparison of the geodesic surveying results in the period 2005–2007 presented below with the prognostic values presented above (cf. figs 5.1–5.4), it may be estimated that the latter were considerably lower. For the northern segment of the building, theoretically they were supposed to reach 0.68 m, but practically they reached only 0.06 m, whereas for the southern part, the expected subsidence was estimated as 0.92 m, but the recorded value was only 0.14 m.

In order to provide current supervision of the movements of the building and its groundwork, it was recommended to continue periodical observations of altimetric points located on the building foundations. Additionally, it was suggested to make a stabilization for analogical ground points in the vicinity of the building and a coordinated altimetric measurement for both groups of points in fixed intervals of time, in relation to constant altimetric points.

Taking the influence of mining exploitation on the analyzed building as well as the expected exploitation in the area under consideration, for the same periods of time and the earlier-assumed measurement net, the deformation indicators for the object were estimated again (Table 6.2). As the object is dilated in the middle of its length, the indicators were determined separately for the northern part (points 7–12) and for the southern part (points 1–6). The columns of table 6.2 present the denomination of points, dates of measurements, as well as the determined increase of: subsidence (*W*), maximum deflection (T_{max}), longitudinal deflections ($T_{podł}$), transversal deflections according to main axes of the building (T_{pop}), main strains (ε_{G1}, ε_{G2}), longitudinal strains ($\varepsilon_{podł}$) and transversal strains (ε_{pop}).

TABLE 6.2

Increments of surface deformation indicators for the building

TABELA 6.2

Zestawienie przyrostów wyznaczonych wskaźników deformacji dla budynku

Point	Period to	W [m]	T_{max} [mm/m]	$T_{podł}$ [mm/m]	T_{pop} [mm/m]	ε_{G1} [mm/m]	ε_{G2} [mm/m]	$\varepsilon_{podł}$ [mm/m]	ε_{pop} [mm/m]
1	01.01.2009	0.013	0.15	0.14	-0.04	0.18	-0.07	0.13	-0.03
2	01.01.2010	0.015	0.17	0.16	-0.06	0.24	-0.08	0.13	0.01
3	01.01.2011	0.032	0.40	0.32	-0.23	0.79	-0.29	0.26	0.22
4	01.01.2012	0.093	1.05	0.91	-0.53	1.67	-0.71	0.70	0.18
5	01.01.2013	0.173	1.74	1.60	-0.70	2.07	-0.77	1.14	0.04
6	in-coming	0.177	1.78	1.63	-0.71	2.10	-0.77	1.17	0.04
7	01.01.2009	0.010	0.12	0.11	-0.03	0.15	-0.05	0.12	-0.02
8	01.01.2010	0.011	0.14	0.13	-0.05	0.20	-0.06	0.13	0.01
9	01.01.2011	0.024	0.32	0.26	-0.18	0.67	-0.23	0.24	0.17
10	01.01.2012	0.071	0.85	0.75	-0.42	1.45	-0.57	0.66	0.15
11	01.01.2013	0.134	1.45	1.34	-0.56	1.89	-0.59	1.13	0.06
12	in-coming	0.138	1.49	1.37	-0.57	1.92	-0.59	1.15	0.06

Deformation indicators again display a higher increase of values in the southern part of the object (closer to exploitation). The subsidence is likely to reach the value of 0.177 m. The obtained results of subsidence through profile deflection indicate a possible hazard for the area related to the first category. A serious increase of indicator values will take place after 2012. In relation to strain, it should be pointed out that the maximum increase of transverse extension for the object is likely to appear after 2012 and it may reach 2.1 mm/m, whereas compressive strain will reach approx. –0.77 mm/m and will be still located in the south-western corner of the building. The distribution of deformation indicators in relation to the object's situation indicates that in the longitudinal direction the strain will slightly exceed the value of 1 mm/m (max 1.17 mm/m), whereas the deflections in the longitudinal direction will reach 1.63 mm/m. The obtained values correspond to the first category of mining areas.

Conclusions

1. The paper presents the case of irregular subsidence of a block of flats located in the vicinity of shaft pillar. The measurements of subsidence in surveying points fixed on the building proved that in the period 2002–2004 the subsidence in the analyzed object increased to the value of 60–80 mm. The northern part of the building was less influenced by mining exploitation than the southern one. Such a phenomenon was related to the northbound manner of exploitation. Additionally, extracting particular walls usually terminated in the vicinity of the analyzed object. The location of the southern part of the building directly above the fault zone increased undesirable influences of exploitation and caused deflections of 16.7‰, regarded by the residents of the analyzed building as highly inconvenient. The expected values of deformation indicators for the object calculated for five years demonstrated that there would be an increase of total horizontal strain to 5.4 mm/m in the northern part and to approx. 6.4mm/m in the southern part of the object. This would result from the position of the building in relation to the protection pillar and the advancement of the B-5 wall in the seam 403/1 towards the building's boundaries. In light of the above-mentioned values it was concluded that the stability of the analyzed building would depend upon the rectification of the object and the repairs of existing damage.

2. After the rectification of the building in 2004 the subsidence increased by an additional 68–169 mm. Again, large disproportions of subsidence were recorded in the southern segment, where deflection amounted to 4.2‰. Nevertheless, it was four times lower than before the rectification. Thus, the leveling constrained the process of the building deflection.

3. Slightly higher absolute values of subsidence in comparison to the analogical period of time before rectification was caused by the exploitation carried out directly in the area of the building. On the basis of the comparison of geodesic surveying from the years 2005–2007 with the values of subsidence expected in 2003, it may be estimated that the former were considerably lower. For the northern segment of the building, the subsidence was supposed to be 0.68m theoretically, but practically it was only 0.06 m, whereas for the southern part the expected subsidence was estimated as 0.92 m, but the measured one was just 0.14 m.

4. On the basis of the values analysis of deformation indicators determined in the longitudinal and transversal direction in relation to the analyzed block location it was concluded that the most significant strain occurred in the longitudinal direction (not exceeding 1.17 mm/m), whereas the most significant deflection occurred also in the longitudinal direction (1.63 mm/m). The deflection of the building will thus increase additionally by only 0.3‰, which gives the total value of longitudinal deflection of approx. 4.5‰. Such surface deformations as the ones affecting the building on Krucza Street should not cause any damage requiring renovation works or another rectification of the building's segments. Therefore, the rectification of the analyzed object proved to be a successful and effective method of restoring a full-range functionality of a five-storey block of flats.

REFERENCES

Kaszowska O., Palka J., Koba M., 2003 – Problemy społeczne wynikające z oddziaływania podziemnej eksploatacji górniczej na obiekty budowlane. Półrocznik Akademii Górniczo-Hutniczej Geodezja t. 9 z. 2/1. Kraków, 337–344.

Kawulok M., 1999 – Wybrane problemy projektowania budynków na terenach górniczych. Materiały konferencyjne: „V dni Miernictwa Górniczego i Ochrony Terenów Górniczych". Prace Naukowe GIG, seria: Konferencje nr 30, Katowice, 46–57.

Kwiatek J., 2002 – Obiekty budowlane na terenach górniczych. Wydawnictwo Głównego Instytutu Górnictwa. Katowice.

Kwiatek J., Kowalski A., 2001 – Ocena możliwości prowadzenia eksploatacji górniczej z uwagi na ochronę obiektów budowlanych. Wiadomości Górnicze 11, 450–456.

Majcherczyk T. et al., 2008 – Analiza zakresu eksploatacji ścian w pokładach 403/3 i 404/1 partia B – część wschodnia w aspekcie ochrony powierzchni terenu. Kraków (praca niepubl.).

Majcherczyk T., Hejmanowski R., Małkowski P., 2002 – Określenie wpływu eksploatacji górniczej w partii „B" pokład 403/1 ścianą B-5 na wielorodzinny budynek mieszkalny, położony w Pawłowicach przy ul. Kruczej 10, administrowany przez górniczą spółdzielnię mieszkaniową w Wodzisławiu i Wojskową Agencję Mieszkaniową w Gliwicach. Kraków (praca niepubl.).

Mika W., Niemiec T., 2002 – Rektyfikacja wysokich budynków mieszkalnych na terenach górniczych. Prace Naukowe GIG, seria: Konferencje nr 41, „Problemy ochrony terenów górniczych", Katowice, 323–328.

THE INFLUENCE OF LONGWALL EXPLOITATION CARRIED OUT IN THE VICINITY OF A PROTECTION PILLAR ON A RECTIFIED BUILDING

Key words

Surface protection, influence of mining exploitation on surface and building constructions, prognosis of surface deformation

Abstract

In the case of mining exploitation carried out in the areas of cities, towns and other residential estates, protection of building constructions on the surface seems to be of crucial importance. This issue is frequently taken under consideration both in exploitation projects and estimation of mining activity after its completion. Intensive mining works in the close vicinity of urbanized areas may lead to the occurrence of cracks in construction walls or even to building breakdowns.

The paper presents an analysis of the impact of executed and planned mining exploitation in the vicinity of the protection pillar of the main shafts in the "Pniówek" Coal Mine. Hitherto executed exploitation brought about mining damage in the objects located in the neighborhood of the main mine. Such a situation primarily resulted from the interference of numerous exploitation edges in the boundary of the established pillar. Among the building objects located in the vicinity of the pillar's boundary, there is a five-storey block of flats situated parallel to the panels of extraction walls. The excessive deflection of the building called for the necessity of its rectification.

The analysis of the mining impact on the surface embraced both the periods before and after the building rectification with the assumption that further exploitation in the seams 403/3 and 401/1 would be carried out in the same portion. The influence of exploitation on the surface was additionally determined on the basis of the results of geodesic measurements in the surveying points fixed on the object and surveying lines. The paper also contains the comparison of prognostic calculations and building behavior after its leveling, which clearly indicates a positive influence of rectification on decreasing the inconvenience in using the building object. Hence, the described analysis allowed for the formulation of practical recommendations.

WPŁYW EKSPLOATACJI ŚCIANOWEJ W REJONIE FILARA OCHRONNEGO NA BUDYNEK WIELORODZINNY PODDANY REKTYFIKACJI

Słowa kluczowe

Ochrona powierzchni, wpływ eksploatacji górniczej na powierzchnię terenu i obiekty budowlane, prognoza deformacji powierzchni

Streszczenie

W przypadku prowadzenia eksploatacji górniczej w rejonie miast i osiedli bardzo ważnym zagadnieniem staje się ochrona obiektów budowlanych znajdujących się na powierzchni terenu. Powyższa problematyka uwzględniana jest tak w projektach eksploatacji, jak i w ocenie działalności górniczej po jej zakończeniu. Intensywna działalność górnicza w bliskim sąsiedztwie rejonu zurbanizowanego prowadzi do pękania ścian budynków lub nawet awarii budowlanych.

W artykule wykonano analizę wpływu dokonanej oraz projektowanej eksploatacji górniczej prowadzonej w sąsiedztwie filara ochronnego szybów głównych KWK „Pniówek". Dotychcczasowa eksploatacja spowodowała szkody górnicze w obiektach, które znajdują się w pobliżu zakładu głównego kopalni. Sytuacja ta wywołana została przede wszystkim nakładaniem się wielu krawędzi eksploatacyjnych na granicy ustanowionego filara. Wśród obiektów budowlanych znajdujących się blisko granicy filara ochronnego, szczególnie narażony na wpływy był pięciokondygnacyjny budynek mieszkalny zorientowany równolegle do wybiegu prowadzonych ścian. Jego nadmierne pochylenie spowodowało, że zaszła konieczność jego rektyfikacji.

Wykonana analiza wpływu działalności górniczej na powierzchnię terenu obejmuje okres przed rektyfikacją budynku mieszkalnego oraz po jego rektyfikacji przy założeniu, że w tej samej partii prowadzona będzie kolejna eksploatacja w pokładach 403/3 i 401/1. Wpływ eksploatacji na powierzchnię określony został także na podstawie wyników pomiarów geodezyjnych punktów zastabilizowanych na obiekcie oraz linii obserwacyjnej. W artykule porównano wyniki obliczeń prognostycznych z zachowaniem się budynku po jego wyprostowaniu oraz pokazano wpływ rektyfikacji na zmniejszenie uciążliwości użytkowania obiektu mieszkalnego. Wykonana analiza pozwoliła na sformułowanie wniosków o charakterze praktycznym.